

Red Hat Enterprise Linux Setup Guide

For ThinkStation P520c, P520, P720, & P920



redhat®

Section 1 – BIOS Setup and Preinstallation Steps

The first step before installing Linux is to make sure BIOS is setup correctly. By default, the system BIOS should be set up to handle both UEFI/GPT and Legacy/MBR partitions.

- ➔ **For standalone NVMe PCIe SSDs**, make sure these drives are set up in PCIe mode (not VMD mode).
 - Boot into BIOS by pressing the function F1 key at the “Lenovo” splash screen.
 - Select the “Advanced” menu option (left) and “Intel VMD technology” (right).



- Disable each “CPU x Port y”.

Enable the VMD (Volume Management Device) technology to support configure PCIe storages to VROC (Virtual RAID on CPU) feature.
Note: Only on same PCIe x16 ports are supported to be configured as one VROC (Virtual RAID on CPU) in Intel(R) RSTe RAID Controller menu.
VMD: configure this slot as VMD (Intel Volume Management Device).
PCIe: configure this slot as general PCI Express port.

CPU 0 Port 1.	Disabled
CPU 0 Port 3.	Disabled
CPU 1 Port 1.	Disabled
CPU 1 Port 2.	Disabled
CPU 1 Port 3.	Disabled

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- Select F10 to “Save and Exit” BIOS.

→ **For NVMe PCIe SSDs in RAID mode**, see [Section 4](#) below.



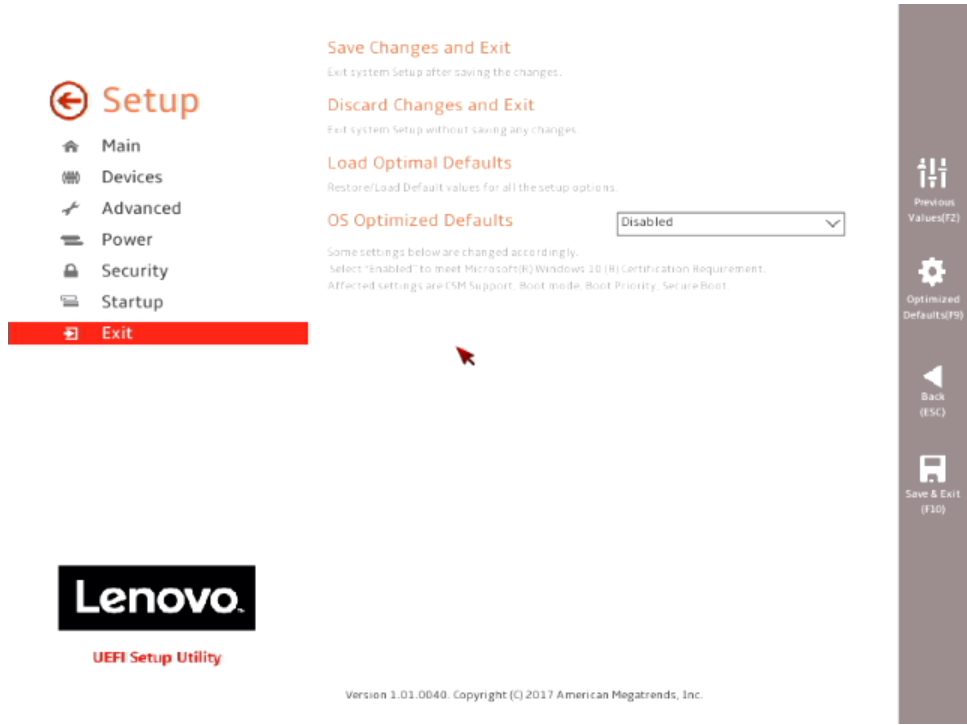
- **For UEFI/GPT installations (recommended):**
 - Boot into BIOS by pressing the function F1 key at the “Lenovo” splash screen.
 - Select “Setup” from the screen indicated below.

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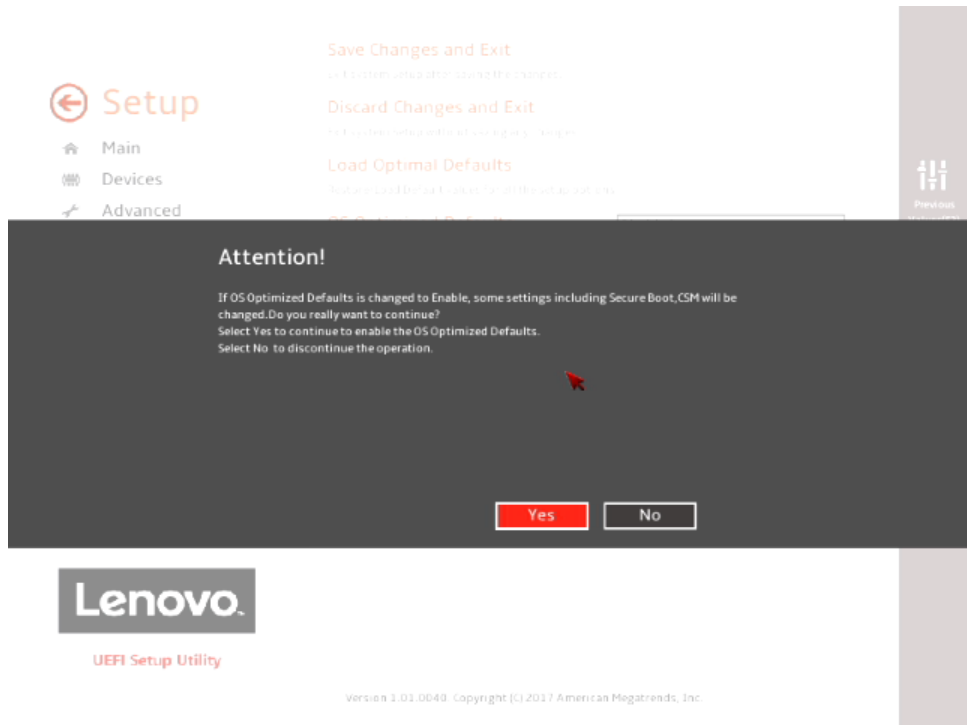
ThinkStation®



- Select “Exit” menu option (left) and set “OS Optimized Defaults” (right) to “Enabled”.



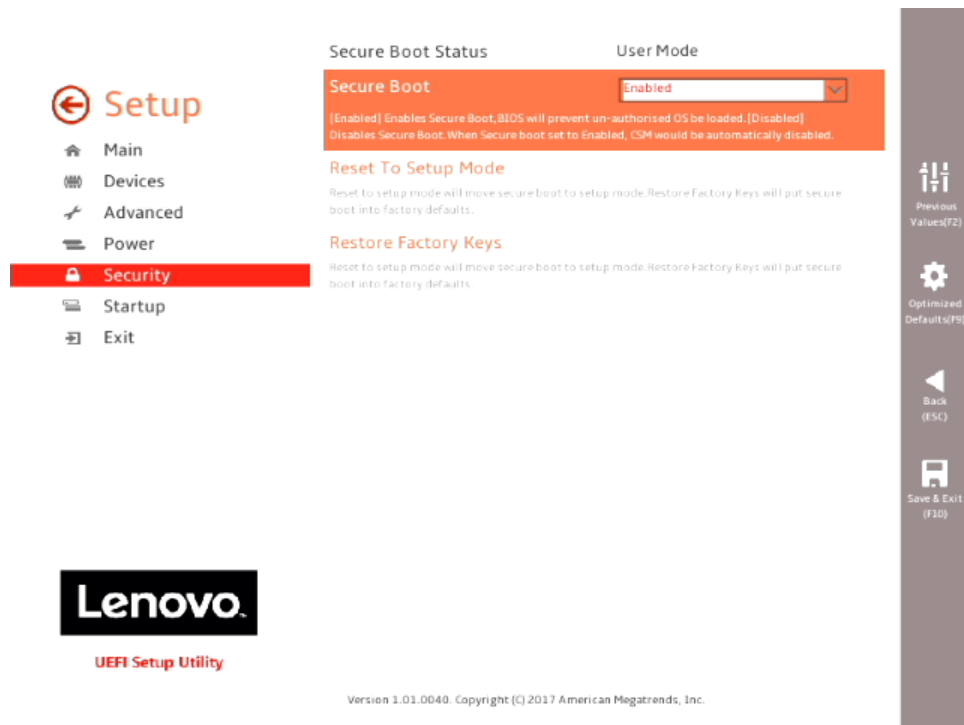
- Select “Yes” at the confirmation screen indicated below.



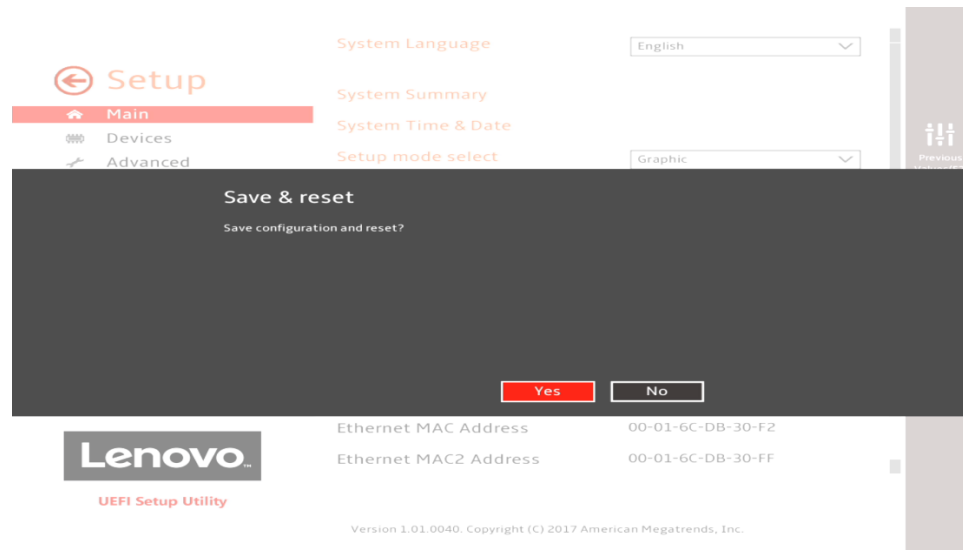
- Select the “Security” menu option (left), then select “Secure Boot” option (right).



