Red Hat OpenShift Service on AWS 4

Cluster administration

Configuring Red Hat OpenShift Service on AWS clusters

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Legal Notice

Abstract

This document provides information about configuring Red Hat OpenShift Service on AWS (ROSA) clusters.

Table of Contents

CHAPTER 1. CONFIGURING PRIVATE CONNECTIONS

1.1. CONFIGURING PRIVATE CONNECTIONS

Private cluster access can be implemented to suit the needs of your Red Hat OpenShift Service on AWS (ROSA) environment.

Procedure

1. Access your ROSA AWS account and use one or more of the following methods to establish a private connection to your cluster:
   - Configuring AWS VPC peering: Enable VPC peering to route network traffic between two private IP addresses.
   - Configuring AWS VPN: Establish a Virtual Private Network to securely connect your private network to your Amazon Virtual Private Cloud.
   - Configuring AWS Direct Connect: Configure AWS Direct Connect to establish a dedicated network connection between your private network and an AWS Direct Connect location.
2. Configure a private cluster on ROSA.

1.2. CONFIGURING AWS VPC PEERING

This sample process configures an Amazon Web Services (AWS) VPC containing an Red Hat OpenShift Service on AWS cluster to peer with another AWS VPC network. For more information about creating an AWS VPC Peering connection or for other possible configurations, see the AWS VPC Peering guide.

1.2.1. VPC peering terms

When setting up a VPC peering connection between two VPCs on two separate AWS accounts, the following terms are used:

Red Hat OpenShift Service on AWS AWS Account	The AWS account that contains the Red Hat OpenShift Service on AWS cluster.
Red Hat OpenShift Service on AWS Cluster VPC	The VPC that contains the Red Hat OpenShift Service on AWS cluster.
Customer AWS Account	Your non-Red Hat OpenShift Service on AWS AWS Account that you would like to peer with.
Customer VPC	The VPC in your AWS Account that you would like to peer with.

Customer VPC Region	The region where the customer's VPC resides.

NOTE

As of July 2018, AWS supports inter-region VPC peering between all commercial regions excluding China.

1.2.2. Initiating the VPC peer request

You can send a VPC peering connection request from the Red Hat OpenShift Service on AWS AWS Account to the Customer AWS Account.

Prerequisites

- Gather the following information about the Customer VPC required to initiate the peering request:
  - Customer AWS account number
  - Customer VPC ID
  - Customer VPC Region
  - Customer VPC CIDR
- Check the CIDR block used by the Red Hat OpenShift Service on AWS Cluster VPC. If it overlaps or matches the CIDR block for the Customer VPC, then peering between these two VPCs is not possible; see the Amazon VPC Unsupported VPC Peering Configurations documentation for details. If the CIDR blocks do not overlap, you can procedure with the procedure.

Procedure

1. Log in to the Web Console for the Red Hat OpenShift Service on AWS AWS Account and navigate to the **VPC Dashboard** in the region where the cluster is being hosted.
2. Go to the **Peering Connections** page and click the **Create Peering Connection** button.
3. Verify the details of the account you are logged in to and the details of the account and VPC you are connecting to:
   a. **Peering connection name tag** Set a descriptive name for the VPC Peering Connection.
   b. **VPC (Requester)**: Select the Red Hat OpenShift Service on AWS Cluster VPC ID from the dropdown *list.
   c. **Account**: Select **Another account** and provide the Customer AWS Account number * (without dashes).
   d. **Region**: If the Customer VPC Region differs from the current region, select **Another Region** and select the customer VPC Region from the dropdown list.
   e. **VPC (Accepter)**: Set the Customer VPC ID.

4. Click **Create Peering Connection**.
5. Confirm that the request enters a **Pending** state. If it enters a **Failed** state, confirm the details and repeat the process.

1.2.3. Accepting the VPC peer request

After you create the VPC peering connection, you must accept the request in the Customer AWS Account.

Prerequisites

- Initiate the VPC peer request.

Procedure

1. Log in to the AWS Web Console.
2. Navigate to **VPC Service**.
3. Go to **Peering Connections**.
4. Click on **Pending peering connection**.
5. Confirm the AWS Account and VPC ID that the request originated from. This should be from the Red Hat OpenShift Service on AWS AWS Account and Red Hat OpenShift Service on AWS Cluster VPC.
6. Click **Accept Request**.

1.2.4. Configuring the routing tables

After you accept the VPC peering request, both VPCs must configure their routes to communicate across the peering connection.

Prerequisites

- Initiate and accept the VPC peer request.

Procedure

1. Log in to the AWS Web Console for the Red Hat OpenShift Service on AWS AWS Account.
2. Navigate to the **VPC Service**, then **Route Tables**.
3. Select the Route Table for the Red Hat OpenShift Service on AWS Cluster VPC.

NOTE

On some clusters, there may be more than one route table for a particular VPC. Select the private one that has a number of explicitly associated subnets.

4. Select the **Routes** tab, then **Edit**.

5. Enter the Customer VPC CIDR block in the **Destination** text box.
6. Enter the Peering Connection ID in the **Target** text box.
7. Click **Save**.
8. You must complete the same process with the other VPC's CIDR block:
    a. Log into the Customer AWS Web Console → **VPC Service** → **Route Tables**.
    b. Select the Route Table for your VPC.
    c. Select the **Routes** tab, then **Edit**.
    d. Enter the Red Hat OpenShift Service on AWS Cluster VPC CIDR block in the **Destination** text box.
    e. Enter the Peering Connection ID in the **Target** text box.
    f. Click **Save**.

The VPC peering connection is now complete. Follow the verification procedure to ensure connectivity across the peering connection is working.

1.2.5. Verifying and troubleshooting VPC peering

After you set up a VPC peering connection, it is best to confirm it has been configured and is working correctly.

Prerequisites

- Initiate and accept the VPC peer request.
- Configure the routing tables.

Procedure

- In the AWS console, look at the route table for the cluster VPC that is peered. Ensure that the steps for configuring the routing tables were followed and that there is a route table entry pointing the VPC CIDR range destination to the peering connection target.
  If the routes look correct on both the Red Hat OpenShift Service on AWS Cluster VPC route table and Customer VPC route table, then the connection should be tested using the **netcat** method below. If the test calls are successful, then VPC peering is working correctly.
- To test network connectivity to an endpoint device, **nc** (or **netcat**) is a helpful troubleshooting tool. It is included in the default image and provides quick and clear output if a connection can be established:
    a. Create a temporary pod using the **busybox** image, which cleans up after itself:

```
$ oc run netcat-test \
    --image=busybox -i -t \
    --restart=Never --rm \
    -- /bin/sh
```

    b. Check the connection using **nc**.

- Example successful connection results:

```
/ nc -zvv 192.168.1.1 8080
10.181.3.180 (10.181.3.180:8080) open
sent 0, rcvd 0
```

- Example failed connection results:

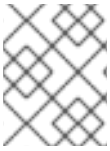
```
/ nc -zvv 192.168.1.2 8080
nc: 10.181.3.180 (10.181.3.180:8081): Connection refused
sent 0, rcvd 0
```

c. Exit the container, which automatically deletes the Pod:

```
/ exit
```

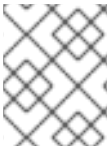
1.3. CONFIGURING AWS VPN

This sample process configures an Amazon Web Services (AWS) Red Hat OpenShift Service on AWS cluster to use a customer's on-site hardware VPN device.



NOTE

AWS VPN does not currently provide a managed option to apply NAT to VPN traffic. See the AWS Knowledge Center for more details.



NOTE

Routing all traffic, for example **0.0.0.0/0**, through a private connection is not supported. This requires deleting the internet gateway, which disables SRE management traffic.

For more information about connecting an AWS VPC to remote networks using a hardware VPN device, see the Amazon VPC VPN Connections documentation.

1.3.1. Creating a VPN connection

You can configure an Amazon Web Services (AWS) Red Hat OpenShift Service on AWS cluster to use a customer's on-site hardware VPN device using the following procedures.

Prerequisites

- Hardware VPN gateway device model and software version, for example Cisco ASA running version 8.3. See the Amazon VPC Network Administrator Guide to confirm whether your gateway device is supported by AWS.
- Public, static IP address for the VPN gateway device.
- BGP or static routing: if BGP, the ASN is required. If static routing, you must configure at least one static route.
- Optional: IP and Port/Protocol of a reachable service to test the VPN connection.

1.3.1.1. Configuring the VPN connection

Procedure

1. Log in to the Red Hat OpenShift Service on AWS AWS Account Dashboard, and navigate to the VPC Dashboard.
2. Click on **Your VPCs** and identify the name and VPC ID for the VPC containing the Red Hat OpenShift Service on AWS cluster.
3. From the VPC Dashboard, click **Customer Gateway**.
4. Click **Create Customer Gateway** and give it a meaningful name.
5. Select the routing method: **Dynamic** or **Static**.
6. If Dynamic, enter the BGP ASN in the field that appears.
7. Paste in the VPN gateway endpoint IP address.
8. Click **Create**.
9. If you do not already have a Virtual Private Gateway attached to the intended VPC:
    a. From the VPC Dashboard, click on **Virtual Private Gateway**.
    b. Click **Create Virtual Private Gateway**, give it a meaningful name, and click **Create**.
    c. Leave the default Amazon default ASN.
    d. Select the newly created gateway, click **Attach to VPC**, and attach it to the cluster VPC you identified earlier.

1.3.1.2. Establishing the VPN Connection

Procedure

1. From the VPC dashboard, click on **Site-to-Site VPN Connections**.
2. Click **Create VPN Connection**.
    a. Give it a meaningful name tag.
    b. Select the virtual private gateway created previously.
    c. For Customer Gateway, select **Existing**.
    d. Select the customer gateway device by name.
    e. If the VPN will use BGP, select **Dynamic**, otherwise select **Static**. Enter Static IP CIDRs. If there are multiple CIDRs, add each CIDR as **Another Rule**.
    f. Click **Create**.
    g. Wait for VPN status to change to **Available**, approximately 5 to 10 minutes.
3. Select the VPN you just created and click **Download Configuration**.

a. From the dropdown list, select the vendor, platform, and version of the customer gateway device, then click **Download**.

b. The **Generic** vendor configuration is also available for retrieving information in a plain text format.

