

DGX Software with Red Hat Enterprise Linux 7

Installation Guide

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Chapter 1. Introduction

The NVIDIA[®] DGXTM systems (DGX-1, DGX-2, and DGX A100 servers, and NVIDIA DGX StationTM and DGX Station A100 systems) are shipped with DGXTM OS which incorporates the NVIDIA DGX software stack built upon the Ubuntu Linux distribution. Instead of running the Ubuntu distribution, you can run Red Hat Enterprise Linux on the DGX system and still take advantage of the advanced DGX features.

This document explains how to install and configure the NVIDIA DGX software stack on DGX systems installed with Red Hat Enterprise Linux.



Note: While it may be possible to use other derived Linux distributions besides Red Hat Enterprise Linux, not all have been tested and qualified by NVIDIA. Refer to the DGX Software for Red Hat Enterprise Linux 7 Release Notes for the list of tested and qualified software and Linux distributions.

Related Documentation

- NVIDIA DGX Software for Red Hat Enterprise Linux Release Notes
- NVIDIA DGX-1 User Guide
- NVIDIA DGX-2 User Guide
- NVIDIA DGX A100 User Guide
- NVIDIA DGX Station User Guide

1.2. Prerequisites

The following are required (or recommended where indicated).

Red Hat Subscription

You need a Red Hat subscription if you plan to install and use Red Hat Enterprise Linux 7 on the DGX. A subscription also lets you obtain update packages and additional packages for

Red Hat Enterprise Linux. You can either purchase a subscription or obtain a free evaluation subscription from the Red Hat Software & Download Center.



Note: Of the available Red Hat Enterprise Linux platforms, only Red Hat Enterprise Linux Server is supported on DGX systems (DGX servers and DGX Station workstation). Other Red Hat Enterprise Linux platforms are **not** supported on any DGX system.

1.2.2. Access to Repositories

The repositories can be accessed from the internet.

If your installation does not allow connection to the internet, see the section Installing Software on Air-Gapped NVIDIA DGX Systems for information about updating software on "airgapped" systems.

If you are using a proxy server, then follow the instructions in the section Configuring a System Proxy to make sure the system can access the necessary URIs.



Note:

You can use yum-config-manager to conveniently enable certain repositories. To use yumconfig-manager, first install the yum utilities.

sudo yum -y install yum-utils

1.2.2.1. NVIDIA Repositories

NVIDIA DGX Software Repository

After installing Red Hat Enterprise Linux on the DGX system, you must enable the NVIDIA DGX software repository. The repository includes the NVIDIA drivers and software for supporting DGX systems.

See the section Enabling the Repositories for instructions on how to enable the repositories.

1.2.2.2. Red Hat Repositories

Installation of the DGX Software over Red Hat Enterprise Linux 7 requires access to several additional repositories.

Red Hat Enterprise Server Extras Repository (required for container support):

DGX Servers: rhel-7-server-extras-rpms

DGX Station: rhel-7-workstation-extras-rpms

Red Hat Enterprise Server Optional Repository (required by NVIDIA System Manager) (NVSM) and the GPU driver):

DGX Servers: rhel-7-server-optional-rpms

DGX Station: rhel-7-workstation-optional-rpms

Red Hat Software Collections Repository:

This repository is required by the NVSM tool for Python 3. If you do not have access to the Red Hat software collections repository, refer to https://access.redhat.com/ solutions/472793 for instructions on requesting access for free.



Important: NVSM is not supported with the python3 package. Be sure to only install the rh-python36 package per the instructions in <u>Installing Diagnostic Components</u>.

DGX Servers: rhel-server-rhscl-7-rpms

1.2.3. Network File System

On DGX servers, the data drives are meant to be used as a cache. DGX Station users can follow the same usage, or can alternatively opt to use these drives for storage. When using the data drives as cache, a network file system (NFS) is recommended to take advantage of the cache file system provided by the DGX software stack.

1.2.4. BMC Password

The DGX BMC comes with default login credentials as specified in Appendix B: Changing the BMC Login.



Important:

NVIDIA recommends disabling the default username and creating a unique BMC username and strong password as soon as possible. Refer to Appendix B: Changing the BMC Login for instructions.

Chapter 2. Installing Red Hat **Enterprise Linux**

There are several methods for installing Red Hat Enterprise Linux as described in the Red Hat Enterprise Linux Installation Guide (https://access.redhat.com/documentation/en-us/ red hat enterprise linux/7/html/installation guide/index).

See the DGX Software for Red Hat Enterprise Linux Release Notes for the Linux distributions that are qualified and tested for use with the DGX Software.

For convenience, this section describes how to install Red Hat Enterprise Linux using the Quick Install method, and shows when to reclaim disk space in the process. It describes a minimal installation. If you have a preferred method for installing Red Hat Enterprise Linux, then you can skip this section but be sure to reclaim disk space occupied by the existing Ubuntu installation.

The interactive method described here installs Red Hat Enterprise Linux on DGX using a connected monitor and keyboard and USB stick with the ISO image, or remotely through the remote console of the BMC.

Obtaining Red Hat Enterprise Linux

Obtain the Red Hat Enterprise Linux ISO image and store on your local disk or create a boot USB drive formatted for UEFI. See <u>Downloading Red Hat Enterprise Linux (https://</u> access.redhat.com/documentation/en-us/red hat enterprise linux/7/html/installation quide/ <u>chap-download-red-hat-enterprise-linux</u>) for instructions.

2.2. Booting Red Hat Enterprise Linux ISO Locally

- 1. Plug the USB flash drive containing the Red Hat Enterprise Linux ISO image into the DGX.
- 2. Connect a monitor and keyboard directly to the DGX.
- 3. Boot the system and press F11 when the NVIDIA logo appears to get to the boot menu.
- 4. Select the UEFI volume name that corresponds to the inserted USB flash drive, and boot the system from it.

5. Follow the instructions at Installing Red Hat Enterprise Linux

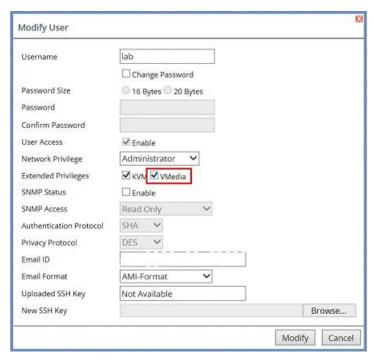
2.3. Booting the Red Hat Enterprise Linux ISO Remotely on the DGX-1, DGX-2, or DGX A100

Skip this chapter if you are using a monitor and keyboard for installing locally, or if you are installing on a DGX Station. The DGX Station cannot be booted remotely.

Booting the ISO Image on the DGX-1 2.3.1. Remotely

Skip this chapter if you are using a monitor and keyboard for installing locally.

- For instructions applicable to the NVIDIA DGX-2, see Booting the ISO Image on the DGX-2 Remotely
- For instructions applicable to the NVIDIA DGX A100, see Booting the ISO Image on the DGX A100 Remotely
- 1. Connect to the BMC and change user privileges.
 - a). Open a Java-enabled web browser within your LAN and go to http://<BMC-ipaddress>/, then log in.
 - Use Firefox or Internet Explorer. Google Chrome is not officially supported by the BMC.
 - b). From the top menu, click **Configuration** and then select **User Management**.
 - c). Select the user name that you created for the BMC, then click **Modify User**.
 - d). In the **Modify User** dialog, select the **VMedia** checkbox to add it to the extended privileges for the user, then click **Modify**.



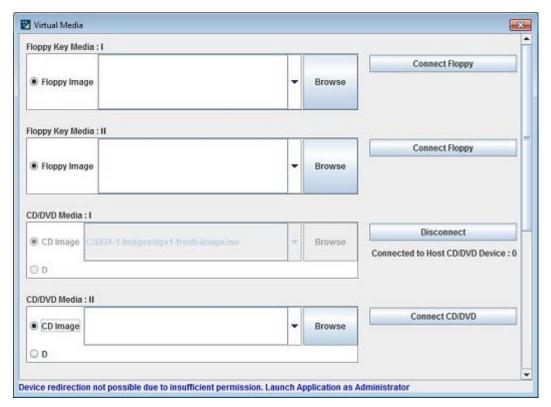
- 2. Set up the ISO image as virtual media and reboot the system.
 - a). From the top menu, click **Remote Control** and select **Console Redirection**.



- b). Click Java Console to open the remote JViewer window. Make sure pop-up blockers are disabled for this site.
- c). From the JViewer top menu bar, click **Media** and then select **Virtual Media Wizard**.



- d). From the CD/DVD Media: I section of the Virtual Media dialog, click **Browse** and then locate the Red Hat Enterprise Linux ISO file on your system and click Open.
 - You can ignore the device redirection warning at the bottom of the Virtual Media wizard as it does not affect the ability to re-image the system.
- e). Click Connect CD/DVD, then click OK at the Information dialog.
 - The Virtual Media window shows that the ISO image is connected.



f). Close the window.

The CD ROM icon in the menu bar turns green to indicate that the ISO image is attached.



g). From the top menu, click **Power** and then select **Reset Server**.

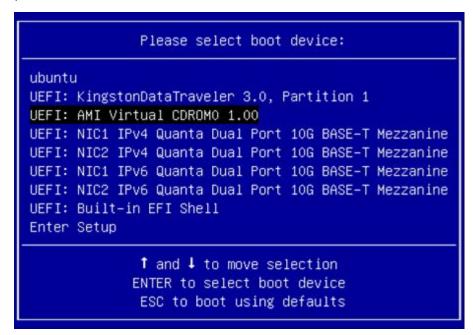


- h). Click Yes and then OK at the Power Control dialogs, then wait for the system to power down and then come back online.
- 3. Boot the CD ROM image.

Typically, the default boot order does not boot the CDROM image. This can be changed in the BIOS or as a one-time option in the boot menu. To bring up the boot menu, press F11 at the beginning of the boot process. Pressing F11 will display Show Boot Options at the top of the virtual display before entering the boot menu. Use the 'soft' keyboard (Menu \rightarrow Keyboard Layout → SoftKeyboard → <Language>) to bring up a virtual keyboard if pressing the physical key has no effect.



a). In the boot menu, select UEFI: AMI Virtual CDROM 1.00 as the boot device and then press **ENTER**.

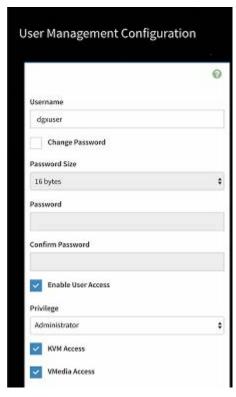


b). Follow the instructions at Installing Red Hat Enterprise Linux.

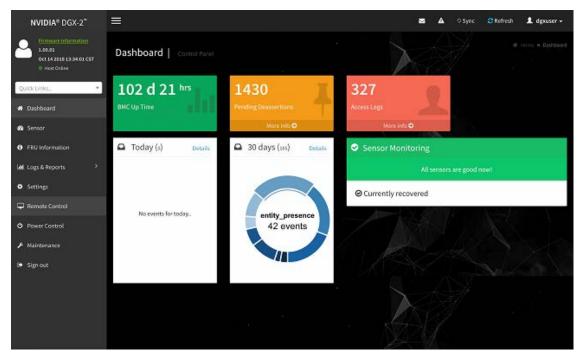
2.3.2. Booting the ISO Image on the DGX-2 Remotely

Skip this chapter if you are using a monitor and keyboard for installing locally.

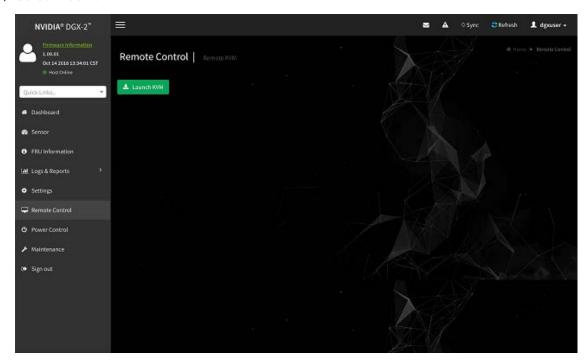
- 1. Connect to the BMC and ensure the required user privileges are set.
 - a). Open a browser within your LAN and go to https://
BMC-ip-address>/, then log in.
 - b). From the left-side menu, click **Settings** and then select **User Management**.
 - c). Click the card with the user name that you created for the BMC.
 - d). In the User Management Configuration dialog, make sure the VMedia Access checkbox is selected, then click Save.



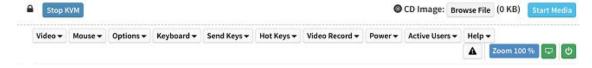
- 2. Set up the ISO image as virtual media.
 - a). From the left-side menu, click **Remote Control**.



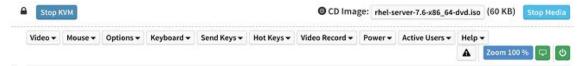
b). Select Launch KVM.



c). From the top menu bar in the KVM window, click **Browse File** and select the ISO image, then click Start Media.



The CD image should now be connected.



- d). From the top menu bar in the KVM window, click **Power** and then select **Reset Server**.
- 3. Boot from the virtual media.

Typically, the default boot order does not boot the CDROM image. This can be changed in the BIOS or as a one-time option in the boot menu.

a). To bring up the boot menu, press **F11** at the beginning of the boot process.

Pressing F11 will display Entering Boot Menu in the virtual display before entering the boot menu.



b). In the boot menu, select UEFI: Virtual CDROM 1.00 as the boot device and then press ENTER.

```
Please select boot device:
Local M.2_0 ubuntu
Local M.2_0 UEFI OS
Local M.2_1 ubuntu
Local M.2_1 UEFI OS
UEFI: Virtual CDROMO 1.00
UEFI: PXE IPv4 Intel(R) I210 Gigabit Network Connection
UEFI: HTTP IPv4 Intel(R) I210 Gigabit Network Connection
UEFI: PXE IPv6 Intel(R) I210 Gigabit Network Connection
UEFI: HTTP IPv6 Intel(R) I210 Gigabit Network Connection
UEFI: Built-in EFI Shell
Enter Setup
                ↑ and ↓ to move selection
              ENTER to select boot device
               ESC to boot using defaults
```

c). Follow the instructions at <u>Installing Red Hat Enterprise Linux</u>

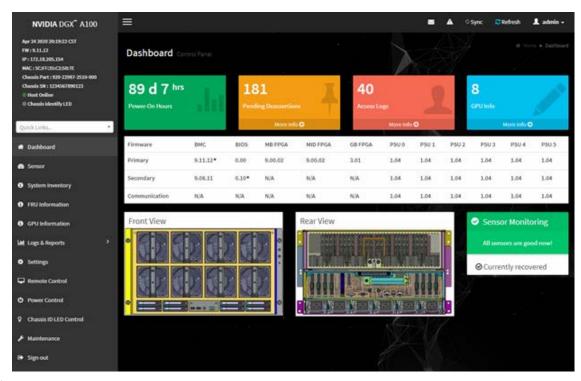
2.3.3. Booting the ISO Image on the DGX A100 Remotely

Skip this chapter if you are using a monitor and keyboard for installing locally.

