

**University Of Mumbai  
Institute of Distance & Open Learning**



**PRACTICAL JOURNAL IN PAPER-III**

**MICROSERVICES ARCHITECTURE**

**SUBMITTED BY  
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APPLICATION ID: 191648  
SEAT NO.:11345**

**MASTER OF SCIENCE IN INFORMATION TECHNOLOGY PART-I  
SEMESTER II**

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**INSTITUTE OF DISTANCE AND OPEN LEARNING  
IDOL BUILDING, VIDYANAGARI,  
SANTACRUZ (EAST), MUMBAI-400 098**

**CONDUCTED AT  
UNIVERSITY DEPARTMENT OF INFORMATION TECHNOLOGY,  
UNIVERSITY OF MUMBAI  
SANTACRUZ (EAST), MUMBAI – 400098**

University Of Mumbai  
Institute of Distance & Open Learning



Dr.Shankar Dayal Sharama Bhavan, Kalina,  
Vidanagari, Santacruz (E), Mumbai-400 098.

## Certificate

This is to certify that Mr. **Sachchidanand Yadav** Application ID:**191648** from University Department Of Information Technology, University of Mumbai, Santacruz East, Mumbai-400098 has successfully completed all the practical of Paper III titled **MICROSERVICES ARCHITECTURE** for M.sc (IT) Part I Semester II in the academic year 2020-2021.

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MSc (IT) Co-ordinator, IDOL

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External Examiner

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<b>Sr. No</b>	<b>Practical</b>
1	Building APT.NET Core MVC Application.
2	Building ASP.NET Core REST API.
3	Working with Docker, Docker Commands, Docker Images and Containers.
4	Installing software packages on Docker, Working with Docker Volumes and Networks.
5	Working with Kubernetes.

## Practical No.1

### **Aim: Building APT.NET Core MVC Application.**

1) Install .Net Core Sdk (Link: <https://dotnet.microsoft.com/learn/dotnet/hello-world-tutorial/install>)

2) create folder MyMVC folder in C: drive or any other drive

3) open command prompt and perform following operations

Command: to create mvc project

dotnet new mvc --auth none

output:



```
C:\windows\system32\cmd.exe

C:\Users>cd..

C:\>cd mymvc

C:\MyMVC>dotnet new mvc --auth none

Welcome to .NET 5.0!
-----
SDK Version: 5.0.301

Telemetry
-----
The .NET tools collect usage data in order to help us improve your experience. It is collected by Microsoft and shared with the community. You can opt-out of telemetry by setting the DOTNET_CLI_TELEMETRY_OPTOUT environment variable to '1' or 'true' using your favorite shell.

Read more about .NET CLI Tools telemetry: https://aka.ms/dotnet-cli-telemetry
-----
Installed an ASP.NET Core HTTPS development certificate.
To trust the certificate run 'dotnet dev-certs https --trust' (Windows and macOS only).
Learn about HTTPS: https://aka.ms/dotnet-https
-----
Write your first app: https://aka.ms/dotnet-hello-world
Find out what's new: https://aka.ms/dotnet-whats-new
Explore documentation: https://aka.ms/dotnet-docs
Report issues and find source on GitHub: https://github.com/dotnet/core
Use 'dotnet --help' to see available commands or visit: https://aka.ms/dotnet-cli
-----
Getting ready...
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/5.0-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 215 ms).
Restore succeeded.

C:\MyMVC>
```

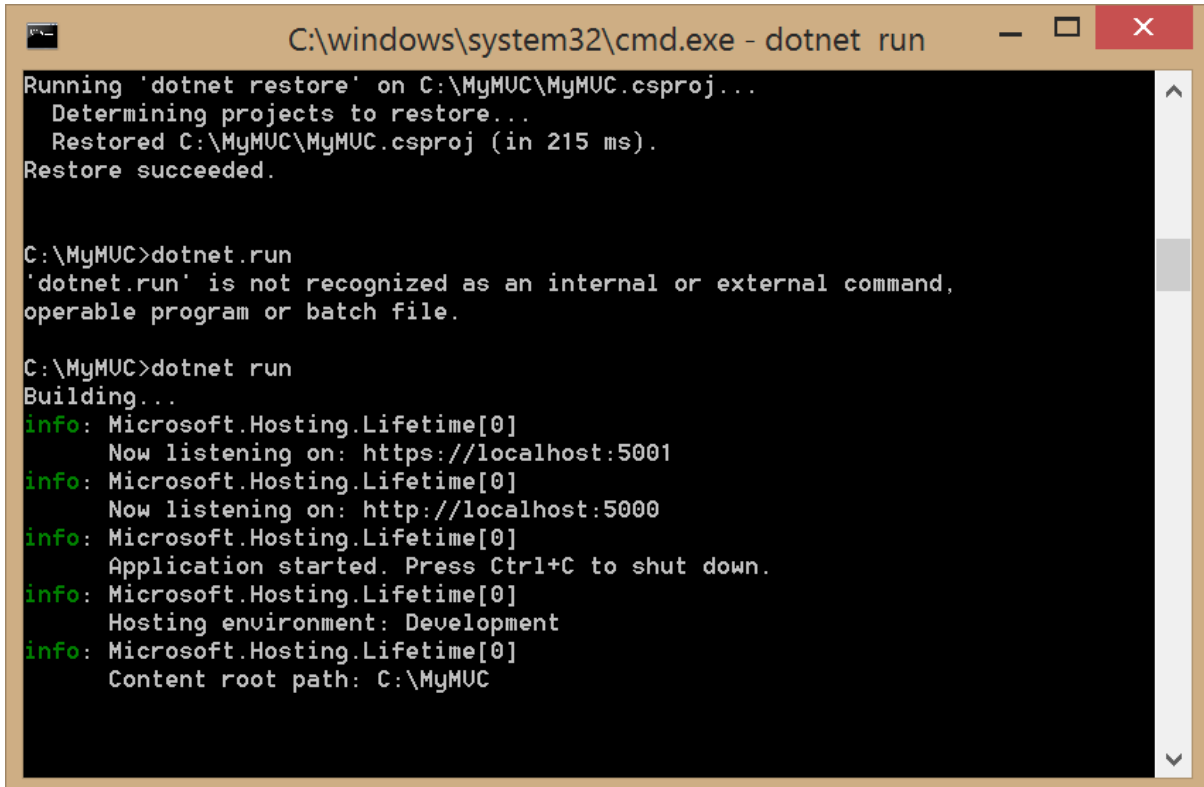
4) Go to controllers folder and modify HomeController.cs file to match following:

Name	Date modified	Type	Size
Controllers	08-07-2021 09:46	File folder	
Models	08-07-2021 09:46	File folder	
obj	08-07-2021 09:46	File folder	
Properties	08-07-2021 09:46	File folder	
Views	08-07-2021 09:46	File folder	
wwwroot	08-07-2021 09:46	File folder	
appsettings.Development	08-07-2021 09:46	JSON File	1 KB
appsettings	08-07-2021 09:46	JSON File	1 KB
MyMVC	08-07-2021 09:46	CSPROJ File	1 KB
Program.cs	08-07-2021 09:46	C# Source File	1 KB
Startup.cs	08-07-2021 09:46	C# Source File	2 KB

```
HomeController.cs - Notepad
File Edit Format View Help
using System.Diagnostics;
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
    {
        public String Index()
        { return "Hello World"; }
    }
}
```

Run the Project



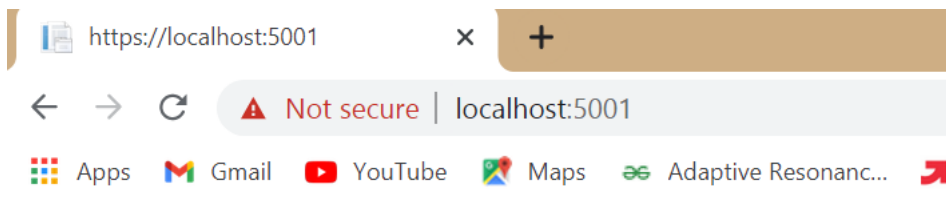
```
C:\windows\system32\cmd.exe - dotnet run

Running 'dotnet restore' on C:\MyMUC\MyMUC.csproj...
Determining projects to restore...
Restored C:\MyMUC\MyMUC.csproj (in 215 ms).
Restore succeeded.

C:\MyMUC>dotnet.run
'dotnet.run' is not recognized as an internal or external command,
operable program or batch file.

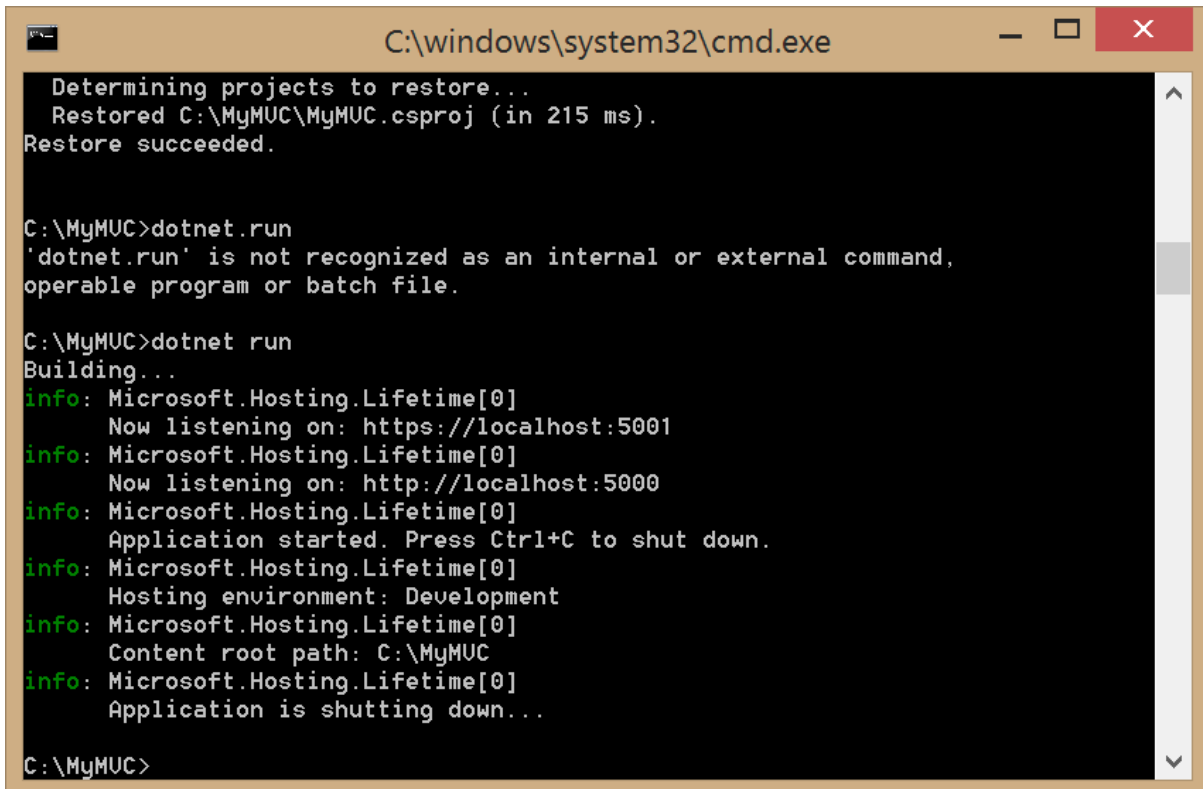
C:\MyMUC>dotnet run
Building...
info: Microsoft.Hosting.Lifetime[0]
      Now listening on: https://localhost:5001
info: Microsoft.Hosting.Lifetime[0]
      Now listening on: http://localhost:5000
info: Microsoft.Hosting.Lifetime[0]
      Application started. Press Ctrl+C to shut down.
info: Microsoft.Hosting.Lifetime[0]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

Now open browser and type URL: localhost:5000



Hello World

Now go back to command prompt and stop running project using CTRL+C



```
C:\windows\system32\cmd.exe

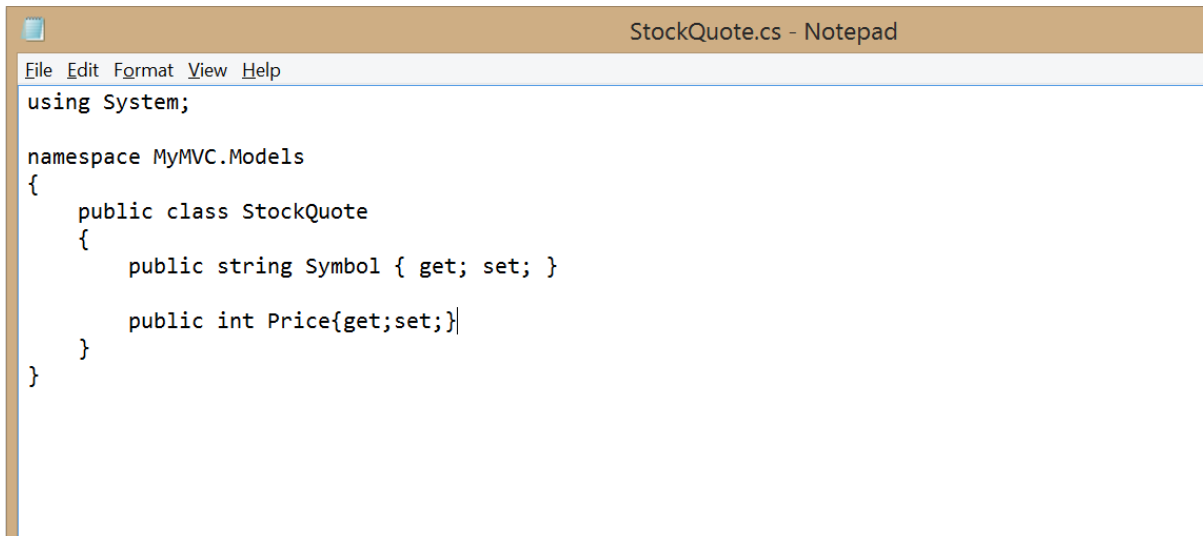
Determining projects to restore...
Restored C:\MyMUC\MyMUC.csproj (in 215 ms).
Restore succeeded.

C:\MyMUC>dotnet.run
'dotnet.run' is not recognized as an internal or external command,
operable program or batch file.

C:\MyMUC>dotnet run
Building...
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:\MyMUC
info: Microsoft.Hosting.Lifetime[0]
      Application is shutting down...