NOTE

After the VPN connection has been established, be sure to set up Route Propagation or the VPN may not function as expected.

NOTE

Note the VPC subnet information, which you must add to your configuration as the remote network.

1.3.1.3. Enabling VPN route propagation

After you have set up the VPN connection, you must ensure that route propagation is enabled so that the necessary routes are added to the VPC's route table.

Procedure

1. From the VPC Dashboard, click on **Route Tables**.
2. Select the private Route table associated with the VPC that contains your Red Hat OpenShift Service on AWS cluster.

NOTE

On some clusters, there may be more than one route table for a particular VPC. Select the private one that has a number of explicitly associated subnets.

3. Click on the **Route Propagation** tab.
4. In the table that appears, you should see the virtual private gateway you created previously. Check the value in the **Propagate column**.
   a. If Propagate is set to **No**, click **Edit route propagation**, check the Propagate checkbox next to the virtual private gateway's name and click **Save**.

After you configure your VPN tunnel and AWS detects it as **Up**, your static or BGP routes are automatically added to the route table.

1.3.2. Verifying the VPN connection

After you have set up your side of the VPN tunnel, you can verify that the tunnel is up in the AWS console and that connectivity across the tunnel is working.

Prerequisites

- Created a VPN connection.

Procedure

1. **Verify the tunnel is up in AWS.**

   a. From the VPC Dashboard, click on **VPN Connections**.

   b. Select the VPN connection you created previously and click the **Tunnel Details** tab.

   c. You should be able to see that at least one of the VPN tunnels is **Up**.

2. **Verify the connection.**
   To test network connectivity to an endpoint device, **nc** (or **netcat**) is a helpful troubleshooting tool. It is included in the default image and provides quick and clear output if a connection can be established:

   a. Create a temporary pod using the **busybox** image, which cleans up after itself:

   ```
   $ oc run netcat-test \
       --image=busybox -i -t \
       --restart=Never --rm \
       -- /bin/sh
   ```

   b. Check the connection using **nc**.

   - Example successful connection results:

   ```
   / nc -zvv 192.168.1.1 8080
   10.181.3.180 (10.181.3.180:8080) open
   sent 0, rcvd 0
   ```

   - Example failed connection results:

   ```
   / nc -zvv 192.168.1.2 8080
   nc: 10.181.3.180 (10.181.3.180:8081): Connection refused
   sent 0, rcvd 0
   ```

   c. Exit the container, which automatically deletes the Pod:

   ```
   / exit
   ```

1.3.3. Troubleshooting the VPN connection

Tunnel does not connect
If the tunnel connection is still **Down**, there are several things you can verify:

- The AWS tunnel will not initiate a VPN connection. The connection attempt must be initiated from the Customer Gateway.
- Ensure that your source traffic is coming from the same IP as the configured customer gateway. AWS will silently drop all traffic to the gateway whose source IP address does not match.
- Ensure that your configuration matches values supported by AWS. This includes IKE versions, DH groups, IKE lifetime, and more.
- Recheck the route table for the VPC. Ensure that propagation is enabled and that there are entries in the route table that have the virtual private gateway you created earlier as a target.

- Confirm that you do not have any firewall rules that could be causing an interruption.
- Check if you are using a policy-based VPN as this can cause complications depending on how it is configured.
- Further troubleshooting steps can be found at the AWS Knowledge Center.

Tunnel does not stay connected
If the tunnel connection has trouble staying **Up** consistently, know that all AWS tunnel connections must be initiated from your gateway. AWS tunnels do not initiate tunneling .

Red Hat recommends setting up an SLA Monitor (Cisco ASA) or some device on your side of the tunnel that constantly sends "interesting" traffic, for example **ping**, **nc**, or **telnet**, at any IP address configured within the VPC CIDR range. It does not matter whether the connection is successful, just that the traffic is being directed at the tunnel.

Secondary tunnel in Down state
When a VPN tunnel is created, AWS creates an additional failover tunnel. Depending upon the gateway device, sometimes the secondary tunnel will be seen as in the **Down** state.

The AWS Notification is as follows:

> You have new non-redundant VPN connections
>
> One or more of your vpn connections are not using both tunnels. This mode of operation is not highly available and we strongly recommend you configure your second tunnel. View your non-redundant VPN connections.

1.4. CONFIGURING AWS DIRECT CONNECT

This process describes accepting an AWS Direct Connect virtual interface with Red Hat OpenShift Service on AWS. For more information about AWS Direct Connect types and configuration, see the AWS Direct Connect components documentation.

1.4.1. AWS Direct Connect methods

A Direct Connect connection requires a hosted Virtual Interface (VIF) connected to a Direct Connect Gateway (DXGateway), which is in turn associated to a Virtual Gateway (VGW) or a Transit Gateway in order to access a remote VPC in the same or another account.

If you do not have an existing DXGateway, the typical process involves creating the hosted VIF, with the DXGateway and VGW being created in the Red Hat OpenShift Service on AWS AWS Account.

If you have an existing DXGateway connected to one or more existing VGWs, the process involves the Red Hat OpenShift Service on AWS AWS Account sending an Association Proposal to the DXGateway owner. The DXGateway owner must ensure that the proposed CIDR will not conflict with any other VGWs they have associated.

See the following AWS documentation for more details:

- Virtual Interfaces
- Direct Connect Gateways
- Associating a VGW across accounts

IMPORTANT

When connecting to an existing DXGateway, you are responsible for the costs.

There are two configuration options available:

Method 1	Create the hosted VIF and then the DXGateway and VGW.
Method 2	Request a connection via an existing Direct Connect Gateway that you own.

1.4.2. Creating the hosted Virtual Interface

Prerequisites

- Gather Red Hat OpenShift Service on AWS AWS Account ID.

1.4.2.1. Determining the type of Direct Connect connection

View the Direct Connect Virtual Interface details to determine the type of connection.

Procedure

1. Log in to the Red Hat OpenShift Service on AWS AWS Account Dashboard and select the correct region.
2. Select **Direct Connect** from the **Services** menu.
3. There will be one or more Virtual Interfaces waiting to be accepted, select one of them to view the **Summary**.
4. View the Virtual Interface type: private or public.
5. Record the **Amazon side ASN** value.

If the Direct Connect Virtual Interface type is Private, a Virtual Private Gateway is created. If the Direct Connect Virtual Interface is Public, a Direct Connect Gateway is created.

1.4.2.2. Creating a Private Direct Connect

A Private Direct Connect is created if the Direct Connect Virtual Interface type is Private.

Procedure

1. Log in to the Red Hat OpenShift Service on AWS AWS Account Dashboard and select the correct region.
2. From the AWS region, select **VPC** from the **Services** menu.
3. Select **Virtual Private Gateways** from **VPN Connections**.
4. Click **Create Virtual Private Gateway**.
5. Give the Virtual Private Gateway a suitable name.

6. Select **Custom ASN** and enter the **Amazon side ASN** value gathered previously.
7. Create the Virtual Private Gateway.
8. Click the newly created Virtual Private Gateway and choose **Attach to VPC** from the **Actions** tab.
9. Select the **Red Hat OpenShift Service on AWS Cluster VPC**from the list, and attach the Virtual Private Gateway to the VPC.
10. From the **Services** menu, click **Direct Connect**. Choose one of the Direct Connect Virtual Interfaces from the list.
11. Acknowledge the **I understand that Direct Connect port charges apply once I click Accept Connection** message, then choose **Accept Connection**.
12. Choose to **Accept** the Virtual Private Gateway Connection and select the Virtual Private Gateway that was created in the previous steps.
13. Select **Accept** to accept the connection.
14. Repeat the previous steps if there is more than one Virtual Interface.

1.4.2.3. Creating a Public Direct Connect

A Public Direct Connect is created if the Direct Connect Virtual Interface type is Public.

Procedure

1. Log in to the Red Hat OpenShift Service on AWS AWS Account Dashboard and select the correct region.
2. From the Red Hat OpenShift Service on AWS AWS Account region, select **Direct Connect** from the **Services** menu.
3. Select **Direct Connect Gateways** and **Create Direct Connect Gateway**.
4. Give the Direct Connect Gateway a suitable name.
5. In the **Amazon side ASN**, enter the Amazon side ASN value gathered previously.
6. Create the Direct Connect Gateway.
7. Select **Direct Connect** from the **Services** menu.
8. Select one of the Direct Connect Virtual Interfaces from the list.
9. Acknowledge the **I understand that Direct Connect port charges apply once I click Accept Connection** message, then choose **Accept Connection**.
10. Choose to **Accept** the Direct Connect Gateway Connection and select the Direct Connect Gateway that was created in the previous steps.
11. Click **Accept** to accept the connection.
12. Repeat the previous steps if there is more than one Virtual Interface.

1.4.2.4. Verifying the Virtual Interfaces

After the Direct Connect Virtual Interfaces have been accepted, wait a short period and view the status of the Interfaces.

Procedure

1. Log in to the Red Hat OpenShift Service on AWS AWS Account Dashboard and select the correct region.
2. From the Red Hat OpenShift Service on AWS AWS Account region, select **Direct Connect** from the **Services** menu.
3. Select one of the Direct Connect Virtual Interfaces from the list.
4. Check the Interface State has become **Available**
5. Check the Interface BGP Status has become **Up**.
6. Repeat this verification for any remaining Direct Connect Interfaces.

After the Direct Connect Virtual Interfaces are available, you can log in to the Red Hat OpenShift Service on AWS AWS Account Dashboard and download the Direct Connect configuration file for configuration on your side.

1.4.3. Connecting to an existing Direct Connect Gateway

Prerequisites

- Confirm the CIDR range of the Red Hat OpenShift Service on AWS VPC will not conflict with any other VGWs you have associated.
- Gather the following information:
  - The Direct Connect Gateway ID.
  - The AWS Account ID associated with the virtual interface.
  - The BGP ASN assigned for the DXGateway. Optional: the Amazon default ASN may also be used.

