MICROSERVICE ARCHITECTURE

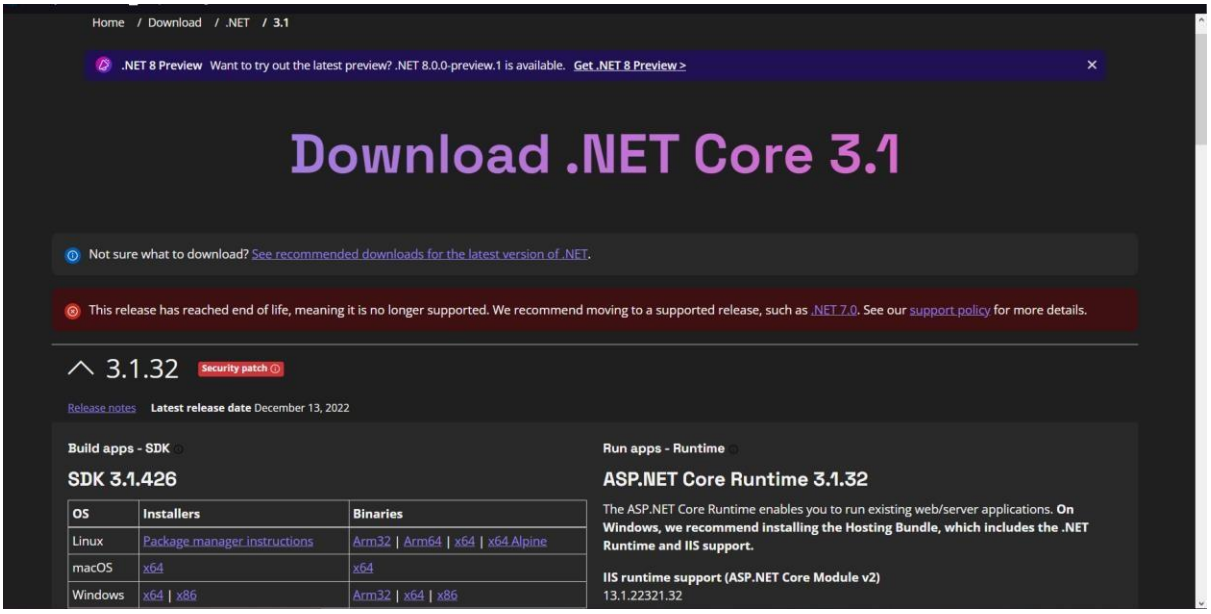
INDEX

Practical 1

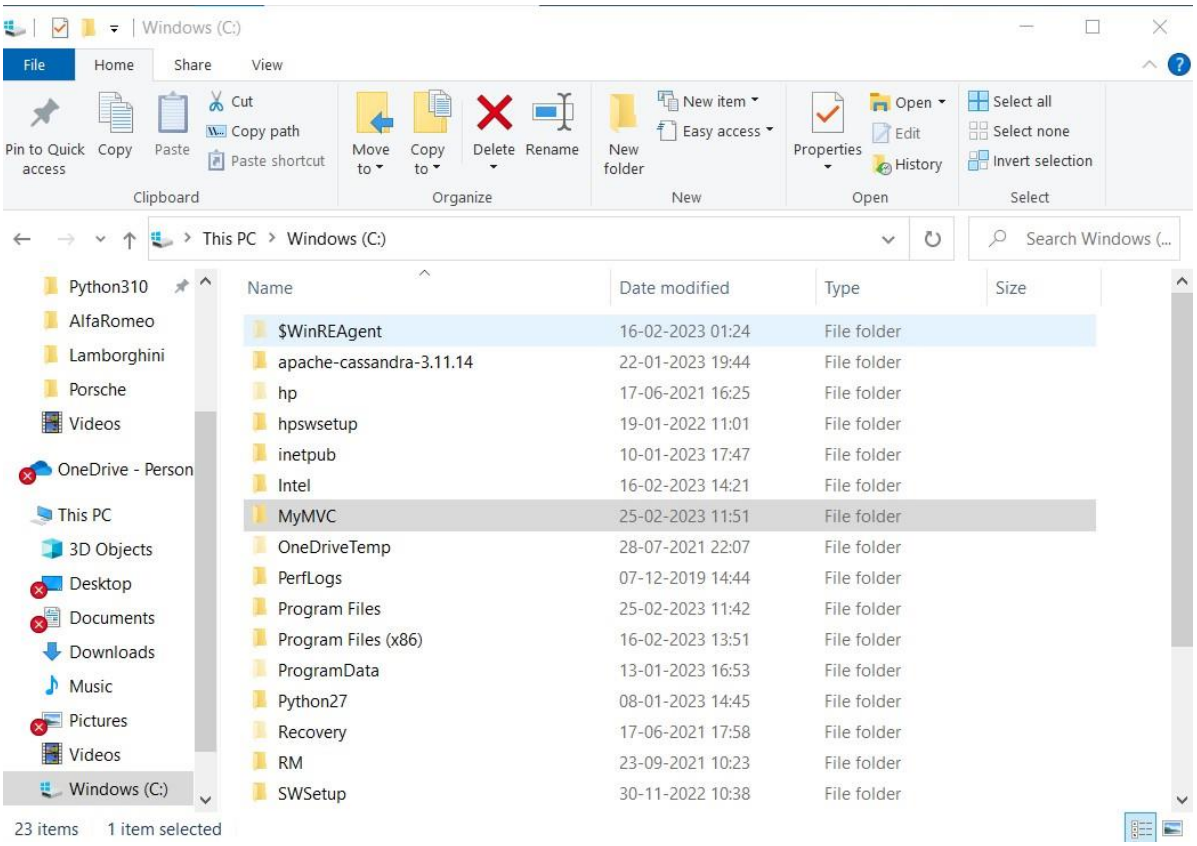
Aim: Building ASP.NET Core MVC Application.

Writeup:

Step 1:
Install .Net Core SDK.



Step 2:
Create a Folder MyMVC in C: drive.



Step 3:

Open Command Prompt and type the following commands:

dotnet new mvc --auth none

```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.19044.2604]
(c) Microsoft Corporation. All rights reserved.

C:\MyMVC>dotnet new mvc --auth none
The template "ASP.NET Core Web App (Model-View-Controller)" was created successfully.
This template contains technologies from parties other than Microsoft, see https://aka.ms/aspnetcore/3.1-third-party-notices for details.

Processing post-creation actions...
Running 'dotnet restore' on C:\MyMVC\MyMVC.csproj...
  Determining projects to restore...
  Restored C:\MyMVC\MyMVC.csproj (in 66 ms).

Restore succeeded.
```

Step 4:

Go to the controllers folder and modify HomeController.cs file to match the following code:

HomeController.cs

Controllers > HomeController.cs

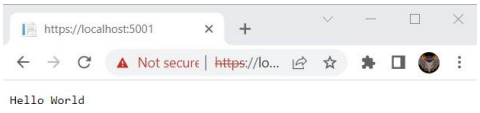
```
1   using System;
2   using System.Collections.Generic;
3   using System.Diagnostics;
4   using System.Linq;
5   using System.Threading.Tasks;
6   using Microsoft.AspNetCore.Mvc;
7   using Microsoft.Extensions.Logging;
8   using MyMVC.Models;
9
10  namespace MyMVC.Controllers
11  {
12      public class HomeController : Controller
13      {
14          private readonly ILogger<HomeController> _logger;
15
16          public String Index()
17          {
18              return "Hello World";
19          }
20
```

Step 5:

- Run the code

```
C:\MyMVC>dotnet run
info: Microsoft.Hosting.Lifetime[0]
      Now listening on: https://localhost:5001
info: Microsoft.Hosting.Lifetime[0]
      Now listening on: http://localhost:5000
info: Microsoft.Hosting.Lifetime[0]
      Application started. Press Ctrl+C to shut down.
info: Microsoft.Hosting.Lifetime[0]
      Hosting environment: Development
info: Microsoft.Hosting.Lifetime[0]
      Content root path: C:\MyMVC
```

- Paster the localhost:5001 link in your browser (In the case we are using Chrome).

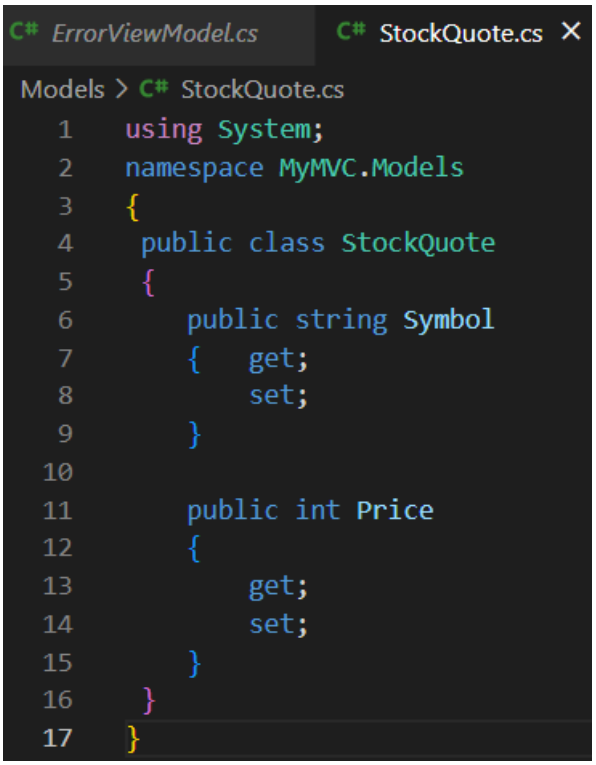


Step 6: Now go back to command prompt and stop running project using CTRL+C.

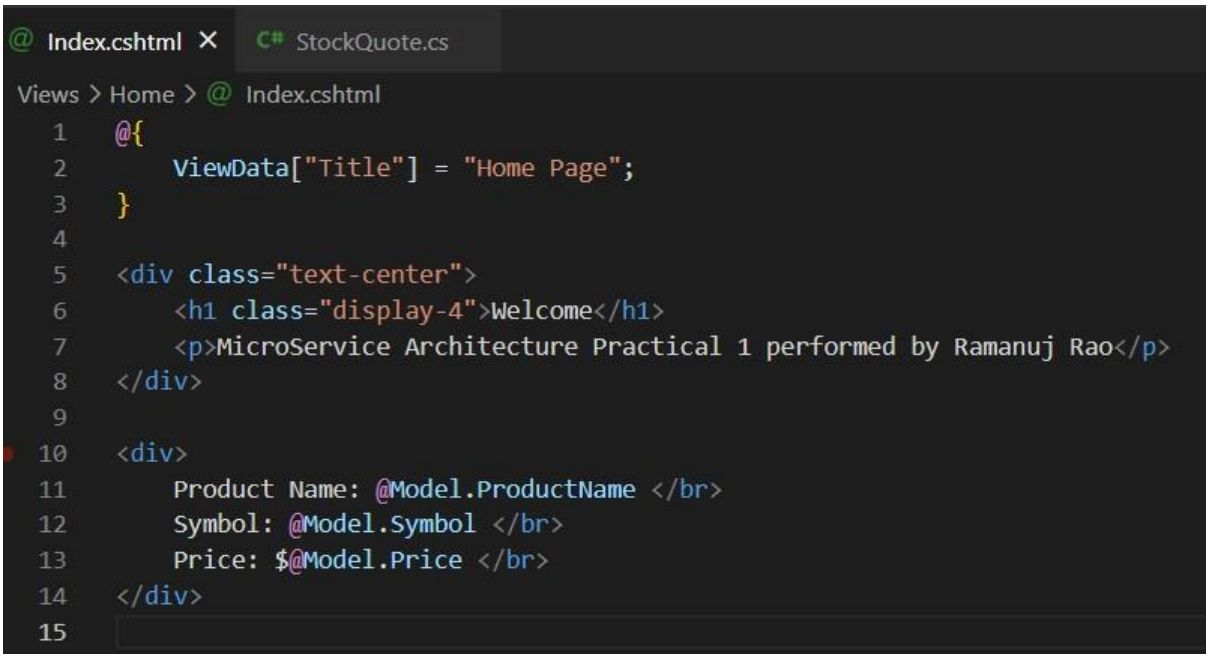
C:\Windows\System32\cmd.exe

```
C:\MyMVC>dotnet run
info: Microsoft.Hosting.Lifetime[0]
      Now listening on: https://localhost:5001
info: Microsoft.Hosting.Lifetime[0]
      Now listening on: http://localhost:5000
info: Microsoft.Hosting.Lifetime[0]
      Application started. Press Ctrl+C to shut down.
info: Microsoft.Hosting.Lifetime[0]
      Hosting environment: Development
info: Microsoft.Hosting.Lifetime[0]
      Content root path: C:\MyMVC
info: Microsoft.Hosting.Lifetime[0]
      Application is shutting down...

C:\MyMVC>
```

Step 7: Go to models folder and add new file StockQuote.cs to it with following content:



Step 8: Now Add View to folder then home folder in it and modify index.cshtml file to match following



Step 9: Now modify HomeController.cs file to match following:

StockQuote.cs HomeController.cs

Controllers > HomeController.cs

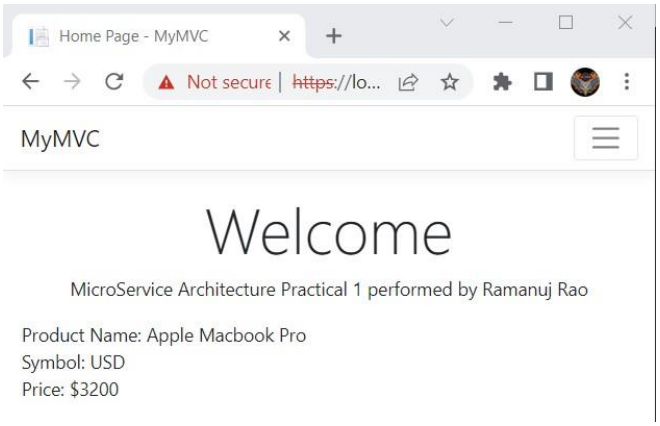
```
using System.Linq;
using System.Threading.Tasks;
using Microsoft.AspNetCore.Mvc;
using Microsoft.Extensions.Logging;
using MyMVC.Models;

namespace MyMVC.Controllers
{
    public class HomeController : Controller
    {
        private readonly ILogger<HomeController> _logger;

        public HomeController(ILogger<HomeController> logger)
        {
            _logger = logger;
        }

        public IActionResult Index()
        {
            var model= new StockQuote{ ProductName='Apple Macbook Pro', Symbol='USD', Price='3200'};
            return View(model);
        }
```

Step 10: Now run the project using **dotnet run**

C:\Windows\System32\cmd.exe - dotnet run

```
C:\MyMVC>dotnet run
info: Microsoft.Hosting.Lifetime[0]
      Now listening on: https://localhost:5001
info: Microsoft.Hosting.Lifetime[0]
      Now listening on: http://localhost:5000
info: Microsoft.Hosting.Lifetime[0]
      Application started. Press Ctrl+C to shut down.
info: Microsoft.Hosting.Lifetime[0]
      Hosting environment: Development
info: Microsoft.Hosting.Lifetime[0]
      Content root path: C:\MyMVC
```

Step 11: Now go back to browser and refresh to get modified view response.



Practical 2

Aim: Building an ASP.NET CORE REST API.

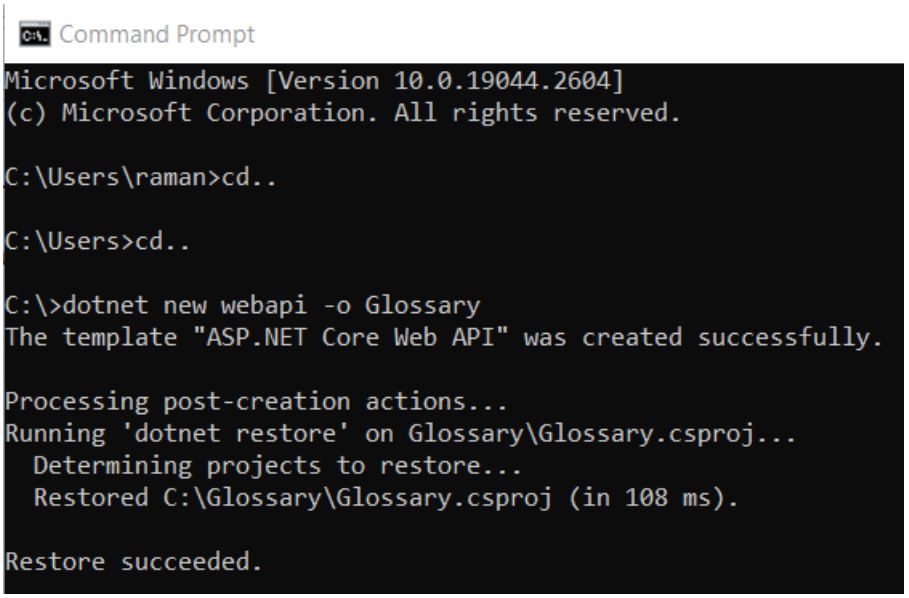
Writeup:

Step 1: Create your Web API.

- Open two command prompts.

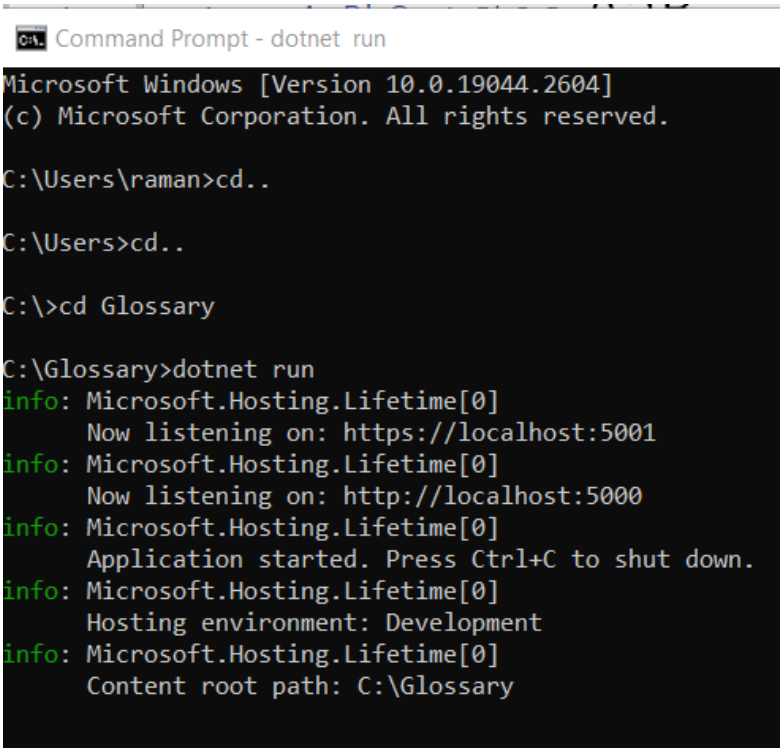
CMD-1:

dotnet new webapi -o Glossary



CMD-2:

cd Glossary
dotnet run



Step 2: In Command Prompt 2: (try running ready made weatherforecast class for testing)

curl --insecure https://localhost:5001/weatherforecast

```
C:\>curl --insecure https://localhost:5001/weatherforecast
[{"date":"2023-03-11T17:28:21.0483959+05:30","temperatureC":50,"temperatureF":121,"summary":"Sweltering"},{"date":"2023-03-12T17:28:21.0487982+05:30","temperatureC
":-13,"temperatureF":9,"summary":"Sweltering"},{"date":"2023-03-13T17:28:21.0488162+05:30","temperatureC":7,"temperatureF":44,"summary":"Cool"},{"date":"2023-03-14
T17:28:21.0488168+05:30","temperatureC":47,"temperatureF":116,"summary":"Warm"},{"date":"2023-03-15T17:28:21.0488171+05:30","temperatureC":37,"temperatureF":98,"su
mmary":"Balmy"}]
```

Step 3: Now Change the content:-

To get started, remove the WeatherForecast.cs file from the root of the project and the WeatherForecastController.cs file from the Controllers folder. Add Following two files

[i] : GlossaryItem.cs

GlossaryItem.cs

```
namespace Glossary
{
    public class GlossaryItem
    {
        public string Term
        {
            get;
            set;
        }

        public string Definition
        {
            get;
            set;
        }
    }
}
```

[ii] : GlossaryController.cs

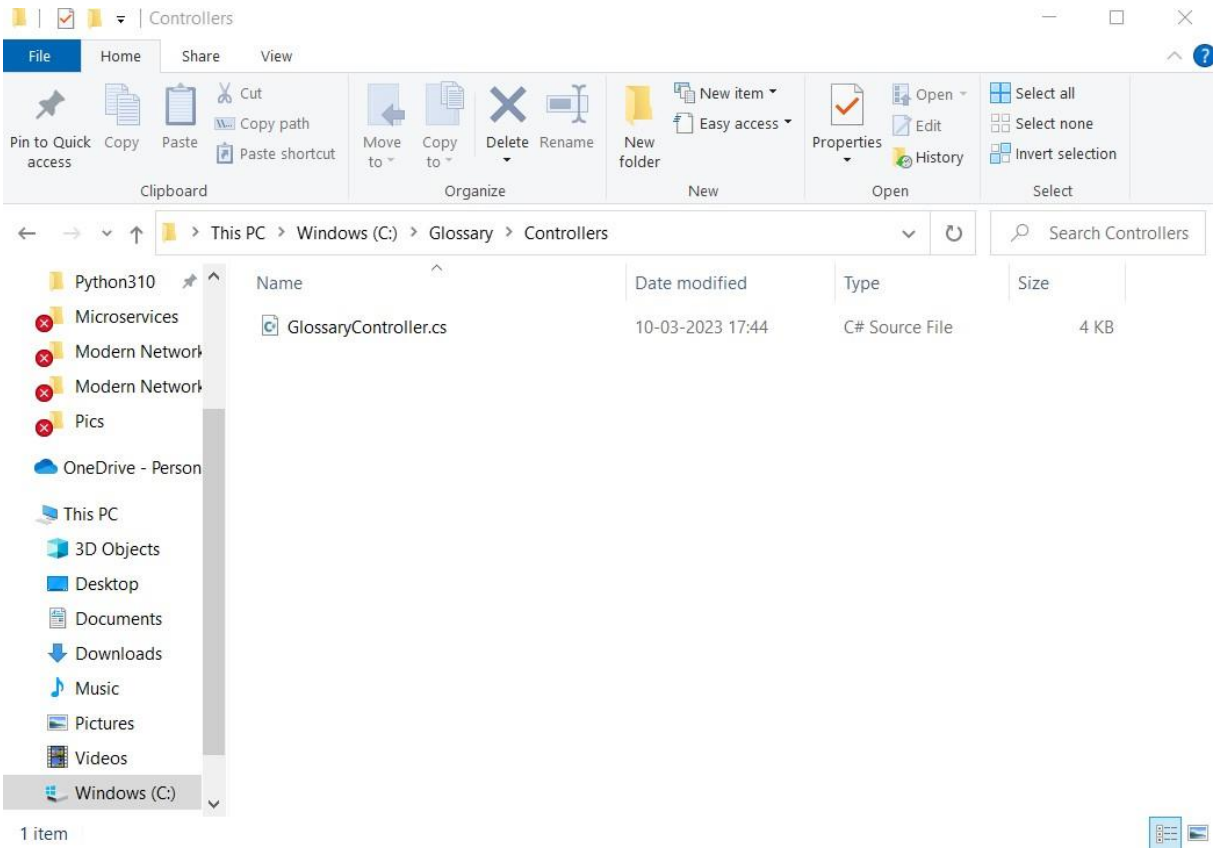
```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Threading.Tasks;
using Microsoft.AspNetCore.Mvc;
using Microsoft.Extensions.Logging;

namespace Glossary.Controllers
{
    [ApiController]
    [Route("api/[controller]")]

     public class GlossaryController: ControllerBase
     {
        private static List<GlossaryItem> Glossary = new List<GlossaryItem>
```

```
        {
            new GlossaryItem
            {
                Term= "HTML",
                Definition = "Hypertext Markup Language"
            },

            new GlossaryItem
            {
                Term= "MVC",
                Definition = "Model View Controller"
            },

            new GlossaryItem
            {
                Term= "OpenID",
                Definition = "An open standard for authentication"
            }
        };

        [HttpGet]
        public ActionResult<List<GlossaryItem>> Get()
        {
            return Ok(Glossary);
        }

        [HttpGet]
        [Route("{term}")]
        public ActionResult<GlossaryItem> Get(string term)
        {
            var glossaryItem = Glossary.Find(item =>
            item.Term.Equals(term,
StringComparison.InvariantCultureIgnoreCase));
            if (glossaryItem == null)
            {
                return NotFound();
            }

            else
            {
                return Ok(glossaryItem);
            }
        }

        [HttpPost]
        public ActionResult Post(GlossaryItem glossaryItem)
        {
            var existingGlossaryItem = Glossary.Find(item =>
```

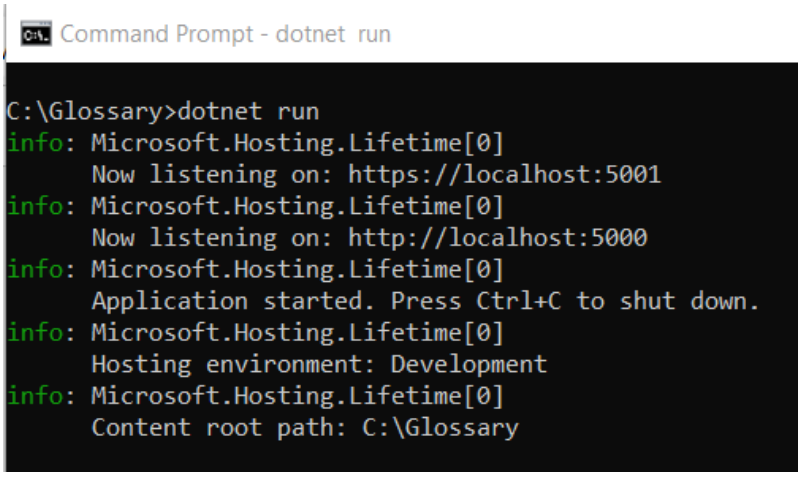
```
            item.Term.Equals(glossaryItem.Term,
StringComparison.InvariantCultureIgnoreCase));
            if (existingGlossaryItem != null)
            {
                return Conflict("Cannot create the term because it already
exists.");
            }

            else
            {
                Glossary.Add(glossaryItem);
                var resourceUrl = Path.Combine(Request.Path.ToString(),
Uri.EscapeUriString(glossaryItem.Term));
                return Created(resourceUrl, glossaryItem);
            }
        }

        [HttpPut]
        public ActionResult Put(GlossaryItem glossaryItem)
        {
            var existingGlossaryItem = Glossary.Find(item =>
            item.Term.Equals(glossaryItem.Term,
StringComparison.InvariantCultureIgnoreCase));
            if (existingGlossaryItem == null)
            {
                return BadRequest("Cannot update a nont existing term.");
            }

            else
            {
                existingGlossaryItem.Definition = glossaryItem.Definition;
                return Ok();
            }
        }
        [HttpDelete]
        [Route("{term}")]
        public ActionResult Delete(string term)
        {
            var glossaryItem = Glossary.Find(item =>
            item.Term.Equals(term,
StringComparison.InvariantCultureIgnoreCase));
            if (glossaryItem == null)
            {
                return NotFound();
            }

            else
            {
```

```
                Glossary.Remove(glossaryItem);
                return NoContent();
            }
        }
    }
}
```

Output:



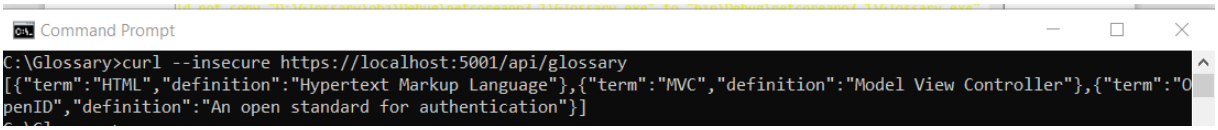
Step 4: Now stop running previous **dotnet run** on command prompt 1 using Ctrl+C. and Run it again for new code.



Step 5: Run commands to perform certain operations on the GlossaryItem dataset.