C:\MyMUC>
```

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

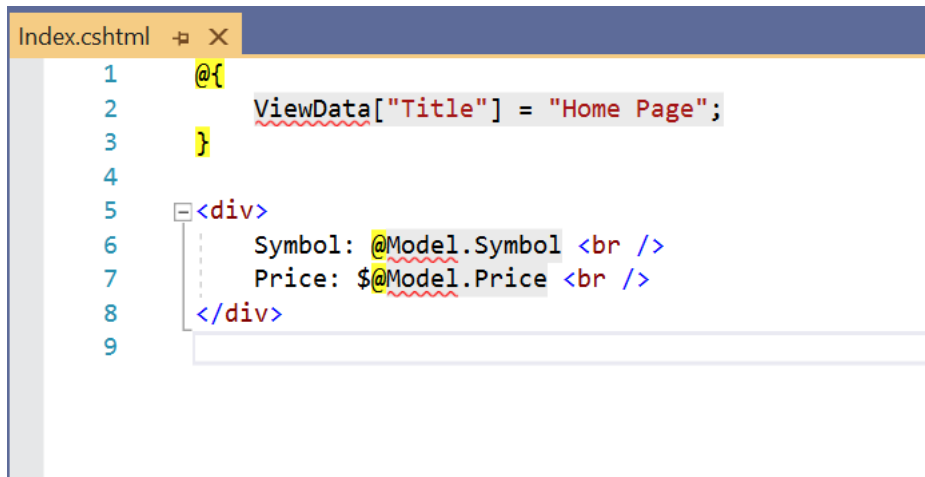


```
StockQuote.cs - Notepad
File Edit Format View Help
using System;

namespace MyMVC.Models
{
    public class StockQuote
    {
        public string Symbol { get; set; }

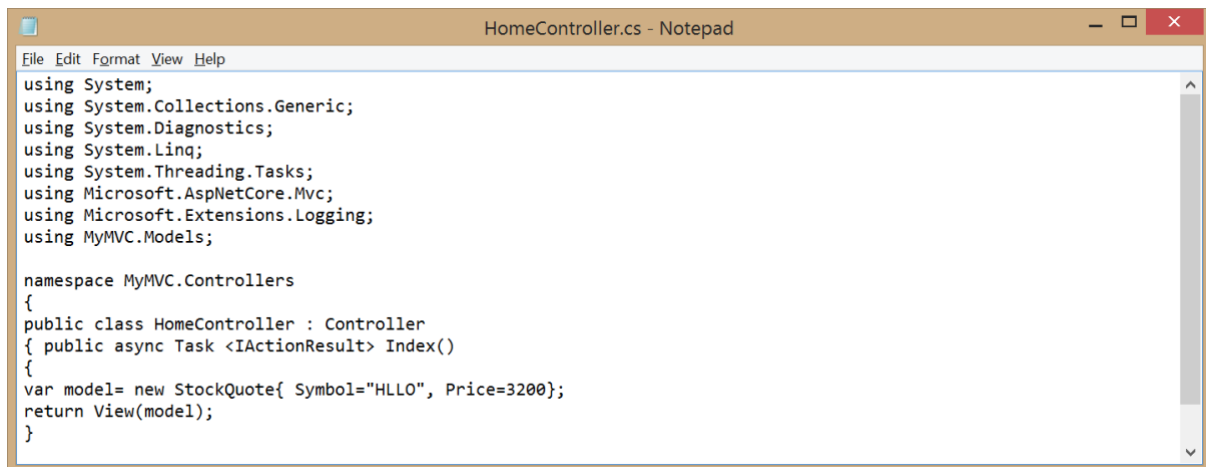
        public int Price { get; set; }
    }
}
```

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



```
1  @{
2      ViewData["Title"] = "Home Page";
3  }
4
5  <div>
6      Symbol: @Model.Symbol <br />
7      Price: $@Model.Price <br />
8  </div>
9
```

Now modify HomeController.cs file to match following:

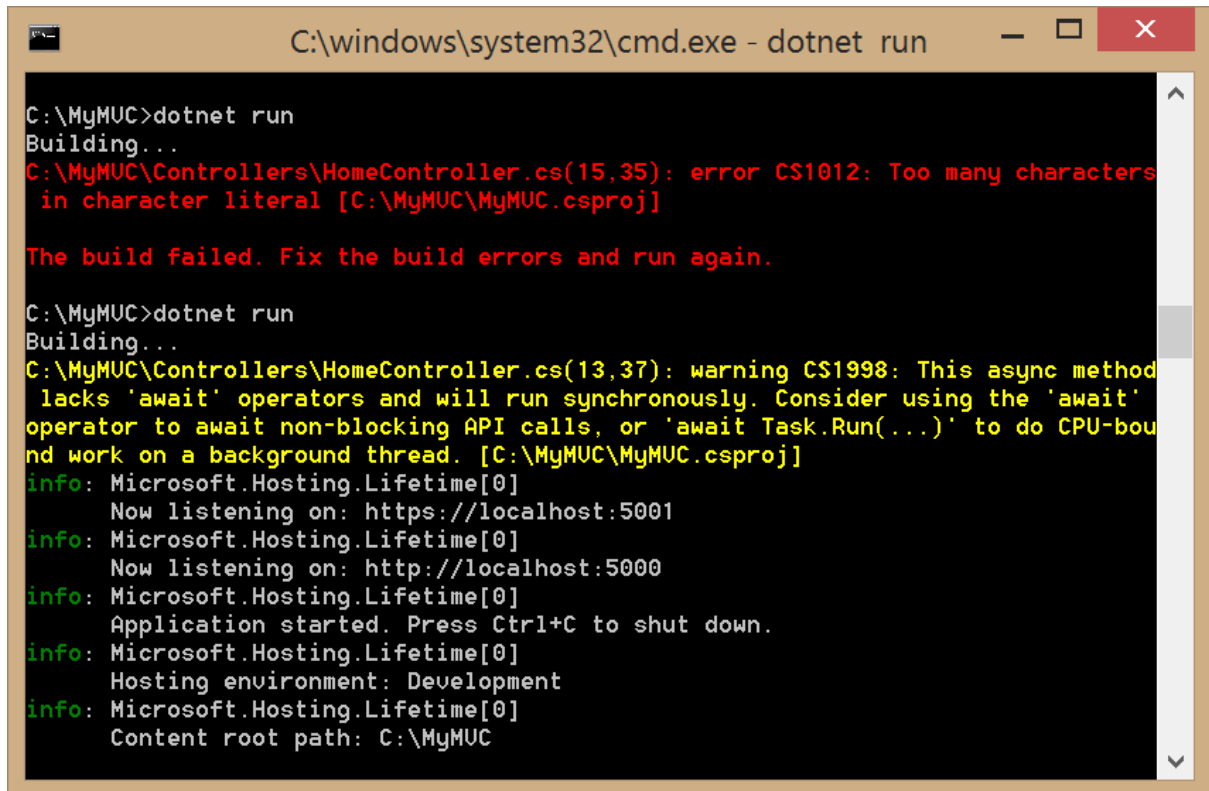


```
HomeController.cs - Notepad
File Edit Format View Help
using System;
using System.Collections.Generic;
using System.Diagnostics;
using System.Linq;
using System.Threading.Tasks;
using Microsoft.AspNetCore.Mvc;
using Microsoft.Extensions.Logging;
using MyMVC.Models;

namespace MyMVC.Controllers
{
    public class HomeController : Controller
    {
        public async Task <ActionResult> Index()
        {
            var model= new StockQuote{ Symbol="HLL0", Price=3200};
            return View(model);
        }
    }
}
```

Now run the project using





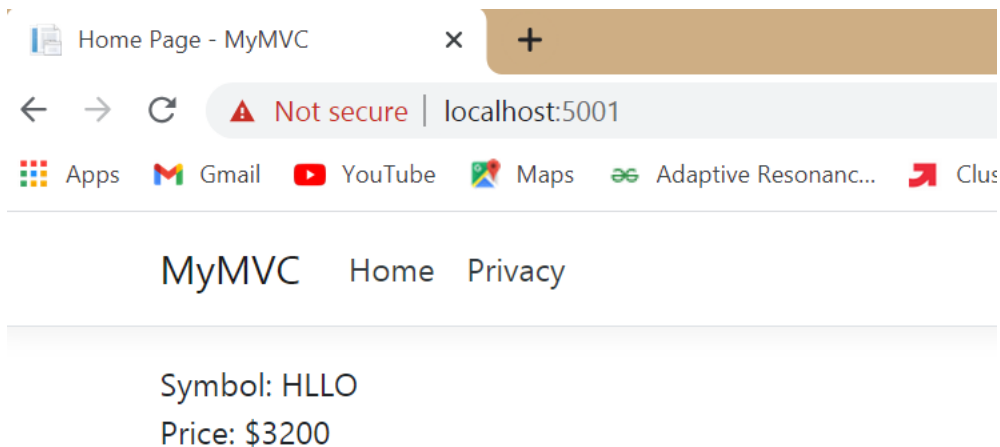
```
C:\windows\system32\cmd.exe - dotnet run

C:\MyMUC>dotnet run
Building...
C:\MyMUC\Controllers\HomeController.cs(15,35): error CS1012: Too many characters
in character literal [C:\MyMUC\MyMUC.csproj]

The build failed. Fix the build errors and run again.

C:\MyMUC>dotnet run
Building...
C:\MyMUC\Controllers\HomeController.cs(13,37): warning CS1998: This async method
lacks 'await' operators and will run synchronously. Consider using the 'await'
operator to await non-blocking API calls, or 'await Task.Run(...)' to do CPU-bou
nd work on a background thread. [C:\MyMUC\MyMUC.csproj]
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:\MyMUC
```

Now go back to browser and refresh to get modified view response



## Practical NO. 2

### **Aim: Building ASP.NET Core REST API.**

Software requirement:

1. Download and install

To start building .NET apps you just need to download and install the .NET SDK (Software Development Kit version 3.0 above).

Link:

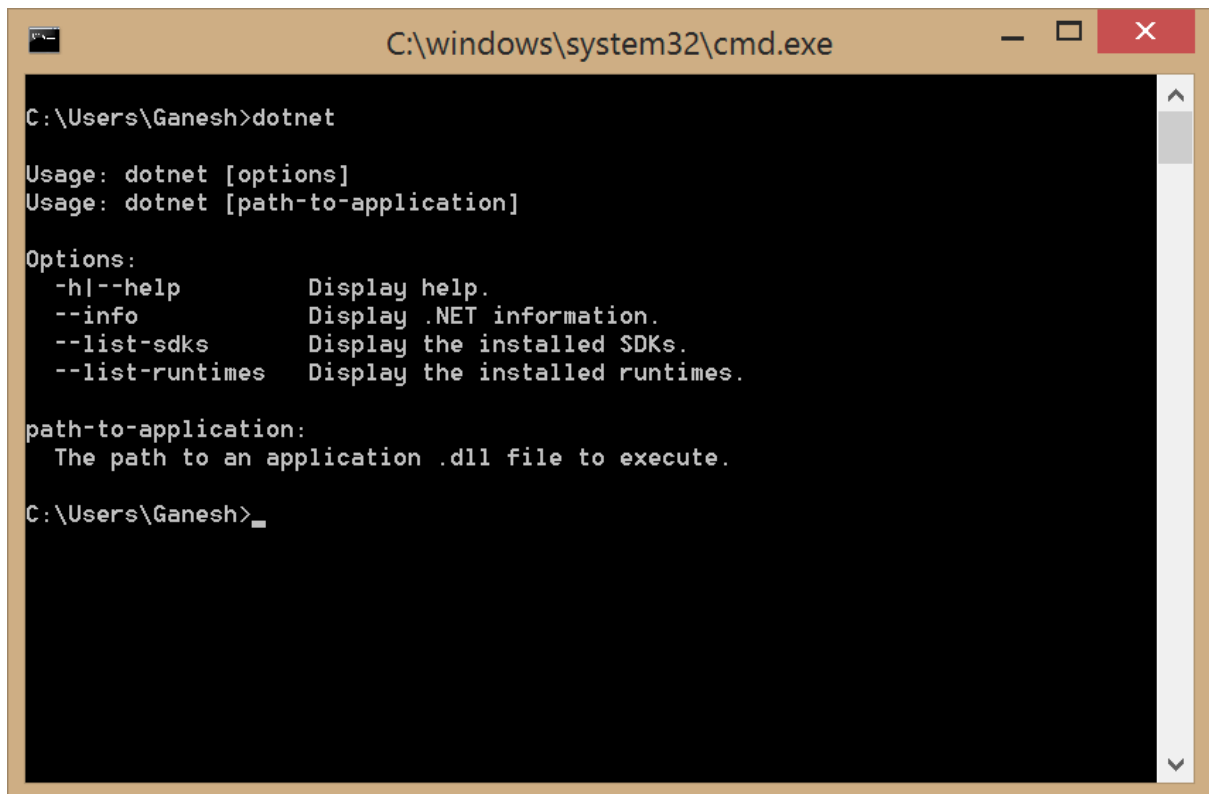
<https://dotnet.microsoft.com/learn/dotnet/hello-world-tutorial/install>

2. Check everything installed correctly

Once you've installed, open a new command prompt and run the following command:

Command prompt

> dotnet



```
C:\windows\system32\cmd.exe

C:\Users\Ganesh>dotnet

Usage: dotnet [options]
Usage: dotnet [path-to-application]

Options:
  -h|--help           Display help.
  --info              Display .NET information.
  --list-sdks         Display the installed SDKs.
  --list-runtimes     Display the installed runtimes.

path-to-application:
  The path to an application .dll file to execute.

C:\Users\Ganesh>
```

Create your web API

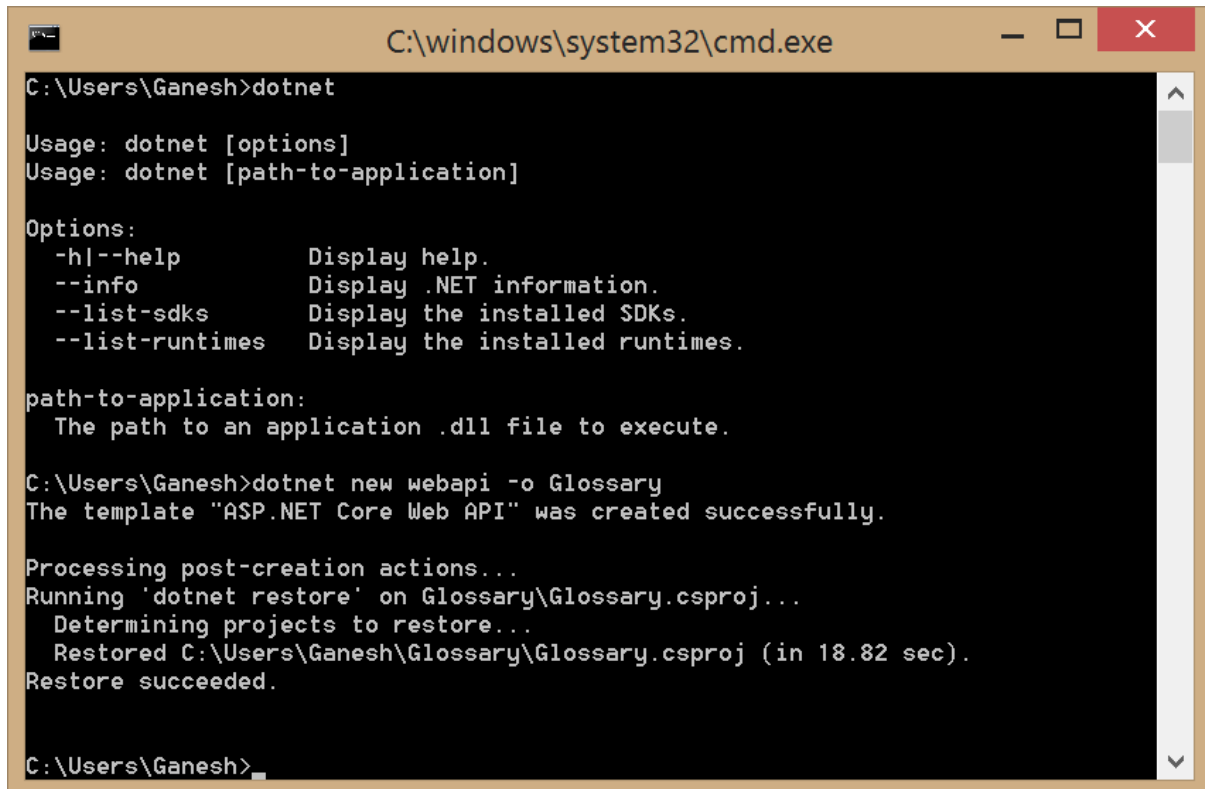
1. Open two command prompts

Command prompt 1:

Command:

dotnet new webapi -o Glossary

**output:**



```
C:\windows\system32\cmd.exe

C:\Users\Ganesh>dotnet

Usage: dotnet [options]
Usage: dotnet [path-to-application]

Options:
  -h|--help           Display help.
  --info              Display .NET information.
  --list-sdks         Display the installed SDKs.
  --list-runtimes     Display the installed runtimes.

path-to-application:
  The path to an application .dll file to execute.

