



NVIDIA JETPACK 3.3

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User Documentation



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JetPack

NVIDIA JetPack SDK is the most comprehensive solution for building AI applications. Use the JetPack installer to flash your Jetson Developer Kit with the latest OS image, to install developer tools for both the host PC and Developer Kit, and to install the libraries and APIs, samples, and documentation needed to jumpstart your development environment.

What's Included in JetPack?

OS Image

A sample file system derived from Ubuntu for [Jetson](#).

Libraries

- CUDA Toolkit for Host PC (Ubuntu with cross-development support)
- CUDA Toolkit for Jetson

CUDA Toolkit provides a comprehensive development environment for C and C++ developers building GPU-accelerated applications. The toolkit includes a compiler for NVIDIA GPUs, math libraries, and tools for debugging and optimizing the performance of your applications.

- [OpenCV](#)
- [VisionWorks](#)

VisionWorks is a software development package for Computer Vision (CV) and image processing. It includes VPI (Vision Programming Interface), a set of optimized CV primitives for use by CUDA developers. The NVX library enables direct access to VPI, and the OVX library enables indirect access to VPI via OpenVX framework.

- [cuDNN](#)

CUDA Deep Neural Network library provides high-performance primitives for deep learning frameworks. It includes support for convolutions, activation functions and tensor transformations.

- [TensorRT](#)

TensorRT is a high performance deep learning inference runtime for image classification, segmentation, and object detection neural networks. It speeds up deep learning inference as well as reducing the runtime memory footprint for convolutional and deconv neural networks.

- MultiMedia API

The Jetson Multimedia API package provides low level APIs for flexible application development.

Camera application API: libargus offers a low-level frame-synchronous API for camera applications, with per frame camera parameter control, multiple (including

synchronized) camera support, and EGL stream outputs. RAW output CSI cameras needing ISP can be used with either libargus or GStreamer plugin. In either case, the V4L2 media-controller sensor driver API is used.

Sensor driver API: V4L2 API enables video decode, encode, format conversion and scaling functionality. V4L2 for encode opens up many features like bit rate control, quality presets, low latency encode, temporal tradeoff, motion vector maps, and more.

Developer Tools

- [NVIDIA System Profiler](#)

A multi-core CPU PC sampling profiler that provides an interactive view of captured profiling data, helping improve overall application performance.

- [Tegra Graphics Debugger](#)

A console-grade tool that allows developers to debug and profile OpenGL ES 2.0, OpenGL ES 3.0, OpenGL ES 3.1, and OpenGL 4.3-4.6 applications, enabling developers to get the most out of the Jetson platform.

Samples

- [NVIDIA GameWorks OpenGL samples](#)
- Multimedia API samples
- [CUDA samples](#)
- [VisionWorks](#)

Documentation

- Tegra Linux Driver Package Documentation
- JetPack Documentation

Release Notes

JetPack 3.3

What's New

- To increase security and data integrity, all server communications will now use the HTTPS protocol.

Known Issues

- Please use the default download and install directories provided by JetPack. Changing the directories may cause an installation error.
- The installation of VisionWorks results in Ubuntu distro OpenCV 2.4.9 packages to be installed, in addition to OpenCV 3.3.1. This does not affect the usage of OpenCV 3.3.1.

Download and Install JetPack

This document is intended to help you get familiar with installing JetPack, using the tools, and running sample code.

System Requirements

Host Platform:

- Ubuntu Linux x64 v16.04

Note that a valid Internet connection and at least 10GB of disk space is needed for the complete installation of JetPack.

Target Platform:

- One of the following developer kits:
 - Jetson TX2
 - Jetson TX2i
 - Jetson TX1
- Additional target requirements:
 - USB Micro-B cable connecting Jetson to your Linux host for flashing.
 - *(Not included in the developer kit)* To connect USB peripherals such as keyboard, mouse, and [optional] USB/Ethernet adapter (for network connection), a USB hub could be connected to the USB port on the Jetson system.
 - An HDMI cable plugged into the HDMI port on Jetson Developer Kit, which is connected to an external HDMI display.
 - An Ethernet cable plugged into the on-board Ethernet port, which is connected to either a secondary network card on your Linux host or the same network router providing internet access for the Linux host.

Download the Latest JetPack Version

The latest version of JetPack is available in the NVIDIA Embedded Developer Zone at:

<https://developer.nvidia.com/jetson-development-pack>

All available JetPack downloads can be found at:

<https://developer.nvidia.com/jetpack-archive>

Downloading JetPack

- On the host machine running Ubuntu, create a new directory to store installation packages.
- Download `JetPack-${VERSION}.run` into the new directory on the host Ubuntu machine.



Avoid running or installing JetPack in a path that contains a ".".
Paths that contain a "." are known to cause installation issues.

Installing JetPack

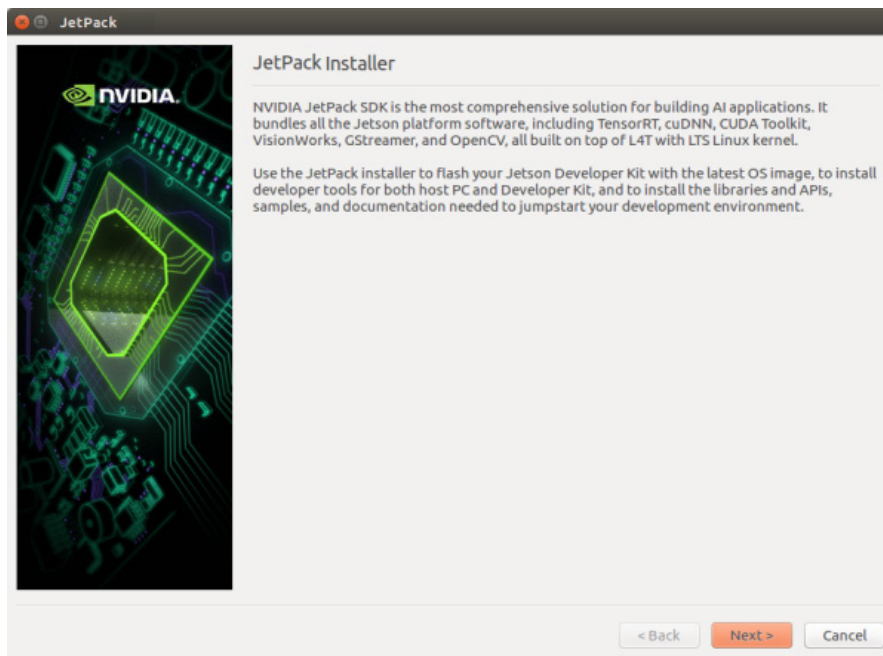
JetPack runs on the host Ubuntu x86_64 machine and sets up your development environment and Jetson Development Kit target via remote access. Please refer to the [System Requirements](#) section for supported hardware configurations.