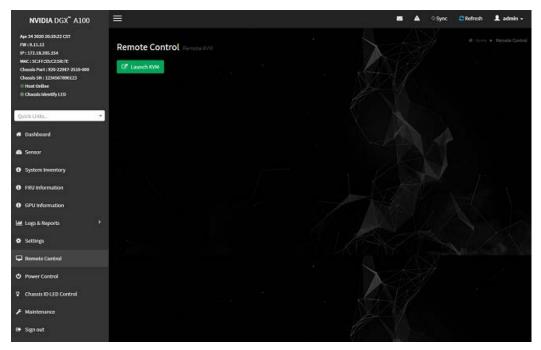
- 1. Connect to the BMC and ensure the required user privileges are set.
 - a). Open a browser within your LAN and go to https://<BMC-ip-address>/, then log in.
 - b). From the left-side menu, click **Settings** and then select **User Management**.
 - c). Click the card with the user name that you created for the BMC.
 - d). In the User Management Configuration dialog, make sure the VMedia Access checkbox is selected, then click Save.



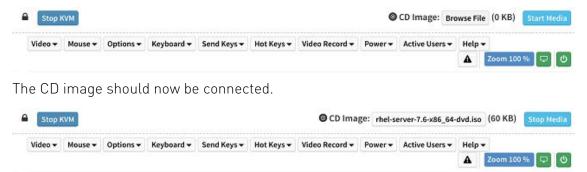
- 2. Set up the ISO image as virtual media.
 - a). From the left-side menu, click Remote Control.



b). Select Launch KVM.



c). From the top menu bar in the KVM window, click **Browse File** and select the ISO image, then click Start Media.



- d). From the top menu bar in the KVM window, click **Power** and then select **Reset Server**.
- 3. Boot from the virtual media.

Typically, the default boot order does not boot the CDROM image. You can change this in the BIOS or as a one-time option in the boot menu.

a). To bring up the boot menu, press F11 at the beginning of the boot process.

Pressing F11 will display Entering Boot Menu in the virtual display before entering the boot menu.



b). In the boot menu, select UEFI: AMI Virtual CDROM 1.00 as the boot device and then press ENTER.

```
Please select boot device:
M2_1 Red Hat Enterprise Linux (S436NAOM519464)
M2_1 RedHat Boot Manager (S436NAOM519464)
UEFI: AMI Virtual CDROMO 1.00
UEFI: Built-in EFI Shell
Enter Setup
          ↑ and ↓ to move selection
         ENTER to select boot device
          ESC to boot using defaults
```

c). Follow the instructions at <u>Installing Red Hat Enterprise Linux</u>

2.4. Installing Red Hat Enterprise Linux

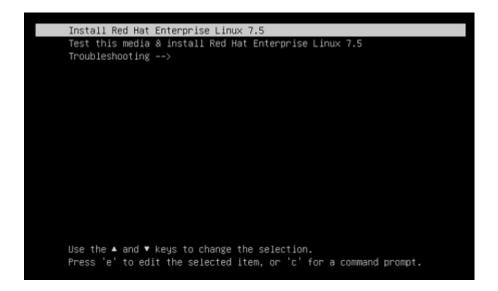
2.4.1. Installing on the DGX-1, DGX Station, or DGX Station A100

This section assumes you have booted the Red Hat Enterprise Linux ISO image, either locally or remotely for DGX-1, or locally for DGX Station. or DGX Station A100

- For instructions applicable to the DGX-2, see Installing on the DGX-2.
- For instructions applicable to the DGX A100, see Installing on the DGX A100.

The screenshots in these instructions are taken from a DGX-1 system. The DGX Station installation can have slight differences with respect to disk size, disk space available, interface names, etc.

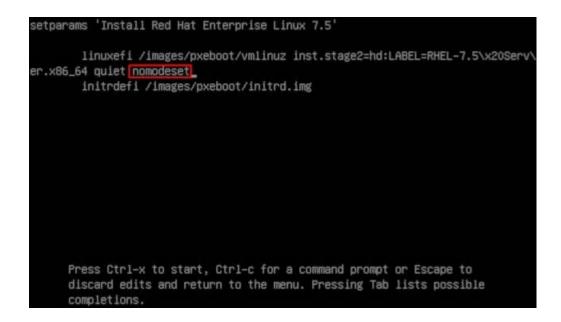
1. After booting the ISO image through either the BMC or from the USB drive, start the installation.



- On the DGX-1: Select Install Red Hat Enterprise Linux and then press Enter to start the installation.
- ▶ On the DGX Station: Update the linuxefi parameters to prevent the Nouveau driver in Red Hat Enterprise Linux from being loaded and then start the installation.

The Nouveau driver does not properly support the GPUs in the DGX Station, which may cause display issues. The GPUs in the DGX Station require that drivers that are installed as explained in Installing and Loading the NVIDIA CUDA Drivers.

- a). Select Install Red Hat Enterprise Linux and then type e.
- b). Append the nomodeset option to the linuxefi parameters.



c). Press **Ctrl+X** to save your changes and start the installation.

The Red Hat Enterprise Linux installer starts.

For guidance on using the installer, refer to Red Hat Enterprise Linux Quick Installation Guide (https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/7/html/ installation guide/chap-simple-install).

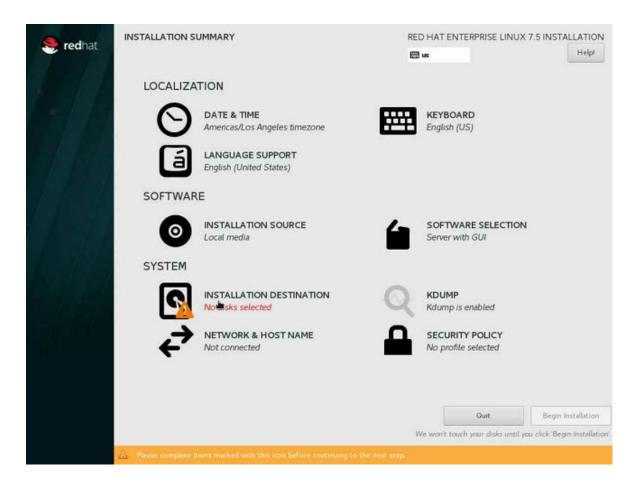
- 2. Configure the language, region, date, time, keyboard, and other configuration options you may need from the **Installation Summary** screen.
- 3. Select the software packages that you want to install.

For detailed instructions, refer to Software Selection in Red Hat Enterprise <u>Linux Installation Guide (https://access.redhat.com/documentation/en-us/</u> red hat enterprise linux/7/html/installation guide/sect-package-selection-x86).

- 4. Set the **Software Selection** to the correct value.
 - For DGX Station and DGX Station A100: Set to Server with GUI.
 - For DGX Servers (DGX 1-1, DGX-2, DGX A100): Set to Minimal Install.



Note: Setting the correct Software Selection is critical for proper operation.

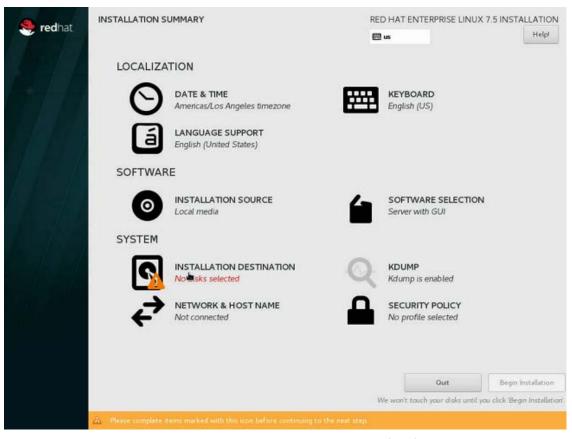


5.

6. Set up the system drive.

This step removes the Ubuntu installation in order to reclaim space for the Red Hat Enterprise Linux installation.

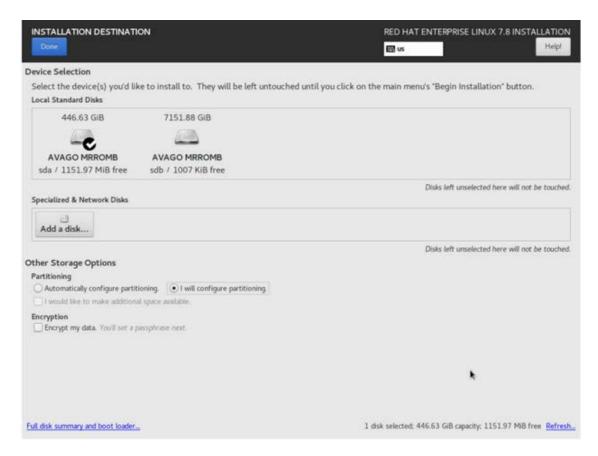
a). From the Installation Summary screen, click INSTALLATION DESTINATION.



- b). At the Installation Destination screen, select the first drive (sda) as the installation
- c). Under Other Storage Options, click the I will configure partitioning radio button then click **Done**.



Note: If the software is being installed on the DGX Station, the number of local standard disks, their labels, capacities, and the amount of free space shown may be different than the examples shown in the screen capture.



The Manual Partitioning dialog box appears.

d). Expand the **Unknown** drop-down menu for the device you've selected, select a partition and then click the "-" button to delete the partition.

Repeat for other existing partitions listed in the **Unknown** drop down until none remain.

e). Create a new partition.

Click the "+" button on the bottom left and set the following fields:

Mount point: /boot/efi

Desired Capacity: 512 MiB

Device Type: Standard Partition

Under **Devices**, ensure only the sda drive you chose is selected, then click **Update** Settings to confirm your changes.

f). Create another partition.

Click the "+" button on the bottom left and set the following fields:

- Mount point: /
- ▶ Desired Capacity: [leave empty to let the installer know to use remaining capacity of the disksl
- Device Type: Standard Partition
- ▶ File System: **XFS**

Under **Devices**, ensure only the sda drive you chose is selected, then click **Update** Settings to confirm your changes.

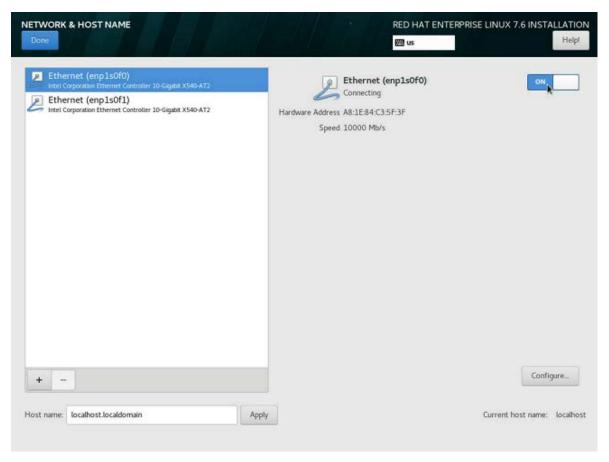
g). Click **Done** when finished.

This causes a yellow warning bar to appear on the bottom because no swap partition has been created.

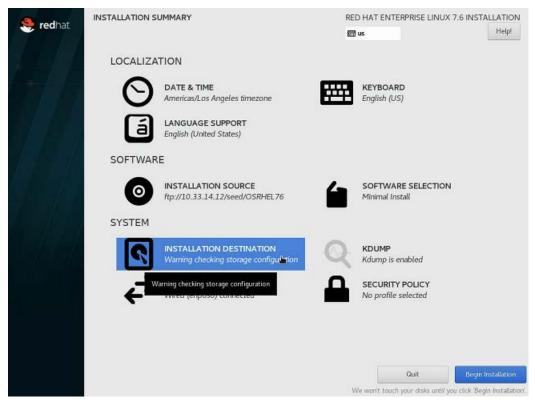
Click **Done** again and then click **Accept Changes** to write all the customizations to disk.

7. Configure Ethernet.

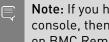
Select and enable the Ethernet device. This defaults to DHCP and can be changed for static IP configurations under Configure.



8. From the INSTALLATION SUMMARY screen, click **Begin installation** to start the installation.



- a). While the installation process is running, set your password (ROOT PASSWORD) and create a new user (USER CREATION) from the Configuration screen.
- b). When the installation completes, click **Reboot** to reboot the system.



Note: If you have installed Red Hat Enterprise Linux 7.5 and are using the BMC remote console, then follow the instructions provided in the release notes under Black screen on BMC Remote Console with Red Hat Enterprise Linux 7.5.

- 9. Register the system with the Red Hat Enterprise Customer Portal to complete the initial setup.
 - If you installed with the Server with GUI base environment, the Initial Setup starts automatically where you can accept the license agreement and register the system. See the Red Hat instructions for details.
 - If you installed with any other base environment, log on to the system as root user and then register the system.

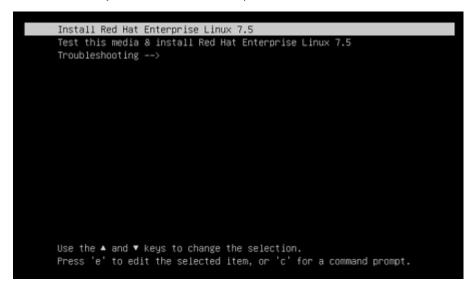
```
subscription-manager register --auto-attach --username=user name --
password=password
```

See How to register and subscribe a system to the Red Hat Customer Portal using Red Hat Subscription-Manager for further information.

Installing on the DGX-2 2.4.2.

This section assumes you have booted the Red Hat Enterprise Linux ISO image, either locally or remotely.

1. After booting the ISO image through either the BMC or from the USB drive, select Install Red Hat Enterprise Linux and then press Enter to start the installation.



The Red Hat Enterprise Linux installer starts.

For guidance on using the installer, refer to Red Hat Enterprise Linux Quick Installation Guide (https://access.redhat.com/documentation/en-us/red hat enterprise linux/7/html/ installation guide/chap-simple-install).

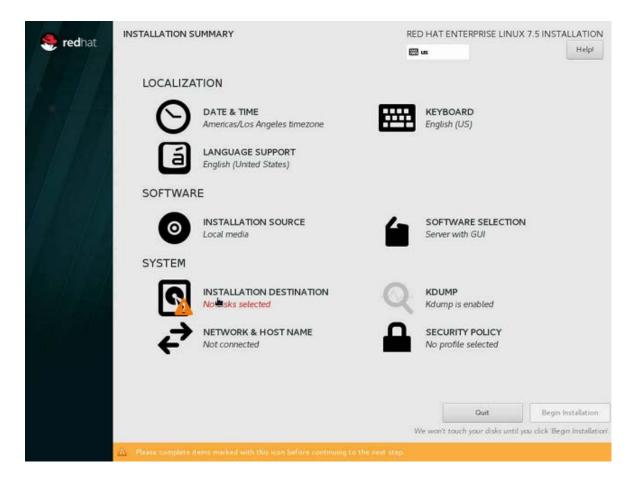
- 2. Configure the language, region, date, time, keyboard, and other configuration options you may need from the Installation Summary screen.
- 3. Select the software packages that you want to install.

