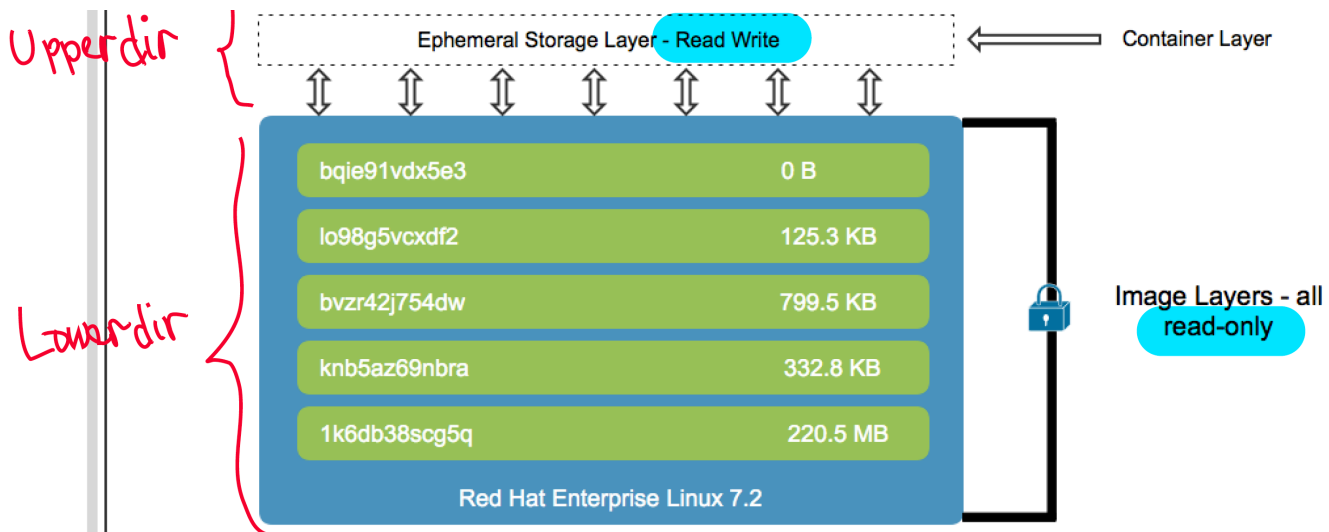


# Exploring Image Layers



## Create Required Directories

```
# vi create-overlay.sh
mkdir -p /podman/overlay/images/image1
mkdir -p /podman/overlay/container/upperdir/container1
mkdir -p /podman/overlay/container/workdir/container1
mkdir -p /podman/overlay/container/merged/container1

cd /podman/overlay/images/image1
mkdir layer-1 layer-2 layer-3 layer-4
mkdir layer-1/{bin,boot,dev,etc}
mkdir layer-2/{home,lib,lib64,media,mnt}
mkdir layer-3/{opt,proc,root,run,sbin}
mkdir layer-4/{srv,sys,tmp,usr,var}
mkdir layer-4/var/{adm,cache,lib,log}
mkdir layer-4/var/lib/mysql

# chmod +x create-overlay.sh
# ./create-overlay.sh
```

## The lowerdir Structure

```
# tree /podman/overlay/images/image1/  
/podman/overlay/images/image1/
```

```
├── layer-1  
│   ├── bin  
│   ├── boot  
│   ├── dev  
│   └── etc  
├── layer-2  
│   ├── home  
│   ├── lib  
│   ├── lib64  
│   ├── media  
│   └── mnt  
├── layer-3  
│   ├── opt  
│   ├── proc  
│   ├── root  
│   ├── run  
│   └── sbin  
└── layer-4  
    ├── srv  
    ├── sys  
    ├── tmp  
    ├── usr  
    └── var  
        ├── adm  
        ├── cache  
        ├── lib  
        │   └── mysql  
        └── log
```

```
28 directories, 0 files
```

## Mount the lowerdir, upperdir & workdir Directories to the Merged Directory

```
# vi mount-overlay.sh
mount -t overlay container1-overlay \
-o lowerdir=/podman/overlay/images/image1/layer-1:/podman/overlay/images/image1/
layer-2:/podman/overlay/images/image1/layer-3:/podman/overlay/images/image1/
layer-4,upperdir=/podman/overlay/container/upperdir/container1,workdir=/podman/overlay/
container/workdir/container1 \
/podman/overlay/container/merged/container1
```

Note:

- The **working directory** (workdir) needs to be an **empty directory** on the same filesystem mount as the upper directory.
- The **lower directory** (lowerdir) can be **read-only** or could be an overlay itself.
- The **upper directory** (upperdir) is normally **writable**.
- The workdir is used to prepare files as they are switched between the layers.
- The lower directory can actually be a list of directories separated by : , all changes in the merged directory are still reflected in upper.

```
# chmod +x mount-overlay.sh
# ./mount-overlay.sh
```

```
# df -h
```

