

**Oracle® VM VirtualBox
Installation Instructions for Windows 7
and
Linux Virtual Machine Creation
for Development with the
Avnet Zynq®-7000 All Programmable SoC**



**Version 1.3
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Installing Oracle VM VirtualBox on Windows 7

This document shows how to install VirtualBox and the Extension Pack to enable the use of a Linux virtual machine for the cross build platform.

General Instruction:

Install Oracle VM VirtualBox using the official VirtualBox installer. For legal distribution reasons, the VirtualBox installation executable cannot be included with any public Avnet materials. To obtain a free legal copy of the Oracle VM VirtualBox and the Extension Pack, please download from the VirtualBox website:

<https://www.virtualbox.org/wiki/Downloads>

The version downloaded may differ from the version shown in this documentation (5.1.2). Be sure to read the VirtualBox EULA to ensure you do not violate the *Personal Use and Evaluation License* (PUEL). You may also wish to consult the *VirtualBox Licensing Frequently Asked Questions* for a quick overview of the intent of the license agreements:

https://www.virtualbox.org/wiki/Licensing_FAQ

Step-by-Step Instructions:

1. To obtain a free legal copy of Oracle VM VirtualBox, download the installer from this website:

<https://www.virtualbox.org/wiki/Downloads>

The version downloaded may differ from the version shown in this documentation (5.1.2). You also need to download the Extension Pack. Make sure the Extension Pack you download is the same version as your VirtualBox installer.

2. Launch the VirtualBox installer from Windows Explorer by double-clicking the self-extracting executable. Allow the installer to make changes to your computer, if so prompted.


 VirtualBox-5.1.2-108956-Win	8/10/2016 10:32 AM	Application	118,410 KB
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Figure 1 – VirtualBox Installer for Windows

- Once the VirtualBox installation wizard appears, click the **Next** button.



Figure 2 – VirtualBox Installation Wizard Welcome

- You may accept all the installation defaults, although you may wish to change the installation location on your development platform using the **Browse** button. If the options are acceptable, click the **Next** button.

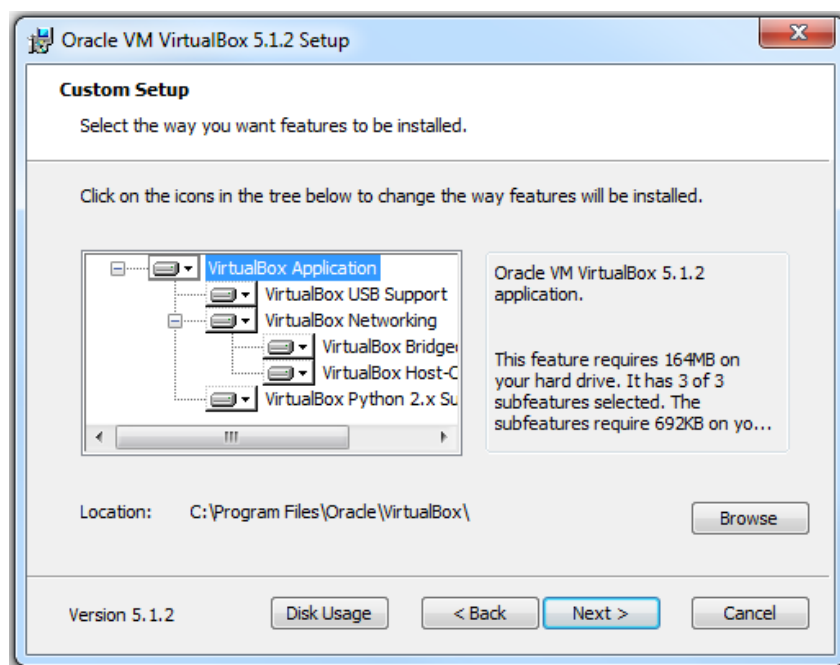


Figure 3 – VirtualBox Custom Setup

5. You may again accept the default options and click the **Next** button.

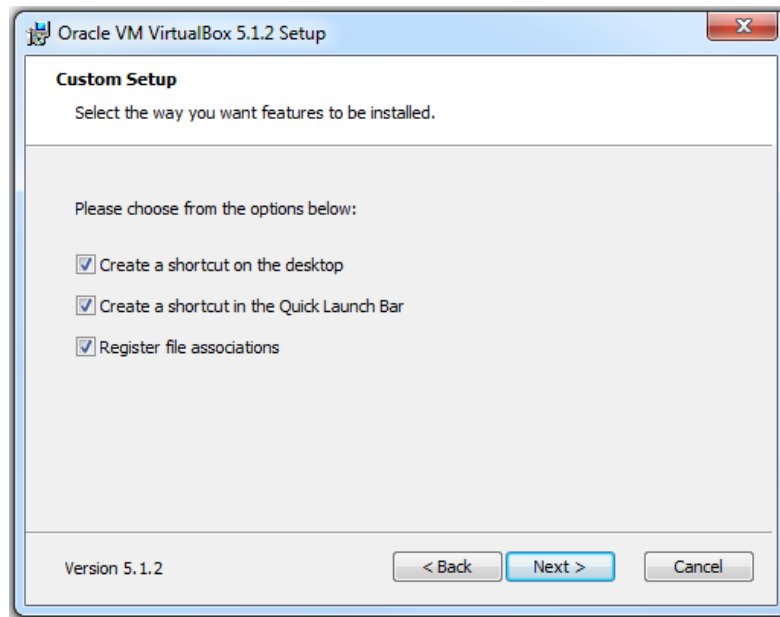


Figure 4 – VirtualBox Custom Setup Options

6. Click the **Yes** button to continue with the installation wizard.

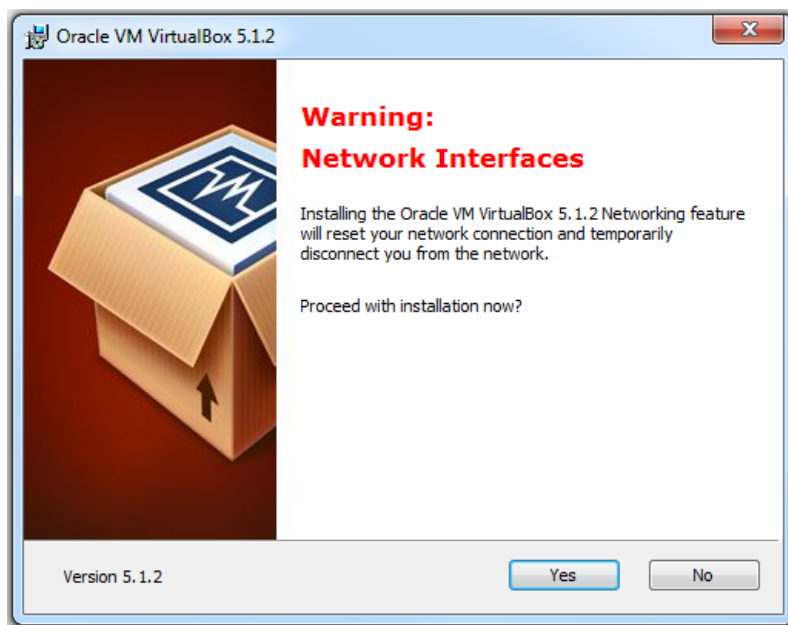


Figure 5 – VirtualBox Network Interfaces

- Click the **Install** button to load VirtualBox to your development system.

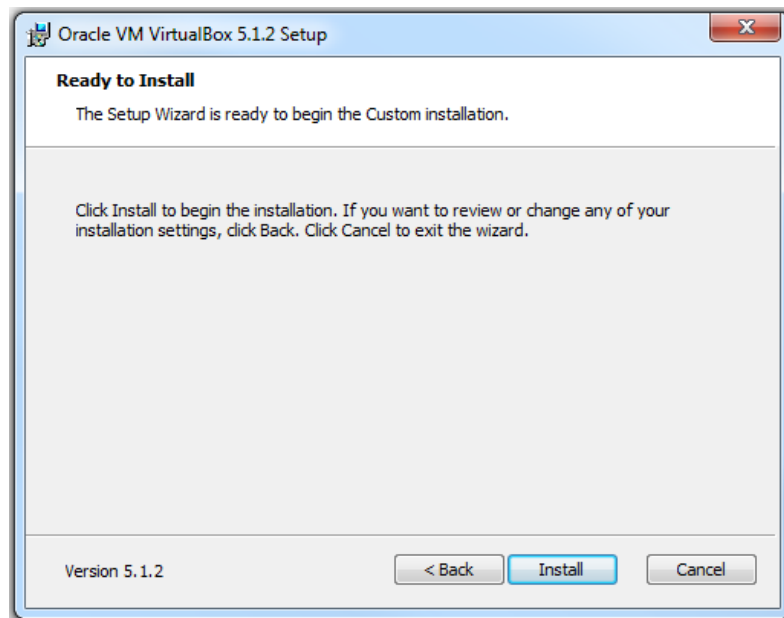


Figure 6 – VirtualBox Ready to Install

- During the installation you may receive prompts to authorize installation of various components. If prompted, allow the installer to make changes to your system, including installation of the USB interface and Network adapters.

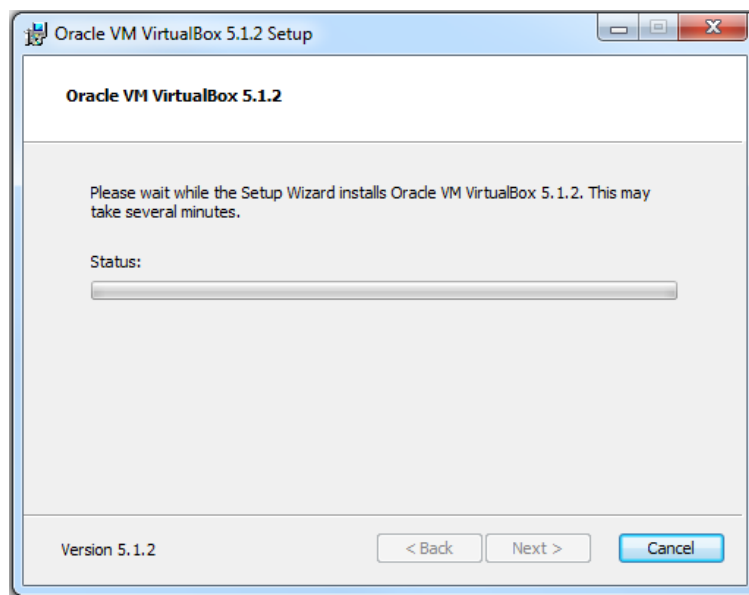


Figure 7 – VirtualBox Installation

- Click the **Finish** button to complete the installation. Leave the checkbox enabled so VirtualBox will start after the installer finishes.

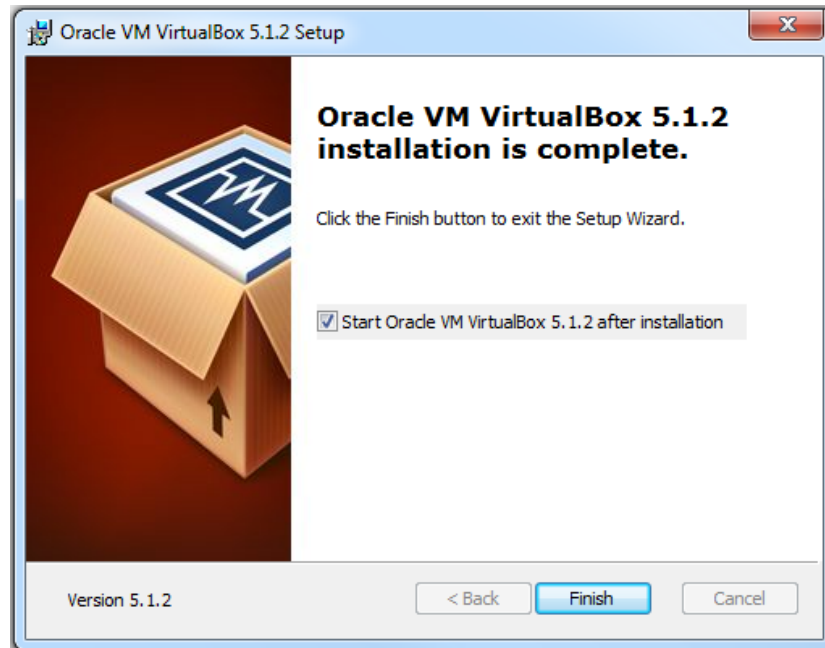


Figure 8 – VirtualBox Installation Complete

- Once VirtualBox starts (you can also start it from the Desktop shortcut, or the Windows Start button), the Extension Pack must be added. From the main menu, select **File > Preferences**.

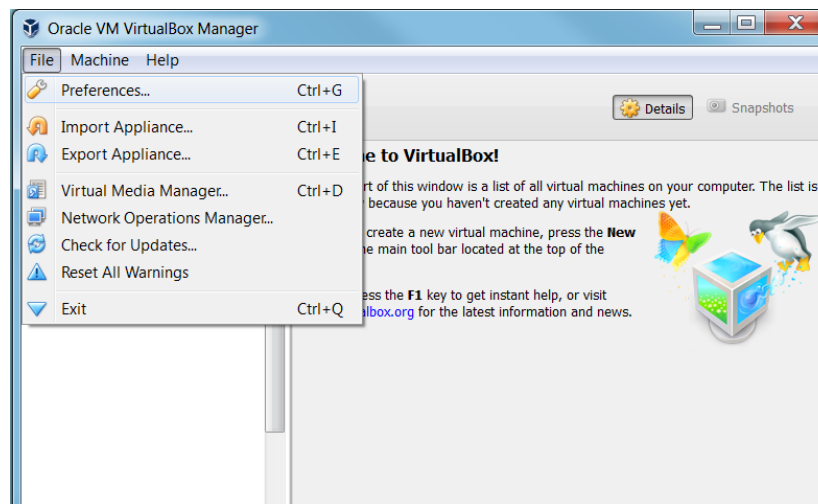


Figure 9 – VirtualBox First Startup

11. Select **Extensions**. Right-click in the *Extension Packages* whitespace box, and select **Add Package**.

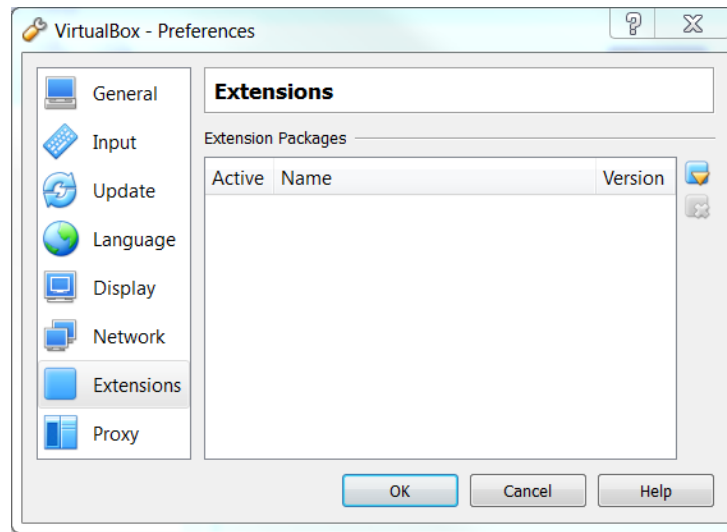


Figure 10 – Add Extension Pack

12. Browse to the location where you downloaded the VirtualBox Extension Pack compatible with your VirtualBox version. Select the Extension Pack and click the **Open** button.

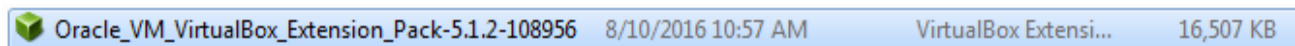


Figure 11 – Select the Compatible Extension Pack

13. Click the **Install** button to add the VirtualBox Extension Pack.

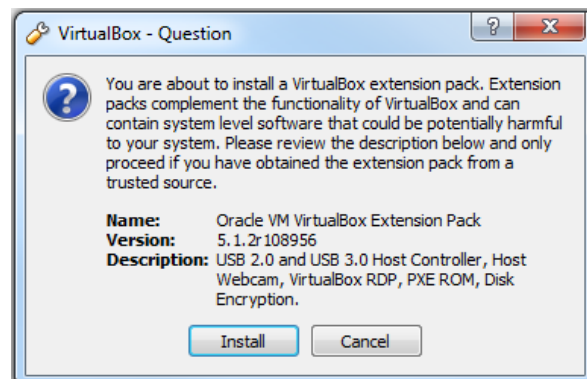


Figure 12 – Install the Extension Pack

14. Read the VirtualBox Extension Pack PUEL License to ensure you will not be in violation of the Oracle definition of Personal Use. See the *VirtualBox Licensing Frequently Asked Questions* for additional details. If you can accept the license conditions, click the **I Agree** button¹. If prompted, allow the installer to make changes to your development system.