Procedure

1. Log in to the Red Hat OpenShift Service on AWS AWS Account Dashboard and select the correct region.
2. From the Red Hat OpenShift Service on AWS AWS Account region, select **VPC** from the **Services** menu.
3. From **VPN Connections**, select **Virtual Private Gateways**.
4. Select **Create Virtual Private Gateway**.
5. Give the Virtual Private Gateway a suitable name.

6. Click **Custom ASN** and enter the **Amazon side ASN** value gathered previously or use the Amazon Provided ASN.
7. Create the Virtual Private Gateway.
8. In the **Navigation** pane of the Red Hat OpenShift Service on AWS AWS Account Dashboard, choose **Virtual private gateways** and select the virtual private gateway. Choose **View details**.
9. Choose **Direct Connect gateway associations** and click **Associate Direct Connect gateway**.
10. Under **Association account type**, for Account owner, choose **Another account**.
11. For **Direct Connect gateway owner**, enter the ID of the AWS account that owns the Direct Connect gateway.
12. Under **Association settings**, for Direct Connect gateway ID, enter the ID of the Direct Connect gateway.
13. Under **Association settings**, for Virtual interface owner, enter the ID of the AWS account that owns the virtual interface for the association.
14. Optional: Add prefixes to Allowed prefixes, separating them using commas.
15. Choose **Associate Direct Connect gateway**.
16. After the Association Proposal has been sent, it will be waiting for your acceptance. The final steps you must perform are available in the AWS Documentation.

1.4.4. Troubleshooting Direct Connect

Further troubleshooting can be found in the Troubleshooting AWS Direct Connect documentation.

CHAPTER 2. NODES

2.1. ABOUT MACHINE POOLS

Red Hat OpenShift Service on AWS uses machine pools as an elastic, dynamic provisioning method on top of your cloud infrastructure.

The primary resources are machines, machine sets, and machine pools.

IMPORTANT

As of the Red Hat OpenShift Service on AWS versions 4.8.35, 4.9.26, 4.10.6, the Red Hat OpenShift Service on AWS default per-pod pid limit is **4096**. If you want to enable this PID limit, you must upgrade your Red Hat OpenShift Service on AWS clusters to these versions or later. Red Hat OpenShift Service on AWS clusters with prior versions use a default PID limit of **1024**.

You cannot configure the per-pod PID limit on any Red Hat OpenShift Service on AWS cluster.

2.1.1. Machines

A machine is a fundamental unit that describes the host for a worker node.

2.1.2. Machine sets

MachineSet resources are groups of machines. If you need more machines or must scale them down, change the number of replicas in the machine pool to which the machine sets belong.

Machine sets are not directly modifiable in ROSA.

2.1.3. Machine pools

Machine pools are a higher level construct to machine sets.

A machine pool creates machine sets that are all clones of the same configuration across availability zones. Machine pools perform all of the host node provisioning management actions on a worker node. If you need more machines or must scale them down, change the number of replicas in the machine pool to meet your compute needs. You can manually configure scaling or set autoscaling.

By default, a cluster is created with one machine pool. You can add additional machine pools to an existing cluster, modify the default machine pool, and delete machine pools.

Multiple machine pools can exist on a single cluster, and they can each have different types or different size nodes.

2.1.4. Machine pools in multiple zone clusters

When you create a machine pool in a multiple availability zone (Multi-AZ) cluster, that one machine pool has 3 zones. The machine pool, in turn, creates a total of 3 machine sets - one machine set for each zone in the cluster. Each of those machine sets manages one or more machines in its respective availability zone.

If you create a new Multi-AZ cluster, the machine pools are replicated to those zones automatically. If

you add a machine pool to an existing Multi-AZ, the new pool is automatically created in those zones. Similarly, deleting a machine pool will delete it from all zones. Due to this multiplicative effect, using machine pools in Multi-AZ cluster can consume more of your project's quota for a specific region when creating machine pools.

2.1.5. Additional resources

- Managing worker nodes
- About autoscaling

2.2. MANAGING COMPUTE NODES

This document describes how to manage compute (also known as worker) nodes with Red Hat OpenShift Service on AWS (ROSA).

The majority of changes for compute nodes are configured on machine pools. A machine pool is a group of compute nodes in a cluster that have the same configuration, providing ease of management.

You can edit machine pool configuration options such as scaling, adding node labels, and adding taints.

2.2.1. Creating a machine pool

A default machine pool is created when you install a Red Hat OpenShift Service on AWS (ROSA) cluster. After installation, you can create additional machine pools for your cluster by using OpenShift Cluster Manager or the ROSA CLI (**rosa**).

2.2.1.1. Creating a machine pool using OpenShift Cluster Manager

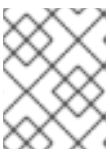
You can create additional machine pools for your Red Hat OpenShift Service on AWS (ROSA) cluster by using OpenShift Cluster Manager.

Prerequisites

- You created a ROSA cluster.

Procedure

1. Navigate to OpenShift Cluster Manager Hybrid Cloud Console and select your cluster.
2. Under the **Machine pools** tab, click **Add machine pool**.
3. Add a **Machine pool name**.
4. Select a **Worker node instance type** from the drop-down menu. The instance type defines the vCPU and memory allocation for each compute node in the machine pool.



NOTE

You cannot change the instance type for a machine pool after the pool is created.

5. Optional: Configure autoscaling for the machine pool:

a. Select **Enable autoscaling** to automatically scale the number of machines in your machine pool to meet the deployment needs.

b. Set the minimum and maximum node count limits for autoscaling. The cluster autoscaler does not reduce or increase the machine pool node count beyond the limits that you specify.

- If you deployed your cluster using a single availability zone, set the **Minimum and maximum node count**. This defines the minimum and maximum compute node limits in the availability zone.
- If you deployed your cluster using multiple availability zones, set the **Minimum nodes per zone** and **Maximum nodes per zone**. This defines the minimum and maximum compute node limits per zone.

NOTE

Alternatively, you can set your autoscaling preferences for the machine pool after the machine pool is created.

6. If you did not enable autoscaling, select a compute node count:

- If you deployed your cluster using a single availability zone, select a **Worker node count** from the drop-down menu. This defines the number of compute nodes to provision to the machine pool for the zone.
- If you deployed your cluster using multiple availability zones, select a **Worker node count (per zone)** from the drop-down menu. This defines the number of compute nodes to provision to the machine pool per zone.

7. Optional: Add node labels and taints for your machine pool:

a. Expand the **Edit node labels and taints** menu.

b. Under **Node labels**, add **Key** and **Value** entries for your node labels.

c. Under **Taints**, add **Key** and **Value** entries for your taints.

d. For each taint, select an **Effect** from the drop-down menu. Available options include **NoSchedule**, **PreferNoSchedule**, and **NoExecute**.

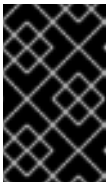
NOTE

Alternatively, you can add the node labels and taints after you create the machine pool.

8. Optional: Use Amazon EC2 Spot Instances if you want to configure your machine pool to deploy machines as non-guaranteed AWS Spot Instances:

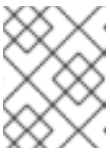
a. Select **Use Amazon EC2 Spot Instances**.

b. Leave **Use On-Demand instance price** selected to use the on-demand instance price. Alternatively, select **Set maximum price** to define a maximum hourly price for a Spot Instance.
For more information about Amazon EC2 Spot Instances, see the AWS documentation.



IMPORTANT

Your Amazon EC2 Spot Instances might be interrupted at any time. Use Amazon EC2 Spot Instances only for workloads that can tolerate interruptions.



NOTE

If you select **Use Amazon EC2 Spot Instances** for a machine pool, you cannot disable the option after the machine pool is created.

9. Click **Add machine pool** to create the machine pool.

Verification

- Verify that the machine pool is visible on the **Machine pools** page and the configuration is as expected.

2.2.1.2. Creating a machine pool using the ROSA CLI

You can create additional machine pools for your Red Hat OpenShift Service on AWS (ROSA) cluster by using the ROSA CLI (**rosa**).

Prerequisites

- You installed and configured the latest AWS (**aws**), ROSA (**rosa**), and OpenShift (**oc**) CLIs on your workstation.
- You logged in to your Red Hat account by using the **rosa** CLI.
- You created a ROSA cluster.

Procedure

- To add a machine pool that does not use autoscaling, create the machine pool and define the instance type, compute (also known as worker) node count, and node labels:

```
$ rosa create machinepool --cluster=<cluster-name> \
                          --name=<machine_pool_id> \ 1
                          --replicas=<replica_count> \ 2
                          --instance-type=<instance_type> \ 3
                          --labels=<key>=<value>,<key>=<value> \ 4
                          --taints=<key>=<value>:<effect>,<key>=<value>:<effect> \ 5
                          --use-spot-instances \ 6
                          --spot-max-price=0.5 7
```

1. Specifies the name of the machine pool. Replace **<machine_pool_id>** with the name of your machine pool.
2. Specifies the number of compute nodes to provision. If you deployed ROSA using a single availability zone, this defines the number of compute nodes to provision to the machine pool for the zone. If you deployed your cluster using multiple availability zones, this defines the number of compute nodes to provision in total across all zones and the count must be a

multiple of 3. The **--replicas** argument is required when autoscaling is not configured.

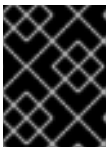
3. Optional: Sets the instance type for the compute nodes in your machine pool. The instance type defines the vCPU and memory allocation for each compute node in the pool. Replace **<instance_type>** with an instance type. The default is **m5.xlarge**. You cannot change the instance type for a machine pool after the pool is created.

4. Optional: Defines the labels for the machine pool. Replace **<key>=<value>,<key>=<value>** with a comma-delimited list of key-value pairs, for example **--labels=key1=value1,key2=value2**.

5. Optional: Defines the taints for the machine pool. Replace **<key>=<value>:<effect>, <key>=<value>:<effect>** with a key, value, and effect for each taint, for example **--taints=key1=value1:NoSchedule,key2=value2:NoExecute**. Available effects include **NoSchedule**, **PreferNoSchedule**, and **NoExecute**.

6. Optional: Configures your machine pool to deploy machines as non-guaranteed AWS Spot Instances. For information, see Amazon EC2 Spot Instances in the AWS documentation. If you select **Use Amazon EC2 Spot Instances** for a machine pool, you cannot disable the option after the machine pool is created.

