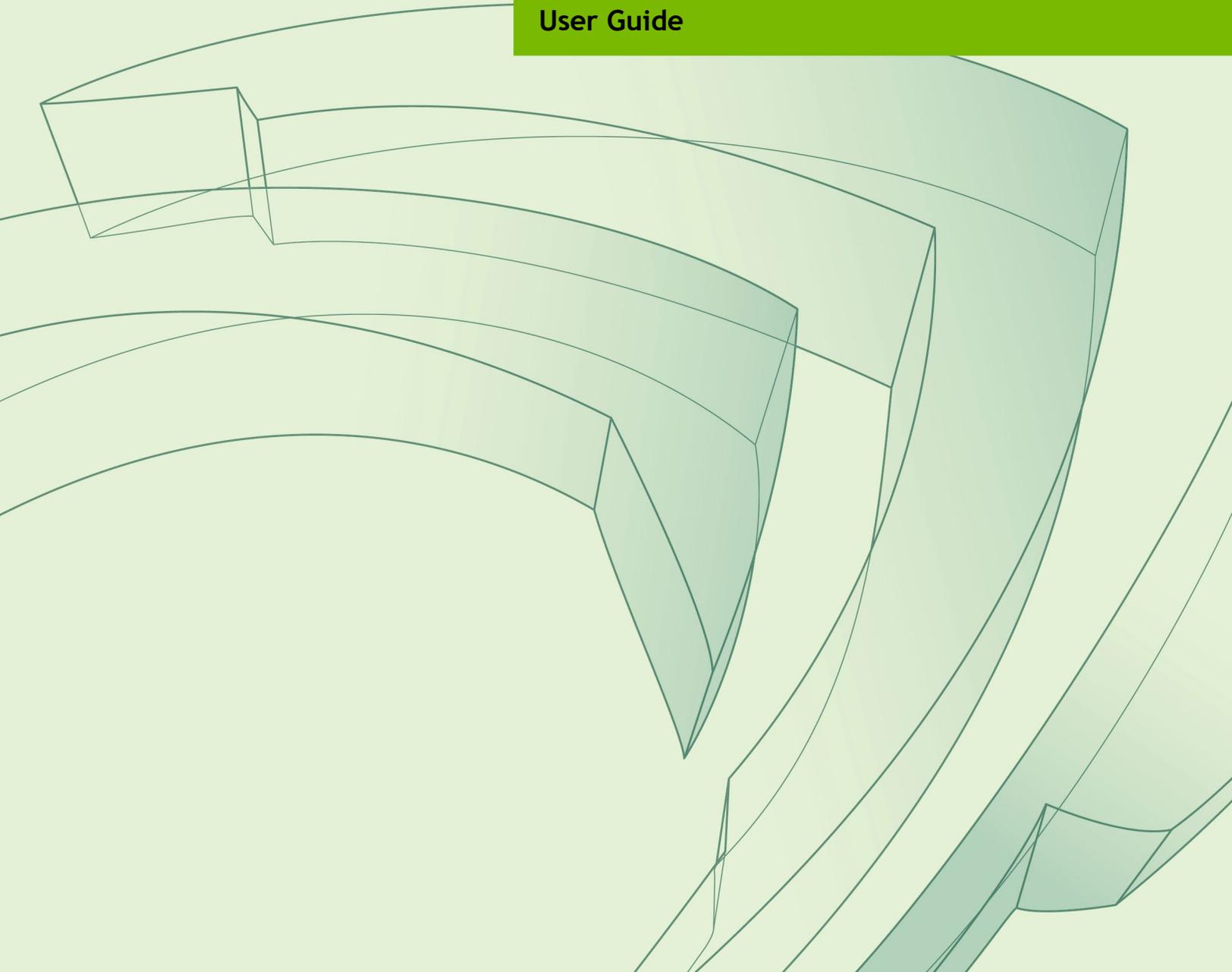




# JETSON XAVIER NX DEVELOPER KIT

DA\_09814-002 | May 19, 2020

**User Guide**



## DOCUMENT CHANGE HISTORY

DA\_09814-002

Version	Date	Authors	Description of Change
1.0	May 14, 2020	plawrence	Initial release.
1.1	May 19, 2020	jSachs	Added link to Graphics API Reference.

