OpenShift Container Platform 4.10

Monitoring

Configuring and using the monitoring stack in OpenShift Container Platform
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Abstract

This document provides instructions for configuring and using the Prometheus monitoring stack in OpenShift Container Platform.
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CHAPTER 1. MONITORING OVERVIEW

1.1. ABOUT OPENSIFT CONTAINER PLATFORM MONITORING

OpenShift Container Platform includes a preconfigured, preinstalled, and self-updating monitoring stack that provides monitoring for core platform components. You also have the option to enable monitoring for user-defined projects.

A cluster administrator can configure the monitoring stack with the supported configurations. OpenShift Container Platform delivers monitoring best practices out of the box.

A set of alerts are included by default that immediately notify cluster administrators about issues with a cluster. Default dashboards in the OpenShift Container Platform web console include visual representations of cluster metrics to help you to quickly understand the state of your cluster. With the OpenShift Container Platform web console, you can view and manage metrics, alerts, and review monitoring dashboards.

In the Observe section of OpenShift Container Platform web console, you can access and manage monitoring features such as metrics, alerts, monitoring dashboards, and metrics targets.

After installing OpenShift Container Platform, cluster administrators can optionally enable monitoring for user-defined projects. By using this feature, cluster administrators, developers, and other users can specify how services and pods are monitored in their own projects. As a cluster administrator, you can find answers to common problems such as user metrics unavailability and high consumption of disk space by Prometheus in Troubleshooting monitoring issues.

1.2. UNDERSTANDING THE MONITORING STACK

The OpenShift Container Platform monitoring stack is based on the Prometheus open source project and its wider ecosystem. The monitoring stack includes the following:

- **Default platform monitoring components.** A set of platform monitoring components are installed in the openshift-monitoring project by default during an OpenShift Container Platform installation. This provides monitoring for core OpenShift Container Platform components including Kubernetes services. The default monitoring stack also enables remote health monitoring for clusters. These components are illustrated in the Installed by default section in the following diagram.

- **Components for monitoring user-defined projects.** After optionally enabling monitoring for user-defined projects, additional monitoring components are installed in the openshift-user-workload-monitoring project. This provides monitoring for user-defined projects. These components are illustrated in the User section in the following diagram.
1.2.1. Default monitoring components

By default, the OpenShift Container Platform 4.10 monitoring stack includes these components:

Table 1.1. Default monitoring stack components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster Monitoring Operator</td>
<td>The Cluster Monitoring Operator (CMO) is a central component of the monitoring stack. It deploys and manages Prometheus instances, the Thanos Querier, the Telemeter Client, and metrics targets and ensures that they are up to date. The CMO is deployed by the Cluster Version Operator (CVO).</td>
</tr>
<tr>
<td>Prometheus Operator</td>
<td>The Prometheus Operator (PO) in the openshift-monitoring project creates, configures, and manages platform Prometheus instances and Alertmanager instances. It also automatically generates monitoring target configurations based on Kubernetes label queries.</td>
</tr>
<tr>
<td>Prometheus</td>
<td>Prometheus is the monitoring system on which the OpenShift Container Platform monitoring stack is based. Prometheus is a time-series database and a rule evaluation engine for metrics. Prometheus sends alerts to Alertmanager for processing.</td>
</tr>
<tr>
<td>Prometheus Adapter</td>
<td>The Prometheus Adapter (PA in the preceding diagram) translates Kubernetes node and pod queries for use in Prometheus. The resource metrics that are translated include CPU and memory utilization metrics. The Prometheus Adapter exposes the cluster resource metrics API for horizontal pod autoscaling. The Prometheus Adapter is also used by the <code>oc adm top nodes</code> and <code>oc adm top pods</code> commands.</td>
</tr>
<tr>
<td>Alertmanager</td>
<td>The Alertmanager service handles alerts received from Prometheus. Alertmanager is also responsible for sending the alerts to external notification systems.</td>
</tr>
<tr>
<td><code>kube-state-metrics</code> agent</td>
<td>The <code>kube-state-metrics</code> exporter agent (KSM in the preceding diagram) converts Kubernetes objects to metrics that Prometheus can use.</td>
</tr>
<tr>
<td><code>openshift-state-metrics</code> agent</td>
<td>The <code>openshift-state-metrics</code> exporter (OSM in the preceding diagram) expands upon <code>kube-state-metrics</code> by adding metrics for OpenShift Container Platform-specific resources.</td>
</tr>
</tbody>
</table>
### Component Description

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>node-exporter agent</td>
<td>The node-exporter agent (NE in the preceding diagram) collects metrics about every node in a cluster. The node-exporter agent is deployed on every node.</td>
</tr>
<tr>
<td>Thanos Querier</td>
<td>The Thanos Querier aggregates and optionally deduplicates core OpenShift Container Platform metrics and metrics for user-defined projects under a single, multi-tenant interface.</td>
</tr>
<tr>
<td>Grafana</td>
<td>The Grafana analytics platform provides dashboards for analyzing and visualizing the metrics. The Grafana instance that is provided with the monitoring stack, along with its dashboards, is read-only.</td>
</tr>
<tr>
<td>Telemeter Client</td>
<td>The Telemeter Client sends a subsection of the data from platform Prometheus instances to Red Hat to facilitate Remote Health Monitoring for clusters.</td>
</tr>
</tbody>
</table>

All of the components in the monitoring stack are monitored by the stack and are automatically updated when OpenShift Container Platform is updated.

**NOTE**

All components of the monitoring stack use the TLS security profile settings that are centrally configured by a cluster administrator. If you configure a monitoring stack component that uses TLS security settings, the component uses the TLS security profile settings that already exist in the `tlsSecurityProfile` field in the global OpenShift Container Platform `apiservers.config.openshift.io/cluster` resource.

### 1.2.2. Default monitoring targets

In addition to the components of the stack itself, the default monitoring stack monitors:

- CoreDNS
- Elasticsearch (if Logging is installed)
- etcd
- Fluentd (if Logging is installed)
- HAProxy
- Image registry
- Kubelets
- Kubernetes API server
- Kubernetes controller manager
- Kubernetes scheduler
- Metering (if Metering is installed)
- OpenShift API server
- OpenShift Controller Manager
- Operator Lifecycle Manager (OLM)

**NOTE**

Each OpenShift Container Platform component is responsible for its monitoring configuration. For problems with the monitoring of an OpenShift Container Platform component, open a bug in Bugzilla against that component, not against the general monitoring component.

Other OpenShift Container Platform framework components might be exposing metrics as well. For details, see their respective documentation.

### 1.2.3. Components for monitoring user-defined projects

OpenShift Container Platform 4.10 includes an optional enhancement to the monitoring stack that enables you to monitor services and pods in user-defined projects. This feature includes the following components:

#### Table 1.2. Components for monitoring user-defined projects

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prometheus Operator</td>
<td>The Prometheus Operator (PO) in the <code>openshift-user-workload-monitoring</code> project creates, configures, and manages Prometheus and Thanos Ruler instances in the same project.</td>
</tr>
<tr>
<td>Prometheus</td>
<td>Prometheus is the monitoring system through which monitoring is provided for user-defined projects. Prometheus sends alerts to Alertmanager for processing.</td>
</tr>
<tr>
<td>Thanos Ruler</td>
<td>The Thanos Ruler is a rule evaluation engine for Prometheus that is deployed as a separate process. In OpenShift Container Platform 4.10, Thanos Ruler provides rule and alerting evaluation for the monitoring of user-defined projects.</td>
</tr>
</tbody>
</table>

**NOTE**

The components in the preceding table are deployed after monitoring is enabled for user-defined projects.
All of the components in the monitoring stack are monitored by the stack and are automatically updated when OpenShift Container Platform is updated.

1.2.4. Monitoring targets for user-defined projects

When monitoring is enabled for user-defined projects, you can monitor:

- Metrics provided through service endpoints in user-defined projects.
- Pods running in user-defined projects.

1.3. ADDITIONAL RESOURCES

- About remote health monitoring
- Granting users permission to monitor user-defined projects
- Configuring TLS security profiles

1.4. NEXT STEPS

- Configuring the monitoring stack
CHAPTER 2. CONFIGURING THE MONITORING STACK

The OpenShift Container Platform 4 installation program provides only a low number of configuration options before installation. Configuring most OpenShift Container Platform framework components, including the cluster monitoring stack, happens post-installation.

This section explains what configuration is supported, shows how to configure the monitoring stack, and demonstrates several common configuration scenarios.

2.1. PREREQUISITES

- The monitoring stack imposes additional resource requirements. Consult the computing resources recommendations in Scaling the Cluster Monitoring Operator and verify that you have sufficient resources.

2.2. MAINTENANCE AND SUPPORT FOR MONITORING

The supported way of configuring OpenShift Container Platform Monitoring is by configuring it using the options described in this document. Do not use other configurations, as they are unsupported. Configuration paradigms might change across Prometheus releases, and such cases can only be handled gracefully if all configuration possibilities are controlled. If you use configurations other than those described in this section, your changes will disappear because the cluster-monitoring-operator reconciles any differences. The Operator resets everything to the defined state by default and by design.

2.2.1. Support considerations for monitoring

The following modifications are explicitly not supported:

- Creating additional ServiceMonitor, PodMonitor, and PrometheusRule objects in the openshift-* and kube-* projects.

- Modifying any resources or objects deployed in the openshift-monitoring or openshift-user-workload-monitoring projects. The resources created by the OpenShift Container Platform monitoring stack are not meant to be used by any other resources, as there are no guarantees about their backward compatibility.

NOTE

The Alertmanager configuration is deployed as a secret resource in the openshift-monitoring project. To configure additional routes for Alertmanager, you need to decode, modify, and then encode that secret. This procedure is a supported exception to the preceding statement.

- Modifying resources of the stack. The OpenShift Container Platform monitoring stack ensures its resources are always in the state it expects them to be. If they are modified, the stack will reset them.

- Deploying user-defined workloads to openshift-* and kube-* projects. These projects are reserved for Red Hat provided components and they should not be used for user-defined workloads.

- Modifying the monitoring stack Grafana instance.
• Installing custom Prometheus instances on OpenShift Container Platform.

• Enabling symptom based monitoring by using the `Probe` custom resource definition (CRD) in Prometheus Operator.

• Modifying Alertmanager configurations by using the `AlertmanagerConfig` CRD in Prometheus Operator.

**NOTE**
Backward compatibility for metrics, recording rules, or alerting rules is not guaranteed.

### 2.2.2. Support policy for monitoring Operators

Monitoring Operators ensure that OpenShift Container Platform monitoring resources function as designed and tested. If Cluster Version Operator (CVO) control of an Operator is overridden, the Operator does not respond to configuration changes, reconcile the intended state of cluster objects, or receive updates.

While overriding CVO control for an Operator can be helpful during debugging, this is unsupported and the cluster administrator assumes full control of the individual component configurations and upgrades.

**Overriding the Cluster Version Operator**

The `spec.overrides` parameter can be added to the configuration for the CVO to allow administrators to provide a list of overrides to the behavior of the CVO for a component. Setting the `spec.overrides[].unmanaged` parameter to `true` for a component blocks cluster upgrades and alerts the administrator after a CVO override has been set:

Disabling ownership via cluster version overrides prevents upgrades. Please remove overrides before continuing.

**WARNING**

Setting a CVO override puts the entire cluster in an unsupported state and prevents the monitoring stack from being reconciled to its intended state. This impacts the reliability features built into Operators and prevents updates from being received. Reported issues must be reproduced after removing any overrides for support to proceed.

### 2.3. PREPARING TO CONFIGURE THE MONITORING STACK

You can configure the monitoring stack by creating and updating monitoring config maps.

#### 2.3.1. Creating a cluster monitoring config map

To configure core OpenShift Container Platform monitoring components, you must create the `cluster-monitoring-config ConfigMap` object in the `openshift-monitoring` project.
NOTE
When you save your changes to the `cluster-monitoring-config ConfigMap` object, some or all of the pods in the `openshift-monitoring` project might be redeployed. It can sometimes take a while for these components to redeploy.

Prerequisites

- You have access to the cluster as a user with the `cluster-admin` role.
- You have installed the OpenShift CLI (`oc`).

Procedure

1. Check whether the `cluster-monitoring-config ConfigMap` object exists:
   
   ```bash
   $ oc -n openshift-monitoring get configmap cluster-monitoring-config
   ```

2. If the ConfigMap object does not exist:
   
   a. Create the following YAML manifest. In this example the file is called `cluster-monitoring-config.yaml`:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
     namespace: openshift-monitoring
   data:
     config.yaml:
   ```

   b. Apply the configuration to create the ConfigMap object:

   ```bash
   $ oc apply -f cluster-monitoring-config.yaml
   ```

2.3.2. Creating a user-defined workload monitoring config map

To configure the components that monitor user-defined projects, you must create the `user-workload-monitoring-config ConfigMap` object in the `openshift-user-workload-monitoring` project.

NOTE
When you save your changes to the `user-workload-monitoring-config ConfigMap` object, some or all of the pods in the `openshift-user-workload-monitoring` project might be redeployed. It can sometimes take a while for these components to redeploy. You can create and configure the config map before you first enable monitoring for user-defined projects, to prevent having to redeploy the pods often.

Prerequisites

- You have access to the cluster as a user with the `cluster-admin` role.
- You have installed the OpenShift CLI (`oc`).
1. Check whether the user-workload-monitoring-config ConfigMap object exists:

```
$ oc -n openshift-user-workload-monitoring get configmap user-workload-monitoring-config
```

2. If the user-workload-monitoring-config ConfigMap object does not exist:
   
a. Create the following YAML manifest. In this example the file is called user-workload-monitoring-config.yaml:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
```

b. Apply the configuration to create the ConfigMap object:

```
$ oc apply -f user-workload-monitoring-config.yaml
```

**NOTE**

Configurations applied to the user-workload-monitoring-config ConfigMap object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.

Additional resources

- Enabling monitoring for user-defined projects

### 2.4. CONFIGURING THE MONITORING STACK

In OpenShift Container Platform 4.10, you can configure the monitoring stack using the cluster-monitoring-config or user-workload-monitoring-config ConfigMap objects. Config maps configure the Cluster Monitoring Operator (CMO), which in turn configures the components of the stack.

**Prerequisites**

- If you are configuring core OpenShift Container Platform monitoring components
  - You have access to the cluster as a user with the cluster-admin role.
  - You have created the cluster-monitoring-config ConfigMap object.

- If you are configuring components that monitor user-defined projects
  - You have access to the cluster as a user with the cluster-admin role, or as a user with the user-workload-monitoring-config-edit role in the openshift-user-workload-monitoring project.
  - You have created the user-workload-monitoring-config ConfigMap object.
• You have installed the OpenShift CLI (oc).

Procedure

1. Edit the ConfigMap object.

   • To configure core OpenShift Container Platform monitoring components

      a. Edit the cluster-monitoring-config ConfigMap object in the openshift-monitoring project:

         $ oc -n openshift-monitoring edit configmap cluster-monitoring-config

      b. Add your configuration under data/config.yaml as a key-value pair

         <component_name>: <component_configuration>

         Substitute <component> and <configuration_for_the_component> accordingly.

         The following example ConfigMap object configures a persistent volume claim (PVC) for Prometheus. This relates to the Prometheus instance that monitors core OpenShift Container Platform components only:

         ```yaml
         apiVersion: v1
         kind: ConfigMap
         metadata:
           name: cluster-monitoring-config
           namespace: openshift-monitoring
         data:
           config.yaml: |
             <component>:
               <configuration_for_the_component>
        ```

         1 Defines the Prometheus component and the subsequent lines define its configuration.

   • To configure components that monitor user-defined projects

         ...
a. Edit the `user-workload-monitoring-config ConfigMap` object in the `openshift-user-workload-monitoring` project:

```
$ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
```

b. Add your configuration under `data/config.yaml` as a key-value pair:

```
<component_name>: <configuration_for_the_component>
```

Substitute `<component>` and `<configuration_for_the_component>` accordingly.