7. Optional: If you have opted to use Spot Instances, you can specify this argument to define a maximum hourly price for a Spot Instance. If this argument is not specified, the on-demand price is used.



IMPORTANT

Your Amazon EC2 Spot Instances might be interrupted at any time. Use Amazon EC2 Spot Instances only for workloads that can tolerate interruptions.

The following example creates a machine pool called **mymachinepool** that uses the **m5.xlarge** instance type and has 2 compute node replicas. The example also adds 2 workload-specific labels:

```
$ rosa create machinepool --cluster=mycluster --name=mymachinepool --replicas=2 --
instance-type=m5.xlarge --labels=app=db,tier=backend
```

Example output

```
I: Machine pool 'mymachinepool' created successfully on cluster 'mycluster'
I: To view all machine pools, run 'rosa list machinepools -c mycluster'
```

- To add a machine pool that uses autoscaling, create the machine pool and define the autoscaling configuration, instance type and node labels:

```
$ rosa create machinepool --cluster=<cluster-name> \
                          --name=<machine_pool_id> \ 1
                          --enable-autoscaling \ 2
                          --min-replicas=<minimum_replica_count> \ 3
                          --max-replicas=<maximum_replica_count> \ 4
                          --instance-type=<instance_type> \ 5
                          --labels=<key>=<value>,<key>=<value> \ 6
```

```
--taints=<key>=<value>:<effect>,<key>=<value>:<effect> \ 7
--use-spot-instances \ 8
--spot-max-price=0.5 9
```

1. Specifies the name of the machine pool. Replace **<machine_pool_id>** with the name of your machine pool.
2. Enables autoscaling in the machine pool to meet the deployment needs.
3. 4. Defines the minimum and maximum compute node limits. The cluster autoscaler does not reduce or increase the machine pool node count beyond the limits that you specify. If you deployed ROSA using a single availability zone, the **--min-replicas** and **--max-replicas** arguments define the autoscaling limits in the machine pool for the zone. If you deployed your cluster using multiple availability zones, the arguments define the autoscaling limits in total across all zones and the counts must be multiples of 3.
5. Optional: Sets the instance type for the compute nodes in your machine pool. The instance type defines the vCPU and memory allocation for each compute node in the pool. Replace **<instance_type>** with an instance type. The default is **m5.xlarge**. You cannot change the instance type for a machine pool after the pool is created.
6. Optional: Defines the labels for the machine pool. Replace **<key>=<value>,<key>=<value>** with a comma-delimited list of key-value pairs, for example **--labels=key1=value1,key2=value2**.
7. Optional: Defines the taints for the machine pool. Replace **<key>=<value>:<effect>, <key>=<value>:<effect>** with a key, value, and effect for each taint, for example **--taints=key1=value1:NoSchedule,key2=value2:NoExecute**. Available effects include **NoSchedule**, **PreferNoSchedule**, and **NoExecute**.
8. Optional: Configures your machine pool to deploy machines as non-guaranteed AWS Spot Instances. For information, see Amazon EC2 Spot Instances in the AWS documentation. If you select **Use Amazon EC2 Spot Instances** for a machine pool, you cannot disable the option after the machine pool is created.
9. Optional: If you have opted to use Spot Instances, you can specify this argument to define a maximum hourly price for a Spot Instance. If this argument is not specified, the on-demand price is used.

IMPORTANT

Your Amazon EC2 Spot Instances might be interrupted at any time. Use Amazon EC2 Spot Instances only for workloads that can tolerate interruptions.

The following example creates a machine pool called **mymachinepool** that uses the **m5.xlarge** instance type and has autoscaling enabled. The minimum compute node limit is 3 and the maximum is 6 overall. The example also adds 2 workload-specific labels:

```
$ rosa create machinepool --cluster=mycluster --name=mymachinepool --enable-autoscaling
--min-replicas=3 --max-replicas=6 --instance-type=m5.xlarge --labels=app=db,tier=backend
```

Example output

```
I: Machine pool 'mymachinepool' created successfully on cluster 'mycluster'
I: To view all machine pools, run 'rosa list machinepools -c mycluster'
```

Verification

1. List the available machine pools in your cluster:

```
$ rosa list machinepools --cluster=<cluster_name>
```

Example output

```
ID           AUTOSCALING  REPLICAS  INSTANCE TYPE  LABELS                TAINTS
AVAILABILITY ZONES                SPOT INSTANCES
Default      No           3         m5.xlarge                            us-east-1a, us-east-1b, us-
east-1c    N/A
mymachinepool  Yes        3-6       m5.xlarge      app=db, tier=backend  us-east-1a,
us-east-1b, us-east-1c    No
```

2. Verify that the machine pool is included in the output and the configuration is as expected.

Additional resources

- For a detailed list of the arguments that are available for the **rosa create machinepool** subcommand, see Managing objects with the rosa CLI.

2.2.2. Scaling compute nodes manually

If you have not enabled autoscaling for your machine pool, you can manually scale the number of compute (also known as worker) nodes in the pool to meet your deployment needs.

You must scale each machine pool separately.

Prerequisites

- You installed and configured the latest AWS (**aws**), ROSA (**rosa**), and OpenShift (**oc**) CLIs on your workstation.
- You logged in to your Red Hat account by using the **rosa** CLI.
- You created a Red Hat OpenShift Service on AWS (ROSA) cluster.
- You have an existing machine pool.

Procedure

1. List the machine pools in the cluster:

```
$ rosa list machinepools --cluster=<cluster_name>
```

Example output

```
ID       AUTOSCALING   REPLICAS    INSTANCE TYPE  LABELS    TAINTS
AVAILABILITY ZONES
```

```
default   No        2        m5.xlarge                   us-east-1a
mp1       No        2        m5.xlarge                   us-east-1a
```

2. Increase or decrease the number of compute node replicas in a machine pool:

```
$ rosa edit machinepool --cluster=<cluster_name> \
                        --replicas=<replica_count> \ 1
                        <machine_pool_id> 2
```

1. If you deployed Red Hat OpenShift Service on AWS (ROSA) using a single availability zone, the replica count defines the number of compute nodes to provision to the machine pool for the zone. If you deployed your cluster using multiple availability zones, the count defines the total number of compute nodes in the machine pool across all zones and must be a multiple of 3.

2. Replace **<machine_pool_id>** with the ID of your machine pool, as listed in the output of the preceding command.

Verification

1. List the available machine pools in your cluster:

```
$ rosa list machinepools --cluster=<cluster_name>
```

Example output

```
ID       AUTOSCALING   REPLICAS    INSTANCE TYPE  LABELS    TAINTS
AVAILABILITY ZONES
default   No          2          m5.xlarge                   us-east-1a
mp1       No          3          m5.xlarge                   us-east-1a
```

2. In the output of the preceding command, verify that the compute node replica count is as expected for your machine pool. In the example output, the compute node replica count for the **mp1** machine pool is scaled to 3.

2.2.3. Node labels

A label is a key-value pair applied to a **Node** object. You can use labels to organize sets of objects and control the scheduling of pods.

You can add labels during cluster creation or after. Labels can be modified or updated at any time.

Additional resources

- For more information about labels, see Kubernetes Labels and Selectors overview .

2.2.3.1. Adding node labels to a machine pool

Add or edit labels for compute (also known as worker) nodes at any time to manage the nodes in a manner that is relevant to you. For example, you can assign types of workloads to specific nodes.

Labels are assigned as key-value pairs. Each key must be unique to the object it is assigned to.

Prerequisites

- You installed and configured the latest AWS (**aws**), ROSA (**rosa**), and OpenShift (**oc**) CLIs on your workstation.
- You logged in to your Red Hat account by using the **rosa** CLI.
- You created a Red Hat OpenShift Service on AWS (ROSA) cluster.
- You have an existing machine pool.

Procedure

1. List the machine pools in the cluster:

```
$ rosa list machinepools --cluster=<cluster_name>
```

Example output

```
ID          AUTOSCALING  REPLICAS  INSTANCE TYPE  LABELS    TAINTS
AVAILABILITY ZONES    SPOT INSTANCES
Default     No           2         m5.xlarge                  us-east-1a          N/A
db-nodes-mp  No          2         m5.xlarge                  us-east-1a          No
```

2. Add or update the node labels for a machine pool:

   - To add or update node labels for a machine pool that does not use autoscaling, run the following command:

```
$ rosa edit machinepool --cluster=<cluster_name> \
                        --replicas=<replica_count> \ 1
                        --labels=<key>=<value>,<key>=<value> \ 2
                        <machine_pool_id>
```

   1. For machine pools that do not use autoscaling, you must provide a replica count when adding node labels. If you do not specify the **--replicas** argument, you are prompted for a replica count before the command completes. If you deployed Red Hat OpenShift Service on AWS (ROSA) using a single availability zone, the replica count defines the number of compute nodes to provision to the machine pool for the zone. If you deployed your cluster using multiple availability zones, the count defines the total number of compute nodes in the machine pool across all zones and must be a multiple of 3.
   2. Replace **<key>=<value>,<key>=<value>** with a comma-delimited list of key-value pairs, for example **--labels=key1=value1,key2=value2**. This list overwrites any modifications made to node labels on an ongoing basis.

   The following example adds labels to the **db-nodes-mp** machine pool:

```
$ rosa edit machinepool --cluster=mycluster --replicas=2 --labels=app=db,tier=backend
db-nodes-mp
```

Example output

```
I: Updated machine pool 'db-nodes-mp' on cluster 'mycluster'
```

- To add or update node labels for a machine pool that uses autoscaling, run the following command:

```
$ rosa edit machinepool --cluster=<cluster_name> \
                        --min-replicas=<minimum_replica_count> \ 1
                        --max-replicas=<maximum_replica_count> \ 2
                        --labels=<key>=<value>,<key>=<value> \ 3
                        <machine_pool_id>
```

1 2 For machine pools that use autoscaling, you must provide minimum and maximum compute node replica limits. If you do not specify the arguments, you are prompted for the values before the command completes. The cluster autoscaler does not reduce or increase the machine pool node count beyond the limits that you specify. If you deployed ROSA using a single availability zone, the **--min-replicas** and **--max-replicas** arguments define the autoscaling limits in the machine pool for the zone. If you deployed your cluster using multiple availability zones, the arguments define the autoscaling limits in total across all zones and the counts must be multiples of 3.

