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About this Guide

*NVIDIA AI Enterprise Quick Start Guide* provides minimal instructions for a bare-metal, single-node deployment of NVIDIA AI Enterprise on a third-party NVIDIA-certified system and for using a Cloud License Service (CLS) instance to serve licenses.

If you need complete instructions for installing and configuring NVIDIA AI Enterprise, are using NVIDIA AI Enterprise in an NVIDIA vGPU deployment, or are using multiple nodes, refer to *NVIDIA AI Enterprise User Guide*.

If you are using Delegated License Service (DLS) instances to serve licenses, refer to *NVIDIA License System User Guide*.

**Note:** The instructions in this guide do not apply to NVIDIA® DGX™ systems. For information about how to use these systems, refer to *NVIDIA DGX Systems*. 
Chapter 1. Getting NVIDIA AI Enterprise

After your order for NVIDIA AI Enterprise is processed, you will receive an order confirmation message from NVIDIA. This message contains information that you need for getting NVIDIA AI Enterprise and technical support from NVIDIA.

To get NVIDIA AI Enterprise and technical support from NVIDIA, you must have an NVIDIA Enterprise Account, which provides login access to the following NVIDIA web properties:

- **NVIDIA NGC™**, which provides access to all enterprise software, services, and management tools included in NVIDIA AI Enterprise
- **NVIDIA Licensing Portal**, which provides access to your entitlements and options for managing your NVIDIA AI Enterprise license servers
- **NVIDIA Enterprise Support Portal**, which provides access to NVIDIA AI Enterprise support services

1.1. Before You Begin

Before following the procedures in this guide, ensure that the following prerequisites are met:

- You have a third-party **NVIDIA-certified server platform** that supports NVIDIA AI Enterprise.
- One or more NVIDIA GPUs that support NVIDIA AI Enterprise is installed in your server platform.
- You have a valid NVIDIA software subscription.
- If you are using a GPU that is supplied with NVIDIA AI Enterprise software, such as the NVIDIA H100 PCIe GPU, your **NVIDIA AI Enterprise license for H100 has been activated**.

For information about supported hardware and software, and any known issues for this release of NVIDIA AI Enterprise, refer to **NVIDIA AI Enterprise Release Notes**.
1.2. Your Order Confirmation Message

After your order for NVIDIA AI Enterprise is processed, you will receive an order confirmation message to which your NVIDIA Entitlement Certificate is attached.

Thank you for your software and/or services order!

Please find enclosed your Entitlement Certificate for the Software and/or Services products you ordered.

Please refer to the attached Entitlement Certificate to register for your software and services.

The following is your order information:

<table>
<thead>
<tr>
<th>PO Number</th>
<th>NVIDIA Sales Order</th>
<th>NVIDIA Delivery Number</th>
</tr>
</thead>
</table>

Questions?
NVIDIA Enterprise Support contact information can be found here https://www.NVIDIA.com/en-us/support/enterprise/

Your NVIDIA Entitlement Certificate contains your product activation keys.
Your NVIDIA Entitlement Certificate also provides instructions for using the certificate.
If you are a data center administrator, follow the instructions in the NVIDIA Entitlement Certificate to use the certificate. Otherwise, forward your order confirmation message, including the attached NVIDIA Entitlement Certificate, to a data center administrator in your organization.

1.3. NVIDIA Enterprise Account Requirements

To get NVIDIA AI Enterprise, you must have a suitable NVIDIA Enterprise Account for getting NVIDIA AI Enterprise and technical support from NVIDIA.

- If you do not have an account, follow the Register link in the instructions for using the certificate to create your account. For details, refer to Creating your NVIDIA Enterprise Account.
- If you have an account that was created for an evaluation license and you want to access licenses that you purchased, follow the Register link in the instructions for using the certificate to create an account for your purchased licenses. You can choose to create a separate account for your purchased licenses or link your existing account for an evaluation license to the account for your purchased licenses.
To create a separate account for your purchased licenses, follow the instructions in Creating your NVIDIA Enterprise Account, specifying a different e-mail address than the address with which you created your existing account.