C:\Users\Ganesh>dotnet new webapi -o Glossary
The template "ASP.NET Core Web API" was created successfully.

Processing post-creation actions...
Running 'dotnet restore' on Glossary\Glossary.csproj...
  Determining projects to restore...
  Restored C:\Users\Ganesh\Glossary\Glossary.csproj (in 18.82 sec).
Restore succeeded.

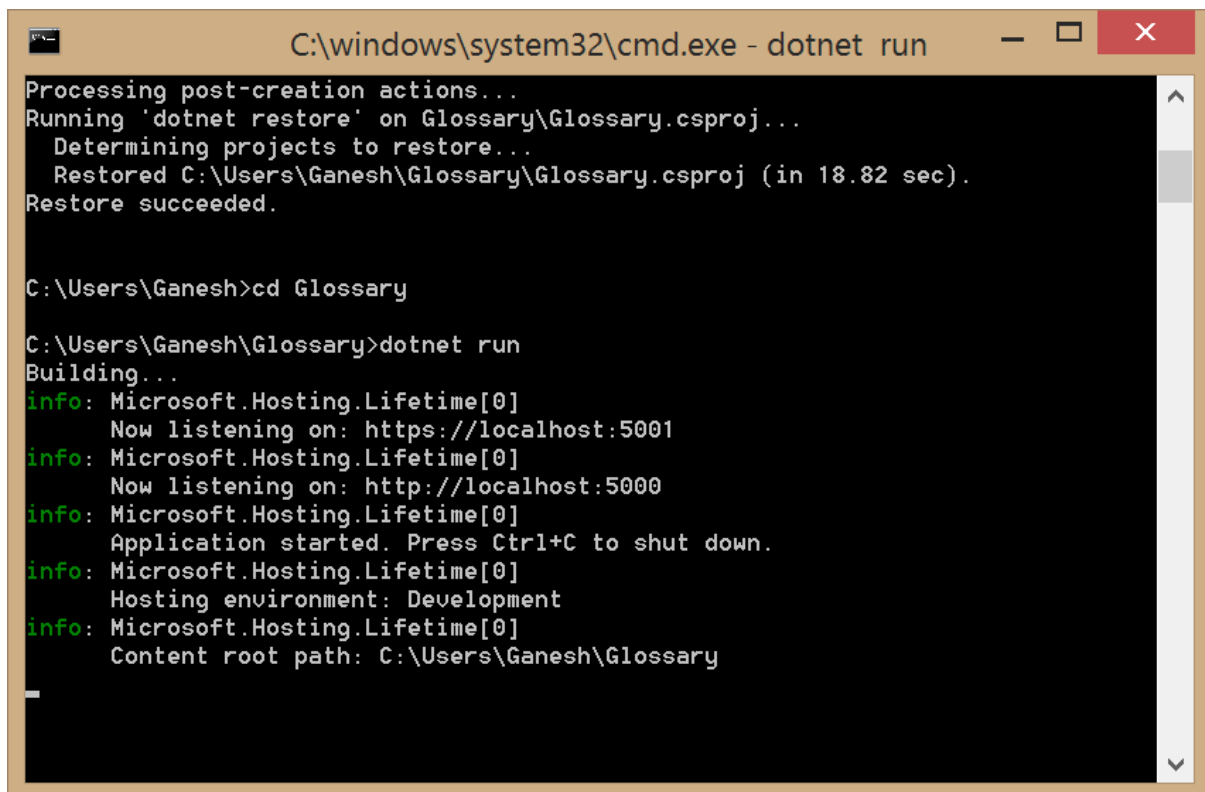
C:\Users\Ganesh>
```

Command:

cd Glossary

dotnet run

Output:



```
C:\windows\system32\cmd.exe - dotnet run

Processing post-creation actions...
Running 'dotnet restore' on Glossary\Glossary.csproj...
  Determining projects to restore...
  Restored C:\Users\Ganesh\Glossary\Glossary.csproj (in 18.82 sec).
Restore succeeded.

C:\Users\Ganesh>cd Glossary
C:\Users\Ganesh\Glossary>dotnet run
Building...
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:\Users\Ganesh\Glossary
```

Name	Date modified	Type	Size
bin	09-07-2021 07:29	File folder	
Controllers	09-07-2021 07:26	File folder	
obj	09-07-2021 07:29	File folder	
Properties	09-07-2021 07:26	File folder	
appsettings.Development	09-07-2021 07:26	JSON File	1 KB
appsettings	09-07-2021 07:26	JSON File	1 KB
Glossary	09-07-2021 07:26	CSPROJ File	1 KB
Program.cs	09-07-2021 07:26	C# Source File	1 KB
Startup.cs	09-07-2021 07:26	C# Source File	2 KB
WeatherForecast.cs	09-07-2021 07:26	C# Source File	1 KB

Command Prompt 2: (try running readymade weatherforecast class for testing)

Command:

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

output:

```
C:\windows\system32\cmd.exe

ass="social-media-icons"><p><a href="/page/contact_us"></a><a href="https://twitter.com/eviltester"></a><a href="https://www.youtube.com/subscription_center?add_user=EvilTesterVideos"></a><a href="https://uk.linkedin.com/in/eviltester"></a><a href="https://github.com/eviltester"></a><a href="https://uk.pinterest.com/eviltester/"></a><a href="https://www.instagram.com/eviltester/"></a><a href="https://www.facebook.com/eviltester/"></a><a href="https://www.eviltester.com/index.xml"></a></p></div></div></div></div>

C:\Users\Ganesh>curl --insecure https://localhost:5001/weatherforecast
[{"date": "2021-07-10T09:09:58.6266731+05:30", "temperatureC": 14, "temperatureF": 57, "summary": "Warm"}, {"date": "2021-07-11T09:09:58.6266782+05:30", "temperatureC": 26, "temperatureF": 78, "summary": "Mild"}, {"date": "2021-07-12T09:09:58.6266782+05:30", "temperatureC": 6, "temperatureF": 42, "summary": "Cool"}, {"date": "2021-07-13T09:09:58.6266786+05:30", "temperatureC": 16, "temperatureF": 60, "summary": "Chilly"}, {"date": "2021-07-14T09:09:58.6266786+05:30", "temperatureC": -3, "temperatureF": 27, "summary": "Hot"}]

C:\Users\Ganesh>
```

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

1) D:\Glossary\GlossaryItem.cs (type it in notepad and save as all files)

```
//GlossaryItem.cs
```

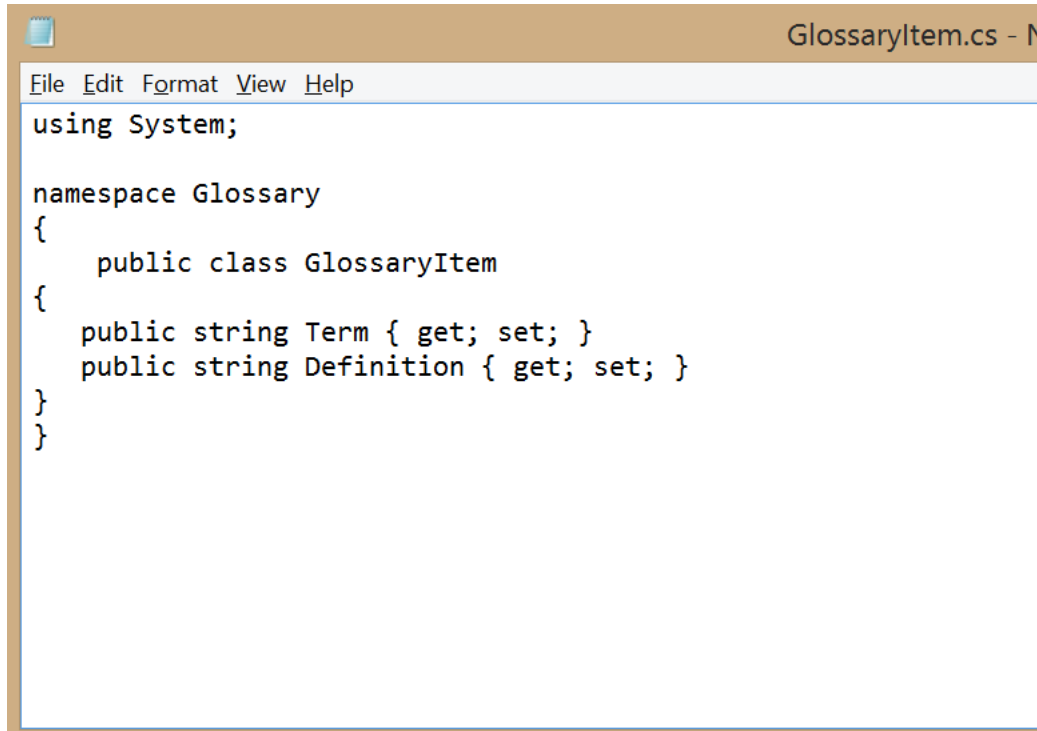
## namespace Glossary

 $\{$ 

```
public class GlossaryItem
```

$$\{$$

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



```
File Edit Format View Help  
using System;  
  
namespace Glossary  
{  
    public class GlossaryItem  
    {  
        public string Term { get; set; }  
        public string Definition { get; set; }  
    }  
}
```

D:\Glossary\Controllers\ GlossaryController.cs (type it in notepad and save as all files)

```
//Controllers/GlossaryController.cs  
using System;  
using System.Collections.Generic;  
using Microsoft.AspNetCore.Mvc;  
using System.IO;  
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"
}
};

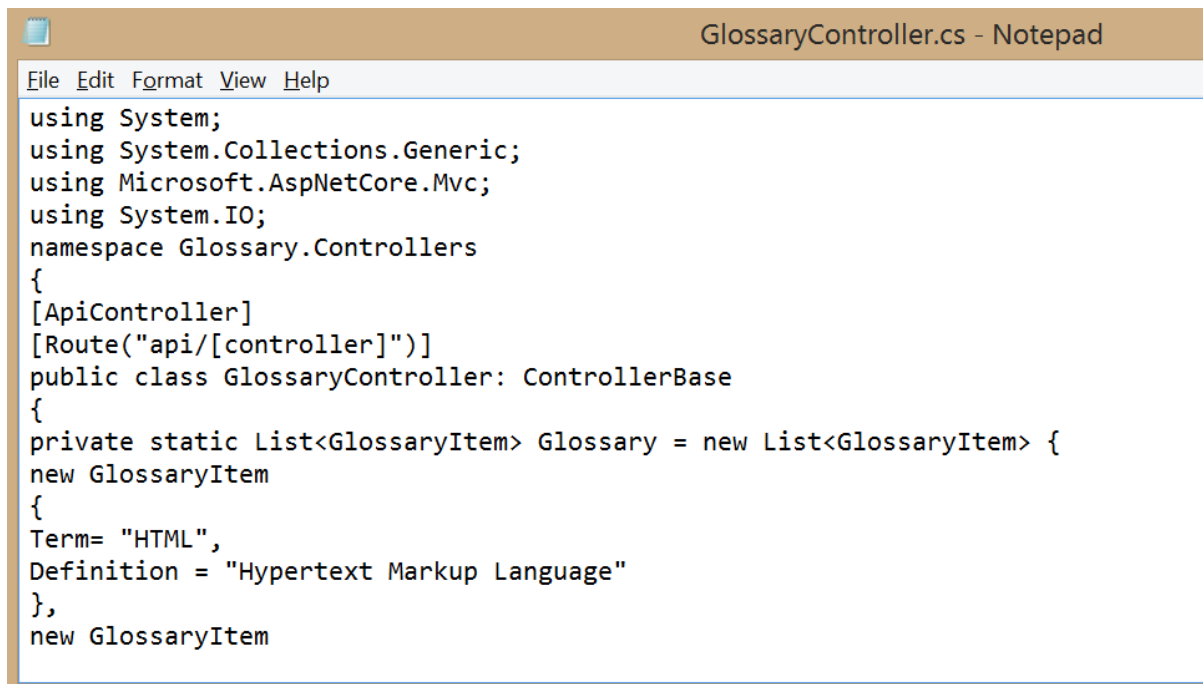
[HttpGet]
public ActionResult<List<GlossaryItem>> Get()
{ return Ok(Glossary);
}

[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();  
    }  
}  
}  
}  
}
```



```
GlossaryController.cs - Notepad  
File Edit Format View Help  
using System;  
using System.Collections.Generic;  
using Microsoft.AspNetCore.Mvc;  
using System.IO;  
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
```

**Output:**

Name	Date modified	Type	Size
bin	09-07-2021 07:29	File folder	
Controllers	09-07-2021 09:20	File folder	
obj	09-07-2021 07:29	File folder	
Properties	09-07-2021 07:26	File folder	
appsettings.Development	09-07-2021 07:26	JSON File	1 KB
appsettings	09-07-2021 07:26	JSON File	1 KB
Glossary	09-07-2021 07:26	CSPROJ File	1 KB
GlossaryItem.cs	09-07-2021 09:19	C# Source File	1 KB
Program.cs	09-07-2021 07:26	C# Source File	1 KB
Startup.cs	09-07-2021 07:26	C# Source File	2 KB

Name	Date modified	Type
GlossaryController.cs	09-07-2021 09:22	C# Source File

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

On Command prompt1:

Command:

dotnet run

output:

```

C:\windows\system32\cmd.exe - dotnet run
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:\Users\Ganesh\Glossary
info: Microsoft.Hosting.Lifetime[0]
Application is shutting down...

