OpenShift Container Platform 4.9

Monitoring

Configuring and using the monitoring stack in OpenShift Container Platform

Last Updated: 2021-11-23

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Legal Notice

Abstract

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

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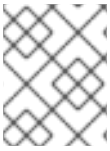
CHAPTER 1. UNDERSTANDING THE MONITORING STACK

OpenShift Container Platform includes a pre-configured, pre-installed, and self-updating monitoring stack that provides **monitoring for core platform components** 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.

After installing OpenShift Container Platform 4.9, 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. You can then query metrics, review dashboards, and manage alerting rules and silences for your own projects in the OpenShift Container Platform web console.



NOTE

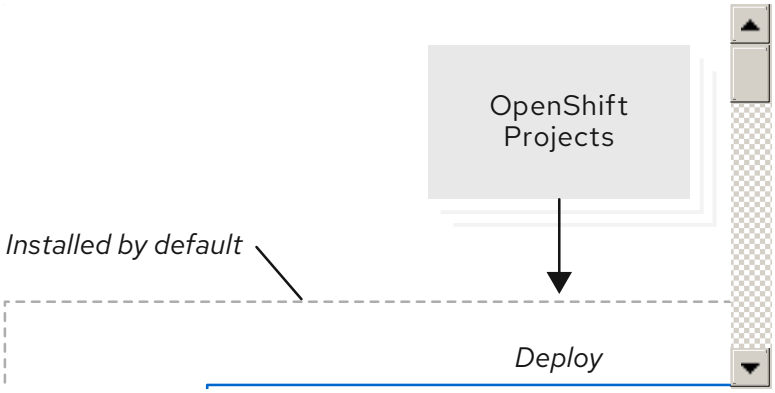
Cluster administrators can grant developers and other users permission to monitor their own projects. Privileges are granted by assigning one of the predefined monitoring roles.

1.1. 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.



1.1.1. Default monitoring components

By default, the OpenShift Container Platform 4.9 monitoring stack includes these components:

Table 1.1. Default monitoring stack components

Component	Description
Cluster Monitoring Operator	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).
Prometheus Operator	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.
Prometheus	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.
Prometheus Adapter	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 **oc adm top nodes** and **oc adm top pods** commands.
Alertmanager	The Alertmanager service handles alerts received from Prometheus. Alertmanager is also responsible for sending the alerts to external notification systems.
kube-state-metrics agent	The **kube-state-metrics** exporter agent (KSM in the preceding diagram) converts Kubernetes objects to metrics that Prometheus can use.
openshift-state-metrics agent	The **openshift-state-metrics** exporter (OSM in the preceding diagram) expands upon **kube-state-metrics** by adding metrics for OpenShift Container Platform-specific resources.
node-exporter agent	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.

Component	Description
Thanos Querier	The Thanos Querier aggregates and optionally deduplicates core OpenShift Container Platform metrics and metrics for user-defined projects under a single, multi-tenant interface.
Grafana	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.
Telemeter Client	The Telemeter Client sends a subsection of the data from platform Prometheus instances to Red Hat to facilitate Remote Health Monitoring for clusters.

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

1.1.2. 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.

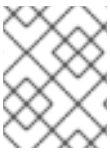
Other OpenShift Container Platform framework components might be exposing metrics as well. For details, see their respective documentation.

1.1.3. Components for monitoring user-defined projects

OpenShift Container Platform 4.9 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

Component	Description
Prometheus Operator	The Prometheus Operator (PO) in the **openshift-user-workload-monitoring** project creates, configures, and manages Prometheus and Thanos Ruler instances in the same project.
Prometheus	Prometheus is the monitoring system through which monitoring is provided for user-defined projects. Prometheus sends alerts to Alertmanager for processing.
Thanos Ruler	The Thanos Ruler is a rule evaluation engine for Prometheus that is deployed as a separate process. In OpenShift Container Platform 4.9, Thanos Ruler provides rule and alerting evaluation for the monitoring of user-defined projects.



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.

1.1.4. 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.

1.2. ADDITIONAL RESOURCES

- About remote health monitoring
- Granting users permission to monitor user-defined projects

1.3. 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.

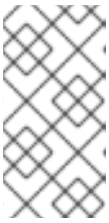
2.2. MAINTENANCE AND SUPPORT FOR MONITORING

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:

```
$ 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**:

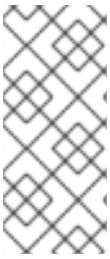
```
apiVersion: v1
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
```

   b. Apply the configuration to create the **ConfigMap** object:

```
$ 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**).