To link your existing account for an evaluation license to the account for your purchased licenses, follow the instructions in Linking an Evaluation Account to an NVIDIA Enterprise Account for Purchased Licenses, specifying the e-mail address with which you created your existing account.

If you already have a suitable NVIDIA Enterprise Account for getting NVIDIA AI Enterprise and technical support from NVIDIA, use this account to log in to NVIDIA NGC™ to obtain the enterprise software, services, and management tools included in NVIDIA AI Enterprise. For details, refer to Accessing the Enterprise Catalog and the NGC Private Registry.

You can also follow the Login link in the instructions for using the certificate to log in to the NVIDIA Enterprise Application Hub to go to the NVIDIA Licensing Portal or the NVIDIA Enterprise Support Portal.

1.4. Creating your NVIDIA Enterprise Account

If you do not have an NVIDIA Enterprise Account, you must create an account to be able to log in to the web properties for getting NVIDIA AI Enterprise and technical support from NVIDIA.

For details of these web properties, refer to Getting NVIDIA AI Enterprise.

If you already have an account, skip this task and go to Accessing the Enterprise Catalog and the NGC Private Registry.

However, if you have an account that was created for an evaluation license and you want to access licenses that you purchased, you must repeat the registration process when you receive your purchased licenses. You can choose to create a separate account for your purchased licenses or link your existing account for an evaluation license to the account for your purchased licenses.

To create a separate account for your purchased licenses, perform this task, specifying a different e-mail address than the address with which you created your existing account.

To link your existing account for an evaluation license to the account for your purchased licenses, follow the instructions in Linking an Evaluation Account to an NVIDIA Enterprise Account for Purchased Licenses, specifying the e-mail address with which you created your existing account.

Before you begin, ensure that you have your order confirmation message.

1. In the instructions for using your NVIDIA Entitlement Certificate, follow the Register link.
2. Fill out the form on the NVIDIA Enterprise Account Registration page and click Register.

3. Enter and re-enter your new password and click SUBMIT.
   
   A message confirming that your password has been set successfully appears.
   
   You are then automatically directed to log in to the NVIDIA Licensing Portal with your new password.

1.5. Linking an Evaluation Account to an NVIDIA Enterprise Account for Purchased Licenses

If you have an account that was created for an evaluation license, you must repeat the registration process when you receive your purchased licenses. To link your existing account for an evaluation license to the account for your purchased licenses, register for an NVIDIA Enterprise Account with the e-mail address with which you created your existing account.

If you want to create a separate account for your purchased licenses, follow the instructions in Creating your NVIDIA Enterprise Account, specifying a different e-mail address than the address with which you created your existing account.

1. In the instructions for using the NVIDIA Entitlement Certificate for your purchased licenses, follow the Register link.

2. Fill out the form on the NVIDIA Enterprise Account Registration page, specifying the e-mail address with which you created your existing account, and click Register.
3. When a message stating that your e-mail address is already linked to an evaluation account is displayed, click **LINK TO NEW ACCOUNT**.

Log in to the NVIDIA Licensing Portal with the credentials for your existing account.
Chapter 2. Accessing the Enterprise Catalog and the NGC Private Registry

2.1. The Enterprise Catalog

The NVIDIA AI Enterprise Software Suite is distributed through the Enterprise Catalog. After you access the Enterprise Catalog, you will see the NVIDIA AI Enterprise Software Suite collection. Detailed documentation makes it easy to utilize the software, and if additional support is required, users can submit the ticket directly from the portal.

2.1.1. Accessing the NVIDIA AI Enterprise Collection

1. Go to https://catalog.ngc.nvidia.com/enterprise and, if prompted, log in. Click on the NVIDIA AI Enterprise Collection.
2. Click on the **Entities** tab to review all the software assets part of the NVIDIA AI Enterprise stack.

