Red Hat OpenShift Service on AWS 4

Tutorials

Red Hat OpenShift Service on AWS tutorials

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Legal Notice

Abstract

Tutorials on creating your first Red Hat OpensShift Service on AWS (ROSA) cluster.

Table of Contents

CHAPTER 1. TUTORIALS OVERVIEW

Step-by-step tutorials from Red Hat experts to help you get the most out of your Managed OpenShift cluster.

In an effort to make this Cloud Expert tutorial content available quickly, it may not yet be tested on every supported configuration.

CHAPTER 2. TUTORIAL: ROSA WITH HCP ACTIVATION AND ACCOUNT LINKING

This tutorial describes the process for activating Red Hat OpenShift Service on AWS (ROSA) with hosted control planes (HCP) and linking to an AWS account, before deploying the first cluster.

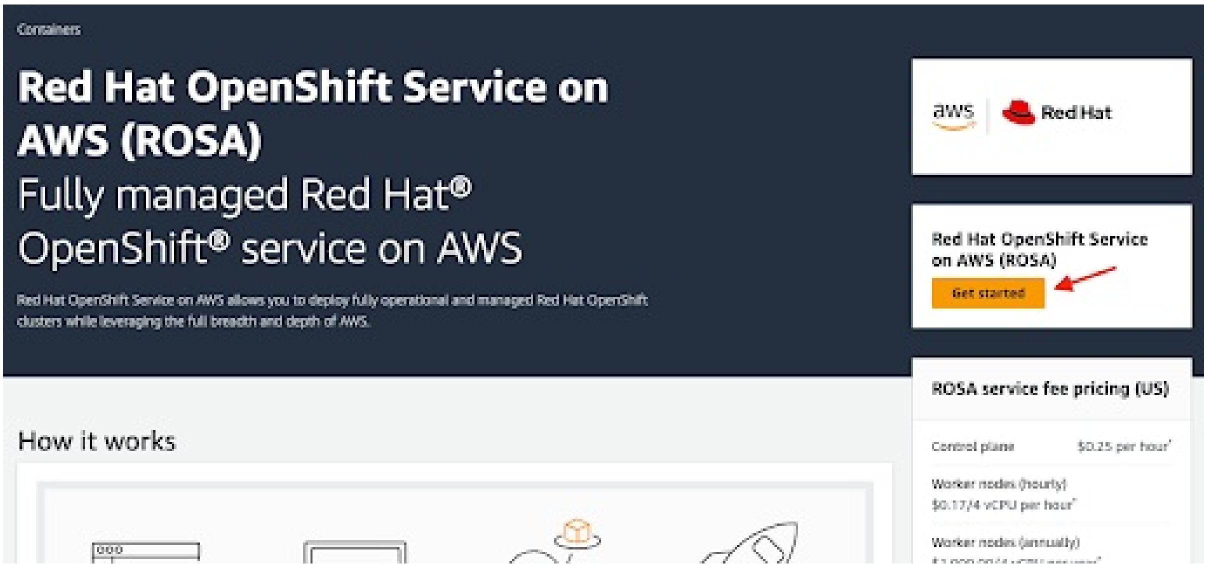
> **IMPORTANT**
>
> If you have received a private offer for the product, make sure to proceed according to the instructions provided with the private offer before following this tutorial. The private offer is designed either for a case when the product is already activated, which replaces an active subscription, or for first time activations.

2.1. PREREQUISITES

- Make sure to log into the Red Hat account that you plan to associate with the AWS account where you have activated ROSA with HCP in previous steps.
- Only a single AWS account that will be used for service billing can be associated with a Red Hat account. Typically an organizational AWS account that has other AWS accounts, such as developer accounts, linked would be the one that is to be billed, rather than individual AWS end user accounts.
- Red Hat accounts belonging to the same Red Hat organization will be linked with the same AWS account. Therefore, you can manage who has access to creating ROSA with HCP clusters on the Red Hat organization account level.

2.2. SUBSCRIPTION ENABLEMENT AND AWS ACCOUNT SETUP

1. Activate the ROSA with HCP product at the AWS console page by clicking the **Get started** button:



Containers

Red Hat OpenShift Service on AWS (ROSA)

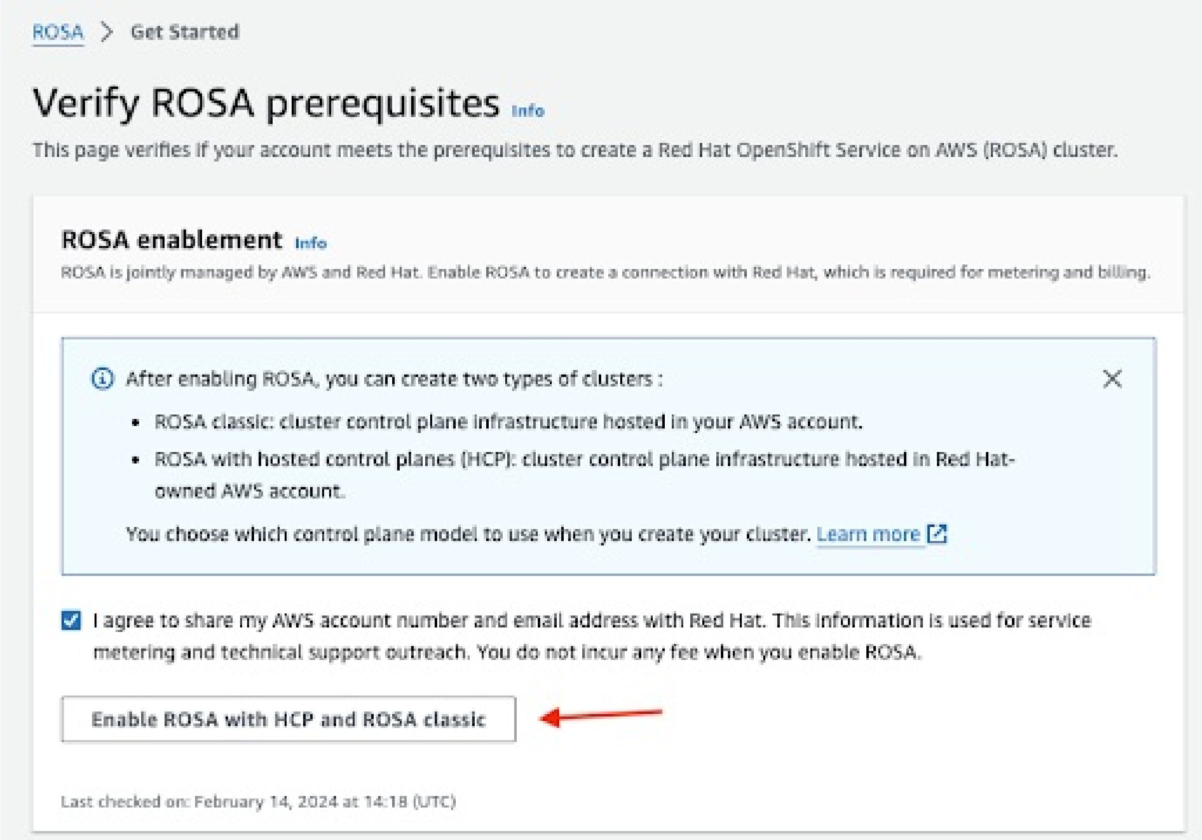
Fully managed Red Hat® OpenShift® service on AWS

Red Hat OpenShift Service on AWS allows you to deploy fully operational and managed Red Hat OpenShift clusters while leveraging the full breadth and depth of AWS.

How it works

If you have activated ROSA before but did not complete the process, you can click the button and complete the account linking as described in the following steps.

2. Confirm that you want your contact information to be shared with Red Hat and enable the service:



ROSA > Get Started

Verify ROSA prerequisites Info

This page verifies if your account meets the prerequisites to create a Red Hat OpenShift Service on AWS (ROSA) cluster.

ROSA enablement Info

ROSA is jointly managed by AWS and Red Hat. Enable ROSA to create a connection with Red Hat, which is required for metering and billing.

After enabling ROSA, you can create two types of clusters :

- ROSA classic: cluster control plane infrastructure hosted in your AWS account.
- ROSA with hosted control planes (HCP): cluster control plane infrastructure hosted in Red Hat-owned AWS account.

You choose which control plane model to use when you create your cluster. Learn more

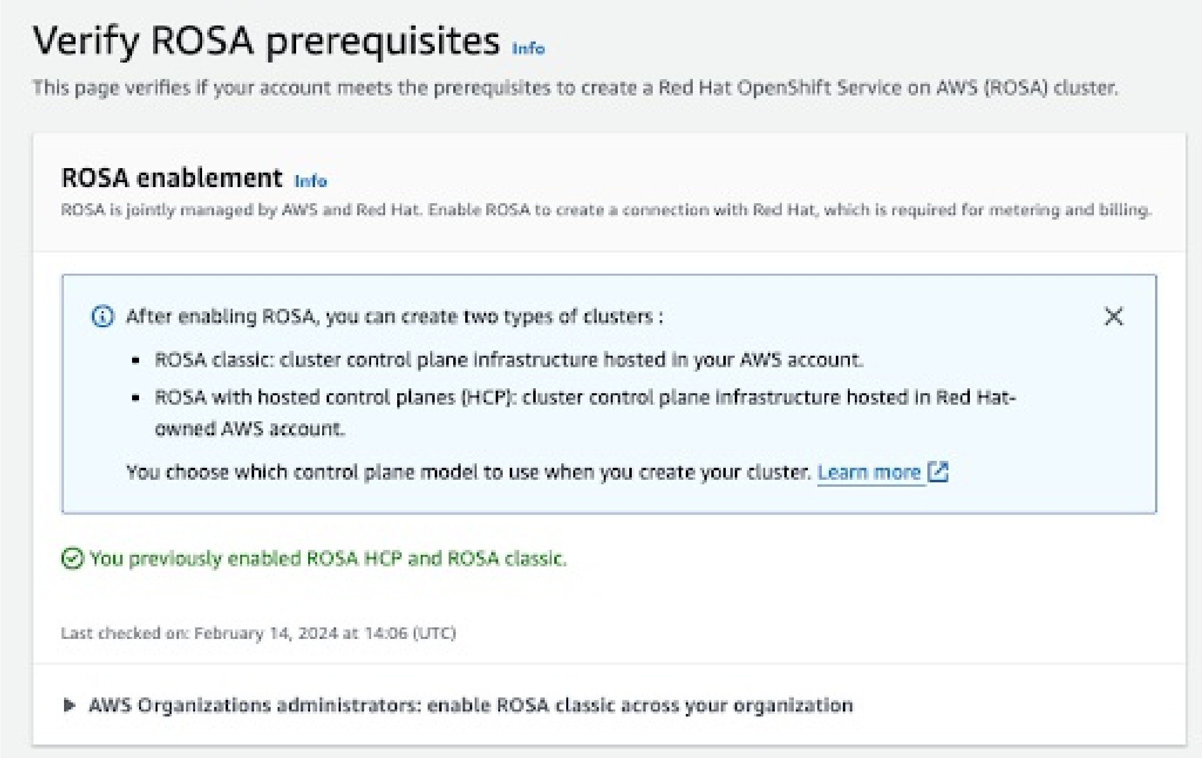
☑ I agree to share my AWS account number and email address with Red Hat. This information is used for service metering and technical support outreach. You do not incur any fee when you enable ROSA.

Enable ROSA with HCP and ROSA classic

Last checked on: February 14, 2024 at 14:18 (UTC)

- You will not be charged by enabling the service in this step. The connection is made for billing and metering that will take place only after you deploy your first cluster. This could take a few minutes.

3. After the process is completed, you will see a confirmation:



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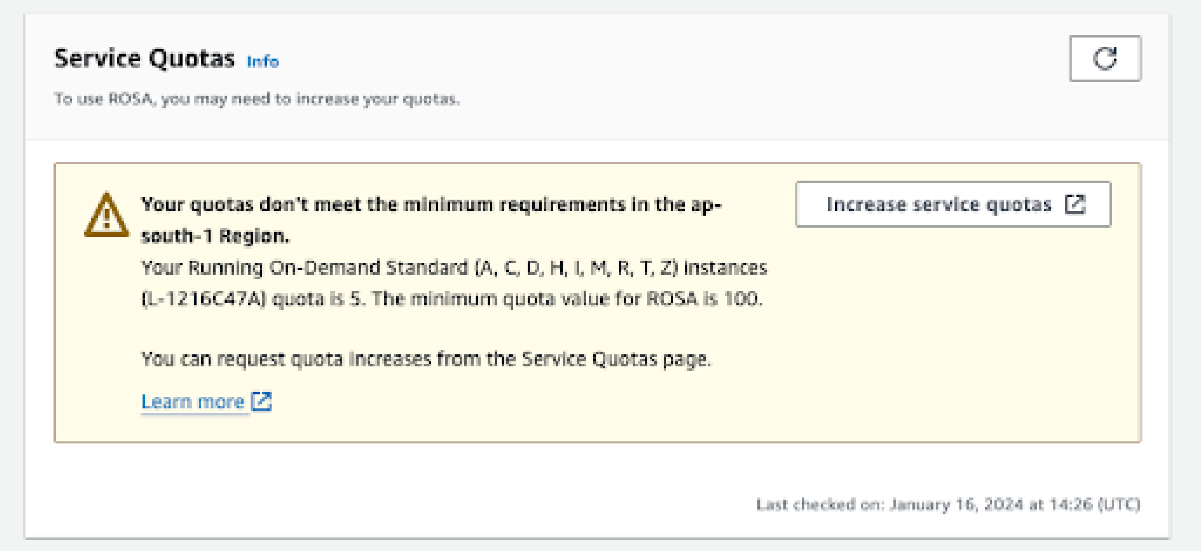
You choose which control plane model to use when you create your cluster. Learn more

✓ You previously enabled ROSA HCP and ROSA classic.

Last checked on: February 14, 2024 at 14:06 (UTC)

▸ AWS Organizations administrators: enable ROSA classic across your organization

4. Other sections on this verification page show the status of additional prerequisites. In case any of these prerequisites are not met, a respective message is shown. Here is an example of insufficient quotas in the selected region:



Service Quotas Info

To use ROSA, you may need to increase your quotas.

Your quotas don't meet the minimum requirements in the ap-south-1 Region.
Your Running On-Demand Standard (A, C, D, H, I, M, R, T, Z) instances (L-1216C47A) quota is 5. The minimum quota value for ROSA is 100.

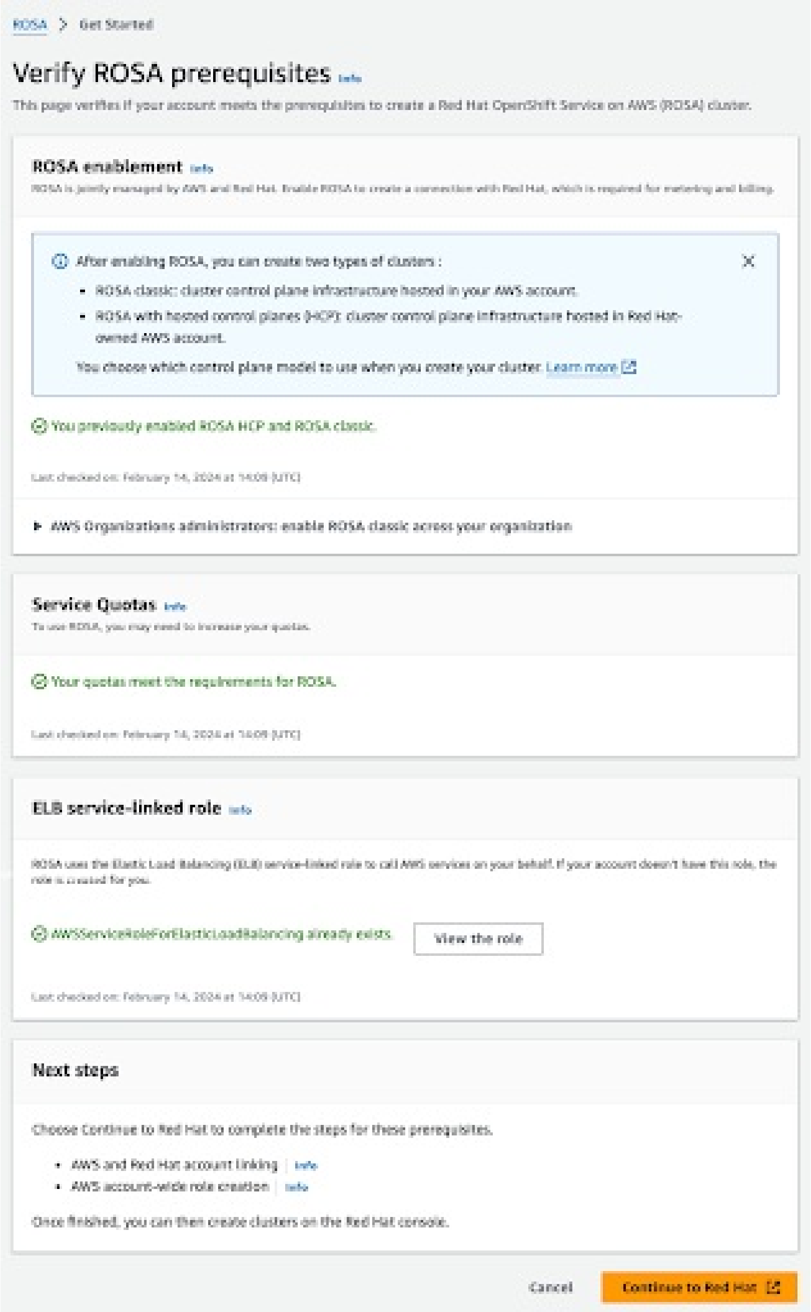
You can request quota increases from the Service Quotas page.

Learn more

Last checked on: January 16, 2024 at 14:26 (UTC)

a. Click the **Increase service quotas** button or use the **Learn more** link to get more information about the about how to manage service quotas. In the case of insufficient quotas, note that quotas are region-specific. You can use the region switcher in the upper right corner of the web console to re-run the quota check for any region you are interested in and then submit service quota increase requests as needed.

5. If all the prerequisites are met, the page will look like this:



ROSA > Get Started

Verify ROSA prerequisites Info

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You choose which control plane model to use when you create your cluster. Learn more

You previously enabled ROSA HCP and ROSA classic.

Last checked on: February 14, 2024 at 14:09 (UTC)

▸ AWS Organizations administrators: enable ROSA classic across your organization

Service Quotas Info

To use ROSA, you may need to increase your quotas.

Your quotas meet the requirements for ROSA.

Last checked on: February 14, 2024 at 14:09 (UTC)

ELB service-linked role Info

ROSA uses the Elastic Load Balancing (ELB) service-linked role to call AWS services on your behalf. If your account doesn't have this role, the role is created for you.

AWSServiceRoleForElasticLoadBalancing already exists.

Last checked on: February 14, 2024 at 14:09 (UTC)

Next steps

Choose Continue to Red Hat to complete the steps for these prerequisites.

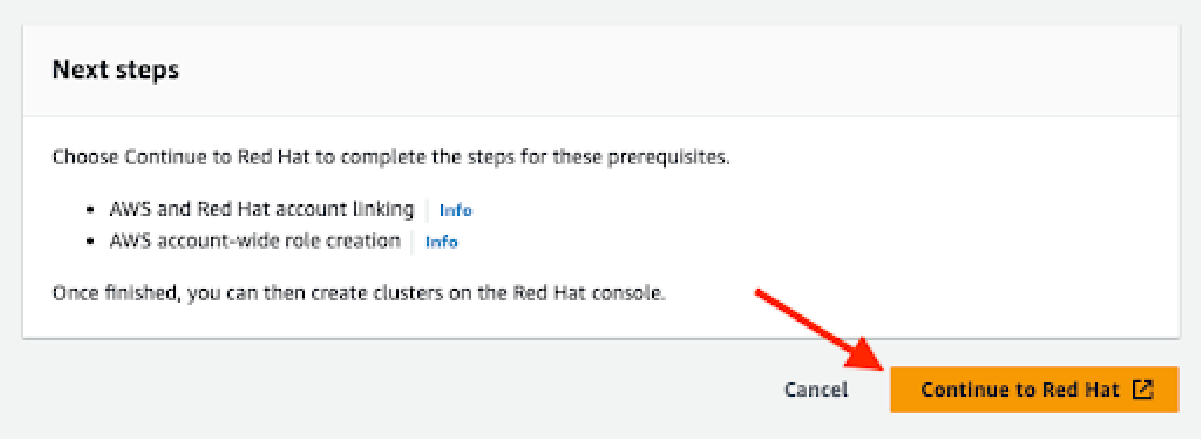
- AWS and Red Hat account linking | Info
- AWS account-wide role creation | Info

Once finished, you can then create clusters on the Red Hat console.

The ELB service-linked role is created for you automatically. You can click any of the small **Info** blue links to get contextual help and resources.

2.3. AWS AND RED HAT ACCOUNT AND SUBSCRIPTION LINKING

1. Click the orange **Continue to Red Hat**button to proceed with account linking:



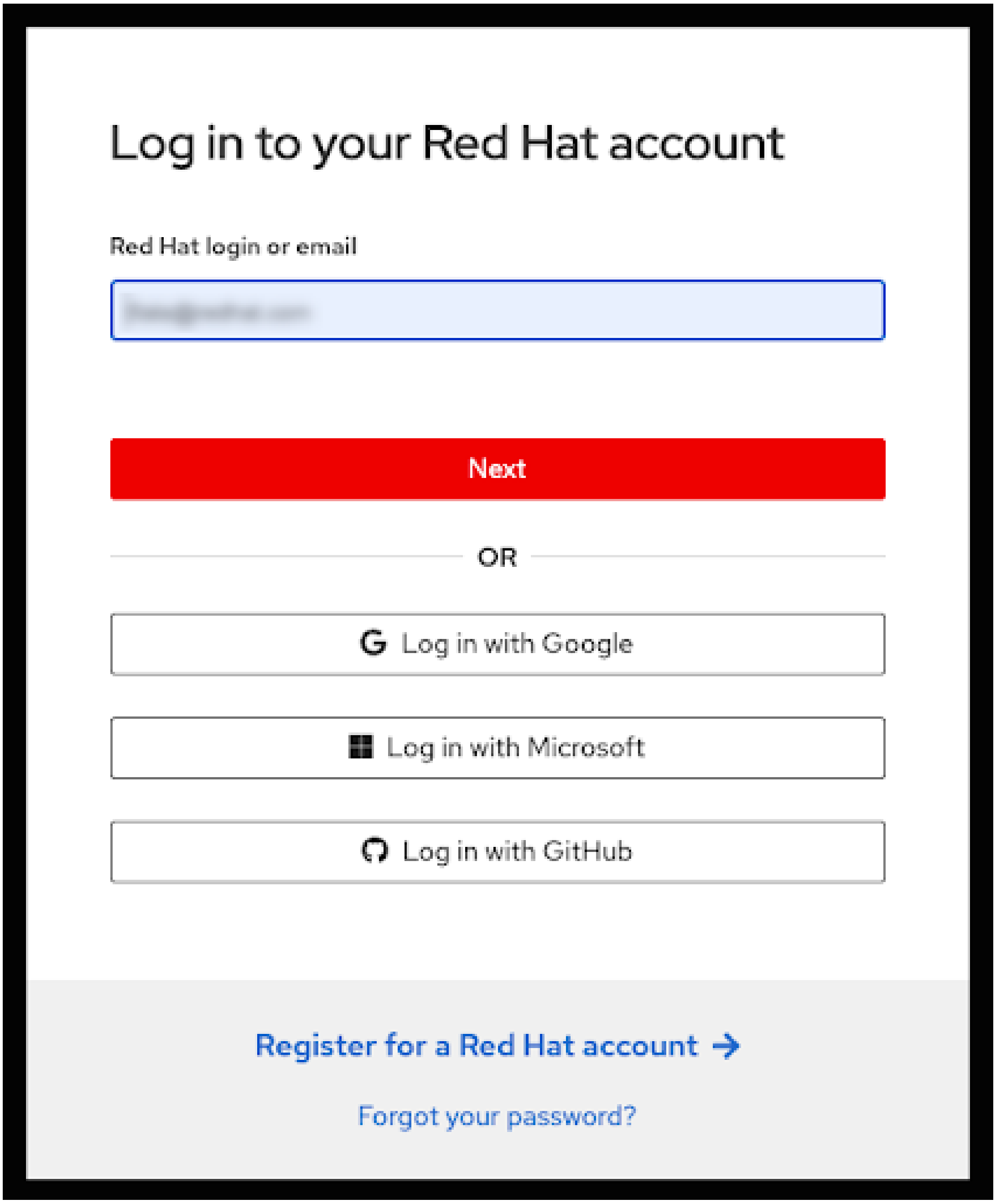
Next steps

Choose Continue to Red Hat to complete the steps for these prerequisites.

- AWS and Red Hat account linking | Info
- AWS account-wide role creation | Info

Once finished, you can then create clusters on the Red Hat console.

2. If you are not already logged in to your Red Hat account in your current browser's session, you will be asked to log in to your account:



Log in to your Red Hat account

Red Hat login or email

- You can also register for a new Red Hat account or reset your password on this page.

- Make sure to log into the Red Hat account that you plan to associate with the AWS account where you have activated ROSA with HCP in previous steps.

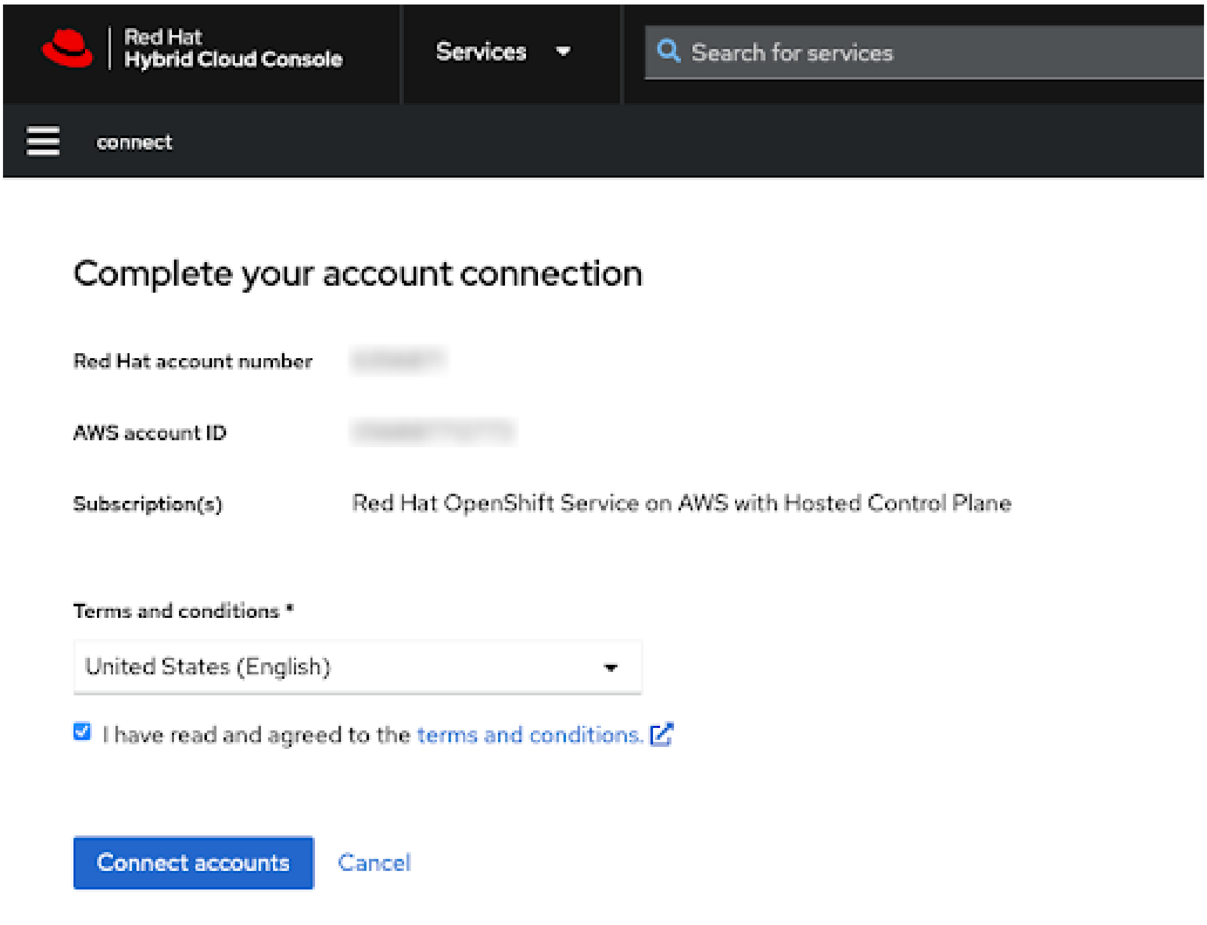
- Only a single AWS account that will be used for service billing can be associated with a Red Hat account. Typically an organizational AWS account that has other AWS accounts, such as developer accounts, linked would be the one that is to be billed, rather than individual AWS end user accounts.

- Red Hat accounts belonging to the same Red Hat organization will be linked with the same AWS account. Therefore, you can manage who has access to creating ROSA with HCP clusters on the Red Hat organization account level.

3. Complete the Red Hat account linking after reviewing the terms and conditions:

NOTE

This step is available only if the logged-in Red Hat account, or the Red Hat organization managing the Red Hat account, was not linked to an AWS account before.



Complete your account connection

Red Hat account number [redacted]

AWS account ID [redacted]

Subscription(s) Red Hat OpenShift Service on AWS with Hosted Control Plane

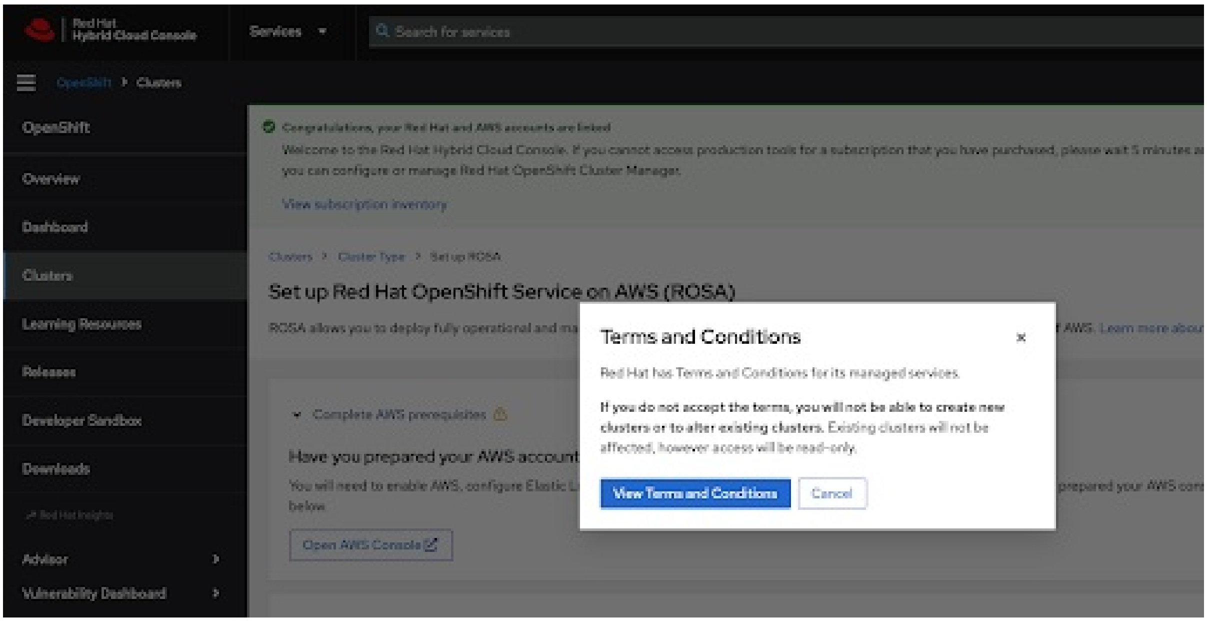
Terms and conditions *

United States (English)

☑ I have read and agreed to the terms and conditions.

Both the Red Hat and AWS account numbers are shown on this screen.

4. Click the **Connect accounts** button if you agree with the service terms. If this is the first time you are using the Red Hat Hybrid Cloud Console, you will be asked to agree with the general managed services terms and conditions before being able to create the first ROSA cluster:



Congratulations, your Red Hat and AWS accounts are linked

Welcome to the Red Hat Hybrid Cloud Console. If you cannot access production tools for a subscription that you have purchased, please wait 5 minutes a you can configure or manage Red Hat OpenShift Cluster Manager.

View subscription inventory

Set up Red Hat OpenShift Service on AWS (ROSA)

ROSA allows you to deploy fully operational and ma f AWS. Learn more abou

Have you prepared your AWS account

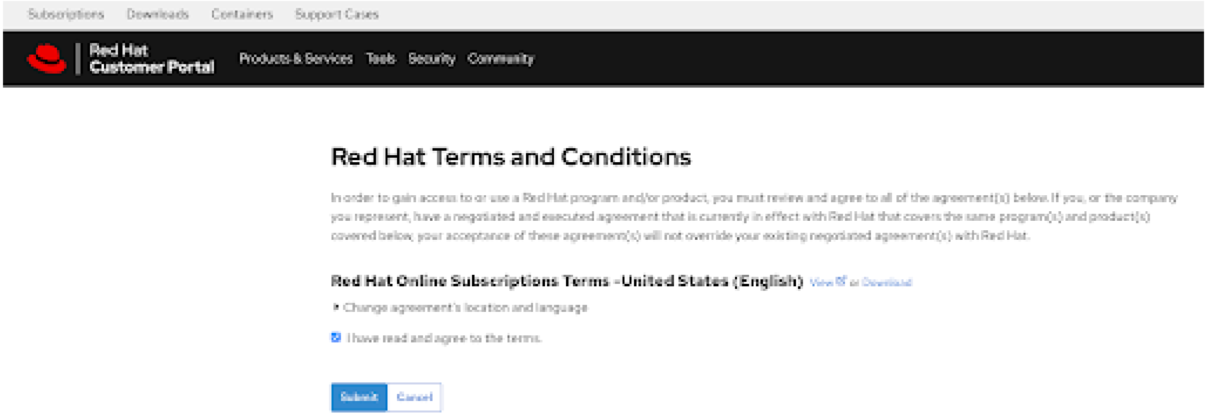
You will need to enable AWS, configure Elastic L prepared your AWS con below

Terms and Conditions

Red Hat has Terms and Conditions for its managed services.

If you do not accept the terms, you will not be able to create new clusters or to alter existing clusters. Existing clusters will not be affected, however access will be read-only.

Additional terms that need to be reviewed and accepted will be shown after clicking the **View Terms and Conditions** button:



Red Hat Terms and Conditions

In order to gain access to or use a Red Hat program and/or product, you must review and agree to all of the agreement(s) below. If you, or the company you represent, have a negotiated and executed agreement that is currently in effect with Red Hat that covers the same program(s) and product(s) covered below, your acceptance of these agreement(s) will not override your existing negotiated agreement(s) with Red Hat.

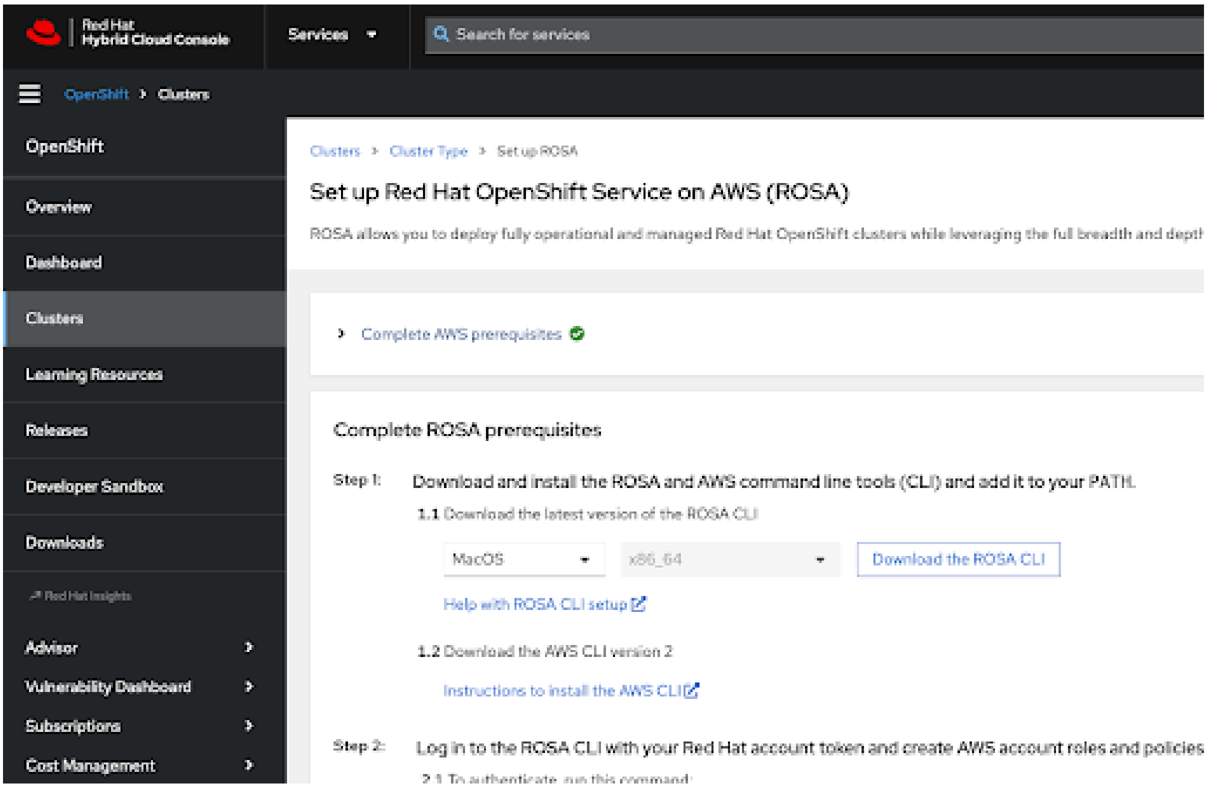
Red Hat Online Subscriptions Terms -United States (English)

▸ Change agreement's location and language

☑ I have read and agree to the terms.

Submit your agreement once you have reviewed any additional terms when prompted at this time.

5. The Hybrid Cloud Console provides a confirmation that AWS prerequisites were completed and lists the first steps needed for cluster deployment:



Set up Red Hat OpenShift Service on AWS (ROSA)

ROSA allows you to deploy fully operational and managed Red Hat OpenShift clusters while leveraging the full breadth and dept

> Complete AWS prerequisites ✓

Complete ROSA prerequisites

Step 1: Download and install the ROSA and AWS command line tools (CLI) and add it to your PATH.

1.1 Download the latest version of the ROSA CLI

MacOS ▾ x86_64 ▾ Download the ROSA CLI

Help with ROSA CLI setup

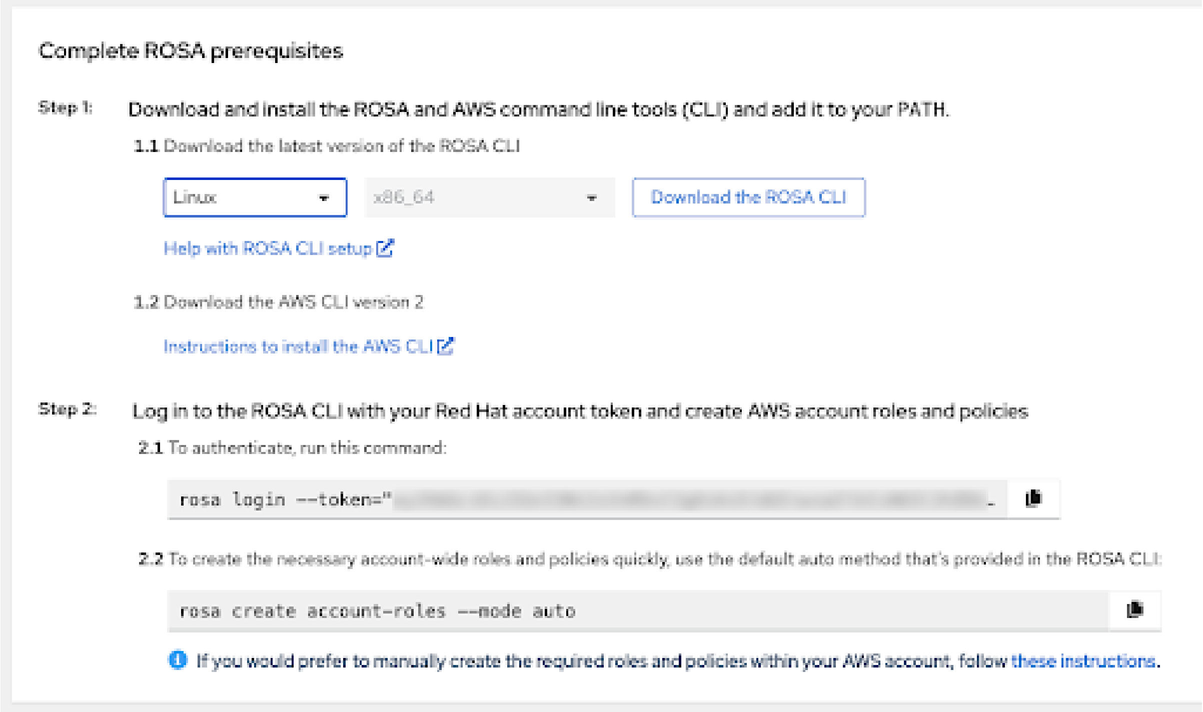
1.2 Download the AWS CLI version 2

Instructions to install the AWS CLI

Step 2: Log in to the ROSA CLI with your Red Hat account token and create AWS account roles and policies

2.1 To authenticate, run this command:

6. The following steps pertain to technical deployment of the cluster:



Complete ROSA prerequisites

Step 1: Download and install the ROSA and AWS command line tools (CLI) and add it to your PATH.

1.1 Download the latest version of the ROSA CLI

Linux ▾ x86_64 ▾ Download the ROSA CLI

Help with ROSA CLI setup

1.2 Download the AWS CLI version 2

Instructions to install the AWS CLI

Step 2: Log in to the ROSA CLI with your Red Hat account token and create AWS account roles and policies

2.1 To authenticate, run this command:

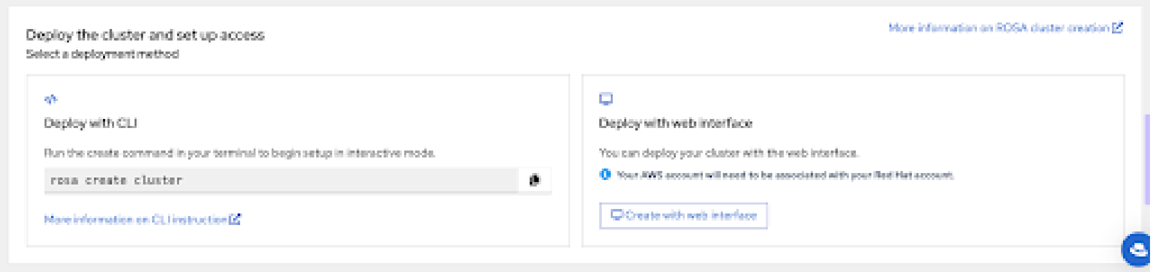
```
rosa login --token="[redacted]
```

2.2 To create the necessary account-wide roles and policies quickly, use the default auto method that's provided in the ROSA CLI:

```
rosa create account-roles --mode auto
```

If you would prefer to manually create the required roles and policies within your AWS account, follow these instructions.

- It is possible that these steps will be performed on a different machine than where the service enablement and account linking were completed.
- As mentioned previously, any Red Hat account belonging to the Red Hat organization that was linked with the AWS account that activated the ROSA service will have access to creating a cluster and will be able to select the billing AWS account that was linked under this Red Hat organization previously.
  The last section of this page shows cluster deployment options, either using the **rosa** CLI or through the web console:



Deploy the cluster and set up access
Select a deployment method

More information on ROSA cluster creation

Deploy with CLI

Run the create command in your terminal to begin setup in interactive mode.

```
rosa create cluster
```

More information on CLI instruction

Deploy with web interface

You can deploy your cluster with the web interface.

Your AWS account will need to be associated with your Red Hat account.

- The following steps describe cluster deployment using the **rosa** CLI.
- If you are interested in deployment using the web console only, you can skip to the *ROSA with HCP cluster deployment using the web console* section. However, note that the **rosa** CLI is required for certain tasks, such as creating the account roles. If you are deploying ROSA for the first time, follow this the CLI steps until running the **rosa whoami** command, before skipping to the web console deployment steps.

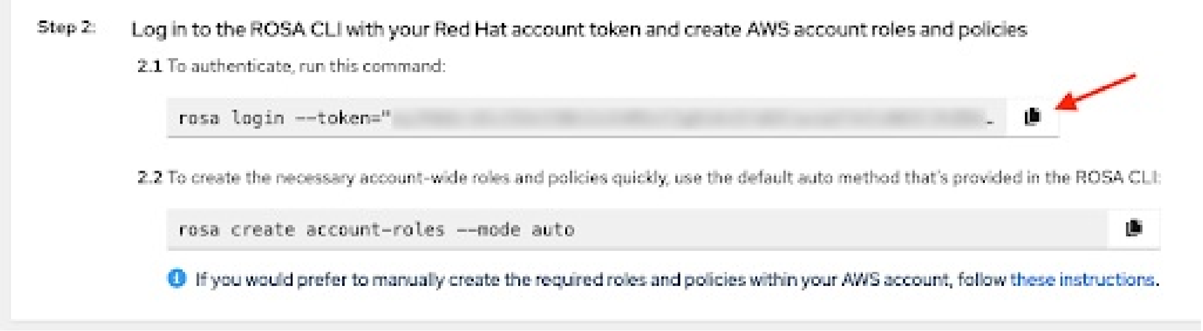
2.4. ROSA WITH HCP CLUSTER DEPLOYMENT USING THE CLI

1. Click the **Download the ROSA CLI**button to download the ROSA command line interface (CLI) for your operating system and set it up as described in the Help with ROSA CLI setup.

   > **IMPORTANT**
   >
   > Make sure that you have the most recent AWS CLI installed. See Instructions to install the AWS CLI for more information.

2. After the previous steps are completed, you can verify that both CLI are available by running the **rosa version**. This command shows an update notification if you are using an older version and **aws –version** commands in your terminal.

3. The prerequisite for creating a ROSA with HCP cluster is to log in using the **rosa** cli by the personalized command with your unique token shown under step *2.1. To authenticate, run this command* on the web console. Use the **copy** button for easy copy and pasting of the command with full token into your terminal:



Step 2: Log in to the ROSA CLI with your Red Hat account token and create AWS account roles and policies

2.1 To authenticate, run this command:

```
rosa login --token="[redacted]
```

2.2 To create the necessary account-wide roles and policies quickly, use the default auto method that's provided in the ROSA CLI:

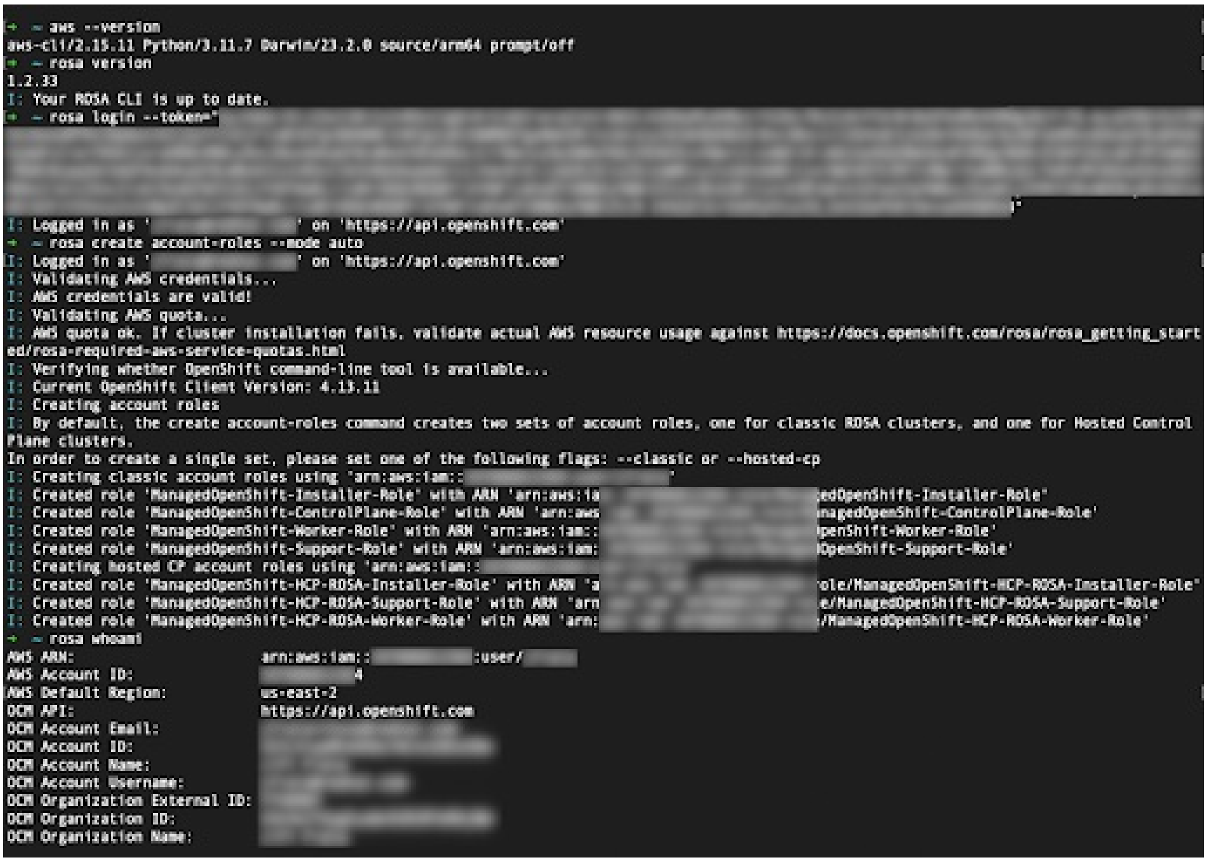
```
rosa create account-roles --mode auto
```

If you would prefer to manually create the required roles and policies within your AWS account, follow these instructions.

   Do not share your unique token.

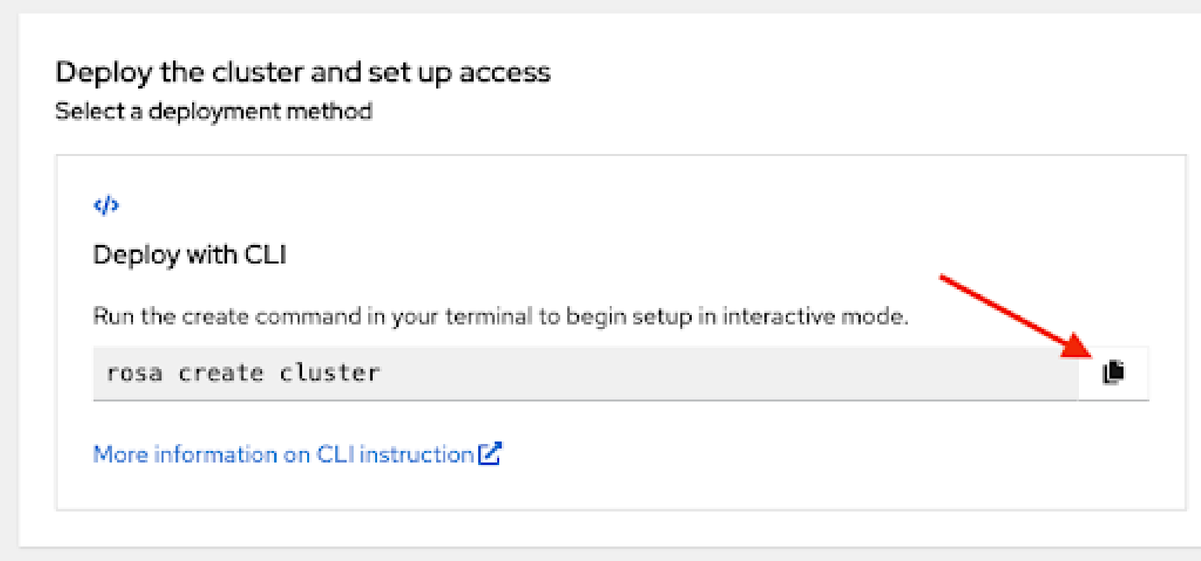
4. The final prerequisite before your first cluster deployment is making sure the necessary account-wide roles and policies are created. The **rosa** CLI can help with that by using the command shown under step *2.2. To create the necessary account-wide roles and policies quickly…* on the web console. The alternative to that is manual creation of these roles and policies.

5. After logging in, creating the account roles, and verifying your identity using the **rosa whoami** command, your terminal will look similar to this:



```
→  ~ aws --version
aws-cli/2.15.11 Python/3.11.7 Darwin/23.2.0 source/arm64 prompt/off
→  ~ rosa version
1.2.33
I: Your ROSA CLI is up to date.
→  ~ rosa login --token="[redacted]"
I: Logged in as '[redacted]' on 'https://api.openshift.com'
→  ~ rosa create account-roles --mode auto
I: Logged in as '[redacted]' on 'https://api.openshift.com'
I: Validating AWS credentials...
I: AWS credentials are valid!
I: Validating AWS quota...
I: AWS quota ok. If cluster installation fails, validate actual AWS resource usage against https://docs.openshift.com/rosa/rosa_getting_start
ed/rosa-required-aws-service-quotas.html
I: Verifying whether OpenShift command-line tool is available...
I: Current OpenShift Client Version: 4.13.11
I: Creating account roles
I: By default, the create account-roles command creates two sets of account roles, one for classic ROSA clusters, and one for Hosted Control
Plane clusters.
In order to create a single set, please set one of the following flags: --classic or --hosted-cp
I: Creating classic account roles using 'arn:aws:iam::[redacted]'
I: Created role 'ManagedOpenShift-Installer-Role' with ARN 'arn:aws:ia[redacted]edOpenShift-Installer-Role'
I: Created role 'ManagedOpenShift-ControlPlane-Role' with ARN 'arn:aws[redacted]nagedOpenShift-ControlPlane-Role'
I: Created role 'ManagedOpenShift-Worker-Role' with ARN 'arn:aws:iam::[redacted]penShift-Worker-Role'
I: Created role 'ManagedOpenShift-Support-Role' with ARN 'arn:aws:iam:[redacted]OpenShift-Support-Role'
I: Creating hosted CP account roles using 'arn:aws:iam::[redacted]
I: Created role 'ManagedOpenShift-HCP-ROSA-Installer-Role' with ARN 'a[redacted]role/ManagedOpenShift-HCP-ROSA-Installer-Role'
I: Created role 'ManagedOpenShift-HCP-ROSA-Support-Role' with ARN 'arn[redacted]e/ManagedOpenShift-HCP-ROSA-Support-Role'
I: Created role 'ManagedOpenShift-HCP-ROSA-Worker-Role' with ARN 'arn:[redacted]/ManagedOpenShift-HCP-ROSA-Worker-Role'
→  ~ rosa whoami
AWS ARN:                      arn:aws:iam::[redacted]:user/[redacted]
AWS Account ID:               [redacted]4
AWS Default Region:           us-east-2
OCM API:                      https://api.openshift.com
OCM Account Email:            [redacted]
OCM Account ID:               [redacted]
OCM Account Name:             [redacted]
OCM Account Username:         [redacted]
OCM Organization External ID: [redacted]
OCM Organization ID:          [redacted]
OCM Organization Name:        [redacted]
```

6. Initiate the cluster deployment using the presented command. You can click the **copy** button again and paste the command in your terminal:



Deploy the cluster and set up access

Select a deployment method

Deploy with CLI

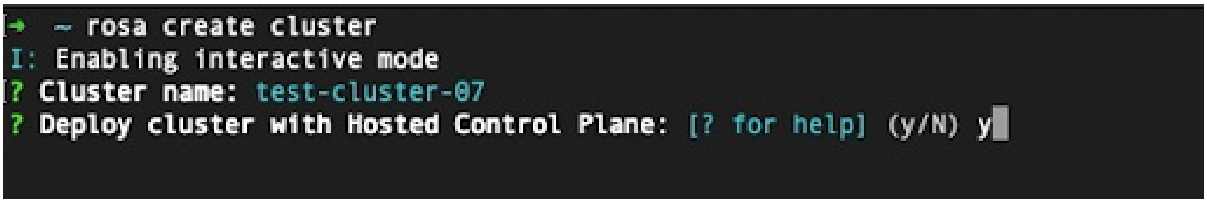
Run the create command in your terminal to begin setup in interactive mode.

```
rosa create cluster
```

More information on CLI instruction

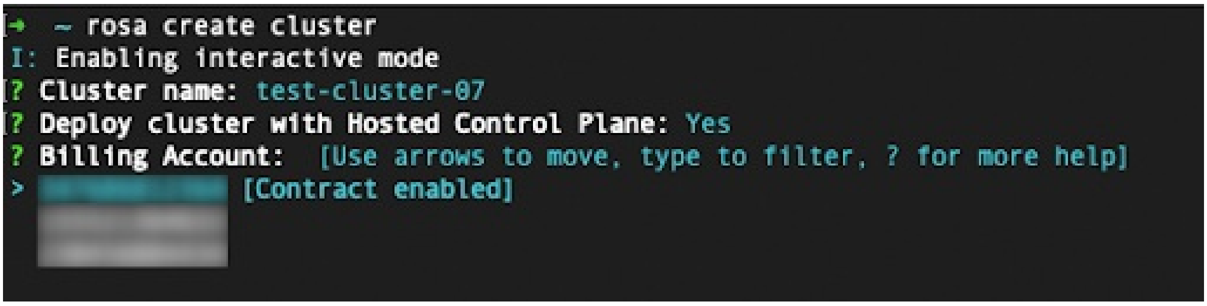
7. To use a custom AWS profile, one of the non-default profiles specified in your **~/.aws/credentials**, you can add the **–profile <profile_name>** selector to the rosa create cluster command so that the command looks like rosa create cluster **–profile stage**. If no AWS CLI profile is specified using this option, the default AWS CLI profile will determine the AWS infrastructure profile into which the cluster is deployed. The billing AWS profile is selected in one of the following steps.

