# Red Hat Quay 3.11

## Vulnerability reporting with Clair on Red Hat Quay

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## Legal Notice



## Abstract

Getting started with Clair

# Table of Contents

# PREFACE

The contents within this guide provide an overview of Clair for Red Hat Quay, running Clair on standalone Red Hat Quay and Operator deployments, and advanced Clair configuration.

# PART I. VULNERABILITY REPORTING WITH CLAIR ON RED HAT QUAY OVERVIEW

The content in this guide explains the key purposes and concepts of Clair on Red Hat Quay. It also contains information about Clair releases and the location of official Clair containers.

# CHAPTER 1. CLAIR SECURITY SCANNER

Clair v4 (Clair) is an open source application that leverages static code analyses for parsing image content and reporting vulnerabilities affecting the content. Clair is packaged with Red Hat Quay and can be used in both standalone and Operator deployments. It can be run in highly scalable configurations, where components can be scaled separately as appropriate for enterprise environments.

## 1.1. ABOUT CLAIR

Clair uses Common Vulnerability Scoring System (CVSS) data from the National Vulnerability Database (NVD) to enrich vulnerability data, which is a United States government repository of security-related information, including known vulnerabilities and security issues in various software components and systems. Using scores from the NVD provides Clair the following benefits:

- **Data synchronization**. Clair can periodically synchronize its vulnerability database with the NVD. This ensures that it has the latest vulnerability data.
- **Matching and enrichment** Clair compares the metadata and identifiers of vulnerabilities it discovers in container images with the data from the NVD. This process involves matching the unique identifiers, such as Common Vulnerabilities and Exposures (CVE) IDs, to the entries in the NVD. When a match is found, Clair can enrich its vulnerability information with additional details from NVD, such as severity scores, descriptions, and references.
- **Severity Scores**. The NVD assigns severity scores to vulnerabilities, such as the Common Vulnerability Scoring System (CVSS) score, to indicate the potential impact and risk associated with each vulnerability. By incorporating NVD's severity scores, Clair can provide more context on the seriousness of the vulnerabilities it detects.

If Clair finds vulnerabilities from NVD, a detailed and standardized assessment of the severity and potential impact of vulnerabilities detected within container images is reported to users on the UI. CVSS enrichment data provides Clair the following benefits:

- **Vulnerability prioritization**. By utilizing CVSS scores, users can prioritize vulnerabilities based on their severity, helping them address the most critical issues first.
- **Assess Risk**. CVSS scores can help Clair users understand the potential risk a vulnerability poses to their containerized applications.
- **Communicate Severity**. CVSS scores provide Clair users a standardized way to communicate the severity of vulnerabilities across teams and organizations.
- **Inform Remediation Strategies**. CVSS enrichment data can guide Quay.io users in developing appropriate remediation strategies.
- **Compliance and Reporting**. Integrating CVSS data into reports generated by Clair can help organizations demonstrate their commitment to addressing security vulnerabilities and complying with industry standards and regulations.

### 1.1.1. Clair releases

New versions of Clair are regularly released. The source code needed to build Clair is packaged as an archive and attached to each release. Clair releases can be found at Clair releases.

Release artifacts also include the **clairctl** command line interface tool, which obtains updater data from the internet by using an open host.

**Clair 4.7.1**
Clair 4.7.1 was released as part of Red Hat Quay 3.9.1. The following changes have been made:

- With this release, you can view unpatched vulnerabilities from Red Hat Enterprise Linux (RHEL) sources. If you want to view unpatched vulnerabilities, you can the set **ignore_unpatched** parameter to **false**. For example:

```
updaters:
  config:
    rhel:
      ignore_unpatched: false
```

  To disable this feature, you can set **ignore_unpatched** to **true**.

**Clair 4.7**
Clair 4.7 was released as part of Red Hat Quay 3.9, and includes support for the following features:

- Native support for indexing Golang modules and RubeGems in container images.
- Change to OSV.dev as the vulnerability database source for any programming language package managers.
  - This includes popular sources like GitHub Security Advisories or PyPA.
  - This allows offline capability.
- Use of pyup.io for Python and CRDA for Java is suspended.
- Clair now supports Java, Golang, Python, and Ruby dependencies.

### 1.1.2. Clair vulnerability databases

Clair uses the following vulnerability databases to report for issues in your images:

- Ubuntu Oval database
- Debian Security Tracker
- Red Hat Enterprise Linux (RHEL) Oval database
- SUSE Oval database
- Oracle Oval database
- Alpine SecDB database
- VMware Photon OS database
- Amazon Web Services (AWS) UpdateInfo
- Open Source Vulnerability (OSV) Database

### 1.1.3. Clair supported dependencies

Clair supports identifying and managing the following dependencies:

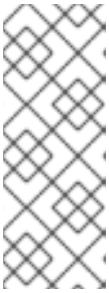
- Java

- Golang
- Python
- Ruby

This means that it can analyze and report on the third-party libraries and packages that a project in these languages relies on to work correctly.

When an image that contains packages from a language unsupported by Clair is pushed to your repository, a vulnerability scan cannot be performed on those packages. Users do not receive an analysis or security report for unsupported dependencies or packages. As a result, the following consequences should be considered:

- **Security risks**. Dependencies or packages that are not scanned for vulnerability might pose security risks to your organization.
- **Compliance issues**. If your organization has specific security or compliance requirements, unscanned, or partially scanned, container images might result in non-compliance with certain regulations.



NOTE

Scanned images are indexed, and a vulnerability report is created, but it might omit data from certain unsupported languages. For example, if your container image contains a Lua application, feedback from Clair is not provided because Clair does not detect it. It can detect other languages used in the container image, and shows detected CVEs for those languages. As a result, Clair images are *fully scanned* based on what it supported by Clair.

### 1.1.4. Clair containers

Official downstream Clair containers bundled with Red Hat Quay can be found on the Red Hat Ecosystem Catalog.

Official upstream containers are packaged and released as a container at Quay.io/projectquay/clair. The latest tag tracks the Git development branch. Version tags are built from the corresponding release.

## 1.2. CLAIR SEVERITY MAPPING

Clair offers a comprehensive approach to vulnerability assessment and management. One of its essential features is the normalization of security databases' severity strings. This process streamlines the assessment of vulnerability severities by mapping them to a predefined set of values. Through this mapping, clients can efficiently react to vulnerability severities without the need to decipher the intricacies of each security database's unique severity strings. These mapped severity strings align with those found within the respective security databases, ensuring consistency and accuracy in vulnerability assessment.

### 1.2.1. Clair severity strings

Clair alerts users with the following severity strings:

- Unknown
- Negligible

- Low
- Medium
- High
- Critical

These severity strings are similar to the strings found within the relevant security database.

**Alpine mapping**
Alpine SecDB database does not provide severity information. All vulnerability severities will be Unknown.

| Alpine Severity | Clair Severity |
|---|---|
| * | Unknown |

**AWS mapping**
AWS UpdateInfo database provides severity information.

| AWS Severity | Clair Severity |
|---|---|
| low | Low |
| medium | Medium |
| important | High |
| critical | Critical |

**Debian mapping**
Debian Oval database provides severity information.

| Debian Severity | Clair Severity |
|---|---|
| * | Unknown |
| Unimportant | Low |
| Low | Medium |
| Medium | High |
| High | Critical |

**Oracle mapping**
Oracle Oval database provides severity information.

| Oracle Severity | Clair Severity |
|---|---|
| N/A | Unknown |
| LOW | Low |
| MODERATE | Medium |
| IMPORTANT | High |
| CRITICAL | Critical |

**RHEL mapping**
RHEL Oval database provides severity information.

| RHEL Severity | Clair Severity |
|---|---|
| None | Unknown |
| Low | Low |
| Moderate | Medium |
| Important | High |
| Critical | Critical |

**SUSE mapping**
SUSE Oval database provides severity information.

| Severity | Clair Severity |
|---|---|
| None | Unknown |
| Low | Low |
| Moderate | Medium |
| Important | High |
| Critical | Critical |

**Ubuntu mapping**
Ubuntu Oval database provides severity information.

| Severity | Clair Severity |
|---|---|
| Untriaged | Unknown |
| Negligible | Negligible |
| Low | Low |
| Medium | Medium |
| High | High |
| Critical | Critical |

### OSV mapping

**Table 1.1. CVSSv3**

| Base Score | Clair Severity |
|---|---|
| 0.0 | Negligible |
| 0.1-3.9 | Low |
| 4.0-6.9 | Medium |
| 7.0-8.9 | High |
| 9.0-10.0 | Critical |

**Table 1.2. CVSSv2**

| Base Score | Clair Severity |
|---|---|
| 0.0-3.9 | Low |
| 4.0-6.9 | Medium |
| 7.0-10 | High |

# CHAPTER 2. CLAIR CONCEPTS

The following sections provide a conceptual overview of how Clair works.

## 2.1. CLAIR IN PRACTICE

A Clair analysis is broken down into three distinct parts: indexing, matching, and notification.

### 2.1.1. Indexing

Clair's indexer service plays a crucial role in understanding the makeup of a container image. In Clair, container image representations called "manifests." Manifests are used to comprehend the contents of the image's layers. To streamline this process, Clair takes advantage of the fact that Open Container Initiative (OCI) manifests and layers are designed for content addressing, reducing repetitive tasks.

During indexing, a manifest that represents a container image is taken and broken down into its essential components. The indexer's job is to uncover the image's contained packages, its origin distribution, and the package repositories it relies on. This valuable information is then recorded and stored within Clair's database. The insights gathered during indexing serve as the basis for generating a comprehensive vulnerability report. This report can be seamlessly transferred to a matcher node for further analysis and action, helping users make informed decisions about their container images' security.

The **IndexReport** is stored in Clair's database. It can be fed to a **matcher** node to compute the vulnerability report.

### 2.1.2. Matching

With Clair, a matcher node is responsible for matching vulnerabilities to a provided index report.

Matchers are responsible for keeping the database of vulnerabilities up to date. Matchers run a set of updaters, which periodically probe their data sources for new content. New vulnerabilities are stored in the database when they are discovered.

The matcher API is designed to always provide the most recent vulnerability report when queried. The vulnerability report summarizes both a manifest's content and any vulnerabilities affecting the content.

New vulnerabilities are stored in the database when they are discovered.

The matcher API is designed to be used often. It is designed to always provide the most recent **VulnerabilityReport** when queried. The **VulnerabilityReport** summarizes both a manifest's content and any vulnerabilities affecting the content.

