# Red Hat Quay 3.4

## Deploy Red Hat Quay for proof-of-concept (non-production) purposes

Deploy Red Hat Quay

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## Legal Notice



## Abstract

Get started with Red Hat Quay

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# PREFACE

Red Hat Quay is an enterprise-quality registry for building, securing and serving container images. This procedure describes how to deploy Red Hat Quay for proof-of-concept (non-production) purposes.

# CHAPTER 1. OVERVIEW

Features of Red Hat Quay include:

- High availability
- Geo-replication
- Repository mirroring
- Docker v2, schema 2 (multiarch) support
- Continuous integration
- Security scanning with Clair
- Custom log rotation
- Zero downtime garbage collection
- 24/7 support

Red Hat Quay provides support for:

- Multiple authentication and access methods
- Multiple storage backends
- Custom certificates for Quay, Clair, and storage backends
- Application registries
- Different container image types

## 1.1. ARCHITECTURE

Red Hat Quay consists of a number of core components, both internal and external.

### 1.1.1. Internal components

- **Quay (container registry)**: Runs the quay container as a service, consisting of several components in the pod.
- **Clair**: Scans container images for vulnerabilities and suggests fixes.

### 1.1.2. External components

- **Database**: Used by Red Hat Quay as its primary metadata storage (not for image storage).
- **Redis (key-value store)**: Stores live builder logs and the Red Hat Quay tutorial.
- **Cloud storage**:For supported deployments, you need to use one of the following types of storage:
    - **Public cloud storage**: In public cloud environments, you should use the cloud provider's object storage, such as Amazon S3 (for AWS) or Google Cloud Storage (for Google Cloud).

- **Private cloud storage**: In private clouds, an S3 or Swift compliant Object Store is needed, such as Ceph RADOS, or OpenStack Swift.

**WARNING**

Do not use "Locally mounted directory" Storage Engine for any production configurations. Mounted NFS volumes are not supported. Local storage is meant for Red Hat Quay test-only installations.

# CHAPTER 2. GETTING STARTED WITH RED HAT QUAY

The Red Hat Quay registry can be deployed for non-production purposes on a single machine (either physical or virtual) with the following specifications.

## 2.1. PREREQUISITES

- **Red Hat Enterprise Linux (RHEL)**: Obtain the latest Red Hat Enterprise Linux 8 server media from the Downloads page and follow the installation instructions available in the Product Documentation for Red Hat Enterprise Linux 8.
- **Valid Red Hat Subscription**: Configure a valid Red Hat Enterprise Linux 8 server subscription.
- **CPUs**: Two or more virtual CPUs
- **RAM**: 4GB or more
- **Disk space**: The required disk space depends on the storage needs for the registry. Approximately 30GB of disk space should be enough for a test system, broken down as follows:
  - At least 10GB of disk space for the operating system (Red Hat Enterprise Linux Server).
  - At least 10GB of disk space for docker storage (to run 3 containers)
  - At least 10GB of disk space for Quay local storage (CEPH or other local storage might require more memory)

More information on sizing can be found at Quay 3.x Sizing Guidlines.

### 2.1.1. Using podman

This document uses **podman** for creating and deploying containers. If you do not have **podman** installed on your system, you should be able to use the equivalent **docker** commands. For more information on podman and related technologies, see Building, running, and managing Linux containers on Red Hat Enterprise Linux 8.

## 2.2. CONFIGURING THE RHEL SERVER

### 2.2.1. Install and register Red Hat Enterprise Linux server

Install the latest RHEL 8 server. You can do a minimal install (shell access only) or Server plus GUI (if you want a desktop). Register and subscribe your RHEL server system as described in How to register and subscribe a system.... The following commands register your system and list available subscriptions. Choose an available RHEL server subscription, attach to its pool ID and upgrade to the latest software:

+

```
# subscription-manager register --username=<user_name> --password=<password>
# subscription-manager refresh
# subscription-manager list --available
# subscription-manager attach --pool=<pool_id>
# yum update -y
```

### 2.2.2. Installing podman

Install podman, if it is not already present on your system:

```
$ sudo yum install -y podman
```

Alternatively, you can install the **container-tools** module, which pulls in the full set of container software packages:

```
$ sudo yum module install -y container-tools
```

### 2.2.3. Registry authentication

Set up authentication to **registry.redhat.io**, so that you can pull the quay container, as described in Red Hat Container Registry Authentication. Note that this differs from earlier Red Hat Quay releases where the images were hosted on quay.io.

For example, you can log in to the registry:

```
$ sudo podman login registry.redhat.io
Username: <username>
Password: <password>
```

### 2.2.4. Firewall configuration

If you have a firewall running on your system, to access the Red Hat Quay config tool (port 8443) and application (ports 8080 and 443) outside of the local system, run the following commands (add **--zone=<yourzone>** for each command to open ports on a particular zone):

```
# firewall-cmd --permanent --add-port=8443/tcp
# firewall-cmd --permanent --add-port=8080/tcp
# firewall-cmd --permanent --add-port=443/tcp
# firewall-cmd --reload
```

### 2.2.5. IP addressing and naming services

There are a number of ways to configure the component containers in Red Hat Quay so that they can talk to each other:

- **Using the IP addresses for the containers:** You can determine the IP address for containers with **podman inspect** and then use these values in the configuration tool when specifying the connection strings, for example:

  ```
  $ sudo podman inspect -f "{{.NetworkSettings.IPAddress}}" postgresql-quay
  ```

  This approach is susceptible to host restarts, as the IP addresses for the containers will change after a reboot.

