



NVIDIA TensorRT

Installation Guide | NVIDIA Docs

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Chapter 1. Overview

The core of NVIDIA® TensorRT™ is a C++ library that facilitates high-performance inference on NVIDIA graphics processing units (GPUs). TensorRT takes a trained network, which consists of a network definition and a set of trained parameters, and produces a highly optimized runtime engine that performs inference for that network.

TensorRT provides API's via C++ and Python that help to express deep learning models via the Network Definition API or load a pre-defined model via the parsers that allow TensorRT to optimize and run them on an NVIDIA GPU. TensorRT applies graph optimizations, layer fusion, among other optimizations, while also finding the fastest implementation of that model leveraging a diverse collection of highly optimized kernels. TensorRT also supplies a runtime that you can use to execute this network on all of NVIDIA's GPU's from the NVIDIA Kepler™ generation onwards.

TensorRT also includes optional high speed mixed precision capabilities introduced in the NVIDIA Tegra® X1, and extended with the NVIDIA Pascal™, NVIDIA Volta™, NVIDIA Turing™, and NVIDIA Ampere Architectures.

Chapter 2. Getting Started

Ensure you are familiar with the following installation requirements and notes.

- ▶ Python support for Windows included in the zip package is considered a preview release and not ready for production use.
- ▶ If you are using the TensorRT Python API and PyCUDA isn't already installed on your system, see [Installing PyCUDA](#). If you encounter any issues with PyCUDA usage, you may need to recompile it yourself. For more information, refer to [Installing PyCUDA on Linux](#).
- ▶ Ensure you are familiar with the [NVIDIA TensorRT Release Notes](#).
- ▶ Verify that you have the NVIDIA CUDA[®] toolkit installed; versions [10.2](#), [11.0 update 1](#), [11.1 update 1](#), [11.2 update 2](#), [11.3 update 1](#), and [11.4 update 3](#) are supported.
- ▶ The TensorFlow to TensorRT model export requires [TensorFlow 1.15.5](#). Some Python samples require [TensorFlow 2.5.1](#), such as `efficientdet` and `efficientnet`.
- ▶ The PyTorch examples have been tested with [PyTorch 1.9.0](#), but may work with older versions.
- ▶ The TensorRT ONNX parser has been tested with [ONNX 1.9.0](#) and supports opset 14.
- ▶ If the target system has both TensorRT and one or more training frameworks installed on it, the simplest strategy is to use the same version of cuDNN for the training frameworks as the one that TensorRT ships with. If this is not possible, or for some reason strongly undesirable, be careful to properly manage the side-by-side installation of cuDNN on the single system. In some cases, depending on the training framework being used, this may not be possible without patching the training framework sources.
- ▶ The installation instructions below assume you want the full TensorRT; both the C++ and Python APIs. In some environments and use cases, you may not want to install the Python functionality. If that is the case, simply don't install the Debian or RPM packages labeled Python or the `whl` files. None of the C++ API functionality depends on Python. You would need to install the UFF `whl` file if you want to export UFF files from TensorFlow models.

Chapter 3. Downloading TensorRT

Ensure you are a member of the NVIDIA Developer Program. If not, follow the prompts to gain access.

Procedure

1. Go to: <https://developer.nvidia.com/tensorrt>.
2. Click **Download Now**.
3. Select the version of TensorRT that you are interested in.
4. Select the check-box to agree to the license terms.
5. Click the package you want to install. Your download begins.

Chapter 4. Installing TensorRT

You can choose between the following installation options when installing TensorRT; Debian or RPM packages, a `pip` wheel file, a tar file, or a zip file.

About this task

The Debian and RPM installations automatically install any dependencies, however, it:

- ▶ requires `sudo` or root privileges to install
- ▶ provides no flexibility as to which location TensorRT is installed into
- ▶ requires that the CUDA toolkit and cuDNN have also been installed using Debian or RPM packages.
- ▶ does not allow more than one minor version of TensorRT to be installed at the same time

The tar file provides more flexibility, such as installing multiple versions of TensorRT at the same time. However, you need to ensure that you have the necessary dependencies already installed and you must manage `LD_LIBRARY_PATH` yourself. For more information, see [Tar File Installation](#).

The zip file is the only option currently for Windows. It does not support any other platforms besides Windows. Ensure that you have the necessary dependencies already installed. For more information, see [Zip File Installation](#).

TensorRT versions: TensorRT is a product made up of separately versioned components. The version of the product conveys important information about the significance of new features while the library version conveys information about the compatibility or incompatibility of the API. The following table shows the versioning of the TensorRT components.

Table 1. Versioning of TensorRT components

Product or Component	Previously Released Version	Current Version	Version Description
TensorRT product	8.2.0	8.2.1	+1.0 when significant new

Product or Component		Previously Released Version	Current Version	Version Description
				capabilities are added. +0.1 when capabilities have been improved.
nvinfer libraries, headers, samples, and documentation.		8.2.0	8.2.1	+1.0 when the API or ABI changes in a non-compatible way. +0.1 when the API or ABI changes are backward compatible
UFF	uff-converter-tf Debian and RPM packages	8.2.0	8.2.1	+0.1 while we are developing the core functionality.
	uff-*.whl file	0.6.8	0.6.9	Set to 1.0 when we have all base functionality in place.
graphsurgeon	graphsurgeon-tf Debian and RPM packages	8.2.0	8.2.1	+0.1 while we are developing the core functionality.
	graphsurgeon-*.whl file	0.4.4	0.4.5	Set to 1.0 when we have all base functionality in place.
onnx-graphsurgeon	onnx-graphsurgeon Debian and RPM packages	8.2.0	8.2.1	+0.1 while we are developing the core functionality.
	onnx_graphsurgeon*.whl file	0.3.10	0.3.12	Set to 1.0 when we have all base functionality in place.