### NOTE

Welcome to the NVIDIA Jetson platform! There two key things you should do right away:

1. Sign up for the [NVIDIA Developer Program](#) – this enables you to ask questions and contribute on the [NVIDIA Jetson Forums](#), gives access to all documentation and collateral on the [Jetson Download Center](#), and more.
2. Read this User Guide! After that, check out these important links:
  - [Jetson FAQ](#) – Please read the FAQ.
  - [Support Resources](#) – This web page links to important resources, including the Jetson Forum and the Jetson Ecosystem page.
  - [NVIDIA Jetson Linux Developer Guide](#) – Jetson Linux is a key component of the Jetson platform, and provides the sample filesystem for your developer kit. Comprehensive documentation may be found in the *Developer Guide*.

Thanks,

The NVIDIA Jetson team

# TABLE OF CONTENTS

<b>Note</b> .....	<b>ii</b>
<b>Developer Kit Setup and Hardware</b> .....	<b>1</b>
Included in the Box .....	1
Developer Kit Setup .....	2
Developer Kit Interfaces .....	3
Interface Details .....	4
Power Guide .....	6
<b>JetPack</b> .....	<b>7</b>
Summary of JetPack Components .....	7
How to Install JetPack .....	9
Initial Configuration upon First Boot .....	10
Headless Mode.....	10
<b>Working with Jetson Linux Driver Package</b> .....	<b>11</b>

# DEVELOPER KIT SETUP AND HARDWARE

The NVIDIA® Jetson Xavier™ NX Developer Kit enables development of full-featured, multi-modal AI applications for products based on the Jetson Xavier NX module.

The Jetson Xavier NX Developer Kit (P3518\*) includes a non-production specification Jetson Xavier NX module (P3668-0000) attached to a reference carrier board (P3509-0000).

Jetson Xavier NX is supported by the comprehensive NVIDIA® JetPack™ SDK, including:

- Full Linux software development environment including NVIDIA drivers
- NVIDIA Container Runtime with Docker integration
- AI, Computer Vision, and Multimedia libraries and APIs
- Developer tools, documentation, and sample code

## INCLUDED IN THE BOX

Your Jetson Xavier NX Developer Kit's box includes:

- A Jetson Xavier NX module with heatsink. This version of the module (P3668-0000) is only for use in a developer kit and is not intended for production environments.
- A reference carrier board (P3509-0000).
- A 19-volt power supply.
- An appropriate power cable for your region.
- An 802.11 plug-in WLAN and Bluetooth® module with antennas (assembled underneath the carrier board).

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\* "P3518" refers to developer kit Part Numbers 945-83518-0000-000, 945-83518-0005-000, and 945-83518-0007-000.

- A small paper card with quick start and support information.

**Note**

**NVIDIA recommends using the Jetson Xavier NX Developer Kit only with the power supply provided. Using an incompatible power supply may damage the carrier board or the module or both. If you use another power supply in place of the one provided, you are responsible for ensuring that it is compatible with the developer kit hardware.**

## DEVELOPER KIT SETUP

Before using your developer kit, you must set up a microSD card with the operating system and JetPack components. The simplest method is to download the microSD card image and follow instructions found in [Getting Started with Jetson Xavier NX Developer Kit](#).