- **Using a naming service:** If you want your deployment to survive container restarts, which typically result in changed IP addresses, you can implement a naming service. For example, the dnsname plugin is used to allow containers to resolve each other by name.

- **Using the host network:** You can use the **podman run** command with the **--net=host** option

and then use container ports on the host when specifying the addresses in the configuration. This option is susceptible to port conflicts when two containers want to use the same port, and as a result it is not recommended.

- **Configuring port mapping:** You can use port mappings to expose ports on the host and then use these ports in combination with the host IP address or host name.

This document uses port mapping in the subsequent examples, and assumes a static IP address for your host system. In this example, **quay-server** has the IP address **192.168.1.112**.

```
$ cat /etc/hosts
...
192.168.1.112   quay-server
```

| Component | Port mapping | Address |
|---|---|---|
| Quay | **-p 8080:8080** | http://quay-server:8080 |
| Postgres for Quay | **-p 5432:5432** | quay-server:5432 |
| Redis | **-p 6379:6379** | quay-server:6379 |
| Postgres for Clair V4 | **-p 5433:5432** | quay-server:5433 |
| Clair V4 | **-p 8081:8080** | http://quay-server:8081 |

## 2.3. CONFIGURING THE DATABASE

Quay requires a database for storing metadata and Postgres is recommended, especially for highly available configurations. Alternatively, you can use MySQL with a similar approach to configuration as described below for Postgres.

### 2.3.1. Setting up Postgres

In this proof-of-concept scenario, you will use a directory on the local file system to persist database data.

- In the installation folder, denoted here by the variable $QUAY, create a directory for the database data and set the permissions appropriately:

```
$ mkdir -p $QUAY/postgres-quay
$ setfacl -m u:26:-wx $QUAY/postgres-quay
```

- Use podman to run the Postgres container, specifying the username, password, database name and port, together with the volume definition for database data:

```
$ sudo podman run -d --rm --name postgresql-quay \
  -e POSTGRESQL_USER=quayuser \
  -e POSTGRESQL_PASSWORD=quaypass \
  -e POSTGRESQL_DATABASE=quay \
```

```
    -e POSTGRESQL_ADMIN_PASSWORD=adminpass \
    -p 5432:5432 \
    -v $QUAY/postgres-quay:/var/lib/pgsql/data:Z \
    registry.redhat.io/rhel8/postgresql-10:1
```

- Ensure that the Postgres **pg_trgm** module is installed, as it is required by Quay:

```
$ sudo podman exec -it postgresql-quay /bin/bash -c 'echo "CREATE EXTENSION IF NOT EXISTS pg_trgm" | psql -d quay -U postgres'
```

## 2.4. CONFIGURING REDIS

Redis ia a key-value store, used by Quay for live builder logs and the Red Hat Quay tutorial.

### 2.4.1. Setting up Redis

Use podman to run the Redis container, specifying the port and password:

```
$ sudo podman run -d --rm --name redis \
  -p 6379:6379 \
  -e REDIS_PASSWORD=strongpassword \
  registry.redhat.io/rhel8/redis-5:1
```

## 2.5. CONFIGURING RED HAT QUAY

Before running the Red Hat Quay service, you need to generate a configuration file containing details of all the components, including registry settings, and database and Redis connection parameters. To generate the configuration file, you run the quay container in **config** mode, specifying a password (in this instance, **secret**) for the **quayconfig** user:

```
$ sudo podman run --rm -it --name quay_config -p 8080:8080 registry.redhat.io/quay/quay-rhel8:v3.4.7 config secret
```

Use your browser to access the user interface for the configuration tool at **http://quay-server:8080** (assuming you have configured the **quay-server** hostname in your **hosts** file). Login with the username **quayconfig** and password **secret** (or whatever value you specified in the podman run command above).

### 2.5.1. Red Hat Quay setup

In the configuration editor, you enter details for the following:

- Basic configuration
- Server configuration
- Database
- Redis

#### 2.5.1.1. Basic configuration

In the basic configuration setting, complete the registry title and the registry short title fields (or you can use the default values, if they are specified).

#### 2.5.1.2. Server configuration

Specify the HTTP host and port, for the location where the registry will be accessible on the network, in this instance, **quay-server:8080**.

#### 2.5.1.3. Database

In the database section, specify connection details for the database that Red Hat Quay uses to store metadata. If you have followed the instructions in this document for deploying a proof-of-concept system, the following values would be entered:

- **Database Type:** Postgres
- **Database Server:** quay-server:5432
- **Username:** quayuser
- **Password:** quaypass
- **Database Name:** quay

#### 2.5.1.4. Redis

The Redis key-value store is used to store real-time events and build logs. If you have followed the instructions in this document for deploying a proof-of-concept system, the following values would be specified:

- **Redis Hostname:** quay-server
- **Redis port:** 6379 (default)

### 2.5.2. Validate and download configuration

When all required fields have been set, validate your settings by choosing the Validate Configuration Changes button. If any errors are reported, continue editing your configuration until all required fields are valid and Red Hat Quay can connect to your database and Redis servers.