Product or Component		Previously Released Version	Current Version	Version Description
libnvinfer Python packages ¹	<ul style="list-style-type: none"> python3-libnvinfer python3-libnvinfer-dev 	8.2.0	8.2.1	+1.0 when the API or ABI changes in a non-compatible way.
	Debian and RPM packages			+0.1 when the API or ABI changes are backward compatible.
	tensorrt.whl file	8.2.0	8.2.1	

4.1. Debian Installation

This section contains instructions for a developer installation. This installation method is for new users or users who want the complete developer installation, including samples and documentation for both the C++ and Python APIs.

About this task

For advanced users who are already familiar with TensorRT and want to get their application running quickly, are using an NVIDIA CUDA container with cuDNN included, or want to setup automation, follow the network repo installation instructions (see [Using The NVIDIA CUDA Network Repo For Debian Installation](#)).



Note:

- ▶ The following commands are examples for `amd64`, however, the commands are identical for `arm64`.
- ▶ When installing Python packages using this method, you will need to install dependencies manually with `pip`.

Procedure

1. [Download](#) the TensorRT local repo file that matches the Ubuntu version and CPU architecture that you are using.
2. Install TensorRT from the Debian local repo package. Replace `ubuntuxx04`, `cuda.x.x`, `trt8.x.x.x` and `yyyymmdd` with your specific OS version, CUDA version, TensorRT version and package date.

```
os="ubuntuxx04"
tag="cuda.x.x-trt8.x.x.x-yyyymmdd"
```

¹ These components are not included in the zip file installation for Windows.

```

sudo dpkg -i nv-tensorrt-repo-${os}-${tag}_1-1_amd64.deb
sudo apt-key add /var/nv-tensorrt-repo-${os}-${tag}/7fa2af80.pub

sudo apt-get update
sudo apt-get install tensorrt

python3 -m pip install numpy
sudo apt-get install python3-libnvinfer-dev

```

The following additional packages will be installed:

```
python3-libnvinfer
```

If you plan to use TensorRT with TensorFlow:

```

python3 -m pip install protobuf
sudo apt-get install uff-converter-tf

```

The `graphsurgeon-tf` package will also be installed with the above command.

If you would like to run the samples that require ONNX `graphsurgeon` or use the Python module for your own project, run:

```

python3 -m pip install numpy onnx
sudo apt-get install onnx-graphsurgeon

```

3. Verify the installation.

```
dpkg -l | grep TensorRT
```

You should see something similar to the following:

```

ii  graphsurgeon-tf 8.2.1-1+cuda11.4 amd64 GraphSurgeon for TensorRT package
ii  libnvinfer-bin  8.2.1-1+cuda11.4 amd64 TensorRT binaries
ii  libnvinfer-dev  8.2.1-1+cuda11.4 amd64 TensorRT development libraries and headers
ii  libnvinfer-doc  8.2.1-1+cuda11.4 all TensorRT documentation
ii  libnvinfer-plugin-dev 8.2.1-1+cuda11.4 amd64 TensorRT plugin libraries
ii  libnvinfer-plugin8 8.2.1-1+cuda11.4 amd64 TensorRT plugin libraries
ii  libnvinfer-samples 8.2.1-1+cuda11.4 all TensorRT samples
ii  libnvinfer8      8.2.1-1+cuda11.4 amd64 TensorRT runtime libraries
ii  libnvonnxparsers-dev 8.2.1-1+cuda11.4 amd64 TensorRT ONNX libraries
ii  libnvonnxparsers8 8.2.1-1+cuda11.4 amd64 TensorRT ONNX libraries
ii  libnvparsers-dev 8.2.1-1+cuda11.4 amd64 TensorRT parsers libraries
ii  libnvparsers8    8.2.1-1+cuda11.4 amd64 TensorRT parsers libraries
ii  python3-libnvinfer 8.2.1-1+cuda11.4 amd64 Python 3 bindings for TensorRT
ii  python3-libnvinfer-dev 8.2.1-1+cuda11.4 amd64 Python 3 development package for
    TensorRT
ii  tensorrt 8.2.1.x-1+cuda11.4 amd64 Meta package of TensorRT
ii  uff-converter-tf 8.2.1-1+cuda11.4 amd64 UFF converter for TensorRT package
ii  onnx-graphsurgeon 8.2.1-1+cuda11.4 amd64 ONNX GraphSurgeon for TensorRT package

```

4.1.1. Using The NVIDIA CUDA Network Repo For Debian Installation

This installation method is for advanced users who are already familiar with TensorRT and want to get their application running quickly or to set up automation, such as when using containers. New users or users who want the complete installation, including samples and documentation, should follow the local repo installation instructions (refer to [Debian Installation](#)).

About this task



Note: If you are using a CUDA container with cuDNN included, then the NVIDIA CUDA network repository will already be set up and you can skip step 1.

Procedure

1. To install the CUDA network repository, follow the instructions at the [CUDA Toolkit Download](#) page.
 - a). Select the **Linux** operating system.
 - b). Select the desired architecture.
 - c). Select the **Ubuntu** distribution.
 - d). Select the desired Ubuntu version.
 - e). Select the “**deb (network)**” installer type.
 - f). Enter the commands provided into your terminal.

You can omit the final `apt-get install` command if you do not require the entire CUDA toolkit. While installing TensorRT, `apt` downloads the required CUDA and cuDNN dependencies for you automatically.

