Red Hat OpenShift Data Science 1

Getting started with Red Hat OpenShift Data Science

Learn how to work in an OpenShift Data Science environment
Red Hat OpenShift Data Science 1 Getting started with Red Hat OpenShift Data Science

Learn how to work in an OpenShift Data Science environment
Abstract

Log in and start up your notebook server to get started working with your notebooks in JupyterHub.
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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. LOGGING IN TO OPENSШFT DATA SCIENCE

Log in to OpenShift Data Science from a browser for easy access to JupyterHub and your data science projects.

Procedure

1. Browse to the OpenShift Data Science instance URL and click Log in with OpenShift.
   - If you are a data scientist user, your administrator must provide you with the OpenShift Data Science instance URL, for example, https://rhods-dashboard-redhat-ods-applications.apps.example.abc1.p1.openshiftapps.com/.
   - If you have access to OpenShift Dedicated, you can browse to the OpenShift Dedicated web console and click the Application Launcher → Red Hat OpenShift Data Science.

2. Click the name of your identity provider, for example, GitHub.

3. Enter your credentials and click Log in (or equivalent for your identity provider).
   - If you have not previously authorized the rhods-dashboard service account to access your account, the Authorize Access page appears prompting you to provide authorization. Inspect the permissions selected by default, and click the Allow selected permissions button.

Verification

- OpenShift Data Science opens on the Enabled applications page.

Troubleshooting

- If you see An authentication error occurred or Could not create user when you try to log in:
  - You might have entered your credentials incorrectly. Confirm that your credentials are correct.
  - You might have an account in more than one configured identity provider. If you have logged in with a different identity provider previously, try again with that identity provider.

Additional resources

- Launching JupyterHub and starting a notebook server
CHAPTER 2. THE OPENSHIFT DATA SCIENCE USER INTERFACE

The Red Hat OpenShift Data Science interface is based on the OpenShift web console user interface.

The OpenShift Data Science user interface is divided into several areas:

- The global navigation bar, which provides access to useful controls, such as Help and Notifications.

Figure 2.1. The global navigation bar

- The side navigation menu, which contains different categories of pages available in OpenShift Data Science.
2.1. GLOBAL NAVIGATION

There are four items in the top navigation:

- The **Toggle side navigation menu** button ( سيتم تفعيل الخطة في هذا الملف) toggles whether or not the side navigation is displayed.
• The Notifications button (ALARMA) opens and closes the Notifications drawer, letting you read current and previous notifications in more detail.

• The Help menu (HELP) provides a link to create a ticket with Red Hat Support and access the OpenShift Data Science documentation.

• The User menu displays the name of the currently logged-in user and provides access to the Log out button.

2.2. SIDE NAVIGATION

There are three main sections in the side navigation:

Applications → Enabled

The Enabled page displays applications that are enabled and ready to use on OpenShift Data Science. This page is the default landing page for OpenShift Data Science. Click the Launch application button on an application card to open the application interface in a new tab. If an application has an associated quick start tour, click the drop-down menu on the application’s card and select Open quick start to access it. This page also displays applications and components that have been disabled by your administrator. Disabled applications are denoted with Disabled on the application’s card. Click Disabled on the application’s card to access links allowing you to remove the card itself, and to re-validate its license, if the license had previously expired.

Applications → Explore

The Explore page displays applications that are available for use with OpenShift Data Science. Click on a card for more information about the application or to access the Enable button. The Enable button is only visible if your administrator has purchased and enabled an application at the OpenShift Dedicated level.

Resources

The Resources page displays learning resources such as documentation, how-to material, and quick start tours. You can filter visible resources using the options displayed on the left, or enter terms into the search bar.

Settings → Notebook images

The Notebook image settings page allows you to configure custom notebook images that cater for your project’s specific requirements. After you have added custom notebook images to your deployment of OpenShift Data Science, they are available for selection when creating a notebook server.

Settings → Cluster settings

The Cluster settings page allows you to perform the following administrative tasks on your cluster:

• Enable or disable Red Hat’s ability to collect data about OpenShift Data Science usage on your cluster.

• Configure how resources are claimed within your cluster by changing the default size of the cluster’s persistent volume claim (PVC).

• Reduce resource usage in your OpenShift Data Science deployment by stopping notebook servers that have been idle.
CHAPTER 3. NOTIFICATIONS IN OPENSIFT DATA SCIENCE

Red Hat OpenShift Data Science displays notifications when important events happen in the cluster.