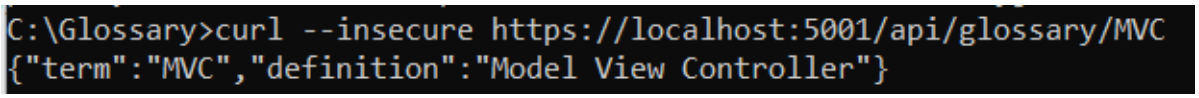
[i] : Getting a list of items.

curl --insecure https://localhost:5001/api/glossary



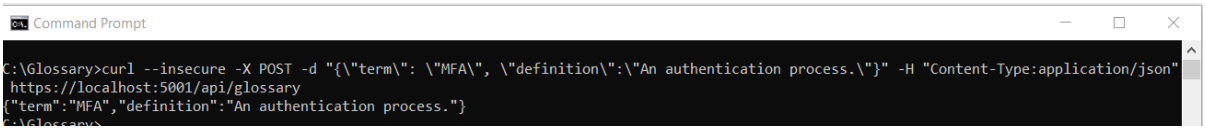
[ii] : Getting a single item.

curl --insecure https://localhost:5001/api/glossary/MVC



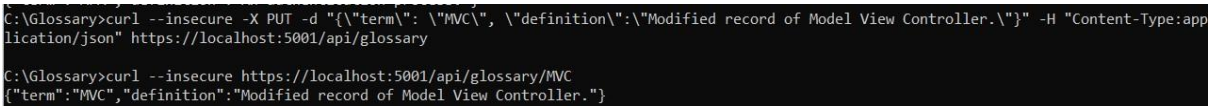
[iii] : Creating an item.

curl --insecure -X POST -d "{\"term\": \"MFA\", \"definition\":\"An authentication process.\"}" -H "ContentType:application/json" https://localhost:5001/api/glossary



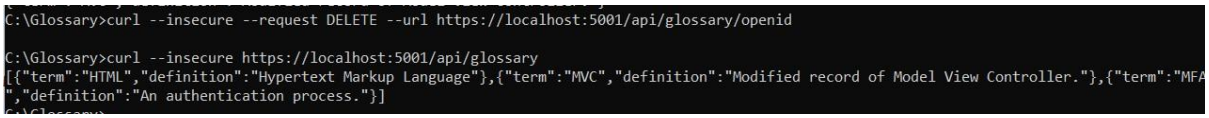
[iv] : Update an item.

curl --insecure -X PUT -d "{\"term\": \"MVC\", \"definition\":\"Modified record of Model View Controller.\"}" -H "Content-Type:application/json" https://localhost:5001/api/glossary



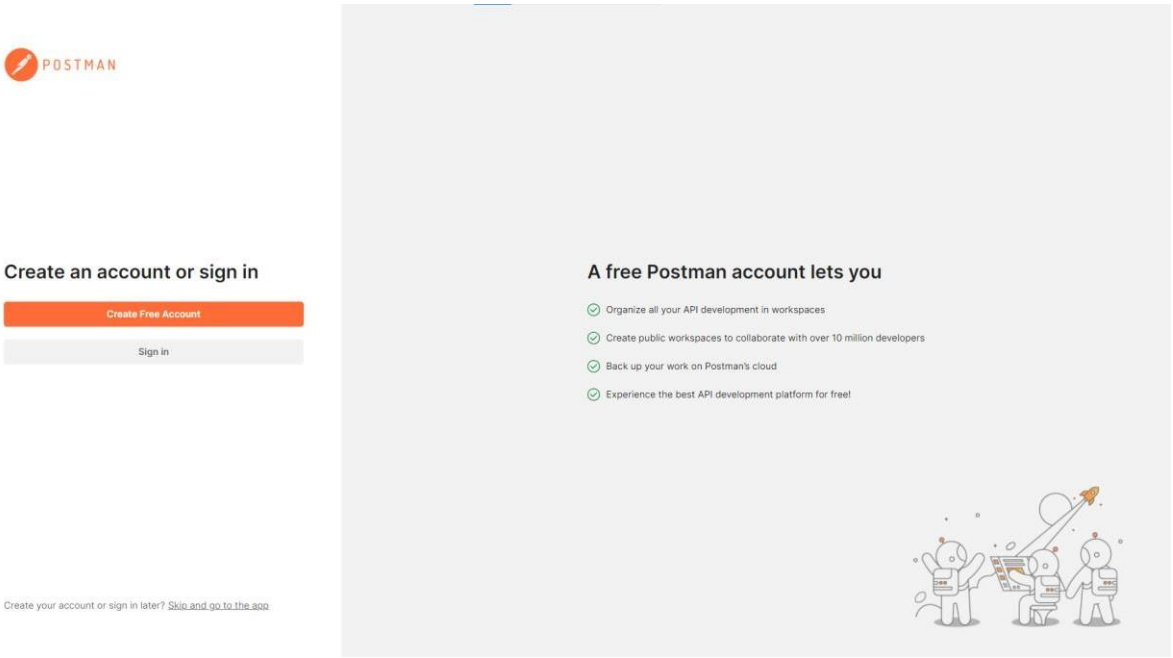
[v] : Delete an item.

curl --insecure --request DELETE --url https://localhost:5001/api/glossary/openid

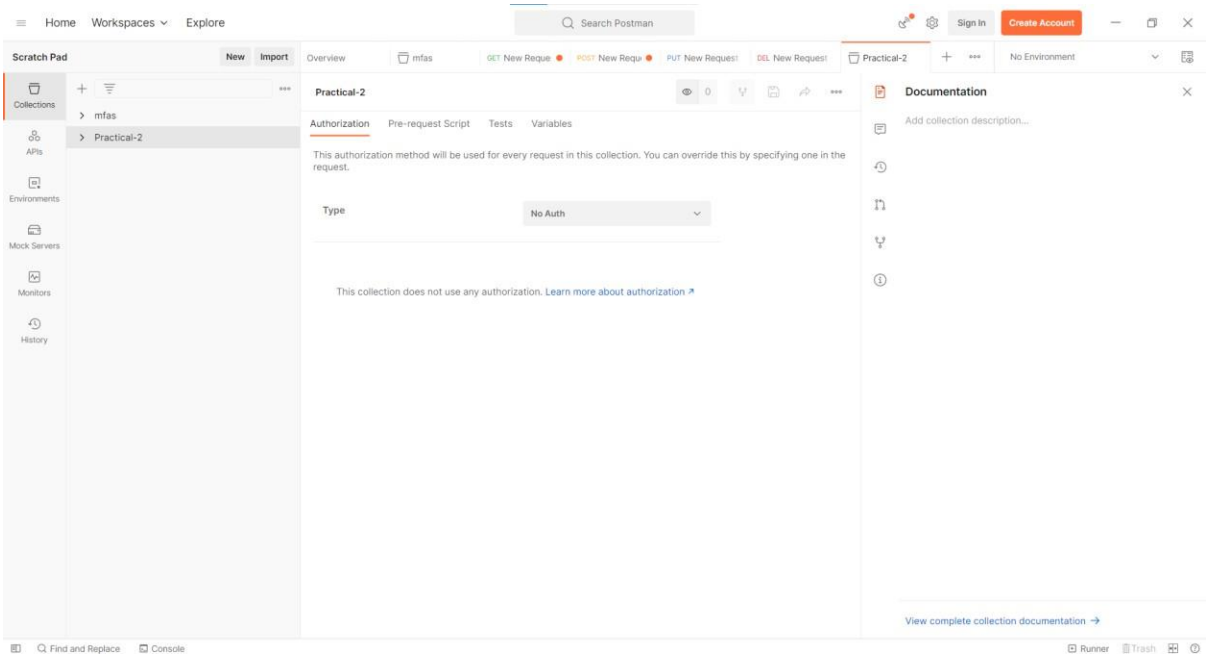


Extra (Step 6): Running commands using Postman.

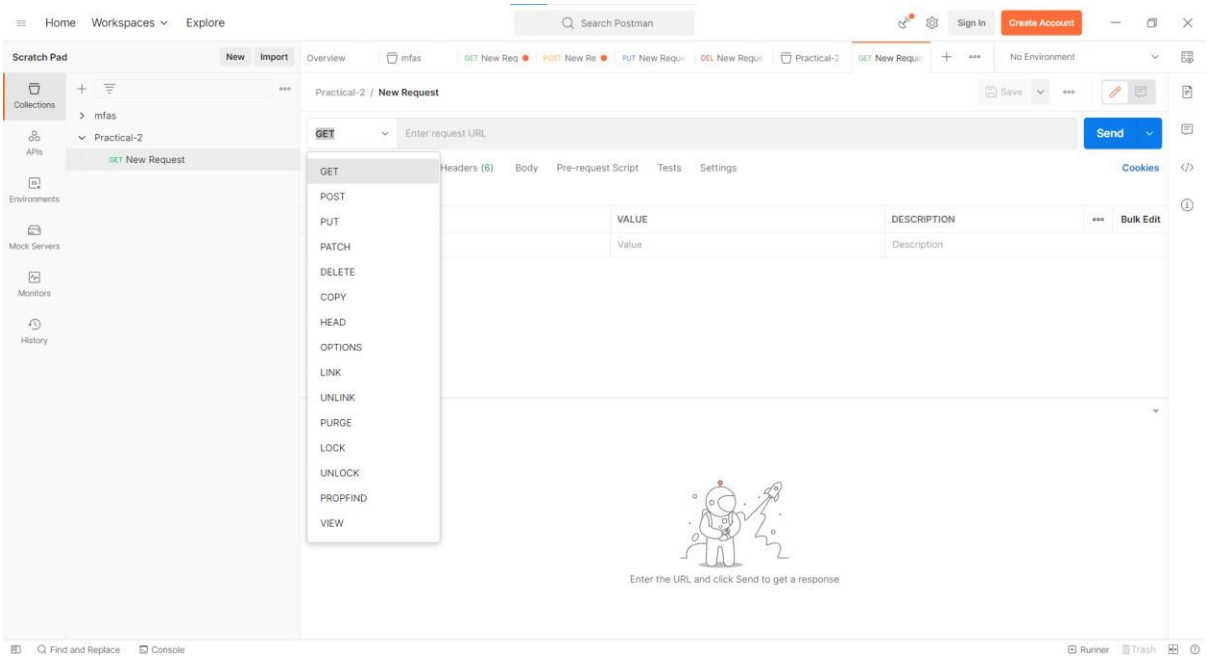
- First you have you download and install Postman.
- After installing you will see this screen



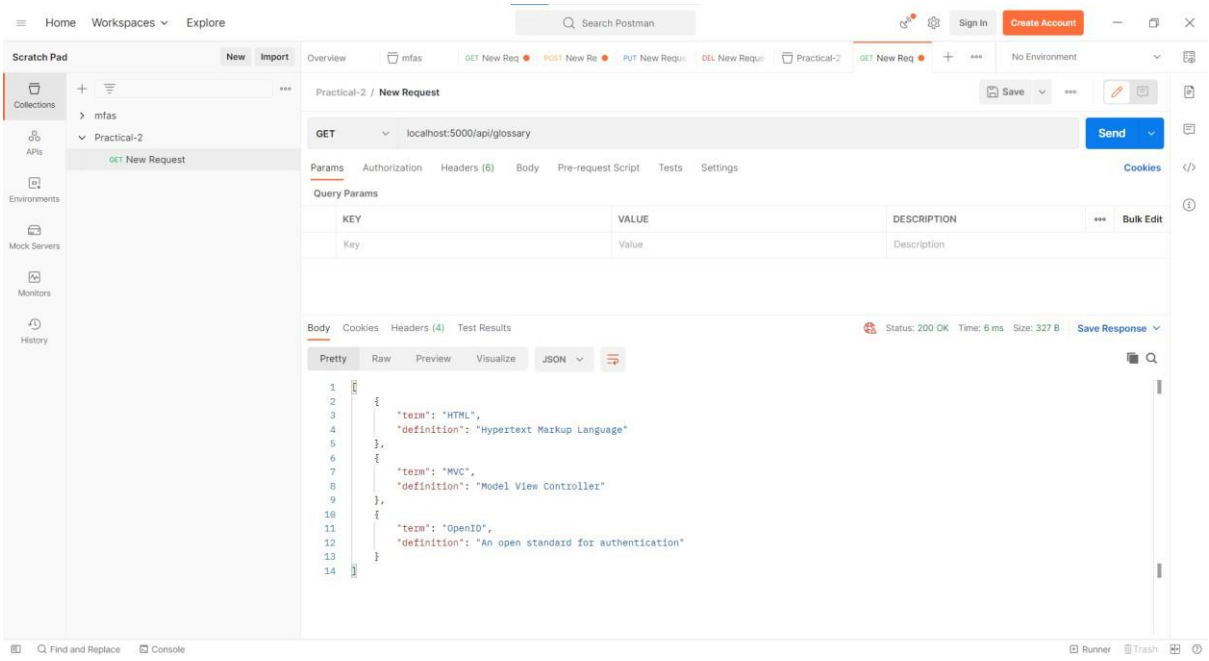
- Click on “Skip and go to the app”
- Now Click on New Collection and give it a name or your choice



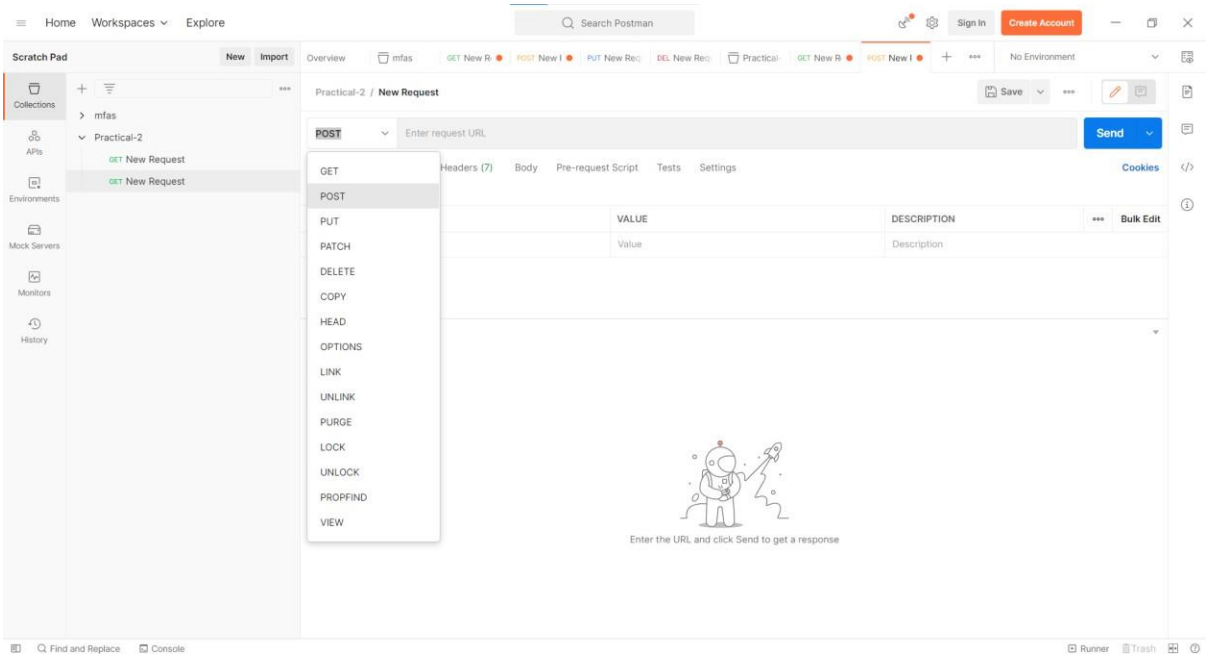
- Now within the new collection Click on “Add new Request” and within the choices choose the “GET” option.



- Now type in **localhost:5000/api/glossary** in the field and Click **Send**.



- Now within the new collection Click on “Add new Request” and within the choices choose the “POST” option.

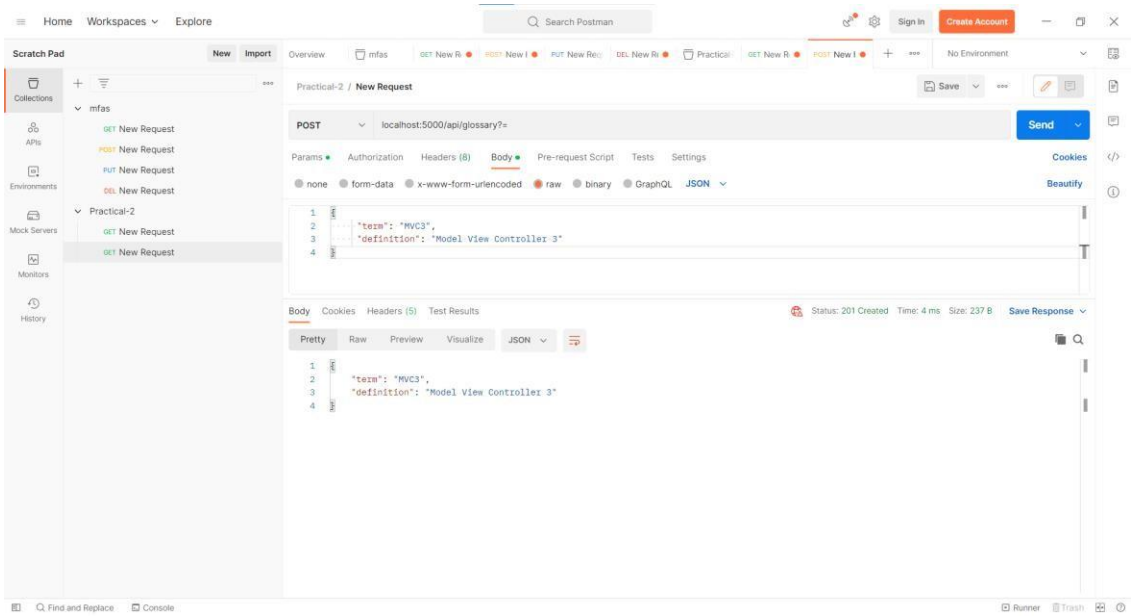


- Now type in **localhost:5000/api/glossary?=** in the field.
- Then choose the “Body” option below and select “Raw” and fill out the following code:

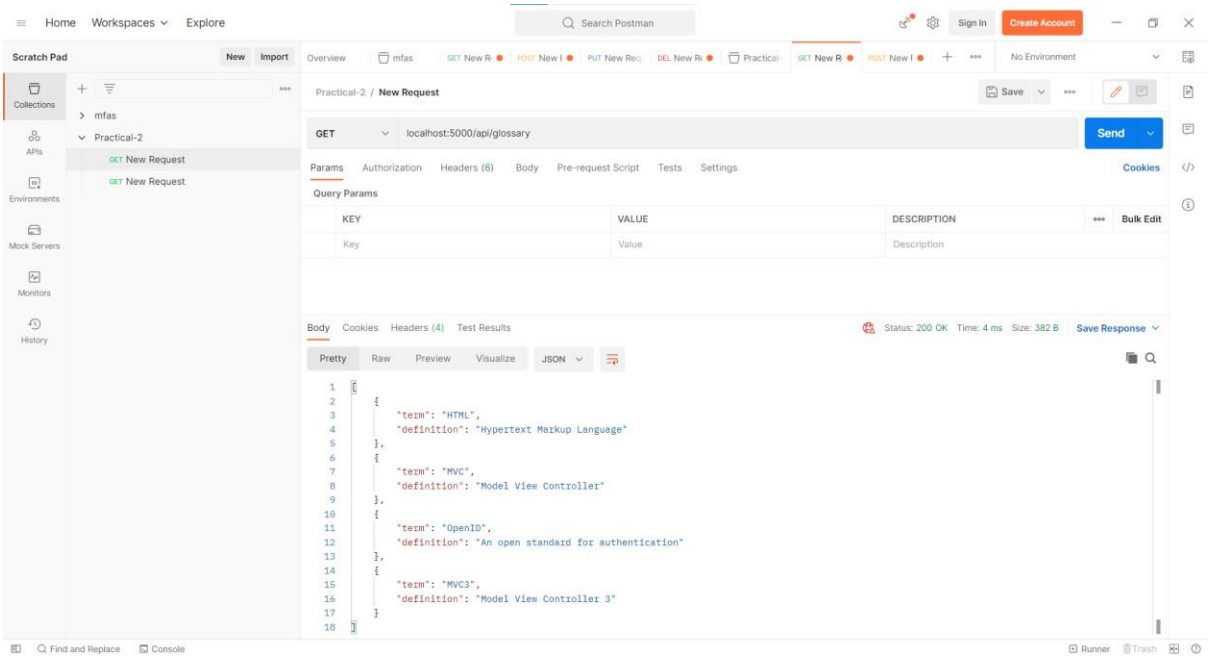
Code:

```
{
        "term": "MVC3",
        "definition": "Model View Controller 3"
}
```

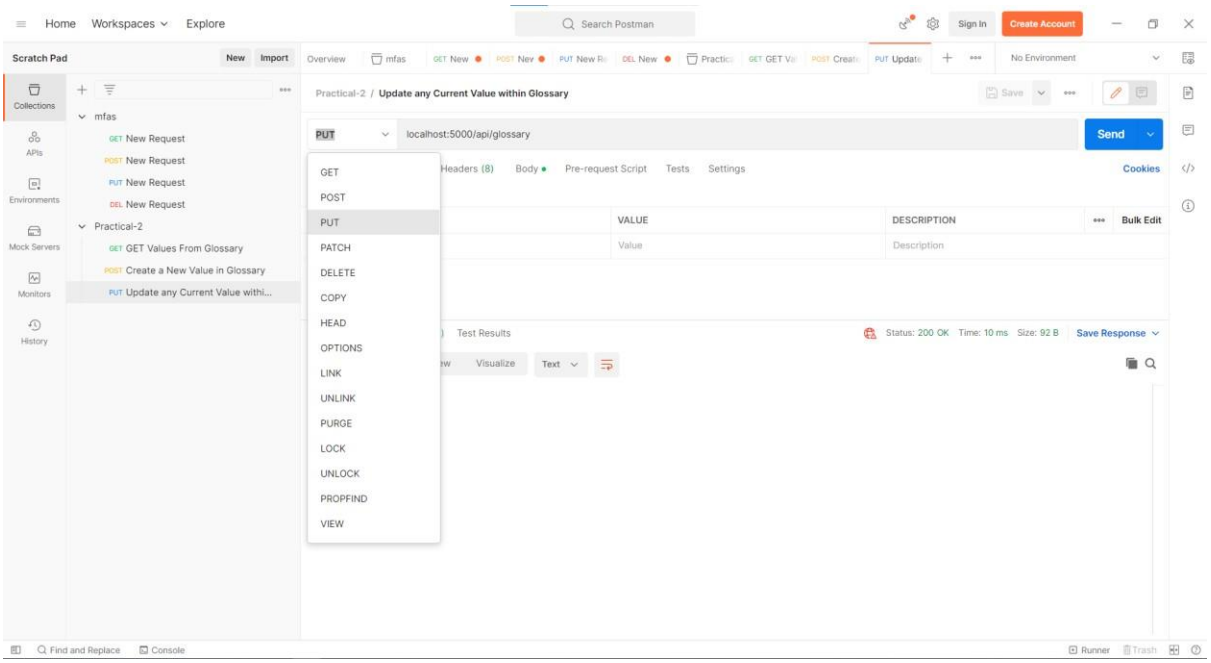
- Now Click **Send**.
- Tip: Make sure to select **JSON** instead of **Text**.



- To confirm that the **POST** Request worked send another **GET** Request and it would have updated with a new value, if not then check you code.



- Now within the new collection Click on “Add new Request” and within the choices choose the “PUT” option.

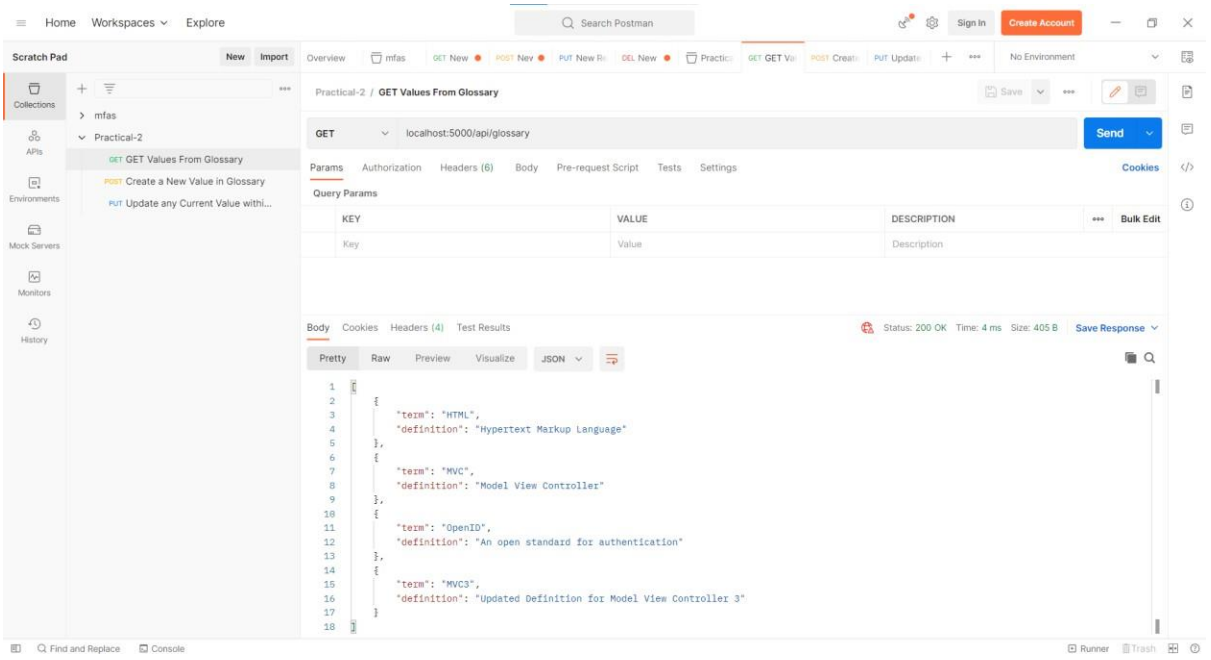


- Now type in **localhost:5000/api/glossary** in the field.
- Then choose the “Body” option below and select “Raw” and fill out the following code:

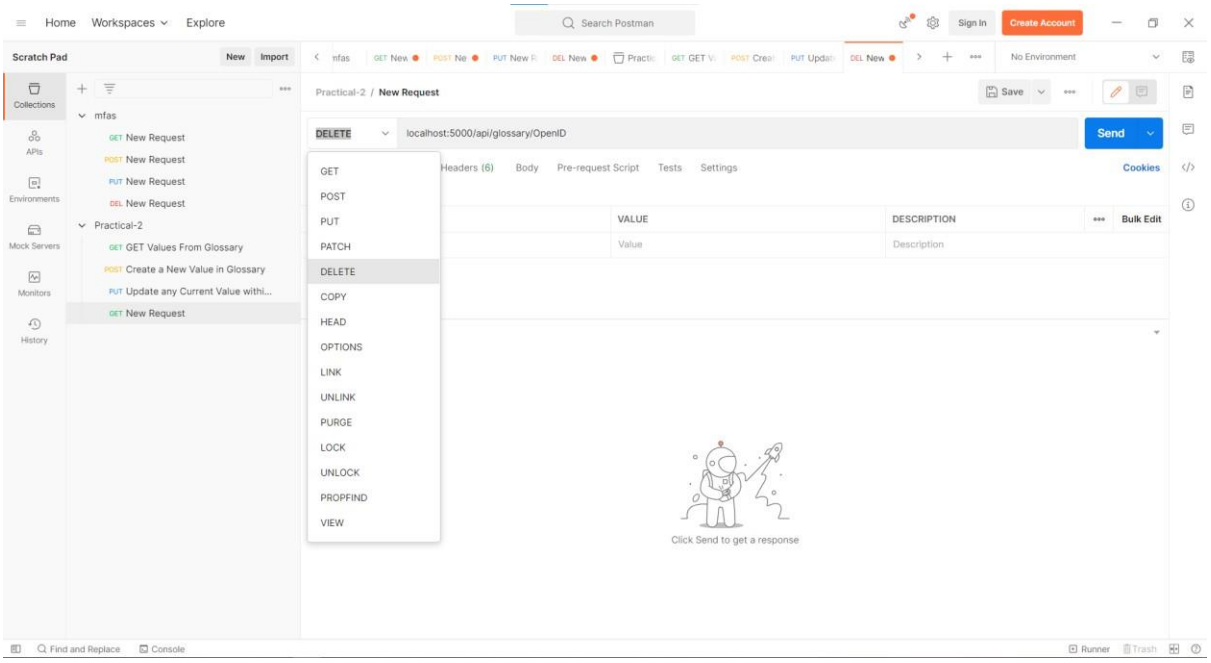
Code:

```
{
    "term": "MVC3",
    "definition": "Updated Definition for Model View Controller 3"
}
```

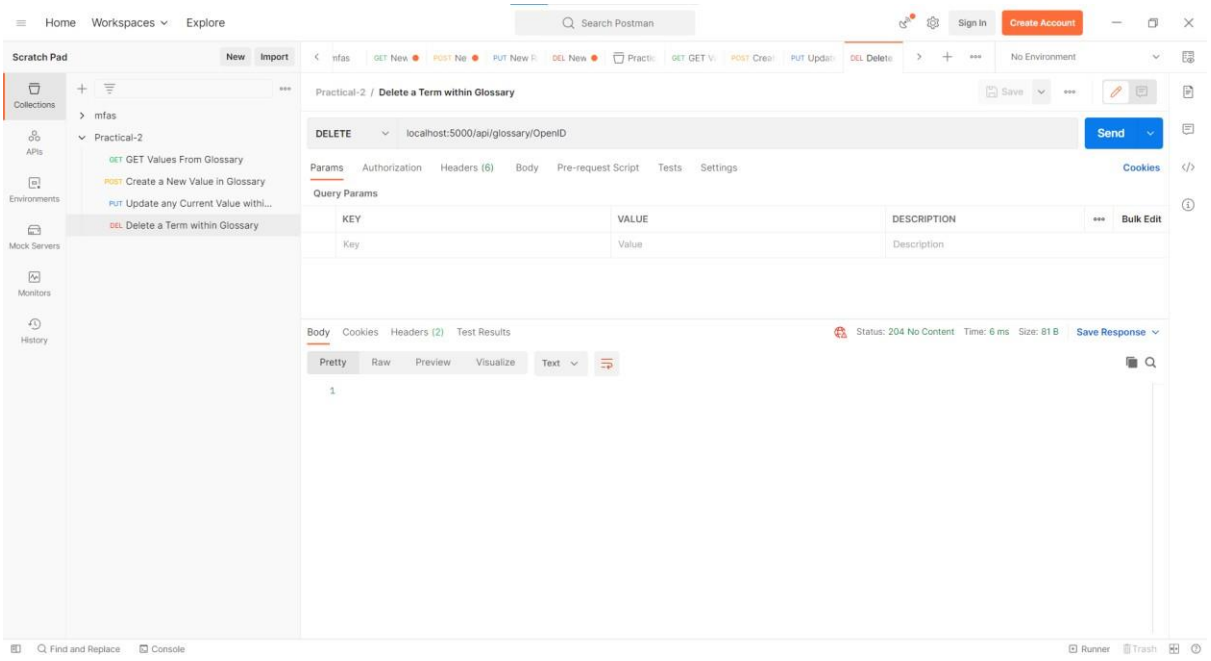
- Click **Send**.
- To confirm the changes made by the PUT Request, send another GET Request to update the values.



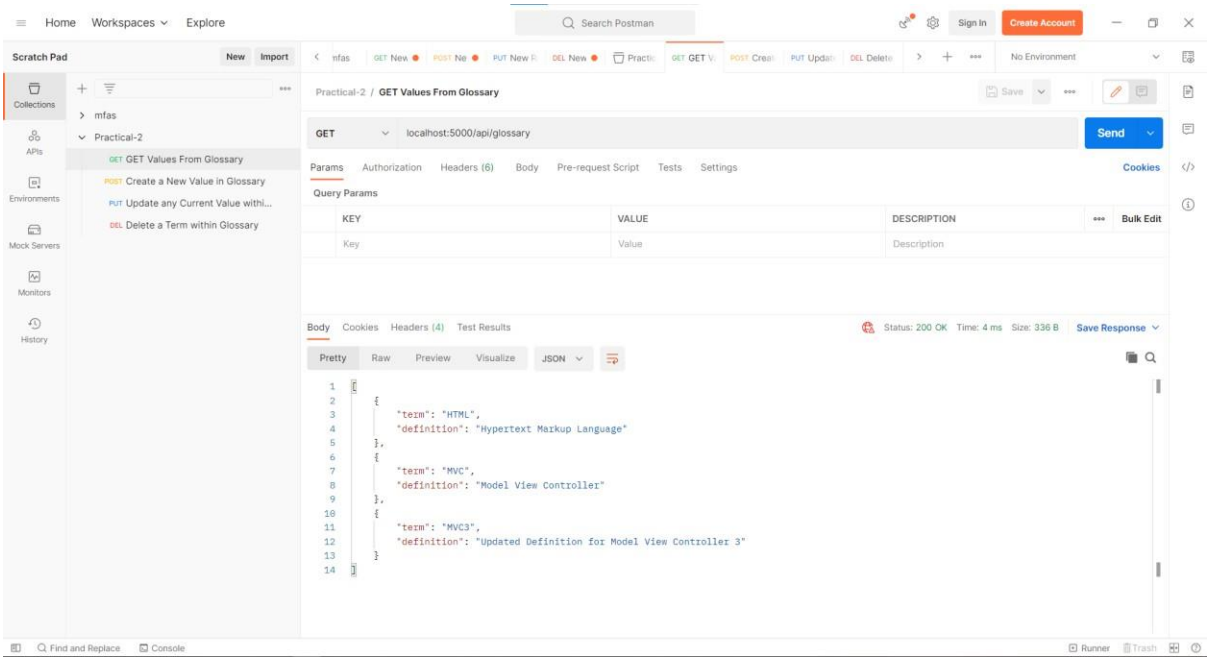
- Now within the new collection Click on “Add new Request” and within the choices choose the “DELETE” option.



- Now type in “**localhost:5000/api/glossary/**” in the field and after it choose the term you would like to remove in this case I have chosen “**OpenID**”.
- After this Click **Send**.