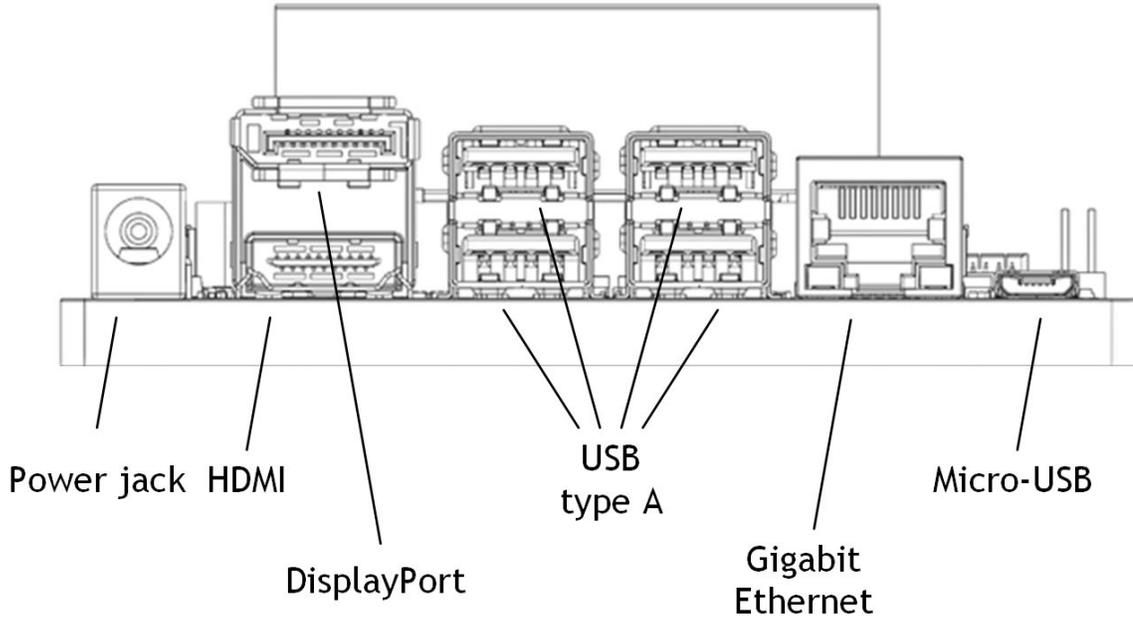
In summary:

- You need a 16 GB or larger UHS-1 microSD card, HDMI™ or DP monitor, USB keyboard, and mouse.
- Download the Jetson Xavier NX Developer Kit SD Card image and write it to the microSD card.
- Insert the microSD card into the slot on the underside the Jetson Xavier NX module, then attach the display, keyboard, and mouse. Optionally connect an Ethernet cable. (The developer kit includes a WLAN networking adapter that can be configured during initial setup or later.)
- Connect the provided power supply. The developer kit powers on automatically.

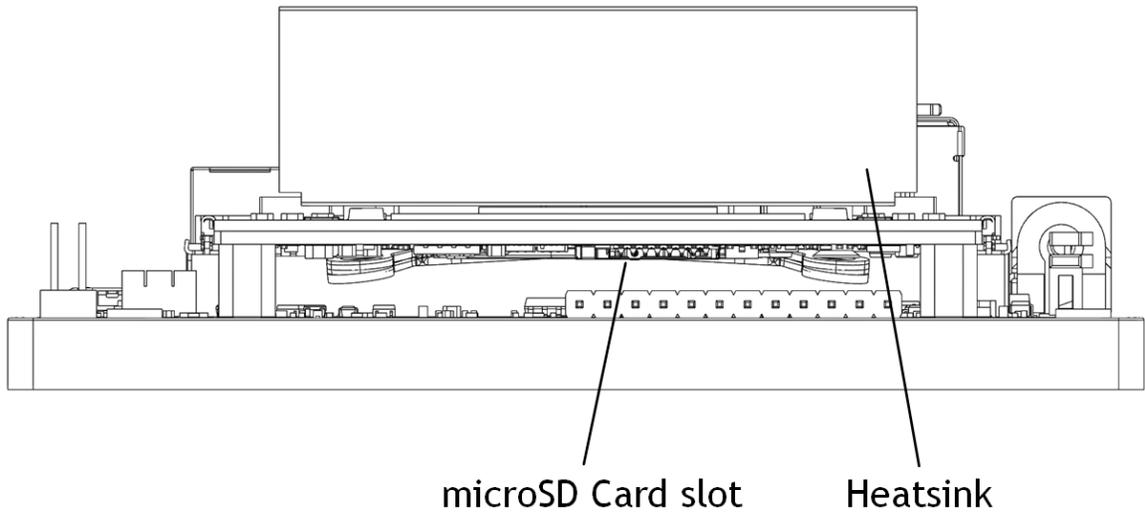
For information about other installation methods, see [How to Install JetPack](#), below.

