CS216: Introduction to Software Engineering Techniques (Summer, 2020)
Lab Assignment 1
(20 points)

Today's Date: Tuesday, June 9
Due Date: Friday, June 12

The purpose of this lab assignment is

- Learning how to access your Virtual Machine (VM)
- Getting familiar with Linux/Unix environment
- Practicing basic Unix commands
- Getting familiar with file transfer to/from your VM and assignment submission through Canvas.

Part I: Connecting

You will need to be able to access your Virtual Machine. Your Virtual Machine account should be the same as your linkblue ID.
Basic information for connecting to your virtual machine can be found here:
http://protocols.netlab.uky.edu/~pike/vmPrimer.html
Read the information from the above link first. Trying to keep things clear for this course, we'll also give instructions on how to connect to your VM in this document.

GUI-based Linux Environment

To access your VM with Graphical User Interface (GUI):
Step one: Logging on to your OpenStack Dashboard

- Browse to https://dasher.netlab.uky.edu/
- OpenStack Username: *linkblueid*
- OpenStack Password: *password*

Step two: Connect to your virtual machine's console

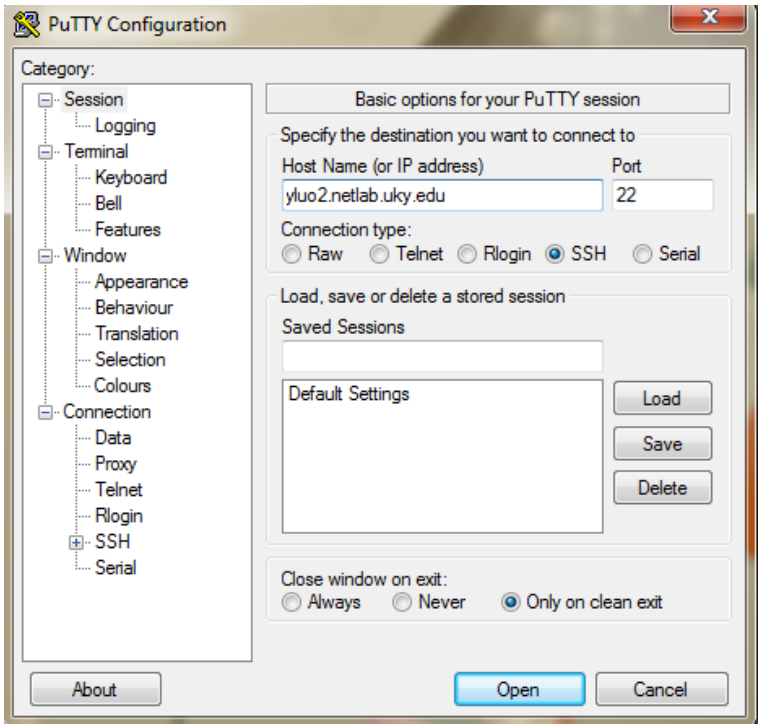
- click the blue instance name (*linkblueid*)
- click the **Console** tab. You should see a login screen
- Linux Username: *linkblueid*
- Linux Password: *password*

Now you should find "Applications" and "Places" on the top left of your window. Click one at a time and get familiar with your GUI-based Linux Environment. You may find "Firefox Web Browser" and "Google Chrome" from "Applications --> Internet", which are the browser you are familiar with. But for this lab, you need to practice some Unix commands. Click "Applications --> System Tools --> Terminal". In the terminal window, you are automatically placed into your home directory, which is a file system directory containing files for a given user of the system. Now you can go to Part II and try some Unix commands shown in the table.