- To Confirm the DELETE Request, send another GET Request to update the table.

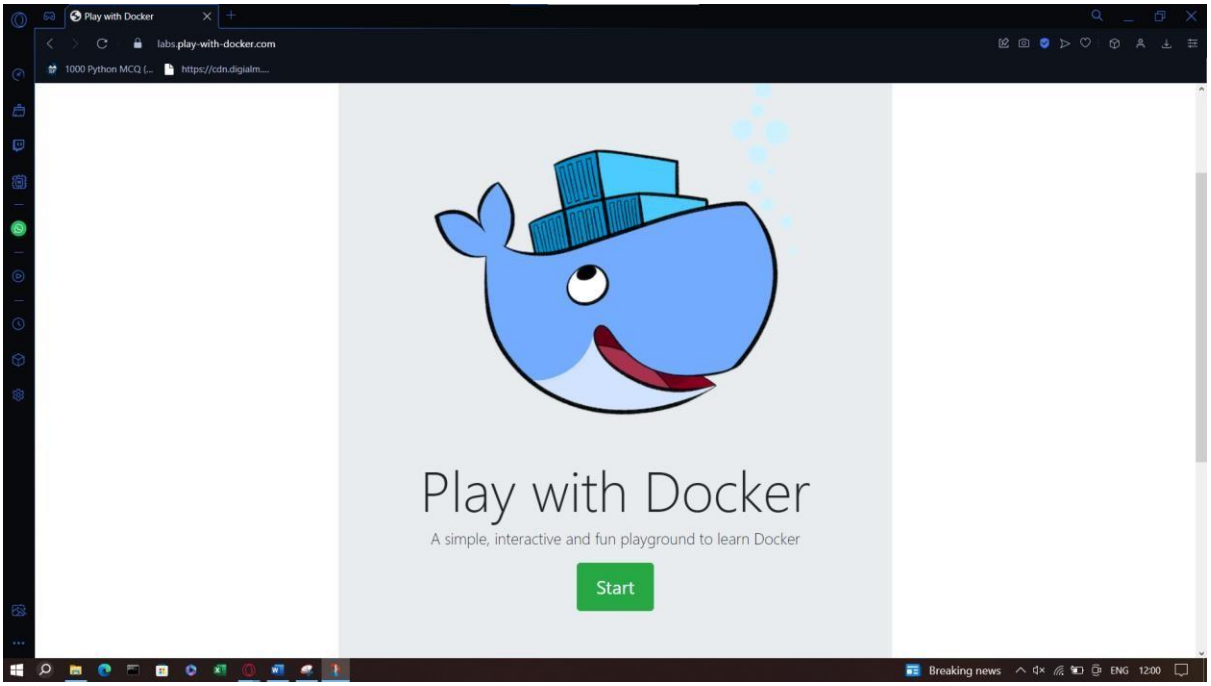


Practical 3

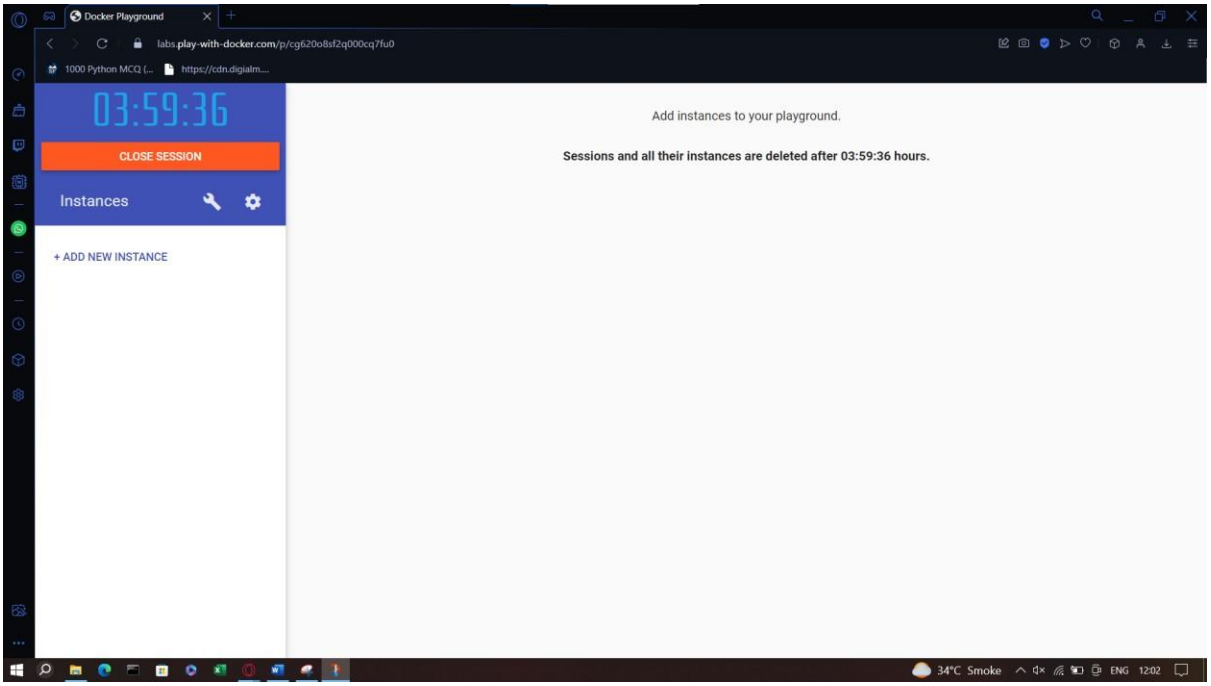
Aim: Working with Docker, Docker Commands, Docker Images and Containers.

Writeup:

Step 1: Create a Docker Hub Account (Sign Up)
Login to this website https://labs.play-with-docker.com/



Step 2: Click on Start and Add a new Instance.



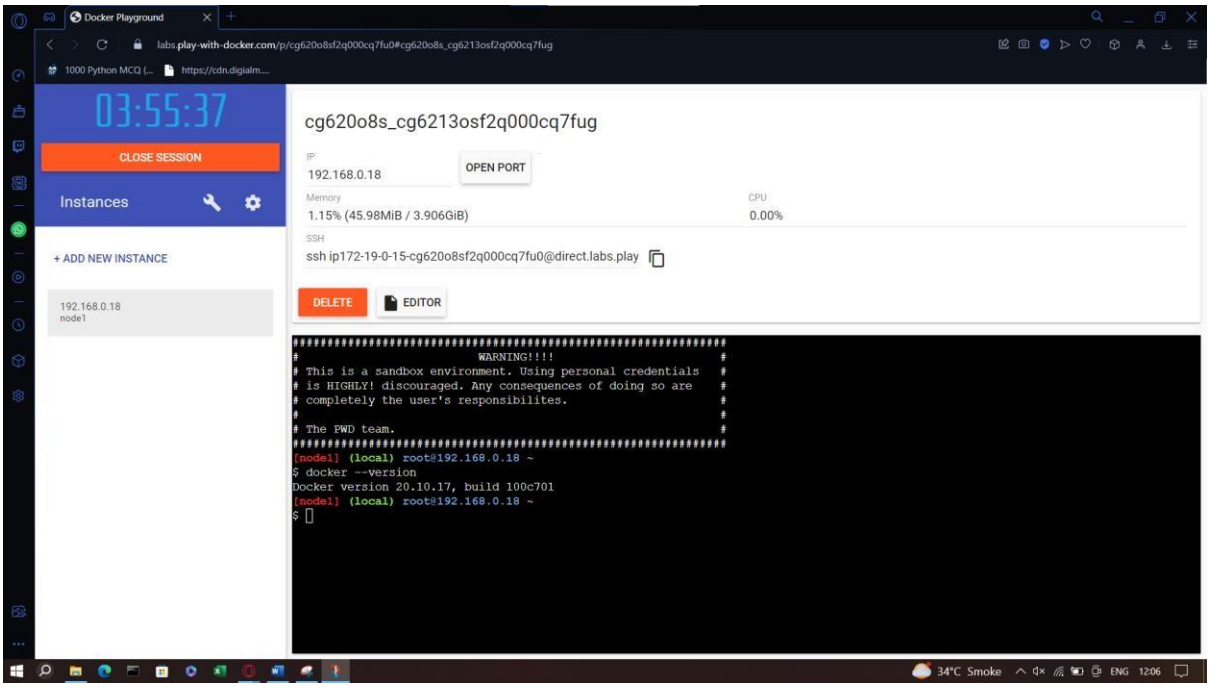
Step 3: Perform the following

Method 1: To pull and push images using docker

Command: To check docker version

docker –version

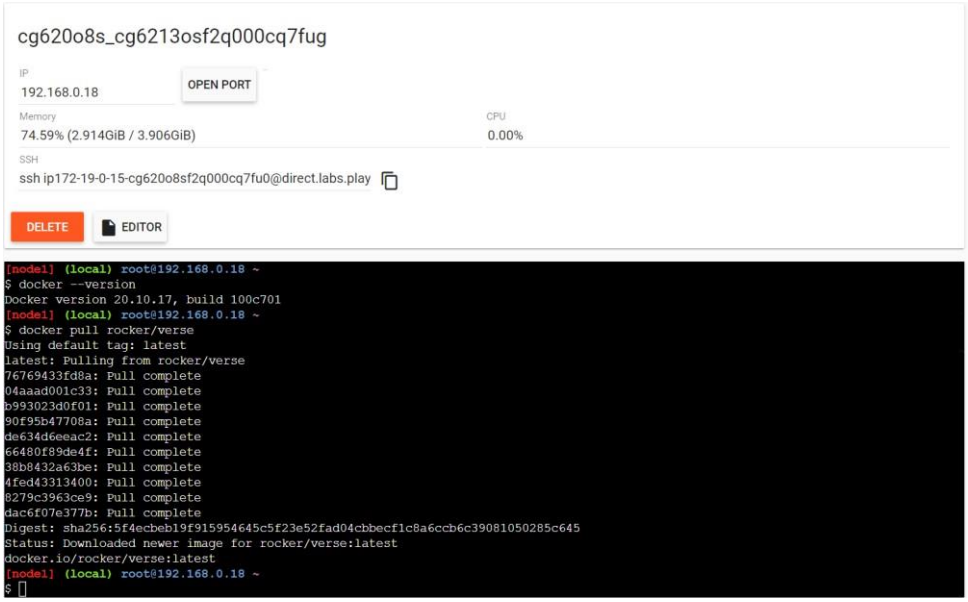
Output:



Command: To pull ready-made images.

docker pull rocker/verse

Output:



Command: To check images in docker.

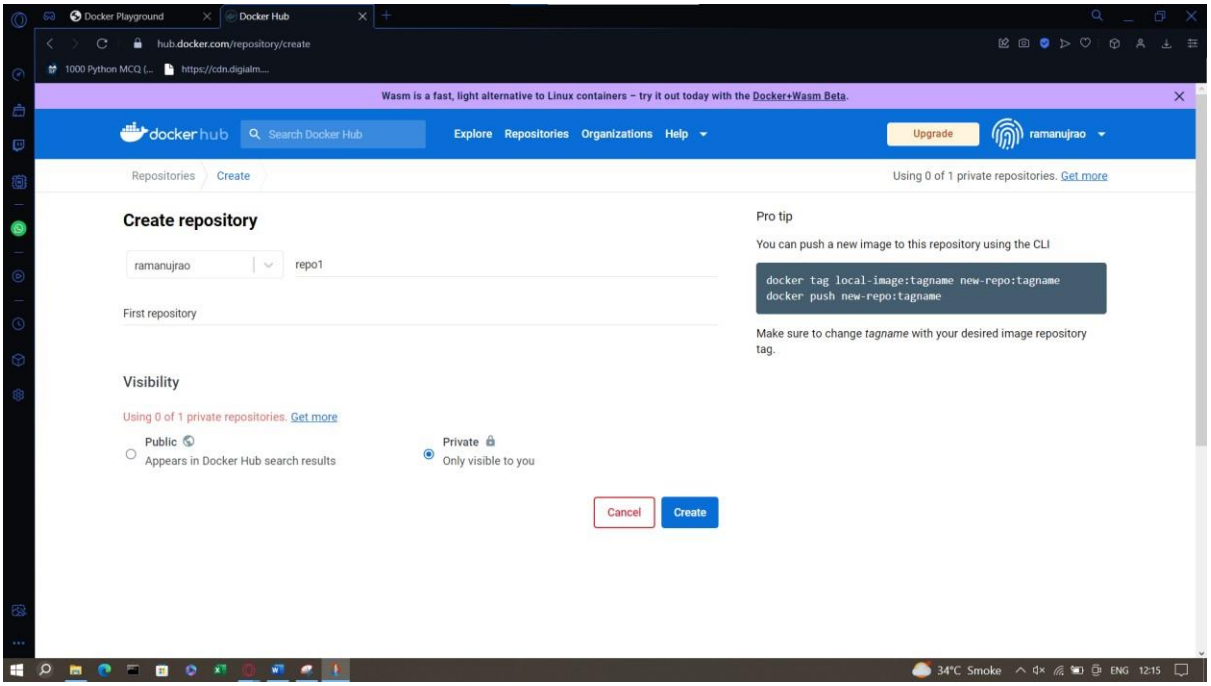
docker images

Output:

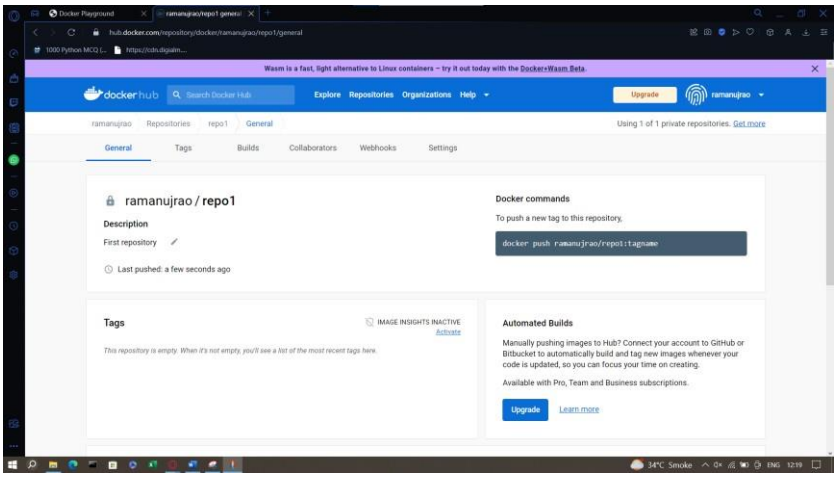
```
$ docker images
REPOSITORY      TAG       IMAGE ID       CREATED       SIZE
rocker/verse    latest    551e1a37de34   8 days ago    3.43GB
[node1] (local) root@192.168.0.18 ~
```

- Now login to Docker Hub and create a repository.

Output:



- Click on Create Button
- Check to see if the repository has been created



Command: to login to your docker account.

docker login --username=ramanujrao
password:

```
[node1] (local) root@192.168.0.18 ~
$ docker login --username=ramanujrao
Password:
Error response from daemon: Get "https://registry-1.docker.io/v2/": unauthorized: incorrect username or password
[node1] (local) root@192.168.0.18 ~
$ docker login --username=ramanujrao
Password:
Error: Password Required
[node1] (local) root@192.168.0.18 ~
$ docker login --username=ramanujrao
Password:
WARNING! Your password will be stored unencrypted in /root/.docker/config.json.
Configure a credential helper to remove this warning. See
https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded
[node1] (local) root@192.168.0.18 ~
$
```

Command: To tag an image.

docker tag 551e1a37de34 ramanujrao/repo1:firsttry

Output:

```
[node1] (local) root@192.168.0.18 ~
$ docker images
REPOSITORY      TAG       IMAGE ID       CREATED       SIZE
rocker/verse    latest    551e1a37de34   8 days ago    3.43GB
[node1] (local) root@192.168.0.18 ~
$ docker tag 551e1a37de34 ramanujrao/repo1:firsttry
[node1] (local) root@192.168.0.18 ~
$
```

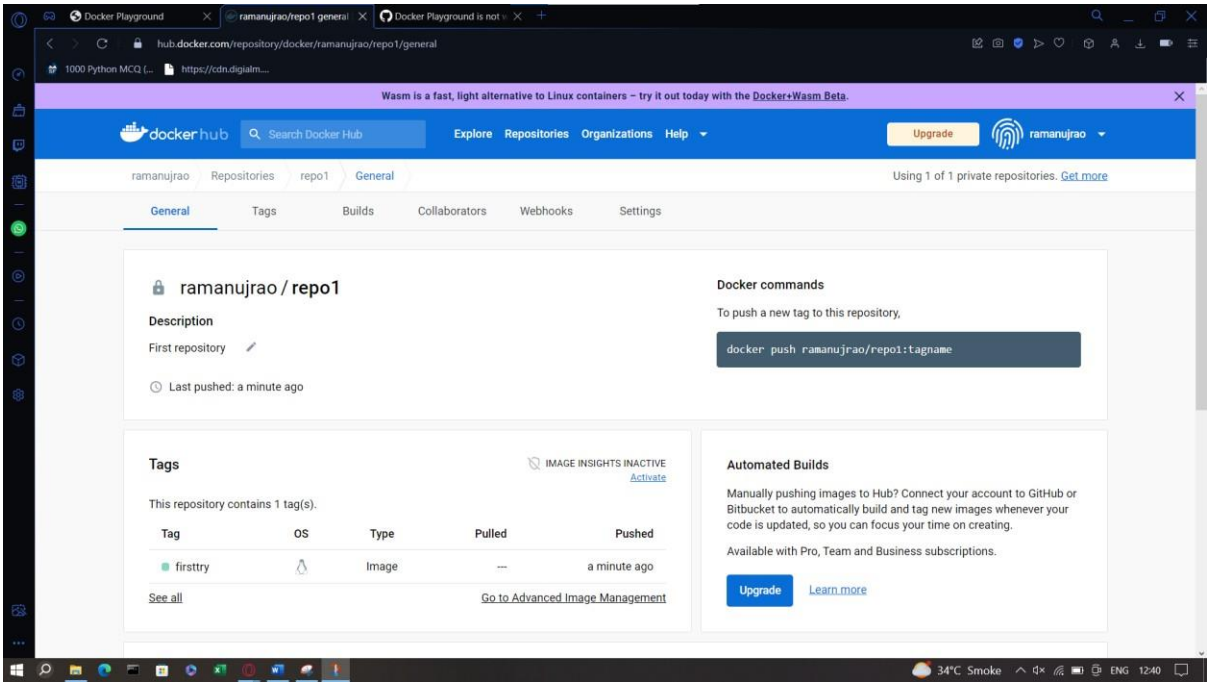
Command: To push image to docker hub account.

docker push ramanujrao/repo1:firsttry

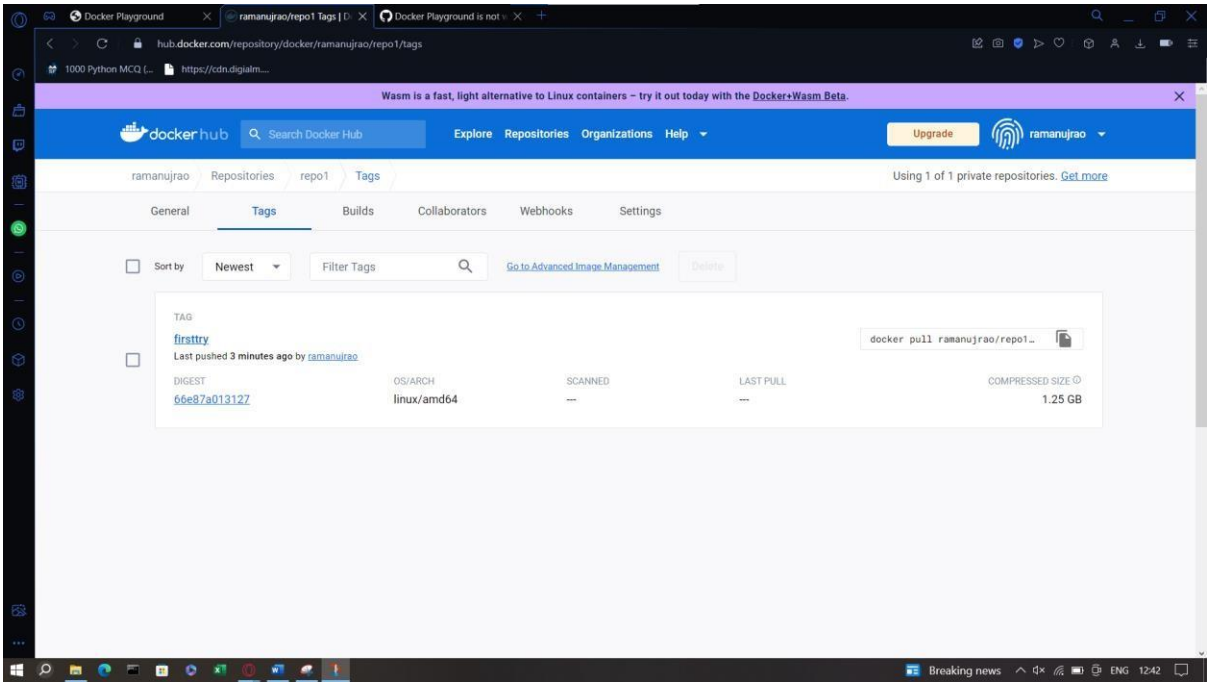
Output:

```
$ docker push ramanujrao/repo1:firsttry
The push refers to repository [docker.io/ramanujrao/repo1]
6c1711f305ff: Mounted from rocker/verse
54cc7e366446: Mounted from rocker/verse
1e82ee1f79d4: Mounted from rocker/verse
e4f6f141a475: Mounted from rocker/verse
94644a51ea10: Mounted from rocker/verse
99e44ef3e8e9: Mounted from rocker/verse
fa35739b43d8: Mounted from rocker/verse
a0f5608ee4a8: Mounted from rocker/verse
e7484d5519b7: Mounted from rocker/verse
202fe64c3ce3: Mounted from rocker/verse
firsttry: digest: sha256:66e87a013127faaf3065f9c9544c47f5fd61484321fec6058f411a0687de4a6f size: 2428
[node1] (local) root@192.168.0.18 ~
$
```

- Check it in Docker Hub now.



- Click on tags and check



Method 2: Build an image then push it to docker and run it.

Command: To create a docker file.

cat > Dockerfile <<EOF
FROM busybox
CMD echo "Hello world! This is my first Docker image."
EOF

Output:

```
[node1] (local) root@192.168.0.18 ~
$ cat > Dockerfile << EOF
> FROM busybox
> CMD echo "Hello world! This is Ramanuj Rao and this is my Docker Image."
> EOF
[node1] (local) root@192.168.0.18 ~
$
```

Command: to build image for a docker file.

docker build –t ramanujrao/repo2

Output:

```
$ docker build -t ramanujrao/repo2  .
Sending build context to Docker daemon   12.8kB
Step 1/2 : FROM busybox
latest: Pulling from library/busybox
1487bff95222: Pull complete
Digest: sha256:c118f538365369207c12e5794c3cbfb7b042d950af590ae6c287ede74f29b7d4
Status: Downloaded newer image for busybox:latest
 ---> bab98d58e29e
Step 2/2 : CMD echo "Hello world! This is Ramanuj Rao and this is my Docker Image."
 ---> Running in 304e5f79022a
Removing intermediate container 304e5f79022a
 ---> 45baae10ed17
Successfully built 45baae10ed17
Successfully tagged ramanujrao/repo2:latest
[node1] (local) root@192.168.0.18 ~
```

Command: To check docker images.

docker images

```
[node1] (local) root@192.168.0.18 ~
$ docker images
REPOSITORY          TAG         IMAGE ID       CREATED              SIZE
ramanujrao/repo2    latest      45baae10ed17   About a minute ago   4.86MB
busybox             latest      bab98d58e29e   4 days ago           4.86MB
rocker/verse        latest      551e1a37de34   8 days ago           3.43GB
ramanujrao/repo1    firsttry    551e1a37de34   8 days ago           3.43GB
[node1] (local) root@192.168.0.18 ~
$
```

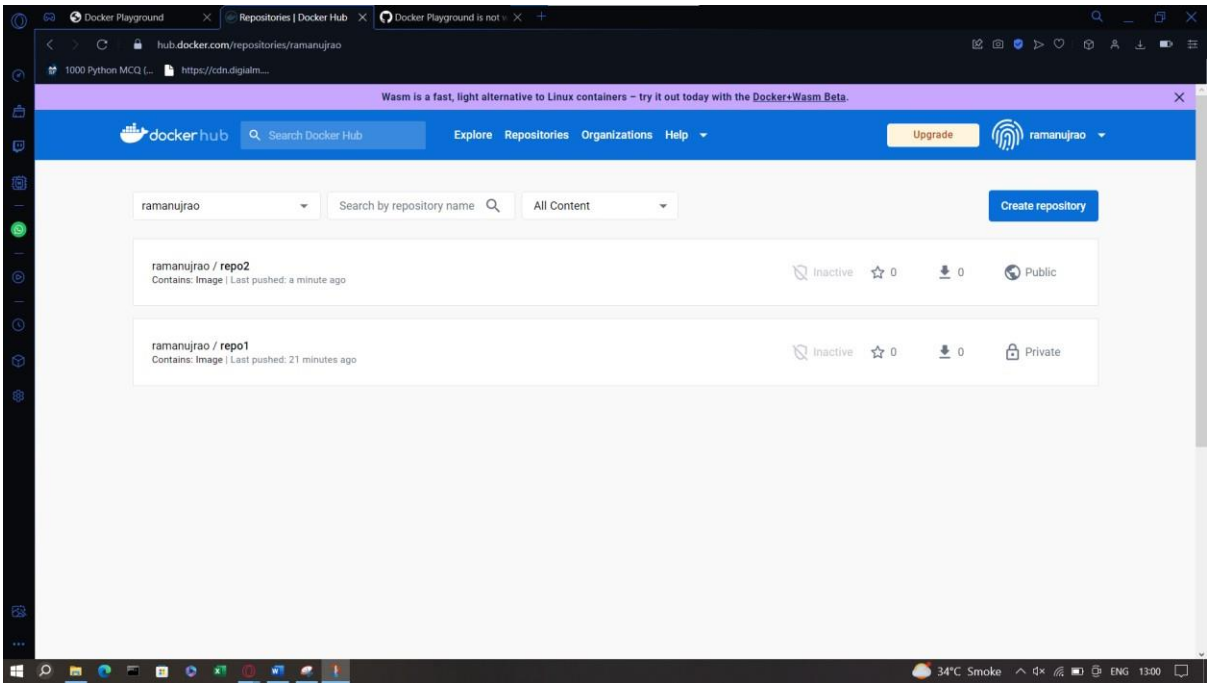
Command: to push image to docker hub.

docker push ramanujrao/repo2 .

Output:

```
[node1] (local) root@192.168.0.18 ~
$ docker push ramanujrao/repo2
Using default tag: latest
The push refers to repository [docker.io/ramanujrao/repo2]
427701cb9c96: Mounted from library/busybox
latest: digest: sha256:bb7a35449124b00ee196485e5020f5d7bc646c49576b7de608d4b9b81cf099bc size: 528
[node1] (local) root@192.168.0.18 ~
$
```

- Now check in Docker Hub.



Command: to run docker image:

docker run ramanujrao/repo2

Output:

```
$ docker run ramanujrao/repo2
Hello world! This is Ramanuj Rao and this is my Docker Image.
[node1] (local) root@192.168.0.18 ~
$
```

Practical 4

Aim: Installing software packages on Docker, Working with Docker Volumes and Networks.

Writeup:

Step 1: Working with Basic Functionalities Docker

[A] : Creating a volume using the **docker volume** command.

```
Microsoft Windows [Version 10.0.19044.2728]
(c) Microsoft Corporation. All rights reserved.

C:\Users\raman>docker volume

Usage:  docker volume COMMAND

Manage volumes

Commands:
  create      Create a volume
  inspect     Display detailed information on one or more volumes
  ls          List volumes
  prune       Remove all unused local volumes
  rm          Remove one or more volumes

Run 'docker volume COMMAND --help' for more information on a command.
```

[B] : Creating the Actual Volume using command **docker volume create myvol1**

```
C:\Users\raman>docker volume create myvol1
myvol1
```

[C] : To list the volume we will write the command **docker volume ls**

```
C:\Users\raman>docker volume ls
DRIVER    VOLUME NAME
local     myvol1
```

[D] : To get the details of our volume we have to write the command **docker volume inspect myvol1**

```
C:\Users\raman>docker volume inspect myvol1
[
    {
        "CreatedAt": "2023-03-18T08:28:07Z",
        "Driver": "local",
        "Labels": {},
        "Mountpoint": "/var/lib/docker/volumes/myvol1/_data",
        "Name": "myvol1",
        "Options": {},
        "Scope": "local"
    }
]
```

[E] **:** To remove your volume you can use the command **docker volume rm myvol1**
Also using **docker volume ls** to confirm that the volume has been removed.

```
C:\Users\raman>docker volume rm myvol1
myvol1

C:\Users\raman>docker volume ls
DRIVER    VOLUME NAME

C:\Users\raman>
```

Step 2: Working with Docker Network

[A] : To Connect a container to a network using command **docker network create Vol**

```
C:\Users\raman>docker network create Vol
28deade85cb4918dcccf3dab6905c56d63c27bb9c9c1ca2638c829336f851503
```

[B] : To get details of a container from a network using command **docker network inspect Vol**

```
C:\Users\raman>docker network inspect Vol
[
    {
        "Name": "Vol",
        "Id": "28deade85cb4918dcccf3dab6905c56d63c27bb9c9c1ca2638c829336f851503",
        "Created": "2023-04-07T10:55:14.586981516Z",
        "Scope": "local",
        "Driver": "bridge",
        "EnableIPv6": false,
        "IPAM": {
            "Driver": "default",
            "Options": {},
            "Config": [
                {
                    "Subnet": "172.18.0.0/16",
                    "Gateway": "172.18.0.1"
                }
            ]
        },
        "Internal": false,
        "Attachable": false,
        "Ingress": false,
        "ConfigFrom": {
            "Network": ""
        },
        "ConfigOnly": false,
        "Containers": {},
        "Options": {},
        "Labels": {}
    }
]
```

[C] : To see the list of networks use command **docker network ls**

```
C:\Users\raman>docker network ls
NETWORK ID     NAME      DRIVER    SCOPE
28deade85cb4   Vol       bridge    local
008c69b55069   bridge    bridge    local
26198ed8c76c   host      host      local
aed51ccdff48   none      null      local
```

[D] : To remove all unused networks using the command **docker network prune**
Also using **docker network ls** to confirm the removal of the network.

```
C:\Users\raman>docker network prune
WARNING! This will remove all custom networks not used by at least one container.
Are you sure you want to continue? [y/N] y
Deleted Networks:
Vol


C:\Users\raman>docker network ls
NETWORK ID     NAME      DRIVER    SCOPE
008c69b55069   bridge    bridge    local
26198ed8c76c   host      host      local
aed51ccdff48   none      null      local
```

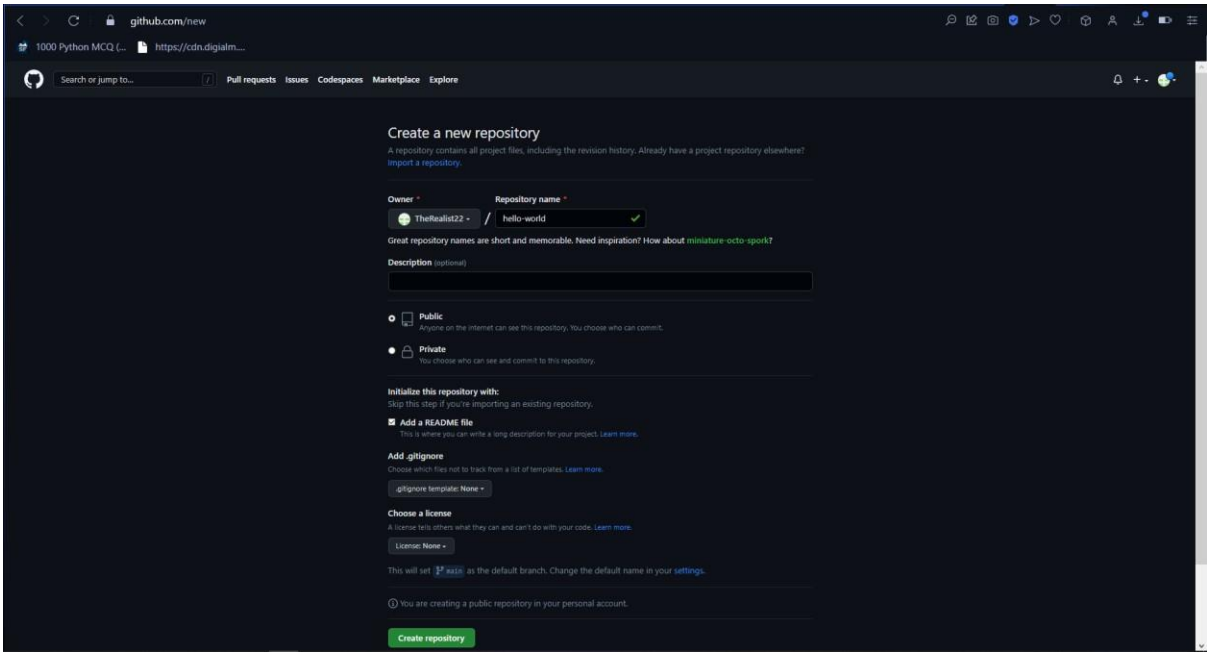
Practical 5

Aim: Working with Circle CI for continuous integration.

