Installing OpenShift Data Science

Use Red Hat OpenShift Cluster Manager to install Red Hat OpenShift Data Science as an Add-on to your OpenShift Dedicated cluster
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Abstract

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PREFACE

See the following documents for service and life cycle information related to this release:

- OpenShift Data Science Service Definition
- OpenShift Data Science Life Cycle
CHAPTER 1. ARCHITECTURE OF OPENSHIFT DATA SCIENCE

Red Hat OpenShift Data Science is a fully Red Hat managed cloud service that is available as an Add-on to Red Hat OpenShift Dedicated and Red Hat OpenShift Service on Amazon Web Services (ROSA).

OpenShift Data Science integrates the following components and services:

- At the service layer:
  
  **OpenShift Data Science dashboard**
  
  A customer-facing dashboard that shows available and installed applications for the OpenShift Data Science environment as well as learning resources such as tutorials, quick start examples, and documentation.

  **JupyterHub (Red Hat managed)**
  
  A Red Hat managed application that allows data scientists to configure their own notebook server environment and develop machine learning models in JupyterLab.

- At the management layer:

  **The Red Hat OpenShift Data Science operator**
  
  A meta-operator that deploys and maintains all components and sub-operators that are part of OpenShift Data Science.

  **Monitoring services**
  
  Alertmanager, Prometheus and Grafana work together to gather metrics from OpenShift Data Science and organise and display those metrics in useful ways for monitoring and billing purposes.

- At the data layer:

  **JupyterHub database**
  
  A database that stores all user data for JupyterHub.

When you install the OpenShift Data Science Add-on in the Cluster Manager, the following new projects are created:

- The **redhat-ods-operator** project contains the OpenShift Data Science operator.

- The **redhat-ods-applications** project installs the dashboard and other required components of OpenShift Data Science.

- The **redhat-ods-monitoring** project contains services for monitoring and billing.

- The **rhods-notebooks** project is where notebook environments are deployed by default.

You or your data scientists must create additional projects for the OpenShift applications that will use your machine learning models.

Do not install independent software vendor (ISV) applications in namespaces associated with OpenShift Data Science Add-ons unless you are specifically directed to do so on the application's card on the dashboard.

**Additional resources**

- **Installing OpenShift Data Science**
CHAPTER 2. OVERVIEW OF DEPLOYING OPENSShift DATA SCIENCE

Read this section to understand how to deploy Red Hat OpenShift Data Science as a development and testing environment for data scientists.

Installing OpenShift Data Science involves the following high-level tasks:

1. Confirm that your OpenShift Dedicated cluster meets all requirements.
2. Configure an identity provider for OpenShift Dedicated.
3. Add administrative users for OpenShift Dedicated. See Adding users for OpenShift Data Science for more information.
4. Install the OpenShift Data Science Add-on. See Installing OpenShift Data Science on OpenShift Dedicated for more information.
5. Configure user and administrator groups to provide user access to OpenShift Data Science.
6. Provide your users with the URL for the OpenShift Dedicated cluster on which you deployed OpenShift Data Science.
CHAPTER 3. REQUIREMENTS FOR OPENSOURCE DATA SCIENCE

Your environment must meet certain requirements in order to receive support for Red Hat OpenShift Data Science.

Installation requirements

You need to meet the following requirements before you are able to install OpenShift Data Science on your Red Hat OpenShift Dedicated or Red Hat OpenShift Service on Amazon Web Services (ROSA) cluster.

- A Red Hat customer account
  Go to OpenShift Cluster Manager (http://console.redhat.com/openshift) and log in or register for a new account.

- Product subscriptions
  Subscriptions for the following product and Add-on:
  - Red Hat OpenShift Dedicated or ROSA
  - Red Hat OpenShift Data Science Add-on

  Contact your Red Hat account manager to purchase new subscriptions. If you do not yet have an account manager, complete the form at https://cloud.redhat.com/products/dedicated/contact/ to request one.

