NVIDIA GH200 SuperChip

MGX System Quick Start Guide

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Document History

DU-11592-001_04

Version	Date	Description of Change
01	November 9, 2023	Initial release
02	December 6, 2023	• Updated the OS and the GPU/CUDA installation steps for Ubuntu. • Added the SLES GPU/CUDA installation steps.
03	January 22, 2024	Updated the post-install sequence for Ubuntu.
04	May 17, 2024	Updated the firmware versions.

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Introduction

The information in this quick start guide is helps you unbox and set up a Quanta Grace Hopper Unit:

Figure 1. Front and Back View of the NVIDIA MGX GH200

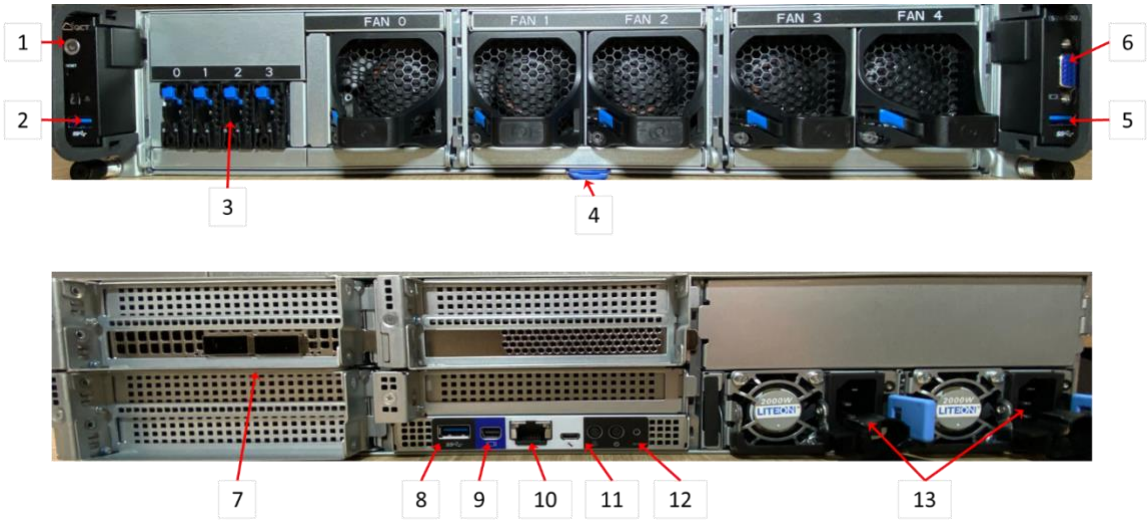


Table 1. Details About NVIDIA® MGX GH200

Item Number	Part Name
1	Front Panel Power
2	Front Left USB 3 (FL-USB)
3	NVMe Drive Bay
4	BMC Information Tag
5	Front Left USB 3 (FR-USB)
6	Front Panel Serial Connection
7	ConnectX-7 QSFP Ports
8	Rear Panel USB
9	Micro Display Port
10	BMC RJ45 Ethernet
11	UART/Serial
12	Rear Panel Power
13	Power Supply Cable Inserts

Prerequisites

If you plan to use your NVIDIA® MGX GH200 node outside an at-scale or planned deployment, such a lab environment or a pilot environment, we strongly recommend that you purchase the accessories in Table 2.

Note: NVIDIA does not provide these accessories.

Table 2. Required Accessories

Item	Required / Optional	Description
2x IEC C13 to NMEA 5-15P Power Cables (Standard 15A rated)	Required	Needed for system power-up.
Gigabit Ethernet Adapter (USB or PCIe)	Optional, recommended	Provides a network adapter that can be used by the operating system without configuring the bundled high-speed CX7 card. This accessory is necessary in benchtop or lab without needing a high-speed network, or during the operating system installation **before** you install the CX7 configuration tools. Any device supported by the Linux kernel will work such as the following: > **USB**: Devices powered by the ASIX AX88179 chipset, such as the solutions from Plugable. > **PCIe**: Single-port gigabit adapters built around the I210AT chipset.
Mini DisplayPort to HDMI Adapter & HDMI monitor, or VGA monitor; USB Keyboard	Optional	If the DHCP lease information is unavailable, this accessory is used to access the local system video for BIOS menus, particularly the BMC IP configuration.
MicroUSB to USB-A Cable	Optional	Can be used to access the BMC UART from a client device.
Hearing Protection	Review environmental requirements	Datacenter-class server hardware might exceed the permissible noise levels for laboratory and benchtop environments. Review the server manufacturer specification and relevant health and safety regulations for compliance information.