The following example `ConfigMap` object configures a data retention period and minimum container resource requests for Prometheus. This relates to the Prometheus instance that monitors user-defined projects only:

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    prometheus:
      retention: 24h
      resources:
        requests:
          cpu: 200m
          memory: 2Gi
```

1. Defines the Prometheus component and the subsequent lines define its configuration.
2. Configures a twenty-four hour data retention period for the Prometheus instance that monitors user-defined projects.
3. Defines a minimum resource request of 200 millicores for the Prometheus container.
4. Defines a minimum pod resource request of 2 GiB of memory for the Prometheus container.
The Prometheus config map component is called `prometheusK8s` in the `cluster-monitoring-config` ConfigMap object and `prometheus` in the `user-workload-monitoring-config` ConfigMap object.

2. Save the file to apply the changes to the ConfigMap object. The pods affected by the new configuration are restarted automatically.

**NOTE**
Configurations applied to the `user-workload-monitoring-config` ConfigMap object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.

**WARNING**
When changes are saved to a monitoring config map, the pods and other resources in the related project might be redeployed. The running monitoring processes in that project might also be restarted.

Additional resources
- See Preparing to configure the monitoring stack for steps to create monitoring config maps
- Enabling monitoring for user-defined projects

### 2.5. CONFIGURABLE MONITORING COMPONENTS

This table shows the monitoring components you can configure and the keys used to specify the components in the `cluster-monitoring-config` and `user-workload-monitoring-config` ConfigMap objects:

**Table 2.1. Configurable monitoring components**

<table>
<thead>
<tr>
<th>Component</th>
<th><code>cluster-monitoring-config</code> ConfigMap key</th>
<th><code>user-workload-monitoring-config</code> ConfigMap key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prometheus Operator</td>
<td><code>prometheusOperator</code></td>
<td><code>prometheusOperator</code></td>
</tr>
<tr>
<td>Prometheus</td>
<td><code>prometheusK8s</code></td>
<td><code>prometheus</code></td>
</tr>
<tr>
<td>Alertmanager</td>
<td><code>alertmanagerMain</code></td>
<td></td>
</tr>
<tr>
<td>kube-state-metrics</td>
<td><code>kubeStateMetrics</code></td>
<td></td>
</tr>
<tr>
<td>openshift-state-metrics</td>
<td><code>openshiftStateMetrics</code></td>
<td></td>
</tr>
</tbody>
</table>
## 2.6. MOVING MONITORING COMPONENTS TO DIFFERENT NODES

You can move any of the monitoring stack components to specific nodes.

### Prerequisites

- **If you are configuring core OpenShift Container Platform monitoring components**
  - You have access to the cluster as a user with the `cluster-admin` role.
  - You have created the `cluster-monitoring-config` ConfigMap object.

- **If you are configuring components that monitor user-defined projects**
  - You have access to the cluster as a user with the `cluster-admin` role, or as a user with the `user-workload-monitoring-config-edit` role in the `openshift-user-workload-monitoring` project.
  - You have created the `user-workload-monitoring-config` ConfigMap object.

- You have installed the OpenShift CLI (`oc`).

### Procedure

1. Edit the `ConfigMap` object:

   - **To move a component that monitors core OpenShift Container Platform projects**
     a. Edit the `cluster-monitoring-config` ConfigMap object in the `openshift-monitoring` project:

     ```bash
     $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
     ```
b. Specify the **nodeSelector** constraint for the component under `data/config.yaml`:

```yaml
apiVersion: v1
class: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    <component>:
      nodeSelector:
      <node_key>: <node_value>
      <node_key>: <node_value>
      <...>
```

Substitute `<component>` accordingly and substitute `<node_key>: <node_value>` with the map of key-value pairs that specifies a group of destination nodes. Often, only a single key-value pair is used.

The component can only run on nodes that have each of the specified key-value pairs as labels. The nodes can have additional labels as well.

**IMPORTANT**

Many of the monitoring components are deployed by using multiple pods across different nodes in the cluster to maintain high availability. When moving monitoring components to labeled nodes, ensure that enough matching nodes are available to maintain resilience for the component. If only one label is specified, ensure that enough nodes contain that label to distribute all of the pods for the component across separate nodes. Alternatively, you can specify multiple labels each relating to individual nodes.

**NOTE**

If monitoring components remain in a **Pending** state after configuring the **nodeSelector** constraint, check the pod logs for errors relating to taints and tolerations.

For example, to move monitoring components for core OpenShift Container Platform projects to specific nodes that are labeled `nodename: controlplane1`, `nodename: worker1`, `nodename: worker2`, and `nodename: worker2`, use:

```yaml
apiVersion: v1
class: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    prometheusOperator:
      nodeSelector:
        nodename: controlplane1
    prometheusK8s:
```
To move a component that monitors user-defined projects:

a. Edit the `user-workload-monitoring-config` ConfigMap object in the `openshift-user-workload-monitoring` project:

```
$ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
```

b. Specify the `nodeSelector` constraint for the component under `data/config.yaml`:

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    <component>:
      nodeSelector:
        <node_key>: <node_value>
        <node_key>: <node_value>
        ...
```

Substitute `<component>` accordingly and substitute `<node_key>: <node_value>` with the map of key-value pairs that specifies the destination nodes. Often, only a single key-value pair is used.
The component can only run on nodes that have each of the specified key-value pairs as labels. The nodes can have additional labels as well.

**IMPORTANT**

Many of the monitoring components are deployed by using multiple pods across different nodes in the cluster to maintain high availability. When moving monitoring components to labeled nodes, ensure that enough matching nodes are available to maintain resilience for the component. If only one label is specified, ensure that enough nodes contain that label to distribute all of the pods for the component across separate nodes. Alternatively, you can specify multiple labels each relating to individual nodes.

**NOTE**

If monitoring components remain in a **Pending** state after configuring the `nodeSelector` constraint, check the pod logs for errors relating to taints and tolerations.

For example, to move monitoring components for user-defined projects to specific worker nodes labeled `nodename: worker1`, `nodename: worker2`, and `nodename: worker2`, use:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    prometheusOperator:
      nodeSelector:
        nodename: worker1
    prometheus:
      nodeSelector:
        nodename: worker1
    nodename: worker2
    thanosRuler:
      nodeSelector:
        nodename: worker1
        nodename: worker2
```

2. Save the file to apply the changes. The components affected by the new configuration are moved to the new nodes automatically.

**NOTE**

Configurations applied to the `user-workload-monitoring-config ConfigMap` object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.
WARNING

When changes are saved to a monitoring config map, the pods and other resources in the related project might be redeployed. The running monitoring processes in that project might also be restarted.

Additional resources

- See [Preparing to configure the monitoring stack](#) for steps to create monitoring config maps
- [Enabling monitoring for user-defined projects](#)
- [Understanding how to update labels on nodes](#)
- [Placing pods on specific nodes using node selectors](#)
- See the [Kubernetes documentation](#) for details on the nodeSelector constraint

2.7. ASSIGNING TOLERATIONS TO MONITORING COMPONENTS

You can assign tolerations to any of the monitoring stack components to enable moving them to tainted nodes.

Prerequisites

- If you are configuring core OpenShift Container Platform monitoring components
  - You have access to the cluster as a user with the `cluster-admin` role.
  - You have created the `cluster-monitoring-config` ConfigMap object.

- If you are configuring components that monitor user-defined projects
  - You have access to the cluster as a user with the `cluster-admin` role, or as a user with the `user-workload-monitoring-config-edit` role in the `openshift-user-workload-monitoring` project.
  - You have created the `user-workload-monitoring-config` ConfigMap object.

- You have installed the OpenShift CLI (`oc`).

Procedure

1. Edit the ConfigMap object:

   - To assign tolerations to a component that monitors core OpenShift Container Platform projects:
     a. Edit the `cluster-monitoring-config` ConfigMap object in the `openshift-monitoring` project:

     ```
     $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
     ```
b. Specify **tolerations** for the component:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    <component>:
      tolerations:
        <toleration_specification>
```

Substitute `<component>` and `<toleration_specification>` accordingly.

For example, `oc adm taint nodes node1 key1=value1:NoSchedule` adds a taint to `node1` with the key `key1` and the value `value1`. This prevents monitoring components from deploying pods on `node1` unless a toleration is configured for that taint. The following example configures the `alertmanagerMain` component to tolerate the example taint:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    alertmanagerMain:
      tolerations:
        - key: "key1"
          operator: "Equal"
          value: "value1"
          effect: "NoSchedule"
```

- **To assign tolerations to a component that monitors user-defined projects**
  
a. Edit the `user-workload-monitoring-config` ConfigMap object in the `openshift-user-workload-monitoring` project:

```bash
$ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
```

b. Specify **tolerations** for the component:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    <component>:
      tolerations:
        <toleration_specification>
```
Substitute `<component>` and `<toleration_specification>` accordingly.

For example, `oc adm taint nodes node1 key1=value1:NoSchedule` adds a taint to `node1` with the key `key1` and the value `value1`. This prevents monitoring components from deploying pods on `node1` unless a toleration is configured for that taint. The following example configures the `thanosRuler` component to tolerate the example taint:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    thanosRuler:
      tolerations:
      - key: "key1"
        operator: "Equal"
        value: "value1"
        effect: "NoSchedule"
```

2. Save the file to apply the changes. The new component placement configuration is applied automatically.

**NOTE**

Configurations applied to the `user-workload-monitoring-config ConfigMap` object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.

**WARNING**

When changes are saved to a monitoring config map, the pods and other resources in the related project might be redeployed. The running monitoring processes in that project might also be restarted.

Additional resources

- See Preparing to configure the monitoring stack for steps to create monitoring config maps
- Enabling monitoring for user-defined projects
- See the OpenShift Container Platform documentation on taints and tolerations
- See the Kubernetes documentation on taints and tolerations

**2.8. CONFIGURING PERSISTENT STORAGE**

Running cluster monitoring with persistent storage means that your metrics are stored to a persistent
volume (PV) and can survive a pod being restarted or recreated. This is ideal if you require your metrics or alerting data to be guarded from data loss. For production environments, it is highly recommended to configure persistent storage. Because of the high IO demands, it is advantageous to use local storage.

NOTE
See Recommended configurable storage technology.

2.8.1. Persistent storage prerequisites

- Dedicate sufficient local persistent storage to ensure that the disk does not become full. How much storage you need depends on the number of pods. For information on system requirements for persistent storage, see Prometheus database storage requirements.

- Make sure you have a persistent volume (PV) ready to be claimed by the persistent volume claim (PVC), one PV for each replica. Because Prometheus has two replicas and Alertmanager has three replicas, you need five PVs to support the entire monitoring stack. The PVs should be available from the Local Storage Operator. This does not apply if you enable dynamically provisioned storage.

- Use the block type of storage.

- Configure local persistent storage.

NOTE
If you use a local volume for persistent storage, do not use a raw block volume, which is described with volumeMode: block in the LocalVolume object. Prometheus cannot use raw block volumes.

2.8.2. Configuring a local persistent volume claim

For monitoring components to use a persistent volume (PV), you must configure a persistent volume claim (PVC).

Prerequisites

- If you are configuring core OpenShift Container Platform monitoring components
  - You have access to the cluster as a user with the cluster-admin role.
  - You have created the cluster-monitoring-config ConfigMap object.

- If you are configuring components that monitor user-defined projects
  - You have access to the cluster as a user with the cluster-admin role, or as a user with the user-workload-monitoring-config-edit role in the openshift-user-workload-monitoring project.
  - You have created the user-workload-monitoring-config ConfigMap object.

- You have installed the OpenShift CLI (oc).

Procedure
1. Edit the ConfigMap object:

   - To configure a PVC for a component that monitors core OpenShift Container Platform projects:
     a. Edit the `cluster-monitoring-config` ConfigMap object in the `openshift-monitoring` project:

       ```
       $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
       ```

     b. Add your PVC configuration for the component under `data/config.yaml`:

       ```yaml
       apiVersion: v1
       kind: ConfigMap
       metadata:
         name: cluster-monitoring-config
         namespace: openshift-monitoring
       data:
         config.yaml: |
         
         <component>:
           volumeClaimTemplate:
             spec:
               storageClassName: <storage_class>
               resources:
                 requests:
                   storage: <amount_of_storage>
       ```

       See the Kubernetes documentation on PersistentVolumeClaims for information on how to specify `volumeClaimTemplate`.

       The following example configures a PVC that claims local persistent storage for the Prometheus instance that monitors core OpenShift Container Platform components:

       ```yaml
       apiVersion: v1
       kind: ConfigMap
       metadata:
         name: cluster-monitoring-config
         namespace: openshift-monitoring
       data:
         config.yaml: |
         
         prometheusK8s:
           volumeClaimTemplate:
             spec:
               storageClassName: local-storage
               resources:
                 requests:
                   storage: 40Gi
       ```

       In the above example, the storage class created by the Local Storage Operator is called `local-storage`.

       The following example configures a PVC that claims local persistent storage for Alertmanager:

       ```yaml
       apiVersion: v1
       ```
To configure a PVC for a component that monitors user-defined projects:

a. Edit the user-workload-monitoring-config ConfigMap object in the openshift-user-workload-monitoring project:

```bash
$ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
```

b. Add your PVC configuration for the component under data/config.yaml:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    <component>:
      volumeClaimTemplate:
        spec:
          storageClassName: <storage_class>
          resources:
            requests:
              storage: <amount_of_storage>
```

See the Kubernetes documentation on PersistentVolumeClaims for information on how to specify volumeClaimTemplate.

The following example configures a PVC that claims local persistent storage for the Prometheus instance that monitors user-defined projects:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    prometheus:
      volumeClaimTemplate:
        spec:
```
In the above example, the storage class created by the Local Storage Operator is called **local-storage**.

The following example configures a PVC that claims local persistent storage for Thanos Ruler:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    thanosRuler:
      volumeClaimTemplate:
        spec:
          storageClassName: local-storage
          resources:
            requests:
              storage: 10Gi
```

**NOTE**

Storage requirements for the `thanosRuler` component depend on the number of rules that are evaluated and how many samples each rule generates.

2. Save the file to apply the changes. The pods affected by the new configuration are restarted automatically and the new storage configuration is applied.

**NOTE**

Configurations applied to the `user-workload-monitoring-config` ConfigMap object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.

**WARNING**

When changes are saved to a monitoring config map, the pods and other resources in the related project might be redeployed. The running monitoring processes in that project might also be restarted.

2.8.3. Modifying the retention time for Prometheus metrics data
By default, the OpenShift Container Platform monitoring stack configures the retention time for Prometheus data to be 15 days. You can modify the retention time to change how soon the data is deleted.

Prerequisites

- If you are configuring core OpenShift Container Platform monitoring components
  - You have access to the cluster as a user with the `cluster-admin` role.
  - You have created the `cluster-monitoring-config` ConfigMap object.

- If you are configuring components that monitor user-defined projects
  - You have access to the cluster as a user with the `cluster-admin` role, or as a user with the `user-workload-monitoring-config-edit` role in the `openshift-user-workload-monitoring` project.
  - You have created the `user-workload-monitoring-config` ConfigMap object.

- You have installed the OpenShift CLI (`oc`).

Procedure

1. Edit the `ConfigMap` object:

   - To modify the retention time for the Prometheus instance that monitors core OpenShift Container Platform projects:
     a. Edit the `cluster-monitoring-config` ConfigMap object in the `openshift-monitoring` project:

        ```bash
        $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
        ```

     b. Add your retention time configuration under `data/config.yaml`:

        ```yaml
        apiVersion: v1
        kind: ConfigMap
        metadata:
          name: cluster-monitoring-config
          namespace: openshift-monitoring
        data:
          config.yaml: |
            prometheusK8s:
              retention: <time_specification>
        ```

        Substitute `<time_specification>` with a number directly followed by `ms` (milliseconds), `s` (seconds), `m` (minutes), `h` (hours), `d` (days), `w` (weeks), or `y` (years).

        The following example sets the retention time to 24 hours for the Prometheus instance that monitors core OpenShift Container Platform components:

        ```yaml
        apiVersion: v1
        kind: ConfigMap
        metadata:
          name: cluster-monitoring-config
        ```
To modify the retention time for the Prometheus instance that monitors user-defined projects:

1. Edit the `user-workload-monitoring-config` ConfigMap object in the `openshift-user-workload-monitoring` project:

   ```bash
   $ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
   ```

2. Add your retention time configuration under `data/config.yaml`:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: user-workload-monitoring-config
     namespace: openshift-user-workload-monitoring
   data:
     config.yaml: |
       prometheus:
         retention: <time_specification>
   ```

   Substitute `<time_specification>` with a number directly followed by `ms` (milliseconds), `s` (seconds), `m` (minutes), `h` (hours), `d` (days), `w` (weeks), or `y` (years).

   The following example sets the retention time to 24 hours for the Prometheus instance that monitors user-defined projects:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: user-workload-monitoring-config
     namespace: openshift-user-workload-monitoring
   data:
     config.yaml: |
       prometheus:
         retention: 24h
   ```

2. Save the file to apply the changes. The pods affected by the new configuration are restarted automatically.

   **NOTE**

   Configurations applied to the `user-workload-monitoring-config` ConfigMap object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.
WARNING
When changes are saved to a monitoring config map, the pods and other resources in the related project might be redeployed. The running monitoring processes in that project might also be restarted.

Additional resources

- See [Preparing to configure the monitoring stack](#) for steps to create monitoring config maps.
- [Enabling monitoring for user-defined projects](#)
- [Understanding persistent storage](#)
- [Optimizing storage](#)

2.9. CONFIGURING REMOTE WRITE STORAGE

You can configure remote write storage to enable Prometheus to send ingested metrics to remote systems for long-term storage. Doing so has no impact on how or for how long Prometheus stores metrics.