Once your configuration is valid, download the configuration file and then stop the quay container that is running the configuration editor.

## 2.6. DEPLOYING RED HAT QUAY

### 2.6.1. Prerequisites

- Your Quay database and Redis servers are running.
- You have generated a valid configuration bundle.
- You have stopped the Quay container that you used to run the configuration editor.

### 2.6.2. Prepare config folder

Unpack the configuration bundle so that Quay can use it, for example:

```
$ mkdir $QUAY/config
$ cp ~/Downloads/quay-config.tar.gz $QUAY/config
$ cd $QUAY/config
$ tar xvf quay-config.tar.gz
```

### 2.6.3. Prepare local storage for image data

In this proof-of-concept deployment, use the local file system to store the registry images:

```
$ mkdir $QUAY/storage
$ setfacl -m u:1001:-wx $QUAY/storage
```

### 2.6.4. Deploy the Red Hat Quay registry

Use podman to run the quay container, specifying the appropriate volumes for your configuration data and local storage for image data:

```
$ sudo podman run -d --rm -p 8080:8080  \
  --name=quay \
  -v $QUAY/config:/conf/stack:Z \
  -v $QUAY/storage:/datastorage:Z \
  registry.redhat.io/quay/quay-rhel8:v3.4.7
```

## 2.7. USING RED HAT QUAY

Use your browser to access the user interface for the Red Hat Quay registry at **quay-server:8080** (assuming you have configured the **quay-server** hostname in your **hosts** file). Select 'Create User' and add a user, for example, **quayadmin** with a password **password**.

You can now use the user interface to create new organizations and repositories, and to search and browse existing repositories. Alternatively, you can use the command line interface to interact with the registry and to pull and push images.

From the command line, log in to the registry:

```
$ sudo podman login --tls-verify=false quay-server:8080
Username: quayadmin
Password:
Login Succeeded!
```

### 2.7.1. Push and pull images

To test pushing and pulling images from the Red Hat Quay registry, first pull a sample image from an external registry:

```
$ sudo podman pull busybox
Trying to pull docker.io/library/busybox...
Getting image source signatures
Copying blob 4c892f00285e done
Copying config 22667f5368 done
```

```
Writing manifest to image destination
Storing signatures
22667f53682a2920948d19c7133ab1c9c3f745805c14125859d20cede07f11f9
```

Use the **podman images** command to see the local copy:

```
$ sudo podman images
REPOSITORY                      TAG      IMAGE ID       CREATED         SIZE
docker.io/library/busybox       latest   22667f53682a   14 hours ago    1.45 MB
...
```

Tag this image, in preparation for pushing it to the Red Hat Quay registry:

```
$ sudo podman tag docker.io/library/busybox quay-server:8080/quayadmin/busybox:test
```

Now push the image to the Red Hat Quay registry:

```
$ sudo podman push --tls-verify=false quay-server:8080/quayadmin/busybox:test
Getting image source signatures
Copying blob 6b245f040973 done
Copying config 22667f5368 done
Writing manifest to image destination
Storing signatures
```

At this point, you can use your browser to see the tagged image in your repository. To test access to the image from the command line, first delete the local copy of the image:

```
$ sudo podman rmi quay-server:8080/quayadmin/busybox:test
Untagged: quay-server:8080/quayadmin/busybox:test
```

Now pull the image again, this time from your Red Hat Quay registry:

```
$ sudo podman pull --tls-verify=false quay-server:8080/quayadmin/busybox:test
Trying to pull quay-server:8080/quayadmin/busybox:test...
Getting image source signatures
Copying blob 6ef22a7134ba [--------------------------------------] 0.0b / 0.0b
Copying config 22667f5368 done
Writing manifest to image destination
Storing signatures
22667f53682a2920948d19c7133ab1c9c3f745805c14125859d20cede07f11f9
```

# CHAPTER 3. ADVANCED RED HAT QUAY DEPLOYMENT

## 3.1. QUAY SUPERUSER

A **superuser** is a Quay user account that has extended privileges, including the ability to:

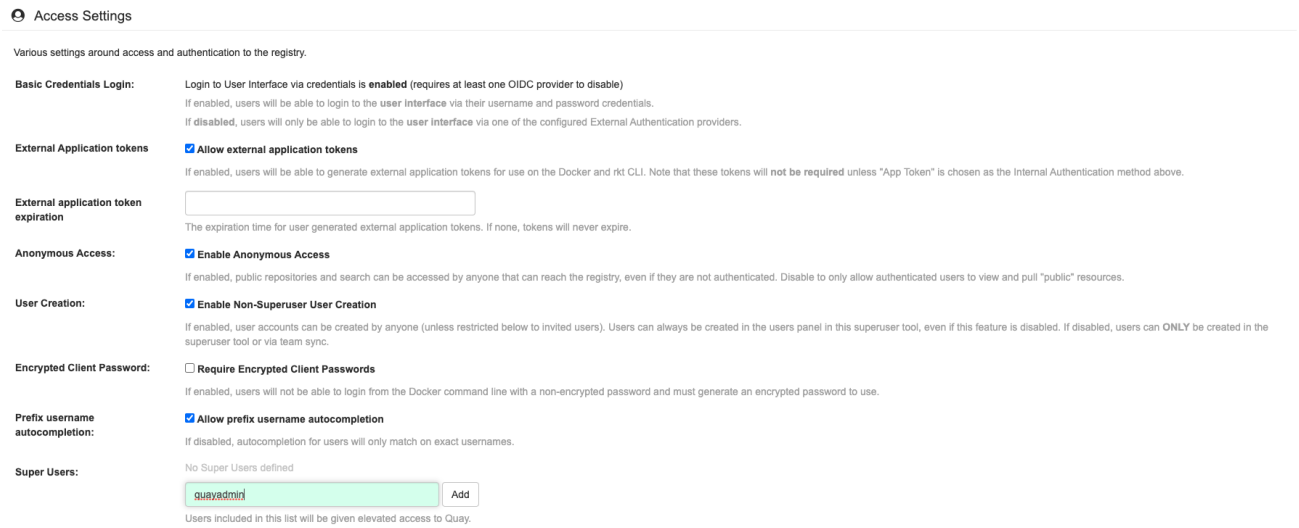
- Manage users
- Manage organizations
- Manage service keys
- View the change log
- Query the usage logs
- Create globally visible user messages

### 3.1.1. Adding a superuser to Quay using the UI

Stop the Quay registry if it is running, and restart the container in configuration mode, loading the existing configuration as a volume:

```
$ sudo podman run --rm -it --name quay_config \
  -p 8080:8080 \
  -v $QUAY/config:/conf/stack:Z \
  registry.redhat.io/quay/quay-rhel8:v3.4.7 config secret
```

In the Access Settings section of the UI, enter the name of the user (in this instance, **quayadmin**) in the Super Users field and press Add.




Validate and download the configuration bundle and then terminate the Quay container that is running in config mode. Extract the **config.yaml** file to the configuration directory and restart the Quay container in registry mode.

### 3.1.2. Editing the config.yaml file to add a superuser

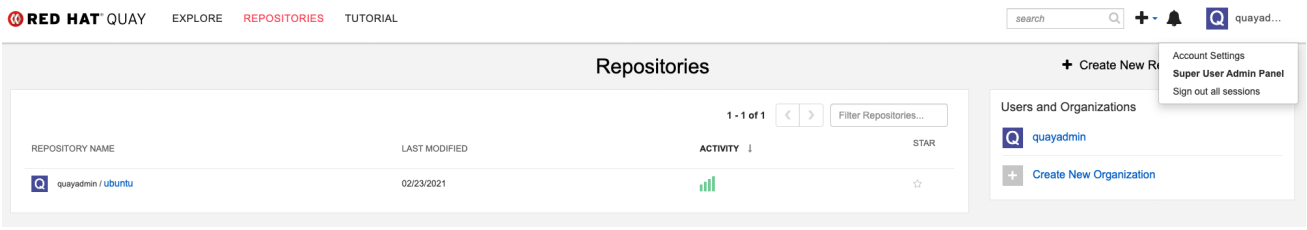
You can also add a superuser by editing the **config.yaml** file directly. The list of superuser accounts is stored as an array in the field **SUPER_USERS**:

**$QUAY/config/config.yaml**

```
SERVER_HOSTNAME: quay-server:8080
SETUP_COMPLETE: true
SUPER_USERS:
  - quayadmin
...
```

### 3.1.3. Accessing the superuser admin panel

To access the Super User Admin Panel, click on the current user's name or avatar in the top right-hand corner of the UI. If the user has been added as a superuser, an extra item is presented in the drop-down list called Super User Admin Panel.




## 3.2. DEPLOYING CLAIR V4

Clair is an application for parsing image contents and reporting vulnerabilities affecting the contents. This is performed via static analysis and not at runtime. Clair's analysis is broken into three distinct parts:

- **Indexing:** Indexing starts with submitting a Manifest to Clair. On receipt, Clair will fetch layers, scan their contents, and return an intermediate representation called an IndexReport. Manifests are Clair's representation of a container image. Clair leverages the fact that OCI Manifests and Layers are content-addressed to reduce duplicated work. Once a Manifest is indexed, the IndexReport is persisted for later retrieval.

- **Matching:** Matching takes an IndexReport and correlates vulnerabilities affecting the manifest that the report represents. Clair is continually ingesting new security data and a request to the matcher will always provide you with the most up to date vulnerability analysis of an IndexReport.

- **Notifications:** Clair implements a notification service. When new vulnerabilities are discovered, the notifier service will determine if these vulnerabilities affect any indexed Manifests. The notifier will then take action according to its configuration.

### 3.2.1. Deploying a separate database for Clair

Clair requires a Postgres database. You can share a common database between Quay and Clair if Quay is also using Postgres, but in this example a separate, Clair-specific database is deployed.

In this proof-of-concept scenario, you will use a directory on the local file system to persist database data.