3. Click on the software asset you are interested in to learn more or download the software in the entities view.
2.1.2. Container Images

To pull AI and data science containers using Docker, follow these steps within the VM:

1. Generate your API key.
2. Access the Enterprise Catalog Container Registry.
   a). Log in to the NGC container registry.
   ```
   sudo docker login nvcr.io
   ```
   b). When prompted for your username, enter the text $oauthtoken.
   ```
   Username: $oauthtoken
   ```
   c). When prompted for your password, enter your NGC API key.
   ```
   Password: my-api-key
   ```
3. For each AI or data science application that you are interested in, load the container.
   ```
   sudo docker pull nvcr.io/nvaie/tensorflow:21.02-tf2-py3
   ```

2.1.3. Helm Charts

The Enterprise Catalog contains Helm charts for use by NVIDIA GPU Operator and NVIDIA Network Operator to deploy and manage GPU resources and network resources for deployments based on Kubernetes.

1. Go to the Enterprise Catalog.
2. Click on the NVIDIA AI Enterprise Collection.
3. Go to the Entities tab and select the Helm chart you are interested in.
4. Here is how you download a Helm chart from the Enterprise Catalog.

2.1.4. Models

The Enterprise Catalog contains pretrained unencrypted models for MONAI and Tao Toolkit.

1. Go to the Enterprise Catalog.
2. Click on the NVIDIA AI Enterprise Collection.
3. Go to the Entities tab and select the model you are interested in.
4. On the page that opens for the model that you selected, click Download.

2.1.5. Resources

1. Go to the Enterprise Catalog.
2. Click on the NVIDIA AI Enterprise Collection.
3. Go to the Entities tab and select the Resource you are interested in. You can either download the Resource directly from the UI or use the displayed `wget` or `CLI` commands.
2.2. Adding Additional Users from Your Organization to the Enterprise Catalog (Admins Only)

As an admin, you are responsible for giving members of your organization access to the Enterprise Catalog.

1. Make sure you are signed in.
2. Make sure to select your company's organization from the user menu on the top right.
3. On the left side menu, select Organization and click on Users, then click the + icon at the bottom of the screen and then click the Invite New User icon.
4. Provide the name and email address of the user you would like to add.
5. Provision user roles for the new user:
   a). To give the new user access to the entities in the Enterprise Catalog, provide them with the user role NVIDIA AI Enterprise Viewer.
   b). To make the user an admin that can add additional users to the Enterprise Catalog, provision the user roles: NVIDIA AI Enterprise Viewer and User Admin.
   c). To give the user access to your organization’s Private Registry, see Accessing Your NGC Private Registry. Provisioning access to the Enterprise Catalog and your organization’s Private Registry can be done in one or two steps.

2.3. The NGC Private Registry

As an NVIDIA AI Enterprise user, you have exclusive access to your organization’s own NGC Private Registry, which gives authorized users within your organization privileges to store your company’s proprietary software and tools, including custom models, frameworks, and helm charts, in one location.

The complete NGC Private Registry user guide can be found here.

2.3.1. Accessing Your NGC Private Registry

1. To access your NGC Private Registry, sign in with your NGC Account.
2. In the top right corner, click your user account icon and select the orgname.
3. To view artifacts in your NGC Private Registry, select **Private Registry** in the left-hand menu.
4. You can access the content of the NGC Private Registry by selecting one of the entity types (Collections, Containers, Helm Charts, Models, Resources).

5. To upload entities to your NGC Private Registry, click on Entity Creation Hub.

### 2.3.2. Managing Teams and Users

As an admin, you can add users to your organization’s NGC Private Registry and create teams within the NGC Private Registry.

Before adding users and teams, familiarize yourself with the following definitions of each role [here](#).

#### 2.3.2.1. Creating Teams

Creating teams allows users to share images within a team while keeping them invisible to other teams in the same organization. Only organization administrators can create teams.

[Here](#) is how you create a team.

#### 2.3.2.2. Creating Users

As the organization administrator, you must create user accounts to allow others to use the NGC container registry within the organization.