The following instructions assume you have downloaded the latest JetPack version, `JetPack-${VERSION}.run`, where `${VERSION}` refers to the version string for the installer you have.

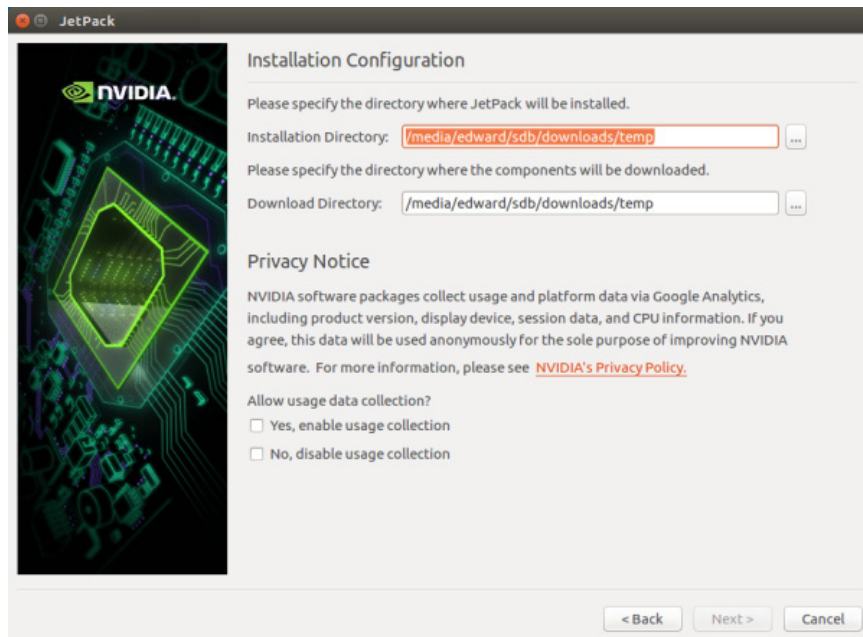
1. Add exec permission for the `JetPack-${VERSION}.run`

```
chmod +x JetPack-${VERSION}.run
```

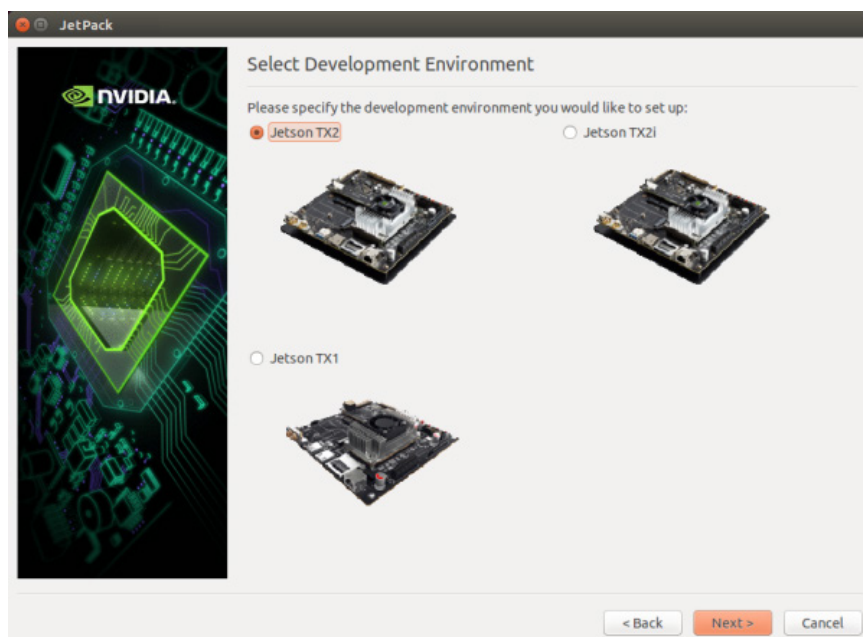
2. Run `JetPack-${VERSION}.run` in terminal on your host Ubuntu machine.



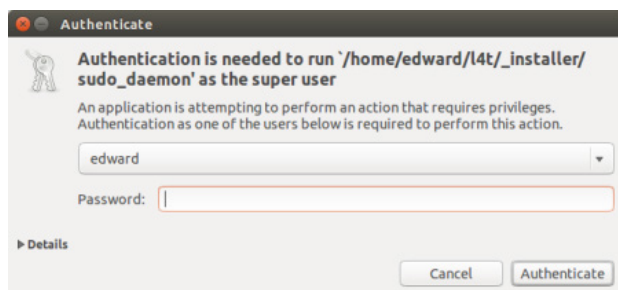
3. Next, the JetPack installer will indicate the installation directory. In the Privacy Notice section, select whether or not to enable data collection.



