DevOps Exercises

Session 6: Understanding Docker Disk Management

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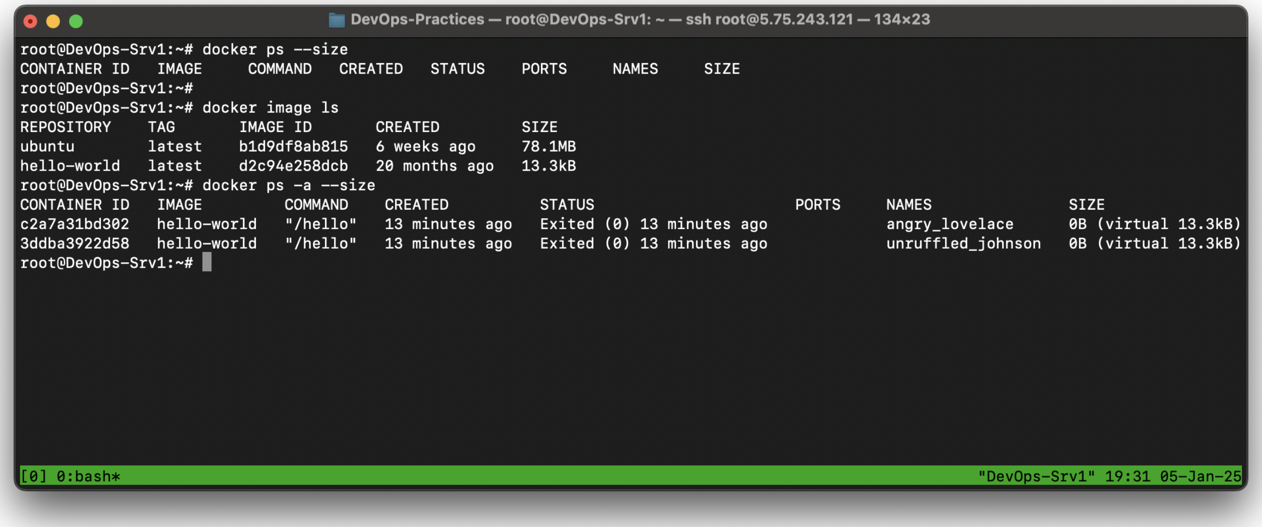
1. Difference Between "Size" and "Virtual Size" in Docker and Virtual Machines:

Docker:

- **Size:**
  Refers to the amount of disk space consumed by the writable layer of the container. This includes changes made after the container was started (like added files or installed packages).

- **Virtual Size:**
  Represents the total size of the container, which is the sum of the base image size and the writable layer. It provides a broader view of the container's disk usage.


DevOps-Practices — root@DevOps-Srv1: ~ — ssh root@5.75.243.121 — 134×23

```
root@DevOps-Srv1:~# docker ps --size
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES     SIZE
root@DevOps-Srv1:~#
root@DevOps-Srv1:~# docker image ls
REPOSITORY    TAG       IMAGE ID       CREATED          SIZE
ubuntu        latest    b1d9df8ab815   6 weeks ago      78.1MB
hello-world   latest    d2c94e258dcb   20 months ago    13.3kB
root@DevOps-Srv1:~# docker ps -a --size
CONTAINER ID   IMAGE         COMMAND    CREATED          STATUS                      PORTS     NAMES               SIZE
c2a7a31bd302   hello-world   "/hello"   13 minutes ago   Exited (0) 13 minutes ago             angry_lovelace      0B (virtual 13.3kB)
3ddba3922d58   hello-world   "/hello"   13 minutes ago   Exited (0) 13 minutes ago             unruffled_johnson   0B (virtual 13.3kB)
root@DevOps-Srv1:~#
```

Virtual Machines (VMs):

- **Size:**
  Indicates the actual disk space being used by the virtual machine's data and operating system.