### 2.1.3. Notifier service

Clair uses a notifier service that keeps track of new security database updates and informs users if new or removed vulnerabilities affect an indexed manifest.

When the notifier becomes aware of new vulnerabilities affecting a previously indexed manifest, it uses the configured methods in your **config.yaml** file to issue notifications about the new changes. Returned notifications express the most severe vulnerability discovered because of the change. This avoids creating excessive notifications for the same security database update.

When a user receives a notification, it issues a new request against the matcher to receive an up to date vulnerability report.

You can subscribe to notifications through the following mechanics:

- Webhook delivery
- AMQP delivery
- STOMP delivery

Configuring the notifier is done through the Clair YAML configuration file.

## 2.2. CLAIR AUTHENTICATION

In its current iteration, Clair v4 (Clair) handles authentication internally.

NOTE

Previous versions of Clair used JWT Proxy to gate authentication.

Authentication is configured by specifying configuration objects underneath the **auth** key of the configuration. Multiple authentication configurations might be present, but they are used preferentially in the following order:

1. PSK. With this authentication configuration, Clair implements JWT-based authentication using a pre-shared key.
2. Configuration. For example:

```
auth:
  psk:
    key: >-
      MDQ4ODBlNDAtNDc0ZC00MWUxLThhMzAtOTk0MzEwMGQwYTMxCg==
    iss: 'issuer'
```

In this configuration the **auth** field requires two parameters: **iss**, which is the issuer to validate all incoming requests, and **key**, which is a base64 coded symmetric key for validating the requests.

## 2.3. CLAIR UPDATERS

Clair uses **Go** packages called *updaters* that contain the logic of fetching and parsing different vulnerability databases.

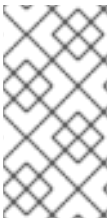
Updaters are usually paired with a matcher to interpret if, and how, any vulnerability is related to a package. Administrators might want to update the vulnerability database less frequently, or not import vulnerabilities from databases that they know will not be used.

## 2.4. INFORMATION ABOUT CLAIR UPDATERS

The following table provides details about each Clair updater, including the configuration parameter, a brief description, relevant URLs, and the associated components that they interact with. This list is not exhaustive, and some servers might issue redirects, while certain request URLs are dynamically constructed to ensure accurate vulnerability data retrieval.

For Clair, each updater is responsible for fetching and parsing vulnerability data related to a specific package type or distribution. For example, the Debian updater focuses on Debian-based Linux

distributions, while the AWS updater focuses on vulnerabilities specific to Amazon Web Services' Linux distributions. Understanding the package type is important for vulnerability management because different package types might have unique security concerns and require specific updates and patches.



NOTE

If you are using a proxy server in your environment with Clair's updater URLs, you must identify which URL needs to be added to the proxy allowlist to ensure that Clair can access them unimpeded. Use the following table to add updater URLs to your proxy allowlist.

Table 2.1. Clair updater information

| Updater | Description | URLs | Component |
|---|---|---|---|
| **alpine** | The Alpine updater is responsible for fetching and parsing vulnerability data related to packages in Alpine Linux distributions. | • **https://secdb.alpinelinux.org/** | Alpine Linux SecDB database |
| **aws** | The AWS updater is focused on AWS Linux-based packages, ensuring that vulnerability information specific to Amazon Web Services' custom Linux distributions is kept up-to-date. | • **http://repo.us-west-2.amazonaws.com/2018.03/updates/x86_64/mirror.list**<br>• **https://cdn.amazonlinux.com/2/core/latest/x86_64/mirror.list**<br>• **https://cdn.amazonlinux.com/al2023/core/mirrors/latest/x86_64/mirror.list** | Amazon Web Services (AWS) UpdateInfo |
| **debian** | The Debian updater is essential for tracking vulnerabilities in packages associated with Debian-based Linux distributions. | • **https://deb.debian.org/**<br>• **https://security-tracker.debian.org/tracker/data/json** | Debian Security Tracker |
| **clair.cvss** | The Clair Common Vulnerability Scoring System (CVSS) updater focuses on maintaining data about vulnerabilities and their associated CVSS scores. This is not tied to a specific package type but rather to the severity and risk assessment of vulnerabilities in general. | • **https://nvd.nist.gov/feeds/json/cve/1.1/** | National Vulnerability Database (NVD) feed for Common Vulnerabilities and Exposures (CVE) data in JSON format |

| Updater | Description | URLs | Component |
|---|---|---|---|
| **oracle** | The Oracle updater is dedicated to Oracle Linux packages, maintaining data on vulnerabilities that affect Oracle Linux systems. | • **https://linux.oracle.com/security/oval/com.oracle.elsa-*.xml.bz2** | Oracle Oval database |
| **photon** | The Photon updater deals with packages in VMware Photon OS. | • **https://packages.vmware.com/photon/photon_oval_definitions/** | VMware Photon OS oval definitions |
| **rhel** | The Red Hat Enterprise Linux (RHEL) updater is responsible for maintaining vulnerability data for packages in Red Hat's Enterprise Linux distribution. | • **https://access.redhat.com/security/cve/**<br>• **https://access.redhat.com/security/data/oval/v2/PULP_MANIFEST** | Red Hat Enterprise Linux (RHEL) Oval database |
| **rhcc** | The Red Hat Container Catalog (RHCC) updater is connected to Red Hat's container images. This updater ensures that vulnerability information related to Red Hat's containerized software is kept current. | • **https://access.redhat.com/security/data/metrics/cvemap.xml** | Resource Handler Configuration Controller (RHCC) database |
| **suse** | The SUSE updater manages vulnerability information for packages in the SUSE Linux distribution family, including openSUSE, SUSE Enterprise Linux, and others. | • **https://support.novell.com/security/oval/** | SUSE Oval database |
| **ubuntu** | The Ubuntu updater is dedicated to tracking vulnerabilities in packages associated with Ubuntu-based Linux distributions. Ubuntu is a popular distribution in the Linux ecosystem. | • **https://security-metadata.canonical.com/oval/com.ubuntu.*.cve.oval.xml**<br>• **https://api.launchpad.net/1.0/** | Ubuntu Oval Database |

| Updater | Description | URLs | Component |
|---|---|---|---|
| **osv** | The Open Source Vulnerability (OSV) updater specializes in tracking vulnerabilities within open source software components. OSV is a critical resource that provides detailed information about security issues found in various open source projects. | • **https://osv-vulnerabilities.storage.googleapis.com/** | Open Source Vulnerabilities database |

## 2.5. CONFIGURING UPDATERS

Updaters can be configured by the **updaters.sets** key in your **clair-config.yaml** file.

IMPORTANT

- If the **sets** field is not populated, it defaults to using all sets. In using all sets, Clair tries to reach the URL or URLs of each updater. If you are using a proxy environment, you must add these URLs to your proxy allowlist.
- If updaters are being run automatically within the matcher process, which is the default setting, the period for running updaters is configured under the matcher's configuration field.

### 2.5.1. Selecting specific updater sets

Use the following references to select one, or multiple, updaters for your Red Hat Quay deployment.

**Configuring Clair for multiple updaters**

**Multiple specific updaters**

```
#...
updaters:
  sets:
    - alpine
    - aws
    - osv
#...
```

**Configuring Clair for Alpine**

**Alpine config.yaml example**

```
#...
updaters:
  sets:
    - alpine
#...
```

**Configuring Clair for AWS**

#### AWS config.yaml example

```
#...
updaters:
  sets:
    - aws
#...
```

#### Configuring Clair for Debian

#### Debian config.yaml example

```
#...
updaters:
  sets:
    - debian
#...
```

#### Configuring Clair for Clair CVSS

#### Clair CVSS config.yaml example

```
#...
updaters:
  sets:
    - clair.cvss
#...
```

#### Configuring Clair for Oracle

#### Oracle config.yaml example

```
#...
updaters:
  sets:
    - oracle
#...
```

#### Configuring Clair for Photon

#### Photon config.yaml example

```
#...
updaters:
  sets:
    - photon
#...
```

#### Configuring Clair for SUSE

#### SUSE config.yaml example

```
#...
```

```
updaters:
  sets:
    - suse
#...
```

**Configuring Clair for Ubuntu**

**Ubuntu config.yaml example**

```
#...
updaters:
  sets:
    - ubuntu
#...
```

**Configuring Clair for OSV**

**OSV config.yaml example**

```
#...
updaters:
  sets:
    - osv
#...
```

### 2.5.2. Selecting updater sets for full Red Hat Enterprise Linux (RHEL) coverage

For full coverage of vulnerabilities in Red Hat Enterprise Linux (RHEL), you must use the following updater sets:

- **rhel**. This updater ensures that you have the latest information on the vulnerabilities that affect RHEL.
- **rhcc**. This updater keeps track of vulnerabilities related to Red hat's container images.
- **clair.cvss**. This updater offers a comprehensive view of the severity and risk assessment of vulnerabilities by providing Common Vulnerabilities and Exposures (CVE) scores.
- **osv**. This updater focuses on tracking vulnerabilities in open-source software components. This updater is recommended due to how common the use of Java and Go are in RHEL products.

**RHEL updaters example**

```
#...
updaters:
  sets:
    - rhel
    - rhcc
    - clair.cvss
    - osv
#...
```

### 2.5.3. Advanced updater configuration

In some cases, users might want to configure updaters for specific behavior, for example, if you want to allowlist specific ecosystems for the Open Source Vulnerabilities (OSV) updaters.

Advanced updater configuration might be useful for proxy deployments or air gapped deployments. Configuration for specific updaters in these scenarios can be passed by putting a key underneath the **config** environment variable of the **updaters** object. Users should examine their Clair logs to double-check names.

The following YAML snippets detail the various settings available to some Clair updater

IMPORTANT

For more users, advanced updater configuration is unnecessary.