Prerequisites

- **If you are configuring core OpenShift Container Platform monitoring components:**
  - You have access to the cluster as a user with the `cluster-admin` role.
  - You have created the `cluster-monitoring-config` ConfigMap object.

- **If you are configuring components that monitor user-defined projects:**
  - You have access to the cluster as a user with the `cluster-admin` role or as a user with the `user-workload-monitoring-config-edit` role in the `openshift-user-workload-monitoring` project.
  - You have created the `user-workload-monitoring-config` ConfigMap object.

- You have installed the OpenShift CLI (`oc`).

- You have set up a remote write compatible endpoint (such as Thanos) and know the endpoint URL. See the [Prometheus remote endpoints and storage documentation](#) for information about endpoints that are compatible with the remote write feature.

- You have set up authentication credentials for the remote write endpoint.

CAUTION

To reduce security risks, avoid sending metrics to an endpoint via unencrypted HTTP or without using authentication.
Procedure

1. Edit the `cluster-monitoring-config` ConfigMap object in the `openshift-monitoring` project:

   ```bash
   $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
   ```

2. Add a `remoteWrite` section under `data/config.yaml/prometheusK8s`.

3. Add an endpoint URL and authentication credentials in this section:

   ```json
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
     namespace: openshift-monitoring
   data:
     config.yaml: |
     prometheusK8s:
       remoteWrite:
         - url: "https://remote-write.endpoint"
           <endpoint_authentication_credentials>
   ```

For `endpoint_authentication_credentials` substitute the credentials for the endpoint. Currently supported authentication methods are basic authentication (`basicAuth`) and client TLS (`tlsConfig`) authentication.

- The following example configures basic authentication:

  ```json
  basicAuth:
    username: <usernameSecret>
    password: <passwordSecret>
  ```

Substitute `<usernameSecret>` and `<passwordSecret>` accordingly.

The following sample shows basic authentication configured with `remoteWriteAuth` for the `name` values and `user` and `password` for the `key` values. These values contain the endpoint authentication credentials:

```json
apiVersion: v1
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
  prometheusK8s:
    remoteWrite:
      - url: "https://remote-write.endpoint"
        remoteWriteAuth:
          basicAuth:
            username:
              name: remoteWriteAuth
            key: user
```
The following example configures client TLS authentication:

```yaml
password:
  name: remoteWriteAuth
  key: password
```

- The following sample shows a TLS authentication configuration using `selfsigned-mtls-bundle` for the `name` values and `ca.crt` for the `ca` key value, `client.crt` for the `cert` key value, and `client.key` for the `keySecret` key value:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    prometheusK8s:
      remoteWrite:
        - url: "https://remote-write.endpoint"
          tlsConfig:
            ca:
              secret:
                name: selfsigned-mtls-bundle
                key: ca.crt
            cert:
              secret:
                name: selfsigned-mtls-bundle
                key: client.crt
            keySecret:
              name: selfsigned-mtls-bundle
              key: client.key
```

4. Add write relabel configuration values after the authentication credentials:

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    prometheusK8s:
      remoteWrite:
```
For `<write_relabel_configs>` substitute a list of write relabel configurations for metrics that you want to send to the remote endpoint.

The following sample shows how to forward a single metric called `my_metric`:

```yaml
apiVersion: v1
class: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml:
    prometheusK8s:
      remoteWrite:
        - url: "https://remote-write.endpoint"
          writeRelabelConfigs:
            - sourceLabels: [__name__]
              regex: 'my_metric'
              action: keep

See the Prometheus relabel_config documentation for information about write relabel configuration options.

5. If required, configure remote write for the Prometheus instance that monitors user-defined projects by changing the `name` and `namespace metadata` values as follows:

```yaml
apiVersion: v1
class: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml:
    prometheus:
      remoteWrite:
        - url: "https://remote-write.endpoint"
          <endpoint_authentication_credentials>
          <write_relabel_configs>

NOTE

The Prometheus config map component is called `prometheusK8s` in the `cluster-monitoring-config ConfigMap` object and `prometheus` in the `user-workload-monitoring-config ConfigMap` object.

6. Save the file to apply the changes to the `ConfigMap` object. The pods affected by the new configuration restart automatically.
NOTE
Configurations applied to the user-workload-monitoring-config ConfigMap object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.

WARNING
Saving changes to a monitoring ConfigMap object might redeploy the pods and other resources in the related project. Saving changes might also restart the running monitoring processes in that project.

Additional resources

- See Setting up remote write compatible endpoints for steps to create a remote write compatible endpoint (such as Thanos).
- See Tuning remote write settings for information about how to optimize remote write settings for different use cases.
- For information about additional optional fields, please refer to the API documentation.

2.10. CONTROLLING THE IMPACT OF UNBOUND METRICS ATTRIBUTES IN USER-DEFINED PROJECTS

Developers can create labels to define attributes for metrics in the form of key-value pairs. The number of potential key-value pairs corresponds to the number of possible values for an attribute. An attribute that has an unlimited number of potential values is called an unbound attribute. For example, a customer_id attribute is unbound because it has an infinite number of possible values.

Every assigned key-value pair has a unique time series. The use of many unbound attributes in labels can result in an exponential increase in the number of time series created. This can impact Prometheus performance and can consume a lot of disk space.

Cluster administrators can use the following measures to control the impact of unbound metrics attributes in user-defined projects:

- Limit the number of samples that can be accepted per target scrape in user-defined projects
- Create alerts that fire when a scrape sample threshold is reached or when the target cannot be scraped

NOTE
Limiting scrape samples can help prevent the issues caused by adding many unbound attributes to labels. Developers can also prevent the underlying cause by limiting the number of unbound attributes that they define for metrics. Using attributes that are bound to a limited set of possible values reduces the number of potential key-value pair combinations.
2.10.1. Setting a scrape sample limit for user-defined projects

You can limit the number of samples that can be accepted per target scrape in user-defined projects.

**WARNING**

If you set a sample limit, no further sample data is ingested for that target scrape after the limit is reached.

**Prerequisites**

- You have access to the cluster as a user with the `cluster-admin` role, or as a user with the `user-workload-monitoring-config-edit` role in the `openshift-user-workload-monitoring` project.
- You have created the `user-workload-monitoring-config` ConfigMap object.
- You have installed the OpenShift CLI (`oc`).

**Procedure**

1. Edit the `user-workload-monitoring-config` ConfigMap object in the `openshift-user-workload-monitoring` project:

   ```bash
   $ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
   ```

2. Add the `enforcedSampleLimit` configuration to `data/config.yaml` to limit the number of samples that can be accepted per target scrape in user-defined projects:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: user-workload-monitoring-config
     namespace: openshift-user-workload-monitoring
   data:
     config.yaml:
       prometheus:
         enforcedSampleLimit: 50000
   ```

   A value is required if this parameter is specified. This `enforcedSampleLimit` example limits the number of samples that can be accepted per target scrape in user-defined projects to 50,000.

3. Save the file to apply the changes. The limit is applied automatically.

**NOTE**

Configurations applied to the `user-workload-monitoring-config` ConfigMap object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.
WARNING

When changes are saved to the user-workload-monitoring-config ConfigMap object, the pods and other resources in the openshift-user-workload-monitoring project might be redeployed. The running monitoring processes in that project might also be restarted.

2.10.2. Creating scrape sample alerts

You can create alerts that notify you when:

- The target cannot be scraped or is not available for the specified for duration
- A scrape sample threshold is reached or is exceeded for the specified for duration

Prerequisites

- You have access to the cluster as a user with the cluster-admin role, or as a user with the user-workload-monitoring-config-edit role in the openshift-user-workload-monitoring project.
- You have enabled monitoring for user-defined projects.
- You have created the user-workload-monitoring-config ConfigMap object.
- You have limited the number of samples that can be accepted per target scrape in user-defined projects, by using enforcedSampleLimit.
- You have installed the OpenShift CLI (oc).

Procedure

1. Create a YAML file with alerts that inform you when the targets are down and when the enforced sample limit is approaching. The file in this example is called monitoring-stack-alerts.yaml:

   ```yaml
   apiVersion: monitoring.coreos.com/v1
   kind: PrometheusRule
   metadata:
     labels:
       prometheus: k8s
       role: alert-rules
     name: monitoring-stack-alerts  
     namespace: ns1  
   spec:
     groups:
       - name: general.rules
         rules:
           - alert: TargetDown
             annotations:
               message: "{{ printf \"%.4g\" $value }}% of the {{ $labels.job }}/\{{ $labels.service \}} targets in {{ $labels.namespace \}} namespace are down."
   ```
1. Defines the name of the alerting rule.
2. Specifies the user-defined project where the alerting rule will be deployed.
3. The TargetDown alert will fire if the target cannot be scraped or is not available for the for duration.
4. The message that will be output when the TargetDown alert fires.
5. The conditions for the TargetDown alert must be true for this duration before the alert is fired.
6. Defines the severity for the TargetDown alert.
7. The ApproachingEnforcedSamplesLimit alert will fire when the defined scrape sample threshold is reached or exceeded for the specified for duration.
8. The message that will be output when the ApproachingEnforcedSamplesLimit alert fires.
9. The threshold for the ApproachingEnforcedSamplesLimit alert. In this example the alert will fire when the number of samples per target scrape has exceeded 80% of the enforced sample limit of 50000. The for duration must also have passed before the alert will fire. The $number$ in the expression scrape_samples_scraped/$number$ > $threshold$ must match the enforcedSampleLimit value defined in the user-workload-monitoring-config ConfigMap object.
10. The conditions for the ApproachingEnforcedSamplesLimit alert must be true for this duration before the alert is fired.
11. Defines the severity for the ApproachingEnforcedSamplesLimit alert.

2. Apply the configuration to the user-defined project:

```bash
$ oc apply -f monitoring-stack-alerts.yaml
```

Additional resources

- Creating a user-defined workload monitoring config map
- Enabling monitoring for user-defined projects

- See Determining why Prometheus is consuming a lot of disk space for steps to query which metrics have the highest number of scrape samples.
CHAPTER 3. CONFIGURING EXTERNAL ALERTMANAGER INSTANCES

The OpenShift Container Platform monitoring stack includes a local Alertmanager instance that routes alerts from Prometheus. You can add external Alertmanager instances by configuring the `cluster-monitoring-config` config map in either the `openshift-monitoring` project or the `user-workload-monitoring-config` project.

If you add the same external Alertmanager configuration for multiple clusters and disable the local instance for each cluster, you can then manage alert routing for multiple clusters by using a single external Alertmanager instance.

Prerequisites

- You have installed the OpenShift CLI (`oc`).
- If you are configuring core OpenShift Container Platform monitoring components in the `openshift-monitoring` project:
  - You have access to the cluster as a user with the `cluster-admin` role.
  - You have created the `cluster-monitoring-config` config map.
- If you are configuring components that monitor user-defined projects
  - You have access to the cluster as a user with the `cluster-admin` role, or as a user with the `user-workload-monitoring-config-edit` role in the `openshift-user-workload-monitoring` project.
  - You have created the `user-workload-monitoring-config` config map.

Procedure

1. Edit the ConfigMap object.
   - To configure additional Alertmanagers for routing alerts from core OpenShift Container Platform projects:
     a. Edit the `cluster-monitoring-config` config map in the `openshift-monitoring` project:
        
        ```bash
        $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
        ```
      b. Add an additionalAlertmanagerConfig section under `data/config.yaml/prometheusK8s`.
     c. Add the configuration details for additional Alertmanagers in this section:

        ```yaml
        apiVersion: v1
        kind: ConfigMap
        metadata:
          name: cluster-monitoring-config
          namespace: openshift-monitoring
        data:
          config.yaml: |
        ```
For `<alertmanager_specification>`, substitute authentication and other configuration details for additional Alertmanager instances. Currently supported authentication methods are bearer token (`bearerToken`) and client TLS (`tlsConfig`). The following sample config map configures an additional Alertmanager using a bearer token with client TLS authentication:

```yaml
apiVersion: v1
class: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    prometheusK8s:
      additionalAlertmanagerConfigs:
        - <alertmanager_specification>
```

To configure additional Alertmanager instances for routing alerts from user-defined projects:

a. Edit the `user-workload-monitoring-config` config map in the `openshift-user-workload-monitoring` project:

   ```bash
   $ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
   ```

b. Add a `<component>/additionalAlertmanagerConfigs:` section under `data/config.yaml`:

c. Add the configuration details for additional Alertmanagers in this section:

   ```yaml
   apiVersion: v1
   ```
For `<component>`, substitute one of two supported external Alertmanager components: `prometheus` or `thanosRuler`.

For `<alertmanager_specification>`, substitute authentication and other configuration details for additional Alertmanager instances. Currently supported authentication methods are bearer token (`bearerToken`) and client TLS (`tlsConfig`). The following sample config map configures an additional Alertmanager using Thanos Ruler with a bearer token and client TLS authentication:

```yaml
apiVersion: v1
class: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    thanosRuler:
      additionalAlertmanagerConfigs:
      - scheme: https
        pathPrefix: /
        timeout: "30s"
        apiVersion: v1
        bearerToken:
          name: alertmanager-bearer-token
          key: token
        tlsConfig:
          key:
            name: alertmanager-tls
            key: tls.key
        cert:
          name: alertmanager-tls
          key: tls.crt
        ca:
          name: alertmanager-tls
          key: tls.ca
      staticConfigs:
      - external-alertmanager1-remote.com
      - external-alertmanager1-remote2.com
```

**NOTE**

Configurations applied to the `user-workload-monitoring-config ConfigMap` object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.
2. Save the file to apply the changes to the ConfigMap object. The new component placement configuration is applied automatically.

### 3.1. ATTACHING ADDITIONAL LABELS TO YOUR TIME SERIES AND ALERTS

Using the external labels feature of Prometheus, you can attach custom labels to all time series and alerts leaving Prometheus.

**Prerequisites**

- **If you are configuring core OpenShift Container Platform monitoring components**
  - You have access to the cluster as a user with the `cluster-admin` role.
  - You have created the `cluster-monitoring-config` ConfigMap object.

- **If you are configuring components that monitor user-defined projects**
  - You have access to the cluster as a user with the `cluster-admin` role, or as a user with the `user-workload-monitoring-config-edit` role in the `openshift-user-workload-monitoring` project.
  - You have created the `user-workload-monitoring-config` ConfigMap object.

- You have installed the OpenShift CLI (`oc`).

**Procedure**

1. Edit the ConfigMap object:

   - **To attach custom labels to all time series and alerts leaving the Prometheus instance that monitors core OpenShift Container Platform projects:**
     a. Edit the `cluster-monitoring-config` ConfigMap object in the `openshift-monitoring` project:

        ```shell
        $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
        ```

     b. Define a map of labels you want to add for every metric under `data/config.yaml`:

        ```yaml
        apiVersion: v1
        kind: ConfigMap
        metadata:
          name: cluster-monitoring-config
          namespace: openshift-monitoring
        data:
          config.yaml:
            | prometheusK8s:
              | externalLabels:
              |   <key>: <value> 1
        ```

        1 Substitute `<key>: <value>` with a map of key-value pairs where `<key>` is a unique name for the new label and `<value>` is its value.
WARNING

Do not use prometheus or prometheus_replica as key names, because they are reserved and will be overwritten.

For example, to add metadata about the region and environment to all time series and alerts, use:

apiVersion: v1
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    prometheusK8s:
    externalLabels:
      region: eu
      environment: prod

- To attach custom labels to all time series and alerts leaving the Prometheus instance that monitors user-defined projects:
  a. Edit the user-workload-monitoring-config ConfigMap object in the openshift-user-workload-monitoring project:

     $ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config

  b. Define a map of labels you want to add for every metric under data/config.yaml:

     apiVersion: v1
     kind: ConfigMap
     metadata:
       name: user-workload-monitoring-config
       namespace: openshift-user-workload-monitoring
data:
      config.yaml: |
        prometheus:
        externalLabels:
          <key>: <value>  

1 Substitute <key>: <value> with a map of key-value pairs where <key> is a unique name for the new label and <value> is its value.
WARNING
Do not use prometheus or prometheus_replica as key names, because they are reserved and will be overwritten.

NOTE
In the openshift-user-workload-monitoring project, Prometheus handles metrics and Thanos Ruler handles alerting and recording rules. Setting externalLabels for prometheus in the user-workload-monitoring-config ConfigMap object will only configure external labels for metrics and not for any rules.

For example, to add metadata about the region and environment to all time series and alerts related to user-defined projects, use:

```yaml
apiVersion: v1
class: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    prometheus:
      externalLabels:
        region: eu
        environment: prod
```

2. Save the file to apply the changes. The new configuration is applied automatically.

NOTE
Configurations applied to the user-workload-monitoring-config ConfigMap object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.

WARNING
When changes are saved to a monitoring config map, the pods and other resources in the related project might be redeployed. The running monitoring processes in that project might also be restarted.

Additional resources
- See Preparing to configure the monitoring stack for steps to create monitoring config maps.
Enabling monitoring for user-defined projects

### 3.2. SETTING LOG LEVELS FOR MONITORING COMPONENTS

You can configure the log level for Alertmanager, Prometheus Operator, Prometheus, Thanos Querier, and Thanos Ruler.

The following log levels can be applied to the relevant component in the `cluster-monitoring-config` and `user-workload-monitoring-config` ConfigMap objects:

- **debug**: Log debug, informational, warning, and error messages.
- **info**: Log informational, warning, and error messages.
- **warn**: Log warning and error messages only.
- **error**: Log error messages only.

The default log level is **info**.

#### Prerequisites

- **If you are setting a log level for Alertmanager, Prometheus Operator, Prometheus, or Thanos Querier in the `openshift-monitoring` project:**
  - You have access to the cluster as a user with the `cluster-admin` role.
  - You have created the `cluster-monitoring-config` ConfigMap object.

- **If you are setting a log level for Prometheus Operator, Prometheus, or Thanos Ruler in the `openshift-user-workload-monitoring` project:**
  - You have access to the cluster as a user with the `cluster-admin` role, or as a user with the `user-workload-monitoring-config-edit` role in the `openshift-user-workload-monitoring` project.
  - You have created the `user-workload-monitoring-config` ConfigMap object.
  - You have installed the OpenShift CLI (`oc`).

#### Procedure

1. Edit the ConfigMap object:

   - **To set a log level for a component in the `openshift-monitoring` project:**
     
     a. Edit the `cluster-monitoring-config` ConfigMap object in the `openshift-monitoring` project:

        ```bash
        $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
        ```

     b. Add `logLevel: <log_level>` for a component under `data/config.yaml`:

        ```yaml
        apiVersion: v1
        kind: ConfigMap
        metadata:
        ```
To set a log level for a component in the `openShift-user-workload-monitoring` project:

a. Edit the `user-workload-monitoring-config` ConfigMap object in the `openShift-user-workload-monitoring` project:

   ```bash
   $ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
   
   ```

b. Add `logLevel: <log_level>` for a component under `data/config.yaml`:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: user-workload-monitoring-config
     namespace: openshift-user-workload-monitoring
   data:
     config.yaml: |
     <component>: 1
     logLevel: <log_level> 2
   
   ```

   1. The monitoring component that you are applying a log level to.
   2. The log level to apply to the component.

2. Save the file to apply the changes. The pods for the component restarts automatically when you apply the log-level change.