- **Virtual Size:**
  Refers to the maximum allocated disk space for the virtual machine, regardless of how much is

currently in use.

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2. Create a Docker Container with Limited Disk Space:

This exercise demonstrates how to create a Docker container with limited disk space and handle the "filesystem does not support" error when setting storage options.

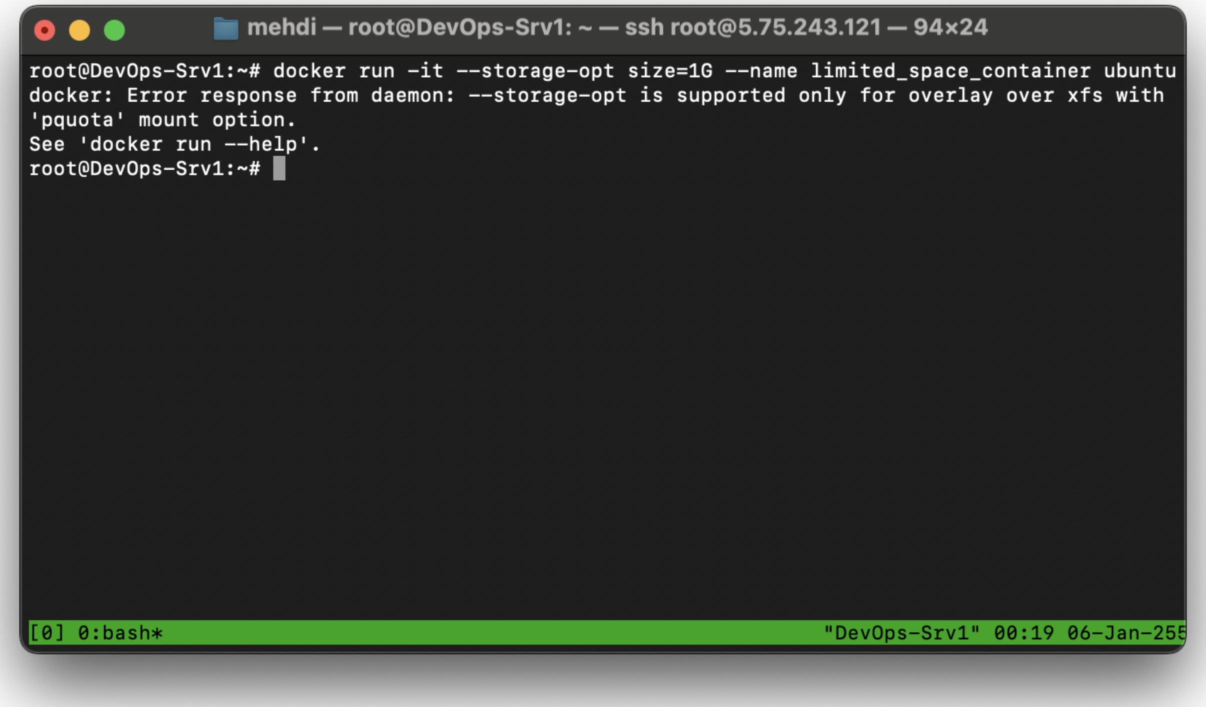
Step 1: Attempt to Create a Container with Limited Disk Space

Run the following command to create a container with limited disk space:

```
docker run -it --storage-opt size=1G --name limited_space_container ubuntu
```

You may encounter the following error:

```
docker: Error response from daemon: --storage-opt is supported only for
overlay over xfs with 'pquota' mount option.
```



mehdi — root@DevOps-Srv1: ~ — ssh root@5.75.243.121 — 94×24

```
root@DevOps-Srv1:~# docker run -it --storage-opt size=1G --name limited_space_container ubuntu
docker: Error response from daemon: --storage-opt is supported only for overlay over xfs with
'pquota' mount option.
See 'docker run --help'.
root@DevOps-Srv1:~#
```

[0] 0:bash*
"DevOps-Srv1" 00:19 06-Jan-25

This error occurs because the underlying filesystem does not support the required `pquota` mount option for disk space quotas.

