Homework #0 – Introduction to Linux

Due date: see course website

Introduction

The primary purpose of this assignment is to build skill in the Linux/UNIX command line, an essential skill in computing. Basic competency with it is necessary to this and many other courses at Duke, and mastery of it will simplify your computing life immensely. To build these skills, you'll be learning the basics right at the start of the course. The mechanism for doing so will be a Duke OIT online course which incorporates video lessons and interactive exercises, as well as a few supplemental tasks later in this document.

This assignment also serves a second purpose: to ensure you are familiar with the Duke environment, including the Duke Linux cluster and the GradeScope assignment submission facility.

A note on the two environments you'll be using

There are two separate Linux environments you'll be exposed to here. In Part 1, you'll use an *Ubuntu Linux* docker container in the VM Manage environment. This container is easy to set up and access via just a web browser from anywhere. On the down side, the interface can be a bit slow – Part 2 of this document and Recitation 1 of the course will show you some alternatives.

In Part 2, you'll learn about connecting to the Duke Linux Cluster at login.oit.duke.edu. This is a cluster of Linux machines that are configured identically; it's running a version of Linux called *CentOS*. It's useful to also become familiar with this environment.

Ubuntu Linux is the environment your assignments will be graded.

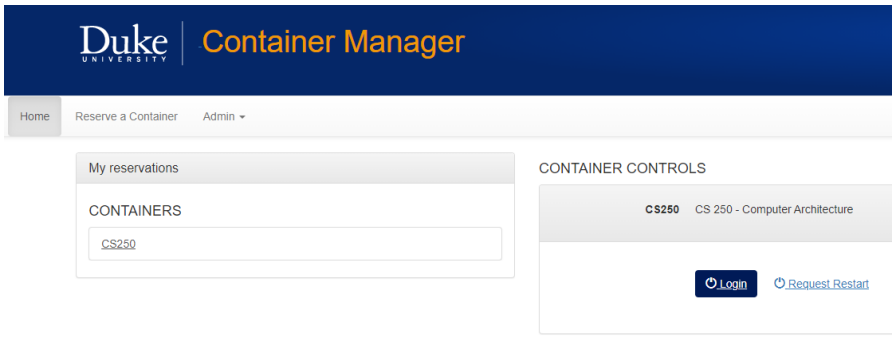
*NOTE: You need to submit **two** things in this assignment; read this write-up carefully.*

Part 1

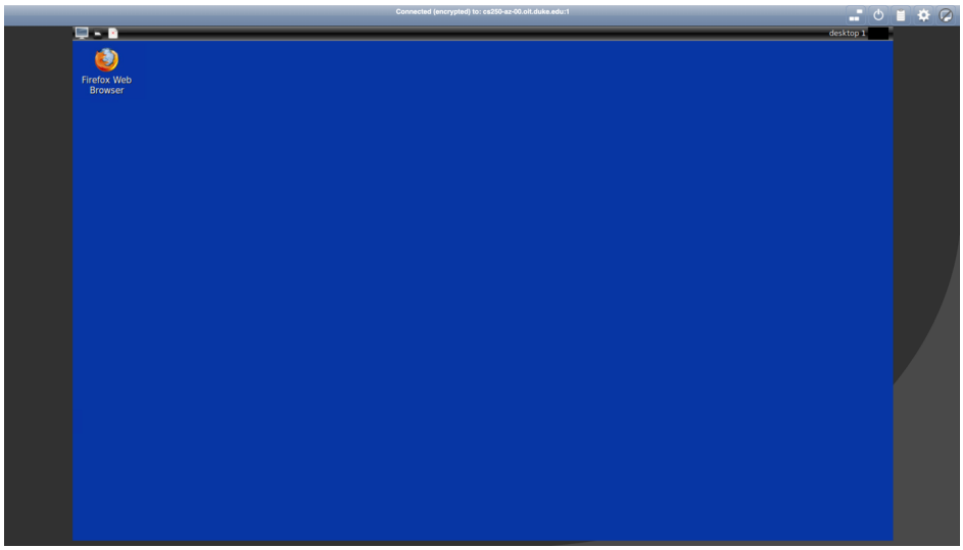
NOTE: The training asks you to create a virtual machine in the Duke Virtual Computing Manager (VCM). You can skip this, and instead use the ECE/CS 250 docker container.

