NVIDIA Grace Software with Ubuntu 22.04

Installation Guide
## Document History

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**Introduction**

NVIDIA® Grace systems can run the version of Ubuntu Server that is distributed by Canonical and take advantage of the advanced Grace features.

This document explains how to install and configure Grace systems with Ubuntu Server 22.04.3.

| Attention: Although it might be possible to use other Linux distributions that are related to (or inspired by) an Ubuntu Server, for example Kubuntu, **only** the Ubuntu Server 22.04 has been pre-validated with the steps in this guide for installation on Grace platforms. |

**Related Documentation**

Refer to the [Ubuntu Server documentation](#) for more information about Ubuntu.

**Prerequisites**

This section lists the required (or recommended) prerequisites.

**Access to Repositories**

The repositories can be accessed from the internet. If you are using a proxy server, follow the instructions in the [Ubuntu Server Installation Guide](#) to ensure that the system can access the necessary URIs.

**Installing the Ubuntu Server**

Canonical provides several methods to install Ubuntu (refer to the Ubuntu Server Documentation for more information). **Before you install**, review platform-dependent workarounds to determine whether modifications are required for your environment.

This section describes how to install Ubuntu using the Quick Install method and reclaim the disk space used by an existing installation in the process. It describes a minimal installation and assumes that the system has internet connectivity to access updates. If you have a preferred method to install Ubuntu, you can skip this section but ensure that you reclaim the disk space that is used by an existing OS installation.
This method installs Ubuntu Server on the Grace system remotely through facilities hosted on the BMC.

Obtaining the Ubuntu Server 22.04

Obtain the Ubuntu Server ISO for Arm® image (aarch64) and store it on your local disk. Refer to Downloading Ubuntu Server for the instructions.

If you are deploying Ubuntu on Grace-based platforms at-scale, contact Canonical for information about ongoing bug fixes, critical security patching, and long-term support. For information about using Canonical's Ubuntu images on a commercial project, read Canonical's IP policy or contact Canonical.

Remotely Booting the Ubuntu 22.04 Server

22.04 ISO

**Attention:** Here is some important information to know **before** you begin:

- The Grace BMC comes with default login credentials, and NVIDIA recommends that you create a unique user ID and password.
  - Contact the system vendor if you have issues logging into the BMC.
- As a performance consideration, for networks that are distributed across a wide geographical area, such as a corporate VPN, we recommend that you use a browser from a host near the target server.
  - This can be accomplished by using a remote application software solution, for example VNC, or by exporting the application X session and tunneling over SSH.
- This sequence is intended for the NVIDIA reference BMC, and your results might vary when using an IBV BMC.
1. Connect to the BMC.
   a. Open a browser in your LAN, navigate to https://<BMC-IP-address>/, and log in.

   **Figure 1.** BMC Login

2. Download the ISO image to a location that can be accessed by the browser.

3. Set up the ISO image as virtual media.
   a. From the left hand menu, expand **Operations**.
   b. Select **Virtual media**.
   c. Click **Add file**, navigate to the downloaded ISO image, and select it.
   d. To begin serving the ISO image to the target server, click **Start**.
4. **Boot from the virtual media.**
   Typically, the default boot order does not boot the CD-ROM image. You can change this in the BIOS or as a one-time option in the boot menu.
   a. Connect to the console.
      i. From the left hand menu, expand **Operations**, and select the SOL console.
      ii. Alternatively, SSH to the BMC from a terminal emulator, log in, and at the prompt, run the `obmc-console-client` command.
   b. To bring up the boot menu, press **Escape** or **F11** at the beginning of the boot process.
Figure 3. Console Splash Screen

Figure 4. Boot Manager Menu
c. In the boot menu, select **UEFI OpenBMC Virtual Media Device** as the boot device and press **Enter**.

d. Follow the instructions in **Installing Ubuntu Server**.

Figure 5. Boot Manager

---

**Installing Ubuntu Server**

**Prerequisites:** This section assumes you have already booted the Ubuntu ISO image.

1. After booting the ISO image, the GRUB boot menu will appear. The menu will time out after 60 seconds. If no action is taken, it will proceed with booting the default selection (**Try or Install Ubuntu Server**).
2. To automate the installation with an autoinstall configuration file, refer to Installing with Autoinstall.

3. Select **Ubuntu Server with the HWE kernel**. Refer to the Ubuntu Server Installer Operations for guidance on using the installer.

   The performance of the Virtual Media device on Grace systems has been known to interfere with the Ubuntu installer, and this issue can cause services and cloud-init to time out.

   When this is experienced, a hybrid approach to load the kernel and initial ramdisk and use the network to load the rest of the ISO is required:
   a. Host the Ubuntu Server ISO from a web server. This can be an existing web server or a spontaneous web server.
   b. Ensure that **Ubuntu Server with the HWE kernel** selected and press e from the GRUB boot menu.
   c. Append `ip=dhcp` and `url=http://webserver:port/path/to/UbuntuServer.iso` to the list of kernel boot parameters.