Notification messages are displayed in the lower left corner of the Red Hat OpenShift Data Science interface when they are triggered.

If you miss a notification message, click the **Notifications** button (_alarm) to open the **Notifications** drawer and view unread messages.

*Figure 3.1. The Notifications drawer*
Launch JupyterHub and start a notebook server to start working with your notebooks.

Prerequisites

- You have logged in to Red Hat OpenShift Data Science.
- You know the names and values you want to use for any environment variables in your notebook server environment, for example, `AWS_SECRET_ACCESS_KEY`.
- If you want to work with a very large data set, work with your administrator to proactively increase the storage capacity of your notebook server.

Procedure

1. Locate the JupyterHub card on the Enabled applications page.
2. Click Launch application.
   
   a. If prompted, select your identity provider.
   
   b. Enter your credentials and click Log in (or equivalent for your identity provider).
   
      If you see Error 403: Forbidden, you are not in the default user group or the default administrator group for OpenShift Data Science. Contact your administrator so that they can add you to the correct group using Adding users for OpenShift Data Science.

      If you have not previously authorized the jupyterhub-hub service account to access your account, the Authorize Access page appears prompting you to provide authorization. Inspect the permissions selected by default, and click the Allow selected permissions button.

3. Start a notebook server.
   
   This is not required if you have previously opened JupyterHub.
   
   a. Select the Notebook image to use for your server.
   
   b. If the notebook image contains multiple versions, select the version of the notebook image from the Versions section.

   **NOTE**

   When a new version of a notebook image is released, the previous version remains available and supported on the cluster. This gives you time to migrate your work to the latest version of the notebook image.

   Notebook images can take up to 40 minutes to install. Notebooks images that have not finished installing are not available for you to select. If an installation of a notebook image has not completed, an alert is displayed.

   c. Select the Container size for your server.
   
   d. Optional: Select the Number of GPUs (graphics processing units) for your server.
Using GPUs to accelerate workloads is only supported with the PyTorch, TensorFlow, and CUDA notebook server images.

e. Optional: Select and specify values for any new Environment variables. For example, if you plan to integrate with Red Hat OpenShift Streams for Apache Kafka, create environment variables to store your Kafka bootstrap server and the service account username and password here.

The interface stores these variables so that you only need to enter them once. Example variable names for common environment variables are automatically provided for frequently integrated environments and frameworks, such as Amazon Web Services (AWS).

IMPORTANT

Ensure that you select the Secret checkbox for any variables with sensitive values that must be kept private, such as passwords.

f. Click Start server. The Starting server progress indicator appears. If you encounter a problem during this process, an error message appears with more information. Click Expand event log to view additional information about the server creation process. Depending on the deployment size and resources you requested, starting the server can take up to several minutes. After the server starts, the JupyterLab interface opens.

WARNING

You can be logged in to JupyterHub for a maximum of 24 hours. After 24 hours, your user credentials expire, you are logged out of JupyterHub, and your notebook server pod is stopped and deleted regardless of any work running in the notebook server. To help mitigate this, your administrator can configure OAuth tokens to expire after a set period of inactivity. See Configuring the internal OAuth server for more information.

Verification

- The JupyterLab interface opens in a new tab.

Additional resources

- Options for notebook server environments

Troubleshooting

- If you see the "Unable to load notebook server configuration options" error message, contact your administrator so that they can review the logs associated with your JupyterHub pod and determine further details about the problem.
4.1. OPTIONS FOR NOTEBOOK SERVER ENVIRONMENTS

When you start JupyterHub for the first time, or after stopping your notebook server, you must select server options in the **Start a notebook server** wizard so that the software and variables that you expect are available on your server. This section explains the options available in the **Start a notebook server** wizard in detail.

The **Start a notebook server** page is divided into several sections:

**Notebook image**

Specifies the container image that your notebook server is based on. Different notebook images have different packages installed by default. See Notebook image options for details.

**Deployment size**

Specifies the compute resources available on your notebook server. **Container size** controls the number of CPUs, the amount of memory, and the minimum and maximum request capacity of the container.

**Environment variables**

Specifies the name and value of variables to be set on the notebook server. Setting environment variables during server startup means that you do not need to define them in the body of your notebooks, or with the JupyterHub command line interface. See Recommended environment variables for a list of reserved variable names for each item in the **Environment variables** list.