- An OpenShift Dedicated cluster
  Use an existing cluster or create a new cluster by following the OpenShift Dedicated documentation: Creating your cluster.

  Your cluster must have at least 2 worker nodes with at least 8 CPUs and 32 GiB RAM (instance type m5.2xlarge or larger) available for OpenShift Data Science use when you install the Add-on. The installation process fails to start and an error is displayed if this requirement is not met.

  By default, a cluster is created with one machine pool. You can add an additional machine pool or modify the default pool in order to meet the minimum requirements. However, the minimum resource requirements must be met by a single machine pool in the cluster. You cannot meet the requirements using the resources of multiple machine pools. For more information, see Creating a machine pool.

- On ROSA clusters, AWS Identity and Access Management credentials
  You cannot install OpenShift Data Science on a ROSA cluster that uses AWS Security Token Service (STS). When you install OpenShift Data Science on ROSA, you must use AWS Identity and Access Management (IAM) credentials only. See the ROSA documentation for advice on deploying without STS: Deploying ROSA without AWS STS.
CHAPTER 4. CONFIGURING AN IDENTITY PROVIDER FOR OPENSHIFT DEDICATED

Configure an identity provider for your OpenShift Dedicated cluster to manage users and groups.

**IMPORTANT**

Adding more than one OpenShift Identity Provider can create problems when the same user name exists in multiple providers.

When `mappingMethod` is set to `claim` (the default mapping method for identity providers) and multiple providers have credentials associated with the same user name, the first provider used to log in to OpenShift is the one that works for that user, regardless of the order in which identity providers are configured.

Refer to [Identity provider parameters](https://openshift.redhat.com/documentation) in the OpenShift Dedicated documentation for more information about mapping methods.

**Prerequisites**

- Credentials for OpenShift Cluster Manager ([https://console.redhat.com/openshift/](https://console.redhat.com/openshift/)).
- An existing OpenShift Dedicated cluster.

**Procedure**

1. Log in to OpenShift Cluster Manager ([https://console.redhat.com/openshift/](https://console.redhat.com/openshift/)).
2. Click **Clusters**. The **Clusters** page opens.
3. Click the name of the cluster to configure.
4. Click the **Access control** tab.
5. Click **Identity providers**.
6. Click **Add identity provider**.
   a. Select your provider from the **Identity Provider** list.
   b. Complete the remaining fields relevant to the identity provider that you selected. See [Configuring identity providers](https://openshift.redhat.com/documentation) for more information.
7. Click **Confirm**.

**Verification**

- The configured identity providers are visible on the **Access control** tab of the **Cluster details** page.

**Additional resources**

- Configuring identity providers
- Identity management options for OpenShift Data Science
4.1. IDENTITY MANAGEMENT OPTIONS FOR OPENSHIFT DATA SCIENCE

Red Hat OpenShift Data Science supports the same authentication systems as Red Hat OpenShift Dedicated and Red Hat OpenShift Service on Amazon Web Services (ROSA).

Check the appropriate documentation for your cluster for more information.

Additional resources

- Supported identity providers on OpenShift Dedicated
- Supported identity providers on ROSA
CHAPTER 5. ADDING ADMINISTRATIVE USERS FOR OPENSHIFT DEDICATED

Before you can install and configure OpenShift Data Science for your data scientist users, you must define administrative users. Only administrative users can install and configure OpenShift Data Science.

Prerequisites

- Credentials for OpenShift Cluster Manager (https://console.redhat.com/openshift/).
- An existing OpenShift Dedicated cluster with an identity provider configured.

Procedure

1. Log in to OpenShift Cluster Manager (https://console.redhat.com/openshift/).
2. Click Clusters. The Clusters page opens.
3. Click the name of the cluster to configure.
4. Click the Access control tab.
5. Click Cluster Roles and Access.
6. Under Cluster administrative users click the Add user button. The Add cluster user popover appears.
7. Enter the user name in the User ID field.
8. Select an appropriate Group for the user.