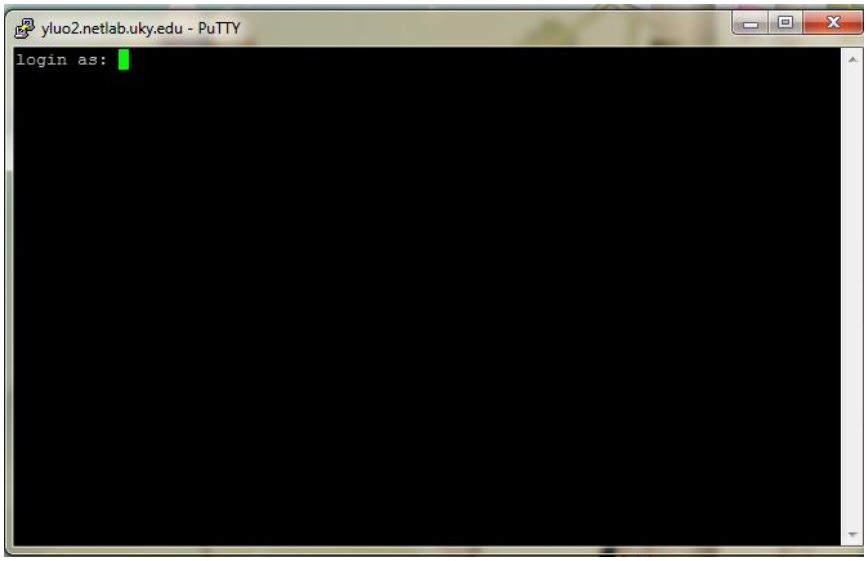
Terminal-based Linux Environment

Your VM is named after your linkblue ID. To connect to your virtual machine remotely and use Terminal-based Linux Environment, you need ssh client:

1, SSH client – putty (Does not come with a file transfer function)
The Windows machines in the computer lab all have Putty installed. When you run it, you should be greeted with a screen that looks something like this:

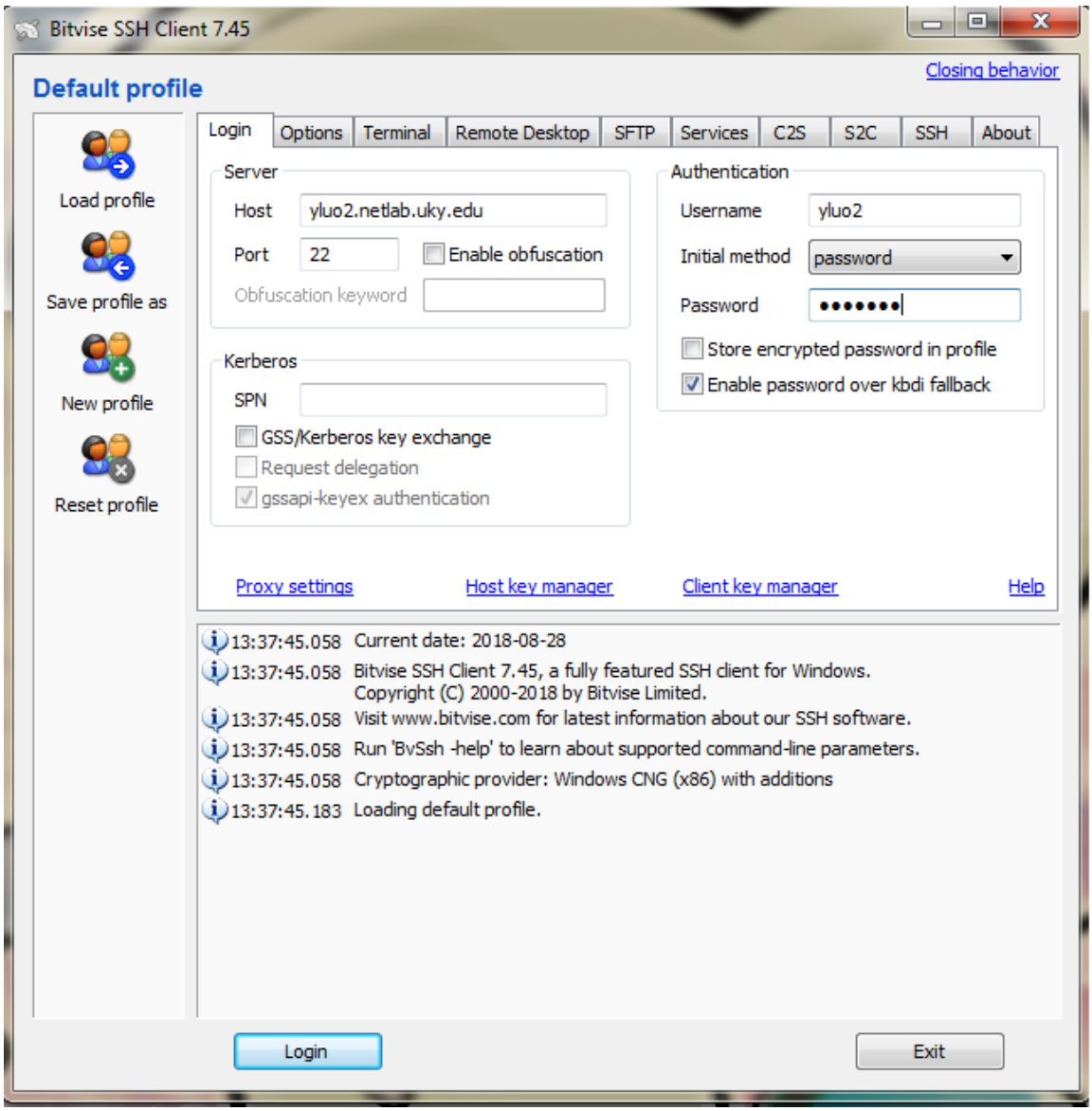


To connect to your virtual machine, just enter its name **<your linkblue id>.netlab.uky.edu** (note that you need to use your linkblude ID to replace **yluo2** shown in the figure above) in the "Host Name (or IP address)" field. After doing that and hitting Open (do not change other configuration fields), you should be greeted with something like this:



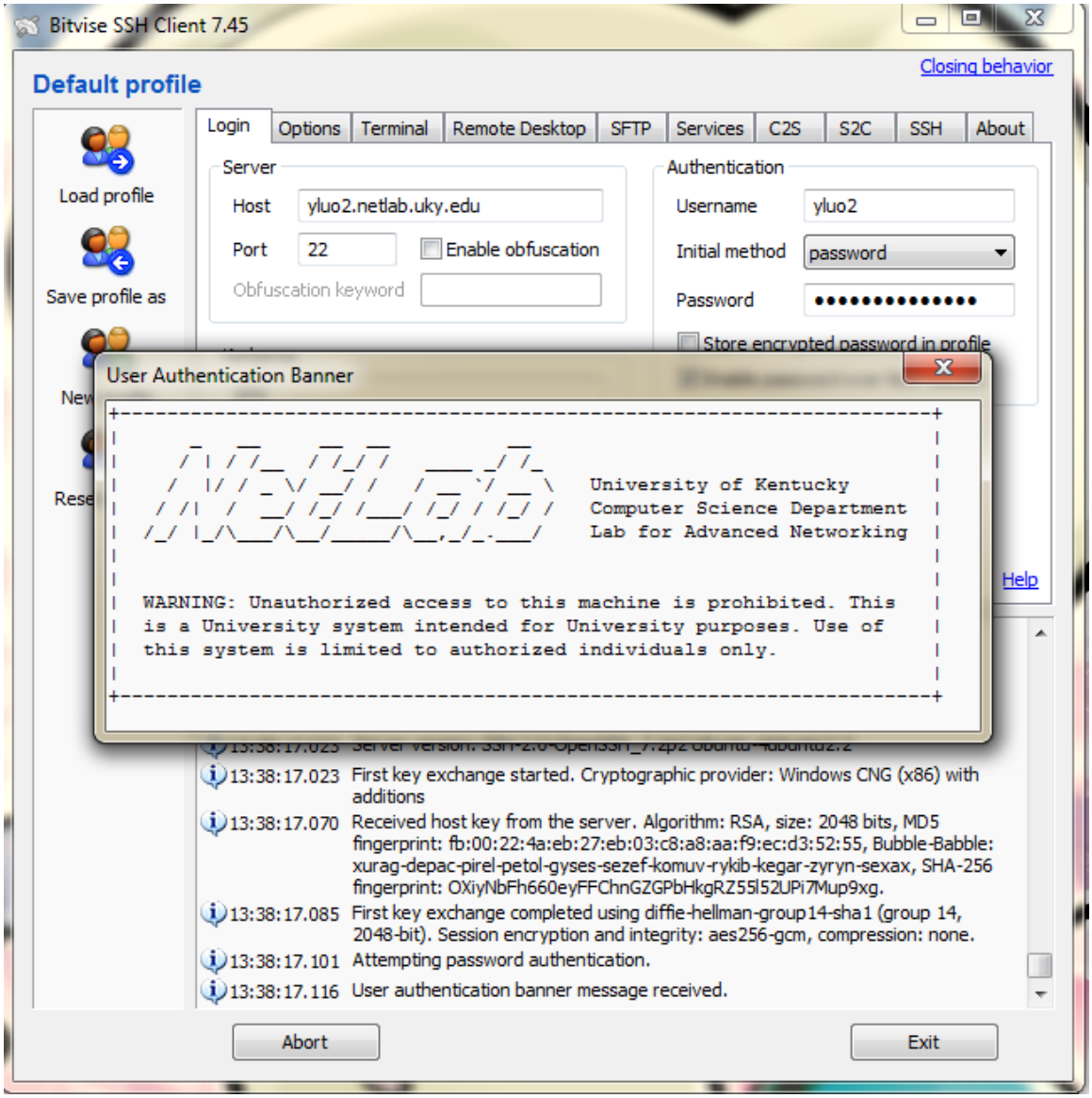
From there, just enter your linkblue ID and password (note that the password will not be displayed on the screen when you type your password). After you log in, you are automatically placed into your home directory, which is a file system directory containing files for a given user of the system. Now you can go to Part II and type some Unix commands from the table.