- In the installation folder, denoted here by the variable $QUAY, create a directory for the Clair database data and set the permissions appropriately:

```
$ mkdir -p $QUAY/postgres-clairv4
$ setfacl -m u:26:-wx $QUAY/postgres-clairv4
```

- Use podman to run the Postgres container, specifying the username, password, database name and port, together with the volume definition for database data. As the standard Postgres port, **5432**, is already in use by the Quay deployment, expose a different port, in this instance **5433**:

```
$ sudo podman run -d --rm --name postgresql-clairv4 \
  -e POSTGRESQL_USER=clairuser \
  -e POSTGRESQL_PASSWORD=clairpass \
  -e POSTGRESQL_DATABASE=clair \
  -e POSTGRESQL_ADMIN_PASSWORD=adminpass \
  -p 5433:5432 \
  -v $QUAY/postgres-clairv4:/var/lib/pgsql/data:Z \
  registry.redhat.io/rhel8/postgresql-10:1
```

- Ensure that the Postgres **uuid-ossp** module is installed, as it is required by Clair:

```
$ sudo podman exec -it postgresql-clairv4 /bin/bash -c 'echo "CREATE EXTENSION IF NOT EXISTS \"uuid-ossp\"" | psql -d clair -U postgres'
```

### 3.2.2. Quay configuration for Clair

Stop the Quay container if it is running, and restart it in configuration mode, loading the existing configuration as a volume:

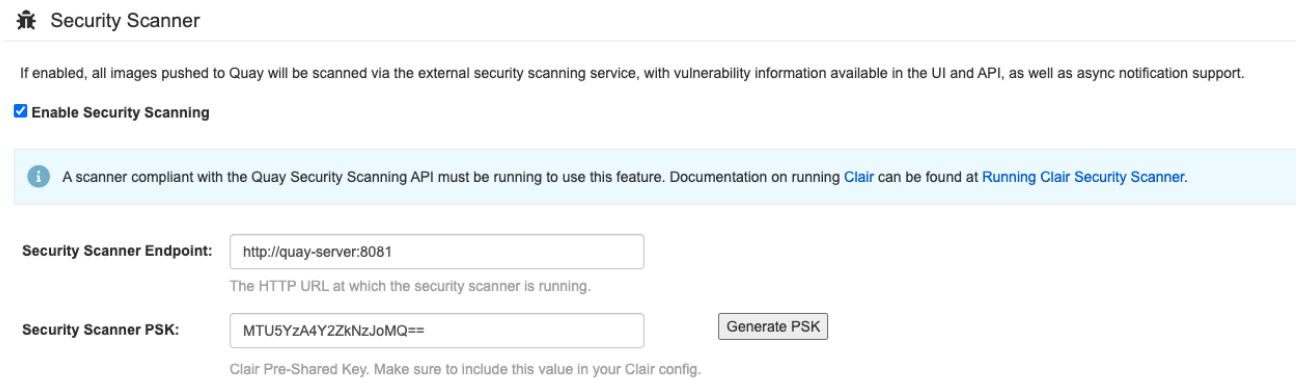
```
$ sudo podman run --rm -it --name quay_config \
  -p 8080:8080 \
  -v $QUAY/config:/conf/stack:Z \
  registry.redhat.io/quay/quay-rhel8:v3.4.7 config secret
```

Log in to the configuration tool and enable scanning, in the Security Scanner section of the UI. Set the HTTP endpoint for Clair, using a port that is not already in use on the **quay-server** system, for example **8081**. Create a Clair pre-shared key (PSK) using the **Generate PSK** button, for example:

- **Security Scanner Endpoint: http://quay-server:8081**
- **Security Scanner PSK: MTU5YzA4Y2ZkNzJoMQ==**

The UI for setting the scanner data is shown in the following image:

#### Security Scanner UI



Validate and download the configuration and then stop the Quay container that is running the configuration editor. Extract the configuration bundle as before into the **$QUAY/config** directory.

```
$ cp ~/Downloads/quay-config.tar.gz $QUAY/config
$ cd $QUAY/config
$ tar xvf quay-config.tar.gz
```

The Quay configuration file has been updated to contain the fields for the security scanner:

**$QUAY/config/config.yaml**

```
...
FEATURE_SECURITY_NOTIFICATIONS: false
FEATURE_SECURITY_SCANNER: true
...
SECURITY_SCANNER_INDEXING_INTERVAL: 30
SECURITY_SCANNER_V4_ENDPOINT: http://quay-server:8081
SECURITY_SCANNER_V4_PSK: MTU5YzA4Y2ZkNzJoMQ==
SERVER_HOSTNAME: quay-server:8080
...
```

### 3.2.3. Clair configuration

Detailed information on Clair configuration is available at https://github.com/quay/clair/blob/main/Documentation/reference/config.md. The following example provides a minimal configuration for use in a proof of concept deployment:

**/etc/clairv4/config/config.yaml**

```
http_listen_addr: :8081
introspection_addr: :8089
log_level: debug
indexer:
  connstring: host=quay-server port=5433 dbname=clair user=clairuser password=clairpass
sslmode=disable
  scanlock_retry: 10
  layer_scan_concurrency: 5
  migrations: true
matcher:
  connstring: host=quay-server port=5433 dbname=clair user=clairuser password=clairpass
sslmode=disable
  max_conn_pool: 100
  run: ""
  migrations: true
  indexer_addr: clair-indexer
notifier:
  connstring: host=quay-server port=5433 dbname=clair user=clairuser password=clairpass
sslmode=disable
  delivery_interval: 1m
  poll_interval: 5m
  migrations: true
auth:
  psk:
    key: "MTU5YzA4Y2ZkNzJoMQ=="
```

```
    iss: ["quay"]
# tracing and metrics
trace:
  name: "jaeger"
  probability: 1
  jaeger:
    agent_endpoint: "localhost:6831"
    service_name: "clair"
metrics:
  name: "prometheus"
```

- **http_listen_addr** is set to the port of the Clair HTTP endpoint that you specified in the Quay configuration tool, in this case **:8081**.
- The Clair pre-shared key (PSK) that you generated in the Quay configuration tool is used for authentication, with the issuer, specified in the **iss** field, set to **quay**.

### 3.2.4. Running Clair

Use the **podman run** command to run the Clair container, exposing the HTTP endpoint port that you specified in the configuration tool, in this case **8081**:

```
sudo podman run -d --rm --name clairv4 \
  -p 8081:8081 -p 8089:8089 \
  -e CLAIR_CONF=/clair/config.yaml -e CLAIR_MODE=combo \
  -v /etc/clairv4/config:/clair:Z \
  registry.redhat.io/quay/clair-rhel8:v3.4.7
```

Now restart the Quay container, using the updated configuration file containing the scanner settings:

```
$ sudo podman run -d --rm -p 8080:8080  \
   --name=quay \
   -v $QUAY/config:/conf/stack:Z \
   -v $QUAY/storage:/datastorage:Z \
   registry.redhat.io/quay/quay-rhel8:v3.4.7
```

### 3.2.5. Using Clair security scanning

From the command line, log in to the registry:

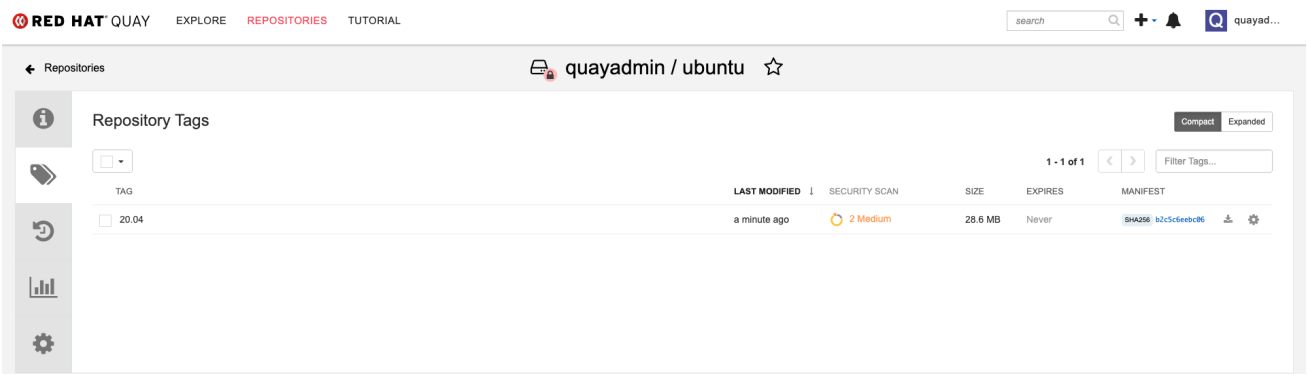
```
$ sudo podman login --tls-verify=false quay-server:8080
Username: quayadmin
Password:
Login Succeeded!
```

Pull, tag and push a sample image to the registry:

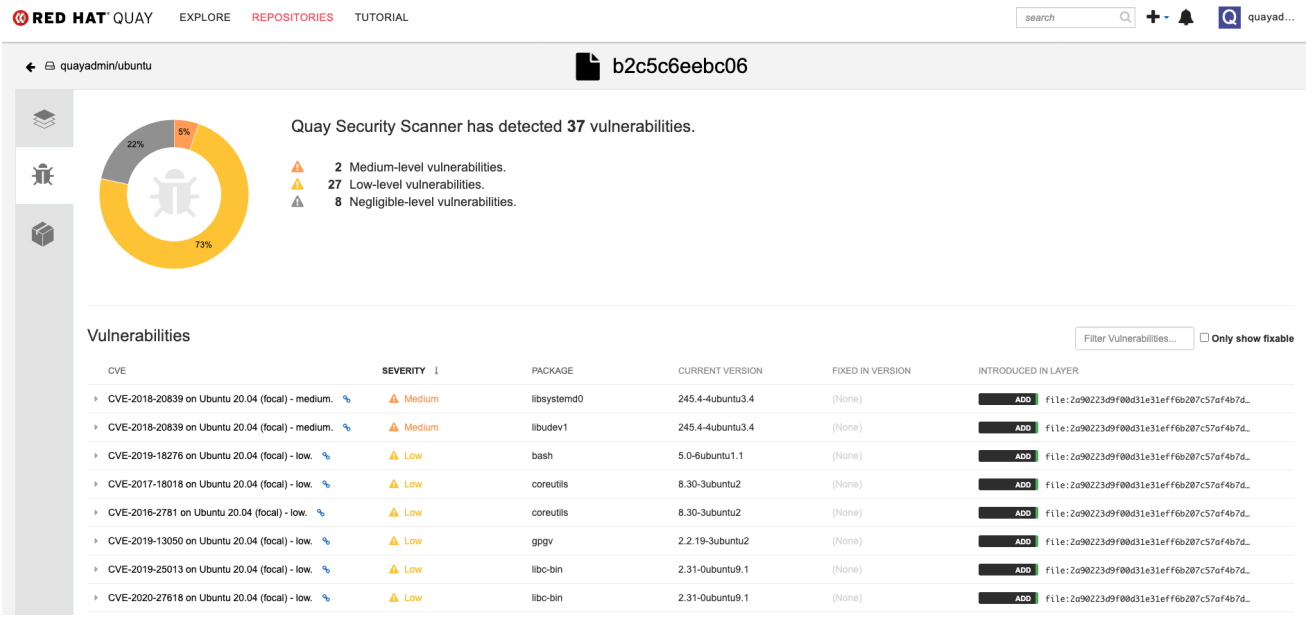
```
$ sudo podman pull ubuntu:20.04
$ sudo podman tag docker.io/library/ubuntu:20.04 quay-server:8080/quayadmin/ubuntu:20.04
$ sudo podman push --tls-verify=false quay-server:8080/quayadmin/ubuntu:20.04
```