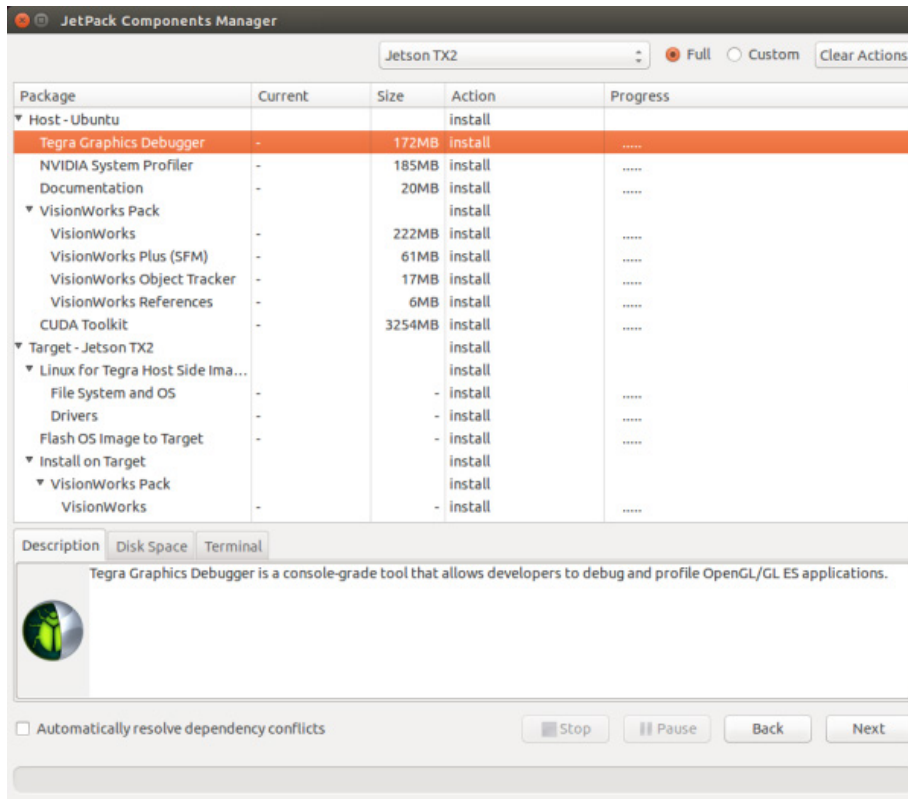
4. Select the development environment to setup.



5. The JetPack installer will pop up a window to ask for permission to use during the installation process; you will need to enter your sudo password here.

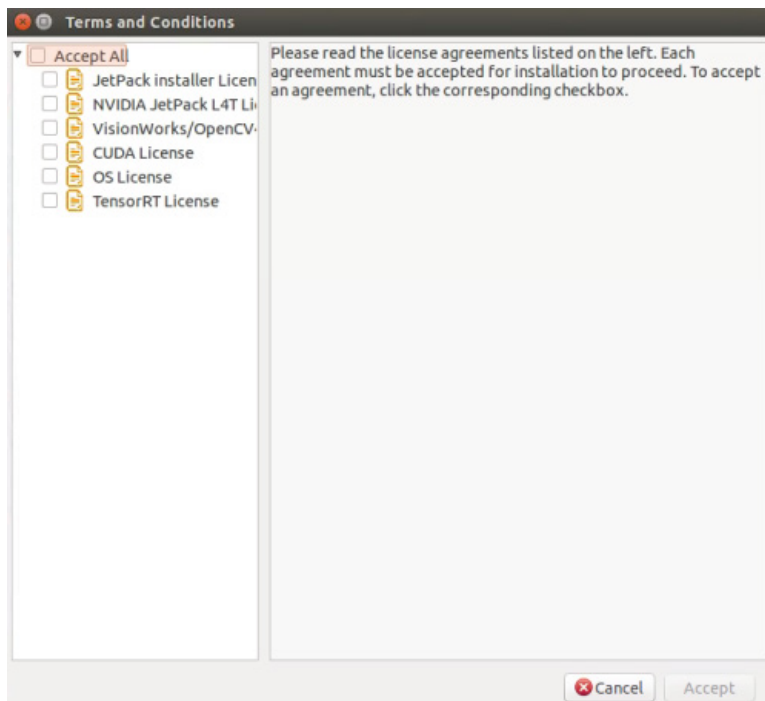


- The Component Manager opens, which allows you to customize which components to install. Select the Jetson Developer Kit you would like to develop for to customize the installation components for each device.

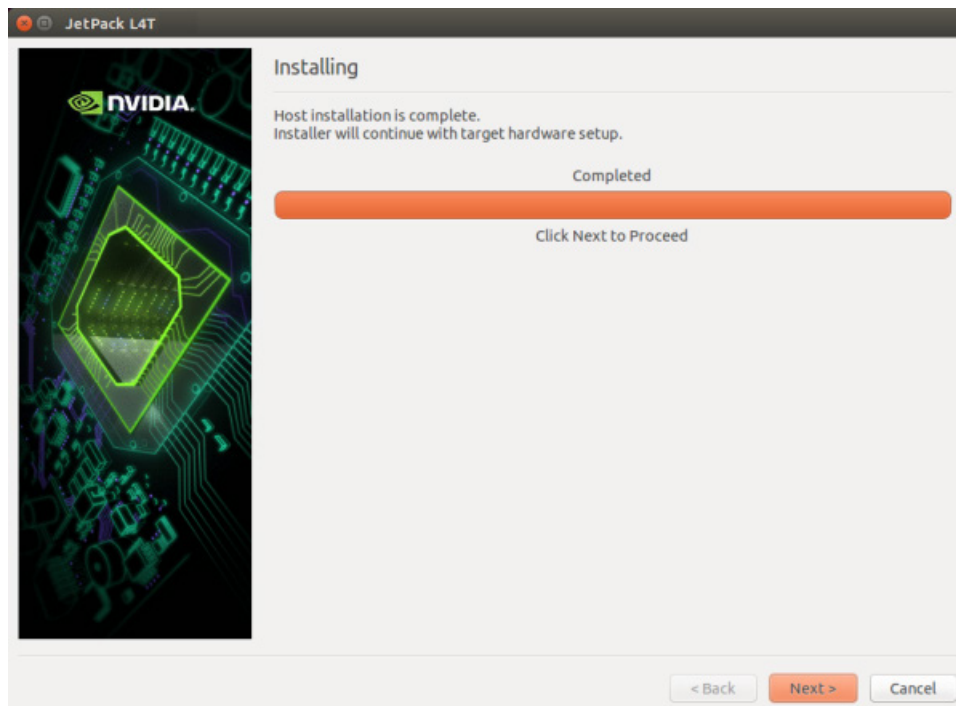


NOTE: To run a standalone Ubuntu install, deselect Jetson target specific entries.