Filesystem	Size	Used	Avail	Use%	Mounted on
devtmpfs	462M	0	462M	0%	/dev
tmpfs	482M	0	482M	0%	/dev/shm
tmpfs	482M	6.6M	475M	2%	/run
tmpfs	482M	0	482M	0%	/sys/fs/cgroup
/dev/mapper/cs-root	61G	2.3G	59G	4%	/
/dev/sda1	1014M	176M	839M	18%	/boot
tmpfs	97M	0	97M	0%	/run/user/1000
<b>container1-overlay</b>	<b>61G</b>	<b>2.3G</b>	<b>59G</b>	<b>4%</b>	<b>/podman/overlay/container/merged/container1</b>

```
# mount|grep overlay
container1-overlay on /podman/overlay/container/merged/container1 type overlay
(rw,relatime,seclabel,lowerdir=/podman/overlay/images/image1/layer-1:/podman/overlay/
images/image1/layer-2:/podman/overlay/images/image1/layer-3:/podman/overlay/images/
image1/layer-4,upperdir=/podman/overlay/container/upperdir/container1,workdir=/podman/
overlay/container/workdir/container1)
```

## The Merged Directory Structure

```
# tree /podman/overlay/container/merged/container1/  
/podman/overlay/container/merged/container1/
```

```
├── bin  
├── boot  
├── dev  
├── etc  
├── home  
├── lib  
├── lib64  
├── media  
├── mnt  
├── opt  
├── proc  
├── root  
├── run  
├── sbin  
├── srv  
├── sys  
├── tmp  
├── usr  
└── var  
    ├── adm  
    ├── cache  
    ├── lib  
    │   └── mysql  
    └── log
```

## Changing the Merged Directory Directory

```
# cd /podman/overlay/container/merged/container1
```

```
# ls
```

```
bin boot dev etc home lib lib64 media mnt opt proc root run sbin  
srv sys tmp usr var
```

```
# touch etc/{passwd,group,shadow}
```

```
# touch var/log/messages
```

```
# touch var/lib/mysql/mydata1.db
```

```
# mkdir home/{furqan,irfan}
```

```
# tree
```

```
.  
├── bin  
├── boot  
├── dev  
├── etc  
│   ├── group  
│   ├── passwd  
│   └── shadow  
├── home  
│   ├── furqan  
│   └── irfan  
├── lib  
├── lib64  
└── media
```

```

├── mnt
├── opt
├── proc
├── root
├── run
├── sbin
├── srv
├── sys
├── tmp
├── usr
└── var
    ├── adm
    ├── cache
    ├── lib
    │   ├── mysql
    │   └── mydata1.db
    ├── log
    └── messages

```

26 directories, 5 files

### **All Changes are Stored in the upperdir Directory**

```
# tree /podman/overlay/container/upperdir/container1/
/podman/overlay/container/upperdir/container1/
```

```

├── etc
│   ├── group
│   ├── passwd
│   └── shadow
├── home
│   ├── furqan
│   └── irfan
└── var
    ├── lib
    │   ├── mysql
    │   └── mydata1.db
    ├── log
    └── messages

```

8 directories, 5 files

## There is no change on the lowerdir Directory

```
# tree /podman/overlay/images/image1/  
/podman/overlay/images/image1/
```

```
├── layer-1  
│   ├── bin  
│   ├── boot  
│   ├── dev  
│   └── etc  
├── layer-2  
│   ├── home  
│   ├── lib  
│   ├── lib64  
│   ├── media  
│   └── mnt  
├── layer-3  
│   ├── opt  
│   ├── proc  
│   ├── root  
│   ├── run  
│   └── sbin  
└── layer-4  
    ├── srv  
    ├── sys  
    ├── tmp  
    ├── usr  
    └── var  
        ├── adm  
        ├── cache  
        ├── lib  
        │   └── mysql  
        └── log
```

28 directories, 0 files

## Exploring httpd Image

```
# podman pull docker.io/library/httpd
Trying to pull docker.io/library/httpd:latest...
Getting image source signatures
Copying blob acb3e3b931b8 done
Copying blob 3a141a09d1d0 done
Copying blob 6f28985ad184 done
Copying blob 1633384edb75 done
Copying blob f6dc6b8b1d70 done
Copying config ae15ff2bdc done
Writing manifest to image destination
Storing signatures
ae15ff2bdc44d66199dc364b273ab5b108fb120bb95f022cedabbfab3253701

# podman images
REPOSITORY          TAG       IMAGE ID       CREATED        SIZE
docker.io/library/httpd  latest    ae15ff2bdc4    2 weeks ago   142 MB

# podman image inspect docker.io/library/httpd
...
"GraphDriver": {
    "Name": "overlay",
    "Data": {

"LowerDir":
"/var/lib/containers/storage/overlay/0a8a.../diff:
/var/lib/containers/storage/overlay/7c98.../diff:
/var/lib/containers/storage/overlay/9e3f.../diff:
/var/lib/containers/storage/overlay/14a1.../diff",

"UpperDir":
"/var/lib/containers/storage/overlay/fbd5.../diff",

"WorkDir":
"/var/lib/containers/storage/overlay/fbd5.../work"
    }
}
```