# DEVELOPER KIT INTERFACES

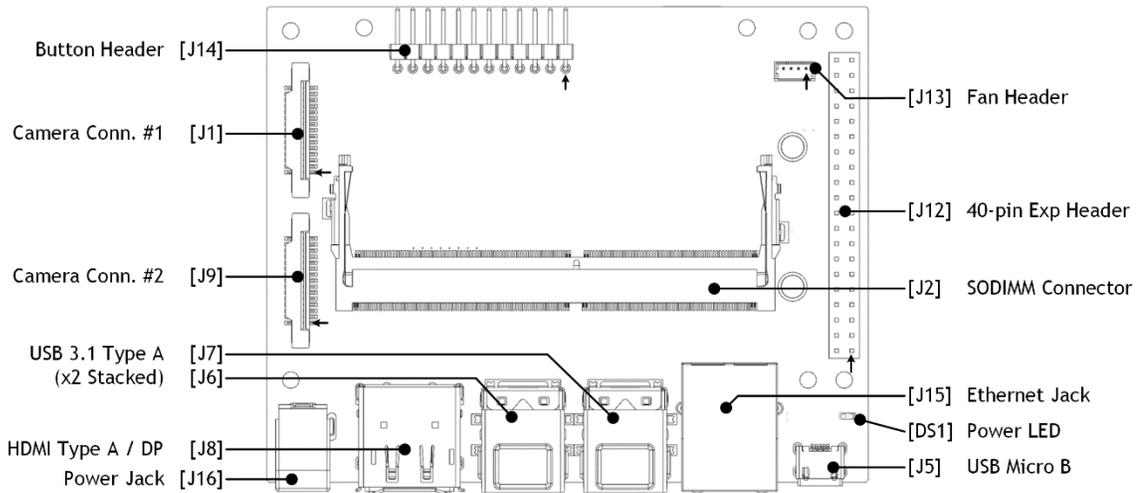
Developer kit module and carrier board: front view



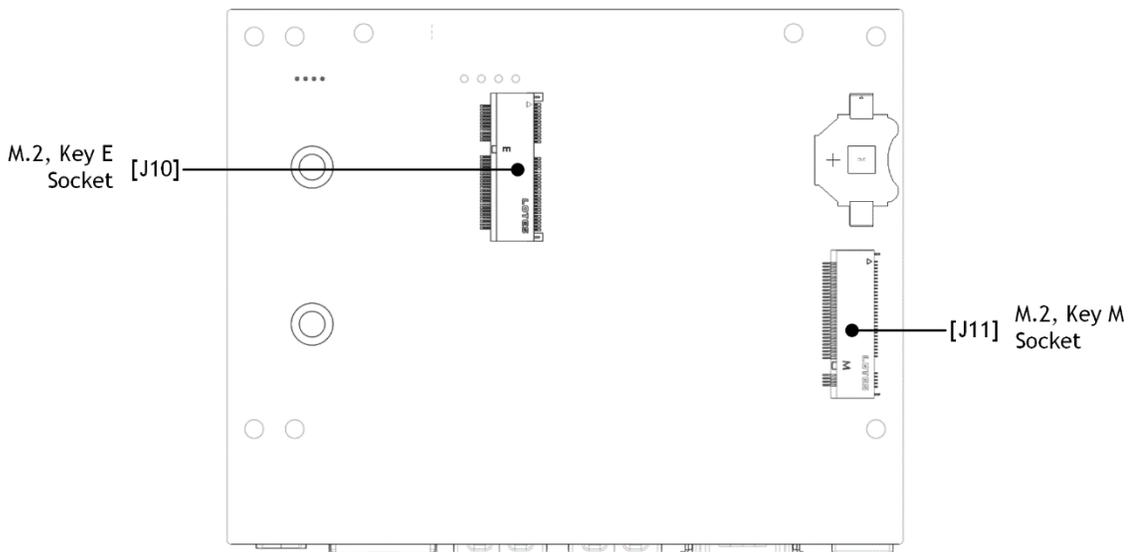
Developer kit module and carrier board: rear view



## Developer kit carrier board: top view



## Developer kit carrier board: bottom view



## Interface Details

This section highlights some of the Jetson Xavier NX Developer Kit interfaces. See *Jetson Xavier NX Developer Kit Carrier Board Specification* for comprehensive information.