- Accept the license agreement for the selected components.

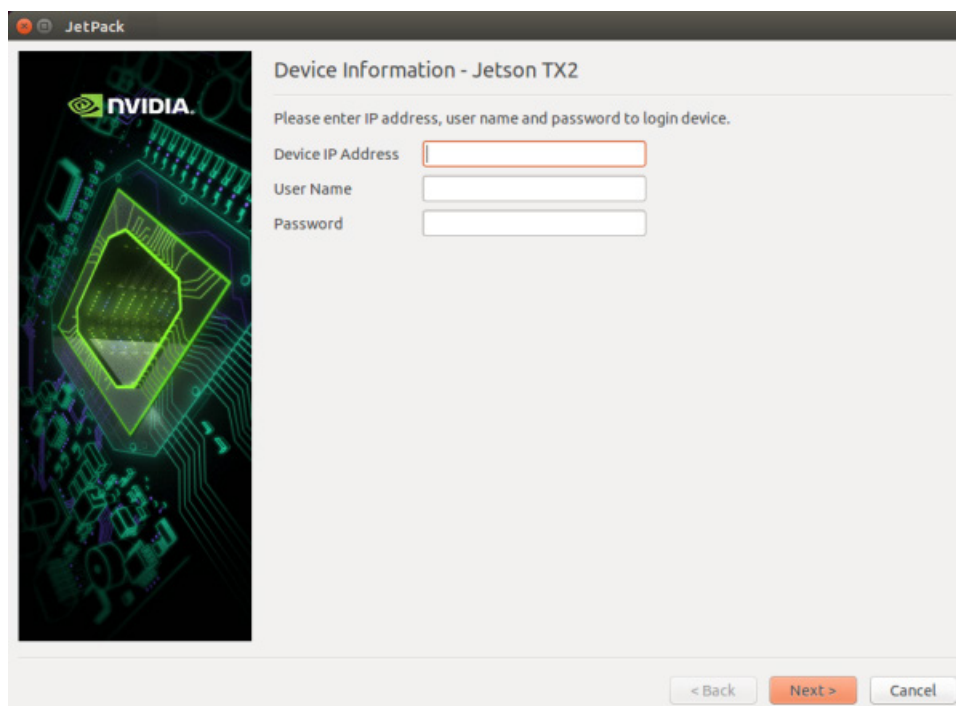


8. The Component Manager will proceed with the installation. Once the host installation steps are completed, click the Next button to continue with the installation of target components.



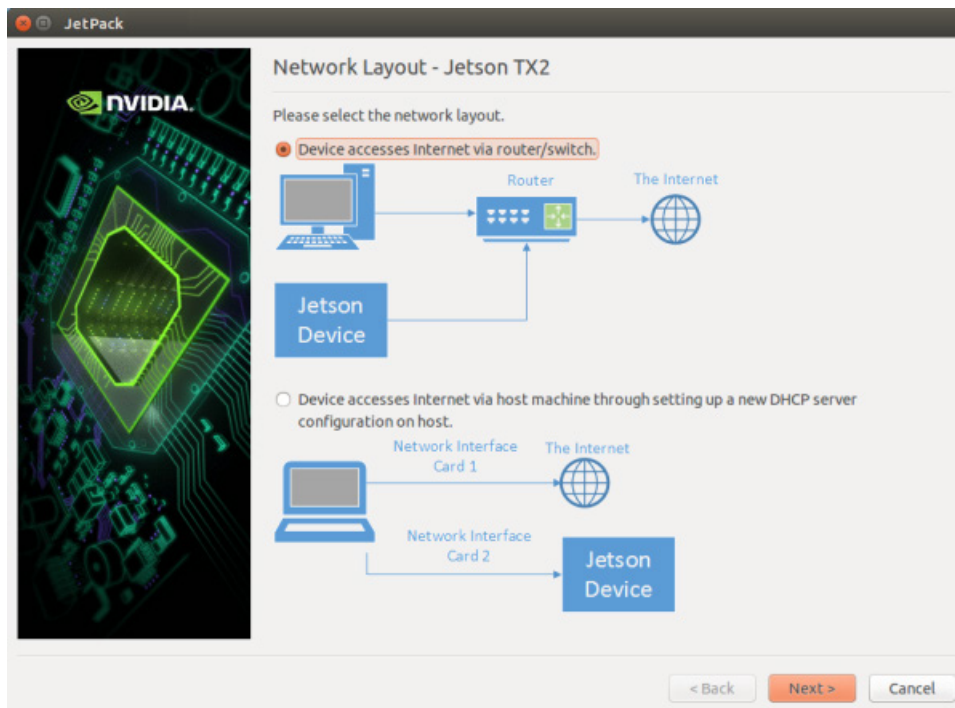
NOTE: JetPack will now proceed with setting up the Jetson Developer Kit target, if the corresponding components were selected (i.e., flashing the OS and pushing components to the Jetson Developer Kit target).

9. If you de-selected **Flash OS** in the [Component Manager](#), you will need to enter the IP address, user name, and password to set up an ssh connection to the target device.