2, Or SSH client – BitVise (has file transfer function)
The Windows machines in the computer lab all have BitVise installed. When you run it, you should be greeted with a screen that looks something like this:



To connect to your virtual machine, just enter its name **<your linkblue id>.netlab.uky.edu** (note that you need to use your linkblude ID to replace **yluo2** shown in the figure above) in the "Host Name (or IP address)" field. From "Authentication" window on the top right, enter your linkblue ID again as "Username", and choose

"password" from the drop-down menu of "Initial method", then type your linkblue password in the "Password" field. After doing that and hitting Login, you will see "User Authentication Banner" window popped out, just click the top right corner to close this window, then you should be greeted with two windows: your VM terminal window and file transfer window (drag files from left/right to right/left to transfer files from/to your VM.



3, SSH client – ssh command (your own Laptop)

If you are going to work on your own computer, which is either (i) a Linux or Mac OS X Laptop; or (ii) a Windows 10 Laptop, you can use the ssh command to connect to your Virtual Machine:

a) If your Laptop is a Linux or Mac OS X machine:
You can click "Applications --> Utilities --> Terminal" to open up a terminal window and use the **ssh** command to connect to your Virtual Machine by typing the following command at the prompt **$**: (note that **$** is the shell prompt, you only need to start to type **ssh**):

$ ssh username@username.netlab.uky.edu

Note that the username in the above command is your linkblue ID.

b) If your Laptop is a Windows 10 machine: You can click "Start --> Windows Terminal --> Windows PowerShell" to open up a terminal window and use the **ssh** command to connect to your Virtual Machine by typing the following command at the prompt **$**: (note that **$** is the shell prompt, you only need to start to type **ssh**):

$ ssh username@username.netlab.uky.edu

Note that the username in the above command is your linkblue ID.

Part II. Basic Unix commands

You can get to know some basic Unix commands by typing a command at the prompt in the terminal shell.

Command	Description
man	Display the manual page for a command
ls **ls -l**	List contents of the current directory List contents in a 'long listing format', which contains lots of useful information
cd *dir* **cd ..** **cd ~**	Change directory to *dir* Take you one level up from your current directory Take you back to your home directory
pwd	Display what directory you are in (your working directory)
mkdir *dir*	Create a new directory *dir*
cp *file1 file2*	Copy *file1* to *file2*
rm *filename*	Delete a file called *filename*
whoami	Returns your username
cat *file1* **cat** *file1 file2 > file3*	Display the content of *file1* Concatenate *file1* and *file2* then write to *file3* > redirect output from a command to a file. Note, if the file already exists, it will be erased and overwritten without warning.
exit	Log out of the current session

You may want to spend some time trying different commands, and then you are ready to generate the output for this lab assignment.