### Module

- A slot for a microSD card, [J501]. (This slot is on the Jetson Xavier NX module, and so is not shown in the diagrams of the carrier board.)
- The heatsink supports 15W module power usage at 35 °C ambient temperature. Depending on your use case, you can configure it to “quiet” (no or slow fan) or “cool” (higher speed fan). For details, see the section “Fan Mode Control” in the

topic “Power Management for Jetson Xavier NX and Jetson AGX Xavier Series Devices” of *Jetson Linux Developer Guide*.

## Carrier Board

- [DS1] Power LED; lights when the developer kit is powered on.
- [J1] Camera connector; enables use of CSI cameras. The Jetson Xavier NX Developer Kit works with IMX219 camera modules, including Leopard Imaging LI-IMX219-MIPI-FF-NANO camera module and Raspberry Pi Camera Module V2.
- [J2] SO-DIMM connector for Jetson Xavier NX module.
- [J5] Micro-USB 2.0 connector; operates in device mode only.
- [J6] and [J7] are each a stack of two USB 3.1 Type A connectors. Each stack is limited to 1A total power delivery. All four are connected to the Jetson Xavier NX module via a USB 3.1 hub built into the carrier board.
- [J8] HDMI and DP connector stack.
- [J9] Second camera connector; supplements [J1].
- [J10] M.2 Key E connector can be used for wireless networking cards; includes interfaces for PCIe (x1), USB 2.0, UART, I2S, and I2C. The developer kit includes a wireless networking card preinstalled in this connector.
- [J11] M.2 Key M socket. Only single-sided M.2 modules can be used.
- [J12] 40-pin expansion header; includes:
  - Power out pins.

Two 3.3-volt power pins and two 5-volt power pins. The 5-volt supply is always present when the developer kit is receiving power, but the 3.3-volt supply is available *only* when the module is in the ON state or the SC7 state.

The power pins can only provide power out. They may not be used to deliver power to the developer kit.
  - Interface signal pins.

All signals use 3.3-volt levels.

By default, all interface signal pins are configured as GPIOs, except pins 3 and 5 and pins 27 and 28, which are I2C SDA and SCL, and pins 8 and 10, which are UART TX and RX. L4T includes a Python library, `Jetson.GPIO`, for controlling GPIOs. See `/opt/nvidia/jetson-gpio/doc/README.txt` on your Jetson system for details.

L4T includes the `jetson-io` utility to configure pins for SFIOs. See [Configuring the 40-Pin Expansion Header](#) in [Jetson Linux Developer Guide](#) for more information. L4T also includes the `Jetson.GPIO` Python library for easy control of GPIOs. See the [Jetson.GPIO](#) GitHub page for more information.
- [J13] 4-pin fan control header. Supports Pulse Width Modulation (PWM) output and tachometer input.

- [J14]: 12-pin button header. Brings out system power, reset, force recovery, UART console, and other signals:
  - Pin 1 connects to LED cathode to indicate System Sleep/Wake (Off when system is in sleep mode).
  - Pin 2 connects to LED anode.
  - Pins 3 and 4 are respectively UART Receive and Send.
  - Pins 5 and 6 disable auto power-on if connected.
  - Pins 7 and 8 reset the system if connected when the system is running.
  - Pins 9 and 10 put the developer kit into Force Recovery Mode if they are connected when it is powered on.
  - Pins 11 and 12 initiate power-on when connected if auto power-on is disabled.
- [J15] RJ45 connector for gigabit Ethernet. The connector includes two lights: an amber light to indicate activity, and a green light to indicate link speed. The green light is on for a 1000 Mbps link, and off for a 100 Mbps or 10 Mbps link.
- [J16] Power jack for nominal 19-volt power supply. (The maximum supported continuous current is 4.4A.) Accepts a 2.5×5.5×9.5 mm (ID × OD × length) plug with center positive polarity.