2. Install the TensorRT package that fits your particular needs.

- a). For only running TensorRT C++ applications:

```
sudo apt-get install libnvinfer8 libvonnxparsers8 libnvparse8 libnvinfer-plugin8
```

- b). For also building TensorRT C++ applications:

```
sudo apt-get install libnvinfer-dev libvonnxparsers-dev
libnvparse8-dev libnvinfer-plugin-dev
```

- c). For running TensorRT Python applications:

```
python3 -m pip install numpy
sudo apt-get install python3-libnvinfer
```

3. When using the CUDA network repository, Ubuntu will by default install TensorRT for the latest CUDA version. The following commands will install `libnvinfer8` for an older CUDA version and hold the `libnvinfer8` package at this version. Replace `8.x.x` with your version of TensorRT and `cuda.x.x` with your CUDA version for your install.

```
version="8.x.x-1+cuda.x.x"
sudo apt-get install libnvinfer8=${version} libvonnxparsers8=${version} libnvparse8=
${version} libnvinfer-plugin8=${version} libnvinfer-dev=${version} libvonnxparsers-
dev=${version} libnvparse8-dev=${version} libnvinfer-plugin-dev=${version} python3-
libnvinfer=${version}

sudo apt-mark hold libnvinfer8 libvonnxparsers8 libnvparse8 libnvinfer-plugin8
libnvinfer-dev libvonnxparsers-dev libnvparse8-dev libnvinfer-plugin-dev python3-
libnvinfer
```

If you want to upgrade to the latest version of TensorRT or the latest version of CUDA, then you can unhold the `libnvinfer8` package using the following command.

```
sudo apt-mark unhold libnvinfer8 libvonnxparsers8 libnvparse8 libnvinfer-plugin8
libnvinfer-dev libvonnxparsers-dev libnvparse8-dev libnvinfer-plugin-dev python3-
libnvinfer
```

You may need to repeat these steps for `libcudnn8` to prevent cuDNN from being updated to the latest CUDA version. Refer to the [NVIDIA TensorRT Release Notes](#) for the specific version of cuDNN that was tested with your version of TensorRT. Example commands for downgrading and holding the cuDNN version can be found in [Upgrading TensorRT](#). See the [NVIDIA cuDNN Installation Guide](#) for additional information.

If the CUDA network repository and a TensorRT local repository are enabled at the same time you may observe package conflicts with either TensorRT or cuDNN. You will need to configure APT so that it prefers local packages over network packages. You can do this by creating a new file at `/etc/apt/preferences.d/local-repo` with the following lines:

```
Package: *
Pin: origin ""
Pin-Priority: 1001
```



Note: This preference change will affect more than just TensorRT in the unlikely event that you have other repositories which are also not downloaded over HTTP(S). To revert APT to its original behavior simply remove the newly created file.

4.2. App Server Installation

This type of installation is for cloud users or container users who will be going to production.

About this task

If you are going to be deploying the application to a server and running an already existing application in a minimal or standalone environment, then this type of installation allows you to set up a runtime environment instead of a full development environment. It provides a simple list of packages you can install if you want to run an application you've already developed.

When setting up servers which will host TensorRT powered applications, you can simply install any of the following Debian packages using `apt-get`:

- ▶ the `libnvinfer8` package (C++) plus any additional library packages you require, or
- ▶ the `python3-libnvinfer` package (Python 3.x).

4.3. Cross Compile Installation

If you intend to cross compile TensorRT for AArch64, then start with the [Using The NVIDIA CUDA Network Repo For Debian Installation](#) section to set up the network repository and TensorRT for the host. Steps to prepare your machine for cross compilation and how to cross compile the TensorRT samples can be found in [Cross Compiling Samples For AArch64 Users](#).

4.4. RPM Installation

This section contains instructions for installing TensorRT from an RPM package. This installation method is for new users or users who want the complete installation, including samples and documentation.

About this task

For advanced users who are already familiar with TensorRT and want to get their application running quickly or to set up automation, follow the network repo installation instructions (see [Using The NVIDIA CUDA Network Repo For RPM Installation](#)).

Before you begin



Note:

- ▶ Before issuing the following commands, you'll need to replace `cuda.x`, `trt8.x.x.x`, and `yyyymmdd` with your specific CUDA version, TensorRT version, and package date.
- ▶ The following example commands are for `x86_64`, but the commands should be identical for `ppc64le`.
- ▶ When installing Python packages using this method, you will need to install dependencies manually with `pip`.

Procedure

1. [Download](#) the TensorRT local repo file that matches the RHEL/CentOS version and CPU architecture you are using.
2. Install TensorRT from the RPM local repo package.

```
os="rhelx"
tag="cuda.x-trt8.x.x.x-yyyymmdd"
sudo rpm -Uvh nv-tensorrt-repo-${os}-${tag}-1-1.x86_64.rpm
sudo yum clean expire-cache
```

The packages which can be installed are:

```
graphsurgeon-tf.x86_64
libnvinfer-bin.x86_64
libnvinfer-devel.x86_64
libnvinfer-doc.x86_64
libnvinfer-plugin-devel.x86_64
libnvinfer-plugin8.x86_64
libnvinfer-samples.x86_64
libnvinfer8.x86_64
libvonnxparsers-devel.x86_64
libvonnxparsers8.x86_64
libvnparsers-devel.x86_64
libvnparsers8.x86_64
python3-libnvinfer.x86_64
python3-libnvinfer-devel.x86_64
tensorrt.x86_64
uff-converter-tf.x86_64
```

```
onnx-graphsurgeon.x86_64
```

Install TensorRT.

```
sudo yum install tensorrt
```

If using Python 3.x:

```
python3 -m pip install numpy
sudo yum install python3-libnvinfer-devel
```

The following additional packages will be installed:

```
python3-libnvinfer
```

For the UFF converter (only required if you plan to use TensorRT with TensorFlow):

```
python3 -m pip install protobuf
sudo yum install uff-converter-tf
```

The graphsurgeon-tf package will also be installed with the above command.