Getting an ECE/CS 250 Container Instance[1]

Go to https://cmgr.oit.duke.edu/containers and locate the "CS250 - CS 250 – Computer Architecture" container. After the initial login, you should see the following When you choose CS250; You can Login just by hitting "Login". If something goes wrong, you can hit "Request restart".



If you get a "No session for pid 14" error, it's okay, just click "OK" to continue. You should see the following screen once you log in:

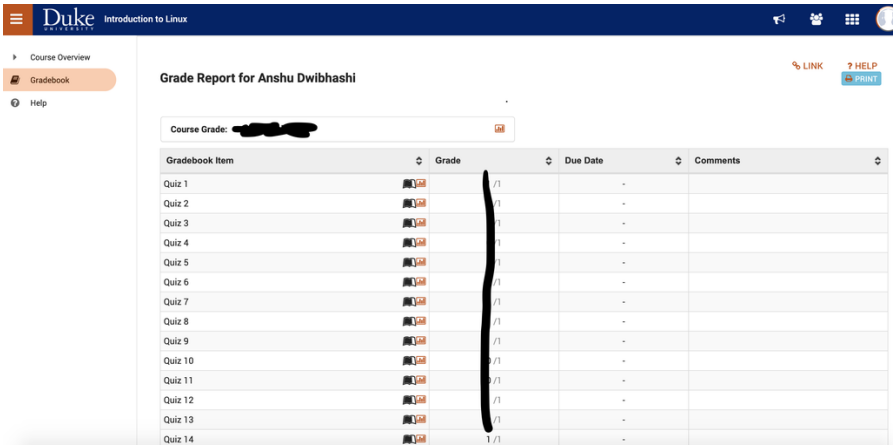


That's it! You now have your own ECE/CS 250 container instance for the semester!

[1] This is section the same content found in recitation 1 on this topic.

Linux command line training

1. Find the course materials on the Duke Sakai site: https://sakai.duke.edu/portal/site/250linux
2. Watch the videos and answer the assessment questions.
3. Upon completion, go to the Gradebook view to review your evaluation scores. **Save a screenshot of this.** It should look like this:



NOTE: The docker container does not give access to the Duke home directory described in Part 2. It has its own local home directory that is unique to the VM and not available via the methods described in Part 2.

Part 2

There are a few things left out of the general Linux intro course that you'll also need to know.
THE INFORMATION BELOW WILL MAKE A LOT OF THINGS EASIER FOR YOUR TIME HERE AT DUKE.

Be sure to read all the way to the end to find what you have to **submit** for part 2!

The Duke Linux cluster and your Duke home directory

- Duke maintains a cluster of Linux machines available for student use. You can connect one such Linux machine by SSHing to **login.oit.duke.edu** with your NetID.
- Each time you SSH to that address, you will be connected to a random machine in the cluster (ensuring that the load is balanced among that available computers).
- However, all the computers will give you the same **home directory** (the directory you default into when you connect; commonly abbreviated with the symbol **~**). This is done via a **storage server** that hosts your home directory which the Linux machines are all connected to. This means that you can treat all the Linux machines as equivalent, and even use multiple ones at once without worrying about it.

- Note: Due to security enhancements deployed on this server, if you use an SSH key instead of a password to login, you'll need to issue the "`kinit`" command to mount your home directory. Password-based logins are unaffected.