For detailed instructions, refer to Software Selection in Red Hat Enterprise <u>Linux Installation Guide (https://access.redhat.com/documentation/en-us/</u> red hat enterprise linux/7/html/installation guide/sect-package-selection-x86).

- 4. Set the **Software Selection** to the correct value.
 - For DGX Station and DGX Station A100: Set to Server with GUI.
 - For DGX Servers (DGX 1-1, DGX-2, DGX A100): Set to Minimal Install.



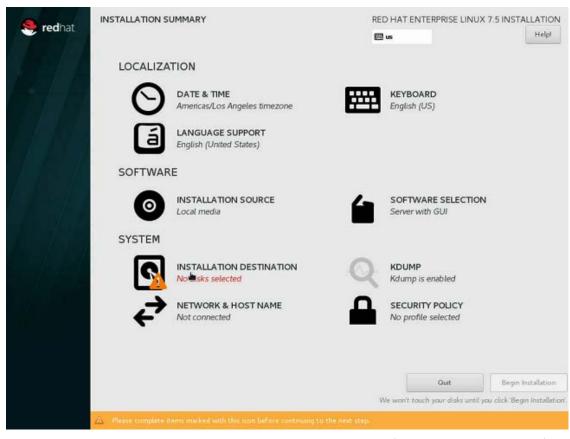
Note: Setting the correct Software Selection is critical for proper operation.



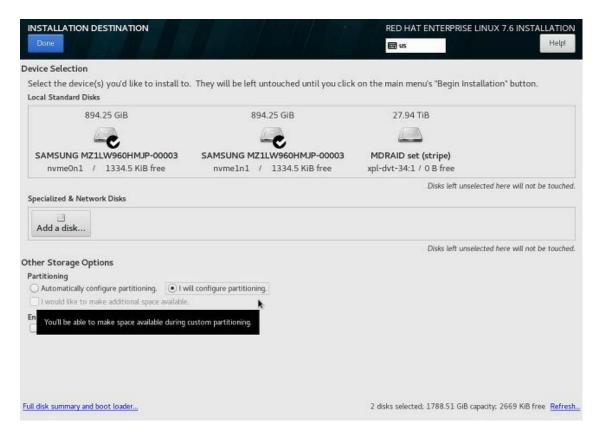
5. Set up the boot disks.

The DGX OS, which is installed in the factory before shipping out the DGX-2, creates a RAID-1 array on the two M.2 NVMe boot disks. Therefore, it is necessary to select both boot disks when installing RHEL 7 on a DGX-2.

a). From the Installation Summary screen, click INSTALLATION DESTINATION.

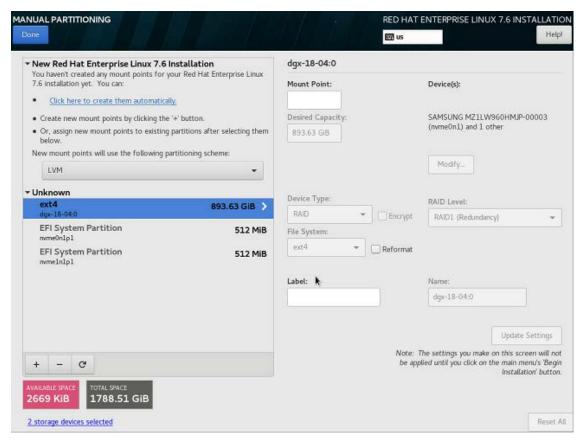


b). At the Installation Destination screen, select both M.2 disks (i.e. the 894.25 GB ones) and the "I will configure partitioning" radio button, then click Done.



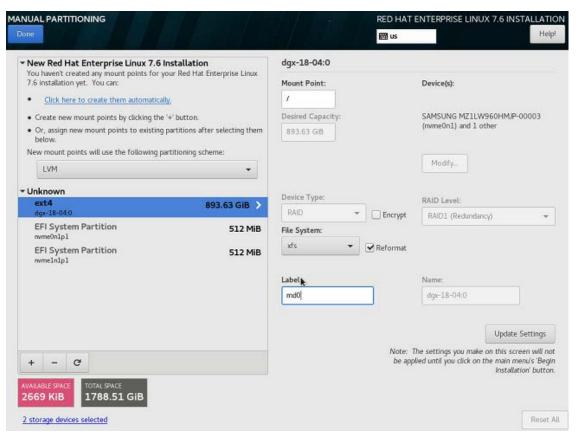
The Manual Partitioning window appears.

c). Expand the **Unknown** drop-down menu.

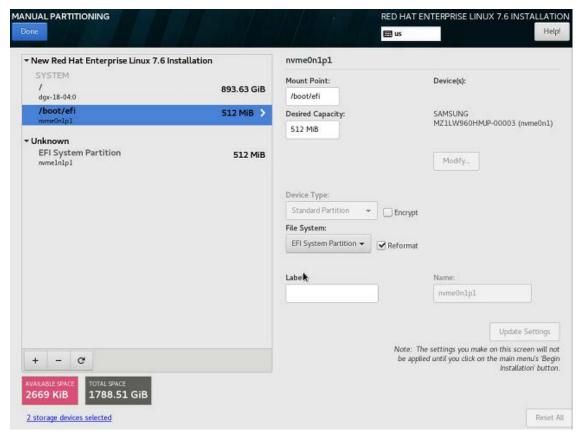


This shows the disks that Red Hat Enterprise Linux has identified. They will be

- the RAID-1 root partition (ext4, 893 GB),
- the first EFI system partition (ESP) (nvme0n1p1, 512 MB), and
- the second ESP (nvme1n1p1, 512 MB).
- d). Select the ext4 partition and reformat it as xfs, then set the mount point to "/" and label it as "md0"



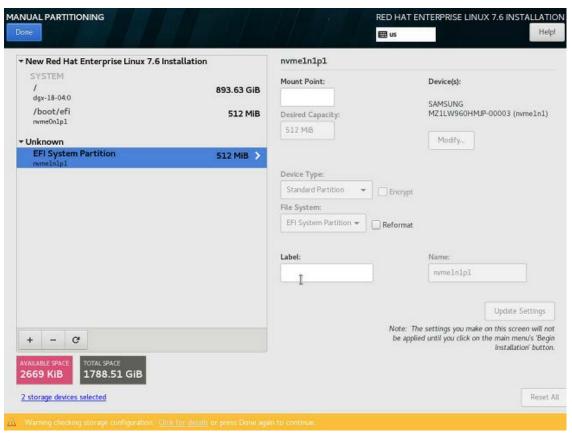
- e). Click Update Settings.
- 6. Create an EFI partition.
 - a). Select the nvme0n1p1 partition and reformat it as an EFI System Partition, then set the mount point to "/boot/efi" and click **Update Settings**.



At this point, the two partitions you configured will be under the New Red Hat Enterprise Linux Installation drop down menu, and the nvme1n1p1 EFI partition will still be in **Unknown**. We can't create a second ESP because Red Hat Enterprise Linux won't allow you to create two partitions mounted on the same mount point, i.e. /boot/ efi, even if they are on different disks. You can replicate the ESP after installing the "DGX System Management" yum group, which provides a tool to accomplish this.

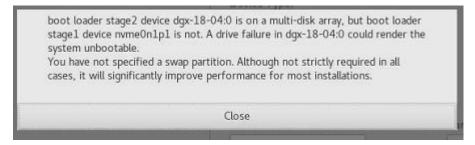
b). Click Done.

A yellow-highlighted warning appears on the bottom of the screen.



c). Click the yellow-highlighted warning message.

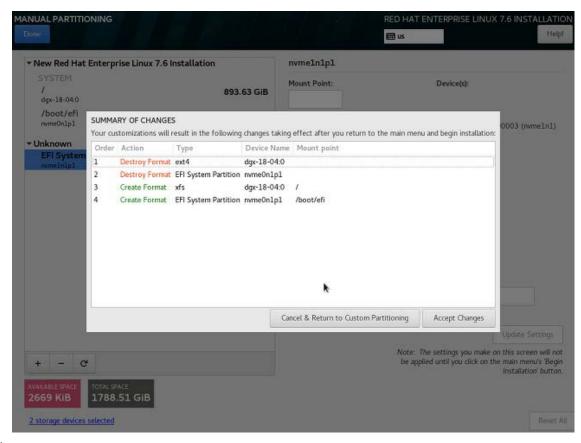
The following message appears.



The message appears because the DGX OS from the factory has created a RAID 1 array for the root partition, and has replicated the EFI system partitions.

d). Close the warning and then press **Done**.

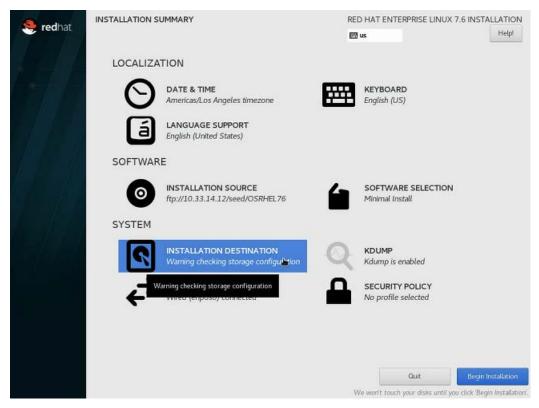
A summary of the partitioning steps appears.



e). Click Accept Changes to get back to the main Installation Summary Screen.

There should no longer be a yellow warning icon on the System: Installation **Destination** option.

- 7. Configure Ethernet.
 - Select and enable the Ethernet device. This defaults to DHCP and can be changed for static IP configurations under Configure.
- 8. From the INSTALLATION SUMMARY screen, click **Begin installation** to start the installation.



- a). While the installation process is running, set your password (ROOT PASSWORD) and create a new user (USER CREATION) from the Configuration screen.
- b). When the installation completes, click **Reboot** to reboot the system.



Note: If you have installed Red Hat Enterprise Linux 7.5 and are using the BMC remote console, then follow the instructions provided in the release notes under Black screen on BMC Remote Console with Red Hat Enterprise Linux 7.5.

- 9. Register the system with the Red Hat Enterprise Customer Portal to complete the initial setup.
 - If you installed with the Server with GUI base environment, the Initial Setup starts automatically where you can accept the license agreement and register the system. See the Red Hat instructions for details.
 - If you installed with any other base environment, log on to the system as root user and then register the system.

```
subscription-manager register --auto-attach --username=user_name --
password=password
```

See How to register and subscribe a system to the Red Hat Customer Portal using Red Hat Subscription-Manager for further information.

2.4.3. Installing on the DGX A100

This section assumes you have booted the Red Hat Enterprise Linux ISO image, either locally or remotely.

For instructions applicable to the DGX-1 and the DGX Station, see Installing on the DGX-1, DGX Station, or DGX Station A100.

For instructions applicable to the DGX-2, see <u>Installing on the DGX-2</u>.

1. After booting the ISO image through either the BMC or from the USB drive, select Install **Red Hat Enterprise Linux** and then press **Enter** to start the installation.



The Red Hat Enterprise Linux installer starts.

For guidance on using the installer, refer to Red Hat Enterprise Linux Quick Installation <u>Guide (https://access.redhat.com/documentation/en-us/</u>red hat enterprise linux/7/html/ installation quide/chap-simple-install).

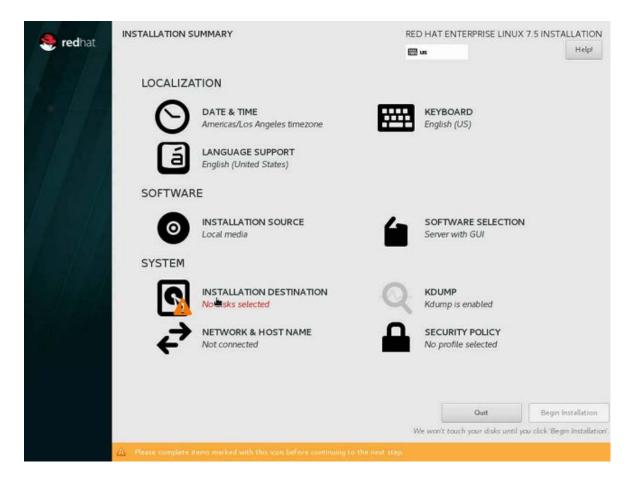
- 2. Configure the language, region, date, time, keyboard, and other configuration options you may need from the Installation Summary screen.
- 3. Select the software packages that you want to install.

For detailed instructions, refer to Software Selection in Red Hat Enterprise Linux Installation Guide (https://access.redhat.com/documentation/en-us/ red hat enterprise linux/7/html/installation guide/sect-package-selection-x86).

- 4. Set the **Software Selection** to the correct value.
 - For DGX Station and DGX Station A100: Set to Server with GUI.
 - For DGX Servers (DGX 1-1, DGX-2, DGX A100): Set to Minimal Install.



Note: Setting the correct Software Selection is critical for proper operation.



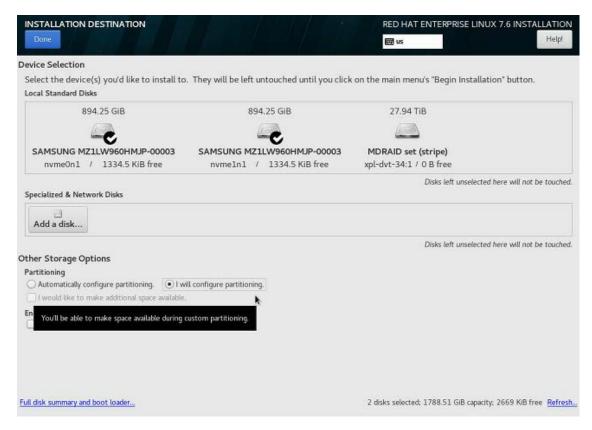
5. Set up the boot disks.

The DGX OS, which is installed in the factory before shipping out the DGX A100, creates a RAID-1 array on the two M.2 NVMe boot disks. Therefore, it is necessary to select both boot disks when installing RHEL 7 on a DGX A100.

a). From the Installation Summary screen, click INSTALLATION DESTINATION.

