CentOS 7 Linux VM Setup

Install a CentOS 7 Linux workstation in a virtual machine (VM). This is the recommended setup if you have a laptop with at least 8GB of memory.

It will work on machines with less than 8GB of memory, but it would be rather slow. If you have a such a laptop or you have no laptop, please contact your instructor to get a VM on our servers setup for you. Most software companies use VMs for testing and development, so understanding what they are and how to set one up are good tools to have in your toolbox.

The instructions in this document are meant to get you started. You may still want to watch a video or read installation documentation or post on Piazza if you have questions.

Videos

VMware Player Installation (video)
Linux Virtual Machine Configuration (video)
Linux OS Installation (video)
Linux Software Updates with Yum (video)
Linux Software Management with Yum (video)
Linux User Management (video)

Tasks

Part 1 - Build the Linux (CentOS) Virtual Machine

Install VMware Player

First, you will need to install Virtual Machine Software on your *host system* (aka the operating system currently installed on your laptop). There are several options available depending on the operating system of your host.

Windows

You can install either VMware Workstation or VirtualBox. We use VMWare Player extensively in the department and recommend it for students. It is available for free for Windows and Linux.

Mac OS X

VMWare Player isn't available for free on Mac OS X, but you can get VMware Fusion for free using your Microsoft Imagine account information. Sign in with your Microsoft Imagine account information here:

http://e5.onthehub.com/d.ashx?s=kw3jtuc8h6

If you don't remember your login information, try searching your email inbox for "An account has been created for you" or "Boise State University - ITS, College of Engineering". The account information is automatically emailed to you by the end of the first week.

Download OS Image

Now that you have your VM software installed and ready to go, you will want to download a CentOS 7 LiveKDE iso image [file name: CentOS-7-x86_64-LiveKDE-1708.iso]. Here is one place you can get the image from: from: from: http://mirrors.syringanetworks.net/centos/7.4.1708/isos/x86_64/CentOS-7-x86_64-LiveKDE-1708.iso. If download from this site is slow, you can cancel it and search for other mirror sites here http://isoredirect.centos.org/centos/7/isos/x86_64/. Generally mirror sites in west coast will be the fastest for us. You will use this image to install CentOS 7 on your Virtual Machine. Make sure to read through the next section before you boot into the CentOS 7 image!

Install image on your VM and Customize it

Create and install the CentOS 7 Linux image on a VM

When you create a new VM using VMWare Player, you will have several options to customize the hardware. Please read below to choose the options we need.

Important notes:

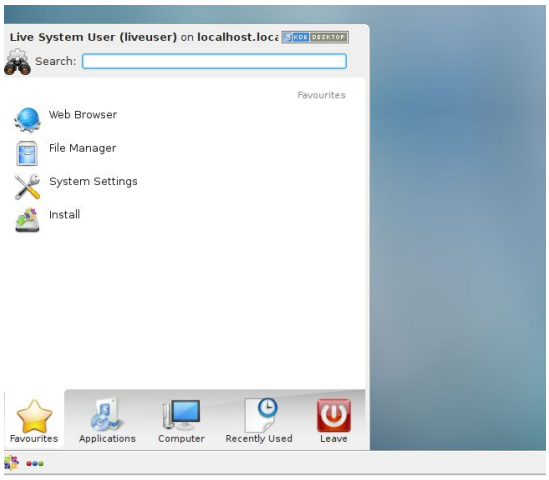
- Allocate enough memory: On a laptop with 8GB of RAM, we recommend setting the VM memory to 4GB. If you have 12-16GB of memory, then use 6-8GB for the VM. The option to select memory is available by clicking on the "*Customize Hardware*" button in the wizard to create a new VM.

- Use more processors: Allocate at least 2 processors to your VM to get better speed. If you have more than four processors/cores, than allocate half the processors to your VM!

Additional Notes:

- If you get an error when you try to start your VM, you may need to enable virtualization in your BIOS. If you google something like “enable virtualization in bios windows 10” there are several videos/tutorials showing you how to do this.