C:\Users\Ganesh\Glossary>dotnet run
Building...
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:\Users\Ganesh\Glossary

```





```

C:\windows\system32\cmd.exe
connect on LinkedIn"/></a><a href="https://github.com/eviltester"></a><a href="https://uk.pinterest.com
/eviltester/">
</a><a href="https://www.instagram.com/eviltester/"></a><a href="https://www.facebook.com/evil
tester/"></a><a
href="https://www.eviltester.com/index.xml"></a></p></div></div></div></div></div></div>
</div><script async defer data-domain="compendiumdev.co.uk" src="https://plaus
ible.io/js/plausible.js"></script></body></html>
C:\Users\Ganesh>curl --insecure https://localhost:5001/weatherforecast
[{"date": "2021-07-10T09:09:58.6266731+05:30", "temperatureC": 14, "temperatureF": 57,
"summary": "Warm"}, {"date": "2021-07-11T09:09:58.6266782+05:30", "temperatureC": 26,
"temperatureF": 78, "summary": "Mild"}, {"date": "2021-07-12T09:09:58.6266782+05:30",
"temperatureC": 6, "temperatureF": 42, "summary": "Cool"}, {"date": "2021-07-13T09:09:
58.6266786+05:30", "temperatureC": 16, "temperatureF": 60, "summary": "Chilly"}, {"date
": "2021-07-14T09:09:58.6266786+05:30", "temperatureC": -3, "temperatureF": 27, "summa
ry": "Hot"}]
C:\Users\Ganesh>curl --insecure https://localhost:5001/api/glossary
[{"term": "HTML", "definition": "Hypertext Markup Language"}, {"term": "MUC", "definit
ion": "Model View Controller"}, {"term": "OpenID", "definition": "An open standard fo
r authentication"}]
C:\Users\Ganesh>curl --insecure https://localhost:5001/api/glossary/MUC
{"term": "MUC", "definition": "Model View Controller"}
C:\Users\Ganesh>

```

Creating an item

Command:

curl --insecure -X POST -d '{"term": "MFA", "definition": "An authentication process."}' -H "Content-Type:application/json" <https://localhost:5001/api/glossary>

```

C:\windows\system32\cmd.exe
C:\Users\Ganesh>curl --insecure https://localhost:5001/api/glossary
[{"term": "HTML", "definition": "Hypertext Markup Language"}, {"term": "MUC", "definit
ion": "Model View Controller"}, {"term": "OpenID", "definition": "An open standard fo
r authentication"}]
C:\Users\Ganesh>curl --insecure https://localhost:5001/api/glossary/MUC
{"term": "MUC", "definition": "Model View Controller"}
C:\Users\Ganesh>curl --insecure -X POST -d '{"term": "MFA", "definition": "
An authentication process."}' -H "Content-
curl: no URL specified!
curl: try 'curl --help' or 'curl --manual' for more information

C:\Users\Ganesh>curl --insecure -X POST -d '{"term": "MFA", "definition": "
An authentication process."}' -H "Content-
curl: no URL specified!
curl: try 'curl --help' or 'curl --manual' for more information

C:\Users\Ganesh>curl --insecure -X POST -d '{"term": "MFA", "definition": "
An authentication process."}' -H "Content-Type:application/json" https://loca
localhost:5001/api/glossary
{"term": "MFA", "definition": "An authentication process."}
C:\Users\Ganesh>curl --insecure https://localhost:5001/api/glossary
[{"term": "HTML", "definition": "Hypertext Markup Language"}, {"term": "MUC", "definit
ion": "Model View Controller"}, {"term": "OpenID", "definition": "An open standard fo
r authentication"}, {"term": "MFA", "definition": "An authentication process."}]
C:\Users\Ganesh>

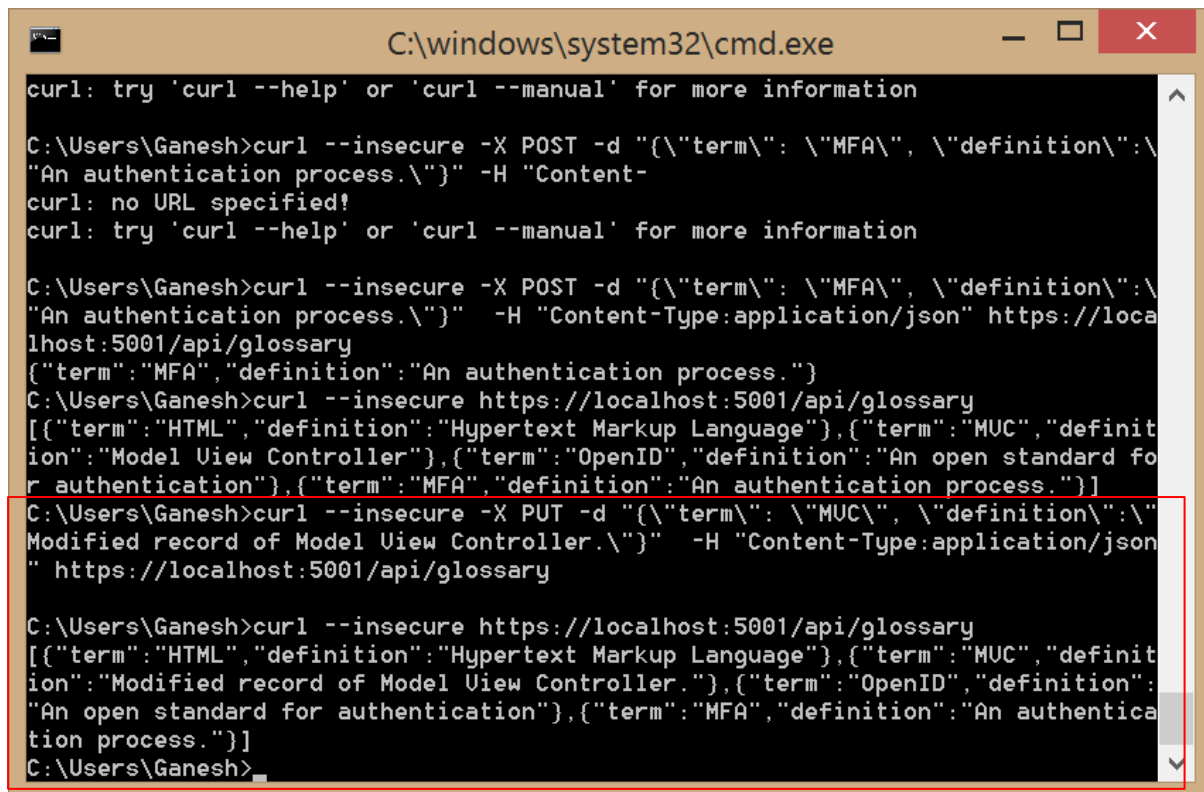
```

Update Item

Command:

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

Output:



```
C:\windows\system32\cmd.exe

curl: try 'curl --help' or 'curl --manual' for more information

C:\Users\Ganesh>curl --insecure -X POST -d '{"term\": \"MFA\", \"definition\": \"An authentication process.\"}' -H \"Content-Type:application/json\" https://localhost:5001/api/glossary
curl: no URL specified!
curl: try 'curl --help' or 'curl --manual' for more information

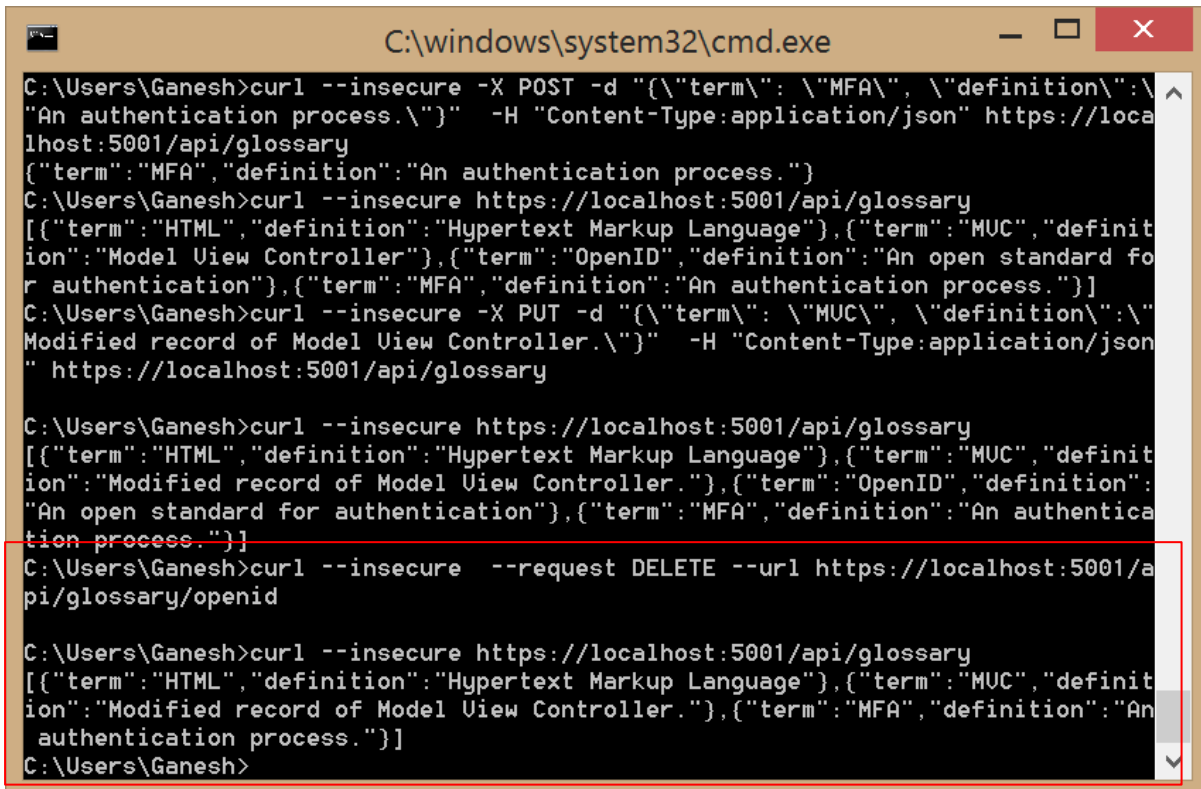
C:\Users\Ganesh>curl --insecure -X POST -d '{"term\": \"MFA\", \"definition\": \"An authentication process.\"}' -H \"Content-Type:application/json\" https://localhost:5001/api/glossary
{"term": "MFA", "definition": "An authentication process."}
C:\Users\Ganesh>curl --insecure https://localhost:5001/api/glossary
[{"term": "HTML", "definition": "Hypertext Markup Language"}, {"term": "MUC", "definition": "Modified record of Model View Controller"}, {"term": "OpenID", "definition": "An open standard for authentication"}, {"term": "MFA", "definition": "An authentication process."}]
C:\Users\Ganesh>curl --insecure -X PUT -d '{"term\": \"MUC\", \"definition\": \"Modified record of Model View Controller.\"}' -H \"Content-Type:application/json\" https://localhost:5001/api/glossary
{"term": "MUC", "definition": "Modified record of Model View Controller."}
C:\Users\Ganesh>curl --insecure https://localhost:5001/api/glossary
[{"term": "HTML", "definition": "Hypertext Markup Language"}, {"term": "MUC", "definition": "Modified record of Model View Controller"}, {"term": "OpenID", "definition": "An open standard for authentication"}, {"term": "MFA", "definition": "An authentication process."}]
C:\Users\Ganesh>
```

Delete Item

Command:

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

Output:



```
C:\windows\system32\cmd.exe

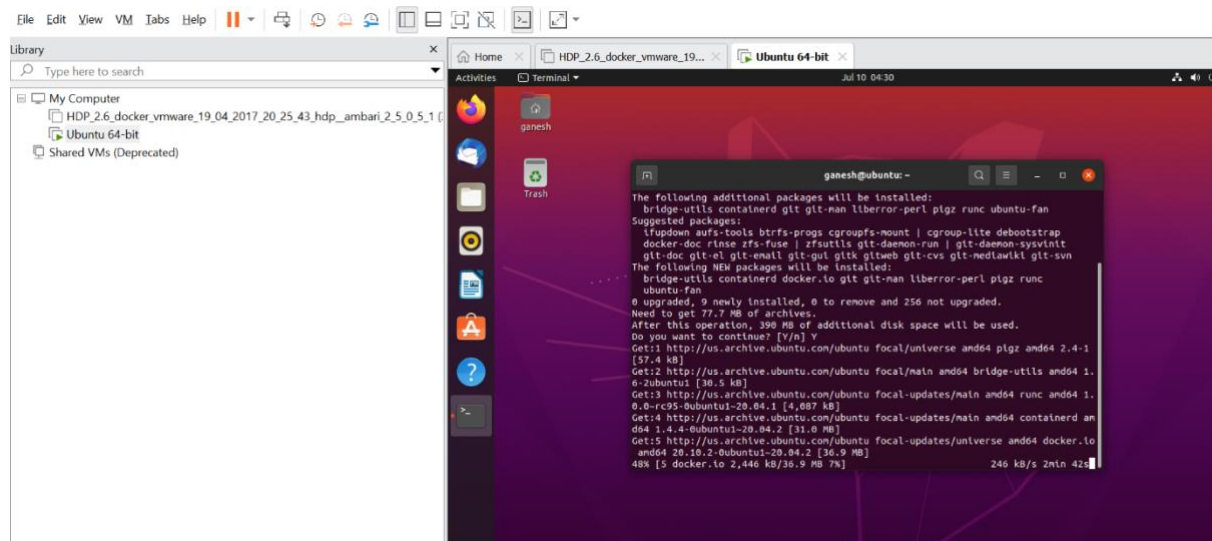
C:\Users\Ganesh>curl --insecure -X POST -d '{"term": "MFA", "definition": "An authentication process."}' -H "Content-Type:application/json" https://localhost:5001/api/glossary
{"term": "MFA", "definition": "An authentication process."}
C:\Users\Ganesh>curl --insecure https://localhost:5001/api/glossary
[{"term": "HTML", "definition": "Hypertext Markup Language"}, {"term": "MUC", "definition": "Model View Controller"}, {"term": "OpenID", "definition": "An open standard for authentication"}, {"term": "MFA", "definition": "An authentication process."}]
C:\Users\Ganesh>curl --insecure -X PUT -d '{"term": "MUC", "definition": "Modified record of Model View Controller."}' -H "Content-Type:application/json" https://localhost:5001/api/glossary
{"term": "MUC", "definition": "Modified record of Model View Controller."}
C:\Users\Ganesh>curl --insecure https://localhost:5001/api/glossary
[{"term": "HTML", "definition": "Hypertext Markup Language"}, {"term": "MUC", "definition": "Modified record of Model View Controller."}, {"term": "OpenID", "definition": "An open standard for authentication"}, {"term": "MFA", "definition": "An authentication process."}]
C:\Users\Ganesh>curl --insecure --request DELETE --url https://localhost:5001/api/glossary/openid
{"term": "MUC", "definition": "Modified record of Model View Controller."}
C:\Users\Ganesh>curl --insecure https://localhost:5001/api/glossary
[{"term": "HTML", "definition": "Hypertext Markup Language"}, {"term": "MUC", "definition": "Modified record of Model View Controller."}, {"term": "OpenID", "definition": "An open standard for authentication"}, {"term": "MFA", "definition": "An authentication process."}]
C:\Users\Ganesh>
```

## Practical No. 3

### **Aim: Working with Docker, Docker Commands, Docker Images and Containers**

After install ubuntu in vmware. Install docker

Command: `sudo apt-get install docker.io`



Install using the repository

Before you install Docker Engine for the first time on a new host machine, you need to set up the Docker repository. Afterward, you can install and update Docker from the repository.

Set up the repository

Update the apt package index and install packages to allow apt to use a repository over HTTPS:

1. `$ sudo apt-get update`
2. `$ sudo apt-get install \`  
`apt-transport-https \`  
`ca-certificates \`  
`curl \`  
`gnupg \`  
`lsb-release`