Physical Installation

Depending on location of install, install the server rail kit by following the manufacturer's instructions that are located inside the shipping container.

Note: Install the server rail kit into server rack by following the rack manufacturer's recommended instructions.

Installing the Cable

Note: In this section, the numbers in parenthesis refer to the callout numbers in Figure 1

1. The server comes with a ConnectX-7 networking card that is configured with dual QSFP+ ports.
   > If your network is already QSFP compatible, plug the cables for general server networking into this port.
   > If the final configuration of the server is going to be for copper ethernet, you need a set of the following adapters:
   - Mellanox QSFP+ to SFP+ Adapter, such as MAM1Q00A-QSA.
   - SFP+ to Copper RJ45, such as Transceiver Module for FS Switches

   *The links are for the examples and are **not** specific product recommendations.

2. Changing the ConnectX-7 card from QSFP mode to Ethernet Mode requires a change in the firmware at the OS level.
   - If you are converting from QSFP+ to RJ45, complete the initial setup of the machine by using a USB-to-Ethernet adapter.
   - To issue a change to the Mellanox firmware, the OFED toolset must be in a fully installed server.
   - To use Ethernet during OS installation, plug a USB-to-Ethernet converter into one of the following:
     - (2) Front Left USB
     - (8) Rear Panel USB

   *When this guide was written, the Front Right USB was not functional during the system setup.

3. Connect the (10) BMC RJ45 Ethernet to the network switch that will be used to manage the Baseboard Management Console (BMC).
4. (Optional) Connect the Keyboard and Video Monitor to ports (8) and (9).

   This step is optional because the BMC interface provides virtualized platforms that provide the same functionality as physical devices.

5. Connect the C13 power cables into both power supplies on the rear of the server.
6. Insert Power Supply (Cable (13)).

First Boot

Note: In this section, the numbers in parenthesis refer to the callout numbers in Figure 1

You can now boot the server using (1) or (12) power buttons. After several minutes, the server will complete different types of cycles on its own and eventually “come to life”. Approximately five minutes

later, you will be able to log into the BMC console through its http interface. You will need to use various methods available to you.

For your convenience, the manufacturer includes a helpful information tag (4) that includes the BMC's MAC address you can use to create a static IP address for the BMC or use the address to locate the BMC on your network.

You **must** ensure that the platform has, at a minimum, the versions in Table 3.

Table 3. Minimum Software Revisions

Item	Version
BMC	v3.19.00
EROT	01.03.0114.000-n01-rel-prod
Unlock key	CG1_DOT_package_2023_0829
CPLD	v07
FPGA	v8A
SBIOS	v3A11
VBIOS	96.00.84.00.02

Locating the BMC on the Automatic DHCP Network

To determine your BMC's IP address, use one of the following methods:

- **Common way:** Open your router's web interface and find the list of issued IP addresses.

  The list depends on the router model.

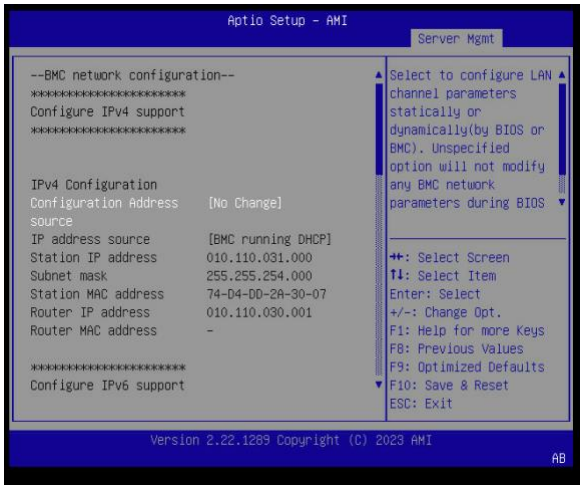
- **Linux only**: Run the `arp-scan –localnet` command.
- **Linux, MacOS, and Windows**: Download and run Angry IP Scanner.
- **Windows PowerShell**: Run the `arp -a` command.

Accessing BMC Information through the System BIOS

With a keyboard and monitor attached to the server, you can determine the BMC settings and information through the System BIOS interface.

1. During initial boot, monitor for the BIOS options screen and follow instructions to enter the setup.
2. In the System BIOS menu, press tab until the **Server Mgmt** option is selected.
3. Press **Enter** to select the **BMC network configuration** option.