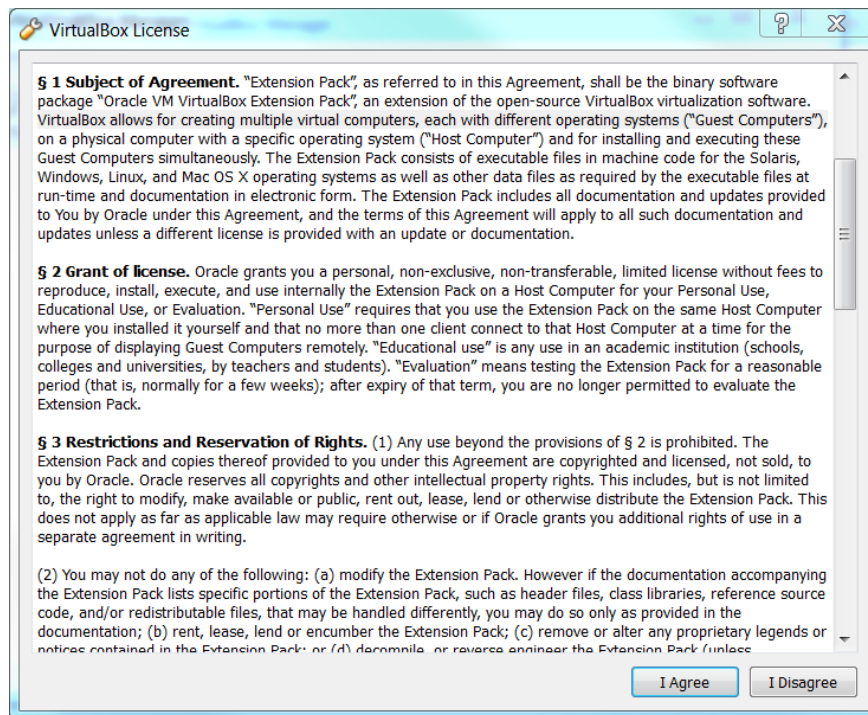


Figure 13 – Extension Pack License Agreement

15. Click the **OK** button to complete the installation.

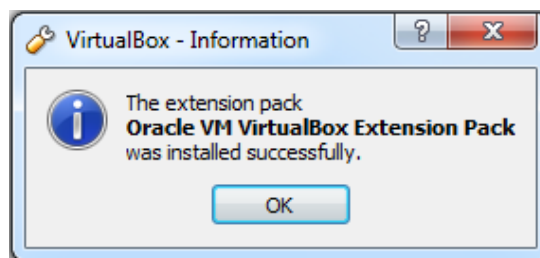


Figure 14 – Extension Pack Installation Complete

¹ If you must disagree, the installation will be terminated. You should either purchase a commercial license or uninstall VirtualBox from your host computer.

16. Click the **OK** button to return to VirtualBox.

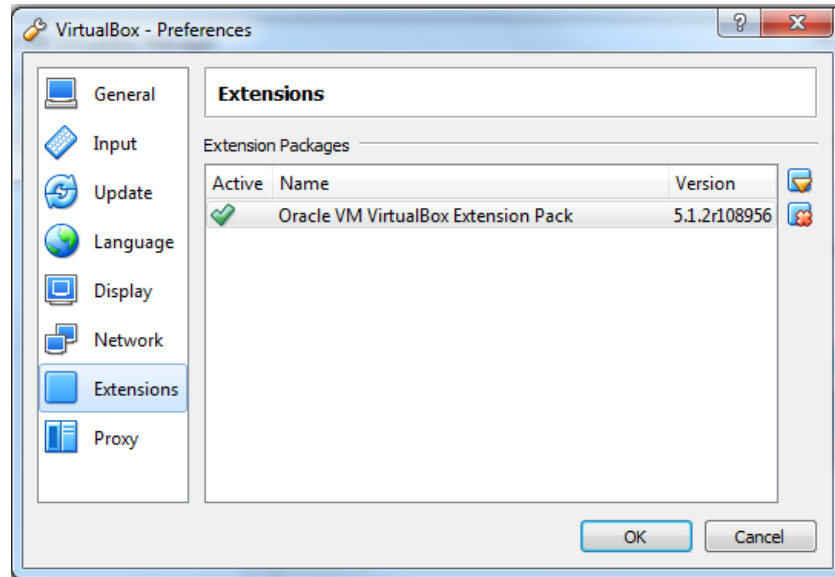


Figure 15 – VirtualBox Extension Pack Installation Complete

This completes the installation of VirtualBox on your host development system. VirtualBox is now ready to accept a new Virtual Machine.

Create a New Virtual Machine

1. Launch VirtualBox and click the **New** icon at the upper left.



Figure 16 – Create a New Virtual Machine

2. Select a descriptive name for the VM. Set the *Type* to **Linux** and the *Version* to one that corresponds to the OS you wish to install.
 - a. For CentOS, choose **Red Hat (64-bit)**.
 - b. For Ubuntu, choose **Ubuntu (64-bit)**.

Click the **Next** button.

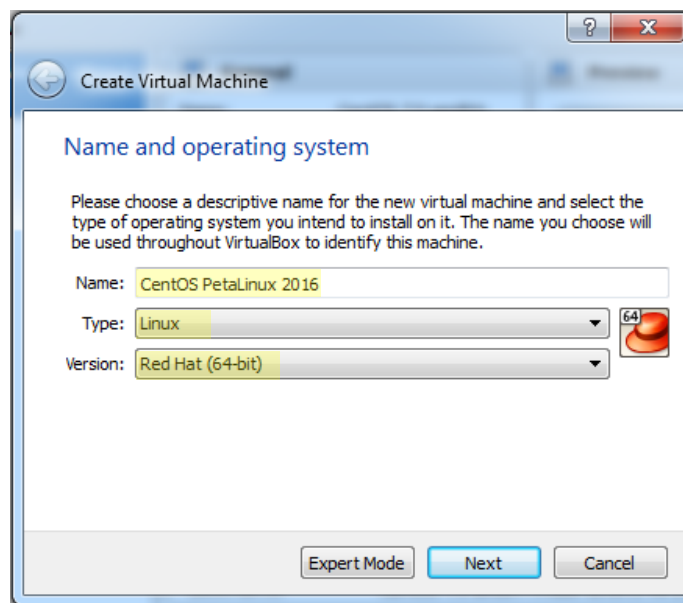


Figure 17 – Set the Virtual Machine Name

3. Select the amount of memory to be allocated to the Virtual Machine. Allocating more memory² will improve the VM performance, but you must leave sufficient memory available for your host system for all other concurrent processes. For a host system with 16 GB of RAM, a value of **2048 MB** is recommended for the Virtual Machine. You may wish to experiment with this value to optimize your performance. Once you have selected a memory size, click the **Next** button.

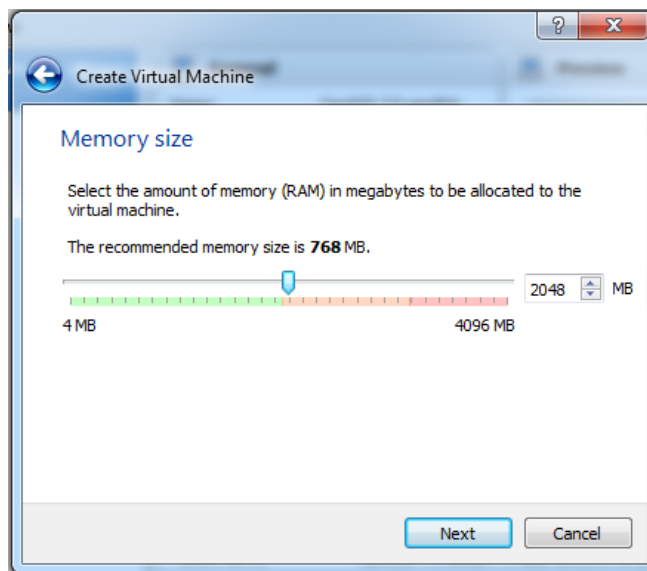


Figure 18 –Select a VM Memory Size

4. Click the **Create**³ button to allocate a virtual hard drive now.

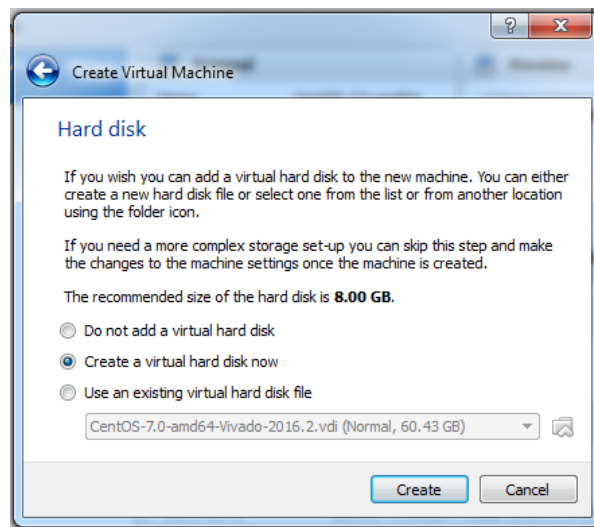


Figure 19 – Create a Virtual Hard Drive

² You may need more memory if you intend to run Vivado with large Xilinx devices.

³ If you are importing an existing Virtual Machine, click the "Use an existing..." button.

- Click the **Next** button to accept the default file type for a VirtualBox Disk Image.

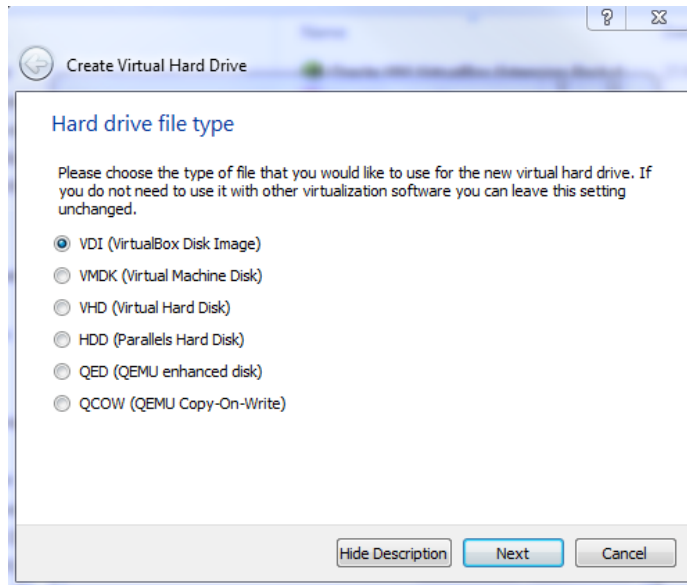


Figure 20 – Set Virtual Disk Type

- Select **Fixed Size** for the physical storage on your host hard drive. This will improve overall performance of the Virtual Machine. Click the **Next** button.

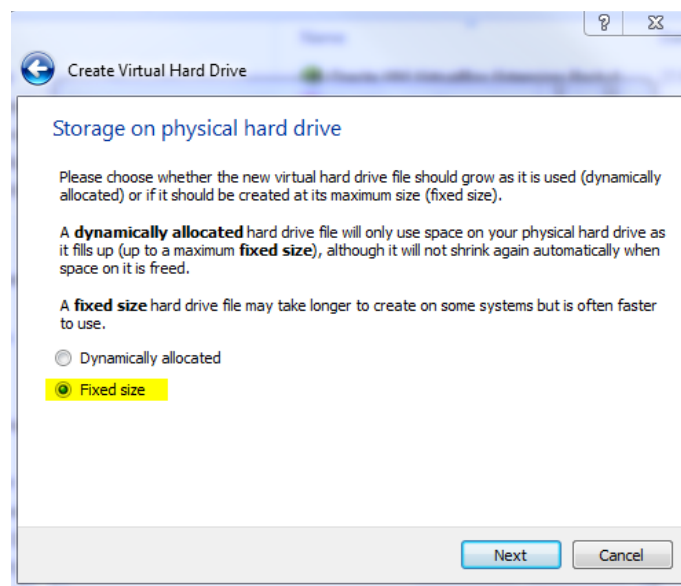


Figure 21 – Set Virtual Disk Storage

7. Select the name and location for the Virtual Machine within your host file system. It is recommended that the default size be set at **60.0 GB** to accommodate the Xilinx tools. If this space is unavailable, 20.0 GB is sufficient if you plan to install only the Software Development Kit and not Vivado. Click the **Create** button.

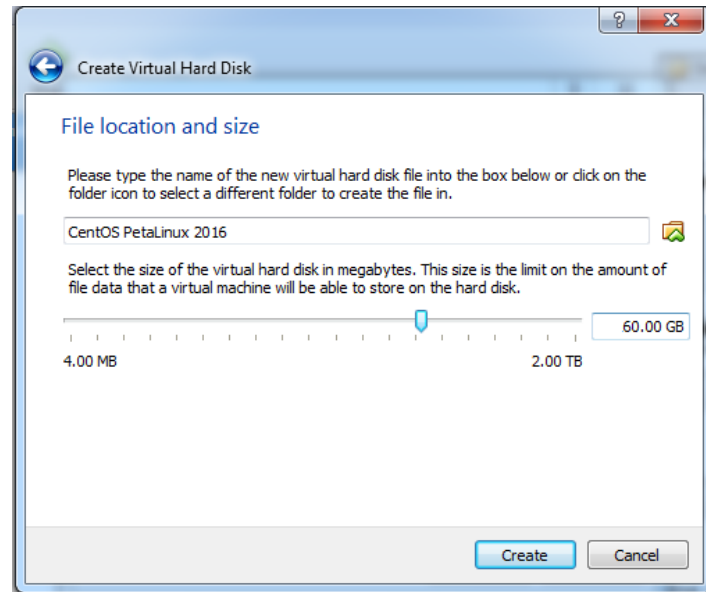


Figure 22 – Create Virtual Hard Disk

The Virtual Hard Disk may take a few minutes to create and initialize on your host file system.

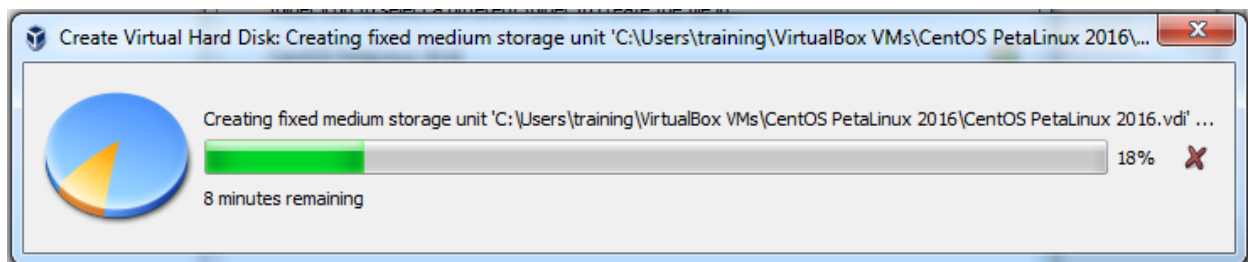


Figure 23 – Virtual Hard Disk Creation

8. Once the Virtual Disk completes, your VM is ready to accept an operating system.

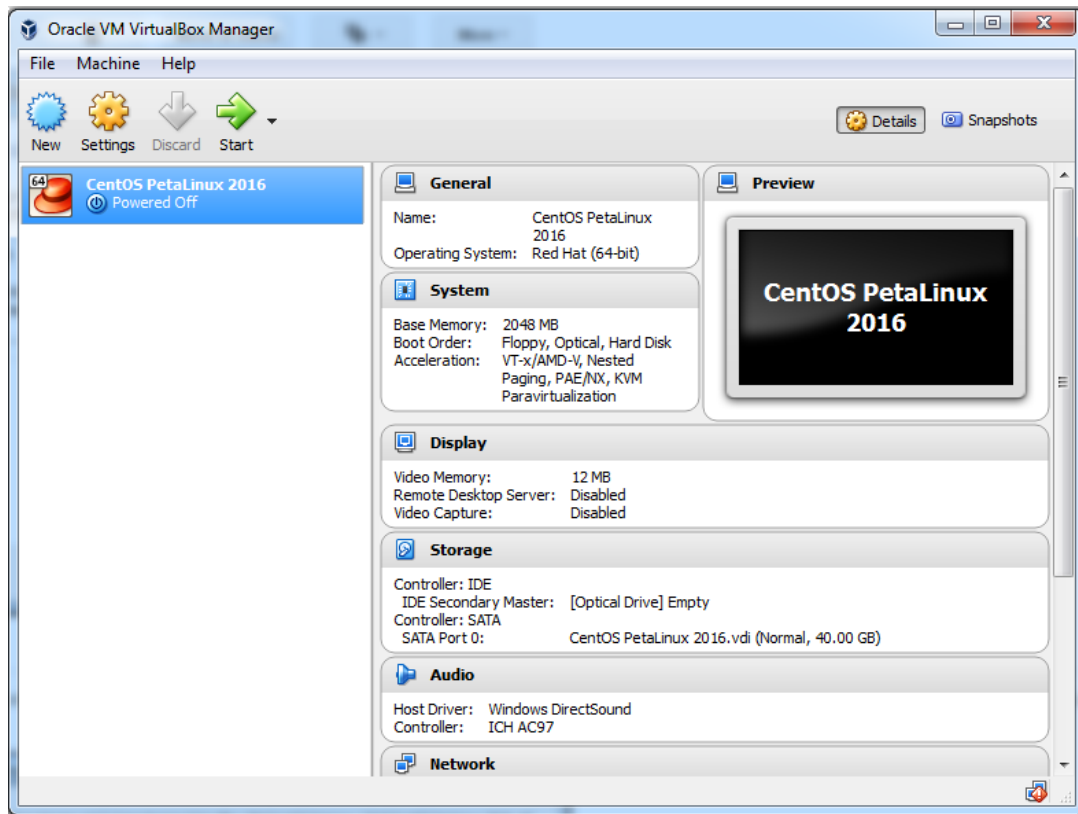


Figure 24 – Virtual Hard Disk Creation Complete

Install the CentOS 7 Operating System

To perform the steps in this section, you will need to download a bootable OS image in .iso format to your host system. The most recent CentOS images can be downloaded from:

<http://www.centos.org/download/>

For the Xilinx 2016.2 tools, the latest version of CentOS officially supported by Xilinx is CentOS 7.0.