[Here](#) is how you create a new user.
Chapter 3. Installing and Licensing NVIDIA AI Enterprise Software Components

3.1. Installing the NVIDIA AI Enterprise Graphics Driver on Ubuntu from a Debian Package

The NVIDIA AI Enterprise graphics driver for Ubuntu is distributed as a Debian package file.

This task requires `sudo` privileges.

1. Copy the NVIDIA AI Enterprise Linux driver package, for example `nvidia-linux-grid-525_525.125.06_amd64.deb`, to the guest VM where you are installing the driver.

2. Log in to the guest VM as a user with `sudo` privileges.

3. Open a command shell and change to the directory that contains the NVIDIA AI Enterprise Linux driver package.

4. From the command shell, run the command to install the package.

   ```
   $ sudo apt-get install ./nvidia-linux-grid-525_525.125.06_amd64.deb
   ```

5. Verify that the NVIDIA driver is operational.
   a). Reboot the system and log in.
   b). After the system has rebooted, confirm that you can see your NVIDIA vGPU device in the output from the `nvidia-smi` command.

   ```
   $ nvidia-smi
   ```

3.2. Configuring a Licensed Client

A client with a network connection obtains a license by leasing it from a NVIDIA License System service instance. The service instance serves the license to the client over the network from a pool of floating licenses obtained from the NVIDIA Licensing Portal. The license is returned to the service instance when the licensed client is shut down.
The graphics driver creates a default location in which to store the client configuration token on the client.

The process for configuring a licensed client is the same for CLS and DLS instances but depends on the OS that is running on the client.

### 3.2.1. Performing an Express CLS Installation

Performing an express CLS installation creates a license server that NVIDIA License System automatically binds to and installs on the default CLS instance. The license server that you create defines the set of licenses to be allotted to an NVIDIA License System instance.

If no default CLS instance exists, NVIDIA License System creates a default instance for you. After you perform an express installation, no further action is required to complete the initial configuration of the CLS instance. The instance is ready to serve licenses to clients.

1. In the NVIDIA Licensing Portal, navigate to the organization or virtual group for which you want to perform an express CLS installation.
   a). If you are not already logged in, log in to the NVIDIA Enterprise Application Hub and click NVIDIA LICENSING PORTAL to go to the NVIDIA Licensing Portal.
   b). Optional: If your assigned roles give you access to multiple virtual groups, click View settings at the top right of the page and in the My Info window that opens, select the virtual group from the Virtual Group drop-down list, and close the My Info window.

   If no license servers have been created for your organization or virtual group, the NVIDIA Licensing Portal dashboard displays a message asking if you want to create a license server.

2. In the left navigation pane of the NVIDIA Licensing Portal dashboard, expand LICENSE SERVER and click CREATE SERVER.

   The Create License Server wizard opens.

3. On the Basic details page of the wizard, provide the details of your license server.
   a). Ensure that the Create legacy server option is not set.
   b). In the Server Name field, enter your choice of name for the license server.
   c). In the Description field, enter a text description of the license server.
      This description is required and will be displayed on the details page for the license server that you are creating.
   d). Select the Express CLS Installation? option.
   e). Click Next: Select features.

4. On the Select features page of the wizard, add the licenses for the products that you want to allot to this license server.

   For each product, add the licenses as follows:
   a). In the list of products, select the product for which you want to add licenses.
   b). In the text-entry field in the ADDED column, enter the number of licenses for the product that you want to add.
c). Click **Next: Preview server creation**.

5. On the **Preview server creation** page, click **CREATE SERVER**.

### 3.2.2. Generating a Client Configuration Token for a CLS Instance

1. Log in to the [NVIDIA Enterprise Application Hub](https://app.nvidia.com) and click **NVIDIA LICENSING PORTAL** to go to the NVIDIA Licensing Portal.

2. If your assigned roles give you access to multiple virtual groups, select the virtual group for which you are managing licenses from the list of virtual groups at the top right of the NVIDIA Licensing Portal dashboard.