**Configuring the alpine updater**

```
#...
updaters:
  sets:
    - apline
  config:
    alpine:
      url: https://secdb.alpinelinux.org/
#...
```

**Configuring the debian updater**

```
#...
updaters:
  sets:
    - debian
  config:
    debian:
      mirror_url: https://deb.debian.org/
      json_url: https://security-tracker.debian.org/tracker/data/json
#...
```

**Configuring the clair.cvss updater**

```
#...
updaters:
  config:
    clair.cvss:
      url: https://nvd.nist.gov/feeds/json/cve/1.1/
#...
```

**Configuring the oracle updater**

```
#...
updaters:
  sets:
    - oracle
  config:
    oracle-2023-updater:
```

```
      url:
        - https://linux.oracle.com/security/oval/com.oracle.elsa-2023.xml.bz2
    oracle-2022-updater:
      url:
        - https://linux.oracle.com/security/oval/com.oracle.elsa-2022.xml.bz2
#...
```

**Configuring the photon updater**

```
#...
updaters:
  sets:
    - photon
  config:
    photon:
      url: https://packages.vmware.com/photon/photon_oval_definitions/
#...
```

**Configuring the rhel updater**

```
#...
updaters:
  sets:
    - rhel
  config:
    rhel:
      url: https://access.redhat.com/security/data/oval/v2/PULP_MANIFEST
      ignore_unpatched: true (1)
#...
```

(1) Boolean. Whether to include information about vulnerabilities that do not have corresponding patches or updates available.

**Configuring the rhcc updater**

```
#...
updaters:
  sets:
    - rhcc
  config:
    rhcc:
      url: https://access.redhat.com/security/data/metrics/cvemap.xml
#...
```

**Configuring the suse updater**

```
#...
updaters:
  sets:
    - suse
  config:
    suse:
      url: https://support.novell.com/security/oval/
#...
```

**Configuring the ubuntu updater**

```
#...
updaters:
  config:
    ubuntu:
      url: https://api.launchpad.net/1.0/
      name: ubuntu
      force: (1)
        - name: focal (2)
          version: 20.04 (3)
#...
```

(1) Used to force the inclusion of specific distribution and version details in the resulting UpdaterSet, regardless of their status in the API response. Useful when you want to ensure that particular distributions and versions are consistently included in your updater configuration.

(2) Specifies the distribution name that you want to force to be included in the UpdaterSet.

(3) Specifies the version of the distribution you want to force into the UpdaterSet.

**Configuring the osv updater**

```
#...
updaters:
  sets:
    - osv
  config:
    osv:
      url: https://osv-vulnerabilities.storage.googleapis.com/
      allowlist: (1)
        - npm
        - pypi
#...
```

(1) The list of ecosystems to allow. When left unset, all ecosystems are allowed. Must be lowercase. For a list of supported ecosystems, see the documentation for defined ecosystems.

### 2.5.4. Disabling the Clair Updater component

In some scenarios, users might want to disable the Clair updater component. Disabling updaters is required when running Red Hat Quay in a disconnected environment.

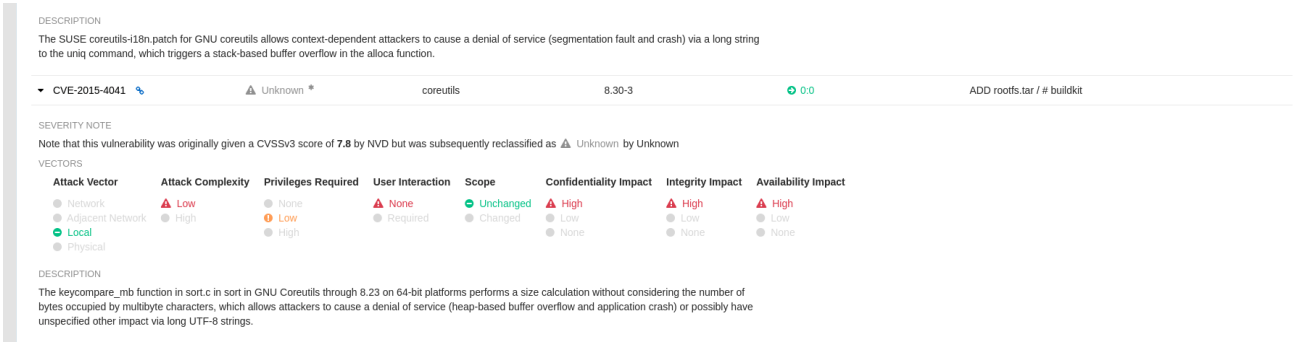
In the following example, Clair updaters are disabled:

```
#...
matcher:
  disable_updaters: true
#...
```

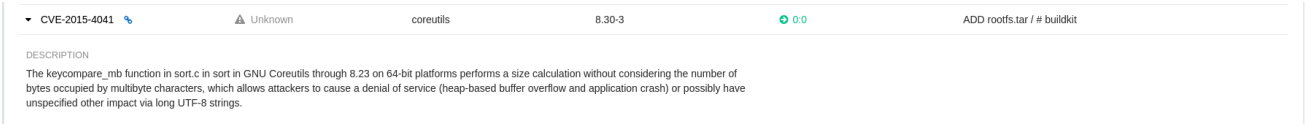
## 2.6. CVE RATINGS FROM THE NATIONAL VULNERABILITY DATABASE

As of Clair v4.2, Common Vulnerability Scoring System (CVSS) enrichment data is now viewable in the Red Hat Quay UI. Additionally, Clair v4.2 adds CVSS scores from the National Vulnerability Database for detected vulnerabilities.

With this change, if the vulnerability has a CVSS score that is within 2 levels of the distribution score, the Red Hat Quay UI present's the distribution's score by default. For example:




This differs from the previous interface, which would only display the following information:




## 2.7. FEDERAL INFORMATION PROCESSING STANDARD (FIPS) READINESS AND COMPLIANCE

The Federal Information Processing Standard (FIPS) developed by the National Institute of Standards and Technology (NIST) is regarded as the highly regarded for securing and encrypting sensitive data, notably in highly regulated areas such as banking, healthcare, and the public sector. Red Hat Enterprise Linux (RHEL) and OpenShift Container Platform support FIPS by providing a *FIPS mode*, in which the system only allows usage of specific FIPS-validated cryptographic modules like **openssl**. This ensures FIPS compliance.

### 2.7.1. Enabling FIPS compliance

Use the following procedure to enable FIPS compliance on your Red Hat Quay deployment.

**Prerequisite**

- If you are running a standalone deployment of Red Hat Quay, your Red Hat Enterprise Linux (RHEL) deployment is version 8 or later and FIPS-enabled.
- If you are deploying Red Hat Quay on OpenShift Container Platform, OpenShift Container Platform is version 4.10 or later.
- Your Red Hat Quay version is 3.5.0 or later.
- If you are using the Red Hat Quay on OpenShift Container Platform on an IBM Power or IBM Z cluster:
  - OpenShift Container Platform version 4.14 or later is required
  - Red Hat Quay version 3.10 or later is required

- You have administrative privileges for your Red Hat Quay deployment.

**Procedure**

- In your Red Hat Quay **config.yaml** file, set the **FEATURE_FIPS** configuration field to **true**. For example:

```
---
FEATURE_FIPS = true
---
```

With **FEATURE_FIPS** set to **true**, Red Hat Quay runs using FIPS-compliant hash functions.

# PART II. CLAIR ON RED HAT QUAY

This guide contains procedures for running Clair on Red Hat Quay in both standalone and OpenShift Container Platform Operator deployments.

# CHAPTER 3. SETTING UP CLAIR ON STANDALONE RED HAT QUAY DEPLOYMENTS

For standalone Red Hat Quay deployments, you can set up Clair manually.

**Procedure**

1. In your Red Hat Quay installation directory, create a new directory for the Clair database data:

```
$ mkdir /home/<user-name>/quay-poc/postgres-clairv4
```

2. Set the appropriate permissions for the **postgres-clairv4** file by entering the following command:

```
$ setfacl -m u:26:-wx /home/<user-name>/quay-poc/postgres-clairv4
```

3. Deploy a Clair Postgres database by entering the following command:

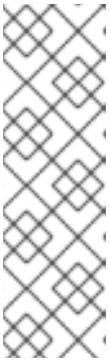
```
$ sudo podman run -d --name postgresql-clairv4 \
  -e POSTGRESQL_USER=clairuser \
  -e POSTGRESQL_PASSWORD=clairpass \
  -e POSTGRESQL_DATABASE=clair \
  -e POSTGRESQL_ADMIN_PASSWORD=adminpass \
  -p 5433:5433 \
  -v /home/<user-name>/quay-poc/postgres-clairv4:/var/lib/pgsql/data:Z \
  registry.redhat.io/rhel8/postgresql-13:1-109
```

4. Install the Postgres **uuid-ossp** module for your Clair deployment:

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

**Example output**

```
CREATE EXTENSION
```



**NOTE**

Clair requires the **uuid-ossp** extension to be added to its Postgres database. For users with proper privileges, creating the extension will automatically be added by Clair. If users do not have the proper privileges, the extension must be added before start Clair.

If the extension is not present, the following error will be displayed when Clair attempts to start: **ERROR: Please load the "uuid-ossp" extension. (SQLSTATE 42501)**.

5. 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 80:8080 -p 443:8443 \
```

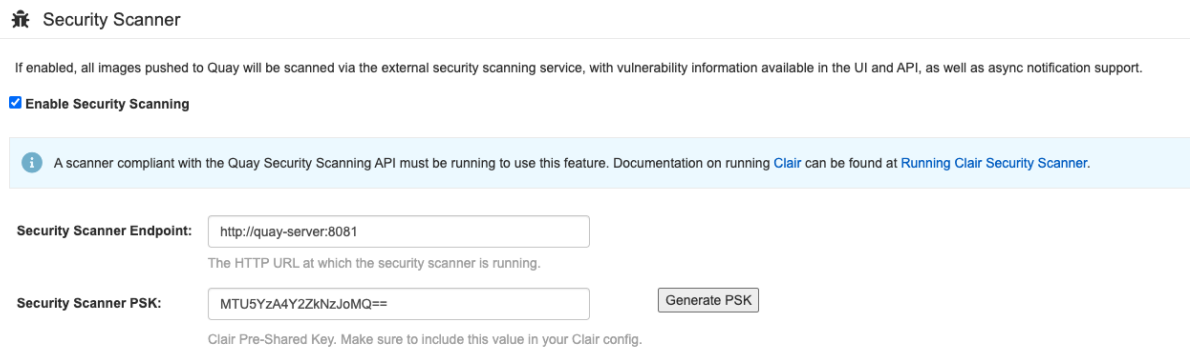
```
-v $QUAY/config:/conf/stack:Z \
{productrepo}/{quayimage}:{productminv} config secret
```

6. Log in to the configuration tool and click **Enable Security Scanning** in the **Security Scanner** section of the UI.

7. Set the HTTP endpoint for Clair using a port that is not already in use on the **quay-server** system, for example, **8081**.

8. Create a pre-shared key (PSK) using the **Generate PSK** button.

**Security Scanner UI**




9. Validate and download the **config.yaml** file for Red Hat Quay, and then stop the **Quay** container that is running the configuration editor.

10. Extract the new configuration bundle into your Red Hat Quay installation directory, for example:

```
$ tar xvf quay-config.tar.gz -d /home/<user-name>/quay-poc/
```

11. Create a folder for your Clair configuration file, for example:

```
$ mkdir /etc/opt/clairv4/config/
```

12. Change into the Clair configuration folder:

```
$ cd /etc/opt/clairv4/config/
```

13. Create a Clair configuration file, for example:

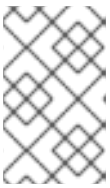
```
http_listen_addr: :8081
introspection_addr: :8088
log_level: debug
indexer:
  connstring: host=quay-server.example.com port=5433 dbname=clair user=clairuser
password=clairpass sslmode=disable
  scanlock_retry: 10
  layer_scan_concurrency: 5
  migrations: true
matcher:
  connstring: host=quay-server.example.com port=5433 dbname=clair user=clairuser
password=clairpass sslmode=disable
  max_conn_pool: 100
  migrations: true
```

```
  indexer_addr: clair-indexer
notifier:
  connstring: host=quay-server.example.com 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"
```

For more information about Clair's configuration format, see Clair configuration reference.

14. Start Clair by using the container image, mounting in the configuration from the file you created:

```
$ sudo podman run -d --name clairv4 \
-p 8081:8081 -p 8088:8088 \
-e CLAIR_CONF=/clair/config.yaml \
-e CLAIR_MODE=combo \
-v /etc/opt/clairv4/config:/clair:Z \
registry.redhat.io/quay/clair-rhel8:v3.11.0
```

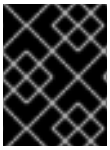


**NOTE**

Running multiple Clair containers is also possible, but for deployment scenarios beyond a single container the use of a container orchestrator like Kubernetes or OpenShift Container Platform is strongly recommended.

## 3.1. USING CLAIR WITH AN UPSTREAM IMAGE FOR RED HAT QUAY

For most users, independent upgrades of Clair from the current version (4.7.2) are unnecessary. In some cases, however, customers might want to pull an image of Clair from the upstream repository for various reasons, such as for specific bug fixes or to try new features that have not yet been released downstream. You can use the following procedure to run an upstream version of Clair with Red Hat Quay.



**IMPORTANT**

Upstream versions of Clair have not been fully tested for compatibility with Red Hat Quay. As a result, this combination might cause issues with your deployment.

**Procedure**

1. Enter the following command to stop Clair if it is running:

```
$ podman stop <clairv4_container_name>
```

2. Navigate to the upstream repository, find the version of Clair that you want to use, and pull it to your local machine. For example:

```
$ podman pull quay.io/projectquay/clair:nightly-2024-02-03
```

3. Start Clair by using the container image, mounting in the configuration from the file you created:

```
$ podman run -d --name clairv4 \
-p 8081:8081 -p 8088:8088 \
-e CLAIR_CONF=/clair/config.yaml \
-e CLAIR_MODE=combo \
-v /etc/opt/clairv4/config:/clair:Z \
quay.io/projectquay/clair:nightly-2024-02-03
```

# CHAPTER 4. CLAIR ON OPENSHIFT CONTAINER PLATFORM

To set up Clair v4 (Clair) on a Red Hat Quay deployment on OpenShift Container Platform, it is recommended to use the Red Hat Quay Operator. By default, the Red Hat Quay Operator installs or upgrades a Clair deployment along with your Red Hat Quay deployment and configure Clair automatically.

# CHAPTER 5. TESTING CLAIR

Use the following procedure to test Clair on either a standalone Red Hat Quay deployment, or on an OpenShift Container Platform Operator-based deployment.

### Prerequisites

- You have deployed the Clair container image.

### Procedure

1. Pull a sample image by entering the following command:

```
$ podman pull ubuntu:20.04
```

2. Tag the image to your registry by entering the following command:

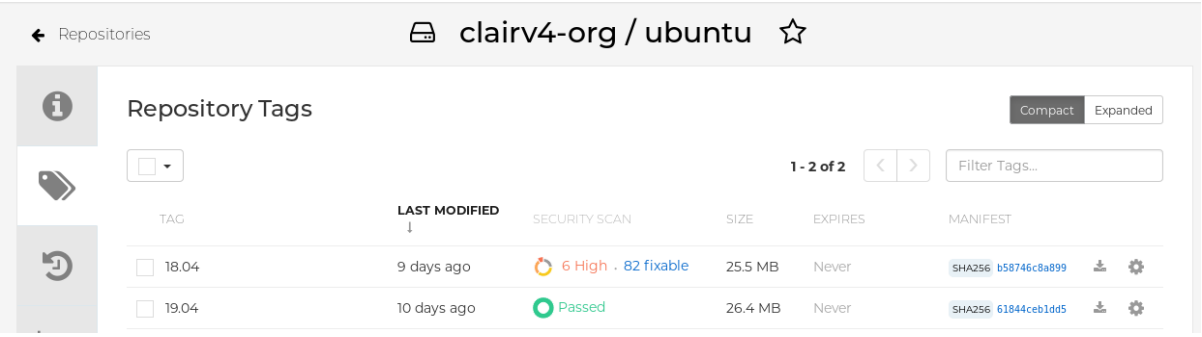
```
$ sudo podman tag docker.io/library/ubuntu:20.04 <quay-server.example.com>/<user-name>/ubuntu:20.04
```

3. Push the image to your Red Hat Quay registry by entering the following command:

```
$ sudo podman push --tls-verify=false quay-server.example.com/quayadmin/ubuntu:20.04
```

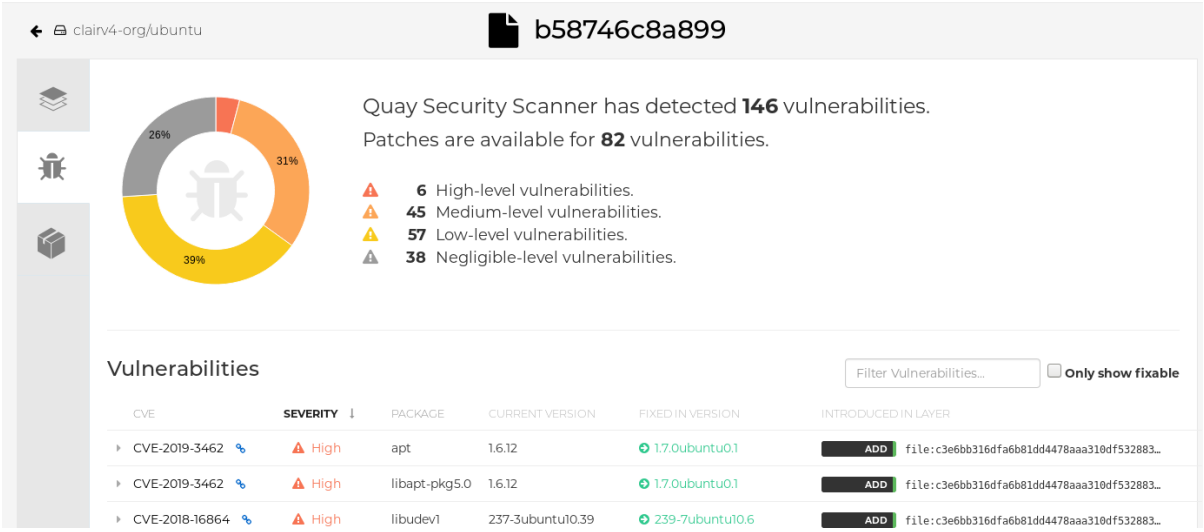
4. Log in to your Red Hat Quay deployment through the UI.
5. Click the repository name, for example, **quayadmin/ubuntu**.
6. In the navigation pane, click **Tags**.

#### Report summary




7. Click the image report, for example, **45 medium**, to show a more detailed report:

#### Report details




## NOTE

In some cases, Clair shows duplicate reports on images, for example, **ubi8/nodejs-12** or **ubi8/nodejs-16**. This occurs because vulnerabilities with same name are for different packages. This behavior is expected with Clair vulnerability reporting and will not be addressed as a bug.

# PART III. ADVANCED CLAIR CONFIGURATION

Use this section to configure advanced Clair features.

# CHAPTER 6. UNMANAGED CLAIR CONFIGURATION

Red Hat Quay users can run an unmanaged Clair configuration with the Red Hat Quay OpenShift Container Platform Operator. This feature allows users to create an unmanaged Clair database, or run their custom Clair configuration without an unmanaged database.

An unmanaged Clair database allows the Red Hat Quay Operator to work in a geo-replicated environment, where multiple instances of the Operator must communicate with the same database. An unmanaged Clair database can also be used when a user requires a highly-available (HA) Clair database that exists outside of a cluster.

## 6.1. RUNNING A CUSTOM CLAIR CONFIGURATION WITH AN UNMANAGED CLAIR DATABASE

Use the following procedure to set your Clair database to unmanaged.

**Procedure**

- In the Quay Operator, set the **clairpostgres** component of the **QuayRegistry** custom resource to **managed: false**:

```
apiVersion: quay.redhat.com/v1
kind: QuayRegistry
metadata:
  name: quay370
spec:
  configBundleSecret: config-bundle-secret
  components:
    - kind: objectstorage
      managed: false
    - kind: route
      managed: true
    - kind: tls
      managed: false
    - kind: clairpostgres
      managed: false
```

## 6.2. CONFIGURING A CUSTOM CLAIR DATABASE WITH AN UNMANAGED CLAIR DATABASE

Red Hat Quay on OpenShift Container Platform allows users to provide their own Clair database.

Use the following procedure to create a custom Clair database.

**NOTE**

The following procedure sets up Clair with SSL/TLS certifications. To view a similar procedure that does not set up Clair with SSL/TSL certifications, see "Configuring a custom Clair database with a managed Clair configuration".

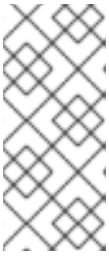
**Procedure**

1. Create a Quay configuration bundle secret that includes the **clair-config.yaml** by entering the following command:

```
$ oc create secret generic --from-file config.yaml=./config.yaml --from-file extra_ca_cert_rds-ca-2019-root.pem=./rds-ca-2019-root.pem --from-file clair-config.yaml=./clair-config.yaml --from-file ssl.cert=./ssl.cert --from-file ssl.key=./ssl.key config-bundle-secret
```

**Example Clair config.yaml file**