If you would like to run the samples that require ONNX graphsurgeon or use the Python module for your own project, run:

```
python3 -m pip install numpy onnx
sudo yum install onnx-graphsurgeon
```

3. Verify the installation.

a). Run:

```
rpm -qa | grep tensorrt
```

You should see something similar to the following:

```
tensorrt-8.2.1.x-1.cuda11.4.x86_64
```

b). Run:

```
rpm -qa | grep -e libnvinfer -e libnv.*parsers
```

You should see something similar to the following:

```
libnvinfer-doc-8.2.1-1.cuda11.4.x86_64
libnvinfer-plugin8-8.2.1-1.cuda11.4.x86_64
libnvinfer-devel-8.2.1-1.cuda11.4.x86_64
libnvinfer-bin-8.2.1-1.cuda11.4.x86_64
libnvinfer8-8.2.1-1.cuda11.4.x86_64
libnvinfer-samples-8.2.1-1.cuda11.4.x86_64
libnvinfer-plugin-devel-8.2.1-1.cuda11.4.x86_64
libnvonnxparsers8-8.2.1-1.cuda11.4.x86_64
libnvonnxparsers-devel-8.2.1-1.cuda11.4.x86_64
libnvparsers8-8.2.1-1.cuda11.4.x86_64
libnvparsers-devel-8.2.1-1.cuda11.4.x86_64
python3-libnvinfer-8.2.1-1.cuda11.4.x86_64
python3-libnvinfer-devel-8.2.1-1.cuda11.4.x86_64
```

c). Run:

```
rpm -qa | grep graphsurgeon-tf
```

You should see something similar to the following:

```
graphsurgon-tf-8.2.1-1.cuda11.4.x86_64
```

d). Run:

```
rpm -qa | grep uff-converter-tf
```

You should see something similar to the following:

```
uuff-converter-tf-8.2.1-1.cuda11.4.x86_64
```

e). Run:

```
rpm -qa | grep onnx-graphsurgeon
```

You should see something similar to the following:

```
onnx-graphsurgeon-8.2.1-1.cuda11.4.x86_64
```

4.4.1. Using The NVIDIA CUDA Network Repo For RPM Installation

This installation method is for advanced users who are already familiar with TensorRT and want to get their application running quickly or to set up automation. New users or users who want the complete installation, including samples and documentation, should follow the local repo installation instructions (see [RPM Installation](#)).

About this task



Note: If you are using an CUDA container with cuDNN included, then the CUDA network repository will already be set up and you can skip step 1.

Procedure

1. To install the CUDA network repository, follow the instructions at the [CUDA Toolkit Download](#) page for the latest CUDA version.
 - a). Select the **Linux** operating system.
 - b). Select the desired architecture.
 - c). Select the **CentOS** or **RHEL** distribution.
 - d). Select the desired CentOS/RHEL version.
 - e). Select the “**rpm (network)**” installer type.
 - f). Enter the commands provided into your terminal.

You can omit the final `yum/dnf install` command if you do not require the entire CUDA toolkit. While installing TensorRT, `yum/dnf` downloads the required CUDA and cuDNN dependencies for you automatically.

2. Install the TensorRT package that fits your particular needs. When using the NVIDIA CUDA network repository, RHEL will by default install TensorRT for the latest CUDA version. If you need the libraries for other CUDA versions, refer to next step.

- a). For only running TensorRT C++ applications:

```
sudo yum install libnvinfer8 libnvparzers8 libnvonnxparzers8 libnvinfer-plugin8
```

- b). For also building TensorRT C++ applications:

```
sudo yum install libnvinfer-devel libnvparzers-devel libnvonnxparzers-devel
libnvinfer-plugin-devel
```

- c). For running TensorRT Python applications:

```
sudo yum install python3-libnvinfer
```

3. The following commands install `libnvinfer8` for an older CUDA version and hold the `libnvinfer8` package at this version. Replace `8.x.x` with your version of TensorRT and `cuda.x.x` with your CUDA version for your install.

```
version="8.x.x-1.cuda.x.x"
sudo yum downgrade libnvinfer8-${version} libnvparzers8-${version} libnvonnxparzers8-
${version} libnvinfer-plugin8-${version} libnvinfer-devel-${version} libnvparzers-devel-
${version} libnvonnxparzers-devel-${version} libnvinfer-plugin-devel-${version} python3-
libnvinfer-${version}
```



```
sudo yum install yum-plugin-versionlock
sudo yum versionlock libnvinfer8 libnvparse8 libnvonnxparsers8 libnvinfer-plugin8
libnvinfer-devel libnvparse8-devel libnvonnxparsers8-devel libnvinfer-plugin-devel
python3-libnvinfer
```

If you want to upgrade to the latest version of TensorRT or the latest version of CUDA, then you can unhold the `libnvinfer8` package using the following command.

```
sudo yum versionlock delete libnvinfer8 libnvparse8 libnvonnxparsers8 libnvinfer-
plugin8 libnvinfer-devel libnvparse8-devel libnvonnxparsers8-devel libnvinfer-plugin-
devel python3-libnvinfer
```

You may need to repeat these steps for `libcudnn8` to prevent cuDNN from being updated to the latest CUDA version. Refer to the [NVIDIA TensorRT Release Notes](#) for the specific version of cuDNN that was tested with your version of TensorRT. Example commands for downgrading and holding the cuDNN version can be found in [Upgrading TensorRT](#). See the [NVIDIA cuDNN Installation Guide](#) for additional information.