**IMPORTANT**

If this user needs to use existing groups in an identity provider to control OpenShift Data Science access, select cluster-admins.

Check Administering your cluster in the OpenShift Dedicated documentation for more information about these user types.

9. Click Add user.

Verification

- The user name and selected group are visible in the list of Cluster administrative users.

Additional resources

- Administering your OpenShift Dedicated cluster
CHAPTER 6. INSTALLING OPENSOURCE DATA SCIENCE ON OPENSOURCE DEDICATED

You can install Red Hat OpenShift Data Science as an Add-on to your Red Hat OpenShift Dedicated cluster using Red Hat OpenShift Cluster Manager.

Prerequisites

- Purchase entitlements for OpenShift Data Science.
- Credentials for OpenShift Cluster Manager (https://console.redhat.com/openshift/).
- Administrator access to the OpenShift Dedicated cluster.

Procedure

1. Log in to OpenShift Cluster Manager (https://console.redhat.com/openshift/).
2. Click Clusters.
   The Clusters page opens.
3. Click the name of the cluster you want to install OpenShift Data Science on.
   The Details page for the cluster opens.
4. Click the Add-ons tab and locate the Red Hat OpenShift Data Science card.
5. Click Install. The Configure Red Hat OpenShift Data Science pane appears.
6. In the Notification email field, enter any email addresses that you want to receive important alerts about the state of Red Hat OpenShift Data Science, such as outage alerts.
7. Click Install.

Verification

- In OpenShift Cluster Manager, under the Add-ons tab for the cluster, confirm that the OpenShift Data Science card shows one of the following states:
  - Installing - installation is in progress; wait for this to change to Installed. This takes around 30 minutes.
  - Installed - installation is complete; verify that the View in console button is visible.
- In OpenShift Dedicated, click Home → Projects and confirm that the following project namespaces are visible and listed as Active:
  - redhat-ods-applications
  - redhat-ods-monitoring
  - redhat-ods-operator
  - rhods-notebooks

Additional resources
• Adding users for OpenShift Data Science
CHAPTER 7. ENABLING GPU SUPPORT IN OPENSHIFT DATA SCIENCE

To ensure that your data scientists can utilize compute-heavy workloads in their models, you can enable graphics processing units (GPUs) in OpenShift Data Science. To make GPUs available in OpenShift Data Science, after you install OpenShift Data Science, you must install the NVIDIA GPU Add-On. This add-on locates and enables any GPU-enabled worker nodes in your cluster, making GPU instance types available for selection. After you have installed the NVIDIA GPU Add-On, and you have ensured there are GPU-enabled worker nodes in your cluster, your data scientists can select one of the GPU-enabled notebooks in JupyterHub, along with the number of GPUs they require for their data science work.

Red Hat recommends that you use a separate machine pool for GPU nodes that have the `nvidia.com/gpu NoSchedule` taint. If you edit an existing machine pool to add this taint, you must first scale the machine pool down to zero nodes, and then increase the machine pool to the number of nodes that you require. This ensures that the new taint is applied to all nodes in the machine pool. To ensure consistent behavior across all nodes in the machine pool, Red Hat recommends that you increase the scale of your machine nodes promptly. As scaling nodes to zero has a disruptive effect on your deployment, Red Hat recommends that you perform this action as soon as possible, while considering your service usage patterns when selecting an appropriate time.

**Prerequisites**

- You have credentials for OpenShift Cluster Manager ([https://console.redhat.com/openshift/](https://console.redhat.com/openshift/)).
- You are part of the `cluster-admins` user group in OpenShift Dedicated.
- You have provisioned a cluster that contains enough resources to satisfy the requirements of OpenShift Data Science and the NVIDIA GPU Add-On.
- You have installed and logged in to Red Hat OpenShift Data Science.
- You must have installed and logged in to the OpenShift CLI (`oc`).