The results from the security scanning can be seen in the Quay UI, as shown in the following images:

### Scanning summary




### Scanning details




## 3.3. RESTARTING CONTAINERS

Because the **--restart** option is not fully supported by podman, you can configure **podman** as a systemd service, as described in Porting containers to systemd using Podman

### 3.3.1. Using systemd unit files with Podman

By default, Podman generates a unit file for existing containers or pods. You can generate more portable systemd unit files using the **podman generate systemd --new** command. The **--new** flag instructs Podman to generate unit files that create, start and remove containers.

- Create the systemd unit files from a running Red Hat Quay registry as follows:

```
$ sudo podman generate systemd --new --files --name redis
$ sudo podman generate systemd --new --files --name postgresql-quay
$ sudo podman generate systemd --new --files --name quay
$ sudo podman generate systemd --new --files --name postgresql-clairv4
$ sudo podman generate systemd --new --files --name clairv4
```

- Copy the unit files to **/usr/lib/systemd/system** for installing them as a root user:

```
$ sudo cp -Z container-redis.service /usr/lib/systemd/system
$ sudo cp -Z container-postgresql-quay.service /usr/lib/systemd/system
$ sudo cp -Z container-quay.service /usr/lib/systemd/system
$ sudo cp -Z container-postgresql-clairv4.service /usr/lib/systemd/system
$ sudo cp -Z container-clairv4.service /usr/lib/systemd/system
```

- Reload systemd manager configuration:

```
$ sudo systemctl daemon-reload
```

- Enable the services and start them at boot time:

```
$ sudo systemctl enable --now container-redis.service
$ sudo systemctl enable --now container-postgresql-quay.service
$ sudo systemctl enable --now container-quay.service
$ sudo systemctl enable --now container-postgresql-clairv4.service
$ sudo systemctl enable --now container-clairv4.service
```

### 3.3.2. Starting, stopping and checking the status of services

- Check the status of the Quay components:

```
$ sudo systemctl status container-redis.service
$ sudo systemctl status container-postgresql-quay.service
$ sudo systemctl status container-quay.service
$ sudo systemctl status container-postgresql-clairv4.service
$ sudo systemctl status container-clairv4.service
```

- To stop the Quay component services:

```
$ sudo systemctl stop container-redis.service
$ sudo systemctl stop container-postgresql-quay.service
$ sudo systemctl stop container-quay.service
$ sudo systemctl stop container-postgresql-clairv4.service
$ sudo systemctl stop container-clairv4.service
```

- To start the Quay component services:

```
$ sudo systemctl start container-redis.service
$ sudo systemctl start container-postgresql-quay.service
$ sudo systemctl start container-quay.service
$ sudo systemctl start container-postgresql-clairv4.service
$ sudo systemctl start container-clairv4.service
```

### 3.3.3. Testing restart after reboot

Once you have the services configured and enabled, reboot the system. When the system has re-started, use **podman ps** to check that all the containers for the Quay components have been restarted:

```
$ sudo podman ps -a
CONTAINER ID  IMAGE                                COMMAND       CREATED       STATUS
PORTS                NAMES
```

```
4e87c7889246  registry.redhat.io/rhel8/postgresql-10:1    run-postgresql  19 seconds ago  Up 18
seconds ago  0.0.0.0:5432->5432/tcp  postgresql-quay
b8fbac1920d4  registry.redhat.io/rhel8/redis-5:1          run-redis       19 seconds ago  Up 18 seconds
ago  0.0.0.0:6379->6379/tcp  redis
d959d5bf7a24  registry.redhat.io/rhel8/postgresql-10:1    run-postgresql  18 seconds ago  Up 18
seconds ago  0.0.0.0:5433->5432/tcp  postgresql-clairv4
e75ff8651dbd  registry.redhat.io/quay/clair-rhel8:v3.4.0                  18 seconds ago  Up 17 seconds
ago  0.0.0.0:8081->8080/tcp  clairv4
```

In this instance, the Quay container itself has failed to start up. This is due to the fact that, when security scanning is enabled in Quay, it tries to connect to Clair on startup. However, Clair has not finished initializing and cannot accept connections and, as a result, Quay terminates immediately. To overcome this issue, you need to configure the Quay service to have a dependency on the Clair service, as shown in the following section.