4.5. pip Wheel File Installation

This section contains instructions for installing TensorRT from a standalone `pip` [wheel file](#).

About this task



Note: While the TensorRT packages also contain `pip` wheel files, those wheel files require the rest of the `.deb` or `.rpm` packages to be installed and will not work alone. The standalone `pip`-installable TensorRT wheel files differ in that they are fully self-contained and installable without any prior TensorRT installation or use of `.deb` or `.rpm` files.

The `pip`-installable `nvidia-tensorrt` Python wheel files only support Python versions 3.6 to 3.9 and CUDA 11.4 at this time and will not work with other Python or CUDA versions. Only the Linux operating system and x86_64 CPU architecture is currently supported. These wheel files are expected to work on CentOS 7 or newer and Ubuntu 18.04 or newer.



Note: If you do not have root access, you are running outside a Python virtual environment, or for any other reason you would prefer a user installation, then append `--user` to any of the `pip` commands provided.

Before you begin

You must first install the `nvidia-pyindex` package, which is required in order to set up your `pip` installation to fetch additional Python modules from the NVIDIA NGC™ PyPI repo.

If your `pip` and `setuptools` Python modules are outdated, then use the following command to upgrade these Python modules. If these Python modules are outdated then the commands which follow later in this section may fail.

```
python3 -m pip install --upgrade setuptools pip
```

You should now be able to install the `nvidia-pyindex` module.

```
python3 -m pip install nvidia-pyindex
```

If your project is using a `requirements.txt` file, then you can add the following line to your `requirements.txt` file as an alternative to installing the `nvidia-pyindex` package.

```
--extra-index-url https://pypi.ngc.nvidia.com
```

Procedure

1. Install the TensorRT Python wheel.

```
python3 -m pip install --upgrade nvidia-tensorrt
```

The above `pip` command will pull in all the required CUDA libraries and cuDNN in Python wheel format because they are dependencies of the TensorRT Python wheel. Also, it will upgrade `nvidia-tensorrt` to the latest version if you had a previous version installed.

If you receive an error message in the form of a Python exception similar to the error message below, then either the `nvidia-pyindex` package was not set up properly, or you might be using a Python version other than 3.6 to 3.9.

```
#####
The package you are trying to install is only a placeholder project on PyPI.org
repository.
This package is hosted on NVIDIA Python Package Index.
```

```
This package can be installed as:
```

```
...
$ pip install nvidia-pyindex
$ pip install nvidia-tensorrt
...
```

```
#####
```

2. To verify that your installation is working, use the following Python commands to:

- ▶ Import the `tensorrt` Python module.
- ▶ Confirm that the correct version of TensorRT has been installed.
- ▶ Create a `Builder` object to verify that your CUDA installation is working.

```
python3
>>> import tensorrt
>>> print(tensorrt.__version__)
>>> assert tensorrt.Builder(tensorrt.Logger())
```

If the final Python command fails with an error message similar to the error message below, then you may not have the NVIDIA driver installed or the NVIDIA driver may not be working properly. If you are running inside a container, then try starting from one of the `nvidia/cuda:x.y-base-<os>` containers.

```
[TensorRT] ERROR: CUDA initialization failure with error 100. Please check your CUDA
installation: ...
```

If the Python commands above worked, then you should now be able to run any of the TensorRT Python samples to further confirm that your TensorRT installation is working. For more information about TensorRT samples, refer to the [NVIDIA TensorRT Sample Support Guide](#).

4.6. Tar File Installation

Procedure

1. Install the following dependencies, if not already present:
 - ▶ [CUDA 10.2](#), [11.0 update 1](#), [11.1 update 1](#), [11.2 update 2](#), [11.3 update 1](#), or [11.4 update 3](#)
 - ▶ [cuDNN 8.2.1](#)
 - ▶ Python 3 (Optional)
2. [Download](#) the TensorRT tar file that matches the CPU architecture and CUDA version you are using.
3. Choose where you want to install TensorRT. This tar file will install everything into a subdirectory called `TensorRT-8.x.x.x`.
4. Unpack the tar file.

```
version="8.x.x.x"
arch=$(uname -m)
cuda="cuda-x.x"
cudnn="cudnn8.x"
tar xzvf TensorRT-${version}.Linux.${arch}-gnu.${cuda}.${cudnn}.tar.gz
```

Where:

- ▶ `8.x.x.x` is your TensorRT version
- ▶ `cuda-x.x` is CUDA version 10.2 or 11.4
- ▶ `cudnn8.x` is cuDNN version 8.2

This directory will have sub-directories like `lib`, `include`, `data`, etc...

```
ls TensorRT-${version}
bin data doc graphsurgeon include lib onnx_graphsurgeon python samples targets
TensorRT-Release-Notes.pdf uff
```

5. Add the absolute path to the TensorRT `lib` directory to the environment variable `LD_LIBRARY_PATH`:

```
export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:<TensorRT-${version}/lib>
```

6. Install the Python TensorRT wheel file.

```
cd TensorRT-${version}/python
python3 -m pip install tensorrt-*-cp3x-none-linux_x86_64.whl
```