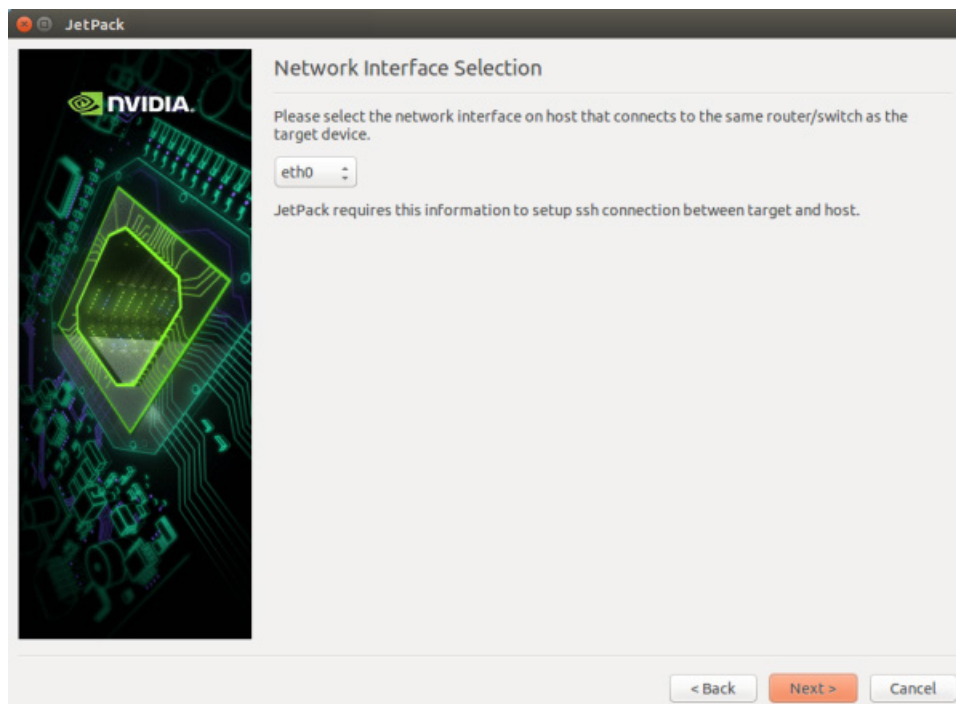


After you enter the required information and click **Next**, JetPack will begin installing components on the target device.

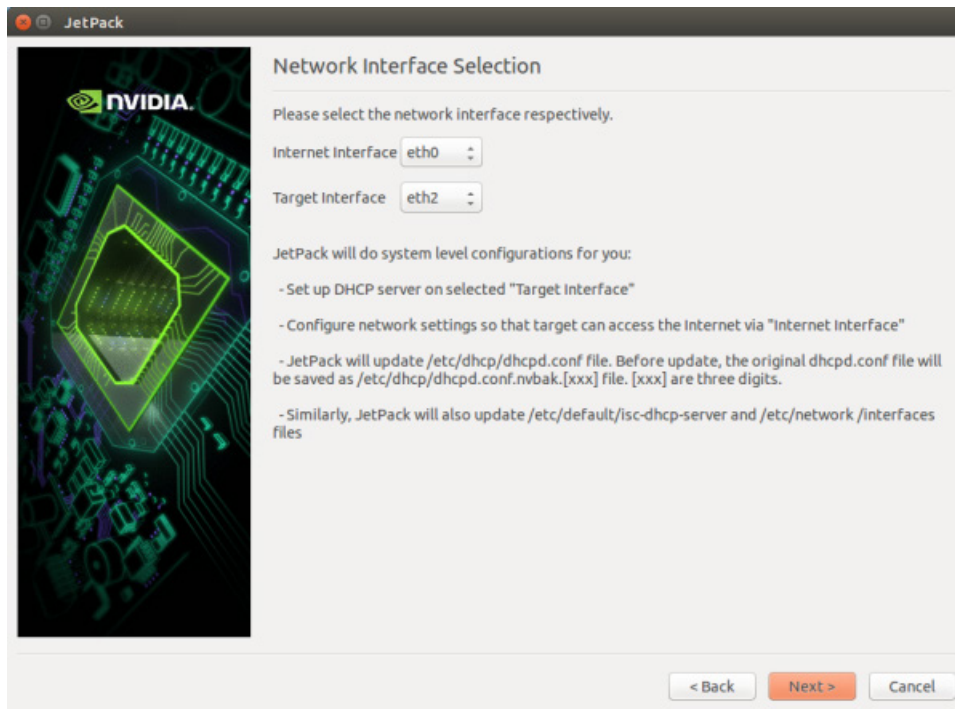
10. If you selected **Flash OS** in the [Component Manager](#), you will need to select the network layout for your specific environment.



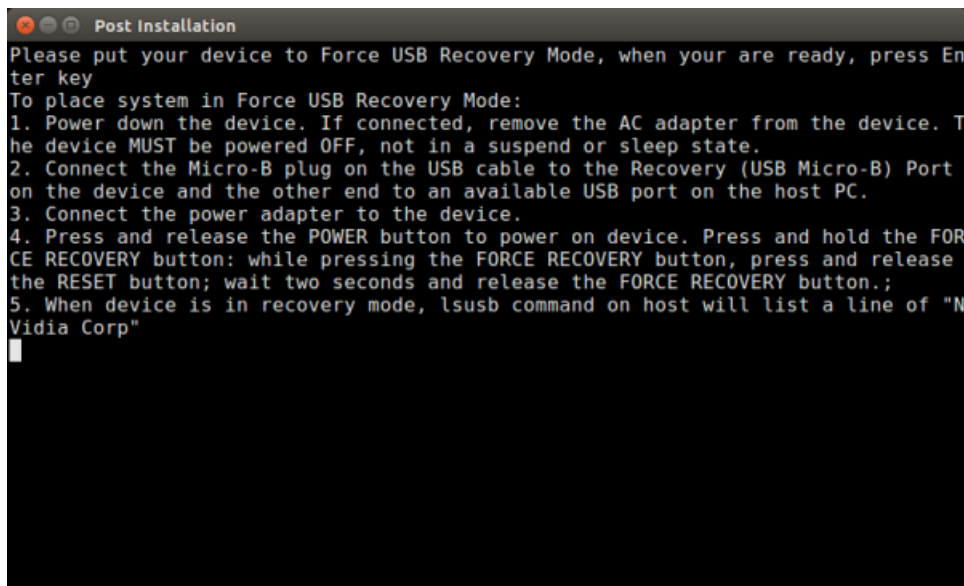
11. If you selected the **Device access Internet via router/switch** layout, you will be asked to select which interface to use for Internet access.