Figure 2. BMC network configuration Option



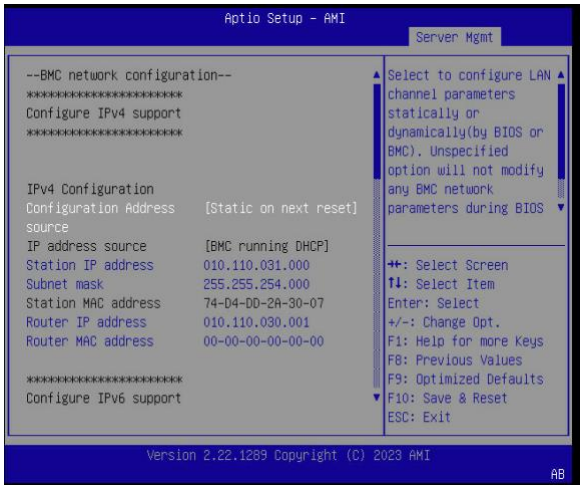
Setting a Static IP for the BMC through the System BIOS

For network configurations that require a static IP, this IP address can also be configured through the System BIOS settings. Refer to ”Accessing BMC Information through the System BIOS” on page 7.” for the steps. In the BMC Network Configuration menu:

1. Select **Configuration Address source**.
2. Select **Static on next reset**.

   You can now change the network and router information to configure your BMC into your infrastructure.

Figure 3. Setting the Static IP Address



Accessing the BMC Network Interface

After you locate the IP address that is assigned to the server BMC, open a web browser on the same network and navigate to the IP address. For instance, if your network assigned 192.168.1.100 to your BMC's MAC address, open a browser for a computer on the same network, and enter **https://192.168.1.100** as the web address.

Note: To correctly load the page, https:// is required.

On the landing page, you will be prompted for a username and password. The default username from QCT is **`admin`** , and the initial password is located on the BMC information tag (4) on the front of the machine After you enter the username, and you enter the website, you will be prompted to change the login BMC password.

Caution: Remember to record the new password because going forward, it will be needed to log in to the BMC.

Installing the Operating System

Through the BMC's Remote Control menu, the following interfaces are needed to complete the operating system installation:

- The HTML5 Viewer, a virtual monitor, which is like a physical monitor that is connected to the box.
- The Serial over Lan (SOL) interface.

1. Select one of the following options:
   - If you are installing the operating system (OS) image through virtual media, mount the ISO in the virtual media interface.
   - If you are installing using a physical drive, burn the ISO image in a bootable way on the USB drive and place it into the server.
2. Launch the Viewer window and the SOL Console.
3. Use the resulting interfaces to power cycle the server and begin a fresh boot sequence.
   - If the system drive **is** completely blank, it will eventually boot to the mounted media,
   - If the system drive **is not** blank, watch the BIOS init screen and select the option to choose boot media.
4. Select the available USB boot item.

NVIDIA provides guides for each of the major OS distributions that are available in the following links:

	Note: Before you review the other guides, we recommend that you always start with this Quick Start Guide.

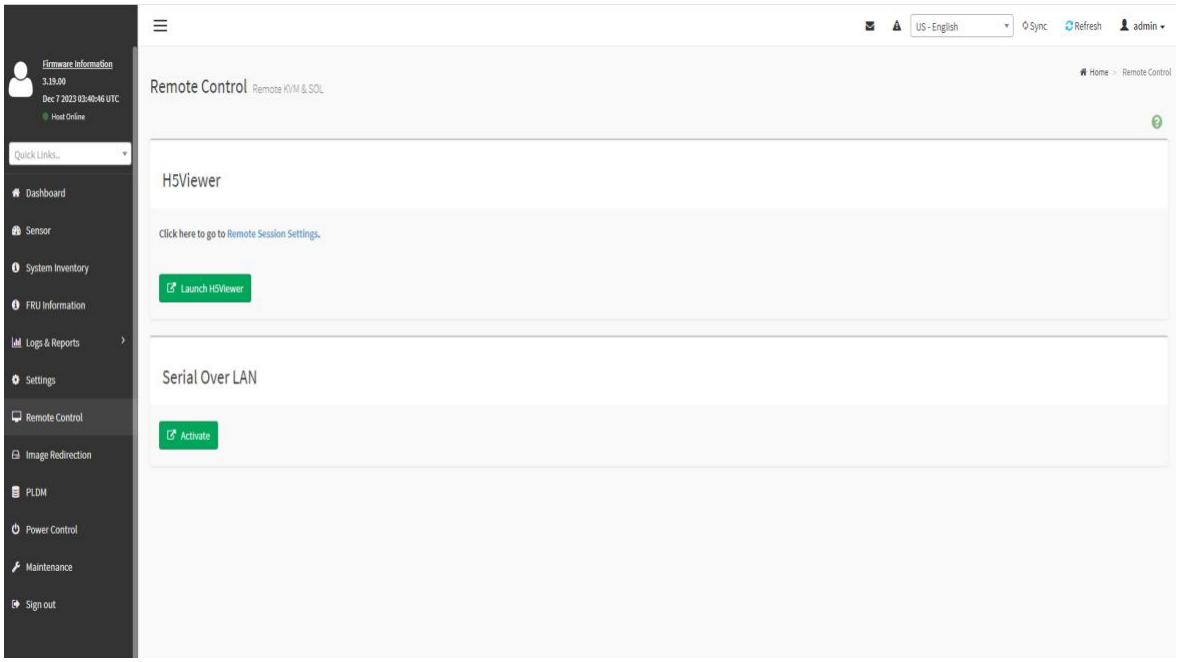
- NVIDIA Grace Software with Ubuntu 22.04 Installation Guide
- NVIDIA Grace Software with Red Hat Enterprise Linux 9 Installation Guide
- NVIDIA Grace Software with SUSE Linux Enterprise Server 15 Installation Guide