8. After entering a cluster name, you will be asked whether to use the hosted control plane. Select **yes**:



```
→  ~ rosa create cluster
I: Enabling interactive mode
? Cluster name: test-cluster-07
? Deploy cluster with Hosted Control Plane: [? for help] (y/N) y
```

9. When deploying a ROSA with HCP cluster, the billing AWS account needs to be specified:



```
→  ~ rosa create cluster
I: Enabling interactive mode
? Cluster name: test-cluster-07
? Deploy cluster with Hosted Control Plane: Yes
? Billing Account:  [Use arrows to move, type to filter, ? for more help]
> [redacted] [Contract enabled]
  [redacted]
```

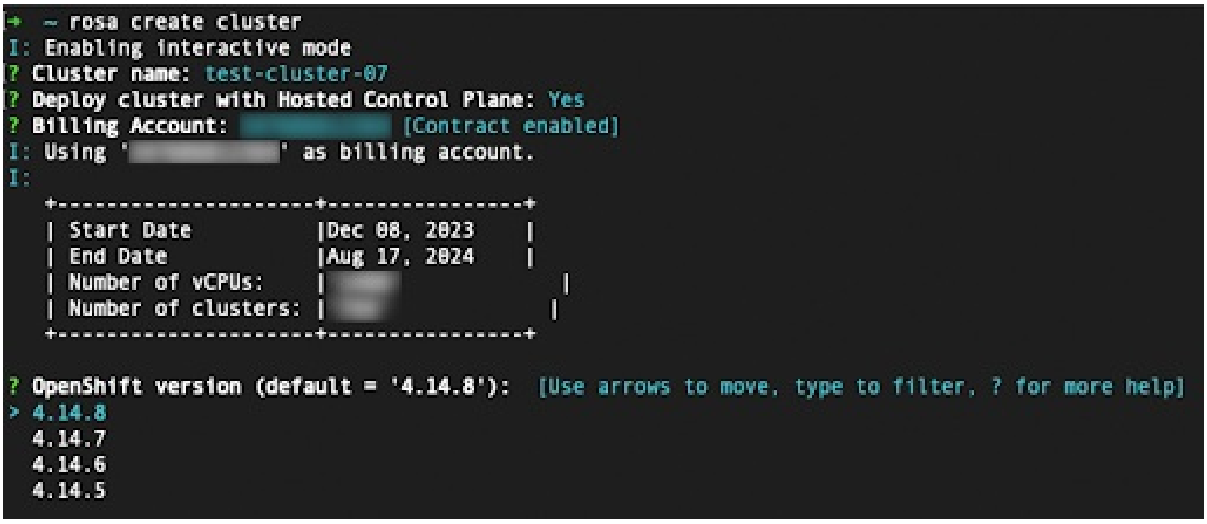
- Only AWS accounts that were linked to the Red Hat organization that is currently used will be shown.

- The specified AWS account will be charged for using the ROSA service, regardless of whether the infrastructure AWS account is linked to it in the same AWS organization.

- You can see an indicator of whether the ROSA contract is enabled for a given AWS billing account or not.

- To select an AWS account that does not have the contract enabled, refer to the first few steps in this tutorial to enable the contract and allow the service charging, which is required for a successful cluster deployment.

10. In the following steps, you will specify technical details of the cluster that is to be deployed:



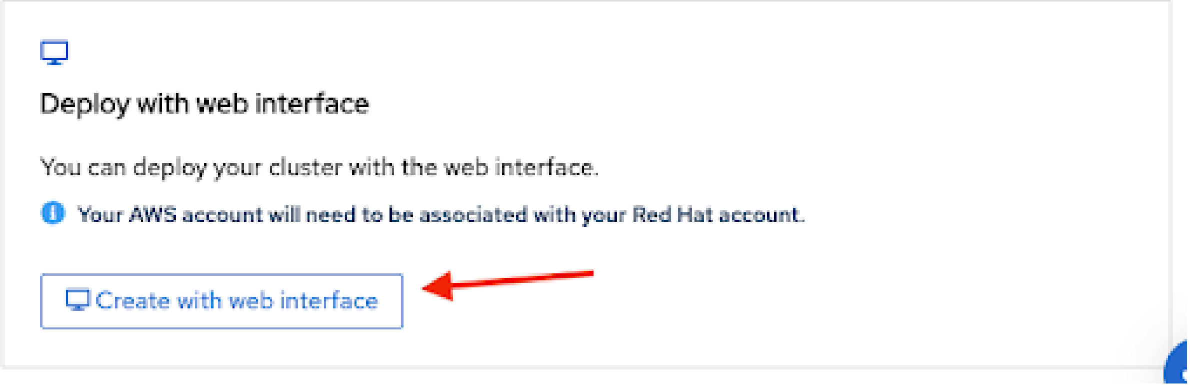
```
→  ~ rosa create cluster
I: Enabling interactive mode
? Cluster name: test-cluster-07
? Deploy cluster with Hosted Control Plane: Yes
? Billing Account: [redacted] [Contract enabled]
I: Using '[redacted]' as billing account.
I:
   +--------------------+---------------+
   | Start Date         |Dec 08, 2023   |
   | End Date           |Aug 17, 2024   |
   | Number of vCPUs:   |[redacted]     |
   | Number of clusters: |[redacted]    |
   +--------------------+---------------+

? OpenShift version (default = '4.14.8'):  [Use arrows to move, type to filter, ? for more help]
> 4.14.8
  4.14.7
  4.14.6
  4.14.5
```

- These steps are beyond the scope of this tutorial. See Creating ROSA with HCP clusters using the default options for more details about how to complete the ROSA with HCP cluster deployment using the CLI.

2.5. ROSA WITH HCP CLUSTER DEPLOYMENT USING THE WEB CONSOLE

1. A cluster can be created using the web console by selecting the second option in the bottom section of the introductory **Set up ROSA** page:

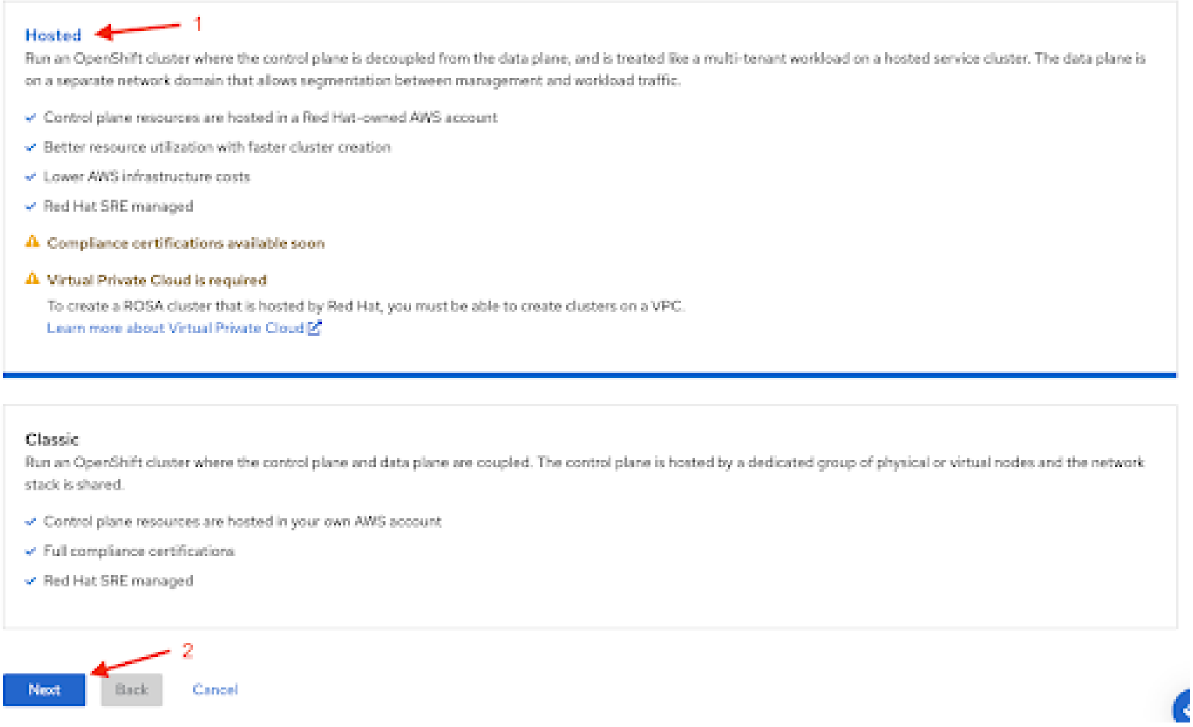


Deploy with web interface

You can deploy your cluster with the web interface.

Your AWS account will need to be associated with your Red Hat account.

2. The first step when creating a ROSA cluster using the web console is the control plane selection. Make sure the **Hosted** option is selected before clicking the **Next** button:



Hosted

Run an OpenShift cluster where the control plane is decoupled from the data plane, and is treated like a multi-tenant workload on a hosted service cluster. The data plane is on a separate network domain that allows segmentation between management and workload traffic.

✓ Control plane resources are hosted in a Red Hat-owned AWS account

✓ Better resource utilization with faster cluster creation

✓ Lower AWS infrastructure costs

✓ Red Hat SRE managed

⚠ Compliance certifications available soon

⚠ Virtual Private Cloud is required

To create a ROSA cluster that is hosted by Red Hat, you must be able to create clusters on a VPC.

Learn more about Virtual Private Cloud

Classic

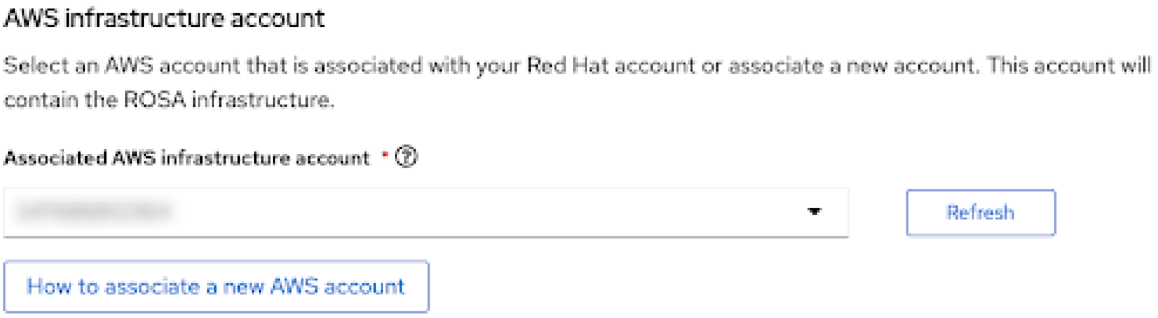
Run an OpenShift cluster where the control plane and data plane are coupled. The control plane is hosted by a dedicated group of physical or virtual nodes and the network stack is shared.

✓ Control plane resources are hosted in your own AWS account

✓ Full compliance certifications

✓ Red Hat SRE managed

3. The next step **Accounts and roles** allows you specifying the infrastructure AWS account, into which the the ROSA cluster will be deployed and where the resources will be consumed and managed:



AWS infrastructure account

Select an AWS account that is associated with your Red Hat account or associate a new account. This account will contain the ROSA infrastructure.

Associated AWS infrastructure account * ⓘ

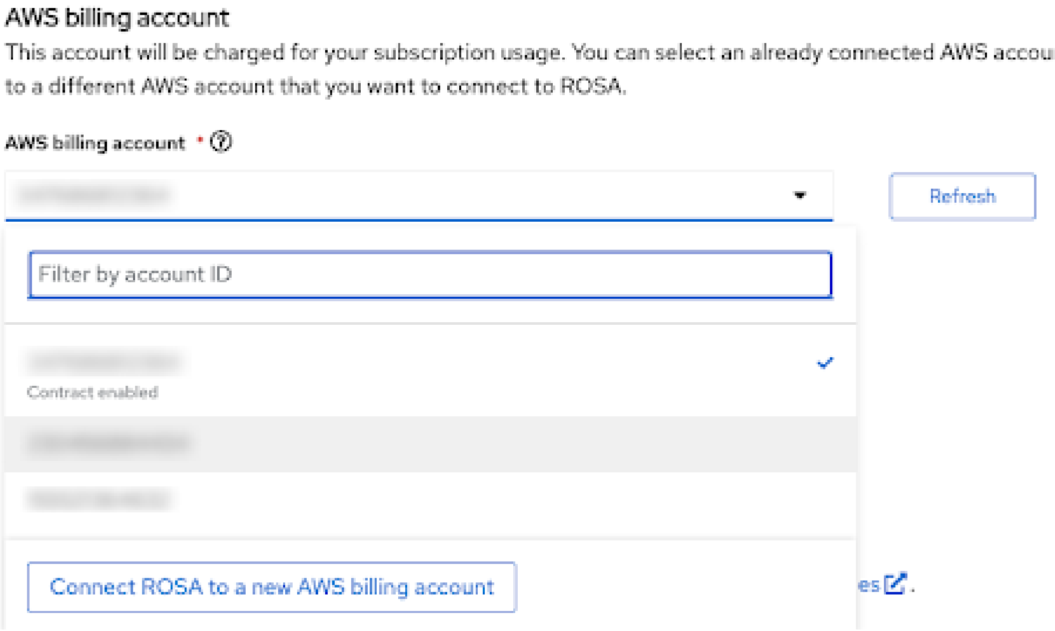
[redacted]

- Click the **How to associate a new AWS account** if you don not see the account into which you want to deploy the ROSA cluster for detailed information on how to create or link account roles for this association.

- The **rosa** CLI is used for this.

- If you are using multiple AWS accounts and have their profiles configured for the AWS CLI, you can use the **--profile** selector to specify the AWS profile when working with the **rosa** CLI commands.

4. The billing AWS account is selected in the immediately following section:



AWS billing account

This account will be charged for your subscription usage. You can select an already connected AWS account or sign in to a different AWS account that you want to connect to ROSA.

AWS billing account * ⓘ

[redacted] ▾ Refresh

Filter by account ID

[redacted] ✓
Contract enabled

[redacted]

[redacted]

Connect ROSA to a new AWS billing account

es.

- Only AWS accounts that were linked to the Red Hat organization that is currently used will be shown.

- The specified AWS account will be charged for using the ROSA service, regardless of whether the infrastructure AWS account is linked to it in the same AWS organization.

- You can see an indicator whether the ROSA contract is enabled for a given AWS billing account or not.

- In case you would like to use an AWS account that does not have a contract enabled yet, you can either use the *Connect ROSA to a new AWS billing account* to reach the ROSA AWS console page, where you can activate it after logging in using the respective AWS account by following steps described earlier in this tutorial, or ask the administrator of the AWS account to do that for you.

The following steps past the billing AWS account selection are beyond the scope of this tutorial.

Additional resources

- For information on using the CLI to create a cluster, see Creating a ROSA with HCP cluster using the CLI.

- See this learning path for more details on how to complete ROSA cluster deployment using the web console.

CHAPTER 3. TUTORIAL: VERIFYING PERMISSIONS FOR A ROSA STS DEPLOYMENT

To proceed with the deployment of a ROSA cluster, an account must support the required roles and permissions. AWS Service Control Policies (SCPs) cannot block the API calls made by the installer or operator roles.

Details about the IAM resources required for an STS-enabled installation of ROSA can be found here: About IAM resources for ROSA clusters that use STS

This guide is validated for ROSA v4.11.X.

3.1. PREREQUISITES

- AWS CLI
- ROSA CLI v1.2.6
- jq CLI
- AWS role with required permissions

3.2. VERIFYING ROSA PERMISSIONS

To verify the permissions required for ROSA, we can run the script included in the following section without ever creating any AWS resources.

The script uses the **rosa**, **aws**, and **jq** CLI commands to create files in the working directory that will be used to verify permissions in the account connected to the current AWS configuration.

The AWS Policy Simulator is used to verify the permissions of each role policy against the API calls extracted by **jq**; results are then stored in a text file appended with **.results**.

This script is designed to verify the permissions for the current account and region.

3.3. USAGE INSTRUCTIONS

1. To use the script, run the following commands in a **bash** terminal (the -p option defines a prefix for the roles):

```
$ mkdir scratch
$ cd scratch
$ cat << 'EOF' > verify-permissions.sh
#!/bin/bash
while getopts 'p:' OPTION; do
  case "$OPTION" in
    p)
      PREFIX="$OPTARG"
      ;;
    ?)
      echo "script usage: $(basename \$0) [-p PREFIX]" >&2
      exit 1
      ;;
  esac
```

```
done
shift "$(($OPTIND -1))"
rosa create account-roles --mode manual --prefix $PREFIX
INSTALLER_POLICY=$(cat sts_installer_permission_policy.json | jq )
CONTROL_PLANE_POLICY=$(cat sts_instance_controlplane_permission_policy.json | jq)
WORKER_POLICY=$(cat sts_instance_worker_permission_policy.json | jq)
SUPPORT_POLICY=$(cat sts_support_permission_policy.json | jq)
simulatePolicy () {
   outputFile="${2}.results"
   echo $2
   aws iam simulate-custom-policy --policy-input-list "$1" --action-names $(jq '.Statement |
map(select(.Effect == "Allow"))[].Action | if type == "string" then . else .[] end' "$2" -r) --output
text > $outputFile
}
simulatePolicy "$INSTALLER_POLICY" "sts_installer_permission_policy.json"
simulatePolicy "$CONTROL_PLANE_POLICY"
"sts_instance_controlplane_permission_policy.json"
simulatePolicy "$WORKER_POLICY" "sts_instance_worker_permission_policy.json"
simulatePolicy "$SUPPORT_POLICY" "sts_support_permission_policy.json"
EOF
$ chmod +x verify-permissions.sh
$ ./verify-permissions.sh -p SimPolTest
```

2. After the script completes, review each results file to ensure that none of the required API calls are blocked:

```
$ for file in $(ls *.results); do echo $file; cat $file; done
```

The output will look similar to the following:

```
sts_installer_permission_policy.json.results
EVALUATIONRESULTS       autoscaling:DescribeAutoScalingGroups   allowed *
MATCHEDSTATEMENTS       PolicyInputList.1       IAM Policy
ENDPOSITION     6       195
STARTPOSITION   17      3
EVALUATIONRESULTS       ec2:AllocateAddress     allowed *
MATCHEDSTATEMENTS       PolicyInputList.1       IAM Policy
ENDPOSITION     6       195
STARTPOSITION   17      3
EVALUATIONRESULTS       ec2:AssociateAddress    allowed *
MATCHEDSTATEMENTS       PolicyInputList.1       IAM Policy
...
```

NOTE

If any actions are blocked, review the error provided by AWS and consult with your Administrator to determine if SCPs are blocking the required API calls.

CHAPTER 4. CONFIGURING LOG FORWARDING FOR CLOUDWATCH LOGS AND STS

Use this tutorial to deploy the Red Hat OpenShift Logging Operator and configure it to use Security Token Services (STS) authentication to forward logs to CloudWatch.

Prerequisites

- A Red Hat OpenShift Service on AWS (ROSA) Classic cluster
- The **jq** command-line interface (CLI)
- The Amazon Web Services (AWS) CLI (**aws**)

4.1. SETTING UP YOUR ENVIRONMENT

1. Configure the following environment variables, changing the cluster name to suit your cluster:

   NOTE

   You must be logged in as an administrator.

   ```
   $ export ROSA_CLUSTER_NAME=$(oc get infrastructure cluster -o=jsonpath="
   {.status.infrastructureName}"  | sed 's/-[a-z0-9]\{5\}$//')
   $ export REGION=$(rosa describe cluster -c ${ROSA_CLUSTER_NAME} --output json | jq -r
   .region.id)
   $ export OIDC_ENDPOINT=$(oc get authentication.config.openshift.io cluster -o json | jq -r
   .spec.serviceAccountIssuer | sed  's|^https://||')
   $ export AWS_ACCOUNT_ID=`aws sts get-caller-identity --query Account --output text`
   $ export AWS_PAGER=""
   $ export SCRATCH="/tmp/${ROSA_CLUSTER_NAME}/clf-cloudwatch-sts"
   $ mkdir -p ${SCRATCH}
   ```

2. Ensure all fields output correctly before moving to the next section:

   ```
   $ echo "Cluster: ${ROSA_CLUSTER_NAME}, Region: ${REGION}, OIDC Endpoint:
   ${OIDC_ENDPOINT}, AWS Account ID: ${AWS_ACCOUNT_ID}"
   ```

4.2. PREPARING YOUR AWS ACCOUNT

1. Create an Identity Access Management (IAM) policy for logging:

   ```
   $ POLICY_ARN=$(aws iam list-policies --query "Policies[?PolicyName=='RosaCloudWatch'].
   {ARN:Arn}" --output text)
   $ if [[ -z "${POLICY_ARN}" ]]; then
   cat << EOF > ${SCRATCH}/policy.json
   {
     "Version": "2012-10-17",
     "Statement": [
        {
             "Effect": "Allow",
             "Action": [
   ```

```
                "logs:CreateLogGroup",
                "logs:CreateLogStream",
                "logs:DescribeLogGroups",
                "logs:DescribeLogStreams",
                "logs:PutLogEvents",
                "logs:PutRetentionPolicy"
              ],
              "Resource": "arn:aws:logs:*:*:*"
          }
]
}
EOF
POLICY_ARN=$(aws iam create-policy --policy-name "RosaCloudWatch" \
--policy-document file:///${SCRATCH}/policy.json --query Policy.Arn --output text)
fi
$ echo ${POLICY_ARN}
```

2. Create an IAM role trust policy for the cluster:

```
$ cat <<EOF > ${SCRATCH}/trust-policy.json
{
   "Version": "2012-10-17",
   "Statement": [{
     "Effect": "Allow",
     "Principal": {
       "Federated": "arn:aws:iam::${AWS_ACCOUNT_ID}:oidc-provider/${OIDC_ENDPOINT}"
     },
     "Action": "sts:AssumeRoleWithWebIdentity",
     "Condition": {
       "StringEquals": {
         "${OIDC_ENDPOINT}:sub": "system:serviceaccount:openshift-logging:logcollector"
       }
     }
   }]
}
EOF
$ ROLE_ARN=$(aws iam create-role --role-name "${ROSA_CLUSTER_NAME}-
RosaCloudWatch" \
      --assume-role-policy-document file://${SCRATCH}/trust-policy.json \
      --query Role.Arn --output text)
$ echo ${ROLE_ARN}
```

3. Attach the IAM policy to the IAM role:

```
$ aws iam attach-role-policy --role-name "${ROSA_CLUSTER_NAME}-RosaCloudWatch" \
   --policy-arn ${POLICY_ARN}
```

4.3. DEPLOYING OPERATORS

1. Deploy the Red Hat OpenShift Logging Operator:

```
$  cat << EOF | oc apply -f -
   apiVersion: operators.coreos.com/v1alpha1
   kind: Subscription
   metadata:
     labels:
      operators.coreos.com/cluster-logging.openshift-logging: ""
     name: cluster-logging
     namespace: openshift-logging
   spec:
     channel: stable
     installPlanApproval: Automatic
     name: cluster-logging
     source: redhat-operators
     sourceNamespace: openshift-marketplace
EOF
```

2. Create a secret:

```
$  cat << EOF | oc apply -f -
  apiVersion: v1
  kind: Secret
  metadata:
    name: cloudwatch-credentials
    namespace: openshift-logging
  stringData:
    role_arn: $ROLE_ARN
EOF
```

4.4. CONFIGURING CLUSTER LOGGING

1. Create a **ClusterLogForwarder** custom resource (CR):

```
$ cat << EOF | oc apply -f -
  apiVersion: "logging.openshift.io/v1"
  kind: ClusterLogForwarder
  metadata:
    name: instance
    namespace: openshift-logging
  spec:
    outputs:
      - name: cw
        type: cloudwatch
        cloudwatch:
          groupBy: namespaceName
          groupPrefix: rosa-${ROSA_CLUSTER_NAME}
          region: ${REGION}
        secret:
          name: cloudwatch-credentials
    pipelines:
      - name: to-cloudwatch
        inputRefs:
          - infrastructure
          - audit
          - application
        outputRefs:
          - cw
EOF
```

2. Create a **ClusterLogging** CR:

```
$ cat << EOF | oc apply -f -
  apiVersion: logging.openshift.io/v1
  kind: ClusterLogging
  metadata:
    name: instance
    namespace: openshift-logging
  spec:
    collection:
      logs:
         type: vector
    managementState: Managed
EOF
```

4.5. CHECKING CLOUDWATCH FOR LOGS

- Use either the AWS console or the AWS CLI to validate that there are log streams from the cluster.
  - To validate the logs in the AWS CLI, run the following command:

```
$ aws logs describe-log-groups --log-group-name-prefix rosa-
${ROSA_CLUSTER_NAME}
```

Sample output

```
{
  "logGroups": [
      {
        "logGroupName": "rosa-xxxx.audit",
        "creationTime": 1661286368369,
        "metricFilterCount": 0,
        "arn": "arn:aws:logs:us-east-2:xxxx:log-group:rosa-xxxx.audit:*",
        "storedBytes": 0
      },
      {
        "logGroupName": "rosa-xxxx.infrastructure",
        "creationTime": 1661286369821,
        "metricFilterCount": 0,
        "arn": "arn:aws:logs:us-east-2:xxxx:log-group:rosa-xxxx.infrastructure:*",
        "storedBytes": 0
      }
  ]
}
```

NOTE

If this is a new cluster, you might not see a log group for **application** logs as applications are not yet running.

4.6. CLEANING UP YOUR RESOURCES

1. Delete the **ClusterLogForwarder** CR:

```
$ oc delete -n openshift-logging clusterlogforwarder instance
```

2. Delete the **ClusterLogging** CR:

```
$ oc delete -n openshift-logging clusterlogging instance
```

3. Detach the IAM policy to the IAM role:

```
$ aws iam detach-role-policy --role-name "${ROSA_CLUSTER_NAME}-RosaCloudWatch" \
  --policy-arn "${POLICY_ARN}"
```

4. Delete the IAM role:

```
$ aws iam delete-role --role-name "${ROSA_CLUSTER_NAME}-RosaCloudWatch"
```

5. Delete the IAM policy:

IMPORTANT

Only delete the IAM policy if there are no other resources using the policy.

```
$ aws iam delete-policy --policy-arn "${POLICY_ARN}"
```

6. Delete the CloudWatch log groups:

```
$ aws logs delete-log-group --log-group-name "rosa-${ROSA_CLUSTER_NAME}.audit"
$ aws logs delete-log-group --log-group-name "rosa-
${ROSA_CLUSTER_NAME}.infrastructure"
```

CHAPTER 5. TUTORIAL: USING AWS WAF AND AMAZON CLOUDFRONT TO PROTECT ROSA WORKLOADS

AWS WAF is a web application firewall that lets you monitor the HTTP and HTTPS requests that are forwarded to your protected web application resources.

You can use an Amazon CloudFront to add a Web Application Firewall (WAF) to your Red Hat OpenShift Service on AWS (ROSA) workloads. Using an external solution protects ROSA resources from experiencing denial of service due to handling the WAF.

5.1. PREREQUISITES

- A ROSA Classic cluster.
- You have access to the OpenShift CLI (**oc**).
- You have access to the AWS CLI (**aws**).

5.1.1. Environment setup

- Prepare the environment variables:

```
$ export AWS_PAGER=""
$ export CLUSTER_NAME=$(oc get infrastructure cluster -o=jsonpath="
{.status.infrastructureName}"  | sed 's/-[a-z0-9]\{5\}$//')
$ export REGION=$(oc get infrastructure cluster -o=jsonpath="
{.status.platformStatus.aws.region}")
$ export AWS_ACCOUNT_ID=$(aws sts get-caller-identity --query Account --output text)
$ export SCRATCH="/tmp/${CLUSTER_NAME}/cloudfront-waf"
$ mkdir -p ${SCRATCH}
$ echo "Cluster: ${CLUSTER_NAME}, Region: ${REGION}, AWS Account ID:
${AWS_ACCOUNT_ID}"
```

5.2. CUSTOM DOMAIN SETUP

It is necessary to configure a secondary ingress controller to segment your external WAF-protected traffic from your standard (and default) cluster ingress controller. In ROSA, we do this using the Custom Domain Operator.

Prerequisites

- A unique domain, such as ***.apps.<company_name>.io**
- A custom SAN or wildcard certificate, such as **CN=*.apps.<company_name>.io**

Procedure

1. Create a new project

```
$ oc new-project waf-demo
```

2. Create a new TLS secret from a private key and a public certificate, where **fullchain.pem** is your full wildcard certificate chain (including any intermediaries) and **privkey.pem** is your wildcard certificate's private key.

   Example

   ```
   $ oc -n waf-demo create secret tls waf-tls --cert=fullchain.pem --key=privkey.pem
   ```

3. Create a new **CustomDomain** custom resource (CR):

   Example waf-custom-domain.yaml

   ```
   apiVersion: managed.openshift.io/v1alpha1
   kind: CustomDomain
   metadata:
     name: cloudfront-waf
   spec:
     domain: apps.<company_name>.io 1
     scope: External
     loadBalancerType: NLB
     certificate:
       name: waf-tls
       namespace: waf-demo
     routeSelector: 2
       matchLabels:
        route: waf
   ```

   1 The custom domain.

   2 Filters the set of routes serviced by the CustomDomain ingress. In this tutorial, we will use the **waf** route selector, but if no value was to be provided, no filtering would occur.

4. Apply the CR:

   Example

   ```
   $ oc apply -f waf-custom-domain.yaml
   ```

5. Verify that your custom domain ingress controller has been deployed and is **Ready**:

   ```
   $ oc get customdomains
   ```

   Example output

   ```
   NAME            ENDPOINT                                                    DOMAIN                STATUS
   cloudfront-waf     xxrywp.<company_name>.cluster-01.opln.s1.openshiftapps.com  *.apps.
   <company_name>.io     Ready
   ```

5.2.1. Configure the AWS WAF

The AWS WAF service is a web application firewall that lets you monitor, protect, and control the HTTP and HTTPS requests that are forwarded to your protected web application resources, like ROSA.

1. Create a AWS WAF rules file to apply to our web ACL:

```
$ cat << EOF > ${SCRATCH}/waf-rules.json
[
  {
    "Name": "AWS-AWSManagedRulesCommonRuleSet",
    "Priority": 0,
    "Statement": {
      "ManagedRuleGroupStatement": {
        "VendorName": "AWS",
        "Name": "AWSManagedRulesCommonRuleSet"
      }
    },
    "OverrideAction": {
      "None": {}
    },
    "VisibilityConfig": {
      "SampledRequestsEnabled": true,
      "CloudWatchMetricsEnabled": true,
      "MetricName": "AWS-AWSManagedRulesCommonRuleSet"
    }
  },
  {
    "Name": "AWS-AWSManagedRulesSQLiRuleSet",
    "Priority": 1,
    "Statement": {
      "ManagedRuleGroupStatement": {
        "VendorName": "AWS",
        "Name": "AWSManagedRulesSQLiRuleSet"
      }
    },
    "OverrideAction": {
      "None": {}
    },
    "VisibilityConfig": {
      "SampledRequestsEnabled": true,
      "CloudWatchMetricsEnabled": true,
      "MetricName": "AWS-AWSManagedRulesSQLiRuleSet"
    }
  }
]
EOF
```

   This will enable the Core (Common) and SQL AWS Managed Rule Sets.

2. Create an AWS WAF Web ACL using the rules we specified above:

```
$ WAF_WACL=$(aws wafv2 create-web-acl \
  --name cloudfront-waf \
  --region ${REGION} \
  --default-action Allow={} \
  --scope CLOUDFRONT \
  --visibility-config
SampledRequestsEnabled=true,CloudWatchMetricsEnabled=true,MetricName=${CLUSTER_N
AME}-waf-metrics \
  --rules file://${SCRATCH}/waf-rules.json \
  --query 'Summary.Name' \
  --output text)
```

5.3. CONFIGURE AMAZON CLOUDFRONT

1. Retrieve the newly created custom domain ingress controller’s NLB hostname:

```
$ NLB=$(oc -n openshift-ingress get service router-cloudfront-waf \
  -o jsonpath='{.status.loadBalancer.ingress[0].hostname}')
$ echo "Origin domain: ${NLB}"
```

2. Import your certificate into Amazon Certificate Manager, where **cert.pem** is your wildcard certificate, **fullchain.pem** is your wildcard certificate’s chain and **privkey.pem** is your wildcard certificate’s private key.

NOTE

Regardless of what region your cluster is deployed, you must import this certificate to **us-east-1** as Amazon CloudFront is a global AWS service.

Example

```
$ aws acm import-certificate --certificate file://cert.pem \
  --certificate-chain file://fullchain.pem \
  --private-key file://privkey.pem \
  --region us-east-1
```

3. Log into the AWS console to create a CloudFront distribution.

4. Configure the CloudFront distribution by using the following information:

NOTE

If an option is not specified in the table below, leave them the default (which may be blank).

Option	Value
Origin domain	Output from the command above [1]
Name	rosa-waf-ingress [2]
Viewer protocol policy	Redirect HTTP to HTTPS
Allowed HTTP methods	GET, HEAD, OPTIONS, PUT, POST, PATCH, DELETE
Cache policy	CachingDisabled

Option	Value
Origin request policy	AllViewer
Web Application Firewall (WAF)	Enable security protections
Use existing WAF configuration	true
Choose a web ACL	**cloudfront-waf**
Alternate domain name (CNAME)	*.apps.<company_name>.io [3]
Custom SSL certificate	Select the certificate you imported from the step above [4]

1. Run **echo ${NLB}** to get the origin domain.
2. If you have multiple clusters, ensure the origin name is unique.
3. This should match the wildcard domain you used to create the custom domain ingress controller.
4. This should match the alternate domain name entered above.

5. Retrieve the Amazon CloudFront Distribution endpoint:

```
$ aws cloudfront list-distributions --query "DistributionList.Items[?Origins.Items[?
DomainName=='${NLB}']].DomainName" --output text
```

6. Update the DNS of your custom wildcard domain with a CNAME to the Amazon CloudFront Distribution endpoint from the step above.

Example

```
*.apps.<company_name>.io CNAME d1b2c3d4e5f6g7.cloudfront.net
```

5.4. DEPLOY A SAMPLE APPLICATION

1. Deploy a hello world application:

```
$ oc -n waf-demo new-app --image=docker.io/openshift/hello-openshift
```

2. Create a route for the application specifying your custom domain name:

Example

```
$ oc -n waf-demo create route edge --service=hello-openshift hello-openshift-tls \
--hostname hello-openshift.apps.<company_name>.io
```

3. Label the route to admit it to your custom domain ingress controller:

```
$ oc -n waf-demo label route.route.openshift.io/hello-openshift-tls route=waf
```

5.5. TEST THE WAF

1. Test that the app is accessible behind Amazon CloudFront:

Example

```
$ curl "https://hello-openshift.apps.<company_name>.io"
```

Example output

```
Hello OpenShift!
```

2. Test that the WAF denies a bad request:

Example

```
$ curl -X POST "https://hello-openshift.apps.<company_name>.io" \
  -F "user='<script><alert>Hello></alert></script>'"
```

Example output

```
<html>
<head><title>403 Forbidden</title></head>
<body>
<center><h1>403 Forbidden</h1></center>
</body>
</html
```

The expected result is a **403 Forbidden** error, which means the AWS WAF is protecting your application.

5.6. ADDITIONAL RESOURCES

- Custom domains for applications in the Red Hat documentation
- Adding Extra Security with AWS WAF, CloudFront and ROSA | Amazon Web Services on YouTube

CHAPTER 6. TUTORIAL: USING AWS WAF AND AWS ALBS TO PROTECT ROSA WORKLOADS

AWS WAF is a web application firewall that lets you monitor the HTTP and HTTPS requests that are forwarded to your protected web application resources.

You can use an AWS Application Load Balancer (ALB) to add a Web Application Firewall (WAF) to your Red Hat OpenShift Service on AWS (ROSA) workloads. Using an external solution protects ROSA resources from experiencing denial of service due to handling the WAF.

NOTE

It is recommended that you use the CloudFront method unless you absolutely must use an ALB based solution.

6.1. PREREQUISITES

NOTE

AWS ALBs require a multi-AZ cluster, as well as three public subnets split across three AZs in the same VPC as the cluster.

- A multi-AZ ROSA Classic cluster.
- You have access to the OpenShift CLI (**oc**).
- You have access to the AWS CLI (**aws**).

6.1.1. Environment setup

- Prepare the environment variables:

```
$ export AWS_PAGER=""
$ export CLUSTER_NAME=$(oc get infrastructure cluster -o=jsonpath="
{.status.infrastructureName}"  | sed 's/-[a-z0-9]\{5\}$//')
$ export REGION=$(oc get infrastructure cluster -o=jsonpath="
{.status.platformStatus.aws.region}")
$ export OIDC_ENDPOINT=$(oc get authentication.config.openshift.io cluster -o
jsonpath='{.spec.serviceAccountIssuer}' | sed  's|^https://||')
$ export AWS_ACCOUNT_ID=$(aws sts get-caller-identity --query Account --output text)
$ export SCRATCH="/tmp/${CLUSTER_NAME}/alb-waf"
$ mkdir -p ${SCRATCH}
$ echo "Cluster: ${CLUSTER_NAME}, Region: ${REGION}, OIDC Endpoint:
${OIDC_ENDPOINT}, AWS Account ID: ${AWS_ACCOUNT_ID}"
```

6.1.2. AWS VPC and subnets

NOTE

This section only applies to clusters that were deployed into existing VPCs. If you did not deploy your cluster into an existing VPC, skip this section and proceed to the installation section below.

1. Set the below variables to the proper values for your ROSA deployment:

```
$ export VPC_ID=<vpc-id>
$ export PUBLIC_SUBNET_IDS=<public-subnets>
$ export PRIVATE_SUBNET_IDS=<private-subnets>
```

2. Add a tag to your cluster's VPC with the cluster name:

```
$ aws ec2 create-tags --resources ${VPC_ID} --tags
Key=kubernetes.io/cluster/${CLUSTER_NAME},Value=owned --region ${REGION}
```

3. Add a tag to your public subnets:

```
$ aws ec2 create-tags \
    --resources ${PUBLIC_SUBNET_IDS} \
    --tags Key=kubernetes.io/role/elb,Value='' \
    --region ${REGION}
```

4. Add a tag to your private subnets:

```
$ aws ec2 create-tags \
    --resources "${PRIVATE_SUBNET_IDS}" \
    --tags Key=kubernetes.io/role/internal-elb,Value='' \
    --region ${REGION}
```

6.2. DEPLOY THE AWS LOAD BALANCER OPERATOR

The AWS Load Balancer Operator is used to used to install, manage and configure an instance of **aws-load-balancer-controller** in a ROSA cluster. To deploy ALBs in ROSA, we need to first deploy the AWS Load Balancer Operator.

1. Create an AWS IAM policy for the AWS Load Balancer Controller:

   NOTE

   The policy is sourced from the upstream AWS Load Balancer Controller policy plus permission to create tags on subnets. This is required by the operator to function.

```
$ oc new-project aws-load-balancer-operator
$ POLICY_ARN=$(aws iam list-policies --query \
    "Policies[?PolicyName=='aws-load-balancer-operator-policy'].{ARN:Arn}" \
    --output text)
$ if [[ -z "${POLICY_ARN}" ]]; then
   wget -O "${SCRATCH}/load-balancer-operator-policy.json" \
      https://raw.githubusercontent.com/rh-mobb/documentation/main/content/docs/rosa/aws-
load-balancer-operator/load-balancer-operator-policy.json
    POLICY_ARN=$(aws --region "$REGION" --query Policy.Arn \
    --output text iam create-policy \
    --policy-name aws-load-balancer-operator-policy \
    --policy-document "file://${SCRATCH}/load-balancer-operator-policy.json")
fi
$ echo $POLICY_ARN
```

2. Create an AWS IAM trust policy for AWS Load Balancer Operator:

```
$ cat <<EOF > "${SCRATCH}/trust-policy.json"
{
 "Version": "2012-10-17",
 "Statement": [
 {
 "Effect": "Allow",
 "Condition": {
   "StringEquals" : {
     "${OIDC_ENDPOINT}:sub": ["system:serviceaccount:aws-load-balancer-operator:aws-load-balancer-operator-controller-manager", "system:serviceaccount:aws-load-balancer-operator:aws-load-balancer-controller-cluster"]
   }
 },
 "Principal": {
   "Federated": "arn:aws:iam::$AWS_ACCOUNT_ID:oidc-provider/${OIDC_ENDPOINT}"
 },
 "Action": "sts:AssumeRoleWithWebIdentity"
 }
 ]
}
EOF
```

3. Create an AWS IAM role for the AWS Load Balancer Operator:

```
$ ROLE_ARN=$(aws iam create-role --role-name "${CLUSTER_NAME}-alb-operator" \
   --assume-role-policy-document "file://${SCRATCH}/trust-policy.json" \
   --query Role.Arn --output text)
$ echo $ROLE_ARN

$ aws iam attach-role-policy --role-name "${CLUSTER_NAME}-alb-operator" \
     --policy-arn $POLICY_ARN
```

4. Create a secret for the AWS Load Balancer Operator to assume our newly created AWS IAM role:

```
$ cat << EOF | oc apply -f -
apiVersion: v1
kind: Secret
metadata:
  name: aws-load-balancer-operator
  namespace: aws-load-balancer-operator
stringData:
  credentials: |
    [default]
    role_arn = $ROLE_ARN
    web_identity_token_file = /var/run/secrets/openshift/serviceaccount/token
EOF
```

5. Install the Red Hat AWS Load Balancer Operator:

```
$ cat << EOF | oc apply -f -
apiVersion: operators.coreos.com/v1
```

```
kind: OperatorGroup
metadata:
  name: aws-load-balancer-operator
  namespace: aws-load-balancer-operator
spec:
  upgradeStrategy: Default
---
apiVersion: operators.coreos.com/v1alpha1
kind: Subscription
metadata:
  name: aws-load-balancer-operator
  namespace: aws-load-balancer-operator
spec:
  channel: stable-v1.0
  installPlanApproval: Automatic
  name: aws-load-balancer-operator
  source: redhat-operators
  sourceNamespace: openshift-marketplace
  startingCSV: aws-load-balancer-operator.v1.0.0
EOF
```

6. Deploy an instance of the AWS Load Balancer Controller using the operator:

   NOTE

   If you get an error here wait a minute and try again, it means the Operator has not completed installing yet.

```
$ cat << EOF | oc apply -f -
apiVersion: networking.olm.openshift.io/v1
kind: AWSLoadBalancerController
metadata:
  name: cluster
spec:
  credentials:
    name: aws-load-balancer-operator
  enabledAddons:
    - AWSWAFv2
EOF
```

7. Check the that the operator and controller pods are both running:

```
$ oc -n aws-load-balancer-operator get pods
```

   You should see the following, if not wait a moment and retry:

```
NAME                                                  READY   STATUS    RESTARTS   AGE
aws-load-balancer-controller-cluster-6ddf658785-pdp5d           1/1     Running   0          99s
aws-load-balancer-operator-controller-manager-577d9ffcb9-w6zqn   2/2     Running   0
2m4s
```

6.3. DEPLOY A SAMPLE APPLICATION

1. Create a new project for our sample application:

```
$ oc new-project hello-world
```

2. Deploy a hello world application:

```
$ oc new-app -n hello-world --image=docker.io/openshift/hello-openshift
```

3. Convert the pre-created service resource to a NodePort service type:

```
$ oc -n hello-world patch service hello-openshift -p '{"spec":{"type":"NodePort"}}'
```

4. Deploy an AWS ALB using the AWS Load Balancer Operator:

```
$ cat << EOF | oc apply -f -
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: hello-openshift-alb
  namespace: hello-world
  annotations:
    alb.ingress.kubernetes.io/scheme: internet-facing
spec:
  ingressClassName: alb
  rules:
    - http:
        paths:
          - path: /
            pathType: Exact
            backend:
              service:
                name: hello-openshift
                port:
                  number: 8080
EOF
```

5. Curl the AWS ALB Ingress endpoint to verify the hello world application is accessible:

NOTE

AWS ALB provisioning takes a few minutes. If you receive an error that says **curl: (6) Could not resolve host**, please wait and try again.

```
$ INGRESS=$(oc -n hello-world get ingress hello-openshift-alb -o
jsonpath='{.status.loadBalancer.ingress[0].hostname}')
$ curl "http://${INGRESS}"
```

Example output

```
Hello OpenShift!
```

6.3.1. Configure the AWS WAF

The AWS WAF service is a web application firewall that lets you monitor, protect, and control the HTTP and HTTPS requests that are forwarded to your protected web application resources, like ROSA.

1. Create a AWS WAF rules file to apply to our web ACL:

```
$ cat << EOF > ${SCRATCH}/waf-rules.json
[
  {
   "Name": "AWS-AWSManagedRulesCommonRuleSet",
   "Priority": 0,
   "Statement": {
    "ManagedRuleGroupStatement": {
     "VendorName": "AWS",
     "Name": "AWSManagedRulesCommonRuleSet"
    }
   },
   "OverrideAction": {
    "None": {}
   },
   "VisibilityConfig": {
    "SampledRequestsEnabled": true,
    "CloudWatchMetricsEnabled": true,
    "MetricName": "AWS-AWSManagedRulesCommonRuleSet"
   }
  },
  {
   "Name": "AWS-AWSManagedRulesSQLiRuleSet",
   "Priority": 1,
   "Statement": {
    "ManagedRuleGroupStatement": {
     "VendorName": "AWS",
     "Name": "AWSManagedRulesSQLiRuleSet"
    }
   },
   "OverrideAction": {
    "None": {}
   },
   "VisibilityConfig": {
    "SampledRequestsEnabled": true,
    "CloudWatchMetricsEnabled": true,
    "MetricName": "AWS-AWSManagedRulesSQLiRuleSet"
   }
  }
]
EOF
```

   This will enable the Core (Common) and SQL AWS Managed Rule Sets.

2. Create an AWS WAF Web ACL using the rules we specified above:

```
$ WAF_ARN=$(aws wafv2 create-web-acl \
 --name ${CLUSTER_NAME}-waf \
 --region ${REGION} \
 --default-action Allow={} \
 --scope REGIONAL \
 --visibility-config
SampledRequestsEnabled=true,CloudWatchMetricsEnabled=true,MetricName=${CLUSTER_N
AME}-waf-metrics \
  --rules file://${SCRATCH}/waf-rules.json \
  --query 'Summary.ARN' \
  --output text)
```

3. Annotate the Ingress resource with the AWS WAF Web ACL ARN:

```
$ oc annotate -n hello-world ingress.networking.k8s.io/hello-openshift-alb \
  alb.ingress.kubernetes.io/wafv2-acl-arn=${WAF_ARN}
```

4. Wait for 10 seconds for the rules to propagate and test that the app still works:

```
$ curl "http://${INGRESS}"
```

Example output

```
Hello OpenShift!
```

5. Test that the WAF denies a bad request:

```
$ curl -X POST "http://${INGRESS}" \
  -F "user='<script><alert>Hello></alert></script>'"
```

Example output

```
<html>
<head><title>403 Forbidden</title></head>
<body>
<center><h1>403 Forbidden</h1></center>
</body>
</html
```

The expected result is a **403 Forbidden** error, which means the AWS WAF is protecting your application.

6.4. ADDITIONAL RESOURCES

- Custom domains for applications in the Red Hat documentation
- Adding Extra Security with AWS WAF, CloudFront and ROSA | Amazon Web Services on YouTube

CHAPTER 7. TUTORIAL: DEPLOYING OPENSHIFT API FOR DATA PROTECTION ON A ROSA CLUSTER

IMPORTANT

This content is authored by Red Hat experts, but has not yet been tested on every supported configuration.

Prerequisites

- A ROSA classic cluster

Environment

- Prepare the environment variables:

  NOTE

  Change the cluster name to match your ROSA cluster and ensure you are logged into the cluster as an Administrator. Ensure all fields are outputted correctly before moving on.

```
$ export CLUSTER_NAME=$(oc get infrastructure cluster -o=jsonpath="
{.status.infrastructureName}"  | sed 's/-[a-z0-9]\{5\}$//')
$ export ROSA_CLUSTER_ID=$(rosa describe cluster -c ${CLUSTER_NAME} --output json
| jq -r .id)
$ export REGION=$(rosa describe cluster -c ${CLUSTER_NAME} --output json | jq -r
.region.id)
$ export OIDC_ENDPOINT=$(oc get authentication.config.openshift.io cluster -o
jsonpath='{.spec.serviceAccountIssuer}' | sed  's|^https://||')
$ export AWS_ACCOUNT_ID=`aws sts get-caller-identity --query Account --output text`
$ export CLUSTER_VERSION=`rosa describe cluster -c ${CLUSTER_NAME} -o json | jq -r
.version.raw_id | cut -f -2 -d '.'`
$ export ROLE_NAME="${CLUSTER_NAME}-openshift-oadp-aws-cloud-credentials"
$ export AWS_PAGER=""
$ export SCRATCH="/tmp/${CLUSTER_NAME}/oadp"
$ mkdir -p ${SCRATCH}
$ echo "Cluster ID: ${ROSA_CLUSTER_ID}, Region: ${REGION}, OIDC Endpoint:
${OIDC_ENDPOINT}, AWS Account ID: ${AWS_ACCOUNT_ID}"
```

7.1. PREPARE AWS ACCOUNT

1. Create an IAM Policy to allow for S3 Access:

```
$ POLICY_ARN=$(aws iam list-policies --query "Policies[?PolicyName=='RosaOadpVer1'].
{ARN:Arn}" --output text)
if [[ -z "${POLICY_ARN}" ]]; then
$ cat << EOF > ${SCRATCH}/policy.json
{
"Version": "2012-10-17",
"Statement": [
 {
   "Effect": "Allow",
   "Action": [
     "s3:CreateBucket",
     "s3:DeleteBucket",
     "s3:PutBucketTagging",
     "s3:GetBucketTagging",
     "s3:PutEncryptionConfiguration",
     "s3:GetEncryptionConfiguration",
     "s3:PutLifecycleConfiguration",
     "s3:GetLifecycleConfiguration",
     "s3:GetBucketLocation",
     "s3:ListBucket",
     "s3:GetObject",
     "s3:PutObject",
     "s3:DeleteObject",
     "s3:ListBucketMultipartUploads",
     "s3:AbortMultipartUpload",
     "s3:ListMultipartUploadParts",
     "ec2:DescribeSnapshots",
     "ec2:DescribeVolumes",
     "ec2:DescribeVolumeAttribute",
     "ec2:DescribeVolumesModifications",
     "ec2:DescribeVolumeStatus",
     "ec2:CreateTags",
     "ec2:CreateVolume",
     "ec2:CreateSnapshot",
     "ec2:DeleteSnapshot"
   ],
   "Resource": "*"
 }
]}
EOF
$ POLICY_ARN=$(aws iam create-policy --policy-name "RosaOadpVer1" \
--policy-document file:///${SCRATCH}/policy.json --query Policy.Arn \
--tags Key=rosa_openshift_version,Value=${CLUSTER_VERSION}
Key=rosa_role_prefix,Value=ManagedOpenShift
Key=operator_namespace,Value=openshift-oadp Key=operator_name,Value=openshift-oadp
\
--output text)
fi
$ echo ${POLICY_ARN}
```

2. Create an IAM Role trust policy for the cluster:

```
$ cat <<EOF > ${SCRATCH}/trust-policy.json
{
  "Version": "2012-10-17",
  "Statement": [{
    "Effect": "Allow",
    "Principal": {
      "Federated": "arn:aws:iam::${AWS_ACCOUNT_ID}:oidc-provider/${OIDC_ENDPOINT}"
    },
    "Action": "sts:AssumeRoleWithWebIdentity",
    "Condition": {
      "StringEquals": {
         "${OIDC_ENDPOINT}:sub": [
          "system:serviceaccount:openshift-adp:openshift-adp-controller-manager",
          "system:serviceaccount:openshift-adp:velero"]
      }
    }
  }]
}
EOF
$ ROLE_ARN=$(aws iam create-role --role-name \
 "${ROLE_NAME}" \
  --assume-role-policy-document file://${SCRATCH}/trust-policy.json \
  --tags Key=rosa_cluster_id,Value=${ROSA_CLUSTER_ID}
Key=rosa_openshift_version,Value=${CLUSTER_VERSION}
Key=rosa_role_prefix,Value=ManagedOpenShift
Key=operator_namespace,Value=openshift-adp Key=operator_name,Value=openshift-oadp \
  --query Role.Arn --output text)

$ echo ${ROLE_ARN}
```

3. Attach the IAM Policy to the IAM Role:

```
$ aws iam attach-role-policy --role-name "${ROLE_NAME}" \
 --policy-arn ${POLICY_ARN}
```

7.2. DEPLOY OADP ON THE CLUSTER

1. Create a namespace for OADP:

```
$ oc create namespace openshift-adp
```

2. Create a credentials secret:

```
$ cat <<EOF > ${SCRATCH}/credentials
[default]
role_arn = ${ROLE_ARN}
web_identity_token_file = /var/run/secrets/openshift/serviceaccount/token
EOF
$ oc -n openshift-adp create secret generic cloud-credentials \
 --from-file=${SCRATCH}/credentials
```

3. Deploy the OADP Operator:

NOTE

There is currently an issue with version 1.1 of the Operator with backups that have a **PartiallyFailed** status. This does not seem to affect the backup and restore process, but it should be noted as there are issues with it.

```
$ cat << EOF | oc create -f -
apiVersion: operators.coreos.com/v1
kind: OperatorGroup
metadata:
 generateName: openshift-adp-
 namespace: openshift-adp
```

```
  name: oadp
spec:
  targetNamespaces:
  - openshift-adp
---
apiVersion: operators.coreos.com/v1alpha1
kind: Subscription
metadata:
  name: redhat-oadp-operator
  namespace: openshift-adp
spec:
  channel: stable-1.2
  installPlanApproval: Automatic
  name: redhat-oadp-operator
  source: redhat-operators
  sourceNamespace: openshift-marketplace
EOF
```

4. Wait for the Operator to be ready:

```
$ watch oc -n openshift-adp get pods
```

Example output

```
NAME                                                READY   STATUS    RESTARTS   AGE
openshift-adp-controller-manager-546684844f-qqjhn   1/1     Running   0          22s
```

5. Create Cloud Storage:

```
$ cat << EOF | oc create -f -
apiVersion: oadp.openshift.io/v1alpha1
kind: CloudStorage
metadata:
  name: ${CLUSTER_NAME}-oadp
  namespace: openshift-adp
spec:
  creationSecret:
    key: credentials
    name: cloud-credentials
  enableSharedConfig: true
  name: ${CLUSTER_NAME}-oadp
  provider: aws
  region: $REGION
EOF
```

6. Check your application’s storage default storage class:

```
$ oc get pvc -n <namespace> 1
```

1 Enter your application’s namespace.

Example output

```
NAME     STATUS   VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   AGE
applog   Bound    pvc-351791ae-b6ab-4e8b-88a4-30f73caf5ef8   1Gi        RWO            gp3-
csi        4d19h
mysql    Bound    pvc-16b8e009-a20a-4379-accc-bc81fedd0621   1Gi        RWO            gp3-
csi        4d19h
```

```
$ oc get storageclass
```

Example output

```
NAME                PROVISIONER             RECLAIMPOLICY   VOLUMEBINDINGMODE
ALLOWVOLUMEEXPANSION   AGE
gp2                 kubernetes.io/aws-ebs   Delete          WaitForFirstConsumer   true
4d21h
gp2-csi             ebs.csi.aws.com         Delete          WaitForFirstConsumer   true
4d21h
gp3                 ebs.csi.aws.com         Delete          WaitForFirstConsumer   true
4d21h
gp3-csi (default)   ebs.csi.aws.com         Delete          WaitForFirstConsumer   true
4d21h
```

Using either gp3-csi, gp2-csi, gp3 or gp2 will work. If the application(s) that are being backed up are all using PV's with CSI, include the CSI plugin in the OADP DPA configuration.

