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## Assignment No 7

**Title: Deploy a static website using Docker.**

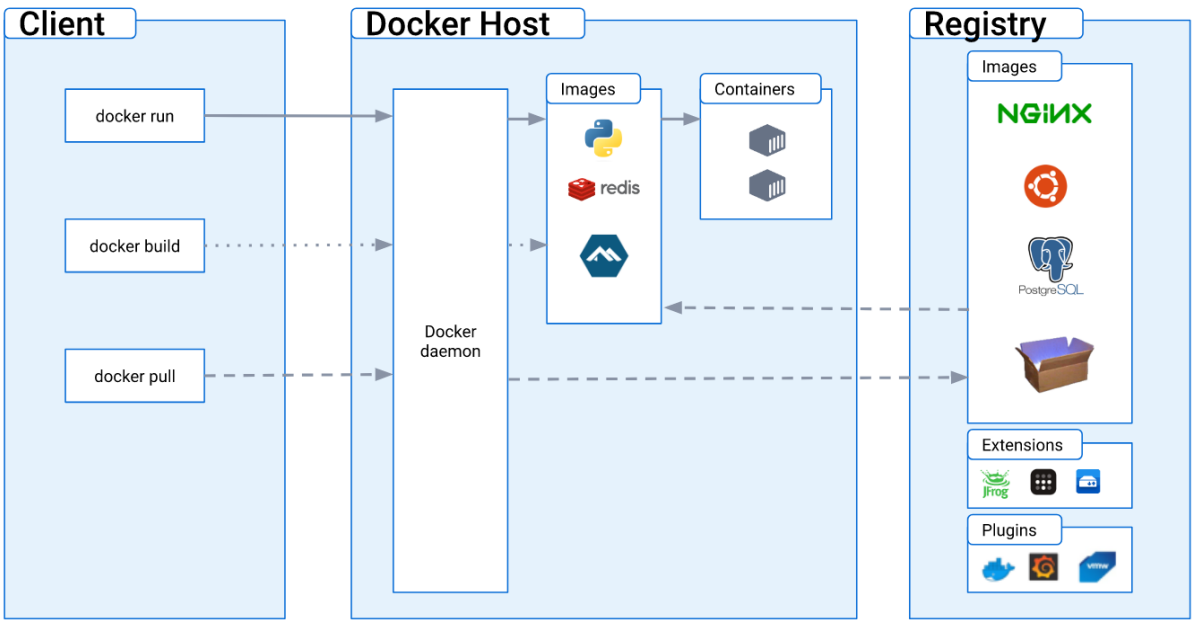
**Theory:**

1) What is Docker?

**Docker is an open platform for developing, shipping, and running applications. Docker enables you to separate your applications from your infrastructure so you can deliver software quickly. With Docker, you can manage your infrastructure in the same ways you manage your applications. By taking advantage of Docker's methodologies for shipping, testing, and deploying code quickly, you can significantly reduce the delay between writing code and running it in production.**

2) Docker Architecture

**Docker uses a client-server architecture. The Docker *client* talks to the Docker *daemon*, which does the heavy lifting of building, running, and distributing your Docker containers. The Docker client and daemon *can* run on the same system, or you can connect a Docker client to a remote Docker daemon. The Docker client and daemon communicate using a REST API, over UNIX sockets or a network interface. Another Docker client is Docker Compose, that lets you work with applications consisting of a set of containers.**



1. **Docker Daemon: The Docker daemon is the core component of the Docker architecture. It runs on the host machine and manages the lifecycle of Docker containers and images.**
2. **Docker Client: The Docker client is a command-line interface (CLI) tool that allows developers to interact with the Docker daemon. It can be used to build, run, and manage Docker containers and images.**
3. **Docker Registries: Docker registries are repositories where Docker images are stored and shared. The most common Docker registry is Docker Hub, which is a public repository that hosts thousands of pre-built Docker images.**
4. **Docker Images: Docker images are the building blocks of Docker containers. They contain everything that is needed to run an application, including the application code, dependencies, and runtime environment.**
5. **Docker Containers: Docker containers are instances of Docker images that are running on a host machine. They are isolated from the host environment and from other containers, providing a consistent runtime environment for the application.**
6. **Docker Compose: Docker Compose is a tool that allows developers to define and manage multi-container Docker applications. It uses YAML files to define the services, networks, and volumes that make up the application.**