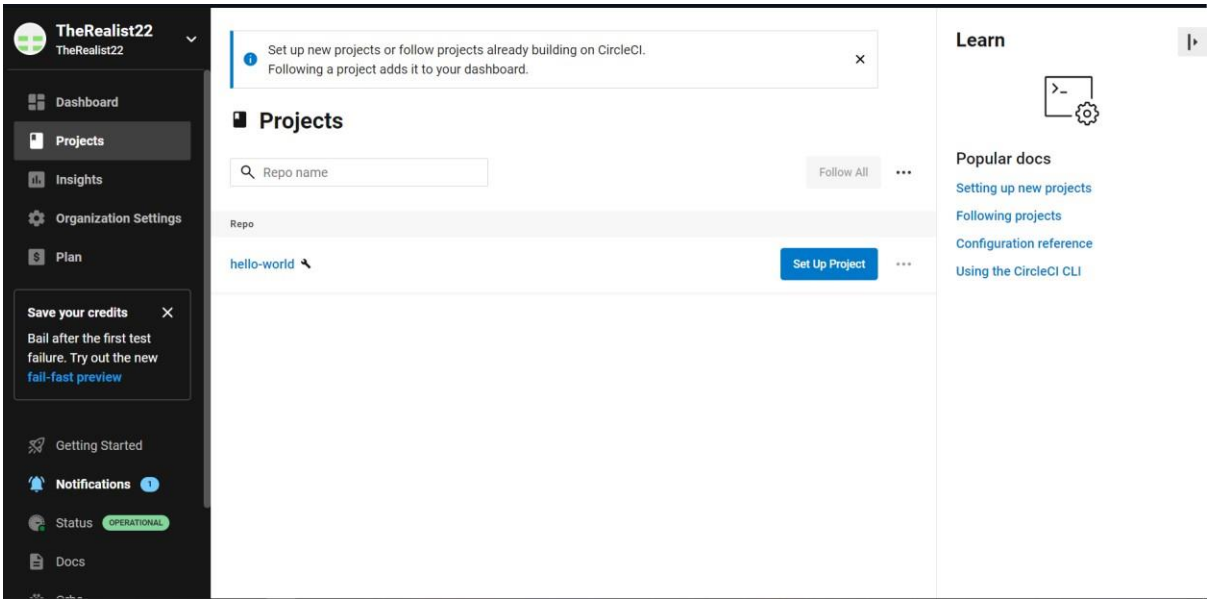
Writeup:

Step 1: Create a repository

- Log in to GitHub and begin the process to create a new repository.
- Enter a name for your repository (for example, hello-world).
- Select the option to initialize the repository with a README file.
- Finally, click Create repository.
- There is no need to add any source code for now.

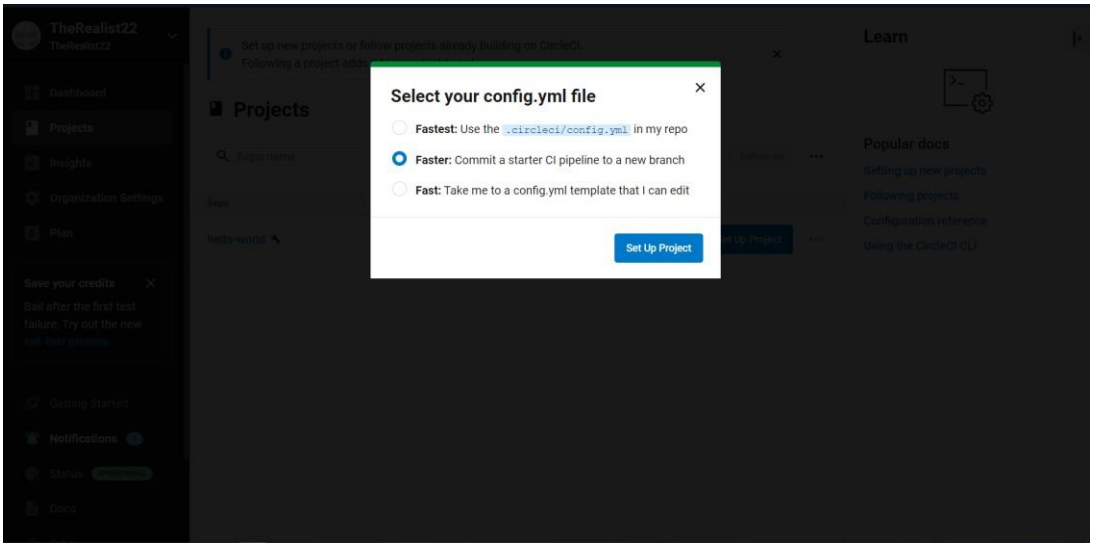


- Login to Circle CI https://app.circleci.com/ Using GitHub Login, Once logged in navigate to Projects.



Step 2: Setup CircleCI

- Navigate to the CircleCI Projects page. If you created your new repository under an organization, you will need to select the organization name.
- You will be taken to the Projects dashboard. On the dashboard, select the project you want to set up (hello-world).
- Select the option to commit a starter CI pipeline to a new branch, and click Set Up Project. This will create a file.circleci/config.yml at the root of your repository on a new branch called circleci-project-setup.

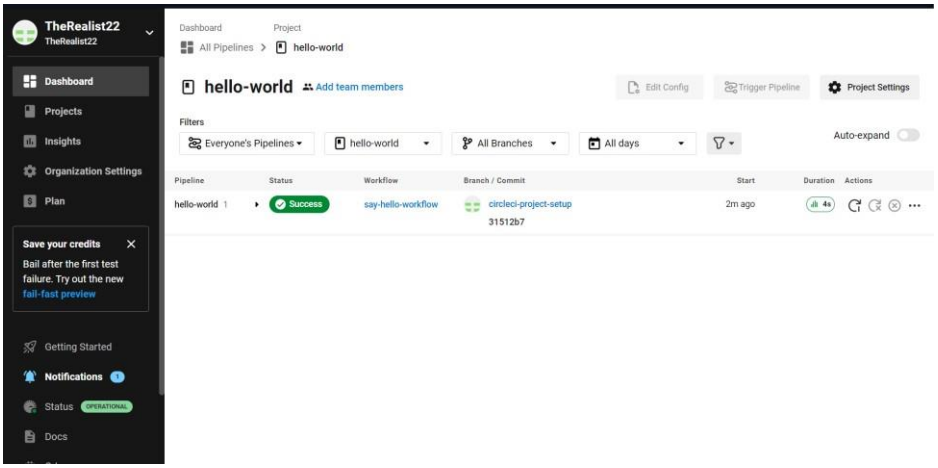


Step 3: First Pipeline

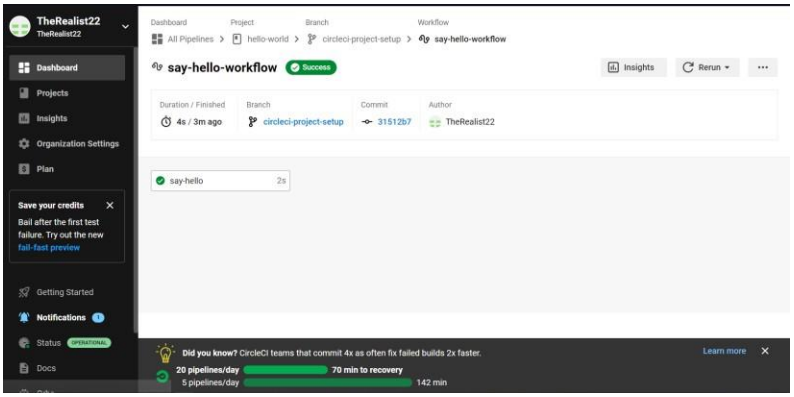
- On your project's pipeline page, click the green Success button, which brings you to the workflow that ran (say-hello-workflow).

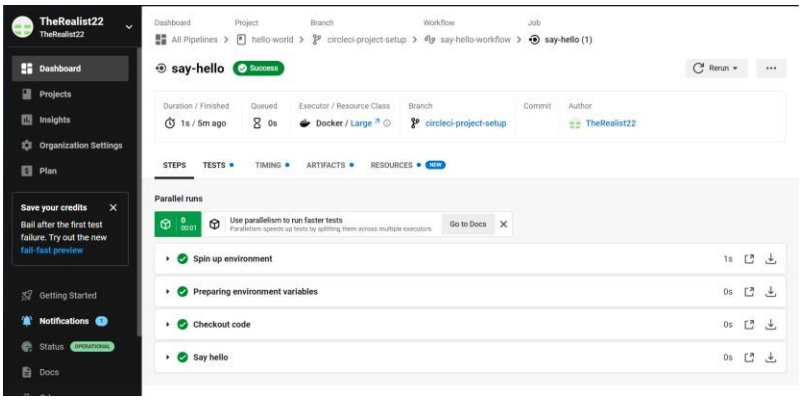
- Within this workflow, the pipeline ran one job, called say-hello. Click say-hello to see the steps in this job:
  a. Spin up environment
  b. Preparing environment variables
  c. Checkout code
  d. Say hello

- Now select the "say-hello-workflow" to the right of Success status column.

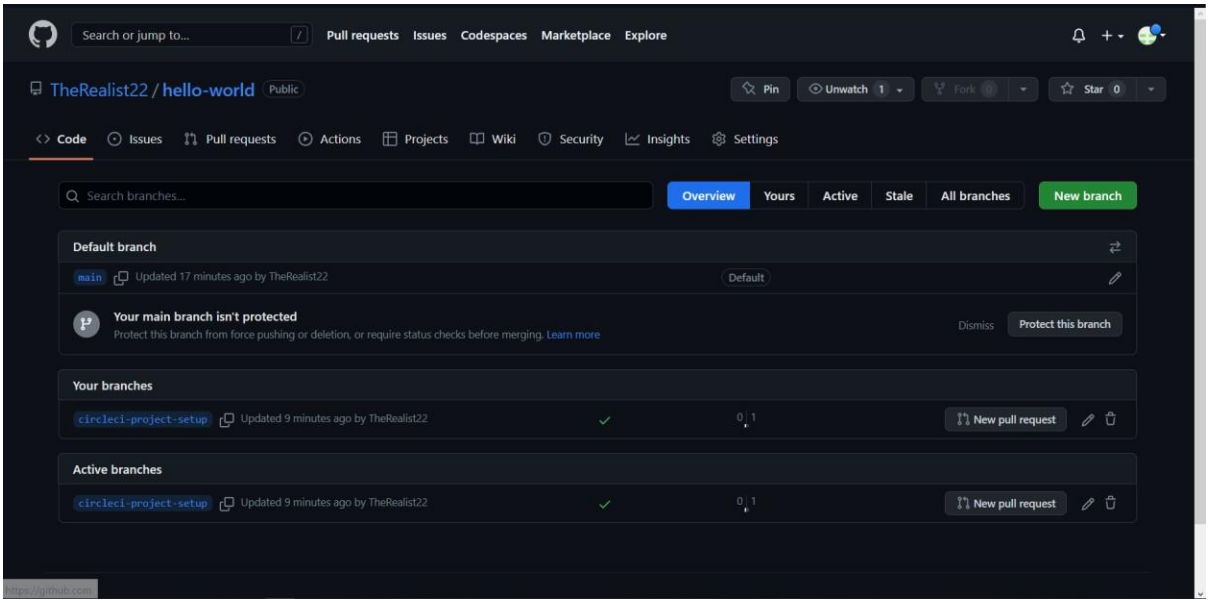


- Select “say-hello” Job with a green tick.



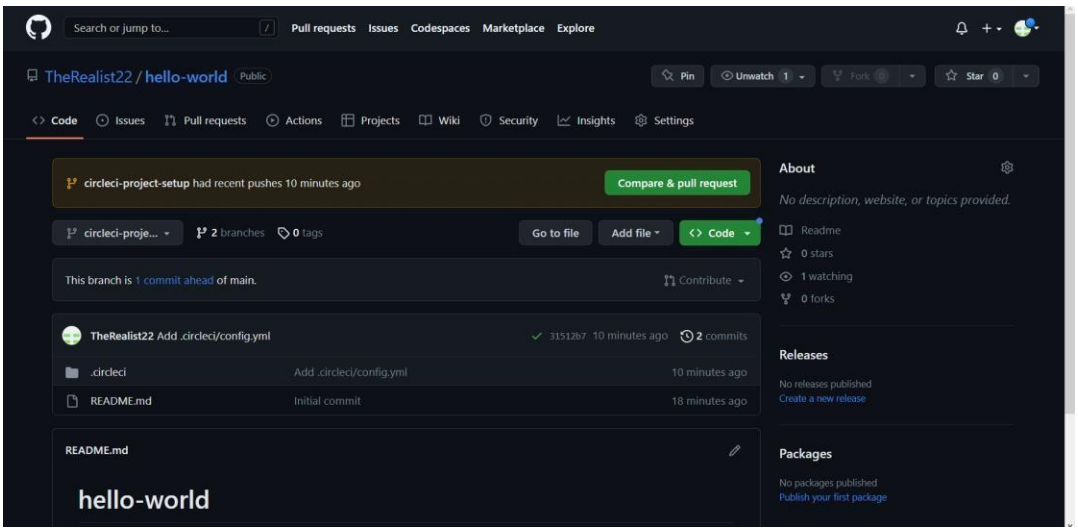


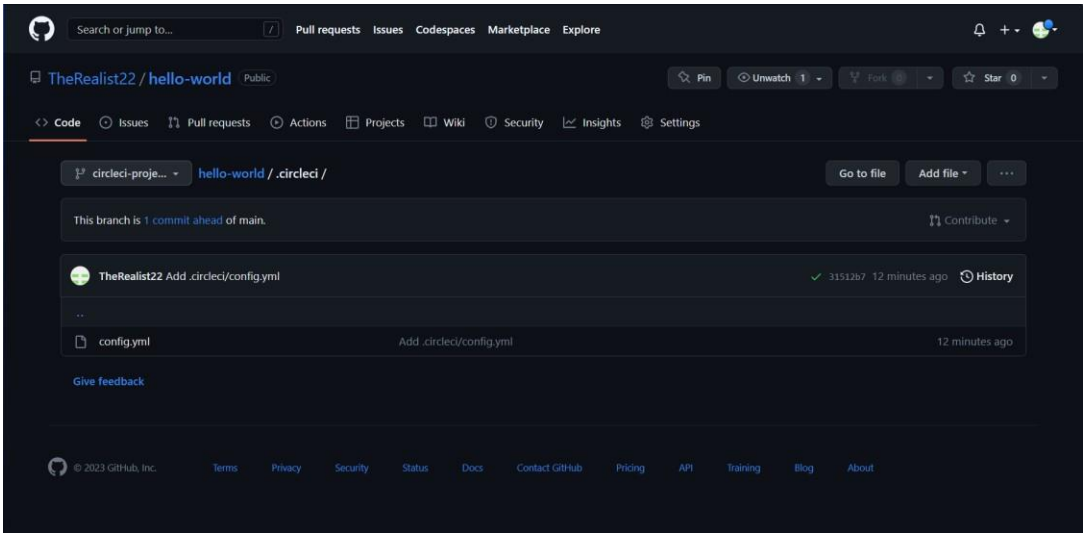
- Select Branch and option circleci-project-setup

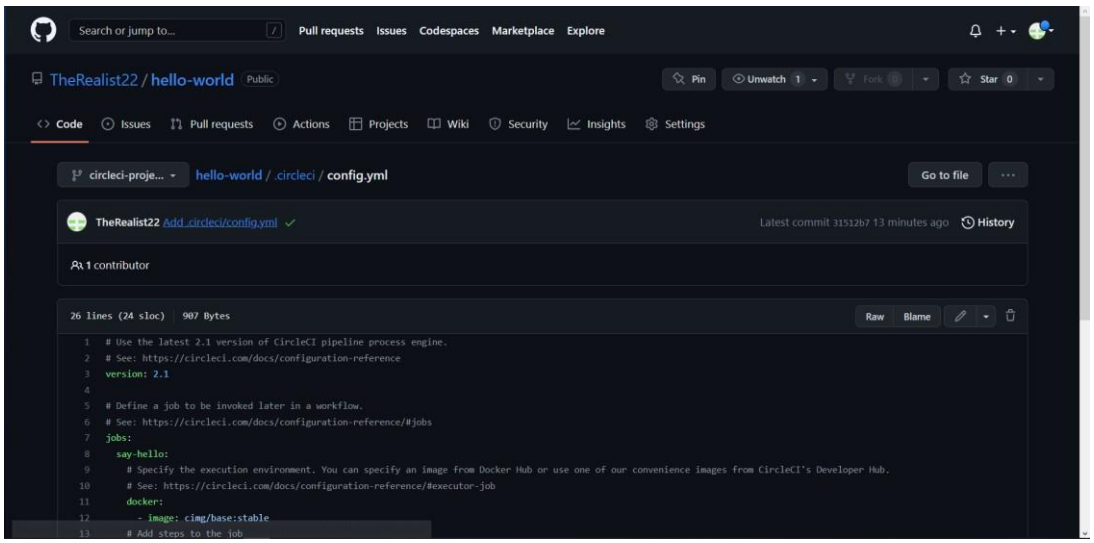


Step 4: Break your build.

- In this section, you will edit the .circleci/config.yml file and see what happens if a build does not complete successfully.
- It is possible to edit files directly on GitHub.



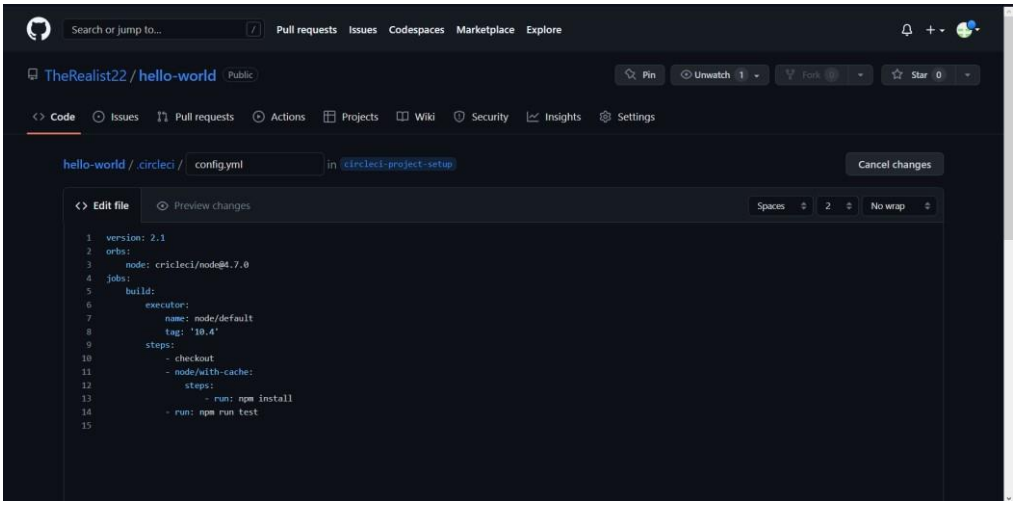




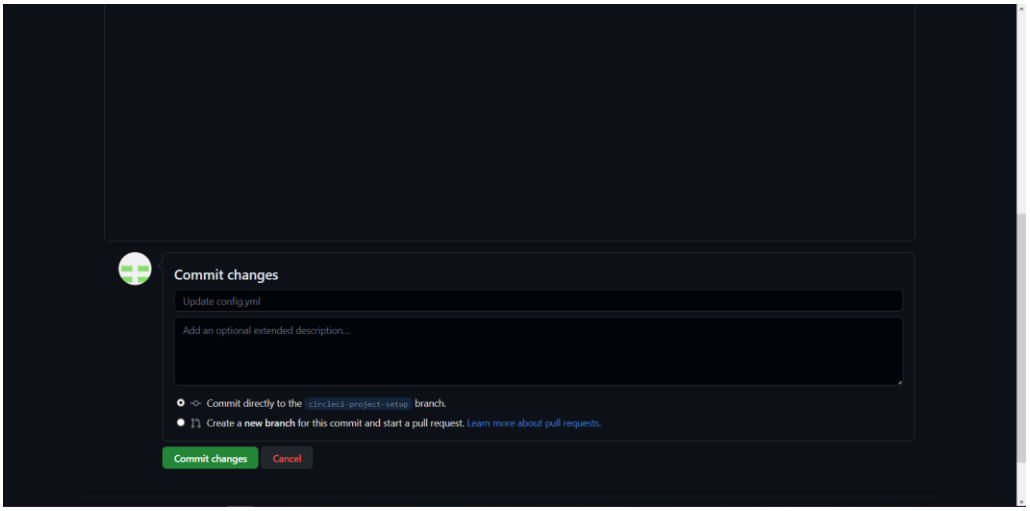
- Replace the existing code with new code:

```yaml
version: 2.1
orbs:
    node: cricleci/node@4.7.0
jobs:
    build:
        executor:
            name: node/default
            tag: '10.4'
        steps:
            - checkout
            - node/with-cache:
                steps:
                    - run: npm install
            - run: npm run test
```

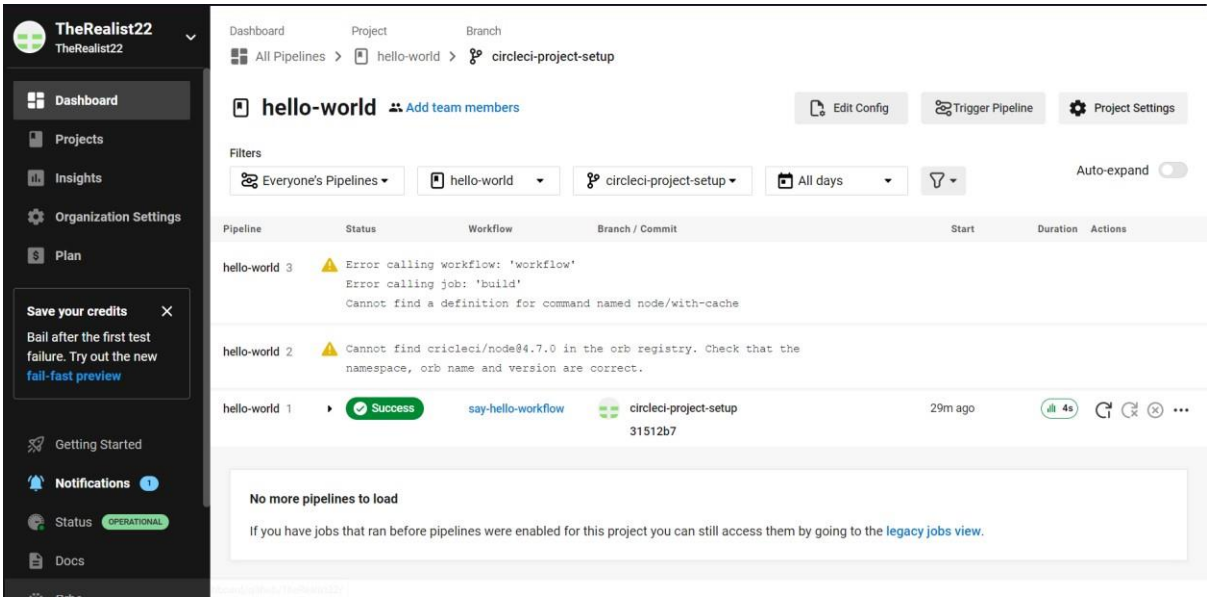
- The Github File Editor should look like this



- Scroll down and Commit your changes on GitHub



- After committing your changes, then return to the Projects page in CircleCI. You should see a new pipeline running... and it will fail! What's going on? The Node orb runs some common Node tasks. Because you are working with an empty repository, running npm run test, a Node script, causes the configuration to fail. To fix this, you need to set up a Node project in your repository.



Step 5: Use Workflows

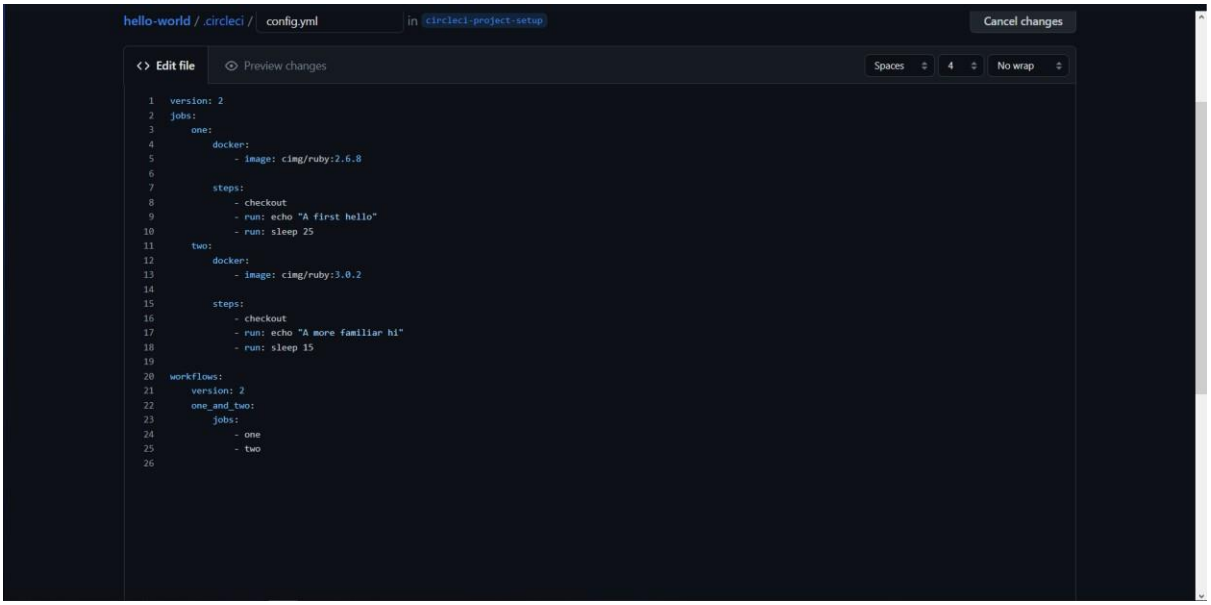
- You do not have to use orbs to use CircleCI. The following example details how to create a custom configuration that also uses the workflow feature of CircleCI.
- Take a moment and read the comments in the code block below. Then, to see workflows in action, edit your .circleci/config.yml file and copy and paste the following text into it.

Code:

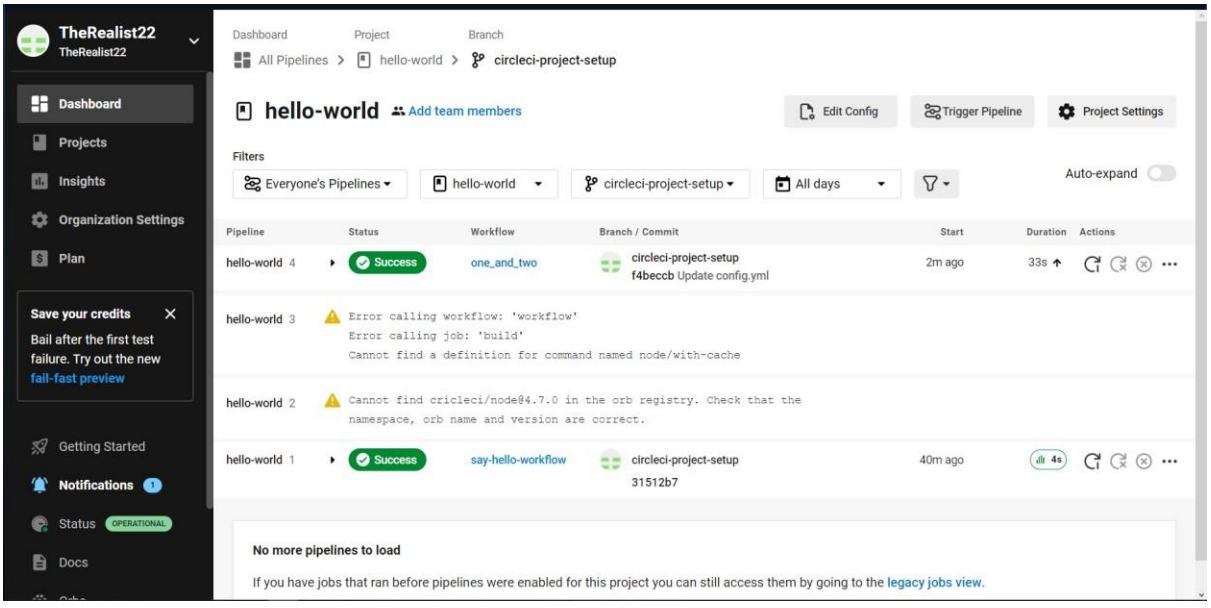
```
version: 2
jobs:
    one:
        docker:
            - image: cimg/ruby:2.6.8

        steps:
            - checkout
            - run: echo "A first hello"
            - run: sleep 25
    two:
        docker:
            - image: cimg/ruby:3.0.2

        steps:
            - checkout
            - run: echo "A more familiar hi"
            - run: sleep 15

workflows:
    version: 2
    one_and_two:
        jobs:
```

```
            - one
            - two
```

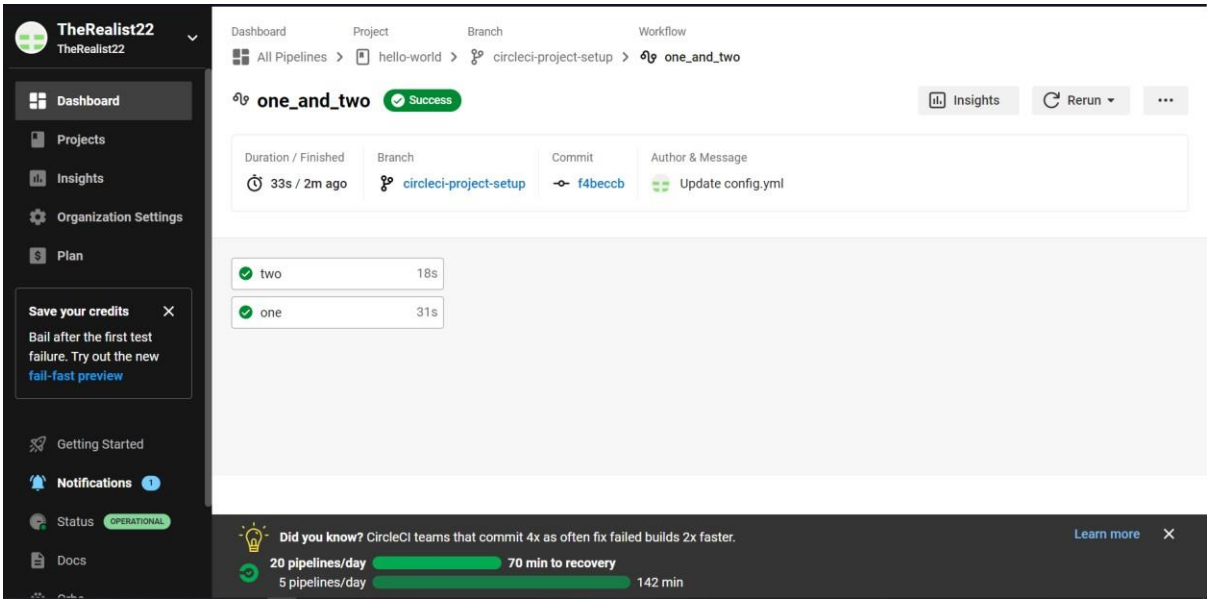
- Commit these changes to your repository and navigate back to the CircleCI Pipelines page. You should see your pipeline running.