1. Launch VirtualBox (if necessary) and select the VM you wish to start in the left-hand panel. Click the **Start** button to execute the VM.

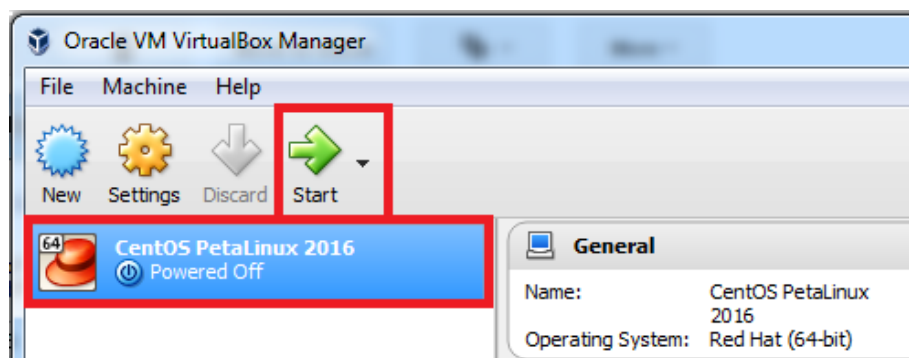


Figure 25 – Launch the New VM

2. Your VM may issue one or more warning messages similar to the one shown below. In most cases these will not impact the operation required for creating a PetaLinux development environment, and you may click the **OK** button. Correcting such issues is machine-dependent and is beyond the scope of this document.

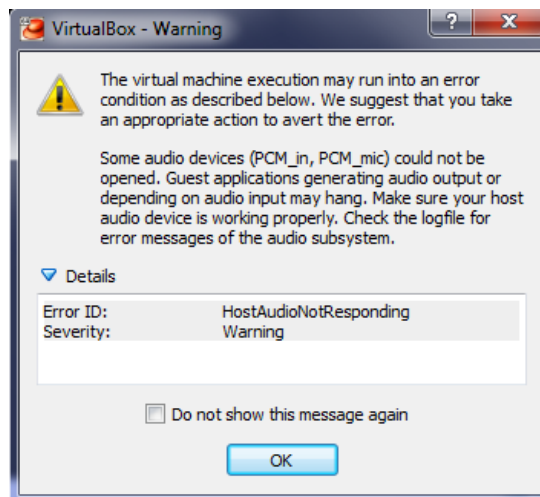



Figure 26 – Startup Warning Message(s)

3. Select the **Browse**  icon to locate the .iso image for the OS you wish to install on your Virtual Machine. Click the **Start** button to begin.

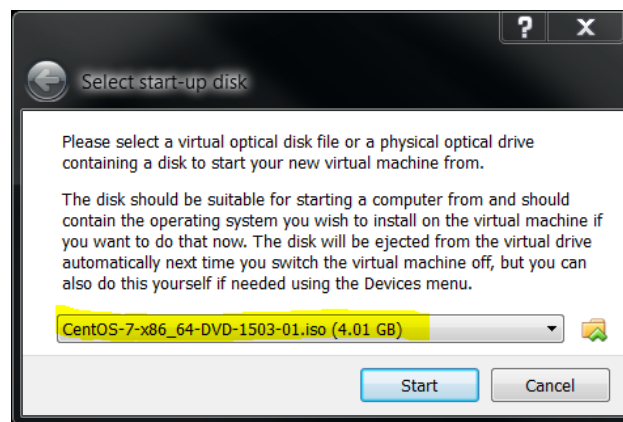


Figure 27 – Select VM OS Image

4. Proceed with **Install CentOS 7**.
5. Select the option (default) to **Install CentOS 7** and hit the *Enter* key. If desired, you may move between options using the up/down arrow keys. During the installation, you can recapture the cursor in Windows by pressing the *Right Ctrl* key.

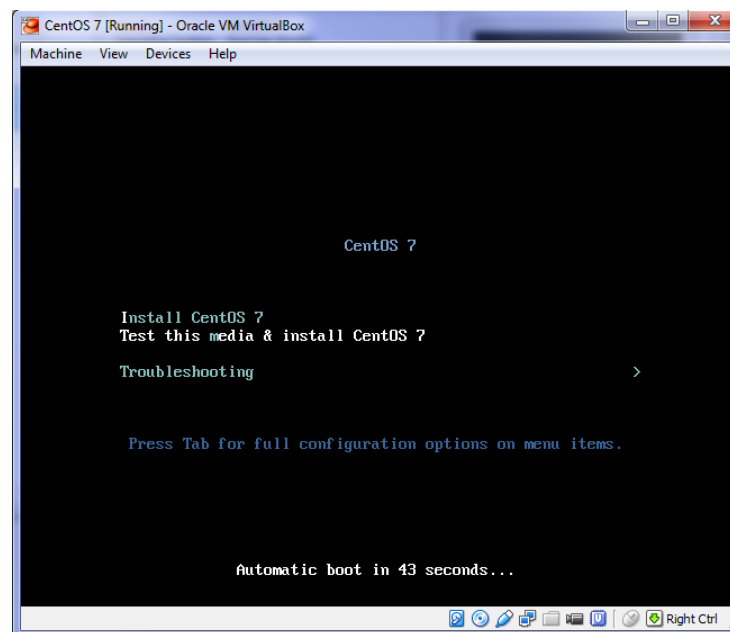


Figure 28 – CentOS 7 Initial Installation Screen

6. Select your language using the mouse and click the **Continue** button.

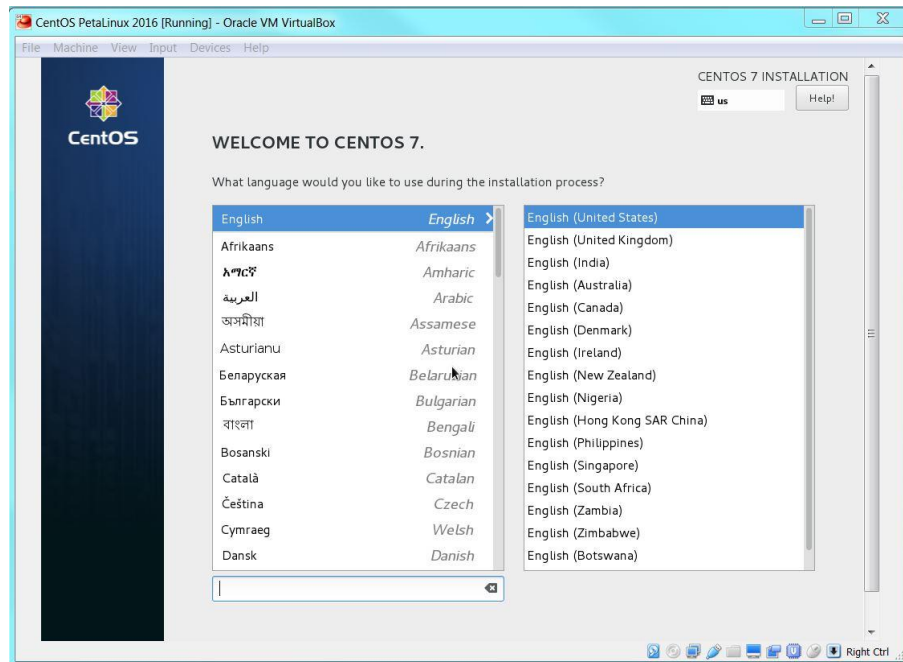



Figure 29 – CentOS 7 Initial Installation Screen

7. You *must* complete any sections marked with the  icon before proceeding. However, you may want to adjust other sections as well. These adjustments are included in the following sub-bullets.

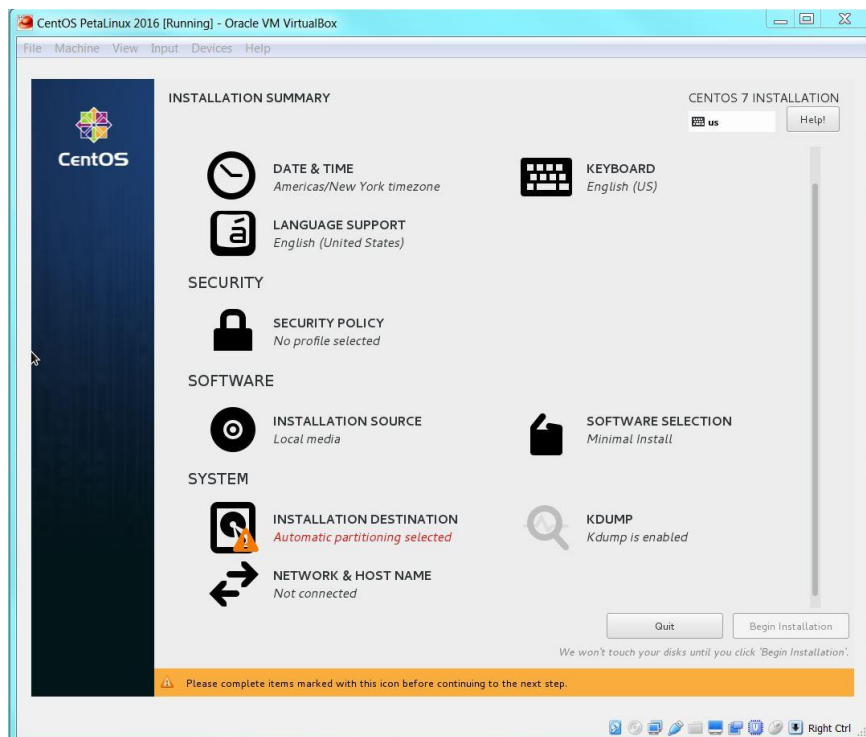


Figure 30 – CentOS 7 Installation Summary

- a. Click the **Network & Host Name** entry. In the new panel, click the button next to the *OFF* indicator (highlighted) at the upper left to turn networking *ON*.



Figure 31 – Activate Networking

Click the **Configure** button in the panel. Click the checkbox to automatically connect to the network when it is available. Click the **Save** button to make the setting permanent.

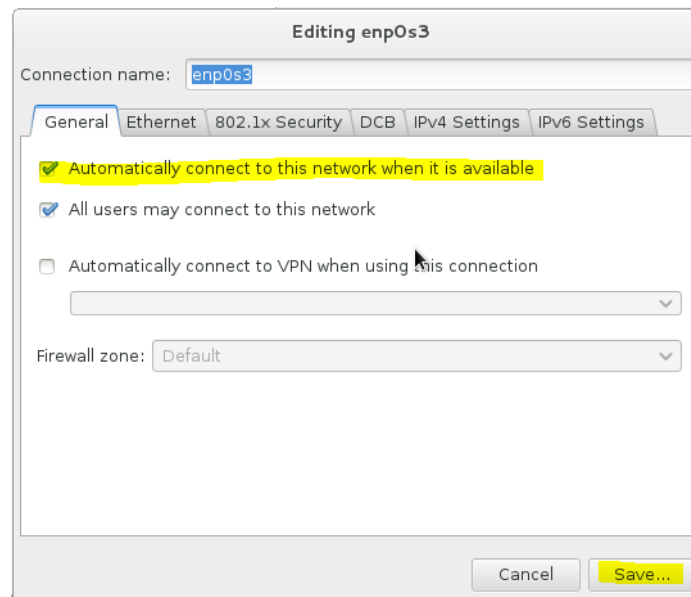


Figure 32 – Automatically Connect Network Interface

Click the **Done** button at the upper left of the *Network & Host Name* panel to return to the *Installation Summary* screen.

- b. Click the **Date & Time** entry. Select your time zone by clicking on the appropriate section of the world map. You can also choose to set your clock to an NTP server by turning the Network Time on by clicking on the slider button at the upper right.

If you wish you can also set the date and time of day manually by using the controls provided at the bottom of the panel.

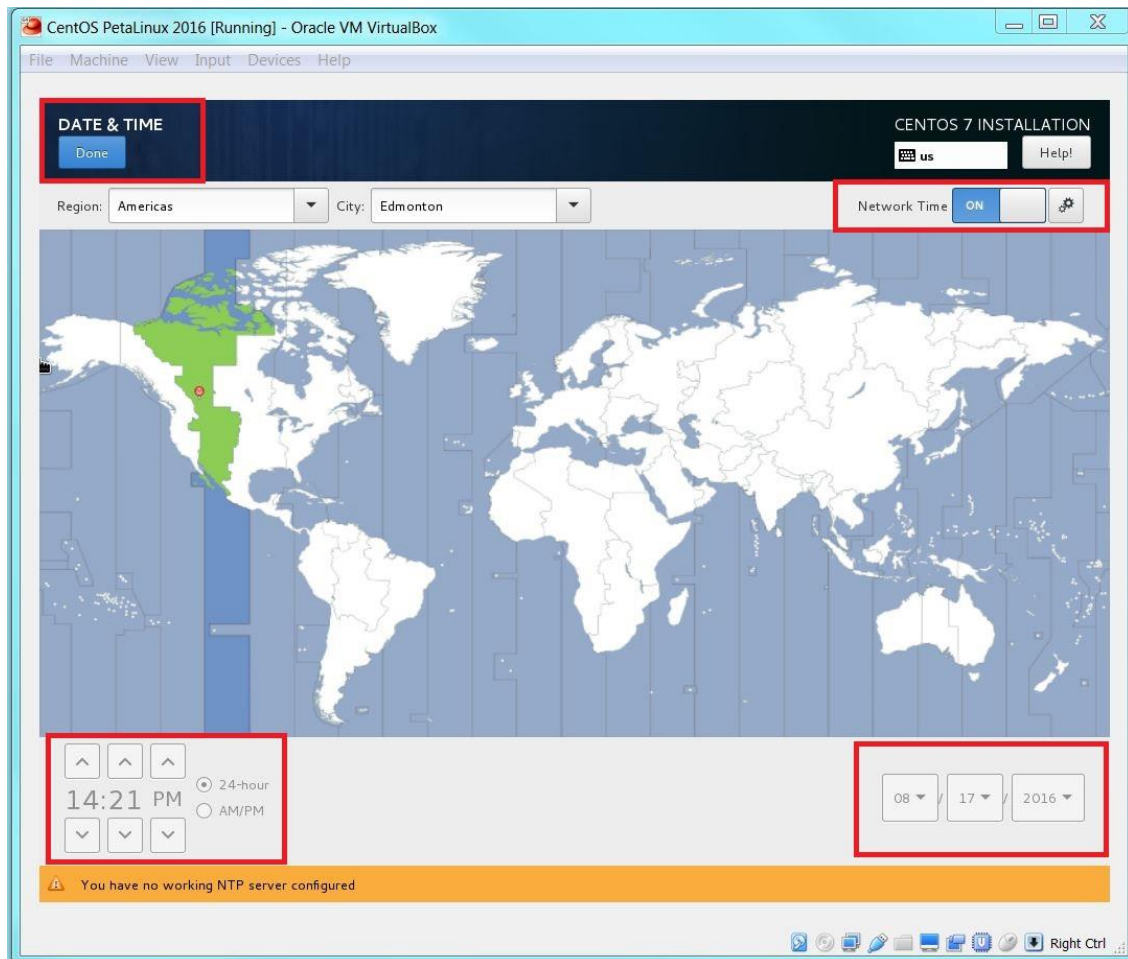


Figure 33 – Time and Date Selection

Click the **Done** button at the upper left to return to the *Installation Summary* screen.

- c. Click the **Software Selection** entry. By default, a minimal installation is selected which provides only a command line interface. You probably want a desktop for ease of use, so the recommendation is to select GNOME Desktop⁴. This will populate the *Add-Ons* panel with additional options. At a minimum you should select the GNOME Applications, Legacy X-Window System Compatibility and Development Tools here.

