



# **Example Kubeflow Operations and Tasks**

NetApp Solutions

NetApp

February 15, 2023

This PDF was generated from [https://docs.netapp.com/us-en/netapp-solutions/ai/aicp\\_example\\_kubeflow\\_operations\\_and\\_tasks\\_overview.html](https://docs.netapp.com/us-en/netapp-solutions/ai/aicp_example_kubeflow_operations_and_tasks_overview.html) on February 15, 2023. Always check docs.netapp.com for the latest.

# Table of Contents

- Example Kubeflow Operations and Tasks ..... 1
  - Example Kubeflow Operations and Tasks ..... 1
  - Provision a Jupyter Notebook Workspace for Data Scientist or Developer Use ..... 1
  - Example Notebooks and Pipelines ..... 8

# Example Kubeflow Operations and Tasks

This section includes examples of various operations and tasks that you may want to perform using Kubeflow.

Next: [Provision a Jupyter Notebook Workspace for Data Scientist or Developer Use.](#)

## Example Kubeflow Operations and Tasks

This section includes examples of various operations and tasks that you may want to perform using Kubeflow.

Next: [Provision a Jupyter Notebook Workspace for Data Scientist or Developer Use.](#)

## Provision a Jupyter Notebook Workspace for Data Scientist or Developer Use

Kubeflow is capable of rapidly provisioning new Jupyter Notebook servers to act as data scientist workspaces. To provision a new Jupyter Notebook server with Kubeflow, perform the following tasks. For more information about Jupyter Notebooks within the Kubeflow context, see the [official Kubeflow documentation](#).

1. From the Kubeflow central dashboard, click Notebook Servers in the main menu to navigate to the Jupyter Notebook server administration page.



2. Click New Server to provision a new Jupyter Notebook server.



3. Give your new server a name, choose the Docker image that you want your server to be based on, and specify the amount of CPU and RAM to be reserved by your server. If the Namespace field is blank, use the Select Namespace menu in the page header to choose a namespace. The Namespace field is then auto-populated with the chosen namespace.

In the following example, the `kubeflow-anonymous` namespace is chosen. In addition, the default values for Docker image, CPU, and RAM are accepted.



The screenshot shows the Kubeflow Central Dashboard interface. The browser address bar indicates the URL is `10.61.218.131:31380/_jupyter/?ns=kubeflow-anonym...`. The dashboard header shows the Kubeflow logo and the selected namespace, `kubeflow-anonymous`. The main content area is titled 'Name' and 'Image'. The 'Name' section includes a 'Name' input field with the value 'mike' and a 'Namespace' dropdown menu with the value 'kubeflow-anonymous'. The 'Image' section includes a 'Custom Image' checkbox and a dropdown menu with the value 'gcr.io/kubeflow-images-public/tensorflow-1.13.1-notebook-cpu:v0.5.0'. The 'CPU / RAM' section includes a 'CPU' input field with the value '0.5' and a 'Memory' input field with the value '1.0Gi'.

4. Specify the workspace volume details. If you choose to create a new volume, then that volume or PVC is provisioned using the default StorageClass. Because a StorageClass utilizing Trident was designated as the default StorageClass in the section [Kubeflow Deployment](#), the volume or PVC is provisioned with Trident. This volume is automatically mounted as the default workspace within the Jupyter Notebook Server container. Any notebooks that a user creates on the server that are not saved to a separate data volume are automatically saved to this workspace volume. Therefore, the notebooks are persistent across reboots.

**Workspace Volume**

Configure the Volume to be mounted as your personal Workspace.

☐ Don't use Persistent Storage for User's home

Type	Name	Size	Mode	Mount Point
New	workspace-mike	10Gi	ReadWriteOnce	/home/jovyan

5. Add data volumes. The following example specifies an existing PVC named 'pb-fg-all' and accepts the default mount point.

**Data Volumes**

Configure the Volumes to be mounted as your Datasets.

[+ ADD VOLUME](#)

Type	Name	Size	Mode	Mount Point
Existing	pb-fg-all	10Gi	ReadWriteOnce	/home/jovyan/data-vol-1

6. **Optional:** Request that the desired number of GPUs be allocated to your notebook server. In the following example, one GPU is requested.

**Configurations**

Extra layers of configurations that will be applied to the new Notebook. (e.g. Insert credentials as Secrets, set Environment Variables.)

Configurations

**Extra Resources**

Specify extra resources that might be needed in the Notebook Server.

☒ Enable Shared Memory

Extra Resources \*

`{"nvidia.com/gpu": 1}`

Extra Resources available in the cluster (ex. NVIDIA GPUs)

**LAUNCH** **CANCEL**

7. Click Launch to provision your new notebook server.
8. Wait for your notebook server to be fully provisioned. This can take several minutes if you have never provisioned a server using the Docker image that you specified because the image needs to be downloaded. When your server has been fully provisioned, you see a green check mark in the Status column on the Jupyter Notebook server administration page.

