Red Hat
Training and
Certification

Managing and Building Container Images and Containers)

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Table of Contents

Introduction

This guide with cover additional and supplemental materials for the DO180 custom container course. As part of this guide, students will be learning the following concepts:

Course Objectives

- Exploring SystemD and Creating SystemD Services
- Exploring FirewallD and FirewallD Custom Services
- Exploring Cockpit and the Red Hat Web Console
- Rootless Podman
- Leveraging Podman's Pod Capabilities
- Managing Containers with the Red Hat Web Console (Cockpit)
- Running Containers as a Service (SystemD)
- Building Container Images with Buildah (from scratch)
- Building Container Images from Containerfile/Dockerfile Files
- Installing/Configuring/Using Quay Container Registry
- Using ClairV4 and Quay Mirroring with Quay
- Exploring Skopeo

Courses for Reference

- DO180
- RH134
- RH354

This course will use a DO180 course for the hands-on lab environment. The environment has been modified to have an additional machine to perform custom exercises and have the Quay registry installed locally.

Lab Machine Requirements

In addition to the DO180 lab environment, a new VM has been added to that environment. This machine can be setup and configured locally with the following requirements:

VM Requirements

- RHEL 8.4+
- 6 vCPU (8 vCPU Recommended)
- 12GB RAM (16GB Recommended)
- 60GB Storage (Image and Database storage)

Using the Lab Guide

This lab guide and contents within the guide are meant to supplement the course and materials delivered as part of a custom DO180 delivery. It is advisable to download the RH354 course manual and the RH134 course manual prior to the class delivery. The DO180 course guide can be downloaded as part of the course.

Course Materials

All course materials and lab materials for the custom portion of the course can be found here: https://github.com/tmichett/OCP_Demos

The lab guide for this course can be downloaded from here: https://github.com/tmichett/OCP_Demos/blob/main/Containers/Containers.pdf

1. RHEL 8 Changes

2. Managing Containers with the New Runtime

2.1. Deploying Containers with the New Container Runtime

2.1.1. The Podman Container Engine

RHEL8 includes he **container-tools** package module. New engine is **podman** replaces **docker** and **moby**. It also contains new tools **buildah** to build container images and **skopeo** to manage images on registries like **runc**. The new toolset allows building/running containers without daemons.

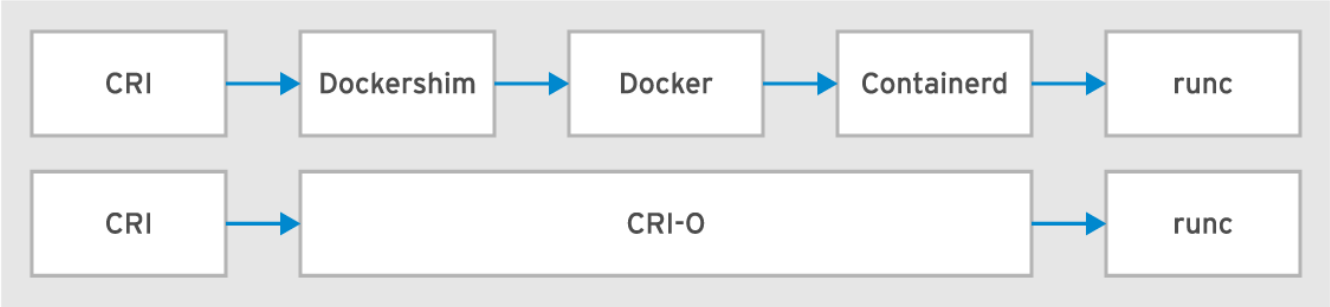

Figure 1. Docker to RHEL8 Container Runtime

Container Runtime Toolset

- Docker replaced with new container runtime
- New toolset supports OCI and reuse of third-party images
- Integrates with **audit** of Docker client-server model
- **container-tools** module provides new container runtime tools and engine.