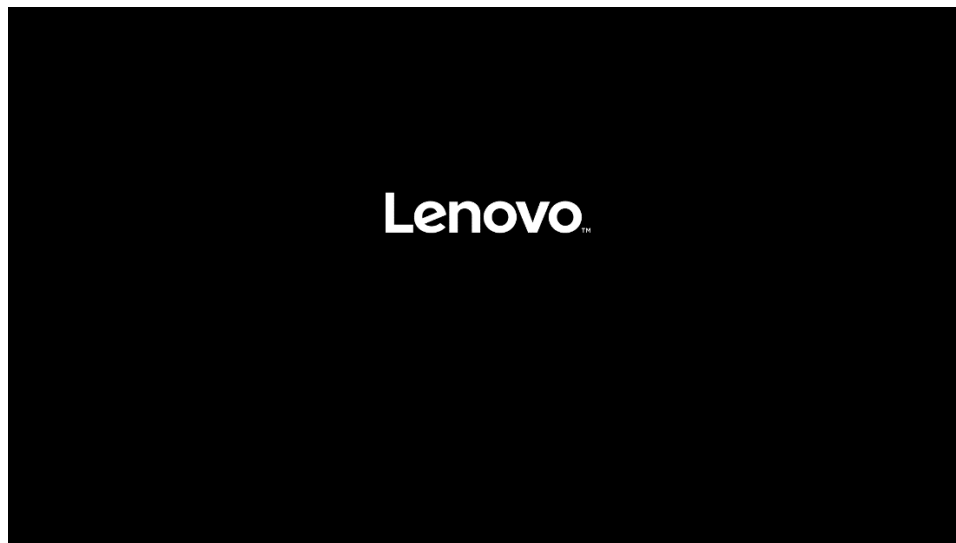
- Disable “Secure Boot”.



- Select F10 to “Save and Exit” BIOS.



- Insert the RHEL 7 install media (either through USB or CD/DVD).
- Power on the system and press the F12 function key whenever the following Lenovo splash screen appears.



- Select the Linux bootable installation media “UEFI” option from the F12 boot menu.

```
Startup Device Menu:
-----
SATA 1: SanDisk SD7SB6S256G1001
└ Legacy: SanDisk SD7SB6S256G1001
SATA 6: HL-DT-ST DVDROM DH60N
└ Legacy: HL-DT-ST DVDROM DH60N
└ UEFI: HL-DT-ST DVDROM DH60N
Network 1:
└ Legacy: IBA CL Slot 00FE v0110
└ UEFI: IPV4 Intel(R) Ethernet Connection (H) I219-LM
└ UEFI: IPV6 Intel(R) Ethernet Connection (H) I219-LM
Network 2:
└ Legacy: IBA GE Slot 0400 v1555
└ UEFI: IPV4 Intel(R) I210 Gigabit Network Connection
└ UEFI: IPV6 Intel(R) I210 Gigabit Network Connection
Enter Setup

↑ and ↓ to move selection
```



- **For Legacy/MBR installations (not recommended):**
 - Boot into BIOS by pressing the function F1 key at the “Lenovo” splash screen.
 - Select “Setup” from the screen indicated below.

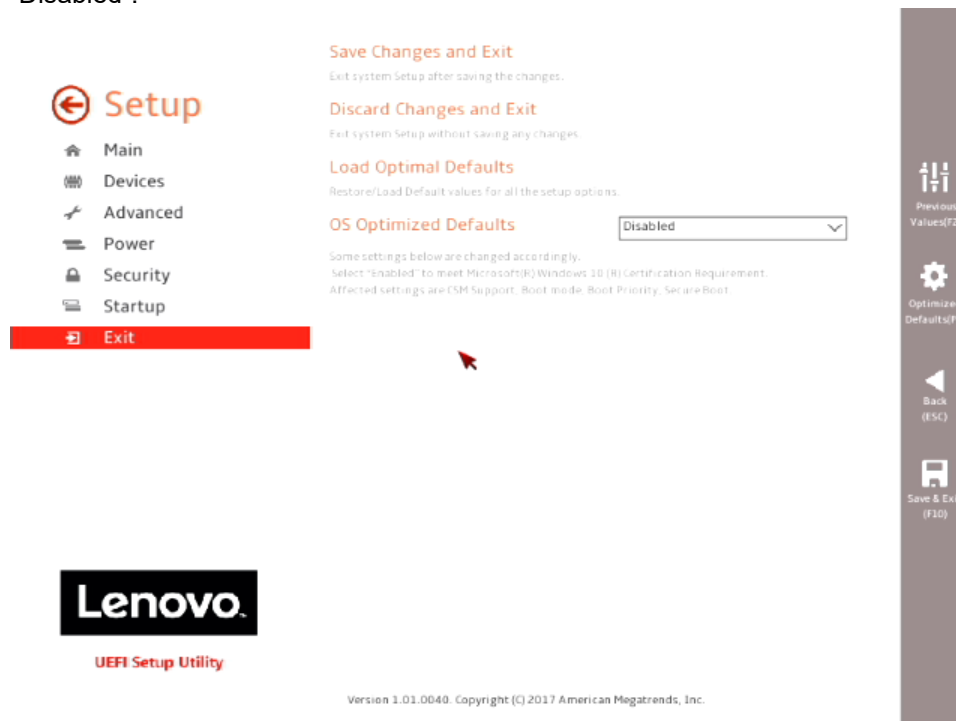
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- Select “Exit” menu option (left) and set “OS Optimized Defaults” (right) to “Disabled”.



- Select “Startup” menu option (left) and “CSM Configuration” (right).

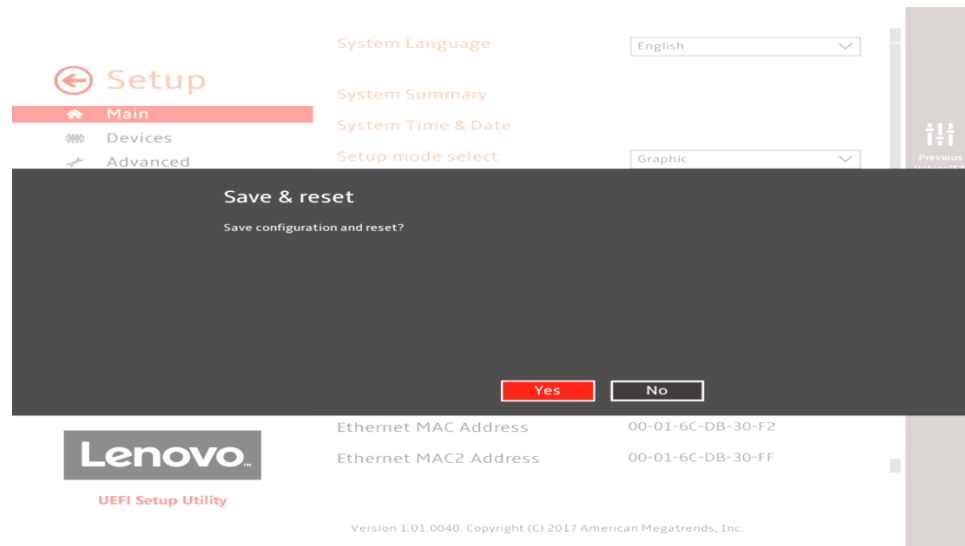
The screenshot shows the 'Setup' utility with the 'Startup' menu item highlighted in red on the left-hand navigation pane. The main display area shows the 'CSM Configuration' screen, which is also highlighted with an orange header. Under 'CSM Configuration', the 'CSM' dropdown menu is set to 'Enabled' and the 'Boot Mode' dropdown menu is set to 'Auto'. The 'Startup' menu items are: Main, Devices, Advanced, Power, Security, Startup (highlighted), and Exit. The 'CSM Configuration' screen includes instructions for Primary, Automatic, and Error Boot Sequences. A vertical toolbar on the right contains icons for Previous Values (F2), Optimized Defaults (F9), Back (Esc), and Save & Exit (F10). The Lenovo logo and 'UEFI Setup Utility' text are at the bottom left, and the version 'Version 1.01.0040. Copyright (C) 2017 American Megatrends, Inc.' is at the bottom center.



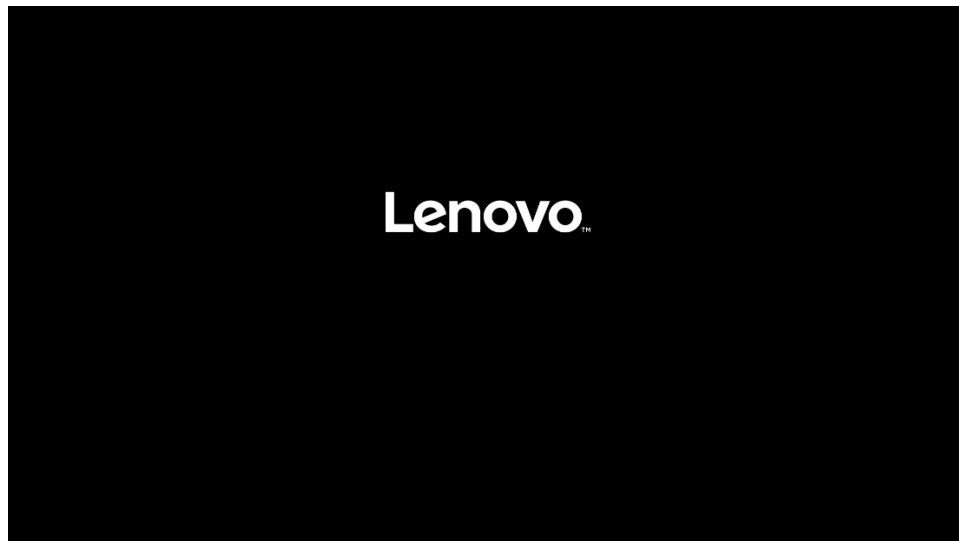
- Select the “Storage” option ROM and set the pull-down menu to “Legacy”.