Procedure

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**:

```
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 4.9, 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>**:

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

     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:

     ```
     apiVersion: v1
     kind: ConfigMap
     metadata:
       name: cluster-monitoring-config
       namespace: openshift-monitoring
     data:
       config.yaml: |
         prometheusK8s: 1
           volumeClaimTemplate:
             spec:
               storageClassName: fast
               volumeMode: Filesystem
               resources:
                 requests:
                   storage: 40Gi
     ```

     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>: <component_configuration>**:

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    <component>:
      <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: 1
      retention: 24h 2
      resources:
        requests:
          cpu: 200m 3
          memory: 2Gi 4
```

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.

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.

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

Component	cluster-monitoring-config config map key	user-workload-monitoring-config config map key
Prometheus Operator	**prometheusOperator**	**prometheusOperator**
Prometheus	**prometheusK8s**	**prometheus**
Alertmanager	**alertmanagerMain**	
kube-state-metrics	**kubeStateMetrics**	
openshift-state-metrics	**openshiftStateMetrics**	

Component	cluster-monitoring-config config map key	user-workload-monitoring-config config map key
Grafana	**grafana**	
Telemeter Client	**telemeterClient**	
Prometheus Adapter	**k8sPrometheusAdapter**	
Thanos Querier	**thanosQuerier**	
Thanos Ruler		**thanosRuler**

NOTE

The Prometheus key is called **prometheusK8s** in the **cluster-monitoring-config ConfigMap** object and **prometheus** in the **user-workload-monitoring-config ConfigMap** object.

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:

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

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

```
apiVersion: v1
kind: 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:

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    prometheusOperator:
      nodeSelector:
        nodename: controlplane1
    prometheusK8s:
```

```
      nodeSelector:
        nodename: worker1
        nodename: worker2
    alertmanagerMain:
      nodeSelector:
        nodename: worker1
        nodename: worker2
    kubeStateMetrics:
      nodeSelector:
        nodename: worker1
    grafana:
      nodeSelector:
        nodename: worker1
    telemeterClient:
      nodeSelector:
        nodename: worker1
    k8sPrometheusAdapter:
      nodeSelector:
        nodename: worker1
        nodename: worker2
    openshiftStateMetrics:
      nodeSelector:
        nodename: worker1
    thanosQuerier:
      nodeSelector:
        nodename: worker1
        nodename: worker2
```

- **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:

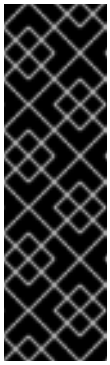
  ```
  $ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
  ```

  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.

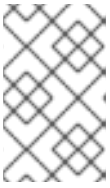
NOTE

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:

```
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:

```
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:

```
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:

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

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

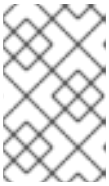
```
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    <component>:
      tolerations:
        <toleration_specification>
```

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:

```
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.

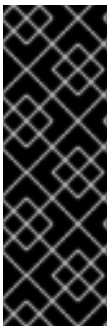
Additional resources

- 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.



IMPORTANT

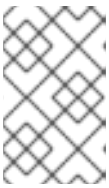
If you are running cluster monitoring with an attached PVC for Prometheus, you might experience OOM kills during cluster upgrade. When persistent storage is in use for Prometheus, Prometheus memory usage doubles during cluster upgrade and for several hours after upgrade is complete. To avoid the OOM kill issue, allow worker nodes with double the size of memory that was available prior to the upgrade. For example, if you are running monitoring on the minimum recommended nodes, which is 2 cores with 8 GB of RAM, increase memory to 16 GB. For more information, see BZ#1925061.