- When it boots it is booting a live image, but it isn't actually installed yet. A live image is good to play with it before an actual install. However, it is read only and cannot be modified until we actually install it! Click on the CentOS icon on the bottom left and choose the *Install* option to actually install it onto your VM. See below:



- Make sure to add yourself as an admin user when asked.

After you install the OS, you are almost ready to go! CentOS 7 will have most of the tools you will need for development, but we will customize so that it may be useful to you in several courses.

A common error is that when you reboot it goes back to the live image (that cannot be modified). You will get an input/output error when you do some of the following steps. To solve this, before reboot, go into Devices->Optical Drives then unclick the disk image you used initially and and force unmount it. Then when you restart the virtual machine it should ask you to to accept the user agreement and show the user you created.

Customize the CentOS 7 KDE Plasma Desktop workstation.
After CentOS 7 Linux installation is complete, reboot the VM and login.

1. Right click on the desktop and start a terminal (`konsole`). You can increase the font size with keystroke combo: `Ctrl++` You can also customize the look and feel of the `konsole` from the *Settings* menu.

2. Do a full update as follows:
```
sudo yum update
```

3. **Disable SElinux** by editing `/etc/selinux/config` using `kwrite` and changing the `enforcing` to `disabled` in the appropriate line. SELinux is a Security Enhanced Linux that is complex to manage so we disable it for now. We would not disable it on a server for public use! Then reboot the system.
```
sudo kwrite /etc/sysconfig/selinux
change this line -->SELINUX=enforcing to SELINUX=disabled
sudo reboot
```

4. Install additional software. To list groups, type:
```
sudo yum group list
```

5. We recommend installing the following groups and packages that would be useful for 221 and beyond.
```
sudo yum group install "Development Tools"
sudo yum group install "Web Server"
sudo yum install kernel-devel
sudo yum install qt-devel xz-libs openssl-devel elfutils-libelf-devel
sudo yum install valgrind gitk gvim
```

6. **Install the static C library** as we use it in some classes later on
```
sudo yum install glibc-static
```

7. **Install LibreOffice** for office applications (optional)
```
sudo yum install libreoffice
```

8. **Install Google Chrome**. First we need to setup Google Chrome repository and install Google Chrome.
```
sudo kwrite /etc/yum.repos.d/google-chrome.repo
```

   And then insert (make sure there no spaces at the start of each line!):
```
[google-chrome]
name=google-chrome - 64-bit
baseurl=http://dl.google.com/linux/chrome/rpm/stable/x86_64
enabled=1
gpgcheck=1
gpgkey=https://dl-ssl.google.com/linux/linux_signing_key.pub
```

   Now, install Google Chrome as follows:
```
sudo rpm --import https://dl-ssl.google.com/linux/linux_signing_key.pub
sudo yum install google-chrome-stable
```

9. **Install Oracle Java.** Install the latest Java SE JDK 8 by downloading the rpm file for 64-bit Linux from the Oracle Java download site (google for “Oracle Java JDK”). The name of the file would something like: `jdk-8u144-linux-x64.rpm` (the numbers 8 and 144 may be different). Install it using the

following command (the rpm file will most likely be in your Downloads folder):

```
sudo yum install jdk-8u144-linux-x64.rpm
```

10. **Configure Java** using the following commands:

```
sudo alternatives --install /usr/bin/java java /usr/java/default/bin/java 20000
sudo alternatives --config java (choose /usr/java/default/bin/java as the default)
sudo alternatives --install /usr/bin/javac javac /usr/java/default/bin/javac 20000
sudo alternatives --config javac (choose /usr/java/default/bin/javac as the default)
sudo alternatives --install /usr/bin/jar jar /usr/java/default/bin/jar 20000
sudo alternatives --config jar (choose /usr/java/default/bin/jar as the default)
```

Verify with the `java -version` command and the version should match what you installed.