## Power Guide

The Jetson Xavier NX Developer Kit requires a 9–20-volt power supply. The 19-volt power supply packaged in the kit attaches to power jack [J16].

The Jetson Xavier NX module is designed to optimize power efficiency and supports two software-defined power modes. The default mode provides a 10W power budget for the module; the other provides a 15W budget. These power modes constrain the module to near their 10W or 15W budgets by capping the GPU and CPU frequencies and the number of online CPU cores at a pre-qualified level. See [NVIDIA Jetson Linux Developer Guide](#) for details about power modes.

# JETPACK

NVIDIA JetPack SDK is the most comprehensive solution for building AI applications. It includes the latest OS images for Jetson products, along with libraries and APIs, samples, developer tools, and documentation.

## SUMMARY OF JETPACK COMPONENTS

This section briefly describes each component of JetPack. For additional details about these components, see the [online documentation for JetPack](#).

### OS Image

JetPack includes a reference file system derived from Ubuntu.

### Libraries and APIs

JetPack libraries and APIs include:

- TensorRT and cuDNN for high-performance deep learning applications
- CUDA for GPU accelerated applications across multiple domains
- NVIDIA Container Runtime for containerized GPU accelerated applications
- Multimedia API package for camera applications and sensor driver development
- VisionWorks, OpenCV, and VPI for visual computing applications
- Sample applications

### Sample Applications

JetPack includes several samples which demonstrate the use of JetPack components. These are stored in the reference filesystem and can be compiled on the developer kit.

JetPack component	Sample locations on reference filesystem
<a href="#">TensorRT</a>	/usr/src/tensorrt/samples/
<a href="#">cuDNN</a>	/usr/src/cudnn_samples_<version>/
<a href="#">CUDA</a>	/usr/local/cuda-<version>/samples/
<a href="#">Multimedia API</a>	/usr/src/tegra_multimedia_api/
<a href="#">VisionWorks</a>	/usr/share/visionworks/sources/samples/ /usr/share/visionworks-tracking/sources/samples/ /usr/share/visionworks-sfm/sources/samples/
<a href="#">OpenCV</a>	/usr/share/OpenCV/samples/
<a href="#">VPI</a>	/opt/nvidia/vpi/vpi-<version>/samples

## Developer Tools

JetPack includes the following developer tools. Some are used directly on a Jetson system, and others run on a Linux host computer connected to a Jetson system.

- Tools for application development and debugging:
  - [NSight Eclipse Edition](#) for development of GPU accelerated applications: Runs on Linux host computer. Supports all Jetson products.
  - [CUDA-GDB](#) for application debugging: Runs on the Jetson system or the Linux host computer. Supports all Jetson products.
  - [CUDA-MEMCHECK](#) for debugging application memory errors: Runs on the Jetson system. Supports all Jetson products.
- Tools for application profiling and optimization:
  - [NSight Systems](#) for application multi-core CPU profiling: Runs on the Linux host computer. Helps you improve application performance by identifying slow parts of code. Supports all Jetson products.
  - [NVIDIA® Nsight™ Compute](#) kernel profiler: An interactive profiling tool for CUDA applications. It provides detailed performance metrics and API debugging via a user interface and command line tool.
  - [NSight Graphics](#) for graphics application debugging and profiling: A console-grade tool for debugging and optimizing OpenGL and OpenGL ES programs. Runs on the Linux host computer. Supports all Jetson products.