7. CSI only: Deploy a Data Protection Application:

```
$ cat << EOF | oc create -f -
apiVersion: oadp.openshift.io/v1alpha1
kind: DataProtectionApplication
metadata:
 name: ${CLUSTER_NAME}-dpa
 namespace: openshift-adp
spec:
 backupImages: true
 features:
   dataMover:
     enable: false
 backupLocations:
 - bucket:
     cloudStorageRef:
       name: ${CLUSTER_NAME}-oadp
     credential:
       key: credentials
       name: cloud-credentials
     prefix: velero
     default: true
     config:
       region: ${REGION}
 configuration:
   velero:
     defaultPlugins:
     - openshift
     - aws
     - csi
   restic:
     enable: false
EOF
```

NOTE

If you run this command for CSI volumes, you can skip the next step.

8. Non-CSI volumes: Deploy a Data Protection Application:

```
$ cat << EOF | oc create -f -
apiVersion: oadp.openshift.io/v1alpha1
kind: DataProtectionApplication
metadata:
 name: ${CLUSTER_NAME}-dpa
 namespace: openshift-adp
spec:
 backupImages: true
 features:
   dataMover:
     enable: false
 backupLocations:
 - bucket:
     cloudStorageRef:
       name: ${CLUSTER_NAME}-oadp
     credential:
       key: credentials
       name: cloud-credentials
     prefix: velero
     default: true
     config:
       region: ${REGION}
 configuration:
   velero:
     defaultPlugins:
     - openshift
     - aws
   restic:
     enable: false
 snapshotLocations:
   - velero:
       config:
         credentialsFile: /tmp/credentials/openshift-adp/cloud-credentials-credentials
         enableSharedConfig: 'true'
         profile: default
         region: ${REGION}
       provider: aws
EOF
```

NOTE

- In OADP 1.1.x ROSA STS environments, the container image backup and restore (**spec.backupImages**) value must be set to **false** as it is not supported.
- The Restic feature (**restic.enable=false**) is disabled and not supported in ROSA STS environments.
- The DataMover feature (**dataMover.enable=false**) is disabled and not supported in ROSA STS environments.

7.3. PERFORM A BACKUP

NOTE

The following sample hello-world application has no attached persistent volumes. Either DPA configuration will work.

1. Create a workload to back up:

```
$ oc create namespace hello-world
$ oc new-app -n hello-world --image=docker.io/openshift/hello-openshift
```

2. Expose the route:

```
$ oc expose service/hello-openshift -n hello-world
```

3. Check that the application is working:

```
$ curl `oc get route/hello-openshift -n hello-world -o jsonpath='{.spec.host}'`
```

Example output

```
Hello OpenShift!
```

4. Back up the workload:

```
$ cat << EOF | oc create -f -
apiVersion: velero.io/v1
kind: Backup
metadata:
 name: hello-world
 namespace: openshift-adp
spec:
 includedNamespaces:
 - hello-world
 storageLocation: ${CLUSTER_NAME}-dpa-1
 ttl: 720h0m0s
EOF
```

5. Wait until the backup is done:

```
$ watch "oc -n openshift-adp get backup hello-world -o json | jq .status"
```

Example output

```
{
  "completionTimestamp": "2022-09-07T22:20:44Z",
  "expiration": "2022-10-07T22:20:22Z",
  "formatVersion": "1.1.0",
  "phase": "Completed",
  "progress": {
    "itemsBackedUp": 58,
    "totalItems": 58
  },
  "startTimestamp": "2022-09-07T22:20:22Z",
  "version": 1
}
```

6. Delete the demo workload:

```
$ oc delete ns hello-world
```

7. Restore from the backup:

```
$ cat << EOF | oc create -f -
apiVersion: velero.io/v1
kind: Restore
metadata:
  name: hello-world
  namespace: openshift-adp
spec:
  backupName: hello-world
EOF
```

8. Wait for the Restore to finish:

```
$ watch "oc -n openshift-adp get restore hello-world -o json | jq .status"
```

Example output

```
{
  "completionTimestamp": "2022-09-07T22:25:47Z",
  "phase": "Completed",
  "progress": {
    "itemsRestored": 38,
    "totalItems": 38
  },
  "startTimestamp": "2022-09-07T22:25:28Z",
  "warnings": 9
}
```

9. Check that the workload is restored:

```
$ oc -n hello-world get pods
```

Example output

```
NAME                            READY   STATUS    RESTARTS   AGE
hello-openshift-9f885f7c6-kdjpj   1/1     Running   0          90s
```

```
$ curl `oc get route/hello-openshift -n hello-world -o jsonpath='{.spec.host}'`
```

Example output

```
Hello OpenShift!
```

10. For troubleshooting tips please refer to the OADP team's troubleshooting documentation

11. Additional sample applications can be found in the OADP team's sample applications directory

7.4. CLEANUP

1. Delete the workload:

```
$ oc delete ns hello-world
```

2. Remove the backup and restore resources from the cluster if they are no longer required:

```
$ oc delete backup hello-world
$ oc delete restore hello-world
```

3. To delete the backup/restore and remote objects in s3:

```
$ velero backup delete hello-world
$ velero restore delete hello-world
```

4. Delete the Data Protection Application:

```
$ oc -n openshift-adp delete dpa ${CLUSTER_NAME}-dpa
```

5. Delete the Cloud Storage:

```
$ oc -n openshift-adp delete cloudstorage ${CLUSTER_NAME}-oadp
```

WARNING

If this command hangs, you might need to delete the finalizer:

```
$ oc -n openshift-adp patch cloudstorage ${CLUSTER_NAME}-oadp -p
'{"metadata":{"finalizers":null}}' --type=merge
```

6. Remove the Operator if it is no longer required:

   ```
   $ oc -n openshift-adp delete subscription oadp-operator
   ```

7. Remove the namespace for the Operator:

   ```
   $ oc delete ns redhat-openshift-adp
   ```

8. Remove the Custom Resource Definitions from the cluster if you no longer wish to have them:

   ```
   $ for CRD in `oc get crds | grep velero | awk '{print $1}'`; do oc delete crd $CRD; done
   $ for CRD in `oc get crds | grep -i oadp | awk '{print $1}'`; do oc delete crd $CRD; done
   ```

9. Delete the AWS S3 Bucket:

   ```
   $ aws s3 rm s3://${CLUSTER_NAME}-oadp --recursive
   $ aws s3api delete-bucket --bucket ${CLUSTER_NAME}-oadp
   ```

10. Detach the Policy from the role:

    ```
    $ aws iam detach-role-policy --role-name "${ROLE_NAME}" \
     --policy-arn "${POLICY_ARN}"
    ```

11. Delete the role:

    ```
    $ aws iam delete-role --role-name "${ROLE_NAME}"
    ```

CHAPTER 8. TUTORIAL: AWS LOAD BALANCER OPERATOR ON ROSA

IMPORTANT

This content is authored by Red Hat experts, but has not yet been tested on every supported configuration.

TIP

Load Balancers created by the AWS Load Balancer Operator cannot be used for OpenShift Routes, and should only be used for individual services or ingress resources that do not need the full layer 7 capabilities of an OpenShift Route.

The AWS Load Balancer Controller manages AWS Elastic Load Balancers for a Red Hat OpenShift Service on AWS (ROSA) cluster. The controller provisions AWS Application Load Balancers (ALB) when you create Kubernetes Ingress resources and AWS Network Load Balancers (NLB) when implementing Kubernetes Service resources with a type of LoadBalancer.

Compared with the default AWS in-tree load balancer provider, this controller is developed with advanced annotations for both ALBs and NLBs. Some advanced use cases are:

- Using native Kubernetes Ingress objects with ALBs
- Integrate ALBs with the AWS Web Application Firewall (WAF) service
- Specify custom NLB source IP ranges
- Specify custom NLB internal IP addresses

The AWS Load Balancer Operator is used to used to install, manage and configure an instance of **aws-load-balancer-controller** in a ROSA cluster.

8.1. PREREQUISITES

NOTE

AWS ALBs require a multi-AZ cluster, as well as three public subnets split across three AZs in the same VPC as the cluster. This makes ALBs unsuitable for many PrivateLink clusters. AWS NLBs do not have this restriction.

- A multi-AZ ROSA classic cluster
- BYO VPC cluster
- AWS CLI
- OC CLI

8.1.1. Environment

- Prepare the environment variables:
  -

```
$ export AWS_PAGER=""
$ export ROSA_CLUSTER_NAME=$(oc get infrastructure cluster -o=jsonpath="
{.status.infrastructureName}"  | sed 's/-[a-z0-9]\{5\}$//')
$ export REGION=$(oc get infrastructure cluster -o=jsonpath="
{.status.platformStatus.aws.region}")
$ export OIDC_ENDPOINT=$(oc get authentication.config.openshift.io cluster -o
jsonpath='{.spec.serviceAccountIssuer}' | sed  's|^https://||')
$ export AWS_ACCOUNT_ID=$(aws sts get-caller-identity --query Account --output text)
$ export SCRATCH="/tmp/${ROSA_CLUSTER_NAME}/alb-operator"
$ mkdir -p ${SCRATCH}
$ echo "Cluster: ${ROSA_CLUSTER_NAME}, Region: ${REGION}, OIDC Endpoint:
${OIDC_ENDPOINT}, AWS Account ID: ${AWS_ACCOUNT_ID}"
```

8.1.2. AWS VPC and subnets

NOTE

This section only applies to clusters that were deployed into existing VPCs. If you did not deploy your cluster into an existing VPC, skip this section and proceed to the installation section below.

1. Set the below variables to the proper values for your ROSA deployment:

```
$ export VPC_ID=<vpc-id>
$ export PUBLIC_SUBNET_IDS=<public-subnets>
$ export PRIVATE_SUBNET_IDS=<private-subnets>
$ export CLUSTER_NAME=$(oc get infrastructure cluster -o=jsonpath="
{.status.infrastructureName}")
```

2. Add a tag to your cluster's VPC with the cluster name:

```
$ aws ec2 create-tags --resources ${VPC_ID} --tags
Key=kubernetes.io/cluster/${CLUSTER_NAME},Value=owned --region ${REGION}
```

3. Add a tag to your public subnets:

```
$ aws ec2 create-tags \
    --resources ${PUBLIC_SUBNET_IDS} \
    --tags Key=kubernetes.io/role/elb,Value='' \
    --region ${REGION}
```

4. Add a tag to your private subnets:

```
$ aws ec2 create-tags \
    --resources "${PRIVATE_SUBNET_IDS}" \
    --tags Key=kubernetes.io/role/internal-elb,Value='' \
    --region ${REGION}
```

8.2. INSTALLATION

1. Create an AWS IAM policy for the AWS Load Balancer Controller:

NOTE

The policy is sourced from the upstream AWS Load Balancer Controller policy plus permission to create tags on subnets. This is required by the operator to function.

```
$ oc new-project aws-load-balancer-operator
$ POLICY_ARN=$(aws iam list-policies --query \
     "Policies[?PolicyName=='aws-load-balancer-operator-policy'].{ARN:Arn}" \
     --output text)
$ if [[ -z "${POLICY_ARN}" ]]; then
    wget -O "${SCRATCH}/load-balancer-operator-policy.json" \
       https://raw.githubusercontent.com/rh-mobb/documentation/main/content/docs/rosa/aws-load-balancer-operator/load-balancer-operator-policy.json
     POLICY_ARN=$(aws --region "$REGION" --query Policy.Arn \
     --output text iam create-policy \
     --policy-name aws-load-balancer-operator-policy \
     --policy-document "file://${SCRATCH}/load-balancer-operator-policy.json")
fi
$ echo $POLICY_ARN
```

2. Create an AWS IAM trust policy for AWS Load Balancer Operator:

```
$ cat <<EOF > "${SCRATCH}/trust-policy.json"
{
 "Version": "2012-10-17",
 "Statement": [
 {
 "Effect": "Allow",
 "Condition": {
   "StringEquals" : {
     "${OIDC_ENDPOINT}:sub": ["system:serviceaccount:aws-load-balancer-operator:aws-load-balancer-operator-controller-manager", "system:serviceaccount:aws-load-balancer-operator:aws-load-balancer-controller-cluster"]
   }
 },
 "Principal": {
   "Federated": "arn:aws:iam::$AWS_ACCOUNT_ID:oidc-provider/${OIDC_ENDPOINT}"
 },
 "Action": "sts:AssumeRoleWithWebIdentity"
 }
 ]
}
EOF
```

3. Create an AWS IAM role for the AWS Load Balancer Operator:

```
$ ROLE_ARN=$(aws iam create-role --role-name "${ROSA_CLUSTER_NAME}-alb-operator" \
   --assume-role-policy-document "file://${SCRATCH}/trust-policy.json" \
   --query Role.Arn --output text)
$ echo $ROLE_ARN

$ aws iam attach-role-policy --role-name "${ROSA_CLUSTER_NAME}-alb-operator" \
     --policy-arn $POLICY_ARN
```

4. Create a secret for the AWS Load Balancer Operator to assume our newly created AWS IAM role:

```
$ cat << EOF | oc apply -f -
apiVersion: v1
kind: Secret
metadata:
  name: aws-load-balancer-operator
  namespace: aws-load-balancer-operator
stringData:
  credentials: |
    [default]
    role_arn = $ROLE_ARN
    web_identity_token_file = /var/run/secrets/openshift/serviceaccount/token
EOF
```

5. Install the Red Hat AWS Load Balancer Operator:

```
$ cat << EOF | oc apply -f -
apiVersion: operators.coreos.com/v1
kind: OperatorGroup
metadata:
  name: aws-load-balancer-operator
  namespace: aws-load-balancer-operator
spec:
  upgradeStrategy: Default
---
apiVersion: operators.coreos.com/v1alpha1
kind: Subscription
metadata:
  name: aws-load-balancer-operator
  namespace: aws-load-balancer-operator
spec:
  channel: stable-v1.0
  installPlanApproval: Automatic
  name: aws-load-balancer-operator
  source: redhat-operators
  sourceNamespace: openshift-marketplace
  startingCSV: aws-load-balancer-operator.v1.0.0
EOF
```

6. Deploy an instance of the AWS Load Balancer Controller using the operator:

NOTE

If you get an error here wait a minute and try again, it means the Operator has not completed installing yet.

```
$ cat << EOF | oc apply -f -
apiVersion: networking.olm.openshift.io/v1
kind: AWSLoadBalancerController
metadata:
  name: cluster
```

```
spec:
  credentials:
    name: aws-load-balancer-operator
EOF
```

7. Check the that the operator and controller pods are both running:

```
$ oc -n aws-load-balancer-operator get pods
```

You should see the following, if not wait a moment and retry:

```
NAME                                                              READY   STATUS    RESTARTS   AGE
aws-load-balancer-controller-cluster-6ddf658785-pdp5d             1/1     Running   0          99s
aws-load-balancer-operator-controller-manager-577d9ffcb9-w6zqn   2/2     Running   0
2m4s
```

8.3. VALIDATING THE DEPLOYMENT

1. Create a new project:

```
$ oc new-project hello-world
```

2. Deploy a hello world application:

```
$ oc new-app -n hello-world --image=docker.io/openshift/hello-openshift
```

3. Configure a NodePort service for the AWS ALB to connect to:

```
$ cat << EOF | oc apply -f -
apiVersion: v1
kind: Service
metadata:
  name: hello-openshift-nodeport
  namespace: hello-world
spec:
  ports:
    - port: 80
      targetPort: 8080
      protocol: TCP
  type: NodePort
  selector:
    deployment: hello-openshift
EOF
```

4. Deploy an AWS ALB using the AWS Load Balancer Operator:

```
$ cat << EOF | oc apply -f -
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: hello-openshift-alb
  namespace: hello-world
  annotations:
    alb.ingress.kubernetes.io/scheme: internet-facing
spec:
  ingressClassName: alb
  rules:
    - http:
        paths:
          - path: /
            pathType: Exact
            backend:
              service:
                name: hello-openshift-nodeport
                port:
                  number: 80
EOF
```

5. Curl the AWS ALB Ingress endpoint to verify the hello world application is accessible:

   NOTE

   AWS ALB provisioning takes a few minutes. If you receive an error that says **curl: (6) Could not resolve host**, please wait and try again.

   ```
   $ INGRESS=$(oc -n hello-world get ingress hello-openshift-alb \
       -o jsonpath='{.status.loadBalancer.ingress[0].hostname}')
   $ curl "http://${INGRESS}"
   ```

   Example output

   ```
   Hello OpenShift!
   ```

6. Deploy an AWS NLB for your hello world application:

   ```
   $ cat << EOF | oc apply -f -
   apiVersion: v1
   kind: Service
   metadata:
     name: hello-openshift-nlb
     namespace: hello-world
     annotations:
       service.beta.kubernetes.io/aws-load-balancer-type: external
       service.beta.kubernetes.io/aws-load-balancer-nlb-target-type: instance
       service.beta.kubernetes.io/aws-load-balancer-scheme: internet-facing
   spec:
     ports:
       - port: 80
         targetPort: 8080
         protocol: TCP
     type: LoadBalancer
     selector:
       deployment: hello-openshift
   EOF
   ```

7. Test the AWS NLB endpoint:

NOTE

NLB provisioning takes a few minutes. If you receive an error that says **curl: (6) Could not resolve host**, please wait and try again.

```
$ NLB=$(oc -n hello-world get service hello-openshift-nlb \
  -o jsonpath='{.status.loadBalancer.ingress[0].hostname}')
$ curl "http://${NLB}"
```

Example output

```
Hello OpenShift!
```

8.4. CLEANING UP

1. Delete the hello world application namespace (and all the resources in the namespace):

```
$ oc delete project hello-world
```

2. Delete the AWS Load Balancer Operator and the AWS IAM roles:

```
$ oc delete subscription aws-load-balancer-operator -n aws-load-balancer-operator
$ aws iam detach-role-policy \
  --role-name "${ROSA_CLUSTER_NAME}-alb-operator" \
  --policy-arn $POLICY_ARN
$ aws iam delete-role \
  --role-name "${ROSA_CLUSTER_NAME}-alb-operator"
```

3. Delete the AWS IAM policy:

```
$ aws iam delete-policy --policy-arn $POLICY_ARN
```

CHAPTER 9. TUTORIAL: CONFIGURING ROSA/OSD TO USE CUSTOM TLS CIPHERS ON THE INGRESS CONTROLLER

> IMPORTANT
>
> This content is authored by Red Hat experts, but has not yet been tested on every supported configuration.

This guide demonstrates how to properly patch the cluster Ingress Controllers, as well as Ingress Controllers created by the Custom Domain Operator. This functionality allows customers to modify the **tlsSecurityProfile** value on cluster Ingress Controllers. This guide demonstrates how to apply a custom **tlsSecurityProfile**, a scoped service account with the associated role and role binding, and a CronJob that the cipher changes are reapplied with 60 minutes in the event that an Ingress Controller is recreated or modified.

Prerequisites

- Review the OpenShift Documentation that explains the options for the **tlsSecurityProfile**. By default, Ingress Controllers are configured to use the **Intermediate** profile, which corresponds to the Intermediate Mozilla profile.

Procedure

1. Create a service account for the CronJob to use.
   A service account allows our CronJob to directly access the cluster API, without using a regular user's credentials. To create a service account, run the following command:

```
$ oc create sa cron-ingress-patch-sa -n openshift-ingress-operator
```

2. Create a role and role binding that allows limited access to patch the Ingress Controllers.
   Role-based access control (RBAC) is critical to ensuring security inside your cluster. Creating a role allows us to provide scoped access to only the API resources needed within the cluster. To create the role, run the following command:

```
$ oc create role cron-ingress-patch-role --verb=get,patch,update --
resource=ingresscontroller.operator.openshift.io -n openshift-ingress-operator
```

   Once the role has been created, you must bind the role to the service account using a role binding. To create the role binding, run the following command:

```
$ oc create rolebinding cron-ingress-patch-rolebinding --role=cron-ingress-patch-role --
serviceaccount=openshift-ingress-operator:cron-ingress-patch-sa -n openshift-ingress-
operator
```

3. Patch the Ingress Controllers.

> IMPORTANT
>
> The examples provided below add an additional cipher to the Ingress Controller's **tlsSecurityProfile** to allow IE 11 access from Windows Server 2008 R2. Modify this command to meet your specific business requirements.

Before creating the CronJob, apply the **tlsSecurityProfile** configuration to validate changes. This process depends on if you are using the Custom Domain Operator.

a. Clusters not using the Custom Domain Operator:
   If you are only using the default Ingress Controller, and not using the Custom Domain Operator, run the following command to patch the Ingress Controller:

```
$ oc patch ingresscontroller/default -n openshift-ingress-operator --type=merge -p
'{"spec":{"tlsSecurityProfile":{"type":"Custom","custom":{"ciphers":
["TLS_AES_128_GCM_SHA256","TLS_AES_256_GCM_SHA384","ECDHE-ECDSA-
AES128-GCM-SHA256","ECDHE-RSA-AES128-GCM-SHA256","ECDHE-ECDSA-
AES256-GCM-SHA384","ECDHE-RSA-AES256-GCM-SHA384","ECDHE-ECDSA-
CHACHA20-POLY1305","ECDHE-RSA-CHACHA20-POLY1305","DHE-RSA-AES128-
GCM-SHA256","DHE-RSA-AES256-GCM-
SHA384","TLS_CHACHA20_POLY1305_SHA256","TLS_ECDHE_RSA_WITH_AES_128
_CBC_SHA"],"minTLSVersion":"VersionTLS12"}}}}'
```

   This patch adds the **TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA** cipher which allows access from IE 11 on Windows Server 2008 R2 when using RSA certificates.

   Once you run the command, you will receive a response that looks like this:

Example output

```
ingresscontroller.operator.openshift.io/default patched
```

b. Clusters using the Custom Domain Operator:
   Customers who are using the Custom Domain Operator need to loop through each of their Ingress Controllers to patch each one. To patch all of your cluster's Ingress Controllers, run the following command:

```
$ for ic in $(oc get ingresscontroller -o name -n openshift-ingress-operator); do oc patch
${ic} -n openshift-ingress-operator --type=merge -p '{"spec":{"tlsSecurityProfile":
{"type":"Custom","custom":{"ciphers":
["TLS_AES_128_GCM_SHA256","TLS_AES_256_GCM_SHA384","ECDHE-ECDSA-
AES128-GCM-SHA256","ECDHE-RSA-AES128-GCM-SHA256","ECDHE-ECDSA-
AES256-GCM-SHA384","ECDHE-RSA-AES256-GCM-SHA384","ECDHE-ECDSA-
CHACHA20-POLY1305","ECDHE-RSA-CHACHA20-POLY1305","DHE-RSA-AES128-
GCM-SHA256","DHE-RSA-AES256-GCM-
SHA384","TLS_CHACHA20_POLY1305_SHA256","TLS_ECDHE_RSA_WITH_AES_128
_CBC_SHA"],"minTLSVersion":"VersionTLS12"}}}}'; done
```

   Once you run the command, you will receive a response that looks like this:

Example output

```
ingresscontroller.operator.openshift.io/default patched
ingresscontroller.operator.openshift.io/custom1 patched
ingresscontroller.operator.openshift.io/custom2 patched
```

4. Create the CronJob to ensure that the TLS configuration is not overwritten.
   Occasionally, the cluster's Ingress Controllers can get recreated. In these cases, the Ingress Controller will likely not retain the **tlsSecurityProfile** changes that were applied. To ensure this does not happen, create a CronJob that goes through and updates the cluster's Ingress

Controllers. This process depends on if you are using the Custom Domain Operator.

a. Clusters not using the Custom Domain Operator:
If you are not using the Custom Domain Operator, create the CronJob by running the following command:

```
$ cat << EOF | oc apply -f -
apiVersion: batch/v1
kind: CronJob
metadata:
  name: tls-patch
  namespace: openshift-ingress-operator
spec:
  schedule: '@hourly'
  jobTemplate:
    spec:
      template:
        spec:
          containers:
            - name: tls-patch
              image: registry.redhat.io/openshift4/ose-tools-rhel8:latest
              args:
                - /bin/sh
                - '-c'
                - oc patch ingresscontroller/default -n openshift-ingress-operator --type=merge
-p '{"spec":{"tlsSecurityProfile":{"type":"Custom","custom":{"ciphers":
["TLS_AES_128_GCM_SHA256","TLS_AES_256_GCM_SHA384","ECDHE-ECDSA-
AES128-GCM-SHA256","ECDHE-RSA-AES128-GCM-SHA256","ECDHE-ECDSA-
AES256-GCM-SHA384","ECDHE-RSA-AES256-GCM-SHA384","ECDHE-ECDSA-
CHACHA20-POLY1305","ECDHE-RSA-CHACHA20-POLY1305","DHE-RSA-AES128-
GCM-SHA256","DHE-RSA-AES256-GCM-
SHA384","TLS_CHACHA20_POLY1305_SHA256","TLS_ECDHE_RSA_WITH_AES_128
_CBC_SHA"],"minTLSVersion":"VersionTLS12"}}}}'
          restartPolicy: Never
          serviceAccountName: cron-ingress-patch-sa
EOF
```

NOTE

This CronJob runs every hour and patches the Ingress Controllers, if necessary. It is important that this CronJob does not run constantly, as it can trigger reconciles that could overload the OpenShift Ingress Operator. Most of the time, the logs of the CronJob pod looks like the following example, as it will not be changing anything:

Example output

```
ingresscontroller.operator.openshift.io/default patched (no change)
```

b. Clusters using the Custom Domain Operator:
If you are using the Custom Domain Operator, the CronJob needs to loop through and patch each Ingress Controller. To create this CronJob, run the following command:

```
$ cat << EOF | oc apply -f -
```

```
apiVersion: batch/v1
kind: CronJob
metadata:
  name: tls-patch
  namespace: openshift-ingress-operator
spec:
  schedule: '@hourly'
  jobTemplate:
    spec:
      template:
        spec:
          containers:
            - name: tls-patch
              image: registry.redhat.io/openshift4/ose-tools-rhel8:latest
              args:
                - /bin/sh
                - '-c'
                - for ic in $(oc get ingresscontroller -o name -n openshift-ingress-operator); do
oc patch ${ic} -n openshift-ingress-operator --type=merge -p '{"spec":{"tlsSecurityProfile":
{"type":"Custom","custom":{"ciphers":
["TLS_AES_128_GCM_SHA256","TLS_AES_256_GCM_SHA384","ECDHE-ECDSA-
AES128-GCM-SHA256","ECDHE-RSA-AES128-GCM-SHA256","ECDHE-ECDSA-
AES256-GCM-SHA384","ECDHE-RSA-AES256-GCM-SHA384","ECDHE-ECDSA-
CHACHA20-POLY1305","ECDHE-RSA-CHACHA20-POLY1305","DHE-RSA-AES128-
GCM-SHA256","DHE-RSA-AES256-GCM-
SHA384","TLS_CHACHA20_POLY1305_SHA256","TLS_ECDHE_RSA_WITH_AES_128
_CBC_SHA"],"minTLSVersion":"VersionTLS12"}}}}'; done
          restartPolicy: Never
          serviceAccountName: cron-ingress-patch-sa
EOF
```

NOTE

This CronJob runs every hour and patches the Ingress Controllers, if necessary. It is important that this CronJob does not run constantly, as it can trigger reconciles that could overload the OpenShift Ingress Operator. Most of the time, the logs of the CronJob pod will look something like this, as it will not be changing anything:

Example output

```
ingresscontroller.operator.openshift.io/default patched (no change)
ingresscontroller.operator.openshift.io/custom1 patched (no change)
ingresscontroller.operator.openshift.io/custom2 patched (no change)
```

CHAPTER 10. TUTORIAL: CONFIGURING MICROSOFT ENTRA ID (FORMERLY AZURE ACTIVE DIRECTORY) AS AN IDENTITY PROVIDER

You can configure Microsoft Entra ID (formerly Azure Active Directory) as the cluster identity provider in Red Hat OpenShift Service on AWS (ROSA).

This tutorial guides you to complete the following tasks:

1. Register a new application in Entra ID for authentication.
2. Configure the application registration in Entra ID to include optional and group claims in tokens.
3. Configure the Red Hat OpenShift Service on AWS cluster to use Entra ID as the identity provider.
4. Grant additional permissions to individual groups.

10.1. PREREQUISITES

- You created a set of security groups and assigned users by following the Microsoft documentation.

10.2. REGISTERING A NEW APPLICATION IN ENTRA ID FOR AUTHENTICATION

To register your application in Entra ID, first create the OAuth callback URL, then register your application.

Procedure

1. Create the cluster's OAuth callback URL by changing the specified variables and running the following command:

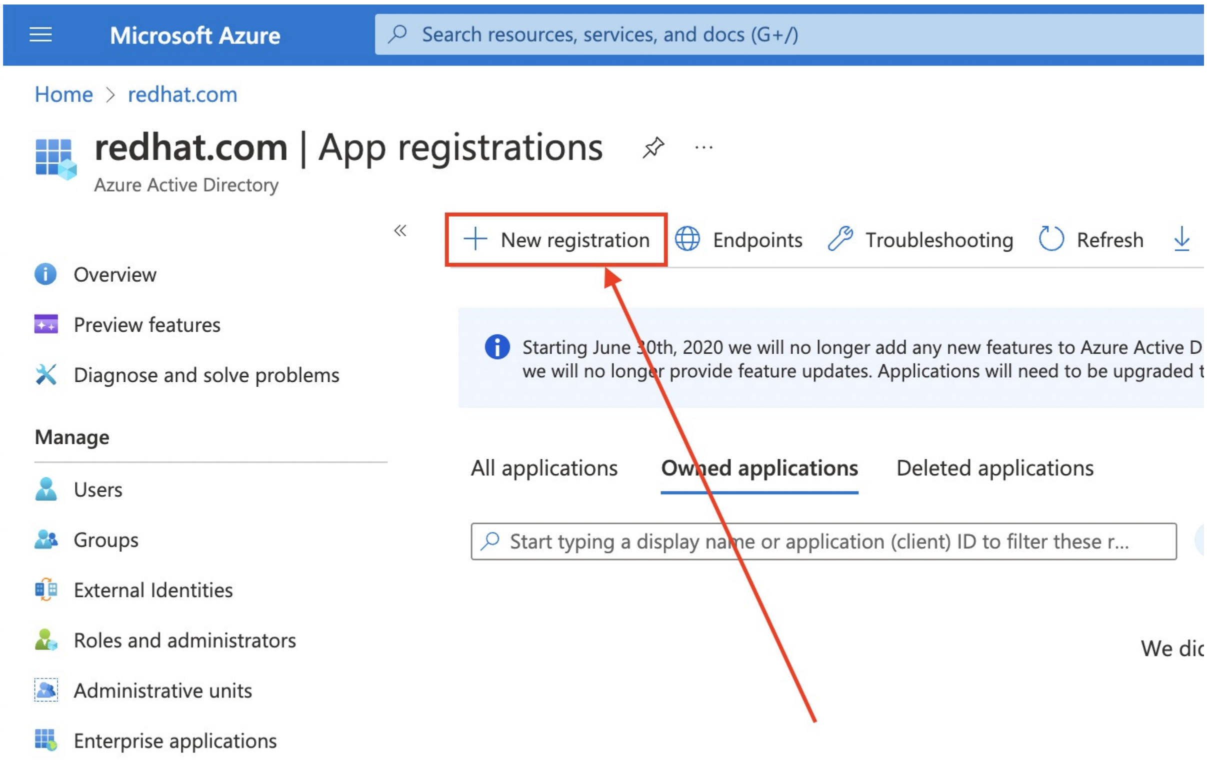
   NOTE

   Remember to save this callback URL; it will be required later in the process.

   ```
   $ domain=$(rosa describe cluster -c <cluster_name> | grep "DNS" | grep -oE
   '\S+.openshiftapps.com')
   $ echo "OAuth callback URL: https://oauth-openshift.apps.$domain/oauth2callback/AAD"
   ```

   The "AAD" directory at the end of the OAuth callback URL must match the OAuth identity provider name that you will set up later in this process.

2. Create the Entra ID application by logging in to the Azure portal, and select the App registrations blade. Then, select **New registration** to create a new application.

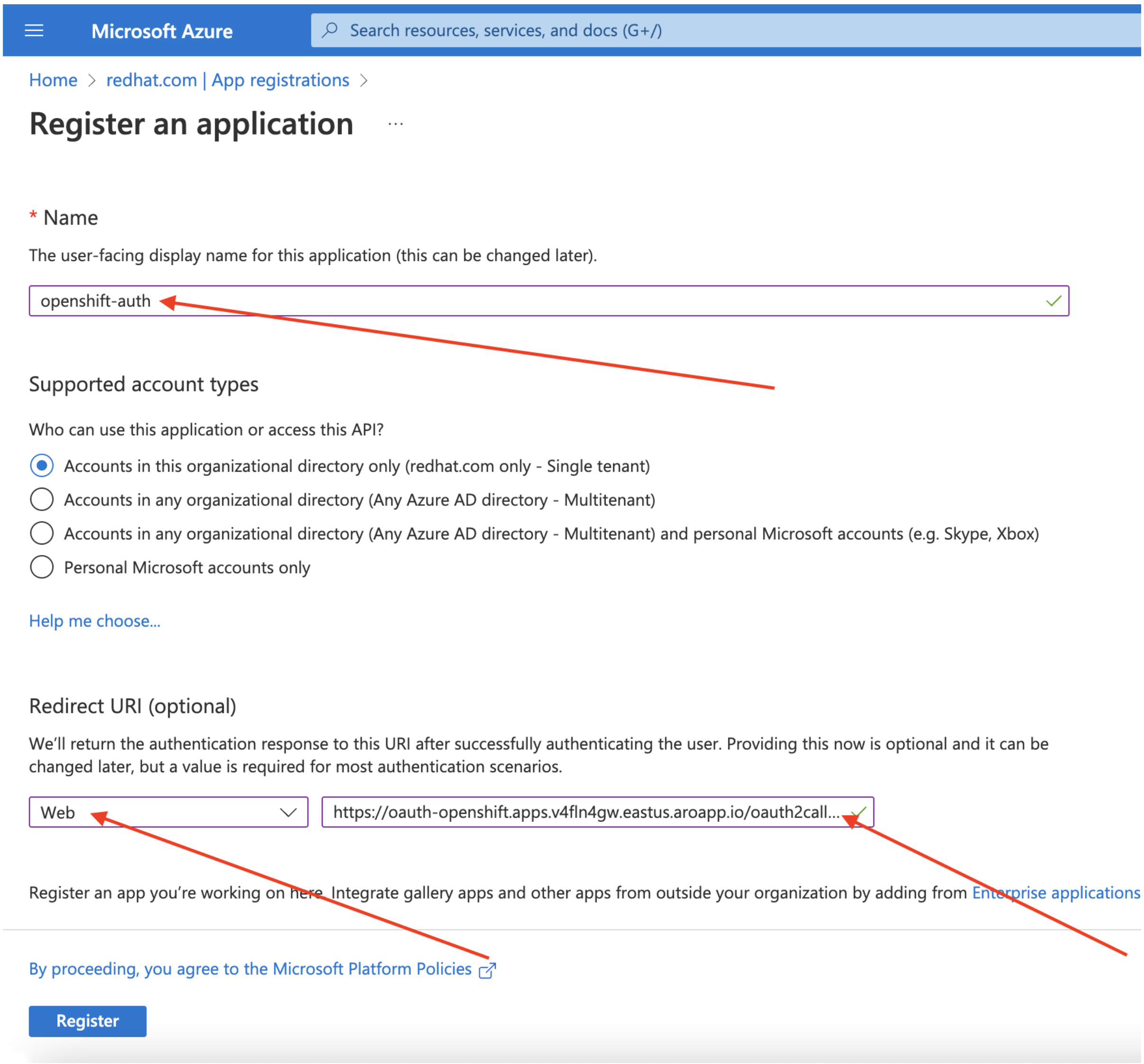


Starting June 30th, 2020 we will no longer add any new features to Azure Active D
we will no longer provide feature updates. Applications will need to be upgraded t

3. Name the application, for example **openshift-auth**.

4. Select **Web** from the *Redirect URI* dropdown and enter the value of the OAuth callback URL you retrieved in the previous step.

5. After providing the required information, click **Register** to create the application.



Microsoft Azure
Search resources, services, and docs (G+/)
Home > redhat.com | App registrations >

Register an application

* Name

The user-facing display name for this application (this can be changed later).

openshift-auth

Supported account types

Who can use this application or access this API?

● Accounts in this organizational directory only (redhat.com only - Single tenant)

○ Accounts in any organizational directory (Any Azure AD directory - Multitenant)

○ Accounts in any organizational directory (Any Azure AD directory - Multitenant) and personal Microsoft accounts (e.g. Skype, Xbox)

○ Personal Microsoft accounts only

Help me choose...

Redirect URI (optional)

We'll return the authentication response to this URI after successfully authenticating the user. Providing this now is optional and it can be changed later, but a value is required for most authentication scenarios.

Web

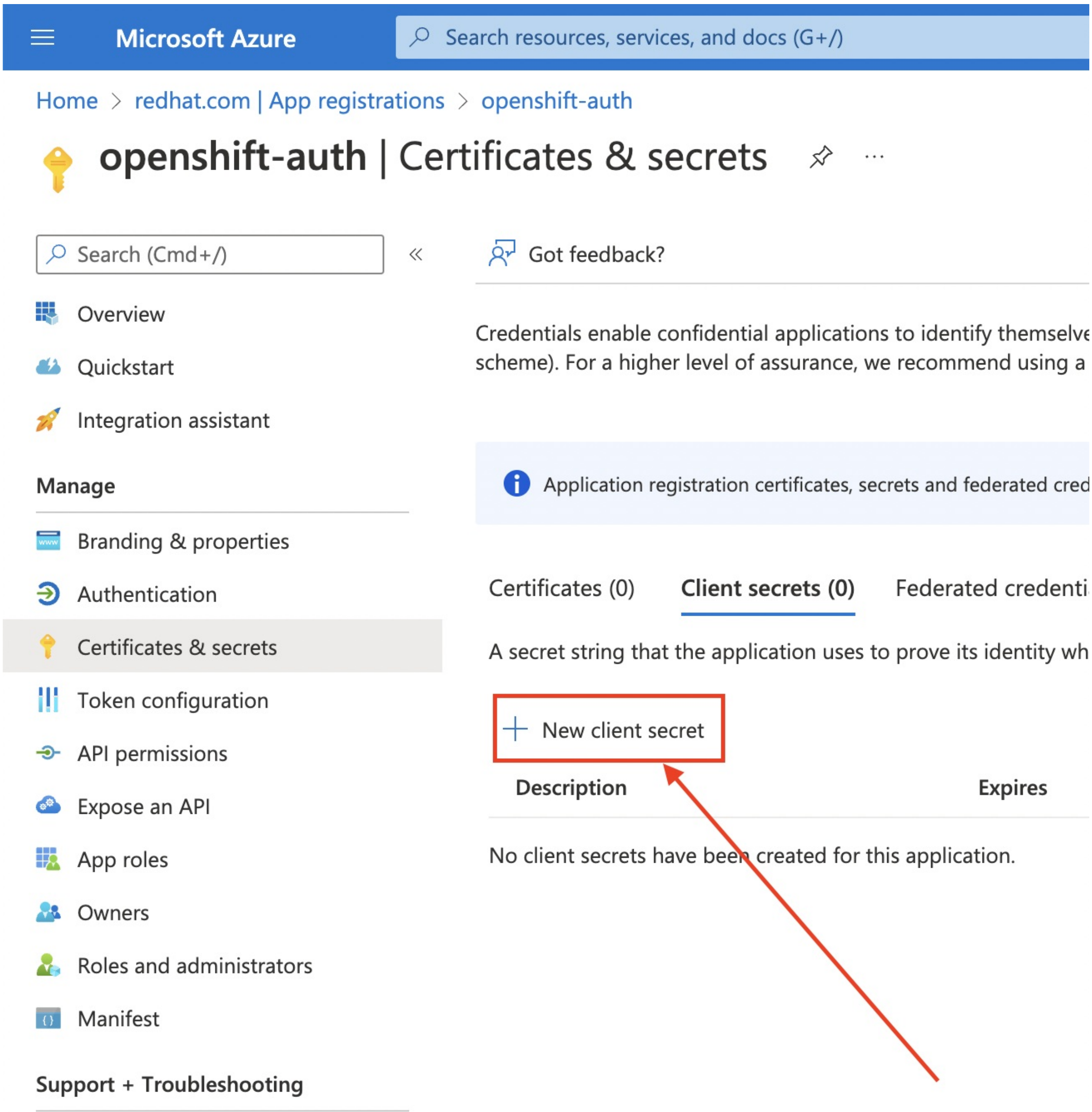
https://oauth-openshift.apps.v4fln4gw.eastus.aroapp.io/oauth2call...

Register an app you're working on here. Integrate gallery apps and other apps from outside your organization by adding from Enterprise applications

By proceeding, you agree to the Microsoft Platform Policies

Register

6. Select the **Certificates & secrets** sub-blade and select **New client secret**.



Credentials enable confidential applications to identify themselve scheme). For a higher level of assurance, we recommend using a

Application registration certificates, secrets and federated cred

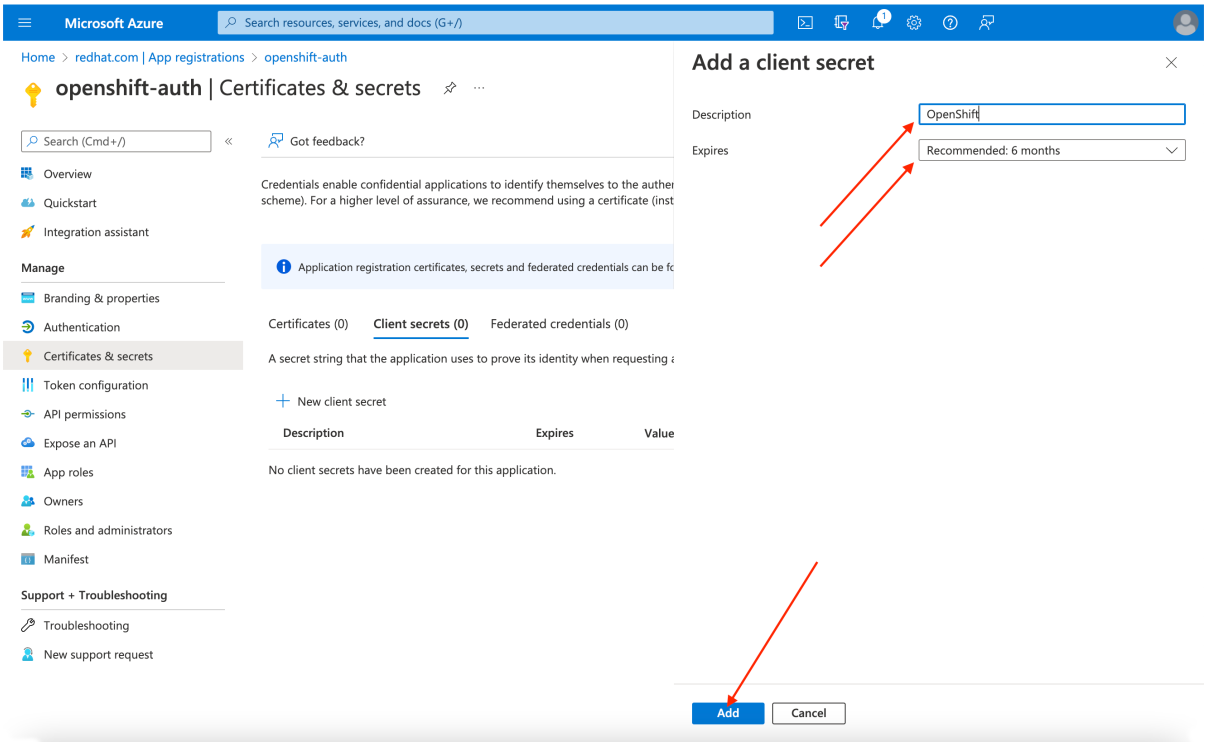
A secret string that the application uses to prove its identity wh

No client secrets have been created for this application.

7. Complete the requested details and store the generated client secret value. This secret is required later in this process.

IMPORTANT

After initial setup, you cannot see the client secret. If you did not record the client secret, you must generate a new one.



Credentials enable confidential applications to identify themselves to the auther scheme). For a higher level of assurance, we recommend using a certificate (inst

Application registration certificates, secrets and federated credentials can be fc

A secret string that the application uses to prove its identity when requesting a

Description	Expires	Value

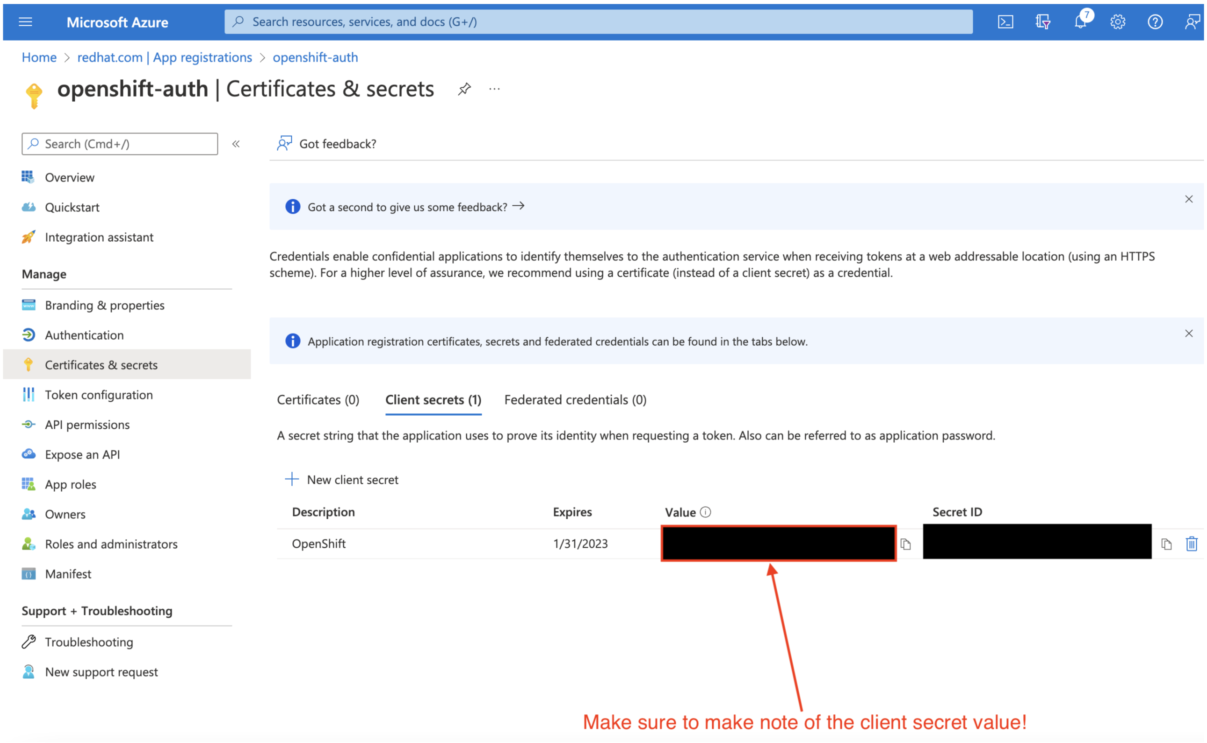
No client secrets have been created for this application.

Add a client secret

Description: OpenShift

Expires: Recommended: 6 months

8. Select the **Overview** sub-blade and note the **Application (client) ID** and **Directory (tenant) ID**. You will need these values in a future step.



Got a second to give us some feedback? →

Credentials enable confidential applications to identify themselves to the authentication service when receiving tokens at a web addressable location (using an HTTPS scheme). For a higher level of assurance, we recommend using a certificate (instead of a client secret) as a credential.

Application registration certificates, secrets and federated credentials can be found in the tabs below.

A secret string that the application uses to prove its identity when requesting a token. Also can be referred to as application password.

Description	Expires	Value	Secret ID
OpenShift	1/31/2023	[redacted]	[redacted]

Make sure to make note of the client secret value!

10.3. CONFIGURING THE APPLICATION REGISTRATION IN ENTRA ID TO INCLUDE OPTIONAL AND GROUP CLAIMS

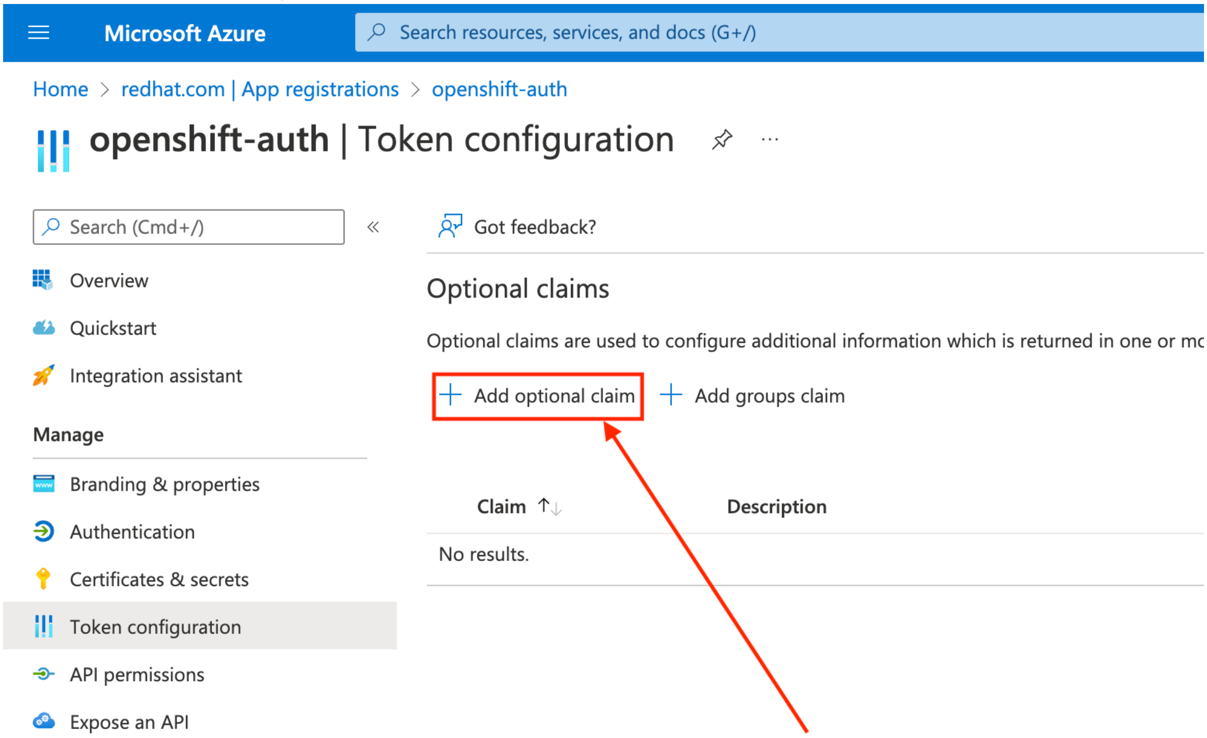
So that Red Hat OpenShift Service on AWS has enough information to create the user’s account, you must configure Entra ID to give two optional claims: **email** and **preferred_username**. For more information about optional claims in Entra ID, see the Microsoft documentation.

In addition to individual user authentication, Red Hat OpenShift Service on AWS provides group claim functionality. This functionality allows an OpenID Connect (OIDC) identity provider, such as Entra ID, to offer a user’s group membership for use within Red Hat OpenShift Service on AWS.

Configuring optional claims

You can configure the optional claims in Entra ID.

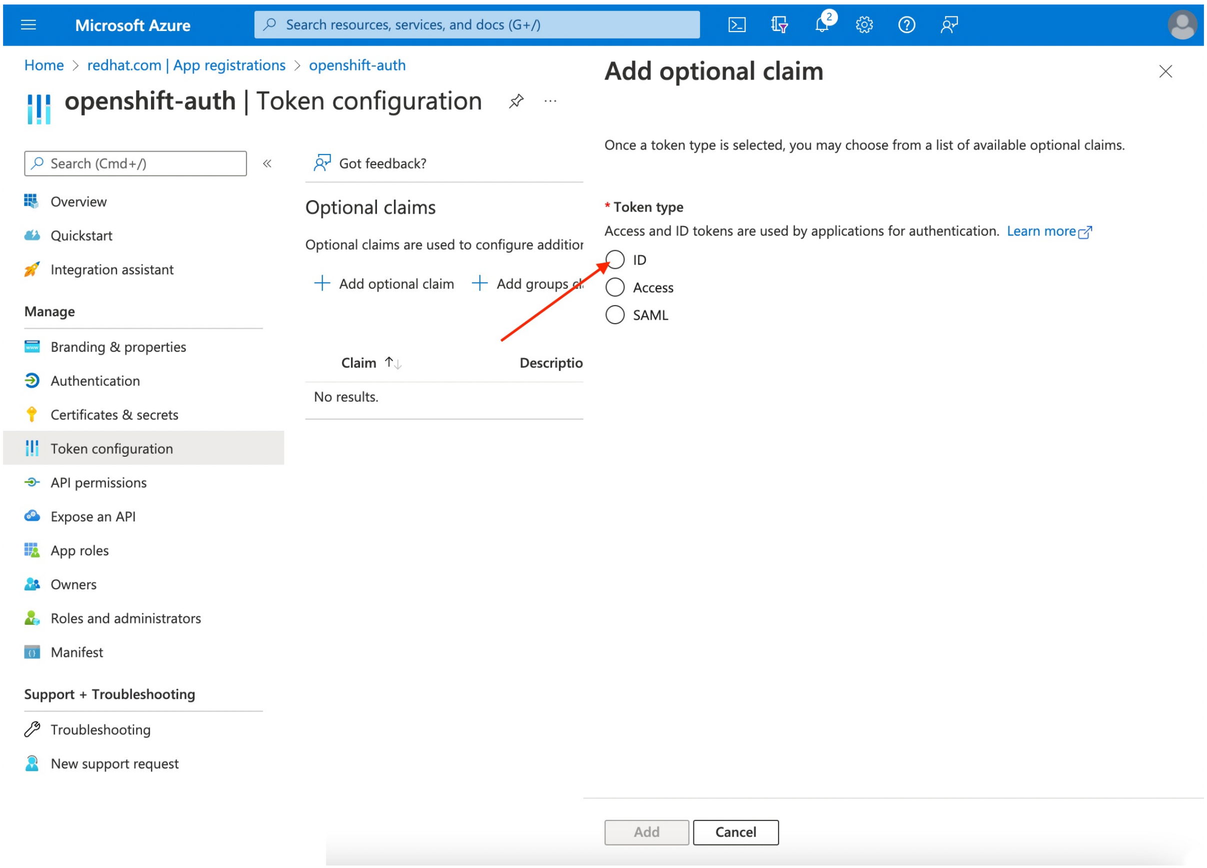
1. Click the **Token configuration** sub-blade and select the **Add optional claim** button.



Optional claims are used to configure additional information which is returned in one or mc

No results.

2. Select the **ID** radio button.



Optional claims are used to configure additior

No results.

Once a token type is selected, you may choose from a list of available optional claims.