**Overall, the Docker architecture provides a powerful and flexible platform for building, packaging, and deploying applications in a consistent and scalable way.**

### 3) Difference between Docker and Virtual machine

**Docker and virtual machines (VMs) are two different technologies used for creating isolated environments to run applications. While they share some similarities, there are also some key differences between them.**

1. **Architecture: Docker uses containerization technology to create isolated environments, while VMs use hypervisor technology to create virtualized environments.**
2. **Resource Utilization: Docker containers share the host operating system's kernel, which allows them to use fewer resources and start up faster than VMs. In contrast, VMs require their own complete operating system, which can consume more resources and take longer to start up.**
3. **Portability: Docker containers are more portable than VMs because they can be easily moved between hosts and platforms, while VMs are tied to a specific host system architecture.**
4. **Security: Docker containers are generally considered to be less secure than VMs because they share the host operating system's kernel, which can potentially expose them to security vulnerabilities. VMs, on the other hand, are more isolated and provide a higher level of security.**
5. **Management: Docker containers are easier to manage than VMs because they can be managed with command-line tools, APIs, and container orchestration platforms like Kubernetes. VMs require more complex management tools, such as virtual machine managers and hypervisors.**

**Overall, Docker and VMs have different use cases and trade-offs. Docker is often used for lightweight, portable applications that require high scalability and resource utilization, while VMs are better suited for applications that require higher levels of security and isolation.**

## 4) Docker Commands

**Here are some of the most used Docker commands:**

1. `docker run:` **This command is used to create and run a Docker container. For example,** `docker run -it ubuntu:latest` **will start a new container running the latest version of the Ubuntu image.**
2. `docker ps:` **This command lists all the running Docker containers.**
3. `docker images:` **This command lists all the Docker images that are available locally on your machine.**
4. `docker pull:` **This command is used to download a Docker image from a registry. For example,** `docker pull nginx:latest` **will download the latest version of the Nginx image.**
5. `docker build:` **This command is used to build a Docker image from a Dockerfile. For example,** `docker build -t myimage:latest .` **will build an image named "myimage" from the Dockerfile in the current directory.**
6. `docker stop:` **This command is used to stop a running Docker container. For example,** `docker stop container_id` **will stop the container with the specified ID.**
7. `docker rm:` **This command is used to remove a Docker container. For example,** `docker rm container_id` **will remove the container with the specified ID.**
8. `docker rmi:` **This command is used to remove a Docker image. For example,** `docker rmi image_name` **will remove the image with the specified name.**
9. `docker exec:` **This command is used to execute a command inside a running Docker container. For example,** `docker exec -it container_id /bin/bash` **will open a shell inside the container with the specified ID.**

## 5) Dockerfile

**A Dockerfile is a text file that contains instructions for building a Docker image. It provides a way to automate the creation of Docker images, which can then be used to run containers. Here is an example of a simple Dockerfile:**

```
FROM ubuntu:latest

RUN apt-get update && apt-get install -y curl

CMD ["/usr/bin/curl", "http://example.com"]
```

**Here's what each line of the Dockerfile does:**

- `FROM` **specifies the base image that the new image will be built on. In this case, we are using the latest version of the Ubuntu image as our base image.**
- `RUN` **executes a command during the build process. In this case, we are using** `apt-get` **to update the package index and install the** `curl` **package.**
- `CMD` **specifies the default command that will be executed when a container is started from the image. In this case, we are using** `curl` **to make a GET request to http://example.com.**

**To build an image from this Dockerfile, save it as "Dockerfile" in a directory on your machine, navigate to that directory in a terminal, and run the following command:**