Step 2: Prepare the /dev/sda2 Partition

Assume we have an unused partition at `/dev/sda2`. We will configure this partition with the XFS filesystem and enable the `pquota` option.

1. **Format the Partition with XFS**:

   ```
   mkfs.xfs -f /dev/sda2
   ```

2. **Backup Existing Docker Data**:

   Stop the Docker service and back up the existing data:

   ```
   systemctl stop docker.socket
   systemctl stop docker.service
   tar -czvf /tmp/docker_backup.tar.gz /var/lib/docker
   ```

3. **Remove Previous Data**:

   Since we do not need the previous data in `/var/lib/docker`, the directory can be cleared to prepare for the new partition.

   ```
   rm -rf /var/lib/docker/*
   ```

4. **Mount the Disk with 'pquota'**:

   Edit the /etc/fstab file and add the following line:

   ```
   /dev/sda2 /var/lib/docker xfs defaults,pquota 0 0
   ```

   Apply the changes:

   ```
   mount -a
   ```

Step 3: Restore Docker Data

1. **Restore Data to the New Partition**:

   Extract the backed-up data into the new partition:

   ```
   tar -xzvf /tmp/docker_backup.tar.gz -C /
   ```

2. **Restart Docker Service**:

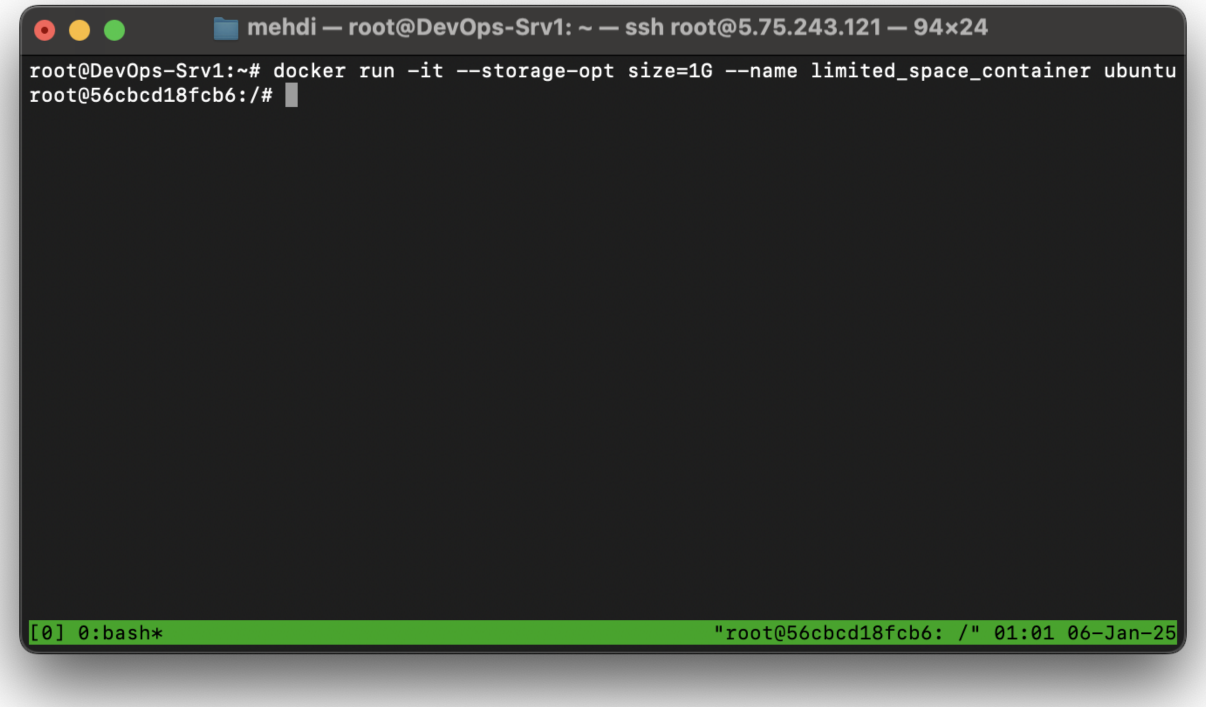
   ```
   systemctl start docker
   ```

Step 4: Create the Container Again

Run the command to create the container with limited disk space:

```
docker run -it --storage-opt size=1G --name limited_space_container ubuntu
```

This time, the container should be created successfully.



```
root@DevOps-Srv1:~# docker run -it --storage-opt size=1G --name limited_space_container ubuntu
root@56cbcd18fcb6:/# 
```

```
[0] 0:bash*                                          "root@56cbcd18fcb6: /" 01:01 06-Jan-25
```

Step 5: Verify Disk Space Inside the Container

1. Start the container:

   ```
   docker start -ai limited_space_container
   ```

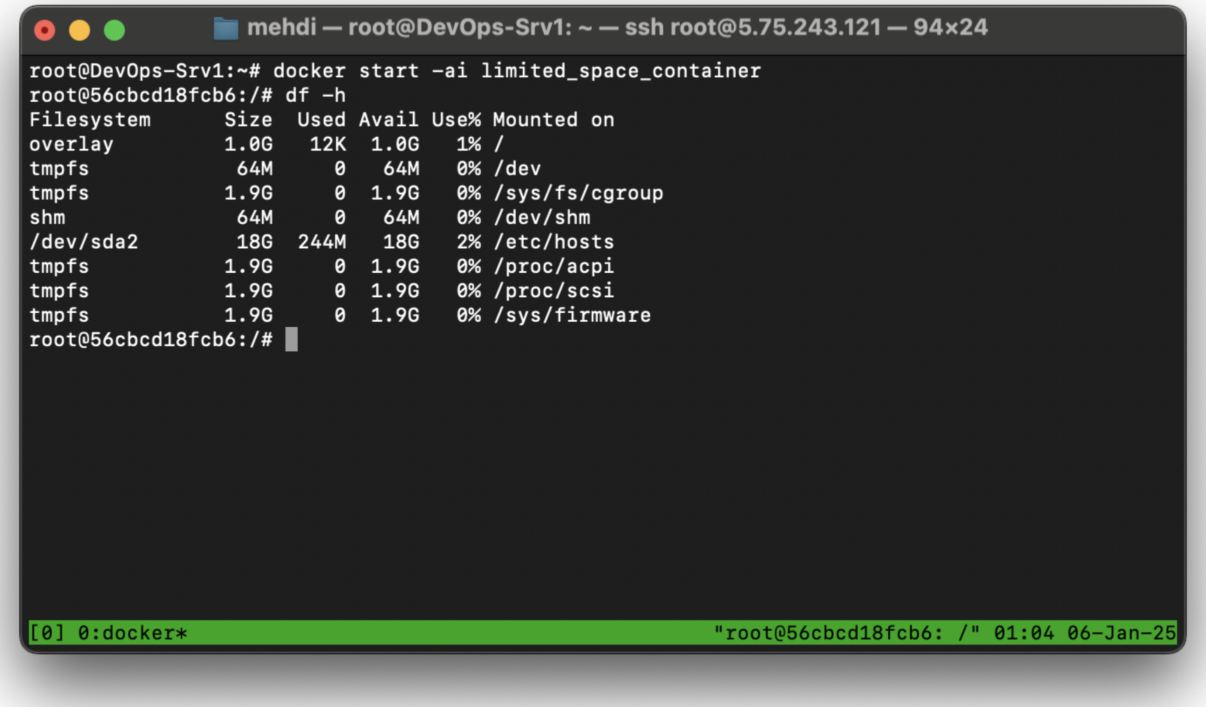
2. Check the available disk space:

   ```
   df -h
   ```

Output:

```
Filesystem      Size  Used Avail Use% Mounted on
overlay         1.0G     0  1.0G   0% /
```

This confirms that the container is limited to 1GB of disk space.