* Token type

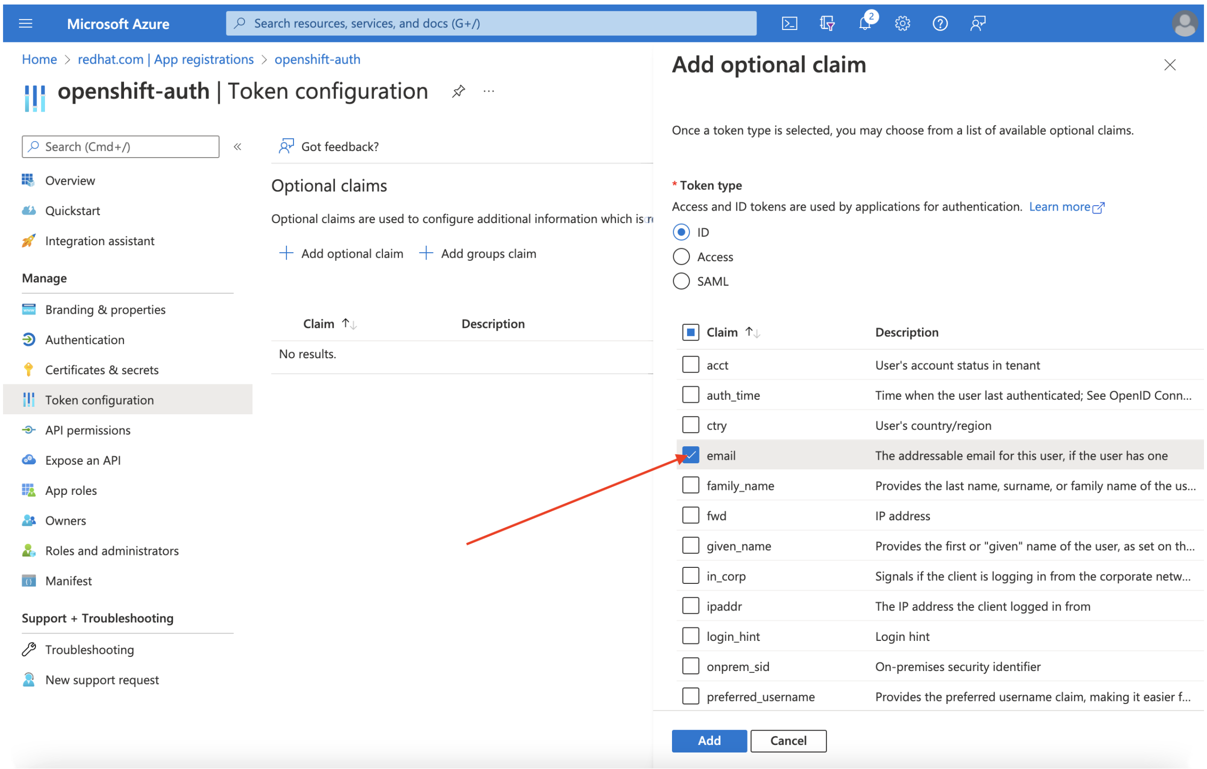
Access and ID tokens are used by applications for authentication. Learn more

○ ID

○ Access

○ SAML

3. Select the **email** claim checkbox.



Optional claims

Optional claims are used to configure additional information which is r

Claim	Description
No results.	

Add optional claim

Once a token type is selected, you may choose from a list of available optional claims.

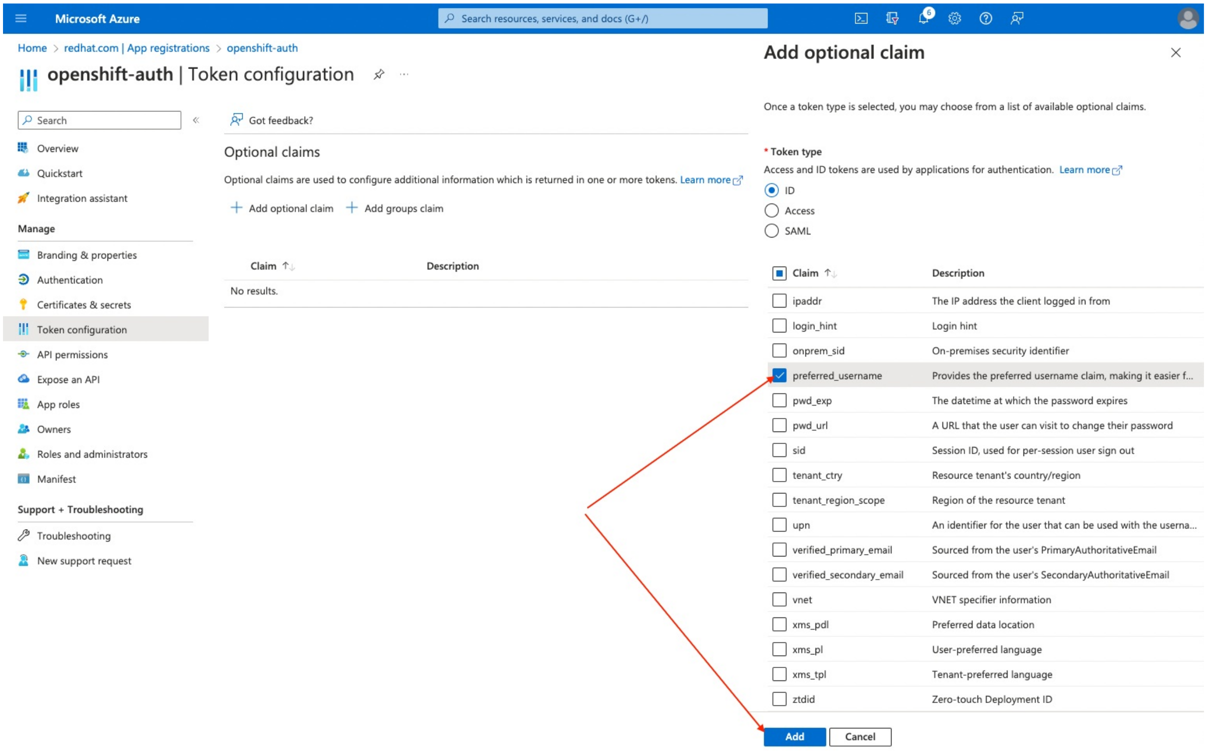
* Token type

Access and ID tokens are used by applications for authentication. Learn more

● ID
○ Access
○ SAML

	Claim	Description
□	acct	User's account status in tenant
□	auth_time	Time when the user last authenticated; See OpenID Conn...
□	ctry	User's country/region
☑	email	The addressable email for this user, if the user has one
□	family_name	Provides the last name, surname, or family name of the us...
□	fwd	IP address
□	given_name	Provides the first or "given" name of the user, as set on th...
□	in_corp	Signals if the client is logging in from the corporate netw...
□	ipaddr	The IP address the client logged in from
□	login_hint	Login hint
□	onprem_sid	On-premises security identifier
□	preferred_username	Provides the preferred username claim, making it easier f...

4. Select the **preferred_username** claim checkbox. Then, click **Add** to configure the **email** and **preferred_username** claims your Entra ID application.



Optional claims

Optional claims are used to configure additional information which is returned in one or more tokens. Learn more

Claim	Description
No results.	

Add optional claim

Once a token type is selected, you may choose from a list of available optional claims.

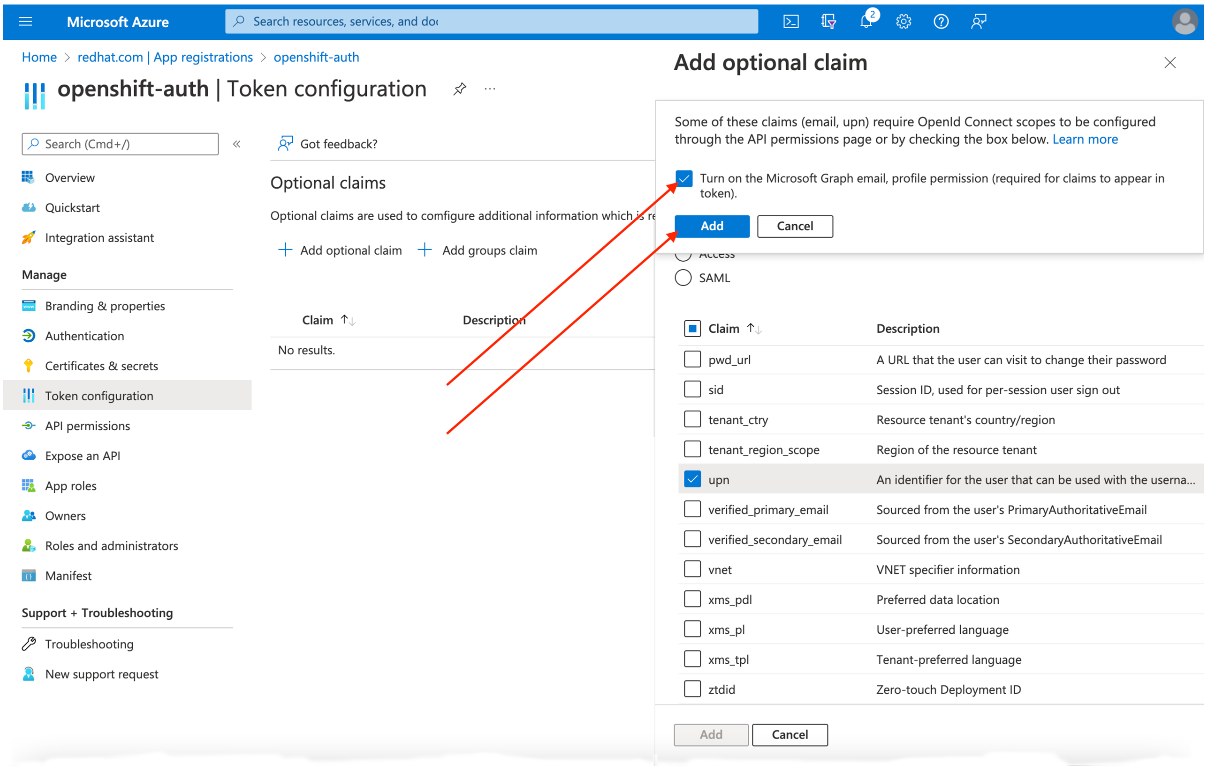
* Token type

Access and ID tokens are used by applications for authentication. Learn more

● ID
○ Access
○ SAML

	Claim	Description
□	ipaddr	The IP address the client logged in from
□	login_hint	Login hint
□	onprem_sid	On-premises security identifier
☑	preferred_username	Provides the preferred username claim, making it easier f...
□	pwd_exp	The datetime at which the password expires
□	pwd_url	A URL that the user can visit to change their password
□	sid	Session ID, used for per-session user sign out
□	tenant_ctry	Resource tenant's country/region
□	tenant_region_scope	Region of the resource tenant
□	upn	An identifier for the user that can be used with the userna...
□	verified_primary_email	Sourced from the user's PrimaryAuthoritativeEmail
□	verified_secondary_email	Sourced from the user's SecondaryAuthoritativeEmail
□	vnet	VNET specifier information
□	xms_pdl	Preferred data location
□	xms_pl	User-preferred language
□	xms_tpl	Tenant-preferred language
□	ztdid	Zero-touch Deployment ID

5. A dialog box appears at the top of the page. Follow the prompt to enable the necessary Microsoft Graph permissions.



Optional claims are used to configure additional information which is re

Claim ↑↓	Description
No results.	

Some of these claims (email, upn) require OpenId Connect scopes to be configured through the API permissions page or by checking the box below. Learn more

☑ Turn on the Microsoft Graph email, profile permission (required for claims to appear in token).

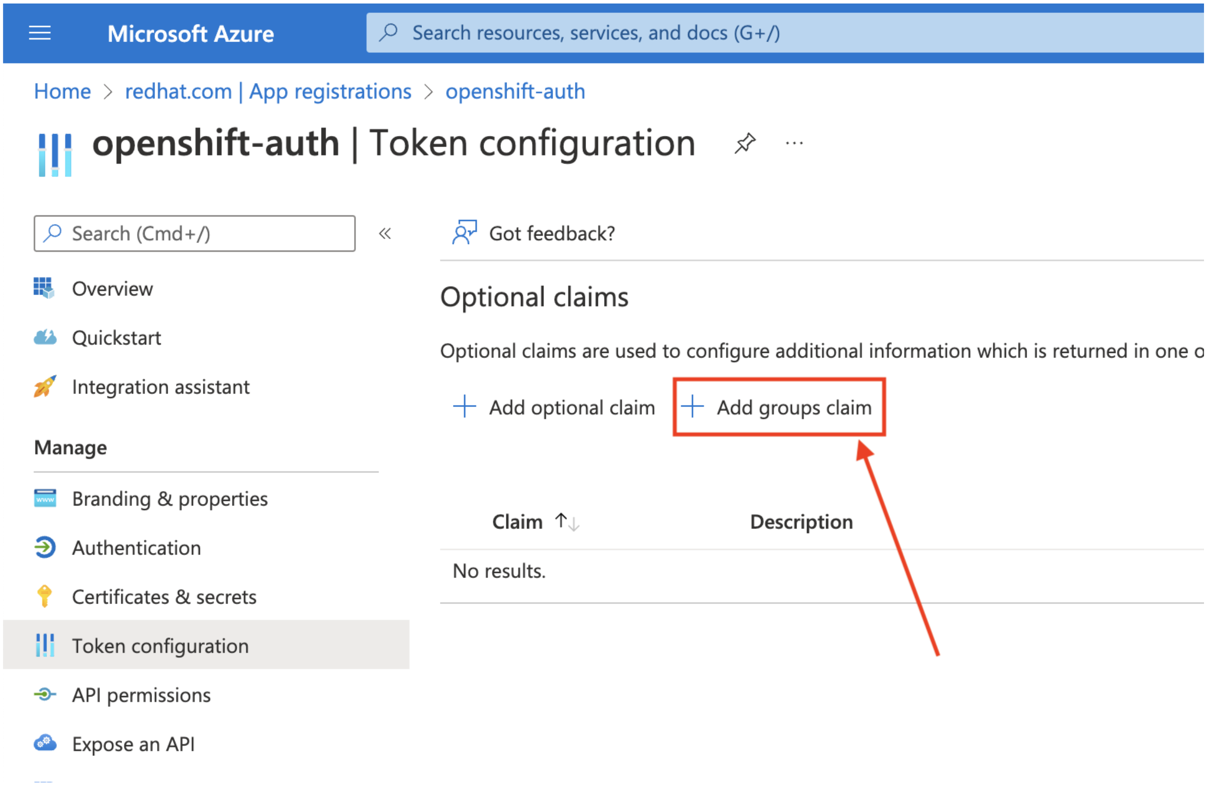
	Claim ↑↓	Description
□	pwd_url	A URL that the user can visit to change their password
□	sid	Session ID, used for per-session user sign out
□	tenant_ctry	Resource tenant's country/region
□	tenant_region_scope	Region of the resource tenant
☑	upn	An identifier for the user that can be used with the userna...
□	verified_primary_email	Sourced from the user's PrimaryAuthoritativeEmail
□	verified_secondary_email	Sourced from the user's SecondaryAuthoritativeEmail
□	vnet	VNET specifier information
□	xms_pdl	Preferred data location
□	xms_pl	User-preferred language
□	xms_tpl	Tenant-preferred language
□	ztdid	Zero-touch Deployment ID

Configuring group claims (optional)

Configure Entra ID to offer a groups claim.

Procedure

1. From the **Token configuration** sub-blade, click **Add groups claim**.



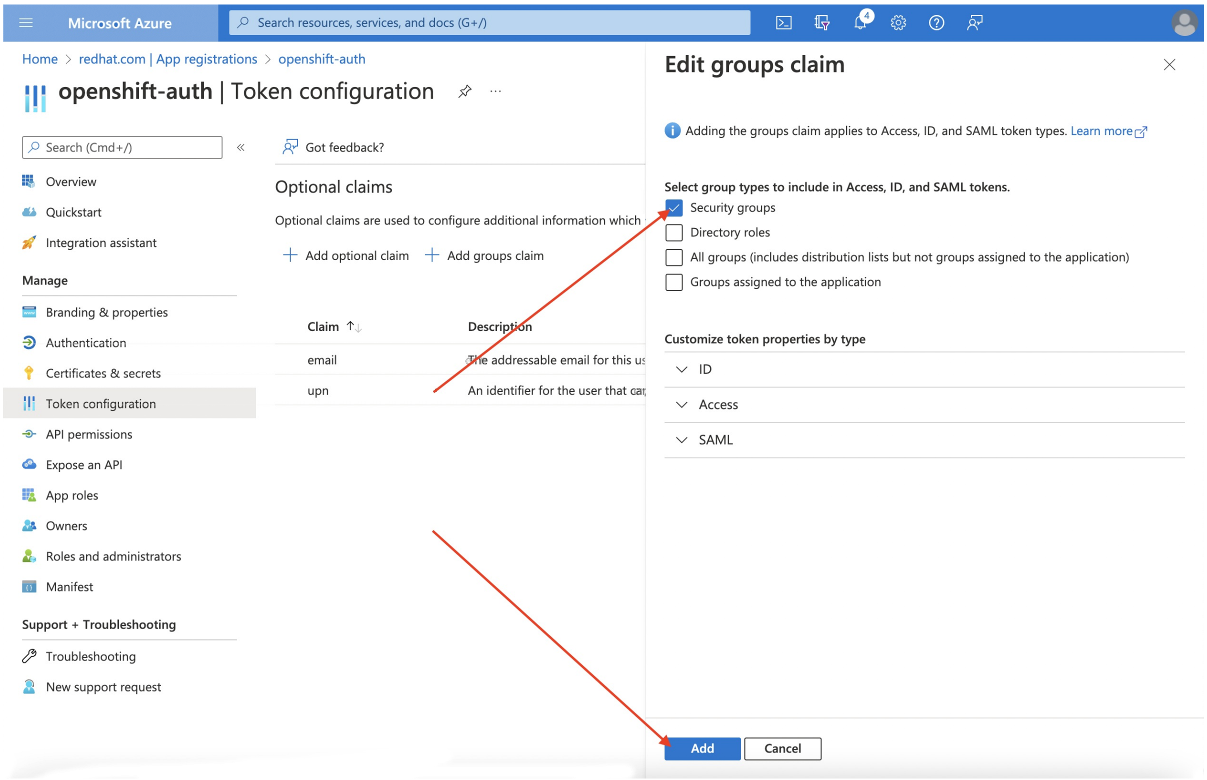
Optional claims are used to configure additional information which is returned in one o

Claim ↑↓	Description
No results.	

2. To configure group claims for your Entra ID application, select **Security groups** and then click the **Add**.

NOTE

In this example, the group claim includes all of the security groups that a user is a member of. In a real production environment, ensure that the groups that the group claim only includes groups that apply to Red Hat OpenShift Service on AWS.



Optional claims

Optional claims are used to configure additional information which

Claim ↑↓	Description
email	The addressable email for this us
upn	An identifier for the user that ca

Edit groups claim

Adding the groups claim applies to Access, ID, and SAML token types. Learn more

Select group types to include in Access, ID, and SAML tokens.

☑ Security groups
□ Directory roles
□ All groups (includes distribution lists but not groups assigned to the application)
□ Groups assigned to the application

Customize token properties by type

- ID
- Access
- SAML

10.4. CONFIGURING THE RED HAT OPENSHIFT SERVICE ON AWS CLUSTER TO USE ENTRA ID AS THE IDENTITY PROVIDER

You must configure Red Hat OpenShift Service on AWS to use Entra ID as its identity provider.

Although ROSA offers the ability to configure identity providers by using OpenShift Cluster Manager, use the ROSA CLI to configure the cluster's OAuth provider to use Entra ID as its identity provider. Before configuring the identity provider, set the necessary variables for the identity provider configuration.

Procedure

1. Create the variables by running the following command:

```
$ CLUSTER_NAME=example-cluster 1
$ IDP_NAME=AAD 2
$ APP_ID=yyyyyyyy-yyyy-yyyy-yyyy-yyyyyyyyyyyy 3
$ CLIENT_SECRET=xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx 4
$ TENANT_ID=zzzzzzzz-zzzz-zzzz-zzzz-zzzzzzzzzzzz 5
```

1 Replace this with the name of your ROSA cluster.

2 Replace this value with the name you used in the OAuth callback URL that you generated earlier in this process.

3 Replace this with the Application (client) ID.

4 Replace this with the Client Secret.

5 Replace this with the Directory (tenant) ID.

2. Configure the cluster's OAuth provider by running the following command. If you enabled group claims, ensure that you use the **--group-claims groups** argument.

   - If you enabled group claims, run the following command:

```
$ rosa create idp \
--cluster ${CLUSTER_NAME} \
--type openid \
--name ${IDP_NAME} \
--client-id ${APP_ID} \
--client-secret ${CLIENT_SECRET} \
--issuer-url https://login.microsoftonline.com/${TENANT_ID}/v2.0 \
--email-claims email \
--name-claims name \
--username-claims preferred_username \
--extra-scopes email,profile \
--groups-claims groups
```

   - If you did not enable group claims, run the following command:

```
$ rosa create idp \
--cluster ${CLUSTER_NAME} \
--type openid \
--name ${IDP_NAME} \
--client-id ${APP_ID} \
--client-secret ${CLIENT_SECRET} \
--issuer-url https://login.microsoftonline.com/${TENANT_ID}/v2.0 \
--email-claims email \
--name-claims name \
--username-claims preferred_username \
--extra-scopes email,profile
```

After a few minutes, the cluster authentication Operator reconciles your changes, and you can log in to the cluster by using Entra ID.

10.5. GRANTING ADDITIONAL PERMISSIONS TO INDIVIDUAL USERS AND GROUPS

When your first log in, you might notice that you have very limited permissions. By default, Red Hat OpenShift Service on AWS only grants you the ability to create new projects, or namespaces, in the cluster. Other projects are restricted from view.

You must grant these additional abilities to individual users and groups.

Granting additional permissions to individual users

Red Hat OpenShift Service on AWS includes a significant number of preconfigured roles, including the **cluster-admin** role that grants full access and control over the cluster.

Procedure

- Grant a user access to the **cluster-admin** role by running the following command:

```
$ rosa grant user cluster-admin \
    --user=<USERNAME> 1
    --cluster=${CLUSTER_NAME}
```

1 Provide the Entra ID username that you want to have cluster admin permissions.

Granting additional permissions to individual groups

If you opted to enable group claims, the cluster OAuth provider automatically creates or updates the user’s group memberships by using the group ID. The cluster OAuth provider does not automatically create **RoleBindings** and **ClusterRoleBindings** for the groups that are created; you are responsible for creating those bindings by using your own processes.

To grant an automatically generated group access to the **cluster-admin** role, you must create a **ClusterRoleBinding** to the group ID.

Procedure

- Create the **ClusterRoleBinding** by running the following command:

```
$ oc create clusterrolebinding cluster-admin-group \
--clusterrole=cluster-admin \
--group=<GROUP_ID> 1
```

1 Provide the Entra ID group ID that you want to have cluster admin permissions.

Now, any user in the specified group automatically receives **cluster-admin** access.

10.6. ADDITIONAL RESOURCES

For more information about how to use RBAC to define and apply permissions in Red Hat OpenShift Service on AWS, see the Red Hat OpenShift Service on AWS documentation .

CHAPTER 11. TUTORIAL: USING AWS SECRETS MANAGER CSI ON ROSA WITH STS

The AWS Secrets and Configuration Provider (ASCP) provides a way to expose AWS Secrets as Kubernetes storage volumes. With the ASCP, you can store and manage your secrets in Secrets Manager and then retrieve them through your workloads running on Red Hat OpenShift Service on AWS (ROSA).

11.1. PREREQUISITES

Ensure that you have the following resources and tools before starting this process:

- A ROSA cluster deployed with STS
- Helm 3
- **aws** CLI
- **oc** CLI
- **jq** CLI

Additional environment requirements

1. Log in to your ROSA cluster by running the following command:

```
$ oc login --token=<your-token> --server=<your-server-url>
```

You can find your login token by accessing your cluster in pull secret from Red Hat OpenShift Cluster Manager.

2. Validate that your cluster has STS by running the following command:

```
$ oc get authentication.config.openshift.io cluster -o json \
  | jq .spec.serviceAccountIssuer
```

Example output

```
"https://xxxxx.cloudfront.net/xxxxx"
```

If your output is different, do not proceed. See Red Hat documentation on creating an STS cluster before continuing this process.

3. Set the **SecurityContextConstraints** permission to allow the CSI driver to run by running the following command:

```
$ oc new-project csi-secrets-store
$ oc adm policy add-scc-to-user privileged \
    system:serviceaccount:csi-secrets-store:secrets-store-csi-driver
$ oc adm policy add-scc-to-user privileged \
    system:serviceaccount:csi-secrets-store:csi-secrets-store-provider-aws
```

4. Create environment variables to use later in this process by running the following command:

```
$ export REGION=$(oc get infrastructure cluster -o=jsonpath="
{.status.platformStatus.aws.region}")
$ export OIDC_ENDPOINT=$(oc get authentication.config.openshift.io cluster \
  -o jsonpath='{.spec.serviceAccountIssuer}' | sed  's|^https://||')
$ export AWS_ACCOUNT_ID=`aws sts get-caller-identity --query Account --output text`
$ export AWS_PAGER=""
```

11.2. DEPLOYING THE AWS SECRETS AND CONFIGURATION PROVIDER

1. Use Helm to register the secrets store CSI driver by running the following command:

```
$ helm repo add secrets-store-csi-driver \
    https://kubernetes-sigs.github.io/secrets-store-csi-driver/charts
```

2. Update your Helm repositories by running the following command:

```
$ helm repo update
```

3. Install the secrets store CSI driver by running the following command:

```
$ helm upgrade --install -n csi-secrets-store \
    csi-secrets-store-driver secrets-store-csi-driver/secrets-store-csi-driver
```

4. Deploy the AWS provider by running the following command:

```
$ oc -n csi-secrets-store apply -f \
    https://raw.githubusercontent.com/rh-mobb/documentation/main/content/misc/secrets-
store-csi/aws-provider-installer.yaml
```

5. Check that both Daemonsets are running by running the following command:

```
$ oc -n csi-secrets-store get ds \
    csi-secrets-store-provider-aws \
    csi-secrets-store-driver-secrets-store-csi-driver
```

6. Label the Secrets Store CSI Driver to allow use with the restricted pod security profile by running the following command:

```
$ oc label csidriver.storage.k8s.io/secrets-store.csi.k8s.io security.openshift.io/csi-ephemeral-
volume-profile=restricted
```

11.3. CREATING A SECRET AND IAM ACCESS POLICIES

1. Create a secret in Secrets Manager by running the following command:

```
$ SECRET_ARN=$(aws --region "$REGION" secretsmanager create-secret \
    --name MySecret --secret-string \
    '{"username":"shadowman", "password":"hunter2"}' \
    --query ARN --output text)
$ echo $SECRET_ARN
```

2. Create an IAM Access Policy document by running the following command:

```
$ cat << EOF > policy.json
{
  "Version": "2012-10-17",
  "Statement": [{
    "Effect": "Allow",
    "Action": [
      "secretsmanager:GetSecretValue",
      "secretsmanager:DescribeSecret"
    ],
    "Resource": ["$SECRET_ARN"]
    }]
}
EOF
```

3. Create an IAM Access Policy by running the following command:

```
$ POLICY_ARN=$(aws --region "$REGION" --query Policy.Arn \
--output text iam create-policy \
--policy-name openshift-access-to-mysecret-policy \
--policy-document file://policy.json)
$ echo $POLICY_ARN
```

4. Create an IAM Role trust policy document by running the following command:

NOTE

The trust policy is locked down to the default service account of a namespace you create later in this process.

```
$ cat <<EOF > trust-policy.json
{
  "Version": "2012-10-17",
  "Statement": [
  {
  "Effect": "Allow",
  "Condition": {
    "StringEquals" : {
      "${OIDC_ENDPOINT}:sub": ["system:serviceaccount:my-application:default"]
     }
   },
   "Principal": {
      "Federated": "arn:aws:iam::$AWS_ACCOUNT_ID:oidc-provider/${OIDC_ENDPOINT}"
   },
   "Action": "sts:AssumeRoleWithWebIdentity"
   }
   ]
}
EOF
```

5. Create an IAM role by running the following command:

```
$ ROLE_ARN=$(aws iam create-role --role-name openshift-access-to-mysecret \
--assume-role-policy-document file://trust-policy.json \
--query Role.Arn --output text)
$ echo $ROLE_ARN
```

6. Attach the role to the policy by running the following command:

```
$ aws iam attach-role-policy --role-name openshift-access-to-mysecret \
    --policy-arn $POLICY_ARN
```

11.4. CREATE AN APPLICATION TO USE THIS SECRET

1. Create an OpenShift project by running the following command:

```
$ oc new-project my-application
```

2. Annotate the default service account to use the STS Role by running the following command:

```
$ oc annotate -n my-application serviceaccount default \
    eks.amazonaws.com/role-arn=$ROLE_ARN
```

3. Create a secret provider class to access our secret by running the following command:

```
$ cat << EOF | oc apply -f -
apiVersion: secrets-store.csi.x-k8s.io/v1
kind: SecretProviderClass
metadata:
  name: my-application-aws-secrets
spec:
  provider: aws
  parameters:
    objects: |
      - objectName: "MySecret"
        objectType: "secretsmanager"
EOF
```

4. Create a Deployment by using our secret in the following command:

```
$ cat << EOF | oc apply -f -
apiVersion: v1
kind: Pod
metadata:
  name: my-application
  labels:
    app: my-application
spec:
  volumes:
  - name: secrets-store-inline
    csi:
      driver: secrets-store.csi.k8s.io
      readOnly: true
      volumeAttributes:
        secretProviderClass: "my-application-aws-secrets"
  containers:
```

```
  - name: my-application-deployment
    image: k8s.gcr.io/e2e-test-images/busybox:1.29
    command:
      - "/bin/sleep"
      - "10000"
    volumeMounts:
    - name: secrets-store-inline
      mountPath: "/mnt/secrets-store"
      readOnly: true
EOF
```

5. Verify the Pod has the secret mounted by running the following commandv:

```
$ oc exec -it my-application -- cat /mnt/secrets-store/MySecret
```

11.5. CLEAN UP

1. Delete the application by running the following command:

```
$ oc delete project my-application
```

2. Delete the secrets store csi driver by running the following command:

```
$ helm delete -n csi-secrets-store csi-secrets-store-driver
```

3. Delete Security Context Constraints by running the following command:

```
$ oc adm policy remove-scc-from-user privileged \
    system:serviceaccount:csi-secrets-store:secrets-store-csi-driver
$ oc adm policy remove-scc-from-user privileged \
    system:serviceaccount:csi-secrets-store:csi-secrets-store-provider-aws
```

4. Delete the AWS provider by running the following command:

```
$ oc -n csi-secrets-store delete -f \
https://raw.githubusercontent.com/rh-mobb/documentation/main/content/misc/secrets-store-csi/aws-provider-installer.yaml
```

5. Delete AWS Roles and Policies by running the following command:

```
$ aws iam detach-role-policy --role-name openshift-access-to-mysecret \
    --policy-arn $POLICY_ARN
$ aws iam delete-role --role-name openshift-access-to-mysecret
$ aws iam delete-policy --policy-arn $POLICY_ARN
```

6. Delete the Secrets Manager secret by running the following command:

```
$ aws secretsmanager --region $REGION delete-secret --secret-id $SECRET_ARN
```

CHAPTER 12. TUTORIAL: USING AWS CONTROLLERS FOR KUBERNETES ON ROSA

AWS Controllers for Kubernetes (ACK) lets you define and use AWS service resources directly from Red Hat OpenShift Service on AWS (ROSA). With ACK, you can take advantage of AWS-managed services for your applications without needing to define resources outside of the cluster or run services that provide supporting capabilities such as databases or message queues within the cluster.

You can install various ACK Operators directly from OperatorHub. This makes it easy to get started and use the Operators with your applications. This controller is a component of the AWS Controller for Kubernetes project, which is currently in developer preview.

Use this tutorial to deploy the ACK S3 Operator. You can also adapt it for any other ACK Operator in the OperatorHub of your cluster.

12.1. PREREQUISITES

- A ROSA cluster
- A user account with **cluster-admin** privileges
- The OpenShift CLI (**oc**)
- The Amazon Web Services (AWS) CLI (**aws**)

12.2. SETTING UP YOUR ENVIRONMENT

1. Configure the following environment variables, changing the cluster name to suit your cluster:

```
$ export CLUSTER_NAME=$(oc get infrastructure cluster -o=jsonpath="
{.status.infrastructureName}"  | sed 's/-[a-z0-9]\{5\}$//')
$ export REGION=$(rosa describe cluster -c ${ROSA_CLUSTER_NAME} --output json | jq -r
.region.id)
$ export OIDC_ENDPOINT=$(oc get authentication.config.openshift.io cluster -o json | jq -r
.spec.serviceAccountIssuer | sed  's|^https://||')
$ export AWS_ACCOUNT_ID=`aws sts get-caller-identity --query Account --output text`
$ export ACK_SERVICE=s3
$ export ACK_SERVICE_ACCOUNT=ack-${ACK_SERVICE}-controller
$ export POLICY_ARN=arn:aws:iam::aws:policy/AmazonS3FullAccess
$ export AWS_PAGER=""
$ export SCRATCH="/tmp/${ROSA_CLUSTER_NAME}/ack"
$ mkdir -p ${SCRATCH}
```

2. Ensure all fields output correctly before moving to the next section:

```
$ echo "Cluster: ${ROSA_CLUSTER_NAME}, Region: ${REGION}, OIDC Endpoint:
${OIDC_ENDPOINT}, AWS Account ID: ${AWS_ACCOUNT_ID}"
```

12.3. PREPARING YOUR AWS ACCOUNT

1. Create an AWS Identity Access Management (IAM) trust policy for the ACK Operator:

```
$ cat <<EOF > "${SCRATCH}/trust-policy.json"
```

```
{
 "Version": "2012-10-17",
 "Statement": [
 {
 "Effect": "Allow",
 "Condition": {
   "StringEquals" : {
     "${OIDC_ENDPOINT}:sub": "system:serviceaccount:ack-
system:${ACK_SERVICE_ACCOUNT}"
   }
 },
 "Principal": {
   "Federated": "arn:aws:iam::$AWS_ACCOUNT_ID:oidc-provider/${OIDC_ENDPOINT}"
 },
 "Action": "sts:AssumeRoleWithWebIdentity"
 }
 ]
}
EOF
```

2. Create an AWS IAM role for the ACK Operator to assume with the **AmazonS3FullAccess** policy attached:

NOTE

You can find the recommended policy in each project's GitHub repository, for example https://github.com/aws-controllers-k8s/s3-controller/blob/main/config/iam/recommended-policy-arn.

```
$ ROLE_ARN=$(aws iam create-role --role-name "ack-${ACK_SERVICE}-controller" \
   --assume-role-policy-document "file://${SCRATCH}/trust-policy.json" \
   --query Role.Arn --output text)
$ echo $ROLE_ARN

$ aws iam attach-role-policy --role-name "ack-${ACK_SERVICE}-controller" \
     --policy-arn ${POLICY_ARN}
```

12.4. INSTALLING THE ACK S3 CONTROLLER

1. Create a project to install the ACK S3 Operator into:

```
$ oc new-project ack-system
```

2. Create a file with the ACK S3 Operator configuration:

NOTE

ACK_WATCH_NAMESPACE is purposefully left blank so the controller can properly watch all namespaces in the cluster.

```
$ cat <<EOF > "${SCRATCH}/config.txt"
ACK_ENABLE_DEVELOPMENT_LOGGING=true
```

```
ACK_LOG_LEVEL=debug
ACK_WATCH_NAMESPACE=
AWS_REGION=${REGION}
AWS_ENDPOINT_URL=
ACK_RESOURCE_TAGS=${CLUSTER_NAME}
ENABLE_LEADER_ELECTION=true
LEADER_ELECTION_NAMESPACE=
EOF
```

3. Use the file from the previous step to create a ConfigMap:

```
$ oc -n ack-system create configmap \
  --from-env-file=${SCRATCH}/config.txt ack-${ACK_SERVICE}-user-config
```

4. Install the ACK S3 Operator from OperatorHub:

```
$ cat << EOF | oc apply -f -
apiVersion: operators.coreos.com/v1
kind: OperatorGroup
metadata:
  name: ack-${ACK_SERVICE}-controller
  namespace: ack-system
spec:
  upgradeStrategy: Default
---
apiVersion: operators.coreos.com/v1alpha1
kind: Subscription
metadata:
  name: ack-${ACK_SERVICE}-controller
  namespace: ack-system
spec:
  channel: alpha
  installPlanApproval: Automatic
  name: ack-${ACK_SERVICE}-controller
  source: community-operators
  sourceNamespace: openshift-marketplace
EOF
```

5. Annotate the ACK S3 Operator service account with the AWS IAM role to assume and restart the deployment:

```
$ oc -n ack-system annotate serviceaccount ${ACK_SERVICE_ACCOUNT} \
  eks.amazonaws.com/role-arn=${ROLE_ARN} && \
  oc -n ack-system rollout restart deployment ack-${ACK_SERVICE}-controller
```

6. Verify that the ACK S3 Operator is running:

```
$ oc -n ack-system get pods
```

Example output

```
NAME                                 READY   STATUS    RESTARTS   AGE
ack-s3-controller-585f6775db-s4lfz   1/1     Running   0          51s
```

12.5. VALIDATING THE DEPLOYMENT

1. Deploy an S3 bucket resource:

```
$ cat << EOF | oc apply -f -
apiVersion: s3.services.k8s.aws/v1alpha1
kind: Bucket
metadata:
  name: ${CLUSTER-NAME}-bucket
  namespace: ack-system
spec:
  name: ${CLUSTER-NAME}-bucket
EOF
```

2. Verify the S3 bucket was created in AWS:

```
$ aws s3 ls | grep ${CLUSTER_NAME}-bucket
```

Example output

```
2023-10-04 14:51:45 mrmc-test-maz-bucket
```

12.6. CLEANING UP

1. Delete the S3 bucket resource:

```
$ oc -n ack-system delete bucket.s3.services.k8s.aws/${CLUSTER-NAME}-bucket
```

2. Delete the ACK S3 Operator and the AWS IAM roles:

```
$ oc -n ack-system delete subscription ack-${ACK_SERVICE}-controller
$ aws iam detach-role-policy \
  --role-name "ack-${ACK_SERVICE}-controller" \
  --policy-arn ${POLICY_ARN}
$ aws iam delete-role \
  --role-name "ack-${ACK_SERVICE}-controller"
```

3. Delete the **ack-system** project:

```
$ oc delete project ack-system
```

CHAPTER 13. TUTORIAL: DEPLOYING THE EXTERNAL DNS OPERATOR ON ROSA

WARNING

Starting with Red Hat OpenShift Service on AWS 4.14, the Custom Domain Operator is deprecated. To manage Ingress in Red Hat OpenShift Service on AWS 4.14, use the Ingress Operator. The functionality is unchanged for Red Hat OpenShift Service on AWS 4.13 and earlier versions.

Configuring the Custom Domain Operator requires a wildcard CNAME DNS record in your Amazon Route 53 hosted zone. If you do not want to use a wildcard record, you can use the **External DNS** Operator to create individual entries for routes.

Use this tutorial to deploy and configure the **External DNS** Operator with a custom domain in Red Hat OpenShift Service on AWS (ROSA).

IMPORTANT

The **External DNS** Operator does not support STS using IAM Roles for Service Accounts (IRSA) and uses long-lived Identity Access Management (IAM) credentials instead. This tutorial will be updated when the Operator supports STS.

13.1. PREREQUISITES

- A ROSA cluster
- A user account with **dedicated-admin** privileges
- The OpenShift CLI (**oc**)
- The Amazon Web Services (AWS) CLI (**aws**)
- A unique domain, such as ***.apps.<company_name>.io**
- An Amazon Route 53 public hosted zone for the above domain

13.2. SETTING UP YOUR ENVIRONMENT

1. Configure the following environment variables, replacing **CLUSTER_NAME** with the name of your cluster:

```
$ export DOMAIN=apps.<company_name>.io 1
$ export AWS_PAGER=""
$ export CLUSTER_NAME=$(oc get infrastructure cluster -o=jsonpath="
{.status.infrastructureName}"  | sed 's/-[a-z0-9]\{5\}$//')
$ export REGION=$(oc get infrastructure cluster -o=jsonpath="
{.status.platformStatus.aws.region}")
```

```
$ export AWS_ACCOUNT_ID=$(aws sts get-caller-identity --query Account --output text)
$ export SCRATCH="/tmp/${CLUSTER_NAME}/external-dns"
$ mkdir -p ${SCRATCH}
```

1 The custom domain.

2. Ensure all fields output correctly before moving to the next section:

```
$ echo "Cluster: ${CLUSTER_NAME}, Region: ${REGION}, AWS Account ID:
${AWS_ACCOUNT_ID}"
```

13.3. SETTING UP YOUR CUSTOM DOMAIN

ROSA manages secondary Ingress Controllers using the **Custom Domain** Operator. Use the following procedure to deploy a secondary Ingress Controller using a custom domain.

Prerequisites

- A unique domain, such as ***.apps.<company_name>.io**
- A custom SAN or wildcard certificate, such as **CN=*.apps.<company_name>.io**

Procedure

1. Create a new project:

```
$ oc new-project external-dns-operator
```

2. Create a new TLS secret from a private key and a public certificate, where **fullchain.pem** is your full wildcard certificate chain (including any intermediaries) and **privkey.pem** is your wildcard certificate's private key:

```
$ oc -n external-dns-operator create secret tls external-dns-tls --cert=fullchain.pem --
key=privkey.pem
```

3. Create a new **CustomDomain** custom resource (CR):

Example external-dns-custom-domain.yaml

```
apiVersion: managed.openshift.io/v1alpha1
kind: CustomDomain
metadata:
  name: external-dns
spec:
  domain: apps.<company_name>.io 1
  scope: External
  loadBalancerType: NLB
  certificate:
    name: external-dns-tls
    namespace: external-dns-operator
```

1 The custom domain.

4. Apply the CR:

```
$ oc apply -f external-dns-custom-domain.yaml
```

5. Verify that your custom domain Ingress Controller has been deployed and has a **Ready** status:

```
$ oc get customdomains
```

Example output

```
NAME            ENDPOINT                                                DOMAIN              STATUS
external-dns     xxrywp.<company_name>.cluster-01.opln.s1.openshiftapps.com  *.apps.
<company_name>.io     Ready
```

13.4. PREPARING YOUR AWS ACCOUNT

1. Retrieve the Amazon Route 53 public hosted zone ID:

```
$ export ZONE_ID=$(aws route53 list-hosted-zones-by-name --output json \
  --dns-name "${DOMAIN}." --query 'HostedZones[0]'.Id --out text | sed 's/\/hostedzone\///')
```

2. Create an AWS IAM Policy document that allows the **External DNS** Operator to update *only* the custom domain public hosted zone:

```
$ cat << EOF > "${SCRATCH}/external-dns-policy.json"
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "route53:ChangeResourceRecordSets"
      ],
      "Resource": [
        "arn:aws:route53:::hostedzone/${ZONE_ID}"
      ]
    },
    {
      "Effect": "Allow",
      "Action": [
        "route53:ListHostedZones",
        "route53:ListResourceRecordSets"
      ],
      "Resource": [
        "*"
      ]
    }
  ]
}
EOF
```

3. Create an AWS IAM policy:

```
$ export POLICY_ARN=$(aws iam create-policy --policy-name "${CLUSTER_NAME}-
AllowExternalDNSUpdates" \
  --policy-document file://${SCRATCH}/external-dns-policy.json \
  --query 'Policy.Arn' --output text)
```

4. Create an AWS IAM user:

```
$ aws iam create-user --user-name "${CLUSTER_NAME}-external-dns-operator"
```

5. Attach the policy:

```
$ aws iam attach-user-policy --user-name "${CLUSTER_NAME}-external-dns-operator" --
policy-arn $POLICY_ARN
```

NOTE

This will be changed to STS using IRSA in the future.

6. Create AWS keys for the IAM user:

```
$ SECRET_ACCESS_KEY=$(aws iam create-access-key --user-name
"${CLUSTER_NAME}-external-dns-operator")
```

7. Create static credentials:

```
$ cat << EOF > "${SCRATCH}/credentials"
[default]
aws_access_key_id = $(echo $SECRET_ACCESS_KEY | jq -r '.AccessKey.AccessKeyId')
aws_secret_access_key = $(echo $SECRET_ACCESS_KEY | jq -r
'.AccessKey.SecretAccessKey')
EOF
```

13.5. INSTALLING THE EXTERNAL DNS OPERATOR

1. Install the **External DNS** Operator from OperatorHub:

```
$ cat << EOF | oc apply -f -
apiVersion: operators.coreos.com/v1
kind: OperatorGroup
metadata:
  name: external-dns-group
  namespace: external-dns-operator
spec:
  targetNamespaces:
  - external-dns-operator
---
apiVersion: operators.coreos.com/v1alpha1
kind: Subscription
metadata:
  name: external-dns-operator
  namespace: external-dns-operator
spec:
  channel: stable-v1.1
  installPlanApproval: Automatic
  name: external-dns-operator
  source: redhat-operators
  sourceNamespace: openshift-marketplace
EOF
```

2. Wait until the **External DNS** Operator is running:

   ```
   $ oc rollout status deploy external-dns-operator --timeout=300s
   ```

3. Create a secret from the AWS IAM user credentials:

   ```
   $ oc -n external-dns-operator create secret generic external-dns \
     --from-file "${SCRATCH}/credentials"
   ```

4. Deploy the **ExternalDNS** controller:

   ```
   $ cat << EOF | oc apply -f -
   apiVersion: externaldns.olm.openshift.io/v1beta1
   kind: ExternalDNS
   metadata:
     name: ${DOMAIN}
   spec:
     domains:
       - filterType: Include
         matchType: Exact
         name: ${DOMAIN}
     provider:
       aws:
         credentials:
           name: external-dns
       type: AWS
     source:
       openshiftRouteOptions:
         routerName: external-dns
       type: OpenShiftRoute
     zones:
       - ${ZONE_ID}
   EOF
   ```

5. Wait until the controller is running:

   ```
   $ oc rollout status deploy external-dns-${DOMAIN} --timeout=300s
   ```

13.6. DEPLOYING A SAMPLE APPLICATION

Now that the **ExternalDNS** controller is running, you can deploy a sample application to confirm that the custom domain is configured and trusted when you expose a new route.

1. Create a new project for your sample application:

   ```
   $ oc new-project hello-world
   ```

2. Deploy a hello world application:

```
$ oc new-app -n hello-world --image=docker.io/openshift/hello-openshift
```

3. Create a route for the application specifying your custom domain name:

```
$ oc -n hello-world create route edge --service=hello-openshift hello-openshift-tls \
--hostname hello-openshift.${DOMAIN}
```

4. Check if the DNS record was created automatically by ExternalDNS:

NOTE

It can take a few minutes for the record to appear in Amazon Route 53.

```
$ aws route53 list-resource-record-sets --hosted-zone-id ${ZONE_ID} \
  --query "ResourceRecordSets[?Type == 'CNAME']" | grep hello-openshift
```

5. Optional: You can also view the TXT records that indicate they were created by ExternalDNS:

```
$ aws route53 list-resource-record-sets --hosted-zone-id ${ZONE_ID} \
  --query "ResourceRecordSets[?Type == 'TXT']" | grep ${DOMAIN}
```

6. Navigate to your custom console domain in the browser where you see the OpenShift login:

```
$ echo console.${DOMAIN}
```

CHAPTER 14. TUTORIAL: DYNAMICALLY ISSUING CERTIFICATES USING THE CERT-MANAGER OPERATOR ON ROSA

While wildcard certificates provide simplicity by securing all first-level subdomains of a given domain with a single certificate, other use cases can require the use of individual certificates per domain.

Learn how to use the cert-manager Operator for Red Hat OpenShift and Let’s Encrypt to dynamically issue certificates for routes created using a custom domain.

14.1. PREREQUISITES

- A ROSA cluster
- A user account with **cluster-admin** privileges
- The OpenShift CLI (**oc**)
- The Amazon Web Services (AWS) CLI (**aws**)
- A unique domain, such as ***.apps.<company_name>.io**
- An Amazon Route 53 public hosted zone for the above domain

14.2. SETTING UP YOUR ENVIRONMENT

1. Configure the following environment variables:

```
$ export DOMAIN=apps.<company_name>.io ❶
$ export EMAIL=<youremail@company_name.io> ❷
$ export AWS_PAGER=""
$ export CLUSTER_NAME=$(oc get infrastructure cluster -o=jsonpath="
{.status.infrastructureName}"  | sed 's/-[a-z0-9]\{5\}$//')
$ export OIDC_ENDPOINT=$(oc get authentication.config.openshift.io cluster -o json | jq -r
.spec.serviceAccountIssuer | sed  's|^https://||')
$ export REGION=$(oc get infrastructure cluster -o=jsonpath="
{.status.platformStatus.aws.region}")
$ export AWS_ACCOUNT_ID=$(aws sts get-caller-identity --query Account --output text)
$ export SCRATCH="/tmp/${CLUSTER_NAME}/dynamic-certs"
$ mkdir -p ${SCRATCH}
```

❶ The custom domain.

❷ The e-mail Let’s Encrypt will use to send notifications about your certificates.

2. Ensure all fields output correctly before moving to the next section:

```
$ echo "Cluster: ${CLUSTER_NAME}, Region: ${REGION}, OIDC Endpoint:
${OIDC_ENDPOINT}, AWS Account ID: ${AWS_ACCOUNT_ID}"
```

14.3. PREPARING YOUR AWS ACCOUNT

When cert-manager requests a certificate from Let's Encrypt (or another ACME certificate issuer), Let's Encrypt servers validate that you control the domain name in that certificate using *challenges*. For this tutorial, you are using a DNS-01 challenge that proves that you control the DNS for your domain name by putting a specific value in a TXT record under that domain name. This is all done automatically by cert-manager. To allow cert-manager permission to modify the Amazon Route 53 public hosted zone for your domain, you need to create an Identity Access Management (IAM) role with specific policy permissions and a trust relationship to allow access to the pod.

The public hosted zone that is used in this tutorial is in the same AWS account as the ROSA cluster. If your public hosted zone is in a different account, a few additional steps for Cross Account Access are required.

1. Retrieve the Amazon Route 53 public hosted zone ID:

   > NOTE
   >
   > This command looks for a public hosted zone that matches the custom domain you specified earlier as the **DOMAIN** environment variable. You can manually specify the Amazon Route 53 public hosted zone by running **export ZONE_ID=<zone_ID>**, replacing **<zone_ID>** with your specific Amazon Route 53 public hosted zone ID.

   ```
   $ export ZONE_ID=$(aws route53 list-hosted-zones-by-name --output json \
     --dns-name "${DOMAIN}." --query 'HostedZones[0]'.Id --out text | sed 's/\/hostedzone\///')
   ```

2. Create an AWS IAM policy document for the **cert-manager** Operator that provides the ability to update *only* the specified public hosted zone:

   ```
   $ cat <<EOF > "${SCRATCH}/cert-manager-policy.json"
   {
     "Version": "2012-10-17",
     "Statement": [
       {
         "Effect": "Allow",
         "Action": "route53:GetChange",
         "Resource": "arn:aws:route53:::change/*"
       },
       {
         "Effect": "Allow",
         "Action": [
           "route53:ChangeResourceRecordSets",
           "route53:ListResourceRecordSets"
         ],
         "Resource": "arn:aws:route53:::hostedzone/${ZONE_ID}"
       },
       {
         "Effect": "Allow",
         "Action": "route53:ListHostedZonesByName",
         "Resource": "*"
       }
     ]
   }
   EOF
   ```

3. Create the IAM policy using the file you created in the previous step:

```
$ POLICY_ARN=$(aws iam create-policy --policy-name "${CLUSTER_NAME}-cert-manager-policy" \
  --policy-document file://${SCRATCH}/cert-manager-policy.json \
  --query 'Policy.Arn' --output text)
```

4. Create an AWS IAM trust policy for the **cert-manager** Operator:

```
$ cat <<EOF > "${SCRATCH}/trust-policy.json"
{
 "Version": "2012-10-17",
 "Statement": [
 {
 "Effect": "Allow",
 "Condition": {
   "StringEquals" : {
     "${OIDC_ENDPOINT}:sub": "system:serviceaccount:cert-manager:cert-manager"
   }
 },
 "Principal": {
   "Federated": "arn:aws:iam::$AWS_ACCOUNT_ID:oidc-provider/${OIDC_ENDPOINT}"
 },
 "Action": "sts:AssumeRoleWithWebIdentity"
 }
 ]
}
EOF
```

5. Create an IAM role for the **cert-manager** Operator using the trust policy you created in the previous step:

```
$ ROLE_ARN=$(aws iam create-role --role-name "${CLUSTER_NAME}-cert-manager-operator" \
   --assume-role-policy-document "file://${SCRATCH}/trust-policy.json" \
   --query Role.Arn --output text)
```

6. Attach the permissions policy to the role:

```
$ aws iam attach-role-policy --role-name "${CLUSTER_NAME}-cert-manager-operator" \
  --policy-arn ${POLICY_ARN}
```

14.4. INSTALLING THE CERT-MANAGER OPERATOR

1. Create a project to install the **cert-manager** Operator into:

```
$ oc new-project cert-manager-operator
```

IMPORTANT

Do not attempt to use more than one **cert-manager** Operator in your cluster. If you have a community **cert-manager** Operator installed in your cluster, you must uninstall it before installing the **cert-manager** Operator for Red Hat OpenShift.

2. Install the **cert-manager** Operator for Red Hat OpenShift:

```
$ cat << EOF | oc apply -f -
apiVersion: operators.coreos.com/v1
kind: OperatorGroup
metadata:
  name: openshift-cert-manager-operator-group
  namespace: cert-manager-operator
spec:
  targetNamespaces:
  - cert-manager-operator
---
apiVersion: operators.coreos.com/v1alpha1
kind: Subscription
metadata:
  name: openshift-cert-manager-operator
  namespace: cert-manager-operator
spec:
  channel: stable-v1
  installPlanApproval: Automatic
  name: openshift-cert-manager-operator
  source: redhat-operators
  sourceNamespace: openshift-marketplace
EOF
```

NOTE

It takes a few minutes for this Operator to install and complete its set up.

3. Verify that the **cert-manager** Operator is running:

```
$ oc -n cert-manager-operator get pods
```

Example output

```
NAME                                                        READY   STATUS    RESTARTS   AGE
cert-manager-operator-controller-manager-84b8799db5-gv8mx   2/2     Running   0          12s
```

4. Annotate the service account used by the **cert-manager** pods with the AWS IAM role you created earlier:

```
$ oc -n cert-manager annotate serviceaccount cert-manager eks.amazonaws.com/role-
arn=${ROLE_ARN}
```

5. Restart the existing **cert-manager** controller pod by running the following command:

```
$ oc -n cert-manager delete pods -l app.kubernetes.io/name=cert-manager
```

6. Patch the Operator’s configuration to use external nameservers to prevent DNS-01 challenge resolution issues:

```
$ oc patch certmanager.operator.openshift.io/cluster --type merge \
  -p '{"spec":{"controllerConfig":{"overrideArgs":["--dns01-recursive-nameservers-only","--
dns01-recursive-nameservers=1.1.1.1:53"]}}}'
```

7. Create a **ClusterIssuer** resource to use Let's Encrypt by running the following command:

```
$ cat << EOF | oc apply -f -
apiVersion: cert-manager.io/v1
kind: ClusterIssuer
metadata:
  name: letsencrypt-production
spec:
  acme:
    server: https://acme-v02.api.letsencrypt.org/directory
    email: ${EMAIL}
    # This key doesn't exist, cert-manager creates it
    privateKeySecretRef:
      name: prod-letsencrypt-issuer-account-key
    solvers:
    - dns01:
        route53:
         hostedZoneID: ${ZONE_ID}
         region: ${REGION}
         secretAccessKeySecretRef:
           name: ''
EOF
```

8. Verify the **ClusterIssuer** resource is ready:

```
$ oc get clusterissuer.cert-manager.io/letsencrypt-production
```

Example output

```
NAME                     READY   AGE
letsencrypt-production   True    47s
```

14.5. CREATING A CUSTOM DOMAIN INGRESS CONTROLLER

1. Create a new project:

```
$ oc new-project custom-domain-ingress
```

2. Create and configure a certificate resource to provision a certificate for the custom domain Ingress Controller:

NOTE

The following example uses a single domain certificate. SAN and wildcard certificates are also supported.

```
$ cat << EOF | oc apply -f -
apiVersion: cert-manager.io/v1
```

```
kind: Certificate
metadata:
  name: custom-domain-ingress-cert
  namespace: custom-domain-ingress
spec:
  secretName: custom-domain-ingress-cert-tls
  issuerRef:
     name: letsencrypt-production
     kind: ClusterIssuer
  commonName: "${DOMAIN}"
  dnsNames:
  - "${DOMAIN}"
EOF
```

3. Verify the certificate has been issued:

NOTE

It takes a few minutes for this certificate to be issued by Let's Encrypt. If it takes longer than 5 minutes, run **oc -n custom-domain-ingress describe certificate.cert-manager.io/custom-domain-ingress-cert** to see any issues reported by cert-manager.

```
$ oc -n custom-domain-ingress get certificate.cert-manager.io/custom-domain-ingress-cert
```

Example output

```
NAME                         READY   SECRET                           AGE
custom-domain-ingress-cert   True    custom-domain-ingress-cert-tls   9m53s
```

4. Create a new **CustomDomain** custom resource (CR):

```
$ cat << EOF | oc apply -f -
apiVersion: managed.openshift.io/v1alpha1
kind: CustomDomain
metadata:
  name: custom-domain-ingress
spec:
  domain: ${DOMAIN}
  scope: External
  loadBalancerType: NLB
  certificate:
    name: custom-domain-ingress-cert-tls
    namespace: custom-domain-ingress
EOF
```

5. Verify that your custom domain Ingress Controller has been deployed and has a **Ready** status:

```
$ oc get customdomains
```

Example output

```
NAME                    ENDPOINT                                                    DOMAIN
```

```
STATUS
custom-domain-ingress   tfoxdx.custom-domain-ingress.cluster.1234.p1.openshiftapps.com
example.com       Ready
```

6. Prepare a document with the necessary DNS changes to enable DNS resolution for your custom domain Ingress Controller:

```
$ INGRESS=$(oc get customdomain.managed.openshift.io/custom-domain-ingress --
template={{.status.endpoint}})
$ cat << EOF > "${SCRATCH}/create-cname.json"
{
  "Comment":"Add CNAME to custom domain endpoint",
  "Changes":[{
      "Action":"CREATE",
      "ResourceRecordSet":{
        "Name": "*.${DOMAIN}",
      "Type":"CNAME",
      "TTL":30,
      "ResourceRecords":[{
        "Value": "${INGRESS}"
      }]
    }
  }]
}
EOF
```

7. Submit your changes to Amazon Route 53 for propagation:

```
$ aws route53 change-resource-record-sets \
  --hosted-zone-id ${ZONE_ID} \
  --change-batch file://${SCRATCH}/create-cname.json
```

NOTE

While the wildcard CNAME record avoids the need to create a new record for every new application you deploy using the custom domain Ingress Controller, the certificate that each of these applications use **is not** a wildcard certificate.