```

ganesh@ubuntu: ~
Experimental: true
not permission denied while trying to connect to the Docker daemon socket at uni
x://var/run/docker.sock: Get http://%2Fvar%2Frun%2Fdocker.sock/v1.24/version: d
ial unix /var/run/docker.sock: connect: permission denied
ganesh@ubuntu:~$ sudo apt-get update
Hit:1 http://us.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 https://download.docker.com/linux/ubuntu focal InRelease
Hit:3 http://us.archive.ubuntu.com/ubuntu focal-updates InRelease
Get:4 http://us.archive.ubuntu.com/ubuntu focal-backports InRelease [101 kB]
Get:5 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Fetched 214 kB in 4s (48.8 kB/s)
Reading package lists... Done
ganesh@ubuntu:~$ sudo apt-get install \
  apt-transport-https \
  ca-certificates \
  curl \
  gnupg \
  lsb-release
Reading package lists... Done
Building dependency tree
Reading state information... Done
lsb-release is already the newest version (11.1.0ubuntu2).
lsb-release set to manually installed.
ca-certificates is already the newest version (20210119~20.04.1)

```

1. Add Docker's official GPG key:

```
$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --
dearmor -o /usr/share/keyrings/docker-archive-keyring.gpg
```

Use the following command to set up the **stable** repository

```
$ echo \
  "deb [arch=amd64 signed-by=/usr/share/keyrings/docker-archive-
  keyring.gpg] https://download.docker.com/linux/ubuntu \
  $(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list
> /dev/null
```

```

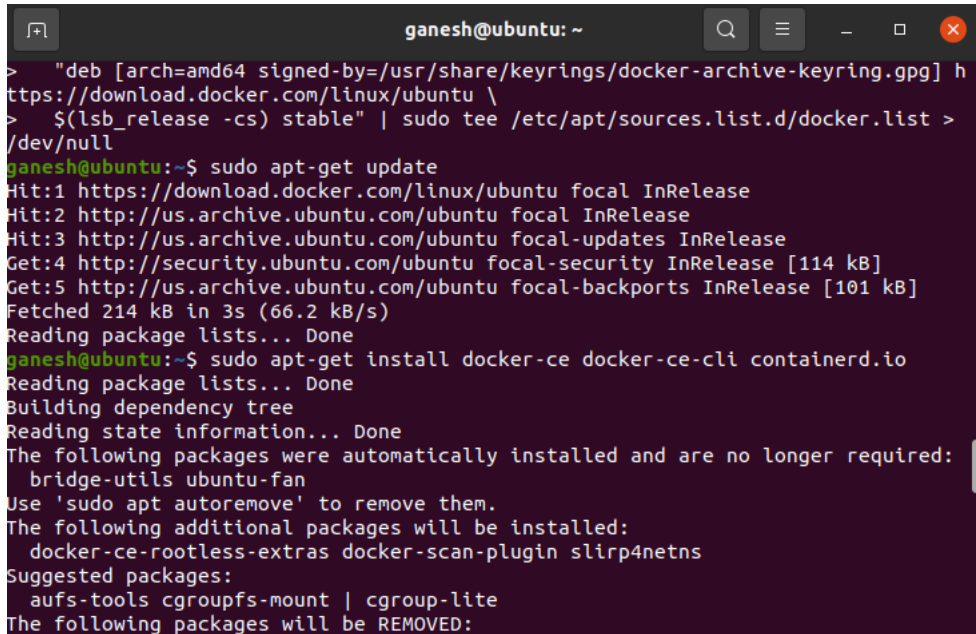
ganesh@ubuntu: ~
Setting up gnupg-utils (2.2.19-3ubuntu2.1) ...
Setting up gpg-agent (2.2.19-3ubuntu2.1) ...
Setting up gpgsm (2.2.19-3ubuntu2.1) ...
Setting up dirmngr (2.2.19-3ubuntu2.1) ...
Setting up gpg-wks-server (2.2.19-3ubuntu2.1) ...
Setting up gpg-wks-client (2.2.19-3ubuntu2.1) ...
Setting up gnupg (2.2.19-3ubuntu2.1) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for install-info (6.7.0.dfsg.2-5) ...
ganesh@ubuntu:~$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo
gpg --dearmor -o /usr/share/keyrings/docker-archive-keyring.gpg
File '/usr/share/keyrings/docker-archive-keyring.gpg' exists. Overwrite? (y/N) Y
ganesh@ubuntu:~$ echo \
> "deb [arch=amd64 signed-by=/usr/share/keyrings/docker-archive-keyring.gpg] h
https://download.docker.com/linux/ubuntu \
> $(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list >
/dev/null
ganesh@ubuntu:~$ sudo apt-get update
Hit:1 https://download.docker.com/linux/ubuntu focal InRelease
Hit:2 http://us.archive.ubuntu.com/ubuntu focal InRelease
Hit:3 http://us.archive.ubuntu.com/ubuntu focal-updates InRelease
Get:4 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu focal-backports InRelease [101 kB]
Fetched 214 kB in 3s (66.2 kB/s)

```

## Install Docker Engine

Update the apt package index, and install the *latest version* of Docker Engine and containerd, or go to the next step to install a specific version:

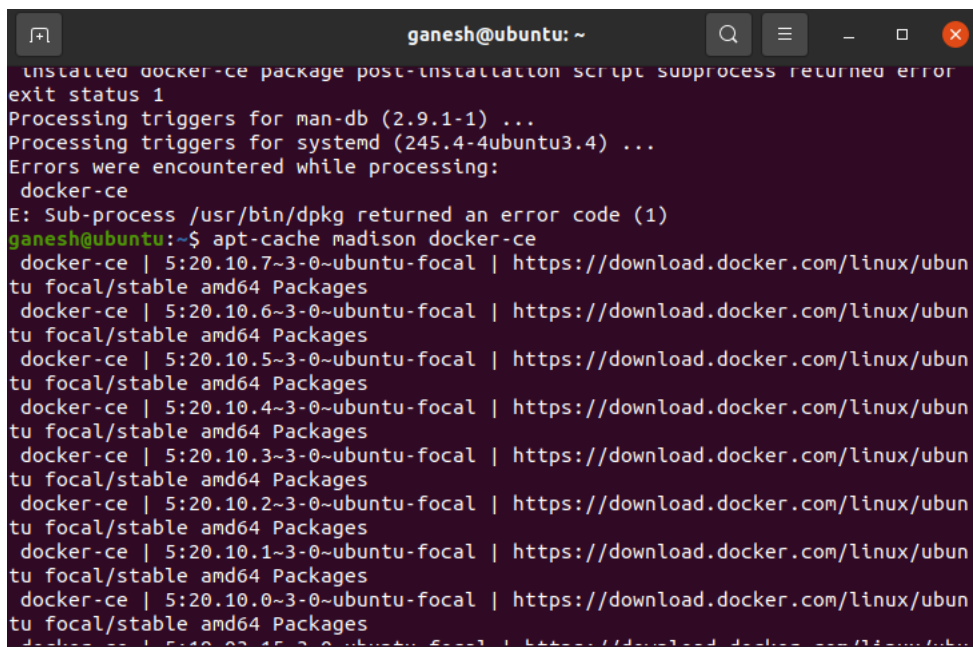
```
$ sudo apt-get update
$ sudo apt-get install docker-ce docker-ce-cli containerd.io
```



```
ganesh@ubuntu: ~
> "deb [arch=amd64 signed-by=/usr/share/keyrings/docker-archive-keyring.gpg] h
https://download.docker.com/linux/ubuntu \
> $(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list >
/dev/null
ganesh@ubuntu:~$ sudo apt-get update
Hit:1 https://download.docker.com/linux/ubuntu focal InRelease
Hit:2 http://us.archive.ubuntu.com/ubuntu focal InRelease
Hit:3 http://us.archive.ubuntu.com/ubuntu focal-updates InRelease
Get:4 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu focal-backports InRelease [101 kB]
Fetched 214 kB in 3s (66.2 kB/s)
Reading package lists... Done
ganesh@ubuntu:~$ sudo apt-get install docker-ce docker-ce-cli containerd.io
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  bridge-utils ubuntu-fan
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  docker-ce-rootless-extras docker-scan-plugin slurp4netns
Suggested packages:
  aufs-tools cgroupfs-mount | cgroup-lite
The following packages will be REMOVED:
```

To install a *specific version* of Docker Engine, list the available versions in the repo, then select and install:

apt-cache madison docker-ce



```
ganesh@ubuntu: ~
Installed docker-ce package post-installation script subprocess returned error
exit status 1
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for systemd (245.4-4ubuntu3.4) ...
Errors were encountered while processing:
  docker-ce
E: Sub-process /usr/bin/dpkg returned an error code (1)
ganesh@ubuntu:~$ apt-cache madison docker-ce
docker-ce | 5:20.10.7~3-0-ubuntu-focal | https://download.docker.com/linux/ubun
tu focal/stable amd64 Packages
docker-ce | 5:20.10.6~3-0-ubuntu-focal | https://download.docker.com/linux/ubun
tu focal/stable amd64 Packages
docker-ce | 5:20.10.5~3-0-ubuntu-focal | https://download.docker.com/linux/ubun
tu focal/stable amd64 Packages
docker-ce | 5:20.10.4~3-0-ubuntu-focal | https://download.docker.com/linux/ubun
tu focal/stable amd64 Packages
docker-ce | 5:20.10.3~3-0-ubuntu-focal | https://download.docker.com/linux/ubun
tu focal/stable amd64 Packages
docker-ce | 5:20.10.2~3-0-ubuntu-focal | https://download.docker.com/linux/ubun
tu focal/stable amd64 Packages
docker-ce | 5:20.10.1~3-0-ubuntu-focal | https://download.docker.com/linux/ubun
tu focal/stable amd64 Packages
docker-ce | 5:20.10.0~3-0-ubuntu-focal | https://download.docker.com/linux/ubun
tu focal/stable amd64 Packages
docker-ce | 5:20.10.0~3-0-ubuntu-focal | https://download.docker.com/linux/ubun
tu focal/stable amd64 Packages
```



Docker Commands:

Docker --version

Docker version

```
ganesh@ubuntu: ~  
E: Package 'docker-ce' has no installation candidate  
E: Unable to locate package docker-ce-cli  
E: Unable to locate package containerd.io  
E: Couldn't find any package by glob 'containerd.io'  
E: Couldn't find any package by regex 'containerd.io'  
ganesh@ubuntu:~$ docker --version  
Docker version 20.10.2, build 20.10.2-0ubuntu1~20.04.2  
ganesh@ubuntu:~$ docker version  
Client:  
Version:      20.10.2  
API version:  1.41  
Go version:   go1.13.8  
Git commit:   20.10.2-0ubuntu1~20.04.2  
Built:        Tue Mar 30 21:24:57 2021  
OS/Arch:      linux/amd64  
Context:      default  
Experimental: true  
Got permission denied while trying to connect to the Docker daemon socket at unix:  
x:///var/run/docker.sock: Get http://%2Fvar%2Frun%2Fdocker.sock/v1.24/version: dial  
unix /var/run/docker.sock: connect: permission denied  
ganesh@ubuntu:~$ docker images  
Got permission denied while trying to connect to the Docker daemon socket at uni  
x:///var/run/docker.sock: Get http://%2Fvar%2Frun%2Fdocker.sock/v1.24/images/js
```

Docker pull httpd

Pull an image or a repository from a registry

```
ganesh@ubuntu: ~  
4. The Docker daemon streamed that output to the Docker client, which sent it  
to your terminal.  
To try something more ambitious, you can run an Ubuntu container with:  
$ docker run -it ubuntu bash  
Share images, automate workflows, and more with a free Docker ID:  
https://hub.docker.com/  
For more examples and ideas, visit:  
https://docs.docker.com/get-started/  
ganesh@ubuntu:~$ docker pull httpd  
Using default tag: latest  
latest: Pulling from library/httpd  
b4d181a07f80: Pull complete  
4b72f5187e6e: Pull complete  
12b2c44d04b2: Pull complete  
35c238b46d30: Pull complete  
1adcec05f52b: Pull complete  
Digest: sha256:1fd07d599a519b594b756d2e4e43a72edf7e30542ce646f5eb3328cf3b12341a  
Status: Downloaded newer image for httpd:latest  
docker.io/library/httpd:latest  
ganesh@ubuntu:~$
```

Docker images



It lists all the images

```

ganesh@ubuntu: ~
$ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
https://hub.docker.com/

For more examples and ideas, visit:
https://docs.docker.com/get-started/

ganesh@ubuntu:~$ docker pull httpd
Using default tag: latest
latest: Pulling from library/httpd
b4d181a07f80: Pull complete
4b72f5187e6e: Pull complete
12b2c44d04b2: Pull complete
35c238b46d30: Pull complete
1adcec05f52b: Pull complete
Digest: sha256:1fd07d599a519b594b756d2e4e43a72edf7e30542ce646f5eb3328cf3b12341a
Status: Downloaded newer image for httpd:latest
docker.io/library/httpd:latest
ganesh@ubuntu:~$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
httpd          latest    bd29370f84ea   38 hours ago   138MB
hello-world    latest    d1165f221234   4 months ago   13.3kB
ganesh@ubuntu:~$

```

#nano Dockerfile

FROM busybox

CMD echo "Hello world! This is my first Docker image."

//above two line we have to add into dockerfile

to save press ctrl+o(to write) then enter then ctrl+x (to exit)

docker build --tag "hello-world:pract1" .

docker images

```

ganesh@ubuntu: ~
invalid argument "Dockerfile:pract1" for "-t, --tag" flag: invalid reference for
mat: repository name must be lowercase
See 'docker build --help'.
ganesh@ubuntu:~$ docker build --tag "hello-world:pract1" .
Sending build context to Docker daemon 10.36MB
Step 1/2 : FROM busybox
latest: Pulling from library/busybox
b71f96345d44: Pull complete
Digest: sha256:930490f97e5b921535c153e0e7110d251134cc4b72bbb8133c6a5065cc68580d
Status: Downloaded newer image for busybox:latest
--> 69593048aa3a
Step 2/2 : CMD echo "Hello world! This is my first Docker image."
--> Running in f7b326450d64
Removing intermediate container f7b326450d64
--> 77ded695389b
Successfully built 77ded695389b
Successfully tagged hello-world:pract1
ganesh@ubuntu:~$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
hello-world    pract1     77ded695389b   3 minutes ago   1.24MB
httpd          latest    bd29370f84ea   38 hours ago   138MB
busybox        latest    69593048aa3a   4 weeks ago    1.24MB
hello-world    latest    d1165f221234   4 months ago   13.3kB
ganesh@ubuntu:~$

```

docker run hello-world:pract1