7. Install the Python UFF wheel file. This is only required if you plan to use TensorRT with TensorFlow.

```
cd TensorRT-${version}/uff
python3 -m pip install uff-0.6.9-py2.py3-none-any.whl
```

Check the installation with:

```
which convert-to-uff
```

8. Install the Python `graphsurgeon` wheel file.

```
cd TensorRT-${version}/graphsurgeon
```

```
python3 -m pip install graphsurgeon-0.4.5-py2.py3-none-any.whl
```

9. Install the Python onnx-graphsurgeon wheel file.

```
cd TensorRT-${version}/onnx_graphsurgeon
```

```
python3 -m pip install onnx_graphsurgeon-0.3.12-py2.py3-none-any.whl
```

10. Verify the installation:

- a). Ensure that the installed files are located in the correct directories. For example, run the `tree -d` command to check whether all supported installed files are in place in the `lib`, `include`, `data`, etc... directories.
- b). Build and run one of the shipped samples, for example, `sampleMNIST` in the installed directory. You should be able to compile and execute the sample without additional settings. For more information, refer to [sampleMNIST](#).
- c). The Python samples are in the `samples/python` directory.

4.7. Zip File Installation

This section contains instructions for installing TensorRT from a zip package on Windows 10.

Before you begin

Ensure that you have the following dependencies installed.

- ▶ [CUDA 10.2](#), [11.0 update 1](#), [11.1 update 1](#), [11.2 update 2](#), [11.3 update 1](#), or [11.4 update 3](#)
- ▶ [cuDNN 8.2.1](#)

Procedure

1. [Download](#) the TensorRT zip file that matches the Windows version you are using.
2. Choose where you want to install TensorRT. The zip file will install everything into a subdirectory called `TensorRT-8.x.x.x`. This new subdirectory will be referred to as `<installpath>` in the steps below.
3. Unzip the `TensorRT-8.x.x.x.Windows10.x86_64.cuda-x.x.cudnn8.x.zip` file to the location that you chose.

Where:

- ▶ `8.x.x.x` is your TensorRT version
 - ▶ `cuda-x.x` is CUDA version 10.2 or 11.4
 - ▶ `cudnn8.x` is cuDNN version 8.2
4. Add the TensorRT library files to your system `PATH`. There are two ways to accomplish this task:
 - a). Leave the DLL files where they were unzipped and add `<installpath>/lib` to your system `PATH`. You can add a new path to your system `PATH` using the steps below.
 - i. Press the **Windows** key and search for **"environment variables"** which should present you with the option **Edit the system environment variables** and click it.
 - ii. Click **Environment Variables...** at the bottom of the window.

- iii. Under **System variables**, select **Path** and click **Edit...**
 - iv. Click either **New** or **Browse** to add a new item that contains <installpath>/lib.
 - v. Continue to click **OK** until all the newly opened windows are closed.
 - vi. If your cuDNN libraries were not copied to the CUDA installation directory and instead left where they were unzipped, then repeat the above steps for the cuDNN bin directory.
- b). Copy the DLL files from <installpath>/lib to your CUDA installation directory, for example, C:\Program Files\NVIDIA GPU Computing Toolkit\CUDA\vx.Y\bin, where vx.Y is your CUDA version. The CUDA installer should have already added the CUDA path to your system PATH.
5. Install one of the TensorRT Python wheel files from <installpath>/python:
- ```
python.exe -m pip install tensorrt-*cp3x-none-win_amd64.whl
```
6. To verify that your installation is working you should open a Visual Studio Solution file from one of the samples, such as [sampleMNIST](#), and confirm that you are able to build and run the sample.

If you want to use TensorRT in your own project, ensure that the following is present in your Visual Studio Solution project properties:

- a). <installpath>/lib has been added to your PATH variable and is present under **VC++ Directories > Executable Directories**.
- b). <installpath>/include is present under **C/C++ > General > Additional Directories**.
- c). nvinfer.lib and any other LIB files that your project requires are present under **Linker > Input > Additional Dependencies**.



**Note:** In order to build the included samples, you should have [Visual Studio 2017](#) installed. The community edition is sufficient to build the TensorRT samples.

7. If you are using TensorFlow or PyTorch, install the uff, graphsurgeon, and onnx\_graphsurgeon wheel packages. You must prepare the Python environment before installing uff, graphsurgeon or onnx\_graphsurgeon.

If using Python 3.x:

```
python3 -m pip install <installpath>\graphsurgeon\graphsurgeon-0.4.5-py2.py3-none-any.whl
python3 -m pip install <installpath>\uff\uff-0.6.9-py2.py3-none-any.whl
python3 -m pip install <installpath>\onnx_graphsurgeon\onnx_graphsurgeon-0.3.12-py2.py3-none-any.whl
```

## 4.8. Additional Installation Methods

Aside from installing TensorRT from the product package, you can also install TensorRT from the following locations.

### TensorRT container

The TensorRT container provides an easy method for deploying TensorRT with all necessary dependencies already packaged in the container. For information about installing TensorRT via a container, see the [NVIDIA TensorRT Container Release Notes](#).

**NVIDIA JetPack™**

JetPack bundles all Jetson platform software, including TensorRT. Use it to flash your Jetson Developer Kit with the latest OS image, install NVIDIA SDKs, and jump-start your development environment. For information about installing TensorRT through JetPack, refer to the [JetPack documentation](#).

For JetPack downloads, see [Develop: Jetpack](#).