**NOTE**

Configurations applied to the `user-workload-monitoring-config` ConfigMap object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.
3. Confirm that the log-level has been applied by reviewing the deployment or pod configuration in the related project. The following example checks the log level in the `prometheus-operator` deployment in the `openshift-user-workload-monitoring` project:

```bash
$ oc -n openshift-user-workload-monitoring get deploy prometheus-operator -o yaml | grep "log-level"
```

**Example output**

```
- --log-level=debug
```

4. Check that the pods for the component are running. The following example lists the status of pods in the `openshift-user-workload-monitoring` project:

```bash
$ oc -n openshift-user-workload-monitoring get pods
```

**NOTE**

If an unrecognized `loglevel` value is included in the `ConfigMap` object, the pods for the component might not restart successfully.

### 3.3. ENABLING THE QUERY LOG FILE FOR PROMETHEUS

You can configure Prometheus to write all queries that have been run by the engine to a log file. You can do so for default platform monitoring and for user-defined workload monitoring.

**IMPORTANT**

Because log rotation is not supported, only enable this feature temporarily when you need to troubleshoot an issue. After you finish troubleshooting, disable query logging by reverting the changes you made to the `ConfigMap` object to enable the feature.

**Prerequisites**

- You have installed the OpenShift CLI (`oc`).
- If you are enabling the query log file feature for Prometheus in the `openshift-monitoring` project:
  - You have access to the cluster as a user with the `cluster-admin` role.
  - You have created the `cluster-monitoring-config` `ConfigMap` object.
• If you are enabling the query log file feature for Prometheus in the `openshift-user-workload-monitoring` project:
  - You have access to the cluster as a user with the `cluster-admin` role, or as a user with the `user-workload-monitoring-config-edit` role in the `openshift-user-workload-monitoring` project.
  - You have created the `user-workload-monitoring-config` ConfigMap object.

Procedure

• To set the query log file for Prometheus in the `openshift-monitoring` project:

  1. Edit the `cluster-monitoring-config` ConfigMap object in the `openshift-monitoring` project:

     ```bash
     $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
     ```

  2. Add `queryLogFile: <path>` for `prometheusK8s` under `data/config.yaml`:

     ```yaml
     apiVersion: v1
     kind: ConfigMap
     metadata:
       name: cluster-monitoring-config
       namespace: openshift-monitoring
     data:
       config.yaml:
         prometheusK8s:
           queryLogFile: <path>
     ```

     1 The full path to the file in which queries will be logged.

  3. Save the file to apply the changes.

     **WARNING**

     When you save changes to a monitoring config map, pods and other resources in the related project might be redeployed. The running monitoring processes in that project might also be restarted.

  4. Verify that the pods for the component are running. The following sample command lists the status of pods in the `openshift-monitoring` project:

     ```bash
     $ oc -n openshift-monitoring get pods
     ```

  5. Read the query log:

     ```bash
     $ oc -n openshift-monitoring exec prometheus-k8s-0 -- cat <path>
     ```
IMPORTANT

Revert the setting in the config map after you have examined the logged query information.

To set the query log file for Prometheus in the openshift-user-workload-monitoring project:

1. Edit the user-workload-monitoring-config ConfigMap object in the openshift-user-workload-monitoring project:

   $ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config

2. Add queryLogFile: <path> for prometheus under data/config.yaml:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: user-workload-monitoring-config
     namespace: openshift-user-workload-monitoring
   data:
     config.yaml: |
     prometheus:
       queryLogFile: <path> ①
   ```

   ① The full path to the file in which queries will be logged.

3. Save the file to apply the changes.

NOTE

Configurations applied to the user-workload-monitoring-config ConfigMap object are not activated unless a cluster administrator has enabled monitoring for user-defined projects.

WARNING

When you save changes to a monitoring config map, pods and other resources in the related project might be redeployed. The running monitoring processes in that project might also be restarted.

4. Verify that the pods for the component are running. The following example command lists the status of pods in the openshift-user-workload-monitoring project:

   $ oc -n openshift-user-workload-monitoring get pods

5. Read the query log:
IMPORTANT
Revert the setting in the config map after you have examined the logged query information.

Additional resources
- See Preparing to configure the monitoring stack for steps to create monitoring config maps
- See Enabling monitoring for user-defined projects for steps to enable user-defined monitoring.

3.4. ENABLING QUERY LOGGING FOR THANOS QUERIER

For default platform monitoring in the openshift-monitoring project, you can enable the Cluster Monitoring Operator to log all queries run by Thanos Querier.

IMPORTANT
Because log rotation is not supported, only enable this feature temporarily when you need to troubleshoot an issue. After you finish troubleshooting, disable query logging by reverting the changes you made to the ConfigMap object to enable the feature.

Prerequisites
- You have installed the OpenShift CLI (oc).
- You have access to the cluster as a user with the cluster-admin role.
- You have created the cluster-monitoring-config ConfigMap object.

Procedure
You can enable query logging for Thanos Querier in the openshift-monitoring project:

1. Edit the cluster-monitoring-config ConfigMap object in the openshift-monitoring project:

   $ oc -n openshift-monitoring edit configmap cluster-monitoring-config

2. Add a thanosQuerier section under data/config.yaml and add values as shown in the following example:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
     namespace: openshift-monitoring
   data:
     config.yaml: |
     thanosQuerier:
       enableRequestLogging: <value> ¹
       logLevel: <value> ²
   ```
1. Set the value to **true** to enable logging and **false** to disable logging. The default value is **false**.

2. Set the value to **debug**, **info**, **warn**, or **error**. If no value exists for **logLevel**, the log level defaults to **error**.

3. Save the file to apply the changes.

**WARNING**

When you save changes to a monitoring config map, pods and other resources in the related project might be redeployed. The running monitoring processes in that project might also be restarted.

**Verification**

1. Verify that the Thanos Querier pods are running. The following sample command lists the status of pods in the **openshift-monitoring** project:

   ```bash
   $ oc -n openshift-monitoring get pods
   ```

2. Run a test query using the following sample commands as a model:

   ```bash
   $ token=`oc sa get-token prometheus-k8s -n openshift-monitoring`
   ```

3. Run the following command to read the query log:

   ```bash
   $ oc -n openshift-monitoring logs <thanos_querier_pod_name> -c thanos-query
   ```

   **NOTE**

   Because the **thanos-querier** pods are highly available (HA) pods, you might be able to see logs in only one pod.

4. After you examine the logged query information, disable query logging by changing the **enableRequestLogging** value to **false** in the config map.

**Additional resources**

- See [Preparing to configure the monitoring stack](#) for steps to create monitoring config maps.
CHAPTER 4. SETTING AUDIT LOG LEVELS FOR THE PROMETHEUS ADAPTER

In default platform monitoring, you can configure the audit log level for the Prometheus Adapter.

Prerequisites

- You have installed the OpenShift CLI (`oc`).
- You have access to the cluster as a user with the `cluster-admin` role.
- You have created the `cluster-monitoring-config` ConfigMap object.

Procedure

You can set an audit log level for the Prometheus Adapter in the default `openshift-monitoring` project:

1. Edit the `cluster-monitoring-config` ConfigMap object in the `openshift-monitoring` project:

   ```bash
   $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
   ```

2. Add `profile:` in the `k8sPrometheusAdapter/audit` section under `data/config.yaml`:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
     namespace: openshift-monitoring
   data:
     config.yaml: |
       k8sPrometheusAdapter:
         audit:
           profile: <audit_log_level>  
   ```

   1. The audit log level to apply to the Prometheus Adapter.

3. Set the audit log level by using one of the following values for the `profile:` parameter:

   - **None**: Do not log events.
   - **Metadata**: Log only the metadata for the request, such as user, timestamp, and so forth. Do not log the request text and the response text. **Metadata** is the default audit log level.
   - **Request**: Log only the metadata and the request text but not the response text. This option does not apply for non-resource requests.
   - **RequestResponse**: Log event metadata, request text, and response text. This option does not apply for non-resource requests.

4. Save the file to apply the changes. The pods for the Prometheus Adapter restart automatically when you apply the change.
Verication

1. In the config map, under `k8sPrometheusAdapter/audit/profile`, set the log level to `Request` and save the file.

2. Confirm that the pods for the Prometheus Adapter are running. The following example lists the status of pods in the `openshift-monitoring` project:

   ```bash
   $ oc -n openshift-monitoring get pods
   ```

3. Confirm that the audit log level and audit log file path are correctly configured:

   ```bash
   $ oc -n openshift-monitoring get deploy prometheus-adapter -o yaml
   ```

   **Example output**

   ```yaml
   ...
   - --audit-policy-file=/etc/audit/request-profile.yaml
   - --audit-log-path=/var/log/adapter/audit.log
   ```

4. Confirm that the correct log level has been applied in the `prometheus-adapter` deployment in the `openshift-monitoring` project:

   ```bash
   $ oc -n openshift-monitoring exec deploy/prometheus-adapter -c prometheus-adapter -- cat /etc/audit/request-profile.yaml
   ```

   **Example output**

   ```yaml
   "apiVersion": "audit.k8s.io/v1"
   "kind": "Policy"
   "metadata":
     "name": "Request"
   "omitStages":
     - "RequestReceived"
   "rules":
     - "level": "Request"
   ```

**NOTE**

If you enter an unrecognized `profile` value for the Prometheus Adapter in the `ConfigMap` object, no changes are made to the Prometheus Adapter, and an error is logged by the Cluster Monitoring Operator.
5. Review the audit log for the Prometheus Adapter:

```bash
$ oc -n openshift-monitoring exec -c <prometheus_adapter_pod_name> -- cat /var/log/adapter/audit.log
```

**Additional resources**

- See [Preparing to configure the monitoring stack](#) for steps to create monitoring config maps.

### 4.1. DISABLING THE DEFAULT GRAFANA DEPLOYMENT

By default, a read-only Grafana instance is deployed with a collection of dashboards displaying cluster metrics. The Grafana instance is not user-configurable.

You can disable the Grafana deployment, causing the associated resources to be deleted from the cluster. You might do this if you do not need these dashboards and want to conserve resources in your cluster. You will still be able to view metrics and dashboards included in the web console. Grafana can be safely enabled again at any time.

**Prerequisites**

- You have access to the cluster as a user with the `cluster-admin` role.
- You have created the `cluster-monitoring-config` ConfigMap object.
- You have installed the OpenShift CLI (`oc`).

**Procedure**

1. Edit the `cluster-monitoring-config` ConfigMap object in the `openshift-monitoring` project:

   ```bash
   $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
   ```

2. Add `enabled: false` for the `grafana` component under `data/config.yaml`:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
     namespace: openshift-monitoring
   data:
     config.yaml: |
     grafana:
       enabled: false
   ```

3. Save the file to apply the changes. The resources will begin to be removed automatically when you apply the change.
4. Check that the Grafana pod is no longer running. The following example lists the status of pods in the openshift-monitoring project:

```bash
$ oc -n openshift-monitoring get pods
```

**NOTE**

It may take a few minutes after applying the change for these pods to terminate.

Additional resources

- See Preparing to configure the monitoring stack for steps to create monitoring config maps.

### 4.2. DISABLING THE LOCAL ALERTMANAGER

A local Alertmanager that routes alerts from Prometheus instances is enabled by default in the openshift-monitoring project of the OpenShift Container Platform monitoring stack.

If you do not need the local Alertmanager, you can disable it by configuring the `cluster-monitoring-config` config map in the openshift-monitoring project.

**Prerequisites**

- You have access to the cluster as a user with the `cluster-admin` role.
- You have created the `cluster-monitoring-config` config map.
- You have installed the OpenShift CLI (`oc`).