The screenshot shows the 'Setup' utility with the 'Startup' menu item highlighted in red on the left-hand navigation pane. The main display area shows the 'Option ROM execution order' screen, which is highlighted with an orange header. Under 'Option ROM execution order', the 'Storage' dropdown menu is set to 'Legacy' and is highlighted with an orange background. The 'Network', 'Video', and 'Other PCI devices' dropdown menus are all set to 'Legacy'. The 'Startup' menu items are: Main, Devices, Advanced, Power, Security, Startup (highlighted), and Exit. The 'Option ROM execution order' screen includes instructions for Network, Storage, Video, and Other PCI devices. A vertical toolbar on the right contains icons for Previous Values (F2), Optimized Defaults (F9), Back (Esc), and Save & Exit (F10). The Lenovo logo and 'UEFI Setup Utility' text are at the bottom left, and the version 'Version 1.01.0040. Copyright (C) 2017 American Megatrends, Inc.' is at the bottom center.

- Select F10 to “Save and Exit” BIOS.



- Insert the RHEL 7 install media (either through USB or CD/DVD).
- Power on the system and press the F12 function key whenever the following Lenovo splash screen appears.



- Select the Linux bootable installation media “Legacy” option from the F12 boot menu.

```
Startup Device Menu:
-----
SATA 1: SanDisk SD7SB6S256G1001
└ Legacy: SanDisk SD7SB6S256G1001
SATA 6: HL-DT-ST DVDROM DH60N
└ Legacy: HL-DT-ST DVDROM DH60N
└ UEFI: HL-DT-ST DVDROM DH60N
Network 1:
└ Legacy: IBA CL Slot 00FE v0110
└ UEFI: IPV4 Intel(R) Ethernet Connection (H) I219-LM
└ UEFI: IPV6 Intel(R) Ethernet Connection (H) I219-LM
Network 2:
└ Legacy: IBA GE Slot 0400 v1555
└ UEFI: IPV4 Intel(R) I210 Gigabit Network Connection
└ UEFI: IPV6 Intel(R) I210 Gigabit Network Connection
Enter Setup

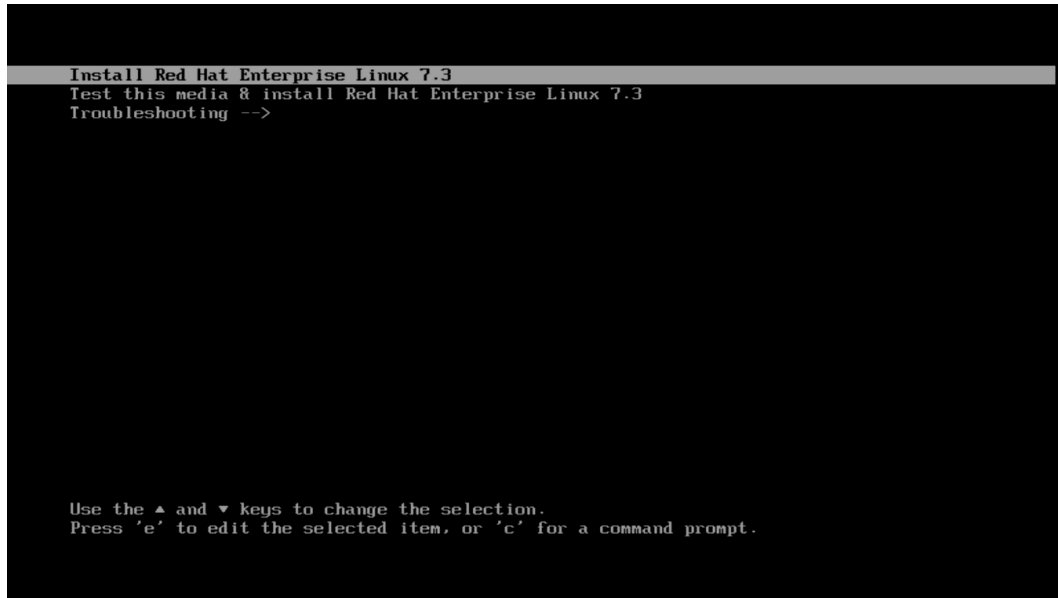
↑ and ↓ to move selection
```



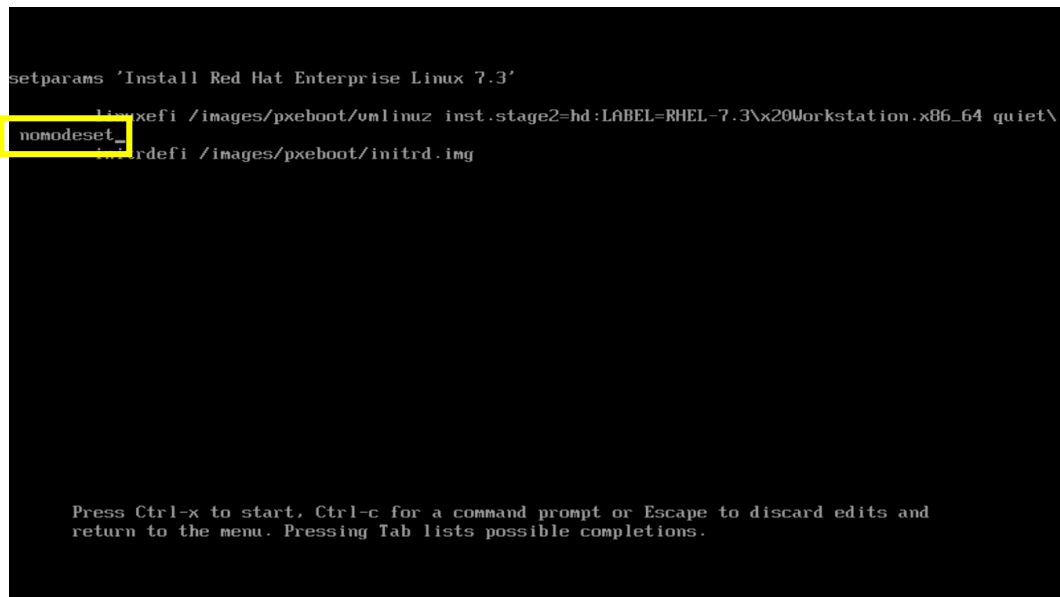
Section 2 – Installing RHEL 7

Please refer to the following instructions and screenshots on how to install RHEL 7 on the ThinkStation P520c, P520, P720, and P920 workstations.

- Highlight the “Install Red Hat Enterprise Linux 7” from the installer menu and press “e”.



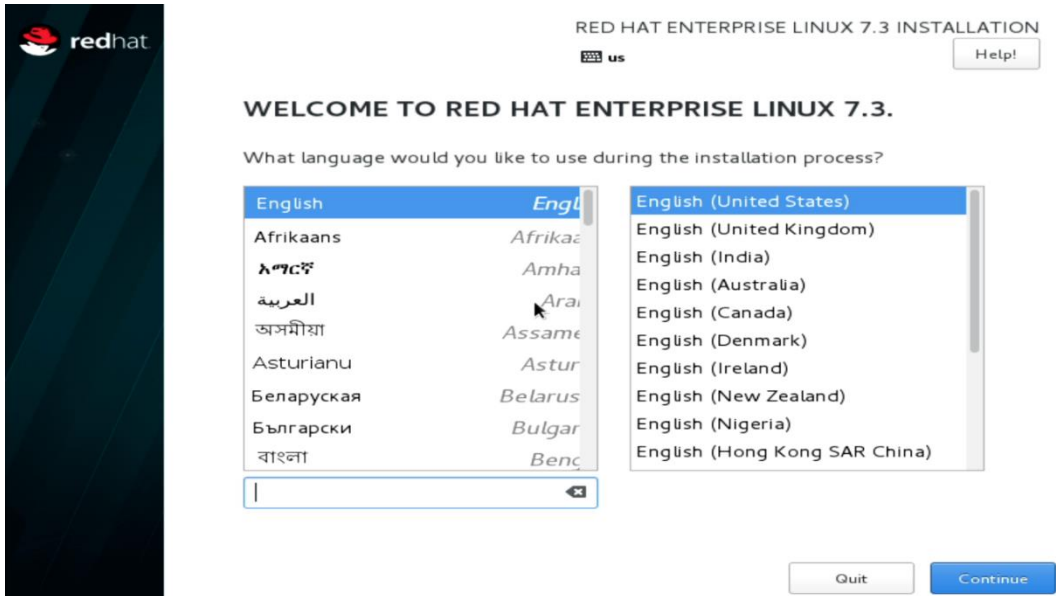
- Add “nomodeset” to the end of the Linux boot image line and press Ctrl-X.



```
[ OK ] Stopped Apply Kernel Variables.
      Stopping Apply Kernel Variables...
[ OK ] Stopped target Slices.
[ OK ] Stopped target Paths.
[ OK ] Stopped Open-iSCSI.
      Stopping Device-Mapper Multipath Device Controller...
[ OK ] Stopped Device-Mapper Multipath Device Controller.
[ OK ] Stopped udev Coldplug all Devices.
      Stopping udev Coldplug all Devices...
[ OK ] Stopped dracut pre-trigger hook.
      Stopping dracut pre-trigger hook...
      Stopping udev Kernel Device Manager...
[ OK ] Stopped udev Kernel Device Manager.
[ OK ] Stopped dracut pre-udev hook.
      Stopping dracut pre-udev hook...
[ OK ] Stopped dracut cmdline hook.
      Stopping dracut cmdline hook...
[ OK ] Stopped Create Static Device Nodes in /dev.
      Stopping Create Static Device Nodes in /dev...
[ OK ] Stopped Create list of required static device nodes for the current kernel.
      Stopping Create list of required static device nodes for the current kernel...
[ OK ] Closed udev Kernel Socket.
[ OK ] Closed udev Control Socket.
      Starting Cleanup udevd DB...
[ OK ] Started Cleanup udevd DB.
[ OK ] Reached target Switch Root.
[ OK ] Started Plymouth switch root service.
      Starting Switch Root...

Welcome to Red Hat Enterprise Linux Client 7.3 (Maipo)!
```