Virtually Mounting the ISO File

This section provides information about how to virtually mount the ISO file.

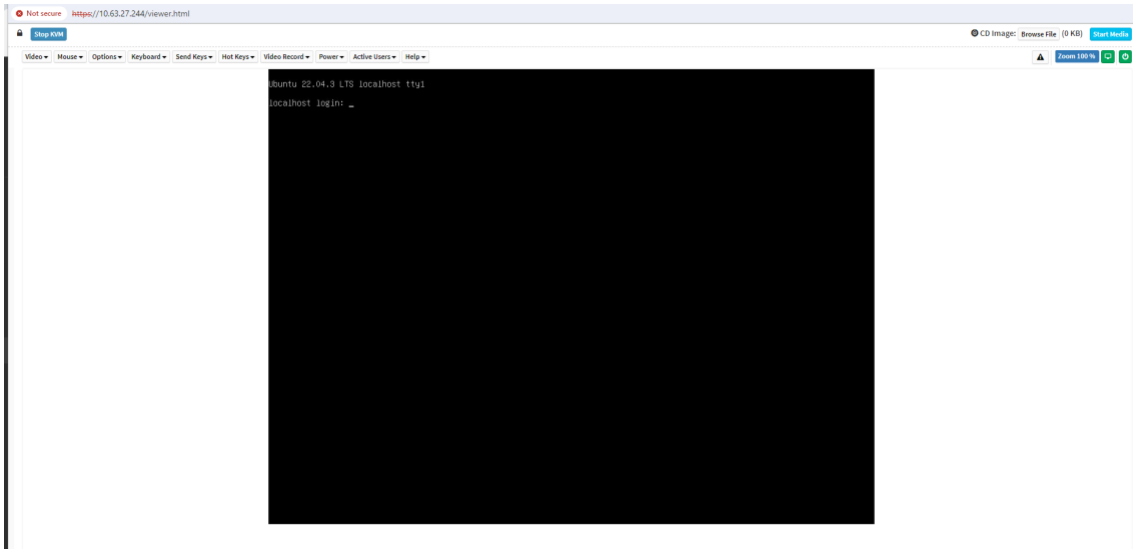
1. On the **Remote Control** tab, click **Launch H5Viewer**.

Figure 4. The Remote Control Tab



2. Next to **CD Image**, click **browser file** and select the ISO file that you want to virtually mount.

Figure 5. Selecting the ISO File



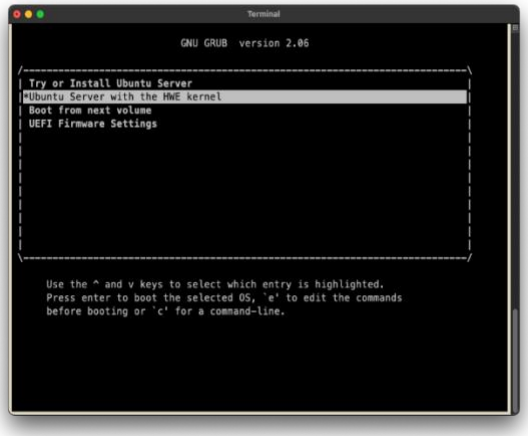
3. To mount the iso image, select **Media Boost** and click start media.