**Table 4.1. Notebook image options**

<table>
<thead>
<tr>
<th>Image name</th>
<th>Preinstalled packages</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUDA</td>
<td>• Python 3.8</td>
</tr>
<tr>
<td></td>
<td>• CUDA 11.6</td>
</tr>
<tr>
<td></td>
<td>• JupyterLab 3.2</td>
</tr>
<tr>
<td></td>
<td>• Notebook 6.4</td>
</tr>
<tr>
<td>Minimal Python (default)</td>
<td>• Python 3.8</td>
</tr>
<tr>
<td></td>
<td>• JupyterLab 3.2</td>
</tr>
<tr>
<td></td>
<td>• Notebook 6.4</td>
</tr>
<tr>
<td>Image name</td>
<td>Preinstalled packages</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>PyTorch</td>
<td>- Python 3.8</td>
</tr>
<tr>
<td></td>
<td>- JupyterLab 3.2</td>
</tr>
<tr>
<td></td>
<td>- Notebook 6.4</td>
</tr>
<tr>
<td></td>
<td>- PyTorch 1.8</td>
</tr>
<tr>
<td></td>
<td>- CUDA 11.6</td>
</tr>
<tr>
<td></td>
<td>- TensorBoard 1.15</td>
</tr>
<tr>
<td></td>
<td>- Boto3 1.17</td>
</tr>
<tr>
<td></td>
<td>- Kafka-Python 2.0</td>
</tr>
<tr>
<td></td>
<td>- Matplotlib 3.4</td>
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<tr>
<td></td>
<td>- Numpy 1.19</td>
</tr>
<tr>
<td></td>
<td>- Pandas 1.2</td>
</tr>
<tr>
<td></td>
<td>- Scikit-learn 0.24</td>
</tr>
<tr>
<td></td>
<td>- SciPy 1.6</td>
</tr>
<tr>
<td>Standard Data Science</td>
<td>- Python 3.8</td>
</tr>
<tr>
<td></td>
<td>- JupyterLab 3.2</td>
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<tr>
<td></td>
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<td>- SciPy 1.6</td>
</tr>
<tr>
<td>Image name</td>
<td>Preinstalled packages</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td>TensorFlow</td>
<td>• Python 3.8</td>
</tr>
<tr>
<td></td>
<td>• JupyterLab 3.2</td>
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<td></td>
<td>• Notebook 6.4</td>
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<td></td>
<td>• TensorFlow 2.7</td>
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<td>• TensorBoard 2.6</td>
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<td></td>
<td>• CUDA 11.6</td>
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<td></td>
<td>• SciPy 1.6</td>
</tr>
</tbody>
</table>

Table 4.2. Recommended environment variables

<table>
<thead>
<tr>
<th>Environment variable option</th>
<th>Recommended variable names</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS</td>
<td>• <strong>AWS_ACCESS_KEY_ID</strong> specifies your Access Key ID for Amazon Web Services.</td>
</tr>
<tr>
<td></td>
<td>• <strong>AWS_SECRET_ACCESS_KEY</strong> specifies your Secret access key for the account specified in <strong>AWS_ACCESS_KEY_ID</strong>.</td>
</tr>
</tbody>
</table>

Additional resources

- [Launching JupyterHub and starting a notebook server](#)
CHAPTER 5. TUTORIALS FOR DATA SCIENTISTS

To help you get started quickly, you can access learning resources for Red Hat OpenShift Data Science and its supported applications. These resources are available on the Resources tab of the Red Hat OpenShift Data Science user interface.