- Click on the running pipeline to view the workflow you have created. You should see that two jobs ran (or are currently running!) concurrently.



- Click on **one_and_two** workflow.



Step 6: Add some changes to use workspaces.

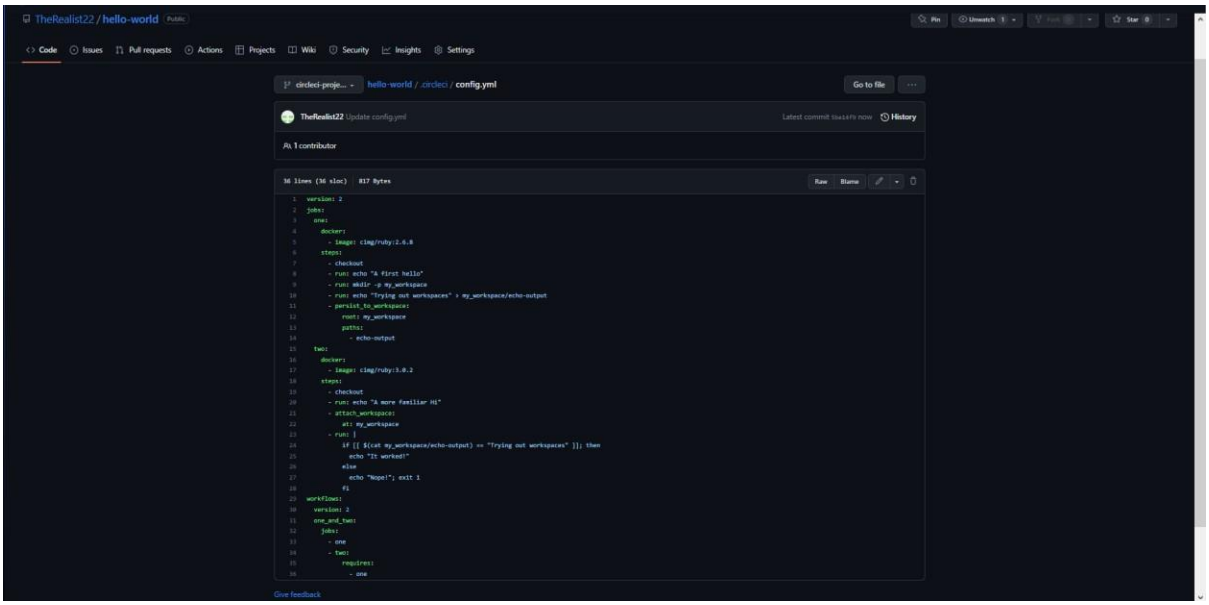
- Each workflow has an associated workspace which can be used to transfer files to downstream jobs as the workflow progresses.
- You can use workspaces to pass along data that is unique to this run and which is needed for downstream jobs.
- Try updating config.yml to the following:

Code:

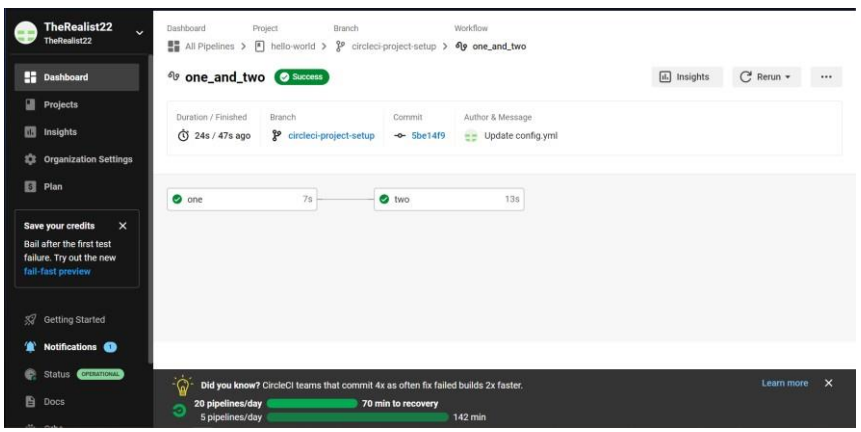
```
version: 2
jobs:
    one:
        docker:
            - image: cimg/ruby:3.0.2

        steps:
            - checkout
            - run: echo "A first hello"
            - run: mkdir -p my_workspace
            - run: echo "Trying out workspaces" > my_workspace/echo-output
            - persist_to_workspace:
                root: my_workspace

                paths:
                    - echo-output

    two:
        docker:
            - image: cimg/ruby:3.0.2

        steps:
            - checkout
            - run: echo "A more familiar hi"
```

```
            - attach_workspace:
                at: my_workspace

            - run: |
                if [[ $(cat my_workspace/echo-output) == "Trying out
workspaces"]]; then
                    echo "It worked!";

workflows:
    version: 2
    one_and_two:
        jobs:
            - one
            - two:
                requires:
                    - one
```

- Updated config.yml in GitHub file editor should be updated like this



- Finally, your workflow with the jobs running should look like this



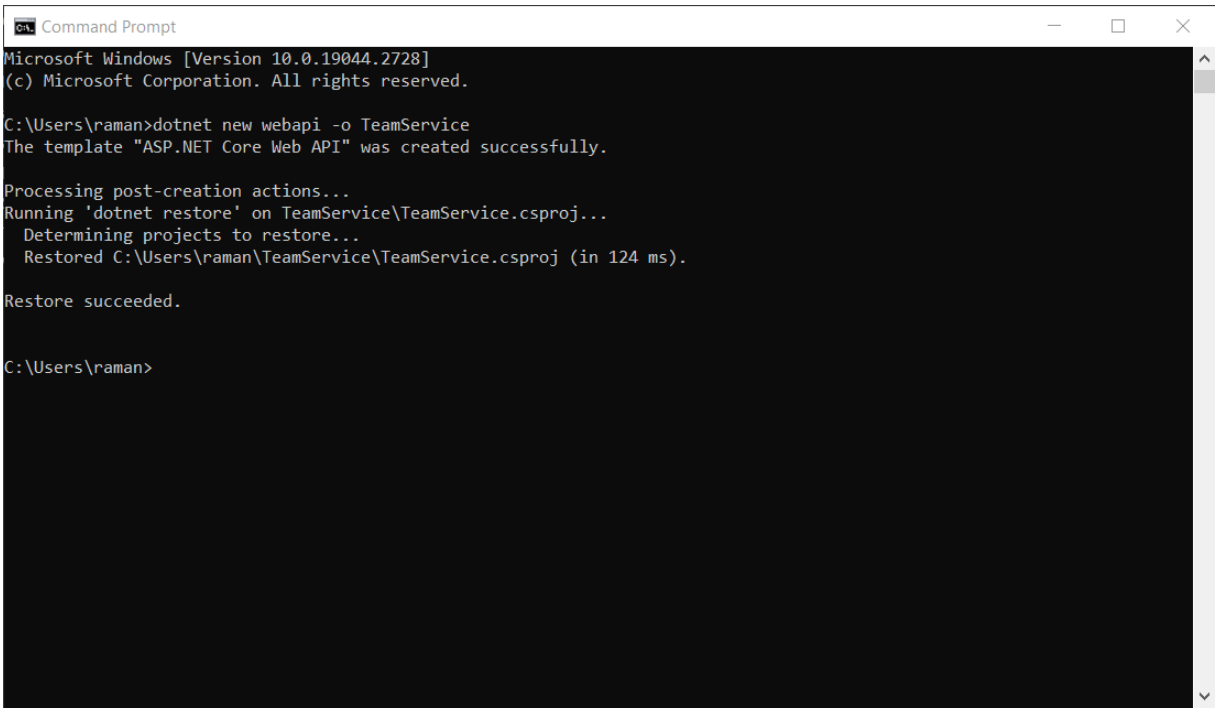
Practical 6

Aim: Creating Microservice with ASP.NET Core.

Writeup:

Step 1: Create new project.

Command: **dotnet new webapi -o TeamService**



Step 2: Remove existing weatherforecast files both model and controller files.

Step 3: Add new files as follows:

[A] : Add Member.cs to "D:\TeamService\Models" folder.

```
using System;
namespace TeamService.Models
{
    public class Member
    {
        public Guid ID
        {
            get;
            set;
        }

        public string FirstName
        {
            get;
            set;
        }

        public string LastName
        {
```

```
            get;
            set;
        }

        public Member()
        {

        }

        public Member(Guid id) : this()
        {
            this.ID = id;
        }

        public Member(string firstName, string lastName, Guid id) : this(id)
        {
            this.FirstName = firstName;
            this.LastName = lastName;
        }

        public override string ToString()
        {
            return this.LastName;
        }
    }
}
```

[B] : Add Team.cs to "D:\TeamService\Models" folder.

```
using System;
using System.Collections.Generic;

namespace TeamService.Models

{
    public class Team
    {
        public string Name
        {
            get;
            set;
        }

        public Guid ID
        {
            get;
            set;
        }
```

```
        public ICollection<Member> Members
        {
            get;
            set;
        }

        public Team()
        {
            this.Members = new List<Member>();
        }

        public Team(string name) : this()
        {
            this.Name = name;
        }

        public Team (string name, Guid id) : this(name)
        {
            this.ID = id;
        }

        public override string ToString()
        {
            return this.Name;
        }
    }
}
```

[C] : Add TeamsController.cs file to “D:\TeamService\Controllers” folder.

```
using System;
using Microsoft.AspNetCore.Hosting;
using Microsoft.AspNetCore.Builder;
using Microsoft.AspNetCore.Mvc;
using System.Collections.Generic;
using System.Linq;
using TeamService.Models;
using System.Threading.Tasks;
using TeamService.Persistence;

namespace TeamService
{
    [Route("[controller]")]
    public class TeamsController : Controller
    {
        ITeamRepository repository;
        public TeamsController(ITeamRepository repo)
        {
            repository = repo;
```

```
        }

        [HttpGet]
        public virtual IActionResult GetAllTeams()
        {
            return this.Ok(repository.List());
        }

        [HttpGet("{id}")]
        public IActionResult GetTeam(Guid id)
        {
            Team team = repository.Get(id);
            if (team != null)
            {
                return this.Ok(team);
            }

            else
            {
                return this.NotFound();
            }
        }

        [HttpPost]
        public virtual IActionResult CreateTeam ([FromBody]Team newTeam)
        {
             repository.Add(newTeam);
             return this.Created($"/teams/{newTeam.ID}", newTeam);
        }

        [HttpPut("{id}")]
        public virtual IActionResult UpdateTeam([FromBody]Team team, Guid id)
        {
            team.ID = id;
            if(repository.Update(team) == null)
            {
                return this.NotFound();
            }

            else
            {
                return this.Ok(team);
            }
        }

        [HttpDelete("{id}")]
        public virtual IActionResult DeleteTeam(Guid id)
        {
```

```
            Team team = repository.Delete(id);
            if(team == null)
            {
                return this.NotFound();
            }

            else
            {
                return this.Ok(team.ID);
            }
        }
    }
}
```

[D] : Add MembersController.cs file to “D:\TeamService\Controllers” folder.

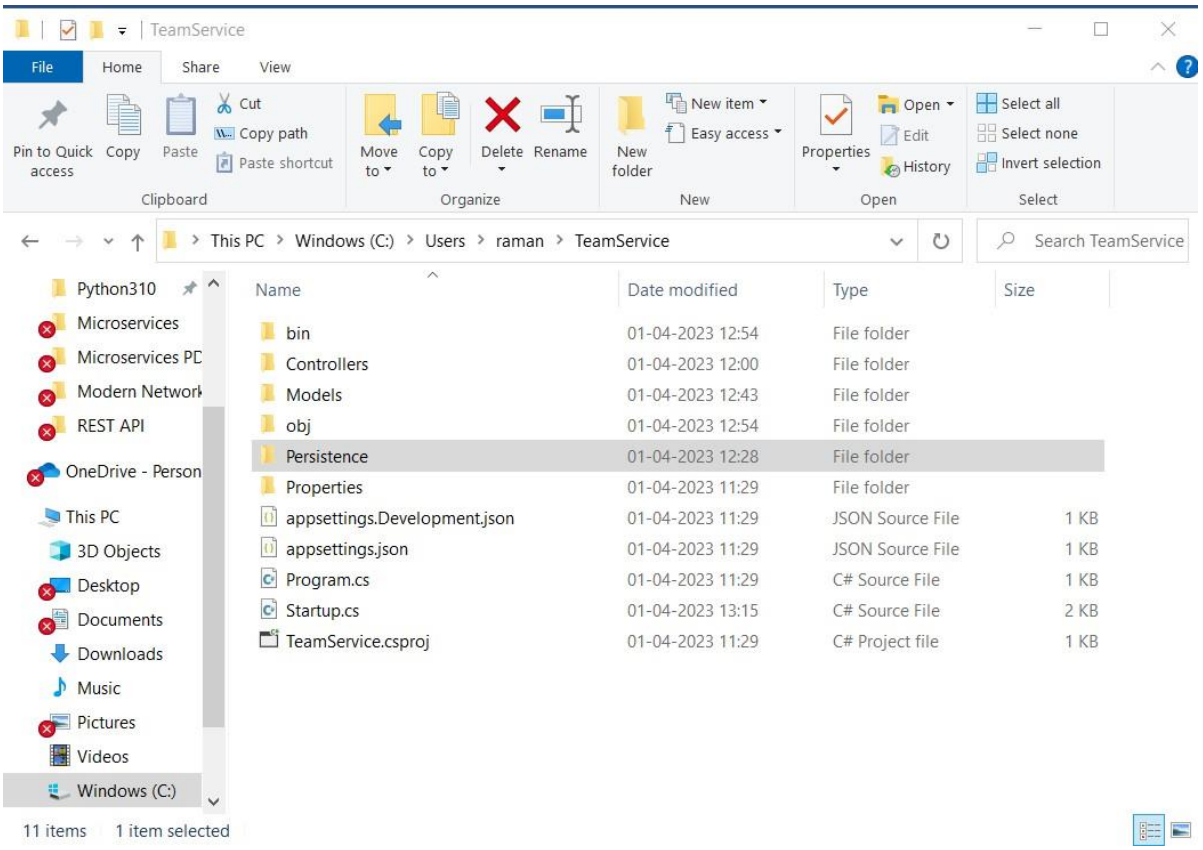
```
using System;
using Microsoft.AspNetCore.Hosting;
using Microsoft.AspNetCore.Builder;
using Microsoft.AspNetCore.Mvc;
using System.Collections.Generic;
using System.Linq;
using TeamService.Models;
using System.Threading.Tasks;
using TeamService.Persistence;

namespace TeamService

{
    [Route("/teams/{teamId}/[controller]")]
    public class MembersController : Controller
    {
        ITeamRepository repository;
        public MembersController(ITeamRepository repo)
        {
            repository = repo;
        }

        [HttpGet]
        public virtual IActionResult GetMembers(Guid teamID)
        {
            Team team = repository.Get(teamID);
            if(team == null)
            {
                return this.NotFound();
            }

            else
            {
```

```
                return this.Ok(team.Members);
            }
        }

        [HttpGet]
        [Route("/teams/{teamId}/[controller]/{memberId}")]
        public virtual IActionResult GetMember(Guid teamID, Guid memberId)
        {
            Team team = repository.Get(teamID);

            if(team == null)
            {
                return this.NotFound();
            }

            else
            {
                var q = team.Members.Where(m => m.ID == memberId);
                if(q.Count() < 1)
                {
                    return this.NotFound();
                }

                else
                {
                    return this.Ok(q.First());
                }
            }
        }

        [HttpPut]
        [Route("/teams/{teamId}/[controller]/{memberId}")]
        public virtual IActionResult UpdateMember ([FromBody]Member
updatedMember, Guid teamID, Guid memberId)
        {
            Team team = repository.Get(teamID);
            if(team == null)
            {
                return this.NotFound();
            }

            else
            {
                var q = team.Members.Where(m => m.ID == memberId);
                if(q.Count() < 1)
                {
                    return this.NotFound();
                }
```

```
                else
                {
                    team.Members.Remove(q.First());
                    team.Members.Add(updatedMember);
                    return this.Ok();
                }
            }
        }

        [HttpPost]
        public virtual IActionResult CreateMember([FromBody]Member newMember,
Guid teamID)
        {
            Team team = repository.Get(teamID);
            if(team == null)
            {
                return this.NotFound();
            }

            else
            {
                team.Members.Add(newMember);
                var teamMember = new {TeamID = team.ID, MemberID =
newMember.ID};
                return
this.Created($"/teams/{teamMember.TeamID}/[controller]/{teamMember.MemberID}",
teamMember);
            }
        }

        [HttpGet]
        [Route("/members/{memberId}/team")]
        public IActionResult GetTeamForMember(Guid memberId)
        {
            var teamId = GetTeamIdForMember(memberId);
            if (teamId != Guid.Empty)
            {
                return this.Ok(new {TeamID = teamId});
            }

            else
            {
                return this.NotFound();
            }
        }

        private Guid GetTeamIdForMember(Guid memberId)
```

```
        {
            foreach (var team in repository.List())
            {
                var member = team.Members.FirstOrDefault(m => m.ID ==
memberId);
                if(member != null)
                {
                    return team.ID;
                }
            }

            return Guid.Empty;
        }
    }
}
```

Step 4: Create folder “D:\TeamService\Persistence”.



Step 5: Add file ITeamReposiroty.cs in “D:\TeamService\Persistence” folder.

```
using System;
using System.Collections.Generic;
using TeamService.Models;

namespace TeamService.Persistence
{
    public interface ITeamRepository
    {
        IEnumerable <Team> List();
        Team Get(Guid id);
        Team Add(Team team);
        Team Update(Team team);
        Team Delete(Guid id);
    }
}
```

Step 6: Add MemoryTeamRepository.cs in “D:\TeamService\Persistence” folder

```
using System;
using System.Collections.Generic;
using System.Linq;
using TeamService;
using TeamService.Models;

namespace TeamService.Persistence
{
    public class MemoryTeamRepository : ITeamRepository
    {
        protected static ICollection<Team> teams;
        public MemoryTeamRepository()
        {
            if(teams == null)
            {
                teams = new List<Team>();
            }
        }


        public MemoryTeamRepository(ICollection<Team> teams)
        {
            MemoryTeamRepository.teams = teams;
        }

        public IEnumerable<Team> List()
        {
            return teams;
        }
```

```
        public Team Get(Guid id)
        {
            return teams.FirstOrDefault(t => t.ID == id);
        }

        public Team Update(Team t)
        {
            Team team = this.Delete(t.ID);
            if(team != null)
            {
                team = this.Add(t);
            }

            return team;
        }

        public Team Add(Team team)
        {
            teams.Add(team);
            return team;
        }

        public Team Delete(Guid id)
        {
            var q = teams.Where(t => t.ID == id);
            Team team = null;
            if(q.Count() > 0)
            {
                team = q.First();
                teams.Remove(team);
            }

            return team;
        }
    }
}
```

Step 7: Add following line to Startup.cs in public void ConfigureServices(IServiceCollection services) method.

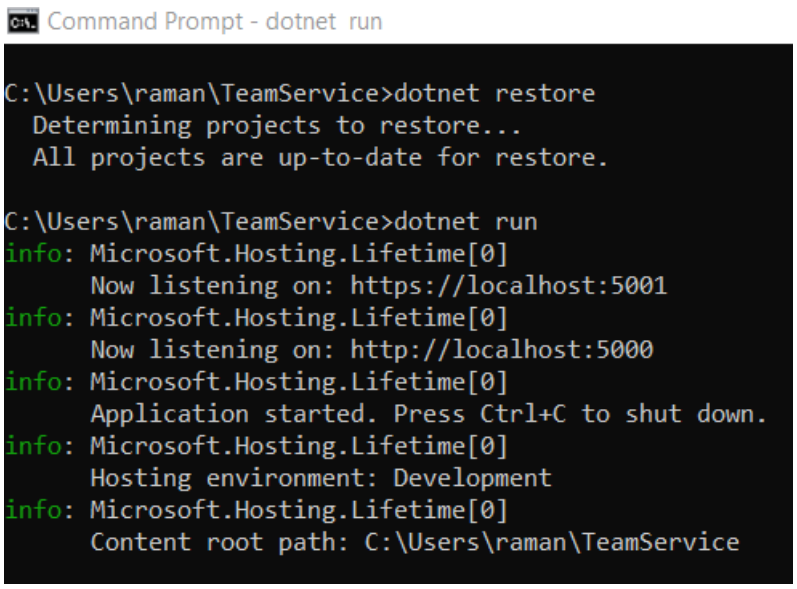
```
services.AddScoped<ITeamRepository, MemoryTeamRepository>();
```

Step 8: Now open two command prompts to run this project.

Step 9: On Command prompt 1 (go inside folder teamservice first)

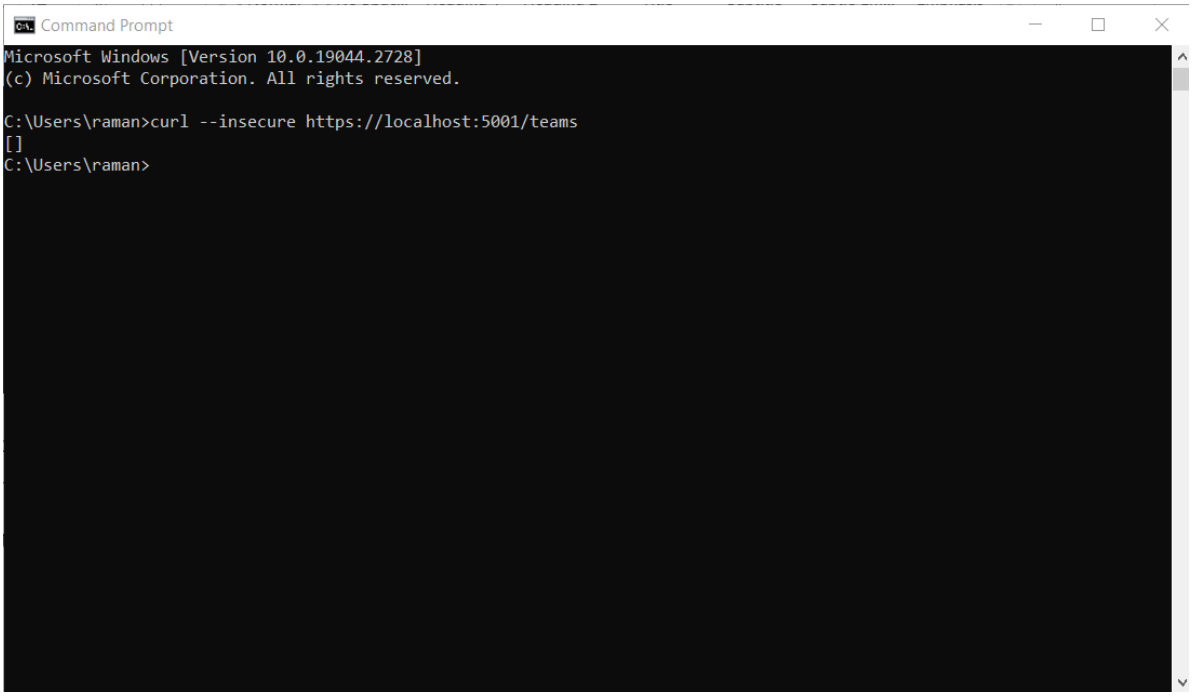
Commands:

dotnet run



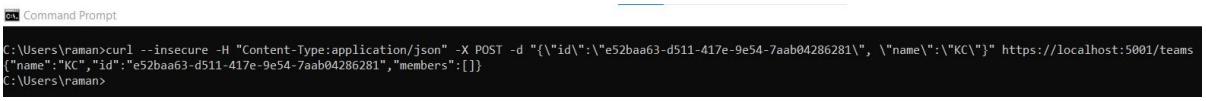
Step 10: On command prompt 2
Command: To get all teams

curl --insecure https://localhost:5001/teams



Step 11: On command prompt 2
Command : To create new team

curl --insecure -H "Content-Type:application/json" –X POST –d "{\"id\":\"e52baa63-d511-417e-9e54-7aab04286281\", \"name\":\"KC\"}" https://localhost:5001/teams



Step 12: On command prompt 2
Command : To create one more new team

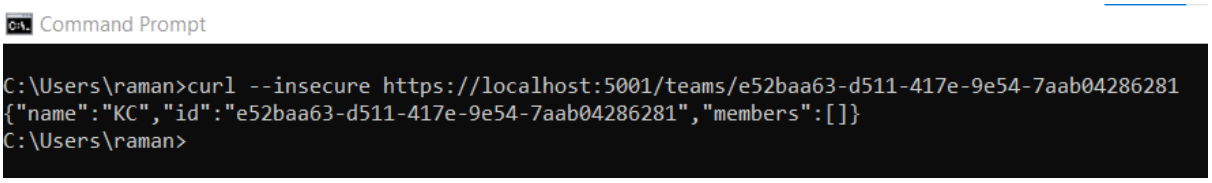
curl --insecure -H "Content-Type:application/json" –X POST –d "{\"id\":\"e12baa63-d511-417e-9e54-7aab04286281\", \"name\":\"MSC Part1\"}" https://localhost:5001/teams

Step 13: On command prompt 2
Command : To get all teams

curl --insecure https://localhost:5001/teams

Step 14: On command prompt 2
Command : To get single team with team-id as parameter

curl --insecure https://localhost:5001/teams/e52baa63-d511-417e-9e54-7aab04286281



Step 15: On command prompt 2
Command : To update team details (change name of first team from "KC" to "KC IT DEPT")

curl --insecure -H "Content-Type:application/json" –X PUT –d "{\"id\":\"e52baa63-d511-417e-9e54-7aab04286281\", \"name\":\"KC IT DEPT\"}" https://localhost:5001/teams/e52baa63-d511-417e-9e54-7aab04286281

Step 16: On command prompt 2
Command : To delete team

curl --insecure -H "Content-Type:application/json" –X DELETE https://localhost:5001/teams/e52baa63-d511-417e-9e54-7aab04286281

Command Prompt

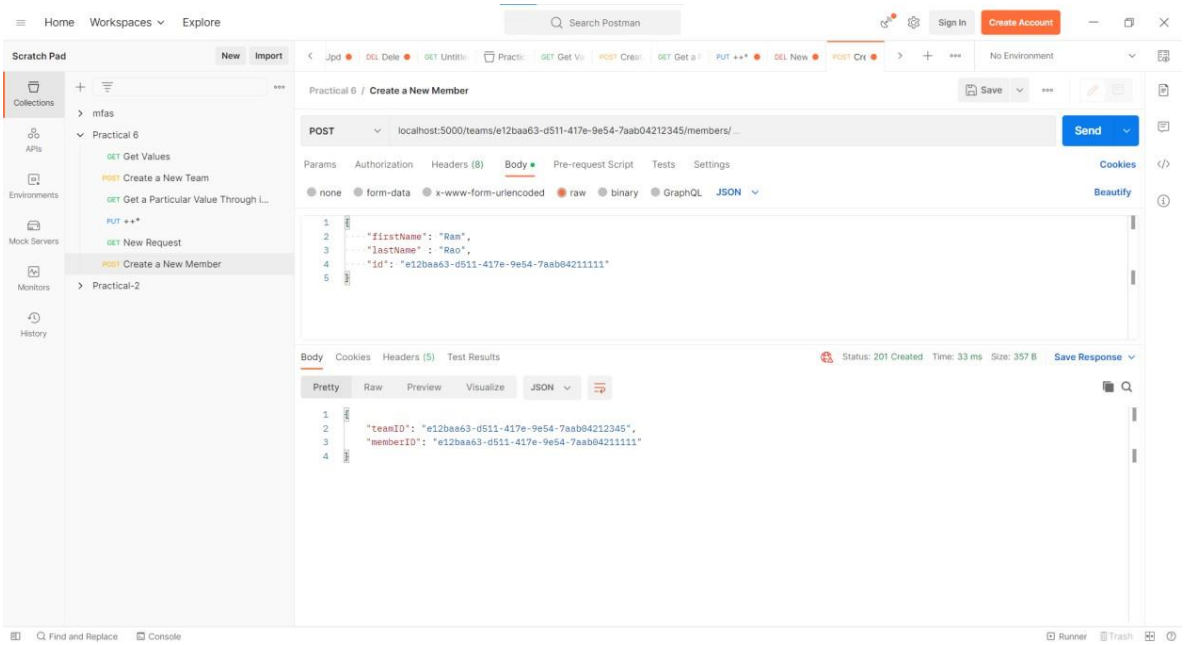
```
C:\Users\raman>curl --insecure -H "Content-Type:application/json" -X DELETE https://localhost:5001/teams/e52baa63-d511-417e-9e54-7aab04286281
"e52baa63-d511-417e-9e54-7aab04286281"
C:\Users\raman>
```

Step 17: Confirm with get all teams now it shows only one team (first one is deleted)
Command: **curl –insecure https://localhost:5001/teams**

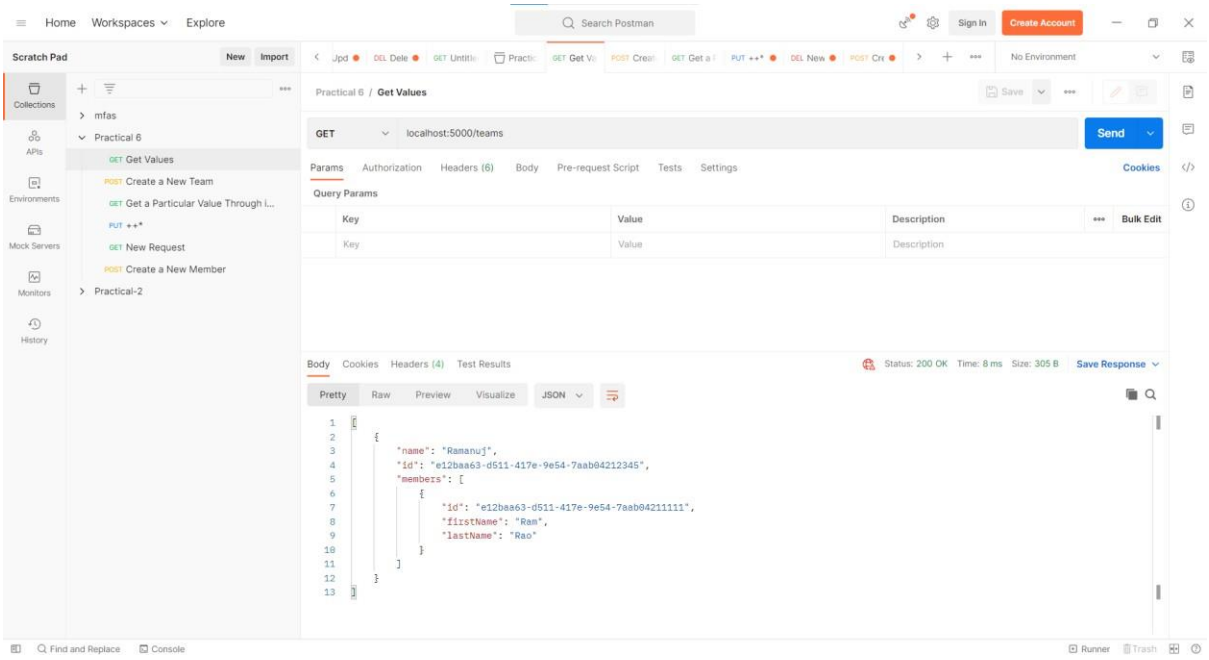
Command Prompt

```
C:\Users\raman>curl -insecure https://localhost:5001/teams
HTTP/1.1 200 OK
Date: Sat, 01 Apr 2023 08:43:18 GMT
Content-Type: application/json; charset=utf-8
Server: Kestrel
Transfer-Encoding: chunked

[{"name":"MSC Part1","id":"e12baa63-d511-417e-9e54-7aab04286281","members":[]}]
C:\Users\raman>
```

Step 18: Adding Members to the team.
Firstly, recreate the team which has been deleted by running the previous command for create in team. Within the created team we will add new properties for "members" within the team with a specific name and id. (Done using Postman)



- Confirm the creation of the member.