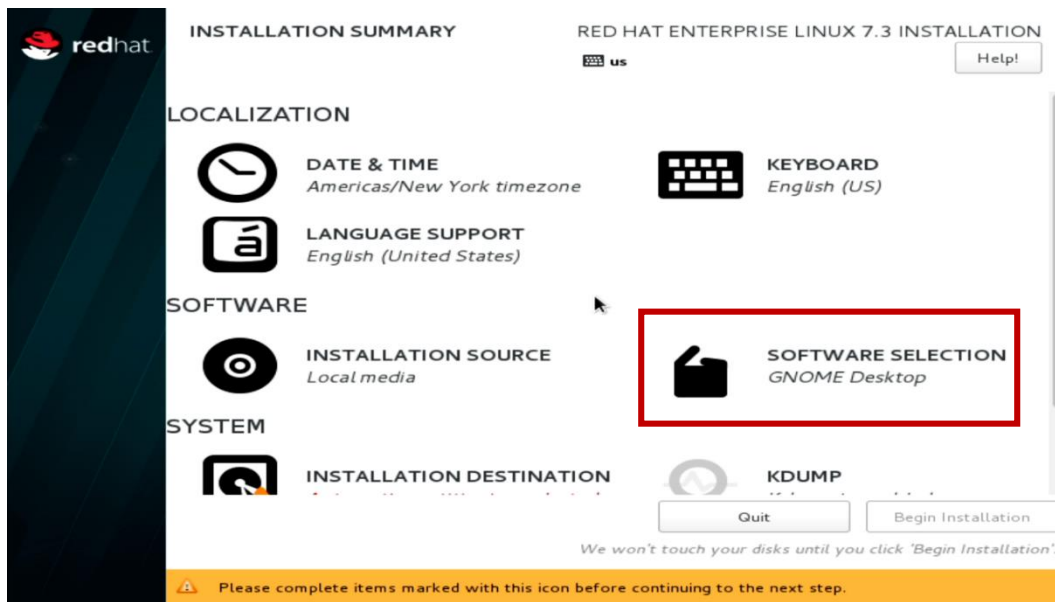
- Select the language to use during the installation process.



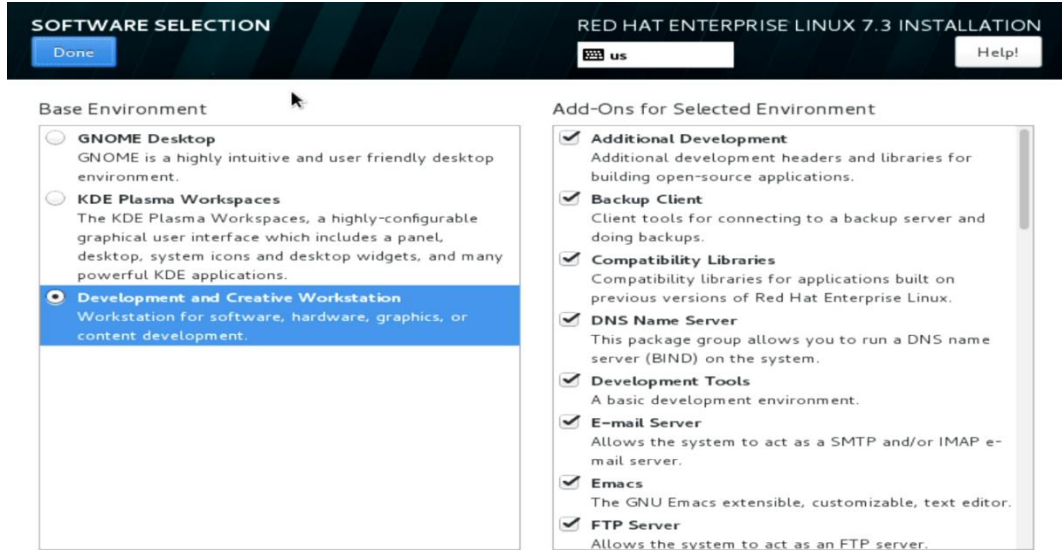
- At the “Installation Summary” screen, feel free to modify any of the default settings for “Date & Time”, “Keyboard”, and “Language Support” by selecting each one.
 - *Default* settings were used throughout this document.



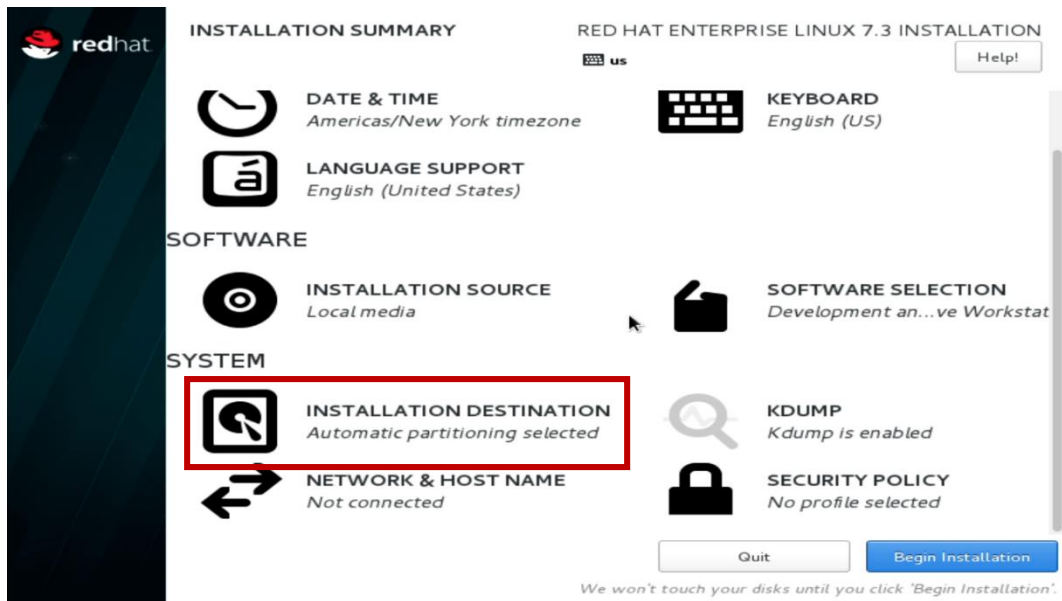
- Select “Software Selection” option from the “Installation Summary” screen.



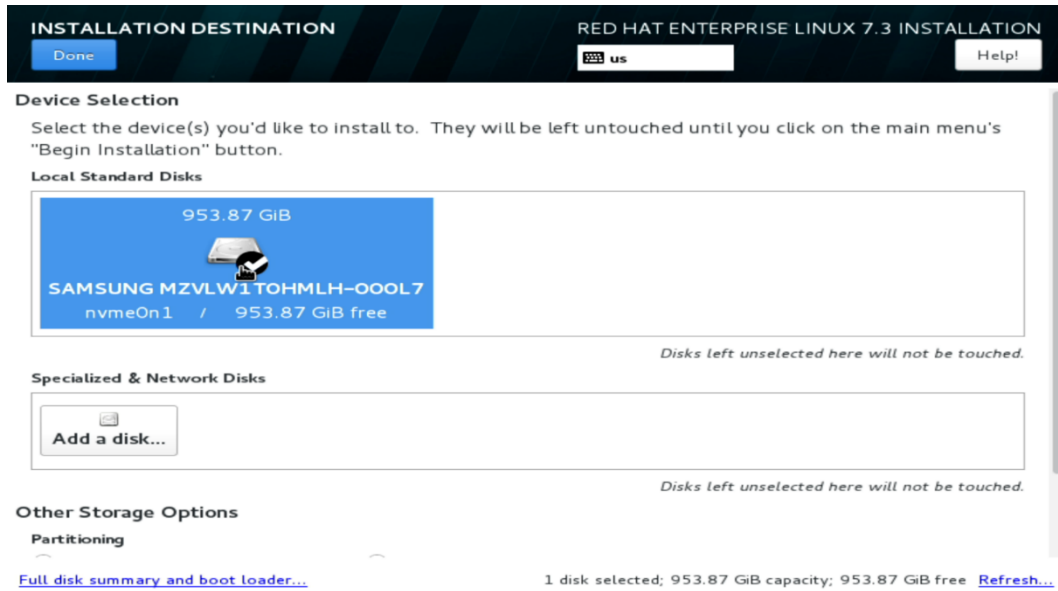
- Select a “Base Environment” at the left and the additional Add-on packages at the right and select “Done” in the upper left corner of the screen.
 - “Development and Creative Workstation” was used throughout this document.