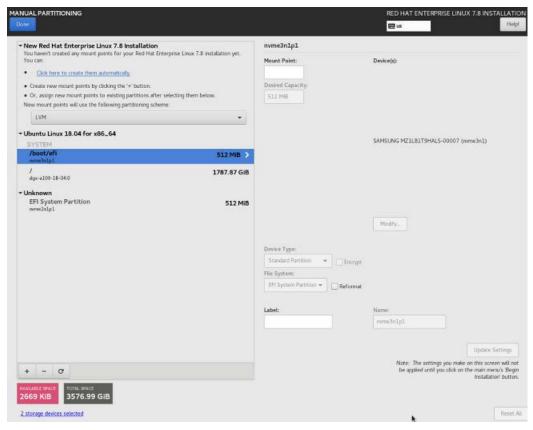


b). At the Installation Destination screen, select both M.2 disks (i.e. 1788 GiB on DGX A100) and the "I will configure partitioning" radio button, then click Done.



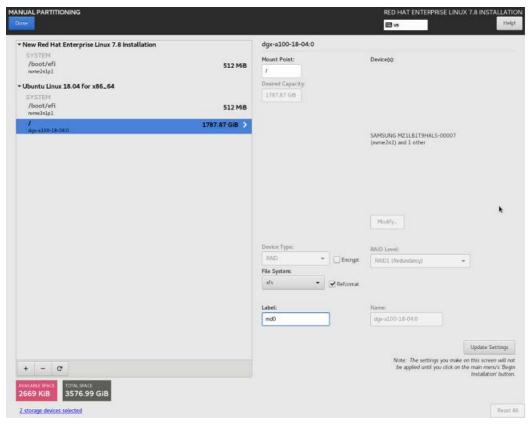
The Manual Partitioning window appears.

c). Expand the **Unknown** drop-down menu.

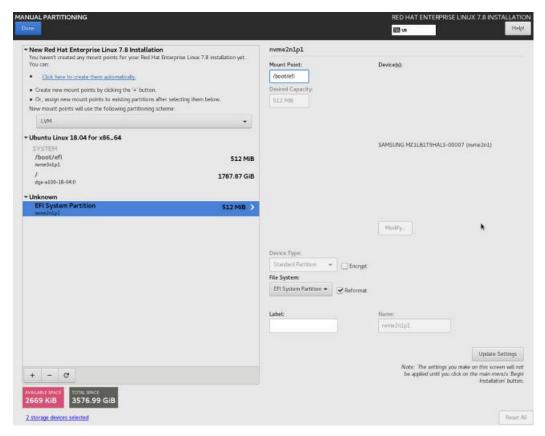


This shows the disks that Red Hat Enterprise Linux has identified. They will be

- the RAID-1 root partition (ext4, 1787.87 GB),
- the first EFI system partition (ESP) (nvme3n1p1, 512 MB), and
- the second ESP (nvme2n1p1, 512 MB).
- d). Select the ext4 partition and reformat it as xfs, then set the mount point to "/" and label it as "md0"



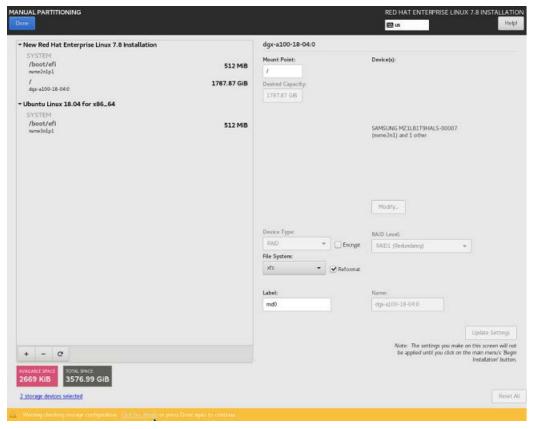
- e). Click **Update Settings**.
- 6. Create an EFI partition.
 - a). Select the second EFI partition, in the Unknown section (nvme2n1p1 on DGX A100), reformat it as an **EFI System Partition**, then set the mount point to "/boot/efi" and click Update Settings.



At this point, the two partitions you configured will be under the New Red Hat Enterprise Linux Installation drop down menu, and the Ubuntu EFI partition (nvme3n1p1 on DGX A100) will be under Ubuntu. We can't create a second ESP because Red Hat Enterprise Linux won't allow you to create two partitions mounted on the same mount point, i.e. /boot/efi, even if they are on different disks. You can replicate the ESP after installing the "DGX System Management" yum group, which provides a tool to accomplish this.

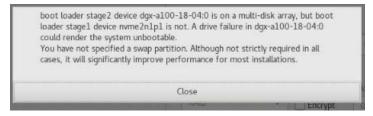
b). Click Done.

A yellow-highlighted warning appears on the bottom of the screen.



c). Click the yellow-highlighted warning message.

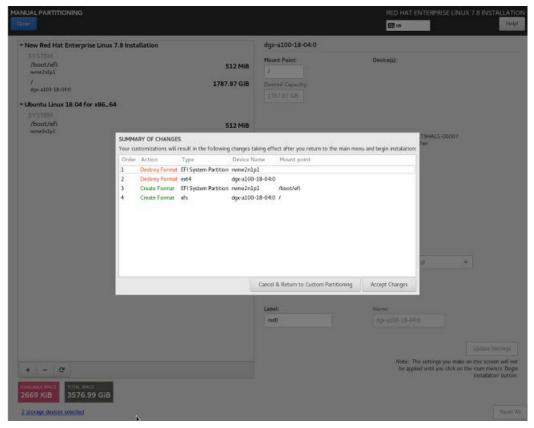
The following message appears.



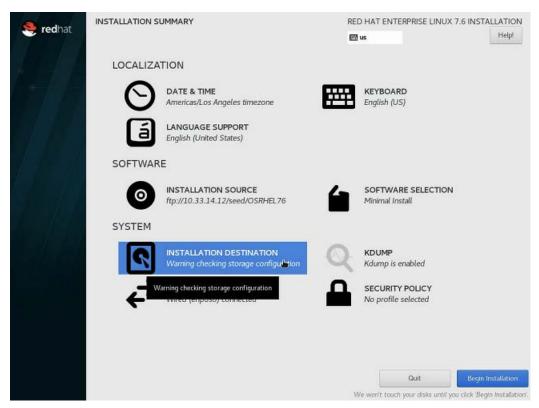
The message appears because the DGX OS from the factory has created a RAID 1 array for the root partition, and has replicated the EFI system partitions.

d). Close the warning and then click **Done**.

A summary of the partitioning steps appears.



- e). Click **Accept Changes** to get back to the main Installation Summary Screen. There should no longer be a yellow warning icon on the **System: Installation Destination** option.
- 7. Configure Ethernet.
 - Select and enable the Ethernet device. This defaults to DHCP and can be changed for static IP configurations under **Configure**. This screen also lets you set the hostname.
- 8. From the INSTALLATION SUMMARY screen, click **Begin installation** to start the installation.



- a). While the installation process is running, set your password (ROOT PASSWORD) and create a new user (USER CREATION) from the Configuration screen.
- b). When the installation completes, click **Reboot** to reboot the system.



Note: If you have installed Red Hat Enterprise Linux 7.5 and are using the BMC remote console, then follow the instructions provided in the release notes under Black screen on BMC Remote Console with Red Hat Enterprise Linux 7.5.

- 9. Register the system with the Red Hat Enterprise Customer Portal to complete the initial setup.
 - If you installed with the Server with GUI base environment, the Initial Setup starts automatically where you can accept the license agreement and register the system. See the Red Hat instructions for details.
 - If you installed with any other base environment, log on to the system as root user and then register the system.

```
subscription-manager register --auto-attach --username=user name --
password=password
```

See How to register and subscribe a system to the Red Hat Customer Portal using Red Hat Subscription-Manager for further information.

Chapter 3. Installing the DGX Software

This section requires that you have already installed Red Hat Enterprise Linux" or derived operating system on the DGX server.

Configuring a System Proxy

If your network requires use of a proxy, then

Edit the file /etc/yum.conf and make sure the following lines are present in the [main] section, using the parameters that apply to your network:

```
proxy=http://<Proxy-Server-IP-Address>:<Proxy-Port>
proxy username=<Proxy-User-Name>
proxy_password=<Proxy-Password>
```

- Make sure that the following domains are not blocked and that the system can access them.
 - cdn.redhat.com
 - international.download.nvidia.com

3.2. **Enabling the Repositories**

1. On Red Hat Enterprise Linux, run the following commands to enable additional repositories required by the DGX software.

```
sudo subscription-manager repos --enable=rhel-7-server-extras-rpms
sudo subscription-manager repos --enable=rhel-7-server-optional-rpms
```

2. Run the following commands to install the DGX software installation package and enable the NVIDIA DGX software repository.



Install the NVIDIA DGX Package for Red Hat Enterprise Linux.

```
$ sudo yum install -y https://international.download.nvidia.com/dgx/repos/rhel-
files/dgx-repo-setup-21.11-1.el7.x86 64.rpm
```

The next steps describe how to enable new driver branch repositories. Newer versions of other various packages can be made available through newer driver branch repositories. For example, enabling rhel7-updates would make 2.8.3 the highest NCCL version available, and enabling rhel7-r450-cuda11-0 afterward would bump the highest NCCL version to 2.11.4.

3. Enable the R450/CUDA 11.0 repository to move to the R450 package.

The step is required for DGX A100 and DGX Station A100, but optional for other DGX platforms.

▶ Either edit /etc/yum.repos.d/nvidia-dgx-7.repo and set enabled=1,

```
[nvidia-dgx-7-r450-cuda11-0]
name=NVIDIA DGX EL7 R450-CUDA11-0
baseurl=https://international.download.nvidia.com/dgx/repos/rhel7-r450-
cuda11-0/
enabled=1
apacheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-dgx-cosmos-support
```

- Or (if you have the yum-utils package installed), issue the following. sudo yum-config-manager --enable nvidia-dgx-7-r450-cuda11-0
- 4. (Optional) Enable the R470/CUDA 11.4 repository to move to the R470 package.

If you are moving from the R418 repo, then enable the R450 repo first as described in the previous step.

Either edit /etc/yum.repos.d/nvidia-dgx-7.repo and set enabled=1,

```
[nvidia-dgx-7-r470-cuda11-4]
name=NVIDIA DGX EL7 R470-CUDA11-4
baseurl=https://international.download.nvidia.com/dgx/repos/rhel7-r470-
cuda11-4/
enabled=1
gpgcheck=1
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-dgx-cosmos-support
```

Or (if you have the yum-utils package installed), issue the following. sudo yum-config-manager --enable nvidia-dgx-7-r470-cuda11-4

If building CUDA 11.4 Samples, install a version of GCC greater than or equal to 5.1.0. For instance, install GCC 9.1.1 by installing Red Hat Developer Toolset 9:

```
sudo yum install -y devtoolset-9
```

In this example, build CUDA samples using the following command in place of the "make"

```
scl enable devtoolset-9 make
```

3.3. Installing Required Components

3.3.1. Installing DGX Tools and Updating Configuration Files

- 1. Install the kernel development tools.
 - a). Install the kernel-devel package.

The kernel-devel package provides kernel headers required for the NVIDIA CUDA driver. Use the following command to install the kernel headers for the kernel version that is currently running on the system.

```
sudo yum install -y "kernel-devel-uname-r == $(uname -r)"
```

b). Ensure that you have installed the latest version of gcc installed, as older versions may not support all of the features required to build the driver.

```
sudo yum install -y gcc
```

- 2. Install DGX tools and configuration files.
 - ► For DGX-1, install **DGX-1 Configurations**.

```
sudo yum group install -y 'DGX-1 Configurations'
```

For the DGX-2, install DGX-2 Configurations.

```
sudo yum group install -y 'DGX-2 Configurations'
```

For the DGX A100, install DGX A100 Configurations.

```
sudo yum group install -y 'DGX A100 Configurations'
```

For the DGX Station, install DGX Station Configurations.

```
sudo yum group install -y 'DGX Station Configurations'
```

For the DGX Station A100, install DGX Station A100 Configurations.

```
sudo yum group install -y 'DGX Station A100 Configurations'
```

The configuration changes take effect only after rebooting the system, which is covered in the next step.

- 3. Update the kernel.
 - a). Issue the following.

\$ sudo yum update

Performing this update also updates the installed Red Hat Enterprise Linux 7 distribution to the latest version. To check the latest Red Hat Enterprise Linux 7 version, visit https://access.redhat.com/articles/3078.

b). Reboot the server into the updated kernel.

```
$ sudo reboot
```

3.3.2. Configuring the /raid Partition

The DGX servers and the DGX Station include multiple SSDs for data caching or data storage. Configure these SSDs as a RAID array in a partition mounted at /raid. For the DGX servers,

these SSDs are intended to be used as a data cache for NFS mounted directories. For the DGX Station, these SSDs are intended to be used either for local persistent storage or as a data cache for NFS mounted directories.

Configuring the /raid Partition as an NFS Cache

If you are using the data SSDs for caching NFS reads, configure these SSDs as a RAID 0 or RAID 5 array, mounted at /raid and update the cachefilesd configuration to use the /raid partition.

1. Configure the RAID array.

This will create the RAID group, mount it to /raid, and create an appropriate entry in / etc/fstab.

- ▶ To configure a RAID 0 array, issue the following: sudo configure_raid_array.py -c -f
- ▶ To configure a RAID 5 array, issue the following: sudo configure raid array.py -c -5 -f



Note:

The RAID array must be configured before installing dgx-conf-cachefilesd, which places the proper SELinux label on the /raid directory. If you ever need to recreate the RAID array - which will wipe out any labeling on /raid - after dgx-conf-cachefilesd has already been installed, be sure to restore the label manually before restarting cachefilesd.

sudo restorecon /raid sudo systemctl restart cachefilesd

2. Install dgx-conf-cachefilesd to update the cachefilesd configuration to use the /raid

sudo yum install -y dgx-conf-cachefilesd

Configuring the /raid Partition for Local 3.3.2.2. Persistent Storage

If you are using the data SSDs in the DGX Station for local persistent storage, configure these SSDs as a RAID 0 or RAID 5 array, mounted at /raid.

RAID 0 provides the maximum storage capacity, but does not provide any redundancy. If a single SSD in the array fails, all data stored on the array is lost. RAID 5 provides some level of protection against failure of a single SSD but with lower storage capacity than RAID 0.

To configure a RAID 0 array, run the following command.

```
sudo configure_raid_array.py -c -f
```

To configure a RAID 5 array, run the following command.

```
sudo configure raid array.py -c -f -5
```

These commands will create the RAID group, mount it to /raid, and create an appropriate entry in /etc/fstab.

3.3.3. Installing and Loading the NVIDIA CUDA **Drivers**

1. Install the driver package.

This will build and install the driver kernel modules. The installation of the dkms-nvidia package can take approximately five minutes.

sudo yum install -y cuda-drivers dgx-persistence-mode



Note: Red Hat Enterprise Linux 7.5 ships with OpenGL libraries that conflict with versions included in the CUDA drivers. Depending on the Software Selection performed in Installing Red Hat Enterprise Linux, you might encounter an error with the following libraries: mesalibGL, mesa-libEGL, or mesa-libGLES. Simply remove these libraries and re-issue the yum install command.

```
sudo rpm -e mesa-libGL.x86_64 --nodeps
sudo rpm -e mesa-libEGL.x86_64 --nodeps
sudo rpm -e mesa-libGLES.x86 64 --nodeps
sudo yum install -y cuda-drivers dgx-persistence-mode
```

2. (DGX Station 100 Only): Install additional required Station A100 packages.