Under your home directory, create a sub directory called **CS216**, change your current directory from home directory to CS216. Then under the directory CS216, create a sub directory called **Lab1**, go into the directory of Lab1. If you type **ls** command, it should

show nothing, since you just create an empty directory. If you type **pwd** command, it should display which directory you are in (it is your current working directory). Now type the following command at the prompt **$**: (note that **$** is the shell prompt, you only need to type **pwd > file1**)

$ pwd > file1

It will create a file named **file1** under the current working directory, it contains one line of text, which displays your current working directory. To check the content of **file1**, I will type the following command at the prompt **$**:

$ cat file1

It will display my working directory /home/yourID/CS216/Lab1 (yours should be a little different), then type the following command at the prompt **$**:

$ ls –l

It will display the content of your current working directory in a long listing format. Then try to append the displayed information to the **file1** you created earlier, by typing the following command at the prompt **$**:

$ ls –l >> file1

Note that this time you use ">>" instead of ">", because the redirect ">>" is to append the new content to the end of the existing file without overwriting the old content of the file. Is the Unix command case sensitive? Try to type the following command at the prompt **$**:

$ LS

Does this display the same result as you type "**ls**"? Now you know that Unix commands are case sensitive. Click the control key "ctrl" and the key of letter "c" at the same time (named **ctrl-c**) to stop the execution of a command and back to the shell prompt **$**.

Then you can add some fun content to your **file1** by typing the following command at the prompt **$**:

$ cowsay "Hello, Yash. I am Ryan Reynolds." >> file1

Here we assume your name is Ryan Renolds and your TA wants you to call him Yash. When you type the above line, find out your TA's full name, and replace "**Yash**". Also type your name instead of the random name:) You can check the content of file1 by typing the following command at the prompt **$**:

$ cat file1

It will display your working directory, and the long list of the content in this directory, then followed by:

```
 _____________________________________
< Hello, Yash. I am Ryan Reynolds. >
 -------------------------------------
        \   ^__^
         \  (oo)\_______
            (__)\       )\/\
                ||----w |
                ||     ||
```

Then type the following command at the prompt **$**:

$ echo shell

$ echo $shell

$ echo $SHELL

Which one is the correct command to display the default login shell of your VM? Try to explain what other two commands are for. And your default login shell should be: /bin/bash

You can try other Unix commands from the table above. If you want to check the possible options for each command, simply use the command **man** followed by the command you want to look at, for example: **$man ls**.

Continue your lab assignment by typing the following command at the prompt **$**:

$ history > file2

It will create a file with name **file2** under the current working directory, it contains a list of commands you typed from the command line. You can check the content of **file2** by typing the following command at the prompt **$**:

$ cat file2

Then type the following command at the prompt **$**:

$ figlet "Enjoy CS216"

It will display large sized text banner (you may see such banners as the welcome message of socket services when connecting via telnet). Then try to append the displayed information to the **file2** you created earlier, by typing the following command at the prompt **$**:

$ figlet "Enjoy CS216" >> file2

One more command, then you are done for this lab assignment.

$ cat file1 file2 > lab1

It will create a new file lab1, which is the one to submit to canvas for this Lab assignment. This file, named **lab1**, should contain the content from **file1**, followed by the content from **file2**. You can verify the content of **lab1** by typing "**cat lab1**" at the prompt **$**, it will display the content of your **lab1**.