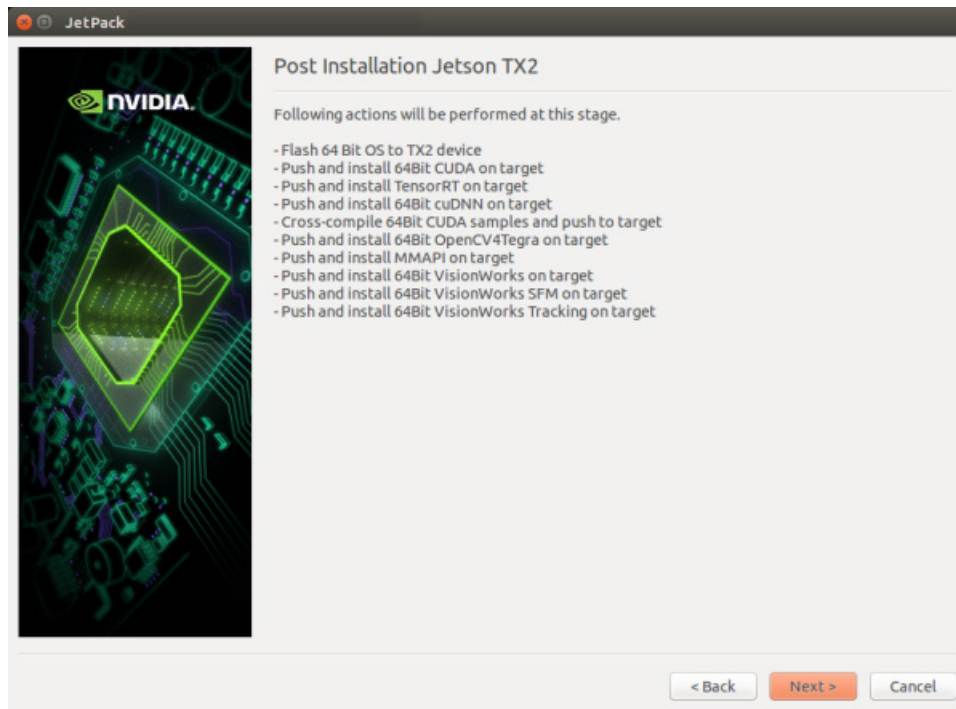
12. If you selected the **Device get IP assigned by DHCP server on host and access Internet via host machine** layout, you must select which interface is to be used for Internet access, and which is to be used for the target interface.



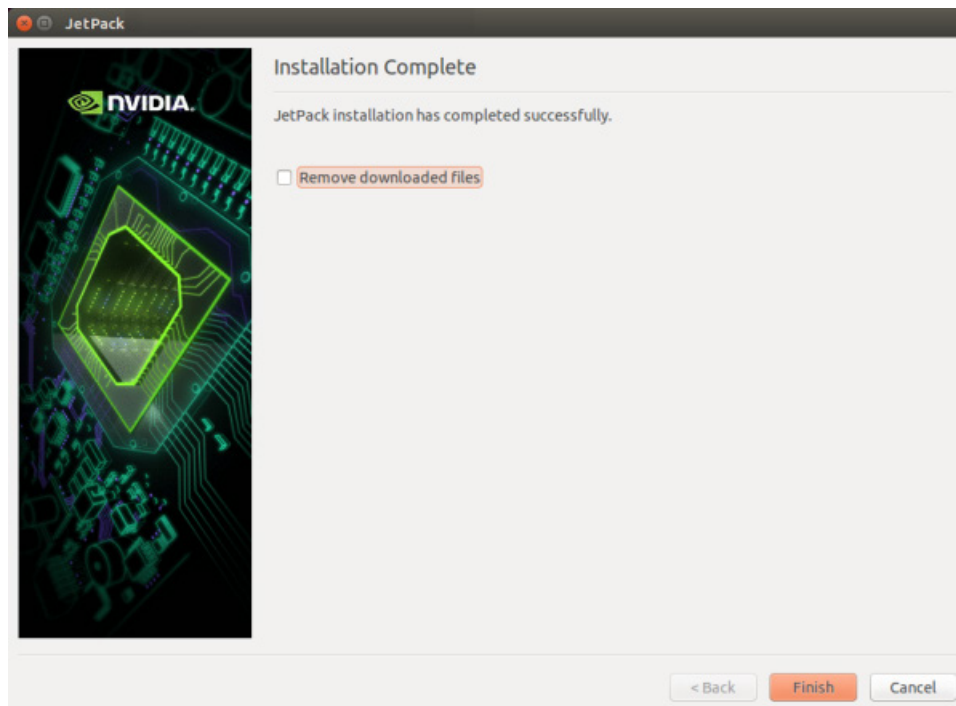
13. A pop-up window will instruct you to put your device into Force USB Recovery Mode, so you can flash the OS.