`docker build -t myimage .`

**This will build a Docker image named "myimage" using the instructions in the Dockerfile. The `.` at the end of the command specifies that the build context is the current directory.**

**Once the image has been built, you can use the `docker run` command to start a container from it.**

## 6) Docker-Compose and Docker-swarm

**Docker Compose is a tool that allows you to define and run multi-container Docker applications. It uses a YAML file to define the services, networks, and volumes that make up an application. With Docker Compose, you can easily start and stop a set of containers and manage their configuration and dependencies.**

**Docker Swarm, on the other hand, is a native clustering tool for Docker that turns a group of Docker hosts into a single, virtual host. It allows you to orchestrate the deployment of Docker containers across multiple hosts, automatically scaling them up and down as needed. Swarm uses a declarative approach to describe the desired state of the system, and continuously monitors and reconciles any differences between the desired state and the current state.**

**Docker Compose is a tool for managing multi-container Docker applications on a single host, while Docker Swarm is a tool for orchestrating Docker containers across multiple hosts in a cluster.**

### Implementation:

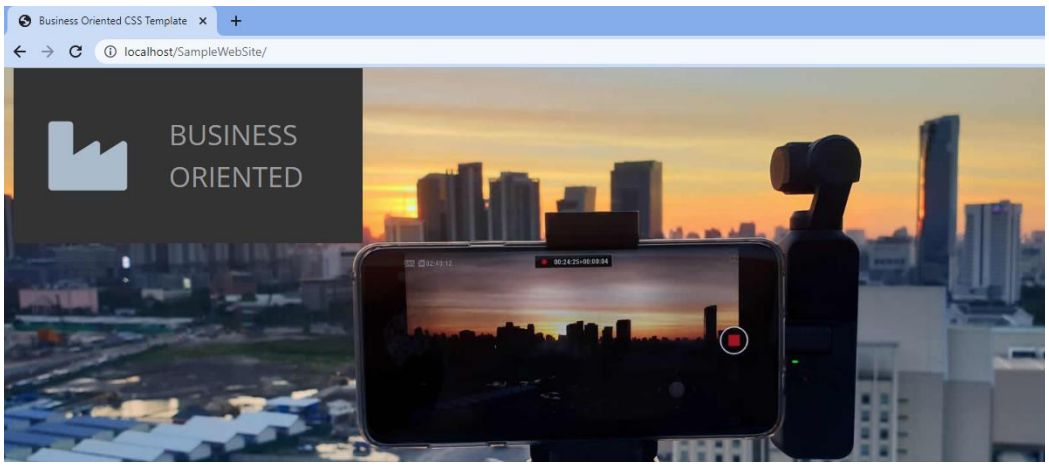
### Step 1: Install nginx on windows follow the link:

**http://nginx.org/en/docs/windows.html**

```
cd c:\
unzip nginx-1.23.4.zip
cd nginx-1.23.4
start nginx
```

### Step 2: Copy the sample-website in "C:\nginx\html\" folder

### Step 3: open browser and run "localhost:80"



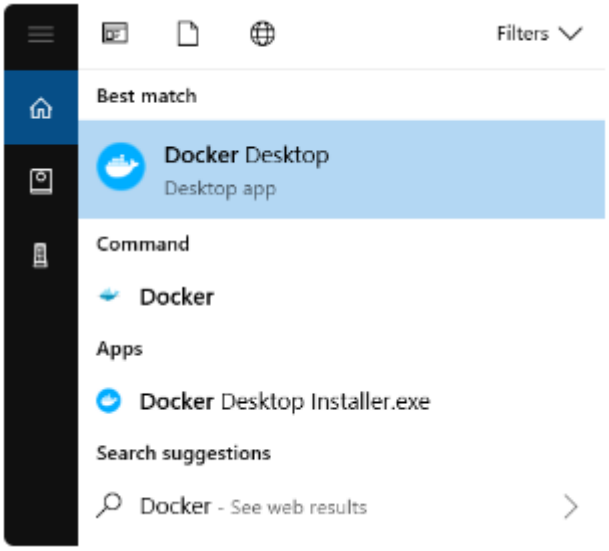
**Step 4: Download Docker for windows,  follow the link**

https://docs.docker.com/desktop/install/windows-install/

**Step 5: Start Docker Desktop**

Docker Desktop does not start automatically after installation. To start Docker Desktop:

1. Search for Docker, and select **Docker Desktop** in the search results.




**Step 6: Open Powershell and check Docker installation using commands:**

a. **docker –version**

```
PS C:\> docker --version
Docker version 20.10.23, build 7155243
PS C:\> _
```

b. **docker info**

c. **docker version --format '{{json .}}'**

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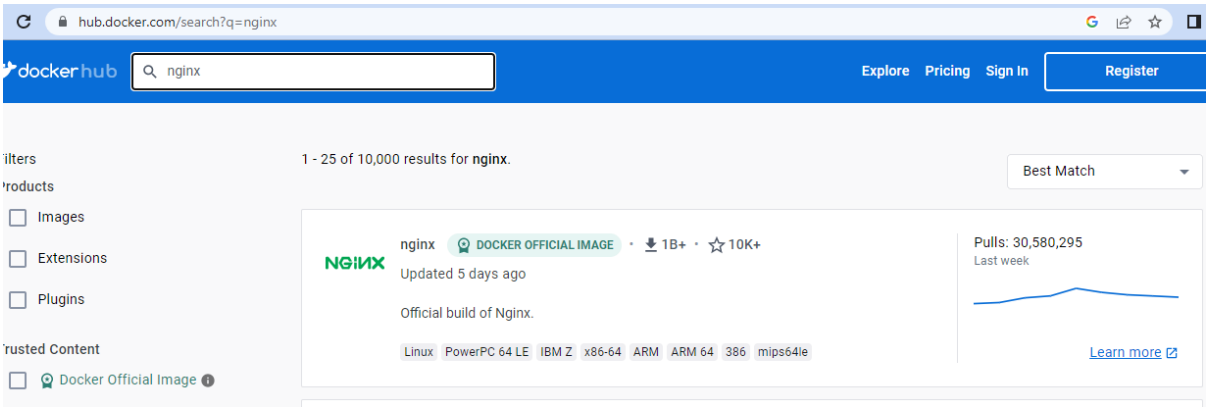
- # Steps to run the “Sample website” in Docker container

**Step 1) visit to Docker hub web site: https://hub.docker.com/**

Step 2) search for “nginx” image on site




**Step 3) pull the latest image of nginx using command**
**"docker pull nginx"**

```
PS C:\> docker pull nginx
Using default tag: latest
latest: Pulling from library/nginx
Digest: sha256:2ab30d6ac53580a6db8b657abf0f68d75360ff5cc1670a85acb5bd85ba1b19c0
Status: Image is up to date for nginx:latest
docker.io/library/nginx:latest
PS C:\>
```