11. **Install Eclipse** with CDT (C Development Toolkit) plugin by downloading it from the following site:
http://cs.boisestate.edu/~amit/teaching/eclipse-jdk-cdt-oxygen-linux.tar.gz

After downloading the file, unpack and setup eclipse as follows:

```
cd Downloads
tar xzvf  eclipse-jdk-cdt-oxygen-linux.tar.gz
mv  eclipse/  ~
```

Now eclipse IDE is located at the path `~/eclipse/eclipse` (where ~ is your home folder). We will create an alias, which gets setup each time we login, so we don't have to type the whole path every time. Create an alias using the command `kwrite ~/.bashrc` and the add the following line to the end of the file (don't use cut and paste though, just type it out!):

```
alias eclipse='~/eclipse/eclipse'
```

Eclipse will print out lots of messages on the console. To avoid seeing them, change the above line to:

```
alias eclipse='~/eclipse/eclipse >& /dev/null'
```

Then run the following command:

```
source ~/.bashrc
```

Now, you can start eclipse from the command line as follows (from anywhere on your system):

```
eclipse
```

12. **Reboot and enjoy!**

Part 2 - Software package management on CentOS Linux

- To **install** a software package that we know the exact name for, use the command similar to the following.

  ```
  sudo yum install readline-devel
  ```

  Here `readline-devel` is a package that contains the readline library that is used in some of the CS courses. Note that yum will automatically install any packages that the package we named depends on.

- What if we don't know the exact package name? Let's say that we want to find the software package that contains a program named "gvim". First, we try the name of the program as often the package has the same name.

  ```
  sudo yum install gvim
  ```

  But that fails. So we try to list all packages that contain the substring "`gvim`" in its name or description:

  ```
  sudo yum search gvim
  ```

  We may find one or more promising packages. In this case, the search fails. Next, we search for what package provides a command named gvim.

  ```
  sudo yum provides gvim
  ```

  Finally, we find what we were looking for in the package vim-X11. We go ahead and install it with

  ```
  yum install vim-X11
  ```

- How to remove a package? We do that with the yum command as well. Note that yum will also remove any packages that depend on the package we are removing (try it to see how it works but then re-install `vim-X11` as we want to use `gvim` :-))

  ```
  sudo yum remove vim-X11
  ```

- **Exercise 1:** Try the above commands!
- **Exercise 2:** Locate the package that contains the program *rhythmbox*. Find more info on the package with the *yum info* command. Then install the program and try to start it from the command line. Finally, remove the package containing *rhythmbox* from your system.

Part 3 - Linux User management

1. We can add a new user with the `useradd` command. For example, we can create a second user on your VM with the login name "`admin`" as follows. The `-c` option provides the full name of the user.
   ```
   sudo useradd -c "Administrator" admin
   ```

2. Add a password for the new user as follows
   ```
   sudo passwd admin
   ```

3. We can test the existence of the user in several ways. For example, try the following commands from a console. The `su -` command switches you in as the new user. Use the `exit` command to switch back to you. **Note**: if you don't find the finger command on your system, how would you install it?
   ```
   finger admin
   sudo grep admin /etc/passwd
   sudo su - admin
   exit
   ```

4. Add superuser (`sudo`) privileges to the new user as follows. Users in the wheel group are allowed to have superuser privileges.
   ```
   sudo usermod -aG wheel admin
   ```

5. Test the privileges of the admin user by switching to the new account and trying a `sudo` command that requires superuser privileges. For example looking through the `/etc/shadow` file, which contains encrypted passwords for users. The `grep` command searches for the string "admin" in the file `/etc/shadow`. The exit command will switch back to your account.
   ```
   sudo su - admin
   sudo grep admin /etc/shadow
   exit
   ```

6. We can remove a user with the `userdel` command as shown below. The `-r` option removes their home directory as well. Then try switching to the user again and see what happens.
   ```
   sudo userdel -r admin
   ```

7. To learn more about a command, use the man command. For example:
   ```
   man useradd
   ```

8. **Exercise**: Try the above commands!