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**:

```
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:

```
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:

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

- **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:

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

  b. Add your PVC configuration 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>:
        volumeClaimTemplate:
          spec:
            storageClassName: <storage_class>
            resources:
              requests:
                storage: <amount_of_storage>
  ```

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

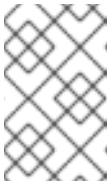
  The following example configures a PVC that claims local persistent storage for the Prometheus instance that monitors user-defined projects:

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

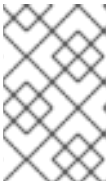
```
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    thanosRuler:
      volumeClaimTemplate:
        spec:
          storageClassName: local-storage
          resources:
            requests:
 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

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

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

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    prometheusK8s:
      retention: 24h
```

- **To modify the retention time for 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. Add your retention time configuration under **data/config.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:

  ```
  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:

```
$ 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:

```
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:

```
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:

```
apiVersion: v1
kind: ConfigMap
```

```
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    prometheusK8s:
      remoteWrite:
      - url: "https://remote-write.endpoint"
        basicAuth:
          username:
            name: remoteWriteAuth
            key: user
          password:
            name: remoteWriteAuth
            key: password
```

- The following example configures client TLS authentication:

```
tlsConfig:
  ca:
    <caSecret>
  cert:
    <certSecret>
  keySecret:
    <keySecret>
```

Substitute **<caSecret>**, **<certSecret>**, and **<keySecret>** accordingly.

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:

```
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:

```
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>
        <write_relabel_configs>
```

For **<write_relabel_configs>** substitute a list of write relabel configurations for metrics that you want to send to the remote endpoint.

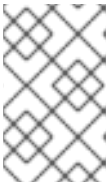
The following sample shows how to forward a single metric called **my_metric**:

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-monitoring
data:
  config.yaml: |
    prometheusK8s:
      remoteWrite:
      - url: "https://remote-write.endpoint"
        writeRelabelConfigs:
        - source_labels: [__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:

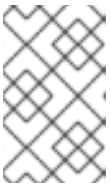
```
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    prometheus:
      remoteWrite:
      - url: "https://remote-write.endpoint"
        <endpoint_authentication_credentials>
        <write_relabel_configs>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



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:

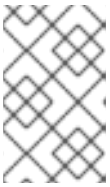
```
$ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
```

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:

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    prometheus:
      enforcedSampleLimit: 50000 1
```

1 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**:

```
apiVersion: monitoring.coreos.com/v1
kind: PrometheusRule
metadata:
  labels:
    prometheus: k8s
    role: alert-rules
  name: monitoring-stack-alerts 1
```

```
  namespace: ns1 (2)
spec:
  groups:
  - name: general.rules
    rules:
    - alert: TargetDown (3)
      annotations:
        message: '{{ printf "%.4g" $value }}% of the {{ $labels.job }}/{{ $labels.service
          }} targets in {{ $labels.namespace }} namespace are down.' (4)
      expr: 100 * (count(up == 0) BY (job, namespace, service) / count(up) BY (job,
        namespace, service)) > 10
      for: 10m (5)
      labels:
        severity: warning (6)
    - alert: ApproachingEnforcedSamplesLimit (7)
      annotations:
        message: '{{ $labels.container }} container of the {{ $labels.pod }} pod in the {{
$labels.namespace }} namespace consumes {{ $value | humanizePercentage }} of the
samples limit budget.' (8)
      expr: scrape_samples_scraped/50000 > 0.8 (9)
      for: 10m (10)
      labels:
        severity: warning (11)
```

(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:

```
$ 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:

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

     b. Add an **additionalAlertmanagerConfigs:** section under **data/config.yaml/prometheusK8s**.

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

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

```
    prometheusK8s:
      additionalAlertmanagerConfigs:
      - <alertmanager_specification>
```

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:

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

- **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:

  ```
  $ 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:

  ```
  apiVersion: v1
  ```

```
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    <component>:
      additionalAlertmanagerConfigs:
      - <alertmanager_specification>
```

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:

```
apiVersion: v1
kind: 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:

```
$ 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**:

```
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
  ```

  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.

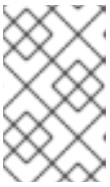
NOTE

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:

```
apiVersion: v1
kind: 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
- See Preparing to configure the monitoring stack for steps to create monitoring config maps

3.2. SETTING LOG LEVELS FOR MONITORING COMPONENTS

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

The following log levels can be applied to each of those components 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 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:

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

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

```
apiVersion: v1
```

```
kind: ConfigMap
metadata:
  name: cluster-monitoring-config
  namespace: openshift-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.

- **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:

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

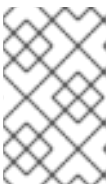
  b. Add **logLevel: <log_level>** for a component under **data/config.yaml**:

  ```
  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.

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.

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:

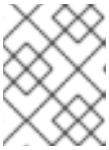
```
$ oc -n openshift-user-workload-monitoring get deploy prometheus-operator -o yaml |  grep "log-level"
```

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:

```
$ 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.

