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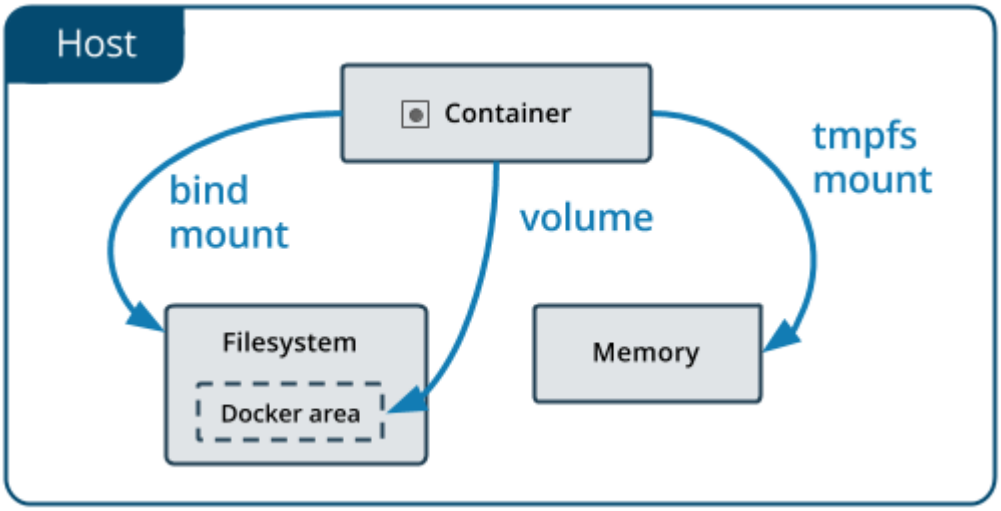
Container Files

```
docker run bash:latest bash -c "echo helloworld > file.txt && cat file.txt"

docker run -it bash:latest bash
bash-5.1# echo helloworld > file.txt && cat file.txt

# The output of the above command is 'helloworld'

# if we run the same image with just the command to output the file's contents:
docker run bash:latest bash -c "cat file.txt"
# The output of the above command will be as below
cat: can't open 'file.txt': No such file or directory

# This is because, each time u are launching a new container, the files are
created in container space,
# and are not directly available for other containers to read.
# The second run of the container runs on a clean file system, so the file is not
found.
```

- Two containers are not able to see the same files
- Containers is not able to access files that are on Host File System

Storage Overview

- By default all files created inside a container are stored on a writable container layer. This means that:
  - The data doesn't persist when that container no longer exists, and it can be difficult to get the data out of the container if another process needs it.
- Docker has two options for containers to store files on the host machine, so that the files are persisted even after the container stops: **bind mounts** and **volumes**.



Bind Mounts

- A Docker `bind mount` is a connection from the container to a directory on the host machine.
- It allows the `host to share its own file system with the container`, which can be made `read-only` or `read-write`.
- This allows to use a container to work with our files on the host.
- The file or directory is referenced by its `absolute path` on the host machine.
- Below are the two options using which directory can be mounted:
  - `-v or --volume` : The `-v` option contains three components, separated by colons:
    - `Source directory` i.e `$(pwd)`
    - Mount point within the container i.e `/var/data`
    - (Optional) `ro` if the mount is to be read-only.
  - `--mount` : Consists of multiple key-value pairs, separated by commas and each consisting of a `<key>=<value>`
    - The `type` of the mount, which can be `bind`, `volume`.
    - The `source` of the mount. For bind mounts, this is the path to the file or directory on the Docker daemon host. Can be specified as `source` or `src`.
    - The `destination` takes as its value the path where the file or directory is mounted in the container. Can be specified as `destination`, `dst`,or `target`.

```
pwd

docker run -v $(pwd):/var/data -it bash:latest
# Inside the container
cd /var/data/
echo "File created from Containers" > /var/data/file.txt
# Access this file from host
# The files created inside the container can be accessible from host.

# launch another container
docker run -v $(pwd):/var/data -it bash:latest
cd /var/data/
cat file.txt

OR
```

```
docker run --mount type=bind,source="$(pwd)",target=/var/data -it bash:latest
ls /var/data/
cat /var/data/file.txt
```

- If containers are lost/killed, the files are still accessible on the host path.
- After running this command, we will have `file.txt` in the working directory of our host machine.
- Similarly, even if multiple containers are launched with above same command, the same host directory will be mounted on those containers.

Docker Volumes

- A bind mount uses the host file system, but `Docker volumes` are native to `Docker`.
- Docker Volumes can be shared between containers.
- `Docker Volumes` is used for managing files outside the lifecycle of the container.
- The data is kept on storage attached to the host – often the local filesystem.
- The volume itself has a lifecycle that's longer than the container's, allowing it to persist until no longer needed.
- Create a new volume that containers can consume and store data in.
- Use below command to Create a volume and then configure the container to use it:
- Let's pull the latest nginx image from the docker hub and run the container and load the home page which listens on port 80.

```
docker run -it --name=WebApp -d -p 80:80 nginx
netstat -nltp
```

- Access the nginx home page in the browser
- Go inside the container and edit the content of `/usr/share/nginx/html`

```
docker ps
docker exec -it WebApp bash
cat /usr/share/nginx/html/index.html
echo "Changing the content of the home page from Hostname as $HOSTNAME" >
/usr/share/nginx/html/index.html
```

- `docker container stop WebApp`
- `docker container rm WebApp`

- We can use `docker stop` and `docker start` to check if content that is changed is accessible.
- If this container is stopped or somehow gets killed, and another container is loaded, the changes made in the previous container are not accessible anymore.