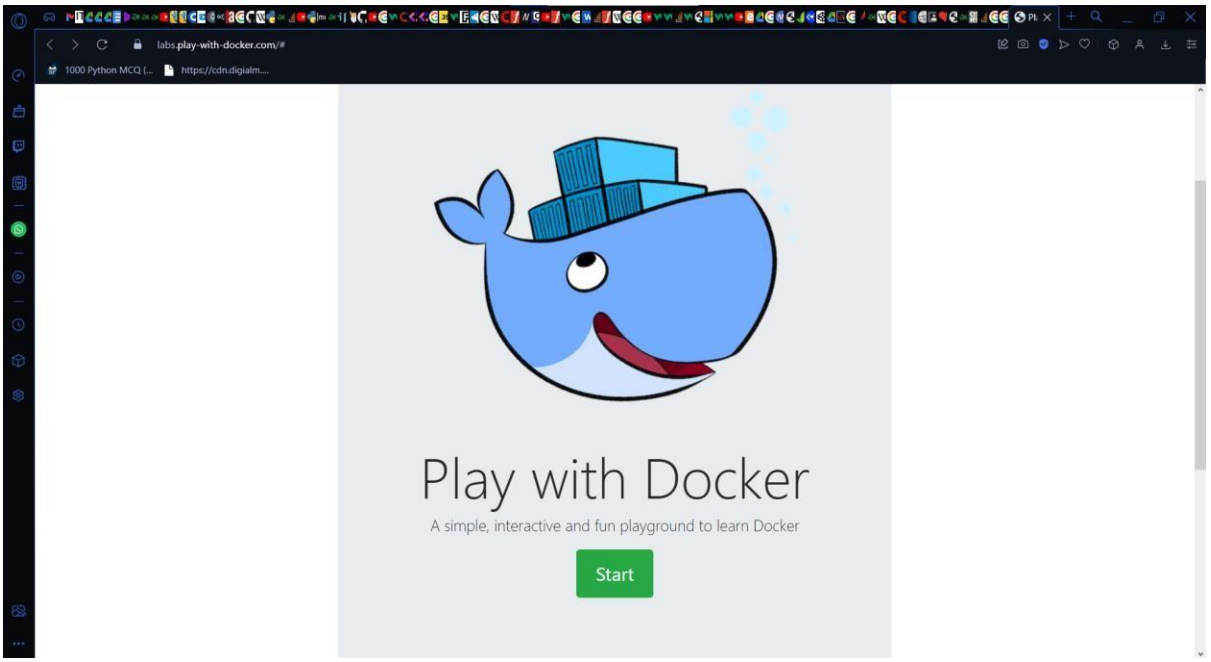


Practical 7

Aim: Creating Backing Service with Docker.

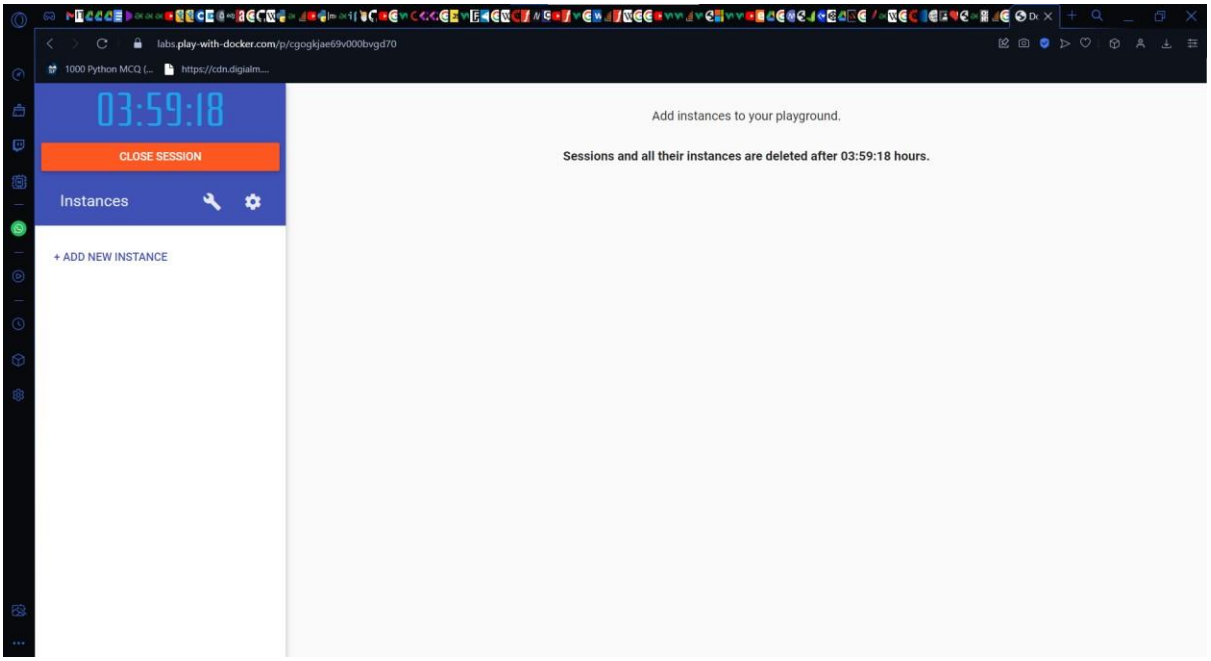
Writeup:

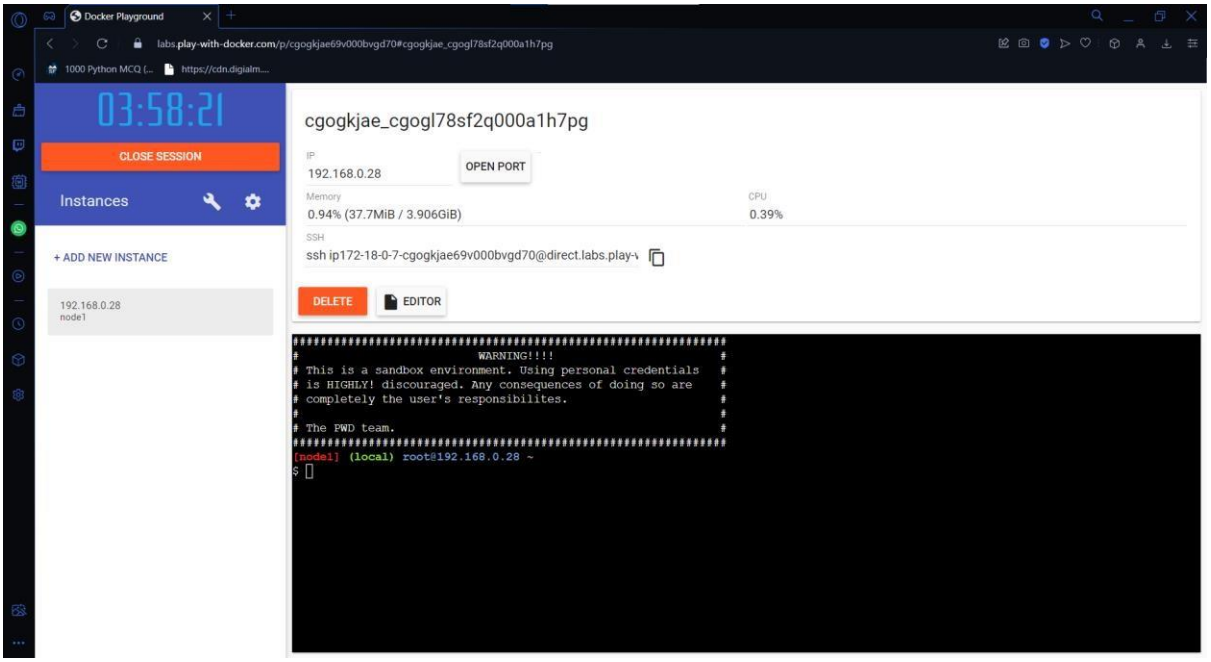
Step 1: Create docker hub login first to use it in play with docker.



- Click on Start

Step 2: Click on Add new instance



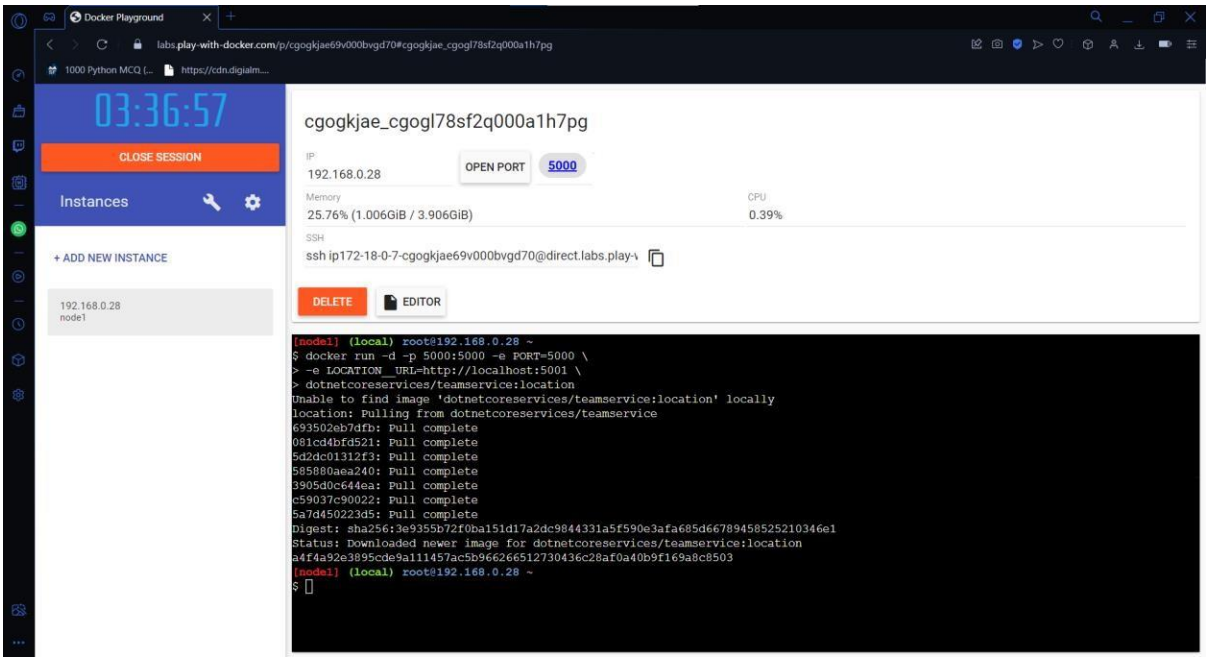


Step 3: Start typing the following command

Command: To run TeamService

**docker run -d -p 5000:5000 -e PORT=5000 **
**-e LOCATION_URL=http://localhost:5001 **
dotnetcoreservices/teamservice:location

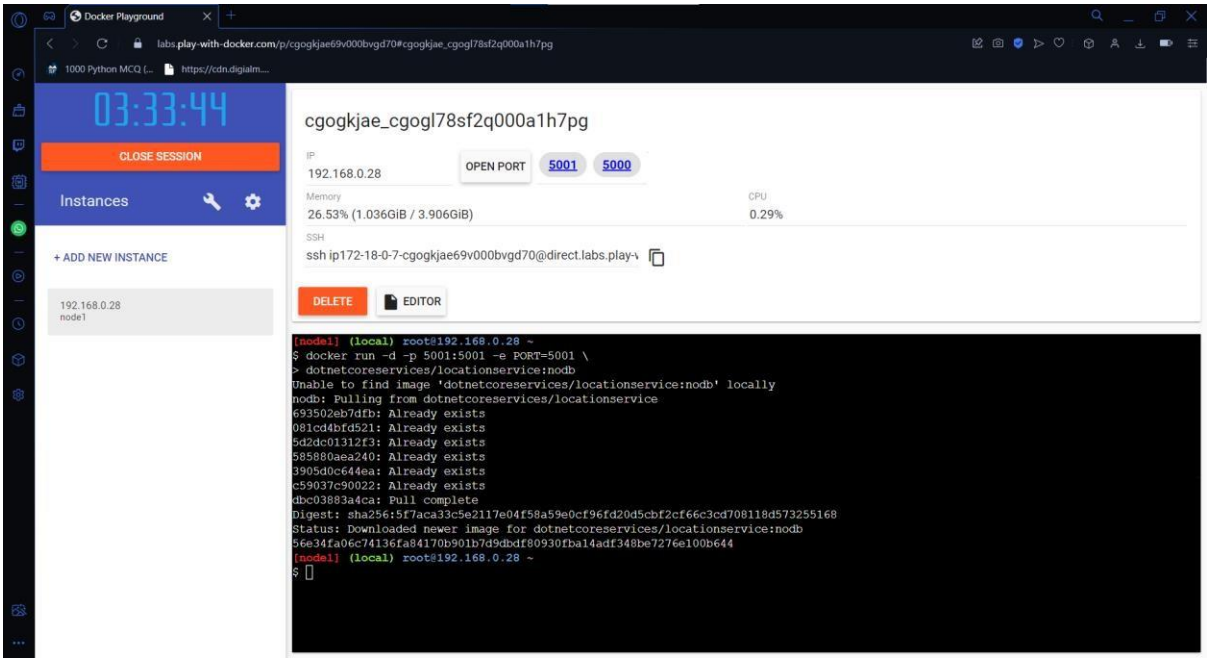
Output:



Command: To run Location Service

**docker run -d -p 5001:5001 -e PORT=5001 **
dotnetcoreservices/locationservice:nodb

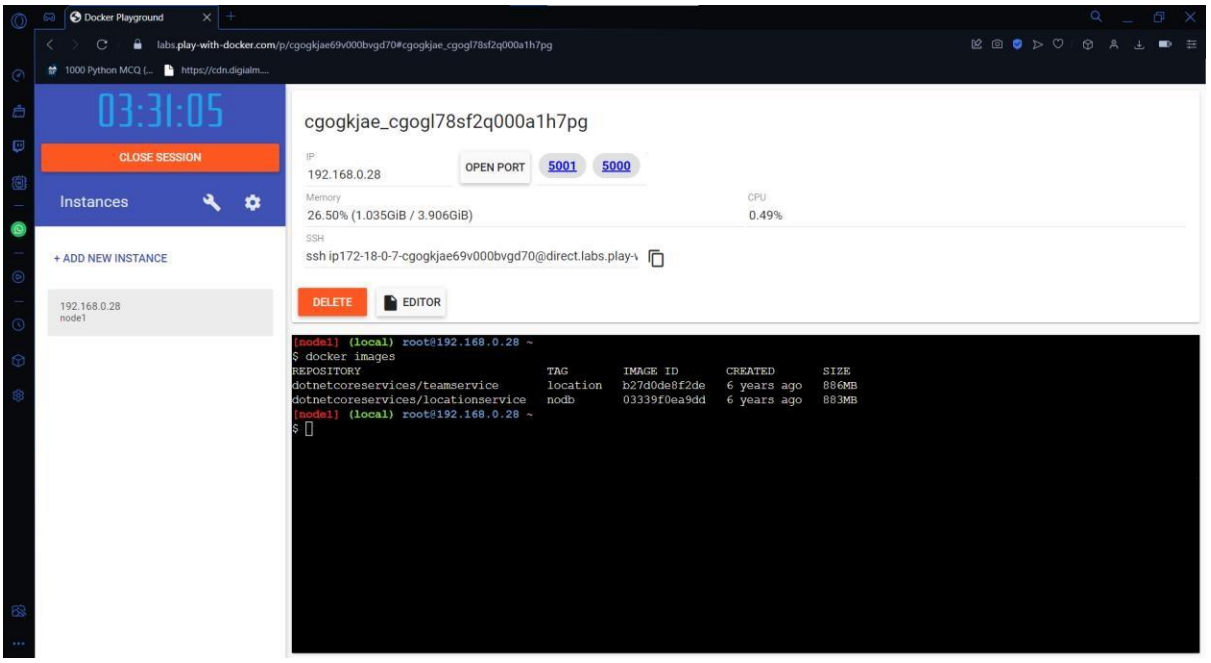
Output:



Command: To check running images in docker

docker images

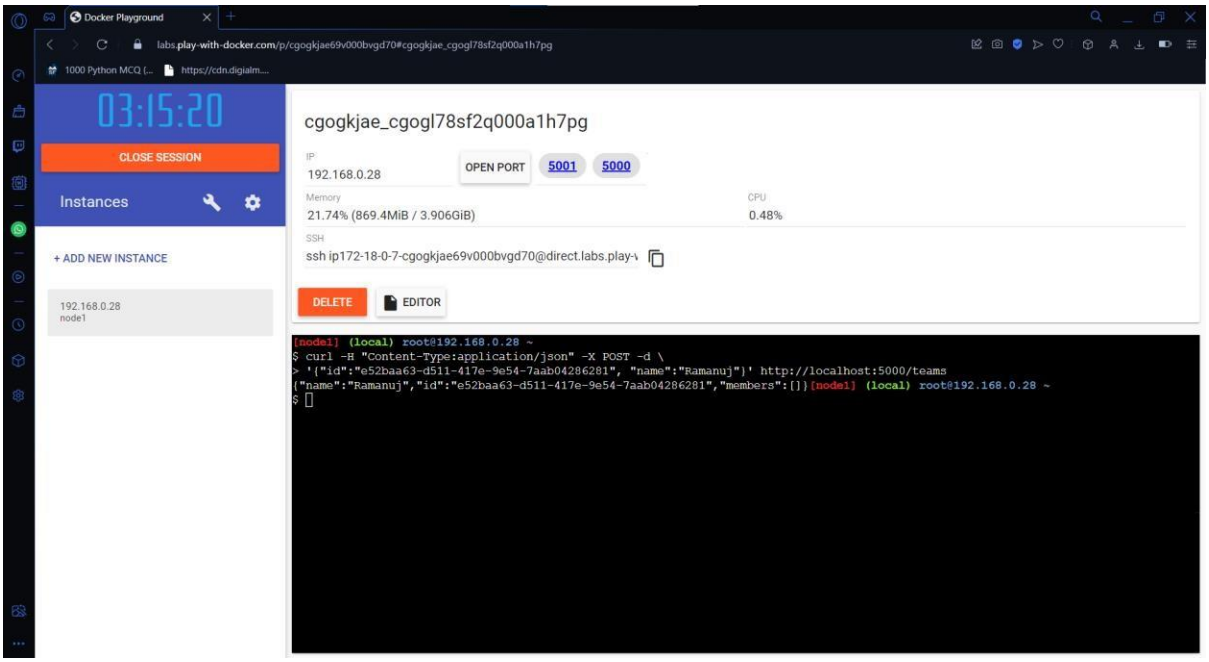
Output:



Command: To create a new team

Output:

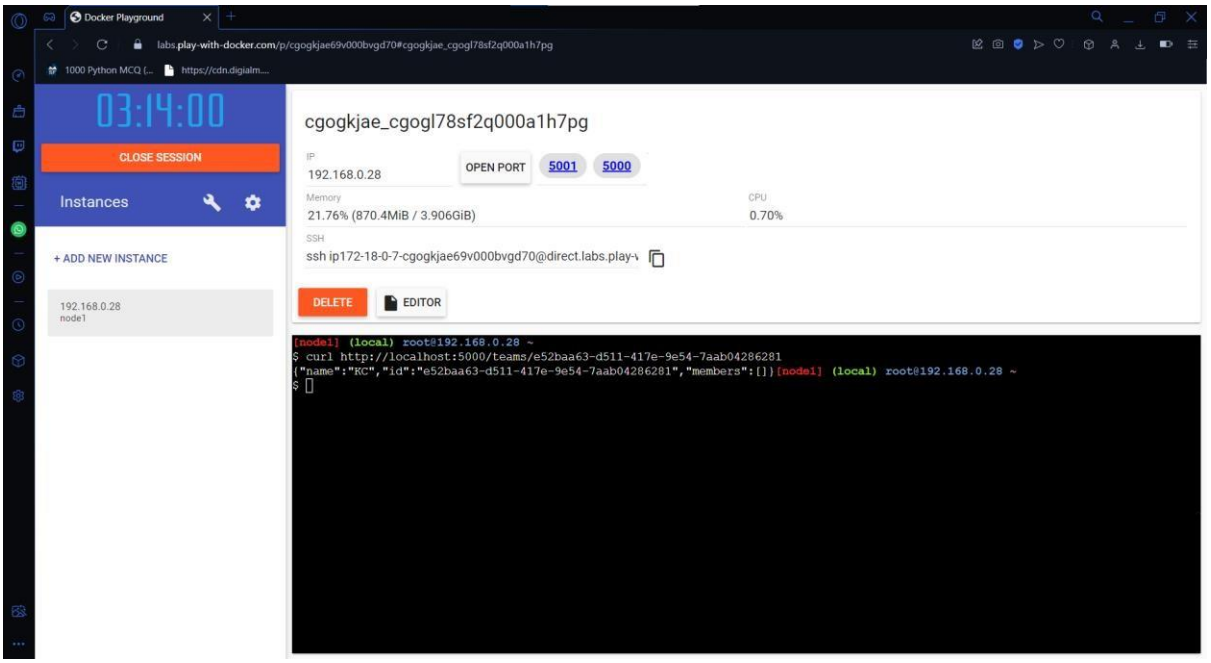
**curl -H "Content-Type:application/json" -X POST -d \
'{"id":"e52baa63-d511-417e-9e54-7aab04286281", "name":"Ramanuj"}'
http://localhost:5000/teams**



Command: To confirm if member is added

curl http://localhost:5000/teams/e52baa63-d511-417e-9e54-7aab04286281

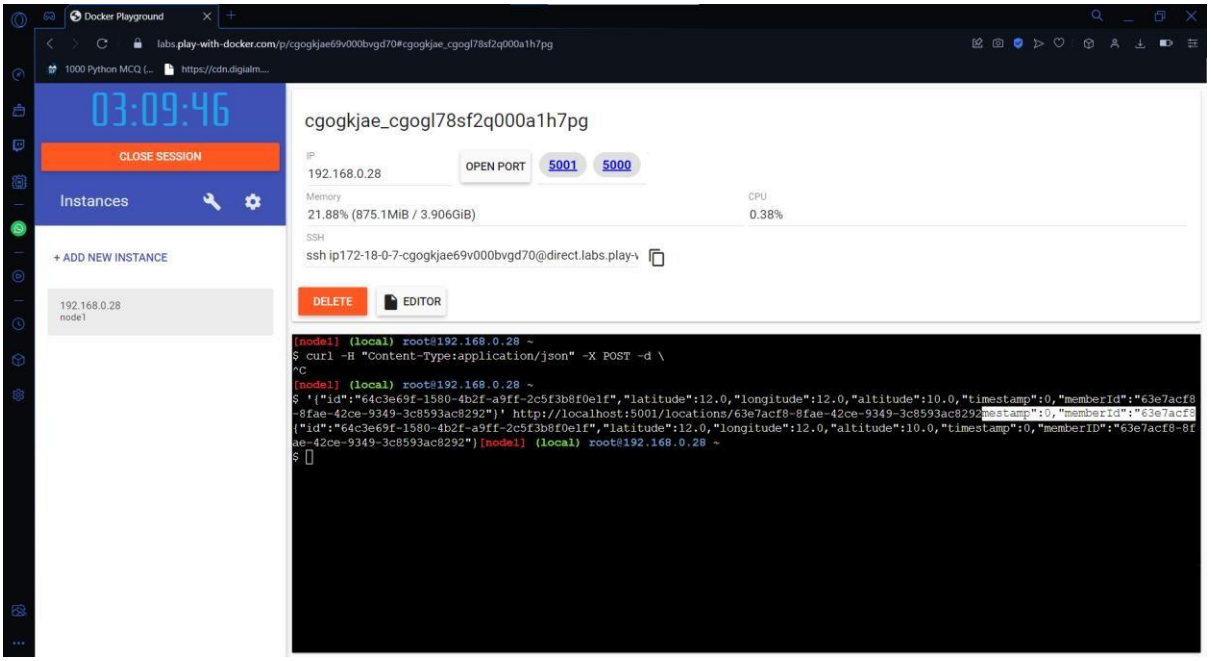
Output:



Command: To add location for member

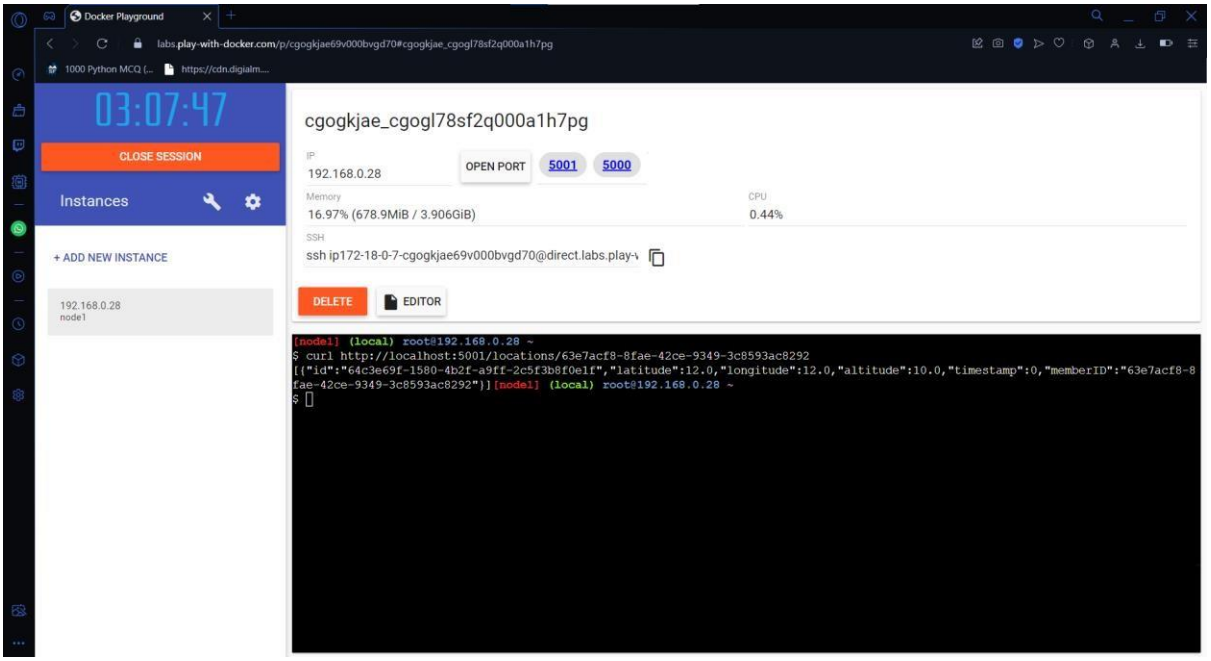
**curl -H "Content-Type:application/json" -X POST -d \
'{"id":"64c3e69f-1580-4b2f-a9ff-2c5f3b8f0e1f","latitude":12.0,"longitude":12.0,"altitude":10.0,"timestamp":0,"memberId":"63e7acf8-8fae-42ce-9349-3c8593ac8292"}' http://localhost:5001/locations/63e7acf8-8fae-42ce-9349-3c8593ac8292**

Output:



Command: To confirm location is added in member

curl http://localhost:5001/locations/63e7acf8-8fae-42ce-9349-3c8593ac8292



Practical 8

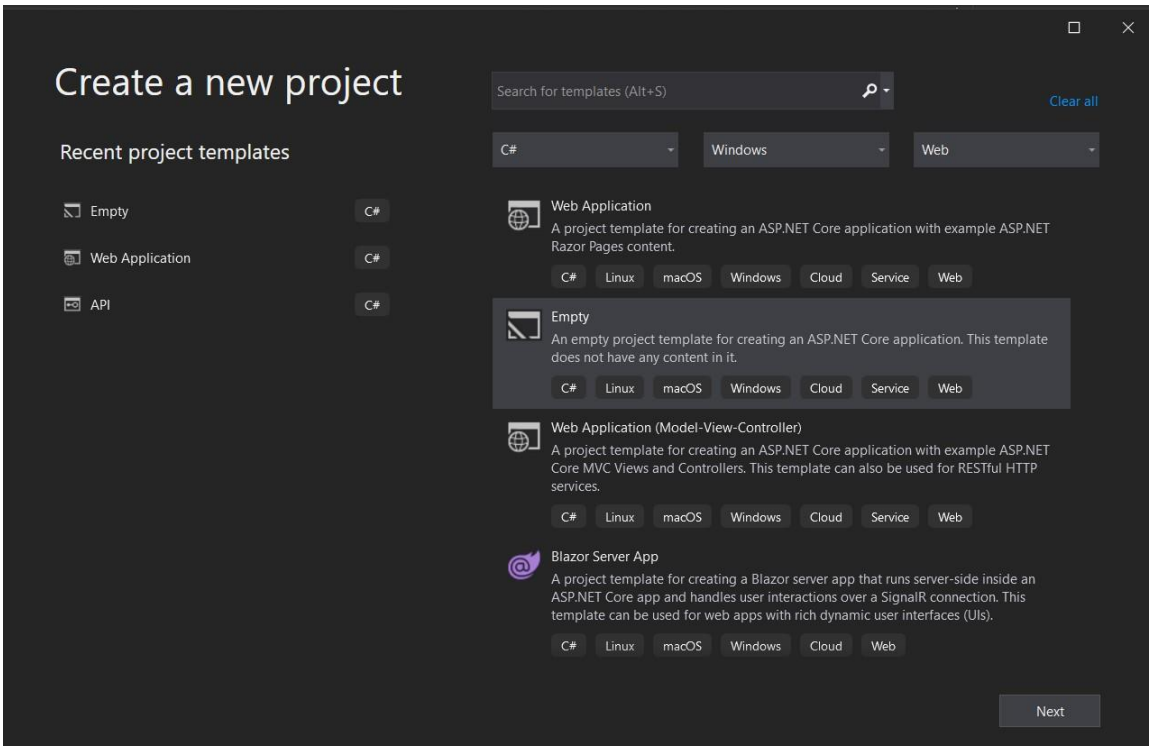
Aim: Building real-time Microservice with ASP.NET Core.