Additional resources

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

3.3. 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:

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

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

WARNING

This change results in some components, including Prometheus and the Thanos Querier, being restarted. This might lead to previously collected metrics being lost if you have not yet followed the steps in the "Configuring persistent storage" section.

4. Check that the Grafana pod is no longer running. The following example lists the status of pods in the **openshift-monitoring** project:

```
$ 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

3.4. 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:

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

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

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

3. Save the file to apply the changes. The Alertmanager instance is disabled automatically when you apply the change.

Additional resources

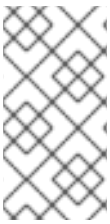
- Prometheus Alertmanager documentation
- Managing alerts

3.5. NEXT STEPS

- Enabling monitoring for user-defined projects
- Learn about remote health reporting and, if necessary, opt out of it

CHAPTER 4. ENABLING MONITORING FOR USER-DEFINED PROJECTS

In OpenShift Container Platform 4.9, you can enable monitoring for user-defined projects in addition to the default platform monitoring. You can now monitor your own projects in OpenShift Container Platform without the need for an additional monitoring solution. Using this new feature centralizes monitoring for core platform components and user-defined projects.

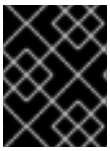


NOTE

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.

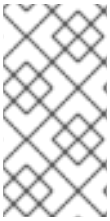
4.1. ENABLING MONITORING FOR USER-DEFINED PROJECTS

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 4.9 you must remove any custom Prometheus instances before enabling monitoring for user-defined projects.

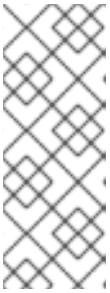


NOTE

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 1
```

1 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

```
NAME                                   READY   STATUS    RESTARTS   AGE
prometheus-operator-6f7b748d5b-t7nbg   2/2     Running   0          3h
prometheus-user-workload-0             4/4     Running   1          3h
prometheus-user-workload-1             4/4     Running   1          3h
thanos-ruler-user-workload-0           3/3     Running   0          3h
thanos-ruler-user-workload-1           3/3     Running   0          3h
```

Additional resources

- Creating a cluster monitoring config map

- Configuring the monitoring stack
- Granting users permission to configure monitoring for user-defined projects

4.2. 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.

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

4.2.1. 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.

4.2.2. 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:

```
$ oc policy add-role-to-user <role> <user> -n <namespace>
```
(1)

(1) 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.

4.3. 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:

```
$ oc -n openshift-user-workload-monitoring adm policy add-role-to-user \
  user-workload-monitoring-config-edit <user> \
  --role-namespace openshift-user-workload-monitoring
```

4.4. 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:

```
$ 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`
```

2. Extract your route host:

```
$ THANOS_QUERIER_HOST=`oc get route thanos-querier -n openshift-monitoring -o json | jq -r '.spec.host'`
```

3. Query the metrics of your own services in the command line. For example:

```
$ NAMESPACE=ns1
```

```
$ curl -X GET -kG "https://$THANOS_QUERIER_HOST/api/v1/query?" --data-urlencode "query=up{namespace='$NAMESPACE'}" -H "Authorization: Bearer $TOKEN"
```

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-jztp2","service":"prometheus-example-app"},"value":[1591881154.748,"1"]}]}}

4.5. 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.

4.6. 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:** to **false** under **data/config.yaml**:

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

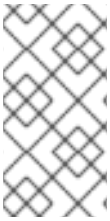
2. Save the file to apply the changes. Monitoring for user-defined projects is then disabled automatically.

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.

4.7. NEXT STEPS

- Managing metrics

CHAPTER 5. MANAGING METRICS

5.1. UNDERSTANDING METRICS

In OpenShift Container Platform 4.9, cluster components are monitored by scraping metrics exposed through service endpoints. You can also configure metrics collection for user-defined projects. Metrics enable you to monitor how cluster components and your own workloads are performing.

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 application and then run the following to view all of its available metrics:

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

Example output

```
# 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.

5.2. 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.

5.2.1. 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:

```
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:0.3.0
        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:

```
$ oc apply -f prometheus-example-app.yaml
```

It takes some time to deploy the service.