   When the system has multiple network interfaces, you might be required to configure an interface with DHCP. This can be accomplished by specifying
ip=:::<interface_name>:dhcp::: instead of ip=dhcp, and this format can also be used to configure the interface with a static IP address configuration. Refer to the `nfsroot` documentation for more information about how to use this kernel boot parameter.

d. To boot, click **Ctrl+X** or press **F10**.
The kernel will display output messages to the console after it begins to boot.

e. Stop the Virtual Media device from the BMC web browser console.

The kernel will load the Ubuntu Server ISO from the network and start the installer.

4. Follow the installer prompts to configure the manual installation.

5. Select the text-based installer mode and update the installer if necessary.

**Figure 7. Installer Mode Selection**

![Installer Mode Selection](image)
6. Select the **Keyboard** configuration.
7. Select the base for the installation.
8. Configure the network connections, proxy settings, and Ubuntu archive mirror.
Figure 11. Network Connections
Figure 12. Proxy Configuration

If this system requires a proxy to connect to the internet, enter its details here.

Proxy address:

If you need to use a HTTP proxy to access the outside world, enter the proxy information here. Otherwise, leave this blank.

The proxy information should be given in the standard form of "http://[user]:[pass]@[host]:[port]/".
9. Select a storage configuration and confirm the destructive action.
Configure a guided storage layout, or create a custom one:

(X) Use an entire disk

[ ] Micron_7400 local disk 447.13G

[X] Set up this disk as an LVM group

[ ] Encrypt the LVM group with LUKS

Passphrase:

Confirm passphrase:

[ Done ]
[ Back ]
Figure 15. Storage Configuration Summary

<table>
<thead>
<tr>
<th>MOUNT POINT</th>
<th>SIZE</th>
<th>TYPE</th>
<th>DEVICE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>/</td>
<td>100.000G</td>
<td>new ext4</td>
<td>new LVM logical volume &gt;</td>
</tr>
<tr>
<td>/boot</td>
<td>2.000G</td>
<td>new ext4</td>
<td>new partition of local disk &gt;</td>
</tr>
<tr>
<td>/boot/efi</td>
<td>1.049G</td>
<td>new fat32</td>
<td>new partition of local disk &gt;</td>
</tr>
</tbody>
</table>

AVAILABLE DEVICES

<table>
<thead>
<tr>
<th>DEVICE</th>
<th>TYPE</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ubuntu-vg (new)</td>
<td>LVM volume group</td>
<td>444.078G &gt;</td>
</tr>
<tr>
<td>free space</td>
<td></td>
<td>344.078G &gt;</td>
</tr>
</tbody>
</table>

[ Create software RAID (md) > ]
[ Create volume group (LVM) > ]
10. Select the system hostname and create a username and password.
11. Select or decline the Ubuntu Pro option (refer to Ubuntu Pro for more information).
Figure 18. **Ubuntu Pro Selection**

12. Select the system SSH server and settings.
Figure 19. SSH Selection

![SSH Setup](image)

You can choose to install the OpenSSH server package to enable secure remote access to your server.

[X] Install OpenSSH server

Import SSH identity: [ No ]
You can import your SSH keys from GitHub or Launchpad.

Import Username:

[X] Allow password authentication over SSH

Done
Back
13. Select the featured Ubuntu server snaps.

**Figure 20. Server Snap Selection**

![Server Snap Selection](image)

14. System installation begins, wait for the **Install Complete** banner and the **Reboot Now** option before proceeding to the next step.
Figure 21. Installing System

```
acquiring and extracting image from
executing curtin install curthooks step
curtin command install
  configuring installed system
    running 'curtin in-target -- setupcon --save-only'
curtin command in-target
  running 'curtin curthooks'
curtin command curthooks
  configuring apt configuring apt
    installing missing packages
    Installing packages on target system: ['efibootmgr',
      'grub-efi-arm64', 'grub-efi-arm64-signed', 'shim-signed']
  configuring iscsi service
  configuring raid (mdadm) service
  installing kernel -
```

[View full log]
15. Once the installation has completed, select **Reboot Now**.

16. After the system reboots, log in using the credentials that were specified during the installation.

17. Run the following commands to update the system and install the NVIDIA optimized Ubuntu kernel variant and reboot:

   ```
   sudo DEBIAN_FRONTEND=noninteractive apt purge linux-image-$(uname -r) 
   linux-headers-$(uname -r) linux-modules-$(uname -r) -y 
   sudo apt update 
   sudo apt install linux-nvidia-64k-hwe-22.04 -y 
   sudo reboot now
   ```

   **Note:** This sequence installs the latest available kernel. If you encounter issues after installing this kernel, it might be a known issue with a workaround described in Appendix D.

18. The system will reboot.
   The installation on Grace is now complete.
Appendix A: Installing Software

The Ubuntu Server uses the `apt` package manager to install, update, and remove packages. The utility can also be used to manage repositories. For more information about using `apt`, refer to [Ubuntu Package Management](#).

### A.1 NVIDIA GPU Driver and CUDA Toolkit

Refer to the [NVIDIA CUDA Installation Guide for Linux](#) for detailed instructions about how to install the NVIDIA GPU driver and CUDA support for Ubuntu. The R535.129.03 driver is the minimum level required for the Hopper GPU.