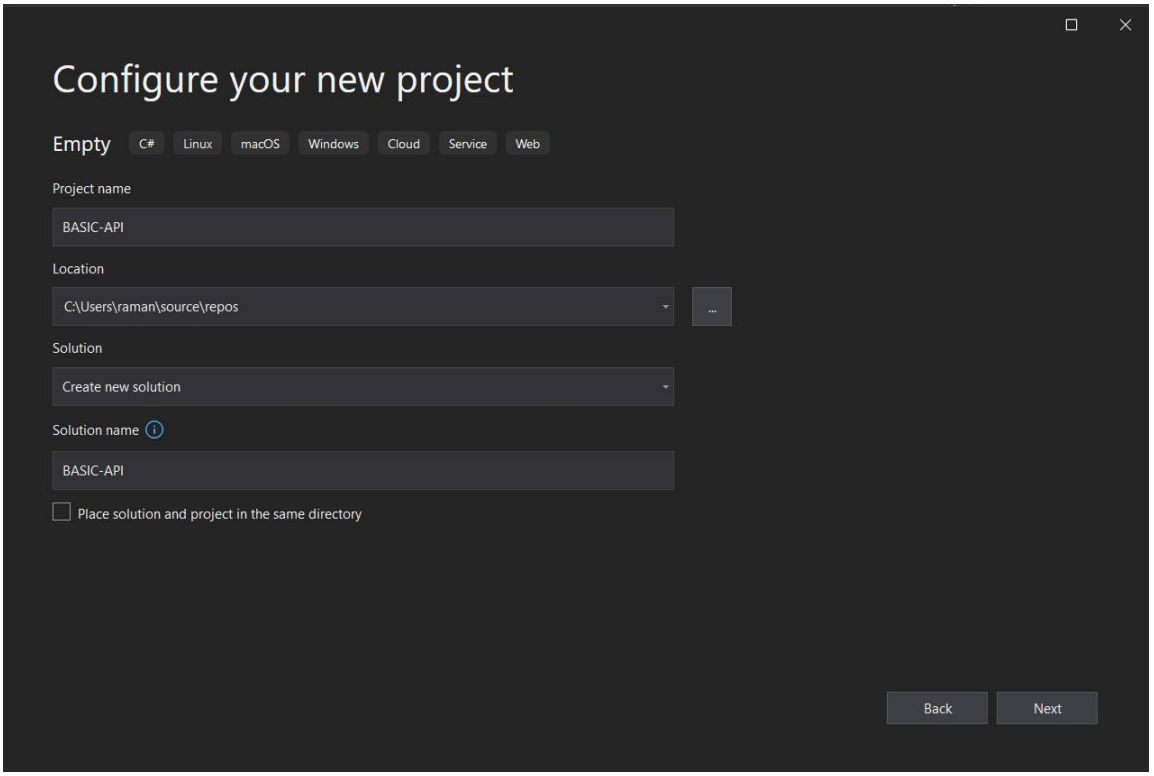
Writeup:

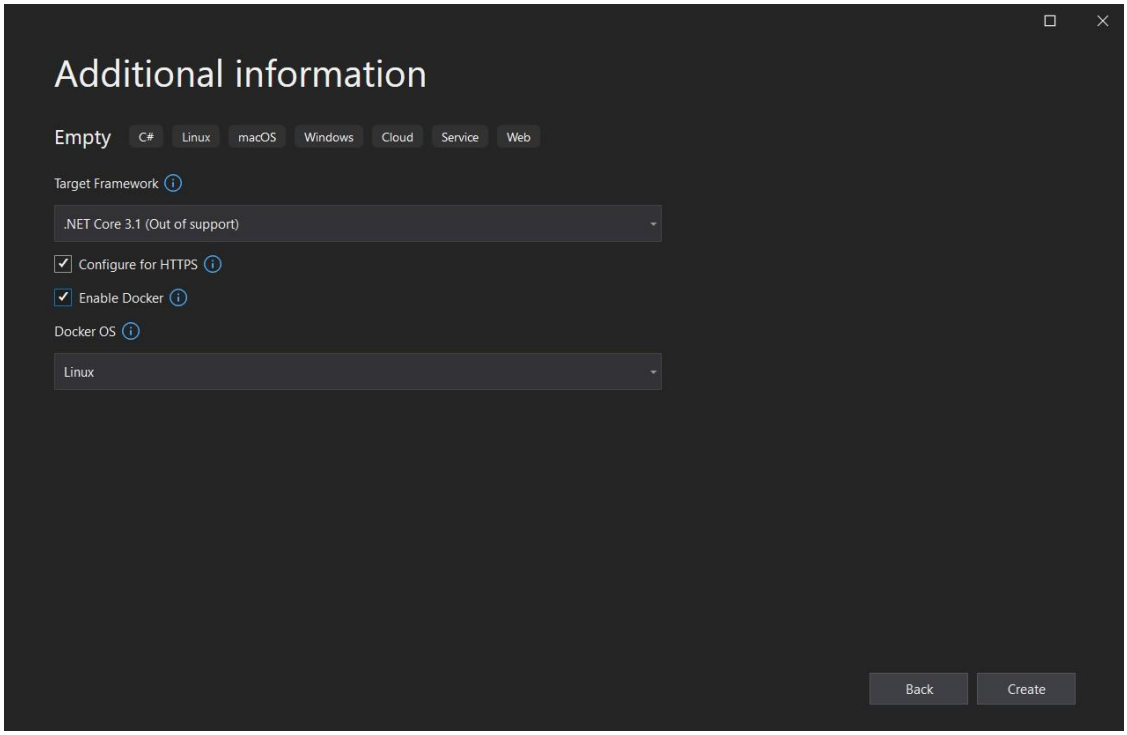
Requirement:

- Microsoft Visual Studio 2019 or higher
- ASP.Net Core 3.1

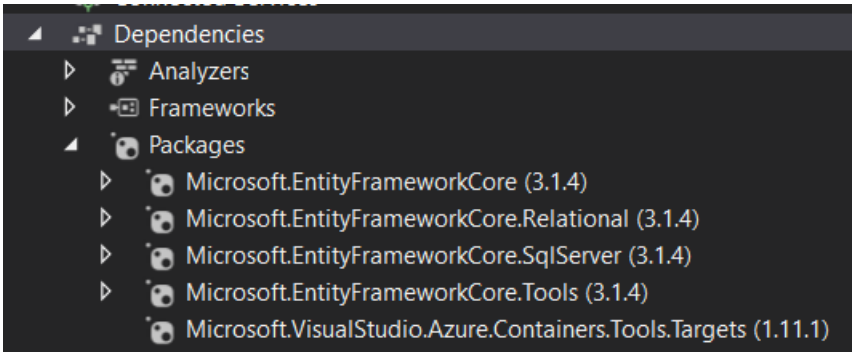
Step 1: Create and Configure a new empty project



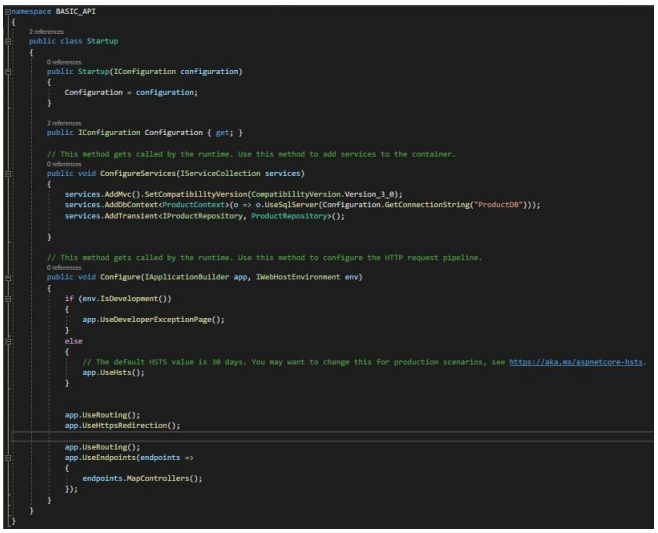




Step 2: Make sure to add these packages via NuGet Package Manager.

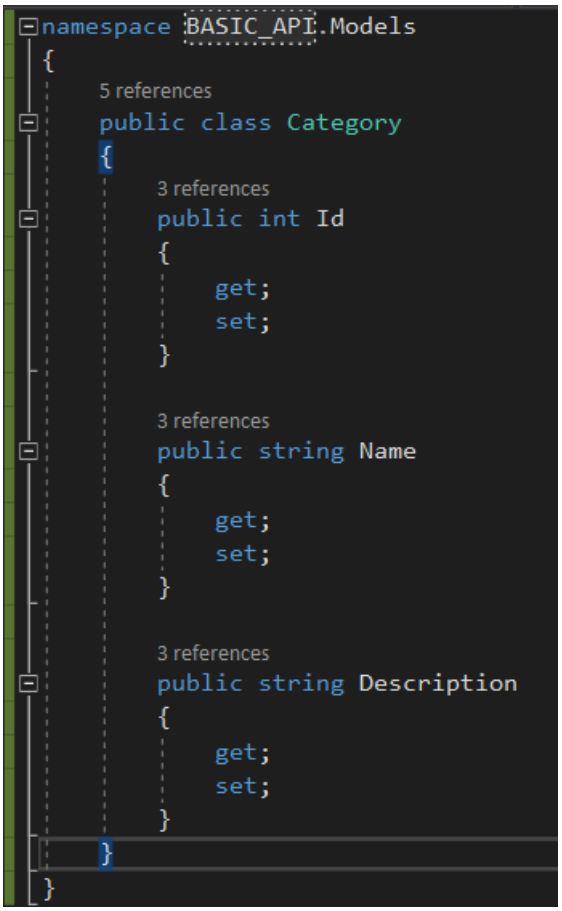


Step 3: Configure the Startup.cs file



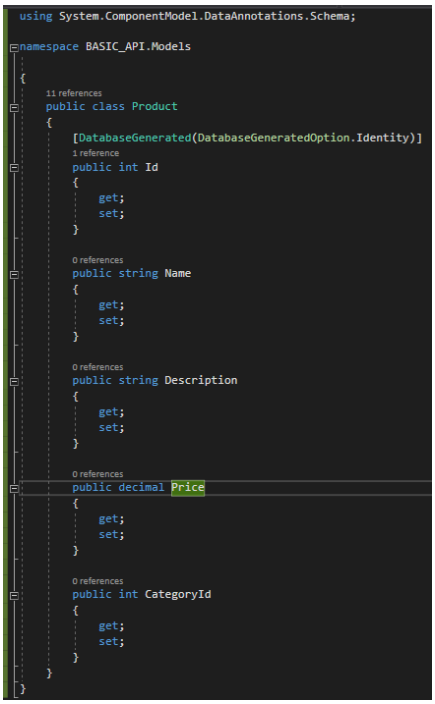
```
namespace BASIC_API
{
    public class Startup
    {
        public Startup(IConfiguration configuration)
        {
            Configuration = configuration;
        }

        public IConfiguration Configuration { get; }

        // This method gets called by the runtime. Use this method to add services to the container.
        public void ConfigureServices(IServiceCollection services)
        {
            services.AddMvc().SetCompatibilityVersion(CompatibilityVersion.Version_3_0);
            services.AddDbContext<ProductContext>(o => o.UseSqlServer(Configuration.GetConnectionString("ProductDB")));
            services.AddTransient<IProductRepository, ProductRepository>();

        }

        // This method gets called by the runtime. Use this method to configure the HTTP request pipeline.
        public void Configure(IApplicationBuilder app, IWebHostEnvironment env)
        {
            if (env.IsDevelopment())
            {
                app.UseDeveloperExceptionPage();
            }
            else
            {
                // The default HSTS value is 30 days. You may want to change this for production scenarios, see https://aka.ms/aspnetcore-hsts.
                app.UseHsts();
            }


            app.UseRouting();
            app.UseHttpsRedirection();

            app.UseRouting();
            app.UseEndpoints(endpoints =>
            {
                endpoints.MapControllers();
            });
        }
    }
}
```

Step 4: Create the Category Model, which will eventually be the Category Table.



```
namespace BASIC_API.Models
{
    5 references
    public class Category
    {
        3 references
        public int Id
        {
            get;
            set;
        }

        3 references
        public string Name
        {
            get;
            set;
        }

        3 references
        public string Description
        {
            get;
            set;
        }
    }
}
```

Step 5: Create the Product Model which will eventually be the Product Table.



```
using System.ComponentModel.DataAnnotations.Schema;

namespace BASIC_API.Models

{
    11 references
    public class Product
    {
        [DatabaseGenerated(DatabaseGeneratedOption.Identity)]
        1 reference
        public int Id
        {
            get;
            set;
        }

        0 references
        public string Name
        {
            get;
            set;
        }

        0 references
        public string Description
        {
            get;
            set;
        }

        0 references
        public decimal Price
        {
            get;
            set;
        }

        0 references
        public int CategoryId
        {
            get;
            set;
        }
    }
}
```

Step 6: Create a ProductRepository for all our operations.

```
using BASIC_API.DBContexts;
using BASIC_API.Models;
using BASIC_API.Repository;
using Microsoft.EntityFrameworkCore;

namespace BASIC_API.Repository
{
    2 references
    public class ProductRepository : IProductRepository
    {
        private readonly ProductContext _dbContext;

        0 references
        public ProductRepository(ProductContext dbContext)
        {
            _dbContext = dbContext;
        }

        2 references
        public void DeleteProduct(int productId)
        {
            var product = _dbContext.Products.Find(productId);
            _dbContext.Products.Remove(product);
            Save();
        }

        2 references
        public Product GetProductByID(int productId)
        {
            return _dbContext.Products.Find(productId);
        }

        2 references
        public IEnumerable<Product> GetProducts()
        {
            return _dbContext.Products.ToList();
        }

        2 references
        public void InsertProduct(Product product)
        {
            _dbContext.Add(product);
            Save();
        }

        4 references
        public void Save()
        {
            _dbContext.SaveChanges();
        }

        2 references
        public void UpdateProduct(Product product)
        {
            _dbContext.Entry(product).State = EntityState.Modified;
            Save();
        }
    }
}
```

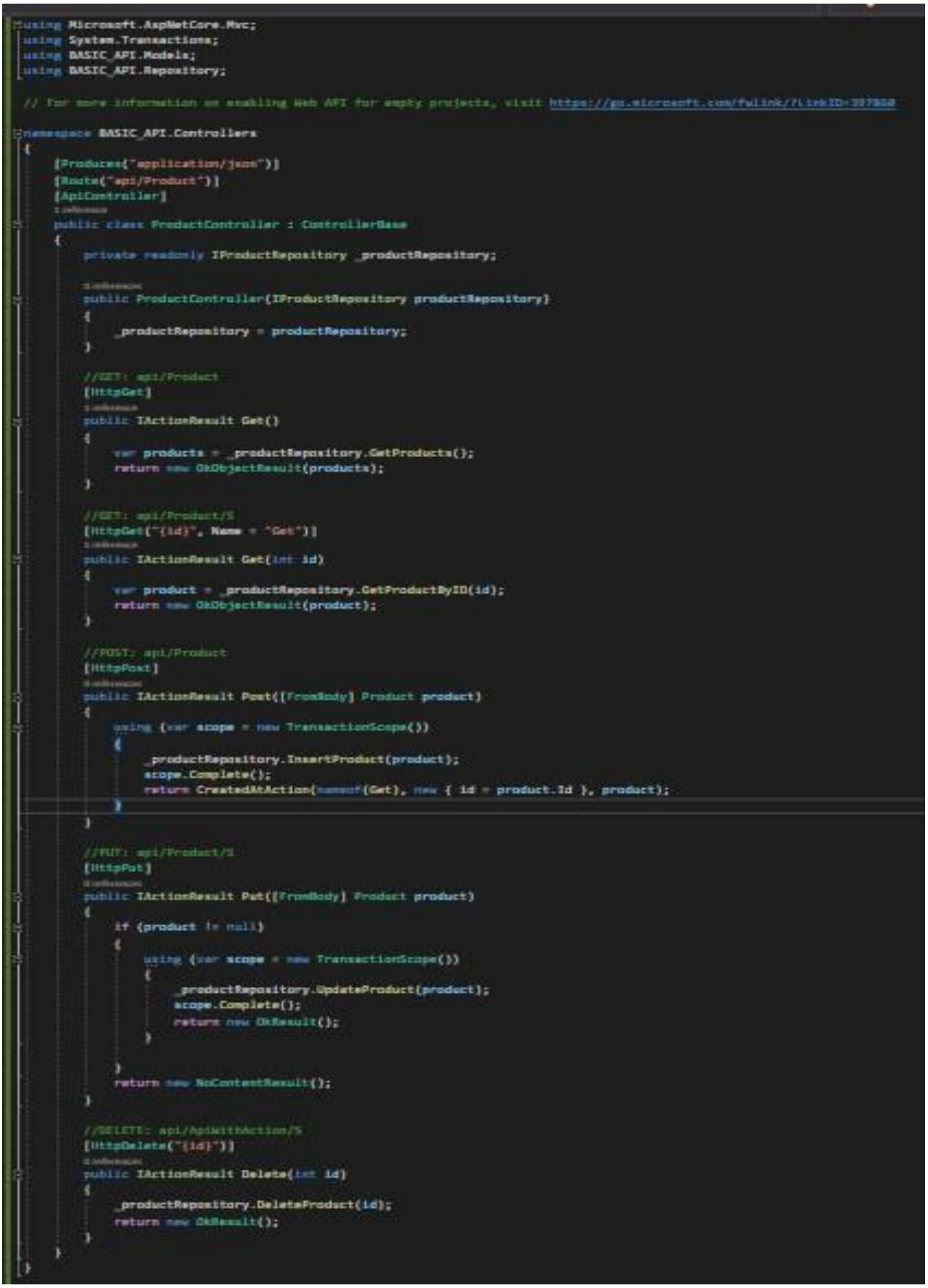
Step 7: Create an interface IProductRepository to access the ProductRepository.

```
using BASIC_API.Models;
using System.Collections.Generic;

namespace BASIC_API.Repository
{
    4 references
    public interface IProductRepository
    {
        2 references
        IEnumerable<Product> GetProducts();
        2 references
        Product GetProductByID(int product);
        2 references
        void InsertProduct(Product product);
        2 references
        void DeleteProduct(int productId);
        2 references
        void UpdateProduct(Product product);
        4 references
        void Save();

    }
}
```

Step 8: Create a ProductContext to build the model for the database; this will be a Code First Database Approach.

```
using Microsoft.EntityFrameworkCore;
using BASIC_API.Models;

namespace BASIC_API.DBContexts
{
    7 references
    public class ProductContext : DbContext
    {
        0 references
        public ProductContext(DbContextOptions<ProductContext> options) : base(options)
        {
        }

        4 references
        public DbSet<Product> Products
        {
            get;
            set;
        }

        0 references
        public DbSet<Category> Categories
        {
            get;
            set;
        }

        0 references
        protected override void OnModelCreating(ModelBuilder modelBuilder)
        {
            modelBuilder.Entity<Category>().HasData(
                new Category
                {
                    Id = 1,
                    Name = "Electronics",
                    Description = "Electronic Items",
                },
                new Category
                {
                    Id = 2,
                    Name = "Clothes",
                    Description = "Dresses",
                },
                new Category
                {
                    Id = 3,
                    Name = "Grocery",
                    Description = "Grocery Items",
                }
            );
        }
    }
}
```

Step 9: Add a ProductController to get an endpoint for the APIs.



```
using Microsoft.AspNetCore.Mvc;
using System.Transactions;
using BASIC_API.Models;
using BASIC_API.Repository;

// For more information on enabling Web API for empty projects, visit https://go.microsoft.com/fwlink/?LinkID=397860

namespace BASIC_API.Controllers
{
    [Produces("application/json")]
    [Route("api/Product")]
    [ApiController]
    public class ProductController : ControllerBase
    {
        private readonly IProductRepository _productRepository;

        public ProductController(IProductRepository productRepository)
        {
            _productRepository = productRepository;
        }

        //GET: api/Product
        [HttpGet]
        public IActionResult Get()
        {
            var products = _productRepository.GetProducts();
            return new OkObjectResult(products);
        }

        //GET: api/Product/5
        [HttpGet("{id}", Name = "Get")]
        public IActionResult Get(int id)
        {
            var product = _productRepository.GetProductByID(id);
            return new OkObjectResult(product);
        }

        //POST: api/Product
        [HttpPost]
        public IActionResult Post([FromBody] Product product)
        {
            using (var scope = new TransactionScope())
            {
                _productRepository.InsertProduct(product);
                scope.Complete();
                return CreatedAtAction(nameof(Get), new { id = product.Id }, product);
            }
        }

        //PUT: api/Product/5
        [HttpPut]
        public IActionResult Put([FromBody] Product product)
        {
            if (product != null)
            {
                using (var scope = new TransactionScope())
                {
                    _productRepository.UpdateProduct(product);
                    scope.Complete();
                    return new OkResult();
                }

            }
            return new NoContentResult();
        }

        //DELETE: api/ApiWithAction/5
        [HttpDelete("{id}")]
        public IActionResult Delete(int id)
        {
            _productRepository.DeleteProduct(id);
            return new OkResult();
        }
    }
}
```

Step 10: Add the connection string settings to connect the project to the SQLSERVER database. Once added run **add-migration** command to run the migration.

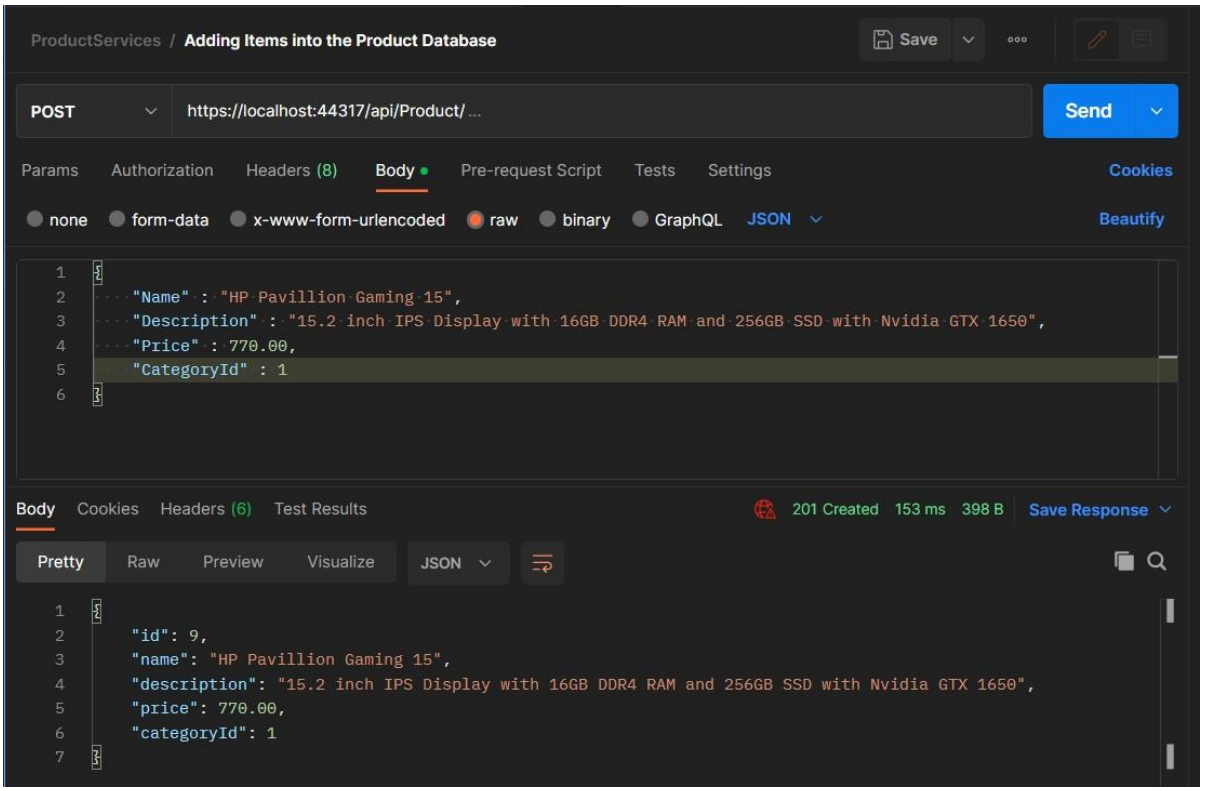

```
PM> add-migration IntitalCreate -verbose
Using project 'BASIC-API'.
Using startup project 'BASIC-API'.
Build started...
Build succeeded.
```

Step 11: Run the **update-database** command to reflect the model changes to the database.

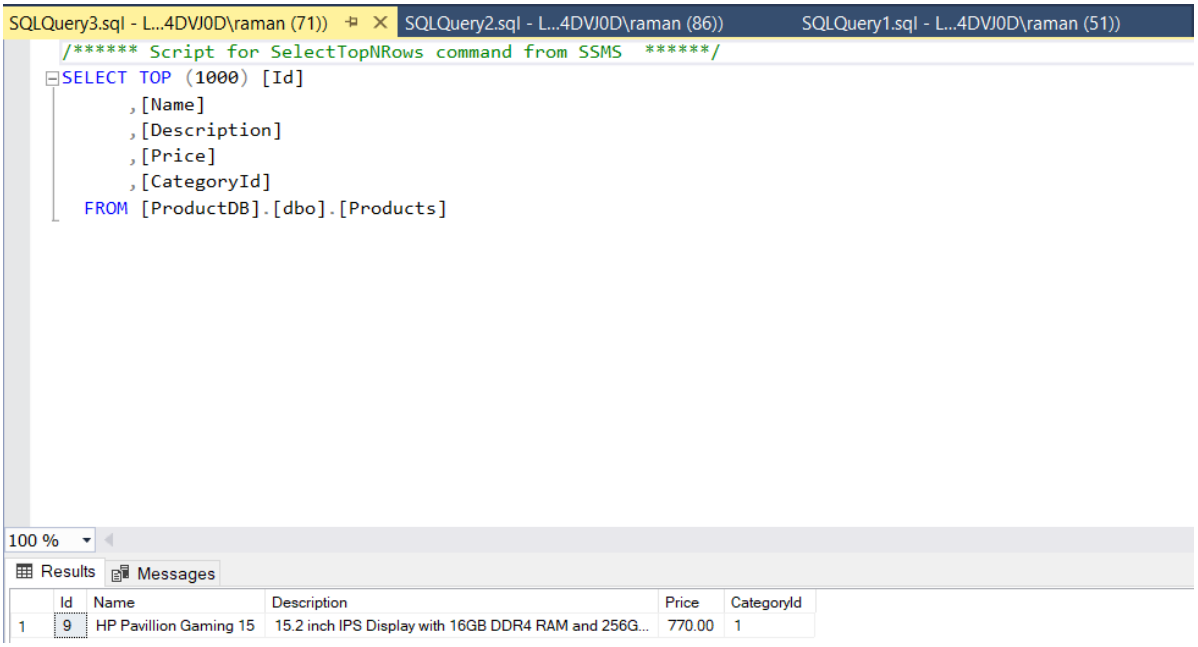
```
PM> update-database -verbose
Using project 'BASIC-API'.
Using startup project 'BASIC-API'.
Build started...
Build succeeded.
```

Step 12: Try to run the project, you will see that a browser window opens with an empty list.

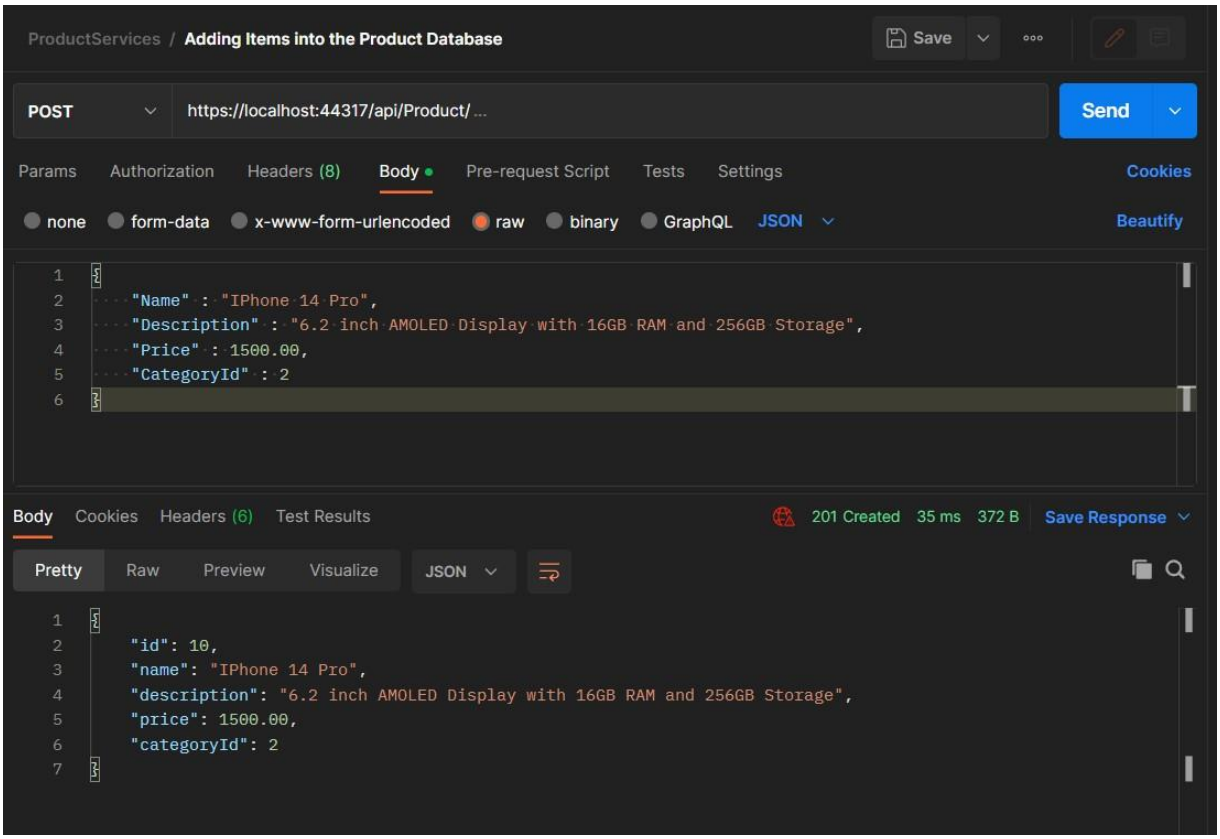
Step 13: Using Postman try to add a product into the product table via the API call.