3. In the left navigation pane, click **SERVICE INSTANCES**.

4. On the Service Instances page that opens, from the **Actions** menu for the CLS instance for which you want to generate a client configuration token, choose **Generate client configuration token**.

5. In the **Generate Client Configuration Token** pop-up window that opens, select the references that you want to include in the client configuration token.
   a). From the list of scope references, select the scope references that you want to include.
You must select **at least one** scope reference.

Each scope reference specifies the license server that will fulfil a license request.

b). **Optional**: Click the **Fulfillment class references** tab, and from the list of fulfillment class references, select the fulfillment class references that you want to include.
Including fulfillment class references is optional.

c). Click **DOWNLOAD CLIENT CONFIGURATION TOKEN**.
A file named `client_configuration_token_mm-dd-yyyy-hh-mm-ss.tok` is saved to your default downloads folder.

### 3.2.3. Configuring a Licensed Client on Linux with Default Settings

Perform this task from the client.

1. As root, open the file `/etc/nvidia/gridd.conf` in a plain-text editor, such as `vi`.
   ```bash
   $ sudo vi /etc/nvidia/gridd.conf
   ```

   **Note:** You can create the `/etc/nvidia/gridd.conf` file by copying the supplied template file `/etc/nvidia/gridd.conf.template`.

2. Add the `FeatureType` configuration parameter to the file `/etc/nvidia/gridd.conf` on a new line as `FeatureType="value"`.
   
   *value* depends on the type of the GPU assigned to the licensed client that you are configuring.

<table>
<thead>
<tr>
<th>GPU Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NVIDIA vGPU</td>
<td>1. NVIDIA AI Enterprise automatically selects the correct type of license based on the vGPU type.</td>
</tr>
<tr>
<td>GPU Type</td>
<td>Value</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Physical GPU</td>
<td>The feature type of a GPU in pass-through mode or a bare-metal deployment:</td>
</tr>
<tr>
<td></td>
<td>‣ 0: NVIDIA Virtual Applications</td>
</tr>
<tr>
<td></td>
<td>‣ 2: NVIDIA RTX Virtual Workstation</td>
</tr>
<tr>
<td></td>
<td>‣ 4: NVIDIA Virtual Compute Server</td>
</tr>
</tbody>
</table>

This example shows how to configure a licensed Linux client for NVIDIA Virtual Compute Server.

```
# /etc/nvidia/gridd.conf.template - Configuration file for NVIDIA Grid Daemon
...
# Description: Set Feature to be enabled
# Data type: integer
# Possible values:
# 0 => for unlicensed state
# 1 => for NVIDIA vGPU
# 2 => for NVIDIA RTX Virtual Workstation
# 4 => for NVIDIA Virtual Compute Server
FeatureType=4
...
```

3. Copy the client configuration token to the `/etc/nvidia/ClientConfigToken` directory.

4. Ensure that the file access modes of the client configuration token allow the owner to read, write, and execute the token, and the group and others only to read the token.
   a). Determine the current file access modes of the client configuration token.
      ```
      # ls -l client-configuration-token-directory
      #
      # chmod 744 ...
      # client-configuration-token-directory
      # The directory to which you copied the client configuration token in the previous step.
      #
      3. Copy the client configuration token to the `/etc/nvidia/ClientConfigToken` directory.
      4. Ensure that the file access modes of the client configuration token allow the owner to read, write, and execute the token, and the group and others only to read the token.
      a). Determine the current file access modes of the client configuration token.
         ```
         # ls -l client-configuration-token-directory
         #
         # chmod 744 ...
         # client-configuration-token-directory
         # The directory to which you copied the client configuration token in the previous step.
         #
      5. Save your changes to the `/etc/nvidia/gridd.conf` file and close the file.
      6. Restart the `nvidia-gridd` service.

      The NVIDIA service on the client should now automatically obtain a license from the CLS or DLS instance.