```
indexer:
    connstring: host=quay-server.example.com port=5432 dbname=quay user=quayrdsdb password=quayrdsdb sslrootcert=/run/certs/rds-ca-2019-root.pem sslmode=verify-ca
    layer_scan_concurrency: 6
    migrations: true
    scanlock_retry: 11
log_level: debug
matcher:
    connstring: host=quay-server.example.com port=5432 dbname=quay user=quayrdsdb password=quayrdsdb sslrootcert=/run/certs/rds-ca-2019-root.pem sslmode=verify-ca
    migrations: true
metrics:
    name: prometheus
notifier:
    connstring: host=quay-server.example.com port=5432 dbname=quay user=quayrdsdb password=quayrdsdb sslrootcert=/run/certs/rds-ca-2019-root.pem sslmode=verify-ca
    migrations: true
```



NOTE

- The database certificate is mounted under **/run/certs/rds-ca-2019-root.pem** on the Clair application pod in the **clair-config.yaml**. It must be specified when configuring your **clair-config.yaml**.
- An example **clair-config.yaml** can be found at Clair on OpenShift config.

2. Add the **clair-config.yaml** file to your bundle secret, for example:

```
apiVersion: v1
kind: Secret
metadata:
  name: config-bundle-secret
  namespace: quay-enterprise
data:
  config.yaml: <base64 encoded Quay config>
  clair-config.yaml: <base64 encoded Clair config>
  extra_ca_cert_<name>: <base64 encoded ca cert>
  ssl.crt: <base64 encoded SSL certificate>
  ssl.key: <base64 encoded SSL private key>
```

NOTE

When updated, the provided **clair-config.yaml** file is mounted into the Clair pod. Any fields not provided are automatically populated with defaults using the Clair configuration module.

3. You can check the status of your Clair pod by clicking the commit in the **Build History** page, or by running **oc get pods -n <namespace>**. For example:

```
$ oc get pods -n <namespace>
```

**Example output**

```
NAME                                READY   STATUS    RESTARTS   AGE
f192fe4a-c802-4275-bcce-d2031e635126-9l2b5-25lg2   1/1     Running   0          7s
```

# CHAPTER 7. RUNNING A CUSTOM CLAIR CONFIGURATION WITH A MANAGED CLAIR DATABASE

In some cases, users might want to run a custom Clair configuration with a managed Clair database. This is useful in the following scenarios:

- When a user wants to disable specific updater resources.
- When a user is running Red Hat Quay in an disconnected environment. For more information about running Clair in a disconnected environment, see Clair in disconnected environments.

NOTE

- If you are running Red Hat Quay in an disconnected environment, the **airgap** parameter of your **clair-config.yaml** must be set to **true**.
- If you are running Red Hat Quay in an disconnected environment, you should disable all updater components.

## 7.1. SETTING A CLAIR DATABASE TO MANAGED

Use the following procedure to set your Clair database to managed.

**Procedure**

- In the Quay Operator, set the **clairpostgres** component of the **QuayRegistry** custom resource to **managed: true**:

```
apiVersion: quay.redhat.com/v1
kind: QuayRegistry
metadata:
  name: quay370
spec:
  configBundleSecret: config-bundle-secret
  components:
    - kind: objectstorage
      managed: false
    - kind: route
      managed: true
    - kind: tls
      managed: false
    - kind: clairpostgres
      managed: true
```

## 7.2. CONFIGURING A CUSTOM CLAIR DATABASE WITH A MANAGED CLAIR CONFIGURATION

Red Hat Quay on OpenShift Container Platform allows users to provide their own Clair database.

Use the following procedure to create a custom Clair database.

**Procedure**

1. Create a Quay configuration bundle secret that includes the **clair-config.yaml** by entering the following command:

```
$ oc create secret generic --from-file config.yaml=./config.yaml --from-file extra_ca_cert_rds-ca-2019-root.pem=./rds-ca-2019-root.pem --from-file clair-config.yaml=./clair-config.yaml config-bundle-secret
```

**Example Clair config.yaml file**

```
indexer:
    connstring: host=quay-server.example.com port=5432 dbname=quay user=quayrdsdb password=quayrdsdb sslmode=disable
    layer_scan_concurrency: 6
    migrations: true
    scanlock_retry: 11
log_level: debug
matcher:
    connstring: host=quay-server.example.com port=5432 dbname=quay user=quayrdsdb password=quayrdsdb sslmode=disable
    migrations: true
metrics:
    name: prometheus
notifier:
    connstring: host=quay-server.example.com port=5432 dbname=quay user=quayrdsdb password=quayrdsdb sslmode=disable
    migrations: true
```

NOTE

- The database certificate is mounted under **/run/certs/rds-ca-2019-root.pem** on the Clair application pod in the **clair-config.yaml**. It must be specified when configuring your **clair-config.yaml**.
- An example **clair-config.yaml** can be found at Clair on OpenShift config.

2. Add the **clair-config.yaml** file to your bundle secret, for example:

```
apiVersion: v1
kind: Secret
metadata:
  name: config-bundle-secret
  namespace: quay-enterprise
data:
  config.yaml: <base64 encoded Quay config>
  clair-config.yaml: <base64 encoded Clair config>
```

NOTE

- When updated, the provided **clair-config.yaml** file is mounted into the Clair pod. Any fields not provided are automatically populated with defaults using the Clair configuration module.

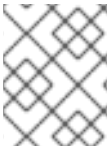
3. You can check the status of your Clair pod by clicking the commit in the **Build History** page, or by running **oc get pods -n <namespace>**. For example:

```
$ oc get pods -n <namespace>
```

**Example output**

```
NAME                                    READY   STATUS    RESTARTS   AGE
f192fe4a-c802-4275-bcce-d2031e635126-9l2b5-25lg2   1/1     Running   0          7s
```

# CHAPTER 8. CLAIR IN DISCONNECTED ENVIRONMENTS

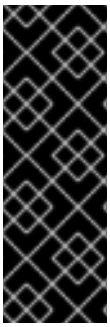


NOTE

Currently, deploying Clair in disconnected environments is not supported on IBM Power and IBM Z.

Clair uses a set of components called *updaters* to handle the fetching and parsing of data from various vulnerability databases. Updaters are set up by default to pull vulnerability data directly from the internet and work for immediate use. However, some users might require Red Hat Quay to run in a disconnected environment, or an environment without direct access to the internet. Clair supports disconnected environments by working with different types of update workflows that take network isolation into consideration. This works by using the **clairctl** command line interface tool, which obtains updater data from the internet by using an open host, securely transferring the data to an isolated host, and then important the updater data on the isolated host into Clair.

Use this guide to deploy Clair in a disconnected environment.



IMPORTANT

Due to known issue PROJQUAY-6577, the Red Hat Quay Operator does not properly render customized Clair **config.yaml** files. As a result, the following procedure does not currently work.

Users must create the entire Clair configuration themselves, from the beginning, instead of relying on the Operator to populate the fields. To do this, following the instructions at Procedure to enable Clair scanning of images in disconnected environments .

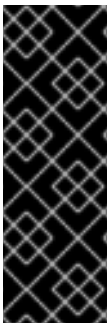
NOTE

Currently, Clair enrichment data is CVSS data. Enrichment data is currently unsupported in disconnected environments.

For more information about Clair updaters, see "Clair updaters".

## 8.1. SETTING UP CLAIR IN A DISCONNECTED OPENSHIFT CONTAINER PLATFORM CLUSTER

Use the following procedures to set up an OpenShift Container Platform provisioned Clair pod in a disconnected OpenShift Container Platform cluster.



IMPORTANT

Due to known issue PROJQUAY-6577, the Red Hat Quay Operator does not properly render customized Clair **config.yaml** files. As a result, the following procedure does not currently work.

Users must create the entire Clair configuration themselves, from the beginning, instead of relying on the Operator to populate the fields. To do this, following the instructions at Procedure to enable Clair scanning of images in disconnected environments .

### 8.1.1. Installing the clairctl command line utility tool for OpenShift Container Platform deployments

Use the following procedure to install the **clairctl** CLI tool for OpenShift Container Platform deployments.

#### Procedure

1. Install the **clairctl** program for a Clair deployment in an OpenShift Container Platform cluster by entering the following command:

```
$ oc -n quay-enterprise exec example-registry-clair-app-64dd48f866-6ptgw -- cat
/usr/bin/clairctl > clairctl
```

NOTE

Unofficially, the **clairctl** tool can be downloaded

2. Set the permissions of the **clairctl** file so that it can be executed and run by the user, for example:

```
$ chmod u+x ./clairctl
```

### 8.1.2. Retrieving and decoding the Clair configuration secret for Clair deployments on OpenShift Container Platform

Use the following procedure to retrieve and decode the configuration secret for an OpenShift Container Platform provisioned Clair instance on OpenShift Container Platform.

#### Prerequisites

- You have installed the **clairctl** command line utility tool.

#### Procedure

1. Enter the following command to retrieve and decode the configuration secret, and then save it to a Clair configuration YAML:

```
$ oc get secret -n quay-enterprise example-registry-clair-config-secret  -o "jsonpath=
{$.data['config\.yaml']}" | base64 -d > clair-config.yaml
```

2. Update the **clair-config.yaml** file so that the **disable_updaters** and **airgap** parameters are set to **true**, for example:

```
---
indexer:
  airgap: true
---
matcher:
  disable_updaters: true
---
```

### 8.1.3. Exporting the updaters bundle from a connected Clair instance

Use the following procedure to export the updaters bundle from a Clair instance that has access to the internet.

#### Prerequisites

- You have installed the **clairctl** command line utility tool.
- You have retrieved and decoded the Clair configuration secret, and saved it to a Clair **config.yaml** file.
- The **disable_updaters** and **airgap** parameters are set to **true** in your Clair **config.yaml** file.

#### Procedure

- From a Clair instance that has access to the internet, use the **clairctl** CLI tool with your configuration file to export the updaters bundle. For example:

```
$ ./clairctl --config ./config.yaml export-updaters updates.gz
```

### 8.1.4. Configuring access to the Clair database in the disconnected OpenShift Container Platform cluster

Use the following procedure to configure access to the Clair database in your disconnected OpenShift Container Platform cluster.

#### Prerequisites

- You have installed the **clairctl** command line utility tool.
- You have retrieved and decoded the Clair configuration secret, and saved it to a Clair **config.yaml** file.
- The **disable_updaters** and **airgap** parameters are set to **true** in your Clair **config.yaml** file.
- You have exported the updaters bundle from a Clair instance that has access to the internet.

#### Procedure

1. Determine your Clair database service by using the **oc** CLI tool, for example:

```
$ oc get svc -n quay-enterprise
```

**Example output**

```
NAME                          TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)
AGE
example-registry-clair-app          ClusterIP     172.30.224.93    <none>
80/TCP,8089/TCP               4d21h
example-registry-clair-postgres     ClusterIP     172.30.246.88    <none>        5432/TCP
4d21h
...
```

2. Forward the Clair database port so that it is accessible from the local machine. For example:

```
$ oc port-forward -n quay-enterprise service/example-registry-clair-postgres 5432:5432
```

3. Update your Clair **config.yaml** file, for example:

```
indexer:
  connstring: host=localhost port=5432 dbname=postgres user=postgres
password=postgres sslmode=disable (1)
  scanlock_retry: 10
  layer_scan_concurrency: 5
  migrations: true
  scanner:
    repo:
      rhel-repository-scanner: (2)
        repo2cpe_mapping_file: /data/cpe-map.json
    package:
      rhel_containerscanner: (3)
        name2repos_mapping_file: /data/repo-map.json
```

(1) Replace the value of the **host** in the multiple **connstring** fields with **localhost**.

(2) For more information about the **rhel-repository-scanner** parameter, see "Mapping repositories to Common Product Enumeration information".

(3) For more information about the **rhel_containerscanner** parameter, see "Mapping repositories to Common Product Enumeration information".

### 8.1.5. Importing the updaters bundle into the disconnected OpenShift Container Platform cluster

Use the following procedure to import the updaters bundle into your disconnected OpenShift Container Platform cluster.

#### Prerequisites

- You have installed the **clairctl** command line utility tool.
- You have retrieved and decoded the Clair configuration secret, and saved it to a Clair **config.yaml** file.
- The **disable_updaters** and **airgap** parameters are set to **true** in your Clair **config.yaml** file.
- You have exported the updaters bundle from a Clair instance that has access to the internet.
- You have transferred the updaters bundle into your disconnected environment.

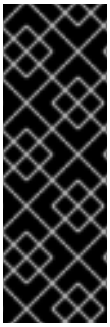
#### Procedure

- Use the **clairctl** CLI tool to import the updaters bundle into the Clair database that is deployed by OpenShift Container Platform. For example:

```
$ ./clairctl --config ./clair-config.yaml import-updaters updates.gz
```

# 8.2. SETTING UP A SELF-MANAGED DEPLOYMENT OF CLAIR FOR A DISCONNECTED OPENSHIFT CONTAINER PLATFORM CLUSTER

Use the following procedures to set up a self-managed deployment of Clair for a disconnected OpenShift Container Platform cluster.



**IMPORTANT**

Due to known issue PROJQUAY-6577, the Red Hat Quay Operator does not properly render customized Clair **config.yaml** files. As a result, the following procedure does not currently work.

Users must create the entire Clair configuration themselves, from the beginning, instead of relying on the Operator to populate the fields. To do this, following the instructions at Procedure to enable Clair scanning of images in disconnected environments .

## 8.2.1. Installing the clairctl command line utility tool for a self-managed Clair deployment on OpenShift Container Platform

Use the following procedure to install the **clairctl** CLI tool for self-managed Clair deployments on OpenShift Container Platform.

### Procedure

1. Install the **clairctl** program for a self-managed Clair deployment by using the **podman cp** command, for example:

```
$ sudo podman cp clairv4:/usr/bin/clairctl ./clairctl
```

2. Set the permissions of the **clairctl** file so that it can be executed and run by the user, for example:

```
$ chmod u+x ./clairctl
```

## 8.2.2. Deploying a self-managed Clair container for disconnected OpenShift Container Platform clusters

Use the following procedure to deploy a self-managed Clair container for disconnected OpenShift Container Platform clusters.

### Prerequisites

- You have installed the **clairctl** command line utility tool.

### Procedure

1. Create a folder for your Clair configuration file, for example:

```
$ mkdir /etc/clairv4/config/
```

2. Create a Clair configuration file with the **disable_updaters** parameter set to **true**, for example:

```
---
indexer:
  airgap: true
---
matcher:
  disable_updaters: true
---
```

3. Start Clair by using the container image, mounting in the configuration from the file you created:

```
$ sudo podman run -it --rm --name clairv4 \
-p 8081:8081 -p 8088:8088 \
-e CLAIR_CONF=/clair/config.yaml \
-e CLAIR_MODE=combo \
-v /etc/clairv4/config:/clair:Z \
registry.redhat.io/quay/clair-rhel8:v3.11.0
```

### 8.2.3. Exporting the updaters bundle from a connected Clair instance

Use the following procedure to export the updaters bundle from a Clair instance that has access to the internet.

#### Prerequisites

- You have installed the **clairctl** command line utility tool.
- You have deployed Clair.
- The **disable_updaters** and **airgap** parameters are set to **true** in your Clair **config.yaml** file.

#### Procedure

- From a Clair instance that has access to the internet, use the **clairctl** CLI tool with your configuration file to export the updaters bundle. For example:

```
$ ./clairctl --config ./config.yaml export-updaters updates.gz
```

### 8.2.4. Configuring access to the Clair database in the disconnected OpenShift Container Platform cluster

Use the following procedure to configure access to the Clair database in your disconnected OpenShift Container Platform cluster.

#### Prerequisites

- You have installed the **clairctl** command line utility tool.
- You have deployed Clair.
- The **disable_updaters** and **airgap** parameters are set to **true** in your Clair **config.yaml** file.
- You have exported the updaters bundle from a Clair instance that has access to the internet.

#### Procedure

Procedure

1. Determine your Clair database service by using the **oc** CLI tool, for example:

```
$ oc get svc -n quay-enterprise
```

**Example output**

```
NAME                              TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)
AGE
example-registry-clair-app        ClusterIP   172.30.224.93   <none>
80/TCP,8089/TCP                   4d21h
example-registry-clair-postgres   ClusterIP   172.30.246.88   <none>        5432/TCP
4d21h
...
```

2. Forward the Clair database port so that it is accessible from the local machine. For example:

```
$ oc port-forward -n quay-enterprise service/example-registry-clair-postgres 5432:5432
```

3. Update your Clair **config.yaml** file, for example:

```
indexer:
  connstring: host=localhost port=5432 dbname=postgres user=postgres
password=postgres sslmode=disable (1)
  scanlock_retry: 10
  layer_scan_concurrency: 5
  migrations: true
  scanner:
    repo:
      rhel-repository-scanner: (2)
        repo2cpe_mapping_file: /data/cpe-map.json
    package:
      rhel_containerscanner: (3)
        name2repos_mapping_file: /data/repo-map.json
```

(1) Replace the value of the **host** in the multiple **connstring** fields with **localhost**.

(2) For more information about the **rhel-repository-scanner** parameter, see "Mapping repositories to Common Product Enumeration information".

(3) For more information about the **rhel_containerscanner** parameter, see "Mapping repositories to Common Product Enumeration information".

### 8.2.5. Importing the updaters bundle into the disconnected OpenShift Container Platform cluster

Use the following procedure to import the updaters bundle into your disconnected OpenShift Container Platform cluster.

**Prerequisites**

- You have installed the **clairctl** command line utility tool.

- You have deployed Clair.
- The **disable_updaters** and **airgap** parameters are set to **true** in your Clair **config.yaml** file.
- You have exported the updaters bundle from a Clair instance that has access to the internet.
- You have transferred the updaters bundle into your disconnected environment.

**Procedure**

- Use the **clairctl** CLI tool to import the updaters bundle into the Clair database that is deployed by OpenShift Container Platform:

```
$ ./clairctl --config ./clair-config.yaml import-updaters updates.gz
```

## 8.3. MAPPING REPOSITORIES TO COMMON PRODUCT ENUMERATION INFORMATION

**NOTE**

Currently, mapping repositories to Common Product Enumeration information is not supported on IBM Power and IBM Z.

Clair's Red Hat Enterprise Linux (RHEL) scanner relies on a Common Product Enumeration (CPE) file to map RPM packages to the corresponding security data to produce matching results. These files are owned by product security and updated daily.

The CPE file must be present, or access to the file must be allowed, for the scanner to properly process RPM packages. If the file is not present, RPM packages installed in the container image will not be scanned.

**Table 8.1. Clair CPE mapping files**

| CPE | Link to JSON mapping file |
|---|---|
| **repos2cpe** | Red Hat Repository-to-CPE JSON |
| **names2repos** | Red Hat Name-to-Repos JSON. |

In addition to uploading CVE information to the database for disconnected Clair installations, you must also make the mapping file available locally:

- For standalone Red Hat Quay and Clair deployments, the mapping file must be loaded into the Clair pod.
- For Red Hat Quay on OpenShift Container Platform deployments, you must set the Clair component to **unmanaged**. Then, Clair must be deployed manually, setting the configuration to load a local copy of the mapping file.

### 8.3.1. Mapping repositories to Common Product Enumeration example configuration

Use the **repo2cpe_mapping_file** and **name2repos_mapping_file** fields in your Clair configuration to include the CPE JSON mapping files. For example:

```
indexer:
 scanner:
    repo:
      rhel-repository-scanner:
        repo2cpe_mapping_file: /data/cpe-map.json
    package:
      rhel_containerscanner:
        name2repos_mapping_file: /data/repo-map.json
```

For more information, see How to accurately match OVAL security data to installed RPMs .

# CHAPTER 9. CLAIR CONFIGURATION OVERVIEW

Clair is configured by a structured YAML file. Each Clair node needs to specify what mode it will run in and a path to a configuration file through CLI flags or environment variables. For example:

```
$ clair -conf ./path/to/config.yaml -mode indexer
```

or

```
$ clair -conf ./path/to/config.yaml -mode matcher
```

The aforementioned commands each start two Clair nodes using the same configuration file. One runs the indexing facilities, while other runs the matching facilities.

If you are running Clair in **combo** mode, you must supply the indexer, matcher, and notifier configuration blocks in the configuration.

## 9.1. INFORMATION ABOUT USING CLAIR IN A PROXY ENVIRONMENT

Environment variables respected by the Go standard library can be specified if needed, for example:

- **HTTP_PROXY**

  ```
  $ export http://<user_name>:<password>@<proxy_host>:<proxy_port>
  ```

- **HTTPS_PROXY**.

  ```
  $ export https://<user_name>:<password>@<proxy_host>:<proxy_port>
  ```

- **SSL_CERT_DIR**.