**Procedure**

1. Edit the `cluster-monitoring-config` config map in the openshift-monitoring project:

   ```bash
   $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
   ```

2. Add `enabled: false` for the `alertmanagerMain` component under `data/config.yaml`:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
   namespace: openshift-monitoring
   ```
3. Save the file to apply the changes. The Alertmanager instance is disabled automatically when you apply the change.

Additional resources

- Prometheus Alertmanager documentation
- Managing alerts

4.3. NEXT STEPS

- Enabling monitoring for user-defined projects
- Learn about remote health reporting and, if necessary, opt out of it.
CHAPTER 5. ENABLING MONITORING FOR USER-DEFINED PROJECTS

In OpenShift Container Platform 4.10, you can enable monitoring for user-defined projects in addition to the default platform monitoring. You can monitor your own projects in OpenShift Container Platform without the need for an additional monitoring solution. Using this feature centralizes monitoring for core platform components and user-defined projects.

NOTE

Custom Prometheus instances and the Prometheus Operator installed through Operator Lifecycle Manager (OLM) can cause issues with user-defined workload monitoring if it is enabled. Custom Prometheus instances are not supported in OpenShift Container Platform.

5.1. ENABLING MONITORING FOR USER-DEFINED PROJECTS

Cluster administrators can enable monitoring for user-defined projects by setting the `enableUserWorkload: true` field in the cluster monitoring `ConfigMap` object.

IMPORTANT

In OpenShift Container Platform 4.10 you must remove any custom Prometheus instances before enabling monitoring for user-defined projects.

NOTE

You must have access to the cluster as a user with the `cluster-admin` role to enable monitoring for user-defined projects in OpenShift Container Platform. Cluster administrators can then optionally grant users permission to configure the components that are responsible for monitoring user-defined projects.

Prerequisites

- You have access to the cluster as a user with the `cluster-admin` role.
- You have installed the OpenShift CLI (`oc`).
- You have created the `cluster-monitoring-config ConfigMap` object.
- You have optionally created and configured the `user-workload-monitoring-config ConfigMap` object in the `openshift-user-workload-monitoring` project. You can add configuration options to this `ConfigMap` object for the components that monitor user-defined projects.

NOTE

Every time you save configuration changes to the `user-workload-monitoring-config ConfigMap` object, the pods in the `openshift-user-workload-monitoring` project are redeployed. It can sometimes take a while for these components to redeploy. You can create and configure the `ConfigMap` object before you first enable monitoring for user-defined projects, to prevent having to redeploy the pods often.
Procedure

1. Edit the `cluster-monitoring-config` ConfigMap object:

   ```
   $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
   ```

2. Add `enableUserWorkload: true` under `data/config.yaml`:

   ```
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
     namespace: openshift-monitoring
   data:
     config.yaml:
       enableUserWorkload: true
   ```

   When set to `true`, the `enableUserWorkload` parameter enables monitoring for user-defined projects in a cluster.

3. Save the file to apply the changes. Monitoring for user-defined projects is then enabled automatically.

   ![WARNING]
   
   When changes are saved to the `cluster-monitoring-config` ConfigMap object, the pods and other resources in the `openshift-monitoring` project might be redeployed. The running monitoring processes in that project might also be restarted.

4. Check that the `prometheus-operator`, `prometheus-user-workload` and `thanos-ruler-user-workload` pods are running in the `openshift-user-workload-monitoring` project. It might take a short while for the pods to start:

   ```
   $ oc -n openshift-user-workload-monitoring get pod
   ```

   **Example output**

<table>
<thead>
<tr>
<th>NAME</th>
<th>READY</th>
<th>STATUS</th>
<th>RESTARTS</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>prometheus-operator-6f7b748d5b-t7nbg</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>3h</td>
</tr>
<tr>
<td>prometheus-user-workload-0</td>
<td>4/4</td>
<td>Running</td>
<td>1</td>
<td>3h</td>
</tr>
<tr>
<td>prometheus-user-workload-1</td>
<td>4/4</td>
<td>Running</td>
<td>1</td>
<td>3h</td>
</tr>
<tr>
<td>thanos-ruler-user-workload-0</td>
<td>3/3</td>
<td>Running</td>
<td>0</td>
<td>3h</td>
</tr>
<tr>
<td>thanos-ruler-user-workload-1</td>
<td>3/3</td>
<td>Running</td>
<td>0</td>
<td>3h</td>
</tr>
</tbody>
</table>

**Additional resources**

- [Creating a cluster monitoring config map](#)
5.2. GRANTING USERS PERMISSION TO MONITOR USER-DEFINED PROJECTS

Cluster administrators can monitor all core OpenShift Container Platform and user-defined projects.

Cluster administrators can grant developers and other users permission to monitor their own projects. Privileges are granted by assigning one of the following monitoring roles:

- The `monitoring-rules-view` role provides read access to `[PrometheusRule]` custom resources for a project.
- The `monitoring-rules-edit` role grants a user permission to create, modify, and deleting `[PrometheusRule]` custom resources for a project.
- The `monitoring-edit` role grants the same privileges as the `monitoring-rules-edit` role. Additionally, it enables a user to create new scrape targets for services or pods. With this role, you can also create, modify, and delete `[ServiceMonitor]` and `[PodMonitor]` resources.

You can also grant users permission to configure the components that are responsible for monitoring user-defined projects:

- The `user-workload-monitoring-config-edit` role in the `[openshift-user-workload-monitoring]` project enables you to edit the `user-workload-monitoring-config` `ConfigMap` object. With this role, you can edit the `ConfigMap` object to configure Prometheus, Prometheus Operator, and Thanos Ruler for user-defined workload monitoring.

You can also grant users permission to configure alert routing for user-defined projects:

- The `alert-routing-edit` role grants a user permission to create, update, and delete `[AlertmanagerConfig]` custom resources for a project.

This section provides details on how to assign these roles by using the OpenShift Container Platform web console or the CLI.

5.2.1. Granting user permissions by using the web console

You can grant users permissions to monitor their own projects, by using the OpenShift Container Platform web console.

**Prerequisites**

- You have access to the cluster as a user with the `cluster-admin` role.
- The user account that you are assigning the role to already exists.

**Procedure**

1. In the Administrator perspective within the OpenShift Container Platform web console, navigate to User Management → Role Bindings → Create Binding.
2. In the Binding Type section, select the "Namespace Role Binding" type.
3. In the **Name** field, enter a name for the role binding.

4. In the **Namespace** field, select the user-defined project where you want to grant the access.

   **IMPORTANT**

   The monitoring role will be bound to the project that you apply in the **Namespace** field. The permissions that you grant to a user by using this procedure will apply only to the selected project.

5. Select *monitoring-rules-view*, *monitoring-rules-edit*, or *monitoring-edit* in the **Role Name** list.

6. In the **Subject** section, select *User*.

7. In the **Subject Name** field, enter the name of the user.

8. Select *Create* to apply the role binding.

### 5.2.2. Granting user permissions by using the CLI

You can grant users permissions to monitor their own projects, by using the OpenShift CLI (*oc*).

**Prerequisites**

- You have access to the cluster as a user with the *cluster-admin* role.
- The user account that you are assigning the role to already exists.
- You have installed the OpenShift CLI (*oc*).

**Procedure**

- Assign a monitoring role to a user for a project:

  ```bash
  $ oc policy add-role-to-user <role> <user> -n <namespace>
  ```

  |<sup>1</sup> | Substitute `<role>` with *monitoring-rules-view*, *monitoring-rules-edit*, or *monitoring-edit*.

  **IMPORTANT**

  Whichever role you choose, you must bind it against a specific project as a cluster administrator.

  As an example, substitute `<role>` with *monitoring-edit*, `<user>` with *johnsmith*, and `<namespace>` with *ns1*. This assigns the user *johnsmith* permission to set up metrics collection and to create alerting rules in the *ns1* namespace.

### 5.3. GRANTING USERS PERMISSION TO CONFIGURE MONITORING FOR USER-DEFINED PROJECTS
You can grant users permission to configure monitoring for user-defined projects.

**Prerequisites**

- You have access to the cluster as a user with the `cluster-admin` role.
- The user account that you are assigning the role to already exists.
- You have installed the OpenShift CLI (`oc`).

**Procedure**

- Assign the `user-workload-monitoring-config-edit` role to a user in the `openshift-user-workload-monitoring` project:

  ```bash
  $ oc -n openshift-user-workload-monitoring adm policy add-role-to-user \n  user-workload-monitoring-config-edit <user> \n  --role-namespace openshift-user-workload-monitoring
  
  $ SECRET=`oc get secret -n openshift-user-workload-monitoring | grep prometheus-user-workload-token | head -n 1 | awk '{print $1 }'`
  
  $ TOKEN=`echo $(oc get secret $SECRET -n openshift-user-workload-monitoring -o json | jq -r '.data.token') | base64 -d`
  
  $ THANOS_QUERIER_HOST=`oc get route thanos-querier -n openshift-monitoring -o json | jq -r '.spec.host'`
  
  $ NAMESPACE=ns1
  
```

5.4. ACCESSING METRICS FROM OUTSIDE THE CLUSTER FOR CUSTOM APPLICATIONS

Learn how to query Prometheus statistics from the command line when monitoring your own services. You can access monitoring data from outside the cluster with the `thanos-querier` route.

**Prerequisites**

- You deployed your own service, following the *Enabling monitoring for user-defined projects* procedure.

**Procedure**

1. Extract a token to connect to Prometheus:

   ```bash
   $ SECRET=`oc get secret -n openshift-user-workload-monitoring | grep prometheus-user-workload-token | head -n 1 | awk '{print $1 }'`
   
   $ TOKEN=`echo $(oc get secret $SECRET -n openshift-user-workload-monitoring -o json | jq -r '.data.token') | base64 -d`
   
   $ THANOS_QUERIER_HOST=`oc get route thanos-querier -n openshift-monitoring -o json | jq -r '.spec.host'`
   
   $ NAMESPACE=ns1
   
```
The output will show you the duration that your application pods have been up.

Example output

```
{
"status":"success","data":{
"resultType":"vector","result" : {
"metric" : {
"__name__" : "up","endpoint" : "web","instance" : "10.129.0.46:8080","job" : "prometheus-example-app","namespace" : "ns1","pod" : "prometheus-example-app-68d47c4fb6-jzt2","service" : "prometheus-example-app"},"value" : [1591881154.748,"1"]},
```

5.5. EXCLUDING A USER-DEFINED PROJECT FROM MONITORING

Individual user-defined projects can be excluded from user workload monitoring. To do so, simply add the `openshift.io/user-monitoring` label to the project’s namespace with a value of `false`.

Procedure

1. Add the label to the project namespace:

   ```
   $ oc label namespace my-project 'openshift.io/user-monitoring=false'
   ```

2. To re-enable monitoring, remove the label from the namespace:

   ```
   $ oc label namespace my-project 'openshift.io/user-monitoring='
   ```

   **NOTE**

   If there were any active monitoring targets for the project, it may take a few minutes for Prometheus to stop scraping them after adding the label.

5.6. DISABLING MONITORING FOR USER-DEFINED PROJECTS

After enabling monitoring for user-defined projects, you can disable it again by setting `enableUserWorkload: false` in the cluster monitoring ConfigMap object.

**NOTE**

Alternatively, you can remove `enableUserWorkload: true` to disable monitoring for user-defined projects.

Procedure

1. Edit the `cluster-monitoring-config` ConfigMap object:

   ```
   $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
   ```

   a. Set `enableUserWorkload: false` under `data/config.yaml`:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
   namespace: openshift-monitoring
   ```
2. Save the file to apply the changes. Monitoring for user-defined projects is then disabled automatically.

3. Check that the `prometheus-operator`, `prometheus-user-workload` and `thanos-ruler-user-workload` pods are terminated in the `openshift-user-workload-monitoring` project. This might take a short while:

```
$ oc -n openshift-user-workload-monitoring get pod
```

**Example output**

No resources found in openshift-user-workload-monitoring project.

**NOTE**

The `user-workload-monitoring-config ConfigMap` object in the `openshift-user-workload-monitoring` project is not automatically deleted when monitoring for user-defined projects is disabled. This is to preserve any custom configurations that you may have created in the `ConfigMap` object.

### 5.7. NEXT STEPS

- Enabling alert routing for user defined projects
CHAPTER 6. ENABLING ALERT ROUTING FOR USER-DEFINED PROJECTS

IMPORTANT

Alert routing for user-defined projects is a Technology Preview feature only. Technology Preview features are not supported with Red Hat production service level agreements (SLAs) and might not be functionally complete. Red Hat does not recommend using them in production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

For more information about the support scope of Red Hat Technology Preview features, see https://access.redhat.com/support/offerings/techpreview/.

In OpenShift Container Platform 4.10, a cluster administrator can enable alert routing for user-defined projects.

6.1. UNDERSTANDING ALERT ROUTING FOR USER-DEFINED PROJECTS

As a cluster administrator, you can enable alert routing for user-defined projects. After doing so, you can allow users to configure alert routing for their user-defined projects. Users can then create and configure user-defined alert routing by creating or editing the AlertmanagerConfig objects.

After a user has defined alert routing for a user-defined project, user-defined alerts are routed to the alertmanager-main pods in the openshift-monitoring namespace.

Note the following limitations and features of alert routing for user-defined projects:

- For user-defined alerting rules, user-defined routing is scoped to the namespace in which the resource is defined. For example, a routing configuration in namespace ns1 only applies to PrometheusRules resources in the same namespace.

- The Cluster Monitoring Operator (CMO) does not deploy a second Alertmanager service dedicated to user-defined alerts. Cluster administrators continue to define the main Alertmanager configuration by using a custom secret or the OpenShift Container Platform web console.

- When a namespace is excluded from user-defined monitoring, AlertmanagerConfig resources in the namespace cease to be part of the Alertmanager configuration.

6.2. ENABLING ALERT ROUTING FOR USER-DEFINED PROJECTS

You can enable alert routing for user-defined projects. By doing so, you enable users with the alert-routing-edit role to configure alert routing and receivers for user-defined projects in Alertmanager.

Prerequisites

- You have enabled monitoring for user-defined projects.

- You have access to the cluster as a user with the cluster-admin role.
You have installed the OpenShift CLI (oc).

### Procedure

1. Edit the `cluster-monitoring-config` ConfigMap object:
   ```bash
   $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
   ```

2. Add `enableUserAlertmanagerConfig: true` under the `alertmanagerMain` key in `data/config.yaml`:
   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
     namespace: openshift-monitoring
   data:
     config.yaml: |
       enableUserWorkload: true
       alertmanagerMain:
         enableUserAlertmanagerConfig: true
   ``

   When set to `true`, the `enableUserAlertmanagerConfig` parameter enables alert routing for user-defined projects in a cluster.

3. Save the file to apply the changes. Alert routing for user-defined projects is enabled automatically.

### 6.3. Granting Users Permission to Configure Alert Routing for User-Defined Projects

You can grant users permission to configure alert routing for user-defined projects.

#### Prerequisites

- You have access to the cluster as a user with the `cluster-admin` role.
- The user account that you are assigning the role to already exists.
- You have installed the OpenShift CLI (oc).
- You have enabled monitoring for user-defined projects.

#### Procedure

- Assign the `alert-routing-edit` role to a user in the user-defined project:
  ```bash
  $ oc -n <namespace> adm policy add-role-to-user alert-routing-edit <user>
  ```

  For `<namespace>`, substitute the namespace for the user-defined project, such as `ns1`. For `<user>`, substitute the username for the account to which you want to assign the role.
6.4. DISABLING ALERT ROUTING FOR USER-DEFINED PROJECTS

If you have enabled alert routing for user-defined projects, you can disable it. By doing so, you prevent users with the `alert-routing-edit` role from configuring alert routing for user-defined projects in Alertmanager.

**NOTE**

Alert routing for user-defined projects is disabled by default. You do not need to disable it if the feature is not already enabled.

**Prerequisites**

- You have enabled monitoring for user-defined projects.
- You have enabled alert routing for user-defined projects.
- You have access to the cluster as a user with the `cluster-admin` role.
- You have installed the OpenShift CLI (`oc`).

**Procedure**

1. Edit the `cluster-monitoring-config ConfigMap` object:

   ```bash
   $ oc -n openshift-monitoring edit configmap cluster-monitoring-config
   ```

2. Change the value to `false` for `enableUserAlertmanagerConfig` under the `alertmanagerMain` key in `data/config.yaml`:

   ```yaml
   apiVersion: v1
   kind: ConfigMap
   metadata:
     name: cluster-monitoring-config
     namespace: openshift-monitoring
   data:
     config.yaml: |
     enableUserWorkload: true
     alertmanagerMain:
       enableUserAlertmanagerConfig: false
   ```

   ![1](image)

   When set to `false`, the `enableUserAlertmanagerConfig` parameter disables alert routing for user-defined projects in a cluster.

3. Save the file to apply the changes. Alert routing for user-defined projects is disabled automatically.

**Additional resources**

- Enabling monitoring for user defined projects
- Managing alerts
6.5. NEXT STEPS

- Creating alert routing for user defined projects
CHAPTER 7. MANAGING METRICS

You can collect metrics to monitor how cluster components and your own workloads are performing.

7.1. UNDERSTANDING METRICS

In OpenShift Container Platform 4.10, cluster components are monitored by scraping metrics exposed through service endpoints. You can also configure metrics collection for user-defined projects.

You can define the metrics that you want to provide for your own workloads by using Prometheus client libraries at the application level.

In OpenShift Container Platform, metrics are exposed through an HTTP service endpoint under the /metrics canonical name. You can list all available metrics for a service by running a `curl` query against `http://<endpoint>/metrics`. For instance, you can expose a route to the `prometheus-example-app` example service and then run the following to view all of its available metrics:

```bash
$ curl http://<example_app_endpoint>/metrics
```

Example output

```bash
# HELP http_requests_total Count of all HTTP requests
# TYPE http_requests_total counter
http_requests_total{code="200",method="get"} 4
http_requests_total{code="404",method="get"} 2
# HELP version Version information about this binary
# TYPE version gauge
version{version="v0.1.0"} 1
```

Additional resources

- See the Prometheus documentation for details on Prometheus client libraries.

7.2. SETTING UP METRICS COLLECTION FOR USER-DEFINED PROJECTS

You can create a ServiceMonitor resource to scrape metrics from a service endpoint in a user-defined project. This assumes that your application uses a Prometheus client library to expose metrics to the /metrics canonical name.

This section describes how to deploy a sample service in a user-defined project and then create a ServiceMonitor resource that defines how that service should be monitored.

7.2.1. Deploying a sample service

To test monitoring of a service in a user-defined project, you can deploy a sample service.

Procedure

1. Create a YAML file for the service configuration. In this example, it is called `prometheus-example-app.yaml`.
2. Add the following deployment and service configuration details to the file:

```yaml
apiVersion: v1
kind: Namespace
metadata:
  name: ns1
---
apiversion: apps/v1
kind: Deployment
metadata:
  labels:
    app: prometheus-example-app
name: prometheus-example-app
namespace: ns1
spec:
  replicas: 1
selector:
  matchLabels:
    app: prometheus-example-app
template:
  metadata:
    labels:
      app: prometheus-example-app
spec:
  containers:
    - image: ghcr.io/rhobs/prometheus-example-app:0.4.0
      imagePullPolicy: IfNotPresent
      name: prometheus-example-app
---
apiversion: v1
kind: Service
metadata:
  labels:
    app: prometheus-example-app
name: prometheus-example-app
namespace: ns1
spec:
  ports:
    - port: 8080
      protocol: TCP
      targetPort: 8080
      name: web
      selector:
        app: prometheus-example-app
type: ClusterIP
```

This configuration deploys a service named `prometheus-example-app` in the user-defined `ns1` project. This service exposes the custom `version` metric.