### 3.2.4. Verifying the NVIDIA AI Enterprise License Status of a Licensed Client

After configuring a client with an NVIDIA AI Enterprise license, verify the license status by displaying the licensed product name and status.

To verify the license status of a licensed client, run `nvidia-smi` with the `-q` or `--query` option. If the product is licensed, the expiration date is shown in the license status.

```
nvidia-smi -q
```

---

---
3.3. Installing NVIDIA Container Toolkit

Use NVIDIA Container Toolkit to build and run GPU accelerated Docker containers. The toolkit includes a container runtime library and utilities to configure containers to use NVIDIA GPUs automatically.
Ensure that the following software is installed in the guest VM:

- Docker 20.10 for your Linux distribution. For instructions, refer to Install Docker Engine on Ubuntu in the Docker product manuals.
- The NVIDIA AI Enterprise graphics driver. For instructions, refer to Installing the NVIDIA AI Enterprise Graphics Driver on Ubuntu from a Debian Package.

**Note:** You do not need to install NVIDIA CUDA Toolkit on the hypervisor host.

1. Set up the GPG key and configure `apt` to use NVIDIA Container Toolkit packages in the file `/etc/apt/sources.list.d/nvidia-docker.list`.
   ```
   $ distribution=$(ls /etc/os-release;echo $ID$VERSION_ID)
   $ curl -s -L https://nvidia.github.io/nvidia-docker/gpgkey | sudo apt-key add -
   $ curl -s -L https://nvidia.github.io/nvidia-docker/$distribution/nvidia-
   docker.list | sudo tee /etc/apt/sources.list.d/nvidia-docker.list
   ```

2. Download information from all configured sources about the latest versions of the packages and install the nvidia-container-toolkit package.
   ```
   $ sudo apt-get update && sudo apt-get install -y nvidia-container-toolkit
   ```

3. Restart the Docker service.
   ```
   $ sudo systemctl restart docker
   ```
3.4. Verifying the Installation of NVIDIA Container Toolkit

1. Run the `nvidia-smi` command contained in the latest official NVIDIA CUDA Toolkit image.
   $ docker run --gpus all nvidia/cuda:11.0-base nvidia-smi

2. Start a GPU-enabled container on any two available GPUs.
   $ docker run --gpus 2 nvidia/cuda:11.0-base nvidia-smi

3. Start a GPU-enabled container on two specific GPUs identified by their index numbers.
   $ docker run --gpus "device=1,2" nvidia/cuda:10.0-base nvidia-smi

4. Start a GPU-enabled container on two specific GPUs with one GPU identified by its UUID and the other GPU identified by its index number.
   $ docker run --gpus "device=UUID-ABCDEF,1" nvidia/cuda:11.0-base nvidia-smi

5. Specify a GPU capability for the container.
   $ docker run --gpus all,capabilities=utility nvidia/cuda:11.0-base nvidia-smi

3.5. Installing Software Distributed as Container Images

The NGC container images accessed through the NVIDIA Enterprise Catalog include the AI and data science applications, frameworks, and software in the infrastructure optimization and cloud native deployment layers. Each container image for an AI and data science application or framework contains the entire user-space software stack that is required to run the application or framework; namely, the CUDA libraries, cuDNN, any required Magnum IO components, TensorRT, and the framework.

Ensure that you have completed the following tasks in NGC Private Registry User Guide:

- Generating Your NGC API Key
- Accessing the NGC Container Registry

Perform this task from the VM.

Obtain the Docker `pull` command for downloading each of the following applications and deep learning framework components from the listing for the application or component in the NGC Public Catalog.

- Applications:
  - NVIDIA Clara Parabricks
  - NVIDIA DeepStream
  - MONAI - Medical Open Network for Artificial Intelligence
Installing and Licensing NVIDIA AI Enterprise Software Components

- RAPIDS
- RAPIDS Accelerator for Apache Spark
- TAO

Deep learning framework components:
- NVIDIA TensorRT
- NVIDIA Triton Inference Server
- PyTorch
- TensorFlow 2

Obtain the command for downloading each of the following NVIDIA AI Enterprise software components from the listing for the component in the NVIDIA AI Enterprise NGC private registry.