3 Replace **<key>=<value>,<key>=<value>** with a comma-delimited list of key-value pairs, for example **--labels=key1=value1,key2=value2**. This list overwrites any modifications made to node labels on an ongoing basis.

The following example adds labels to the **db-nodes-mp** machine pool:

```
$ rosa edit machinepool --cluster=mycluster --min-replicas=2 --max-replicas=3 --
labels=app=db,tier=backend db-nodes-mp
```

Example output

```
I: Updated machine pool 'db-nodes-mp' on cluster 'mycluster'
```

Verification

1. List the available machine pools in your cluster:

```
$ rosa list machinepools --cluster=<cluster_name>
```

Example output

```
ID          AUTOSCALING  REPLICAS  INSTANCE TYPE  LABELS                TAINTS
AVAILABILITY ZONES    SPOT INSTANCES
Default     No           2         m5.xlarge                            us-east-1a          N/A
db-nodes-mp  No          2         m5.xlarge      app=db, tier=backend  us-east-1a
No
```

2. Verify that the labels are included for your machine pool in the output.

2.2.4. Adding taints to a machine pool

You can add taints for compute (also known as worker) nodes in a machine pool to control which pods are scheduled to them. When you apply a taint to a machine pool, the scheduler cannot place a pod on the nodes in the pool unless the pod specification includes a toleration for the taint.

Prerequisites

- You installed and configured the latest AWS (**aws**), ROSA (**rosa**), and OpenShift (**oc**) CLIs on your workstation.
- You logged in to your Red Hat account by using the **rosa** CLI.
- You created a Red Hat OpenShift Service on AWS (ROSA) cluster.
- You have an existing machine pool.

Procedure

1. List the machine pools in the cluster:

```
$ rosa list machinepools --cluster=<cluster_name>
```

Example output

```
ID          AUTOSCALING  REPLICAS  INSTANCE TYPE  LABELS    TAINTS
AVAILABILITY ZONES    SPOT INSTANCES
Default     No           2         m5.xlarge                  us-east-1a          N/A
db-nodes-mp  No          2         m5.xlarge                  us-east-1a          No
```

2. Add or update the taints for a machine pool:

   - To add or update taints for a machine pool that does not use autoscaling, run the following command:

```
$ rosa edit machinepool --cluster=<cluster_name> \
                        --replicas=<replica_count> \ 1
                        --taints=<key>=<value>:<effect>,<key>=<value>:<effect> \ 2
                        <machine_pool_id>
```

1 For machine pools that do not use autoscaling, you must provide a replica count when adding taints. If you do not specify the **--replicas** argument, you are prompted for a replica count before the command completes. If you deployed Red Hat OpenShift Service on AWS (ROSA) using a single availability zone, the replica count defines the number of compute nodes to provision to the machine pool for the zone. If you deployed your cluster using multiple availability zones, the count defines the total number of compute nodes in the machine pool across all zones and must be a multiple of 3.

2 Replace **<key>=<value>:<effect>,<key>=<value>:<effect>** with a key, value, and effect for each taint, for example **--taints=key1=value1:NoSchedule,key2=value2:NoExecute**. Available effects include **NoSchedule**, **PreferNoSchedule**, and **NoExecute**.This list overwrites any modifications made to node taints on an ongoing basis.

The following example adds taints to the **db-nodes-mp** machine pool:

```
$ rosa edit machinepool --cluster=mycluster --replicas 2 --
taints=key1=value1:NoSchedule,key2=value2:NoExecute db-nodes-mp
```

Example output

```
I: Updated machine pool 'db-nodes-mp' on cluster 'mycluster'
```

- To add or update taints for a machine pool that uses autoscaling, run the following command:

```
$ rosa edit machinepool --cluster=<cluster_name> \
                        --min-replicas=<minimum_replica_count> \ 1
                        --max-replicas=<maximum_replica_count> \ 2
                        --taints=<key>=<value>:<effect>,<key>=<value>:<effect> \ 3
                        <machine_pool_id>
```

1 2 For machine pools that use autoscaling, you must provide minimum and maximum compute node replica limits. If you do not specify the arguments, you are prompted for the values before the command completes. The cluster autoscaler does not reduce or increase the machine pool node count beyond the limits that you specify. If you deployed ROSA using a single availability zone, the **--min-replicas** and **--max-replicas** arguments define the autoscaling limits in the machine pool for the zone. If you deployed your cluster using multiple availability zones, the arguments define the autoscaling limits in total across all zones and the counts must be multiples of 3.

3 Replace **<key>=<value>:<effect>,<key>=<value>:<effect>** with a key, value, and effect for each taint, for example **--taints=key1=value1:NoSchedule,key2=value2:NoExecute**. Available effects include **NoSchedule**, **PreferNoSchedule**, and **NoExecute**.This list overwrites any modifications made to node taints on an ongoing basis.

The following example adds taints to the **db-nodes-mp** machine pool:

```
$ rosa edit machinepool --cluster=mycluster --min-replicas=2 --max-replicas=3 --
taints=key1=value1:NoSchedule,key2=value2:NoExecute db-nodes-mp
```

Example output

```
I: Updated machine pool 'db-nodes-mp' on cluster 'mycluster'
```

Verification

1. List the available machine pools in your cluster:

```
$ rosa list machinepools --cluster=<cluster_name>
```

Example output

```
ID          AUTOSCALING  REPLICAS  INSTANCE TYPE  LABELS    TAINTS
AVAILABILITY ZONES    SPOT INSTANCES
Default     No           2         m5.xlarge                                  us-east-1a
```

```
N/A
db-nodes-mp  No        2       m5.xlarge              key1=value1:NoSchedule,
key2=value2:NoExecute   us-east-1a          No
```

2. Verify that the taints are included for your machine pool in the output.

2.2.5. Additional resources

- About machine pools
- About autoscaling
- Enabling autoscaling
- Disabling autoscaling
- ROSA Service Definition

2.3. ABOUT AUTOSCALING NODES ON A CLUSTER

The autoscaler option can be configured to automatically scale the number of machines in a cluster.

The cluster autoscaler increases the size of the cluster when there are pods that failed to schedule on any of the current nodes due to insufficient resources or when another node is necessary to meet deployment needs. The cluster autoscaler does not increase the cluster resources beyond the limits that you specify.

Additionally, the cluster autoscaler decreases the size of the cluster when some nodes are consistently not needed for a significant period, such as when it has low resource use and all of its important pods can fit on other nodes.

When you enable autoscaling, you must also set a minimum and maximum number of worker nodes.

NOTE

Only cluster owners and organization admins can scale or delete a cluster.

2.3.1. Enabling autoscaling nodes on a cluster

You can enable autoscaling on worker nodes to increase or decrease the number of nodes available by editing the machine pool definition for an existing cluster.

Enabling autoscaling nodes in an existing cluster using Red Hat OpenShift Cluster Manager
Enable autoscaling for worker nodes in the machine pool definition from OpenShift Cluster Manager console.

Procedure

1. From OpenShift Cluster Manager Hybrid Cloud Console , navigate to the **Clusters** page and select the cluster that you want to enable autoscaling for.

2. On the selected cluster, select the **Machine pools** tab.

3. Click the Options menu  at the end of the machine pool that you want to enable autoscaling for and select **Scale**.

4. On the **Edit node count** dialog, select the **Enable autoscaling** checkbox.

5. Select **Apply** to save these changes and enable autoscaling for the cluster.

NOTE

Additionally, you can configure autoscaling on the default machine pool when you create the cluster using interactive mode.

Enabling autoscaling nodes in an existing cluster using the rosa CLI
Configure autoscaling to dynamically scale the number of worker nodes up or down based on load.

Successful autoscaling is dependent on having the correct AWS resource quotas in your AWS account. Verify resource quotas and request quota increases from the AWS console.

Procedure

1. To identify the machine pool IDs in a cluster, enter the following command:

```
$ rosa list machinepools --cluster=<cluster_name>
```

Example output

```
ID       AUTOSCALING   REPLICAS   INSTANCE TYPE  LABELS   TINTS   AVAILABILITY ZONES
default  No            2          m5.xlarge                      us-east-1a
mp1      No            2          m5.xlarge                      us-east-1a
```

2. Get the ID of the machine pools that you want to configure.

3. To enable autoscaling on a machine pool, enter the following command:

```
$ rosa edit machinepool --cluster=<cluster_name> <machinepool_ID> --enable-autoscaling --min-replicas=<number> --max-replicas=<number>
```

Example

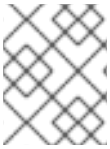
Enable autoscaling on a machine pool with the ID **mp1** on a cluster named **mycluster**, with the number of replicas set to scale between 2 and 5 worker nodes:

```
$ rosa edit machinepool --cluster=mycluster mp1 --enable-autoscaling --min-replicas=2 --max-replicas=5
```

2.3.2. Disabling autoscaling nodes on a cluster

You can disable autoscaling on worker nodes to increase or decrease the number of nodes available by editing the machine pool definition for an existing cluster.

You can disable autoscaling on a cluster using OpenShift Cluster Manager console or the Red Hat OpenShift Service on AWS CLI.



NOTE

Additionally, you can configure autoscaling on the default machine pool when you create the cluster using interactive mode.

Disabling autoscaling nodes in an existing cluster using Red Hat OpenShift Cluster Manager
Disable autoscaling for worker nodes in the machine pool definition from OpenShift Cluster Manager console.

Procedure

1. From OpenShift Cluster Manager Hybrid Cloud Console , navigate to the **Clusters** page and select the cluster with autoscaling that must be disabled.
2. On the selected cluster, select the **Machine pools** tab.
3. Click the Options menu  at the end of the machine pool with autoscaling and select **Scale**.
4. On the "Edit node count" dialog, deselect the **Enable autoscaling** checkbox.
5. Select **Apply** to save these changes and disable autoscaling from the cluster.

Disabling autoscaling nodes in an existing cluster using the rosa CLI
Disable autoscaling for worker nodes in the machine pool definition.