Creating Docker Volumes

- Volumes are saved in the host filesystem `/var/lib/docker/volumes/` which is owned and maintained by docker.
- Any other `non-docker` process can't access it, also as checked above other docker processes/containers can still access the data even container is stopped since it is isolated from the container file system.

```
# create docker volume
docker volume create datavolume
# Check for any volumes
sudo ls /var/lib/docker/volumes/
# list volumes
docker volume ls
# inspect volumes
docker volume inspect datavolume
# removing docker volumes
docker volume rm datavolume
# Stop and remove previously launched containers if any
docker container stop ContainerID
docker container rm ContainerID
```

- Now above scenario can be seen using docker volume to persist the changes in one container and access using another

Mounting a Data Volume

- To mount a data volume to a container add the `--mount` flag to the `docker run` command.
- To run a container and mount a data volume to it, follow the basic syntax: `docker run --mount source=[volume_name],destination=[path_in_container] [docker_image]`
- Replace `[path_in_container]` with the path where you want to place the data volume in the container.Everything stored in that directory automatically gets saved on the data volume on the host as well.

```
docker run -d --name=Container1 --mount
source=datavolume,destination=/usr/share/nginx/html -p 80:80 nginx

#Inspect the container
docker inspect Container1
```

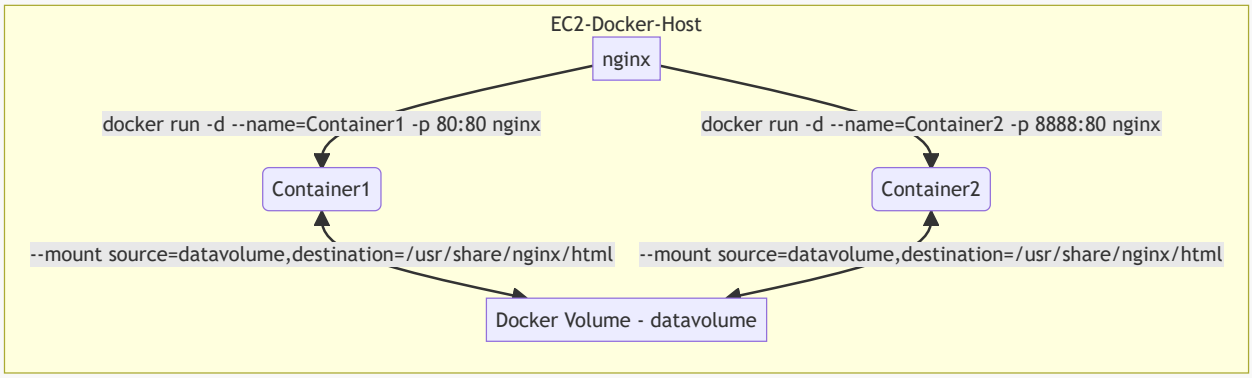
- Access the nginx home page in the browser

```
docker exec -it Container1 bash
ls /usr/share/nginx/html
echo "Changing the content of the home page from Hostname as $HOSTNAME" >>
/usr/share/nginx/html/index.html
```

- Check the content of the file from host : `sudo cat /var/lib/docker/volumes/datavolume/_data/index.html`
- Now if we launched another container and check the content, since Volume is shared by both containers the same file is accessible from this new container.

```
docker run -d --name=Container2 --mount
source=datavolume,destination=/usr/share/nginx/html -p 8888:80 nginx
docker exec -it Container2 bash
ls /usr/share/nginx/html
echo "Changing the content of the home page from Hostname as $HOSTNAME" >>
/usr/share/nginx/html/index.html

#Inspect the container
docker inspect Container2

# To remove volume
docker volume ls
docker volume rm datavolume
[ec2-user@ip-172-31-24-162 ~]$ docker volume rm datavolume
Error response from daemon: remove datavolume: volume is in use -
[c1b796f7a48c0b877189ba8802b75fe122d82dea3ff26add770d23e4c9599b6e, 8ec7e7f84355
04feea83523074f2b11059067e7f4cca2b8b5f115653e6ceafa4]

docker stop Container1 Container2
docker rm Container1 Container2

docker volume rm datavolume
docker volume ls
```

- Access the container on browser with port 8888 or using `curl localhost:8888`



- `docker stats` : Display a live stream of container(s) resource usage statistics

```
CONTAINER ID   NAME              CPU %     MEM USAGE / LIMIT     MEM %     NET
I/O       BLOCK I/O     PIDS
ff70f0a5ae9f   great_bartik      0.00%     768KiB / 965.8MiB     0.08%     1kB /
0B      0B / 0B       1
c559ac5e30c9   frosty_newton     0.00%     772KiB / 965.8MiB     0.08%     1.33kB
/ 0B   0B / 0B       1
a20bf7d5fc8e   sad_jennings      0.00%     764KiB / 965.8MiB     0.08%     1.4kB
/ 0B    0B / 0B       1
03071a5fd70d   elastic_sinoussi  0.00%     780KiB / 965.8MiB     0.08%     1.4kB
/ 0B    0B / 0B       1
d5086de0b615   stupefied_dirac   0.00%     3.113MiB / 965.8MiB   0.32%     1.84kB
/ 0B   3.18MB / 0B   1
```

- To remove all unused volumes and free up space:

```
$ docker volume prune
```

- Display containers information associated with an image

```
docker container ls -a --filter "ancestor=ubuntu:20.04"
```

- Display only container id associated with an image

```
docker container ls -a --filter "ancestor=ubuntu:20.04" -q
```