These packages must be installed after installing the cuda-drivers package.

```
sudo yum install -y nvidia-conf-xconfig nv-docker-gpus
```

3. Reboot the system to load the drivers and to update system configurations.

```
sudo reboot
```

4. After the system has rebooted, verify that the drivers have been loaded and are handling the NVIDIA devices.

```
nvidia-smi
```

The output should show all available GPUs.

Example: Output from a DGX-1 system

NVIDIA-SMI 450.51.05 Driver Version: 450.51.05 CUDA Version: 11.0 GPU Name Persistence-M Bus-Id Disp.A Volatile Uncorr. ECC Fan Temp Perf Pwr:Usage/Cap Memory-Usage GPU-Util Compute M. O Tesla V100-SXM2 On 00:06:00.0 Off 0				
GPU Name				
0 Tesla V100-SXM2 On 00:06:00.0 Off 0				
1 Tesla V100-SXM2 On 00:07:00.0 Off 0				
N/A 35C P0 44W / 300W OMiB / 32480MiB 0% Default				
: :				
7 Tesla V100-SXM2 On 00:8A:00.0 Off 00 N/A 34C P0 44W / 300W 0MiB / 32480MiB 0% Default				
Processes: GPU Memory GPU PID Type Process name Usage				
No running processes found				

3.3.4. Installing the NVIDIA Container Runtime

1. Install Docker from the rhel-7-server-extras-rpms repository. sudo yum install -y docker

2. Install the NVIDIA Container Runtime group.

sudo yum groupinstall -y 'NVIDIA Container Runtime'

3. (DGX Station A100 only): Restart the nv-docker-gpus service.

\$ sudo systemctl restart nv-docker-gpus

- 4. Run the following command to verify the installation.
 - ▶ If the R418 driver package is installed: sudo docker run --security-opt label=type:nvidia container t --rm nvcr.io/ nvidia/cuda:10.0-base nvidia-smi
 - If the R450 driver package is installed: sudo docker run --security-opt label=type:nvidia container t --rm nvcr.io/ nvidia/cuda:11.0-base nvidia-smi

The output should show all available GPUs.

Example: Output on a DGX -1 system

NVIDIA-SMI 450.51.05 Drive	er Version: 450.51.05	5 CUDA Version: 11.0		
GPU Name Persistence-M Fan Temp Perf Pwr:Usage/Cap	Memory-Usage			
0 Tesla V100-SXM2 On N/A 33C P0 45W / 300W	00:06:00.0 Off	0		
1 Tesla V100-SXM2 On N/A 35C P0 44W / 300W				
	:	· •		
7 Tesla V100-SXM2 On N/A 34C P0 44W / 300W				
Processes: GPU Memory GPU PID Type Process name Usage				
=====================================				

See the section Running Containers for more information about this command. For a description of nvcr.io, see the NGC Registry Spaces documentation.

To ensure that Docker can access the NGC container registry through a proxy, refer to the Red Hat customer portal knowledge base article Configure Docker to use a proxy with or without authentication.

Installing Diagnostic Components

NVIDIA System Management (NVSM) provides the diagnostic components for NVIDIA DGX systems. NVSM is a software framework for monitoring NVIDIA DGX server nodes in a data center. It includes active health monitoring, system alerts, and log generation. The NVSM CLI can also be used for checking the health of and obtaining diagnostic information for DGX Station workstations.



Note: The diagnostic components for NVIDIA DGX systems require Python 3. It is available from the Red Hat Enterprise Linux Software Collections (https://developers.redhat.com/products/ softwarecollections/overview/). The Fedora EPEL repository also contains a version of Python 3; however, this combination has not been tested.

1. Enable the Red Hat Software Collections repository.

sudo subscription-manager repos --enable=rhel-server-rhscl-7-rpms

If you do not have access to the Red Hat Software Collections repository, refer to https:// access.redhat.com/solutions/472793 for instructions on requesting access for free.

2. Install Python 3.6.

sudo yum install -y rh-python36



Important: The diagnostic components for NVIDIA DGX systems are not supported with the python3 package. Be sure to only install the rh-python36 package.

3. Install the DGX System Management package group. sudo yum groupinstall -y 'DGX System Management'

For information about using NVSM, see the NVIDIA System Management documentation.

3.5. Replicating the EFI System Partition on DGX-2 or DGX A100

This section applies only to the NVIDIA DGX-2 and DGX A100. Once the 'DGX System Management' group is installed, the 'nvsm' tool can be used to replicate the EFI system partition (ESP) onto the second M.2 drive.



Important: Run these steps ONLY IF

- You are installing Red Hat Enterprise Linux on the NVIDIA DGX-2 or DGX A100, and
- You installed Red Hat Enterprise Linux on the RAID 1 array per instructions in the section <u>Installing on DGX-2</u> or <u>Installing on DGX A100</u> as appropriate.
- 1. Start the NVSM tool.

sudo nvsm

2. Navigate to /systems/localhost/storage/volumes/md0.

nvsm-> cd /systems/localhost/storage/volumes/md0

3. Start the rebuild process.

nvsm(/systems/localhost/storage/volumes/md0) -> start rebuild

a). At the first prompt, specify the second M.2 disk.

```
PROMPT: In order to rebuild this volume, a spare drive
       is required. Please specify the spare drive to
       use to rebuild md0.
Name of spare drive for md0 rebuild (CTRL-C to cancel): nvme1n1
```

This should be the M.2 disk on which you did NOT install the ESP.

- If you followed the instructions in the section Installing on DGX-2, this should be 'nvme1n1'
- If you followed the instructions in the section Installing on DGX A100, this should be
- b). At the second prompt, confirm that you want to proceed.

```
WARNING: Once the volume rebuild process is started, the
         process cannot be stopped.
Start RAID-1 rebuild on md0? [y/n] y
```

Upon successful completion, the following message should appear indicating that the ESP has been replicated:

```
/systems/localhost/storage/volumes/md0/rebuild started at 2019-03-07
14:40:55.844542
RAID-1 rebuild exit status: ESP_REBUILT
If necessary, the RAID 1 array is rebuilt after the ESP has been replicated.
Finished rebuilding RAID-1 on volume md0
100.0% [=======
Status: Done
```

Installing Optional Components

The DGX is fully functional after installing the components as described in Installing Required Components. If you intend to launch NGC containers (which incorporate the CUDA toolkit, NCCL, cuDNN, and TensorRT) on the DGX system, which is the expected use case, then you can skip this section.

If you intend to use your DGX system as a development system for running deep learning applications on bare metal, then install the optional components as described in this section.

1. Install the CUDA toolkit.

```
sudo yum install cuda
```

- 2. Install the NVIDIA Collectives Communication Library (NCCL) Runtime. sudo yum groupinstall 'NVIDIA Collectives Communication Library Runtime'
- 3. Install the CUDA Deep Neural Networks (cuDNN) Library Runtime. sudo yum groupinstall 'CUDA Deep Neural Networks Library Runtime'
- 4. Install NVIDIA TensorRT.

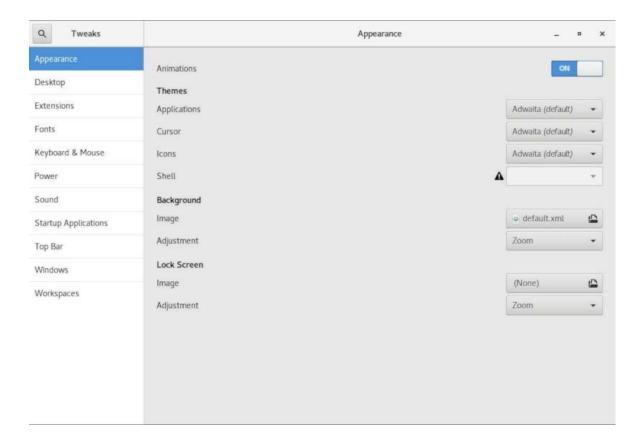
```
sudo yum install tensorrt
```

3.7. Applying an NVIDIA Look and Feel to the Desktop User Interface

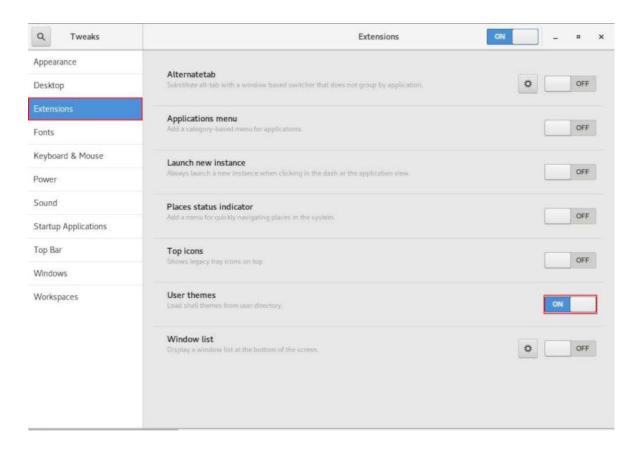
If the GNOME Desktop is installed, you can optionally apply an NVIDIA look and feel to the desktop user interface by applying the NVIDIA theme to applications and the shell, and using NVIDIA images for the desktop background and lock screen.

The GNOME Desktop must already be installed and running on your system. If SOFTWARE SELECTION was set to Server with GUI when you installed Red Hat Enterprise Linux, the GNOME Desktop is already installed. If the GNOME Desktop is not installed, you must install the X Window System and GNOME package groups.

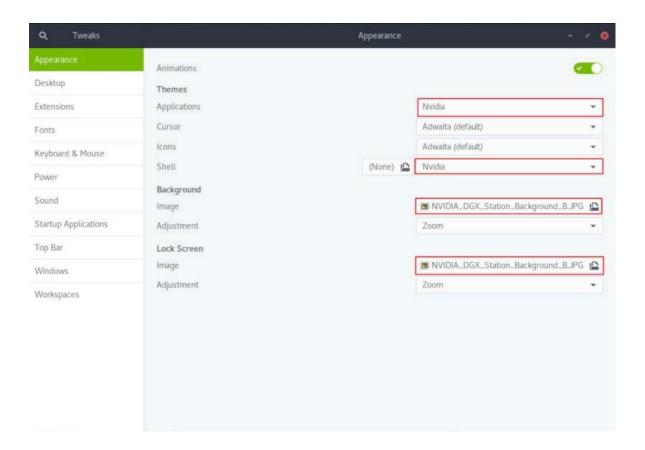
- 1. Install the DGX Desktop Theme package group. sudo yum groupinstall -y 'DGX Desktop Theme'
- 2. Start gnome-tweaks.
- In the Appearance window that opens, under Tweaks, click Extensions.



4. In the Extensions window that opens, set Extensions in the title bar and User themes to ON.



- 5. Stop and restart gnome-tweaks.
- 6. In the Appearance window that opens, apply the NVIDIA theme to applications and the shell, and use NVIDIA images for the desktop background and lock screen.
 - a). Under Themes, in the drop-down lists for Applications and Shell, click Nvidia.
 - b). Under Background and Lock Screen, click the Image file selector.
 - c). In the Image window that opens, select an NVIDIA DGX Station background image, for example, NVIDIA DGX Station Background B.JPG, and click Open.



3.8. Managing CPU Mitigations

DGX Software for Red Hat Enterprise Linux includes security updates to mitigate CPU speculative side-channel vulnerabilities. These mitigations can decrease the performance of deep learning and machine learning workloads.

If your installation of DGX systems incorporates other measures to mitigate these vulnerabilities, such as measures at the cluster level, you can disable the CPU mitigations for individual DGX nodes and thereby increase performance. This capability is available starting with DGX Software for Red Hat Enterprise Linuxsoftware version EL7-20.02.

Determining the CPU Mitigation State of the 3.8.1. **DGX System**

If you do not know whether CPU mitigations are enabled or disabled, issue the following.

\$ cat /sys/devices/system/cpu/vulnerabilities/*

▶ CPU mitigations are enabled if the output consists of multiple lines prefixed with Mitigation:.

Example

```
KVM: Mitigation: Split huge pages
Mitigation: PTE Inversion; VMX: conditional cache flushes, SMT vulnerable
Mitigation: Clear CPU buffers; SMT vulnerable
Mitigation: PTI
Mitigation: Speculative Store Bypass disabled via prctl and seccomp
Mitigation: usercopy/swapgs barriers and __user pointer sanitization
Mitigation: Full generic retpoline, IBPB: conditional, IBRS FW, STIBP:
conditional, RSB filling
Mitigation: Clear CPU buffers; SMT vulnerable
```

▶ CPU mitigations are disabled if the output consists of multiple lines prefixed with Vulnerable.

Example

```
KVM: Vulnerable
Mitigation: PTE Inversion; VMX: vulnerable
Vulnerable; SMT vulnerable
Vulnerable
Vulnerable
Vulnerable: user pointer sanitization and usercopy barriers only; no swapgs
Vulnerable, IBPB: disabled, STIBP: disabled
Vulnerable
```

3.8.2. Disabling CPU Mitigations



CAUTION: Performing the following instructions will disable the CPU mitigations provided by the DGX Software for Red Hat Enterprise Linux.

- Apply the dgx*-no-mitigations profile.
 - On a DGX-2 system, issue
 - \$ sudo tuned-adm profile dgx2-no-mitigations
 - On a DGX-1 system, issue
 - \$ sudo tuned-adm profile dgx-no-mitigations
 - On a DGX Station workstation, issue
 - \$ sudo tuned-adm profile dgxstation-no-mitigations
- 2. Reboot the system.
- Verify CPU mitigations are disabled.
 - \$ cat /sys/devices/system/cpu/vulnerabilities/*

The output should include several Vulnerable lines. See Determining the CPU Mitigation State of the DGX System for example output.

Re-enabling CPU Mitigations 3.8.3.

- 1. Apply the dgx*-performance package.
 - On a DGX-2 system, issue
 - \$ sudo tuned-adm profile dgx2-performance
 - On a DGX-1 system, issue
 - \$ sudo tuned-adm profile dgx-performance
 - On a DGX Station workstation, issue

\$ sudo tuned-adm profile dgxstation-performance

- 2. Reboot the system.
- 3. Verify CPU mitigations are enabled.

\$ cat /sys/devices/system/cpu/vulnerabilities/*

The output should include several Mitigations lines. See <u>Determining the CPU Mitigation</u> <u>State of the DGX System</u> for example output.