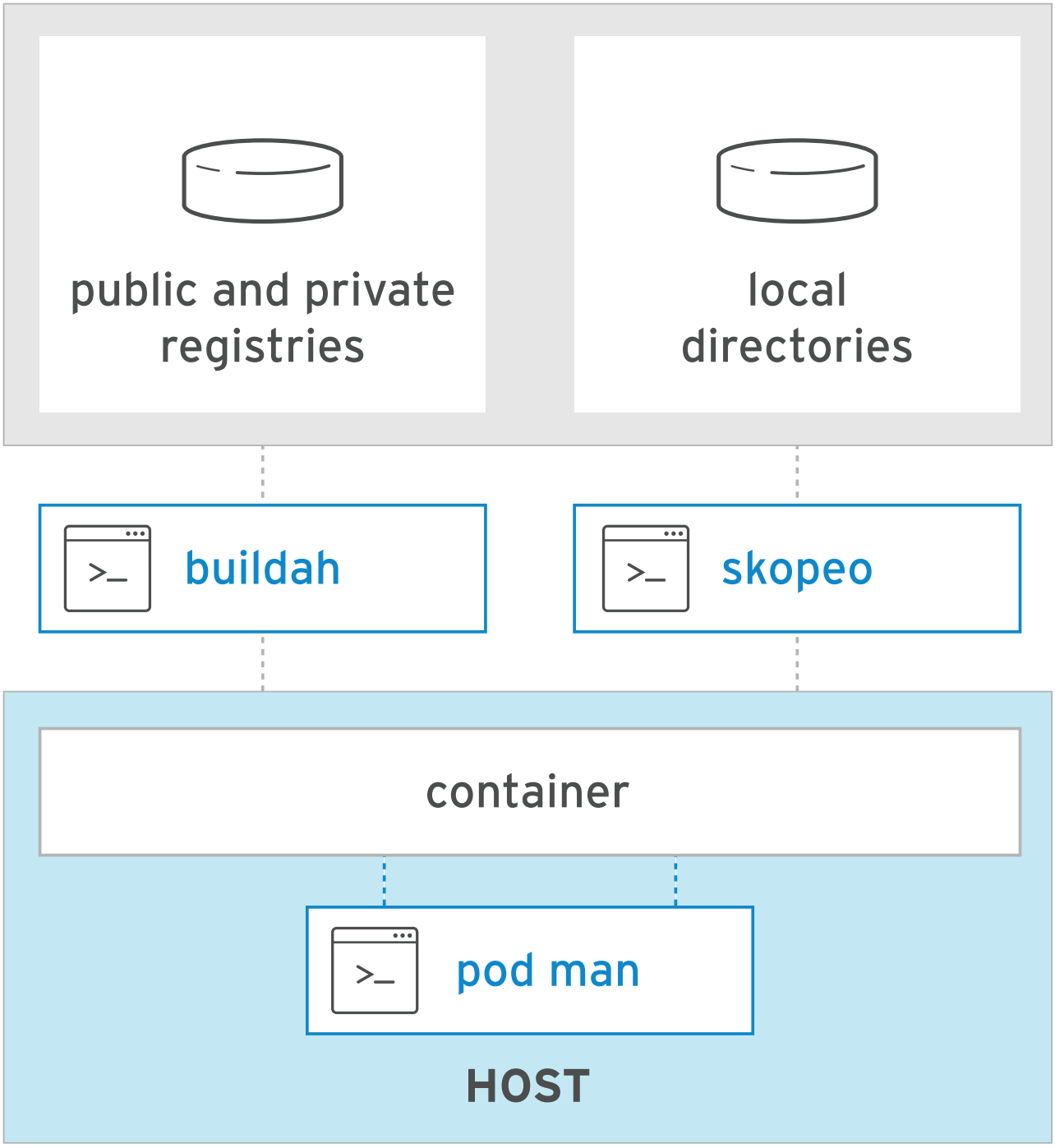

Figure 2. New Container Runtime

Describing new Container Runtime Tool

- The **podman** engine is daemonless and supporting container execution.
- **podman** syntax is similar to the docker command, supporting **Dockerfile** use
- **Buildah** builds container images, from scratch or a Dockerfile.
- Copy and inspect container images in registries with **Skopeo**
- **Skopeo** supports Docker and private registries, the Atomic registry, and local directories, including those which use OCI

RHEL8 includes **Pacemaker** containers with **podman** as a tech preview. Pacemaker supports execution of the container across multiple hosts.