Procedure

1. Enter the following command:

```
$ rosa edit machinepool --cluster=<cluster_name> <machinepool_ID> --enable-autoscaling=false --replicas=<number>
```

Example

Disable autoscaling on the **default** machine pool on a cluster named **mycluster**:

```
$ rosa edit machinepool --cluster=mycluster default --enable-autoscaling=false --replicas=3
```

2.3.3. Additional resources

- About machinepools
- Managing worker nodes
- Managing objects with the rosa CLI

CHAPTER 3. LOGGING

3.1. ACCESSING THE SERVICE LOGS FOR ROSA CLUSTERS

You can view the service logs for your Red Hat OpenShift Service on AWS (ROSA) clusters by using Red Hat OpenShift Cluster Manager. The service logs detail cluster events such as load balancer quota updates and scheduled maintenance upgrades. The logs also show cluster resource changes such as the addition or deletion of users, groups, and identity providers.

Additionally, you can add notification contacts for a ROSA cluster. Subscribed users receive emails about cluster events that require customer action, known cluster incidents, upgrade maintenance, and other topics.

3.1.1. Viewing the service logs by using OpenShift Cluster Manager

You can view the service logs for a Red Hat OpenShift Service on AWS (ROSA) cluster by using Red Hat OpenShift Cluster Manager.

Prerequisites

- You have installed a ROSA cluster.

Procedure

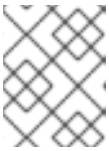
1. Navigate to OpenShift Cluster Manager Hybrid Cloud Console and select your cluster.
2. In the **Overview** page for your cluster, view the service logs in the **Cluster history** section.
3. Optional: Filter the cluster service logs by **Description** or **Severity** from the drop-down menu. You can filter further by entering a specific item in the search bar.
4. Optional: Click **Download history** to download the service logs for your cluster in JSON or CSV format.

3.1.2. Adding cluster notification contacts

You can add notification contacts for your Red Hat OpenShift Service on AWS (ROSA) cluster. When an event occurs that triggers a cluster notification email, subscribed users are notified.

Procedure

1. Navigate to OpenShift Cluster Manager Hybrid Cloud Console and select your cluster.
2. On the **Support** tab, under the **Notification contacts** heading, click **Add notification contact**.
3. Enter the Red Hat username or email of the contact you want to add.



NOTE

The username or email address must relate to a user account in the Red Hat organization where the cluster is deployed.

4. Click **Add contact**.

Verification

- You see a confirmation message when you have successfully added the contact. The user appears under the **Notification contacts** heading on the **Support** tab.

3.2. INSTALLING LOGGING ADD-ON SERVICES

This section describes how to install the logging add-on and Amazon Web Services (AWS) CloudWatch log forwarding add-on services on Red Hat OpenShift Service on AWS (ROSA).

The AWS CloudWatch log forwarding service on ROSA has the following approximate log throughput rates. Message rates greater than these can result in dropped log messages.

Table 3.1. Approximate log throughput rates

Message size (bytes)	Maximum expected rate (messages/second/node)
512	1,000
1,024	650
2,048	450

3.2.1. Install the logging add-on service

Red Hat OpenShift Service on AWS (ROSA) provides logging through the **cluster-logging-operator** add-on. This add-on service offers an optional application log forwarding solution based on AWS CloudWatch. This logging solution can be installed after the ROSA cluster is provisioned.

Procedure

1. Enter the following command:

```
$ rosa install addon cluster-logging-operator --cluster=<cluster_name> --interactive
```

   For **<cluster_name>**, enter the name of your cluster.

2. When prompted, accept the default **yes** to install the **cluster-logging-operator**.

3. When prompted, accept the default **yes** to install the optional Amazon CloudWatch log forwarding add-on or enter **no** to decline the installation of this add-on.

NOTE

It is not necessary to install the AWS CloudWatch service when you install the **cluster-logging-operator**. You can install the AWS CloudWatch service at any time through OpenShift Cluster Manager console from the cluster's **Add-ons** tab.

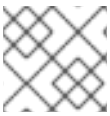
4. For the collection of applications, infrastructure, and audit logs, accept the default values or change them as needed:

- **Applications logs**: Lets the Operator collect application logs, which includes everything that is *not* deployed in the openshift- **, kube-**, and default namespaces. Default: **yes**
- **Infrastructure logs**: Lets the Operator collect logs from OpenShift Container Platform, Kubernetes, and some nodes. Default: **yes**
- **Audit logs**: Type **yes** to let the Operator collect node logs related to security audits. By default, Red Hat stores audit logs outside the cluster through a separate mechanism that does not rely on the Cluster Logging Operator. For more information about default audit logging, see the ROSA Service Definition. Default: **no**

5. For the Amazon CloudWatch region, use the default cluster region, leave the **Cloudwatch region** value empty.

Example output

```
? Are you sure you want to install add-on 'cluster-logging-operator' on cluster
'<cluster_name>'? Yes
? Use AWS CloudWatch (optional): Yes
? Collect Applications logs (optional): Yes
? Collect Infrastructure logs (optional): Yes
? Collect Audit logs (optional): No
? CloudWatch region (optional):
I: Add-on 'cluster-logging-operator' is now installing. To check the status run 'rosa list addons
--cluster=<cluster_name>'
```



NOTE

The installation can take approximately 10 minutes to complete.

Verification steps

1. To verify the logging installation status, enter the following command:

```
$ rosa list addons --cluster=<cluster_name>
```

2. To verify which pods are deployed by **cluster-logging-operator** and their state of readiness:

   a. Log in to the **oc** CLI using **cluster-admin** credentials:

```
$ oc login https://api.mycluster.abwp.s1.example.org:6443 \
  --username cluster-admin
  --password <password>
```

   b. Enter the following command to get information about the pods for the default project. Alternatively, you can specify a different project.

```
$ oc get pods -n openshift-logging
```

Example output

```
NAME                                READY   STATUS    RESTARTS   AGE
cluster-logging-operator-<pod_ID >  2/2     Running   0          7m1s
fluentd-4mnwp                       1/1     Running   0          6m3s
```

```
fluentd-6xt25                  1/1       Running     0          6m3s
fluentd-fqjhv                  1/1       Running     0          6m3s
fluentd-gcvrg                  1/1       Running     0          6m3s
fluentd-vpwrt                  1/1       Running     0          6m3s
```

3. Optional: To get information about the **clusterlogging** instance, enter the following command:

```
$ oc get clusterlogging -n openshift-logging
```

4. Optional: To get information about **clusterlogforwarders** instances, enter the following command:

```
$ oc get clusterlogforwarders -n openshift-logging
```

3.2.2. Additional resources

- Adding services to your cluster

3.3. VIEWING CLUSTER LOGS IN THE AWS CONSOLE

View forwarded cluster logs in the AWS console.

3.3.1. Viewing forwarded logs

Logs that are being forwarded from Red Hat OpenShift Service on AWS are viewed in the Amazon Web Services (AWS) console.

Prerequisites

- The **cluster-logging-operator** add-on service is installed and **Cloudwatch** is enabled.

Procedure

1. Log in to the AWS console.
2. Select the region the cluster is deployed in.
3. Select the **CloudWatch** service.
4. Select **Logs** from the left column, and select **Log Groups**.
5. Select a log group to explore. You can view application, infrastructure, or audit logs, depending on which types were enabled during the add-on service installation. See the Amazon CloudWatch User Guide for more information.

CHAPTER 4. MONITORING USER-DEFINED PROJECTS

4.1. UNDERSTANDING THE MONITORING STACK

In Red Hat OpenShift Service on AWS, you can monitor your own projects in isolation from Red Hat Site Reliability Engineer (SRE) platform metrics. You can monitor your own projects without the need for an additional monitoring solution.

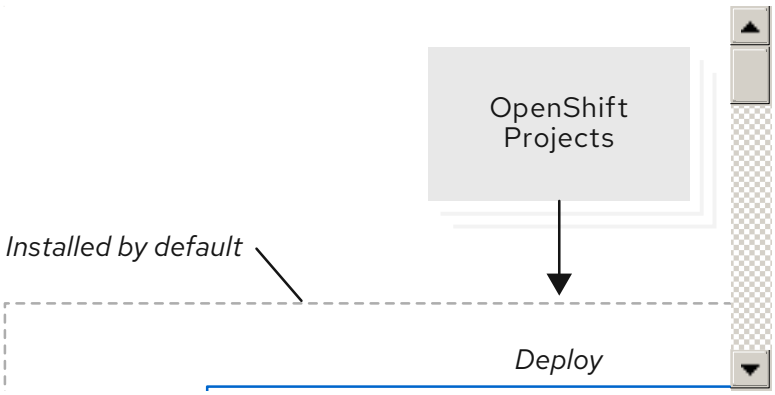
NOTE

Follow the instructions in this document carefully to configure a supported Prometheus instance for monitoring user-defined projects. Custom Prometheus instances are not supported by Red Hat OpenShift Service on AWS.

4.1.1. Understanding the monitoring stack

The Red Hat OpenShift Service on AWS (ROSA) 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 and enabled by default during a ROSA installation. This provides monitoring for core cluster components. The default monitoring stack also enables remote health monitoring for clusters. Critical metrics, such as CPU and memory, are collected from all of the workloads in every namespace and are made available for your use. These components are illustrated in the **Installed by default** section in the following diagram.
- **Components for monitoring user-defined projects** This feature is enabled by default and provides monitoring for user-defined projects. These components are illustrated in the **User** section in the following diagram.



4.1.1.1. Components for monitoring user-defined projects

Red Hat OpenShift Service on AWS 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 4.1. Components for monitoring user-defined projects

Component	Description

Component	Description
Prometheus Operator	The Prometheus Operator 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. However, alert routing is not currently supported.
Thanos Ruler	The Thanos Ruler is a rule evaluation engine for Prometheus that is deployed as a separate process. In Red Hat OpenShift Service on AWS 4, Thanos Ruler provides rule and alerting evaluation for the monitoring of user-defined projects.

All of these components are monitored by the stack and are automatically updated when Red Hat OpenShift Service on AWS is updated.