Chapter 4. Using the NVIDIA Mellanox InfiniBand Drivers

The DGX software stack for Red Hat-derived operating systems does not include the Mellanox OpenFabrics Enterprise Distribution (MLNX OFED) for Linux. This is to ensure that the MLNX OFED driver is in sync with the Red Hat distribution kernel. This section describes how to download, install, and upgrade MLNX_OFED on systems that are running Red Hat Enterprise Linux.

4.1. Determining the MLNX_OFED Version to Install

NVIDIA validates each release of NVIDIA EL7 software with a specific MLNX OFED version. Consult the NVIDIA EL7 release notes for the recommended MLNX_OFED version to install for a particular version of NVIDIA EL7 software.

The following table provides a quick reference for tested versions.

Red Hat Enterprise Linux Version	MLNX_OFED LTS Version
7.9	4.9-2.2.6.0
7.8	4.9-0.1.7.0
7.7	4.7-3.2.9.0

4.2. Installing the NVIDIA Mellanox InfiniBand Drivers

This section describes how to install MLNX_OFED on systems that do not yet have it installed. It is imperative that a validated MLNX OFED version is used for the RHEL version that the DGX system is running. Note that the "yum update" command that is run before installing the NVIDIA driver will update the system to the latest Red Hat Enterprise Linux version.

1. Determine which version of Red Hat Enterprise Linux is installed on the DGX system.

cat /etc/redhat-release

2. Determine the appropriate MLNX OFED software bundle to install..

Refer to Determining the MLNX OFED Version to Install.

- 3. Download the MLNX OFED software bundle.
 - a). Visit the Linux InfiniBand Drivers page, scroll down to the Download wizard, and then click the LTS Download tab.

NVIDIA EL7 software is tested only with LTS versions of MLNX OFED.

- b). At the MLNX OFED Download Center matrix, choose
 - The version to install (you may need to select Archive Versions),
 - RHEL/CentOS (under OS Distribution), and
 - ▶ The relevant OS Distribution Version and Architecture.
- c). Click the desired ISO/tgz package.

To obtain the download link, accept the End User License Agreement.

- 4. After downloading the correct MLNX_OFED software bundle, proceed with the installation steps.
 - a). Re-visit the MLNX OFED Software Releases site and select the MLNX OFED software version you intend to use.
 - b). Use the side menu to navigate to Installation->Installing MLNX OFED, and follow the instructions.
- 5. Install nvidia-mlnx-config.

```
sudo yum install -y nvidia-mlnx-config
```

6. Install kernel headers and development packages for your kernel.

These are needed for the ensuing DKMS compilation.

```
sudo yum install -y kernel-headers-$(uname -r) kernel-devel-$(uname -r)
```

7. After installing the MLNX_OFED drivers, install the NVIDIA peer memory module.

```
sudo yum install -y nvidia-peer-memory-dkms
```

- 8. Load the nv peer mem module, either
 - Manually, by issuing sudo systemctl start nv peer mem, or
 - Set up the system to start it automatically on every system boot as follows.
 - a). Create a file /etc/modules-load.d/nv-peer-mem.conf with contents "nv peer mem".
 - b). Issue sudo dracut --force /boot/initramfs-\$(uname -r).img \$(uname r)

c). Reboot the system.



Note: While in-box drivers may be available, using the in-box drivers is not recommended as they provide lower performance than the official MLNX OFED drivers and they do not support the GPUDirectTM RDMA feature. For more information on configuring the in-box drivers, see the following Red Hat Enterprise Linux documentation:

- Configuring InfiniBand and RDMA Networks, and
- InfiniBand and RDMA Related Software Packages

4.3. Updating the NVIDIA Mellanox InfiniBand Drivers

This section describes how to update MLNX OFED on systems that already have it installed. The Mellanox InfiniBand Drivers in RPM packages are precompiled for a specific kernel version. It is imperative that a validated MLNX_OFED version is used for the Red Hat Enterprise Linux version that the DGX system has been updated to. There is no need to uninstall the current MLNX OFED first, because the "mlnxofedinstall" script will automatically uninstall any previously installed versions.



Note: The MLNX OFED drivers support Red Hat Enterprise Linux weak-modules script. This means that any updates to the kernel within the same Red Hat Enterprise Linux version (for example, 7.9) will not require an update to the MLNX OFED driver.

- 1. Upgrade the Red Hat Enterprise Linux release and kernel version. sudo yum update
- 2. Determine which version of Red Hat Enterprise Linux is installed on the DGX system. cat /etc/redhat-release
- 3. Determine the appropriate MLNX_OFED software bundle to install.
 - Refer to Determining the MLNX OFED Version to Install.
- 4. Download the MLNX_OFED software bundle.
 - a). Visit the Linux InfiniBand Drivers page, scroll down to the Download wizard, and then click the LTS Download tab.

NVIDIA EL7 software is tested only with LTS versions of MLNX OFED.

- b). At the MLNX_OFED Download Center matrix, choose
 - ▶ The version to install (you may need to select **Archive Versions**),
 - RHEL/CentOS (under OS Distribution). and

- The relevant OS Distribution Version and Architecture.
- c). Click the desired ISO/tgz package.

To obtain the download link, accept the End User License Agreement.

5. Mount the downloaded ISO somewhere on the system.

The following example shows the ISO being mounted on the /mnt directory.

sudo mount MLNX OFED LINUX-<version>.iso /mnt

- 6. Prepare to install the driver.
 - a). Remove nvidia-mlnx-config and nvidia-peer-memory-dkms.

sudo dnf remove -y nvidia-mlnx-config nvidia-peer-memory-dkms The mlnxofedinstall step will remove packages prior to installing new ones, causing nvidia-mlnx-config and nvidia-peer-memory-dkms to fall out because they depend on some of these removed packages. Removing those components ahead of time avoids issues. These will be reinstalled as a final step.

- b). Specify the new kernel version to use when installing the driver. NEXTKERNEL=\$(sudo grubby --default-kernel | sed 's/.*vmlinuz\-//g')
- 7. Install the driver with the -k and -s flags to specify the new kernel version and kernel source path.

sudo /mnt/mlnxofedinstall -k \${NEXTKERNEL} -s /lib/modules/\${NEXTKERNEL}/build --



Note: The system may report that additional software needs to be installed before performing the installation. If such a message appears, install the software and then retry installing the MLNX OFED driver.

8. Reboot.

sudo reboot

9. Reinstall nvidia-mlnx-config and nvidia-peer-memory-dkms.

sudo yum install -y nvidia-mlnx-config nvidia-peer-memory-dkms

- 10. Load the nv peer mem module, either
 - Manually, by issuing sudo systemctl start nv peer mem, or
 - ▶ Set up the system to start it automatically on every system boot as follows.
 - a). Create a file /etc/modules-load.d/nv-peer-mem.conf with contents "nv peer mem".
 - b). Issue sudo dracut --force /boot/initramfs-\$(uname -r).img \$(uname -
 - c). Reboot the system.

Chapter 5. Running Containers

The following is an example of running the CUDA container from the NGC registry.

sudo docker run --security-opt label=type:nvidia container t --rm nvcr.io/nvidia/ cuda:10.0-base nvidia-smi



Note: To accommodate SELinux, the DGX software stack includes a package (nvidiacontainer-selinux) that defines a policy for allowing containers to access NVIDIA GPUs. The --security-opt option in the command sets the corresponding label type permitting the specified container to access NVIDIA GPUs. If SELinux is removed or disabled, then the -security-opt option is not needed.

Configuring Storage - NFS Chapter 6. Mount and Cache

The DGX servers and the DGX Station include multiple SSDs for data caching or data storage.

- The DGX-1 server contains four SSDs to be used in a RAID 0 configuration.
- The DGX-2 server contains 8 or 16 SSDs to be used in a RAID 0 configuration.
- The DGX A100 server contains 4 or 8 SSDs to be used in a RAID 0 configuration.
- The DGX Station contains three SSDs to be used in a RAID 0 or RAID 5 configuration.

For the DGX servers, these SSDs are intended to be used as a data cache for NFS mounted directories. For the DGX Station, these SSDs are intended to be used either for local persistent storage or as a data cache for NFS mounted directories. If you are using these SSDs as a data cache for NFS mounted directories, you must set up your own NFS mounted directories for long-term data storage.

The following instructions describe how to mount the NFS directories onto the DGX system, and how to cache the NFS using the DGX SSDs for improved performance.

Make sure that you have an NFS server with one or more exports with data to be accessed by the DGX System, and that there is network access between the DGX System and the NFS server.

1. Install the nfs packages.

\$ sudo yum install nfs-utils

- 2. Configure an NFS mount for the DGX.
 - a). Edit the filesystem tables configuration.

```
sudo vi /etc/fstab
```

b). Add a new line for the NFS mount, using the local mount point of /mnt.

```
<nfs_server>:<export_path> /mnt nfs
rw,noatime,rsize=32768,wsize=32768,nolock,tcp,intr,fsc,nofail 0 0
```

/mnt is used here as an example mount point.

Consult your Network Administrator for the correct values for <nfs_server> and <export path>.

The nfs arguments presented here are a list of recommended values based on typical use cases. However, "fsc" must always be included as that argument specifies use of FS-Cache.

- c). Save the changes.
- 3. Verify the NFS server is reachable.

ping <nfs_server>

Use the server IP address or the server name provided by your network administrator.

4. Mount the NFS export.

sudo mount /mnt

/mnt is the example mount point used in step 1.

5. Verify caching is enabled.

cat /proc/fs/nfsfs/volumes

Look for the text FSC=yes in the output. The NFS will be mounted and cached on the DGX System automatically upon subsequent reboot cycles.

Appendix A. Installing Software on Air-Gapped NVIDIA DGX **Systems**

When installing Red Hat Enterprise Linux on DGX systems, many of the packages that the DGX system requires are downloaded over the internet from both Red Hat and NVIDIA servers. This is not suitable for tightly secured systems which must be "Air-Gapped"; isolated from the internet or outside networks.

For air-gapped systems, Red Hat provides tools (createrepo and reposync) to make local mirrors of the internet available repositories. These repository mirrors can then be copied into the air-gapped environment and activated on the DGX system for installation.

This document assumes that you have created a mirror of the Red Hat repositories. For the NVIDIA repositories, it provides steps for mirroring NVIDIA repositories on a "low-side" system that has public internet access, and then copying and activating the repositories to an airgapped DGX system. It also includes a process for installing Docker containers.

Registering Your System

See the Red Hat customer portal knowledge base article How to register and subscribe a system offline to the Red Hat Customer Portal.

A.2. Creating the Mirrors on the Low-Side Red Hat System

Perform these tasks on a system with network access (low-side Red Hat system), where low-side-user

represents the username on the low-side system.

my-mirror

represents the folder where the mirrored files are create or stored.

1. Set up a directory for creating the mirror. mkdir /home/<low-side-user>/<my-mirror>

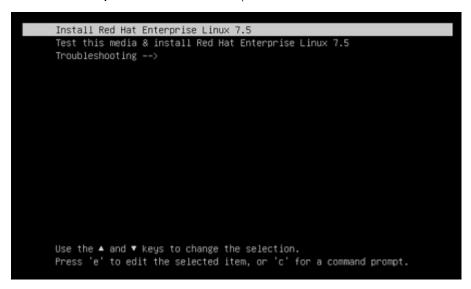
- 2. Mirror the nvidia-dgx-7 repo.
 - a). cd /home/<low-side-user>/<my-mirror>
 - b).sudo reposync --newest-only --gpgcheck -l --repoid nvidia-dgx-7 -download path=/home/<low-side-user>/<my-mirror> --downloadcomps -download-metadata
 - c). cd nvidia-dgx-7/
 - d).sudo createrepo -v /home/<low-side-user>/<my-mirror>/nvidia-dgx-7 -g
 - e).cp /etc/yum.repos.d/nvidia-dgx-7.repo /home/<low-side-user>/<mymirror>/nvidia-dgx-7/
 - f).cp/etc/pki/rpm-gpg/RPM-GPG-KEY-dgx-cosmos-support/home/<low-sideuser>/<my-mirror>/nvidia-dgx-7/
- 3. Mirror the nvidia-dgx-7-updates repo
 - a). cd /home/<low-side-user>/<my-mirror>
 - b). sudo reposync --newest-only --gpgcheck -l --repoid nvidia-dgx-7updates --download path=path/to/mirrored/files --downloadcomps -download-metadata
 - c). sudo createrepo -v /home/<low-side-user>/<my-mirror>/nvidia-dqx-7updates
- 4. Mirror the rhel-7-server-extras-rpms repo.
 - a).cd /home/<low-side-user>/<my-mirror>
 - b).sudo reposync --newest-only --gpgcheck -l --repoid rhel-7-serverextras-rpms --download path=/home/<low-side-user>/<my-mirror> -downloadcomps --download-metadata
 - c).cd rhel-7-server-extras-rpms/
 - d).sudo createrepo -v /home/<low-side-user>/<my-mirror>/rhel-7-serverextras-rpms -q comps.xml
 - e]. sudo cp /etc/yum.repos.d/redhat repo /home/<low-side-user>/<mymirror>/rhel-7-server-extras-rpms/
 - f). sudo cp /etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release /home/<low-sideuser>/<my-mirror>/rhel-7-server-extras-rpms
- 5. Mirror the rhel-7-server-optional-rpms repo
 - a).cd /home/<low-side-user>/<my-mirror>
 - b). sudo reposync --newest-only --gpgcheck -l --repoid rhel-7-serveroptional-rpms --download path=/home/<low-side-user>/<my-mirror> -downloadcomps --download-metadata
 - c). cd rhel-7-server-optional-rpms/
 - d).sudo createrepo -v /home/<low-side-user>/<my-mirror>/rhel-7-serveroptional-rpms -q comps.xml
- 6. Mirror the rhel-7-server-rpms repo
 - a).cd /home/<low-side-user>/<my-mirror>

- b). sudo reposync --newest-only --gpgcheck -l --repoid rhel-7-server-rpms --download path=/home/<low-side-user>/<my-mirror> --downloadcomps -download-metadata
- c). cd rhel-7-server-rpms/
- d).sudo createrepo -v /home/<*low-side-user>/<my-mirror*>/rhel-7-serverrpms -q comps.xml
- 7. Mirror the rhel-server-rhscl-7-rpms repo.
 - a). cd /home/<low-side-user>/<my-mirror>
 - b). sudo reposync --newest-only --gpgcheck -l --repoid rhel-serverrhscl-7-rpms --download path=/home/<low-side-user>/<my-mirror> -downloadcomps --download-metadata
 - c). cd rhel-server-rhscl-7-rpms/
 - d).sudo createrepo -v /home/<low-side-user>/<my-mirror>/rhel-serverrhscl-7-rpms -q comps.xml
- 8. Create an archive of the mirrored repos.

tar cf <mirror-archive-name>.tar <username>

Installing Red Hat Enterprise Linux A.3. on the Air-Gapped DGX-2/DGX A100

1. After booting the ISO image through either the BMC or from the USB drive, select Install **Red Hat Enterprise Linux** and then press **Enter** to start the installation.