Listing 1. Installation of Container Tools

```
[student@workstation ~]$ sudo yum module install container-tools
```

2.2. Managing Containers using the Red Hat Web Console

3. Podman Pods

This will talk about Podman Pods

3.1. Using and Leveraging Pods with Podman

3.2. Podman Image and Container Pruning

References

Managing Containers and Pods: https://developers.redhat.com/blog/2019/01/15/podman-managing-containers-pods?ts=1634314817672#podman_pods__what_you_need_to_know

Managing Containers using Podman and Skopeo: https://www.tecmint.com/manage-containers-using-podman-in-rhel/

Podman: https://docs.podman.io/en/latest/

Podman System Prune:

man pages

podman-system-prune, *podman-container-cleanup*,

4. Building Containers with Buildah

Example 1. EXAMPLE - Creating a Custom Container Image Using Buildah

Listing 2. Creating a Custom Container

```
[root@workstation ~]# buildah from scratch
working-container
```

Listing 3. Naming and Inspecting a Custom Container

```
[root@workstation ~]# buildah config --label name=My-Container working-container
[root@workstation ~]# buildah inspect working-container
```

Listing 4. Installing Packages on Working Container

```
[root@workstation ~]#  buildah mount working-container ①


[root@workstation ~]# yumdownloader --destdir=/tmp redhat-release-server ②

[root@workstation ~]# rpm -ivh --root
/var/lib/containers/storage/overlay/a6a136063f0ada2b1ed4b01eff9a04b4d6419ae828bc4b49e742bca594e08560/merged /tmp/redhat-release-8.0-
0.39.el8.x86_64.rpm ③

[root@workstation ~]# cp  /etc/yum.repos.d/rhel_dvd.repo
/var/lib/containers/storage/overlay/a6a136063f0ada2b1ed4b01eff9a04b4d6419ae828bc4b49e742bca594e08560/merged/etc/yum.repos.d/ ④

[root@workstation ~]# yum install --installroot
/var/lib/containers/storage/overlay/a6a136063f0ada2b1ed4b01eff9a04b4d6419ae828bc4b49e742bca594e08560/merged httpd ⑤


[root@workstation ~]# echo "This is a custom webserver container for me" >>
/var/lib/containers/storage/overlay/a6a136063f0ada2b1ed4b01eff9a04b4d6419ae828bc4b49e742bca594e08560/merged/var/www/html/index.html ⑥

[root@workstation ~]#  yum install --installroot
/var/lib/containers/storage/overlay/a6a136063f0ada2b1ed4b01eff9a04b4d6419ae828bc4b49e742bca594e08560/merged httpd-manual ⑦

[root@workstation ~]# buildah config --cmd "/usr/sbin/httpd -DFOREGROUND" working-container ⑧

[root@workstation ~]# buildah config --port 80/tcp working-container ⑨

[root@workstation ~]# yum clean all --installroot
/var/lib/containers/storage/overlay/a6a136063f0ada2b1ed4b01eff9a04b4d6419ae828bc4b49e742bca594e08560/merged ⑩

[root@workstation ~]#  buildah unmount working-container ⑪

[root@workstation ~]# buildah commit working-container my-container-image ⑫

[root@workstation ~]# buildah images ⑬
```

① Mount container image filesystem for modification

② Download Red Hat Release RPM for installation

③ Install Red Hat Release RPM

④ Create repository for container image so files can be installed

⑤ Install the HTTP package for a webserver

⑥ Create an **index.html** file for the webserver

⑦ Install the Apache manual for reference documentation

⑧ Configure webserver to run

⑨ Configure and open port **80** for the **TCP** protocol for the container

⑩ Clean up yum data to minimize required disk space

⑪ Unmount the container image filesystem

⑫ Commit the container image

⑬ List container images

Listing 5. Testing the Container Image

```
[root@workstation ~]# podman run -d -p 8080:80 localhost/my-container-image

[root@workstation ~]# curl localhost:8080
This is a custom webserver container for me

[root@workstation ~]# curl http://localhost:8080/manual/
```