To quit from bash shell, you type the following command at the prompt **$**:

$ exit

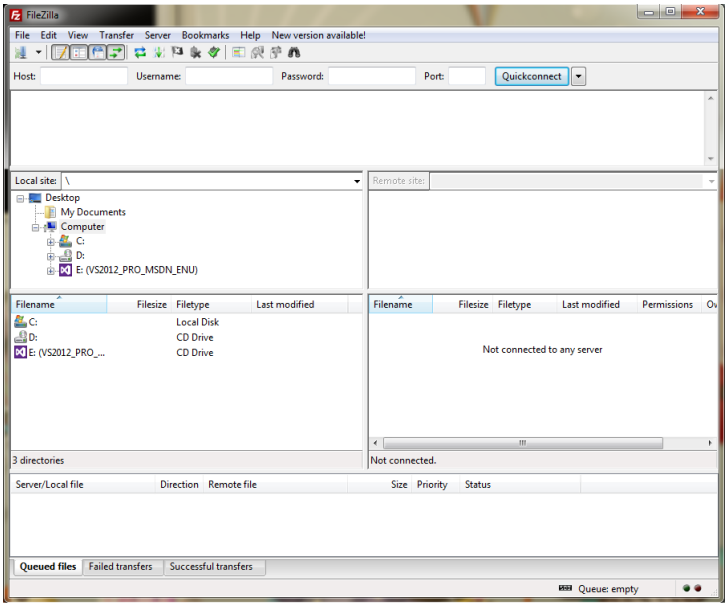
You are ready to submit your assignment for this lab. If you are under the GUI-based Linux environment, you should skip "File Transfer to/from your Virtual Machine" and go directly to Part III. Otherwise, if you are under the terminal-based Linux environment, you need one extra step before **Part III**.

File Transfer to/from your Virtual Machine

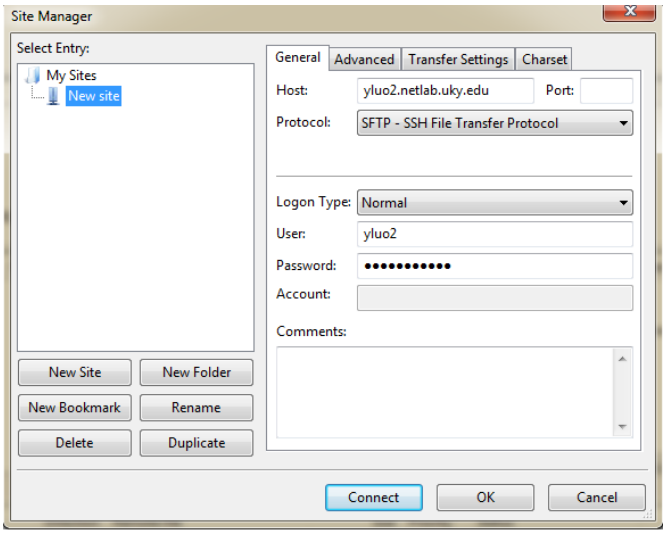
You will need another program, and it can be either FileZilla, WinSCP or BitVise, to transfer files to and from your virtual machine.

1, FileZilla (good for Linux, Windows, MacOS):

When you run it, you should see something like this:



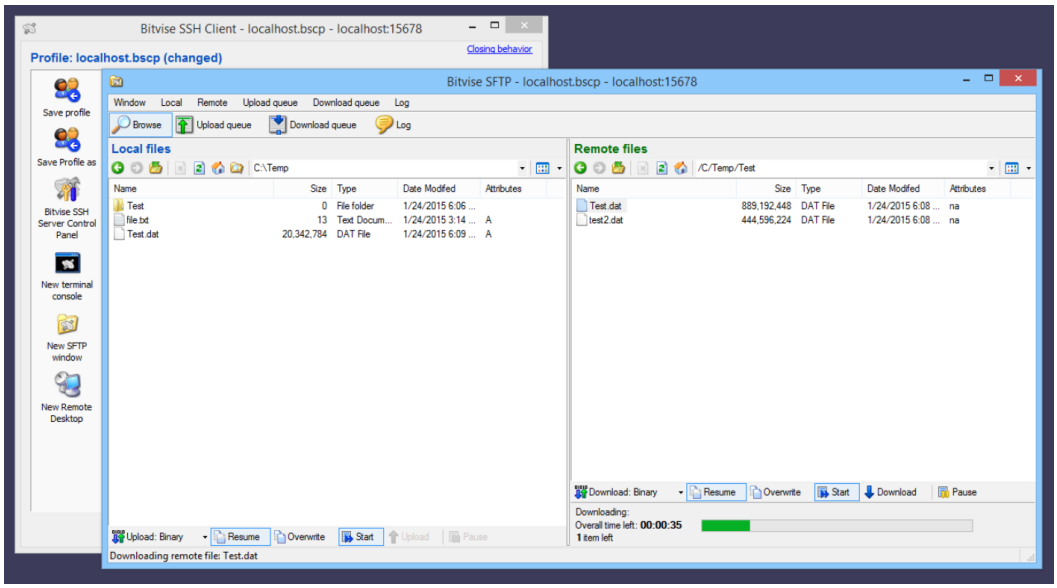
Click the button in the upper left ("Open Site Manager"), hit New Site, and then enter the following into the dialog:



Make sure to enter in the host (using your own hostname to replace the one in the example), change the Protocol to SFTP, and Logon Type to Normal, type your linkblue ID as the User. Hit connect, and then you should be set up to start moving files from the local computer (on the left) to your Virtual Machine (on the right) or the other direction. This is where you can transfer your file lab1 from previous step to your local machine via Filezilla.

2, BitVise:

Since BitVise SSH client for Windows includes state of the art terminal emulation, graphical as well as command-line SFTP support, an FTP-to-SFTP bridge, and so on. After you login through BitVise SSH Client, you will see both terminal window and file transfer window. The file transfer window should look similar to the following one:



The left window contains files from your local machine; and the right window shows the file system in your VM. By dragging files from left /right window to right/left window to transfer files from/to your VM. (Here "dragging" means to copy, the file will not be deleted from the original location)

3, File Transfer using command line

If you are using **ssh** command in Terminal window to connect to your VM from the terminal window in your local machine, you can use **scp** command to transfer files to and from your Virtual Machine.

• Copy a file (or multiple files) from the (remote) server, your VM, to your local computer:

For example, copy the file named LAB1 from your VM to the current directory of your local computer, type the following command (note that $ is not part of the command; you need to use your linkblue ID to replace yourusername below)

$scp yourusername@yourusername.netlab.uky.edu:~/CS216/Lab1/LAB1 ./

• Copy a file (or multiple files) from your local computer to the (remote) server, your VM:

For example, copy all files under your current directory from your local computer to the directory of ~/CS216/Lab1/ at your virtual machine, type the following command (note that $ is not part of the command; you need to use your linkblue ID to replace yourusername below)