```
ganesh@ubuntu: ~  
See 'docker build --help'.  
ganesh@ubuntu:~$ docker build --tag "hello-world:pract1" .  
Sending build context to Docker daemon 10.36MB  
Step 1/2 : FROM busybox  
latest: Pulling from library/busybox  
b71f96345d44: Pull complete  
Digest: sha256:930490f97e5b921535c153e0e7110d251134cc4b72bbb8133c6a5065cc68580d  
Status: Downloaded newer image for busybox:latest  
--> 69593048aa3a  
Step 2/2 : CMD echo "Hello world! This is my first Docker image."  
--> Running in f7b326450d64  
Removing intermediate container f7b326450d64  
--> 77ded695389b  
Successfully built 77ded695389b  
Successfully tagged hello-world:pract1  
ganesh@ubuntu:~$ docker images  
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE  
hello-world    pract1    77ded695389b   3 minutes ago  1.24MB  
httpd         latest    bd29370f84ea   38 hours ago   138MB  
busybox       latest    69593048aa3a   4 weeks ago    1.24MB  
hello-world    latest    d1165f221234   4 months ago   13.3kB  
ganesh@ubuntu:~$ docker run hello-world:pract1  
Hello world! This is my first Docker image.  
ganesh@ubuntu:~$
```

docker run 77ded695389b

```
ganesh@ubuntu: ~  
Sending build context to Docker daemon 10.36MB  
Step 1/2 : FROM busybox  
latest: Pulling from library/busybox  
b71f96345d44: Pull complete  
Digest: sha256:930490f97e5b921535c153e0e7110d251134cc4b72bbb8133c6a5065cc68580d  
Status: Downloaded newer image for busybox:latest  
--> 69593048aa3a  
Step 2/2 : CMD echo "Hello world! This is my first Docker image."  
--> Running in f7b326450d64  
Removing intermediate container f7b326450d64  
--> 77ded695389b  
Successfully built 77ded695389b  
Successfully tagged hello-world:pract1  
ganesh@ubuntu:~$ docker images  
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE  
hello-world    pract1    77ded695389b   3 minutes ago  1.24MB  
httpd         latest    bd29370f84ea   38 hours ago   138MB  
busybox       latest    69593048aa3a   4 weeks ago    1.24MB  
hello-world    latest    d1165f221234   4 months ago   13.3kB  
ganesh@ubuntu:~$ docker run hello-world:pract1  
Hello world! This is my first Docker image.  
ganesh@ubuntu:~$ docker run 77ded695389b  
Hello world! This is my first Docker image.  
ganesh@ubuntu:~$
```

### Docker rmi

Remove one or more images

docker rmi -f images-id

docker rmi -f 77ded695389b

After running docker images we can see that 77ded695389b is deleted.

```

ganesh@ubuntu: ~
Package docker-ce is not available, but is referred to by another package.
This may mean that the package is missing, has been obsoleted, or
is only available from another source

E: Package 'docker-ce' has no installation candidate
E: Unable to locate package docker-ce-cli
E: Unable to locate package containerd.io
E: Couldn't find any package by glob 'containerd.io'
E: Couldn't find any package by regex 'containerd.io'
ganesh@ubuntu:~$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
hello-world   pract1    77ded695389b   13 minutes ago 1.24MB
httpd         latest    bd29370f84ea   38 hours ago   138MB
busybox       latest    69593048aa3a   4 weeks ago    1.24MB
hello-world   latest    d1165f221234   4 months ago   13.3kB
ganesh@ubuntu:~$ docker rmi -f 77ded695389b
Untagged: hello-world:pract1
Deleted: sha256:77ded695389bb5259ef5cdbe14d8a606904fb213e65506dfcbcd76feda73c417
ganesh@ubuntu:~$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
httpd         latest    bd29370f84ea   38 hours ago   138MB
busybox       latest    69593048aa3a   4 weeks ago    1.24MB
hello-world   latest    d1165f221234   4 months ago   13.3kB
ganesh@ubuntu:~$

```

**docker rmi -f Respository-name**

**docker rmi -f Debian**

```

ganesh@ubuntu: ~
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
httpd         latest    bd29370f84ea   38 hours ago   138MB
busybox       latest    69593048aa3a   4 weeks ago    1.24MB
hello-world   latest    d1165f221234   4 months ago   13.3kB
ganesh@ubuntu:~$ docker pull debian
Using default tag: latest
latest: Pulling from library/debian
0bc3020d05f1: Pull complete
Digest: sha256:dc320da8d9d73c9dab5059668852555c171d40cdec297da845da9c929b70e0b1
Status: Downloaded newer image for debian:latest
docker.io/library/debian:latest
ganesh@ubuntu:~$ docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
httpd         latest    bd29370f84ea   38 hours ago   138MB
debian        latest    7a4951775d15   2 weeks ago    114MB
busybox       latest    69593048aa3a   4 weeks ago    1.24MB
hello-world   latest    d1165f221234   4 months ago   13.3kB
ganesh@ubuntu:~$ docker rmi -f debian
Untagged: debian:latest
Untagged: debian@sha256:dc320da8d9d73c9dab5059668852555c171d40cdec297da845da9c929b70e0b1
Deleted: sha256:7a4951775d157843b47250a2a5cc7b561d2abe0b29ae6f19737a04635302eacf
Deleted: sha256:4e006334a6fdea37622f72b21eb75fe1484fc4f20ce8b8526187d6f7bd90a6fe
ganesh@ubuntu:~$

```

**docker rmi -f Respository-name:tag**

**docker rmi -f debian:latest**

**After this debain image will be deleted**

```
ganesh@ubuntu: ~  
Using default tag: latest  
latest: Pulling from library/debian  
0bc3020d05f1: Pull complete  
Digest: sha256:dcb20da8d9d73c9dab5059668852555c171d40cdec297da845da9c929b70e0b1  
Status: Downloaded newer image for debian:latest  
docker.io/library/debian:latest  
ganesh@ubuntu:~$ docker images  
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE  
httpd         latest    bd29370f84ea   38 hours ago   138MB  
debian        latest    7a4951775d15   2 weeks ago    114MB  
busybox       latest    69593048aa3a   4 weeks ago    1.24MB  
hello-world   latest    d1165f221234   4 months ago   13.3kB  
ganesh@ubuntu:~$ docker rmi -f debian:latest  
Untagged: debian:latest  
Untagged: debian@sha256:dcb20da8d9d73c9dab5059668852555c171d40cdec297da845da9c929b70e0b1  
Deleted: sha256:7a4951775d157843b47250a2a5cc7b561d2abe0b29ae6f19737a04635302eacf  
Deleted: sha256:4e006334a6fdea37622f72b21eb75fe1484fc4f20ce8b8526187d6f7bd90a6fe  
ganesh@ubuntu:~$ docker images  
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE  
httpd         latest    bd29370f84ea   38 hours ago   138MB  
busybox       latest    69593048aa3a   4 weeks ago    1.24MB  
hello-world   latest    d1165f221234   4 months ago   13.3kB  
ganesh@ubuntu:~$
```

## Practical No. 4

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

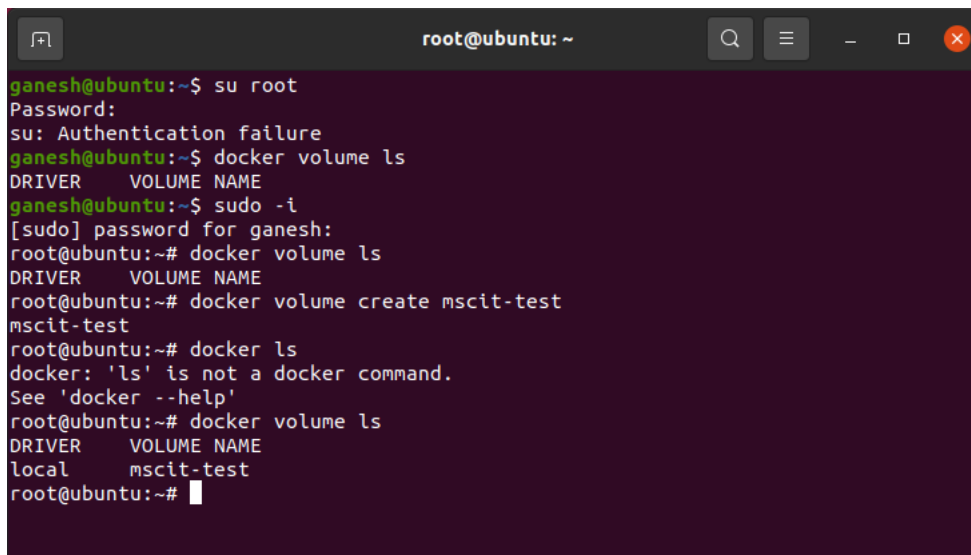
Volumes are the preferred mechanism for persisting data generated by and used by Docker containers. While bind mounts are dependent on the directory structure and OS of the host machine, volumes are completely managed by Docker.

List volumes created

Command: `docker volume ls`

To create volume.

Command: `docker volume create mscit-test`

A terminal window titled 'root@ubuntu: ~' with search, menu, and window control icons. The terminal shows a user 'ganesh' at 'ubuntu' prompt. They attempt to switch to root with 'su root', which fails due to authentication. Then they run 'docker volume ls', which shows no volumes. Next, they run 'sudo -i', which prompts for a password. As root, they run 'docker volume ls' (still empty), then 'docker volume create mscit-test' (successful), and finally 'docker ls' (returns an error: 'ls' is not a docker command). They then run 'docker volume ls' again, which shows the 'mscit-test' volume on the 'local' driver.

```
ganesh@ubuntu:~$ su root
Password:
su: Authentication failure
ganesh@ubuntu:~$ docker volume ls
DRIVER      VOLUME NAME
ganesh@ubuntu:~$ sudo -i
[sudo] password for ganesh:
root@ubuntu:~# docker volume ls
DRIVER      VOLUME NAME
root@ubuntu:~# docker volume create mscit-test
mscit-test
root@ubuntu:~# docker ls
docker: 'ls' is not a docker command.
See 'docker --help'
root@ubuntu:~# docker volume ls
DRIVER      VOLUME NAME
local       mscit-test
root@ubuntu:~#
```

Return low-level information on Docker objects

Command: `docker volume inspect mscit-test`

```
root@ubuntu: ~  
[sudo] password for ganesh:  
root@ubuntu:~# docker volume ls  
DRIVER      VOLUME NAME  
root@ubuntu:~# docker volume create mscit-test  
mscit-test  
root@ubuntu:~# docker ls  
docker: 'ls' is not a docker command.  
See 'docker --help'  
root@ubuntu:~# docker volume ls  
DRIVER      VOLUME NAME  
local       mscit-test  
root@ubuntu:~# docker volume inspect mscit-test  
[  
  {  
    "CreatedAt": "2021-07-10T20:58:04-07:00",  
    "Driver": "local",  
    "Labels": {},  
    "Mountpoint": "/var/lib/docker/volumes/mscit-test/_data",  
    "Name": "mscit-test",  
    "Options": {},  
    "Scope": "local"  
  }  
]  
root@ubuntu:~#
```

Create a directory

mkdir mscit-volume

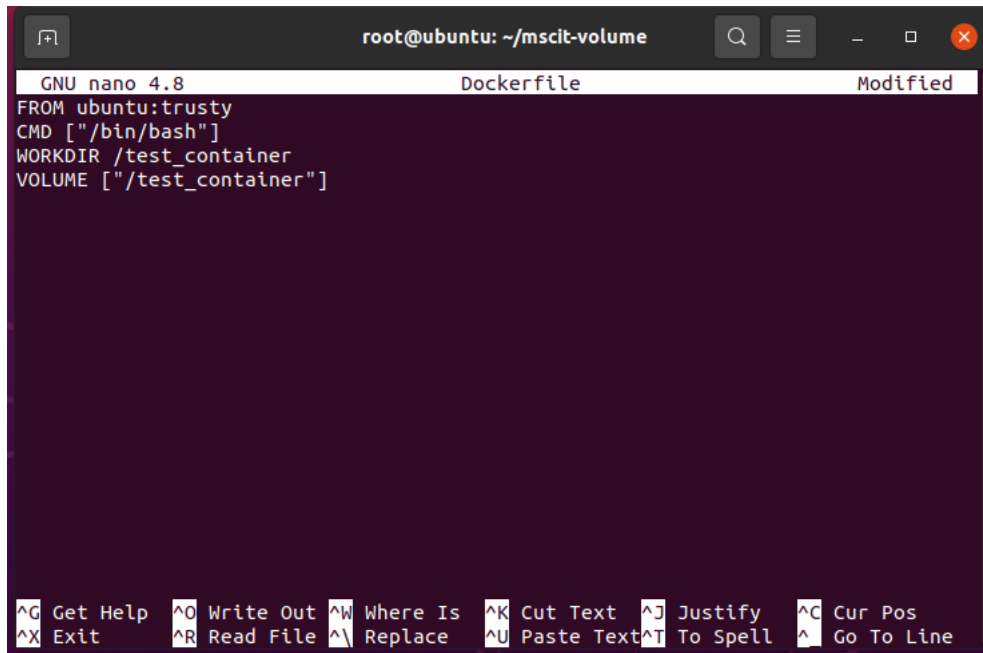
Now, change directory to mscit-volume

cd mscit-volume/