Accessing your Duke home directory via CIFS

- You can connect to this storage server directly using the "CIFS" protocol, also known as a "Windows share" or "network share", allowing you to access your home directory natively from your local computer (on Windows, Mac, and Linux).
- This way, you can use local programs (such as an editor) to manipulate data in your Duke home directory; you can also copy data to/from this directory in this way.
- *Accessing your Duke home directory like this only works from on campus (or when connected to campus via VPN).*
- How-to links:
  - Information on your home directory in general.
  - Directions on connecting to your Duke home directory from Windows.
  - Directions on connecting to your Duke home directory from a Mac.
  - There are no Duke-specific directions for Linux, but you can find info here and here.
  - If you want to do this from off campus, you need to connect to the Duke network via VPN first; info on that is here.

Accessing your Duke home directory via SFTP

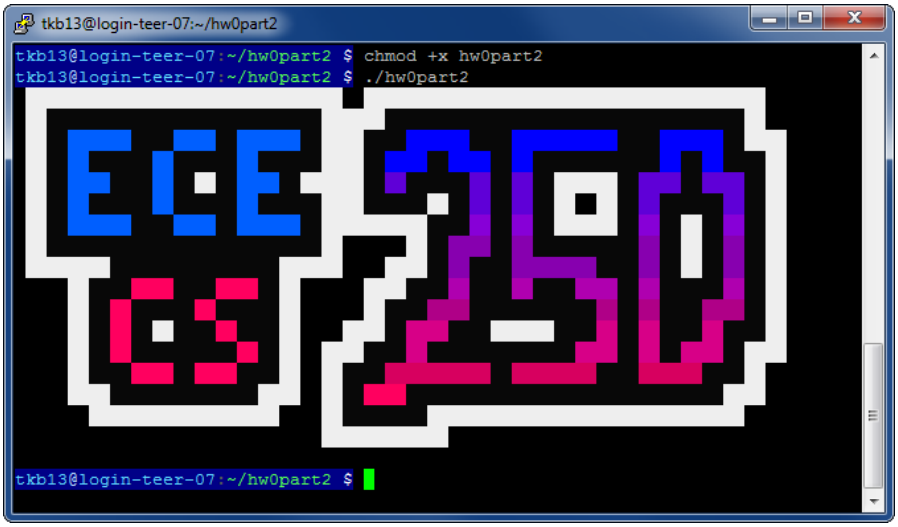
- Basically, any machine you can SSH to you can also access files from via SFTP.
- Therefore, you can also access your Duke home directory via the Linux machines using the SFTP protocol to **login.oit.duke.edu**.
- Unlike CIFS, SSH is considered a secure protocol, and therefore you can access it directly from off-campus.
- How-to links:
  - Windows users can access SFTP using the common open-source GUI tool WinSCP. You can also use the hybrid SSH/SFTP/X-Windows/other-stuff client MobaXterm.
  - On Linux and Mac, you can copy files using SFTP on the command line with the **scp** command, as documented in the Linux course from Part 1.
  - On Mac, there are several GUI tools for SFTP; some are reviewed here.
  - Most Linux GUIs can navigate SFTP in their native GUI; you can also mount SFTP targets as local directories using the **sshfs** package; info here.

What you need to submit

There is a file called **hw0part2** linked from the course site; it is a compiled executable program. Download it to your local computer, and, using the method of your choice, upload it to your Duke home directory. Then SSH to login.oit.duke.edu and do the following:

```
chmod +x hw0part2
./hw0part2
```

The first command will mark the file as executable; the second will run it. You should see some sweet color terminal art:



Take a screenshot similar to the above showing you've run the program in the Duke Linux Cluster and save it.

What and how to submit

Take the two screenshots (the gradebook from Part 1 and the terminal from Part 2) and put them into a document. Save the document as a PDF and submit to GradeScope. See the course site for the GradeScope link.