> **Note:** During the flashing process, after the screen goes blank, leave the HTML5 Viewer window open. If the window is closed, flashing will fail.

Installing Ubuntu on the Grace Server

1. After booting the ISO image, through the BMC's virtual media mount or through a physical media drive, the GRUB boot menu will appear.
2. Select **Ubuntu Server with the HWE kernel**.

Figure 6. Ubuntu Server with the HWE Kernel Option



3. The HTML5 Viewer window will disappear and remain black for the rest of this process.

   This is a known bug in the temporary kernel.

4. To complete the installation, use the Serial over LAN Console (SOL Console).
5. Complete the installations by selecting the options that are appropriate for you.
6. After the installation has completed, select **Reboot Now**.
7. After the system reboots, log in using the credentials that were specified during the installation.
8. Run the following commands to update the system and install the NVIDIA optimized Ubuntu kernel variant and reboot:

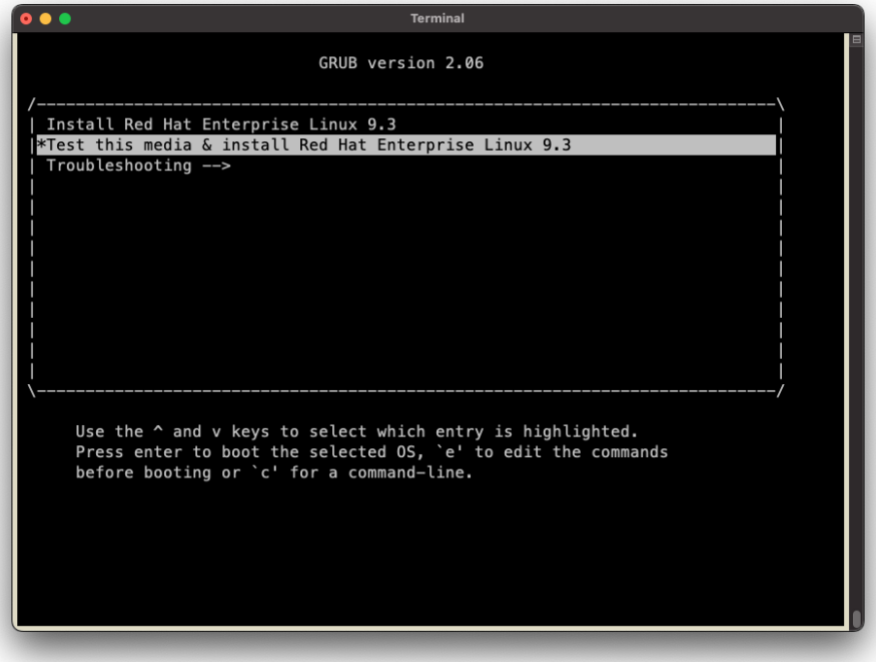
```
sudo DEBIAN_FRONTEND=noninteractive apt purge linux-image-$(uname -r) linux-headers-$(uname -r) linux-modules-$(uname -r) -y
sudo apt update
sudo apt install linux-nvidia-64k-hwe-22.04 -y
sudo reboot now
```

9. The system will reboot and the installation of Ubuntu on the Grace server is complete.

Installing Red Hat Enterprise Linux 9.3 on a Grace Server

1. After booting the ISO image, through the BMC's virtual media mount or through a physical media drive, the GRUB boot menu is displayed.
2. Select **Test this media & install Red Hat Enterprise Linux 9.3**.

Figure 7. Testing the Media



3. The HTML5 Viewer window will disappear and remain black for the rest of this process.
4. To complete the installation, use the SOL Console.
5. Complete the installations by selecting the options that are appropriate for you.
   a. From the Software Selection menu, select the 64k kernel from the Kernel Options submenu.