**Step 4) check the docker images on your desktop by using command:**

**"docker images"**

Administrator: Windows PowerShell

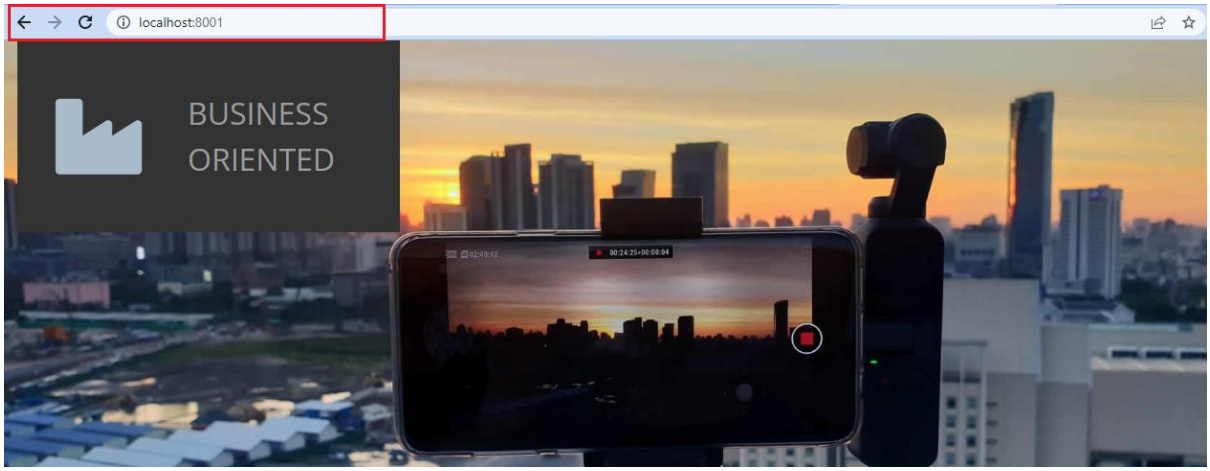
```
PS C:\> docker images
REPOSITORY                TAG       IMAGE ID       CREATED       SIZE
my-web                    v1        7c734f9e30af   4 days ago    146MB
vishalmeshram/newapp      latest    7c734f9e30af   4 days ago    146MB
vishalmeshram/website     v1        7c734f9e30af   4 days ago    146MB
<none>                    <none>    77d8803f7135   4 days ago    146MB
nginx                     latest    080ed0ed8312   6 days ago    142MB
PS C:\>
```

**Step 5) go in the "SampleWebsite" folder and then Create a container using the docker command and sync the "SampleWebsite" folder with folder inside the container folder. (This is called Mount Bind")**

**"docker run -d -p 8001:80 -v ${PWD}:/usr/share/nginx/html --name web-site nginx"**

```
Administrator: Windows PowerShell
PS C:\Users\VAM\Desktop\SampleWebSite> docker run -d -p 8001:80 -v ${PWD}:/usr/share/nginx/html --name
 web-site nginx
d5ba0511e8f81a2339a2922bc7cfafa61b840ed67f2dc8c5699fe1a8b0a7a230
PS C:\Users\VAM\Desktop\SampleWebSite> docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED          STATUS          PORTS
    NAMES
d5ba0511e8f8   nginx     "/docker-entrypoint.…"   14 seconds ago   Up 12 seconds   0.0.0.0:8001->80/tc
p   web-site
```

**Step 6)verify the website open browser and chec "localhost:8001". Now this website is running inside your container.**




Congratulations!!!!

You have successfully deployed your web application in container.

# DockerFile

**Step 1) Create a Directory structure like**

App

- SampleWebSite
- Dockerfile

**Step 2) Write a following script into "Dockerfile"**

```
FROM    nginx:latest
COPY    ./SampleWebSite/    /usr/share/nginx/html/
EXPOSE  80
```

**Step 3) build image from docker file using command**

**"docker build -t my-app:v1 . "**

```
PS C:\Users\VAM\Desktop\app> docker build -t my-app:v1 .
[+] Building 0.6s (7/7) FINISHED
```

**Step 4) check images using command: docker images**

```
PS C:\Users\VAM\Desktop\app> docker images
REPOSITORY   TAG       IMAGE ID       CREATED       SIZE
my-app       v1        7c734f9e30af   5 days ago    146MB
nginx        latest    080ed0ed8312   7 days ago    142MB
PS C:\Users\VAM\Desktop\app>
```

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# PUSH Image to "DockerHub"

**Step 1) login to docker hub using command**

1) **docker login -u vishalmeshram**

```
PS C:\Users\VAM\Desktop\app> docker login -u vishalmeshram
Password:
Login Succeeded

Logging in with your password grants your terminal complete access to your account.
For better security, log in with a limited-privilege personal access token. Learn more at https://docs
.docker.com/go/access-tokens/
PS C:\Users\VAM\Desktop\app>
```