  ```
  $ export SSL_CERT_DIR=/<path>/<to>/<ssl>/<certificates>
  ```

If you are using a proxy server in your environment with Clair's updater URLs, you must identify which URL needs to be added to the proxy allowlist to ensure that Clair can access them unimpeded. For example, the **osv** updater requires access to **https://osv-vulnerabilities.storage.googleapis.com** to fetch ecosystem data dumps. In this scenario, the URL must be added to the proxy allowlist. For a full list of updater URLs, see "Clair updater URLs".

You must also ensure that the standard Clair URLs are added to the proxy allowlist:

- **https://search.maven.org/solrsearch/select**
- **https://catalog.redhat.com/api/containers/**
- **https://access.redhat.com/security/data/metrics/repository-to-cpe.json**
- **https://access.redhat.com/security/data/metrics/container-name-repos-map.json**

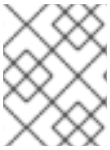
When configuring the proxy server, take into account any authentication requirements or specific proxy settings needed to enable seamless communication between Clair and these URLs. By thoroughly documenting and addressing these considerations, you can ensure that Clair functions effectively while routing its updater traffic through the proxy.

## 9.2. CLAIR CONFIGURATION REFERENCE

The following YAML shows an example Clair configuration:

```
http_listen_addr: ""
introspection_addr: ""
log_level: ""
tls: {}
indexer:
    connstring: ""
    scanlock_retry: 0
    layer_scan_concurrency: 5
    migrations: false
    scanner: {}
    airgap: false
matcher:
    connstring: ""
    indexer_addr: ""
    migrations: false
    period: ""
    disable_updaters: false
    update_retention: 2
matchers:
    names: nil
    config: nil
updaters:
    sets: nil
    config: nil
notifier:
    connstring: ""
    migrations: false
    indexer_addr: ""
    matcher_addr: ""
    poll_interval: ""
    delivery_interval: ""
    disable_summary: false
    webhook: null
    amqp: null
    stomp: null
auth:
  psk: nil
trace:
    name: ""
    probability: null
    jaeger:
        agent:
            endpoint: ""
        collector:
            endpoint: ""
            username: null
            password: null
        service_name: ""
        tags: nil
        buffer_max: 0
metrics:
    name: ""
```

```
  prometheus:
    endpoint: null
  dogstatsd:
    url: ""
```



**NOTE**

The above YAML file lists every key for completeness. Using this configuration file as-is will result in some options not having their defaults set normally.

## 9.3. CLAIR GENERAL FIELDS

The following table describes the general configuration fields available for a Clair deployment.

| Field | Typhttp_listen_ae | Description |
|---|---|---|
| **http_listen_addr** | String | Configures where the HTTP API is exposed.<br><br>Default: **:6060** |
| **introspection_addr** | String | Configures where Clair's metrics and health endpoints are exposed. |
| **log_level** | String | Sets the logging level. Requires one of the following strings: **debug-color**, **debug**, **info**, **warn**, **error**, **fatal**, **panic** |
| **tls** | String | A map containing the configuration for serving the HTTP API of TLS/SSL and HTTP/2. |
| **.cert** | String | The TLS certificate to be used. Must be a full-chain certificate. |

### Example configuration for general Clair fields

The following example shows a Clair configuration.

### Example configuration for general Clair fields

```
# ...
http_listen_addr: 0.0.0.0:6060
introspection_addr: 0.0.0.0:8089
log_level: info
# ...
```

## 9.4. CLAIR INDEXER CONFIGURATION FIELDS

The following table describes the configuration fields for Clair's **indexer** component.

| Field | Type | Description |
|---|---|---|
| **indexer** | Object | Provides Clair indexer node configuration. |
| **.airgap** | Boolean | Disables HTTP access to the internet for indexers and fetchers. Private IPv4 and IPv6 addresses are allowed. Database connections are unaffected. |
| **.connstring** | String | A Postgres connection string. Accepts format as a URL or libpq connection string. |
| **.index_report_request_concurrency** | Integer | Rate limits the number of index report creation requests. Setting this to **0** attemps to auto-size this value. Setting a negative value means unlimited. The auto-sizing is a multiple of the number of available cores.<br><br>The API returns a **429** status code if concurrency is exceeded. |
| **.scanlock_retry** | Integer | A positive integer representing seconds. Concurrent indexers lock on manifest scans to avoid clobbering. This value tunes how often a waiting indexer polls for the lock. |
| **.layer_scan_concurrency** | Integer | Positive integer limiting the number of concurrent layer scans. Indexers will match a manifest's layer concurrently. This value tunes the number of layers an indexer scans in parallel. |
| **.migrations** | Boolean | Whether indexer nodes handle migrations to their database. |

| Field | Type | Description |
|---|---|---|
| **.scanner** | String | Indexer configuration.<br><br>Scanner allows for passing configuration options to layer scanners. The scanner will have this configuration pass to it on construction if designed to do so. |
| **.scanner.dist** | String | A map with the name of a particular scanner and arbitrary YAML as a value. |
| **.scanner.package** | String | A map with the name of a particular scanner and arbitrary YAML as a value. |
| **.scanner.repo** | String | A map with the name of a particular scanner and arbitrary YAML as a value. |

### Example indexer configuration

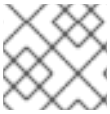
The following example shows a hypothetical indexer configuration for Clair.

### Example indexer configuration

```
# ...
indexer:
  connstring: host=quay-server.example.com port=5433 dbname=clair user=clairuser
password=clairpass sslmode=disable
  scanlock_retry: 10
  layer_scan_concurrency: 5
  migrations: true
# ...
```

## 9.5. CLAIR MATCHER CONFIGURATION FIELDS

The following table describes the configuration fields for Clair's **matcher** component.



NOTE

Differs from **matchers** configuration fields.

| Field | Type | Description |
|---|---|---|
| **matcher** | Object | Provides Clair matcher node configuration. |

| Field | Type | Description |
|---|---|---|
| **.cache_age** | String | Controls how long users should be hinted to cache responses for. |
| **.connstring** | String | A Postgres connection string. Accepts format as a URL or libpq connection string. |
| **.max_conn_pool** | Integer | Limits the database connection pool size.<br><br>Clair allows for a custom connection pool size. This number directly sets how many active database connections are allowed concurrently.<br><br>This parameter will be ignored in a future version. Users should configure this through the connection string. |
| **.indexer_addr** | String | A matcher contacts an indexer to create a vulnerability report. The location of this indexer is required.<br><br>Defaults to **30m**. |
| **.migrations** | Boolean | Whether matcher nodes handle migrations to their databases. |
| **.period** | String | Determines how often updates for new security advisories take place.<br><br>Defaults to **30m**. |
| **.disable_updaters** | Boolean | Whether to run background updates or not.<br><br>Default: **False** |

| Field | Type | Description |
|---|---|---|
| **.update_retention** | Integer | Sets the number of update operations to retain between garbage collection cycles. This should be set to a safe MAX value based on database size constraints.<br><br>Defaults to **10m**.<br><br>If a value of less than **0** is provided, garbage collection is disabled. **2** is the minimum value to ensure updates can be compared to notifications. |

### Example matcher configuration

### Example matcher configuration

```
# ...
matcher:
  connstring: >-
    host=<DB_HOST> port=5432 dbname=<matcher> user=<DB_USER> password=D<B_PASS>
    sslmode=verify-ca sslcert=/etc/clair/ssl/cert.pem sslkey=/etc/clair/ssl/key.pem
    sslrootcert=/etc/clair/ssl/ca.pem
  indexer_addr: http://clair-v4/
  disable_updaters: false
  migrations: true
  period: 6h
  update_retention: 2
# ...
```

## 9.6. CLAIR MATCHERS CONFIGURATION FIELDS

The following table describes the configuration fields for Clair's **matchers** component.

NOTE

Differs from **matcher** configuration fields.

### Table 9.1. Matchers configuration fields

| Field | Type | Description |
|---|---|---|
| **matchers** | Array of strings | Provides configuration for the in-tree **matchers**. |

| Field | Type | Description |
|---|---|---|
| **.names** | String | A list of string values informing the matcher factory about enabled matchers. If value is set to **null**, the default list of matchers run. The following strings are accepted: **alpine-matcher**, **aws-matcher**, **debian-matcher**, **gobin**, **java-maven**, **oracle**, **photon**, **python**, **rhel**, **rhel-container-matcher**, **ruby**, **suse**, **ubuntu-matcher** |
| **.config** | String | Provides configuration to a specific matcher.<br><br>A map keyed by the name of the matcher containing a sub-object which will be provided to the matchers factory constructor. For example: |

### Example matchers configuration

The following example shows a hypothetical Clair deployment that only requires only the **alpine**, **aws**, **debian**, **oracle** matchers.

### Example matchers configuration

```
# ...
matchers:
  names:
  - "alpine-matcher"
  - "aws"
  - "debian"
  - "oracle"
# ...
```

## 9.7. CLAIR UPDATERS CONFIGURATION FIELDS

The following table describes the configuration fields for Clair's **updaters** component.

**Table 9.2. Updaters configuration fields**

| Field | Type | Description |
|---|---|---|
| **updaters** | Object | Provides configuration for the matcher's update manager. |

| Field | Type | Description |
|---|---|---|
| **.sets** | String | A list of values informing the update manager which updaters to run.<br><br>If value is set to **null**, the default set of updaters runs the following: **alpine**, **aws**, **clair.cvss**, **debian**, **oracle**, **photon**, **osv**, **rhel**, **rhcc suse**, **ubuntu**<br><br>If left blank, zero updaters run. |
| **.config** | String | Provides configuration to specific updater sets.<br><br>A map keyed by the name of the updater set containing a sub-object which will be provided to the updater set's constructor. For a list of the sub-objects for each updater, see "Advanced updater configuration". |

### Example updaters configuration

In the following configuration, only the **rhel** set is configured. The **ignore_unpatched** variable, which is specific to the **rhel** updater, is also defined.

### Example updaters configuration