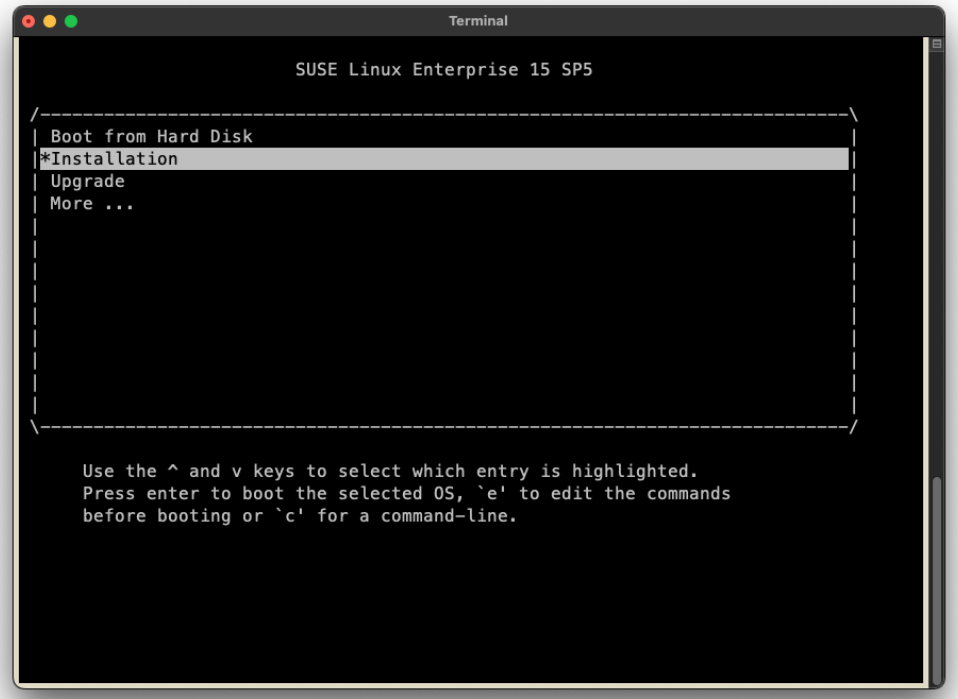
```
Begin the installation and allow the system to reboot.
```

6. After the system reboots, the installation of Red Hat Enterprise Linux 9.3 on the Grace server is complete.

Installing SUSE Linux Enterprise Server 15 SP5 on a Grace Server

1. After booting the ISO image, through the BMC's virtual media mount or through a physical media drive, the GRUB splash menu is displayed.
2. To display the GRUB boot menu, press **t**.

Figure 8. SLES 15 SP5 GRUB Boot Menu



3. Highlight **Installation** and press **e** to edit the boot entry.
4. Append `modprobe.blacklist=ast` to the end of the list of kernel boot parameters.
5. Boot the entry by clicking **Ctrl-X** or pressing **F10**.
5. The HTML5 Viewer window will disappear and remain black for the rest of this process.
6. To complete the installation, use the SOL Console.
7. Complete the installations by selecting the options that are appropriate for you.
   a. From the **Installation Settings** summary, select the **Change menu**.
   b. Select the **Software** submenu to alter the installation to install the 64k kernel as the sole, default kernel for the system.
   c. From the software change pane navigate to the **Search Phrase** box, and search for **kernel-64kb**.
   d. Select the **kernel-64kb** package.
   e. Return to the **Search Phrase** box and search for **kernel-default**.
   f. Deselect the **kernel-default** package.
   g. Navigate to and select **Accept** to update the planned installation.

   ```
   Begin the installation and allow the system to reboot.
   ```
8. After the system reboots, the installation of SUSE Linux Enterprise Server 15 SP5 on the Grace server is complete.

Installing the NVIDIA GPU Driver and the CUDA Toolkit

There are various supported ways to install and maintain NVIDIA's GPU Driver and CUDA SDK. Refer to the NVIDIA CUDA Installation Guide for Linux for more information about the supported installation methods. This quick start guide provides the steps for the Network/Public Repository version of the GPU Driver and CUDA installation method.

Note: The R535.129.03 driver is the **minimum** level required for the Hopper GPU.

> Ubuntu 22.04 Instructions

Run the following commands:

```
sudo apt-get install linux-headers-$(uname -r)

wget https://developer.download.nvidia.com/compute/cuda/repos/ubuntu2204/sbsa/cuda-keyring_1.1-1_all.deb

sudo dpkg -i cuda-keyring*.deb

sudo apt-get update

sudo apt-get install cuda-toolkit-12-2 -y

sudo apt-get install nvidia-kernel-open-535 cuda-drivers-535 -y

sudo reboot
```

> RHEL 9.2 Instructions

Run the following commands:

```
sudo dnf install kernel-64k-devel-$(uname -r| sed 's/+64k//g')

sudo dnf install kernel-headers-$(uname -r| sed 's/+64k//g')

sudo dnf install https://dl.fedoraproject.org/pub/epel/epel-release-latest-9.noarch.rpm

sudo dnf config-manager --add-repo https://developer.download.nvidia.com/compute/cuda/repos/rhel9/sbsa/cuda-rhel9.repo

sudo dnf clean expire-cache

sudo dnf install cuda-toolkit-12-2
```

```
sudo dnf module install nvidia-driver:535-open

sudo systemctl status nvidia-persistenced

sudo reboot
```