14.6. CONFIGURING DYNAMIC CERTIFICATES FOR CUSTOM DOMAIN ROUTES

Now you can expose cluster applications on any first-level subdomains of the specified domain, but the connection will not be secured with a TLS certificate that matches the domain of the application. To ensure these cluster applications have valid certificates for each domain name, configure cert-manager to dynamically issue a certificate to every new route created under this domain.

1. Create the necessary OpenShift resources cert-manager requires to manage certificates for OpenShift routes.
   This step creates a new deployment (and therefore a pod) that specifically monitors annotated routes in the cluster. If the **issuer-kind** and **issuer-name** annotations are found in a new route, it requests the Issuer (ClusterIssuer in this case) for a new certificate that is unique to this route and which will honor the hostname that was specified while creating the route.

NOTE

If the cluster does not have access to GitHub, you can save the raw contents locally and run **oc apply -f localfilename.yaml -n cert-manager**.

```
$ oc -n cert-manager apply -f https://github.com/cert-manager/openshift-
routes/releases/latest/download/cert-manager-openshift-routes.yaml
```

The following additional OpenShift resources are also created in this step:

- **ClusterRole** - grants permissions to watch and update the routes across the cluster
- **ServiceAccount** - uses permissions to run the newly created pod
- **ClusterRoleBinding** - binds these two resources

2. Ensure that the new **cert-manager-openshift-routes** pod is running successfully:

```
$ oc -n cert-manager get pods
```

Example result

```
NAME                                          READY   STATUS    RESTARTS   AGE
cert-manager-866d8f788c-9kspc                 1/1     Running   0          4h21m
cert-manager-cainjector-6885c585bd-znws8      1/1     Running   0          4h41m
cert-manager-openshift-routes-75b6bb44cd-f8kd5   1/1     Running   0          6s
cert-manager-webhook-8498785dd9-bvfdf         1/1     Running   0          4h41m
```

14.7. DEPLOYING A SAMPLE APPLICATION

Now that dynamic certificates are configured, you can deploy a sample application to confirm that certificates are provisioned and trusted when you expose a new route.

1. Create a new project for your sample application:

```
$ oc new-project hello-world
```

2. Deploy a hello world application:

```
$ oc -n hello-world new-app --image=docker.io/openshift/hello-openshift
```

3. Create a route to expose the application from outside the cluster:

```
$ oc -n hello-world create route edge --service=hello-openshift hello-openshift-tls --hostname
hello.${DOMAIN}
```

4. Verify the certificate for the route is untrusted:

```
$ curl -I https://hello.${DOMAIN}
```

Example output

```
curl: (60) SSL: no alternative certificate subject name matches target host name
'hello.example.com'
More details here: https://curl.se/docs/sslcerts.html

curl failed to verify the legitimacy of the server and therefore could not
establish a secure connection to it. To learn more about this situation and
how to fix it, please visit the web page mentioned above.
```

5. Annotate the route to trigger cert-manager to provision a certificate for the custom domain:

```
$ oc -n hello-world annotate route hello-openshift-tls cert-manager.io/issuer-
kind=ClusterIssuer cert-manager.io/issuer-name=letsencrypt-production
```

NOTE

It takes 2-3 minutes for the certificate to be created. The renewal of the certificate will automatically be managed by the **cert-manager** Operator as it approaches expiration.

6. Verify the certificate for the route is now trusted:

```
$ curl -I https://hello.${DOMAIN}
```

Example output

```
HTTP/2 200
date: Thu, 05 Oct 2023 23:45:33 GMT
content-length: 17
content-type: text/plain; charset=utf-8
set-cookie: 52e4465485b6fb4f8a1b1bed128d0f3b=68676068bb32d24f0f558f094ed8e4d7;
path=/; HttpOnly; Secure; SameSite=None
cache-control: private
```

14.8. TROUBLESHOOTING DYNAMIC CERTIFICATE PROVISIONING

NOTE

The validation process usually takes 2-3 minutes to complete while creating certificates.

If annotating your route does not trigger certificate creation during the certificate create step, run **oc describe** against each of the **certificate**,**certificaterequest**,**order**, and **challenge** resources to view the events or reasons that can help identify the cause of the issue.

```
$ oc get certificate,certificaterequest,order,challenge
```

For troubleshooting, you can refer to this helpful guide in debugging certificates .

You can also use the cmctl CLI tool for various certificate management activities, such as checking the status of certificates and testing renewals.

CHAPTER 15. TUTORIAL: ASSIGNING CONSISTENT EGRESS IP FOR EXTERNAL TRAFFIC

It might be desirable to assign a consistent IP address for traffic that leaves the cluster when configuring items such as security groups or other sorts of security controls which require an IP-based configuration. By default, Red Hat OpenShift Service on AWS (ROSA) (using the OVN-Kubernetes CNI) assigns random IP addresses from a pool which makes configuring security lockdowns unpredictable or unnecessarily open. This guide shows you how to configure a set of predictable IP addresses for egress cluster traffic to meet common security standards and guidance and other potential use cases.

See the OpenShift documentation on this topic for more information.

15.1. PREREQUISITES

- ROSA cluster deployed with OVN-Kubernetes
- OpenShift CLI (**oc**)
- ROSA CLI (**rosa**)
- **jq**

15.1.1. Environment

This sets environment variables for the tutorial so that you do not need to copy/paste in your own. Be sure to replace the **ROSA_MACHINE_POOL_NAME** variable if you wish to target a different Machine Pool.:

```
$ export ROSA_CLUSTER_NAME=$(oc get infrastructure cluster -o=jsonpath="
{.status.infrastructureName}"  | sed 's/-[a-z0-9]\{5\}$//')
$ export ROSA_MACHINE_POOL_NAME=Default
```

15.2. ENSURE CAPACITY

For each public cloud provider, there is a limit on the number of IP addresses that may be assigned per node. This can affect the ability to assign an egress IP address. To verify sufficient capacity, you can run the following command to print out the currently assigned IP addresses versus the total capacity in order to identify any nodes which may affected:

```
$ oc get node -o json | \
    jq '.items[] |
        {
            "name": .metadata.name,
            "ips": (.status.addresses | map(select(.type == "InternalIP") | .address)),
            "capacity": (.metadata.annotations."cloud.network.openshift.io/egress-ipconfig" | fromjson[] |
.capacity.ipv4)
        }'
```

Example output

```
---
{
  "name": "ip-10-10-145-88.ec2.internal",
  "ips": [
    "10.10.145.88"
  ],
  "capacity": 14
}
{
  "name": "ip-10-10-154-175.ec2.internal",
  "ips": [
    "10.10.154.175"
  ],
  "capacity": 14
}
---
```

NOTE

The above example uses **jq** as a friendly filter. If you do not have **jq** installed, you can review the **metadata.annotations['cloud.network.openshift.io/egress-ipconfig']** field of each node manually to verify node capacity.

15.3. CREATE THE EGRESS IP RULE(S)

15.3.1. Identify the egress IPs

Before creating the rules, we should identify which egress IPs that we will use. It should be noted that the egress IPs that you select should exist as a part of the subnets in which the worker nodes are provisioned into.

15.3.2. Reserve the egress IPs

It is recommended, but not required, to reserve the egress IPs that you have requested to avoid conflicts with the AWS VPC DHCP service. To do so, you can request explicit IP reservations by following the AWS documentation for CIDR reservations.

15.4. DEPLOY AN EGRESS IP TO A NAMESPACE

Create a project to demonstrate assigning egress IP addresses based on a namespace selection:

```
$ oc create -f demo-egress-pod.yaml
```

Create the egress rule. This rule will ensure that egress traffic will be applied to all pods within the namespace that we just created using the **spec.namespaceSelector** field:

```
$ cat <<EOF | oc apply -f -
apiVersion: k8s.ovn.org/v1
kind: EgressIP
metadata:
  name: demo-egress-ns
spec:
  # NOTE: these egress IPs are within the subnet range(s) in which my worker nodes
  #       are deployed.
  egressIPs:
    - 10.10.100.253
    - 10.10.150.253
    - 10.10.200.253
  namespaceSelector:
    matchLabels:
      kubernetes.io/metadata.name: demo-egress-ns
EOF
```

15.4.1. Assign an egress IP to a pod

Create a project to demonstrate assigning egress IP addresses based on a pod selection:

```
$ oc new-project demo-egress-pod
```

Create the egress rule. This rule will ensure that egress traffic will be applied to the pod which we just created using the **spec.podSelector** field. It should be noted that **spec.namespaceSelector** is a mandatory field:

```
$ cat <<EOF | oc apply -f -
apiVersion: k8s.ovn.org/v1
kind: EgressIP
metadata:
  name: demo-egress-pod
spec:
  # NOTE: these egress IPs are within the subnet range(s) in which my worker nodes
  #       are deployed.
  egressIPs:
    - 10.10.100.254
    - 10.10.150.254
    - 10.10.200.254
  namespaceSelector:
    matchLabels:
      kubernetes.io/metadata.name: demo-egress-pod
  podSelector:
    matchLabels:
      run: demo-egress-pod
EOF
```

15.4.2. Label the nodes

You can run **oc get egressips** and see that the egress IP assignments are pending.

Example output

```
NAME              EGRESSIPS       ASSIGNED NODE   ASSIGNED EGRESSIPS
demo-egress-ns    10.10.100.253
demo-egress-pod   10.10.100.254
```

To complete the egress IP assignment, we need to assign a specific label to the nodes. The egress IP rule that you created in a previous step only applies to nodes with the **k8s.ovn.org/egress-assignable** label. We want to ensure that label exists on only a specific machinepool as set using an environment variable in the set environment variables step.

Assign the necessary label to your machine pool using the following command:

> **WARNING**
>
> If you are reliant upon any node labels for your machinepool, this command will replace those labels. Be sure to input your desired labels into the **--labels** field to ensure your node labels persist.

```
$ rosa update machinepool ${ROSA_MACHINE_POOL_NAME} \
  --cluster="${ROSA_CLUSTER_NAME}" \
  --labels "k8s.ovn.org/egress-assignable="
```

15.4.3. Review the egress IPs

You can review the egress IP assignments by running **oc get egressips** which will produce output as follows:

Example output

```
NAME             EGRESSIPS       ASSIGNED NODE                  ASSIGNED EGRESSIPS
demo-egress-ns     10.10.100.253   ip-10-10-156-122.ec2.internal   10.10.150.253
demo-egress-pod    10.10.100.254   ip-10-10-156-122.ec2.internal   10.10.150.254
```

15.5. TEST THE EGRESS IP RULE

15.5.1. Deploy a sample application

To test the rule, we will create a service which is locked down only to the egress IP addresses in which we have specified. This will simulate an external service which is expecting a small subset of IP addresses.

Run the echoserver which gives us some helpful information:

```
$ oc -n default run demo-service --image=gcr.io/google_containers/echoserver:1.4
```

Expose the pod as a service, limiting the ingress (via the **.spec.loadBalancerSourceRanges** field) to the service to only the egress IP addresses in which we specified our pods should be using:

```
$ cat <<EOF | oc apply -f -
apiVersion: v1
kind: Service
metadata:
  name: demo-service
  namespace: default
  annotations:
    service.beta.kubernetes.io/aws-load-balancer-scheme: "internal"
    service.beta.kubernetes.io/aws-load-balancer-internal: "true"
spec:
  selector:
    run: demo-service
  ports:
    - port: 80
      targetPort: 8080
  type: LoadBalancer
  externalTrafficPolicy: Local
  # NOTE: this limits the source IPs that are allowed to connect to our service.  It
  #       is being used as part of this demo, restricting connectivity to our egress
  #       IP addresses only.
  # NOTE: these egress IPs are within the subnet range(s) in which my worker nodes
  #       are deployed.
  loadBalancerSourceRanges:
    - 10.10.100.254/32
    - 10.10.150.254/32
    - 10.10.200.254/32
    - 10.10.100.253/32
    - 10.10.150.253/32
    - 10.10.200.253/32
EOF
```

Retrieve the load balancer hostname as the **LOAD_BALANCER_HOSTNAME** environment variable which you can copy and use for following steps:

```
$ export LOAD_BALANCER_HOSTNAME=$(oc get svc -n default demo-service -o json | jq -r
'.status.loadBalancer.ingress[].hostname')
```

15.5.2. Test namespace egress

Test the namespace egress rule which was created previously. The following starts an interactive shell which allows you to run curl against the demo service:

```
$ oc run \
  demo-egress-ns \
  -it \
  --namespace=demo-egress-ns \
  --env=LOAD_BALANCER_HOSTNAME=$LOAD_BALANCER_HOSTNAME \
  --image=registry.access.redhat.com/ubi9/ubi -- \
  bash
```

Once inside the pod, you can send a request to the load balancer, ensuring that you can successfully connect:

```
$ curl -s http://$LOAD_BALANCER_HOSTNAME
```

You should see output similar to the following, indicating a successful connection. It should be noted that the **client_address** below is the internal IP address of the load balancer rather than our egress IP. Successful connectivity (by limiting the service to **.spec.loadBalancerSourceRanges**) is what provides a successful demonstration:

Example output

```
CLIENT VALUES:
client_address=10.10.207.247
command=GET
real path=/
query=nil
```

```
request_version=1.1
request_uri=http://internal-a3e61de18bfca4a53a94a208752b7263-148284314.us-east-
1.elb.amazonaws.com:8080/

SERVER VALUES:
server_version=nginx: 1.10.0 - lua: 10001

HEADERS RECEIVED:
accept=*/*
host=internal-a3e61de18bfca4a53a94a208752b7263-148284314.us-east-1.elb.amazonaws.com
user-agent=curl/7.76.1
BODY:
-no body in request-
```

You can safely exit the pod once you are done:

```
$ exit
```

15.5.3. Test pod egress

Test the pod egress rule which was created previously. The following starts an interactive shell which allows you to run curl against the demo service:

```
$ oc run \
  demo-egress-pod \
  -it \
  --namespace=demo-egress-pod \
  --env=LOAD_BALANCER_HOSTNAME=$LOAD_BALANCER_HOSTNAME \
  --image=registry.access.redhat.com/ubi9/ubi -- \
  bash
```

Once inside the pod, you can send a request to the load balancer, ensuring that you can successfully connect:

```
$ curl -s http://$LOAD_BALANCER_HOSTNAME
```

You should see output similar to the following, indicating a successful connection. It should be noted that the **client_address** below is the internal IP address of the load balancer rather than our egress IP. Successful connectivity (by limiting the service to **.spec.loadBalancerSourceRanges**) is what provides a successful demonstration:

Example output

```
CLIENT VALUES:
client_address=10.10.207.247
command=GET
real path=/
query=nil
request_version=1.1
request_uri=http://internal-a3e61de18bfca4a53a94a208752b7263-148284314.us-east-
1.elb.amazonaws.com:8080/

SERVER VALUES:
server_version=nginx: 1.10.0 - lua: 10001
```

```
HEADERS RECEIVED:
accept=*/*
host=internal-a3e61de18bfca4a53a94a208752b7263-148284314.us-east-1.elb.amazonaws.com
user-agent=curl/7.76.1
BODY:
-no body in request-
```

You can safely exit the pod once you are done:

```
$ exit
```

15.5.4. Test blocked egress

Alternatively to a successful connection, you can see that the traffic is successfully blocked when the egress rules do not apply. Unsuccessful connectivity (by limiting the service to **.spec.loadBalancerSourceRanges**) is what provides a successful demonstration in this scenario:

```
$ oc run \
  demo-egress-pod-fail \
  -it \
  --namespace=demo-egress-pod \
  --env=LOAD_BALANCER_HOSTNAME=$LOAD_BALANCER_HOSTNAME \
  --image=registry.access.redhat.com/ubi9/ubi -- \
  bash
```

Once inside the pod, you can send a request to the load balancer:

```
$ curl -s http://$LOAD_BALANCER_HOSTNAME
```

The above command should hang. You can safely exit the pod once you are done:

```
$ exit
```

15.6. CLEAN UP

You can cleanup your cluster by running the following commands:

```
$ oc delete svc demo-service -n default; \
$ oc delete pod demo-service -n default; \
$ oc delete project demo-egress-ns; \
$ oc delete project demo-egress-pod; \
$ oc delete egressip demo-egress-ns; \
$ oc delete egressip demo-egress-pod
```

You can cleanup the assigned node labels by running the following commands:

WARNING

If you are reliant upon any node labels for your machinepool, this command will replace those labels. Be sure to input your desired labels into the **--labels** field to ensure your node labels persist.

```
$ rosa update machinepool ${ROSA_MACHINE_POOL_NAME} \
  --cluster="${ROSA_CLUSTER_NAME}" \
  --labels ""
```

CHAPTER 16. GETTING STARTED WITH ROSA

16.1. TUTORIAL: WHAT IS ROSA

Red Hat OpenShift Service on AWS (ROSA) is a fully-managed turnkey application platform that allows you to focus on what matters most, delivering value to your customers by building and deploying applications. Red Hat and AWS SRE experts manage the underlying platform so you do not have to worry about infrastructure management. ROSA provides seamless integration with a wide range of AWS compute, database, analytics, machine learning, networking, mobile, and other services to further accelerate the building and delivering of differentiating experiences to your customers.

ROSA makes use of AWS Security Token Service (STS) to obtain credentials to manage infrastructure in your AWS account. AWS STS is a global web service that creates temporary credentials for IAM users or federated users. ROSA uses this to assign short-term, limited-privilege, security credentials. These credentials are associated with IAM roles that are specific to each component that makes AWS API calls. This method aligns with the principals of least privilege and secure practices in cloud service resource management. The ROSA command line interface (CLI) tool manages the STS credentials that are assigned for unique tasks and takes action on AWS resources as part of OpenShift functionality.

16.1.1. Key features of ROSA

- **Native AWS service:** Access and use Red Hat OpenShift on-demand with a self-service onboarding experience through the AWS management console.

- **Flexible, consumption-based pricing:** Scale to your business needs and pay as you go with flexible pricing and an on-demand hourly or annual billing model.

- **Single bill for Red Hat OpenShift and AWS usage:** Customers will receive a single bill from AWS for both Red Hat OpenShift and AWS consumption.

- **Fully integrated support experience:** Installation, management, maintenance, and upgrades are performed by Red Hat site reliability engineers (SREs) with joint Red Hat and Amazon support and a 99.95% service-level agreement (SLA).

- **AWS service integration:** AWS has a robust portfolio of cloud services, such as compute, storage, networking, database, analytics, and machine learning. All of these services are directly accessible through ROSA. This makes it easier to build, operate, and scale globally and on-demand through a familiar management interface.

- **Maximum Availability:** Deploy clusters across multiple availability zones in supported regions to maximize availability and maintain high availability for your most demanding mission-critical applications and data.

- **Cluster node scaling:** Easily add or remove compute nodes to match resource demand.

- **Optimized clusters:** Choose from memory-optimized, compute-optimized, or general purpose EC2 instance types with clusters sized to meet your needs.

- **Global availability:** Refer to the product regional availability page to see where ROSA is available globally.

16.1.2. ROSA and Kubernetes

In ROSA, everything you need to deploy and manage containers is bundled, including container management, Operators, networking, load balancing, service mesh, CI/CD, firewall, monitoring, registry, authentication, and authorization capabilities. These components are tested together for unified operations as a complete platform. Automated cluster operations, including over-the-air platform upgrades, further enhance your Kubernetes experience.

16.1.3. Basic responsibilities

In general, cluster deployment and upkeep is Red Hat's or AWS's responsibility, while applications, users, and data is the customer's responsibility. For a more detailed breakdown of responsibilities, see the responsibility matrix.

16.1.4. Roadmap and feature requests

Visit the ROSA roadmap to stay up-to-date with the status of features currently in development. Open a new issue if you have any suggestions for the product team.

16.1.5. AWS region availability

Refer to the product regional availability page for an up-to-date view of where ROSA is available.

16.1.6. Compliance certifications

ROSA is currently compliant with SOC-2 type 2, SOC 3, ISO-27001, ISO 27017, ISO 27018, HIPAA, GDPR, and PCI-DSS. We are also currently working towards FedRAMP High.

16.1.7. Nodes

16.1.7.1. Worker nodes across multiple AWS regions

All nodes in a ROSA cluster must be located in the same AWS region. For clusters configured for multiple availability zones, control plane nodes and worker nodes will be distributed across the availability zones.

16.1.7.2. Minimum number of worker nodes

For a ROSA cluster, the minimum is 2 worker nodes for single availability zone and 3 worker nodes for multiple availability zones.

16.1.7.3. Underlying node operating system

As with all OpenShift v4.x offerings, the control plane, infra and worker nodes run Red Hat Enterprise Linux CoreOS (RHCOS).

16.1.7.4. Node hibernation or shut-down

At this time, ROSA does not have a hibernation or shut-down feature for nodes. The shutdown and hibernation feature is an OpenShift platform feature that is not yet mature enough for widespread cloud services use.

16.1.7.5. Supported instances for worker nodes

For a complete list of supported instances for worker nodes see AWS instance types. Spot instances are also supported.

16.1.7.6. Node autoscaling

Autoscaling allows you to automatically adjust the size of the cluster based on the current workload. See About autoscaling nodes on a cluster for more details.

16.1.7.7. Maximum number of worker nodes

The maximum number of worker nodes is 180 worker nodes for each ROSA cluster. See limits and scalability for more details on node counts.

A list of the account-wide and per-cluster roles is provided in the ROSA documentation.

16.1.8. Administrators

A ROSA customer’s administrator can manage users and quotas in addition to accessing all user-created projects.

16.1.9. OpenShift versions and upgrades

ROSA is a managed service which is based on OpenShift Container Platform. You can view the current version and life cycle dates in the ROSA documentation.

Customers can upgrade to the newest version of OpenShift and use the features from that version of OpenShift. For more information, see life cycle dates. Not all OpenShift features are be available on ROSA. Review the Service Definition for more information.

16.1.10. Support

You can open a ticket directly from the OpenShift Cluster Manager. See the ROSA support documentation for more details about obtaining support.

You can also visit the Red Hat Customer Portal to search or browse through the Red Hat knowledge base of articles and solutions relating to Red Hat products or submit a support case to Red Hat Support.

16.1.10.1. Limited support

If a ROSA cluster is not upgraded before the "end of life" date, the cluster continues to operate in a limited support status. The SLA for that cluster will no longer be applicable, but you can still get support for that cluster. See the limited support status documentation for more details.

Additional support resources

- Red Hat Support
- AWS Support
  AWS support customers must have a valid AWS support contract

16.1.11. Service-level agreement (SLA)

Refer to the ROSA SLA page for details.

16.1.12. Notifications and communication

Red Hat will provide notifications regarding new Red Hat and AWS features, updates, and scheduled maintenance through email and the Hybrid Cloud Console service log.

16.1.13. Open Service Broker for AWS (OBSA)

You can use OSBA with ROSA. However, the preferred method is the more recent AWS Controller for Kubernetes. See Open Service Broker for AWS for more information on OSBA.

16.1.14. Offboarding

Customers can stop using ROSA at any time and move their applications to on-premise, a private cloud, or other cloud providers. Standard reserved instances (RI) policy applies for unused RI.

16.1.15. Authentication

ROSA supports the following authentication mechanisms: OpenID Connect (a profile of OAuth2), Google OAuth, GitHub OAuth, GitLab, and LDAP.

16.1.16. SRE cluster access

All SRE cluster access is secured by MFA. See SRE access for more details.

16.1.17. Encryption

16.1.17.1. Encryption keys

ROSA uses a key stored in KMS to encrypt EBS volumes. Customers also have the option to provide their own KMS keys at cluster creation.

16.1.17.2. KMS keys

If you specify a KMS key, the control plane, infrastructure and worker node root volumes and the persistent volumes are encrypted with the key.

16.1.17.3. Data encryption

By default, there is encryption at rest. The AWS Storage platform automatically encrypts your data before persisting it and decrypts the data before retrieval. See AWS EBS Encryption for more details.

You can also encrypt etcd in the cluster, combining it with AWS storage encryption. This results in double the encryption which adds up to a 20% performance hit. For more details see the etcd encryption documentation.

16.1.17.4. etcd encryption

etcd encryption can only be enabled at cluster creation.

NOTE

etcd encryption incurs additional overhead with negligible security risk mitigation.

16.1.17.5. etcd encryption configuration

etcd encryption is configured the same as in OpenShift Container Platform. The aescbc cypher is used and the setting is patched during cluster deployment. For more details, see the Kubernetes documentation.

16.1.17.6. Multi-region KMS keys for EBS encryption

Currently, the ROSA CLI does not accept multi-region KMS keys for EBS encryption. This feature is in our backlog for product updates. The ROSA CLI accepts single region KMS keys for EBS encryption if it is defined at cluster creation.

16.1.18. Infrastructure

ROSA uses several different cloud services such as virtual machines, storage, and load balancers. You can see a defined list in the AWS prerequisites.

16.1.19. Credential methods

There are two credential methods to grant Red Hat the permissions needed to perform the required actions in your AWS account: AWS with STS or an IAM user with admin permissions. AWS with STS is the preferred method, and the IAM user method will eventually be deprecated. AWS with STS better aligns with the principles of least privilege and secure practices in cloud service resource management.

16.1.20. Prerequisite permission or failure errors

Check for a newer version of the ROSA CLI. Every release of the ROSA CLI is located in two places: Github and the Red Hat signed binary releases.

16.1.21. Storage

Refer to the storage section of the service definition.

OpenShift includes the CSI driver for AWS EFS. For more information, see Setting up AWS EFS for Red Hat OpenShift Service on AWS.

16.1.22. Using a VPC

At installation you can select to deploy to an existing VPC or bring your own VPC. You can then select the required subnets and provide a valid CIDR range that encompasses the subnets for the installation program when using those subnets.

ROSA allows multiple clusters to share the same VPC. The number of clusters on one VPC is limited by the remaining AWS resource quota and CIDR ranges that cannot overlap. See CIDR Range Definitions for more information.

16.1.23. Network plugin

ROSA uses the OpenShift OVN-Kubernetes default CNI network provider.

16.1.24. Cross-namespace networking

Cluster admins can customize, and deny, cross-namespace on a project basis using NetworkPolicy objects. Refer to Configuring multitenant isolation with network policy for more information.

16.1.25. Using Prometheus and Grafana

You can use Prometheus and Grafana to monitor containers and manage capacity using OpenShift User Workload Monitoring. This is a check-box option in the OpenShift Cluster Manager.

16.1.26. Audit logs output from the cluster control-plane

If the Cluster Logging Operator Add-on has been added to the cluster then audit logs are available through CloudWatch. If it has not, then a support request would allow you to request some audit logs. Small targeted and time-boxed logs can be requested for export and sent to a customer. The selection of audit logs available are at the discretion of SRE in the category of platform security and compliance. Requests for exports of a cluster's entirety of logs will be rejected.

16.1.27. AWS Permissions Boundary

You can use an AWS Permissions Boundary around the policies for your cluster.

16.1.28. AMI

ROSA worker nodes use a different AMI from OSD and OpenShift Container Platform. Control Plane and Infra node AMIs are common across products in the same version.

16.1.29. Cluster backups

ROSA STS clusters do not have backups. Users must have their own backup policies for applications and data. See our backup policy for more information.

16.1.30. Custom domain

You can define a custom domain for your applications. See Configuring custom domains for applications for more information.

16.1.31. ROSA domain certificates

Red Hat infrastructure (Hive) manages certificate rotation for default application ingress.

16.1.32. Disconnected environments

ROSA does not support an air-gapped, disconnected environment. The ROSA cluster must have egress to the internet to access our registry, S3, and send metrics. The service requires a number of egress endpoints. Ingress can be limited to a PrivateLink for Red Hat SREs and a VPN for customer access.

Additional Resources

- ROSA product pages:
  - Red Hat product page
  - AWS product page
  - Red Hat customer portal
- ROSA specific resources

  - AWS ROSA getting started guide
  - ROSA documentation
  - ROSA service definition
  - ROSA responsibility assignment matrix
  - Understanding Process and Security
  - About Availability
  - Updates Lifecycle
  - Limits and Scalability
  - ROSA roadmap
- Learn about OpenShift
- OpenShift Cluster Manager
- Red Hat Support

16.2. TUTORIAL: ROSA WITH AWS STS EXPLAINED

This tutorial outlines the two options for allowing Red Hat OpenShift Service on AWS (ROSA) to interact with resources in a user's Amazon Web Service (AWS) account. It details the components and processes that ROSA with Security Token Service (STS) uses to obtain the necessary credentials. It also reviews why ROSA with STS is the more secure, preferred method.

NOTE

This content currently covers ROSA Classic with AWS STS and not does yet account for ROSA with hosted control planes (HCP) with AWS STS.

This tutorial will:

- Enumerate two of the deployment options:
  - ROSA with IAM Users
  - ROSA with STS
- Explain the differences between the two options
- Explain why ROSA with STS is more secure and the preferred option
- Explain how ROSA with STS works

16.2.1. Different credential methods to deploy ROSA

As part of ROSA, Red Hat manages infrastructure resources in your AWS account and must be granted the necessary permissions. There are currently two supported methods for granting those permissions:

- Using static IAM user credentials with an **AdministratorAccess** policy

This is referred to as "ROSA with IAM Users" in this tutorial. It is not the preferred credential method.

- Using AWS STS with short-lived, dynamic tokens
  This is referred to as “ROSA with STS” in this tutorial. It is the preferred credential method.

16.2.1.1. Rosa with IAM Users

When ROSA was first released, the only credential method was ROSA with IAM Users. This method grants IAM users with an **AdministratorAccess** policy full access to create the necessary resources in the AWS account that uses ROSA. The cluster can then create and expand its credentials as needed.

16.2.1.2. ROSA with STS

ROSA with STS grants users limited, short-term access to resources in your AWS account. The STS method uses predefined roles and policies to grant temporary, least-privilege permissions to IAM users or authenticated federated users. The credentials typically expire an hour after being requested. Once expired, they are no longer recognized by AWS and no longer have account access from API requests made with them. For more information, see the AWS documentation. While both ROSA with IAM Users and ROSA with STS are currently enabled, ROSA with STS is the preferred and recommended option.

16.2.2. ROSA with STS security

Several crucial components make ROSA with STS more secure than ROSA with IAM Users:

- An explicit and limited set of roles and policies that the user creates ahead of time. The user knows every requested permission and every role used.
- The service cannot do anything outside of those permissions.
- Whenever the service needs to perform an action, it obtains credentials that expire in one hour or less. This means that there is no need to rotate or revoke credentials. Additionally, credential expiration reduces the risks of credentials leaking and being reused.

16.2.3. AWS STS explained

ROSA uses AWS STS to grant least-privilege permissions with short-term security credentials to specific and segregated IAM roles. The credentials are associated with IAM roles specific to each component and cluster that makes AWS API calls. This method aligns with principles of least-privilege and secure practices in cloud service resource management. The ROSA command line interface (CLI) tool manages the STS roles and policies that are assigned for unique tasks and takes action upon AWS resources as part of OpenShift functionality.

STS roles and policies must be created for each ROSA cluster. To make this easier, the installation tools provide all the commands and files needed to create the roles as policies and an option to allow the CLI to automatically create the roles and policies. See Creating a ROSA cluster with STS using customizations for more information about the different **--mode** options.

16.2.4. Components specific to ROSA with STS

- **AWS infrastructure** - This provides the infrastructure required for the cluster. It contains the actual EC2 instances, storage, and networking components. See AWS compute types to see supported instance types for compute nodes and provisioned AWS infrastructure for control plane and infrastructure node configuration.

- **AWS STS** - See the credential method section above.
- **OpenID Connect (OIDC)** - This provides a mechanism for cluster Operators to authenticate with AWS, assume the cluster roles through a trust policy, and obtain temporary credentials from STS to make the required API calls.
- **Roles and policies** - The roles and policies are one of the main differences between ROSA with STS and ROSA with IAM Users. For ROSA with STS, the roles and policies used by ROSA are broken into account-wide roles and policies and Operator roles and policies.
  The policies determine the allowed actions for each of the roles. See About IAM resources for ROSA clusters that use STS for more details about the individual roles and policies.
  - The account-wide roles are:
    - ManagedOpenShift-Installer-Role
    - ManagedOpenShift-ControlPlane-Role
    - ManagedOpenShift-Worker-Role
    - ManagedOpenShift-Support-Role
  - The account-wide policies are:
    - ManagedOpenShift-Installer-Role-Policy
    - ManagedOpenShift-ControlPlane-Role-Policy
    - ManagedOpenShift-Worker-Role-Policy
    - ManagedOpenShift-Support-Role-Policy
    - ManagedOpenShift-openshift-ingress-operator-cloud-credentials [1]
    - ManagedOpenShift-openshift-cluster-csi-drivers-ebs-cloud-credent [1]
    - ManagedOpenShift-openshift-cloud-network-config-controller-cloud [1]
    - ManagedOpenShift-openshift-machine-api-aws-cloud-credentials [1]
    - ManagedOpenShift-openshift-cloud-credential-operator-cloud-crede [1]
    - ManagedOpenShift-openshift-image-registry-installer-cloud-creden [1]

      1. This policy is used by the cluster Operator roles, listed below. The Operator roles are created in a second step because they are dependent on an existing cluster name and cannot be created at the same time as the account-wide roles.
  - The Operator roles are:
    - <cluster-name\>-xxxx-openshift-cluster-csi-drivers-ebs-cloud-credent
    - <cluster-name\>-xxxx-openshift-cloud-network-config-controller-cloud
    - <cluster-name\>-xxxx-openshift-machine-api-aws-cloud-credentials
    - <cluster-name\>-xxxx-openshift-cloud-credential-operator-cloud-crede

    - <cluster-name\>-xxxx-openshift-image-registry-installer-cloud-creden
    - <cluster-name\>-xxxx-openshift-ingress-operator-cloud-credentials
  - Trust policies are created for each account-wide and Operator role.

16.2.5. Deploying a ROSA STS cluster

You are not expected to create the resources listed in the below steps from scratch. The ROSA CLI creates the required JSON files for you and outputs the commands you need. The ROSA CLI can also take this a step further and run the commands for you, if desired.

Steps to deploy a ROSA with STS cluster

1. Create the account-wide roles and policies.
2. Assign the permissions policy to the corresponding account-wide role.
3. Create the cluster.
4. Create the Operator roles and policies.
5. Assign the permission policy to the corresponding Operator role.
6. Create the OIDC provider.

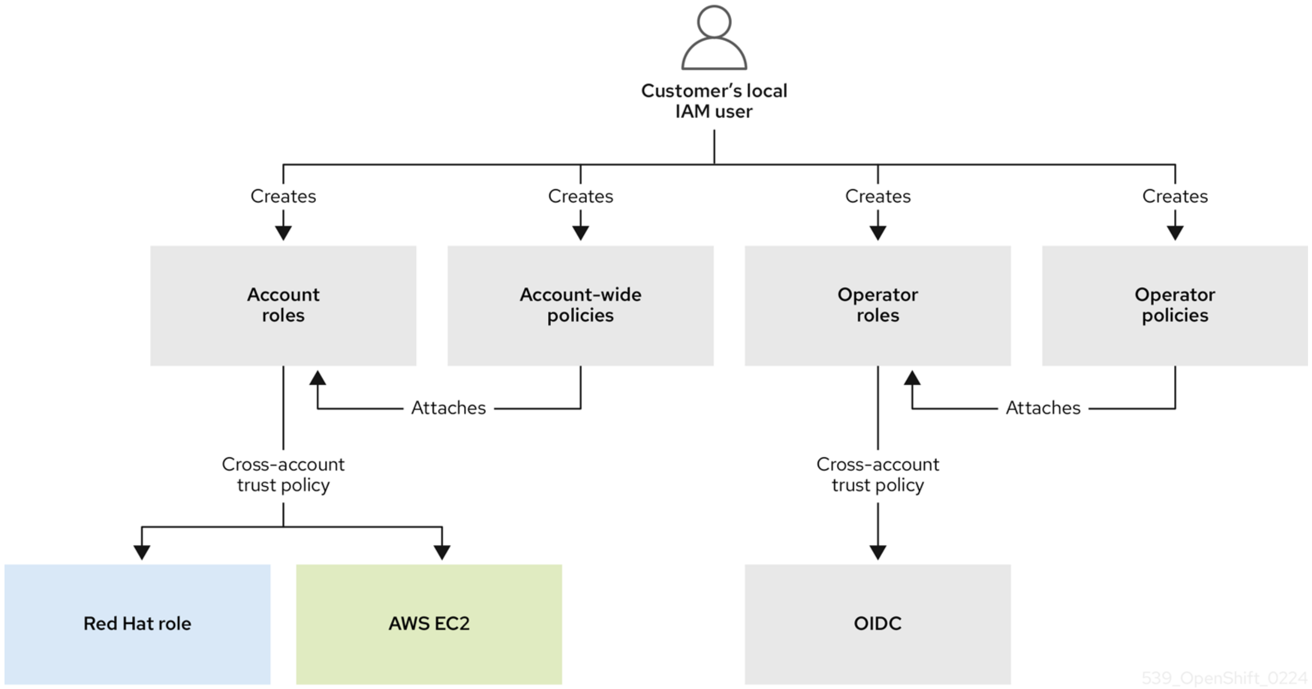
The roles and policies can be created automatically by the ROSA CLI, or they can be manually created by utilizing the **--mode manual** or **--mode auto** flags in the ROSA CLI. For further details about deployment, see Creating a cluster with customizations or the Deploying the cluster tutorial.

16.2.6. ROSA with STS workflow

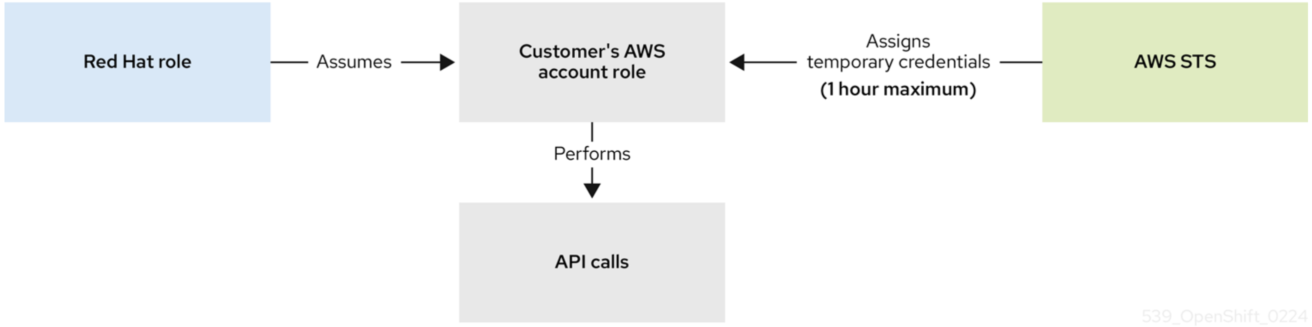
The user creates the required account-wide roles and account-wide policies. For more information, see the components section in this tutorial. During role creation, a trust policy, known as a cross-account trust policy, is created which allows a Red Hat-owned role to assume the roles. Trust policies are also created for the EC2 service, which allows workloads on EC2 instances to assume roles and obtain credentials. The user can then assign a corresponding permissions policy to each role.

After the account-wide roles and policies are created, the user can create a cluster. Once cluster creation is initiated, the Operator roles are created so that cluster Operators can make AWS API calls. These roles are then assigned to the corresponding permission policies that were created earlier and a trust policy with an OIDC provider. The Operator roles differ from the account-wide roles in that they ultimately represent the pods that need access to AWS resources. Because a user cannot attach IAM roles to pods, they must create a trust policy with an OIDC provider so that the Operator, and therefore the pods, can access the roles they need.

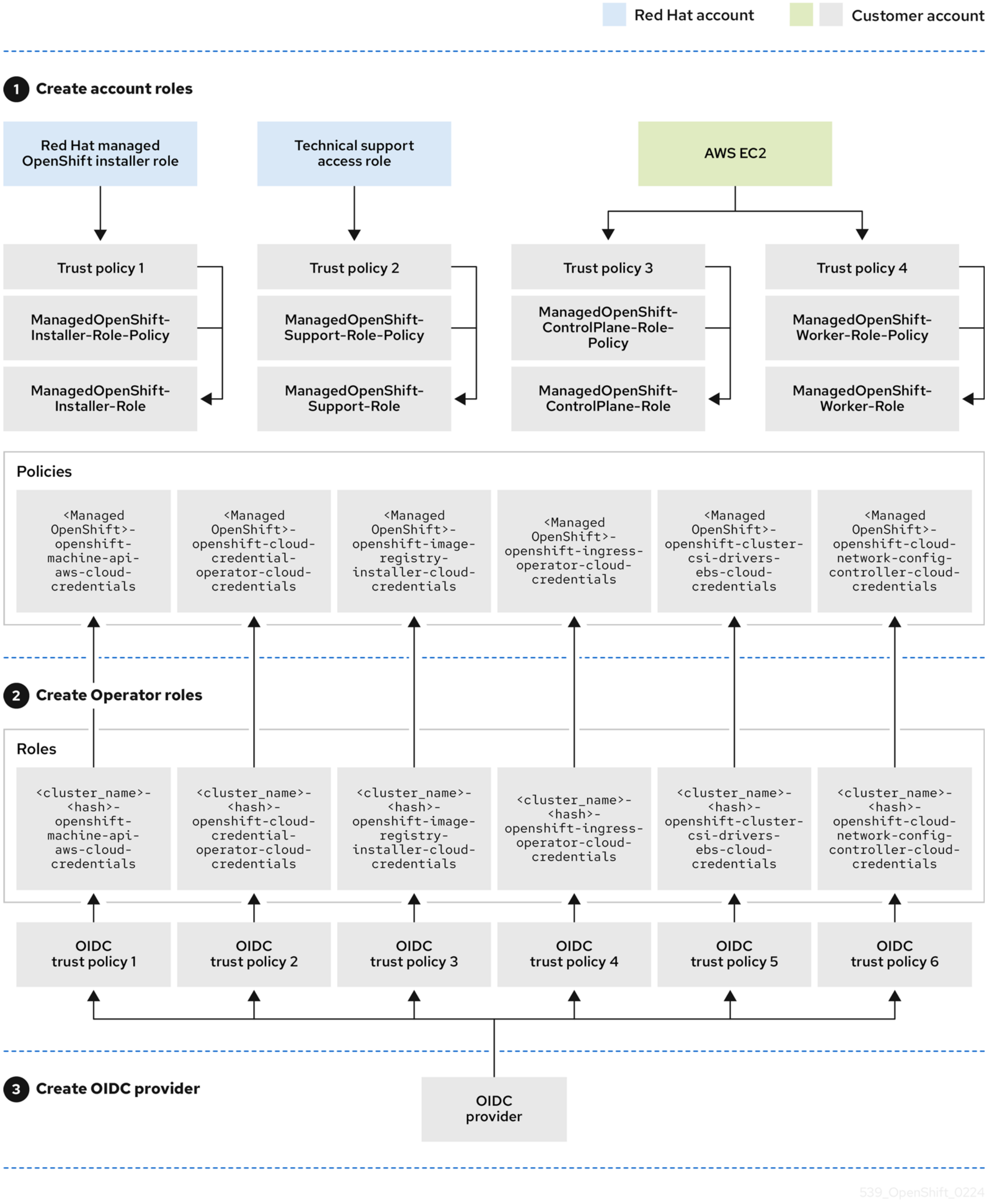
Once the user assigns the roles to the corresponding policy permissions, the final step is creating the OIDC provider.



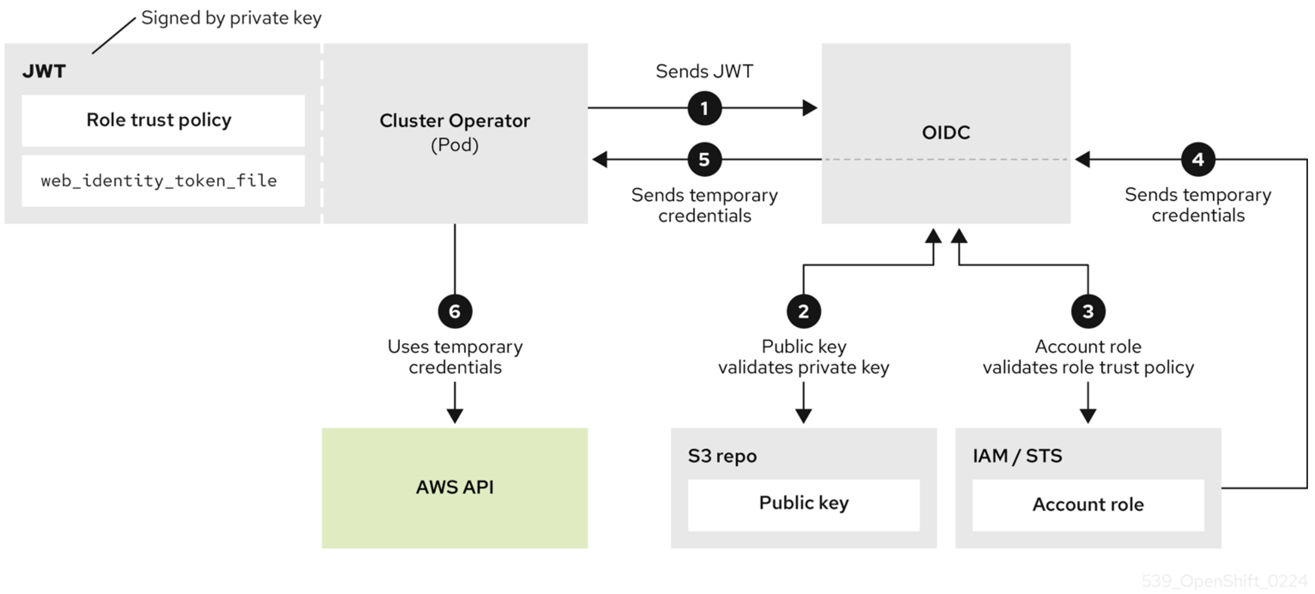
When a new role is needed, the workload currently using the Red Hat role will assume the role in the AWS account, obtain temporary credentials from AWS STS, and begin performing the actions using API calls within the customer's AWS account as permitted by the assumed role's permissions policy. The credentials are temporary and have a maximum duration of one hour.


Red Hat role
Assumes
Customer's AWS account role
Assigns temporary credentials (1 hour maximum)
AWS STS
Performs
API calls
539_OpenShift_0224

The entire workflow is depicted in the following graphic:


Red Hat account
Customer account
1 Create account roles
Red Hat managed OpenShift installer role
Technical support access role
AWS EC2
Trust policy 1
ManagedOpenShift-Installer-Role-Policy
ManagedOpenShift-Installer-Role
Trust policy 2
ManagedOpenShift-Support-Role-Policy
ManagedOpenShift-Support-Role
Trust policy 3
ManagedOpenShift-ControlPlane-Role-Policy
ManagedOpenShift-ControlPlane-Role
Trust policy 4
ManagedOpenShift-Worker-Role-Policy
ManagedOpenShift-Worker-Role
Policies
<Managed OpenShift>-openshift-machine-api-aws-cloud-credentials
<Managed OpenShift>-openshift-cloud-credential-operator-cloud-credentials
<Managed OpenShift>-openshift-image-registry-installer-cloud-credentials
<Managed OpenShift>-openshift-ingress-operator-cloud-credentials
<Managed OpenShift>-openshift-cluster-csi-drivers-ebs-cloud-credentials
<Managed OpenShift>-openshift-cloud-network-config-controller-cloud-credentials
2 Create Operator roles
Roles
<cluster_name>-<hash>-openshift-machine-api-aws-cloud-credentials
<cluster_name>-<hash>-openshift-cloud-credential-operator-cloud-credentials
<cluster_name>-<hash>-openshift-image-registry-installer-cloud-credentials
<cluster_name>-<hash>-openshift-ingress-operator-cloud-credentials
<cluster_name>-<hash>-openshift-cluster-csi-drivers-ebs-cloud-credentials
<cluster_name>-<hash>-openshift-cloud-network-config-controller-cloud-credentials
OIDC trust policy 1
OIDC trust policy 2
OIDC trust policy 3
OIDC trust policy 4
OIDC trust policy 5
OIDC trust policy 6
3 Create OIDC provider
OIDC provider
539_OpenShift_0224

Operators use the following process to obtain the requisite credentials to perform their tasks. Each Operator is assigned an Operator role, a permissions policy, and a trust policy with an OIDC provider. The Operator will assume the role by passing a JSON web token that contains the role and a token file (**web_identity_token_file**) to the OIDC provider, which then authenticates the signed key with a public key. The public key is created during cluster creation and stored in an S3 bucket. The Operator then confirms that the subject in the signed token file matches the role in the role trust policy which ensures that the OIDC provider can only obtain the allowed role. The OIDC provider then returns the temporary credentials to the Operator so that the Operator can make AWS API calls. For a visual representation, see below:



16.2.7. ROSA with STS use cases

Creating nodes at cluster install

The Red Hat installation program uses the **RH-Managed-OpenShift-Installer** role and a trust policy to assume the **Managed-OpenShift-Installer-Role** role in the customer's account. This process returns temporary credentials from AWS STS. The installation program begins making the required API calls with the temporary credentials just received from STS. The installation program creates the required infrastructure in AWS. The credentials expire within an hour and the installation program no longer has access to the customer's account.

The same process also applies for support cases. In support cases, a Red Hat site reliability engineer (SRE) replaces the installation program.

Scaling the cluster

The **machine-api-operator** uses AssumeRoleWithWebIdentity to assume the **machine-api-aws-cloud-credentials** role. This launches the sequence for the cluster Operators to receive the credentials. The **machine-api-operator** role can now make the relevant API calls to add more EC2 instances to the cluster.

16.3. DEPLOYING A CLUSTER

16.3.1. Tutorial: Choosing a deployment method

This tutorial outlines the different ways to deploy a cluster. Choose the deployment method that best fits your preferences and needs.

16.3.1.1. Deployment options

If you want:

- Only the necessary CLI commands - Simple CLI guide
- A user interface - Simple UI guide

- The CLI commands with details - Detailed CLI guide
- A user interface with details - Detailed UI guide
- To experiment with the newest ROSA technologies - ROSA with HCP

All of the above deployment options work well for this tutorial. If you are doing this tutorial for the first time, the Simple CLI guide is the simplest and recommended method.

16.3.2. Tutorial: Simple CLI guide

This page outlines the minimum list of commands to deploy a Red Hat OpenShift Service on AWS (ROSA) cluster using the command line interface (CLI).

> **NOTE**
>
> While this simple deployment works well for a tutorial setting, clusters used in production should be deployed with a more detailed method.

16.3.2.1. Prerequisites

- You have completed the prerequisites in the Setup tutorial.

16.3.2.2. Creating account roles

Run the following command *once* for each AWS account and y-stream OpenShift version:

```
rosa create account-roles --mode auto --yes
```

16.3.2.3. Deploying the cluster

1. Create the cluster with the default configuration by running the following command substituting your own cluster name:

   ```
   rosa create cluster --cluster-name <cluster-name> --sts --mode auto --yes
   ```

2. Check the status of your cluster by running the following command:

   ```
   rosa list clusters
   ```

16.3.3. Tutorial: Detailed CLI guide

This tutorial outlines the detailed steps to deploy a ROSA cluster using the ROSA CLI.

16.3.3.1. CLI deployment modes

There are two modes with which to deploy a ROSA cluster. One is automatic, which is quicker and performs the manual work for you. The other is manual, requires you to run extra commands, and allows you to inspect the roles and policies being created. This tutorial documents both options.

If you want to create a cluster quickly, use the automatic option. If you prefer exploring the roles and policies being created, use the manual option.

Choose the deployment mode by using the **--mode** flag in the relevant commands.

Valid options for **--mode** are:

- **manual:** Role and policies are created and saved in the current directory. You must manually run the provided commands as the next step. This option allows you to review the policy and roles before creating them.
- **auto:** Roles and policies are created and applied automatically using the current AWS account.

TIP

You can use either deployment method for this tutorial. The **auto** mode is faster and has less steps.

16.3.3.2. Deployment workflow

The overall deployment workflow follows these steps:

1. **rosa create account-roles** - This is executed only *once* for each account. Once created, the account roles do **not** need to be created again for more clusters of the same y-stream version.
2. **rosa create cluster**
3. **rosa create operator-roles** - For manual mode only.
4. **rosa create oidc-provider** - For manual mode only.

For each additional cluster in the same account for the same y-stream version, only step 2 is needed for automatic mode. Steps 2 through 4 are needed for manual mode.

16.3.3.3. Automatic mode

Use this method if you want the ROSA CLI to automate the creation of the roles and policies to create your cluster quickly.

16.3.3.3.1. Creating account roles

If this is the *first time* you are deploying ROSA in this account and you have *not* yet created the account roles, then create the account-wide roles and policies, including Operator policies.

Run the following command to create the account-wide roles:

```
rosa create account-roles --mode auto --yes
```

Example output

```
I: Creating roles using 'arn:aws:iam::000000000000:user/rosa-user'
I: Created role 'ManagedOpenShift-ControlPlane-Role' with ARN
'arn:aws:iam::000000000000:role/ManagedOpenShift-ControlPlane-Role'
I: Created role 'ManagedOpenShift-Worker-Role' with ARN
'arn:aws:iam::000000000000:role/ManagedOpenShift-Worker-Role'
I: Created role 'ManagedOpenShift-Support-Role' with ARN
'arn:aws:iam::000000000000:role/ManagedOpenShift-Support-Role'
I: Created role 'ManagedOpenShift-Installer-Role' with ARN
'arn:aws:iam::000000000000:role/ManagedOpenShift-Installer-Role'
```

```
I: Created policy with ARN 'arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-machine-api-aws-cloud-credentials'
I: Created policy with ARN 'arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-cloud-credential-operator-cloud-crede'
I: Created policy with ARN 'arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-image-registry-installer-cloud-creden'
I: Created policy with ARN 'arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-ingress-operator-cloud-credentials'
I: Created policy with ARN 'arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-cluster-csi-drivers-ebs-cloud-credent'
I: To create a cluster with these roles, run the following command:
   rosa create cluster --sts
```

16.3.3.3.2. Creating a cluster

Run the following command to create a cluster with all the default options:

```
rosa create cluster --cluster-name <cluster-name> --sts --mode auto --yes
```

NOTE

This will also create the required Operator roles and OIDC provider. If you want to see all available options for your cluster use the **--help** flag or **--interactive** for interactive mode.