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---

# Chapter 5. Upgrading TensorRT

Upgrading TensorRT to the latest version is only supported when the currently installed TensorRT version is equal to or newer than the last two public GA releases. For example, TensorRT 8.2.x supports upgrading from TensorRT 7.2.x and 8.0.x. If you want to upgrade from an unsupported version, then you should upgrade incrementally until you reach the latest version of TensorRT. If you have an EA version of TensorRT installed, you should first upgrade to the corresponding GA version.

## 5.1. Ubuntu And Windows Users

The following section provides step-by-step instructions for upgrading TensorRT for Ubuntu and Windows users.

### 5.1.1. Upgrading From TensorRT 7.2.x To TensorRT 8.2.x

These upgrade instructions are for Ubuntu and Windows users only. When upgrading from TensorRT 7.2.x to TensorRT 8.2.x, ensure you are familiar with the following.

#### About this task

##### Using a Debian file

- The Debian packages are designed to upgrade your development environment without removing any runtime components that other packages and programs might rely on. If you installed TensorRT 7.2.x via a Debian package and you upgrade to TensorRT 8.2.x, your documentation, samples, and headers will all be updated to the TensorRT 8.2.x content. After you have downloaded the new local repo, use `apt-get` to upgrade your system to the new version of TensorRT.

```
os="ubuntuxx04"
tag="cudax.x-trt8.x.x-yyyymmdd"
sudo dpkg -i nv-tensorrt-repo-${os}-${tag}_1-1_amd64.deb

sudo apt-get update
sudo apt-get install tensorrt libcudnn8
```

Python 2.7 is no longer supported and can be removed:

```
sudo apt-get purge python-libnvinfer
```

If using Python 3.x:

```
sudo apt-get install python3-libnvinfer-dev
```

- ▶ If you are using the `uff-converter` and/or `graphsurgeon`, then you should also upgrade those Debian packages to the latest versions.

```
sudo apt-get install uff-converter-tf graphsurgeon-tf onnx-graphsurgeon
```

- ▶ After you upgrade, ensure you have a directory `/usr/src/tensorrt` and the corresponding version shown by the `dpkg -l tensorrt` command is `8.x.x.x`.
- ▶ If installing a Debian package on a system where the previously installed version was from a tar file, note that the Debian package will not remove the previously installed files. Unless a side-by-side installation is desired, it would be best to remove the older version before installing the new version to avoid compiling against outdated libraries.
- ▶ If you are currently or were previously using the CUDA network repository, then it may conflict with the version of `libcudnn8` that is expected to be installed from the local repository for TensorRT. The following commands will change `libcudnn8` to version `8.2.x.x`, which is supported and tested with TensorRT 8.2.x, and hold the `libcudnn8` package at this version. Replace `cuda.x.x` with the appropriate CUDA version for your install.

```
version="8.2.x.x-1+cuda.x.x"
sudo apt-get install libcudnn8=${version} libcudnn8-dev=${version}
sudo apt-mark hold libcudnn8 libcudnn8-dev
```

## Using a tar file

- ▶ If you are upgrading using the tar file installation method, then install TensorRT into a new location. Tar file installations can support multiple use cases including having a full installation of TensorRT 7.2.x with headers and documentation side-by-side with a full installation of TensorRT 8.2.x. If the intention is to have the new version of TensorRT replace the old version, then the old version should be removed once the new version is verified.
- ▶ If installing a tar file on a system where the previously installed version was from a Debian package, note that the tar file installation will not remove the previously installed packages. Unless a side-by-side installation is desired, it would be best to remove the previously installed `libnvinfer8`, `libnvinfer-dev`, `libnvinfer-samples` and other related packages to avoid confusion.

## Using a zip file

- ▶ If you are upgrading using the zip file installation method, then install TensorRT into a new location. Zip file installations can support multiple use cases including having a full installation of TensorRT 7.2.x with headers and documentation side-by-side with a full installation of TensorRT 8.2.x. If the intention is to have the new version of TensorRT replace the old version, then the old version should be removed once the new version is verified.
- ▶ After unzipping the new version of TensorRT you will need to either update the `PATH` environment variable to point to the new install location or copy the DLL files to



the location where you previously installed the TensorRT libraries. Refer to [Zip File Installation](#) for more information about setting the `PATH` environment variable.

## 5.2. RedHat And CentOS Users

The following section provides step-by-step instructions for upgrading TensorRT for RedHat and CentOS users.

### 5.2.1. Upgrading From TensorRT 7.2.x To TensorRT 8.2.x

These upgrade instructions are for Red Hat Enterprise Linux (RHEL) and CentOS users only. When upgrading from TensorRT 7.2.x to TensorRT 8.2.x, ensure you are familiar with the following.

#### About this task

##### Using an RPM file

- The RPM packages are designed to upgrade your development environment without removing any runtime components that other packages and programs might rely on. If you installed TensorRT 7.2.x via an RPM package and you want to upgrade to TensorRT 8.2.x, your documentation, samples, and headers will all be updated to the TensorRT 8.2.x content. After you have downloaded the new local repo, issue:

```
os="rhelx"
tag="cudax.x-trt8.x.x-yyyymmdd"
sudo rpm -Uvh nv-tensorrt-repo-${os}-${tag}-1-1.x86_64.rpm
sudo yum clean expire-cache
sudo yum install tensorrt libcudnn8
```

Python 2.7 is no longer supported and can be removed:

```
sudo yum erase python-libnvinfer
```