The following commands can be used to install the minimum levels required for the Hopper GPU:

```bash
sudo apt-get install linux-headers-$(uname -r)
sudo dpkg -i cuda-keyring*.deb
sudo apt-get update
sudo apt-get install cuda-toolkit-12-4 -y
sudo apt-get install nvidia-kernel-open-550 cuda-drivers-550 -y
sudo mkdir /lib/systemd/system/nvidia-persistenced.service.d
sudo dd status=none of=/lib/systemd/system/nvidia-persistenced.service.d/override.conf << EOF
[Service]
ExecStart=
ExecStart=/usr/bin/nvidia-persistenced --persistence-mode --verbose
[Install]
WantedBy=multi-user.target
EOF
sudo reboot now
```

**Note:** The open-source GPU driver is required for Hopper GPUs.
A.2 NVIDIA MLNX_OFED

Refer to the NVIDIA MLNX_OFED Linux Drivers for the current version, release notes, and the user manual. The Grace platform requires one of the following NVIDIA MLNX_OFED versions:

- MLNX_OFED v24.01-0.3.3.1 (or later)
- MLNX_OFED LTS v23.10-0.5.8-LTS (or later)

To install NVIDIA MLNX_OFED on Ubuntu 22.04:

1. Add the NVIDIA MLNX_OFED repository to your system.

   ```bash
   echo "deb [signed-by=/usr/share/keyrings/GPG-KEY-Mellanox.gpg] https://linux.mellanox.com/public/repo/mlnx_ofed/latest/ubuntu22.04/arm64 /" | sudo tee /etc/apt/sources.list.d/mlnx.list
   sudo apt-get update
   ```

   **Note:** This sequence configures the repository for the latest available version of NVIDIA MLNX_OFED. If you need a specific version, replace `<latest>` with the version. For example, to get the latest 23.10 LTS version, use the following URI: https://linux.mellanox.com/public/repo/mlnx_ofed/latest-23.10/ubuntu22.04/arm64/

2. Install the NVIDIA MLNX_OFED software.

   ```bash
   sudo apt-get install mlnx-ofed-all -y
   ```

3. Update the device firmware with the version in the MLNX_OFED package.

   ```bash
   sudo apt-get install mlnx-fw-updater
   ```

4. Reboot the system.

   ```bash
   sudo reboot now
   ```

Appendix B: Changing the BMC Login

The NVIDIA Grace servers include a base management controller (BMC) for out-of-band management of the Grace system. NVIDIA recommends that you create a unique username and password as soon as possible.
Appendix C: Automated Installation

This section provides information about automated installations.

C.1 Installing with Autoinstall

Autoinstall allows you to automate the installation process by providing a configuration file with the answers to commonly asked installation questions. For Grace platforms, NVIDIA provides the following Autoinstall template:

https://repo.download.nvidia.com/baseos/ubuntu/ubuntu-les/2204/arm64/ai/user-data.grace

For more information about using Autoinstall files with an Ubuntu Server, refer to the Ubuntu Autoinstall Guide and the Curtin documentation.

In these files, there are tags that you must replace with site-specific information including the following:

- User
- Timezone
- Hostname

Each tag is in the `<CHANGE_YOUR_xxxx>` form and must be replaced with your information.

1. After you customize the autoinstall file for your installation, place that file in a location that can be accessed by NFS, FTP, HTTP, or HTTPS.

   **Note:** The Ubuntu autoinstall expects the following files to be in the location:
   - user-data
   - meta-data
   - vendor-data.

   You must rename user-data.grace to user-data and create the other two files. These files can be empty.

2. After booting from the installation medium, when the grub menu appears, press **e** to edit the grub entry and append the following to the list of kernel boot parameters:

   ```plaintext
   autostart temp=autoinstall
   ```
Appendix D: Platform-Dependent Workarounds

Some Grace platforms require temporary (or permanent) alterations to their configurations to work around known issues, such as hardware errata. These workarounds are described in the following sections by the corresponding Grace platform.

D.1 All Grace Platforms

The Ubuntu 22.04.3 installation media does not carry a patch that is required to resolve an issue with the ast driver that is used to interface with the AST2600 BMC. The absence of this patch can manifest a variety of issues, including kernel hangs and distorted output from the on-board VGA port. Instead of trying to workaround this issue with the Ubuntu 22.04.3 installation media, to resolve the issue, NVIDIA recommends that you use the pre-tested 22.04 LTS daily installer image that contains a later kernel, which includes the ast driver patch. NVIDIA has worked with Canonical to pre-validate this daily installer ISO and ensure that its URL remains active until 22.04.4 is released in early 2024.

- Kernels version 6.5.0-1014 and later introduce a new coresight_etm4x module that might be incompatible with earlier firmware versions and ultimately prevent the system from booting. NVIDIA recommends that you update the system firmware to the latest version.

  If the system still cannot boot after updating the firmware, to avoid loading the coresight_etm4x module, append the following to the list of kernel boot parameters:

  ```
  module_blacklist=coresight_etm4x
  ```
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