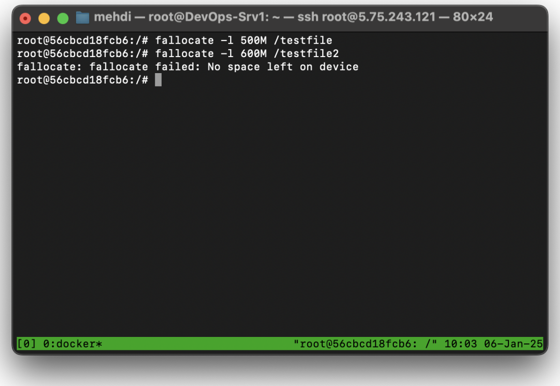
```
root@DevOps-Srv1:~# docker start -ai limited_space_container
root@56cbcd18fcb6:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
overlay         1.0G   12K  1.0G   1% /
tmpfs            64M     0   64M   0% /dev
tmpfs           1.9G     0  1.9G   0% /sys/fs/cgroup
shm              64M     0   64M   0% /dev/shm
/dev/sda2        18G  244M   18G   2% /etc/hosts
tmpfs           1.9G     0  1.9G   0% /proc/acpi
tmpfs           1.9G     0  1.9G   0% /proc/scsi
tmpfs           1.9G     0  1.9G   0% /sys/firmware
root@56cbcd18fcb6:/#
[0] 0:docker*                                         "root@56cbcd18fcb6: /" 01:04 06-Jan-25
```

Step 6: Test Disk Usage in the Container

To validate the quota, create a test file in the container:

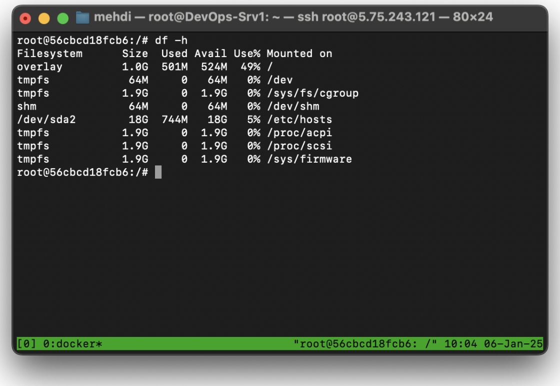
```
fallocate -l 500M /testfile
fallocate -l 600M /testfile2
```

The second command should fail due to exceeding the 1GB limit. Use df -h again to verify the space usage. This step confirms that the quota is enforced correctly.



```
root@56cbcd18fcb6:/# fallocate -l 500M /testfile
root@56cbcd18fcb6:/# fallocate -l 600M /testfile2
fallocate: fallocate failed: No space left on device
root@56cbcd18fcb6:/#
```

```
[0] 0:docker*                            "root@56cbcd18fcb6: /" 10:03 06-Jan-25
```



```
root@56cbcd18fcb6:/# df -h
Filesystem      Size  Used Avail Use% Mounted on
overlay         1.0G  501M  524M  49% /
tmpfs            64M     0   64M   0% /dev
tmpfs           1.9G     0  1.9G   0% /sys/fs/cgroup
shm              64M     0   64M   0% /dev/shm
/dev/sda2        18G  744M   18G   5% /etc/hosts
tmpfs           1.9G     0  1.9G   0% /proc/acpi
tmpfs           1.9G     0  1.9G   0% /proc/scsi
tmpfs           1.9G     0  1.9G   0% /sys/firmware
root@56cbcd18fcb6:/#
```

```
[0] 0:docker*                            "root@56cbcd18fcb6: /" 10:04 06-Jan-25
```