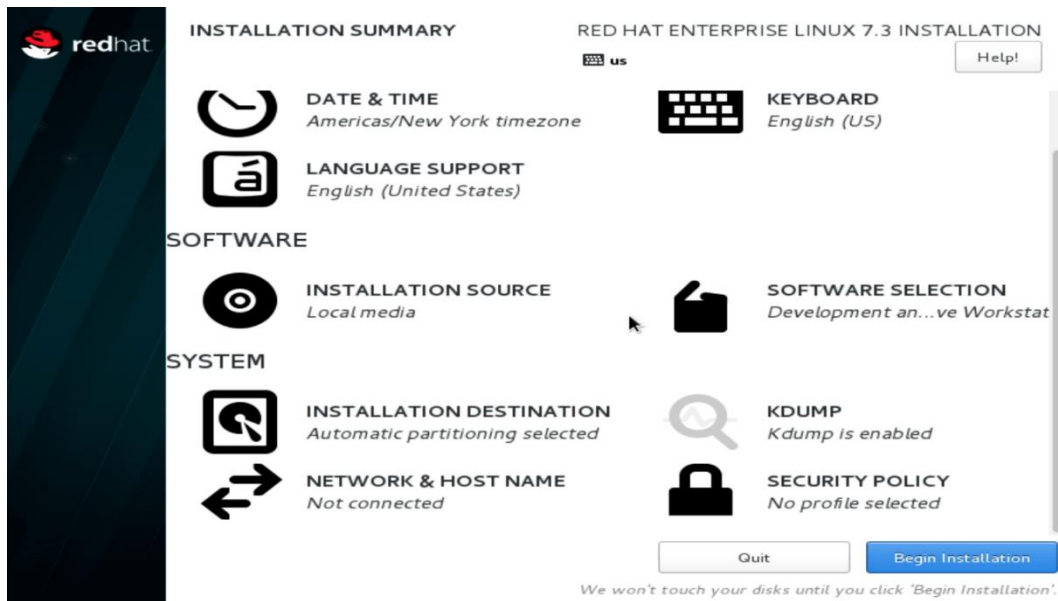
- Select “Installation Destination” option from the “Installation Summary” screen.



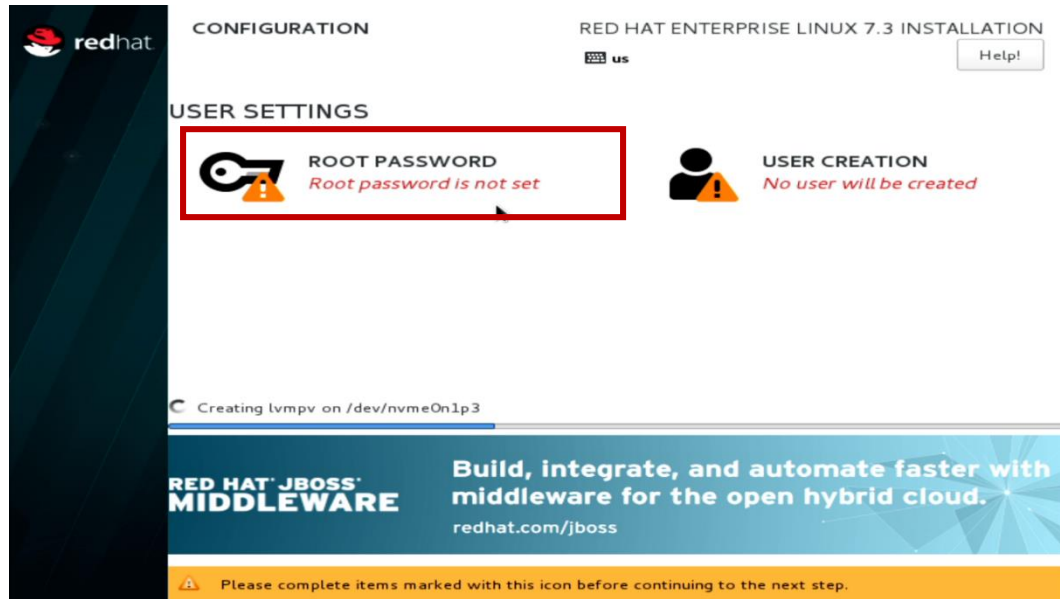
- Select the device on where to install Red Hat Enterprise Linux 7 and “Done” in the upper left corner of the screen.



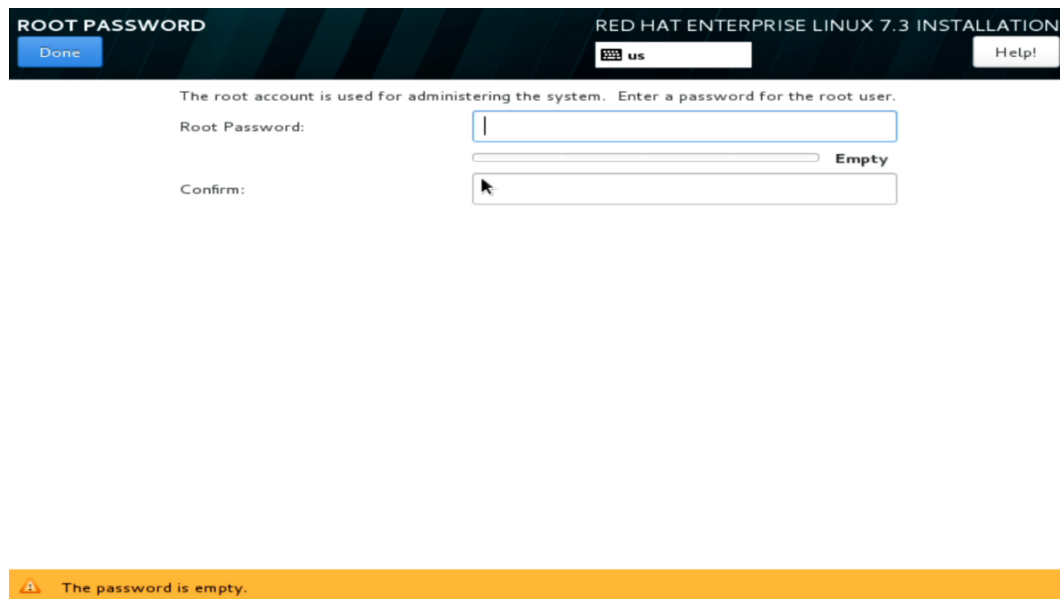
- Select “Begin Installation” in the bottom right corner of the screen.



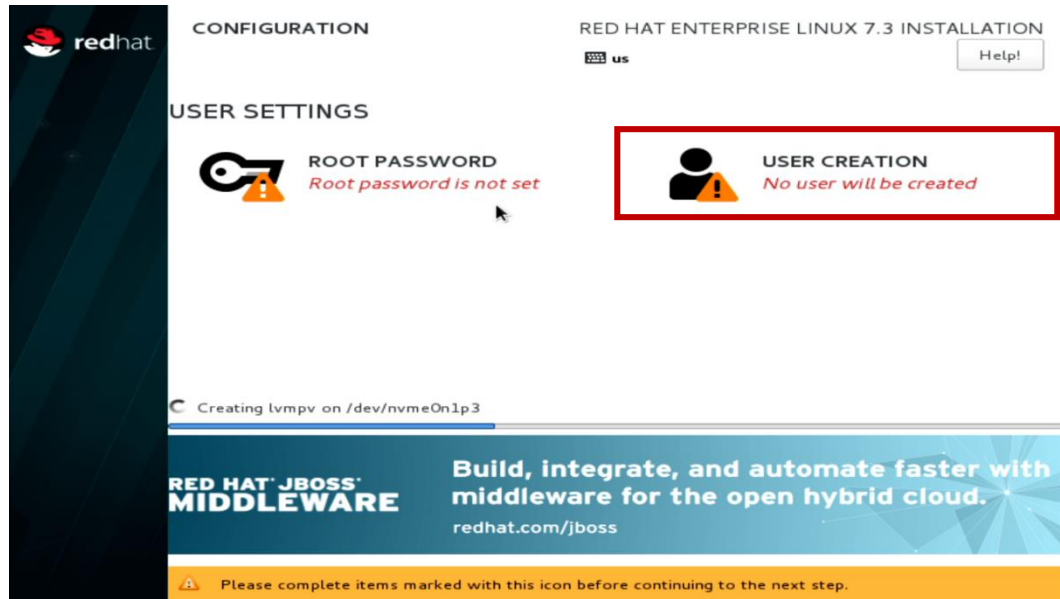
- Select "Root Password".



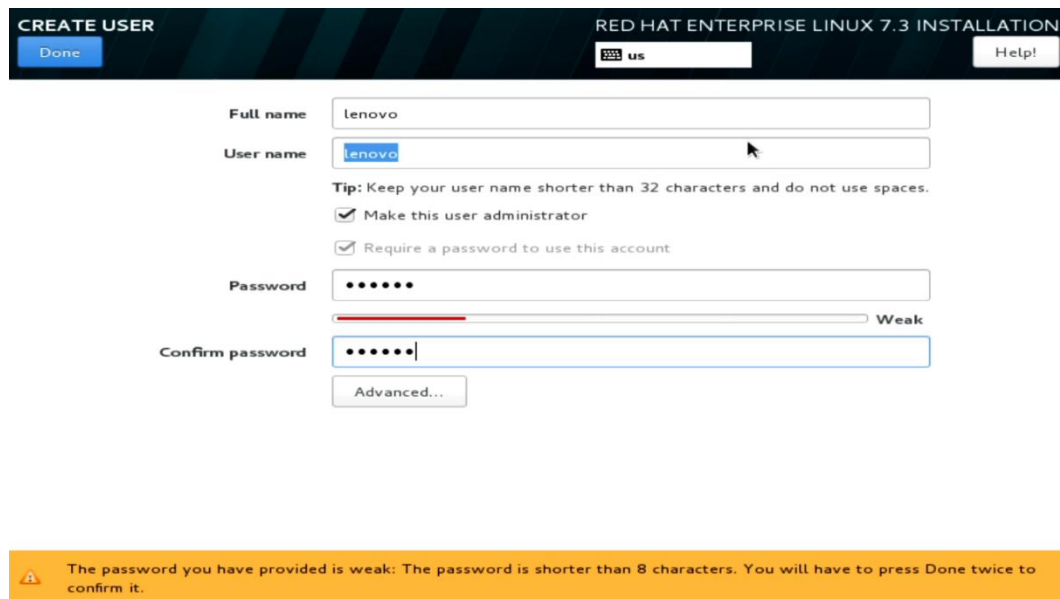
- Enter a password for the root user and select "Done" in the upper left corner of the screen.