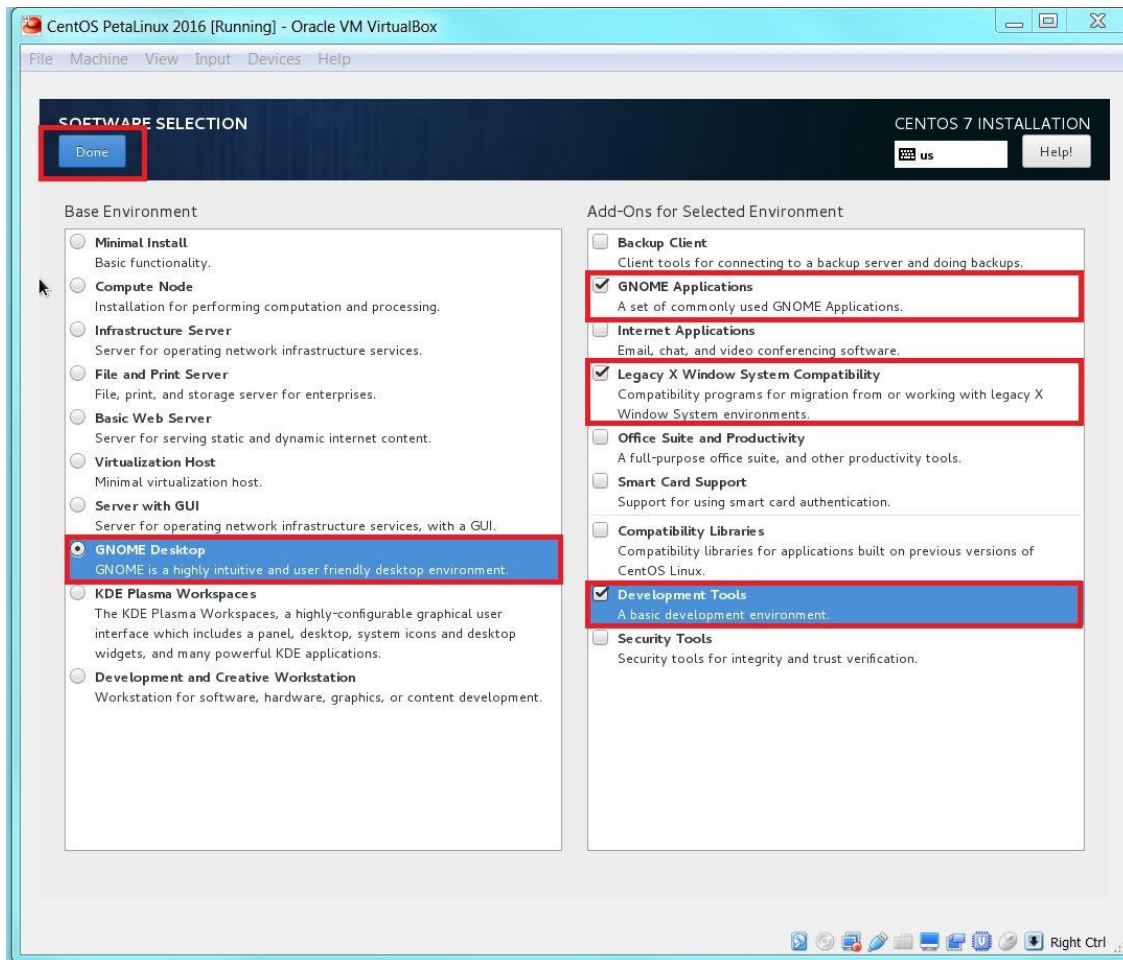


Figure 34 – Software Selection

Click the **Done** button to return to the *Installation Summary* screen.

⁴ If you would like a more extensive set of development tools, select Development and Creative Workstation.

- d. Click the **Installation Destination** entry. As this is a new installation, there is no need to make any changes here. You can allow the system to automatically partition the entire space previously allocated for your Guest OS hard drive. Ensure the **Automatically configure partitioning** option is selected, and click the **Done** button to return to the *Installation Summary* Screen.

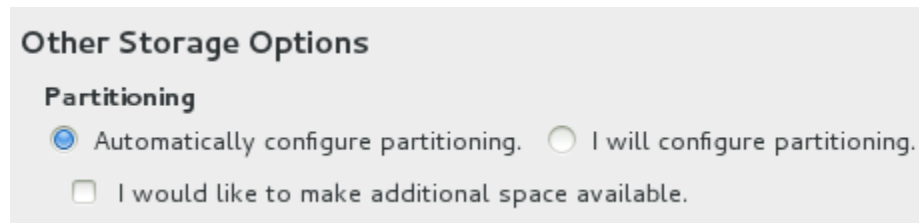


Figure 35 – Virtual Disk Partitioning Options

8. In the Installation Summary screen, click the **Begin Installation** button at the bottom right.



Figure 36 – Start CentOS 7 Install Script

9. As the installation process begins, you will see on the next panel that there is no root password and no user account. You can set both of these while the installation is going on.

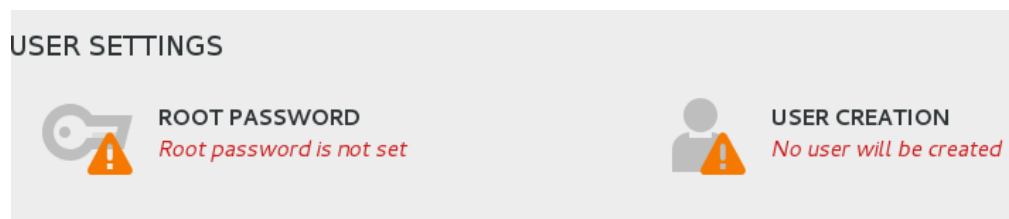


Figure 37 – Configure User Settings

- a. Click the **ROOT PASSWORD** entry. Enter and confirm the *root password* you wish to use for your CentOS installation. If your password does not meet the strength test, you will need to click the **Done** button twice instead of once to exit.

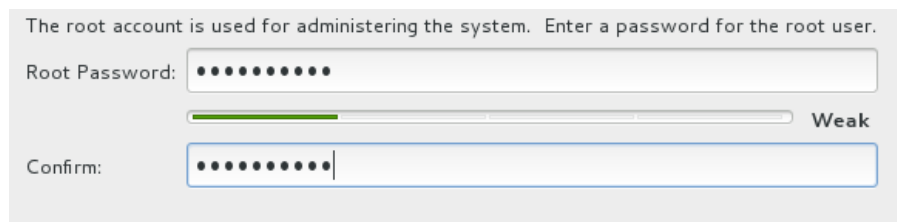
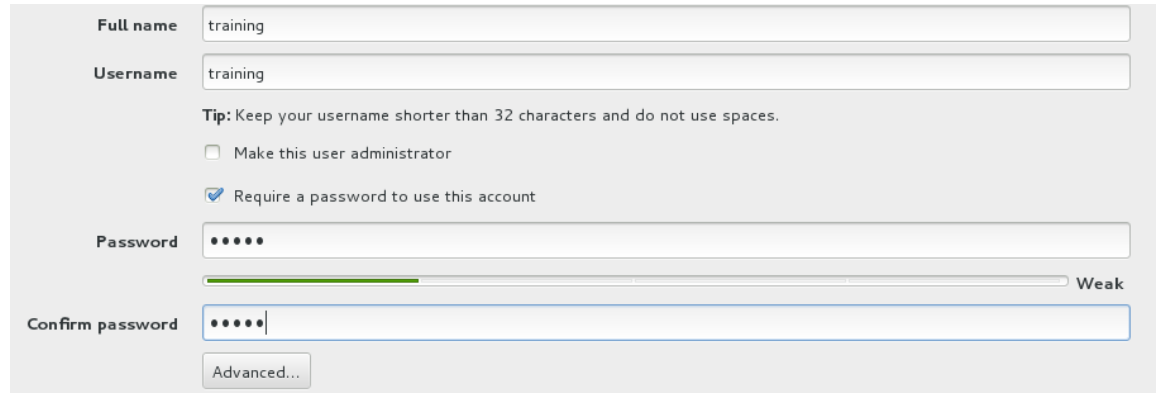


Figure 38 – Set Root Password

- b. Click the **USER CREATION** entry. Enter an account (user) name and password for the account. If you wish, you may uncheck the *Require a password...* box to remove the password requirement from the user account. Click the **Done** button (twice if your password is weak) to confirm the settings.



Full name training

Username training

Tip: Keep your username shorter than 32 characters and do not use spaces.

☐ Make this user administrator

☒ Require a password to use this account

Password

Confirm password

Advanced...

Figure 39 – Set Standard Account and Password

10. When the installation completes, click the **Reboot** button at the bottom right of the screen to continue.

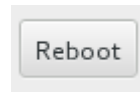


Figure 40 – Reboot

CentOS 7 First Time Configuration

1. After the system reboots, log into Linux using the user account credentials created earlier.

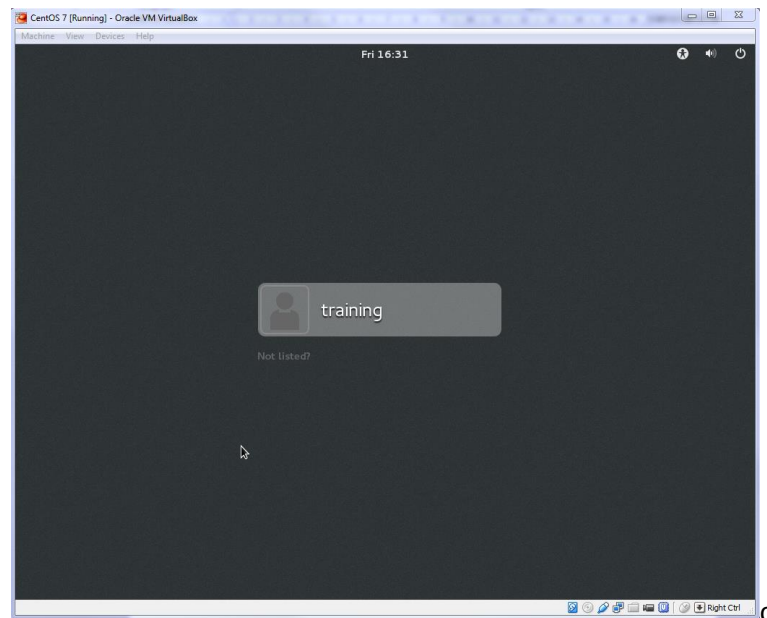


Figure 41 – CentOS 7 Virtual Machine

2. The GNOME desktop has a few more initial setup screens to finalize the user account on the first login. Select your default language and click the **Next** button.

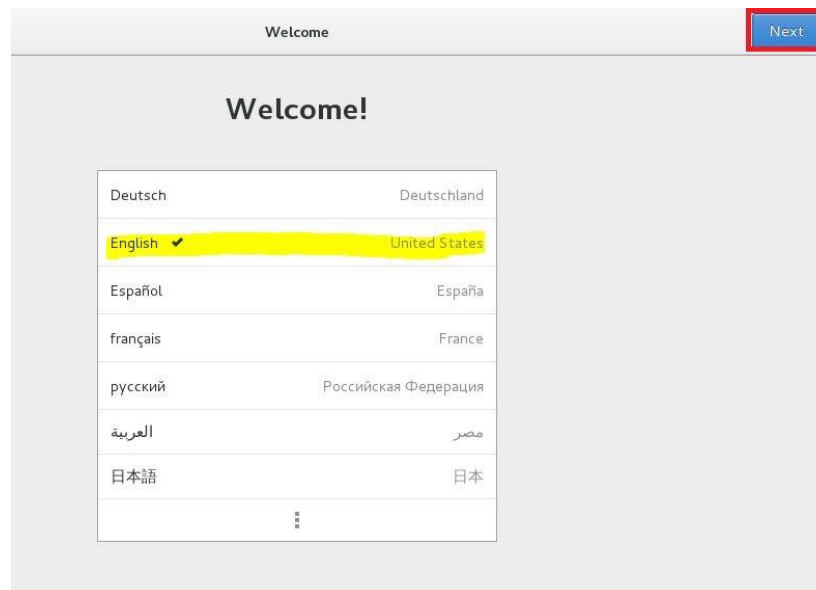


Figure 42 – CentOS 7 User Account Default Language

3. Select your default keyboard input and click the **Next** button.

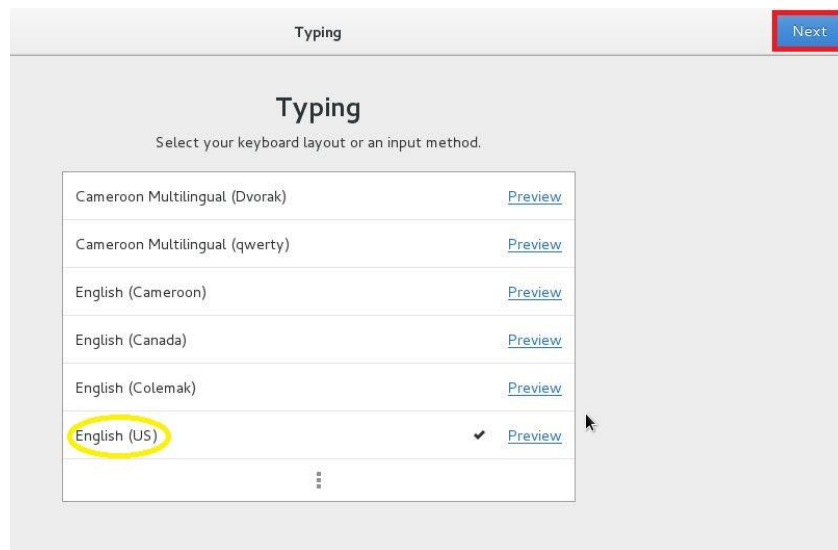


Figure 43 – CentOS 7 User Account Default Keyboard

4. Connecting your Online Accounts and Cloud setup is beyond the scope of this tutorial. Click the **Skip** button.

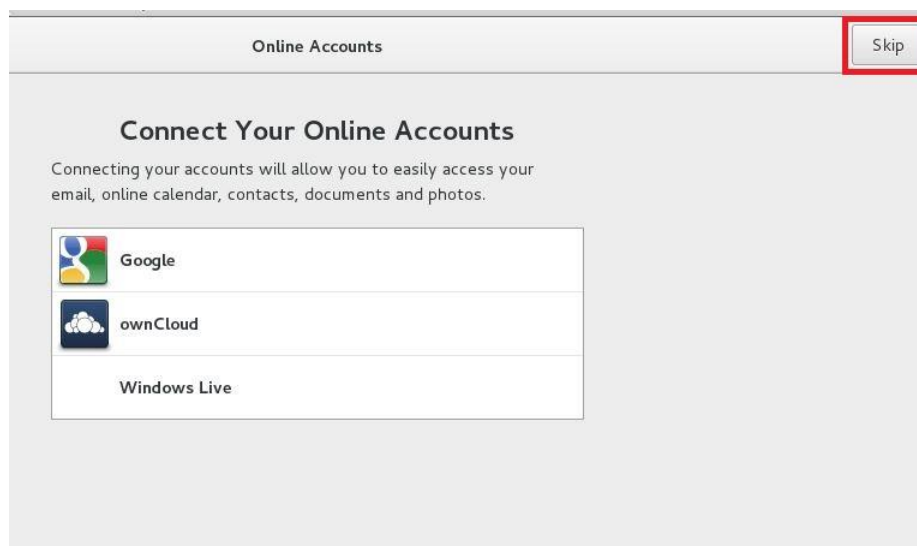


Figure 44 – Skip Cloud Configuration

5. Click the **Start using CentOS Linux** button to complete the first time setup and view the desktop.



Figure 45 – Account Configuration Complete

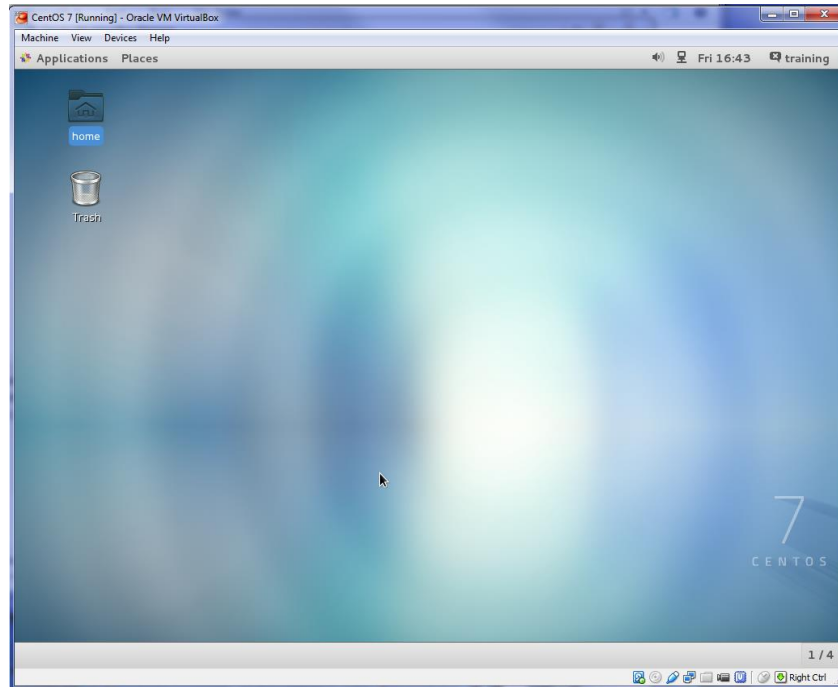


Figure 46 – CentOS 7 Default Desktop

Install the Ubuntu 16.04 Operating System

To perform the steps in this section, you will need to download a bootable OS image in .iso format to your host system. The most recent Ubuntu images can be downloaded from:

<http://www.ubuntu.com/download/desktop>

Repeat the steps outlined in **Create a New Virtual Machine**, entering Ubuntu as the **Name** of the VM. Once the Virtual Disk completes, your VM is ready to accept an operating system.