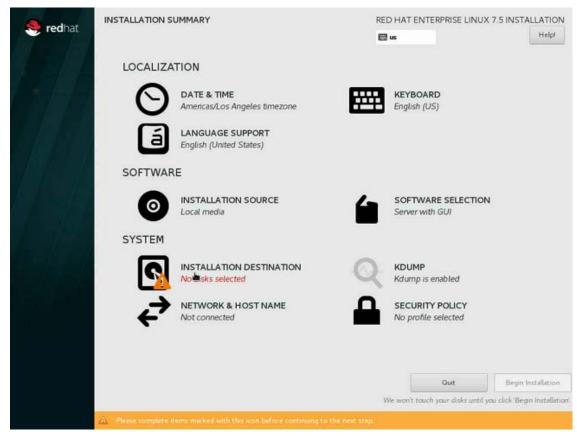
2. Refer to the Red Hat Enterprise Linux Quick Installation Guide (https://access.redhat.com/ documentation/en-us/red hat enterprise linux/7/html/installation quide/chap-simple-<u>install</u>) for guidance on using the installer.

Configure the language, region, date, time, keyboard, and other configuration options you may need from the **Installation Summary** screen.

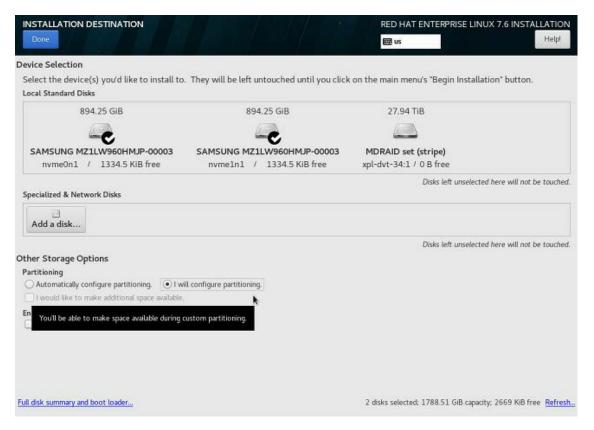
- 3. Set up the system drives.
 - a). Remove all partitions.

At the Installation Destination screen, select both M.2 (894.25 GB on DGX-2 or 1788 GB on DGX A100) disks, the "Automatically configure partitioning" radio button and the I would like to make additional space available check box, then click Done.

- b). At the Reclaim Disk Space screen, click Reclaim Space.
- 4. Create EFI partitions.
 - a). From the Installation Summary screen, click INSTALLATION DESTINATION to create new partitions.



b). At the Installation Destination screen, select both M.2 (894.25 GB on DGX-2 or 1788 GB on DGX A100) disks and the "I will configure partitioning" radio button, then click Done.



The Manual Partitioning window appears.

c). Create a new partition.

At the Manual Partitioning screen, use the **Standard Partition** and then click "+".

- d). Add the mount point for the first EFI partition.
 - Set the Mount Point to /boot/efi and the Desired Capacity to 512 MB, then click Add mount point.
- e). Verify that the installer selects drive nvme0n1p1 (DGX-2) or nvme3n1p1 (DGX A100).
 - If the correct drive is not designated, then click **Modify** and then select the correct drive from the Configure Mount Point dialog box and click Select.
- f). Click "+" to create the alternate EFI boot partition.
- g). Add the mount point for the alternate EFI partition.
 - Set the Mount Point to /boot/efi2 and the Desired Capacity to 512 MB, then click Add mount point
- 5. Create the RAID 1 partition.
 - a). Click "+" to add a new partition.
 - b). Add the mount point for the RAID partition.
 - Set the Mount Point to / and leave the Desired Capacity empty, then click Add mount point.
 - c). Select the new system partition and set the following.

Device Type RAID

RAID-Level

RAID1

Name

md0/

- 6. Verify the following assignments:
 - ▶ DGX-2: /boot/efi is assigned drive nvme0n1p1 and /boot/efi2 is assigned drive nvme1n1p1
 - ▶ DGX A100: /boot/efi is assigned drive nvme3n1p1 and /boot/efi2 is assigned drive nvme2n1p1

Occasionally, the partition names will change. If that happens, select the desired drive and click **Modify->Update settings** to correct.

- 7. Click **Done** to exit and commit the new partition scheme, then click **Accept Changes**.
- 8. Continue following the steps starting with -
 - ▶ DGX-2: Step 5 of Installing on the DGX-2.
 - DGX A100: Step 5 of <u>Installing on the DGX A100</u>

Installing DGX Software on the Air-Α.4. Gapped DGX-2/DGX A100

Perform these tasks on the air-gapped DGX-2 or DGX A100 system, where

dgx-user

represents the DGX user

my-mirror

represents the folder where the mirrored files are create or stored

1. After the system has rebooted, log in and verify the partitioning scheme & correct EFI mount;

NVSM requires the RAID-1 volume to be named md0, and the EFI boot partition to be correctly ordered.

a). Verify that the partition scheme matches the output shown for the following commands:

```
$ ls -ldh /dev/md*
drwxr-xr-x. 2 root root 80 Aug 9 17:26 /dev/md
brw-rw---. 1 root disk 9, 0 Aug 9 17:26 /dev/md0
brw-rw---. 1 root disk 9, 127 Aug 9 17:26 /dev/md127
$ sudo mdadm --detail /dev/md0 | grep nvme
0 259 3 0 active sync /dev/nvme0n1p2
1 259 5 1 active sync /dev/nvme1n1p2
$ sudo lsblk -f | grep efi
```

```
-nvme0n1p1 vfat /boot/efi
-nvmeln1p1 vfat /boot/efi2
```

If the RAID-1 volume is not named md0, see the Appendix: Renaming RAID Volumes for instructions on how to rename the RAID volume.

- b). Edit /etc/fstab and remove the line to mount /boot/efi2.
- 2. Copy over and enable the repo mirror on the DGX-2 system.
 - a). Switch to the directory to place the mirrored repo.

```
cd /home/<dgx-user>
```

b). Secure-copy the mirrored archive from the low-side system.

```
scp <dgx-user>@<low-side-ip-address>:home/<dgx-user>/<mirror-archive-</pre>
```

c). Extract the mirrored archive.

```
sudo tar xf <mirror-archive-name>.tar
```

d). Copy the rhel-7-server-extras and nvidia-dgx-7 repos to the yum.repos.d.

```
sudo cp ./<my-mirror>/rhel-7-server-extras-rpms/redhat.repo /etc/yum.repos.d/
redhat-mirror.repo
```

```
sudo cp ./<my-mirror>/nvidia-dgx-7/nvidia-dgx-7.repo /etc/yum.repos.d/
```

e). Edit /etc/yum.repos.d/nvidia-dgx-7.repo.

Change the nvidia-dgx-7 repo

From:

```
baseurl=https://international.download.nvidia.com/dgx/repos/rhel7/
```

To:

```
baseurl=file:///home/<dgx-user>/<my-mirror>/nvidia-dgx-7
```

Change nvidia-dgx-7-updates repo

From:

baseurl=https://international.download.nvidia.com/dgx/repos/rhel7-updates/

baseurl=file:///home/<dqx-user>/<my-mirror>/nvidia-dqx-7-updates

Change enabled=0 to enabled=1

- f). For each of the following repos (\$reponame):
 - rhel-7-server-extras-rpms
 - rhel-7-server-optional-rpms
 - rhel-7-server-rpms
 - rhel-server-rhscl-7-rpms

Edit /etc/yum.repos.d/redhat-mirror.repo, find the \$reponame section (listed in brackets), and change the text in that section:

```
baseurl=https://cdn.redhat.com/content/dist/rhel/server/7/.
```

```
baseurl=file:///home/<dgs-user>/<my-mirror>/$reponame
```

Set enabled = 1.

g). Copy the GPG key file to your system.

```
sudo cp <my-mirror>/nvidia-dgx-7/RPM-GPG-KEY-dgx-cosmos-support /etc/pki/rpm-
```

h). List the repositories and verify that all 11 repositories are enabled.

sudo yum repolist

The output should look like the following:

```
Loaded plugins: product-id, search-disabled-repos, subscription-manager
This system is not registered with an entitlement server. You can use
subscription-manager to register.
Repo rhel-7-server-extras-rpms forced skip if unavailable=True due to:
/etc/pki/entitlement/9124846071548788754.pem
Repo rhel-7-server-extras-rpms forced skip_if_unavailable=True due to:
/etc/pki/entitlement/9124846071548788754-key.pem
Repo rhel-7-server-rpms forced skip if unavailable=True due to:
/etc/pki/entitlement/9124846071548788754.pem
Repo rhel-7-server-rpms forced skip if unavailable=True due to:
/etc/pki/entitlement/9124846071548788754-key.pem
Repo rhel-7-server-optional-rpms forced skip if unavailable=True due to:
/etc/pki/entitlement/9124846071548788754.pem
Repo rhel-7-server-optional-rpms forced skip if unavailable=True due to:
/etc/pki/entitlement/9124846071548788754-key.pem
Repo rhel-server-rhscl-7-rpms forced skip_if_unavailable=True due to:
/etc/pki/entitlement/3657713380925279193.pem
Repo rhel-server-rhscl-7-rpms forced skip_if unavailable=True due to:
/etc/pki/entitlement/3657713380925279193-key.pem
nvidia-dgx-7
                                                   3.6 kB 00:00
nvidia-dgx-7-updates
                                                 | 2.9 kB 00:00
rhel-7-server-extras-rpms
                                                   3.6 kB 00:00
rhel-7-server-optional-rpms
                                                 | 3.6 kB 00:00
rhel-7-server-rpms
                                                  3.6 kB 00:00
rhel-server-rhscl-7-rpms
                                                 | 3.6 kB 00:00
(1/11): nvidia-dgx-7/group gz
                                                 | 644 B 00:00
(2/11): rhel-7-server-optional-rpms/group gz
                                                 | 6.4 kB 00:00
(3/11): nvidia-dgx-7/primary db
                                                 | 70 kB 00:00
(4/11): rhel-7-server-optional-rpms/primary db
                                                | 2.1 MB 00:00
(5/11): rhel-7-server-rpms/group gz
                                                 | 150 kB 00:00
                                                 | 56 kB 00:00
(6/11): nvidia-dgx-7-updates/primary db
(7/11): rhel-7-server-rpms/primary db
                                                 | 4.4 MB 00:00
(8/11): rhel-7-server-extras-rpms/group_gz (9/11): rhel-7-server-extras-rpms/primary_db
                                                | 133 B 00:00
                                                | 85 kB 00:00
(10/11): rhel-server-rhscl-7-rpms/group gz
                                                | 133 B 00:00
(11/11): rhel-server-rhscl-7-rpms/primary db
                                               | 3.0 MB 00:00
repo id
                            repo name
status
nvidia-dgx-7
                            NVIDIA DGX EL7
146
nvidia-dgx-7-updates
                           NVIDIA DGX EL7 Updates
101
rhel-7-server-extras-rpms
                           Red Hat Enterprise Linux 7 Server - Extras (R
rhel-7-server-optional-rpms Red Hat Enterprise Linux 7 Server - Optional
5,190
rhel-7-server-rpms
                            Red Hat Enterprise Linux 7 Server (RPMs)
5,457
rhel-server-rhscl-7-rpms
                           Red Hat Software Collections RPMs for Red Hat
7.123
repolist: 18,168
```

Continue following the installation steps beginning with <u>Installing Required Components</u>.

Renaming RAID Volumes A.5.

The RAID volume should be /dev/md0. If, during the installation process the volume is incorrectly named /dev/md/root, then rename the volume as follows.

- 1. Convert /dev/md/root to /dev/md0.
 - a). Edit /dev/mdadm.conf.
 - Example: sudo vi /dev/mdadm.conf
 - b). Replace /dev/md/root with /dev/md0.
- 2. Save the file and then reboot.

Installing Docker Containers

This method applies to Docker containers hosted on the NGC Container Registry. Most container images are freely available, but some are locked and require that you have an NGC account to access. See the NGC Registry for DGX User Guide for instructions on accessing locked container images.

- 1. Enter the docker pull command, specifying the image registry, image repository, and tag. docker pull nvcr.io/nvidia/repository:tag
- 2. Verify the image is on your system using docker images.

docker images

3. Save the Docker image as an archive.

docker save nvcr.io/nvidia/repository:tag > framework.tar

- 4. Transfer the image to the air-gapped system using removable media such as a USB flash drive.
- 5. Load the NVIDIA Docker image.

docker load -i framework.tar

6. Verify the image is on your system.

docker images

Appendix B. Installing Software Using Local Repositories

As an alternative to the reposync method described in Appendix A, software can also be installed using local repos. These repos provided by NVIDIA will install all of the available packages locally in the filesystem, allowing installation of packages without network access

B.1. Installing the Base Red Hat Enterprise Linux System

The Red Hat components of the software must be installed either using the standard networkbased installation, or as described in Appendix A. This includes registering and subscribing to the Red Hat Customer Portal.

If the system is connected to the network, follow the steps of the standard Red Hat installation, then enable the additional Red Hat repositories. Finally, execute:

```
sudo yum update -y
sudo yum install -y kernel-devel kernel-headers
```

If the system is not connected to the network, follow the instructions in Appendix A to mirror the Red Hat repositories using reposync.

Downloading the Local Repositories

Download the DGX Software local repository from https://international.download.nvidia.com/ dgx/repos/rhel-files/dgx-local-repo-22.04-1.el7.x86 64.rpm

Installing the Local Repositories B 3

Install the local repositories

```
$ sudo yum install -y ./dgx-local-repo-22.04-1.el7.x86 64.rpm
```

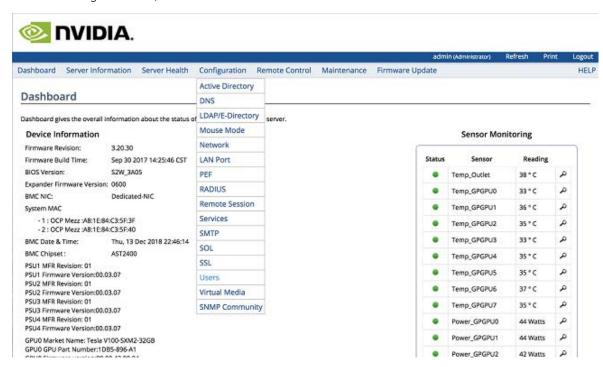
With the local repositories installed, proceed with the standard <u>Installing the DGX Software</u> instructions

Appendix C. Changing the BMC Login

The NVIDIA DGX server includes a base management controller (BMC) for out-of-band management of the DGX system. NVIDIA recommends disabling the default username and creating a unique username and password as soon as possible.