14. Next, you will be prompted to install components on the specific target machine, and to compile samples.



15. After the post installation tasks have been completed, the installation will be complete.



Compiling Samples

JetPack automatically compiles all samples, if **Compile Samples** was checked during the component selection portion of the installation. CUDA samples can be found in the following directory:

```
<JetPack_Install_Dir>/NVIDIA_CUDA-<version>_Samples
```

You can recompile the samples by running:

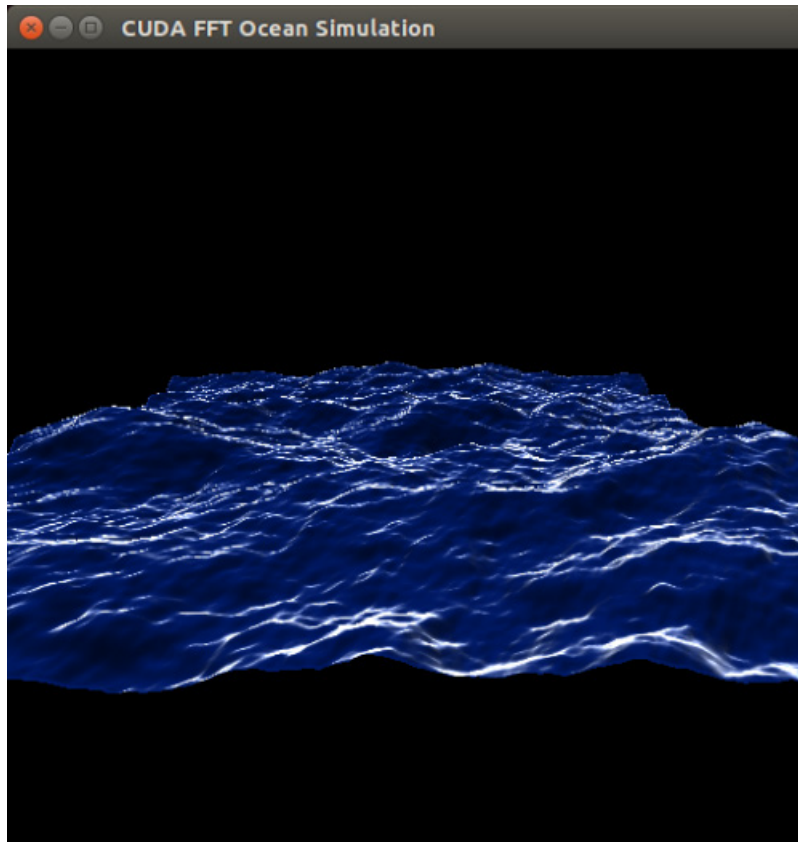
```
SMS=53 EXTRA_LDFLAGS=--unresolved-symbols=ignore-in-shared-libs  
TARGET_ARCH=aarch64 make
```

Run Sample Code

The CUDA samples directory will be copied to the home directory on your device by JetPack. The built binaries are in the following directory:

```
/home/ubuntu/NVIDIA_CUDA-<version>_Samples/bin/aarch64/linux/release/
```

Run them by calling them in terminal, or double-clicking on them in the file browser. For example, when you run the oceanFFT sample, the following screen will be displayed.



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Upon any expiration or termination of the AGREEMENT, a license or a service provided hereunder, (a) any amounts owed to NVIDIA become immediately due and payable, (b) you must promptly discontinue use of the affected Licensed Software and/or service, and (c) you must promptly destroy or return to NVIDIA all copies of the affected Licensed Software and all portions thereof in your possession or control, and each party will promptly destroy or return to the other all of the other party's Confidential Information within its possession or control. Upon written request, you will certify in writing that you have complied with your obligations under this section. Upon expiration or termination of the AGREEMENT all provisions survive except for the license grant provisions.

9. CONSENT TO COLLECTION AND USE OF INFORMATION.

You hereby agree and acknowledge that the Software may access and collect data about your Enterprise computer systems as well as configures the systems in order to (a) properly optimize such systems for use with the Software, (b) deliver content through the Software, (c) improve NVIDIA products and services, and (d) deliver marketing communications. Data collected by the Software includes, but is not limited to, system (i) hardware configuration and ID, (ii) operating system and driver configuration, (iii) installed applications, (iv) applications settings, performance, and usage data, and (iv) usage metrics of the Software. To the extent that you use the Software, you hereby consent to all of the foregoing, and represent and warrant that you have the right to grant such consent. In addition, you agree that you are solely responsible for maintaining appropriate data backups and system restore points for your Enterprise systems, and that NVIDIA will have no responsibility for any damage or loss to such systems (including loss of data or access) arising from or relating to (a) any changes to the configuration, application settings, environment variables, registry, drivers, BIOS, or other attributes of the systems (or any part of such systems) initiated through the Software; or (b) installation of any Software or third party software patches initiated through the Software. In certain systems you may change your system update preferences by unchecking "Automatically check for updates" in the "Preferences" tab of the control panel for the Software.

In connection with the receipt of the Licensed Software or services you may receive access to links to third party websites and services and the availability of those links does not imply any endorsement by NVIDIA. NVIDIA encourages you to review the privacy statements on those sites and services that you choose to visit so that you can understand how they may collect, use and share personal information of individuals. NVIDIA is not responsible or liable for: (i) the availability or accuracy of such links; or (ii) the products, services or information available on or through such links; or (iii) the privacy statements or practices of sites and services controlled by other companies or organizations.

To the extent that you or members of your Enterprise provide to NVIDIA during registration or otherwise personal data, you acknowledge that such information will be collected, used and disclosed by NVIDIA in accordance with NVIDIA's privacy policy, available at URL

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10. GENERAL.

This SLA, any Supplements incorporated hereto, and Orders constitute the entire agreement of the parties with respect to the subject matter hereto and supersede all prior negotiations, conversations, or discussions between the parties relating to the subject matter hereto, oral or written, and all past dealings or industry custom. Any additional and/or conflicting terms and conditions on purchase order(s) or any other documents issued by you are null, void, and invalid. Any amendment or waiver under the AGREEMENT must be in writing and signed by representatives of both parties.

The AGREEMENT and the rights and obligations thereunder may not be assigned by you, in whole or in part, including by merger, consolidation, dissolution, operation of law, or any other manner, without written consent of NVIDIA, and any purported assignment in violation of this provision shall be void and of no effect. NVIDIA may assign, delegate or transfer the AGREEMENT and its rights and obligations hereunder, and if to a non-Affiliate you will be notified.

Each party acknowledges and agrees that the other is an independent contractor in the performance of the AGREEMENT, and each party is solely responsible for all of its employees, agents, contractors, and labor costs and expenses arising in connection therewith. The parties are not partners, joint ventures or otherwise affiliated, and neither has any authority to make any statements, representations or commitments of any kind to bind the other party without prior written consent.