4.1.1.2. Monitoring targets for user-defined projects

Monitoring is enabled by default for Red Hat OpenShift Service on AWS user-defined projects. You can monitor:

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

4.1.2. Additional resources

- Accessing monitoring for user-defined projects
- Default monitoring components
- Default monitoring targets

4.1.3. Next steps

- Accessing monitoring for user-defined projects

4.2. ACCESSING MONITORING FOR USER-DEFINED PROJECTS

When you install a Red Hat OpenShift Service on AWS (ROSA) cluster, monitoring for user-defined projects is enabled by default. With monitoring for user-defined projects enabled, you can monitor your own ROSA projects without the need for an additional monitoring solution.

The **dedicated-admin** user has default permissions to configure and access monitoring for user-defined projects.

NOTE

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

Optionally, you can disable monitoring for user-defined projects during or after a cluster installation.

4.2.1. Next steps

- Configuring the monitoring stack

4.3. CONFIGURING THE MONITORING STACK

After you configure the monitoring stack, you can review common configuration scenarios and configure monitoring of user-defined projects.

4.3.1. Maintenance and support for monitoring

The supported way of configuring Red Hat OpenShift Service on AWS Monitoring is by using the options described in this document. **Do not use other configurations, as they are unsupported.**

IMPORTANT

Installing another Prometheus instance is not supported by the Red Hat Site Reliability Engineers (SREs).

Configuration paradigms can 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.

4.3.1.1. Support considerations for monitoring user-defined projects

The following modifications are explicitly not supported:

- Installing custom Prometheus instances on Red Hat OpenShift Service on AWS

4.3.2. Configuring the monitoring stack

In Red Hat OpenShift Service on AWS, you can configure the stack that monitors workloads for user-defined projects by using the **user-workload-monitoring-config ConfigMap** object. Config maps configure the Cluster Monitoring Operator (CMO), which in turn configures the components of the stack.

Prerequisites

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

Procedure

1. Edit the **ConfigMap** object.

   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 24 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.

2. Save the file to apply the changes to the **ConfigMap** object. The pods affected by the new

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

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.

4.3.3. Configurable monitoring components

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

Table 4.2. Configurable monitoring components

Component	user-workload-monitoring-config config map key
Prometheus Operator	**prometheusOperator**
Prometheus	**prometheus**
Thanos Ruler	**thanosRuler**

4.3.4. Moving monitoring components to different nodes

You can move any of the components that monitor workloads for user-defined projects to specific worker nodes. It is not permitted to move components to control plane or infrastructure nodes.

Prerequisites

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

Procedure

1. To move a component that monitors user-defined projects, edit the **ConfigMap** object:
   a. Edit the **user-workload-monitoring-config ConfigMap** object in the **openshift-user-workload-monitoring** project:

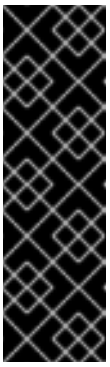
```
$ oc -n openshift-user-workload-monitoring edit configmap user-workload-monitoring-config
```

   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>
        <...>
```

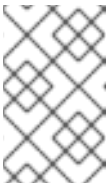
Substitute **<component>** accordingly and substitute **<node_key>: <node_value>** with the map of key-value pairs that specifies the destination nodes. Often, only a single key-value pair is used.

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.

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.

4.3.5. Assigning tolerations to components that monitor user-defined projects

You can assign tolerations to the components that monitor user-defined projects, to enable moving them to tainted worker nodes. Scheduling is not permitted on control plane or infrastructure nodes.

Prerequisites

- You have access to the cluster as a user with the **dedicated-admin** role.
- You have created the **user-workload-monitoring-config ConfigMap** object in the **openshift-user-workload-monitoring** namespace.
- The OpenShift CLI (**oc**) is installed.

Procedure

1. Edit the **ConfigMap** object:
   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.

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 the OpenShift Container Platform documentation on taints and tolerations
- See the Kubernetes documentation on taints and tolerations

4.3.6. 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 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

See Recommended configurable storage technology .

4.3.6.1. Persistent storage prerequisites

- Use the block type of storage.

4.3.6.2. Configuring a local persistent volume claim

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

Prerequisites

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

Procedure

1. To configure a PVC for a component that monitors user-defined projects, edit the **ConfigMap** object:
   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: 40Gi
```

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.

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.

4.3.6.3. Modifying the retention time for Prometheus metrics data

By default, the Red Hat OpenShift Service on AWS monitoring stack configures the retention time for Prometheus data to be 15 days. You can modify the retention time for the Prometheus instance that monitors user-defined projects, to change how soon the data is deleted.

Prerequisites

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

Procedure

1. To modify the retention time for the Prometheus instance that monitors user-defined projects, edit the **ConfigMap** object:

   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.

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

- Understanding persistent storage
- Optimizing storage

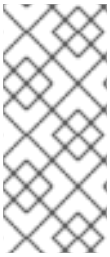
4.3.7. Controlling the impact of unbound metrics attributes in user-defined projects

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.

A **dedicated-admin** can use the following measure 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



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.

4.3.7.1. 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 **dedicated-admin** role.
- 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.

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.

Additional resources

- Determining why Prometheus is consuming a lot of disk space for steps to query which metrics have the highest number of scrape samples

4.3.8. Setting log levels for monitoring components

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

The following log levels can be applied to each of those components in the **user-workload-monitoring-config ConfigMap** object:

- **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

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

Procedure

1. Edit the **ConfigMap** object:
   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.

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

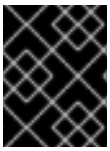
If an unrecognized **loglevel** value is included in the **ConfigMap** object, the pods for the component might not restart successfully.

4.3.9. Next steps

- Managing metrics

4.4. ENABLING ALERT ROUTING FOR USER-DEFINED PROJECTS

In Red Hat OpenShift Service on AWS, a cluster administrator can enable alert routing for user-defined projects.



IMPORTANT

Managing alerting rules for user-defined projects is only available in Red Hat OpenShift Service on AWS version 4.11 and up.

This process consists of two general steps:

- Enable alert routing for user-defined projects to use a separate Alertmanager instance.
- Grant additional users permission to configure alert routing for user-defined projects.

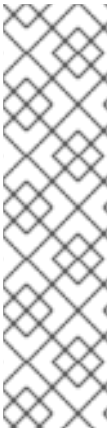
After you complete these steps, developers and other users can configure custom alerts and alert routing for their user-defined projects.

4.4.1. Understanding alert routing for user-defined projects

As a cluster administrator, you can enable alert routing for user-defined projects. With this feature, you can allow users with the **alert-routing-edit** role to configure alert notification routing and receivers for user-defined projects. These notifications are routed by an Alertmanager instance dedicated to user-defined monitoring.

Users can then create and configure user-defined alert routing by creating or editing the **AlertmanagerConfig** objects for their user-defined projects without the help of an administrator.

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



NOTE

The following are limitations of alert routing for user-defined projects:

- For user-defined alerting rules, user-defined routing is scoped to the namespace in which the resource is defined. For example, a routing configuration in namespace **ns1** only applies to **PrometheusRules** resources in the same namespace.
- When a namespace is excluded from user-defined monitoring, **AlertmanagerConfig** resources in the namespace cease to be part of the Alertmanager configuration.

4.4.2. Enabling a separate Alertmanager instance for user-defined alert routing

In Red Hat OpenShift Service on AWS, you may want to deploy a dedicated Alertmanager instance for user-defined projects, which provides user-defined alerts separate from default platform alerts. In these cases, you can optionally enable a separate instance of Alertmanager to send alerts for user-defined projects only.

Prerequisites

- You have access to the cluster as a user with the **cluster-admin** or **dedicated-admin** role.
- You have enabled monitoring for user-defined projects in the **cluster-monitoring-config** config map for the **openshift-monitoring** namespace.
- You have installed the OpenShift CLI (**oc**).

Procedure

1. Edit the **user-workload-monitoring-config ConfigMap** object:

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

2. Add **enabled: true** and **enableAlertmanagerConfig: true** in the **alertmanager** section under **data/config.yaml**:

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: user-workload-monitoring-config
  namespace: openshift-user-workload-monitoring
data:
  config.yaml: |
    alertmanager:
      enabled: true 1
      enableAlertmanagerConfig: true 2
```

1 Set the **enabled** value to **true** to enable a dedicated instance of the Alertmanager for user-defined projects in a cluster. Set the value to **false** or omit the key entirely to disable the Alertmanager for user-defined projects. If you set this value to **false** or if the key is omitted, user-defined alerts are routed to the default platform Alertmanager instance.

2 Set the **enableAlertmanagerConfig** value to **true** to enable users to define their own alert

routing configurations with **AlertmanagerConfig** objects.

3. Save the file to apply the changes. The dedicated instance of Alertmanager for user-defined projects starts automatically.

Verification

- Verify that the **user-workload** Alertmanager instance has started:

```
# oc -n openshift-user-workload-monitoring get alertmanager
```

Example output