Table 5.1. Tutorials

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerating scientific workloads in Python with Numba</td>
<td>Watch a video about how to make your Python code run faster.</td>
</tr>
<tr>
<td>Building interactive visualizations and dashboards in Python</td>
<td>Explore a variety of data across multiple notebooks and learn how to deploy full dashboards and applications.</td>
</tr>
<tr>
<td>Building machine learning models with scikit-learn</td>
<td>Learn how to build machine learning models with scikit-learn for supervised learning, unsupervised learning, and classification problems.</td>
</tr>
<tr>
<td>Building a binary classification model</td>
<td>Train a model to predict if a customer is likely to subscribe to a bank promotion.</td>
</tr>
<tr>
<td>Choosing Python tools for data visualization</td>
<td>Use the PyViz.org website to help you decide on the best open source Python data visualization tools for you.</td>
</tr>
<tr>
<td>Exploring Anaconda for data science</td>
<td>Learn about Anaconda, a freemium open source distribution of the Python and R programming languages.</td>
</tr>
<tr>
<td>Getting started with Pachyderm concepts</td>
<td>Learn Pachyderm’s main concepts by creating pipelines that perform edge detection on a few images.</td>
</tr>
<tr>
<td>GPU Computing in Python with Numba</td>
<td>Learn how to create GPU accelerated functions using Numba.</td>
</tr>
<tr>
<td>Learning about model serving</td>
<td>Follow a series of demos about natural language, image processing classifiers, KubeFlow integration, and models.</td>
</tr>
<tr>
<td>Run a Python notebook to generate results in IBM Watson OpenScale</td>
<td>Run a Python notebook to create, train, and deploy a machine learning model.</td>
</tr>
<tr>
<td>Running an AutoAI experiment to build a model</td>
<td>Watch a video about building a binary classification model for a marketing campaign.</td>
</tr>
</tbody>
</table>
### Resource Name

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training a regression model in Pachyderm</td>
<td>Learn how to create a sample housing data repository using a Pachyderm cluster to run experiments, analyze data, and set up regression.</td>
</tr>
<tr>
<td>Using Dask for parallel data analysis</td>
<td>Analyze medium-sized datasets in parallel locally using Dask, a parallel computing library that scales the existing Python ecosystem.</td>
</tr>
<tr>
<td>Using Jupyter notebooks in Watson Studio</td>
<td>Watch a video about working with Jupyter notebooks in Watson Studio.</td>
</tr>
<tr>
<td>Using Pandas for data analysis in Python</td>
<td>Learn how to use pandas, a data analysis library for the Python programming language.</td>
</tr>
</tbody>
</table>

### Table 5.2. Quick start guides

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting to Red Hat OpenShift Streams for Apache Kafka</td>
<td>Connect to Red Hat Streams for Apache Kafka from a Jupyter notebook.</td>
</tr>
<tr>
<td>Creating a Jupyter notebook</td>
<td>Create a Jupyter notebook in JupyterLab.</td>
</tr>
<tr>
<td>Creating a Machine Learning Model using the NVIDIA GPU Add-on</td>
<td>Creating a Machine Learning model on JupyterHub that uses the GPUs that you have made available.</td>
</tr>
<tr>
<td>Creating an Anaconda-enabled Jupyter notebook</td>
<td>Create an Anaconda-enabled Jupyter notebook and access Anaconda packages that are curated for security and compatibility.</td>
</tr>
<tr>
<td>Deploying a model with Watson Studio</td>
<td>Import a notebook in Watson Studio and use AutoAI to build and deploy a model.</td>
</tr>
<tr>
<td>Deploying a sample Python application using Flask and OpenShift</td>
<td>Deploy your data science model out of a Jupyter notebook and into a Flask application to use as a development sandbox.</td>
</tr>
<tr>
<td>Detecting outlier scores for predictions to a deployed model</td>
<td>Open a TensorFlow image classifier model and detect outlier requests.</td>
</tr>
<tr>
<td>Identifying explanations for a deployed SKLearn model</td>
<td>Open an income classifier model and identify explanations.</td>
</tr>
</tbody>
</table>
## Importing Pachyderm Beginner Tutorial Notebook
Load Pachyderm’s beginner tutorial notebook and learn about Pachyderm’s main concepts such as data repositories, pipelines, and using the pachctl CLI from your cells.

## Installing and verifying the NVIDIA GPU add-on
Learn how to install and verify that JupyterHub detects the GPUs available for use.

## Opening and updating a SKLearn model with canary deployment
Open a SKLearn model and update it using canary deployment practices.

## Monitoring a deployed model for drift
Open a TensorFlow image classifier model and detect drifting requests.

## Querying data with Starburst Galaxy
Learn to query data using Starburst Galaxy from a Jupyter notebook.

## Securing a deployed model using Red Hat OpenShift API Management
Protect a model service API using Red Hat OpenShift API Management.

## Using the Intel® oneAPI AI Analytics Toolkit (AI Kit) Notebook
Run a data science notebook sample with the Intel® oneAPI AI Analytics Toolkit.

## Using the OpenVINO toolkit
Quantize an ONNX computer vision model using the OpenVINO model optimizer and use the result for inference from a notebook.