1. Launch VirtualBox (if necessary) and select the VM you wish to start in the left-hand panel. Click the **Start** button to execute the VM.

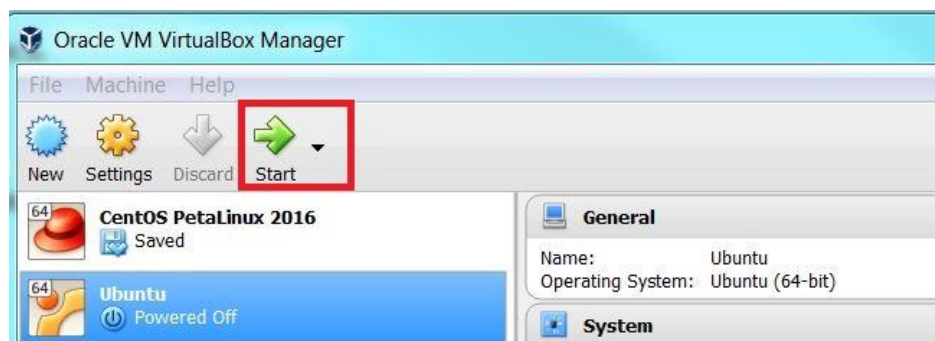



Figure 47 – Launch the New VM

2. Select the **Browse**  icon to locate the .iso image for the OS you wish to install on your Virtual Machine. Click the **Start** button to begin.

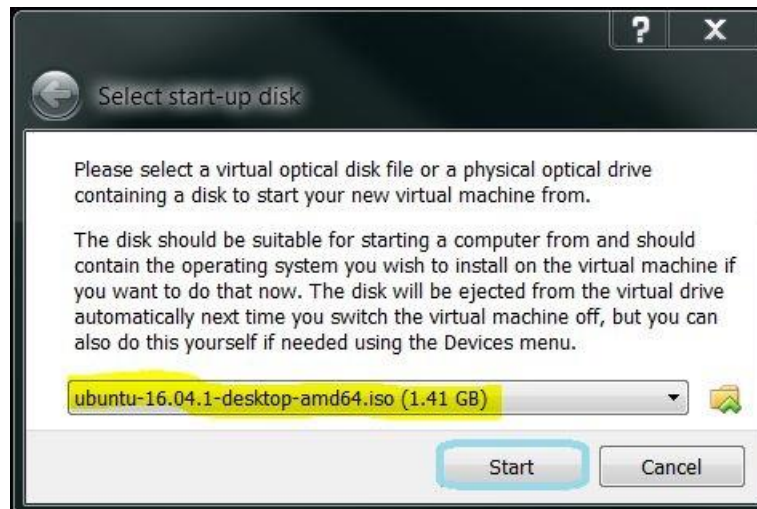


Figure 48 – Select VM OS Image

- When the Install Welcome screen appears, select English and click the **Install Ubuntu** button.

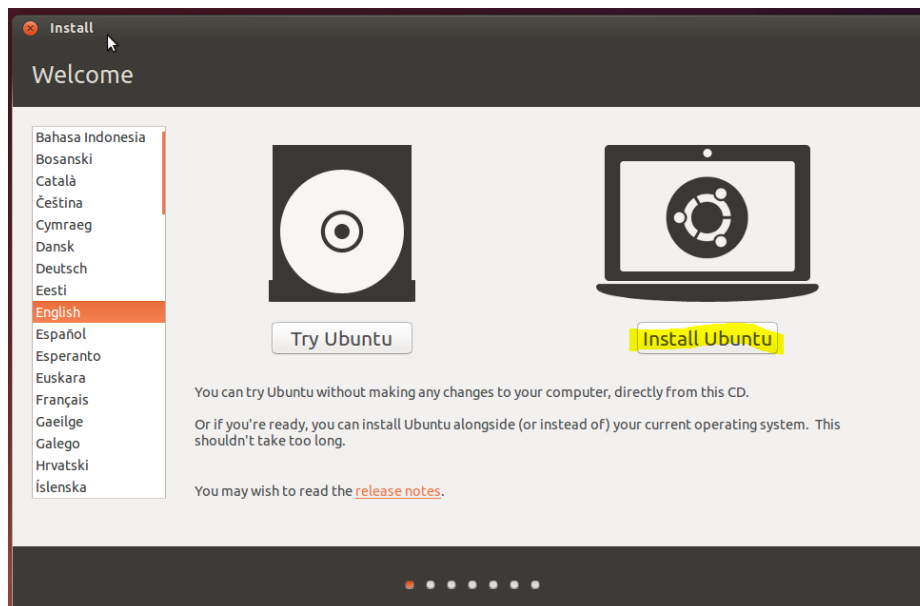


Figure 49 – Install Ubuntu

- The installer shows requirements for installation. Click the **Continue** button.

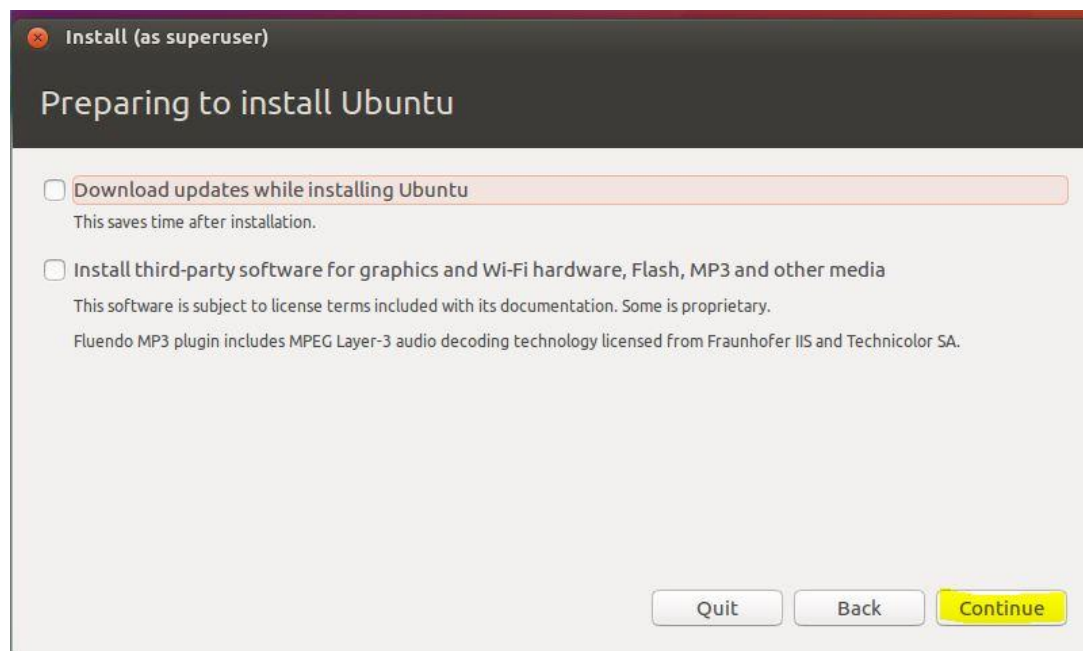


Figure 50 – Requirements for Installation

5. The installer displays various installation types. The default displays as **Erase disk and install Ubuntu**. Click the **Install Now** button.

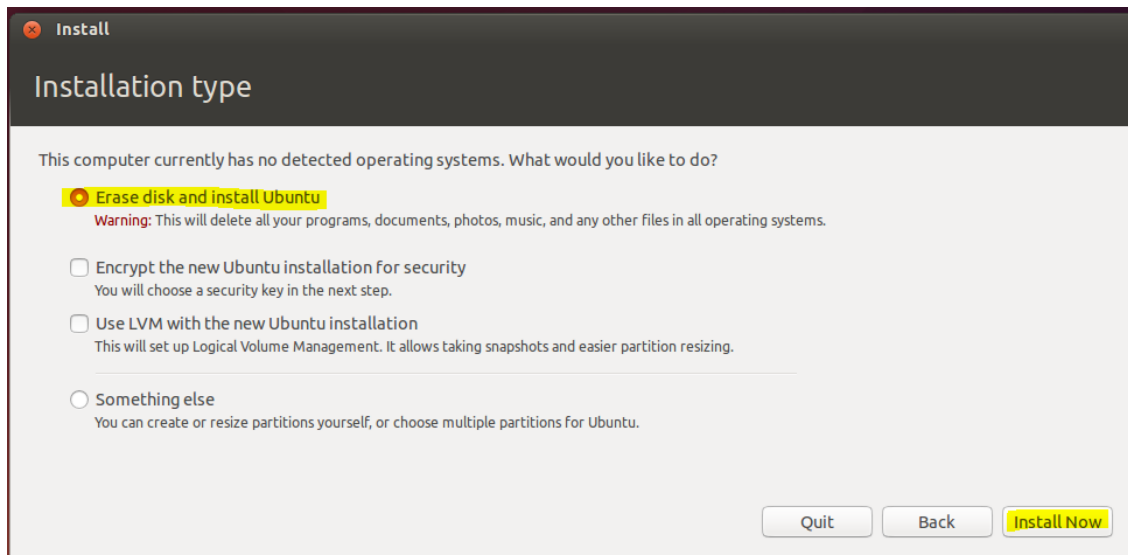


Figure 51 – New Installation

As this is a new installation, we want all changes written to the disks. Click the **Continue** button.

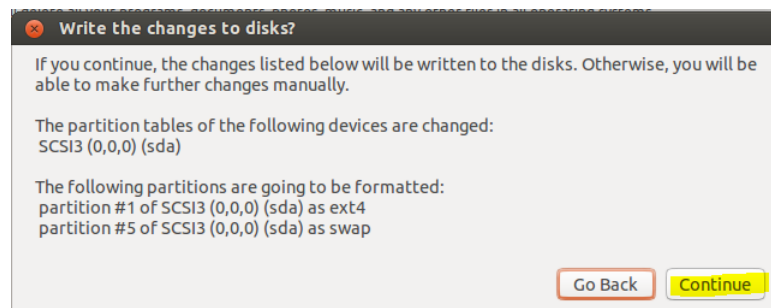


Figure 52 – Write to Disk

6. Select your time zone and click the Continue button.

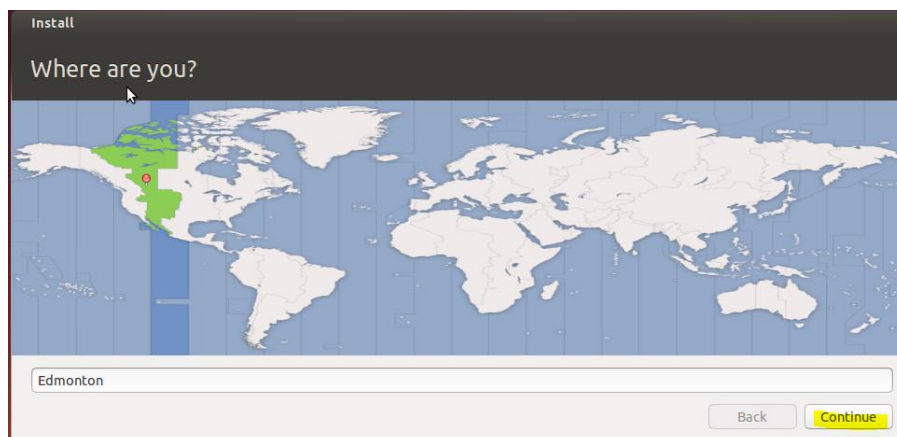


Figure 53 – Time and Date Selection

7. Select your preferred keyboard layout option. The default displays as English (US). Click the **Continue** button.

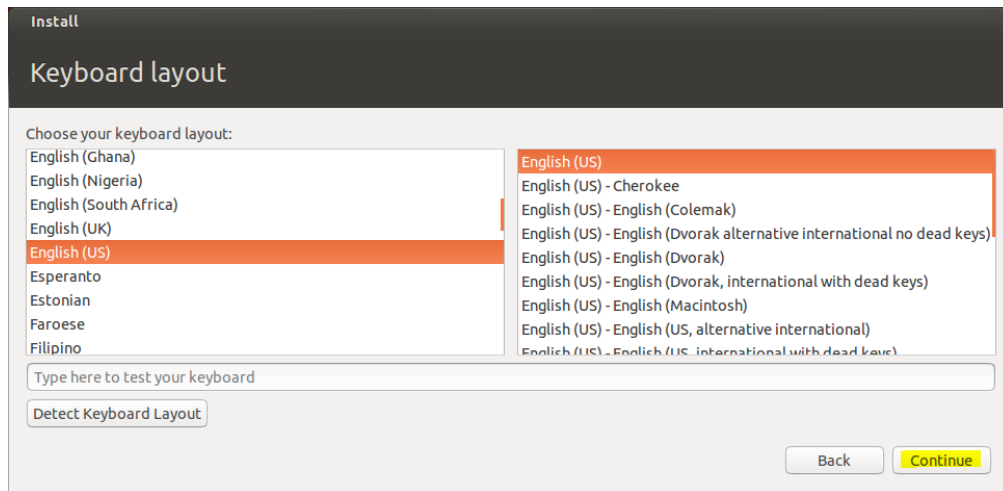


Figure 54 – Keyboard Type

8. Enter the primary user name for the Virtual Machine. The system will auto-populate the computer name and username. Enter and confirm a password. Click the **Continue** button.

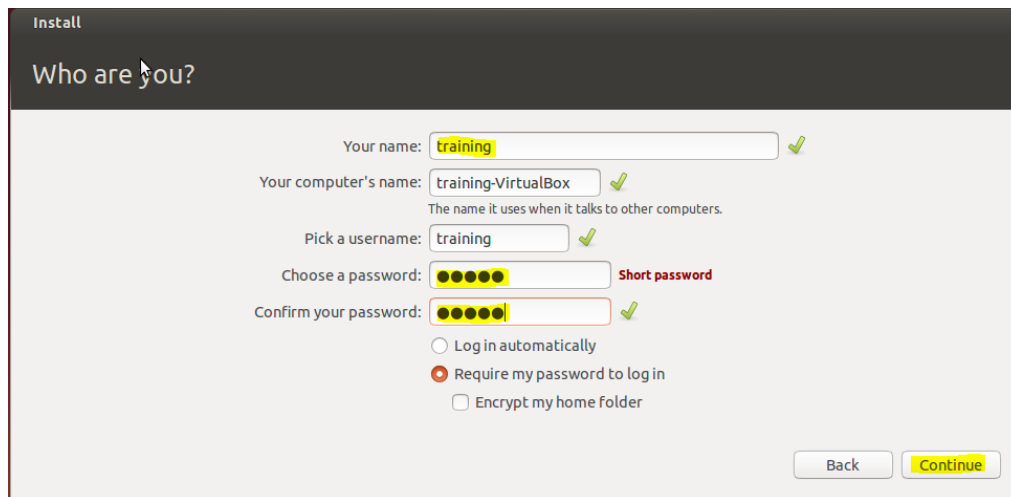


Figure 55 – Ubuntu Preferences

9. The installation displays a Welcome graphic and proceeds with installation. When the installation is complete, a screen appears asking you to restart. Click the **Restart Now** button.

If the Restart appears to “freeze”, you can force a reboot manually:

- a. From the main VirtualBox menu, select **File | Close**.
- b. In the *Close Virtual Machine* dialog, select **Power off the machine** and click the **OK** button.
- c. In the Oracle VM VirtualBox Manager, select your Virtual Machine and click the **Start** button.

VirtualBox Installation Tips

VirtualBox Guest Additions Installation (File Sharing)

1. The use of shared folders allows for easy transfer of files between the host and guest systems. To use the shared file facility of VirtualBox, you must install the Guest Additions. If you attempt to use the shared folder facility without the Additions, you will receive the following error message.

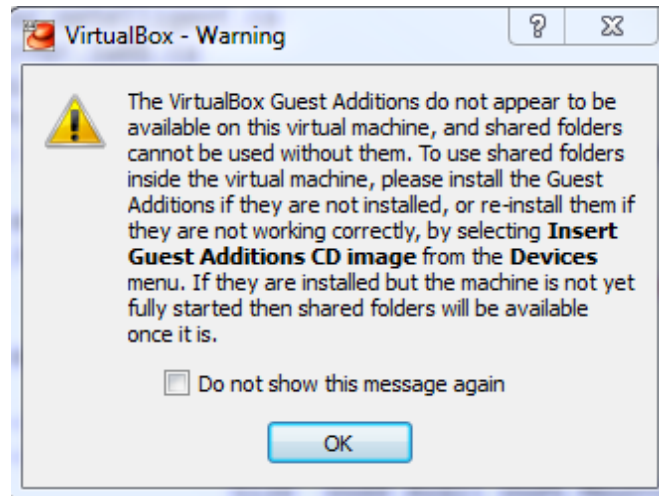


Figure 56 – VirtualBox Guest Additions Missing

After Guest Additions are installed, you can move the cursor between the Virtual Machine and the host OS without having to use the *Right Ctrl* key to recapture the cursor in the host.