~ END ~

Appendix A: Reserving a VM with Virtual Compute Manager (VCM)

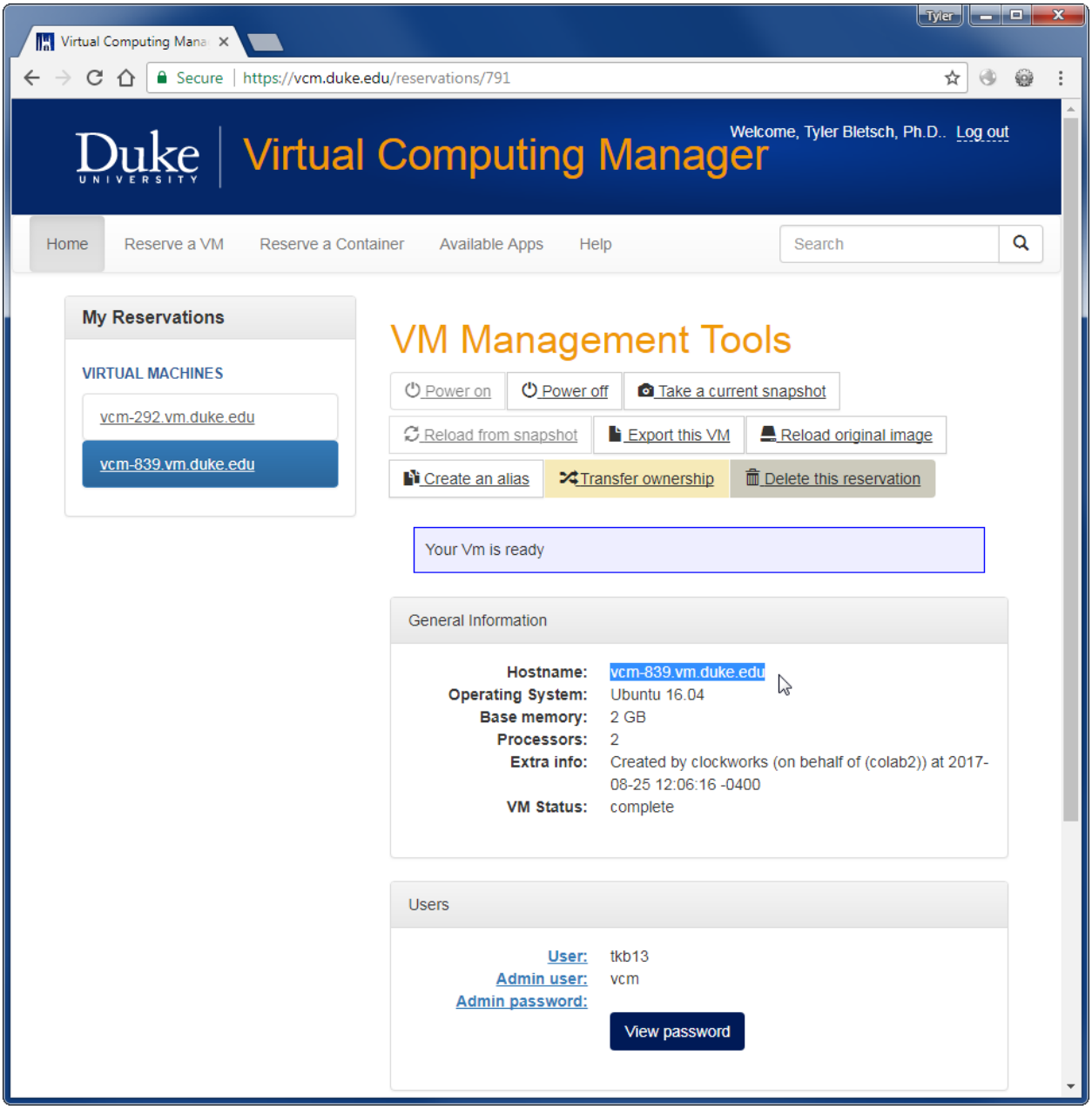
This material is no longer applicable, but is kept here in case you need to use VCM in the future.