Example input

```
$ rosa create cluster --cluster-name my-rosa-cluster --sts --mode auto --yes
```

Example output

```
I: Creating cluster 'my-rosa-cluster'
I: To view a list of clusters and their status, run 'rosa list clusters'
I: Cluster 'my-rosa-cluster' has been created.
I: Once the cluster is installed you will need to add an Identity Provider before you can login into the cluster. See 'rosa create idp --help' for more information.
I: To determine when your cluster is Ready, run 'rosa describe cluster -c my-rosa-cluster'.
I: To watch your cluster installation logs, run 'rosa logs install -c my-rosa-cluster --watch'.
Name:                       my-rosa-cluster
ID:                      1mlhulb3bo0l54ojd0ji000000000000
External ID:
OpenShift Version:
Channel Group:              stable
DNS:                        my-rosa-cluster.ibhp.p1.openshiftapps.com
AWS Account:                000000000000
API URL:
Console URL:
Region:                     us-west-2
Multi-AZ:                   false
Nodes:
- Master:                  3
- Infra:                  2
- Compute:                  2
Network:
```

```
- Service CIDR:          172.30.0.0/16
- Machine CIDR:          10.0.0.0/16
- Pod CIDR:              10.128.0.0/14
- Host Prefix:           /23
STS Role ARN:            arn:aws:iam::000000000000:role/ManagedOpenShift-Installer-Role
Support Role ARN:        arn:aws:iam::000000000000:role/ManagedOpenShift-Support-Role
Instance IAM Roles:
- Master:                arn:aws:iam::000000000000:role/ManagedOpenShift-ControlPlane-Role
- Worker:                arn:aws:iam::000000000000:role/ManagedOpenShift-Worker-Role
Operator IAM Roles:
- arn:aws:iam::000000000000:role/my-rosa-cluster-openshift-image-registry-installer-cloud-
credentials
- arn:aws:iam::000000000000:role/my-rosa-cluster-openshift-ingress-operator-cloud-credentials
- arn:aws:iam::000000000000:role/my-rosa-cluster-openshift-cluster-csi-drivers-ebs-cloud-credentials
- arn:aws:iam::000000000000:role/my-rosa-cluster-openshift-machine-api-aws-cloud-credentials
- arn:aws:iam::000000000000:role/my-rosa-cluster-openshift-cloud-credential-operator-cloud-
credential-oper
State:                   waiting (Waiting for OIDC configuration)
Private:                 No
Created:                 Oct 28 2021 20:28:09 UTC
Details Page:
https://console.redhat.com/openshift/details/s/1wupmiQy45xr1nN000000000000
OIDC Endpoint URL:       https://rh-oidc.s3.us-east-
1.amazonaws.com/1mlhulb3bo0l54ojd0ji000000000000
```

16.3.3.3.2.1. Default configuration

The default settings are as follows:

- Nodes:
  - 3 control plane nodes
  - 2 infrastructure nodes
  - 2 worker nodes
  - No autoscaling
  - See the documentation on ec2 instances for more details.
- Region: As configured for the **aws** CLI
- Networking IP ranges:
  - Machine CIDR: 10.0.0.0/16
  - Service CIDR: 172.30.0.0/16
  - Pod CIDR: 10.128.0.0/14
- New VPC
- Default AWS KMS key for encryption
- The most recent version of OpenShift available to **rosa**

- A single availability zone
- Public cluster

16.3.3.3.3. Checking the installation status

1. Run one of the following commands to check the status of your cluster:
   - For a detailed view of the status, run:

     ```
     rosa describe cluster --cluster <cluster-name>
     ```

   - For an abridged view of the status, run:

     ```
     rosa list clusters
     ```

2. The cluster state will change from “waiting” to “installing” to "ready". This will take about 40 minutes.
3. Once the state changes to “ready” your cluster is installed.

16.3.3.4. Manual Mode

If you want to review the roles and policies before applying them to a cluster, use the manual method. This method requires running a few extra commands to create the roles and policies.

This section uses the **--interactive** mode. See the documentation on interactive mode for a description of the fields in this section.

16.3.3.4.1. Creating account roles

1. If this is the *first time* you are deploying ROSA in this account and you have *not* yet created the account roles, create the account-wide roles and policies, including the Operator policies. The command creates the needed JSON files for the required roles and policies for your account in the current directory. It also outputs the **aws** CLI commands that you need to run to create these objects.
   Run the following command to create the needed files and output the additional commands:

   ```
   rosa create account-roles --mode manual
   ```

   Example output

   ```
   I: All policy files saved to the current directory
   I: Run the following commands to create the account roles and policies:
   aws iam create-role \
   --role-name ManagedOpenShift-Worker-Role \
   --assume-role-policy-document file://sts_instance_worker_trust_policy.json \
   --tags Key=rosa_openshift_version,Value=4.8
   Key=rosa_role_prefix,Value=ManagedOpenShift
   Key=rosa_role_type,Value=instance_worker
   aws iam put-role-policy \
   --role-name ManagedOpenShift-Worker-Role \
   --policy-name ManagedOpenShift-Worker-Role-Policy \
   --policy-document file://sts_instance_worker_permission_policy.json
   ```

2. Check the contents of your current directory to see the new files. Use the **aws** CLI to create each of these objects.

   Example output

   ```
   $ ls
   openshift_cloud_credential_operator_cloud_credential_operator_iam_ro_creds_policy.json
   sts_instance_controlplane_permission_policy.json
   openshift_cluster_csi_drivers_ebs_cloud_credentials_policy.json
   sts_instance_controlplane_trust_policy.json
   openshift_image_registry_installer_cloud_credentials_policy.json
   sts_instance_worker_permission_policy.json
   openshift_ingress_operator_cloud_credentials_policy.json
   sts_instance_worker_trust_policy.json
   openshift_machine_api_aws_cloud_credentials_policy.json
   sts_support_permission_policy.json
   sts_installer_permission_policy.json                    sts_support_trust_policy.json
   sts_installer_trust_policy.json
   ```

3. **Optional:** Open the files to review what you will create. For example, opening the **sts_installer_permission_policy.json** shows:

   Example output

   ```
   $ cat sts_installer_permission_policy.json
           {
           "Version": "2012-10-17",
           "Statement": [
           {
               "Effect": "Allow",
               "Action": [
                   "autoscaling:DescribeAutoScalingGroups",
                   "ec2:AllocateAddress",
                   "ec2:AssociateAddress",
                   "ec2:AssociateDhcpOptions",
                   "ec2:AssociateRouteTable",
                   "ec2:AttachInternetGateway",
                   "ec2:AttachNetworkInterface",
                   "ec2:AuthorizeSecurityGroupEgress",
                   "ec2:AuthorizeSecurityGroupIngress",
                   [...]
   ```

   You can also see the contents in the About IAM resources for ROSA clusters documentation.

4. Run the **aws** commands listed in step 1. You can copy and paste if you are in the same directory as the JSON files you created.

16.3.3.4.2. Creating a cluster

1. After the **aws** commands are executed successfully, run the following command to begin ROSA cluster creation in interactive mode:

   ```
   rosa create cluster --interactive --sts
   ```

   See the ROSA documentation for a description of the fields.

2. For the purpose of this tutorial, copy and then input the following values:

```
Cluster name: my-rosa-cluster
OpenShift version: <choose version>
External ID (optional): <leave blank>
Operator roles prefix: <accept default>
Multiple availability zones: No
AWS region: <choose region>
PrivateLink cluster: No
Install into an existing VPC: No
Enable Customer Managed key: No
Compute nodes instance type: m5.xlarge
Enable autoscaling: No
Compute nodes: 2
Machine CIDR: <accept default>
Service CIDR: <accept default>
Pod CIDR: <accept default>
Host prefix: <accept default>
Encrypt etcd data (optional): No
Disable Workload monitoring: No
```

Example output

```
I: Creating cluster 'my-rosa-cluster'
I: To create this cluster again in the future, you can run:
rosa create cluster --cluster-name my-rosa-cluster --role-arn
arn:aws:iam::000000000000:role/ManagedOpenShift-Installer-Role --support-role-arn
arn:aws:iam::000000000000:role/ManagedOpenShift-Support-Role --master-iam-role
arn:aws:iam::000000000000:role/ManagedOpenShift-ControlPlane-Role --worker-iam-role
arn:aws:iam::000000000000:role/ManagedOpenShift-Worker-Role --operator-roles-prefix
my-rosa-cluster --region us-west-2 --version 4.8.13 --compute-nodes 2 --machine-cidr
10.0.0.0/16 --service-cidr 172.30.0.0/16 --pod-cidr 10.128.0.0/14 --host-prefix 23
I: To view a list of clusters and their status, run 'rosa list clusters'
I: Cluster 'my-rosa-cluster' has been created.
I: Once the cluster is installed you will need to add an Identity Provider before you can login
into the cluster. See 'rosa create idp --help' for more information.
Name:                       my-rosa-cluster
ID:                     1t6i760dbum4mqltqh6o000000000000
External ID:
OpenShift Version:
Channel Group:              stable
DNS:                      my-rosa-cluster.abcd.p1.openshiftapps.com
AWS Account:              000000000000
API URL:
Console URL:
Region:                     us-west-2
Multi-AZ:                   false
Nodes:
- Control plane:            3
- Infra:                  2
- Compute:                  2
Network:
- Service CIDR:             172.30.0.0/16
- Machine CIDR:             10.0.0.0/16
- Pod CIDR:               10.128.0.0/14
```

```
 - Host Prefix:            /23
STS Role ARN:              arn:aws:iam::000000000000:role/ManagedOpenShift-Installer-Role
Support Role ARN:          arn:aws:iam::000000000000:role/ManagedOpenShift-Support-Role
Instance IAM Roles:
 - Control plane:          arn:aws:iam::000000000000:role/ManagedOpenShift-ControlPlane-
Role
 - Worker:                 arn:aws:iam::000000000000:role/ManagedOpenShift-Worker-Role
Operator IAM Roles:
 - arn:aws:iam::000000000000:role/my-rosa-cluster-w7i6-openshift-ingress-operator-cloud-
credentials
 - arn:aws:iam::000000000000:role/my-rosa-cluster-w7i6-openshift-cluster-csi-drivers-ebs-
cloud-credentials
 - arn:aws:iam::000000000000:role/my-rosa-cluster-w7i6-openshift-cloud-network-config-
controller-cloud-cre
 - arn:aws:iam::000000000000:role/my-rosa-cluster-openshift-machine-api-aws-cloud-
credentials
 - arn:aws:iam::000000000000:role/my-rosa-cluster-openshift-cloud-credential-operator-cloud-
credentia
 - arn:aws:iam::000000000000:role/my-rosa-cluster-openshift-image-registry-installer-cloud-
credential
State:                     waiting (Waiting for OIDC configuration)
Private:                   No
Created:                   Jul  1 2022 22:13:50 UTC
Details Page:
https://console.redhat.com/openshift/details/s/2BMQm8xz8Hq5yEN000000000000
OIDC Endpoint URL:         https://rh-oidc.s3.us-east-
1.amazonaws.com/1t6i760dbum4mqltqh6o000000000000
I: Run the following commands to continue the cluster creation:
rosa create operator-roles --cluster my-rosa-cluster
rosa create oidc-provider --cluster my-rosa-cluster
I: To determine when your cluster is Ready, run 'rosa describe cluster -c my-rosa-cluster'.
I: To watch your cluster installation logs, run 'rosa logs install -c my-rosa-cluster --watch'.
```

NOTE

The cluster state will remain as "waiting" until the next two steps are completed.

16.3.3.4.3. Creating Operator roles

1. The above step outputs the next commands to run. These roles need to be created *once* for *each* cluster. To create the roles run the following command:

```
rosa create operator-roles --mode manual --cluster <cluster-name>
```

Example output

```
I: Run the following commands to create the operator roles:
    aws iam create-role \
        --role-name my-rosa-cluster-openshift-image-registry-installer-cloud-credentials \
        --assume-role-policy-document
file://operator_image_registry_installer_cloud_credentials_policy.json \
        --tags Key=rosa_cluster_id,Value=1mkesci269png3tck000000000000000
Key=rosa_openshift_version,Value=4.8 Key=rosa_role_prefix,Value=
Key=operator_namespace,Value=openshift-image-registry
```

```
Key=operator_name,Value=installer-cloud-credentials

   aws iam attach-role-policy \
      --role-name my-rosa-cluster-openshift-image-registry-installer-cloud-credentials \
      --policy-arn arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-image-registry-installer-cloud-creden
   [...]
```

2. Run each of the **aws** commands.

16.3.3.4.4. Creating the OIDC provider

1. Run the following command to create the OIDC provider:

```
rosa create oidc-provider --mode manual --cluster <cluster-name>
```

2. This displays the **aws** commands that you need to run.

Example output

```
I: Run the following commands to create the OIDC provider:
$ aws iam create-open-id-connect-provider \
--url https://rh-oidc.s3.us-east-1.amazonaws.com/1mkesci269png3tckknhh0rfs2da5fj9 \
--client-id-list openshift sts.amazonaws.com \
--thumbprint-list a9d53002e97e00e043244f3d170d000000000000

$ aws iam create-open-id-connect-provider \
--url https://rh-oidc.s3.us-east-1.amazonaws.com/1mkesci269png3tckknhh0rfs2da5fj9 \
--client-id-list openshift sts.amazonaws.com \
--thumbprint-list a9d53002e97e00e043244f3d170d000000000000
```

3. Your cluster will now continue the installation process.

16.3.3.4.5. Checking the installation status

1. Run one of the following commands to check the status of your cluster:
   - For a detailed view of the status, run:

     ```
     rosa describe cluster --cluster <cluster-name>
     ```

   - For an abridged view of the status, run:

     ```
     rosa list clusters
     ```

2. The cluster state will change from “waiting” to “installing” to "ready". This will take about 40 minutes.

3. Once the state changes to “ready” your cluster is installed.

16.3.3.5. Obtaining the Red Hat Hybrid Cloud Console URL

- To obtain the Hybrid Cloud Console URL, run the following command:
  -

```
rosa describe cluster -c <cluster-name> | grep Console
```

The cluster has now been successfully deployed. The next tutorial shows how to create an admin user to be able to use the cluster immediately.

16.3.4. Tutorial: Hosted Control Planes guide

This tutorial outlines deploying a Red Hat OpenShift Service on AWS (ROSA) with hosted control planes (HCP) cluster.

With ROSA with HCP, you can decouple the control plane from the data plane. This is a new deployment model for ROSA in which the control plane is hosted in a Red Hat-owned AWS account. The control plane is no longer hosted in your AWS account, reducing your AWS infrastructure expenses. The control plane is dedicated to a single cluster and is highly available. For more information, see the ROSA with HCP documentation.

16.3.4.1. Prerequisites

Before deploying a ROSA with HCP cluster, you must have the following resources:

- VPC - This is a bring-your-own VPC model, also referred to as BYO-VPC.
- OIDC - OIDC configuration and an OIDC provider with that specific configuration.
- ROSA version 1.2.31 or higher

In this tutorial, we will create these resources first. We will also set up some environment variables so that it is easier to run the command to create the ROSA with HCP cluster.

16.3.4.1.1. Creating a VPC

1. First, ensure that your AWS CLI (**aws**) is configured to use a region where ROSA with HCP is available. To find out which regions are supported run the following command:

   ```
   rosa list regions --hosted-cp
   ```

2. Create the VPC. For this tutorial, the following script will create the VPC and its required components for you. It will use the region configured for the **aws** CLI.

   ```
   curl https://raw.githubusercontent.com/openshift-cs/rosaworkshop/master/rosa-workshop/rosa/resources/setup-vpc.sh | bash
   ```

   For more about VPC requirements, see the VPC documentation.

3. The above script outputs two commands. Set the commands as environment variables to make running the **create cluster** command easier. Copy them from the output and run them as shown:

   ```
   export PUBLIC_SUBNET_ID=<public subnet id here>
   export PRIVATE_SUBNET_ID=<private subnet id here>
   ```

4. Confirm that the environment variables are set by running the following command:

```
echo "Public Subnet: $PUBLIC_SUBNET_ID"; echo "Private Subnet:
$PRIVATE_SUBNET_ID"
```

Example output

```
Public Subnet: subnet-0faeeeb0000000000
Private Subnet: subnet-011fe340000000000
```

16.3.4.1.2. Creating your OIDC configuration

In this tutorial, we will use the automatic mode when creating the OIDC configuration. We will also store the OIDC ID as an environment variable for later use. The command uses the ROSA CLI to create your cluster's unique OIDC configuration.

- To create the OIDC configuration for this tutorial, run the following command:

```
export OIDC_ID=$(rosa create oidc-config --mode auto --managed --yes -o json | jq -r '.id')
```

16.3.4.1.3. Creating additional environment variables

- Run the following command to set up some environment variables so that it is easier to run the command to create the ROSA with HCP cluster:

```
export CLUSTER_NAME=<enter cluster name>
export REGION=<region VPC was created in>
```

TIP

Run **rosa whoami** to find the VPC region.

16.3.4.2. Creating the cluster

If this is the *first time* you are deploying ROSA in this account and you have *not* yet created the account roles, create the account-wide roles and policies, including the Operator policies. Since ROSA uses AWS Security Token Service (STS), this step creates the AWS IAM roles and policies that are needed for ROSA to interact with your account.

1. Run the following command to create the account-wide roles:

```
rosa create account-roles --mode auto --yes
```

2. Run the following command to create the cluster:

```
rosa create cluster --cluster-name $CLUSTER_NAME \
   --subnet-ids ${PUBLIC_SUBNET_ID},${PRIVATE_SUBNET_ID} \
   --hosted-cp \
   --region $REGION \
   --oidc-config-id $OIDC_ID \
   --sts --mode auto --yes
```

The cluster is ready and completely usable after about 10 minutes. The cluster will have a control plane across three AWS availability zones in your selected region and create two worker nodes in your AWS account.

16.3.4.3. Checking the installation status

1. Run one of the following commands to check the status of the cluster:
   - For a detailed view of the cluster status, run:

     ```
     rosa describe cluster --cluster $CLUSTER_NAME
     ```

   - For an abridged view of the cluster status, run:

     ```
     rosa list clusters
     ```

   - To watch the log as it progresses, run:

     ```
     rosa logs install --cluster $CLUSTER_NAME --watch
     ```

2. Once the state changes to “ready” your cluster is installed. It might take a few more minutes for the worker nodes to come online.

16.3.5. Tutorial: Simple UI guide

This page outlines the minimum list of commands to deploy a ROSA cluster using the user interface (UI).

NOTE

While this simple deployment works well for a tutorial setting, clusters used in production should be deployed with a more detailed method.

16.3.5.1. Prerequisites

- You have completed the prerequisites in the Setup tutorial.

16.3.5.2. Creating account roles

Run the following command *once* for each AWS account and y-stream OpenShift version:

```
rosa create account-roles --mode auto --yes
```

16.3.5.3. Creating Red Hat OpenShift Cluster Manager roles

1. Create one OpenShift Cluster Manager role for each AWS account by running the following command:

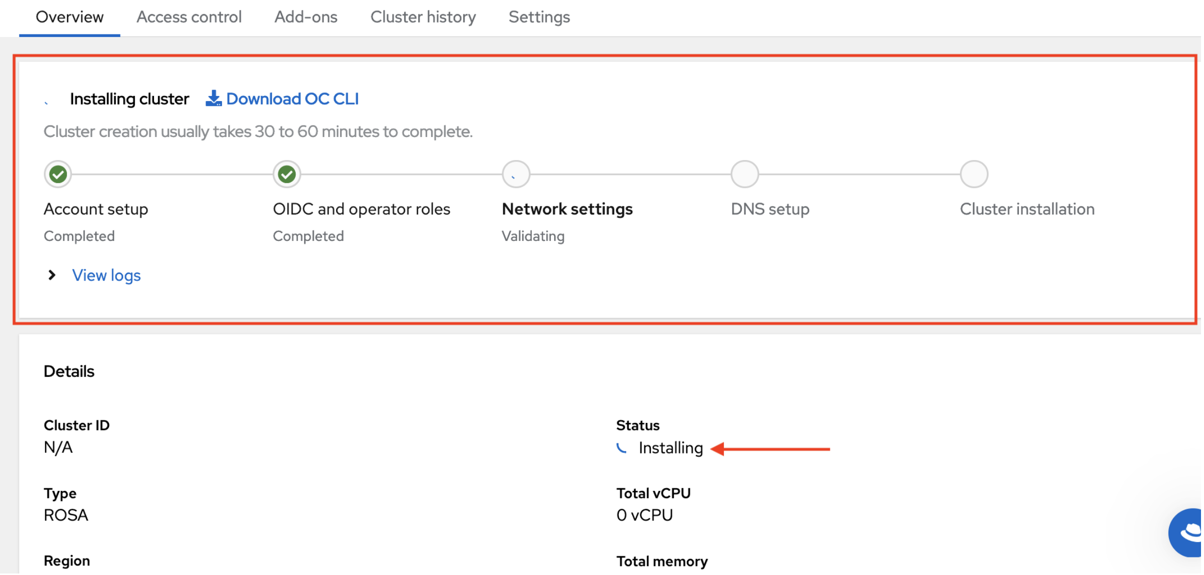
   ```
   rosa create ocm-role --mode auto --admin --yes
   ```

2. Create one OpenShift Cluster Manager user role for each AWS account by running the following command:

```
rosa create user-role --mode auto --yes
```

3. Use the OpenShift Cluster Manager to select your AWS account, cluster options, and begin deployment.

4. OpenShift Cluster Manager UI displays cluster status.



Installing cluster

Cluster creation usually takes 30 to 60 minutes to complete.

Account setup: Completed
OIDC and operator roles: Completed
Network settings: Validating
DNS setup
Cluster installation

Details

Cluster ID
N/A

Status
Installing

Type
ROSA

Total vCPU
0 vCPU

Region

Total memory

16.3.6. Tutorial: Detailed UI guide

This tutorial outlines the detailed steps to deploy a Red Hat OpenShift Service on AWS (ROSA) cluster using the Red Hat OpenShift Cluster Manager user interface (UI).

16.3.6.1. Deployment workflow

The overall deployment workflow follows these steps:

1. Create the account wide roles and policies.

2. Associate your AWS account with your Red Hat account.

   a. Create and link the Red Hat OpenShift Cluster Manager role.

   b. Create and link the user role.

3. Create the cluster.

Step 1 only needs to be performed the **first time** you are deploying into an AWS account. Step 2 only needs to be performed the **first time** you are using the UI. For successive clusters of the same y-stream version, you only need to create the cluster.

16.3.6.2. Creating account wide roles

NOTE

If you already have account roles from an earlier deployment, skip this step. The UI will detect your existing roles after you select an associated AWS account.

If this is the *first time* you are deploying ROSA in this account and you have *not* yet created the account roles, create the account-wide roles and policies, including the Operator policies.

- In your terminal, run the following command to create the account-wide roles:

  ```
  $ rosa create account-roles --mode auto --yes
  ```

  Example output

  ```
  I: Creating roles using 'arn:aws:iam::000000000000:user/rosa-user'
  I: Created role 'ManagedOpenShift-ControlPlane-Role' with ARN
  'arn:aws:iam::000000000000:role/ManagedOpenShift-ControlPlane-Role'
  I: Created role 'ManagedOpenShift-Worker-Role' with ARN
  'arn:aws:iam::000000000000:role/ManagedOpenShift-Worker-Role'
  I: Created role 'ManagedOpenShift-Support-Role' with ARN
  'arn:aws:iam::000000000000:role/ManagedOpenShift-Support-Role'
  I: Created role 'ManagedOpenShift-Installer-Role' with ARN
  'arn:aws:iam::000000000000:role/ManagedOpenShift-Installer-Role'
  I: Created policy with ARN 'arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-
  machine-api-aws-cloud-credentials'
  I: Created policy with ARN 'arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-
  cloud-credential-operator-cloud-crede'
  I: Created policy with ARN 'arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-
  image-registry-installer-cloud-creden'
  I: Created policy with ARN 'arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-
  ingress-operator-cloud-credentials'
  I: Created policy with ARN 'arn:aws:iam::000000000000:policy/ManagedOpenShift-openshift-
  cluster-csi-drivers-ebs-cloud-credent'
  I: To create a cluster with these roles, run the following command:
  rosa create cluster --sts
  ```

16.3.6.3. Associating your AWS account with your Red Hat account

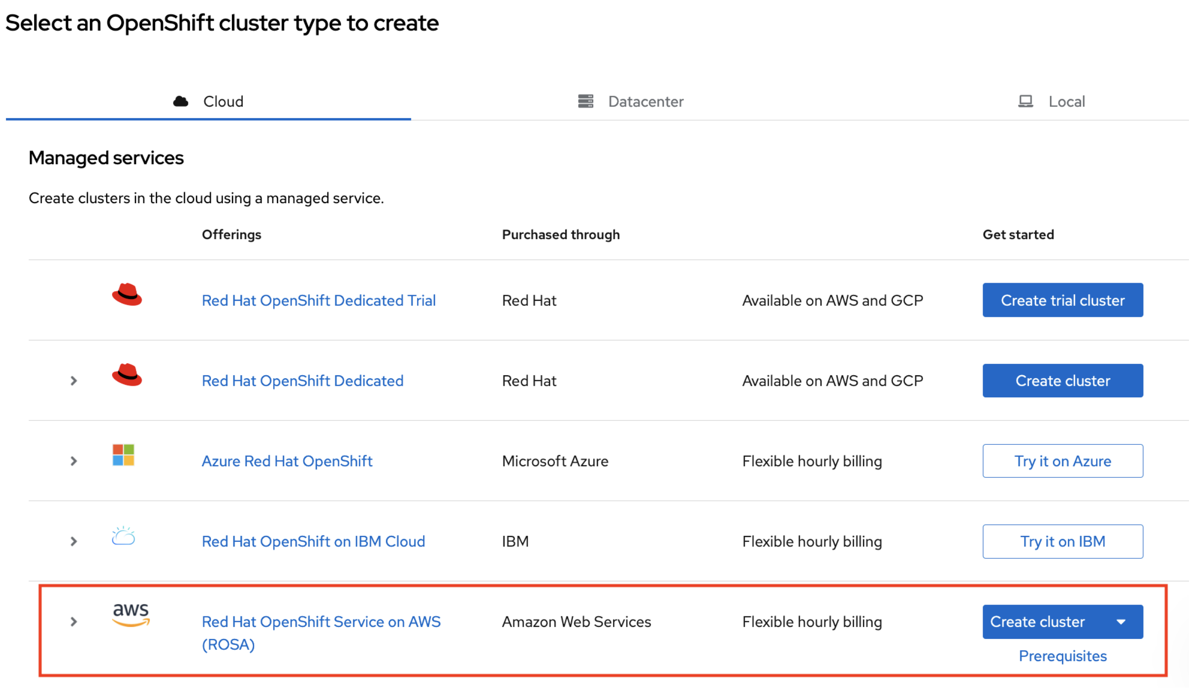
This step tells the OpenShift Cluster Manager what AWS account you want to use when deploying ROSA.

> **NOTE**
>
> If you have already associated your AWS accounts, skip this step.

1. Open the Red Hat Hybrid Cloud Console by visiting the OpenShift Cluster Manager and logging in to your Red Hat account.

2. Click **Create Cluster**.

3. Scroll down to the Red Hat OpenShift Service on AWS (ROSA) row and click **Create Cluster**.



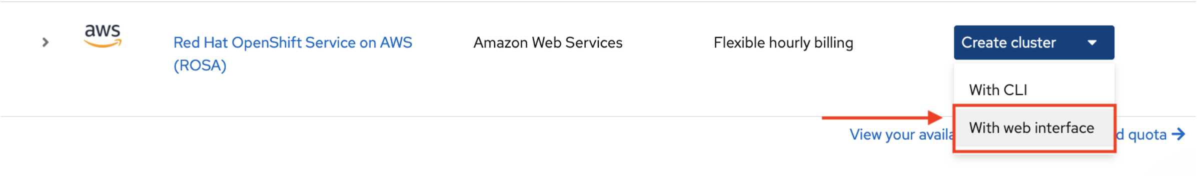
Select an OpenShift cluster type to create

Managed services

Create clusters in the cloud using a managed service.

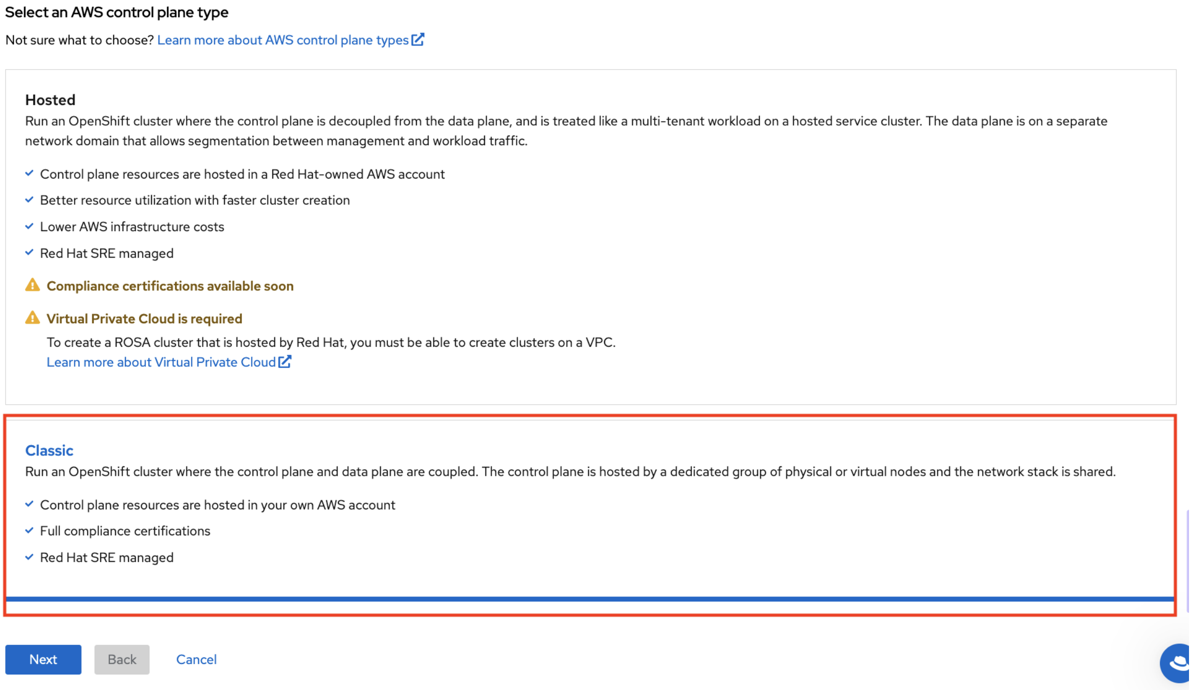
	Offerings	Purchased through		Get started
	Red Hat OpenShift Dedicated Trial	Red Hat	Available on AWS and GCP	Create trial cluster
›	Red Hat OpenShift Dedicated	Red Hat	Available on AWS and GCP	Create cluster
›	Azure Red Hat OpenShift	Microsoft Azure	Flexible hourly billing	Try it on Azure
›	Red Hat OpenShift on IBM Cloud	IBM	Flexible hourly billing	Try it on IBM
›	Red Hat OpenShift Service on AWS (ROSA)	Amazon Web Services	Flexible hourly billing	Create cluster ▾ Prerequisites

4. A dropdown menu appears. Click **With web interface**.



›	Red Hat OpenShift Service on AWS (ROSA)	Amazon Web Services	Flexible hourly billing	Create cluster ▾

5. Under "Select an AWS control plane type," choose **Classic**. Then click **Next**.



Select an AWS control plane type

Not sure what to choose? Learn more about AWS control plane types

Hosted

Run an OpenShift cluster where the control plane is decoupled from the data plane, and is treated like a multi-tenant workload on a hosted service cluster. The data plane is on a separate network domain that allows segmentation between management and workload traffic.

- ✓ Control plane resources are hosted in a Red Hat-owned AWS account
- ✓ Better resource utilization with faster cluster creation
- ✓ Lower AWS infrastructure costs
- ✓ Red Hat SRE managed

⚠ Compliance certifications available soon

⚠ Virtual Private Cloud is required

To create a ROSA cluster that is hosted by Red Hat, you must be able to create clusters on a VPC.
Learn more about Virtual Private Cloud

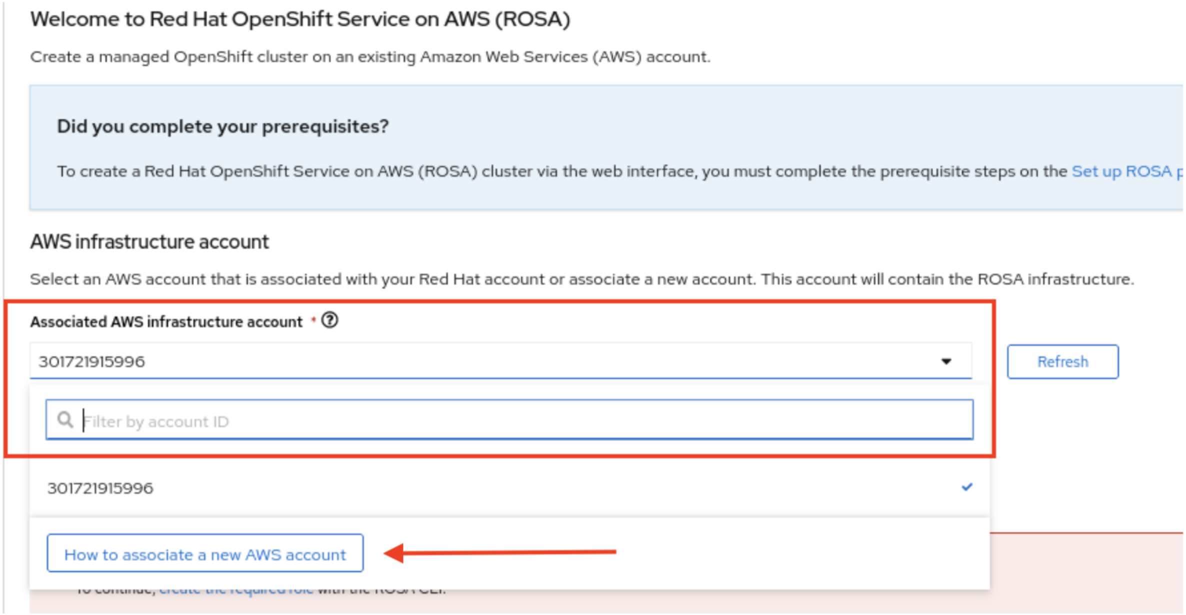
Classic

Run an OpenShift cluster where the control plane and data plane are coupled. The control plane is hosted by a dedicated group of physical or virtual nodes and the network stack is shared.

- ✓ Control plane resources are hosted in your own AWS account
- ✓ Full compliance certifications
- ✓ Red Hat SRE managed

6. Click the dropbox under **Associated AWS infrastructure account** If you have not yet associated any AWS accounts, the dropbox may be empty.

7. Click **How to associate a new AWS account**



Welcome to Red Hat OpenShift Service on AWS (ROSA)

Create a managed OpenShift cluster on an existing Amazon Web Services (AWS) account.

Did you complete your prerequisites?

To create a Red Hat OpenShift Service on AWS (ROSA) cluster via the web interface, you must complete the prerequisite steps on the Set up ROSA p

AWS infrastructure account

Select an AWS account that is associated with your Red Hat account or associate a new account. This account will contain the ROSA infrastructure.

Associated AWS infrastructure account *

301721915996

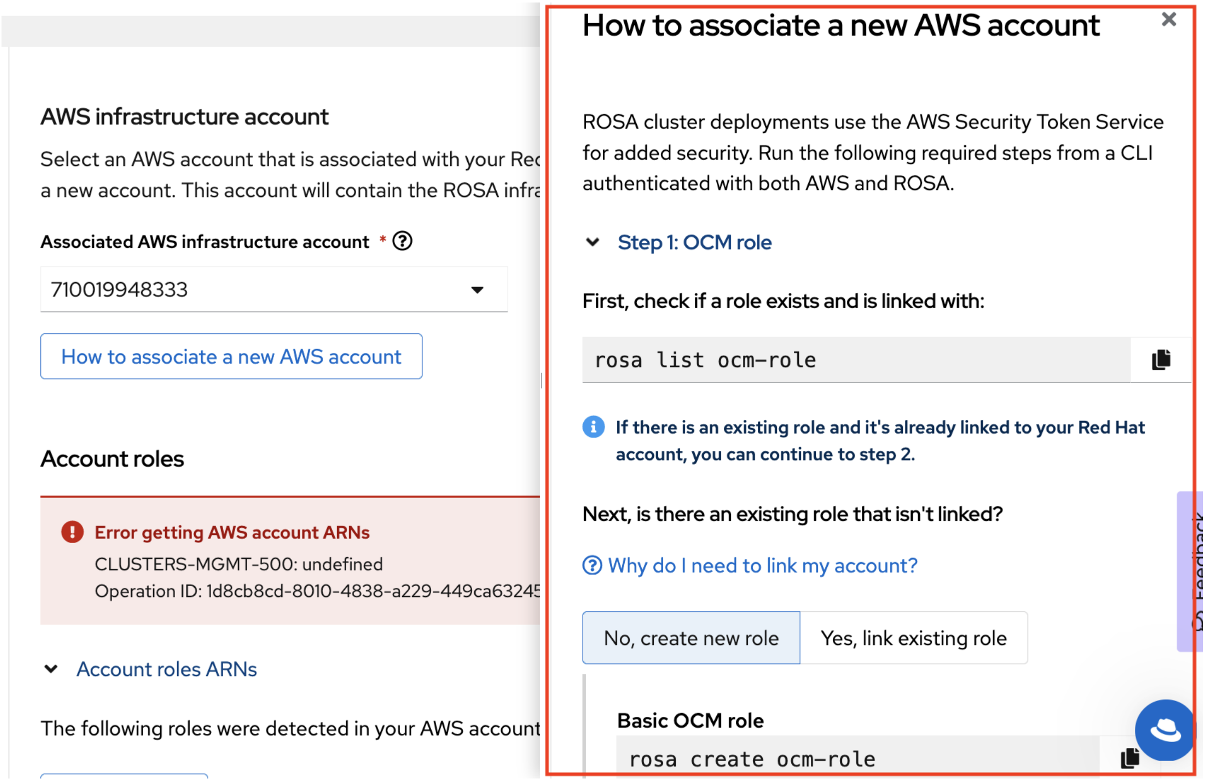
Filter by account ID

301721915996 ✓

How to associate a new AWS account

To continue, create the required role with the ROSA CLI.

8. A sidebar appears with instructions for associating a new AWS account.



AWS infrastructure account

Select an AWS account that is associated with your Rec
a new account. This account will contain the ROSA infra

Associated AWS infrastructure account * ?

710019948333

How to associate a new AWS account

Account roles

Error getting AWS account ARNs
CLUSTERS-MGMT-500: undefined
Operation ID: 1d8cb8cd-8010-4838-a229-449ca63245

Account roles ARNs

The following roles were detected in your AWS account

How to associate a new AWS account ×

ROSA cluster deployments use the AWS Security Token Service for added security. Run the following required steps from a CLI authenticated with both AWS and ROSA.

Step 1: OCM role

First, check if a role exists and is linked with:

```
rosa list ocm-role
```

If there is an existing role and it's already linked to your Red Hat account, you can continue to step 2.

Next, is there an existing role that isn't linked?

Why do I need to link my account?

No, create new role | Yes, link existing role

Basic OCM role

```
rosa create ocm-role
```

16.3.6.4. Creating and associating an OpenShift Cluster Manager role

1. Run the following command to see if an OpenShift Cluster Manager role exists:

```
$ rosa list ocm-role
```

2. The UI displays the commands to create an OpenShift Cluster Manager role with two different levels of permissions:

- **Basic OpenShift Cluster Manager role:** Allows the OpenShift Cluster Manager to have read-only access to the account to check if the roles and policies that are required by ROSA are present before creating a cluster. You will need to manually create the required roles, policies, and OIDC provider using the CLI.

- **Admin OpenShift Cluster Manager role:** Grants the OpenShift Cluster Manager additional permissions to create the required roles, policies, and OIDC provider for ROSA. Using this makes the deployment of a ROSA cluster quicker since the OpenShift Cluster Manager will be able to create the required resources for you.
  To read more about these roles, see the OpenShift Cluster Manager roles and permissions section of the documentation.

  For the purposes of this tutorial, use the **Admin OpenShift Cluster Manager role** for the simplest and quickest approach.

3. Copy the command to create the Admin OpenShift Cluster Manager role from the sidebar or switch to your terminal and enter the following command:

```
$ rosa create ocm-role --mode auto --admin --yes
```

   This command creates the OpenShift Cluster Manager role and associates it with your Red Hat account.

   Example output

```
I: Creating ocm role
I: Creating role using 'arn:aws:iam::000000000000:user/rosa-user'
I: Created role 'ManagedOpenShift-OCM-Role-12561000' with ARN
'arn:aws:iam::000000000000:role/ManagedOpenShift-OCM-Role-12561000'
I: Linking OCM role
I: Successfully linked role-arn 'arn:aws:iam::000000000000:role/ManagedOpenShift-OCM-
Role-12561000' with organization account '1MpZfntsZeUdjWHg7XRgP000000'
```

4. Click **Step 2: User role**.

16.3.6.4.1. Other OpenShift Cluster Manager role creation options

- **Manual mode:** If you prefer to run the AWS CLI commands yourself, you can define the mode as **manual** rather than **auto**. The CLI will output the AWS commands and the relevant JSON files are created in the current directory.
  Use the following command to create the OpenShift Cluster Manager role in manual mode:

```
$ rosa create ocm-role --mode manual --admin --yes
```

- **Basic OpenShift Cluster Manager role:** If you prefer that the OpenShift Cluster Manager has read only access to the account, create a basic OpenShift Cluster Manager role. You will then need to manually create the required roles, policies, and OIDC provider using the CLI.
  Use the following command to create a Basic OpenShift Cluster Manager role:

```
$ rosa create ocm-role --mode auto --yes
```

16.3.6.5. Creating an OpenShift Cluster Manager user role

As defined in the user role documentation, the user role needs to be created so that ROSA can verify your AWS identity. This role has no permissions, and it is only used to create a trust relationship between the installation program account and your OpenShift Cluster Manager role resources.

1. Check if a user role already exists by running the following command:

```
$ rosa list user-role
```

2. Run the following command to create the user role and to link it to your Red Hat account:

```
$ rosa create user-role --mode auto --yes
```

Example output

```
I: Creating User role
I: Creating ocm user role using 'arn:aws:iam::000000000000:user/rosa-user'
I: Created role 'ManagedOpenShift-User-rosa-user-Role' with ARN
'arn:aws:iam::000000000000:role/ManagedOpenShift-User-rosa-user-Role'
I: Linking User role
I: Successfully linked role ARN 'arn:aws:iam::000000000000:role/ManagedOpenShift-User-
rosa-user-Role' with account '1rbOQez0z5j1YolInhcXY000000'
```

NOTE

As before, you can define **--mode manual** if you'd prefer to run the AWS CLI commands yourself. The CLI outputs the AWS commands and the relevant JSON files are created in the current directory. Make sure to link the role.

3. Click **Step 3: Account roles**.

16.3.6.6. Creating account roles

1. Create your account roles by running the following command:

```
$ rosa create account-roles --mode auto
```

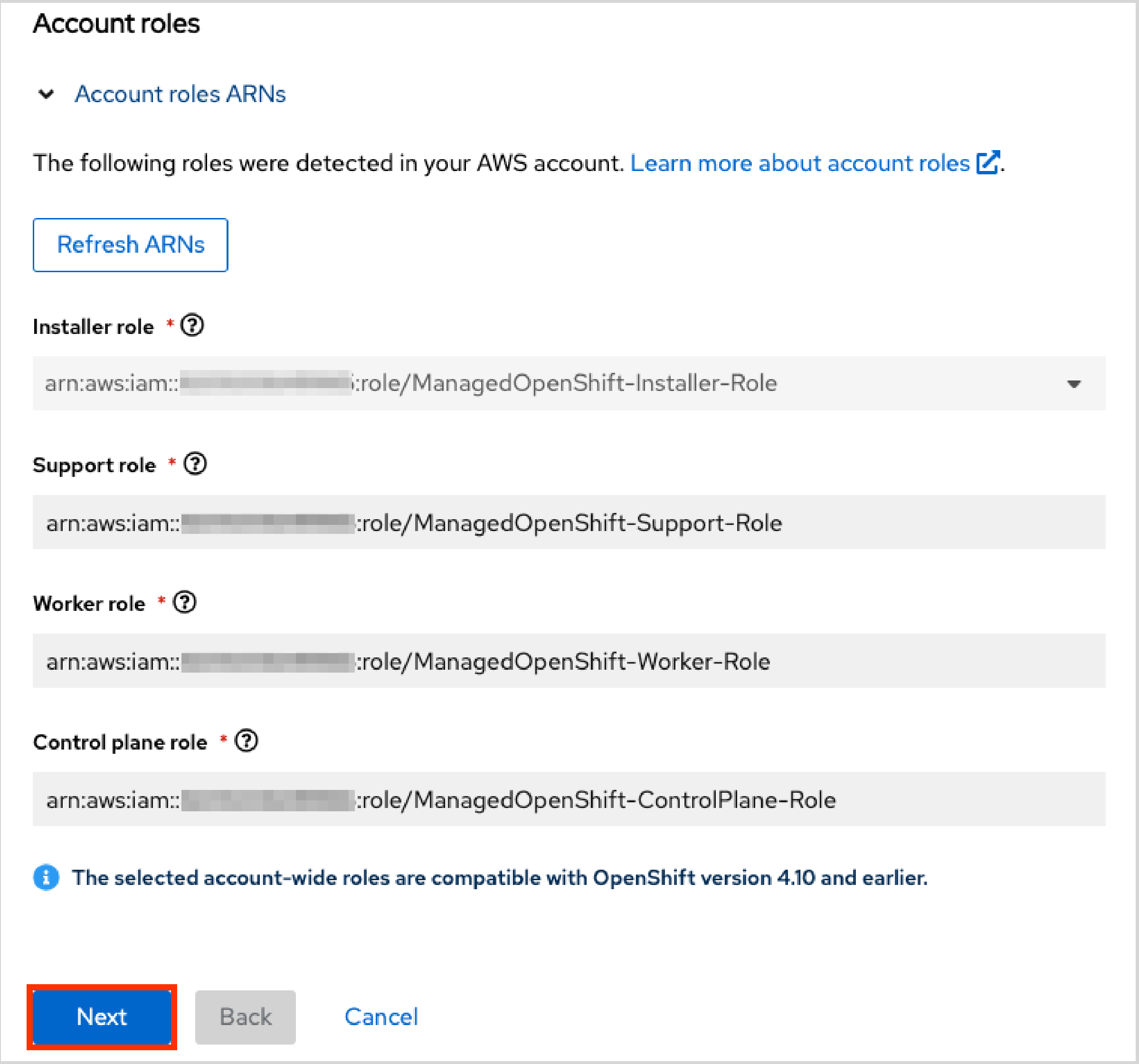
2. Click **OK** to close the sidebar.

16.3.6.7. Confirming successful account association

1. You should now see your AWS account in the **Associated AWS infrastructure account** dropdown menu. If you see your account, account association was successful.

2. Select the account.

3. You will see the account role ARNs populated below.



Account roles

Account roles ARNs

The following roles were detected in your AWS account. Learn more about account roles.

Installer role * ⓘ

arn:aws:iam::[redacted]:role/ManagedOpenShift-Installer-Role

Support role * ⓘ

arn:aws:iam::[redacted]:role/ManagedOpenShift-Support-Role

Worker role * ⓘ

arn:aws:iam::[redacted]:role/ManagedOpenShift-Worker-Role

Control plane role * ⓘ

arn:aws:iam::[redacted]:role/ManagedOpenShift-ControlPlane-Role

The selected account-wide roles are compatible with OpenShift version 4.10 and earlier.

4. Click **Next**.

16.3.6.8. Creating the cluster

1. For the purposes of this tutorial make the following selections:

   Cluster settings

   - Cluster name: **<pick a name\>**
   - Version: **<select latest version\>**
   - Region: **<select region\>**
   - Availability: **Single zone**
   - Enable user workload monitoring: **leave checked**
   - Enable additional etcd encryption: **leave unchecked**
   - Encrypt persistent volumes with customer keys: **leave unchecked**

2. Click **Next**.

3. Leave the default settings on for the machine pool:

   Default machine pool settings

   - Compute node instance type: **m5.xlarge - 4 vCPU 16 GiB RAM**
   - Enable autoscaling: **unchecked**
   - Compute node count: **2**
   - Leave node labels blank

4. Click **Next**.

16.3.6.8.1. Networking

1. Leave all the default values for configuration.
2. Click **Next**.
3. Leave all the default values for CIDR ranges.
4. Click **Next**.

16.3.6.8.2. Cluster roles and policies

For this tutorial, leave **Auto** selected. It will make the cluster deployment process simpler and quicker.

> NOTE
>
> If you selected a **Basic OpenShift Cluster Manager role** earlier, you can only use manual mode. You must manually create the operator roles and OIDC provider. See the "Basic OpenShift Cluster Manager role" section below after you have completed the "Cluster updates" section and started cluster creation.

16.3.6.8.3. Cluster updates

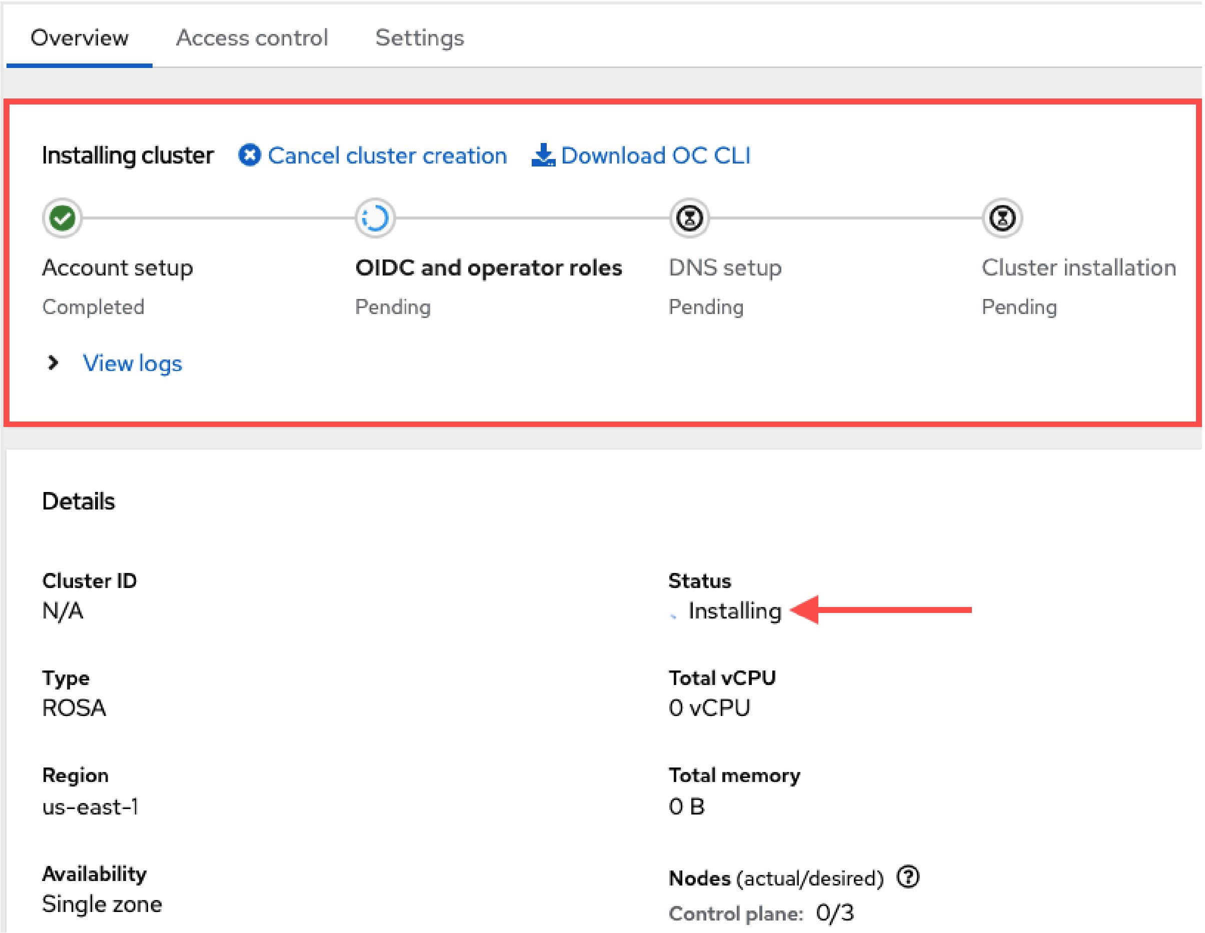
- Leave all the options at default in this section.

16.3.6.8.4. Reviewing and creating your cluster

1. Review the content for the cluster configuration.
2. Click **Create cluster**.

16.3.6.8.5. Monitoring the installation progress

- Stay on the current page to monitor the installation progress. It should take about 40 minutes.



Details

Cluster ID
N/A

Status
Installing

Type
ROSA

Total vCPU
0 vCPU

Region
us-east-1

Total memory
0 B

Availability
Single zone

Nodes (actual/desired)
Control plane: 0/3

16.3.6.9. Basic OpenShift Cluster Manager Role

NOTE

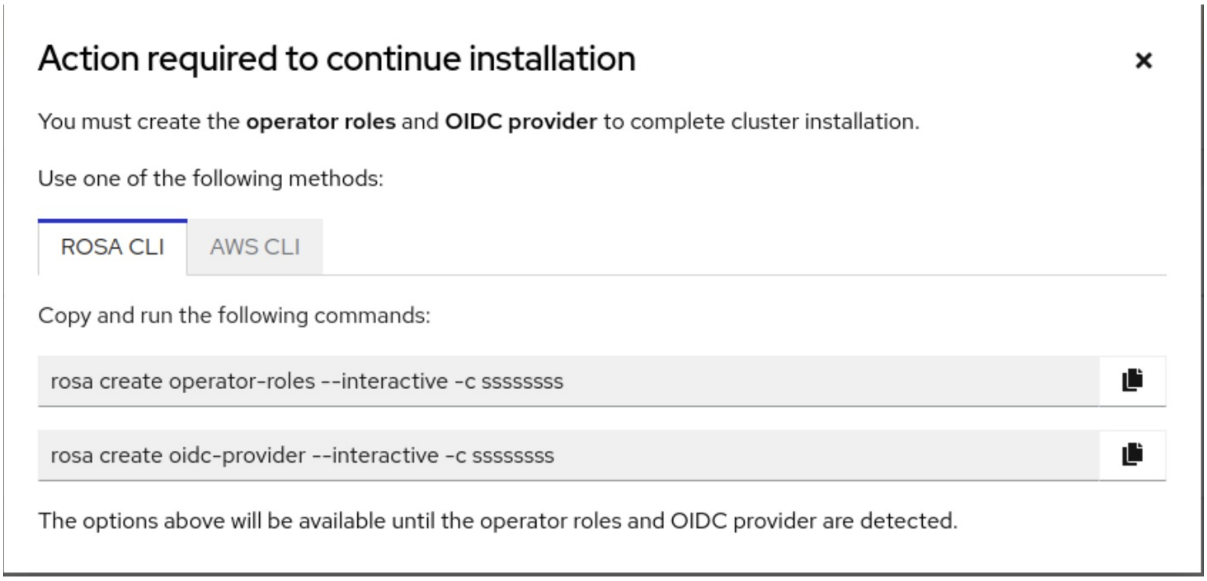
If you created an **Admin OpenShift Cluster Manager role** as directed above **ignore** this entire section. The OpenShift Cluster Manager will create the resources for you.

If you created a **Basic OpenShift Cluster Manager role** earlier, you will need to manually create two more elements before cluster installation can continue:

- Operator roles
- OIDC provider

16.3.6.9.1. Creating Operator roles

1. A pop up window will show you the commands to run.



Action required to continue installation

You must create the **operator roles** and **OIDC provider** to complete cluster installation.

Use one of the following methods:

Copy and run the following commands:

```
rosa create operator-roles --interactive -c ssssssss
```

```
rosa create oidc-provider --interactive -c ssssssss
```

The options above will be available until the operator roles and OIDC provider are detected.