**Procedure**

1. Navigate to your cluster on OpenShift Cluster Manager.
   b. Click Clusters.
      The Clusters page opens.
   c. Click the name of the cluster that you have installed OpenShift Data Science on.
      The Details page for the cluster opens.

2. Add a machine pool for nodes with GPUs.
   a. Click the Machine pools tab.
   b. Click the Add machine pool button.
      The Add machine pool window opens.
   c. Specify a Machine pool name.
   d. Set a Worker node instance type Ensure that the instance type provides one or more GPUs.
e. Set a Worker node count of at least one.

f. Click Edit node labels and taints to expand the Node labels section.

g. Under Taints, add a taint with the Key of nvidia.com/gpu and an Effect of NoSchedule. The Value can be set to any string, for example, true.

```
NOTE
When setting the taint, ensure the taint is correctly declared without typographical errors.
```

h. Click Add machine pool

Your machine pool is created.

i. Confirm that the Taint you specified is visible on the Details page for the machine pool, for example, nvidia.com/gpu=true:NoSchedule.

3. Install the NVIDIA GPU Operator.

a. Click the Add-ons tab.

b. Click on the NVIDIA GPU Operator card.

c. Click Install.

Verification

- In OpenShift Cluster Manager, under the Add-ons tab for the cluster, confirm that the NVIDIA GPU operator is installed.

- In OpenShift Dedicated web console, under Compute → Nodes, confirm that each node in the new machine pool has the nvidia.com/gpu taint set, for example, nvidia.com/gpu=true:NoSchedule.

- The jupyterhub-singleuser-profiles ConfigMap, located in the redhat-ods-applications project on the Workloads → ConfigMaps page, contains the following NoSchedule toleration:

  ```yaml
  gpuTypes:
  - type: gpu_one
    node_tolerations:
    - key: provider
      operator: Equal
      value: gpu-node
      effect: NoSchedule
      # This is the default NoSchedule toleration that is supported by the NVIDIA GPU operator
  - type: nvidia_gpu
    node_tolerations:
    - key: "nvidia.com/gpu"
      operator: Exists
      effect: NoSchedule
  
  - Check that GPU-enabled functionality is available in Red Hat OpenShift Data Science.
    - Check and validate the nvidia-device-plugin-validator logs. At the OpenShift CLI, enter the following command:
oc logs nvidia-device-plugin-validator-<alpha-numeric-string> -n redhat-gpu-operator

Where `<alpha-numeric-string>` is a randomly generated alpha-numeric string.

If the validation is successful, the following response is returned:

device-plugin validation is successful

- Red Hat recommends that you run a sample GPU application to ensure GPU-enabled models can successfully run on Red Hat OpenShift Data Science. For more information, see Running a sample GPU application.

- Run the `nvidia-smi` command within the relevant pod to test the GPU utilization of your sample project. For more information, see Getting information about the GPU.

Additional resources

- Add-on services available for OpenShift Dedicated
- NVIDIA GPU Operator
- Binding infrastructure node workloads using taints and tolerations
CHAPTER 8. SHARING THE INSTANCE ADDRESS WITH USERS

After you have added users to Red Hat OpenShift Data Science, share the instance address with those users to let them log in and work on their data models.

Prerequisites

- You have installed OpenShift Data Science on your OpenShift Dedicated cluster.
- You have added at least one user to the user group for OpenShift Data Science.

Procedure

1. Log in to OpenShift Dedicated web console.
2. Click the application launcher ( ).
3. Right-click on Red Hat OpenShift Data Science and copy the URL for your OpenShift Data Science instance.
4. Provide this instance URL to your data scientists to let them log in to OpenShift Data Science.

Verification

- Confirm that you and your users can log in to OpenShift Data Science using the instance URL.

Additional resources

- Logging in to OpenShift Data Science
CHAPTER 9. ADDITIONAL RESOURCES

- Identity management options for OpenShift Data Science
- Adding users for OpenShift Data Science