### Table 5.3. How to guides

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>How to choose between notebook runtime environment options</td>
<td>Explore available options for configuring your notebook runtime environment.</td>
</tr>
<tr>
<td>How to clean, shape, and visualize data</td>
<td>Learn how to clean and shape tabular data using IBM Watson Studio data refinery.</td>
</tr>
<tr>
<td>How to create a connection to access data</td>
<td>Learn how to create connections to various data sources across the platform.</td>
</tr>
<tr>
<td>How to create a deployment space</td>
<td>Learn how to create a deployment space for machine learning.</td>
</tr>
<tr>
<td>How to create a notebook in Watson Studio</td>
<td>Learn how to create a basic Jupyter notebook in Watson Studio.</td>
</tr>
</tbody>
</table>
### Resource Name

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>How to create a project in Watson Studio</td>
<td>Learn how to create an analytics project in Watson Studio.</td>
</tr>
<tr>
<td>How to create a project that integrates with Git</td>
<td>Learn how to add assets from a Git repository into a project.</td>
</tr>
<tr>
<td>How to install Python packages on your notebook server</td>
<td>Learn how to install additional Python packages on your notebook server.</td>
</tr>
<tr>
<td>How to load data into a Jupyter notebook</td>
<td>Learn how to integrate data sources into a Jupyter notebook by loading data.</td>
</tr>
<tr>
<td>How to perform operational tasks</td>
<td>Explore best practices for managing a Seldon Deploy cluster.</td>
</tr>
<tr>
<td>How to serve a model using OpenVINO Model Server</td>
<td>Learn how to deploy optimized models with the OpenVINO Model Server using OpenVINO custom resources.</td>
</tr>
<tr>
<td>How to set up Watson OpenScale</td>
<td>Learn how to track and measure outcomes from models with OpenScale.</td>
</tr>
<tr>
<td>How to update notebook server settings</td>
<td>Learn how to update the settings or the notebook image on your notebook server.</td>
</tr>
<tr>
<td>How to use data from Amazon S3 buckets</td>
<td>Learn how to connect to data in S3 Storage using environment variables.</td>
</tr>
<tr>
<td>How to view installed packages on your notebook server</td>
<td>Learn how to see which packages are installed on your running notebook server.</td>
</tr>
</tbody>
</table>

## 5.1. ACCESSING TUTORIALS

You can access learning resources for Red Hat OpenShift Data Science and supported applications.

### Prerequisites

- Ensure that you have logged in to Red Hat OpenShift Data Science.
- You have logged in to the OpenShift Dedicated web console.

### Procedure

1. On the Red Hat OpenShift Data Science home page, click **Resources**. The Resources page opens.
2. Click **Access tutorial** on the relevant card.
Verification

- You can view and access the learning resources for Red Hat OpenShift Data Science and supported applications.

Additional resources

- Common questions
CHAPTER 6. ENABLING SERVICES CONNECTED TO OPENSHIFT DATA SCIENCE

You must enable SaaS-based services, such as Red OpenShift Streams for Apache Kafka and Anaconda, before using them with Red Hat OpenShift Data Science. On-cluster services are enabled automatically.

Typically, you can install services, or enable services connected to OpenShift Data Science using one of the following methods:

- Enabling the service from the Explore page on the OpenShift Data Science dashboard, as documented in this procedure.

- Installing the service’s operator from OperatorHub. OperatorHub is a web console for cluster administrators to discover and select Operators to install on their cluster. It is deployed by default in OpenShift Container Platform (Installing from OperatorHub using the web console).

**NOTE**

Deployments containing operators installed from OperatorHub may not be fully supported by Red Hat.

- Installing the service’s operator from Red Hat Marketplace (Install operators).

- Installing the service as an Add-on to your Red Hat OpenShift Dedicated cluster using Red Hat OpenShift Cluster Manager (Installing OpenShift Data Science on OpenShift Dedicated).

For most services, the service endpoint is available on the service’s tile on the Enabled page of OpenShift Data Science. Certain services cannot be accessed directly from their tiles, for example, OpenVINO and Anaconda provide notebook images for use in JupyterHub and do not provide an endpoint link from their tile. Additionally, for services such as OpenShift Streams for Apache Kafka, it may be useful to store these endpoint URLs as environment variables for easy reference in a notebook environment.

Some independent software vendor (ISV) applications must be installed in specific OpenShift Data Science Add-on namespaces. However, do not install 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.

To help you get started quickly, you can access the service’s learning resources and documentation on the Resources page, or by clicking the relevant link on the service’s tile on the Enabled page.