```
root@ubuntu: ~/mscit-volume  
root@ubuntu:~# docker ls  
docker: 'ls' is not a docker command.  
See 'docker --help'  
root@ubuntu:~# docker volume ls  
DRIVER      VOLUME NAME  
local       mscit-test  
root@ubuntu:~# docker volume inspect mscit-test  
[  
  {  
    "CreatedAt": "2021-07-10T20:58:04-07:00",  
    "Driver": "local",  
    "Labels": {},  
    "Mountpoint": "/var/lib/docker/volumes/mscit-test/_data",  
    "Name": "mscit-test",  
    "Options": {},  
    "Scope": "local"  
  }  
]  
root@ubuntu:~# ls  
snap  
root@ubuntu:~# mkdir mscit-volume  
root@ubuntu:~# cd mscit-volume/  
root@ubuntu:~/mscit-volume# nano Dockerfile
```

Create a file

Nano Dockerfile

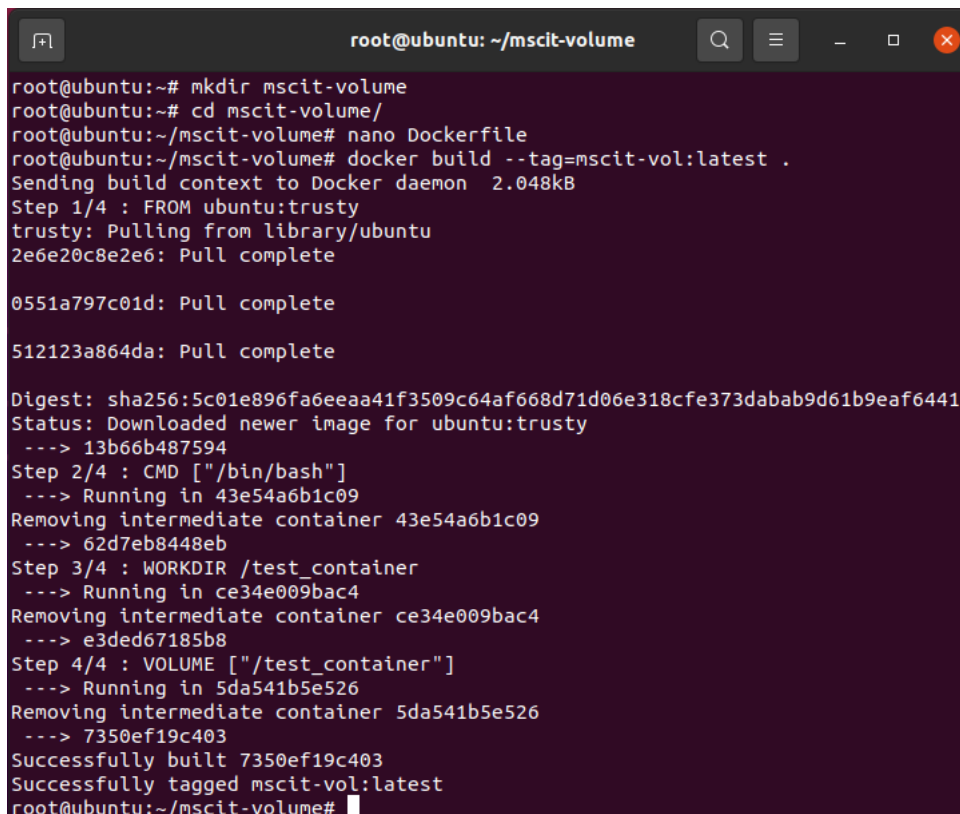


```
root@ubuntu: ~/mscit-volume
GNU nano 4.8 Dockerfile Modified
FROM ubuntu:trusty
CMD ["/bin/bash"]
WORKDIR /test_container
VOLUME ["/test_container"]

^G Get Help  ^O Write Out ^W Where Is  ^K Cut Text  ^J Justify   ^C Cur Pos
^X Exit      ^R Read File ^\ Replace   ^U Paste Text ^T To Spell  ^_ Go To Line
```

To create an image file

`docker build --tag=mscit-vol:latest .`



```
root@ubuntu: ~/mscit-volume
root@ubuntu:~# mkdir mscit-volume
root@ubuntu:~# cd mscit-volume/
root@ubuntu:~/mscit-volume# nano Dockerfile
root@ubuntu:~/mscit-volume# docker build --tag=mscit-vol:latest .
Sending build context to Docker daemon 2.048kB
Step 1/4 : FROM ubuntu:trusty
trusty: Pulling from library/ubuntu
2e6e20c8e2e6: Pull complete

0551a797c01d: Pull complete

512123a864da: Pull complete

Digest: sha256:5c01e896fa6eeaa41f3509c64af668d71d06e318cfe373dabab9d61b9eaf6441
Status: Downloaded newer image for ubuntu:trusty
--> 13b66b487594
Step 2/4 : CMD ["/bin/bash"]
--> Running in 43e54a6b1c09
Removing intermediate container 43e54a6b1c09
--> 62d7eb8448eb
Step 3/4 : WORKDIR /test_container
--> Running in ce34e009bac4
Removing intermediate container ce34e009bac4
--> e3ded67185b8
Step 4/4 : VOLUME ["/test_container"]
--> Running in 5da541b5e526
Removing intermediate container 5da541b5e526
--> 7350ef19c403
Successfully built 7350ef19c403
Successfully tagged mscit-vol:latest
root@ubuntu:~/mscit-volume#
```

Check the image create

Command: `docker images`



```
root@ubuntu: ~/mscit-volume
2e6e20c8e2e6: Pull complete
0551a797c01d: Pull complete
512123a864da: Pull complete
Digest: sha256:5c01e896fa6eaa41f3509c64af668d71d06e318cfe373dabab9d61b9eaf6441
Status: Downloaded newer image for ubuntu:trusty
--> 13b66b487594
Step 2/4 : CMD ["/bin/bash"]
--> Running in 43e54a6b1c09
Removing intermediate container 43e54a6b1c09
--> 62d7eb8448eb
Step 3/4 : WORKDIR /test_container
--> Running in ce34e009bac4
Removing intermediate container ce34e009bac4
--> e3ded67185b8
Step 4/4 : VOLUME ["/test_container"]
--> Running in 5da541b5e526
Removing intermediate container 5da541b5e526
--> 7350ef19c403
Successfully built 7350ef19c403
Successfully tagged mscit-vol:latest
root@ubuntu:~/mscit-volume# docker images
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
mscit-vol     latest   7350ef19c403   3 minutes ago  197MB
httpd         latest   bd29370f84ea   2 days ago    138MB
busybox       latest   69593048aa3a   4 weeks ago   1.24MB
ubuntu        trusty   13b66b487594   3 months ago  197MB
hello-world   latest   d1165f221234   4 months ago  13.3kB
root@ubuntu:~/mscit-volume#
```

Mounting the container

```
docker run -it --mount src=/mscit-shared,target=/test_container,type=bind mscit-vol
```

It will change in root and show test\_Container



```

root@b43347ed3af6: /test_container
REPOSITORY    TAG       IMAGE ID       CREATED        SIZE
mscit-vol     latest   7350ef19c403   26 minutes ago 197MB
httpd        latest   bd29370f84ea   2 days ago    138MB
busybox      latest   69593048aa3a   4 weeks ago    1.24MB
ubuntu       trusty   13b66b487594   3 months ago   197MB
hello-world   latest   d1165f221234   4 months ago   13.3kB
root@ubuntu:~/mscit-volume# cd /mscit-shared
root@ubuntu:~/mscit-shared# invalid mount config for type "bind": bind source path does not exist: /mscit-share.
invalid: command not found
root@ubuntu:~/mscit-shared# docker run -it --mount src=/mscit-share,target=/test_container,type=bind mscit-vol
docker: Error response from daemon: invalid mount config for type "bind": bind source path does not exist: /mscit-share.
See 'docker run --help'.
root@ubuntu:~/mscit-shared# cd /mscit-volume
-bash: cd: /mscit-volume: No such file or directory
root@ubuntu:~/mscit-shared# cd..
cd..: command not found
root@ubuntu:~/mscit-shared# cd
root@ubuntu:~# cd mscit-volume
root@ubuntu:~/mscit-volume# mkdir /mscit-shared
mkdir: cannot create directory '/mscit-shared': File exists
root@ubuntu:~/mscit-volume# docker run -it --mount src=/mscit-share,target=/test_container,type=bind mscit-vol
docker: Error response from daemon: invalid mount config for type "bind": bind source path does not exist: /mscit-share.
See 'docker run --help'.
root@ubuntu:~/mscit-volume# docker run -it --mount src=/mscit-shared,target=/test_container,type=bind mscit-vol
root@b43347ed3af6: /test_container#

```

Now open other terminal and get into mscit-shared directory and create a file called hi

```

[sudo] password for ganesh:
sudo: i: command not found
ganesh@ubuntu:~$ sudo i
sudo: i: command not found
ganesh@ubuntu:~$ su root
Password:
su: Authentication failure
ganesh@ubuntu:~$ su root
Password:
su: Authentication failure
ganesh@ubuntu:~$ su root
Password:
su: Authentication failure
ganesh@ubuntu:~$ su i
su: user i does not exist
ganesh@ubuntu:~$ sudo -i
root@ubuntu:~# 12345
12345: command not found
root@ubuntu:~# ls /mscit-shared/
root@ubuntu:~# pwd
/root
root@ubuntu:~# cd /mscit-shared/
root@ubuntu:/mscit-shared# ls
root@ubuntu:/mscit-shared# pwd
/mscit-shared
root@ubuntu:/mscit-shared# cat >> hi
hello World
root@ubuntu:/mscit-shared# ls
hi
root@ubuntu:/mscit-shared#

```

Now check the file created in root is listed in test\_Container and vice-versa.

```

root@ubuntu:/m
[sudo] password for ganesh:
sudo: i: command not found
ganesh@ubuntu:~$ sudo i
sudo: i: command not found
ganesh@ubuntu:~$ su root
Password:
su: Authentication failure
ganesh@ubuntu:~$ su root
Password:
su: Authentication failure
ganesh@ubuntu:~$ su root
Password:
su: Authentication failure
ganesh@ubuntu:~$ su i
su: user i does not exist
ganesh@ubuntu:~$ sudo -i
root@ubuntu:~# 12345
12345: command not found
root@ubuntu:~# ls /mscit-shared/
root@ubuntu:~# pwd
/root
root@ubuntu:~# cd /mscit-shared/
root@ubuntu:/mscit-shared# ls
root@ubuntu:/mscit-shared# pwd
/mscit-shared
root@ubuntu:/mscit-shared# cat >> hi
hello World
root@ubuntu:/mscit-shared# ls
hi
root@ubuntu:/mscit-shared#

th does not exist: /mscit-share.
invalid: command not found
root@ubuntu:/mscit-shared# docker run -it --mount src=/mscit-share,target=/test
_container,type=bind mscit-vol
docker: Error response from daemon: invalid mount config for type "bind": bind
source path does not exist: /mscit-share.
See 'docker run --help'.
root@ubuntu:/mscit-shared# cd /mscit-volume
-bash: cd: /mscit-volume: No such file or directory
root@ubuntu:/mscit-shared# cd..
cd..: command not found
root@ubuntu:/mscit-shared# cd
root@ubuntu:~# cd mscit-volume
root@ubuntu:~/mscit-volume# mkdir /mscit-shared
mkdir: cannot create directory '/mscit-shared': File exists
root@ubuntu:~/mscit-volume# docker run -it --mount src=/mscit-share,target=/tes
t_container,type=bind mscit-vol
docker: Error response from daemon: invalid mount config for type "bind": bind
source path does not exist: /mscit-share.
See 'docker run --help'.
root@ubuntu:~/mscit-volume# docker run -it --mount src=/mscit-shared,target=/te
st_container,type=bind mscit-vol
root@b43347ed3af6:/test_container# ls
root@b43347ed3af6:/test_container# ls
root@b43347ed3af6:/test_container# pwd
/test_container
root@b43347ed3af6:/test_container# ls
hi
root@b43347ed3af6:/test_container# cat hi
hello World
root@b43347ed3af6:/test_container#

root@ubuntu:/mscit-shared# ls
hi
root@ubuntu:/mscit-shared# ls
hi test
root@ubuntu:/mscit-shared#

```

We can see that file location are mapped.

When below command is executed, it will delete the volume.

```
docker volume rm mscit-test
```

**Network:**

Create network with following command

```
docker network create -d bridge my-bridge-network1
```

```
root@ubuntu: ~  
ganesh@ubuntu:~$ docker volume ls  
DRIVER      VOLUME NAME  
local       mscit-test  
ganesh@ubuntu:~$ sudo -i  
[sudo] password for ganesh:  
root@ubuntu:~# docker volume ls  
DRIVER      VOLUME NAME  
local       mscit-test  
root@ubuntu:~# docker netowrk ls  
docker: 'netowrk' is not a docker command.  
See 'docker --help'  
root@ubuntu:~# docker network ls  
NETWORK ID   NAME      DRIVER    SCOPE  
87cd8bd8494f  bridge   bridge    local  
35e1fce17f4d  host     host      local  
97d3bbe02796  none     null       local  
root@ubuntu:~# docker network create -d bridge my-bridge-network1  
ac121b45c63deb575cb8b8ff075158c840ab9aa993943cfef6d7696dfb9dc1c4  
root@ubuntu:~#
```

Check network is created with below command

Command: docker network ls

```
root@ubuntu: ~  
[sudo] password for ganesh:  
root@ubuntu:~# docker volume ls  
DRIVER      VOLUME NAME  
local       mscit-test  
root@ubuntu:~# docker netowrk ls  
docker: 'netowrk' is not a docker command.  
See 'docker --help'  
root@ubuntu:~# docker network ls  
NETWORK ID   NAME      DRIVER    SCOPE  
87cd8bd8494f  bridge   bridge    local  
35e1fce17f4d  host     host      local  
97d3bbe02796  none     null       local  
root@ubuntu:~# docker network create -d bridge my-bridge-network1  
ac121b45c63deb575cb8b8ff075158c840ab9aa993943cfef6d7696dfb9dc1c4  
root@ubuntu:~# docker volume ls  
DRIVER      VOLUME NAME  
local       mscit-test  
root@ubuntu:~# docker network ls  
NETWORK ID   NAME      DRIVER    SCOPE  
87cd8bd8494f  bridge   bridge    local  
35e1fce17f4d  host     host      local  
ac121b45c63d  my-bridge-network1  bridge    local  
97d3bbe02796  none     null       local  
root@ubuntu:~#
```

We can inspect the created network with below command  
docker network inspect bridge (network name)

```
root@ubuntu: ~  
"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": {}  
}  
]  
root@ubuntu:~#
```

Now, let's remove the create network using below command.

```
docker network rm network-name
```

With `docker network ls` we can see the my-bridge-network1 is deleted.