If using Python 3.x:

```
sudo yum install python3-libnvinfer-devel
```

- If using `uff-converter` and/or `graphsurgeon`:  

```
sudo yum install uff-converter-tf graphsurgeon-tf onnx-graphsurgeon
```
- After you upgrade, ensure you see the `/usr/src/tensorrt` directory and the corresponding version shown by the `rpm -qa tensorrt` command is `8.x.x.x`.
- If you are currently or were previously using the CUDA network repository, then it may conflict with the version of `libcudnn8` that is expected to be installed from the local repository for TensorRT. The following commands will change `libcudnn8` to version `8.2.x.x`, which is supported and tested with TensorRT 8.2.x, and hold the `libcudnn8` package at this version. Replace `cudax.x` with the appropriate CUDA version for your install.

```
version="8.2.x.x-1.cudax.x"
sudo yum downgrade libcudnn8-${version} libcudnn8-devel-${version}
sudo yum install yum-plugin-versionlock
```

```
sudo yum versionlock libcudnn8 libcudnn8-devel
```

---

# Chapter 6. Uninstalling TensorRT

This section provides step-by-step instructions for ways in which you can uninstall TensorRT.

## About this task

To uninstall TensorRT using the untarred file, simply delete the tar files and reset `LD_LIBRARY_PATH` to its original value.

To uninstall TensorRT using the zip file, simply delete the unzipped files and remove the newly added path from the `PATH` environment variable.

To uninstall TensorRT using the Debian or RPM packages, follow these steps:

## Procedure

1. Uninstall `libnvinfer8` which was installed using the Debian or RPM packages.

```
sudo apt-get purge "libnvinfer*"
sudo apt-get purge "nv-tensorrt-repo*"
Or
```

```
sudo yum erase "libnvinfer*"
sudo yum erase "nv-tensorrt-repo"
```

2. Uninstall `uff-converter-tf`, `graphsurgeon-tf`, and `onnx-graphsurgeon` which were also installed using the Debian or RPM packages.

```
sudo apt-get purge graphsurgeon-tf onnx-graphsurgeon
Or
```

```
sudo yum erase graphsurgeon-tf onnx-graphsurgeon
```

The `uff-converter-tf` package will also be removed with the above command.

You can use the following command to uninstall `uff-converter-tf` and not remove `graphsurgeon-tf`, however, it is no longer required.

```
sudo apt-get purge uff-converter-tf
Or
```

```
sudo yum erase uff-converter-tf
```

You can later use `autoremove` to uninstall `graphsurgeon-tf` as well.

```
sudo apt-get autoremove
Or
```

```
sudo yum autoremove
```

3. Uninstall the Python TensorRT wheel file.

If using Python 3.x:

```
sudo pip3 uninstall tensorrt
```

4. Uninstall the Python UFF wheel file.

If using Python 3.x:

```
sudo pip3 uninstall uff
```

5. Uninstall the Python GraphSurgeon wheel file.

If using Python 3.x:

```
sudo pip3 uninstall graphsurgeon
```

6. Uninstall the Python ONNX GraphSurgeon wheel file.

If using Python 3.x:

```
sudo pip3 uninstall onnx-graphsurgeon
```

---

# Chapter 7. Installing PyCUDA

This section provides useful information regarding PyCUDA including how to install.

## About this task



**ATTENTION:** If you have to update your CUDA version on your system, do not install PyCUDA at this time. Perform the steps in [Updating CUDA](#) first, then install PyCUDA.



**Note:** When installing PyCUDA, ensure that you have NumPy installed beforehand. If not, run the following command before proceeding:

```
python -m pip install numpy
```

PyCUDA is used within Python wrappers to access NVIDIA's CUDA APIs. It is not strictly necessary in order to use TensorRT, but many of the samples use it.

Some of the key features of PyCUDA include:

- ▶ Maps all of CUDA into Python.
- ▶ Enables run-time code generation (RTCG) for flexible, fast, automatically tuned codes.
- ▶ Added robustness: automatic management of object lifetimes, automatic error checking
- ▶ Added convenience: comes with ready-made on-GPU linear algebra, reduction, scan.
- ▶ Add-on packages for FFT and LAPACK available.
- ▶ Fast. Near-zero wrapping overhead.

To install PyCUDA first make sure `nvcc` is in your `PATH`, then issue the following command:

```
python -m pip install 'pycuda<2021.1'
```

If you encounter any issues with PyCUDA usage after installing PyCUDA with the above command, you may need to recompile it yourself. For more information, see [Installing PyCUDA on Linux](#).

## 7.1. Updating CUDA

Existing installations of PyCUDA will not automatically work with a newly installed CUDA Toolkit. That is because PyCUDA will only work with a CUDA Toolkit that is already on the

target system when PyCUDA was installed. This requires that PyCUDA be updated after the newer version of the CUDA Toolkit is installed.

The steps below are the most reliable method to ensure that everything works in a compatible fashion after the CUDA Toolkit on your system has been upgraded.

1. Uninstall the existing PyCUDA installation.
2. Update CUDA. For more information, see the [NVIDIA CUDA Installation Guide](#).
3. Install PyCUDA. To install PyCUDA, issue the following command:

```
pip install 'pycuda<2021.1'
```

---

## Chapter 8. Troubleshooting

For troubleshooting support refer to your support engineer or post your questions onto the NVIDIA Developer Forum.

[NVIDIA Developer Forum](#)

---

# Appendix A. Appendix

The following section provides our list of acknowledgements.

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```
$FreeBSD: head/COPYRIGHT 260125 2013-12-31 12:18:10Z gjb $
```

```
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William Hoskins

Director, Office of Technology Licensing

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\$NetBSD: getopt\_long.c,v 1.15 2002/01/31 22:43:40 tv Exp \$

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## RESNET-50 Caffe models

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