**Prerequisites**

- You have logged in to OpenShift Data Science.

- Your administrator has installed or configured the service on your OpenShift Dedicated cluster.

**Procedure**

1. On the OpenShift Data Science home page, click Explore. The Explore page opens.

2. Click the card of the service that you want to enable.
3. Click **Enable** on the drawer for the service.

4. If prompted, enter the service’s key and click **Connect**.

5. Click **Enable** to confirm that you are enabling the service.

**Verification**

- The service that you enabled appears on the **Enabled** page.
- The service endpoint is displayed on the service’s tile on the **Enabled** page.
CHAPTER 7. DISABLING APPLICATIONS CONNECTED TO OPENSHIFT DATA SCIENCE

You can disable applications and components so that they do not appear on the OpenShift Data Science dashboard when you no longer want to use them, for example, when data scientists no longer use an application or when the application’s license expires.

Disabling unused applications allows your data scientists to manually remove these application cards from their OpenShift Data Science dashboard so that they can focus on the applications that they are most likely to use. See Removing disabled applications from OpenShift Data Science for more information about manually removing application cards.

IMPORTANT

Do not follow this procedure when disabling the following applications:

- Red Hat OpenShift API Management. You can only uninstall Red Hat OpenShift API Management from OpenShift Cluster Manager.
- Red Hat OpenShift Streams for Apache Kafka.

Prerequisites

- You have logged in to the OpenShift Dedicated web console.
- You are part of the cluster-admins user group in OpenShift Dedicated.
- You have installed or configured the service on your OpenShift Dedicated cluster.
- The application or component that you want to disable is enabled and appears on the Enabled page.

Procedure

1. In the OpenShift Dedicated web console, change into the Administrator perspective.
2. Change into the redhat-ods-applications project.
3. Click Operators → Installed Operators.
4. Click on the operator that you want to uninstall. You can enter a keyword into the Filter by name field to help you find the operator faster.
5. Delete any operator resources or instances by using the tabs in the operator interface. During installation, some operators require the administrator to create resources or start process instances using tabs in the operator interface. These must be deleted before the operator can uninstall correctly.
7. Select **Uninstall** to uninstall the operator, operator deployments, and pods. After this is complete, the operator stops running and no longer receives updates.

**IMPORTANT**

Removing an operator does not remove any of that operator’s custom resource definitions or managed resources. Custom resource definitions and managed resources still exist and must be cleaned up manually. Any applications deployed by your operator and any configured off-cluster resources continue to run and must be cleaned up manually.

**Verification**

- The operator is uninstalled from its target clusters.
- The operator no longer appears on the Installed Operators page.
- The disabled application is no longer available for your data scientists to use, and is marked as **Disabled** on the Enabled page of the OpenShift Data Science dashboard. This action may take a few minutes to occur following the removal of the operator.

### 7.1. REMOVING DISABLED APPLICATIONS FROM OPENSSHIFT DATA SCIENCE

After your administrator has disabled your unused applications, you can manually remove them from the OpenShift Data Science dashboard. Disabling and removing unused applications allows you to focus on the applications that you are most likely to use.

**Prerequisites**

- Ensure that you have logged in to Red Hat OpenShift Data Science.
- You have logged in to the OpenShift Dedicated web console.
- Your administrator has previously disabled the application that you want to remove.

**Procedure**

1. In the OpenShift Data Science interface, click **Enabled**.
   The Enabled page opens. Disabled applications are denoted with **Disabled** on the application’s card.
2. Click **Disabled** on the card of the application that you want to remove.
3. Click the link to remove the application card.

**Verification**

- The disabled application’s card no longer appears on the Enabled page.
CHAPTER 8. SUPPORT REQUIREMENTS AND LIMITATIONS

Review this section to understand the requirements for Red Hat support and any limitations to Red Hat support of Red Hat OpenShift Data Science.