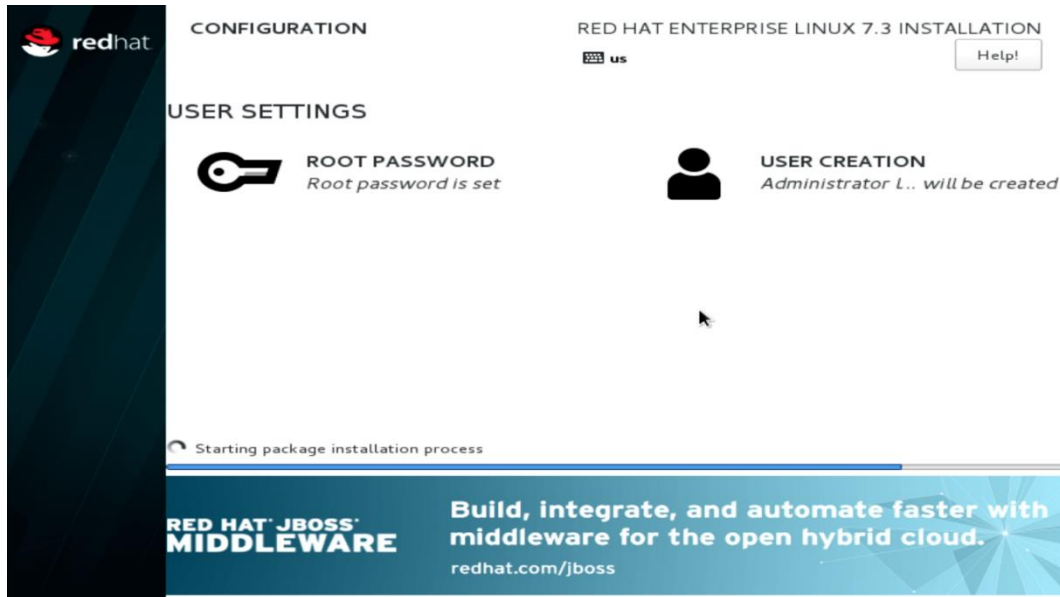
- Select “User Creation”.



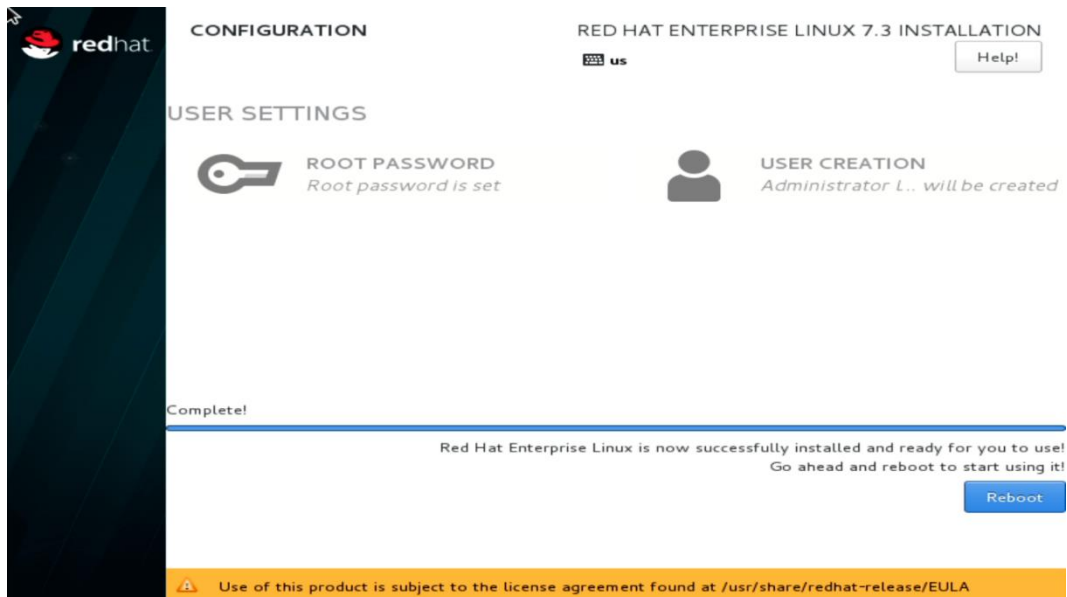
- Enter a Username and Password and select “Done” in the upper left corner of the screen.



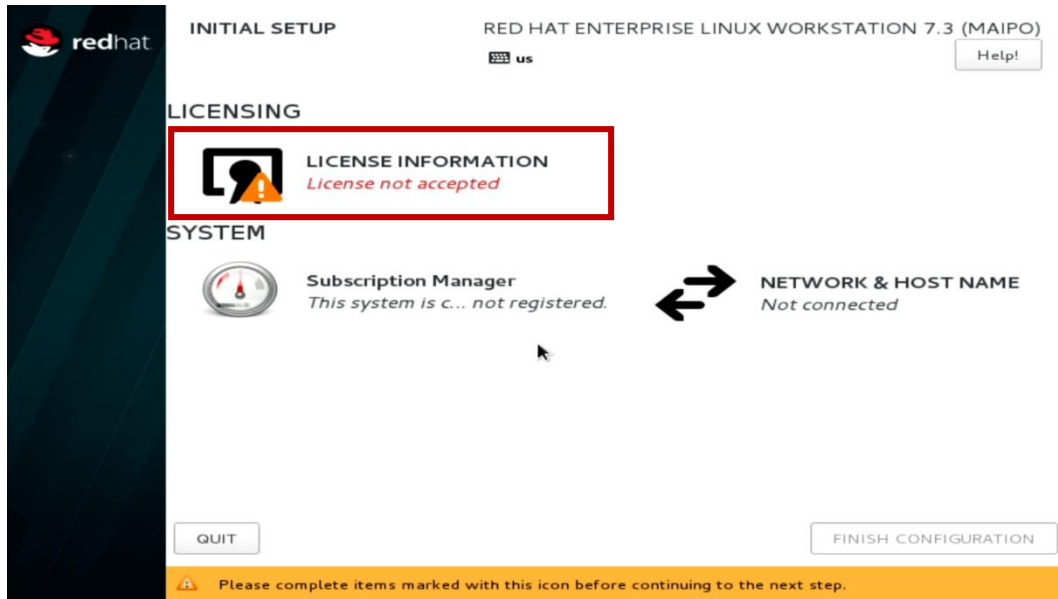
- Let the system finish the installation.



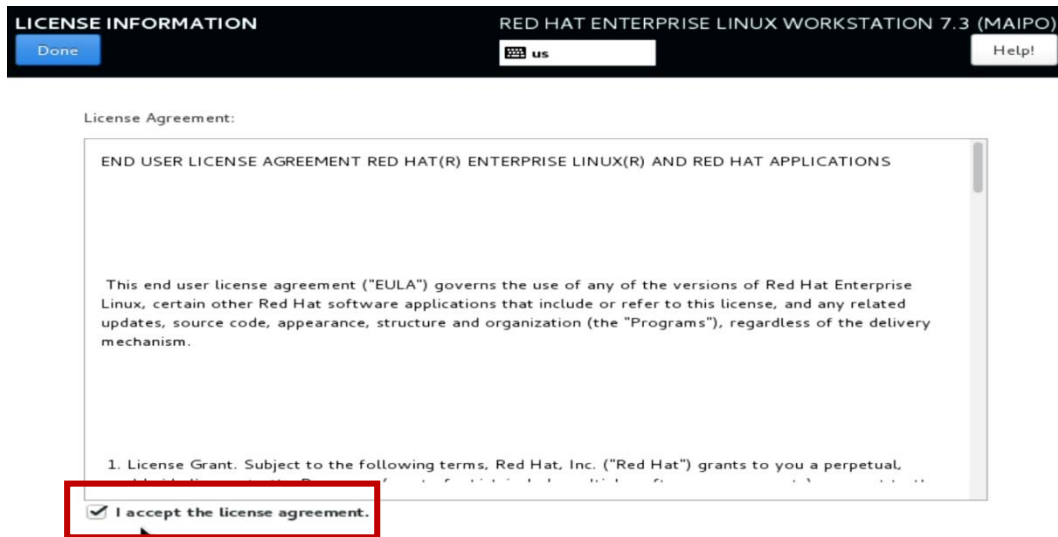
- Once the installation completes, select "Reboot" in the bottom right corner of the screen.



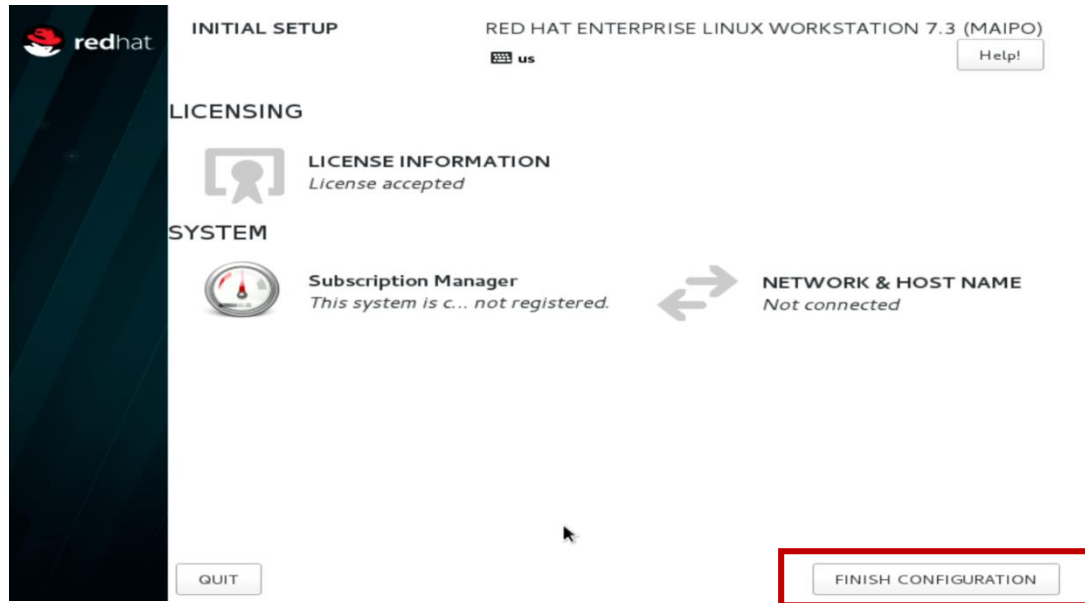
- Once the system reboots, select "License Information" from the initial setup screen.