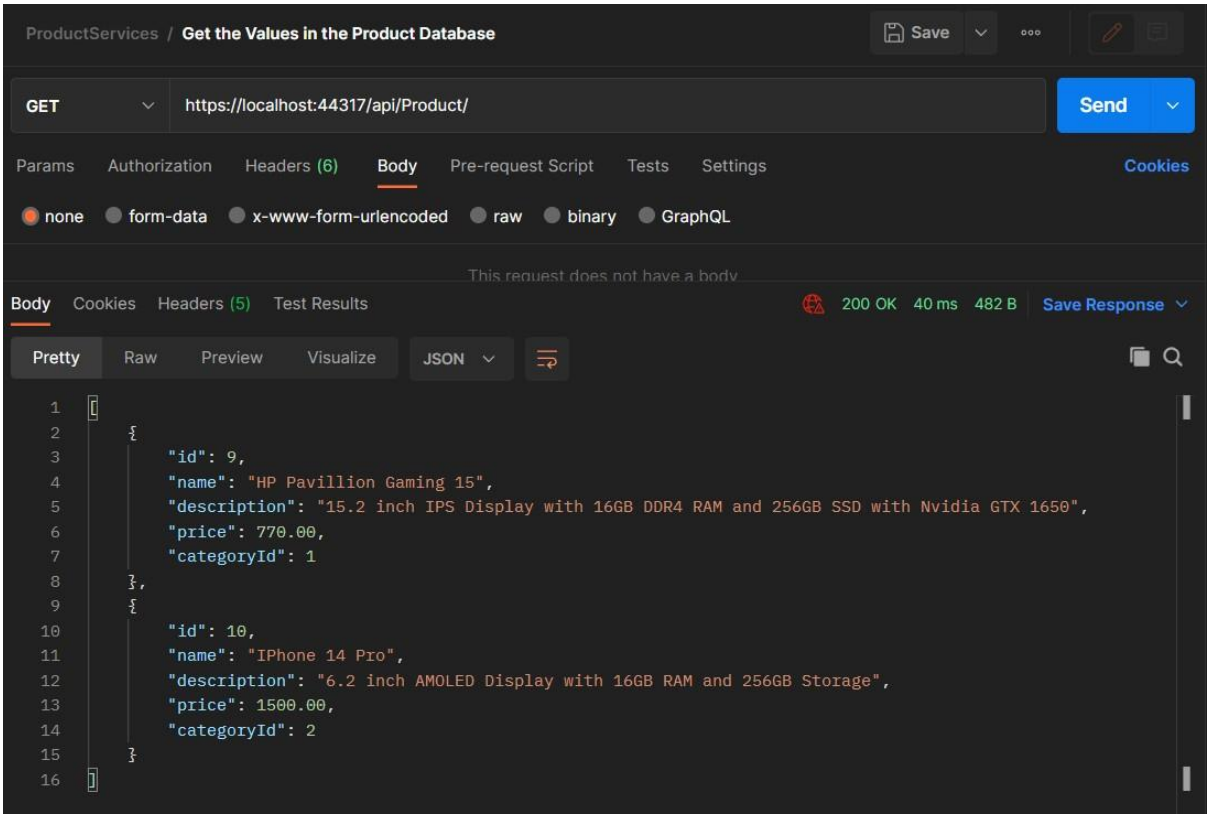
Step 14: You will notice the SQL table to populate with that product.



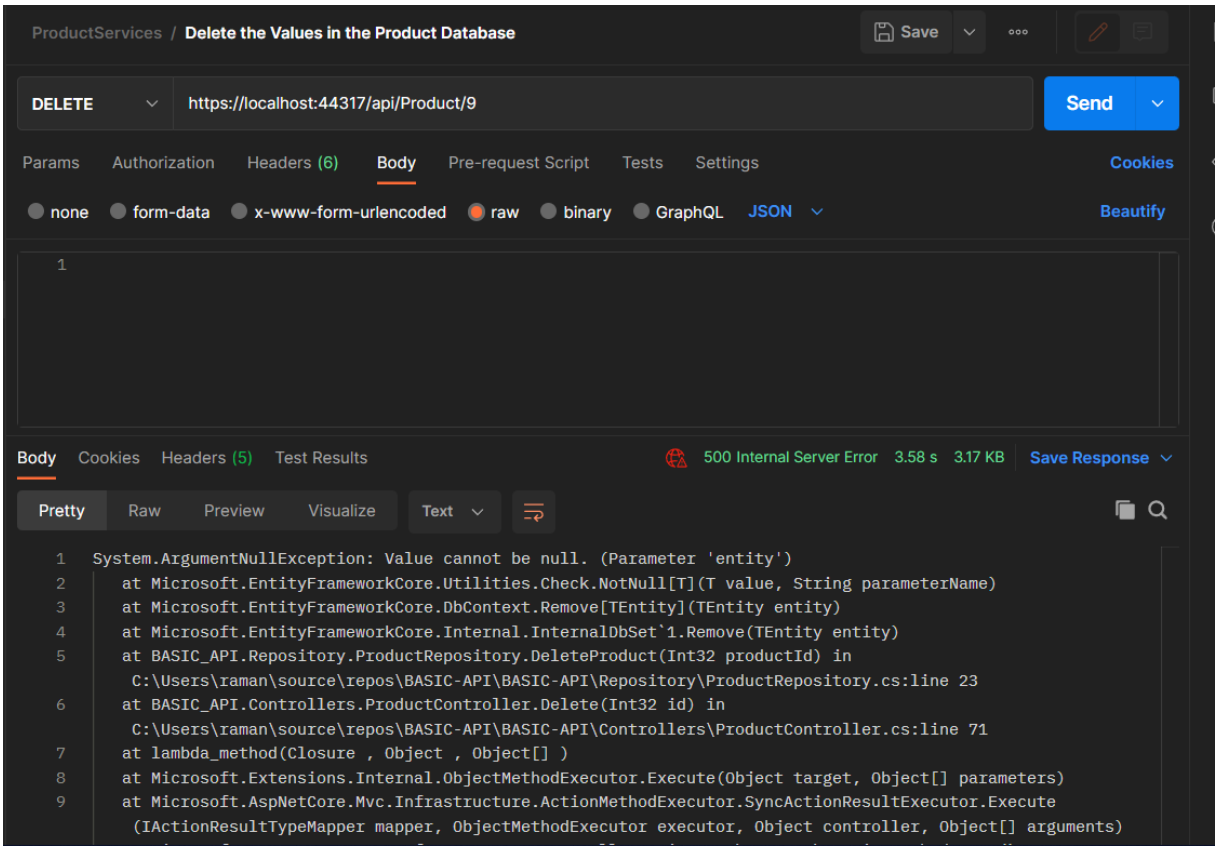
Step 15: Add another Product to test.



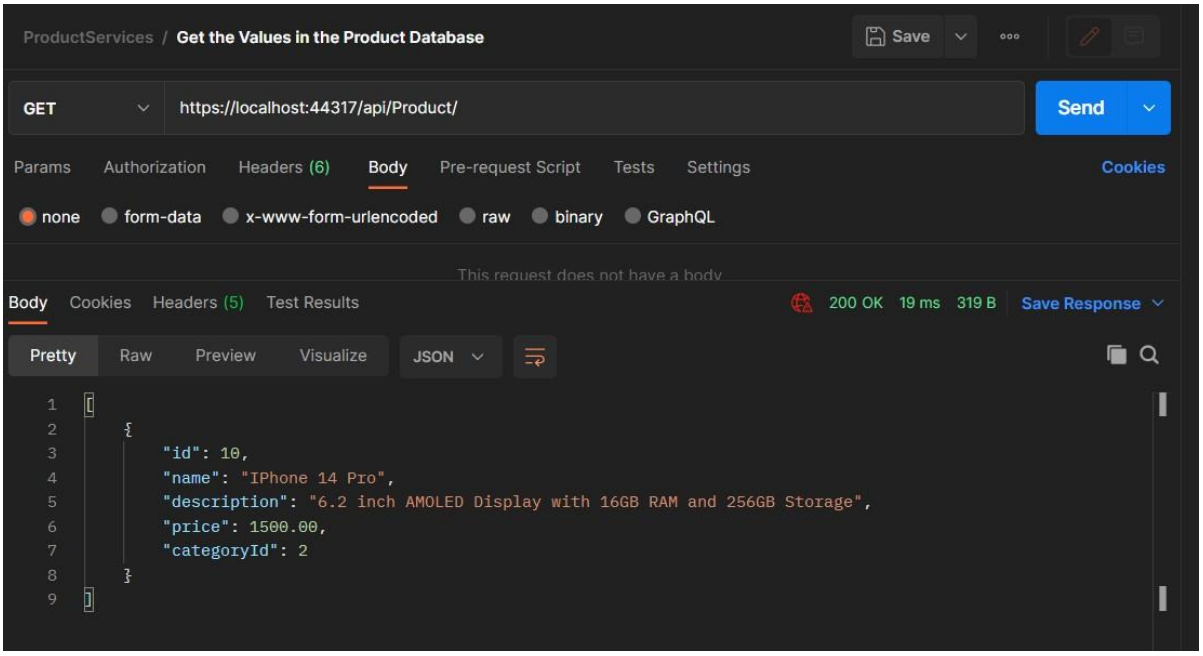
Step 16: Get all the added products using GET.



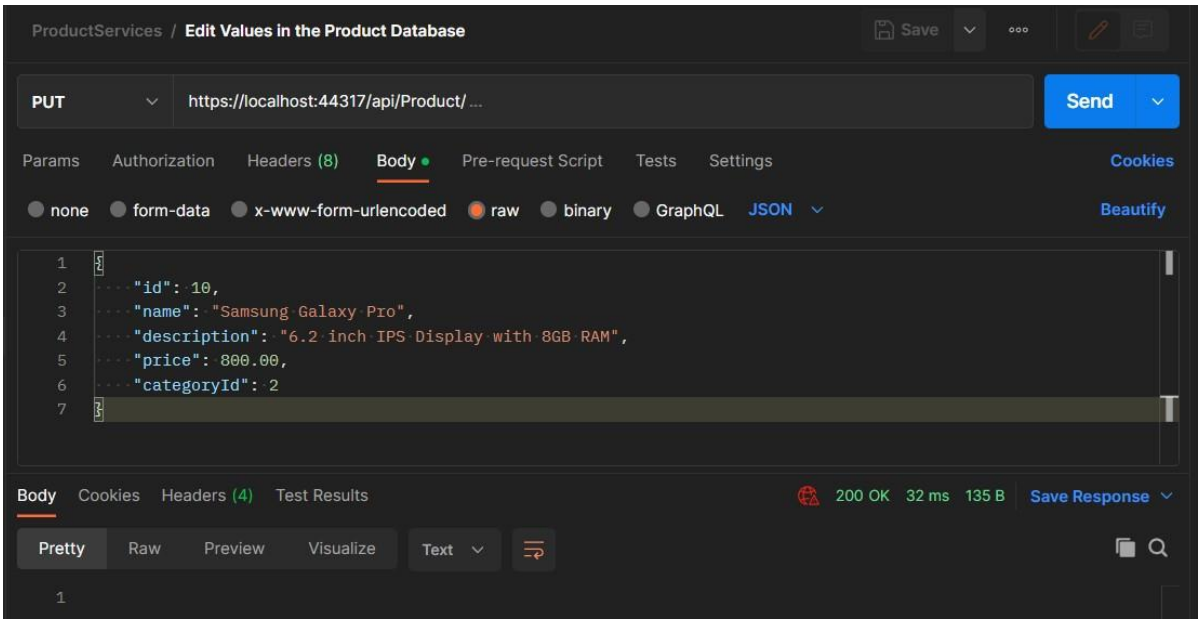
Step 17: Delete a product using DELETE.

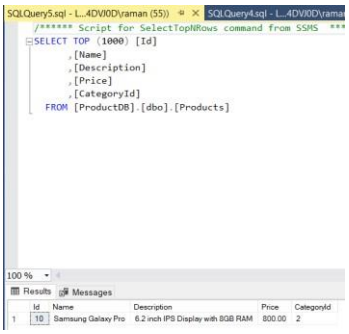


Step 18: Check is product is deleted using GET again.

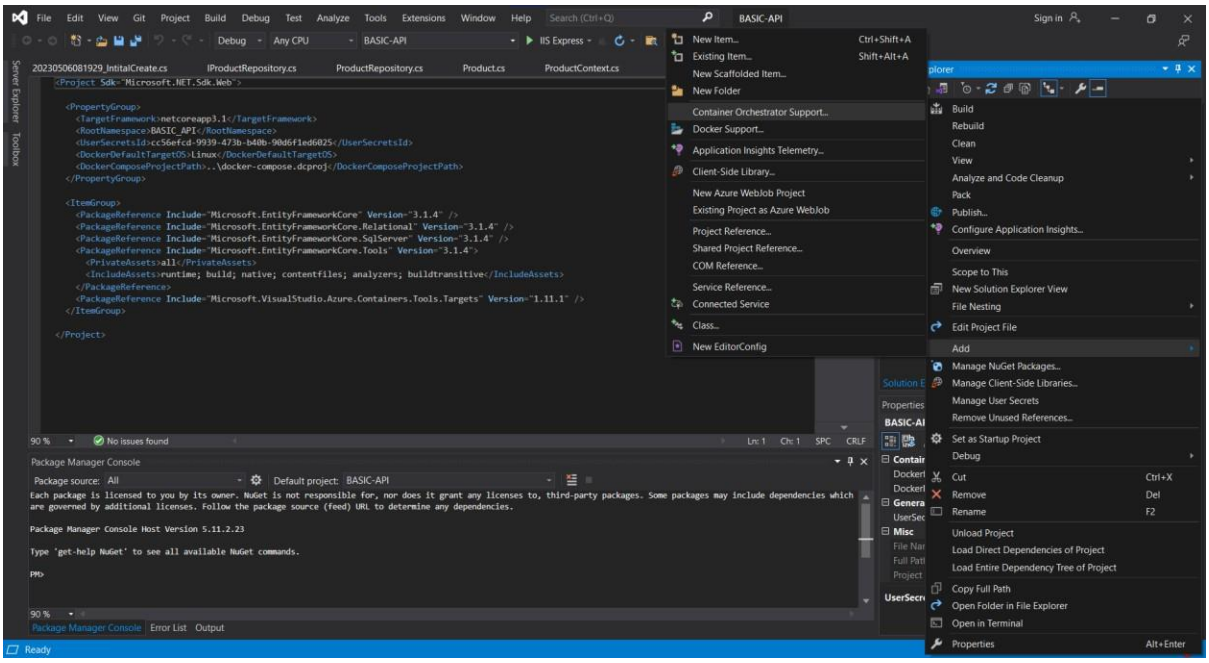


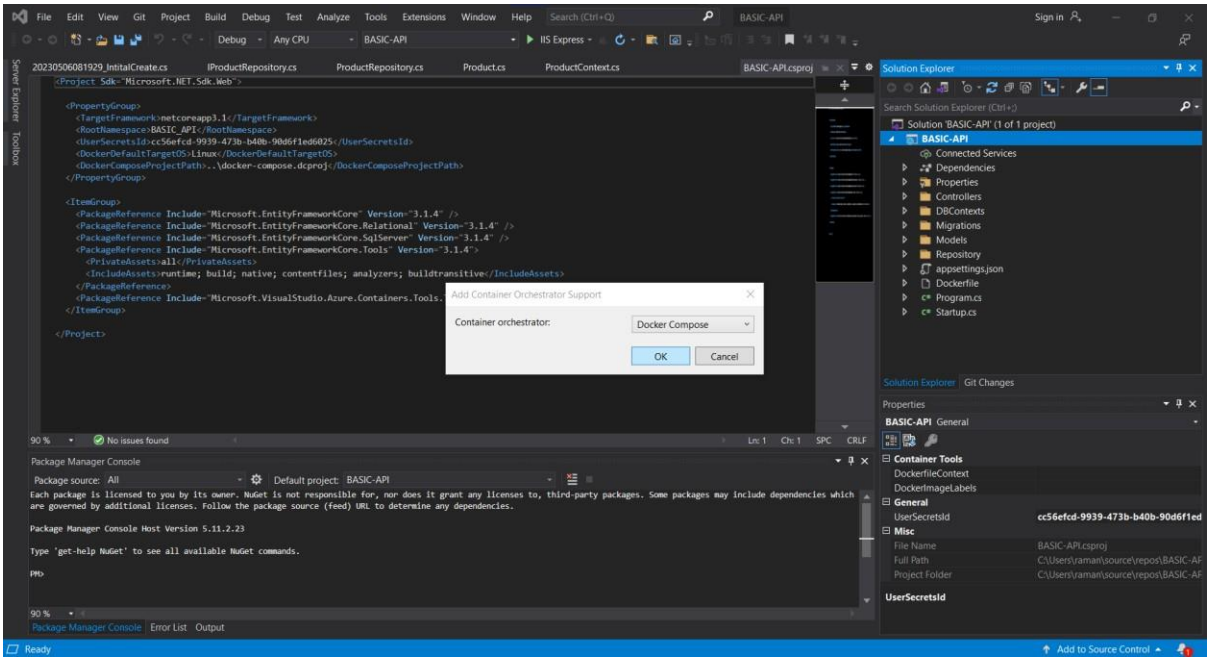
Step 19: Update a product using the PUT.



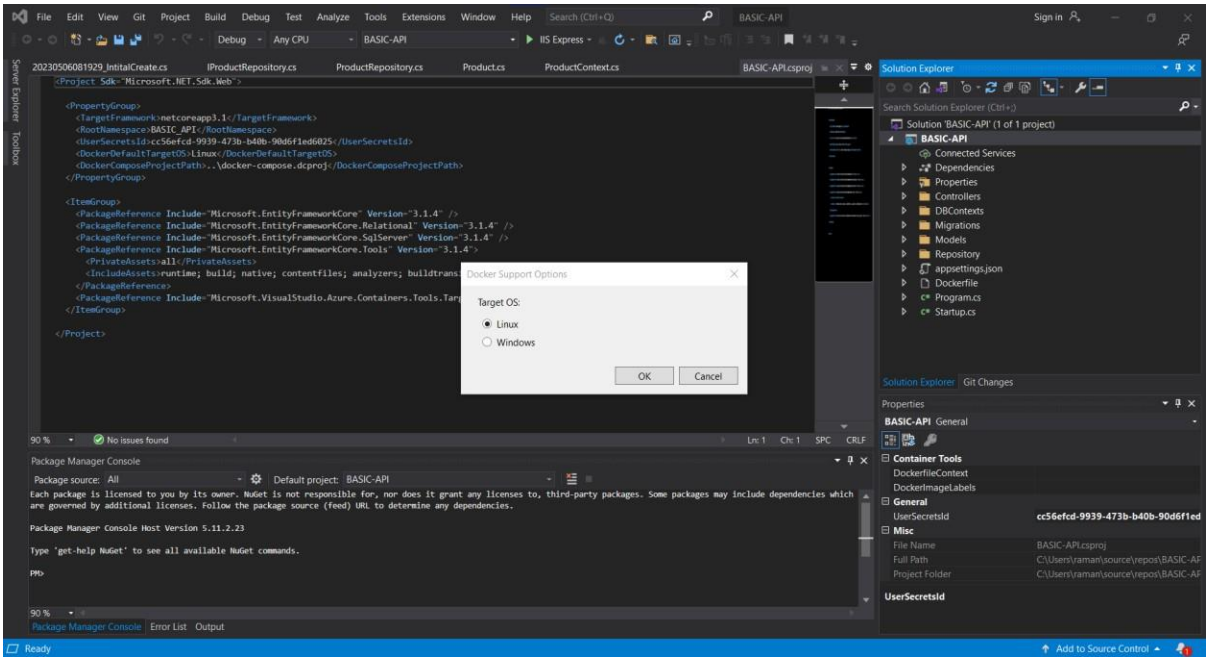


Step 20: Now create a docker container and image of the product. Right click the project and select Container Orchestrator Support and select Ok.

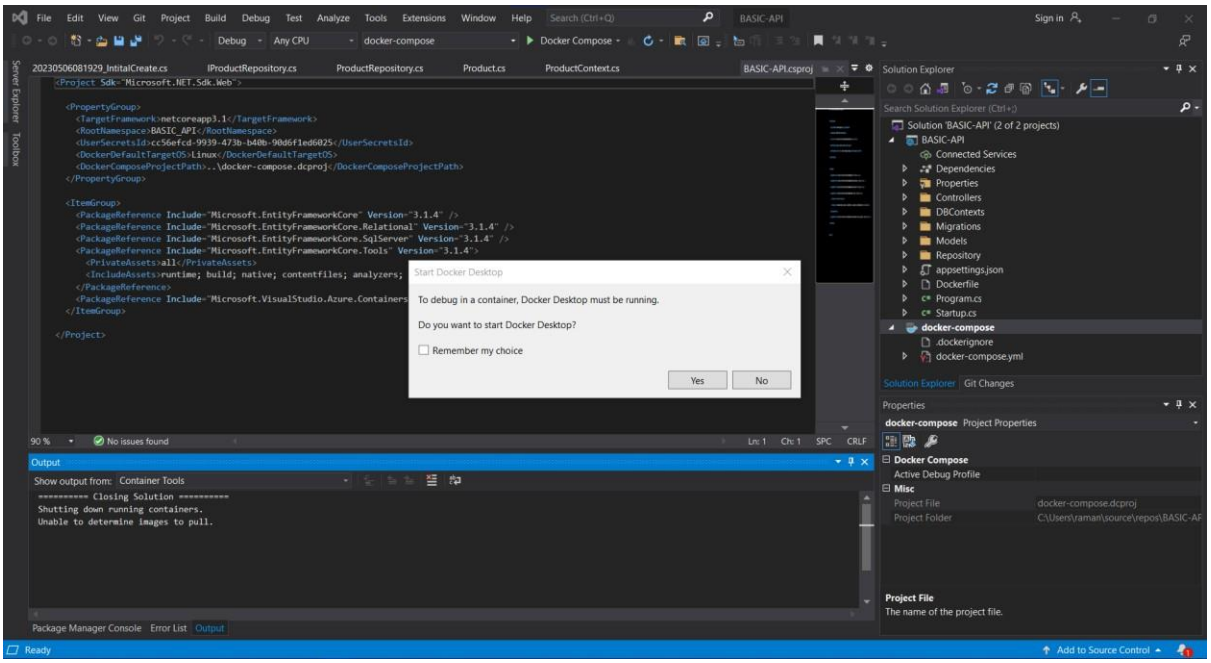




Step 21: Select the target docker OS support which will be LINUX.



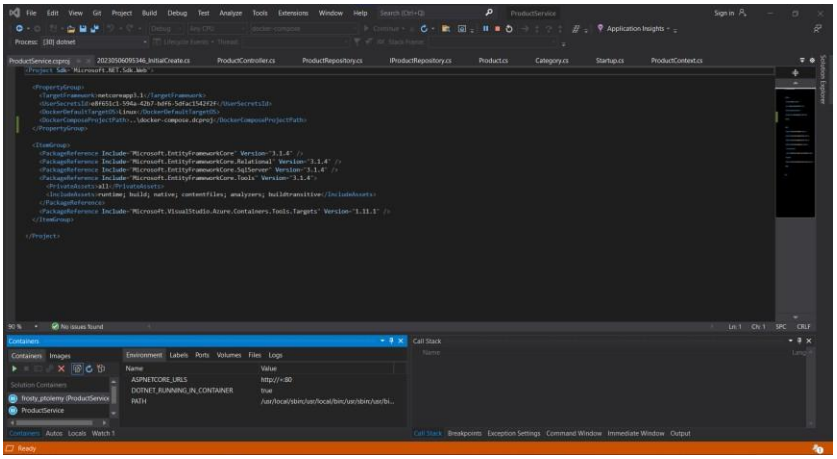
Step 22: You can select Yes to run the Docker desktop too.



Step 23: Run the docker commands ‘docker images’ to see the created image of your project.

```
C:\Users\raman>docker images
REPOSITORY                    TAG       IMAGE ID       CREATED         SIZE
webapi1                       dev       30aee5f1f9c9   7 weeks ago     208MB
webapplication1               dev       872e14f1554c   7 weeks ago     208MB
<none>                        <none>    bae4e11c4bb1   7 weeks ago     208MB
productservice                dev       2a9886bd1404   7 weeks ago     208MB
basicapi                      dev       591cee1a5e44   7 weeks ago     208MB
<none>                        <none>    7a5deb8e122b   7 weeks ago     208MB
webapplication2               dev       5a5a5c6434b9   7 weeks ago     208MB
<none>                        <none>    ba2df3366bff   7 weeks ago     208MB
mcr.microsoft.com/dotnet/aspnet   3.1       454a55eab920   4 months ago    208MB
```

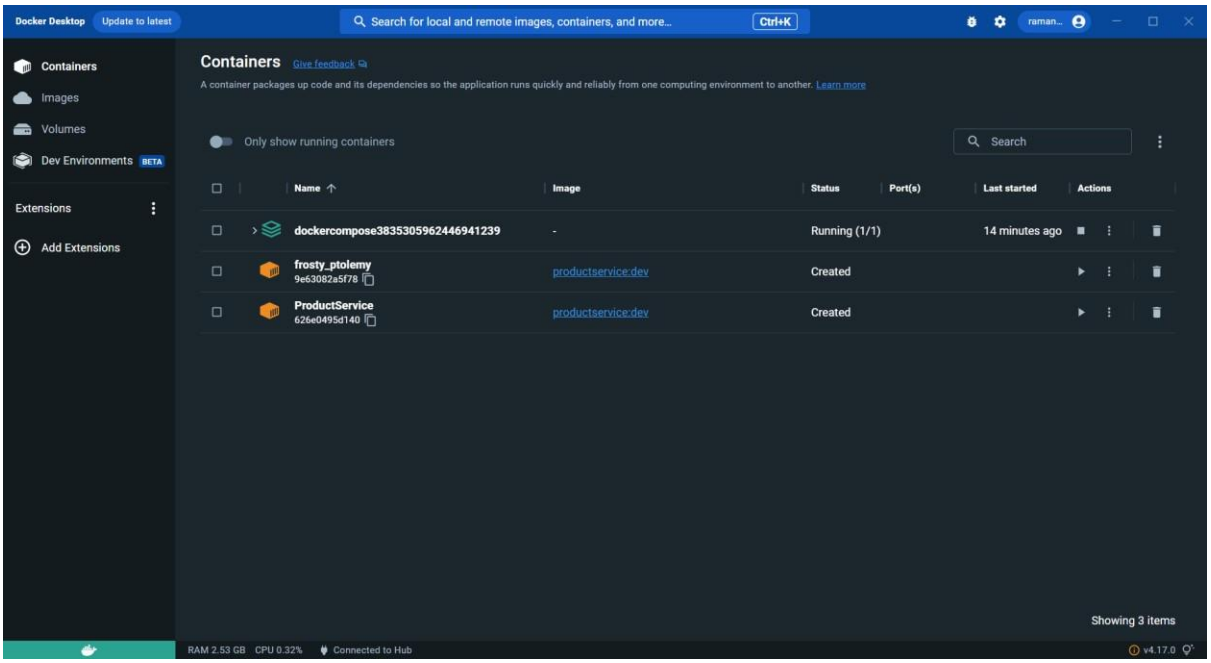
Step 24: Run the Project with the option Docker Compose on the Play.

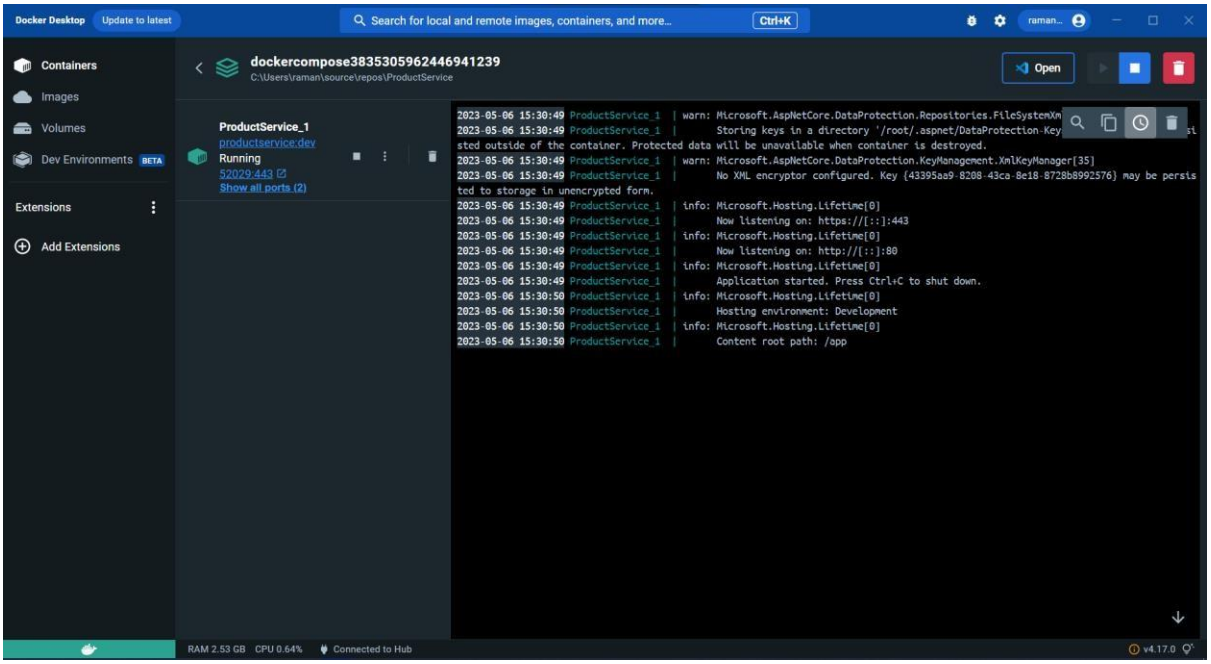


Step 25: Run the **docker ps** command to check the running docker container.

```
C:\Users\raman\source\repos\ProductService>docker ps
CONTAINER ID   IMAGE                 COMMAND                  CREATED          STATUS          PORTS                                                NAMES
6d946df292ed   productservice:dev    "tail -f /dev/null"      11 minutes ago   Up 11 minutes   0.0.0.0:52030->80/tcp, 0.0.0.0:52029->443/tcp        ProductService_1
```

Step 26: Check docker desktop for the running image.





Step 27: The docker image and containers will be running in the docker desktop app.