```
root@ubuntu: ~  
"ConfigFrom": {  
  "Network": ""  
},  
"ConfigOnly": false,  
"Containers": {},  
"Options": {  
  "com.docker.network.bridge.default_bridge": "true",  
  "com.docker.network.bridge.enable_icc": "true",  
  "com.docker.network.bridge.enable_ip_masquerade": "true",  
  "com.docker.network.bridge.host_binding_ipv4": "0.0.0.0",  
  "com.docker.network.bridge.name": "docker0",  
  "com.docker.network.driver.mtu": "1500"  
},  
"Labels": {}  
}  
]  
root@ubuntu:~# docker network rm my-bridge-network1  
my-bridge-network1  
root@ubuntu:~# docker network ls  
NETWORK ID      NAME      DRIVER      SCOPE  
87cd8bd8494f    bridge    bridge      local  
35e1fce17f4d    host      host        local  
97d3bbe02796    none      null        local  
root@ubuntu:~#
```

With below command we can delete unused networks

```
docker network prune
```

```
root@ubuntu: ~
]
root@ubuntu:~# docker network rm my-bridge-network1
my-bridge-network1
root@ubuntu:~# docker network ls
NETWORK ID      NAME      DRIVER      SCOPE
87cd8bd8494f    bridge    bridge      local
35e1fce17f4d    host      host        local
97d3bbe02796    none      null        local
root@ubuntu:~# docker network create -d bridge my-bridge-network1
0f8a74ccffd0694f1e6fe6e69c17fcb269a075429129508a56a3893c349c790a
root@ubuntu:~# docker network ls
NETWORK ID      NAME      DRIVER      SCOPE
87cd8bd8494f    bridge    bridge      local
35e1fce17f4d    host      host        local
0f8a74ccffd0    my-bridge-network1    bridge      local
97d3bbe02796    none      null        local
root@ubuntu:~# 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:
my-bridge-network1
root@ubuntu:~#
```

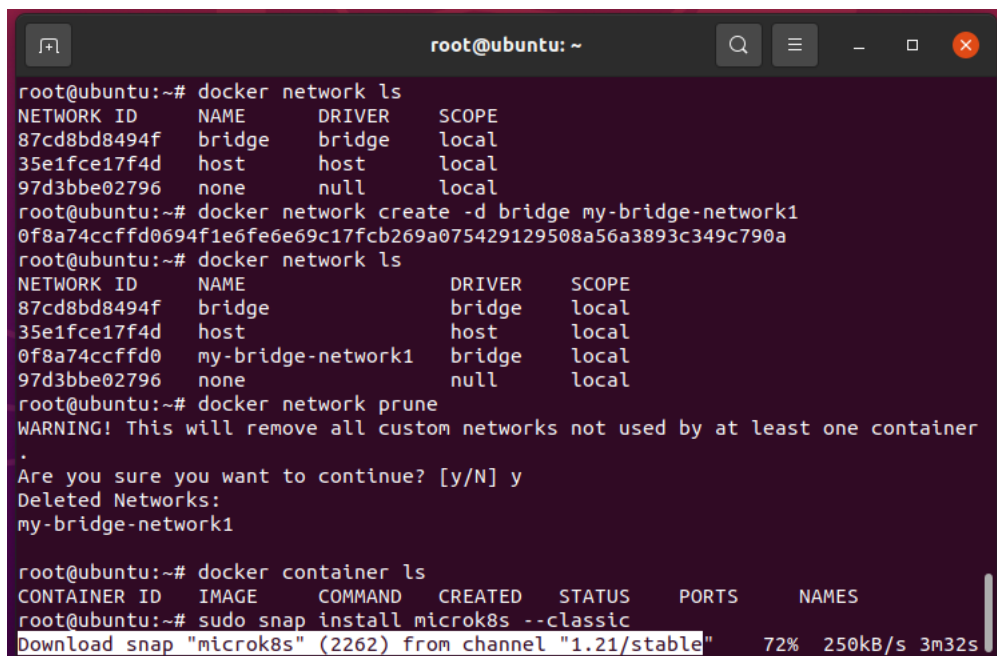
## Practical No. 5

### Aim: Working with Kubernetes.

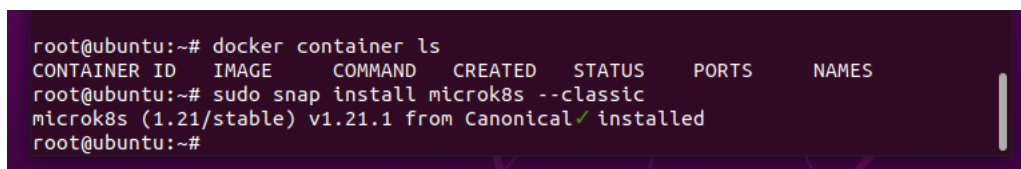
Kubernetes, or k8s, is an open-source platform that automates Linux container operations. It eliminates many of the manual processes involved in deploying and scaling containerized applications. "In other words, you can cluster together groups of hosts running Linux containers, and Kubernetes helps you easily and efficiently manage those clusters."

Install MicroK8s on Linux

sudo snap install microk8s --classic



```
root@ubuntu: ~  
root@ubuntu:~# docker network ls  
NETWORK ID      NAME      DRIVER      SCOPE  
87cd8bd8494f    bridge    bridge      local  
35e1fce17f4d    host      host        local  
97d3bbe02796    none      null        local  
root@ubuntu:~# docker network create -d bridge my-bridge-network1  
0f8a74ccffd0694f1e6fe6e69c17fcb269a075429129508a56a3893c349c790a  
root@ubuntu:~# docker network ls  
NETWORK ID      NAME      DRIVER      SCOPE  
87cd8bd8494f    bridge    bridge      local  
35e1fce17f4d    host      host        local  
0f8a74ccffd0    my-bridge-network1    bridge      local  
97d3bbe02796    none      null        local  
root@ubuntu:~# docker network prune  
WARNING! This will remove all custom networks not used by at least one container  
.br/>Are you sure you want to continue? [y/N] y  
Deleted Networks:  
my-bridge-network1  
  
root@ubuntu:~# docker container ls  
CONTAINER ID    IMAGE    COMMAND    CREATED    STATUS    PORTS    NAMES  
root@ubuntu:~# sudo snap install microk8s --classic  
Download snap "microk8s" (2262) from channel "1.21/stable" 72% 250kB/s 3m32s
```



```
root@ubuntu:~# docker container ls  
CONTAINER ID    IMAGE    COMMAND    CREATED    STATUS    PORTS    NAMES  
root@ubuntu:~# sudo snap install microk8s --classic  
microk8s (1.21/stable) v1.21.1 from Canonical ✓ installed  
root@ubuntu:~#
```

Add your user to the microk8s admin group

MicroK8s creates a group to enable seamless usage of commands which require admin privilege. Use the following commands to join the group:

sudo usermod -a -G microk8s \$USER

sudo chown -f -R \$USER ~/.kube

su - \$USER

```

root@ubuntu:~# docker container ls
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS   NAMES
root@ubuntu:~# sudo snap install microk8s --classic
microk8s (1.21/stable) v1.21.1 from Canonical✓ installed
root@ubuntu:~# sudo usermod -a -G microk8s $USER
root@ubuntu:~# sudo chown -f -R $USER ~/.kube
root@ubuntu:~# su - $USER

```

Check the status while Kubernetes starts  
 microk8s status --wait-ready

```

root@ubuntu:~# microk8s status --wait-ready
microk8s is running
high-availability: no
datastore master nodes: 127.0.0.1:19001
datastore standby nodes: none
addons:
  enabled:
    dashboard          # The Kubernetes dashboard
    ha-cluster          # Configure high availability on the current node
    metrics-server     # K8s Metrics Server for API access to service metri
  disabled:
    ambassador         # Ambassador API Gateway and Ingress
    cilium              # SDN, fast with full network policy
    dns                 # CoreDNS
    fluentd             # Elasticsearch-Fluentd-Kibana logging and monitorin
    gpu                 # Automatic enablement of Nvidia CUDA
    helm                # Helm 2 - the package manager for Kubernetes
    helm3               # Helm 3 - Kubernetes package manager
    host-access         # Allow Pods connecting to Host services smoothly
    ingress             # Ingress controller for external access
    istio               # Core Istio service mesh services
    jaeger              # Kubernetes Jaeger operator with its simple config
    keda                # Kubernetes-based Event Driven Autoscaling
    knative             # The Knative framework on Kubernetes.
    kubeflow            # Kubeflow for easy ML deployments
    linkerd             # Linkerd is a service mesh for Kubernetes and other
  frameworks
    metallb             # Loadbalancer for your Kubernetes cluster
    multus              # Multus CNI enables attaching multiple network inte
  rfaces to pods
    openebs             # OpenEBS is the open-source storage solution for Ku

```

Turn on the services you want  
 microk8s enable dashboard dns ingress

```

root@ubuntu: ~
root@ubuntu:~# microk8s enable dashboard dns ingress
Addon dashboard is already enabled.
Enabling DNS
Applying manifest
serviceaccount/coredns created
configmap/coredns created
deployment.apps/coredns created
service/kube-dns created
clusterrole.rbac.authorization.k8s.io/coredns created
clusterrolebinding.rbac.authorization.k8s.io/coredns created
Restarting kubelet
DNS is enabled
Enabling Ingress
ingressclass.networking.k8s.io/public created
namespace/ingress created
serviceaccount/nginx-ingress-microk8s-serviceaccount created
clusterrole.rbac.authorization.k8s.io/nginx-ingress-microk8s-clusterrole created
role.rbac.authorization.k8s.io/nginx-ingress-microk8s-role created
clusterrolebinding.rbac.authorization.k8s.io/nginx-ingress-microk8s created
rolebinding.rbac.authorization.k8s.io/nginx-ingress-microk8s created
configmap/nginx-load-balancer-microk8s-conf created
configmap/nginx-ingress-tcp-microk8s-conf created
configmap/nginx-ingress-udp-microk8s-conf created
daemonset.apps/nginx-ingress-microk8s-controller created
Ingress is enabled
root@ubuntu:~# microk8s kubectl get all --all-namespaces

```

NAMESPACE	NAME	RESTARTS	AGE	READY	STATUS
kube-system	pod/calico-kube-controllers-f7868dd95-6ffw9	0	17m	0/1	ContainerCreating
kube-system	pod/metrics-server-8bbfb4bdb-74xg8	0	4m20s	0/1	ContainerCreating
kube-system	pod/kubernetes-dashboard-85fd7f45cb-nwbgq	0	2m52s	0/1	ContainerCreating
kube-system	pod/dashboard-metrics-scraper-78d7698477-m2k7v	0		0/1	ContainerCreating

Start using Kubernetes

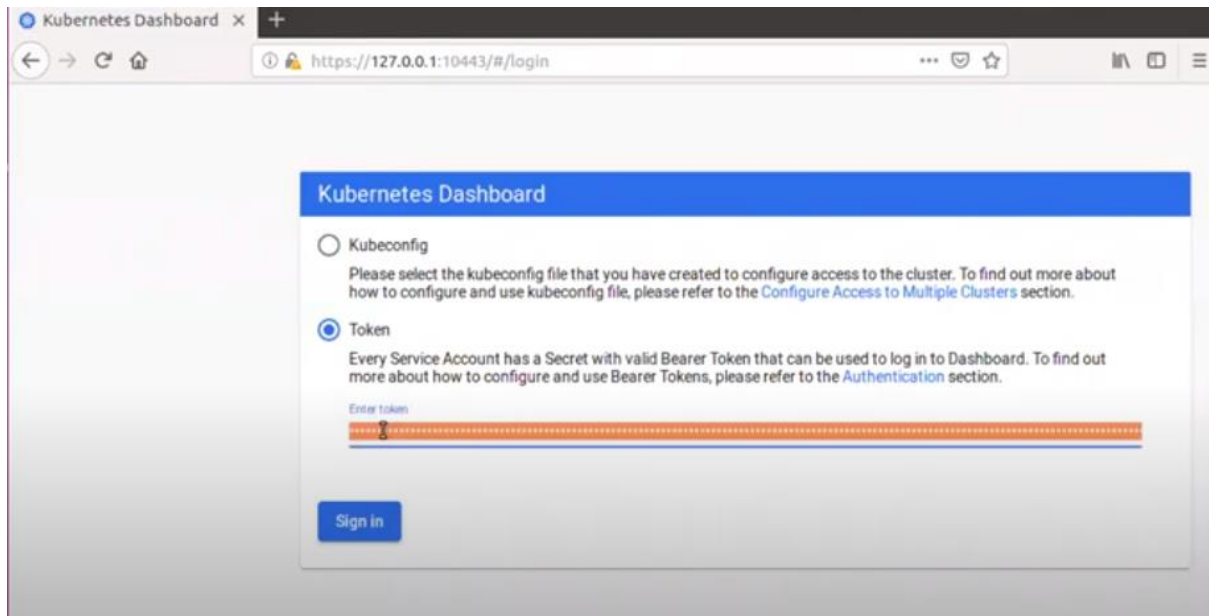
microk8s kubectl get all --all-namespaces

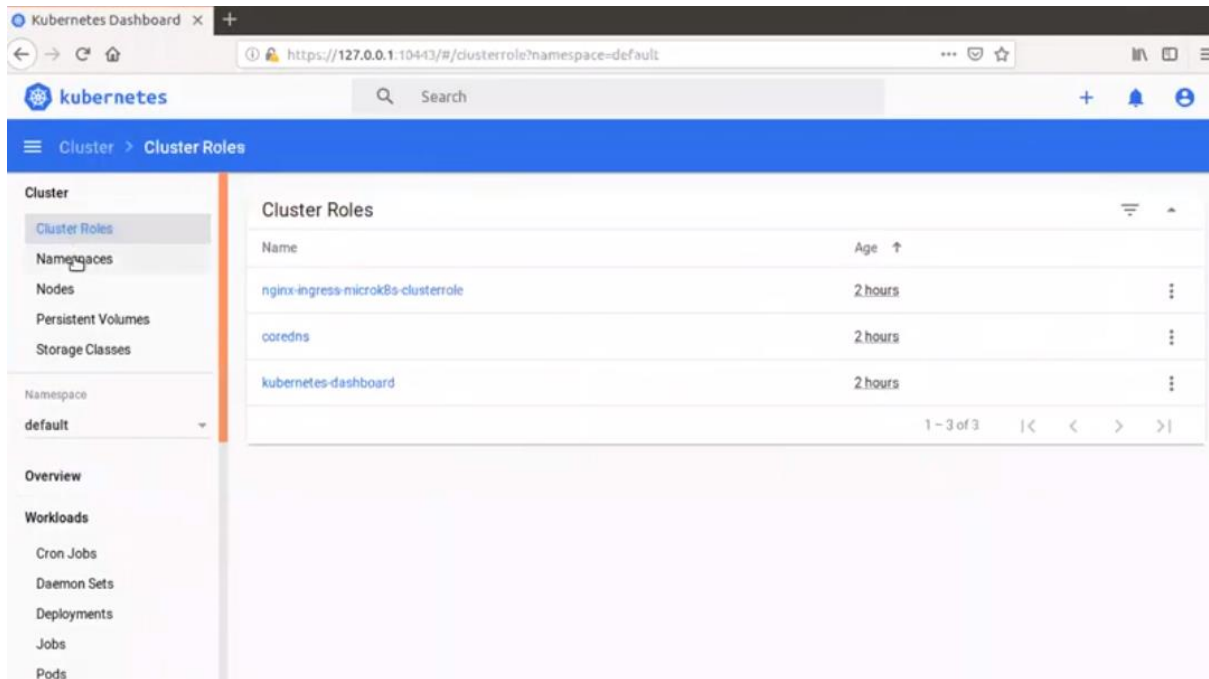




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Sign in with token:





The screenshot displays the Kubernetes Dashboard interface. The left sidebar contains a navigation menu with the following items: Cluster (selected), Namespaces, Nodes, Persistent Volumes, Storage Classes, Overview, Workloads, Cron Jobs, Daemon Sets, Deployments, Jobs, and Pods. The main content area is titled 'Cluster Roles' and shows a table of roles in the 'default' namespace. The table has columns for Name, Age, and a menu icon. Three roles are listed: 'nginx-ingress-microk8s-clusterrole', 'coredns', and 'kubernetes-dashboard', all with an age of '2 hours'. The bottom of the table shows pagination: '1 - 3 of 3'.

Name	Age	
nginx-ingress-microk8s-clusterrole	2 hours	
coredns	2 hours	
kubernetes-dashboard	2 hours	