4. You can check that the pod is running:

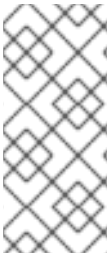
```
$ oc -n ns1 get pod
```

Example output

```
NAME                                  READY   STATUS    RESTARTS   AGE
prometheus-example-app-7857545cb7-sbgwq   1/1     Running   0          81m
```

5.2.2. Specifying how a service is monitored

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.



NOTE

In OpenShift Container Platform 4.9, you can use the **tlsConfig** property for a **ServiceMonitor** resource to specify the TLS configuration to use when scraping metrics from an endpoint. The **tlsConfig** property is not yet available for **PodMonitor** resources. If you need to use a TLS configuration when scraping metrics, you must use **ServiceMonitor** resource.

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.

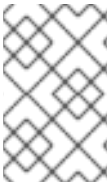
Procedure

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:

```
apiVersion: monitoring.coreos.com/v1
kind: ServiceMonitor
metadata:
  labels:
    k8s-app: prometheus-example-monitor
  name: prometheus-example-monitor
  namespace: ns1
spec:
  endpoints:
```

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

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.

1. Apply the configuration to the cluster:

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

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

2. You can check that the **ServiceMonitor** resource is running:

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

Example output

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

Additional resources

- See the Prometheus Operator API documentation for more information on **ServiceMonitor** and **PodMonitor** resources.
- Enabling monitoring for user-defined projects

5.3. 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.

5.3.1. 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

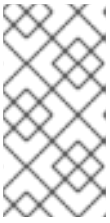
Only cluster administrators have access to the third-party UIs provided with OpenShift Container Platform Monitoring.

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.

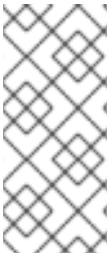
Additional resources

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

5.3.2. 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

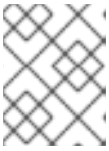
5.3.3. Exploring the visualized metrics

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

5.4. NEXT STEPS

- Managing alerts

CHAPTER 6. MANAGING ALERTS

In OpenShift Container Platform 4.9, 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.

6.1. 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.

6.2. 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.

6.3. 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.

6.4. 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 4.9, 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.

6.4.1. 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 Understanding the monitoring stack for details about OpenShift Container Platform 4.9 monitoring architecture

6.4.2. 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:

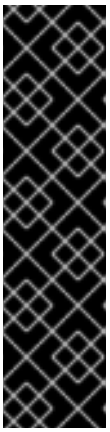
NOTE

When you create an alerting rule, a project label is enforced on it if a rule with the same name exists in another project.

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

```
- name: example
  rules:
  - alert: VersionAlert
    expr: version{job="prometheus-example-app"} == 0
```

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.

6.4.3. 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:

```
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:

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

   It takes some time to create the alerting rule.

- See Understanding the monitoring stack for details about OpenShift Container Platform 4.9 monitoring architecture.

6.4.4. 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>**:

```
$ oc -n <project> get prometheusrule
```

2. To list the configuration of an alerting rule, run the following:

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

6.4.5. Listing alerting rules for all projects in a single view

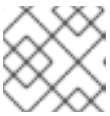
As a cluster administrator, you can list alerting rules for core OpenShift Container Platform and user-defined projects together in a single view.

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 **Monitoring → Alerting → Alerting Rules**.
2. Select the **Platform** and **User** sources in the **Filter** drop-down menu.



NOTE

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

6.4.6. 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:

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

Additional resources

- See the Alertmanager documentation

6.5. 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.

6.5.1. 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  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**.

6.5.2. 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.

6.5.3. 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.

6.6. SENDING NOTIFICATIONS TO EXTERNAL SYSTEMS

In OpenShift Container Platform 4.9, 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.

6.6.1. Configuring alert receivers

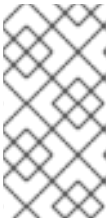
You can configure alert receivers to ensure that you learn about important issues with your cluster.

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.

6.7. 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> 1
    routes:
    - match:
        <your_matching_rules> 2
      receiver: <receiver> 3
receivers:
- 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.

The following Alertmanager configuration example configures PagerDuty as an alert receiver:

```
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: example-app routes: - match: severity: critical receiver: team-frontend-page
receivers:
- name: default
- name: watchdog
- name: team-frontend-page pagerduty_configs: - service_key: "your-key"
```

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 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

6.8. NEXT STEPS

- Reviewing monitoring dashboards

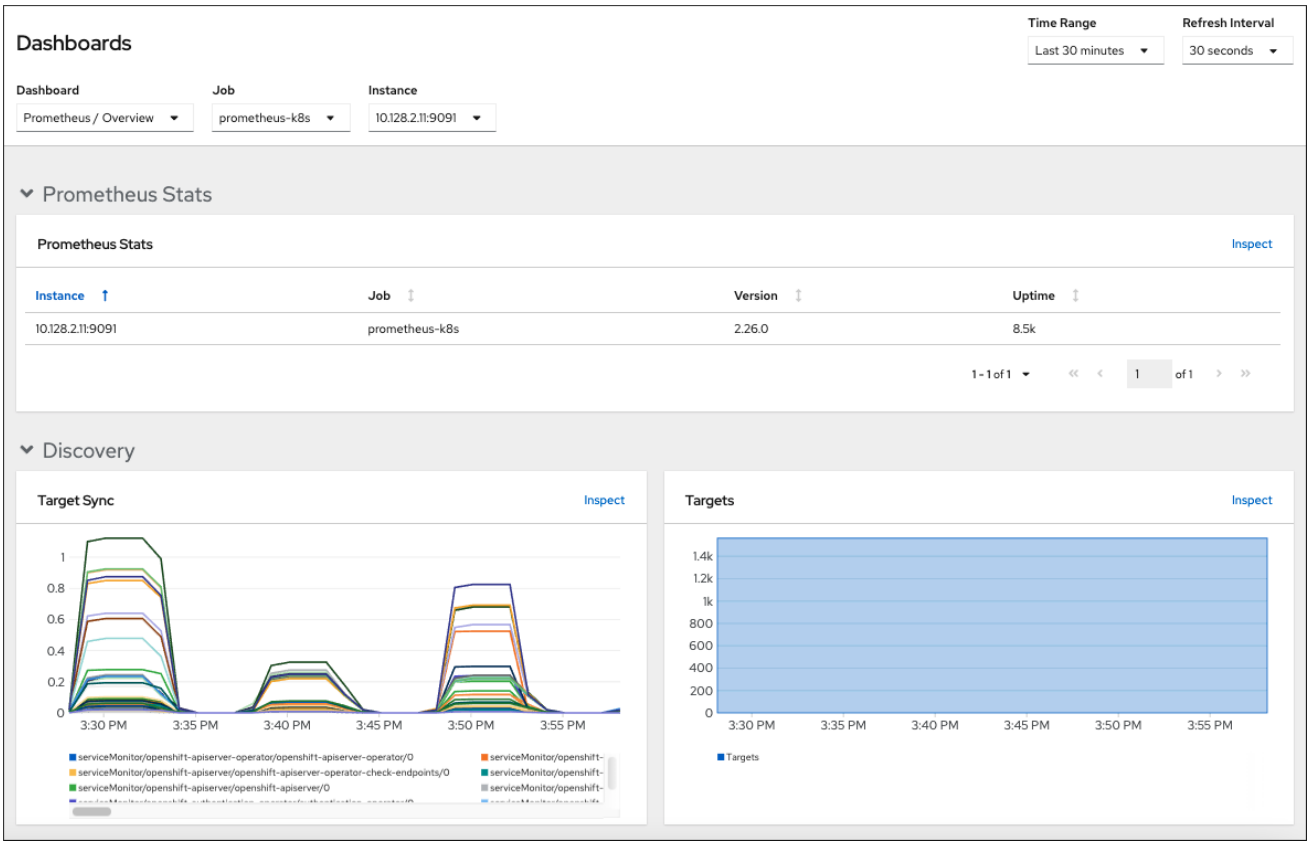
CHAPTER 7. REVIEWING MONITORING DASHBOARDS

OpenShift Container Platform 4.9 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

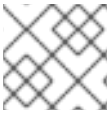
Figure 7.1. Example dashboard in the Administrator perspective



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

Figure 7.2. Example dashboard in the Developer perspective



NOTE

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

7.1. 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.

7.2. 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

7.3. NEXT STEPS

- Accessing third-party UIs

CHAPTER 8. ACCESSING THIRD-PARTY UIS

Integrated Metrics, Alerting, and Dashboard UIs are provided in the OpenShift Container Platform web console. See the following for details on using these integrated UIs:

- Managing metrics
- Managing alerts
- Reviewing monitoring dashboards

OpenShift Container Platform also provides access to the Prometheus, Alertmanager, and Grafana third-party interfaces. Dashboards for some additional platform components are included in **Monitoring → Dashboards** in the OpenShift Container Platform web console.

NOTE

Default access to the third-party monitoring interfaces might be removed in future OpenShift Container Platform releases. Following this, you will need to use port-forwarding to access them.

NOTE

The Grafana instance that is provided with the OpenShift Container Platform monitoring stack, along with its dashboards, is read-only. The Grafana dashboard includes Kubernetes and **cluster-monitoring** metrics only.

8.1. ACCESSING THIRD-PARTY MONITORING UIS BY USING THE WEB CONSOLE

You can access the Alertmanager, Grafana, Prometheus, and Thanos Querier web UIs through the OpenShift Container Platform web console.

Prerequisites

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

Procedure

1. In the **Administrator** perspective, navigate to **Networking → Routes**.

NOTE

Access to the third-party Alertmanager, Grafana, Prometheus, and Thanos Querier UIs is not available from the Developer perspective. Instead, use the Metrics UI link in the Developer perspective, which includes some predefined CPU, memory, bandwidth, and network packet queries for the selected project.

2. Select the **openshift-monitoring** project in the **Project** list.
3. Access a third-party monitoring UI:

- Select the URL in the **alertmanager-main** row to open the login page for the Alertmanager UI.
- Select the URL in the **grafana** row to open the login page for the Grafana UI.
- Select the URL in the **prometheus-k8s** row to open the login page for the Prometheus UI.
- Select the URL in the **thanos-querier** row to open the login page for the Thanos Querier UI.

4. Choose **Log in with OpenShift** to log in using your OpenShift Container Platform credentials.

8.2. ACCESSING THIRD-PARTY MONITORING UIS BY USING THE CLI

You can obtain URLs for the Prometheus, Alertmanager, and Grafana web UIs by using the OpenShift CLI (**oc**) tool.

Prerequisites

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

Procedure

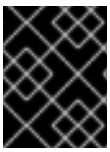
1. Run the following to list routes for the **openshift-monitoring** project:

```
$ oc -n openshift-monitoring get routes
```

Example output

```
NAME                HOST/PORT                                                    ...
alertmanager-main   alertmanager-main-openshift-monitoring.apps._url_.openshift.com ...
grafana             grafana-openshift-monitoring.apps._url_.openshift.com        ...
prometheus-k8s      prometheus-k8s-openshift-monitoring.apps._url_.openshift.com ...
thanos-querier      thanos-querier-openshift-monitoring.apps._url_.openshift.com ...
```

2. Navigate to a **HOST/PORT** route by using a web browser.
3. Select **Log in with OpenShift** to log in using your OpenShift Container Platform credentials.



IMPORTANT

The monitoring routes are managed by the Cluster Monitoring Operator and they cannot be modified by the user.

CHAPTER 9. TROUBLESHOOTING MONITORING ISSUES

9.1. 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

   ```
   NAME                                   READY   STATUS    RESTARTS   AGE
   prometheus-operator-776fcbbd56-2nbfm   2/2     Running   0          132m
   prometheus-user-workload-0             5/5     Running   1          132m
   prometheus-user-workload-1             5/5     Running   1          132m
   thanos-ruler-user-workload-0           3/3     Running   0          132m
   thanos-ruler-user-workload-1           3/3     Running   0          132m
   ```

   b. Obtain the logs from the **prometheus-operator** container in the **prometheus-operator** pod. In the following example, the pod is called **prometheus-operator-776fcbbd56-2nbfm**:

   ```
   $ oc -n openshift-user-workload-monitoring logs prometheus-operator-776fcbbd56-
   2nbfm -c prometheus-operator
   ```

   If there is a 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.

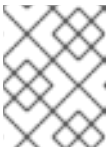
   a. Edit the **user-workload-monitoring-config ConfigMap** object in the **openshift-user-workload-monitoring** project:

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

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"
```

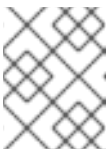
Example output

```
        - --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

- See Specifying how a service is monitored for details on how to create a **ServiceMonitor** or **PodMonitor** resource

9.2. DETERMINING WHY PROMETHEUS IS CONSUMING A LOT OF DISK SPACE

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 U** 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:

```
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