To reserve an appropriate VCM VM:

1. Visit https://vcm.duke.edu/
2. Click “Reserve a VM”:

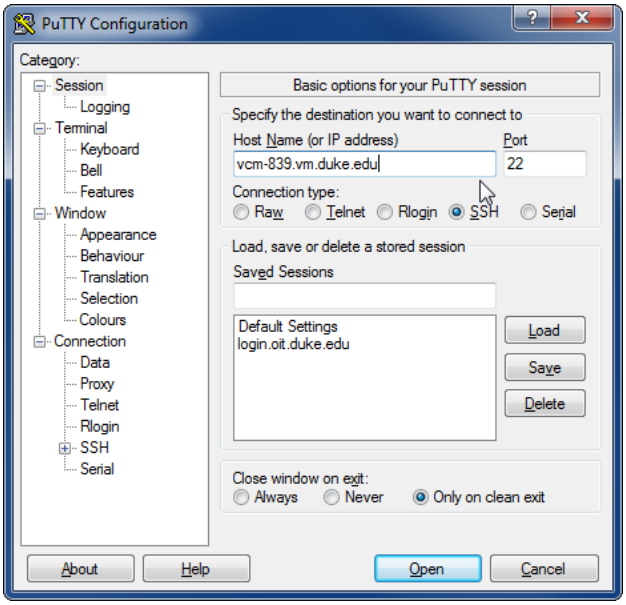
3. Log in using your NetID if needed.
4. Pick *Ubuntu 20.04*.
5. Agree to the Terms of Use.

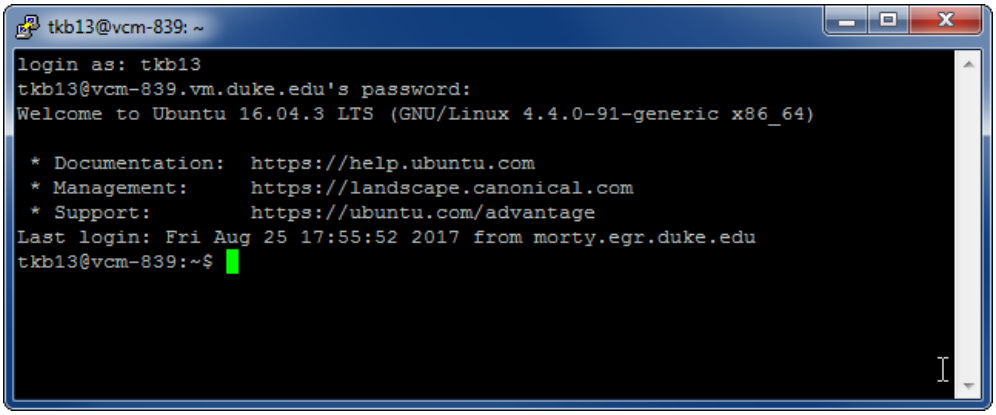
6. Your VM is created. Note its hostname:



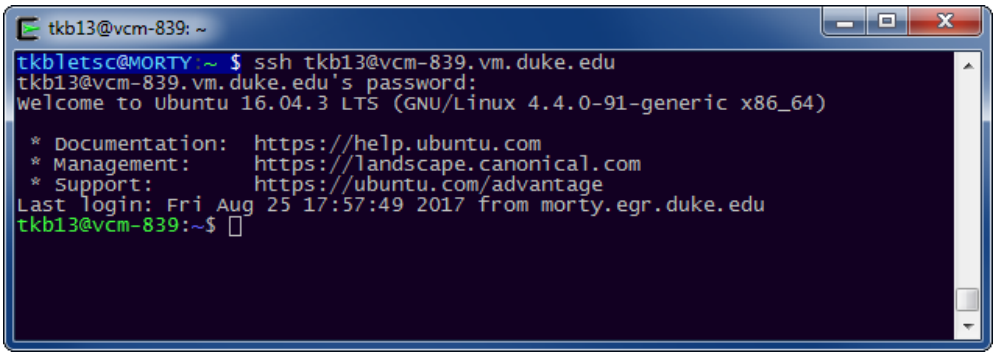
7. Connect to the given hostname using PuTTY (for Windows) or ssh (for Mac). Login with your NetID. You do not need to worry about the "admin password" shown in the web interface.

Windows example:





Mac-style example[2]:



[2] Technically this is on UNIX-style terminal I have on my Windows machine, but it works the same way.