- a. From the **Devices** menu, select **Insert Guest Additions CD image...**

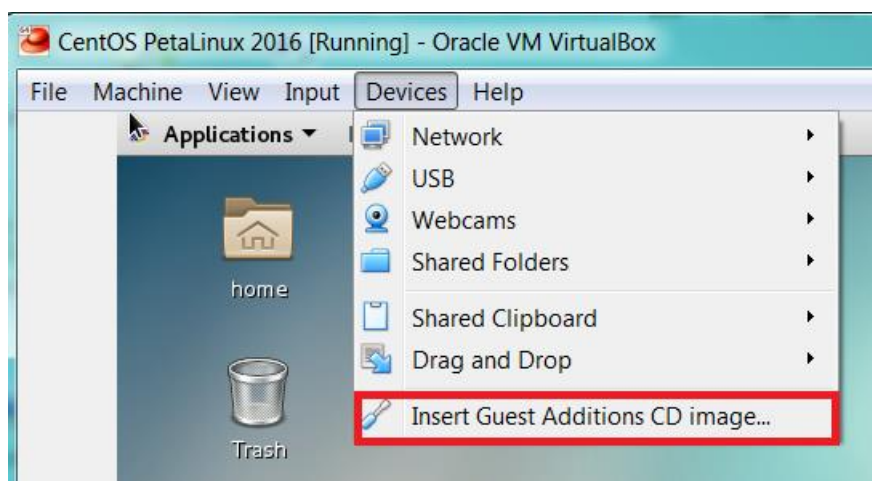


Figure 57 – Guest Additions Install

- b. Click the **Run** button to execute the installation.

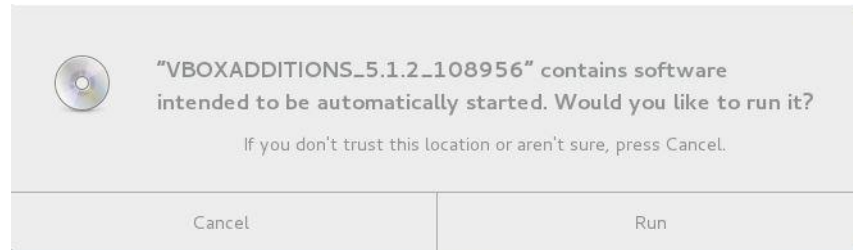


Figure 58 – Run Guest Additions Installation

- c. Enter the root password and click the **Authenticate** button.

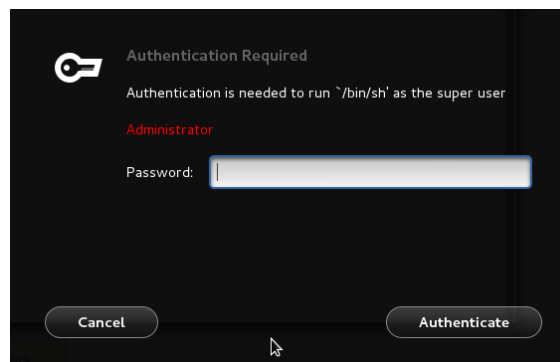


Figure 59 – CentOS 7 Root Authentication

- d. The Guest Additions should install and verify with no failures. Press the **Enter** key to close the installation window.

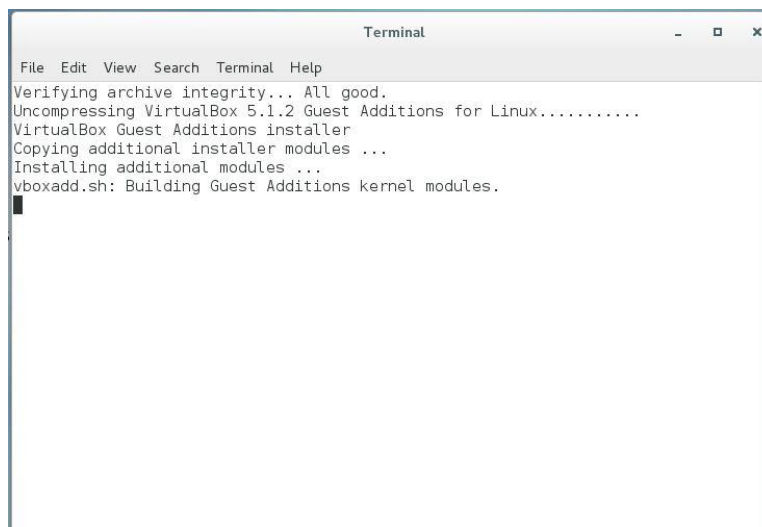


Figure 60 – Guest Additions Installation Complete

VirtualBox Shared Folders

Once the Operating System has been installed, you must select a folder to share between the host and guest systems. This folder is used to transfer files to/from the Virtual Machine and the Host system.

1. From the VirtualBox main menu, select **Devices > Shared Folder > Shared Folders Settings...**

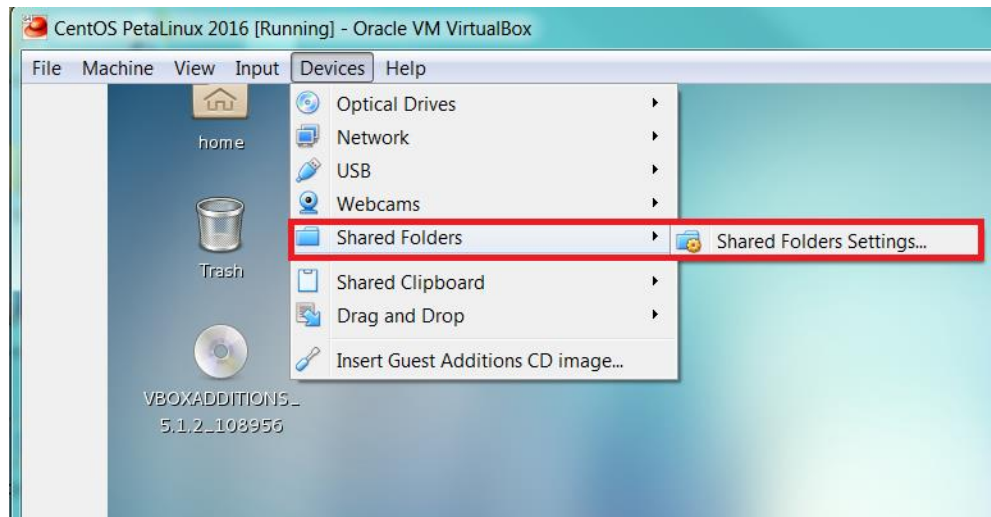


Figure 61 – VirtualBox Shared Folders

2. Right-click *Machine Folders* and select **Add Shared Folder**.

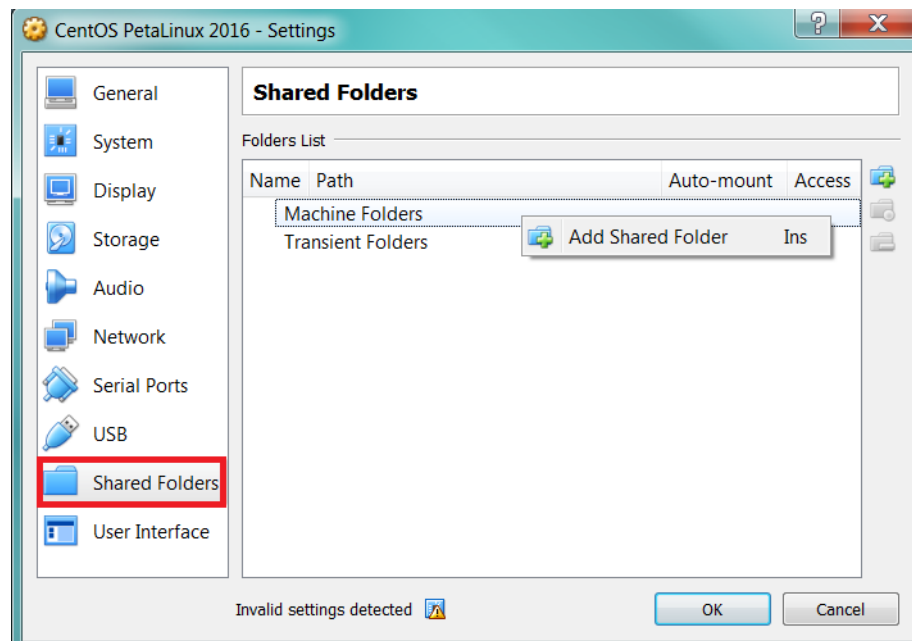


Figure 62 – Add Shared Folder

3. In the *Folder Path* box, click the dropdown arrow on the right. Select the **Other** entry to open a Windows Explorer pane. Browse to the location in Windows where you want to set up a shared folder and click **Select Folder** in the Explorer pane. Click the checkboxes for **Auto-mount** and **Make Permanent**. Click the **OK** button.

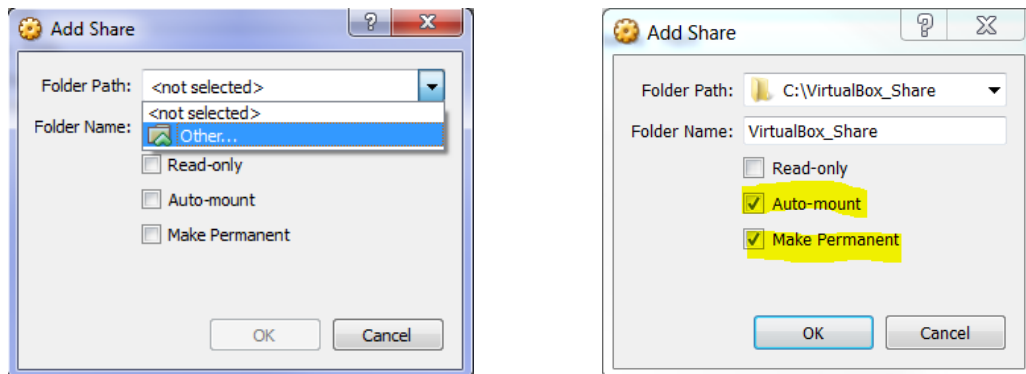


Figure 63 – Create Shared Folder

4. The location of the shared folder in Windows is shown in the Path column. The folder will Auto-mount and Full Access is allowed. The corresponding folder in the Linux VM is `/media/sf_<Windows Folder Name>`. In the example shown, this corresponds to:

`/media/sf_VirtualBox_Share`

Click the **OK** button to close the panel.

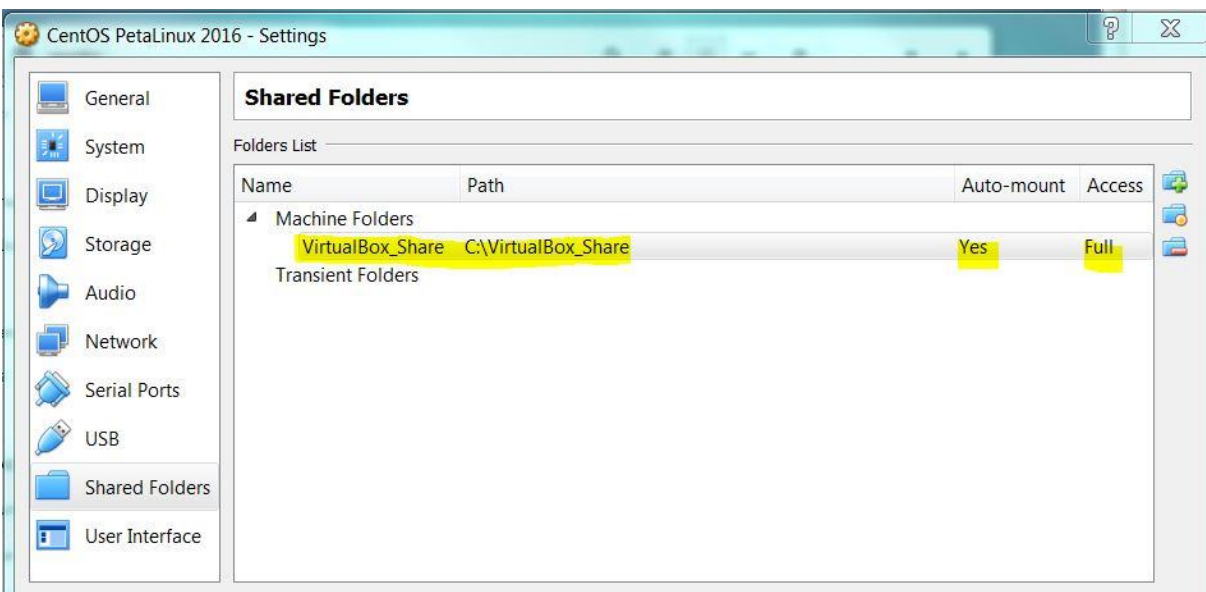


Figure 64 – Shared Folder Established

5. Shared folders are only available to user accounts that are also members of the group *vboxsf*. This means the user account created earlier must be added to this group. This can only be done in CentOS 7 or Ubuntu 16.04 from the command line. To view available groups and members, in a Terminal window enter:

getent group (list all groups)

getent group vboxsf (list a specific group named vboxsf)

To add an existing user to an existing group, in a Terminal with root privilege, enter:

usermod -a -G vboxsf training

To list the groups user *training* belongs to, enter:

sudo⁵ lid training

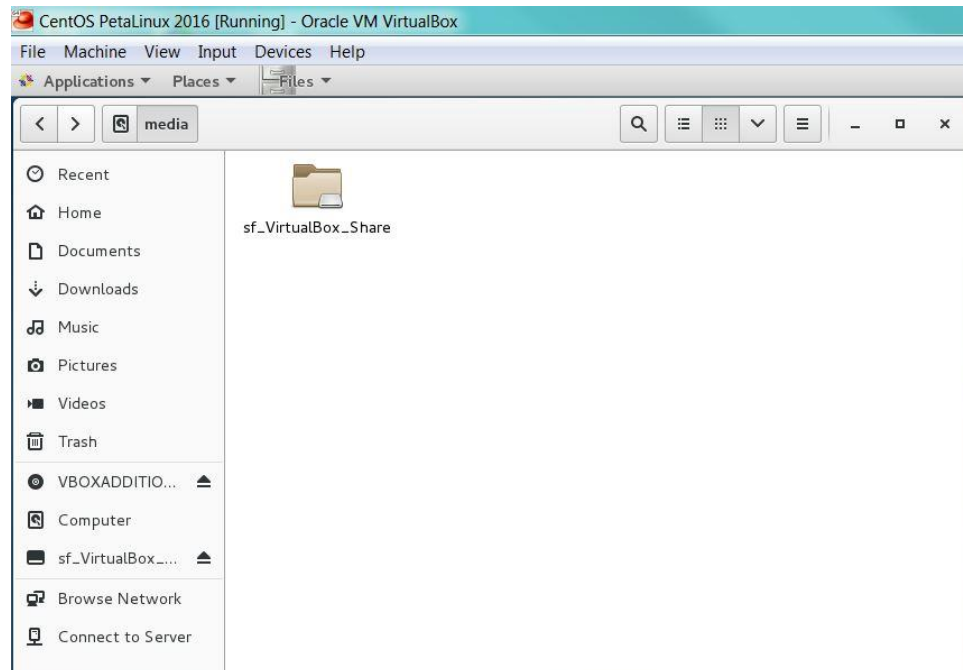
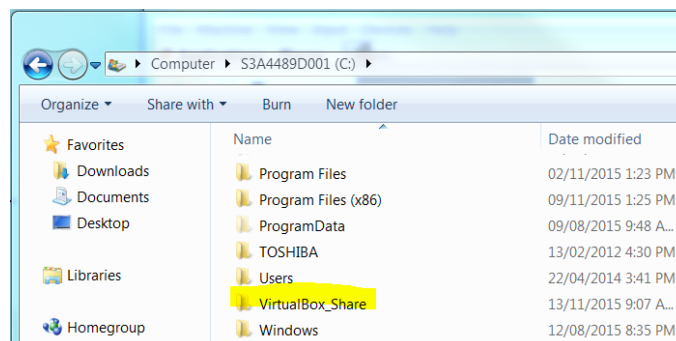
```
[root@localhost ~]# usermod -a -G vboxsf training
[root@localhost ~]# lid training
training(gid=1000)
vboxsf(gid=990)
[root@localhost ~]# █
```

6. Reboot the Virtual Machine.

7. The selected user name will belong to the *vboxsf* group on the next login. To access the shared folder from the Virtual machine, browse to: **/media/sf_<sharename>**

In this example, the folder in Windows is named *VirtualBox_Share*, so the sharename in Linux is **sf_VirtualBox_Share**, automatically mounted in the **/media** folder. Any files in this folder are available to the Virtual Machine and the Host OS system.

⁵ sudo is required in Ubuntu.

**Figure 65 – Shared Folder in Linux****Figure 66 – Shared Folder in Windows**

If you wish to mount a shared folder manually, open a Terminal window and elevate your privilege level to root with the `su` command. The following command will mount the folder `Virtualbox_Share` at `/mnt/Virtualbox_Share`.

```
[root@localhost training]# mount -t vboxsf Virtualbox_Share /mnt
```

CentOS 7 Installation Tips

Set Standard Account for sudo

Many installation and configuration operations must be performed from a process with root privilege. While the `su` command (with root password) is always available, it is often more convenient to use the `sudo` command to allow root privilege to the current operation only. To allow a standard user account access to `sudo`, a configuration change must be made to the Linux system. When authorized for `sudo`, a standard account need only confirm with the account password, not the root password.