### 3.3.4. Configuring Quay's dependency on Clair

In the **systemd** service file for Quay, set up a dependency on the Clair service in the **[Unit]** section by setting **After=container-clairv4.service**. To give the Clair container time to initialize, add a delay in the **[Service]** section, for example **RestartSec=30**. Here is an example of the modified Quay file, after configuring the dependency on Clair:

#### /usr/lib/systemd/system/container-quay.service

```
# container-quay.service
# autogenerated by Podman 2.0.5
# Tue Feb 16 17:02:26 GMT 2021

[Unit]
Description=Podman container-quay.service
Documentation=man:podman-generate-systemd(1)
Wants=network.target
After=container-clairv4.service

[Service]
Environment=PODMAN_SYSTEMD_UNIT=%n
Restart=on-failure
RestartSec=30
ExecStartPre=/bin/rm -f %t/container-quay.pid %t/container-quay.ctr-id
ExecStart=/usr/bin/podman run --conmon-pidfile %t/container-quay.pid --cidfile %t/container-
quay.ctr-id --cgroups=no-conmon -d --rm -p 8080:8080 --name=quay -v
/home/user1/quay/config:/conf/stack:Z -v /home/user1/quay/storage:/datastorage:Z
registry.redhat.io/quay/quay-rhel8:v3.4.0
ExecStop=/usr/bin/podman stop --ignore --cidfile %t/container-quay.ctr-id -t 10
ExecStopPost=/usr/bin/podman rm --ignore -f --cidfile %t/container-quay.ctr-id
PIDFile=%t/container-quay.pid
KillMode=none
Type=forking

[Install]
WantedBy=multi-user.target default.target
```

Once you have updated the Quay service configuration, reboot the server and immediately run **podman ps**:

```
$ sudo podman ps -a
CONTAINER ID  IMAGE                                COMMAND         CREATED         STATUS
PORTS                 NAMES
4e87c7889246  registry.redhat.io/rhel8/postgresql-10:1    run-postgresql  29 seconds ago  Up 28
seconds ago  0.0.0.0:5432->5432/tcp  postgresql-quay
b8fbac1920d4  registry.redhat.io/rhel8/redis-5:1          run-redis       29 seconds ago  Up 28 seconds
ago  0.0.0.0:6379->6379/tcp  redis
d959d5bf7a24  registry.redhat.io/rhel8/postgresql-10:1    run-postgresql  28 seconds ago  Up 28
seconds ago  0.0.0.0:5433->5432/tcp  postgresql-clairv4
e75ff8651dbd  registry.redhat.io/quay/clair-rhel8:v3.4.0                   28 seconds ago  Up 27 seconds
ago  0.0.0.0:8081->8080/tcp  clairv4
```

Initially, the Quay container will not be available, but once the **RestartSec** delay has expired, it should start up:

```
$ sudo podman ps -a
CONTAINER ID  IMAGE                                COMMAND         CREATED         STATUS
PORTS                 NAMES
4e87c7889246  registry.redhat.io/rhel8/postgresql-10:1    run-postgresql  35 seconds ago  Up 34
seconds ago  0.0.0.0:5432->5432/tcp  postgresql-quay
ab9f0e6ad7c3  registry.redhat.io/quay/quay-rhel8:v3.4.0   registry        3 seconds ago   Up 2 seconds
ago   0.0.0.0:8080->8080/tcp  quay
b8fbac1920d4  registry.redhat.io/rhel8/redis-5:1          run-redis       35 seconds ago  Up 34 seconds
ago  0.0.0.0:6379->6379/tcp  redis
d959d5bf7a24  registry.redhat.io/rhel8/postgresql-10:1    run-postgresql  34 seconds ago  Up 34
seconds ago  0.0.0.0:5433->5432/tcp  postgresql-clairv4
e75ff8651dbd  registry.redhat.io/quay/clair-rhel8:v3.4.0                   34 seconds ago  Up 33 seconds
ago  0.0.0.0:8081->8080/tcp  clairv4
```

The **CREATED** field for the quay container shows the 30 second difference in creation time, as configured in the service definition.

Log in to the Red Hat Quay registry at **quay-server:8080** to check that everything has restarted correctly.

# CHAPTER 4. NEXT STEPS

This document shows how to configure and deploy a proof-of-concept version of Red Hat Quay. For more information on deploying to a production environment, see the guide "Deploy Red Hat Quay - High Availability".

The "Use Red Hat Quay" guide shows you how to:

- Add users and repositories
- Use tags
- Automatically build Dockerfiles with build workers
- Set up build triggers
- Add notifications for repository events

The "Manage Red Hat Quay" guide shows you how to:

- Use SSL and TLS
- Enable security scanning with Clair
- Use repository mirroring
- Configure LDAP authentication
- Use georeplication of storage