> SLES 15 SP5 Instructions

Run the following commands:

```
sudo zypper install -y kernel-64kb-devel

sudo usermod -a -G video <username>

sudo zypper addrepo
https://developer.download.nvidia.com/compute/cuda/repos/sles15/sbsa/cuda-
sles15.repo

sudo zypper refresh

sudo zypper install -y cuda-toolkit-12-2

sudo zypper install -y nvidia-open-gfxG05-kmp-
64kb=535.129.03_k5.14.21_150500.55.28-0

sudo sed -i "s/NVreg_DeviceFileGID\=.* /NVreg_DeviceFileGID\=$(grep video
/etc/group | cut -d ':' -f3) /g" /etc/modprobe.d/50-nvidia-64kb.conf

sudo reboot
```

Post-CUDA Installation Checks

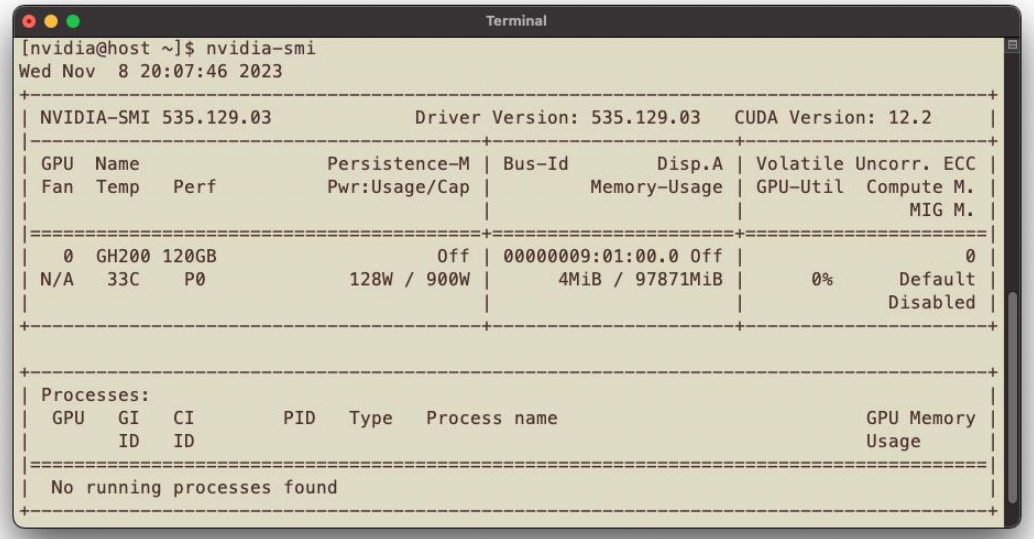
For most users, we recommend that you follow post-installation steps in Post-Installaton Actions..

Checking the CUDA Installation

After OS, Driver, and CUDA are installed, to verify that everything is correctly installed and initialized, we recommend that you do a complete system power cycle.

To do a quick check and determine whether Grace Hopper is ready to call the NVIDIA System Management Interface check, run the `nvidia-smi` command.

Figure 9. The nvidia-smi Command Output



To check and determine whether the CPU and GPU memory subsystems are up and functional, run the following commands.

```
sudo nvidia-persistenced
lsmem
```

Figure 10. The sudo nvidia-persistenced Command Output

```
nvidia@qctcg1:~$ sudo nvidia-persistenced
nvidia@qctcg1:~$ lsmem
RANGE                                  SIZE  STATE REMOVABLE         BLOCK
0x0000000080000000-0x000000787fffffff  480G online       yes          4-963
0x0000400000000000-0x00004017bfffffff   95G online       yes 131072-131261

Memory block size:       512M
Total online memory:     575G
Total offline memory:      0B
```

Installing or Upgrading the ConnectX-7 Driver and Software

Note: In the future, the driver version will be 23.10 driver, but the currently available version is 23.07.