8.1. SUPPORTED BROWSERS

Red Hat OpenShift Data Science supports the latest version of the following browsers:

- Google Chrome
- Mozilla Firefox
- Safari

8.2. SUPPORTED SERVICES

Red Hat OpenShift Data Science supports the following services:

Table 8.1. Supported services

<table>
<thead>
<tr>
<th>Service Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaconda Professional Edition</td>
<td>Anaconda Professional Edition is a popular open source package distribution and management experience that is optimized for commercial use.</td>
</tr>
<tr>
<td>IBM Watson Studio</td>
<td>IBM Watson Studio is a platform for embedding AI and machine learning into your business and creating custom models with your own data.</td>
</tr>
<tr>
<td>Intel® oneAPI AI Analytics Toolkits</td>
<td>The AI Kit is a set of AI software tools to accelerate end-to-end data science and analytics pipelines on Intel® architectures.</td>
</tr>
<tr>
<td>JupyterHub</td>
<td>JupyterHub is a multi-user version of the notebook designed for companies, classrooms, and research labs.</td>
</tr>
</tbody>
</table>

**IMPORTANT**

While every effort is made to make Red Hat OpenShift Data Science resilient to OpenShift node failure, upgrades, and similarly disruptive operations, individual users’ notebook environments can be interrupted during these events. If an OpenShift node restarts or becomes unavailable, any user notebook environment on that node is restarted on a different node. When this occurs, any ongoing process executing in the user’s notebook environment is interrupted, and the user needs to re-execute it when their environment becomes available again.

Due to this limitation, Red Hat recommends that processes for which interruption is unacceptable are not executed in the JupyterHub notebook server environment on OpenShift Data Science. For example, rather than serve a data science model from within a notebook server on OpenShift Data Science, we recommend leveraging the model serving capabilities of Seldon instead.
Pachyderm
Use Pachyderm’s data versioning, pipeline and lineage capabilities to automate the machine learning life cycle and optimize machine learning operations.

Red Hat OpenShift API Management
OpenShift API Management is a service that accelerates time-to-value and reduces the cost of delivering API-first, microservices-based applications.

Red Hat OpenShift Streams for Apache Kafka
OpenShift Streams for Apache Kafka is a service for streaming data that reduces the cost and complexity of delivering real-time applications.

OpenVINO
OpenVINO is an open-source toolkit to help optimize deep learning performance and deploy using an inference engine onto Intel hardware.

Seldon Deploy
Seldon Deploy is a set of tools to simplify and accelerate the process of deploying and managing your machine learning models.

Starburst Galaxy
Starburst Galaxy is a fully managed service to run high-performance queries across your various data sources using SQL.

### 8.3. SUPPORTED PACKAGES

Notebook server images in Red Hat OpenShift Data Science are installed with Python 3.8 by default. See the table in Options for notebook server environments for a complete list of packages and versions included in these images.

You can install packages that are compatible with Python 3.8 on any notebook server that has the binaries required by that package. If the required binaries are not included on the notebook server image you want to use, contact Red Hat Support to request that the binary be considered for inclusion.

You can install packages on a temporary basis by using the `pip install` command. You can also provide a list of packages to the `pip install` command using a `requirements.txt` file. See Installing Python packages on your notebook server for more information.

You must re-install these packages each time you start your notebook server.

You can remove packages by using the `pip uninstall` command.

**Additional resources**

- Installing Python packages on your notebook server
- Options for notebook server environments
In addition to documentation, Red Hat provides several "how-to" documents that answer common questions a data scientist might have as they work.

The currently available "how to" documents are linked here:

- How to update notebook server settings
- How to install python packages on your notebook server
- How to view installed packages on your notebook server
- How to use data from Amazon S3 buckets
- How to use data from Kafka
CHAPTER 10. TROUBLESHOOTING COMMON PROBLEMS IN JUPYTERHUB FOR ADMINISTRATORS

If your users are experiencing errors in Red Hat OpenShift Data Science relating to JupyterHub, their notebooks, or their notebook server, read this section to understand what could be causing the problem, and how to resolve the problem.

If you cannot see the problem here or in the release notes, contact Red Hat Support.

10.1. A USER RECEIVES A 403: FORBIDDEN ERROR WHEN LOGGING IN TO JUPYTERHUB

Problem
If you have configured specialized OpenShift Data Science user groups, the user name might not be added to the default user group for OpenShift Data Science.

Diagnosis
Check whether the user is part of the default user group.

1. Find the names of groups allowed access to JupyterHub.
   a. Log in to OpenShift Dedicated web console.
   b. Click Workloads → ConfigMaps and click on the rhods-groups-config ConfigMap to open it.
   c. Click on the YAML tab and check the values for allowed_groups. These are the names of groups that have access to JupyterHub.

   ```yaml
data:
   admin_groups: <admin-group>
   allowed_groups: <user-group>
   ```

   Where <admin-group> is the name of your administrator group and <user-group> is the name of your user group.