## Documentation

Documents that are relevant to developers using JetPack include:

- [JetPack Documentation](#)
- [NVIDIA Jetson Linux Developer Guide](#)
- [NVIDIA Jetson Linux Release Notes](#)
- [VisionWorks Documentation](#)
- [Nsight Eclipse Edition Documentation](#)
- [CUDA-GDB Documentation](#)
- [CUDA-MEMCHECK Documentation](#)

- [TensorRT Documentation](#)
- [cuDNN Documentation](#)
- [CUDA Toolkit](#)
- [NVIDIA Container Runtime](#)
- [OpenCV Documentation](#)
- [Jetson Linux Graphics API Reference](#)
- [Jetson Linux Multimedia API Reference](#)
- [Nsight Systems](#)
- [nvprof](#)
- [Visual Profiler](#)
- [Nsight Graphics](#)
- [Nsight Compute CLI](#)
- [VPI-Vision Programming Interface](#)

## HOW TO INSTALL JETPACK

There are two ways to install JetPack on your developer kit:

- Use an SD Card image.  
Follow the steps in [Getting Started with Jetson Xavier NX Developer Kit](#) to download the system image and use SD Card writing software to flash it to a microSD card. Then use the microSD card to boot the developer kit.
- Use NVIDIA SDK Manager.  
You must have a Linux host computer with a working Internet connection to run SDK Manager and flash the developer kit. Supported host operating systems are Ubuntu Linux x64, version 18.04 or 16.04.  
Follow these instructions to download and install NVIDIA SDK Manager.

**Note** Use of SDK Manager to install JetPack requires that the developer kit be in Force Recovery mode.

Before using SDK Manager, follow these steps to power up your developer kit and put it into Force Recovery mode:

1. Ensure the device is powered off and the power adapter is disconnected.
2. Verify that a microSD Card is inserted in the Jetson Xavier NX module's card slot.
3. Place a jumper across the Force Recovery Mode pins (9 and 10) on the button header [J14].
4. Connect your host computer to the developer kit's USB Micro-B connector.
5. Connect the power supply to the power jack [J16]. The developer kit automatically powers on in Force Recovery Mode.
6. Remove the jumper from the Force Recovery Mode pins.

Now use SDK Manager to flash your developer kit with the OS image and install other Jetpack components. SDK Manager can also set up your Linux host computer development environment. For full instructions, see the [SDK Manager documentation](#).

# INITIAL CONFIGURATION UPON FIRST BOOT

Whether you use the SD Card image or use SDK Manager to flash your developer kit, upon first boot it will prompt you for initial configuration information like keyboard layout, username and password, etc.

## Headless initial configuration

If no display is attached to the developer kit during first boot, the initial configuration process is “headless.” That is, you must communicate with the developer kit through a serial application on the host computer (e.g., puTTY) connected via a host serial port and the developer kit’s Micro-USB port.

## HEADLESS MODE

You can use a Jetson Xavier NX Developer Kit in **headless mode**, that is, without attaching a display. You control the developer kit from the host, using a terminal program or the remote access application VNC to display the developer kit’s desktop in a window on the host and to use the host’s keyboard and mouse to interact with the developer kit.

Connect the host to the developer kit via the Micro-USB port. Once the developer kit is flashed and powered on, your host computer detects a drive named `L4T-README`. This drive holds various README documents.

You can establish a GUI connection between the host and the developer kit by setting up VNC. Install the VNC client on the host and the VNC server on the developer kit. Use a terminal program such as puTTY to create a connection from to the developer kit and install the VNC server. See `README-vnc.txt` on the `L4T-README` drive for instructions.

# WORKING WITH JETSON LINUX DRIVER PACKAGE

NVIDIA® Jetson™ Linux Driver Package (L4T) is the operating system component of JetPack, and provides the Linux kernel, Bootloader, Jetson Board Support Package (BSP), and sample filesystem for Jetson developer kits. L4T and the other JetPack components are included on the Jetson Xavier NX Developer Kit SD Card image. Alternatively, you can use SDK Manager to install L4T and the other JetPack components to your developer kit.

L4T is also available for download directly from the [main L4T page](#) on the Jetson Developer Site. See the “Quick Start Guide” section of the [NVIDIA Jetson Linux Developer Guide](#) for flashing instructions.

The “Platform Adaptation and Bring-Up” topic in the *Developer Guide* describes how to port the Jetson BSP and bootloader from your developer kit to a new hardware platform incorporating the Jetson module. Porting L4T to a new device enables use of the other JetPack components on that device, along with the software you’ve created using the developer kit.

## Notice

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