```
# ...
updaters:
  sets:
    - rhel
  config:
    rhel:
      ignore_unpatched: false
# ...
```

## 9.8. CLAIR NOTIFIER CONFIGURATION FIELDS

The general notifier configuration fields for Clair are listed below.

| Field | Type | Description |
|---|---|---|
| **notifier** | Object | Provides Clair notifier node configuration. |
| **.connstring** | String | Postgres connection string. Accepts format as URL, or libpq connection string. |

| Field | Type | Description |
|---|---|---|
| **.migrations** | Boolean | Whether notifier nodes handle migrations to their database. |
| **.indexer_addr** | String | A notifier contacts an indexer to create or obtain manifests affected by vulnerabilities. The location of this indexer is required. |
| **.matcher_addr** | String | A notifier contacts a matcher to list update operations and acquire diffs. The location of this matcher is required. |
| **.poll_interval** | String | The frequency at which the notifier will query a matcher for update operations. |
| **.delivery_interval** | String | The frequency at which the notifier attempts delivery of created, or previously failed, notifications. |
| **.disable_summary** | Boolean | Controls whether notifications should be summarized to one per manifest. |

### Example notifier configuration

The following **notifier** snippet is for a minimal configuration.

### Example notifier configuration

```
# ...
notifier:
  connstring: >-
    host=DB_HOST port=5432 dbname=notifier user=DB_USER password=DB_PASS
    sslmode=verify-ca sslcert=/etc/clair/ssl/cert.pem sslkey=/etc/clair/ssl/key.pem
    sslrootcert=/etc/clair/ssl/ca.pem
  indexer_addr: http://clair-v4/
  matcher_addr: http://clair-v4/
  delivery_interval: 5s
  migrations: true
  poll_interval: 15s
  webhook:
    target: "http://webhook/"
    callback: "http://clair-notifier/notifier/api/v1/notifications"
```

```
    headers: ""
  amqp: null
  stomp: null
# ...
```

### 9.8.1. Clair webhook configuration fields

The following webhook fields are available for the Clair notifier environment.

**Table 9.3. Clair webhook fields**

| | | |
|---|---|---|
| **.webhook** | Object | Configures the notifier for webhook delivery. |
| **.webhook.target** | String | URL where the webhook will be delivered. |
| **.webhook.callback** | String | The callback URL where notifications can be retrieved. The notification ID will be appended to this URL.<br><br>This will typically be where the Clair notifier is hosted. |
| **.webhook.headers** | String | A map associating a header name to a list of values. |

#### Example webhook configuration

#### Example webhook configuration

```
# ...
notifier:
# ...
  webhook:
    target: "http://webhook/"
    callback: "http://clair-notifier/notifier/api/v1/notifications"
# ...
```

### 9.8.2. Clair amqp configuration fields

The following Advanced Message Queuing Protocol (AMQP) fields are available for the Clair notifier environment.

| | | |
|---|---|---|
| **.amqp** | Object | Configures the notifier for AMQP delivery.<br><br>[NOTE] ==== Clair does not declare any AMQP components on its own. All attempts to use an exchange or queue are passive only and will fail. Broker administrators should setup exchanges and queues ahead of time. ==== |
| **.amqp.direct** | Boolean | If **true**, the notifier will deliver individual notifications (not a callback) to the configured AMQP broker. |
| **.amqp.rollup** | Integer | When **amqp.direct** is set to **true**, this value informs the notifier of how many notifications to send in a direct delivery. For example, if **direct** is set to **true**, and **amqp.rollup** is set to **5**, the notifier delivers no more than 5 notifications in a single JSON payload to the broker. Setting the value to **0** effectively sets it to **1**. |
| **.amqp.exchange** | Object | The AMQP exchange to connect to. |
| **.amqp.exchange.name** | String | The name of the exchange to connect to. |
| **.amqp.exchange.type** | String | The type of the exchange. Typically one of the following: **direct**, **fanout**, **topic**, **headers**. |
| **.amqp.exchange.durability** | Boolean | Whether the configured queue is durable. |
| **.amqp.exchange.auto_delete** | Boolean | Whether the configured queue uses an **auto_delete_policy**. |
| **.amqp.routing_key** | String | The name of the routing key each notification is sent with. |

| | | |
|---|---|---|
| **.amqp.callback** | String | If **amqp.direct** is set to **false**, this URL is provided in the notification callback sent to the broker. This URL should point to Clair's notification API endpoint. |
| **.amqp.uris** | String | A list of one or more AMQP brokers to connect to, in priority order. |
| **.amqp.tls** | Object | Configures TLS/SSL connection to an AMQP broker. |
| **.amqp.tls.root_ca** | String | The filesystem path where a root CA can be read. |
| **.amqp.tls.cert** | String | The filesystem path where a TLS/SSL certificate can be read.<br><br>[NOTE] ==== Clair also allows **SSL_CERT_DIR**, as documented for the Go **crypto/x509** package. ==== |
| **.amqp.tls.key** | String | The filesystem path where a TLS/SSL private key can be read. |

### Example AMQP configuration

The following example shows a hypothetical AMQP configuration for Clair.

### Example AMQP configuration

```
# ...
notifier:
# ...
  amqp:
    exchange:
        name: ""
        type: "direct"
        durable: true
        auto_delete: false
    uris: ["amqp://user:pass@host:10000/vhost"]
    direct: false
    routing_key: "notifications"
    callback: "http://clair-notifier/notifier/api/v1/notifications"
    tls:
     root_ca: "optional/path/to/rootca"
     cert: "madatory/path/to/cert"
     key: "madatory/path/to/key"
# ...
```

## 9.8.3. Clair STOMP configuration fields

The following Simple Text Oriented Message Protocol (STOMP) fields are available for the Clair notifier environment.

| .stomp | Object | Configures the notifier for STOMP delivery. |
|---|---|---|
| **.stomp.direct** | Boolean | If **true**, the notifier delivers individual notifications (not a callback) to the configured STOMP broker. |
| **.stomp.rollup** | Integer | If **stomp.direct** is set to **true**, this value limits the number of notifications sent in a single direct delivery. For example, if **direct** is set to **true**, and **rollup** is set to **5**, the notifier delivers no more than 5 notifications in a single JSON payload to the broker. Setting the value to **0** effectively sets it to **1**. |
| **.stomp.callback** | String | If **stomp.callback** is set to **false**, the provided URL in the notification callback is sent to the broker. This URL should point to Clair's notification API endpoint. |
| **.stomp.destination** | String | The STOMP destination to deliver notifications to. |
| **.stomp.uris** | String | A list of one or more STOMP brokers to connect to in priority order. |
| **.stomp.tls** | Object | Configured TLS/SSL connection to STOMP broker. |
| **.stomp.tls.root_ca** | String | The filesystem path where a root CA can be read.<br><br>[NOTE] ==== Clair also respects **SSL_CERT_DIR**, as documented for the Go **crypto/x509** package. ==== |
| **.stomp.tls.cert** | String | The filesystem path where a TLS/SSL certificate can be read. |
| **.stomp.tls.key** | String | The filesystem path where a TLS/SSL private key can be read. |

| .stomp | Object | Configures the notifier for STOMP delivery. |
|---|---|---|
| **.stomp.user** | String | Configures login details for the STOMP broker. |
| **.stomp.user.login** | String | The STOMP login to connect with. |
| **.stomp.user.passcode** | String | The STOMP passcode to connect with. |

### Example STOMP configuration

The following example shows a hypothetical STOMP configuration for Clair.

### Example STOMP configuration

```
# ...
notifier:
# ...
  stomp:
    desitnation: "notifications"
    direct: false
    callback: "http://clair-notifier/notifier/api/v1/notifications"
    login:
      login: "username"
      passcode: "passcode"
    tls:
     root_ca: "optional/path/to/rootca"
     cert: "madatory/path/to/cert"
     key: "madatory/path/to/key"
# ...
```

## 9.9. CLAIR AUTHORIZATION CONFIGURATION FIELDS

The following authorization configuration fields are available for Clair.

| Field | Type | Description |
|---|---|---|
| **auth** | Object | Defines Clair's external and intra-service JWT based authentication. If multiple **auth** mechanisms are defined, Clair picks one. Currently, multiple mechanisms are unsupported. |
| **.psk** | String | Defines pre-shared key authentication. |

| Field | Type | Description |
|---|---|---|
| **.psk.key** | String | A shared base64 encoded key distributed between all parties signing and verifying JWTs. |
| **.psk.iss** | String | A list of JWT issuers to verify. An empty list accepts any issuer in a JWT claim. |

### Example authorization configuration

The following **authorization** snippet is for a minimal configuration.

### Example authorization configuration

```
# ...
auth:
  psk:
    key: MTU5YzA4Y2ZkNzJoMQ== 1
    iss: ["quay"]
# ...
```

## 9.10. CLAIR TRACE CONFIGURATION FIELDS

The following trace configuration fields are available for Clair.

| Field | Type | Description |
|---|---|---|
| **trace** | Object | Defines distributed tracing configuration based on OpenTelemetry. |
| **.name** | String | The name of the application traces will belong to. |
| **.probability** | Integer | The probability a trace will occur. |
| **.jaeger** | Object | Defines values for Jaeger tracing. |
| **.jaeger.agent** | Object | Defines values for configuring delivery to a Jaeger agent. |
| **.jaeger.agent.endpoint** | String | An address in the **<host>:<post>** syntax where traces can be submitted. |

| Field | Type | Description |
|---|---|---|
| **.jaeger.collector** | Object | Defines values for configuring delivery to a Jaeger collector. |
| **.jaeger.collector.endpoint** | String | An address in the **<host>:<post>** syntax where traces can be submitted. |
| **.jaeger.collector.username** | String | A Jaeger username. |
| **.jaeger.collector.password** | String | A Jaeger password. |
| **.jaeger.service_name** | String | The service name registered in Jaeger. |
| **.jaeger.tags** | String | Key-value pairs to provide additional metadata. |
| **.jaeger.buffer_max** | Integer | The maximum number of spans that can be buffered in memory before they are sent to the Jaeger backend for storage and analysis. |

### Example trace configuration

The following example shows a hypothetical trace configuration for Clair.

### Example trace configuration

```
# ...
trace:
  name: "jaeger"
  probability: 1
  jaeger:
    agent:
      endpoint: "localhost:6831"
    service_name: "clair"
# ...
```

## 9.11. CLAIR METRICS CONFIGURATION FIELDS

The following metrics configuration fields are available for Clair.

| Field | Type | Description |
|---|---|---|

| Field | Type | Description |
|---|---|---|
| **metrics** | Object | Defines distributed tracing configuration based on OpenTelemetry. |
| **.name** | String | The name of the metrics in use. |
| **.prometheus** | String | Configuration for a Prometheus metrics exporter. |
| **.prometheus.endpoint** | String | Defines the path where metrics are served. |

### Example metrics configuration

The following example shows a hypothetical metrics configuration for Clair.

### Example metrics configuration

```
# ...
metrics:
  name: "prometheus"
  prometheus:
    endpoint: "/metricsz"
# ...
```