2. Click User management → Groups and click on the name of each group to see its members.

Resolution

- If the user is not added to any of the groups allowed access to JupyterHub, follow Adding users for OpenShift Data Science to add them.
- If the user is already added to a group that is allowed to access JupyterHub, contact Red Hat Support.

10.2. A USER’S NOTEBOOK SERVER DOES NOT START

Problem
The OpenShift Dedicated cluster that hosts the user’s notebook server might not have access to enough resources, or the JupyterHub pod may have failed.
Diagnosis

1. Log in to OpenShift Dedicated web console.

2. Delete and restart the notebook server pod for this user.
   a. Click Workloads → Pods and set the Project to rhods-notebooks.
   b. Search for the notebook server pod that belongs to this user, for example, jupyterhub-nb-username-*. If the notebook server pod exists, an intermittent failure may have occurred in the notebook server pod.
   c. If the notebook server pod for the user does not exist, continue with diagnosis.

3. Check the resources currently available in the OpenShift Dedicated cluster against the resources required by the selected notebook server image.
   If worker nodes with sufficient CPU and RAM are available for scheduling in the cluster, continue with diagnosis.

4. Check the state of the JupyterHub pod.

Resolution

- If there was an intermittent failure of the notebook server pod:
  a. Delete the notebook server pod that belongs to the user.
  b. Ask the user to start their notebook server again.

- If the notebook server does not have sufficient resources to run the selected notebook server image, either add more resources to the OpenShift Dedicated cluster, or choose a smaller image size.

- If the JupyterHub pod is in a FAILED state:
  a. Retrieve the logs for the jupyterhub-* pod and send them to Red Hat Support for further evaluation.
  b. Delete the jupyterhub-* pod.

- If none of the previous resolutions apply, contact Red Hat Support.

10.3. THE USER RECEIVES A DATABASE OR DISK IS FULL ERROR OR A NO SPACE LEFT ON DEVICE ERROR WHEN THEY RUN NOTEBOOK CELLS

Problem
The user might have run out of storage space on their notebook server.

Diagnosis

1. Log in to JupyterHub and start the notebook server that belongs to the user having problems. If the notebook server does not start, follow these steps to check whether the user has run out of storage space:
a. Log in to OpenShift Dedicated web console.

b. Click **Workloads** → **Pods** and set the **Project** to **rhods-notebooks**.

c. Click the notebook server pod that belongs to this user, for example, **jupyterhub-nb-username-***.

d. Click **Logs**. The user has exceeded their available capacity if you see lines similar to the following:

   ![Unexpected error while saving file: XXXX database or disk is full]

**Resolution**

- Increase the user’s available storage by expanding their persistent volume: [Expanding persistent volumes](#)

- Work with the user to identify files that can be deleted from the `/opt/app-root/src` directory on their notebook server to free up their existing storage space.
CHAPTER 11. TROUBLESHOOTING COMMON PROBLEMS IN JUPYTERHUB FOR USERS

If you are seeing errors in Red Hat OpenShift Data Science related to JupyterHub, your notebooks, or your notebook server, read this section to understand what could be causing the problem.

If you cannot see your problem here or in the release notes, contact Red Hat Support.

11.1. I SEE A 403: FORBIDDEN ERROR WHEN I LOG IN TO JUPYTERHUB

Problem

If your administrator has configured specialized OpenShift Data Science user groups, your user name might not be added to the default user group or the default administrator group for OpenShift Data Science.

Resolution

- Contact your administrator so that they can add you to the correct group/s.

11.2. MY NOTEBOOK SERVER DOES NOT START

Problem

The OpenShift Dedicated cluster that hosts your notebook server might not have access to enough resources, or the JupyterHub pod may have failed.

Resolution

Check the logs in the Events section in OpenShift Dedicated for error messages associated with the problem. For example:

Server requested
2021-10-28T13:31:29.830991Z [Warning] 0/7 nodes are available: 2 Insufficient memory, 2 node(s) had taint {node-role.kubernetes.io/infra: }, that the pod didn't tolerate, 3 node(s) had taint {node-role.kubernetes.io/master: }, that the pod didn't tolerate.

Contact your administrator with details of any relevant error messages so that they can perform further checks.

11.3. I SEE A DATABASE OR DISK IS FULL ERROR OR NO SPACE LEFT ON DEVICE ERROR WHEN I RUN MY NOTEBOOK CELLS

Problem

You might have run out of storage space on your notebook server.

Resolution

Contact your administrator so that they can perform further checks.