This example uses a standard account named **training**. You can use any standard account on your system.

1. In the CentOS guest operating system, open a terminal window through the **Applications→Favorites→Terminal** menu item.



Figure 67 – Launching the CentOS Terminal from the Desktop

2. Take on root privileges by running the superuser elevation command `su` and entering the root password.

```
$ su
```

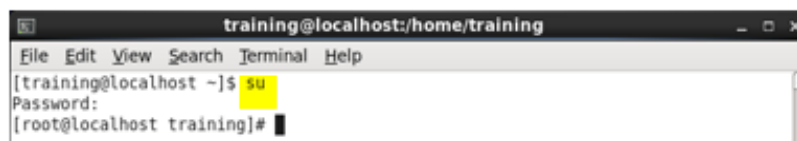


Figure 68 – Elevating to Superuser Privileges

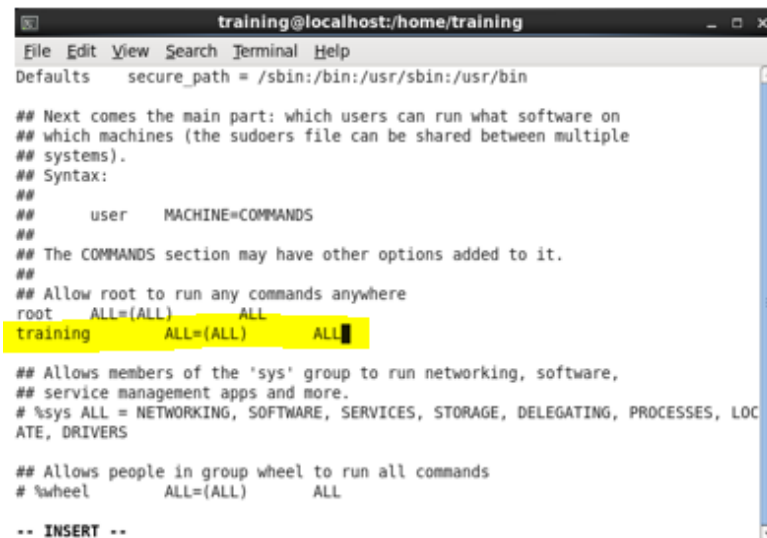
3. Use visudo text editor to edit the `/etc/sudoers` file.

```
# visudo
```

4. Add the **training** user to the sudoers list by inserting the following line to the users section of the sudoers file as shown below. The users section is located towards the end of the file.

```
training    ALL=(ALL)    ALL
```

To add text from within the vi editor, **press the “i” key** on the keyboard to use vi *insert* mode.



```
training@localhost:/home/training
File Edit View Search Terminal Help
Defaults    secure_path = /sbin:/bin:/usr/sbin:/usr/bin

## Next comes the main part: which users can run what software on
## which machines (the sudoers file can be shared between multiple
## systems).
## Syntax:
##
##     user    MACHINE=COMMANDS
##
## The COMMANDS section may have other options added to it.
##
## Allow root to run any commands anywhere
root    ALL=(ALL)    ALL
training    ALL=(ALL)    ALL

## Allows members of the 'sys' group to run networking, software,
## service management apps and more.
# %sys ALL = NETWORKING, SOFTWARE, SERVICES, STORAGE, DELEGATING, PROCESSES, LOC
ATE, DRIVERS

## Allows people in group wheel to run all commands
# %wheel    ALL=(ALL)    ALL

-- INSERT --
```

Figure 69 – Adding training Account to `/etc/sudoers` File

5. Exit the vi editor and save changes to the sudoers file by using the write-quit key sequence:



```
<ESC> :wq
```

6. The **training** user will now have sufficient privileges to do important systems tasks using the `sudo` command. Exit the superuser mode by typing **exit** at the command prompt.

```
# exit
```

No Bootable Media During OS Installation

If you power down an empty Virtual Machine prior to installing the operating system, you may get an error on power-up indicating there is no bootable media found. Correct this by following the instructions below.

1. If shown, click the  icon to close the *Auto capture keyboard* warning, or the  icon to suppress the message permanently.

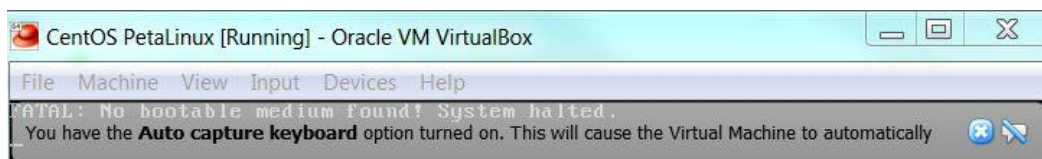


Figure 70 – Auto Capture Keyboard Warning

2. VirtualBox informs you there is no bootable media. This is correct as there is no OS installed at this point.

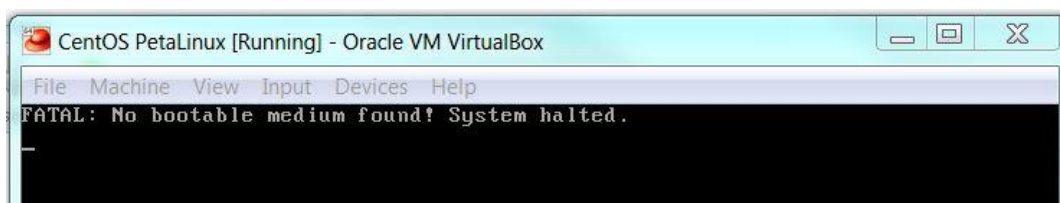


Figure 71 – No Bootable Media Warning

To locate the OS image downloaded earlier to your host system, select **Devices > Optical Drives > Choose disk image...**



Figure 72 – Select a Disk to Install

3. Browse to the download location for your OS image. Select the image and click the **OK** button.



Figure 73 – Browse to the OS Image

4. From the main VirtualBox menu, select **Machine > Reset** to boot from the OS image.

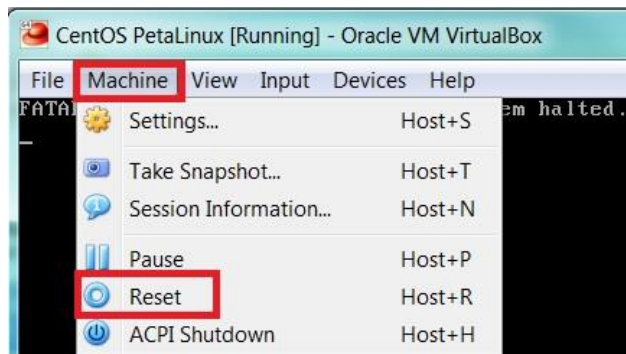


Figure 74 – Reset the Virtual Machine

Network Bridging

When VirtualBox is installed with its default options, the networking is set up to use Network Address Translation (NAT). This allows your Virtual Machine complete outgoing access to your LAN and/or the Internet, but it assigns an internal IP address that may not be compatible with your LAN and the IP address of your host system.

If you would like your Virtual Machine to accept an address from a local DHCP server, you can change the default network type to Bridged. This will make the Virtual Machine available to any other connected device on the same subnet on your LAN.

1. From the main VirtualBox menu in a running Virtual Machine, click on the **Settings** button. If the button is not visible, select **Machine > Settings**.



Figure 75 – Access Virtual Machine Settings

2. Select the Network entry in the left panel. Select the tab for your NIC (typically **Adapter 1**) and expand the dropdown menu for the *Attached to* field.

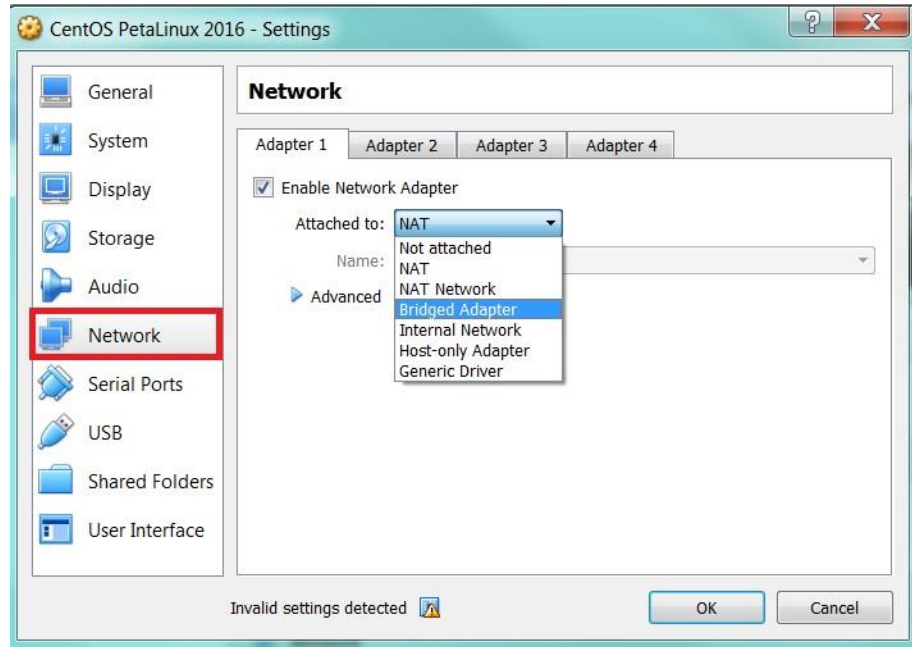


Figure 76 – Network Attachments

3. Select **Bridged Adapter** from the dropdown menu and click the **OK** button to save the changes. Wait a few seconds for your Virtual Machine to request an address from the local DHCP server. Once complete, the VM will now have an address on your local subnet, accessible to all devices on your LAN.
4. If you do not receive a new IP address after a minute, stop and restart the Ethernet service.

Vivado 2016.2 GUI Segmentation Fault at Startup

This problem may manifest when using Vivado 2016.2 on a CentOS 7.0 installation. Even though UG973 shows CentOS 7.0 as a supported OS, there appears to be some compatibility problem when using the Gnome Desktop.

http://www.xilinx.com/support/documentation/sw_manuals/xilinx2015_2/ug97...

To correct the problem, deactivate the `GNOME_DESKTOP_SESSION_ID` environment variable:

```
unset GNOME_DESKTOP_SESSION_ID
```

You can add this command to the `.bashrc` file so it is executed automatically each time a terminal session is started.

Ubuntu 16.04 Installation Tips

Set a root user password

By default, Ubuntu does not set a password for the root user. You can do this by simply invoking the **sudo passwd** command. You supply your own user password, then set the root user password.

```
sudo passwd
<Enter user password>
<Enter new root password>
<Confirm new root password>
```

```
training@training-VirtualBox:~$ sudo passwd
[sudo] password for training:
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
```

From this point forward, you will be able to precede a command with **sudo** to obtain root authority.

Install additional libraries

As long as your system has access to the Internet, you may install additional packages on your system using the **sudo apt-get** command. For example, initially the **lid** command is not available, but Ubuntu provides some helpful clues to obtain it:

```
training@training-VirtualBox:~$ lid training
The program 'lid' can be found in the following packages:
 * id-utils
 * libuser
Try: sudo apt-get install <selected package>
```

Change the default shell to bash for PetaLinux

If you intend to use the PetaLinux tool-chain under Ubuntu, you will find that it requires the bash shell as the default to execute correctly. By default, Ubuntu uses the dash shell, which is an extension of the bash shell with a few additional features and optimized for faster execution. Unfortunately, the dash shell is not compatible with the current PetaLinux tool-chain.

A description for the dash shell and its potential issues can be found here:

<https://wiki.ubuntu.com/DashAsBinSh>

Most distributions use **/bin/sh** as a symbolic link to point to the actual default shell. Under your Ubuntu environment, to determine the current shell, enter:

```
echo $SHELL or
ls -l /bin/sh
```

To change the default shell for all terminal windows, enter:

```
sudo dpkg-reconfigure dash
```

```
training@training-VirtualBox:~$ sudo dpkg-reconfigure dash
[sudo] password for training:
Removing 'diversion of /bin/sh to /bin/sh.distrib by dash'
Adding 'diversion of /bin/sh to /bin/sh.distrib by bash'
Removing 'diversion of /usr/share/man/man1/sh.1.gz to /usr/share/man/man1/sh.distrib.1.gz by dash'
Adding 'diversion of /usr/share/man/man1/sh.1.gz to /usr/share/man/man1/sh.distrib.1.gz by bash'
_
```

Select the option to remove dash as the default shell when prompted. When the change is complete, close all open Terminal windows and open a new Terminal. You may verify the default shell is bash using the commands shown previously:

```
training@training-VirtualBox:~$ ls -l /bin/sh
lrwxrwxrwx 1 root root 4 Aug 20 10:09 /bin/sh -> bash
training@training-VirtualBox:~$ echo $SHELL
/bin/bash
_
```

Xilinx Vivado/SDK Installation Tips

Installing Vivado/SDK tools on a supported Linux system should be straightforward, but depending on the precise configuration of your development system, there could be some challenges to create an optimal environment. This section outlines a few of the common issues that may be encountered.

To perform the steps in this section, you need to download a tar.gz image to your host system. The most recent images can be downloaded from: <http://www.xilinx.com/support/download.html>.

NOTE: Once the download is complete, you may want to verify there is an md5sum utility installed by default. Open a terminal window and enter the following:

```
$ md5sum -b <path to your compressed-Vivado-tar.gz file>
```

The valid checksums for the different download archives are available from the Xilinx download site.

Install Vivado in the VirtualBox Linux VM

1. Copy the All-OS version of the compressed Vivado installer from your host system to your VM desktop.



Figure 77 – Vivado Compressed Installer

2. Open a terminal window and decompress the installer on your desktop. It will create a new folder automatically in the current directory of your Terminal window.

```
$ tar -xvzf ~/Desktop/<Compressed-Vivado-Installer-Name>
```

```
]$ tar -xvzf ~/Desktop/Xilinx_Vivado_SDK_2016.2_0605_1.tar.gz
```

3. Change into the new folder and execute the installer setup script. You will need root privilege to install into the default directory of **/opt/Xilinx** (preferred).

```
[training@localhost ~]$ cd Xilinx_Vivado_SDK_2016.2_0605_1/
[training@localhost Xilinx_Vivado_SDK_2016.2_0605_1]$ ls
bin  lib      msvcrl10.dll  scripts  vccorlib110.dll  xsetup.exe
data msvcpl10.dll payload      tps      xsetup
[training@localhost Xilinx_Vivado_SDK_2016.2_0605_1]$ sudo ./xsetup
[sudo] password for training:
```

4. The Vivado 2016.2 Installer lists the operating systems officially supported by Xilinx. The tools may run on other Linux distributions and versions, but there will likely be some manual configuration required. Installation on unsupported systems is beyond the scope of these notes.

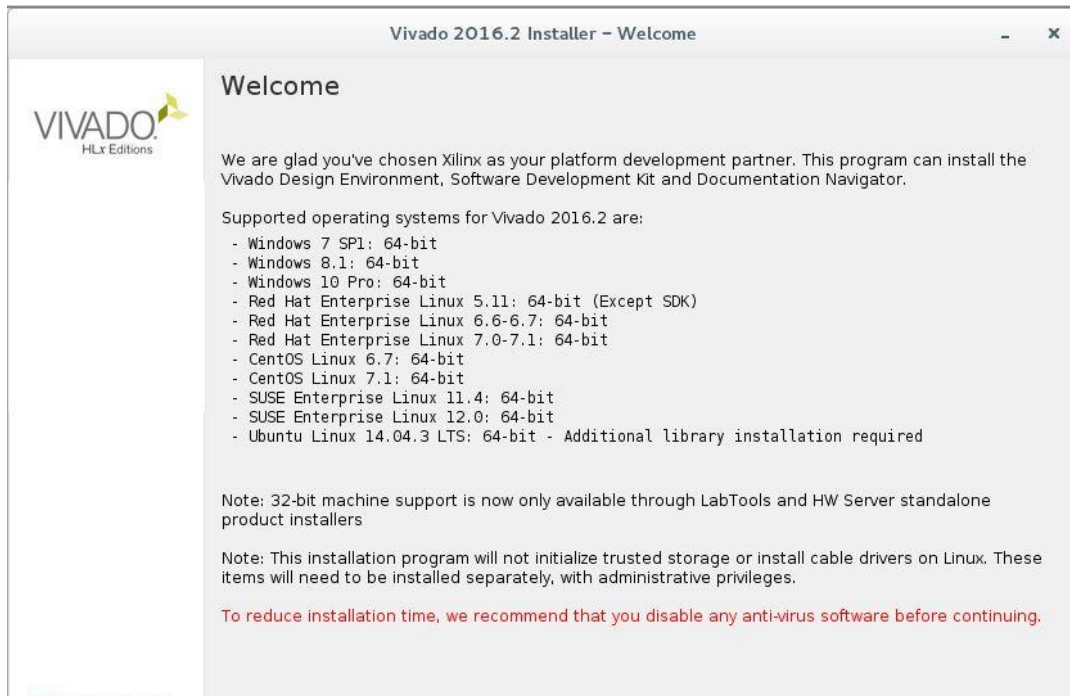


Figure 78 – Vivado Welcome

5. Follow the instructions as shown in the Vivado Installer GUI.
Note: If you also want to install the SDK, select *SDK Development Kit* from the menu below.
 - a. Accept all license agreements.
 - b. Select the Vivado edition (version) you wish to install (or SDK Standalone).
 - c. Select the Devices you need.
 - d. Cable Drivers are no longer installed in Linux. See instructions in the **Install Missing Cable Drivers** section of this document.