**2) docker images**

```
PS C:\Users\VAM\Desktop\app> docker images
REPOSITORY   TAG       IMAGE ID       CREATED      SIZE
my-app       v1        7c734f9e30af   5 days ago   146MB
nginx        latest    080ed0ed8312   7 days ago   142MB
PS C:\Users\VAM\Desktop\app>
```

**3) docker tag (old image name) vishalmeshram/newname**

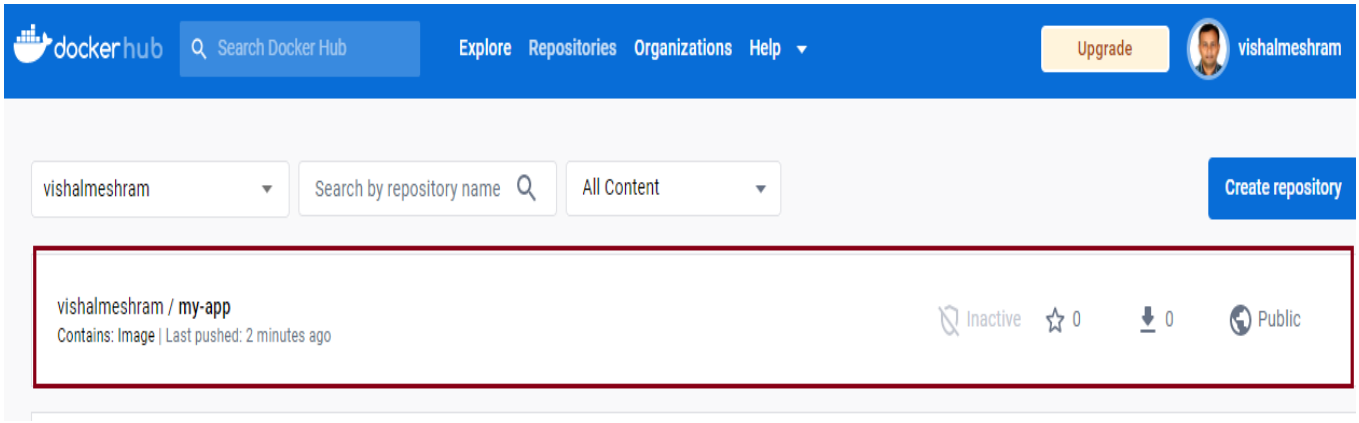
**docker tag my-web:v1 vishalmeshram/newapp**

```
PS C:\Users\VAM\Desktop\app> docker tag my-app:v1 vishalmeshram/my-app:v1
PS C:\Users\VAM\Desktop\app>
PS C:\Users\VAM\Desktop\app>
PS C:\Users\VAM\Desktop\app> docker images
REPOSITORY              TAG       IMAGE ID       CREATED      SIZE
my-app                  v1        7c734f9e30af   5 days ago   146MB
vishalmeshram/my-app    v1        7c734f9e30af   5 days ago   146MB
nginx                   latest    080ed0ed8312   7 days ago   142MB
PS C:\Users\VAM\Desktop\app>
```

**4) docker push vishalmeshram/newapp**

```
PS C:\Users\VAM\Desktop\app> docker push vishalmeshram/my-app:v1
The push refers to repository [docker.io/vishalmeshram/my-app]
3182d22413fc: Pushed
ff4557f62768: Pushed
4d0bf5b5e17b: Pushed
95457f8a16fd: Pushed
a0b795906dc1: Pushed
af29ec691175: Mounted from library/nginx
3af14c9a24c9: Mounted from library/nginx
v1: digest: sha256:dfde7dd6b561fccfa90de432f724d18c5e7484615fa9dfb8c6cbd801be3f63ec size: 1781
PS C:\Users\VAM\Desktop\app>
```

**Step 5) Login to Docker Hub and check the repository**




Congratulations!!!!

Now you can share this image with anyone with running nginx and your web application.

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