C.1. Changing the BMC Login on the DGX-1

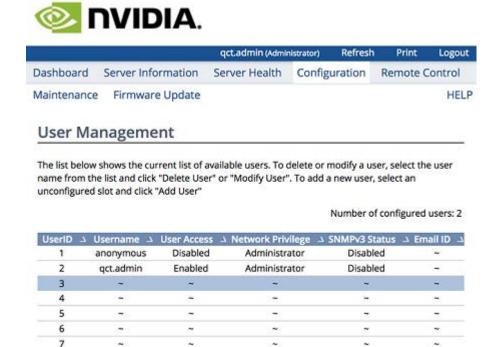
- 1. Log into the BMC.
 - a). Open a browser within your LAN and go to http://<BMC-ip-address>/. Use Firefox or Internet Explorer. Google Chrome is not officially supported by the DGX-1 BMC.
 - b). Log in, using qct.admin/qct.admin for the User ID/Password.
- 2. Select Configuration \rightarrow Users.



3. Add a new user.

8 9 10

a). Select an empty field and click Add User.

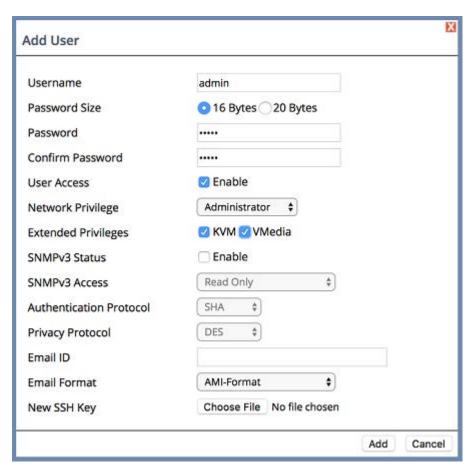


Modify User

Delete User

Add User

b). Enter new user information and click Add.



- 4. Log out and then log back in as the new user.
- 5. Select Configuration \rightarrow Users.
- 6. Disable User Access for the user qct.admin.
 - a). Select the user qct.admin user and select Modify User

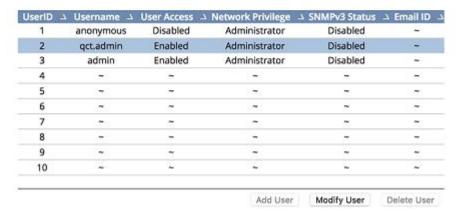




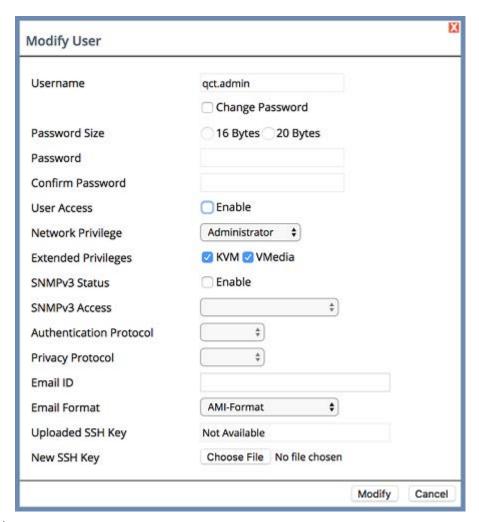
User Management

The list below shows the current list of available users. To delete or modify a user, select the user name from the list and click "Delete User" or "Modify User". To add a new user, select an unconfigured slot and click "Add User"

Number of configured users: 3

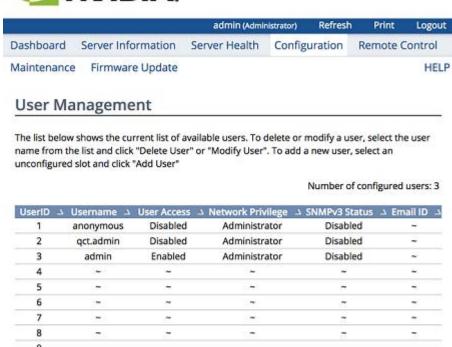


b). Deselect Enable in User Access and click Modify.



c). Ensure User Access is disabled for the user qct.admin.





7. Log out.

Changing the BMC Login on the DGX-2 or DGX A100

Add User

Modify User

Delete User

1. Log into the BMC.

10

- a). Open a browser within your LAN and go to https://<BMC-ip-address>/.
- b). Log in, using admin/admin for the User ID/Password.
- 2. Select **Settings** from the left-side navigation menu.
- 3. Select the **User Management** card.



- 4. Click the green Help icon (?) for information about configuring users, then add a new user with unique username and strong password.
- 5. Log out and then log back in as the new user.
- 6. Select **Settings** \rightarrow **User Management**.
- 7. Disable the **admin** and **anonymous** users.

Appendix D. Using Custom DGX Software Utilities for the **DGX Station**

The DGX Software includes custom utilities for maintaining the DGX Station persistent storage. Custom utilities for managing and obtaining diagnostic information for the DGX Station were included **only** in version EL7-20.01 of the DGX Software.

Rebuilding or Re-Creating the DGX D.1. Station RAID Array

Failure of a single drive in a RAID 5 array is a recoverable error but the failure causes data redundancy for the array to be lost. After replacing a single failed SSD in a RAID 5 array, you must rebuild the array to restore data redundancy for the array. Failure of any number of SSDs in a RAID 0 array and failure of more than one SSD in a RAID 5 array are both unrecoverable failures. After replacing the SSDs in response to an unrecoverable failure, you must re-create the array.

If the DGX Station RAID array is degraded because one or more SSDs failed, replace each failed SSD as explained in <u>DGX Station User Guide</u>.

The DGX Station software includes the custom script configure raid array.py for rebuilding or re-creating the RAID array.

To rebuild a RAID 5 array after replacing a single failed SSD, run the following command:

```
$ sudo configure raid array.py -r
```



Note: The time required to rebuild a RAID 5 array depends on factors such as system load, SSD capacity, and the number of SSDs in the array. Rebuilding the array of three 1.92terabyte SSDs in the DGX Station may require several hours.

You can monitor the progress of a long-running rebuild by examining the contents of the / proc/mdstat file:

```
$ cat /proc/mdstat
Personalities: [raid0] [linear] [multipath] [raid1] [raid6] [raid5] [raid4]
```

```
md0 : active raid5 sdb[0] sdd[3] sdc[1]
      3750486016 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/2] [UU_]
 [>.....] recovery = 4.0% (75580956/1875243008) finish=438.3min speed=68419K/sec
     bitmap: 2/14 pages [8KB], 65536KB chunk
unused devices: <none>
```

In this example, the rebuild is 4.0% complete and the rebuild is estimated to finish in 438.3

To re-create a RAID 5 array after replacing more than one failed SSD, run the following command:

```
$ sudo configure_raid_array.py -c -5 -f
```

- CAUTION: Specify the -c option only if an unrecoverable failure, such as the failure of more than one SSD, has occurred. The -c option erases all data in the array.
- To re-create a RAID 0 array after replacing any number of failed SSDs, run the following command:

```
$ sudo configure_raid_array.py -c -f
```

The RAID array is rebuilt or re-created with the RAID level that you specified.

- If you re-created a RAID 0 or RAID 5 array, all data that was on the array is erased after array is re-created.
- If you rebuilt a RAID 5 array, the data on the array is preserved after array is rebuilt.

If you have re-created a RAID 0 or RAID 5 array and have a backup of data on the array that you want to preserve, restore the data from the backup.

Changing the RAID Level of the RAID **Array**

During the initial installation of the DGX software on Red Hat Enterprise Linux, the data SSDs in the DGX Station are configured as a RAID 0 or RAID 5 array. If your requirements for redundancy or storage capacity change, you can change the RAID level of the array from the level that was initially configured.

Before changing the RAID level of the DGX Station RAID array, back up all data on the array that you want to preserve. Changing the RAID level of the DGX Station RAID array erases all data stored on the array.

The DGX Station software includes the custom script configure raid array.py, which you can use to change the level of the RAID array without unmounting the RAID volume.

To change the RAID level to RAID 5, run the following command:

\$ sudo configure raid array.py -m raid5



Note:

After you change the RAID level to RAID 5, the RAID array is rebuilt. A RAID array that is being rebuilt is online and ready to be used, but a check on the health of the DGX Station reports the status of the RAID volume as unhealthy. Therefore, avoid checking the health of the DGX Station while the RAID array is being rebuilt. For more information, see EL7-20.01 Only: Checking the Health of the DGX Station.

The time required to rebuild the RAID array depends on the workload on the system. On an idle system, the rebuild might be complete within 30 minutes.

To change the RAID level to RAID 0, run the following command:

```
$ sudo configure_raid_array.py -m raid0
```

To confirm that the RAID level was changed as required, run the lsblk command. The entry in the TYPE column for each SSD in the RAID array indicates the RAID level of the array.

The following example shows that the RAID level of the array is RAID 0. The name of the RAID volume is md0 and the mount point of the volume is /raid.

```
~$ lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT sda 8:0 0 1.8T 0 disk | sda1 8:1 0 487M 0 part /boot/efi
| md0 9:0 0 5.2T 0 raid0 /raid
```

D.3. EL7-20.01 Only: Checking the Health of the DGX Station



Note: Starting with release EL7-20.02, the NVIDIA System Health Checker (nyhealth) tool is replaced by NVIDIA System Management (NVSM). For information about how to use NVSM to perform this task, see Show Health in NVIDIA System Management User Guide.

The DGX Station provides the NVIDIA System Health Checker (nvhealth) tool to exercise the system and verify its health. The output of nvhealth is an itemized list of checks and their status, typically Healthy or Unhealthy. On a healthy system, all checks should return Healthy. You should investigate any checks that return Unhealthy to determine their root cause and resolve them.

To check the health of the DGX Station, run the following command:

```
$ sudo nvhealth [-k output-file]
```

output-file

The name and the path of the file in which the raw state of the system is written. The nvhealth command displays this file name at the end of the output from the command.

If you omit the output file, the information is written to the file /tmp/nvhealthlog.random-string.jsonl, for example, /tmp/nvhealth-log.6wf3WriAC3.jsonl.



Note:

If you run the nyhealth command while the RAID array is being rebuilt after a change in RAID level to RAID 5, nyhealth reports the status of the RAID volume as unhealthy. To avoid this potentially misleading result, wait until RAID array is rebuilt before running nyhealth.

To check the progress of the rebuild and show the percentage complete and an estimate of the time to completion, run this command:

```
# cat /proc/mdstat
Personalities: [raid6] [raid5] [raid4] [linear] [multipath] [raid0] [raid1]
md0 : active raid5 sdb[0] sdc[1] sdd[2]
    181764096 blocks super 1.2 level 5, 512k chunk, algorithm 2 [4/3] [UUU ]
     [===>.....] recovery = 17.2% (10426232/60588032)
finish=45.8min speed=18238K/sec
```

EL7-20.01 Only: Collecting D.4. Information for Troubleshooting the **DGX Station**



Note: Starting with release EL7-20.02, the tool to collect troubleshooting information (nvsysinfo) tool is replaced by NVIDIA System Management (NVSM). For information about how to use NVSM to perform this task, see Dump Health in NVIDIA System Management User Guide.

To help diagnose and resolve issues, the DGX Station provides a tool to collect troubleshooting information for NVIDIA Support Enterprise Services.

The tool verifies basic functionality and performance of the DGX Station and collects the following information in an xz-compressed tar archive:

- Log files
- Hardware inventory
- SW inventory

To collect information for troubleshooting the DGX Station, run the following command:

```
sudo nvsysinfo [-o output-file]
```

output-file

The path of the file in which the information is written.

If you omit the output file, the name of the file to which the information is written is /tmp/ nvsysinfo-host-name-timestamp.tar.xz.

Use any method that is convenient for you to send the file to NVIDIA Support Enterprise Services. For example, send the file as an e-mail attachment.

Appendix E. Expanding the DGX Station RAID Array

After adding SSDs to the DGX Station, you must expand the RAID array to add the new SSDs to the array. The procedure for expanding the RAID array is the same for all supported RAID levels.

Add the extra SSDs to the DGX Station as explained in DGX Station User Guide.

Because expanding a RAID array risks loss of data, ensure that you have a backup of data on the array that you want to preserve.

This task requires sudo privileges.

Use standard Linux operating system commands to expand the DGX Station RAID array.

1. Obtain the device IDs of the SSDs that were added by searching for 1.8 T drives that aren't mounted in the output from the lsblk (http://manpages.ubuntu.com/manpages/bionic/ man8/lsblk.8.html) command.

In the following example, the device IDs of the SSDs that were added are sde, sdf, sdg, and sdh.

```
$ 1sblk

NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda 8:0 0 1.8T 0 disk

| sda1 8:1 0 487M 0 part /boot/efi

| sda2 8:2 0 1.8T 0 part /
sdb 8:16 0 1.8T 0 disk

| md0 9:0 0 5.2T 0 raid0 /raid
sdc 8:32 0 1.8T 0 disk

| md0 9:0 0 5.2T 0 raid0 /raid
sdd 8:48 0 1.8T 0 disk

| md0 9:0 0 5.2T 0 raid0 /raid
sdd 8:48 0 1.8T 0 disk
 sde
                          8:64 0 1.8T 0 disk
                            8:80 0 1.8T 0 disk
8:96 0 1.8T 0 disk
 sdf
 sda
                             8:112 0 1.8T 0 disk
 sdh
```

2. Add the SSDs that you added to the DGX Station to the RAID array.

\$ sudo mdadm --add raid-device-path ssd-device-paths

raid-device-path

The device path of the RAID array, for example, /dev/md0.

ssd-device-paths

A space-separated list of the device paths of the SSDs that you added, in which each path is of the form /dev/device-id.

This example adds the SSDs with device paths /dev/sde, /dev/sdf, /dev/sdg, and /dev/ sdh to the RAID array with device path /dev/md0.

sudo mdadm --add /dev/md0 /dev/sde /dev/sdf /dev/sdg /dev/sdh

3. Increase the number of devices in the RAID array to 7.

\$ sudo mdadm --grow --raid-devices=7 raid-device-path

raid-device-path

The device path of the RAID array, for example, /dev/md0.



Note: Increasing the number of devices in the RAID array to 7 may require several hours or even longer. If the system crashes, is shut down, or is rebooted while the number of devices on the array is being increased, all data that was on the array is erased.

This example increases the number of devices in the RAID array with device path /dev/

- \$ sudo mdadm --grow --raid-devices=7 /dev/md0
- 4. Resize the file system that resides on the RAID array to use the additional physical space in the array.
 - \$ sudo resize2fs raid-device-path

raid-device-path

The device path of the RAID array, for example, /dev/md0.

This example resizes the file system that resides on the RAID array with device path /dev/ md0.

\$ sudo resize2fs /dev/md0

The RAID array is expanded with its existing RAID level. The data on the array is preserved, even if the array is a RAID 0 array.

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