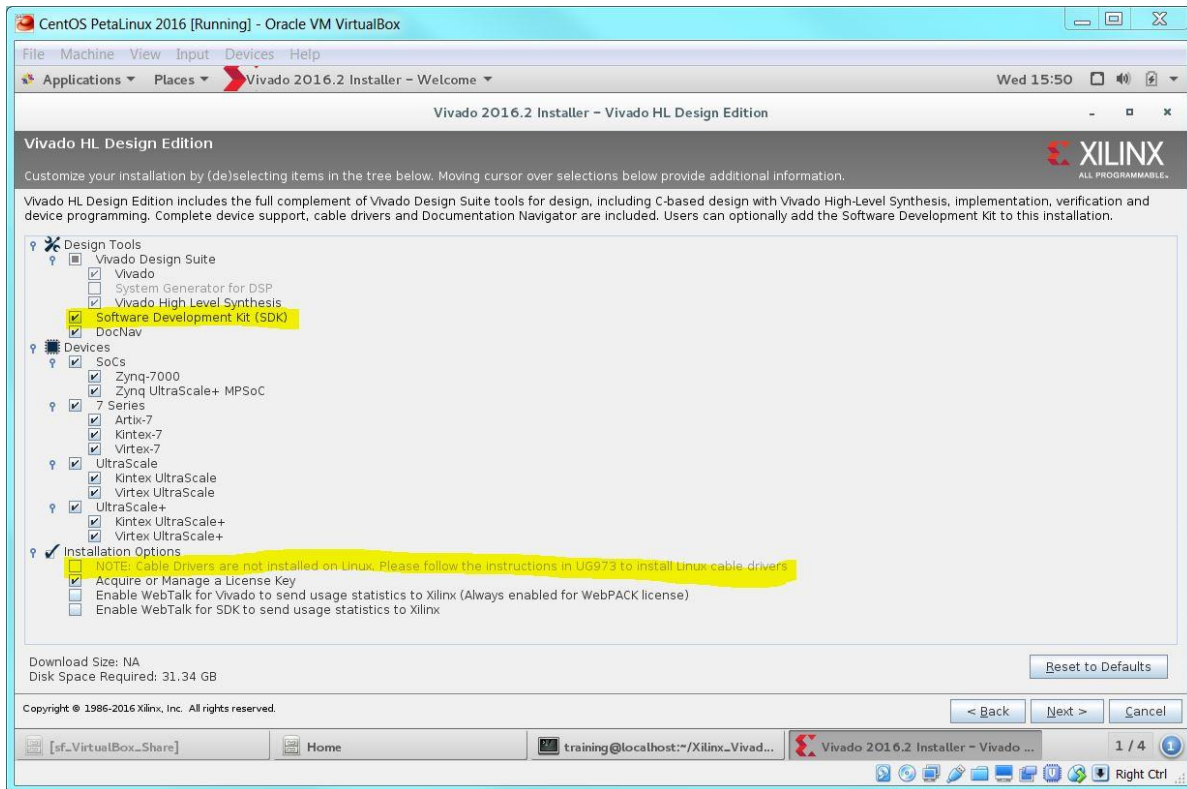


Figure 79 – Vivado Device Selection

- e. Select the default directory for installation. Depending on the size of your virtual disk, you may be space limited here. You can delete the compressed installer and the expanded hierarchy to free 12-16 GB of disk space, if necessary.
 - f. Obtain and install a license for your tools.
6. After installation, run the Xilinx settings script in a terminal window.

```
[training@localhost ~]$ cd Xilinx_Vivado_SDK_2016.2_0605_1
[training@localhost Xilinx_Vivado_SDK_2016.2_0605_1]$ source /opt/Xilinx/Vivado/2016.2/settings64.sh
[training@localhost Xilinx_Vivado_SDK_2016.2_0605_1]$ source /opt/Xilinx/SDK/2016.2/settings64.sh
```

7. You may optionally delete the entire folder where you decompressed the installer to free up additional disk space.

To start Vivado from a Terminal window, enter:

vivado or **vivado &**

To start the Xilinx SDK from a terminal window, enter:

xsdk or **xsdk &**

Install Missing Cable Drivers

The drivers, which were not included with the install, can be installed manually.

1. Open a Terminal window.
2. At the command prompt, enter:

```
$ cd /<Vivado_install_dir>/data/xicom/cable_drivers/lin64/  
install_script/install_drivers/install_drivers  
$ sudo ./install_drivers
```

```
[training@localhost ~]$ cd /opt/Xilinx/Vivado/2016.2/data/xicom/cable_drivers/lin64/install_script/install_drivers  
[training@localhost install_drivers]$ sudo ./install_drivers  
INFO: Installing cable drivers.  
INFO: Script name = ./install_drivers  
INFO: HostName = localhost.localdomain  
INFO: Current working dir = /opt/Xilinx/Vivado/2016.2/data/xicom/cable_drivers/lin64/install_script/install_drivers  
INFO: Kernel version = 3.10.0-327.el7.x86_64.  
INFO: Arch = x86_64.  
Successfully installed Digilent Cable Drivers  
--File /etc/udev/rules.d/52-xilinx-pcusb.rules does not exist.  
--File version of /etc/udev/rules.d/52-xilinx-pcusb.rules = 0000.  
--Updating rules file.  
  
INFO: Digilent Return code = 0  
INFO: Xilinx Return code = 0  
INFO: Return code = 0  
INFO: Driver installation successful.
```

3. You may also use the Terminal Window to install the device manager for the Linux kernel. (CentOS)

```
$ sudo yum install udev
```


Install Libraries for DocNav

Document Navigator requires a specific set of version-specific libraries to operate correctly. If you are having problems with DocNav, the following instructions may be helpful.

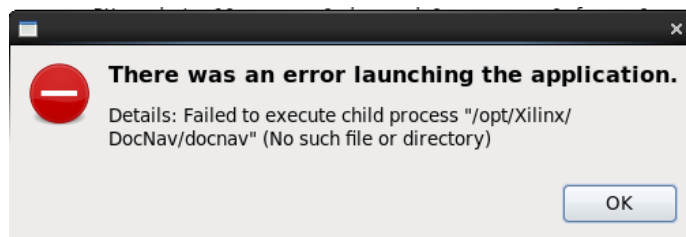


Figure 80 – DocNav Launch Error

```
training@training-VirtualBox:~/Downloads$ docnav
docnav: error while loading shared libraries: libfontconfig.so.1: cannot open sh
ared object file: No such file or directory
```

Figure 81 – DocNav Launch Error from Command Line

CentOS Required 32-bit Libraries

- fontconfig.i686
- libXext.i686
- libXrender.i686
- glib2.i686
- libpng.i686
- libSM.i686
- libstdc++.i686

The libraries may be installed but DocNav might require a new version. The updates can be performed from a command line terminal with root privilege. In CentOS, use the YellowDog Updater (Modified) to update each library. There are two versions of the libraries, one for 64-bit (.x86_64) and one for 32-bit (.i686). You must update the 64-bit library first and then add the 32-bit library, as follows:

```
$ sudo yum update <library_name_without_extension>
$ sudo yum install <library_name_with_extension>
```

```
[training@localhost ~]$ sudo yum update fontconfig
[sudo] password for training:
```

```
[training@localhost ~]$ sudo yum install fontconfig.i686
```

Document Navigator should now operate correctly.

Ubuntu Required 32-bit Libraries

```
libfontconfig1:i386  
libXext6:i386  
libice6:i386  
libXrender1:i386  
libgl2.0-0:i386  
libsm6:i386
```

Install these libraries with the following command:

```
$ sudo apt-get install <package name>
```

Multi-lib Version Error (installing Libraries in CentOS)

If you receive an error similar to the following:

```
Error: Multilib version problems found. This often means that the root  
cause is something else and multilib version checking is just  
pointing out that there is a problem.
```

This is an indication there is a conflicting update required between the 64-bit and 32-bit versions of the packages. To resolve the issue, you must first update the 64-bit library, and then install the 32-bit version.

```
$ sudo yum update <library_name_without_extension>  
$ sudo yum install <library_name_with_extension>
```

For example, if the error is issued for *libseltlinux.i686*, enter the following commands at the root prompt:

```
yum update libseltlinux      (update 64-bit package)  
yum install libseltlinux.i686 (install 32-bit package)
```

Windows 260 Character Path Limit

If you are using the Vivado Design Suite on a Windows 7 host, you may run into issues resulting from Vivado pathnames exceeding the maximum allowed. Vivado projects create a very deep file hierarchy, and it becomes very easy to violate the Windows limit if the project is not extracted near the root of the drive. This can even happen when the archive is decompressed, depending on where you choose to place the project in your existing file hierarchy.

It is not always convenient to place every Vivado project at the root of a drive. To work around this limitation, the recommended procedure is to place the Vivado archive in a shared folder on your host machine, then use Windows Explorer to map a network drive to the directory where the archive will be decompressed. This allows the Vivado project to be mapped to the root of the virtual (mapped) directory, eliminating any path issues.

Vivado also makes use of the Windows temp folder, which may be located several folders removed from the root drive, and this can also cause problems. You can create your own temporary directory in C:\temp, and force Vivado to use the new folder with the following TCL:

```
set_param "project.customTmpDirForArchive" C:/temp
```

For further information, see the Xilinx answer record at:

<http://www.xilinx.com/support/answers/52787.html>

FlexLM Utility Fails to Run in CentOS 7

You may wish to run the Flex License Manager Utility from the command line to determine the Host ID of your development system. The FlexLM Utility (lmutil) can be found in either the Vivado or SDK installation directory:

```
[training@localhost ~]$ cd /opt/Xilinx/SDK/2016.2/bin/unwrapped/lnx64.o
[training@localhost lnx64.o]$
```

If you attempt to run the FlexLM Utility from the Linux command line in CentOS 7, you may receive the following error:

```
[training@localhost lnx64.o]$ ./lmutil lmhostid
bash: ./lmutil: /lib64/ld-lsb-x86-64.so.3: bad ELF interpreter: No such file or directory
[training@localhost lnx64.o]$
```

This problem can be corrected by setting a symbolic link to an older version of the missing library:

```
[training@localhost lnx64.o]$ sudo ln -s /lib64/ld-linux-x86-64.so.2 /lib64/ld-lsb-x86-64.so.3
[sudo] password for training:
```

With the symbolic link in place, the utility should now execute properly.

```
[training@localhost lnx64.o]$ ./lmutil lmhostid
lmutil - Copyright (c) 1989-2015 Flexera Software LLC. All Rights Reserved.
The FlexNet host ID of this machine is "080027d970e7"
[training@localhost lnx64.o]$
```

Vivado License Manager Returns HostID 0x00000000 in CentOS 7

The Vivado License Manager⁶ (vlm) may return an invalid HostID of all zeros when attempting to authorize a valid license file for Vivado or the SDK under CentOS. The reason for this is because until recently, the primary Ethernet adapter in every Linux system had the name `eth0`. CentOS 7 (and many other Linux distributions) have now updated the method for assigning Ethernet adapters using a new package called BIOSDEV, and the old naming convention has been discontinued.

You can check the name of the primary Ethernet adapter in your development system via the `ifconfig` command, as shown below:

```
[training@localhost ~]$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    inet6 fe80::a00:27ff:fed9:70e7 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:d9:70:e7 txqueuelen 1000 (Ethernet)
    RX packets 16033 bytes 13597077 (12.9 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 7069 bytes 440371 (430.0 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

The name assigned in this example is `enp0s3`, which will not be found by the license manager. Until the license manager utilities are updated, the simplest way to work around this problem is to revert to the old naming convention. To do this, we must modify the CentOS 7 boot loader `grub2`⁷ to pass parameters to the kernel that will allow the old naming convention to persist.

You will need root privilege to perform these tasks. (Could Not Do)

1. Log in as `root` or elevate your privilege level with `su`.
2. Locate the `grub2` configuration file at: `/etc/default/grub`
3. Open the file in your favorite Linux editor. In the line beginning with `GRUB_CMDLINE_LINUX`, add the string `net.ifnames=0 biosdevname=0` as shown.

```
GRUB_TIMEOUT=5
GRUB_DEFAULT=saved
GRUB_DISABLE_SUBMENU=true
GRUB_TERMINAL_OUTPUT="console"
GRUB_CMDLINE_LINUX="rd.lvm.lv=centos/root rd.lvm.lv=centos/swap crashkernel=auto rhgb quiet net.ifnames=0 biosdevname=0"
GRUB_DISABLE_RECOVERY="true"
```

4. Recompile the `grub2` configuration file located at: `/boot/grub2/grub.cfg`
`grub2-mkconfig -o /boot/grub2/grub.cfg`

```
[root@localhost ~]# grub2-mkconfig -o /boot/grub2/grub.cfg
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-3.10.0-229.el7.x86_64
Found initrd image: /boot/initramfs-3.10.0-229.el7.x86_64.img
Found linux image: /boot/vmlinuz-0-rescue-436a48f69cbc4d11828b500dd9fc90d7
Found initrd image: /boot/initramfs-0-rescue-436a48f69cbc4d11828b500dd9fc90d7.img
done
```

⁶ The FlexLM Utility will also display this behavior.

⁷ Grand Unified Boot Loader, version 2

5. With the BIOSDEV naming disabled, we can now revert to the original eth0 adapter name by changing a file name in the network-scripts directory. Change to:

/etc/sysconfig/network-scripts

and rename the file **ifcfg-<BIOSDEV Adapter name>** to **ifcfg-eth0**.

```
[root@localhost network-scripts]# pwd
/etc/sysconfig/network-scripts
[root@localhost network-scripts]# mv ifcfg-enp0s3 ifcfg-eth0
```

6. Reboot the Linux system (from the command line: **shutdown now -r**).
7. Once the system has rebooted, log in and check the Ethernet adapter name. You will find it is now called **eth0**.

```
[training@localhost ~]$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.0.103 netmask 255.255.255.0 broadcast 192.168.0.255
    inet6 fe80::a00:27ff:fe04:a2eb prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:04:a2:eb txqueuelen 1000 (Ethernet)
    RX packets 37 bytes 6119 (5.9 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 64 bytes 7628 (7.4 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

8. You can now run the Vivado License Manager to check the host ID. A valid ID will be returned, and now valid tool licenses can be authorized correctly.

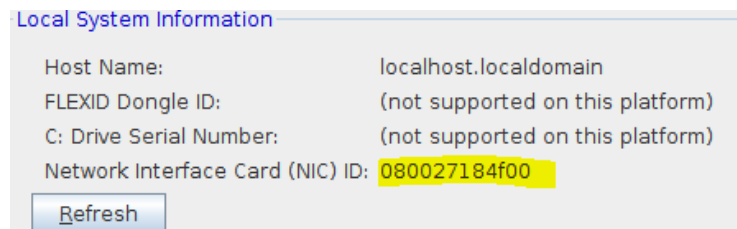


Figure 82 – VLM Host ID

Install the openssl libraries for PetaLinux

As of 2015.2, the PetaLinux tool chain requires the **openssl** libraries installed on the host system.

With CentOS, this can be accomplished in a terminal window with the following command:

```
sudo yum install openssl-devel
```

If you are using Ubuntu, enter:

```
sudo apt-get install libssl-dev
```

Linux Development Tips

Device Tree Reverse Compilation

In some instances you may have a compiled device tree file (.dtb), but no original source. You can use the device tree scripts in your development environment to recreate a facsimile of the original source. The process does not create an exact copy of the original source, as information for symbols is not available, and any structure (.dtsi hierarchy) is lost. However, it is often useful to be able to produce source from compiled device tree files for comparison.

1. Change to the top level directory in your Linux source hierarchy. For purposes of this example, assume the directory is **~/ubuntu**.
2. Provide the compiled device tree file as input, and specify the output .dts file. The example below assumes the compiled device tree file is located in the standard build directory.

```
scripts/dtc/dtc -I dtb -O dts -o <output.dts> arch/arm/boot/dts/<input.dtb>
```

```
[training@localhost ubuntu]$ cd ~/ubuntu
[training@localhost ubuntu]$ scripts/dtc/dtc -I dtb -O dts -o mydevicetree.dts arch/arm/boot/dts/zynq-mini-itx-adv7511.dtb
[training@localhost ubuntu]$ ls -l mydevicetree.dts
-rw-rw-r--. 1 training training 12796 Feb 20 08:49 mydevicetree.dts
```

Revision History

Version	Date	Details
1.0	Feb 19, 2015	VirtualBox 4.3, CentOS 6.5, CentOS 7
1.1	Feb 24, 2015	Device tree reverse compilation, Ethernet Adapter Names
1.2	November 2015	Removed CentOS 6.5 support, validated all instructions, and restructured/standardized document.
1.3	September 2016	CentOS 7 support, Ubuntu 16.04, CentOS PetaLinux 2016.2, and Xilinx Vivado/SDK 2016.2