3. Apply the configuration to the cluster:

   ```bash
   $ oc apply -f prometheus-example-app.yaml
   
   It takes some time to deploy the service.
   
4. You can check that the pod is running:
To use the metrics exposed by your service, you must configure OpenShift Container Platform monitoring to scrape metrics from the /metrics endpoint. You can do this using a `ServiceMonitor` custom resource definition (CRD) that specifies how a service should be monitored, or a `PodMonitor` CRD that specifies how a pod should be monitored. The former requires a `Service` object, while the latter does not, allowing Prometheus to directly scrape metrics from the metrics endpoint exposed by a pod.

This procedure shows you how to create a `ServiceMonitor` resource for a service in a user-defined project.

**Prerequisites**

- You have access to the cluster as a user with the `cluster-admin` role or the `monitoring-edit` role.
- You have enabled monitoring for user-defined projects.
- For this example, you have deployed the `prometheus-example-app` sample service in the `ns1` project.

**NOTE**

The `prometheus-example-app` sample service does not support TLS authentication.

**Procedure**

1. Create a YAML file for the `ServiceMonitor` resource configuration. In this example, the file is called `example-app-service-monitor.yaml`.

2. Add the following `ServiceMonitor` resource configuration details:

```yaml
apiVersion: monitoring.coreos.com/v1
kind: ServiceMonitor
metadata:
  labels:
    k8s-app: prometheus-example-monitor
spec:
  endpoints:
    - interval: 30s
      port: web
      scheme: http
```

Example output

```
NAME                                      READY     STATUS    RESTARTS   AGE
prometheus-example-app-7857545cb7-sbgwq   1/1       Running   0          81m
```
This defines a `ServiceMonitor` resource that scrapes the metrics exposed by the `prometheus-example-app` sample service, which includes the `version` metric.

**NOTE**

A `ServiceMonitor` resource in a user-defined namespace can only discover services in the same namespace. That is, the `namespaceSelector` field of the `ServiceMonitor` resource is always ignored.

3. Apply the configuration to the cluster:

   ```bash
   $ oc apply -f example-app-service-monitor.yaml
   ```

   It takes some time to deploy the `ServiceMonitor` resource.

4. You can check that the `ServiceMonitor` resource is running:

   ```bash
   $ oc -n ns1 get servicemonitor
   ```

   **Example output**

   ```
   NAME                         AGE
   prometheus-example-monitor   81m
   ```

**Additional resources**

- Enabling monitoring for user-defined projects
- How to scrape metrics using TLS in a `ServiceMonitor` configuration in a user-defined project
- PodMonitor API
- ServiceMonitor API

### 7.3. QUERYING METRICS

The OpenShift Container Platform monitoring dashboard enables you to run Prometheus Query Language (PromQL) queries to examine metrics visualized on a plot. This functionality provides information about the state of a cluster and any user-defined workloads that you are monitoring.

As a **cluster administrator**, you can query metrics for all core OpenShift Container Platform and user-defined projects.

As a **developer**, you must specify a project name when querying metrics. You must have the required privileges to view metrics for the selected project.

#### 7.3.1. Querying metrics for all projects as a cluster administrator
As a cluster administrator or as a user with view permissions for all projects, you can access metrics for all
default OpenShift Container Platform and user-defined projects in the Metrics UI.

**NOTE**

Only cluster administrators have access to the third-party UIs provided with OpenShift
Container Platform Monitoring.

**Prerequisites**

- You have access to the cluster as a user with the **cluster-admin** role or with view permissions
  for all projects.
- You have installed the OpenShift CLI (**oc**).

**Procedure**

1. In the **Administrator** perspective within the OpenShift Container Platform web console, select
   **Observe → Metrics**.
2. Select **Insert Metric at Cursor** to view a list of predefined queries.
3. To create a custom query, add your Prometheus Query Language (PromQL) query to the
   **Expression** field.
4. To add multiple queries, select **Add Query**.
5. To delete a query, select **next to the query, then choose Delete query**.
6. To disable a query from being run, select **next to the query and choose Disable query**.
7. Select **Run Queries** to run the queries that you have created. The metrics from the queries are
   visualized on the plot. If a query is invalid, the UI shows an error message.

**NOTE**

Queries that operate on large amounts of data might time out or overload the
browser when drawing time series graphs. To avoid this, select **Hide graph** and
 calibrate your query using only the metrics table. Then, after finding a feasible
query, enable the plot to draw the graphs.

8. Optional: The page URL now contains the queries you ran. To use this set of queries again in the
   future, save this URL.

**Additional resources**

- See the [Prometheus query documentation](#) for more information about creating PromQL
  queries.

7.3.2. Querying metrics for user-defined projects as a developer
You can access metrics for a user-defined project as a developer or as a user with view permissions for the project.

In the Developer perspective, the Metrics UI includes some predefined CPU, memory, bandwidth, and network packet queries for the selected project. You can also run custom Prometheus Query Language (PromQL) queries for CPU, memory, bandwidth, network packet and application metrics for the project.

**NOTE**

Developers can only use the Developer perspective and not the Administrator perspective. As a developer, you can only query metrics for one project at a time. Developers cannot access the third-party UIs provided with OpenShift Container Platform monitoring that are for core platform components. Instead, use the Metrics UI for your user-defined project.

**Prerequisites**

- You have access to the cluster as a developer or as a user with view permissions for the project that you are viewing metrics for.
- You have enabled monitoring for user-defined projects.
- You have deployed a service in a user-defined project.
- You have created a ServiceMonitor custom resource definition (CRD) for the service to define how the service is monitored.

**Procedure**

1. From the Developer perspective in the OpenShift Container Platform web console, select Observe → Metrics.
2. Select the project that you want to view metrics for in the Project: list.
3. Choose a query from the Select Query list, or run a custom PromQL query by selecting Show PromQL.

**NOTE**

In the Developer perspective, you can only run one query at a time.

**Additional resources**

- See the Prometheus query documentation for more information about creating PromQL queries.

**Additional resources**

- See the Querying metrics for user-defined projects as a developer for details on accessing non-cluster metrics as a developer or a privileged user

**7.3.3. Exploring the visualized metrics**
After running the queries, the metrics are displayed on an interactive plot. The X-axis in the plot represents time and the Y-axis represents metrics values. Each metric is shown as a colored line on the graph. You can manipulate the plot interactively and explore the metrics.

Procedure

In the Administrator perspective:

1. Initially, all metrics from all enabled queries are shown on the plot. You can select which metrics are shown.

   NOTE

   By default, the query table shows an expanded view that lists every metric and its current value. You can select «» to minimize the expanded view for a query.

   - To hide all metrics from a query, click for the query and click Hide all series.
   - To hide a specific metric, go to the query table and click the colored square near the metric name.

2. To zoom into the plot and change the time range, do one of the following:
   - Visually select the time range by clicking and dragging on the plot horizontally.
   - Use the menu in the left upper corner to select the time range.

3. To reset the time range, select Reset Zoom.

4. To display outputs for all queries at a specific point in time, hold the mouse cursor on the plot at that point. The query outputs will appear in a pop-up box.

5. To hide the plot, select Hide Graph.

In the Developer perspective:

1. To zoom into the plot and change the time range, do one of the following:
   - Visually select the time range by clicking and dragging on the plot horizontally.
   - Use the menu in the left upper corner to select the time range.

2. To reset the time range, select Reset Zoom.

3. To display outputs for all queries at a specific point in time, hold the mouse cursor on the plot at that point. The query outputs will appear in a pop-up box.

Additional resources

- See the Querying metrics section on using the PromQL interface

7.4. NEXT STEPS

- Managing metrics targets
CHAPTER 8. MANAGING METRICS TARGETS

OpenShift Container Platform Monitoring collects metrics from targeted cluster components by scraping data from exposed service endpoints.

In the Administrator perspective in the OpenShift Container Platform web console, you can use the Metrics Targets page to view, search, and filter the endpoints that are currently targeted for scraping, which helps you to identify and troubleshoot problems. For example, you can view the current status of targeted endpoints to see when OpenShift Container Platform Monitoring is not able to scrape metrics from a targeted component.

The Metrics Targets page shows targets for default OpenShift Container Platform projects and for user-defined projects.

8.1. ACCESSING THE METRICS TARGETS PAGE IN THE ADMINISTRATOR PERSPECTIVE

You can view the Metrics Targets page in the Administrator perspective in the OpenShift Container Platform web console.

Prerequisites

- You have access to the cluster as an administrator for the project for which you want to view metrics targets.

Procedure

- In the Administrator perspective, select Observe → Targets. The Metrics Targets page opens with a list of all service endpoint targets that are being scraped for metrics.

8.2. SEARCHING AND FILTERING METRICS TARGETS

The list of metrics targets can be long. You can filter and search these targets based on various criteria.

In the Administrator perspective, the Metrics Targets page provides details about targets for default OpenShift Container Platform and user-defined projects. This page lists the following information for each target:

- the service endpoint URL being scraped
- the ServiceMonitor component being monitored
- the up or down status of the target
- the namespace
- the last scrape time
- the duration of the last scrape

You can filter the list of targets by status and source. The following filtering options are available:

- Status filters:
  - Up. The target is currently up and being actively scraped for metrics.
- **Down.** The target is currently down and not being scraped for metrics.

- **Source filters:**
  - **Platform.** Platform-level targets relate only to default OpenShift Container Platform projects. These projects provide core OpenShift Container Platform functionality.
  - **User.** User targets relate to user-defined projects. These projects are user-created and can be customized.

You can also use the search box to find a target by target name or label. Select *Text* or *Label* from the search box menu to limit your search.

### 8.3. GETTING DETAILED INFORMATION ABOUT A TARGET

On the **Target details** page, you can view detailed information about a metric target.

**Prerequisites**

- You have access to the cluster as an administrator for the project for which you want to view metrics targets.

**Procedure**

**To view detailed information about a target in the Administrator perspective**

1. Open the OpenShift Container Platform web console and navigate to **Observe → Targets**.
2. Optional: Filter the targets by status and source by selecting filters in the **Filter** list.
3. Optional: Search for a target by name or label by using the **Text** or **Label** field next to the search box.
4. Optional: Sort the targets by clicking one or more of the **Endpoint**, **Status**, **Namespace**, **Last Scrape**, and **Scrape Duration** column headers.
5. Click the URL in the **Endpoint** column for a target to navigate to its **Target details** page. This page provides information about the target, including:
   - The endpoint URL being scraped for metrics
   - The current **Up** or **Down** status of the target
   - A link to the namespace
   - A link to the ServiceMonitor details
   - Labels attached to the target
   - The most recent time that the target was scraped for metrics

### 8.4. NEXT STEPS

- Managing alerts
CHAPTER 9. MANAGING ALERTS

In OpenShift Container Platform 4.10, the Alerting UI enables you to manage alerts, silences, and alerting rules.

- **Alerting rules.** Alerting rules contain a set of conditions that outline a particular state within a cluster. Alerts are triggered when those conditions are true. An alerting rule can be assigned a severity that defines how the alerts are routed.

- **Alerts.** An alert is fired when the conditions defined in an alerting rule are true. Alerts provide a notification that a set of circumstances are apparent within an OpenShift Container Platform cluster.

- **Silences.** A silence can be applied to an alert to prevent notifications from being sent when the conditions for an alert are true. You can mute an alert after the initial notification, while you work on resolving the underlying issue.

**NOTE**

The alerts, silences, and alerting rules that are available in the Alerting UI relate to the projects that you have access to. For example, if you are logged in with `cluster-administrator` privileges, all alerts, silences, and alerting rules are accessible.

9.1. ACCESSING THE ALERTING UI IN THE ADMINISTRATOR AND DEVELOPER PERSPECTIVES

The Alerting UI is accessible through the Administrator perspective and the Developer perspective in the OpenShift Container Platform web console.

- In the **Administrator** perspective, select `Observe` → **Alerting**. The three main pages in the Alerting UI in this perspective are the **Alerts**, **Silences**, and **Alerting Rules** pages.

- In the **Developer** perspective, select `Observe` → `<project_name>` → **Alerts**. In this perspective, alerts, silences, and alerting rules are all managed from the **Alerts** page. The results shown in the **Alerts** page are specific to the selected project.

**NOTE**

In the Developer perspective, you can select from core OpenShift Container Platform and user-defined projects that you have access to in the **Project** list. However, alerts, silences, and alerting rules relating to core OpenShift Container Platform projects are not displayed if you do not have `cluster-admin` privileges.

9.2. SEARCHING AND FILTERING ALERTS, SILENCES, AND ALERTING RULES

You can filter the alerts, silences, and alerting rules that are displayed in the Alerting UI. This section provides a description of each of the available filtering options.

**Understanding alert filters**

In the **Administrator** perspective, the **Alerts** page in the Alerting UI provides details about alerts relating to default OpenShift Container Platform and user-defined projects. The page includes a summary of severity, state, and source for each alert. The time at which an alert went into its current state is also shown.
You can filter by alert state, severity, and source. By default, only Platform alerts that are Firing are displayed. The following describes each alert filtering option:

- **Alert State** filters:
  - **Firing**. The alert is firing because the alert condition is true and the optional for duration has passed. The alert will continue to fire as long as the condition remains true.
  - **Pending**. The alert is active but is waiting for the duration that is specified in the alerting rule before it fires.
  - **Silenced**. The alert is now silenced for a defined time period. Silences temporarily mute alerts based on a set of label selectors that you define. Notifications will not be sent for alerts that match all the listed values or regular expressions.

- **Severity** filters:
  - **Critical**. The condition that triggered the alert could have a critical impact. The alert requires immediate attention when fired and is typically paged to an individual or to a critical response team.
  - **Warning**. The alert provides a warning notification about something that might require attention to prevent a problem from occurring. Warnings are typically routed to a ticketing system for non-immediate review.
  - **Info**. The alert is provided for informational purposes only.
  - **None**. The alert has no defined severity.
  - You can also create custom severity definitions for alerts relating to user-defined projects.

- **Source** filters:
  - **Platform**. Platform-level alerts relate only to default OpenShift Container Platform projects. These projects provide core OpenShift Container Platform functionality.
  - **User**. User alerts relate to user-defined projects. These alerts are user-created and are customizable. User-defined workload monitoring can be enabled post-installation to provide observability into your own workloads.

**Understanding silence filters**
In the Administrator perspective, the Silences page in the Alerting UI provides details about silences applied to alerts in default OpenShift Container Platform and user-defined projects. The page includes a summary of the state of each silence and the time at which a silence ends.

You can filter by silence state. By default, only Active and Pending silences are displayed. The following describes each silence state filter option:

- **Silence State** filters:
  - **Active**. The silence is active and the alert will be muted until the silence is expired.
  - **Pending**. The silence has been scheduled and it is not yet active.
  - **Expired**. The silence has expired and notifications will be sent if the conditions for an alert are true.

**Understanding alerting rule filters**
In the Administrator perspective, the Alerting Rules page in the Alerting UI provides details about alerting rules relating to default OpenShift Container Platform and user-defined projects. The page includes a summary of the state, severity, and source for each alerting rule.

You can filter alerting rules by alert state, severity, and source. By default, only Platform alerting rules are displayed. The following describes each alerting rule filtering option:

- **Alert State** filters:
  - **Firing.** The alert is firing because the alert condition is true and the optional for duration has passed. The alert will continue to fire as long as the condition remains true.
  - **Pending.** The alert is active but is waiting for the duration that is specified in the alerting rule before it fires.
  - **Silenced.** The alert is now silenced for a defined time period. Silences temporarily mute alerts based on a set of label selectors that you define. Notifications will not be sent for alerts that match all the listed values or regular expressions.
  - **Not Firing.** The alert is not firing.

- **Severity** filters:
  - **Critical.** The conditions defined in the alerting rule could have a critical impact. When true, these conditions require immediate attention. Alerts relating to the rule are typically paged to an individual or to a critical response team.
  - **Warning.** The conditions defined in the alerting rule might require attention to prevent a problem from occurring. Alerts relating to the rule are typically routed to a ticketing system for non-immediate review.
  - **Info.** The alerting rule provides informational alerts only.
  - **None.** The alerting rule has no defined severity.

- You can also create custom severity definitions for alerting rules relating to user-defined projects.

- **Source** filters:
  - **Platform.** Platform-level alerting rules relate only to default OpenShift Container Platform projects. These projects provide core OpenShift Container Platform functionality.
  - **User.** User-defined workload alerting rules relate to user-defined projects. These alerting rules are user-created and are customizable. User-defined workload monitoring can be enabled post-installation to provide observability into your own workloads.

**Searching and filtering alerts, silences, and alerting rules in the Developer perspective**

In the Developer perspective, the Alerts page in the Alerting UI provides a combined view of alerts and silences relating to the selected project. A link to the governing alerting rule is provided for each displayed alert.

In this view, you can filter by alert state and severity. By default, all alerts in the selected project are displayed if you have permission to access the project. These filters are the same as those described for the Administrator perspective.
9.3. GETTING INFORMATION ABOUT ALERTS, SILENCES, AND ALERTING RULES

The Alerting UI provides detailed information about alerts and their governing alerting rules and silences.

Prerequisites

- You have access to the cluster as a developer or as a user with view permissions for the project that you are viewing metrics for.

Procedure

To obtain information about alerts in the Administrator perspective

1. Open the OpenShift Container Platform web console and navigate to the Observe → Alerting → Alerts page.
2. Optional: Search for alerts by name using the Name field in the search list.
3. Optional: Filter alerts by state, severity, and source by selecting filters in the Filter list.
4. Optional: Sort the alerts by clicking one or more of the Name, Severity, State, and Source column headers.
5. Select the name of an alert to navigate to its Alert Details page. The page includes a graph that illustrates alert time series data. It also provides information about the alert, including:
   - A description of the alert
   - Messages associated with the alerts
   - Labels attached to the alert
   - A link to its governing alerting rule
   - Silences for the alert, if any exist

To obtain information about silences in the Administrator perspective

1. Navigate to the Observe → Alerting → Silences page.
2. Optional: Filter the silences by name using the Search by name field.
3. Optional: Filter silences by state by selecting filters in the Filter list. By default, Active and Pending filters are applied.
4. Optional: Sort the silences by clicking one or more of the Name, Firing Alerts, and State column headers.
5. Select the name of a silence to navigate to its Silence Details page. The page includes the following details:
   - Alert specification
   - Start time
   - End time
Silence state
Number and list of firing alerts

To obtain information about alerting rules in the Administrator perspective

1. Navigate to the Observe → Alerting → Alerting Rules page.
2. Optional: Filter alerting rules by state, severity, and source by selecting filters in the Filter list.
3. Optional: Sort the alerting rules by clicking one or more of the Name, Severity, Alert State, and Source column headers.
4. Select the name of an alerting rule to navigate to its Alerting Rule Details page. The page provides the following details about the alerting rule:
   - Alerting rule name, severity, and description
   - The expression that defines the condition for firing the alert
   - The time for which the condition should be true for an alert to fire
   - A graph for each alert governed by the alerting rule, showing the value with which the alert is firing
   - A table of all alerts governed by the alerting rule

To obtain information about alerts, silences, and alerting rules in the Developer perspective

1. Navigate to the Observe → <project_name> → Alerts page.
2. View details for an alert, silence, or an alerting rule:
   - Alert Details can be viewed by selecting > to the left of an alert name and then selecting the alert in the list.
   - Silence Details can be viewed by selecting a silence in the Silenced By section of the Alert Details page. The Silence Details page includes the following information:
     - Alert specification
     - Start time
     - End time
     - Silence state
     - Number and list of firing alerts

   - Alerting Rule Details can be viewed by selecting View Alerting Rule in the menu on the right of an alert in the Alerts page.

NOTE
Only alerts, silences, and alerting rules relating to the selected project are displayed in the Developer perspective.
9.4. MANAGING ALERTING RULES

OpenShift Container Platform monitoring ships with a set of default alerting rules. As a cluster administrator, you can view the default alerting rules.

In OpenShift Container Platform 4.10, you can create, view, edit, and remove alerting rules in user-defined projects.

Alerting rule considerations

- The default alerting rules are used specifically for the OpenShift Container Platform cluster.
- Some alerting rules intentionally have identical names. They send alerts about the same event with different thresholds, different severity, or both.
- Inhibition rules prevent notifications for lower severity alerts that are firing when a higher severity alert is also firing.

9.4.1. Optimizing alerting for user-defined projects

You can optimize alerting for your own projects by considering the following recommendations when creating alerting rules:

- Minimize the number of alerting rules that you create for your project. Create alerting rules that notify you of conditions that impact you. It is more difficult to notice relevant alerts if you generate many alerts for conditions that do not impact you.

- Create alerting rules for symptoms instead of causes. Create alerting rules that notify you of conditions regardless of the underlying cause. The cause can then be investigated. You will need many more alerting rules if each relates only to a specific cause. Some causes are then likely to be missed.

- Plan before you write your alerting rules. Determine what symptoms are important to you and what actions you want to take if they occur. Then build an alerting rule for each symptom.

- Provide clear alert messaging. State the symptom and recommended actions in the alert message.

- Include severity levels in your alerting rules. The severity of an alert depends on how you need to react if the reported symptom occurs. For example, a critical alert should be triggered if a symptom requires immediate attention by an individual or a critical response team.

- Optimize alert routing. Deploy an alerting rule directly on the Prometheus instance in the openshift-user-workload-monitoring project if the rule does not query default OpenShift Container Platform metrics. This reduces latency for alerting rules and minimizes the load on monitoring components.
WARNING

Default OpenShift Container Platform metrics for user-defined projects provide information about CPU and memory usage, bandwidth statistics, and packet rate information. Those metrics cannot be included in an alerting rule if you route the rule directly to the Prometheus instance in the openshift-user-workload-monitoring project. Alerting rule optimization should be used only if you have read the documentation and have a comprehensive understanding of the monitoring architecture.

Additional resources

- See the Prometheus alerting documentation for further guidelines on optimizing alerts
- See Monitoring overview for details about OpenShift Container Platform 4.10 monitoring architecture

9.4.2. Creating alerting rules for user-defined projects

You can create alerting rules for user-defined projects. Those alerting rules will fire alerts based on the values of chosen metrics.

Prerequisites

- You have enabled monitoring for user-defined projects.
- You are logged in as a user that has the monitoring-rules-edit role for the project where you want to create an alerting rule.
- You have installed the OpenShift CLI (oc).

Procedure

1. Create a YAML file for alerting rules. In this example, it is called example-app-alerting-rule.yaml.

2. Add an alerting rule configuration to the YAML file. For example:

```yaml
apiVersion: monitoring.coreos.com/v1
kind: PrometheusRule
metadata:
  name: example-alert
namespace: ns1
spec:
  groups:
```

NOTE

When you create an alerting rule, a project label is enforced on it if a rule with the same name exists in another project.
This configuration creates an alerting rule named **example-alert**. The alerting rule fires an alert when the **version** metric exposed by the sample service becomes **0**.

**IMPORTANT**

A user-defined alerting rule can include metrics for its own project and cluster metrics. You cannot include metrics for another user-defined project. For example, an alerting rule for the user-defined project **ns1** can have metrics from **ns1** and cluster metrics, such as the CPU and memory metrics. However, the rule cannot include metrics from **ns2**.

Additionally, you cannot create alerting rules for the **openshift-*** core OpenShift Container Platform projects. OpenShift Container Platform monitoring by default provides a set of alerting rules for these projects.

3. Apply the configuration file to the cluster:

```
$ oc apply -f example-app-alerting-rule.yaml
```

It takes some time to create the alerting rule.

### 9.4.3. Reducing latency for alerting rules that do not query platform metrics

If an alerting rule for a user-defined project does not query default cluster metrics, you can deploy the rule directly on the Prometheus instance in the **openshift-user-workload-monitoring** project. This reduces latency for alerting rules by bypassing Thanos Ruler when it is not required. This also helps to minimize the overall load on monitoring components.

**WARNING**

Default OpenShift Container Platform metrics for user-defined projects provide information about CPU and memory usage, bandwidth statistics, and packet rate information. Those metrics cannot be included in an alerting rule if you deploy the rule directly to the Prometheus instance in the **openshift-user-workload-monitoring** project. The procedure outlined in this section should only be used if you have read the documentation and have a comprehensive understanding of the monitoring architecture.

**Prerequisites**

- You have enabled monitoring for user-defined projects.
- You are logged in as a user that has the **monitoring-rules-edit** role for the project where you want to create an alerting rule.
You have installed the OpenShift CLI (oc).

**Procedure**

1. Create a YAML file for alerting rules. In this example, it is called `example-app-alerting-rule.yaml`.

2. Add an alerting rule configuration to the YAML file that includes a label with the key `openshift.io/prometheus-rule-evaluation-scope` and value `leaf-prometheus`. For example:

   ```yaml
   apiVersion: monitoring.coreos.com/v1
   kind: PrometheusRule
   metadata:
     name: example-alert
     namespace: ns1
     labels:
       openshift.io/prometheus-rule-evaluation-scope: leaf-prometheus
   spec:
     groups:
     - name: example
       rules:
       - alert: VersionAlert
         expr: version{job="prometheus-example-app"} == 0
   ```

   If that label is present, the alerting rule is deployed on the Prometheus instance in the `openshift-user-workload-monitoring` project. If the label is not present, the alerting rule is deployed to Thanos Ruler.

1. Apply the configuration file to the cluster:

   ```bash
   $ oc apply -f example-app-alerting-rule.yaml
   ```

   It takes some time to create the alerting rule.

   - See [Monitoring overview](#) for details about OpenShift Container Platform 4.10 monitoring architecture.

### 9.4.4. Accessing alerting rules for user-defined projects

To list alerting rules for a user-defined project, you must have been assigned the `monitoring-rules-view` role for the project.

**Prerequisites**

- You have enabled monitoring for user-defined projects.

- You are logged in as a user that has the `monitoring-rules-view` role for your project.

- You have installed the OpenShift CLI (oc).

**Procedure**

1. You can list alerting rules in `<project>`:

   ```bash
   $ oc -n <project> get prometheusrule
   ```
To list the configuration of an alerting rule, run the following:

```bash
$ oc -n <project> get prometheusrule <rule> -o yaml
```

### 9.4.5. Listing alerting rules for all projects in a single view

As a cluster administrator, you can list alerting rules for core OpenShift Container Platform and user-defined projects together in a single view.

**Prerequisites**

- You have access to the cluster as a user with the `cluster-admin` role.
- You have installed the OpenShift CLI (`oc`).

**Procedure**

1. In the **Administrator** perspective, navigate to **Observe → Alerting → Alerting Rules**.
2. Select the **Platform** and **User** sources in the **Filter** drop-down menu.

   **NOTE**

   The **Platform** source is selected by default.

### 9.4.6. Removing alerting rules for user-defined projects

You can remove alerting rules for user-defined projects.

**Prerequisites**

- You have enabled monitoring for user-defined projects.
- You are logged in as a user that has the `monitoring-rules-edit` role for the project where you want to create an alerting rule.
- You have installed the OpenShift CLI (`oc`).

**Procedure**

- To remove rule `<foo>` in `<namespace>`, run the following:

  ```bash
  $ oc -n <namespace> delete prometheusrule <foo>
  ```

**Additional resources**

- See the [Alertmanager documentation](https://alertmanager.readthedocs.io/en/latest/)

### 9.5. MANAGING SILENCES

You can create a silence to stop receiving notifications about an alert when it is firing. It might be useful to silence an alert after being first notified, while you resolve the underlying issue.
When creating a silence, you must specify whether it becomes active immediately or at a later time. You must also set a duration period after which the silence expires.

You can view, edit, and expire existing silences.

### 9.5.1. Silencing alerts

You can either silence a specific alert or silence alerts that match a specification that you define.

**Prerequisites**

- You have access to the cluster as a developer or as a user with **edit** permissions for the project that you are viewing metrics for.

**Procedure**

To silence a specific alert:

- **In the Administrator perspective:**
  1. Navigate to the **Observe → Alerting → Alerts** page of the OpenShift Container Platform web console.
  2. For the alert that you want to silence, select the **Silence** in the right-hand column and select **Silence Alert**. The **Silence Alert** form will appear with a pre-populated specification for the chosen alert.
  3. Optional: Modify the silence.
  4. You must add a comment before creating the silence.
  5. To create the silence, select **Silence**.

- **In the Developer perspective:**
  1. Navigate to the **Observe → <project_name> → Alerts** page in the OpenShift Container Platform web console.
  2. Expand the details for an alert by selecting **>** to the left of the alert name. Select the name of the alert in the expanded view to open the **Alert Details** page for the alert.
  3. Select **Silence Alert**. The **Silence Alert** form will appear with a prepopulated specification for the chosen alert.
  4. Optional: Modify the silence.
  5. You must add a comment before creating the silence.
  6. To create the silence, select **Silence**.

To silence a set of alerts by creating an alert specification in the **Administrator** perspective:

1. Navigate to the **Observe → Alerting → Silences** page in the OpenShift Container Platform web console.
2. Select **Create Silence**.
3. Set the schedule, duration, and label details for an alert in the Create Silence form. You must also add a comment for the silence.

4. To create silences for alerts that match the label sectors that you entered in the previous step, select Silence.

9.5.2. Editing silences

You can edit a silence, which will expire the existing silence and create a new one with the changed configuration.

Procedure

To edit a silence in the Administrator perspective:

1. Navigate to the Observe → Alerting → Silences page.

2. For the silence you want to modify, select the in the last column and choose Edit silence. Alternatively, you can select Actions → Edit Silence in the Silence Details page for a silence.

3. In the Edit Silence page, enter your changes and select Silence. This will expire the existing silence and create one with the chosen configuration.

To edit a silence in the Developer perspective:

1. Navigate to the Observe → <project_name> → Alerts page.

2. Expand the details for an alert by selecting > to the left of the alert name. Select the name of the alert in the expanded view to open the Alert Details page for the alert.

3. Select the name of a silence in the Silenced By section in that page to navigate to the Silence Details page for the silence.

4. Select the name of a silence to navigate to its Silence Details page.

5. Select Actions → Edit Silence in the Silence Details page for a silence.

6. In the Edit Silence page, enter your changes and select Silence. This will expire the existing silence and create one with the chosen configuration.

9.5.3. Expiring silences

You can expire a silence. Expiring a silence deactivates it forever.

Procedure

To expire a silence in the Administrator perspective:

1. Navigate to the Observe → Alerting → Silences page.

2. For the silence you want to modify, select the in the last column and choose Expire silence. Alternatively, you can select Actions → Expire Silence in the Silence Details page for a silence.
To expire a silence in the Developer perspective:

1. Navigate to the Observe → <project_name> → Alerts page.
2. Expand the details for an alert by selecting ▼ to the left of the alert name. Select the name of the alert in the expanded view to open the Alert Details page for the alert.
3. Select the name of a silence in the Silenced By section in that page to navigate to the Silence Details page for the silence.
4. Select the name of a silence to navigate to its Silence Details page.
5. Select Actions → Expire Silence in the Silence Details page for a silence.

9.6. SENDING NOTIFICATIONS TO EXTERNAL SYSTEMS

In OpenShift Container Platform 4.10, firing alerts can be viewed in the Alerting UI. Alerts are not configured by default to be sent to any notification systems. You can configure OpenShift Container Platform to send alerts to the following receiver types:

- PagerDuty
- Webhook
- Email
- Slack

Routing alerts to receivers enables you to send timely notifications to the appropriate teams when failures occur. For example, critical alerts require immediate attention and are typically paged to an individual or a critical response team. Alerts that provide non-critical warning notifications might instead be routed to a ticketing system for non-immediate review.

Checking that alerting is operational by using the watchdog alert

OpenShift Container Platform monitoring includes a watchdog alert that fires continuously. Alertmanager repeatedly sends watchdog alert notifications to configured notification providers. The provider is usually configured to notify an administrator when it stops receiving the watchdog alert. This mechanism helps you quickly identify any communication issues between Alertmanager and the notification provider.

9.6.1. Configuring alert receivers

You can configure alert receivers to ensure that you learn about important issues with your cluster.

Prerequisites

- You have access to the cluster as a user with the cluster-admin role.

Procedure

1. In the Administrator perspective, navigate to Administration → Cluster Settings → Configuration → Alertmanager.
NOTE
Alternatively, you can navigate to the same page through the notification drawer. Select the bell icon at the top right of the OpenShift Container Platform web console and choose Configure in the AlertmanagerReceiverNotConfigured alert.

2. Select Create Receiver in the Receivers section of the page.

3. In the Create Receiver form, add a Receiver Name and choose a Receiver Type from the list.

4. Edit the receiver configuration:
   - For PagerDuty receivers:
     a. Choose an integration type and add a PagerDuty integration key.
     b. Add the URL of your PagerDuty installation.
     c. Select Show advanced configuration if you want to edit the client and incident details or the severity specification.
   - For webhook receivers:
     a. Add the endpoint to send HTTP POST requests to.
     b. Select Show advanced configuration if you want to edit the default option to send resolved alerts to the receiver.
   - For email receivers:
     a. Add the email address to send notifications to.
     b. Add SMTP configuration details, including the address to send notifications from, the smarthost and port number used for sending emails, the hostname of the SMTP server, and authentication details.
     c. Choose whether TLS is required.
     d. Select Show advanced configuration if you want to edit the default option not to send resolved alerts to the receiver or edit the body of email notifications configuration.
   - For Slack receivers:
     a. Add the URL of the Slack webhook.
     b. Add the Slack channel or user name to send notifications to.
     c. Select Show advanced configuration if you want to edit the default option not to send resolved alerts to the receiver or edit the icon and username configuration. You can also choose whether to find and link channel names and usernames.

5. By default, firing alerts with labels that match all of the selectors will be sent to the receiver. If you want label values for firing alerts to be matched exactly before they are sent to the receiver:
   a. Add routing label names and values in the Routing Labels section of the form.
   b. Select Regular Expression if want to use a regular expression.
c. Select **Add Label** to add further routing labels.

6. Select **Create** to create the receiver.

### 9.6.2. Creating alert routing for user-defined projects

**IMPORTANT**

Alert routing for user-defined projects is a Technology Preview feature only. Technology Preview features are not supported with Red Hat production service level agreements (SLAs) and might not be functionally complete. Red Hat does not recommend using them in production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

For more information about the support scope of Red Hat Technology Preview features, see [https://access.redhat.com/support/offerings/techpreview](https://access.redhat.com/support/offerings/techpreview).

If you are a non-administrator user who has been given the `alert-routing-edit` role, you can create or edit alert routing for user-defined projects.

**Prerequisites**

- A cluster administrator has enabled monitoring for user-defined projects.
- A cluster administrator has enabled alert routing for user-defined projects.
- You are logged in as a user that has the `alert-routing-edit` role for the project for which you want to create alert routing.
- You have installed the OpenShift CLI (`oc`).

**Procedure**

1. Create a YAML file for alert routing. The example in this procedure uses a file called `example-app-alert-routing.yaml`.

2. Add an **AlertmanagerConfig** YAML definition to the file. For example:

```yaml
apiVersion: monitoring.coreos.com/v1alpha1
kind: AlertmanagerConfig
metadata:
  name: example-routing
  namespace: ns1
spec:
  route:
    receiver: default
    groupBy: [job]
    receivers:
      - name: default
        webhookConfigs:
          - url: https://example.org/post
```
NOTE

For user-defined alerting rules, user-defined routing is scoped to the namespace in which the resource is defined. For example, a routing configuration defined in the AlertmanagerConfig object for namespace ns1 only applies to PrometheusRules resources in the same namespace.

3. Save the file.

4. Apply the resource to the cluster:

   $ oc apply -f example-appalert-routing.yaml

   The configuration is automatically applied to the Alertmanager pods.

9.7. APPLYING A CUSTOM ALERTMANAGER CONFIGURATION

You can overwrite the default Alertmanager configuration by editing the alertmanager-main secret inside the openshift-monitoring project.

Prerequisites

- You have access to the cluster as a user with the cluster-admin role.

Procedure

To change the Alertmanager configuration from the CLI:

1. Print the currently active Alertmanager configuration into file alertmanager.yaml:

   $ oc -n openshift-monitoring get secret alertmanager-main --template="{{ index .data "alertmanager.yaml" }}" | base64 --decode > alertmanager.yaml

2. Edit the configuration in alertmanager.yaml:

   global:
   resolve_timeout: 5m
   route:
   group_wait: 30s
   group_interval: 5m
   repeat_interval: 12h
   receiver: default
   routes:
   - match:
     alertname: Watchdog
     repeat_interval: 5m
     receiver: watchdog
   - match:
     service: <your_service>  
     routes:
   - match:
     <your_matching_rules>
     receiver: <receiver>
   receivers:
The following Alertmanager configuration example configures PagerDuty as an alert receiver:

```
- name: default
- name: watchdog
- name: <receiver>
  # <receiver_configuration>

1. **service** specifies the service that fires the alerts.

2. **<your_matching_rules>** specifies the target alerts.

3. **receiver** specifies the receiver to use for the alert.

With this configuration, alerts of **critical** severity that are fired by the **example-app** service are sent using the **team-frontend-page** receiver. Typically these types of alerts would be paged to an individual or a critical response team.

3. Apply the new configuration in the file:

   ```
   $ oc -n openshift-monitoring create secret generic alertmanager-main --from-file=alertmanager.yaml --dry-run=client -o=yaml | oc -n openshift-monitoring replace secret -filename=-
   ```

To change the Alertmanager configuration from the OpenShift Container Platform web console:

1. Navigate to the **Administration → Cluster Settings → Configuration → Alertmanager → YAML** page of the web console.

2. Modify the YAML configuration file.

3. Select **Save**.

**Additional resources**

- See the [PagerDuty official site](https://www.pagerduty.com) for more information on PagerDuty.
See the PagerDuty Prometheus Integration Guide to learn how to retrieve the *service_key*

See Alertmanager configuration for configuring alerting through different alert receivers

### 9.8. NEXT STEPS

- Reviewing monitoring dashboards
CHAPTER 10. REVIEWING MONITORING DASHBOARDS

OpenShift Container Platform 4.10 provides a comprehensive set of monitoring dashboards that help you understand the state of cluster components and user-defined workloads.

In the Administrator perspective you can access dashboards for core OpenShift Container Platform components, including:

- API performance
- etcd
- Kubernetes compute resources
- Kubernetes network resources
- Prometheus
- USE method dashboards relating to cluster and node performance

Figure 10.1. Example dashboard in the Administrator perspective

In the Developer perspective you can access dashboards that provide the following statistics for a selected project:

- CPU usage
- Memory usage
- Bandwidth information
- Packet rate information
NOTE

In the Developer perspective, you can view dashboards for only one project at a time.

10.1. REVIEWING MONITORING DASHBOARDS AS A CLUSTER ADMINISTRATOR

In the Administrator perspective, you can view dashboards relating to core OpenShift Container Platform cluster components.

Prerequisites

- You have access to the cluster as a user with the cluster-admin role.

Procedure

1. In the Administrator perspective in the OpenShift Container Platform web console, navigate to Observe → Dashboards.

2. Choose a dashboard in the Dashboard list. Some dashboards, such as etcd and Prometheus dashboards, produce additional sub-menus when selected.

3. Optional: Select a time range for the graphs in the Time Range list.
   - Select a pre-defined time period.
   - Set a custom time range by selecting Custom time range in the Time Range list.
     a. Input or select the From and To dates and times.
b. Click **Save** to save the custom time range.

4. Optional: Select a **Refresh Interval**

5. Hover over each of the graphs within a dashboard to display detailed information about specific items.

### 10.2. REVIEWING MONITORING DASHBOARDS AS A DEVELOPER

In the Developer perspective, you can view dashboards relating to a selected project. You must have access to monitor a project to view dashboard information for it.

**Prerequisites**

- You have access to the cluster as a developer or as a user with view permissions for the project that you are viewing the dashboard for.

**Procedure**

1. In the Developer perspective in the OpenShift Container Platform web console, navigate to **Observe → Dashboard**.

2. Choose a project in the **Project** list.

3. Choose a workload in the **All Workloads** list.

4. Optional: Select a time range for the graphs in the **Time Range** list.
   - Select a pre-defined time period.
   - Set a custom time range by selecting **Custom time range** in the **Time Range** list.
     a. Input or select the **From** and **To** dates and times.
     b. Click **Save** to save the custom time range.

5. Optional: Select a **Refresh Interval**

6. Hover over each of the graphs within a dashboard to display detailed information about specific items.

**Additional resources**

- [Monitoring project and application metrics using the Developer perspective](#)

### 10.3. NEXT STEPS

- [Accessing third-party monitoring UIs and APIs](#)
CHAPTER 11. ACCESSING THIRD-PARTY MONITORING UIS AND APIS

In OpenShift Container Platform 4.10, you cannot access third-party web browser user interfaces (UIs) for the following monitoring components: Alertmanager, Thanos Ruler, and Thanos Querier. However, you can access web UIs for Grafana and Prometheus, although this access is deprecated and is planned to be removed in a future OpenShift Container Platform release. In addition, you can access web service APIs for third-party monitoring components from the command line interface (CLI).

11.1. ACCESSING THIRD-PARTY MONITORING UIS

OpenShift Container Platform does not provide or support direct access to third-party web user interfaces (UIs) for the following components in the monitoring stack: Alertmanager, Thanos Ruler, and Thanos Querier. As an alternative to these third-party UIs, navigate to the Observe section of the OpenShift Container Platform web console to access metrics, alerting, metrics targets, and dashboard UIs for platform components.

NOTE

Although you can access the third-party Grafana and Prometheus web UIs from the web console or the CLI, this access is deprecated and is planned to be removed in a future OpenShift Container Platform release.

11.2. ACCESSING THIRD-PARTY MONITORING WEB SERVICE APIS

You can directly access third-party web service APIs from the command line for monitoring stack components such as Prometheus, Alertmanager, Thanos Ruler, and Thanos Querier.

The following example shows how to query the service API receivers for Alertmanager. This example requires that the associated user account be bound against the monitoring-alertmanager-edit role in the openshift-monitoring namespace and that the account has the privilege to view the route. This access only supports using a Bearer Token for authentication.

```bash
$ host=$(oc -n openshift-monitoring get route alertmanager-main -o jsonpath={.spec.host})
$ token=$(oc whoami -t)
$ curl -H "Authorization: Bearer $token" -k "https://$host/api/v2/receivers"
```

NOTE

To access Thanos Ruler and Thanos Querier service APIs, the requesting account must have get permission on the namespaces resource, which can be done by granting the cluster-monitoring-view cluster role to the account.

11.3. ADDITIONAL RESOURCES

- Managing metrics
- Managing alerts
- Reviewing monitoring dashboards
12.1. INVESTIGATING WHY USER-DEFINED METRICS ARE UNAVAILABLE

ServiceMonitor resources enable you to determine how to use the metrics exposed by a service in user-defined projects. Follow the steps outlined in this procedure if you have created a ServiceMonitor resource but cannot see any corresponding metrics in the Metrics UI.

Prerequisites

- You have access to the cluster as a user with the cluster-admin role.
- You have installed the OpenShift CLI (oc).
- You have enabled and configured monitoring for user-defined workloads.
- You have created the user-workload-monitoring-config ConfigMap object.
- You have created a ServiceMonitor resource.

Procedure

1. **Check that the corresponding labels match** in the service and ServiceMonitor resource configurations.
   a. Obtain the label defined in the service. The following example queries the prometheus-example-app service in the ns1 project:

      ```
      $ oc -n ns1 get service prometheus-example-app -o yaml
      ```

      **Example output**

      ```
      labels:
      app: prometheus-example-app
      ```

   b. Check that the **matchLabels app** label in the ServiceMonitor resource configuration matches the label output in the preceding step:

      ```
      $ oc -n ns1 get servicemonitor prometheus-example-monitor -o yaml
      ```

      **Example output**

      ```
      spec:
      endpoints:
      - interval: 30s
        port: web
        scheme: http
        selector:
          matchLabels:
            app: prometheus-example-app
      ```
NOTE

You can check service and ServiceMonitor resource labels as a developer with view permissions for the project.

2. Inspect the logs for the Prometheus Operator in the openshift-user-workload-monitoring project.
   a. List the pods in the openshift-user-workload-monitoring project:

   ```
   $ oc -n openshift-user-workload-monitoring get pods
   ```

   Example output

<table>
<thead>
<tr>
<th>NAME</th>
<th>READY</th>
<th>STATUS</th>
<th>RESTARTS</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>prometheus-operator-776fcbdb56-2nbfm</td>
<td>2/2</td>
<td>Running</td>
<td>0</td>
<td>132m</td>
</tr>
<tr>
<td>prometheus-user-workload-0</td>
<td>5/5</td>
<td>Running</td>
<td>1</td>
<td>132m</td>
</tr>
<tr>
<td>prometheus-user-workload-1</td>
<td>5/5</td>
<td>Running</td>
<td>1</td>
<td>132m</td>
</tr>
<tr>
<td>thanos-ruler-user-workload-0</td>
<td>3/3</td>
<td>Running</td>
<td>0</td>
<td>132m</td>
</tr>
<tr>
<td>thanos-ruler-user-workload-1</td>
<td>3/3</td>
<td>Running</td>
<td>0</td>
<td>132m</td>
</tr>
</tbody>
</table>

   b. Obtain the logs from the prometheus-operator container in the prometheus-operator pod. In the following example, the pod is called prometheus-operator-776fcbdb56-2nbfm:

   ```
   $ oc -n openshift-user-workload-monitoring logs prometheus-operator-776fcbdb56-2nbfm -c prometheus-operator
   ```

   If there is an issue with the service monitor, the logs might include an error similar to this example:

   ```
   level=warn ts=2020-08-10T11:48:20.906739623Z caller=operator.go:1829 component=prometheusoperator msg="skipping servicemonitor" error="it accesses file system via bearer token file which Prometheus specification prohibits" servicemonitor=eagle/eagle namespace=openshift-user-workload-monitoring prometheus=user-workload
   ```

3. Review the target status for your project in the Prometheus UI directly.
   a. Establish port-forwarding to the Prometheus instance in the openshift-user-workload-monitoring project:

   ```
   $ oc port-forward -n openshift-user-workload-monitoring pod/prometheus-user-workload-0 9090
   ```

   b. Open http://localhost:9090/targets in a web browser and review the status of the target for your project directly in the Prometheus UI. Check for error messages relating to the target.

4. Configure debug level logging for the Prometheus Operator in the openshift-user-workload-monitoring project.
   a. Edit the user-workload-monitoring-config ConfigMap object in the openshift-user-workload-monitoring project:
b. Add `logLevel: debug` for `prometheusOperator` under `data/config.yaml` to set the log level to `debug`:

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    prometheusOperator:
      logLevel: debug
```

c. Save the file to apply the changes.

```
NOTE
The `prometheus-operator` in the `openshift-user-workload-monitoring` project restarts automatically when you apply the log-level change.
```

d. Confirm that the `debug` log-level has been applied to the `prometheus-operator` deployment in the `openshift-user-workload-monitoring` project:

```
$ oc -n openshift-user-workload-monitoring get deploy prometheus-operator -o yaml | grep "log-level"
```

**Example output**

```
  --log-level=debug
```

Debug level logging will show all calls made by the Prometheus Operator.

e. Check that the `prometheus-operator` pod is running:

```
$ oc -n openshift-user-workload-monitoring get pods
```

```
NOTE
If an unrecognized Prometheus Operator `loglevel` value is included in the config map, the `prometheus-operator` pod might not restart successfully.
```

f. Review the debug logs to see if the Prometheus Operator is using the `ServiceMonitor` resource. Review the logs for other related errors.

**Additional resources**

- Creating a user-defined workload monitoring config map
Developers can create labels to define attributes for metrics in the form of key-value pairs. The number of potential key-value pairs corresponds to the number of possible values for an attribute. An attribute that has an unlimited number of potential values is called an unbound attribute. For example, a `customer_id` attribute is unbound because it has an infinite number of possible values.

Every assigned key-value pair has a unique time series. The use of many unbound attributes in labels can result in an exponential increase in the number of time series created. This can impact Prometheus performance and can consume a lot of disk space.

You can use the following measures when Prometheus consumes a lot of disk:

- **Check the number of scrape samples** that are being collected.
- **Check the time series database (TSDB) status in the Prometheus UI** for more information on which labels are creating the most time series. This requires cluster administrator privileges.
- **Reduce the number of unique time series that are created** by reducing the number of unbound attributes that are assigned to user-defined metrics.

NOTE

Using attributes that are bound to a limited set of possible values reduces the number of potential key-value pair combinations.

- **Enforce limits on the number of samples that can be scraped** across user-defined projects. This requires cluster administrator privileges.

Prerequisites

- You have access to the cluster as a user with the `cluster-admin` role.
- You have installed the OpenShift CLI (`oc`).

Procedure

1. In the Administrator perspective, navigate to Observe → Metrics.
2. Run the following Prometheus Query Language (PromQL) query in the Expression field. This returns the ten metrics that have the highest number of scrape samples:

   ```promql
   topk(10, count by (job)({__name__=~".\+"}))
   ```

3. Investigate the number of unbound label values assigned to metrics with higher than expected scrape sample counts.

   - **If the metrics relate to a user-defined project** review the metrics key-value pairs assigned to your workload. These are implemented through Prometheus client libraries at the application level. Try to limit the number of unbound attributes referenced in your labels.
• If the metrics relate to a core OpenShift Container Platform project, create a Red Hat support case on the Red Hat Customer Portal.

4. Check the TSDB status in the Prometheus UI.
   a. In the Administrator perspective, navigate to Networking → Routes.
   b. Select the openshift-monitoring project in the Project list.
   c. Select the URL in the prometheus-k8s row to open the login page for the Prometheus UI.
   d. Choose Log in with OpenShift to log in using your OpenShift Container Platform credentials.
   e. In the Prometheus UI, navigate to Status → TSDB Status.

Additional resources

• See Setting a scrape sample limit for user-defined projects for details on how to set a scrape sample limit and create related alerting rules

• Submitting a support case