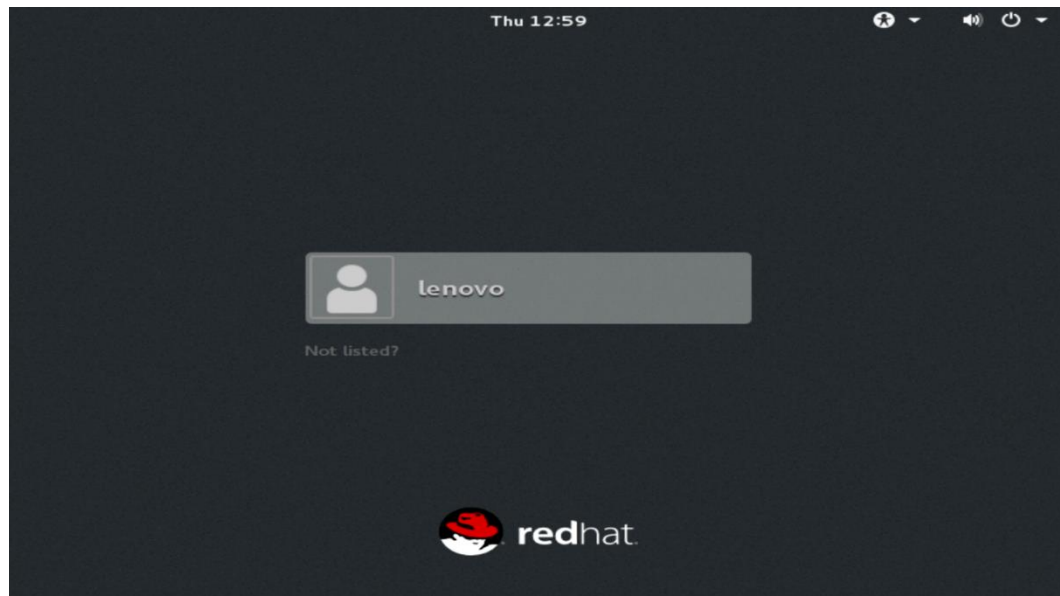
- Check the box that says "I accept the license agreement" and select "Done" in the upper left corner of the screen.



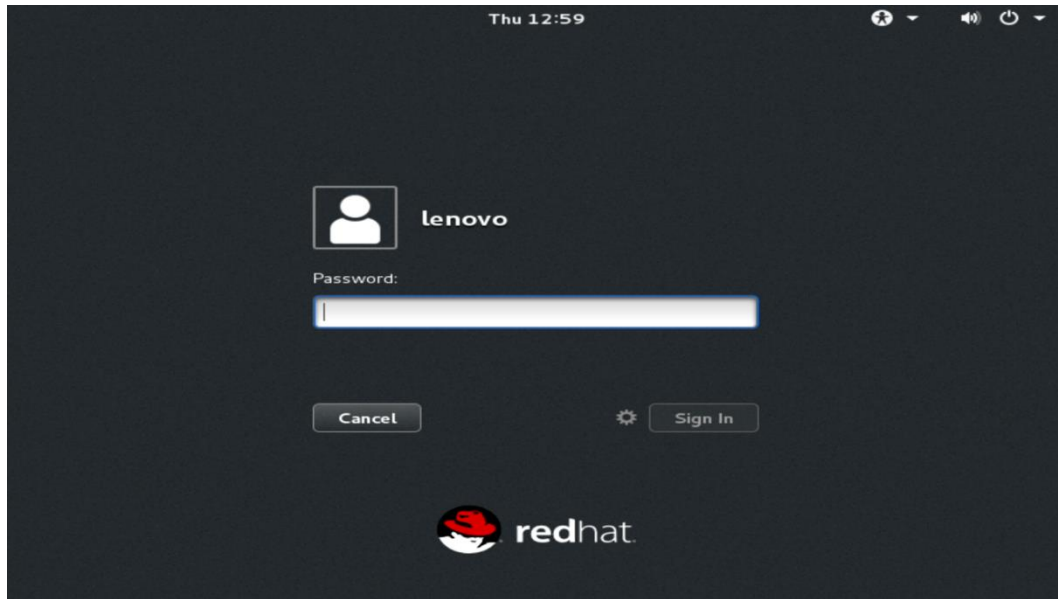
- Select "Finish Configuration".



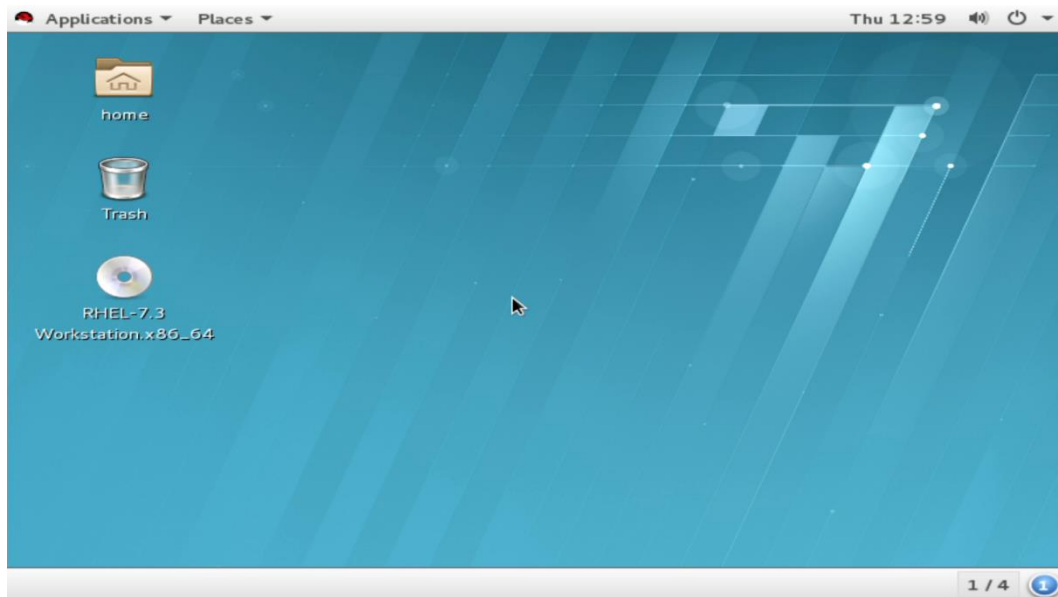
- Select the user created above.



- Enter the password created above and select “Sign In”.



- Red Hat Enterprise 7 desktop screen.



Section 3 – Installing the Nvidia Graphics Driver

In order to get optimal performance out of the Nvidia GPU, it's a good idea to install the Nvidia graphics driver.

To install the latest Nvidia graphics driver, follow the steps below.

- **Step 1:**
 - Download the Nvidia graphics driver from the Lenovo Support Website.
<http://pcsupport.lenovo.com/us/en/products/WORKSTATIONS/THINKSTATION-P-SERIES-WORKSTATIONS/THINKSTATION-P320/downloads/DS121444>
- **Step 2:**
 - Open a terminal window and type “init 3” to stop X-windows.
- **Step 3:**
 - Login as root.

```
Red Hat Enterprise Linux Workstation 7.3 (Maipo)
Kernel 3.10.0-514.el7.x86_64 on an x86_64

localhost login:
```

- **Step 4:**
 - Browse to the directory location to where the Nvidia driver installer is located.

```
[root@localhost ~]# cd /home/lenovo/Desktop/
```

- **Step 5:**
 - Run the Nvidia installer.

```
[root@localhost Desktop]# sh NVIDIA-Linux-x86_64-375.61.run _
```


- Step 6:
 - Accept the Nvidia driver license.

```
NVIDIA accelerated Graphics Driver for Linux-x86_64 (375.61)

Please read the following LICENSE and then select either "Accept" to accept the license and
continue with the installation, or select "Do Not Accept" to abort the installation.

Accept Do Not Accept

License For Customer Use of NVIDIA Software

IMPORTANT NOTICE -- READ CAREFULLY: This License For Customer Use of
NVIDIA Software ("LICENSE") is the agreement which governs use of
the software of NVIDIA Corporation and its subsidiaries ("NVIDIA")
downloadable herefrom, including computer software and associated
printed materials ("SOFTWARE"). By downloading, installing, copying,
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RECITALS

Use of NVIDIA's products requires three elements: the SOFTWARE, the
hardware on a graphics controller board, and a personal computer. The
SOFTWARE is protected by copyright laws and international copyright
treaties, as well as other intellectual property laws and treaties.
The SOFTWARE is not sold, and instead is only licensed for use,
strictly in accordance with this document. The hardware is protected
by various patents, and is sold, but this agreement does not cover
that sale, since it may not necessarily be sold as a package with
the SOFTWARE. This agreement sets forth the terms and conditions
of the SOFTWARE LICENSE only.

1. DEFINITIONS

NVIDIA Software License Top
```