Neither party will be responsible for any failure or delay in its performance under the AGREEMENT (except for any payment obligations) to the extent due to causes beyond its reasonable control for so long as such force majeure event continues in effect.

The AGREEMENT will be governed by and construed under the laws of the State of Delaware and the United States without regard to the conflicts of law provisions thereof and without regard to the United Nations Convention on Contracts for the International Sale of Goods. The parties consent to the personal jurisdiction of the federal and state courts located in Santa Clara County, California. You acknowledge and agree that a breach of any of your promises or agreements contained in the AGREEMENT may result in irreparable and continuing injury to NVIDIA for which monetary damages may not be an adequate remedy and therefore NVIDIA is entitled to seek injunctive relief as well as such other and further relief as may be appropriate. If any court of competent jurisdiction determines that any provision of the AGREEMENT is illegal, invalid or unenforceable, the remaining provisions will remain in full force and effect. Unless otherwise specified, remedies are cumulative.

The Licensed Software has been developed entirely at private expense and is “commercial items” consisting of “commercial computer software” and “commercial computer software documentation” provided with RESTRICTED RIGHTS. Use, duplication or disclosure by the U.S. Government or a U.S. Government subcontractor is subject to the restrictions set forth in the AGREEMENT pursuant to DFARS 227.7202-3(a) or as set forth in subparagraphs (c)(1) and (2) of the Commercial Computer Software - Restricted Rights clause at FAR 52.227-19, as applicable. Contractor/manufacturer is NVIDIA, 2788 San Tomas Expressway, Santa Clara, CA 95051.

You acknowledge that the Licensed Software described under the AGREEMENT is subject to export control under the U.S. Export Administration Regulations (EAR) and economic sanctions regulations administered by the U.S. Department of Treasury’s Office of Foreign Assets Control (OFAC). Therefore, you may not export, reexport or transfer in-country the Licensed Software without first obtaining any license or other approval that may be required by BIS and/or OFAC. You are responsible for any violation of the U.S. or other applicable export control or economic sanctions laws, regulations and requirements related to the Licensed Software. By accepting this SLA, you confirm that you are not a resident or citizen of any country currently embargoed by the U.S. and that you are not otherwise prohibited from receiving the Licensed Software.

Any notice delivered by NVIDIA to you under the AGREEMENT will be delivered via mail, email or fax. Please direct your legal notices or other correspondence to NVIDIA Corporation, 2788 San Tomas Expressway, Santa Clara, California 95051, United States of America, Attention: Legal Department.

GLOSSARY OF TERMS

Certain capitalized terms, if not otherwise defined elsewhere in this SLA, shall have the meanings set forth below:

- a. “Affiliate” means any legal entity that Owns, is Owned by, or is commonly Owned with a party. “Own” means having more than 50% ownership or the right to direct the management of the entity.
- b. “AGREEMENT” means this SLA and all associated Supplements entered by the parties referencing this SLA.
- c. “Authorized Users” means your Enterprise individual employees and any of your Enterprise’s Contractors, subject to the terms of the “Enterprise and Contractors Usage” section.
- d. “Confidential Information” means the Licensed Software (unless made publicly available by NVIDIA without confidentiality obligations), and any NVIDIA business, marketing, pricing, research and development, know-how, technical, scientific, financial status, proposed new products or other information disclosed by NVIDIA to you which, at the time of disclosure, is designated in writing as confidential or proprietary (or like written designation), or orally identified as confidential or proprietary or is otherwise reasonably identifiable by parties exercising reasonable business judgment, as confidential. Confidential Information does not and will not include information that: (i) is or becomes generally known to the public through no fault of or breach of the AGREEMENT by the receiving party; (ii) is rightfully known by the receiving party at the time of disclosure without an obligation of confidentiality; (iii) is independently developed by the receiving party without use of the disclosing party’s Confidential Information; or (iv) is rightfully obtained by the receiving party from a third party without restriction on use or disclosure.
- e. “Contractor” means an individual who works primarily for your Enterprise on a contractor basis from your secure network.
- f. “Documentation” means the NVIDIA documentation made available for use with the Software, including (without limitation) user manuals, datasheets, operations instructions, installation guides, release notes and other materials provided to you under the AGREEMENT.
- g. “Enterprise” means you or any company or legal entity for which you accepted the terms of this SLA, and their subsidiaries of which your company or legal entity owns more than fifty percent (50%) of the issued and outstanding equity.
- h. “Excluded License” includes, without limitation, a software license that requires as a condition of use, modification, and/or distribution that software be (i) disclosed or distributed in source code form; (ii) licensed for the purpose of making derivative works; or (iii) redistributable at no charge.
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- j. “Intellectual Property Rights” means all patent, copyright, trademark, trade secret, trade dress, trade names, utility models, mask work, moral rights, rights of attribution or integrity service marks, master recording and music publishing rights, performance rights, author’s rights, database rights, registered design rights and any applications for the protection or registration of these rights, or other intellectual or industrial property rights or proprietary rights, howsoever arising and in whatever media, whether now known or hereafter devised, whether or not registered, (including all claims and causes of action for infringement, misappropriation or violation and all rights in any registrations and renewals), worldwide and whether existing now or in the future.
- k. “Licensed Software” means Software, Documentation and all modifications owned by NVIDIA.

- l. “Order” means a purchase order issued by you, a signed purchase agreement with you, or other ordering document issued by you to NVIDIA or a NVIDIA authorized reseller (including any on-line acceptance process) that references and incorporates the AGREEMENT and is accepted by NVIDIA.
- m. “Software” means the NVIDIA software programs licensed to you under the AGREEMENT including, without limitation, libraries, sample code, utility programs and programming code.
- n. “Supplement” means the additional terms and conditions beyond those stated in this SLA that apply to certain Licensed Software licensed hereunder.