```
NAME            VERSION   REPLICAS   AGE
user-workload   0.24.0    2          100s
```

4.4.3. Granting users permission to configure alert routing for user-defined projects

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

Prerequisites

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

Procedure

- Assign the **alert-routing-edit** role to a user in the user-defined project:

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

(1) For **<namespace>**, substitute the namespace for the user-defined project, such as **ns1**. For **<user>**, substitute the username for the account to which you want to assign the role.

Additional resources

- Accessing monitoring for user-defined projects
- Creating alert routing for user-defined projects

4.5. MANAGING METRICS

Red Hat OpenShift Service on AWS collects metrics for cluster components, and you can use Prometheus to query and visualize them.

4.5.1. Understanding metrics

In Red Hat OpenShift Service on AWS, 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 Red Hat OpenShift Service on AWS, 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.

4.5.2. 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.

4.5.2.1. 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: quay.io/brancz/prometheus-example-app:v0.2.0
        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:

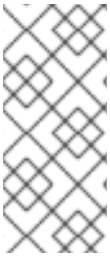
```
$ oc -n ns1 get pod
```

Example output

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

4.5.2.2. Specifying how a service is monitored

To use the metrics exposed by your service, you must configure Red Hat OpenShift Service on AWS 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 Red Hat OpenShift Service on AWS, 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 the **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 **dedicated-admin** role or the **monitoring-edit** role.
- 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.

3. Apply the configuration to the cluster:

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

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

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

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

Example output

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

Additional resources

- Accessing monitoring for user-defined projects.

4.5.3. Querying metrics

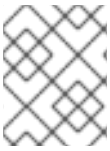
The OpenShift monitoring dashboard lets you run Prometheus Query Language (PromQL) queries to examine metrics visualized on a plot. This functionality provides information about the state of a cluster and any user-defined projects that you are monitoring.

As a **dedicated-admin**, you can query one or more namespaces at a time for metrics about 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.

4.5.3.1. Querying metrics for all projects as an administrator

As a **dedicated-admin** or as a user with view permissions for all projects, you can access metrics for all default Red Hat OpenShift Service on AWS and user-defined projects in the Metrics UI.



NOTE

Only dedicated administrators have access to the third-party UIs provided with Red Hat OpenShift Service on AWS Monitoring.

Prerequisites

- You have access to the cluster as a user with the **dedicated-admin** role or with view permissions for all projects.

Procedure

1. From the **Administrator** perspective in the OpenShift 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.

4.5.3.2. 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

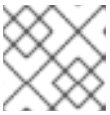
Developers can only use the **Developer** perspective and not the **Administrator** perspective. As a developer you can only query metrics for one project at a time. Developers cannot access the third-party UIs provided with Red Hat OpenShift Service on AWS monitoring.

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 Red Hat OpenShift Service on AWS 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.
- See Querying metrics for user-defined projects as a developer for details on accessing non-cluster metrics as a developer or a privileged user

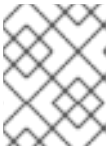
4.5.3.3. Exploring the visualized metrics

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, hover over the plot at that point. The query outputs 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, hover over the plot at that point. The query outputs appear in a pop-up box.

Additional resources

- See the Querying metrics section on using the PromQL interface
- Troubleshooting monitoring issues

4.5.4. Next steps

- Alerts

4.6. ALERTS

In Red Hat OpenShift Service on AWS, 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 Red Hat OpenShift Service on AWS 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.

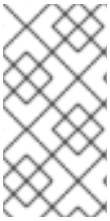
NOTE

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-admin** or **dedicated-admin** privileges, all alerts, silences, and alerting rules are accessible.

4.6.1. 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 Red Hat OpenShift Service on AWS 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 Red Hat OpenShift Service on AWS and user-defined projects that you have access to in the **Project:** list. However, alerts, silences, and alerting rules relating to core Red Hat OpenShift Service on AWS projects are not displayed if you do not have **cluster-admin** privileges.

4.6.2. 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 Red Hat OpenShift Service on AWS 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 Red Hat OpenShift Service on AWS projects. These projects provide core Red Hat OpenShift Service on AWS 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 Red Hat OpenShift Service on AWS 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 Red Hat OpenShift Service on AWS 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 Red Hat OpenShift Service on AWS projects. These projects provide core Red Hat OpenShift Service on AWS 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.

4.6.3. 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 Red Hat OpenShift Service on AWS 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.

4.6.4. 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.

4.6.4.1. 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 Red Hat OpenShift Service on AWS 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 Red Hat OpenShift Service on AWS 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 Red Hat OpenShift Service on AWS 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**.

4.6.4.2. 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.

4.6.4.3. 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.

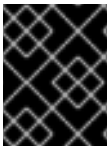
To expire a silence in the **Developer** perspective:

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.

4.6.5. Managing alerting rules for user-defined projects

Red Hat OpenShift Service on AWS monitoring ships with a set of default alerting rules. As a cluster administrator, you can view the default alerting rules.

In Red Hat OpenShift Service on AWS 4, you can create, view, edit, and remove alerting rules in user-defined projects.



IMPORTANT

Managing alerting rules for user-defined projects is only available in Red Hat OpenShift Service on AWS version 4.11 and up.

Alerting rule considerations

- The default alerting rules are used specifically for the Red Hat OpenShift Service on AWS 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.

4.6.5.1. 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 Red Hat OpenShift Service on AWS metrics. This reduces latency for alerting rules and minimizes the load on monitoring components.

WARNING

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

Additional resources

- See the Prometheus alerting documentation for further guidelines on optimizing alerts
- See Monitoring overview for details about Red Hat OpenShift Service on AWS 4 monitoring architecture

4.6.5.2. 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

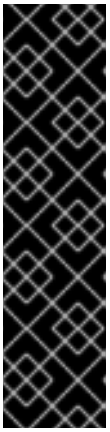
1. Create a YAML file for alerting rules. In this example, it is called **example-app-alerting-rule.yaml**.
2. Add an alerting rule configuration to the YAML file. For example:

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 Red Hat OpenShift Service on AWS projects. Red Hat OpenShift Service on AWS 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.

4.6.5.3. 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 Red Hat OpenShift Service on AWS 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 Monitoring overview for details about Red Hat OpenShift Service on AWS 4 monitoring architecture.

4.6.5.4. 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
```

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

As a cluster administrator, you can list alerting rules for core Red Hat OpenShift Service on AWS and user-defined projects together in a single view.

Prerequisites

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

Procedure

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

NOTE

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

4.6.5.6. 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

Additional resources

- See Monitoring overview for details about Red Hat OpenShift Service on AWS monitoring architecture.
- See the Alertmanager documentation for information about alerting rules.
- See the Prometheus relabeling documentation for information about how relabeling works.
- See the Prometheus alerting documentation for further guidelines on optimizing alerts.

4.6.6. Applying a custom configuration to Alertmanager for user-defined alert routing

If you have enabled a separate instance of Alertmanager dedicated to user-defined alert routing, you can overwrite the configuration for this instance of Alertmanager by editing the **alertmanager-user-workload** secret in the **openshift-user-workload-monitoring** namespace.

Prerequisites

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

Procedure

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

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

2. Edit the configuration in **alertmanager.yaml**:

```
route:
  receiver: Default
  group_by:
  - name: Default
  routes:
  - matchers:
    - "service = prometheus-example-monitor" 1
    receiver: <receiver> 2
receivers:
- name: Default
- name: <receiver>
#  <receiver_configuration>
```

1. Specifies which alerts match the route. This example shows all alerts that have the **service="prometheus-example-monitor"** label.
2. Specifies the receiver to use for the alerts group.

3. Apply the new configuration in the file:

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

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.

4.6.7. Next steps

- Reviewing monitoring dashboards

4.7. REVIEWING MONITORING DASHBOARDS

Red Hat OpenShift Service on AWS provides monitoring dashboards that help you understand the state of user-defined projects.

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 4.1. Example dashboard in the Developer perspective

NOTE

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

4.7.1. 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 **dedicated-admin** 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 Red Hat OpenShift Service on AWS 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.
5. Optional: Select a **Refresh Interval**.
6. Hover over each of the graphs within a dashboard to display detailed information about specific items.

4.7.2. Next steps

- Troubleshooting monitoring issues

4.8. TROUBLESHOOTING MONITORING ISSUES

Find troubleshooting steps for common monitoring issues with user-defined projects.

4.8.1. Determining why user-defined project metrics are unavailable

If metrics are not displaying when monitoring user-defined projects, follow these steps to troubleshoot the issue.

Procedure

1. Query the metric name and verify that the project is correct:
   a. From the **Developer** perspective in the OpenShift Container Platform web console, select **Observe → Metrics**.
   b. Select the project that you want to view metrics for in the **Project:** list.
   c. Choose a query from the **Select Query** list, or run a custom PromQL query by selecting **Show PromQL**.
   The **Select Query** pane shows the metric names.

   Queries must be done on a per-project basis. The metrics that are shown relate to the project that you have selected.
2. Verify that the pod that you want metrics from is actively serving metrics. Run the following **oc exec** command into a pod to target the **podIP**, **port**, and /**metrics**.

```
$ oc exec <sample_pod> -n <sample_namespace> -- curl <target_pod_IP>:<port>/metrics
```

NOTE

You must run the command on a pod that has **curl** installed.

The following example output shows a result with a valid version metric.

Example output

```
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
# HELP version Version information about this binary-- --:--:-- --:--:--     0
# TYPE version gauge
version{version="v0.1.0"} 1
100   102  100   102    0     0  51000      0 --:--:-- --:--:-- --:--:-- 51000
```

An invalid output indicates that there is a problem with the corresponding application.

3. If you are using a **PodMonitor** CRD, verify that the **PodMonitor** CRD is configured to point to the correct pods using label matching. For more information, see the Prometheus Operator documentation.

4. If you are using a **ServiceMonitor** CRD, and if the **/metrics** endpoint of the pod is showing metric data, follow these steps to verify the configuration:

   a. Verify that the service is pointed to the correct **/metrics** endpoint. The service **labels** in this output must match the services monitor **labels** and the **/metrics** endpoint defined by the service in the subsequent steps.

   ```
   $ oc get service
   ```

   Example output

   ```
   apiVersion: v1
   kind: Service (1)
   metadata:
     labels: (2)
       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
   ```

   (1) Specifies that this is a service API.

   (2) Specifies the labels that are being used for this service.

b. Query the **serviceIP**, **port**, and /**metrics** endpoints to see if the same metrics from the **curl** command you ran on the pod previously:

i. Run the following command to find the service IP:

```
$ oc get service -n <target_namespace>
```

ii. Query the /**metrics** endpoint:

```
$ oc exec <sample_pod> -n <sample_namespace> -- curl <service_IP>:
<port>/metrics
```

Valid metrics are returned in the following example.

Example output

```
% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   102  100   102    0     0  51000      0 --:--:-- --:--:-- --:--:--   99k
# HELP version Version information about this binary
# TYPE version gauge
version{version="v0.1.0"} 1
```

c. Use label matching to verify that the **ServiceMonitor** object is configured to point to the desired service. To do this, compare the **Service** object from the **oc get service** output to the **ServiceMonitor** object from the **oc get servicemonitor** output. The labels must match for the metrics to be displayed.
For example, from the previous steps, notice how the **Service** object has the **app: prometheus-example-app** label and the **ServiceMonitor** object has the same **app: prometheus-example-app** match label.

5. If everything looks valid and the metrics are still unavailable, please contact the support team for further help.