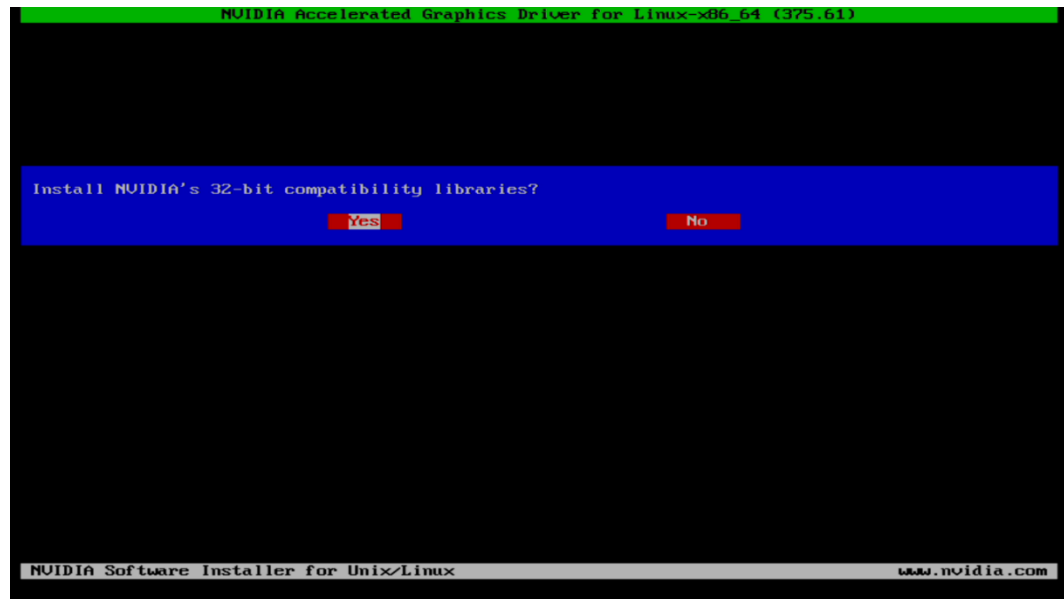
```
NVIDIA accelerated Graphics Driver for Linux-x86_64 (375.61)

Building kernel modules

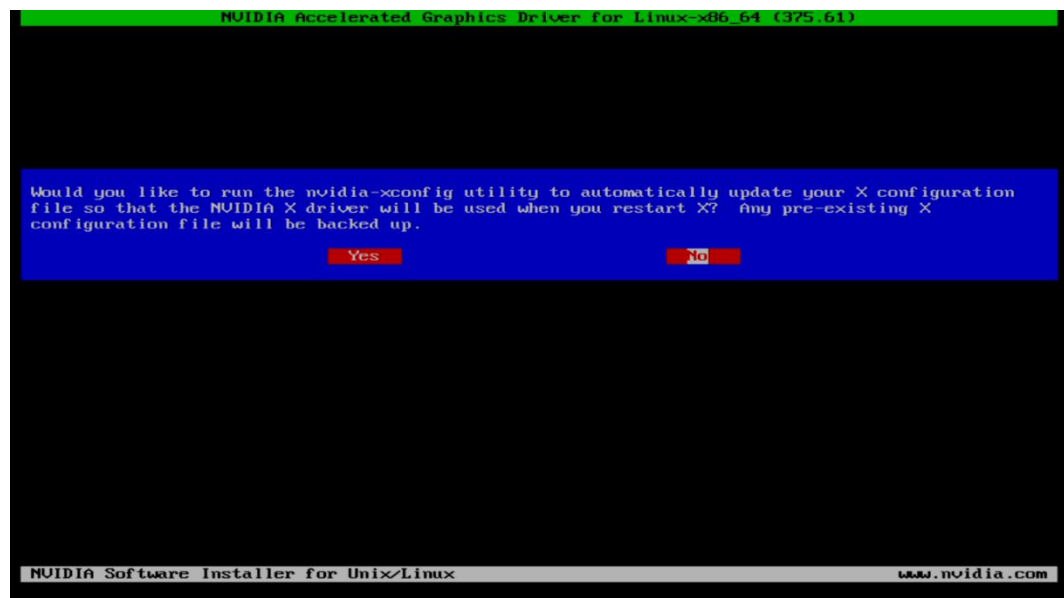
100%

NVIDIA Software Installer for Unix/Linux www.nvidia.com
```

- **Step 7:**
 - Select "Yes" to Install 32-bit compatibility libraries.



- **Step 8:**
 - Select "Yes" to update the X-configuration file.



- **Step 9:**
 - Driver installation complete.

```

NVIDIA accelerated Graphics Driver for Linux-x86_64 (375.61)

Your X configuration file has been successfully updated. Installation of the NVIDIA accelerated
Graphics Driver for Linux-x86_64 (version: 375.61) is now complete.

DE

NVIDIA Software Installer for Unix/Linux www.nvidia.com
  
```

- **Step 10:**
 - Verify the Nvidia driver is loaded by running “*nvidia-smi*”.

```

[root@localhost Desktop]# nvidia-smi
Thu Jul 27 17:04:04 2017

+-----+
| NVIDIA-SMI 375.61                  Driver Version: 375.61          |
+-----+-----+
| GPU   Name           Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf    Pwr:Usage/Cap |      Memory-Usage | GPU-Util  Compute M. |
+-----+-----+-----+-----+
|   0   Quadro P6000      Off      | 0000:01:00.0  Off  |           N/A       |
|  0%   45C    P0      13W /  N/A   |   0MiB /  1996MiB |           0%      Default |
+-----+-----+-----+-----+

+-----+
| Processes:                         GPU Memory |
|  GPU       PID    Type   Process name                     Usage    |
+-----+-----+
| No running processes found         |
+-----+

[root@localhost Desktop]#
  
```

- **Step 11:**
 - Reboot the system.

Section 4 – Installing RHEL 7.3/7.4 using Intel VROC M.2 RAID

Please refer to the following instructions and screenshots on how to install RHEL 7.3 on the ThinkStation P520c, P520, P720, and P920 workstations with Intel VROC M.2 RAID setup.



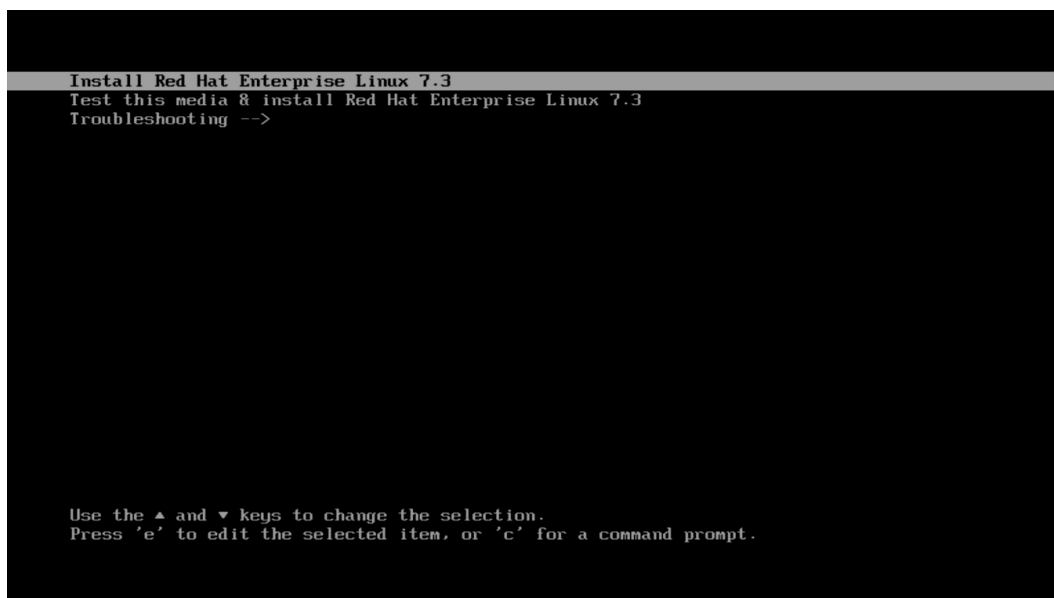
rste-5.1_PV_rhel7.3.iso



rste-5.3_rhel7.4.iso

➔ *RHEL 7.5 or newer should have the Intel VMD driver native to the Linux kernel; therefore, skip back to [Section 2](#).*

1. Format a USB drive in FAT32 filesystem and label it **RSTE**.
2. For RHEL 7.3 installations, extract the *rste-5.1_PV_rhel7.3.iso* onto the USB drive.
For RHEL 7.4 installations, extract the *rste-5.3_rhel7.4.iso* onto the USB drive.
3. Insert the USB drive into the system along with the RHEL 7.3/7.4 installation media.
4. At the RHEL 7.3/7.4 installer menu (shown below), press “e”.



5. Append the following text at the end of the first "linuxefi..." line.

Inst.updates=LABEL=RSTE modprobe.blacklist=qat_c62x

```
setparams 'Install Red Hat Enterprise Linux 7.3'
    linuxefi /images/pxeboot/vmlinuz inst.stage2=hd:LABEL=RHEL-7.3\x20Workstation.x86_64 quiet\
nomodeset_
    initrdefi /images/pxeboot/initrd.img
```

Press Ctrl-x to start, Ctrl-c for a command prompt or Escape to discard edits and return to the menu. Pressing Tab lists possible completions.

6. Press "Ctrl-x" to continue the installation process [here](#):



Section 5 – Installing the Network Wireless Driver

The wireless network device offered for the P520c, P520, P720, and P920 is native to RHEL 7.3; therefore, you will not need to install any additional drivers separately.

Section 6 – Installing the Network LAN Driver

The network LAN device is native to RHEL 7.3; therefore, you will not need to install any additional drivers separately.

OPTIONAL: Configuring “yum” to use CentOS Repositories

For non-registered subscriptions of Red Hat, you may be able to use the CentOS yum package server. In order to do so, follow the instructions below.

1. Open a terminal window and login as root.
2. Add the following centos repository.

```
# vi /etc/yum.repos.d/centos.repo

[centos]
Name=CentOS $releasever - $basearch
baseurl=http://ftp.heanet.ie/pub/centos/7/os/$basearch/
enabled=1
gpgcheck=0
```

3. Run: “yum update”.