2. Run the commands from the window in your terminal to launch interactive mode. Or, for simplicity, run the following command to create the Operator roles:

```
$ rosa create operator-roles --mode auto --cluster <cluster-name> --yes
```

Example output

```
I: Creating roles using 'arn:aws:iam::000000000000:user/rosauser'
I: Created role 'rosacluster-b736-openshift-ingress-operator-cloud-credentials' with ARN 'arn:aws:iam::000000000000:role/rosacluster-b736-openshift-ingress-operator-cloud-credentials'
I: Created role 'rosacluster-b736-openshift-cluster-csi-drivers-ebs-cloud-credent' with ARN 'arn:aws:iam::000000000000:role/rosacluster-b736-openshift-cluster-csi-drivers-ebs-cloud-credent'
I: Created role 'rosacluster-b736-openshift-cloud-network-config-controller-cloud' with ARN 'arn:aws:iam::000000000000:role/rosacluster-b736-openshift-cloud-network-config-controller-cloud'
I: Created role 'rosacluster-b736-openshift-machine-api-aws-cloud-credentials' with ARN 'arn:aws:iam::000000000000:role/rosacluster-b736-openshift-machine-api-aws-cloud-credentials'
I: Created role 'rosacluster-b736-openshift-cloud-credential-operator-cloud-crede' with ARN 'arn:aws:iam::000000000000:role/rosacluster-b736-openshift-cloud-credential-operator-cloud-crede'
I: Created role 'rosacluster-b736-openshift-image-registry-installer-cloud-creden' with ARN 'arn:aws:iam::000000000000:role/rosacluster-b736-openshift-image-registry-installer-cloud-creden'
```

16.3.6.9.2. Creating the OIDC provider

- In your terminal, run the following command to create the OIDC provider:

```
$ rosa create oidc-provider --mode auto --cluster <cluster-name> --yes
```

Example output

```
I: Creating OIDC provider using 'arn:aws:iam::000000000000:user/rosauser'
I: Created OIDC provider with ARN 'arn:aws:iam::000000000000:oidc-provider/rh-oidc.s3.us-east-1.amazonaws.com/1tt4kvrr2kha2rgs8gjfvf0000000000'
```

16.4. TUTORIAL: CREATING AN ADMIN USER

Creating an administration (admin) user allows you to access your cluster quickly. Follow these steps to create an admin user.

NOTE

An admin user works well in this tutorial setting. For actual deployment, use a formal identity provider to access the cluster and grant the user admin privileges.

1. Run the following command to create the admin user:

```
rosa create admin --cluster=<cluster-name>
```

Example output

```
W: It is recommended to add an identity provider to login to this cluster. See 'rosa create idp --help' for more information.
I: Admin account has been added to cluster 'my-rosa-cluster'. It may take up to a minute for the account to become active.
I: To login, run the following command:
oc login https://api.my-rosa-cluster.abcd.p1.openshiftapps.com:6443 \
--username cluster-admin \
--password FWGYL-2mkJI-00000-00000
```

2. Copy the log in command returned to you in the previous step and paste it into your terminal. This will log you in to the cluster using the CLI so you can start using the cluster.

```
$ oc login https://api.my-rosa-cluster.abcd.p1.openshiftapps.com:6443 \
>    --username cluster-admin \
>    --password FWGYL-2mkJI-00000-00000
```

Example output

```
Login successful.

You have access to 79 projects, the list has been suppressed. You can list all projects with ' projects'

Using project "default".
```

3. To check that you are logged in as the admin user, run one of the following commands:

- Option 1:

```
$ oc whoami
```

Example output

```
cluster-admin
```

- Option 2:

```
oc get all -n openshift-apiserver
```

Only an admin user can run this command without errors.

4. You can now use the cluster as an admin user, which will suffice for this tutorial. For actual deployment, it is highly recommended to set up an identity provider, which is explained in the next tutorial.

16.5. TUTORIAL: SETTING UP AN IDENTITY PROVIDER

To log in to your cluster, set up an identity provider (IDP). This tutorial uses GitHub as an example IDP. See the full list of IDPs supported by ROSA .

- To view all IDP options, run the following command:

```
rosa create idp --help
```

16.5.1. Setting up an IDP with GitHub

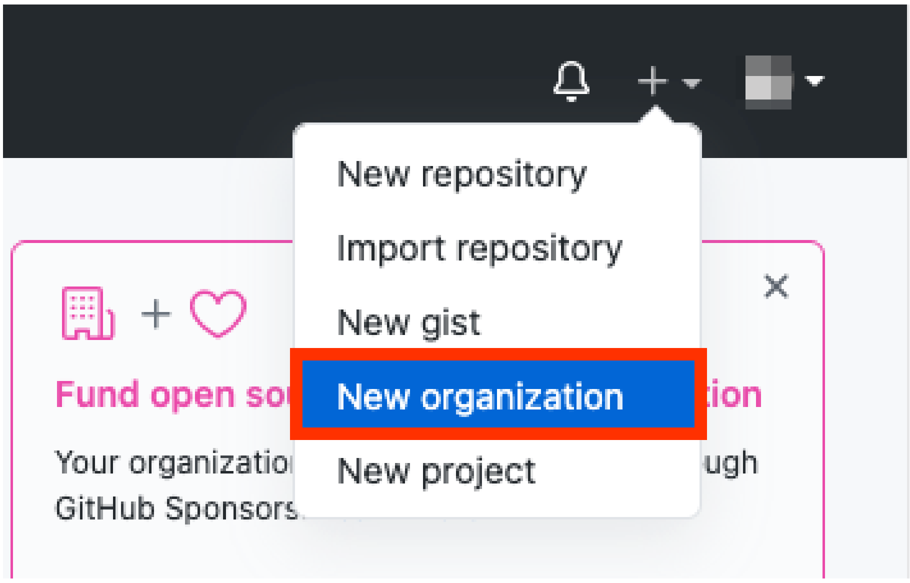
1. Log in to your GitHub account.

2. Create a new GitHub organization where you are an administrator.

TIP

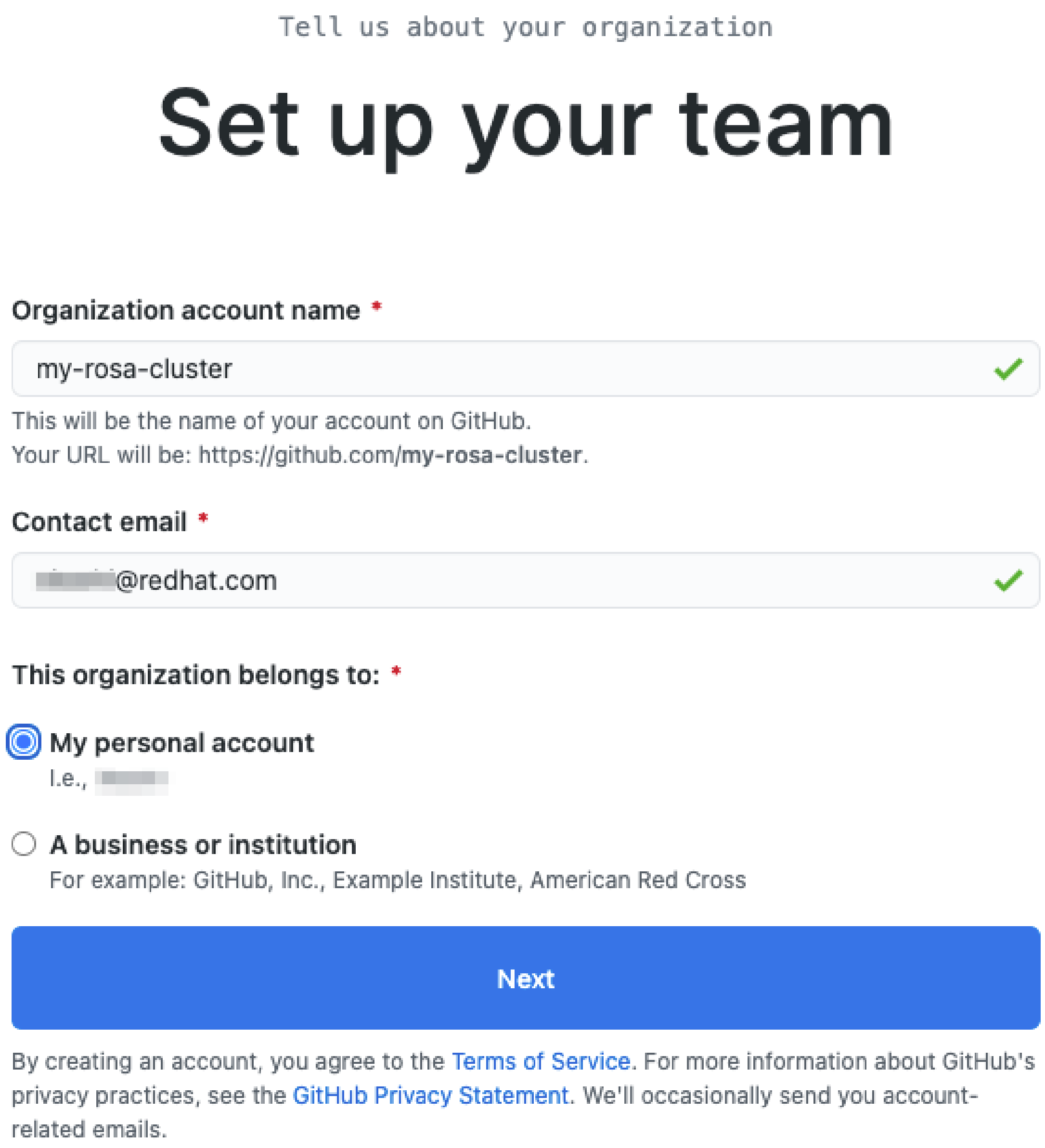
If you are already an administrator in an existing organization and you want to use that organization, skip to step 9.

Click the **+** icon, then click **New Organization**.



3. Choose the most applicable plan for your situation or click **Join for free**.

4. Enter an organization account name, an email, and whether it is a personal or business account. Then, click **Next**.



Tell us about your organization

Set up your team

Organization account name *

my-rosa-cluster ✓

This will be the name of your account on GitHub.
Your URL will be: https://github.com/**my-rosa-cluster**.

Contact email *

[redacted]@redhat.com ✓

This organization belongs to: *

● **My personal account**
I.e., [redacted]

○ **A business or institution**
For example: GitHub, Inc., Example Institute, American Red Cross

By creating an account, you agree to the Terms of Service. For more information about GitHub's privacy practices, see the GitHub Privacy Statement. We'll occasionally send you account-related emails.

5. **Optional:** Add the GitHub IDs of other users to grant additional access to your ROSA cluster. You can also add them later.

6. Click **Complete Setup**.

7. **Optional:** Enter the requested information on the following page.

8. Click **Submit**.

9. Go back to the terminal and enter the following command to set up the GitHub IDP:

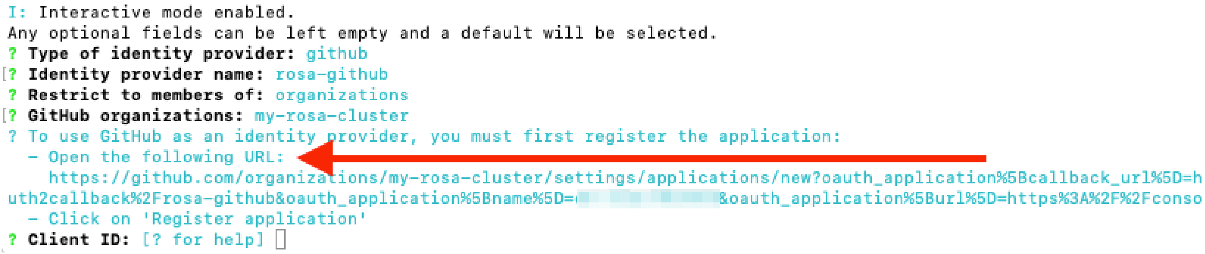
```
rosa create idp --cluster=<cluster name> --interactive
```

10. Enter the following values:

```
Type of identity provider: github
Identity Provider Name: <IDP-name>
Restrict to members of: organizations
```

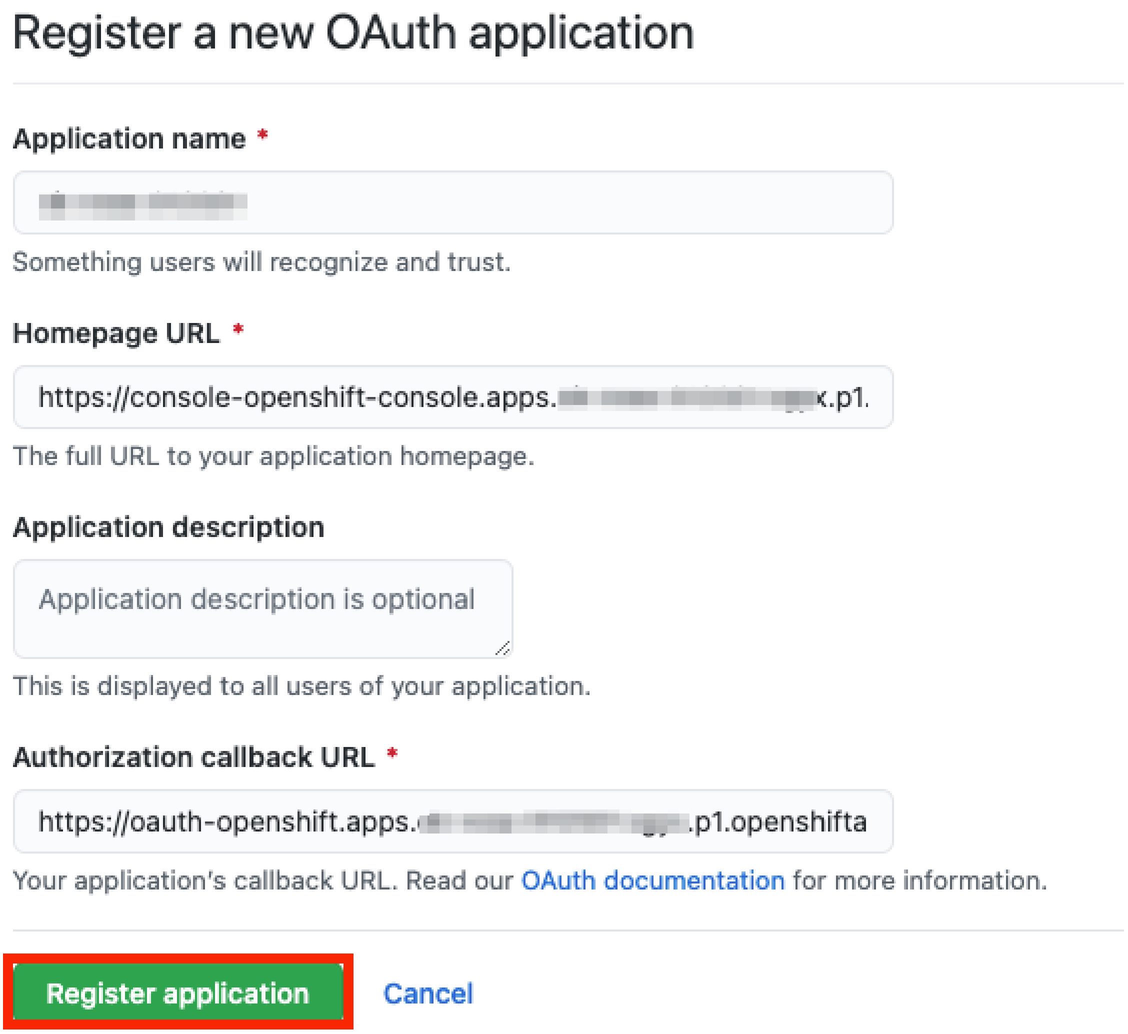
> GitHub organizations: <organization-account-name>

11. The CLI will provide you with a link. Copy and paste the link into a browser and press **Enter**. This will fill the required information to register this application for OAuth. You do not need to modify any of the information.



```
I: Interactive mode enabled.
Any optional fields can be left empty and a default will be selected.
? Type of identity provider: github
[? Identity provider name: rosa-github
? Restrict to members of: organizations
[? GitHub organizations: my-rosa-cluster
? To use GitHub as an identity provider, you must first register the application:
  - Open the following URL:
    https://github.com/organizations/my-rosa-cluster/settings/applications/new?oauth_application%5Bcallback_url%5D=h
uth2callback%2Frosa-github&oauth_application%5Bname%5D=[redacted]&oauth_application%5Burl%5D=https%3A%2F%2Fconso
  - Click on 'Register application'
? Client ID: [? for help] 
```

12. Click **Register application**.



Register a new OAuth application

Application name *

[redacted]

Something users will recognize and trust.

Homepage URL *

https://console-openshift-console.apps.[redacted]x.p1.

The full URL to your application homepage.

Application description

Application description is optional

This is displayed to all users of your application.

Authorization callback URL *

https://oauth-openshift.apps.[redacted].p1.openshifta

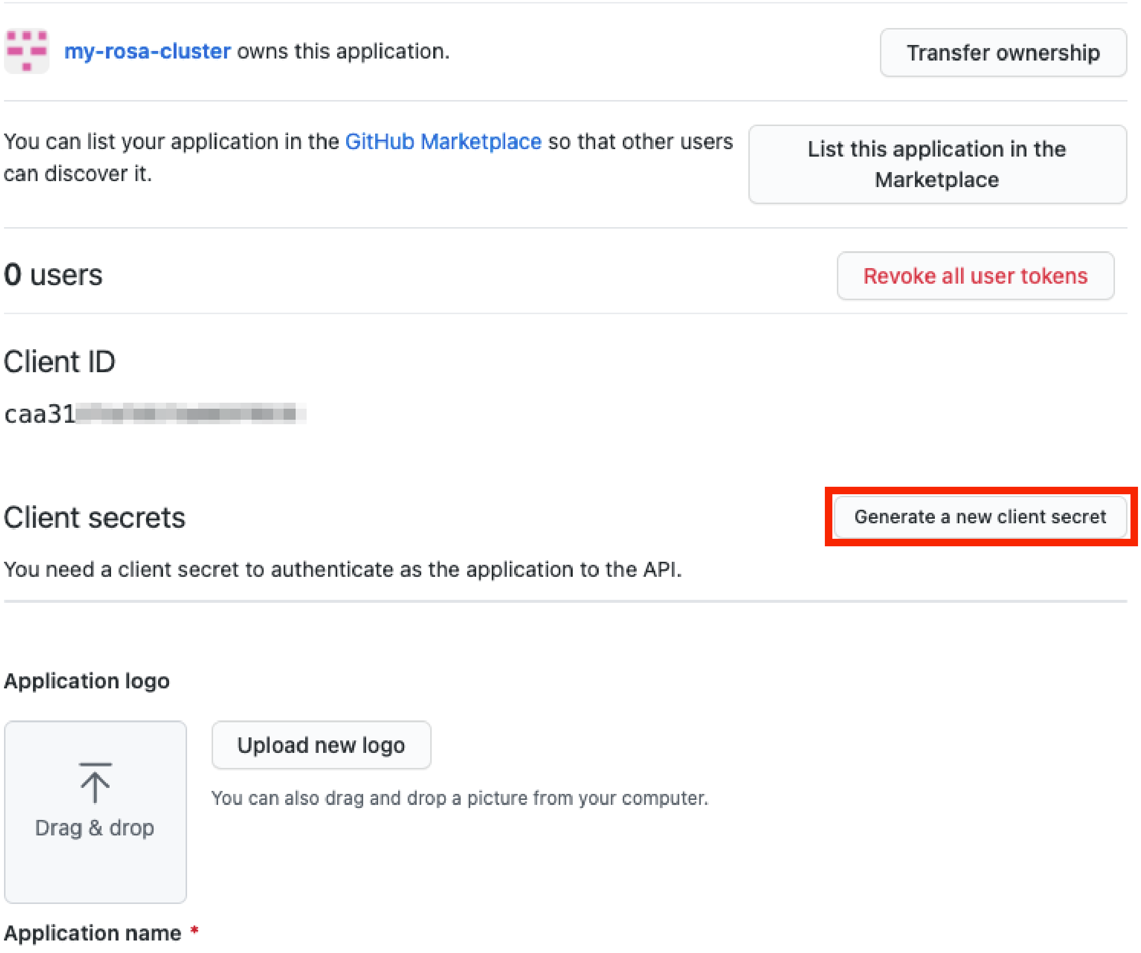
Your application's callback URL. Read our OAuth documentation for more information.

13. The next page displays a **Client ID**. Copy the ID and paste it in the terminal where it asks for **Client ID**.

NOTE

Do not close the tab.

14. The CLI will ask for a **Client Secret**. Go back in your browser and click **Generate a new client secret**.



my-rosa-cluster owns this application.

You can list your application in the GitHub Marketplace so that other users can discover it.

0 users

Client ID

caa31[redacted]

Client secrets

You need a client secret to authenticate as the application to the API.

Application logo

You can also drag and drop a picture from your computer.

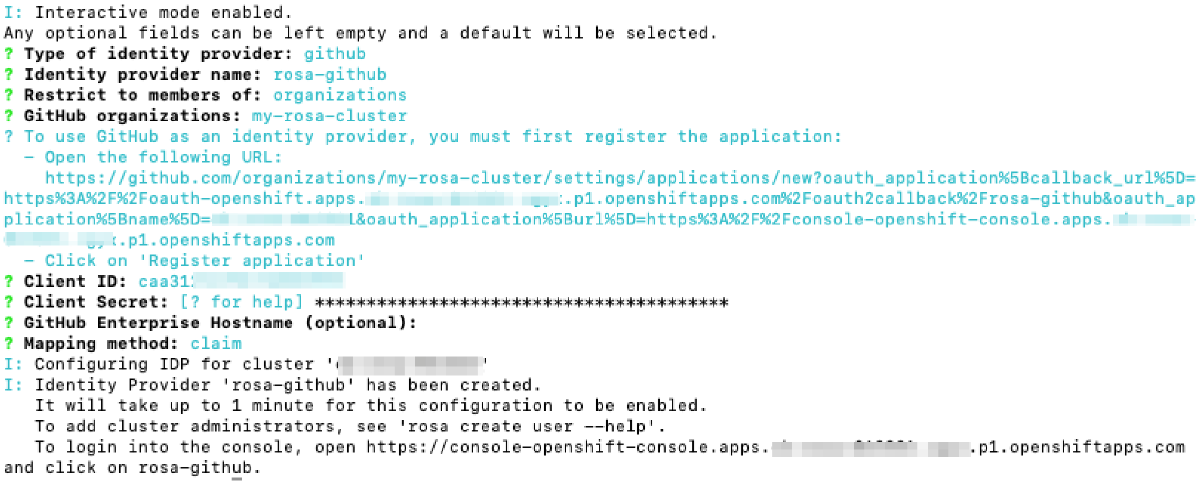
15. A secret is generated for you. Copy your secret because it will never be visible again.

16. Paste your secret into the terminal and press **Enter**.

17. Leave **GitHub Enterprise Hostname** blank.

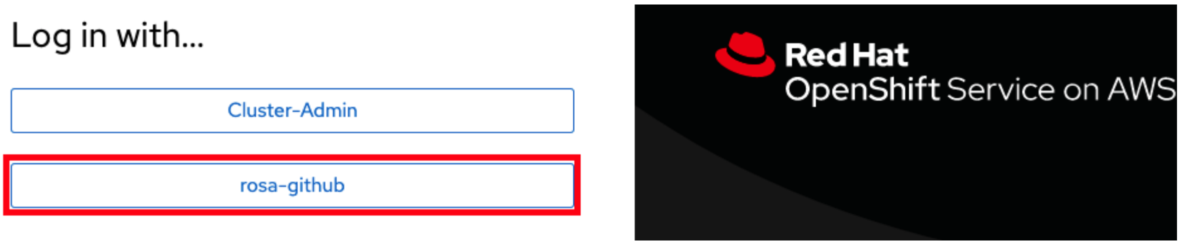
18. Select **claim**.

19. Wait approximately 1 minute for the IDP to be created and the configuration to land on your cluster.



```
I: Interactive mode enabled.
Any optional fields can be left empty and a default will be selected.
? Type of identity provider: github
? Identity provider name: rosa-github
? Restrict to members of: organizations
? GitHub organizations: my-rosa-cluster
? To use GitHub as an identity provider, you must first register the application:
  - Open the following URL:
    https://github.com/organizations/my-rosa-cluster/settings/applications/new?oauth_application%5Bcallback_url%5D=
https%3A%2F%2Foauth-openshift.apps.[redacted].p1.openshiftapps.com%2Foauth2callback%2Frosa-github&oauth_ap
plication%5Bname%5D=[redacted]&oauth_application%5Burl%5D=https%3A%2F%2Fconsole-openshift-console.apps.[redacted].p1.openshiftapps.com
  - Click on 'Register application'
? Client ID: caa31[redacted]
? Client Secret: [? for help] ****************************************
? GitHub Enterprise Hostname (optional):
? Mapping method: claim
I: Configuring IDP for cluster '[redacted]'
I: Identity Provider 'rosa-github' has been created.
   It will take up to 1 minute for this configuration to be enabled.
   To add cluster administrators, see 'rosa create user --help'.
   To login into the console, open https://console-openshift-console.apps.[redacted].p1.openshiftapps.com
and click on rosa-github.
```

20. Copy the returned link and paste it into your browser. The new IDP should be available under your chosen name. Click your IDP and use your GitHub credentials to access the cluster.

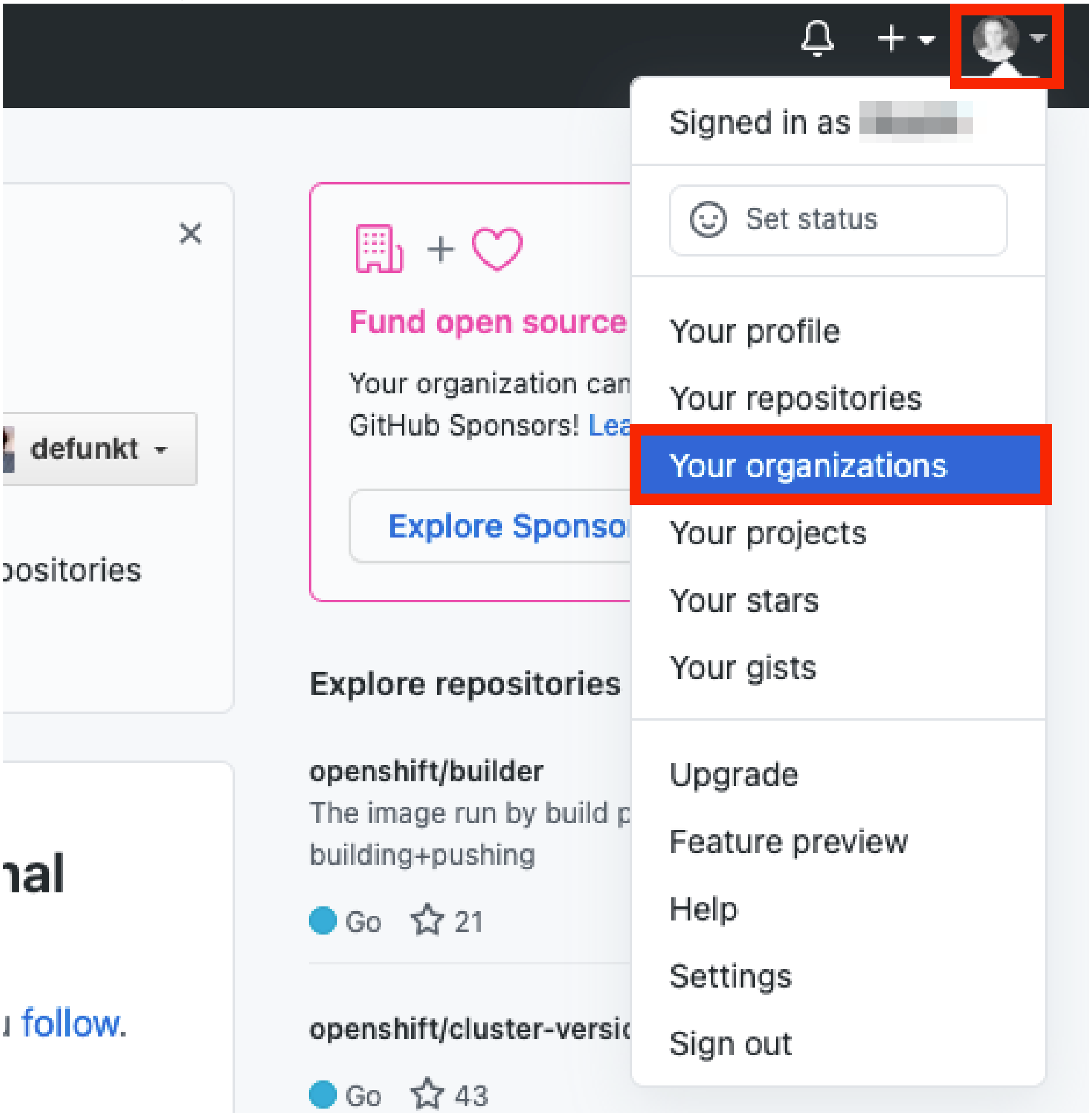


16.5.2. Granting other users access to the cluster

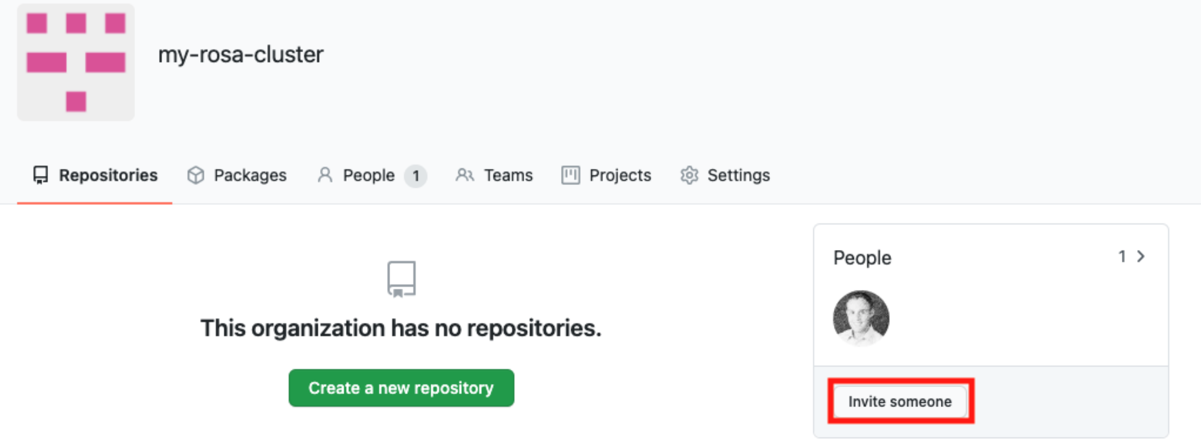
To grant access to other cluster user you will need to add their GitHub user ID to the GitHub organization used for this cluster.

1. In GitHub, go to the **Your organizations** page.

2. Click your **profile icon**, then **Your organizations**. Then click **<your-organization-name>**. In our example, it is **my-rosa-cluster**.



3. Click **Invite someone**.



4. Enter the GitHub ID of the new user, select the correct user, and click **Invite**.

5. Once the new user accepts the invitation, they will be able to log in to the ROSA cluster using the Hybrid Cloud Console link and their GitHub credentials.

16.6. TUTORIAL: GRANTING ADMIN PRIVILEGES

Administration (admin) privileges are not automatically granted to users that you add to your cluster. If you want to grant admin-level privileges to certain users, you will need to manually grant them to each user. You can grant admin privileges from either the ROSA command line interface (CLI) or the Red Hat OpenShift Cluster Manager web user interface (UI).

Red Hat offers two types of admin privileges:

- **cluster-admin**: **cluster-admin** privileges give the admin user full privileges within the cluster.
- **dedicated-admin**: **dedicated-admin** privileges allow the admin user to complete most administrative tasks with certain limitations to prevent cluster damage. It is best practice to use **dedicated-admin** when elevated privileges are needed.

For more information on admin privileges, see the administering a cluster documentation.

16.6.1. Using the ROSA CLI

1. Assuming you are the user who created the cluster, run one of the following commands to grant admin privileges:
   - For **cluster-admin**:

     ```
     $ rosa grant user cluster-admin --user <idp_user_name> --cluster=<cluster-name>
     ```

   - For **dedicated-admin**:

     ```
     $ rosa grant user dedicated-admin --user <idp_user_name> --cluster=<cluster-name>
     ```

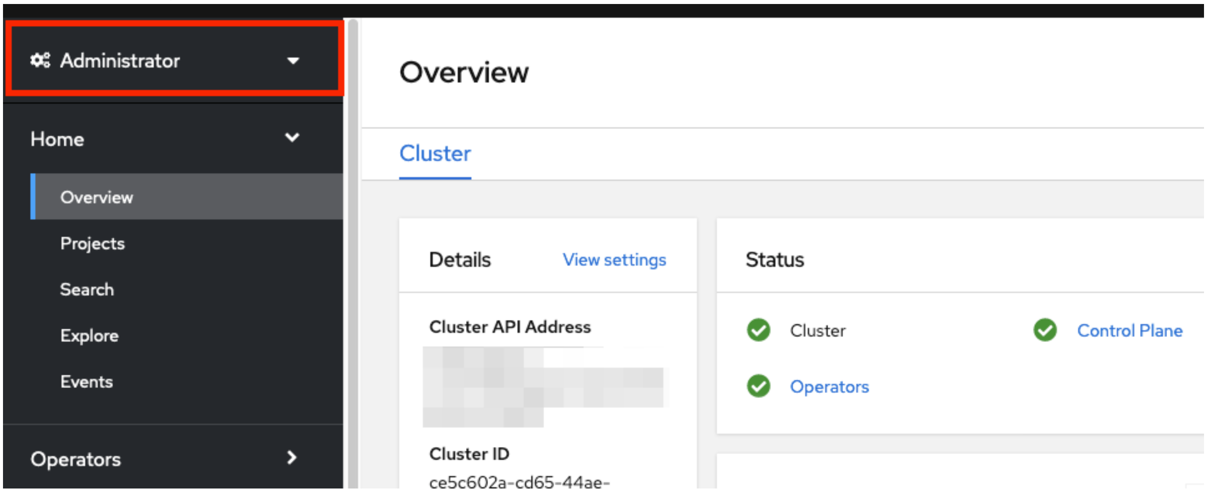
2. Verify that the admin privileges were added by running the following command:

   ```
   $ rosa list users --cluster=<cluster-name>
   ```

   Example output

```
$ rosa list users --cluster=my-rosa-cluster
ID                GROUPS
<idp_user_name>    cluster-admins
```

3. If you are currently logged into the Red Hat Hybrid Cloud Console, log out of the console and log back in to the cluster to see a new perspective with the "Administrator Panel". You might need an incognito or private window.



4. You can also test that admin privileges were added to your account by running the following command. Only a **cluster-admin** users can run this command without errors.

```
$ oc get all -n openshift-apiserver
```

16.6.2. Using the Red Hat OpenShift Cluster Manager UI

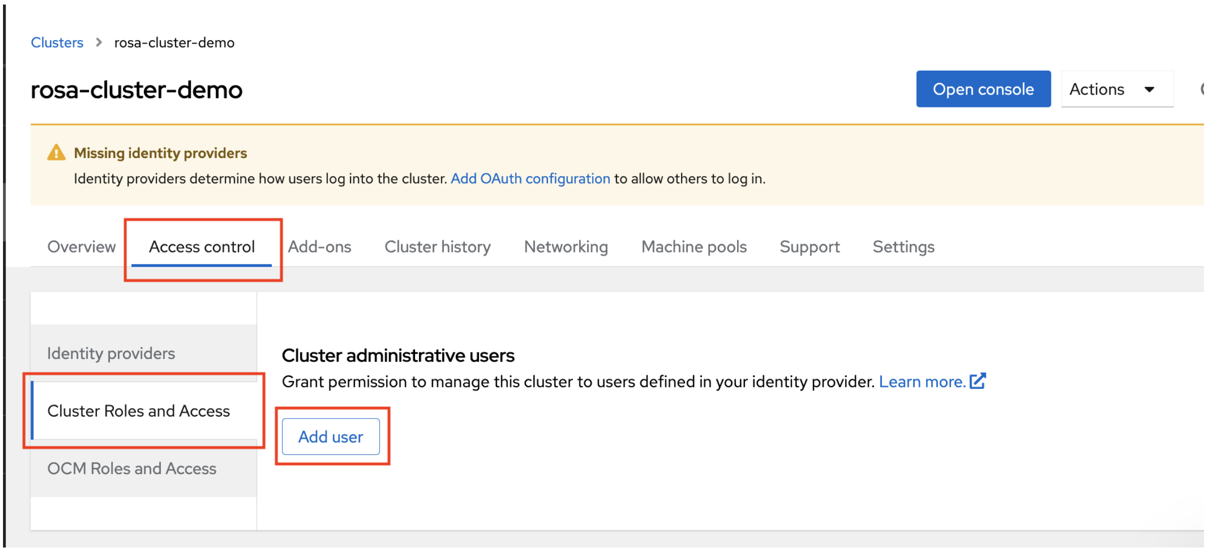
1. Log in to the OpenShift Cluster Manager.

2. Select your cluster.

3. Click the **Access Control** tab.

4. Click the **Cluster roles and Access** tab in the sidebar.

5. Click **Add user**.



Missing identity providers

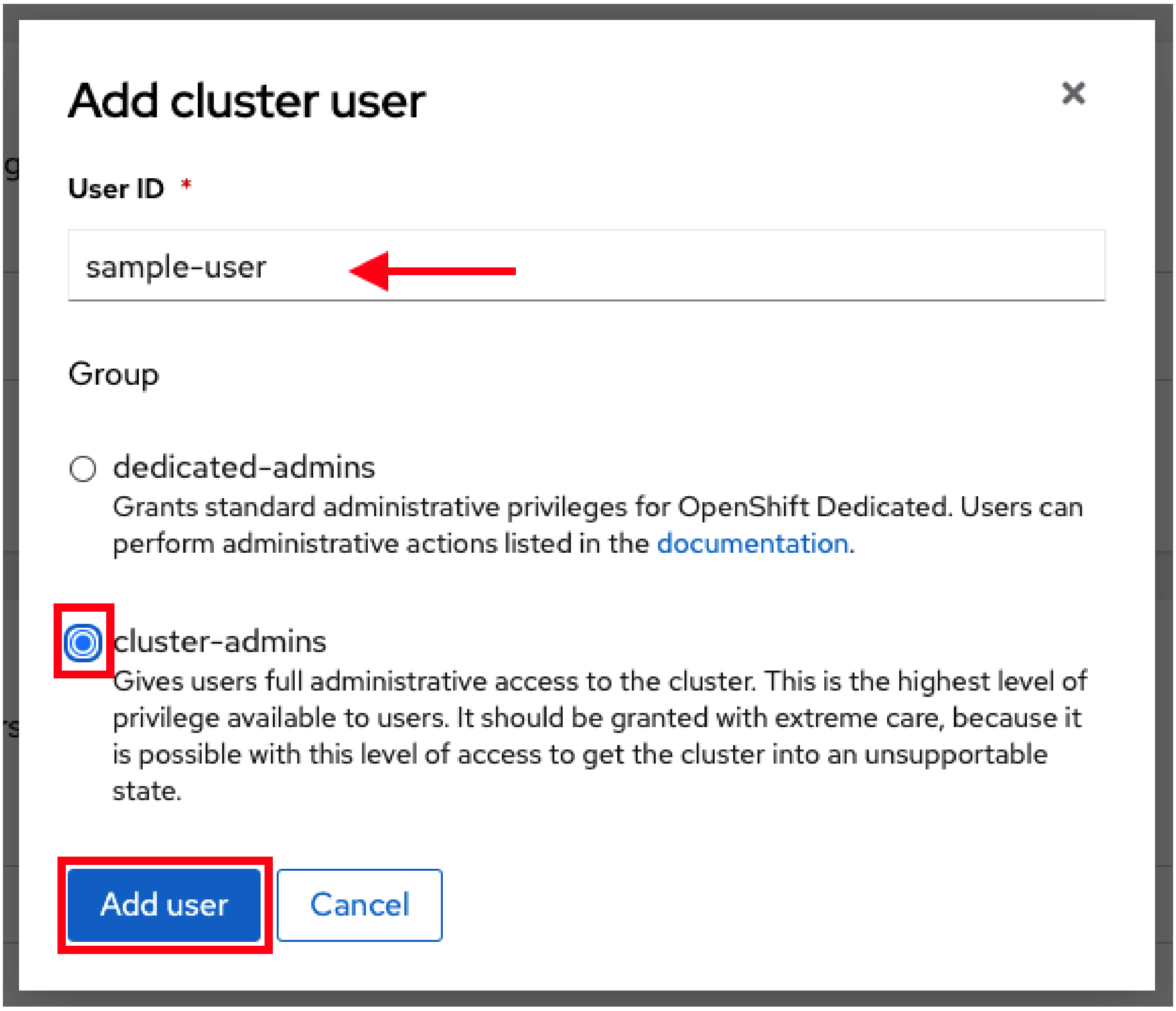
Identity providers determine how users log into the cluster. Add OAuth configuration to allow others to log in.

Cluster administrative users

Grant permission to manage this cluster to users defined in your identity provider. Learn more.

6. On the pop-up screen, enter the user ID.

7. Select whether you want to grant the user **cluster-admins** or **dedicated-admins** privileges.



Add cluster user

User ID *

sample-user

Group

○ dedicated-admins
Grants standard administrative privileges for OpenShift Dedicated. Users can perform administrative actions listed in the documentation.

● cluster-admins
Gives users full administrative access to the cluster. This is the highest level of privilege available to users. It should be granted with extreme care, because it is possible with this level of access to get the cluster into an unsupportable state.

16.7. TUTORIAL: ACCESSING YOUR CLUSTER

You can connect to your cluster using the command line interface (CLI) or the Red Hat Hybrid Cloud Console user interface (UI).

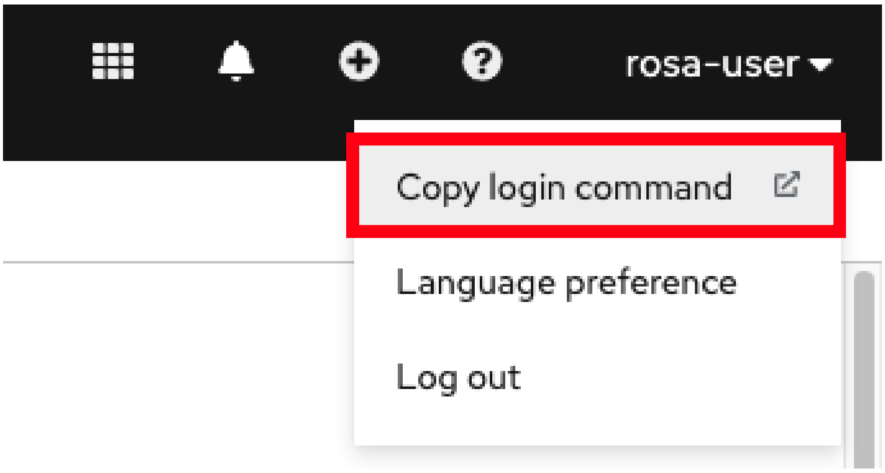
16.7.1. Accessing your cluster using the CLI

To access the cluster using the CLI, you must have the **oc** CLI installed. If you are following the tutorials, you already installed the **oc** CLI.

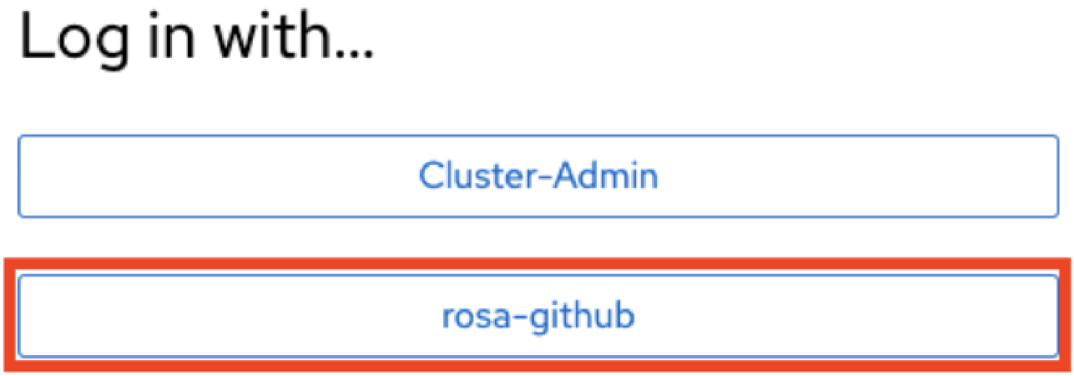
1. Log in to the OpenShift Cluster Manager.

2. Click your username in the top right corner.

3. Click **Copy Login Command**.



4. This opens a new tab with a choice of identity providers (IDPs). Click the IDP you want to use. For example, "rosa-github".



5. A new tab opens. Click **Display token**.

6. Run the following command in your terminal:

```
$ oc login --token=sha256~GBAfS4JQ0t1UTKYHbWAK6OUWGUkdMGz000000000000 --
server=https://api.my-rosa-cluster.abcd.p1.openshiftapps.com:6443
```

Example output

```
Logged into "https://api.my-rosa-cluster.abcd.p1.openshiftapps.com:6443" as "rosa-user"
using the token provided.

You have access to 79 projects, the list has been suppressed. You can list all projects with '
projects'

Using project "default".
```

7. Confirm that you are logged in by running the following command:

```
$ oc whoami
```

Example output

```
rosa-user
```

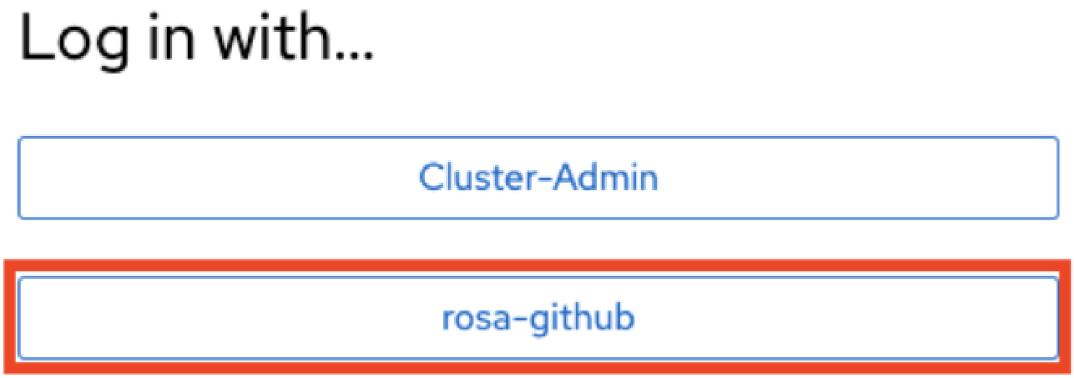
8. You can now access your cluster.

16.7.2. Accessing the cluster via the Hybrid Cloud Console

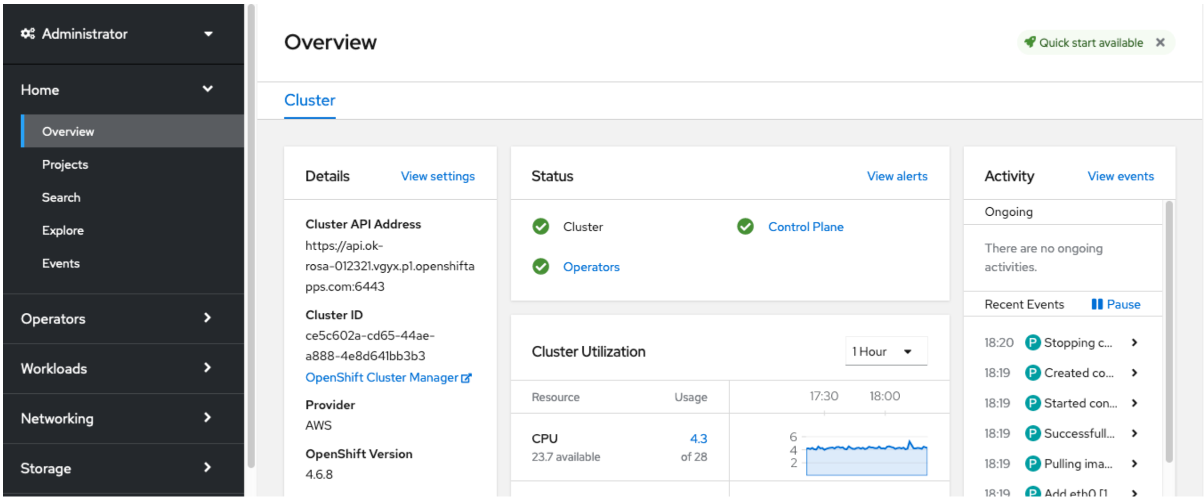
1. Log in to the OpenShift Cluster Manager.
   a. To retrieve the Hybrid Cloud Console URL run:

```
rosa describe cluster -c <cluster-name> | grep Console
```

2. Click your IDP. For example, "rosa-github".



3. Enter your user credentials.
4. You should be logged in. If you are following the tutorials, you will be a cluster-admin and should see the Hybrid Cloud Console webpage with the **Administrator** panel visible.



Cluster API Address
https://api.ok-rosa-012321.vgyx.p1.openshiftapps.com:6443

Cluster ID
ce5c602a-cd65-44ae-a888-4e8d641bb3b3
OpenShift Cluster Manager

Provider
AWS

OpenShift Version
4.6.8

16.8. TUTORIAL: MANAGING WORKER NODES

In Red Hat OpenShift Service on AWS (ROSA), changing aspects of your worker nodes is performed through the use of machine pools. A machine pool allows users to manage many machines as a single entity. Every ROSA cluster has a default machine pool that is created when the cluster is created. For more information, see the machine pool documentation.

16.8.1. Creating a machine pool

You can create a machine pool with either the command line interface (CLI) or the user interface (UI).

16.8.1.1. Creating a machine pool with the CLI

1. Run the following command:

   ```
   rosa create machinepool --cluster=<cluster-name> --name=<machinepool-name> --replicas=
   <number-nodes>
   ```

   Example input

   ```
    $ rosa create machinepool --cluster=my-rosa-cluster --name=new-mp
    --replicas=2
   ```

   Example output

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

2. **Optional:** Add node labels or taints to specific nodes in a new machine pool by running the following command:

   ```
   rosa create machinepool --cluster=<cluster-name> --name=<machinepool-name> --replicas=
   <number-nodes> --labels=`<key=pair>`
   ```

   Example input

   ```
   $ rosa create machinepool --cluster=my-rosa-cluster --name=db-nodes-mp --replicas=2 --
   labels='app=db','tier=backend'
   ```

   Example output

   ```
   I: Machine pool 'db-nodes-mp' created successfully on cluster 'my-rosa-cluster'
   ```

   This creates an additional 2 nodes that can be managed as a unit and also assigns them the labels shown.

3. Run the following command to confirm machine pool creation and the assigned labels:

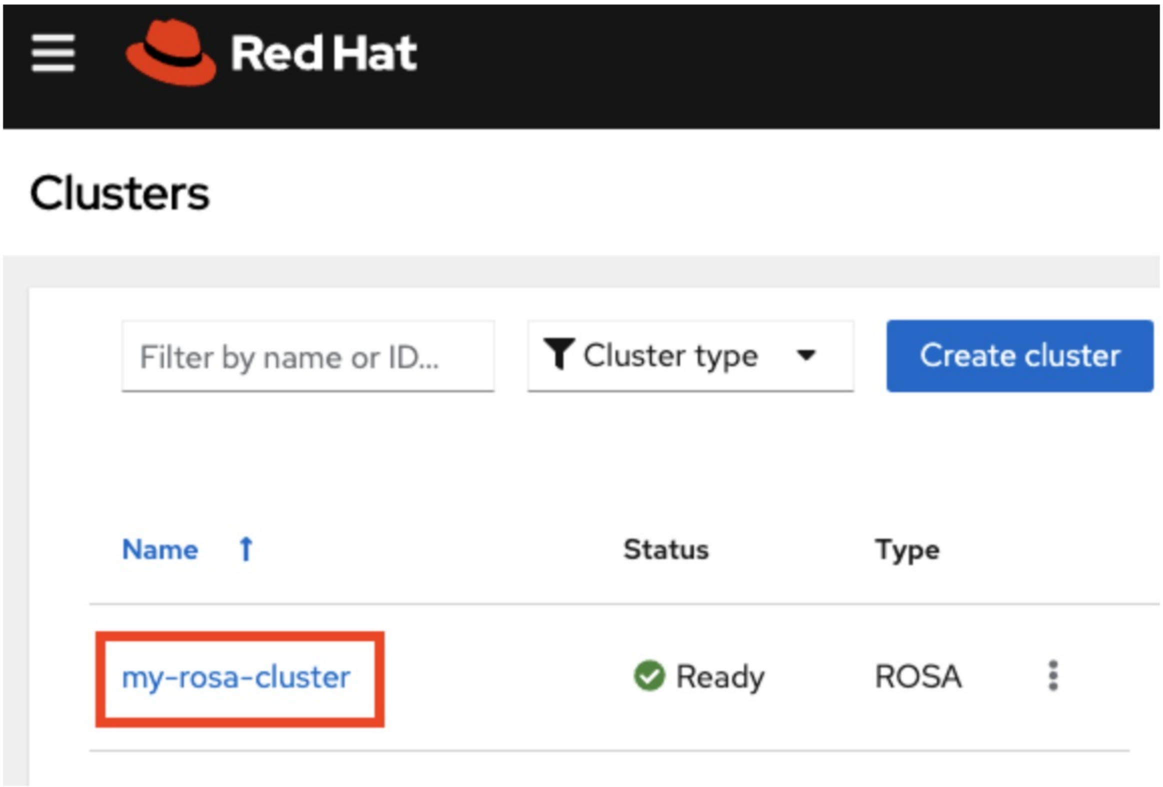
   ```
   rosa list machinepools --cluster=<cluster-name>
   ```

   Example output

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

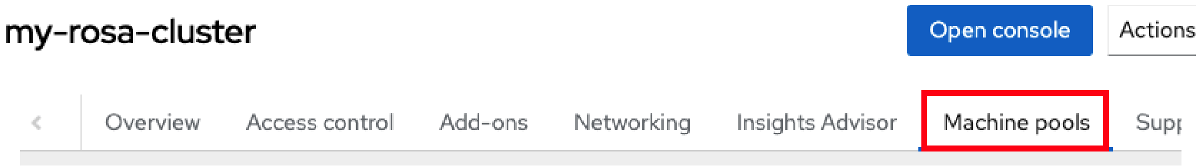
16.8.1.2. Creating a machine pool with the UI

1. Log in to the OpenShift Cluster Manager and click your cluster.



Name	Status	Type
my-rosa-cluster	Ready	ROSA

2. Click **Machine pools**.

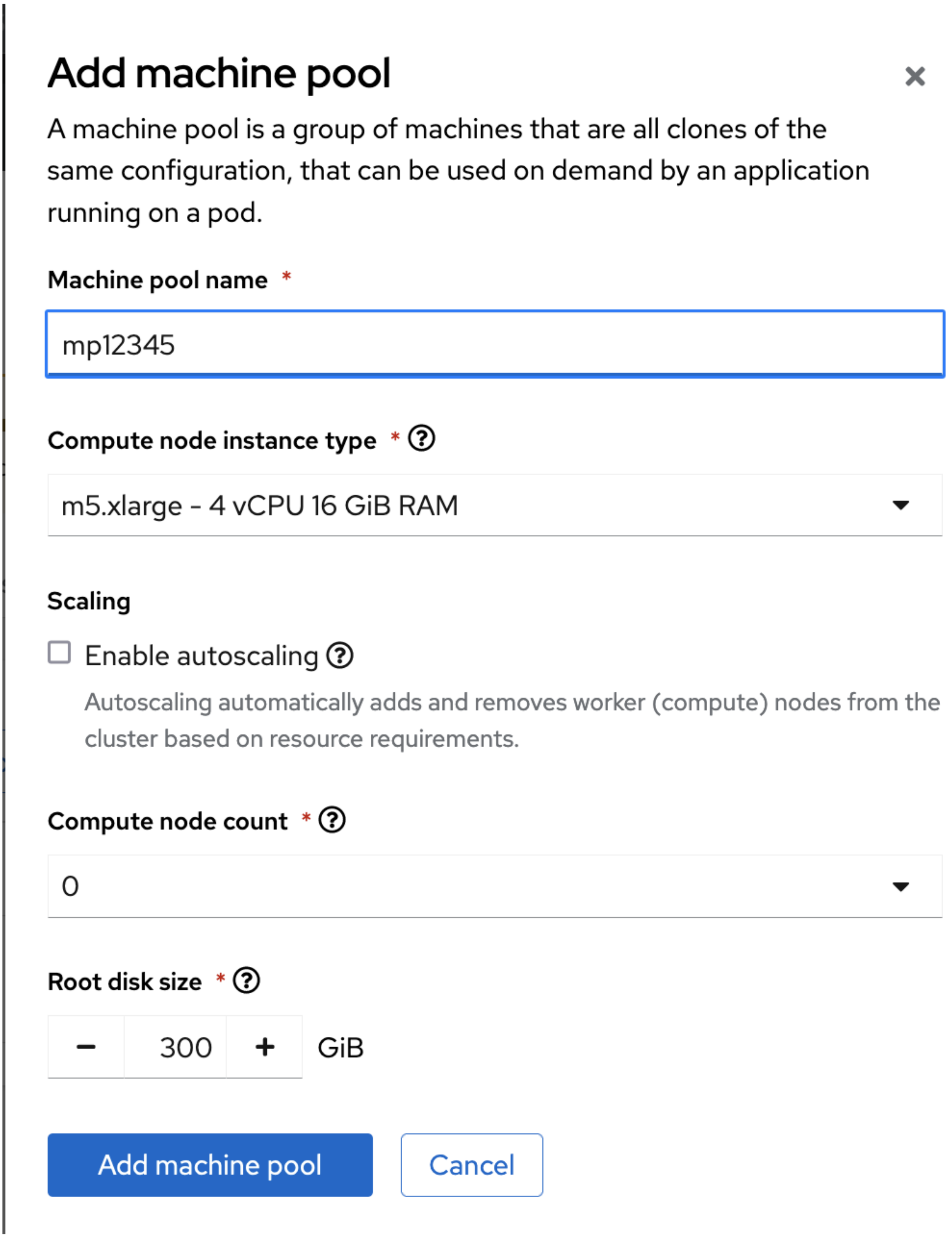


3. Click **Add machine pool**.

4. Enter the desired configuration.

TIP

You can also and expand the **Edit node labels and taints** section to add node labels and taints to the nodes in the machine pool.