- GPU Operator
- Network Operator
- vGPU Guest Driver, Ubuntu 22.04

### 3.6. Running ResNet-50 with TensorRT

1. Launch the NVIDIA TensorRT container image on all GPUs in interactive mode, specifying that the container will be deleted when it is stopped.

   ```
   sudo docker run --gpus all -it --rm nvcr.io/nvaie/tensorrt:21.07-py3
   ```

2. From within the container runtime, change to the directory that contains test data for the ResNet-50 convolutional neural network.

   ```
   cd /workspace/tensorrt/data/resnet50
   ```

3. Run the ResNet-50 convolutional neural network with FP32, FP16, and INT8 precision and confirm that each test is completed with the result **PASSED**.
   a). To run ResNet-50 with the default FP32 precision, run this command:

   ```
   # trtexec --duration=90 --workspace=1024 --percentile=99 --avgRuns=100 \
   --deploy=ResNet50_N2.prototxt --batch=1 --output=prob
   ```

   b). To run ResNet-50 with FP16 precision, add the **--fp16** option:

   ```
   # trtexec --duration=90 --workspace=1024 --percentile=99 --avgRuns=100 \
   --deploy=ResNet50_N2.prototxt --batch=1 --output=prob --fp16
   ```

   c). To run ResNet-50 with INT8 precision, add the **--int8** option:

   ```
   # trtexec --duration=90 --workspace=1024 --percentile=99 --avgRuns=100 \
   --deploy=ResNet50_N2.prototxt --batch=1 --output=prob --int8
   ```

4. Press **Ctrl+P, Ctrl+Q** to exit the container runtime and return to the Linux command shell.
3.7. Running ResNet-50 with TensorFlow

1. Launch the **TensorFlow 1** container image on all GPUs in interactive mode, specifying that the container will be deleted when it is stopped.

   
   ```
   $ sudo docker run --gpus all -it --rm \
   nvcr.io/nvaie/tensorflow:21.07-tf1-py3
   ```

2. From within the container runtime, change to the directory that contains test data for cnn example.

   ```
   # cd /workspace/nvidia-examples/cnn
   ```

3. Run the ResNet-50 training test with FP16 precision.

   ```
   # python resnet.py --layers 50 -b 64 -i 200 -u batch --precision fp16
   ```

4. Confirm that all operations on the application are performed correctly and that a set of results is reported when the test is completed.

5. Press **Ctrl+P, Ctrl+Q** to exit the container runtime and return to the Linux command shell.
Chapter 4. Additional Information

Additional information about containers and resources that are available from the NVIDIA AI Enterprise private registry on NGC is available in the documentation for these entities.

<table>
<thead>
<tr>
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| TensorFlow            | TensorFlow Release Notes  
|                       | TensorFlow User Guide |
| PyTorch               | PyTorch Release Notes   |
| NVIDIA Triton Inference Server | Triton Inference Server Documentation on Github |
| NVIDIA TensorRT       | NVIDIA TensorRT Documentation |
| NVIDIA RAPIDS         | RAPIDS Docs on the RAPIDS project site |
| NVIDIA RAPIDS Accelerator for Apache Spark | RAPIDS Accelerator for Apache Spark Deployment Guide |
| NVIDIA Clara Parabricks | NVIDIA Clara Parabricks Documentation |
| NVIDIA DeepStream     | DeepStream 6.2 Release Notes (PDF)  
|                       | DeepStream SDK Development Guide  
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| MONAI (Medical Open Network for Artificial Intelligence) Enterprise | NVIDIA MONAI Toolkit Documentation |
| TAO Toolkit           | TAO Toolkit Documentation |
| NVIDIA GPU Operator   | NVIDIA GPU Operator Documentation |
| NVIDIA Network Operator | NVIDIA Network Operator Documentation |
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