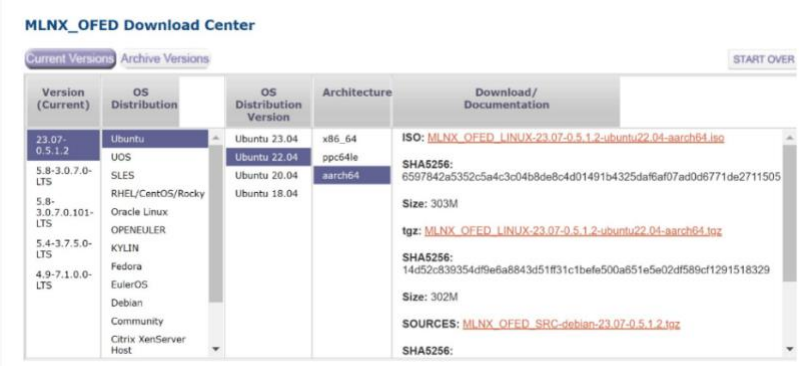
This is a more concise version of some detailed installation instructions that can be found in NVIDIA Networking Linux Driver Installation.

1. Obtain the appropriate driver from NVIDIA Network Download.

Table 4. Driver Information

Component	Description
Version	23.07
OS Distribution	<Ubuntu, RHEL, SLES>
OS Distribution Version	<22.04, 9.2, ?? >
Architecture	Aarch64
Download/Documentation	Select Link for ISO

Figure 11. The NVIDIA Network Download Site



2. Download the ISO file onto the server.

   For example, https://www.mellanox.com/downloads/ofed/MLNX_EN-23.07-0.5.1.2/mlnx-en-23.07-0.5.1.2-ubuntu22.04-aarch64.iso.

3. Create a mount point for the ISO image.

   For example, run `sudo mkdir -p /mnt/iso`.

4. Mount the ISO image.
   ```
   sudo mount -o loop <ISO IMAGE FILE> /mnt/iso
   ```
5. Use the mlnxofedinstall file in the image mount to install the driver and tools.
   ```
   cd /mnt/iso
   sudo ./mlnxofedinstall
   ```
6. Clean up after the installation.
   ```
   cd ~
   sudo umount /mnt/iso
   rm <ISO IMAGE FILE>
   ```
7. Complete one of the following tasks:
   - Hard reboot the machine.
   - Restart the ConnectX-7 device.
     ```
     sudo /etc/init.d/openibd restart
     ```

Checking the Driver/Firmware on ConnectX-7

Note: The Firmware will not show an update before the system has been rebooted or card restarted.

1. To check the driver or firmware on ConnectX-7, run the following command.

   ```
   sudo ibdev2netdev -v
   ```

   Here is the sample output:

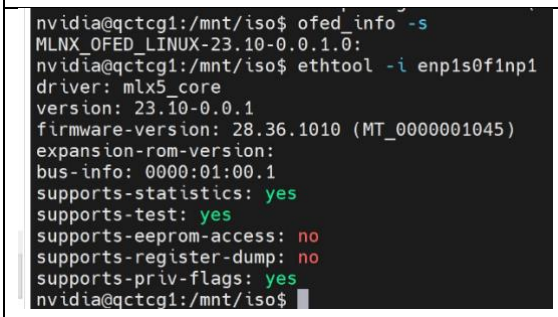
   ```
   nvidia@qctcg1:/mnt/iso$ sudo ibdev2netdev -v
   0000:01:00.1 mlx5_0 (MT4129 - MCX755106AC-HEAT) NVIDIA ConnectX-7 HHHL adapter Card, 200GbE / NDR200 IB, Dual-port QSFP112, PCIe 5.
   0 x16 with x16 PCIe extension option, Crypto and Secure Boot                                    fw 28.36.1010 port 1 (DOWN  ) =
   => enp1s0f1np1 (Down)
   ```

2. Use the net-tools package ifconfig to get the name of the CX-7 device.

   ```
   ethtool -I <nic name>
   ```

   For example, `ethtool -i enp1s0f1np1`

Figure 12. Outputs Showing With and Without Reboot

Without Reboot	With Reboot
	
Firmware version is still **28.36**.	Firmware version is now **28.38**.

Changing the ConnectX-7 Port Mode from IB to Ethernet

To change the ConnectX-7 port mode from IB to Ethernet, run the following command:

```
sudo mst start
sudo mst status -v
# Take the correct pciconf ID related to you NIC from above command
sudo mlxconfig -d /dev/mst/mt4129_pciconf<ID> set LINK_TYPE_P1=ETH LINK_TYPE_P2=ETH
```

where **mt4129** is specific to the ConnectX-7 device. This number might change depending on the version of the installed network card.

Performance Benchmarking Guide

A selection of tests to stress the GraceHopper architecture (refer to NVOnline: **1104321** for more information).

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