Add machine pool

A machine pool is a group of machines that are all clones of the same configuration, that can be used on demand by an application running on a pod.

Machine pool name *: mp12345

Compute node instance type *: m5.xlarge - 4 vCPU 16 GiB RAM

Scaling

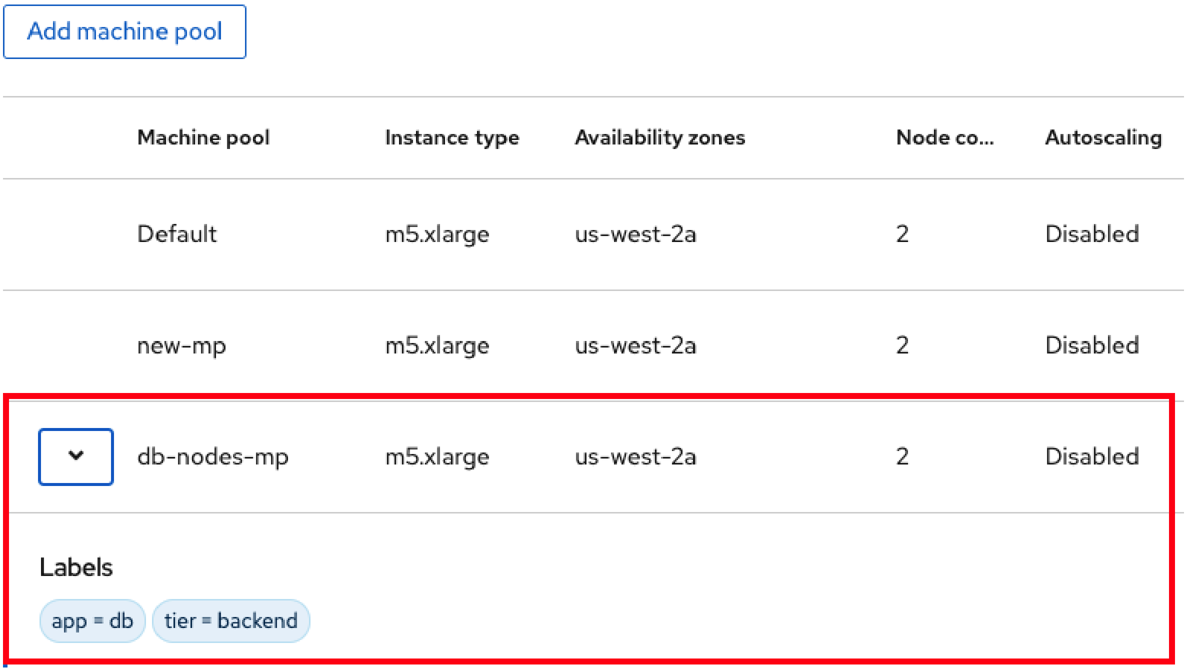
□ Enable autoscaling

Autoscaling automatically adds and removes worker (compute) nodes from the cluster based on resource requirements.

Compute node count *: 0

Root disk size *: 300 GiB

5. You will see the new machine pool you created.



Machine pool	Instance type	Availability zones	Node co...	Autoscaling
Default	m5.xlarge	us-west-2a	2	Disabled
new-mp	m5.xlarge	us-west-2a	2	Disabled
db-nodes-mp	m5.xlarge	us-west-2a	2	Disabled

Labels

app = db tier = backend

16.8.2. Scaling worker nodes

Edit a machine pool to scale the number of worker nodes in that specific machine pool. You can use either the CLI or the UI to scale worker nodes.

16.8.2.1. Scaling worker nodes using the CLI

1. Run the following command to see the default machine pool that is created with each 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
```

2. To scale the default machine pool out to a different number of nodes, run the following command:

```
rosa edit machinepool --cluster=<cluster-name> --replicas=<number-nodes> <machinepool-name>
```

Example input

```
rosa edit machinepool --cluster=my-rosa-cluster --replicas 3 Default
```

3. Run the following command to confirm that the machine pool has scaled:

```
rosa describe cluster --cluster=<cluster-name> | grep Compute
```

Example input

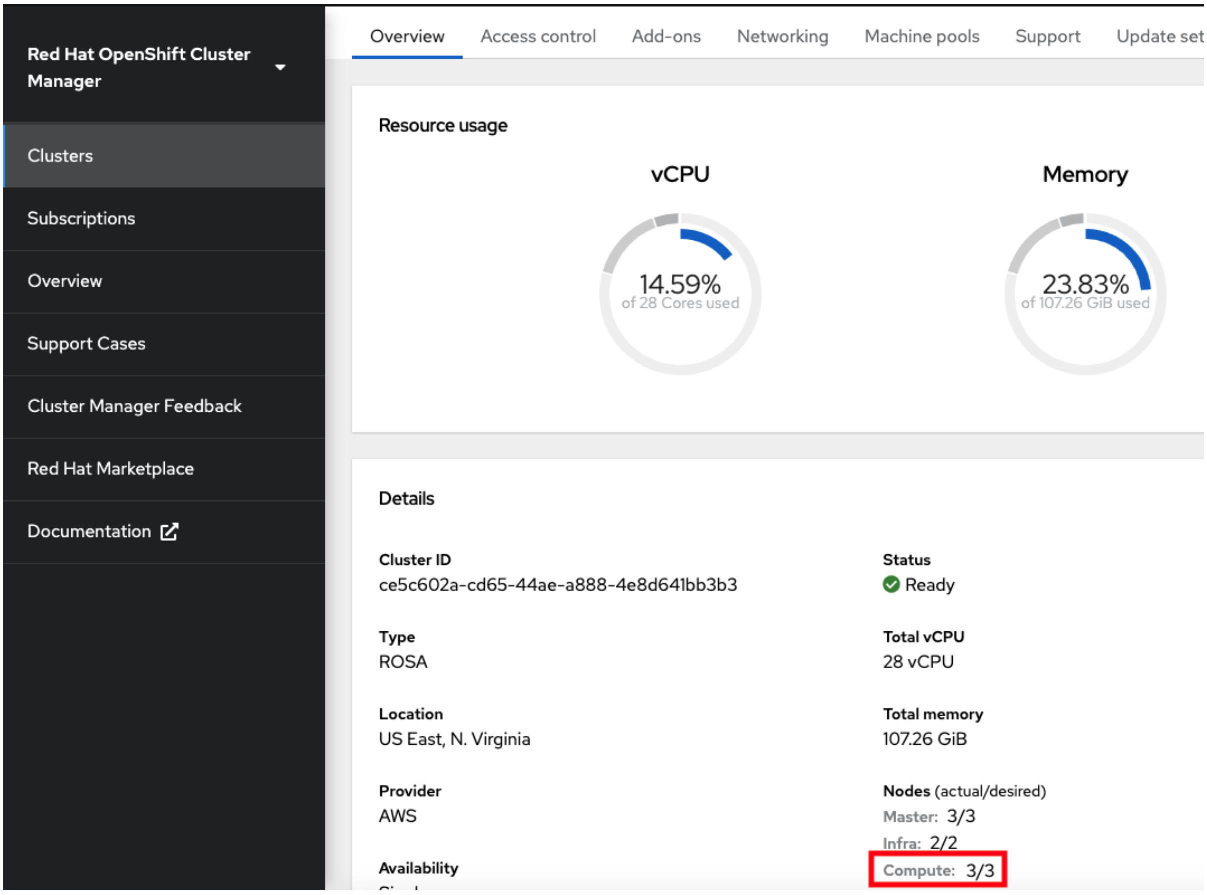
```
$ rosa describe cluster --cluster=my-rosa-cluster | grep Compute
```

Example output

```
- Compute:                 3 (m5.xlarge)
```

16.8.2.2. Scaling worker nodes using the UI

1. Click the three dots to the right of the machine pool you want to edit.
2. Click **Edit**.
3. Enter the desired number of nodes, and click **Save**.
4. Confirm that the cluster has scaled by selecting the cluster, clicking the **Overview** tab, and scrolling to **Compute listing**. The compute listing should equal the scaled nodes. For example, 3/3.



Details

Cluster ID
ce5c602a-cd65-44ae-a888-4e8d641bb3b3

Status
Ready

Type
ROSA

Total vCPU
28 vCPU

Location
US East, N. Virginia

Total memory
107.26 GiB

Provider
AWS

Nodes (actual/desired)
Master: 3/3
Infra: 2/2
Compute: 3/3

Availability

16.8.2.3. Adding node labels

1. Use the following command to add node labels:

```
rosa edit machinepool --cluster=<cluster-name> --replicas=<number-nodes> --
labels='key=value' <machinepool-name>
```

Example input

```
rosa edit machinepool --cluster=my-rosa-cluster --replicas=2 --labels 'foo=bar','baz=one'
new-mp
```

This adds 2 labels to the new machine pool.

IMPORTANT

This command replaces all machine pool configurations with the newly defined configuration. If you want to add another label **and** keep the old label, you must state both the new and preexisting the label. Otherwise the command will replace all preexisting labels with the one you wanted to add. Similarly, if you want to delete a label, run the command and state the ones you want, excluding the one you want to delete.

16.8.3. Mixing node types

You can also mix different worker node machine types in the same cluster by using new machine pools. You cannot change the node type of a machine pool once it is created, but you can create a new machine pool with different nodes by adding the **--instance-type** flag.

1. For example, to change the database nodes to a different node type, run the following command:

```
rosa create machinepool --cluster=<cluster-name> --name=<mp-name> --replicas=<number-nodes> --labels='<key=pair>' --instance-type=<type>
```

Example input

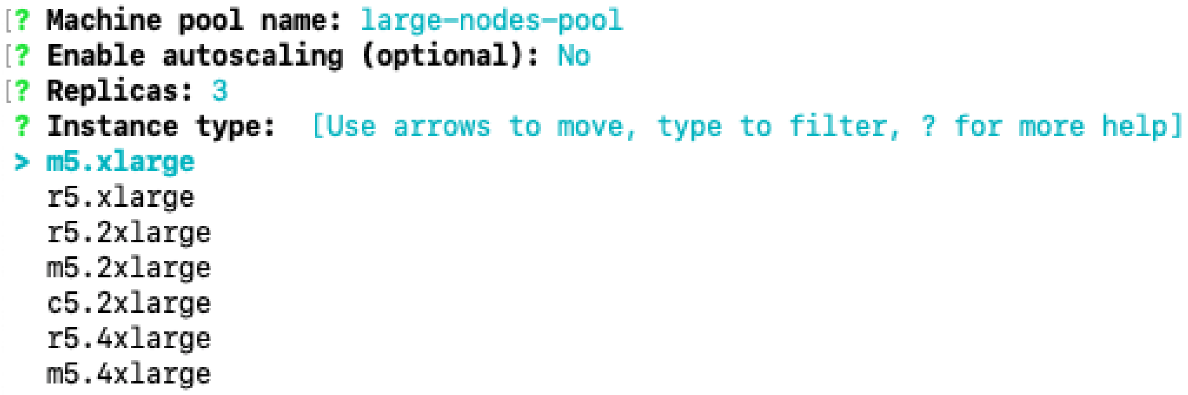
```
rosa create machinepool --cluster=my-rosa-cluster --name=db-nodes-large-mp --replicas=2 --labels='app=db','tier=backend' --instance-type=m5.2xlarge
```

2. To see all the instance types available, run the following command:

```
rosa list instance-types
```

3. To make step-by-step changes, use the **--interactive** flag:

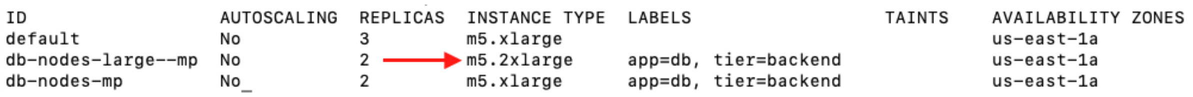
```
rosa create machinepool -c <cluster-name> --interactive
```



```
[? Machine pool name: large-nodes-pool
[? Enable autoscaling (optional): No
[? Replicas: 3
 ? Instance type:  [Use arrows to move, type to filter, ? for more help]
 > m5.xlarge
   r5.xlarge
   r5.2xlarge
   m5.2xlarge
   c5.2xlarge
   r5.4xlarge
   m5.4xlarge
```

4. Run the following command to list the machine pools and see the new, larger instance type:

```
rosa list machinepools -c <cluster-name>
```



```
ID                  AUTOSCALING  REPLICAS  INSTANCE TYPE  LABELS                  TAINTS    AVAILABILITY ZONES
default             No           3         m5.xlarge                                        us-east-1a
db-nodes-large--mp  No           2         m5.2xlarge     app=db, tier=backend              us-east-1a
db-nodes-mp         No_          2         m5.xlarge      app=db, tier=backend              us-east-1a
```

16.9. TUTORIAL: AUTOSCALING

The cluster autoscaler adds or removes worker nodes from a cluster based on pod resources.

The cluster autoscaler increases the size of the cluster when:

- Pods fail to schedule on the current nodes due to insufficient resources.
- Another node is necessary to meet deployment needs.

The cluster autoscaler does not increase the cluster resources beyond the limits that you specify.

The cluster autoscaler decreases the size of the cluster when:

- Some nodes are consistently not needed for a significant period. For example, when a node has low resource use and all of its important pods can fit on other nodes.

16.9.1. Enabling autoscaling for an existing machine pool using the CLI

NOTE

Cluster autoscaling can be enabled at cluster creation and when creating a new machine pool by using the **--enable-autoscaling** option.

1. Autoscaling is set based on machine pool availability. To find out which machine pools are available for autoscaling, run the following command:

```
$ rosa list machinepools -c <cluster-name>
```

Example output

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

2. Run the following command to add autoscaling to an available machine pool:

```
$ rosa edit machinepool -c <cluster-name> --enable-autoscaling <machinepool-name> --min-replicas=<num> --max-replicas=<num>
```

Example input

```
$ rosa edit machinepool -c my-rosa-cluster --enable-autoscaling Default --min-replicas=2 --max-replicas=4
```

The above command creates an autoscaler for the worker nodes that scales between 2 and 4 nodes depending on the resources.

16.9.2. Enabling autoscaling for an existing machine pool using the UI

NOTE

Cluster autoscaling can be enabled at cluster creation by checking the **Enable autoscaling** checkbox when creating machine pools.

1. Go to the **Machine pools** tab and click the three dots in the right..
2. Click **Scale**, then **Enable autoscaling**.
3. Run the following command to confirm that autoscaling was added:

```
$ rosa list machinepools -c <cluster-name>
```

Example output

```
ID        AUTOSCALING  REPLICAS  INSTANCE TYPE  LABELS     TAINTS
AVAILABILITY ZONES
Default    Yes         2-4       m5.xlarge                        us-east-1a
```

16.10. TUTORIAL: UPGRADING YOUR CLUSTER

Red Hat OpenShift Service on AWS (ROSA) executes all cluster upgrades as part of the managed service. You do not need to run any commands or make changes to the cluster. You can schedule the upgrades at a convenient time.

Ways to schedule a cluster upgrade include:

- **Manually using the command line interface (CLI)**: Start a one-time immediate upgrade or schedule a one-time upgrade for a future date and time.
- **Manually using the Red Hat OpenShift Cluster Manager user interface (UI)**: Start a one-time immediate upgrade or schedule a one-time upgrade for a future date and time.
- **Automated upgrades**: Set an upgrade window for recurring y-stream upgrades whenever a new version is available without needing to manually schedule it. Minor versions have to be manually scheduled.

For more details about cluster upgrades, run the following command:

```
$ rosa upgrade cluster --help
```

16.10.1. Manually upgrading your cluster using the CLI

1. Check if there is an upgrade available by running the following command:

```
$ rosa list upgrade -c <cluster-name>
```

Example output

```
$ rosa list upgrade -c <cluster-name>
```

```
VERSION  NOTES
4.14.7   recommended
4.14.6
...
```

In the above example, versions 4.14.7 and 4.14.6 are both available.

2. Schedule the cluster to upgrade within the hour by running the following command:

```
$ rosa upgrade cluster -c <cluster-name> --version <desired-version>
```

3. **Optional:** Schedule the cluster to upgrade at a later date and time by running the following command:

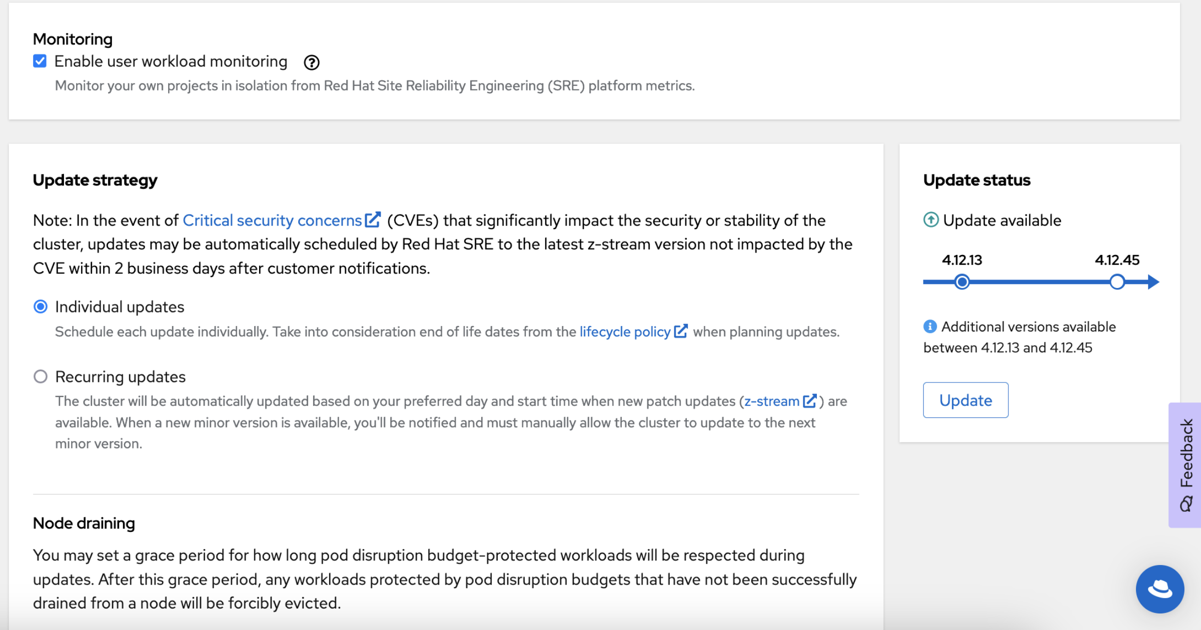
```
$ rosa upgrade cluster -c <cluster-name> --version <desired-version> --schedule-date
<future-date-for-update> --schedule-time <future-time-for-update>
```

16.10.2. Manually upgrading your cluster using the UI

1. Log in to the OpenShift Cluster Manager, and select the cluster you want to upgrade.

2. Click **Settings**.

3. If an upgrade is available, click **Update**.



Monitoring

☑ Enable user workload monitoring

Monitor your own projects in isolation from Red Hat Site Reliability Engineering (SRE) platform metrics.

Update strategy

Note: In the event of Critical security concerns (CVEs) that significantly impact the security or stability of the cluster, updates may be automatically scheduled by Red Hat SRE to the latest z-stream version not impacted by the CVE within 2 business days after customer notifications.

● Individual updates

Schedule each update individually. Take into consideration end of life dates from the lifecycle policy when planning updates.

○ Recurring updates

The cluster will be automatically updated based on your preferred day and start time when new patch updates (z-stream) are available. When a new minor version is available, you'll be notified and must manually allow the cluster to update to the next minor version.

Node draining

You may set a grace period for how long pod disruption budget-protected workloads will be respected during updates. After this grace period, any workloads protected by pod disruption budgets that have not been successfully drained from a node will be forcibly evicted.

Update status

Update available

Additional versions available between 4.12.13 and 4.12.45

4. Select the version to which you want to upgrade in the new window.

5. Schedule a time for the upgrade or begin it immediately.

16.10.3. Setting up automatic recurring upgrades

1. Log in to the OpenShift Cluster Manager, and select the cluster you want to upgrade.

2. Click **Settings**.

    1. Under **Update Strategy**, click **Recurring updates**.

3. Set the day and time for the upgrade to occur.

4. Under **Node draining**, select a grace period to allow the nodes to drain before pod eviction.

5. Click **Save**.

16.11. TUTORIAL: DELETING YOUR CLUSTER

You can delete your Red Hat OpenShift Service on AWS (ROSA) cluster using either the command line interface (CLI) or the user interface (UI).

16.11.1. Deleting a ROSA cluster using the CLI

1. **Optional:** List your clusters to make sure you are deleting the correct one by running the following command:

```
$ rosa list clusters
```

2. Delete a cluster by running the following command:

```
$ rosa delete cluster --cluster <cluster-name>
```

> **WARNING**
>
> This command is non-recoverable.

3. The CLI prompts you to confirm that you want to delete the cluster. Press **y** and then **Enter**. The cluster and all its associated infrastructure will be deleted.

> **NOTE**
>
> All AWS STS and IAM roles and policies will remain and must be deleted manually once the cluster deletion is complete by following the steps below.

4. The CLI outputs the commands to delete the OpenID Connect (OIDC) provider and Operator IAM roles resources that were created. Wait until the cluster finishes deleting before deleting these resources. Perform a quick status check by running the following command:

```
$ rosa list clusters
```

5. Once the cluster is deleted, delete the OIDC provider by running the following command:

```
$ rosa delete oidc-provider -c <clusterID> --mode auto --yes
```

6. Delete the Operator IAM roles by running the following command:

```
$ rosa delete operator-roles -c <clusterID> --mode auto --yes
```

NOTE

This command requires the cluster ID and not the cluster name.

7. Only remove the remaining account roles if they are no longer needed by other clusters in the same account. If you want to create other ROSA clusters in this account, do not perform this step.
   To delete the account roles, you need to know the prefix used when creating them. The default is "ManagedOpenShift" unless you specified otherwise.

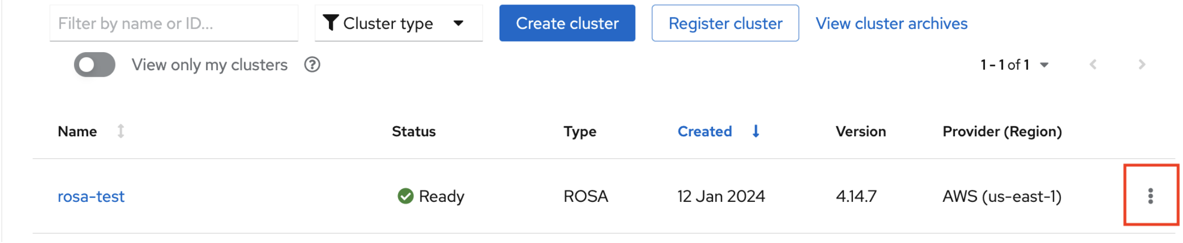
   Delete the account roles by running the following command:

```
$ rosa delete account-roles --prefix <prefix> --mode auto --yes
```

16.11.2. Deleting a ROSA cluster using the UI

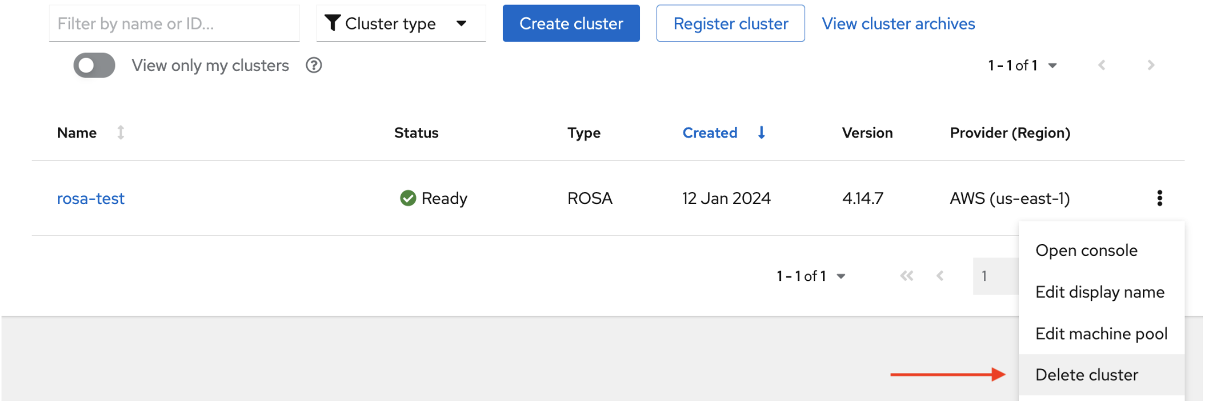
1. Log in to the Red Hat OpenShift Cluster Manager, and locate the cluster you want to delete.

2. Click the three dots to the right of the cluster.



Name	Status	Type	Created	Version	Provider (Region)
rosa-test	Ready	ROSA	12 Jan 2024	4.14.7	AWS (us-east-1)

3. In the dropdown menu, click **Delete cluster**.



Name	Status	Type	Created	Version	Provider (Region)
rosa-test	Ready	ROSA	12 Jan 2024	4.14.7	AWS (us-east-1)

4. Enter the name of the cluster to confirm deletion, and click **Delete**.

16.12. TUTORIAL: OBTAINING SUPPORT

Finding the right help when you need it is important. These are some of the resources at your disposal when you need assistance.

16.12.1. Adding support contacts

You can add additional email addresses for communications about your cluster.

1. On the Red Hat OpenShift Cluster Manager user interface (UI), click **select cluster**.

2. Click the **Support** tab.

3. Click **Add notification contact**, and enter the additional email addresses.

16.12.2. Contacting Red Hat for support using the UI

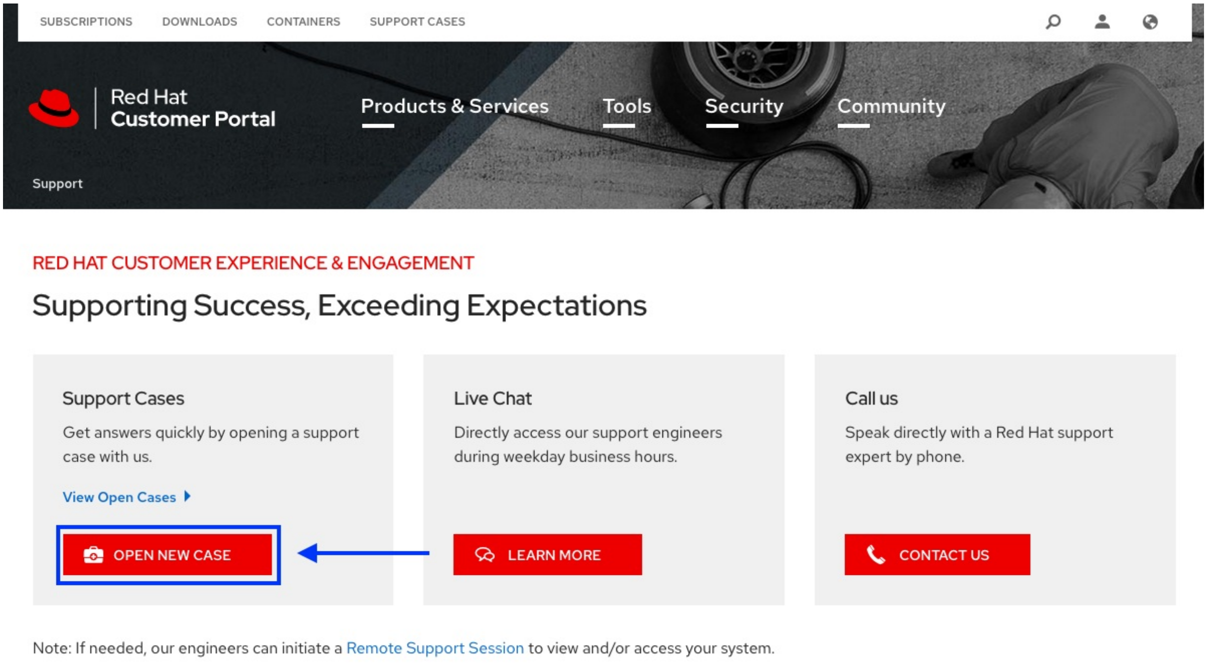
1. On the OpenShift Cluster Manager UI, click the **Support** tab.

2. Click **Open support case**.

16.12.3. Contacting Red Hat for support using the support page

1. Go to the Red Hat support page .

2. Click **Open a new Case**.



RED HAT CUSTOMER EXPERIENCE & ENGAGEMENT

Supporting Success, Exceeding Expectations

Support Cases

Get answers quickly by opening a support case with us.

View Open Cases

Live Chat

Directly access our support engineers during weekday business hours.

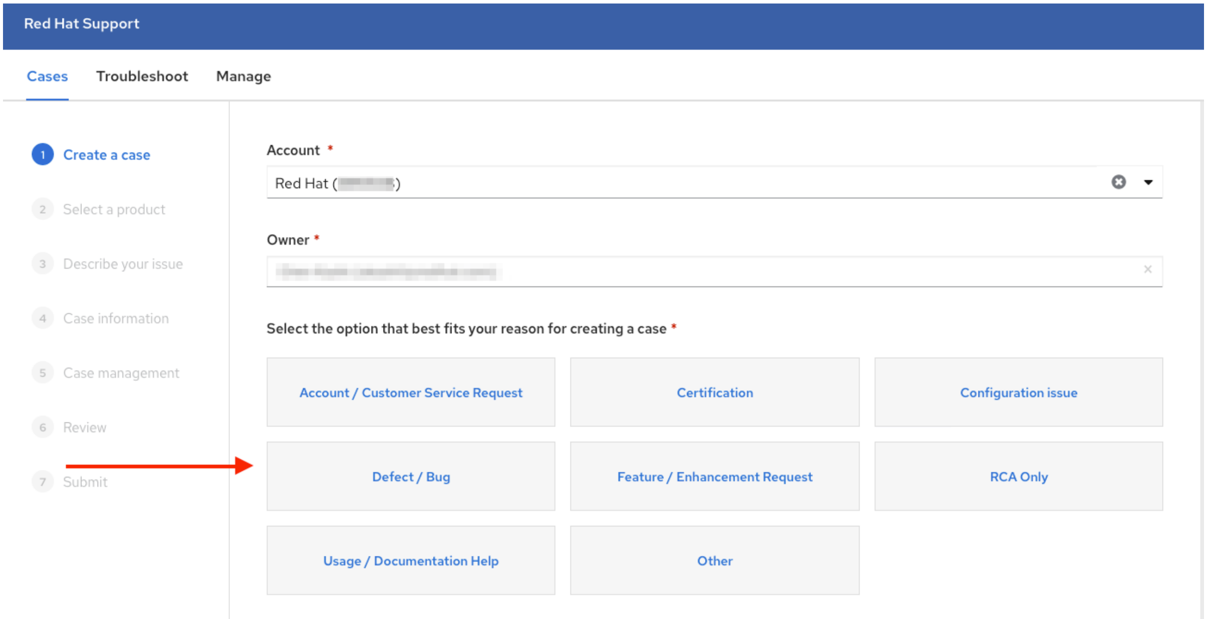
Call us

Speak directly with a Red Hat support expert by phone.

Note: If needed, our engineers can initiate a Remote Support Session to view and/or access your system.

3. Log in to your Red Hat account.

4. Select the reason for contacting support.



Account *

Red Hat ([redacted])

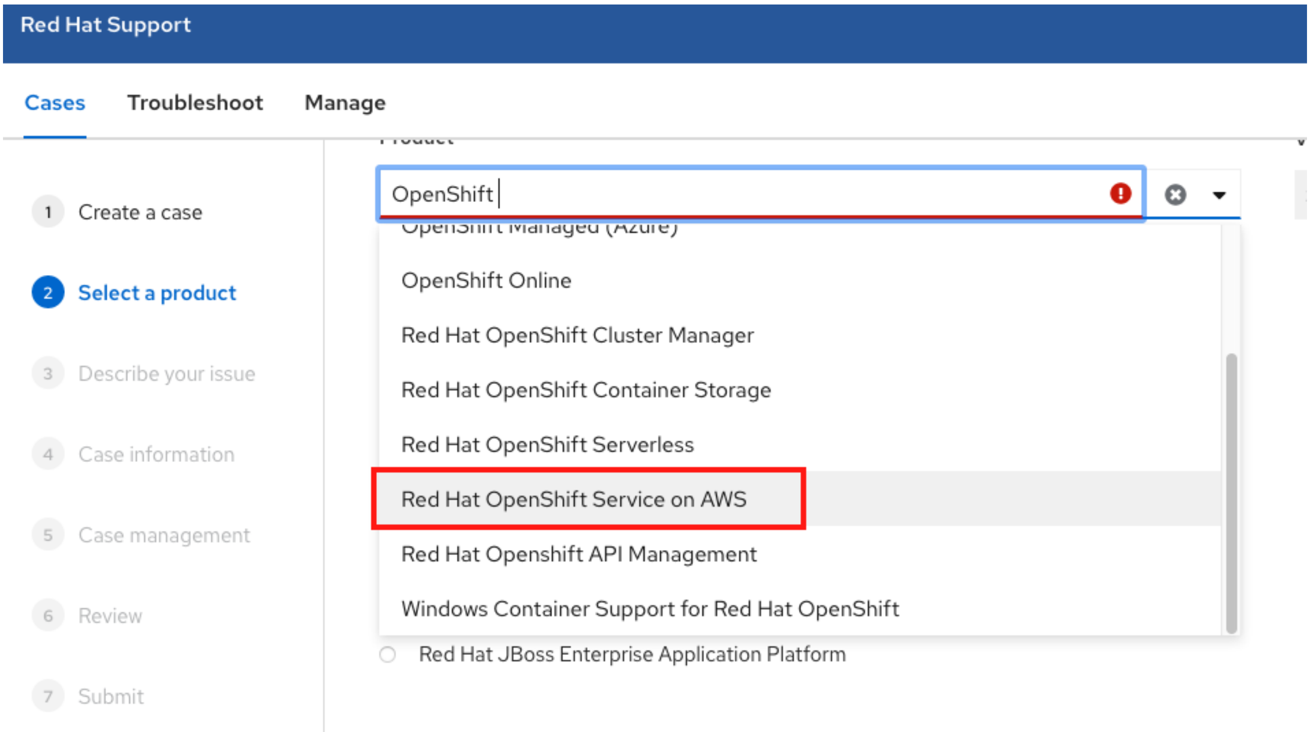
Owner *

[redacted]

Select the option that best fits your reason for creating a case *

Account / Customer Service Request
Certification
Configuration issue
Defect / Bug
Feature / Enhancement Request
RCA Only
Usage / Documentation Help
Other

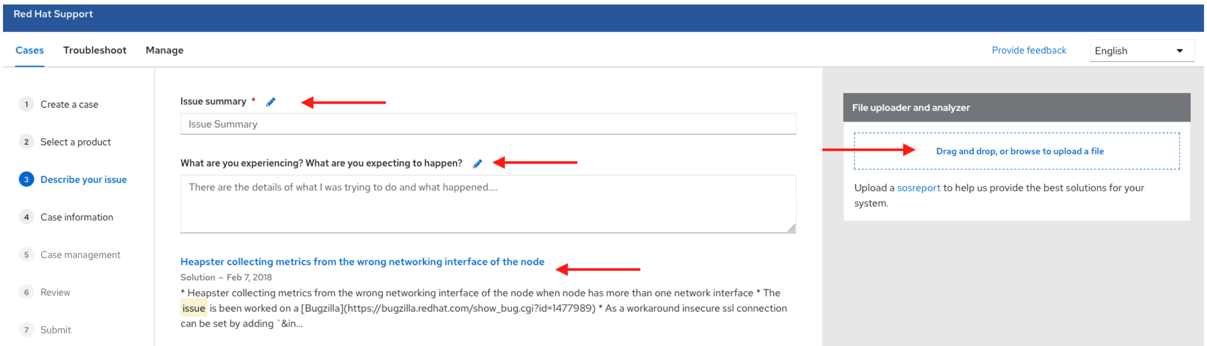
5. Select **Red Hat OpenShift Service on AWS**


Red Hat Support
Cases
Troubleshoot
Manage
1 Create a case
2 Select a product
3 Describe your issue
4 Case information
5 Case management
6 Review
7 Submit
Product
OpenShift
OpenShift Managed (Azure)
OpenShift Online
Red Hat OpenShift Cluster Manager
Red Hat OpenShift Container Storage
Red Hat OpenShift Serverless
Red Hat OpenShift Service on AWS
Red Hat Openshift API Management
Windows Container Support for Red Hat OpenShift
Red Hat JBoss Enterprise Application Platform

1. Click **continue**.

2. Enter a summary of the issue and the details of your request. Upload any files, logs, and screenshots. The more details you provide, the better Red Hat support can help your case.

> **NOTE**
>
> Relevant suggestions that might help with your issue will appear at the bottom of this page.



Issue summary *

Issue Summary

What are you experiencing? What are you expecting to happen?

There are the details of what I was trying to do and what happened....

Heapster collecting metrics from the wrong networking interface of the node

Solution – Feb 7, 2018

* Heapster collecting metrics from the wrong networking interface of the node when node has more than one network interface * The issue is been worked on a [Bugzilla](https://bugzilla.redhat.com/show_bug.cgi?id=1477989) * As a workaround insecure ssl connection can be set by adding `&in...

Upload a sosreport to help us provide the best solutions for your system.

3. Click **Continue**.

4. Answer the questions in the new fields.

5. Click **Continue**.

6. Enter the following information about your case:

   a. **Support level:** Premium

   b. **Severity:** Review the Red Hat Support Severity Level Definitions to choose the correct one.

c. **Group:** If this is related to a few other cases you can select the corresponding group.

d. **Language**

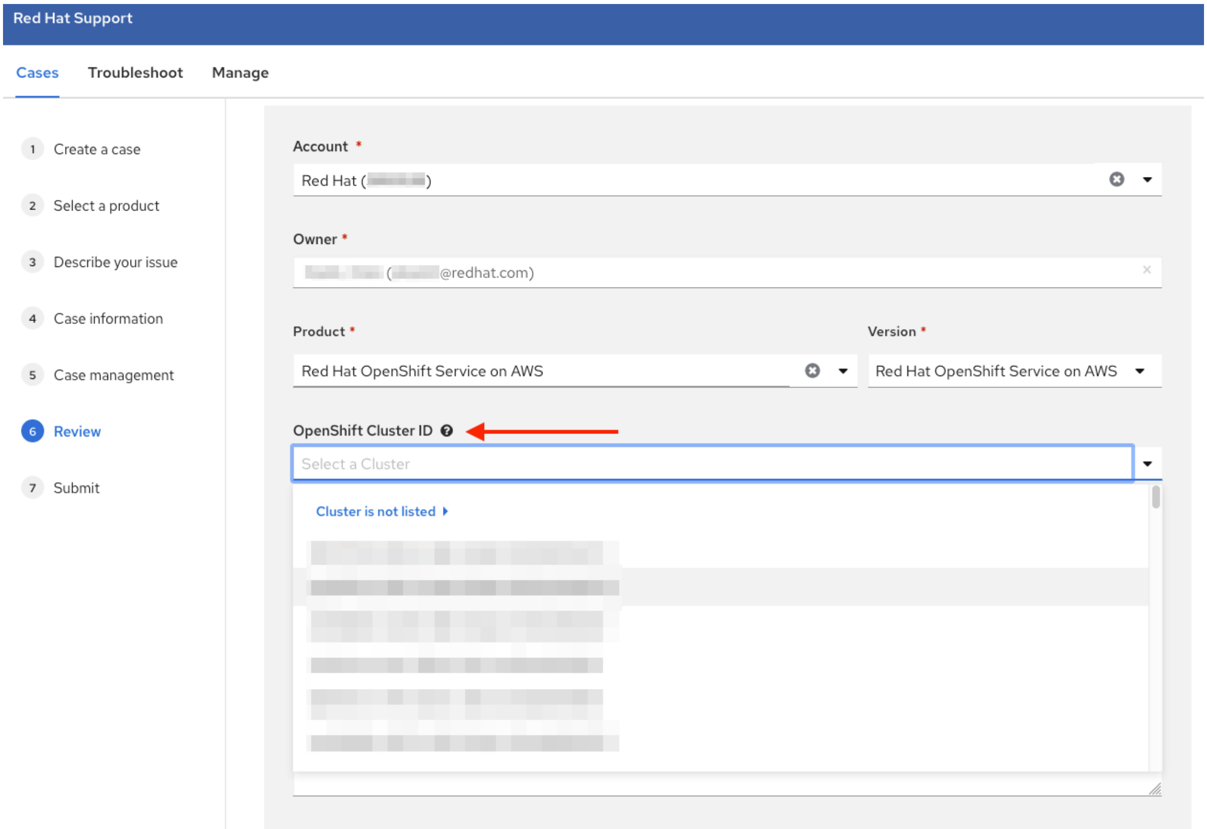
e. **Send notifications:** Add any additional email addresses to keep notified of activity.

f. **Red Hat associates:** If you are working with anyone from Red Hat and want to keep them in the loop you can enter their email address here.

g. **Alternate Case ID:** If you want to attach your own ID to it you can enter it here.

7. Click **Continue**.

8. On the review screen make sure you select the correct cluster ID that you are contacting support about.



Account *: Red Hat ([redacted])

Owner *: [redacted] ([redacted]@redhat.com)

Product *: Red Hat OpenShift Service on AWS

Version *: Red Hat OpenShift Service on AWS

OpenShift Cluster ID: Select a Cluster

Cluster is not listed

[redacted]

9. Click **Submit**.

10. You will be contacted based on the response time committed to for the indicated severity level.

CHAPTER 17. DEPLOYING AN APPLICATION

17.1. TUTORIAL: DEPLOYING AN APPLICATION

17.1.1. Introduction

After successfully provisioning your cluster, you can deploy an application on it. This application allows you to become more familiar with some of the features of Red Hat OpenShift Service on AWS (ROSA) and Kubernetes.

17.1.1.1. Lab overview

In this lab, you will complete the following set of tasks designed to help you understand the concepts of deploying and operating container-based applications:

- Deploy a Node.js based app by using S2I and Kubernetes Deployment objects.
- Set up a continuous delivery (CD) pipeline to automatically push source code changes.
- Explore logging.
- Experience self healing of applications.
- Explore configuration management through configmaps, secrets, and environment variables.
- Use persistent storage to share data across pod restarts.
- Explore networking within Kubernetes and applications.
- Familiarize yourself with ROSA and Kubernetes functionality.
- Automatically scale pods based on loads from the Horizontal Pod Autoscaler.
- Use AWS Controllers for Kubernetes (ACK) to deploy and use an S3 bucket.

This lab uses either the ROSA CLI or ROSA web user interface (UI).

17.2. TUTORIAL: DEPLOYING AN APPLICATION

17.2.1. Prerequisites

1. A Provisioned ROSA cluster
   This lab assumes you have access to a successfully provisioned a ROSA cluster. If you have not yet created a ROSA cluster, see Red Hat OpenShift Service on AWS quickstart guide for more information.

2. The OpenShift Command Line Interface (CLI)
   For more information, see Getting started with the OpenShift CLI.

3. A GitHub Account
   Use your existing GitHub account or register at https://github.com/signup.

17.3. TUTORIAL: DEPLOYING AN APPLICATION

17.3.1. Lab overview

17.3.1.1. Lab resources

- Source code for the OSToy application
- OSToy front-end container image
- OSToy microservice container image
- Deployment Definition YAML files:

  ostoy-frontend-deployment.yaml

```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: ostoy-pvc
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 1Gi
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: ostoy-frontend
  labels:
    app: ostoy
spec:
  selector:
    matchLabels:
      app: ostoy-frontend
  strategy:
    type: Recreate
  replicas: 1
  template:
    metadata:
      labels:
        app: ostoy-frontend
    spec:
      # Uncomment to use with ACK portion of the workshop
      # If you chose a different service account name please replace it.
      # serviceAccount: ostoy-sa
      containers:
      - name: ostoy-frontend
        securityContext:
          allowPrivilegeEscalation: false
          runAsNonRoot: true
          seccompProfile:
            type: RuntimeDefault
          capabilities:
            drop:
            - ALL
        image: quay.io/ostoylab/ostoy-frontend:1.6.0
        imagePullPolicy: IfNotPresent
        ports:
        - name: ostoy-port
          containerPort: 8080
        resources:
          requests:
            memory: "256Mi"
            cpu: "100m"
          limits:
            memory: "512Mi"
            cpu: "200m"
        volumeMounts:
        - name: configvol
          mountPath: /var/config
        - name: secretvol
          mountPath: /var/secret
        - name: datavol
          mountPath: /var/demo_files
        livenessProbe:
          httpGet:
            path: /health
            port: 8080
          initialDelaySeconds: 10
          periodSeconds: 5
        env:
        - name: ENV_TOY_SECRET
          valueFrom:
            secretKeyRef:
              name: ostoy-secret-env
              key: ENV_TOY_SECRET
        - name: MICROSERVICE_NAME
          value: OSTOY_MICROSERVICE_SVC
        - name: NAMESPACE
          valueFrom:
            fieldRef:
              fieldPath: metadata.namespace
      volumes:
        - name: configvol
          configMap:
            name: ostoy-configmap-files
        - name: secretvol
          secret:
            defaultMode: 420
            secretName: ostoy-secret
        - name: datavol
          persistentVolumeClaim:
            claimName: ostoy-pvc
---
apiVersion: v1
kind: Service
metadata:
  name: ostoy-frontend-svc
  labels:
    app: ostoy-frontend
spec:
  type: ClusterIP
  ports:
    - port: 8080
      targetPort: ostoy-port
      protocol: TCP
      name: ostoy
  selector:
    app: ostoy-frontend
---
apiVersion: route.openshift.io/v1
kind: Route
metadata:
  name: ostoy-route
spec:
  to:
    kind: Service
    name: ostoy-frontend-svc
---
apiVersion: v1
kind: Secret
metadata:
  name: ostoy-secret-env
type: Opaque
data:
  ENV_TOY_SECRET: VGhpcyBpcyBhIHRlc3Q=
---
kind: ConfigMap
apiVersion: v1
metadata:
  name: ostoy-configmap-files
data:
  config.json:  '{ "default": "123" }'
---
apiVersion: v1
kind: Secret
metadata:
  name: ostoy-secret
data:
  secret.txt:
VVNFUk5BTUU9bXlfdXNlcgpQQVNTV09SRD1AT3RCbCVYQXAhIzYzMlk1RndDQE1UUWsK
U01UUD1sb2NhbGhvc3QKU01UUF9QT1JUPTI1
type: Opaque
```

ostoy-microservice-deployment.yaml

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: ostoy-microservice
  labels:
    app: ostoy
spec:
  selector:
    matchLabels:
      app: ostoy-microservice
  replicas: 1
  template:
    metadata:
      labels:
        app: ostoy-microservice
    spec:
      containers:
      - name: ostoy-microservice
        securityContext:
          allowPrivilegeEscalation: false
          runAsNonRoot: true
          seccompProfile:
            type: RuntimeDefault
          capabilities:
            drop:
            - ALL
        image: quay.io/ostoylab/ostoy-microservice:1.5.0
        imagePullPolicy: IfNotPresent
        ports:
        - containerPort: 8080
          protocol: TCP
        resources:
          requests:
            memory: "128Mi"
            cpu: "50m"
          limits:
            memory: "256Mi"
            cpu: "100m"
---
apiVersion: v1
kind: Service
metadata:
  name: ostoy-microservice-svc
  labels:
    app: ostoy-microservice
spec:
  type: ClusterIP
  ports:
    - port: 8080
      targetPort: 8080
      protocol: TCP
  selector:
    app: ostoy-microservice
```

- S3 bucket manifest for ACK S3

s3-bucket.yaml

```
apiVersion: s3.services.k8s.aws/v1alpha1
kind: Bucket
metadata:
  name: ostoy-bucket
  namespace: ostoy
spec:
  name: ostoy-bucket
```

NOTE

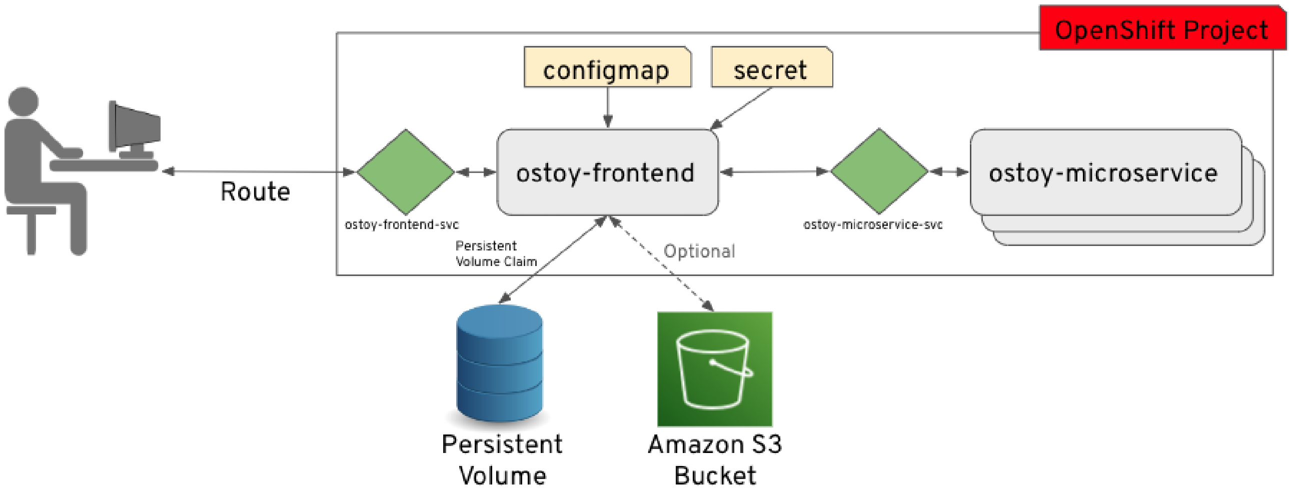
To simplify deployment of the OSToy application, all of the objects required in the above deployment manifests are grouped together. For a typical enterprise deployment, a separate manifest file for each Kubernetes object is recommended.

17.3.1.2. About the OSToy application

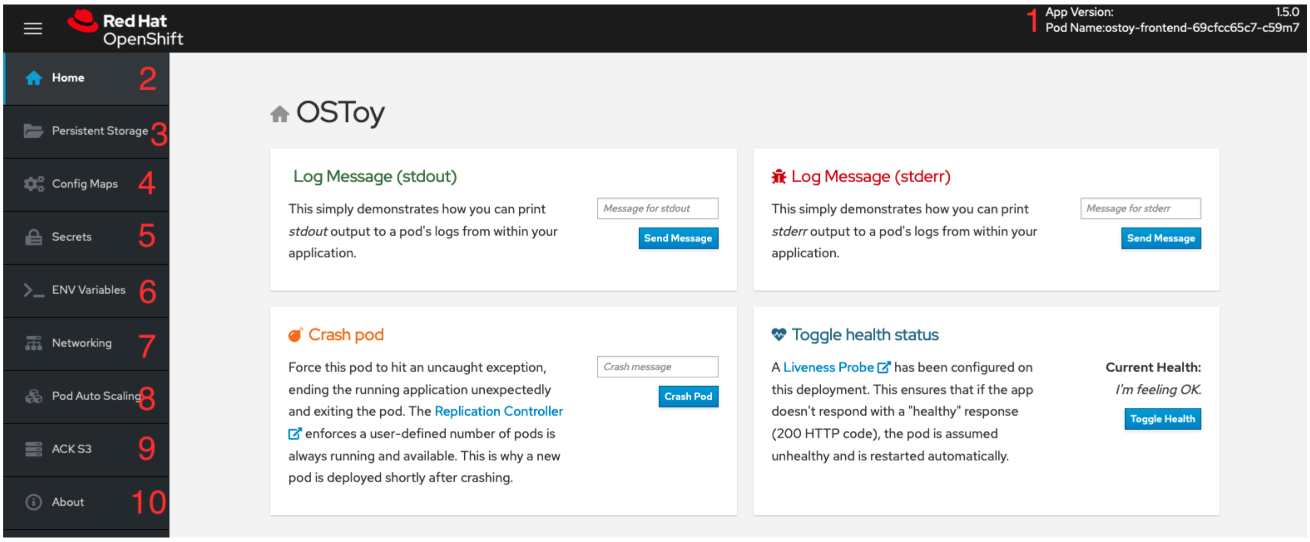
OSToy is a simple Node.js application that you will deploy to a ROSA cluster to help explore the functionality of Kubernetes. This application has a user interface where you can:

- Write messages to the log (stdout / stderr).
- Intentionally crash the application to view self-healing.
- Toggle a liveness probe and monitor OpenShift behavior.
- Read config maps, secrets, and env variables.
- If connected to shared storage, read and write files.
- Check network connectivity, intra-cluster DNS, and intra-communication with the included microservice.
- Increase the load to view automatic scaling of the pods to handle the load using the Horizontal Pod Autoscaler.
- Optional: Connect to an AWS S3 bucket to read and write objects.

17.3.1.3. OSToy Application Diagram



17.3.1.4. Understanding the OSToy UI



Log Message (stdout)

This simply demonstrates how you can print *stdout* output to a pod's logs from within your application.

Log Message (stderr)

This simply demonstrates how you can print *stderr* output to a pod's logs from within your application.

Crash pod

Force this pod to hit an uncaught exception, ending the running application unexpectedly and exiting the pod. The Replication Controller enforces a user-defined number of pods is always running and available. This is why a new pod is deployed shortly after crashing.

Toggle health status

A Liveness Probe has been configured on this deployment. This ensures that if the app doesn't respond with a "healthy" response (200 HTTP code), the pod is assumed unhealthy and is restarted automatically.

Current Health:
I'm feeling OK.

1. Shows the pod name that served your browser the page.

2. **Home:** The main page of the application where you can perform some of the functions listed which we will explore.

3. **Persistent Storage:** Allows you to write data to the persistent volume bound to this application.

4. **Config Maps:** Shows the contents of configmaps available to the application and the key:value pairs.

5. **Secrets:** Shows the contents of secrets available to the application and the key:value pairs.

6. **ENV Variables:** Shows the environment variables available to the application.

7. **Networking:** Tools to illustrate networking within the application.

8. **Pod Auto Scaling:** Tool to increase the load of the pods and test the HPA.

9. **ACK S3:** Optional: Integrate with AWS S3 to read and write objects to a bucket.

   ### NOTE

   In order see the "ACK S3" section of OSToy, you must complete the ACK section of this workshop. If you decide not to complete that section, the OSToy application will still function.

10. **About:** Displays more information about the application.