**Notebook Servers** [+ NEW SERVER](#)

Status	Name	Age	Image	CPU	Memory	Volumes	
	mike	12 mins ago	tensorflow-1.13.1-notebook-cpu:v0.5.0	0.5	1.0Gi		<a href="#">CONNECT</a>

9. Click Connect to connect to your new server web interface.
10. Confirm that the dataset volume that was specified in step 6 is mounted on the server. Note that this volume is mounted within the default workspace by default. From the perspective of the user, this is just another folder within the workspace. The user, who is likely a data scientist and not an infrastructure expert, does not need to possess any storage expertise in order to use this volume.

**jupyter** [Quit](#)

[Files](#) [Running](#) [Clusters](#)

Select items to perform actions on them. [Upload](#) [New](#) [Refresh](#)

	Name	Last Modified	File size
<input type="checkbox"/>	/		
<input type="checkbox"/>	data-vol-1	a day ago	



- Open a Terminal and, assuming that a new volume was requested in step 5, execute `df -h` to confirm that a new Trident-provisioned persistent volume is mounted as the default workspace.

The default workspace directory is the base directory that you are presented with when you first access the server's web interface. Therefore, any artifacts that you create by using the web interface are stored on this Trident-provisioned persistent volume.





```

$ df -h
Filesystem                                Size  Used Avail
Use% Mounted on
overlay                                  439G   34G  382G
9% /
tmpfs                                     64M    0   64M
0% /dev
tmpfs                                     252G    0  252G
0% /sys/fs/cgroup
/dev/sda2                                439G   34G  382G
9% /etc/hosts
192.168.11.11:/trident_pvc_3dcfe7e5_d5a9_11e9_9b9d_00505681a82d 10G  320K   10G
1% /home/jovyan
tmpfs                                     252G    0  252G
0% /dev/shm
192.168.11.11:/pb_fg_all                  10T   10T   47G
100% /home/jovyan/data-vol-1
tmpfs                                     252G   12K  252G
1% /run/secrets/kubernetes.io/serviceaccount
tmpfs                                     252G   12K  252G
1% /proc/driver/nvidia
tmpfs                                     51G   4.9M   51G
1% /run/nvidia-persistenced/socket
udev                                     252G    0  252G
0% /dev/nvidia5
tmpfs                                     252G    0  252G
0% /proc/acpi
tmpfs                                     252G    0  252G
0% /proc/scsi
tmpfs                                     252G    0  252G
0% /sys/firmware
$

```

- Using the terminal, run `nvidia-smi` to confirm that the correct number of GPUs were allocated to the notebook server. In the following example, one GPU has been allocated to the notebook server as requested in step 7.

```

$ nvidia-smi
Fri Sep 13 13:52:15 2019
+-----+
| NVIDIA-SMI 410.104      | Driver Version: 410.104      | CUDA Version: N/A      |
+-----+-----+
| GPU  Name                Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC  |
| Fan  Temp   Perf    Pwr:Usage/Cap|      Memory-Usage | GPU-Util  Compute M.  |
+-----+-----+
|  0  Tesla V100-SXM2...  On          | 00000000:86:00:0 Off  |          0           |
| N/A   38C    P0     46W / 300W | 0MiB / 32480MiB |      0%      Default  |
+-----+-----+

+-----+
| Processes:                 GPU Memory |
|  GPU       PID    Type    Process name                     Usage  |
+-----+-----+
| No running processes found |
+-----+
$

```

Next: [Example Notebooks and Pipelines.](#)

## Example Notebooks and Pipelines

The [NetApp Data Science Toolkit for Kubernetes](#) can be used in conjunction with Kubeflow. Using the NetApp Data Science Toolkit with Kubeflow provides the following benefits:

- Data scientists can perform advanced NetApp data management operations directly from within a Jupyter Notebook.
- Advanced NetApp data management operations can be incorporated into automated workflows using the Kubeflow Pipelines framework.

Refer to the [Kubeflow Examples](#) section within the NetApp Data Science Toolkit GitHub repository for details on using the toolkit with Kubeflow.

[Next: Apache Airflow Deployment.](#)

## Copyright information

Copyright © 2023 NetApp, Inc. All Rights Reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system—without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP “AS IS” AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

LIMITED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (b)(3) of the Rights in Technical Data -Noncommercial Items at DFARS 252.227-7013 (FEB 2014) and FAR 52.227-19 (DEC 2007).

Data contained herein pertains to a commercial product and/or commercial service (as defined in FAR 2.101) and is proprietary to NetApp, Inc. All NetApp technical data and computer software provided under this Agreement is commercial in nature and developed solely at private expense. The U.S. Government has a non-exclusive, non-transferrable, nonsublicensable, worldwide, limited irrevocable license to use the Data only in connection with and in support of the U.S. Government contract under which the Data was delivered. Except as provided herein, the Data may not be used, disclosed, reproduced, modified, performed, or displayed without the prior written approval of NetApp, Inc. United States Government license rights for the Department of Defense are limited to those rights identified in DFARS clause 252.227-7015(b) (FEB 2014).

## Trademark information

NETAPP, the NETAPP logo, and the marks listed at <http://www.netapp.com/TM> are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.