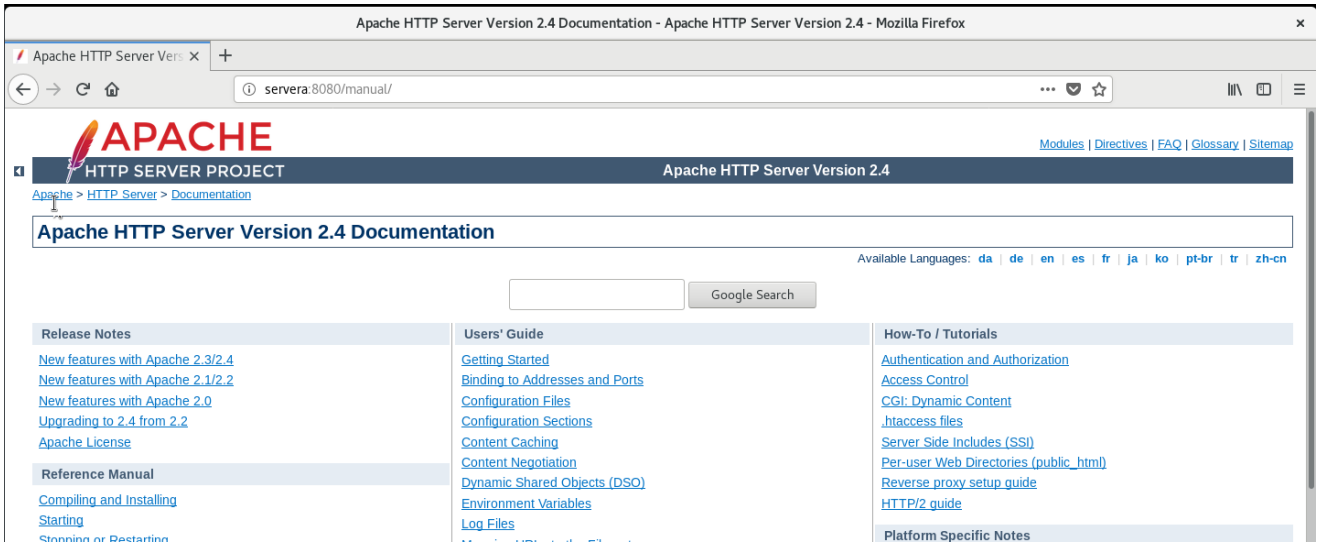

Figure 3. Testing Container

Listing 6. Stopping and Cleanup of Image

```
[root@workstation ~]# podman list ①
CONTAINER ID  IMAGE                                 COMMAND               CREATED        STATUS           PORTS                 NAMES
9bd572633953  localhost/my-container-image:latest  /usr/sbin/httpd -...  2 seconds ago  Up 1 second ago  0.0.0.0:8080->80/tcp
cranky_stonebraker

[root@workstation ~]# podman stop 9bd572633953 ②
9bd572633953276ac75417db3ac8e70875a0f2713e8cdfd32253fe343d06153d

[root@workstation ~]# podman stop -a ③

[root@workstation ~]# podman rm cranky_stonebraker ④

[root@workstation ~]# podman rm 9bd572633953276ac75417db3ac8e70875a0f2713e8cdfd32253fe343d06153d ⑤

[root@workstation ~]# podman rmi localhost/my-container-image ⑥

[root@workstation ~]# buildah delete working-container ⑦
```

① Listing Running Containers

② Stopping Single Container by ID

③ Stopping All Running Containers

④ Remove Container by Name

⑤ Remove Container by ID

⑥ Removing Container Image from Registry

⑦ Delete Working Container from System

4.1. Building an Image Using Buildah Rootless

5. Containers as System Services

6. Container Management with Ansible

6.1. Ansible Podman Collections

6.1.1. Obtaining Podman Collections

The Podman collections for Ansible can be located from Ansible Automation Hub (https://console.redhat.com/ansible/automation-hub).

Ansible Automation Hub

It is required that you have a Red Hat Subscription for Ansible Automation Platform (AAP2.0) in order to access Red Hat Supported Ansible collections. The lab and exercises will use the Ansible Galaxy Podman collection.

Listing 7. Installing Ansible Galaxy Podman Collection

```
ansible-galaxy collection install containers.podman
```

https://galaxy.ansible.com/containers/podman https://docs.ansible.com/ansible/latest/collections/containers/podman/index.html https://docs.ansible.com/ansible/latest/collections/containers/podman/podman_container_module.html

7. Quay Image Registry

7.1. Installing the Quay Image Registry

7.2. Using the Quay Image Registry

7.3. Inspecting Images with Skopeo on Remote Registries