$scp ./* yourusername@yourusername.netlab.uky.edu:~/CS216/Lab1/

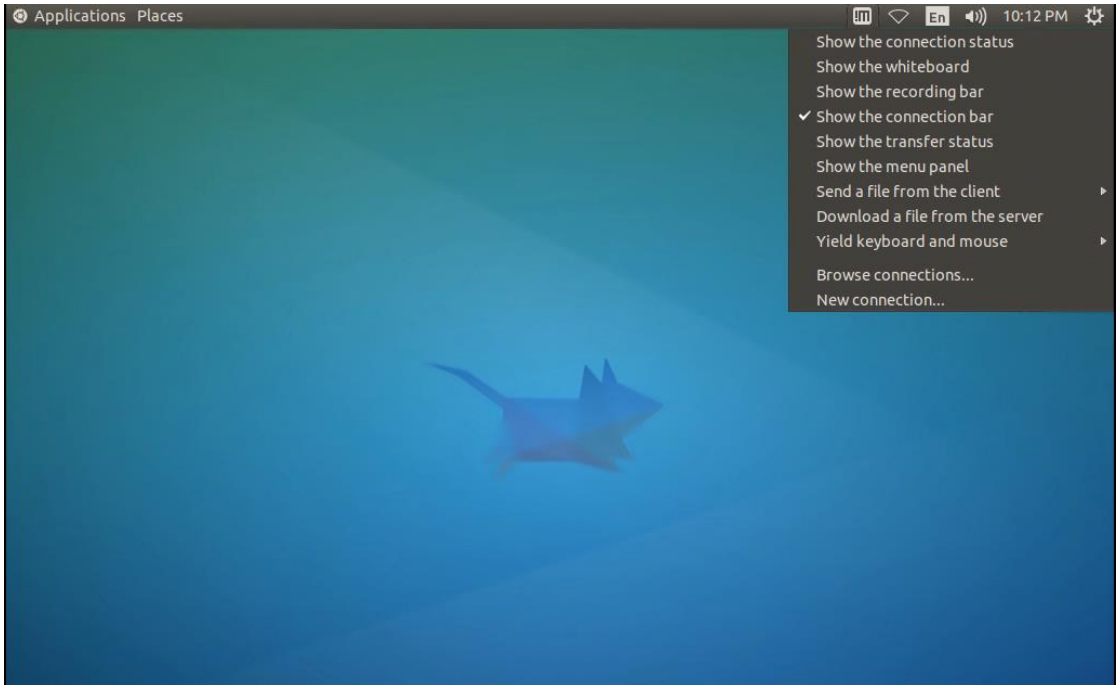
Bonus (3 points): Demonstration
If you finish your program during the Lab class, you may demonstrate your program to your TA and answer your TA's questions, you can earn up to 3 extra points for this lab assignment. (Note that bonus points are for challenging you to finish your lab assignment during the lab class only, you cannot earn the bonus points after the Lab class. Any type of screen capture as the demonstration proof is not accepted.)

Part III: Submission

Open the link to Canvas LMS (https://uk.instructure.com/), and log in to your account using your linkblue user id and password. Please submit your file (**lab1**) through link "**Lab1**". You can find your file lab1 from "Place", then the directory where you saved your file (if you are under the GUI-based Linux). Otherwise, you can transfer your file lab1 from your VM to your local machine via Filezilla (if you are using lab computers) or via NoMachine (if you are using your own computer and have installed NoMachine, see Extra Part for the instructions), and then submit your file (**lab1**) through link "**Lab1**" on canvas.

(Note that the files and directories you create on your Virtual Machine will not be deleted after you log out of your VM. But the files will be lost when your Virtual Machine is deleted. It is important that you regularly backup work you wish to keep to another computer. We generally don't delete your virtual machine until the end of the final week, but if you modify your machine that it no longer boots, we might be forced to delete it and build a new instance.)

Extra (no credit): NoMachine
This is highly recommended for your own computer: to connect to your virtual machine's console using **NoMachine** at (https://www.nomachine.com/download). Your Virtual Machine already runs a NoMachine server, and what you need to download to your own computer is a NoMachine client program to connect to it. Client programs are available for Windows, MacOS X, and Linux. Based on your home computer's operating systems, download the matched ***NoMachine client program***. When you run it, you should create a New connection to your virtual machine (select NX protocol and then type your virtual machine host name, then click continue. Note that you should not change other configuration fields). Then when you see "Connection to <your Link blue ID>.netlab.uky.edu, type your username and password, then click OK. After a few setting pages (simply click OK), you will see your virtual machine's console. Just following the instructions from **Part I GUI-based Linux Environment, Step two** to login to your virtual machine.
As long as you install NoMachine on your home computer, you can directly transfer files from/to your virtual machine using NoMachine server from your Virtual Machine. After you login to your Virtual Machine through NoMachine, you can find the NoMachine icon on the top right of the screen, and click the icon, it will display a list of features as in the following figure:



By choosing "Send a file from the client" or "Download a file from the server", you can transfer a file from your home computer to your virtual machine or transfer a file from your virtual machine to your home computer respectively.

Grading

1. Attend the lab session or have a documented excused absence. (5 points)
2. Submit a file called **lab1**. (2 points)

• the file contains the working directory, which shows that the student creates sub-directory CS216 and Lab1 from his/her home directory. (3 points)

• the file then contains the content of his/her Lab1 directory in a long listing format. (2 points)

• the file then contains the TA's name and the student's name. (3 points)

• the file then contains the list of Unix commands the student typed at the shell prompt during this lab, each line contains a number, followed by the command. (3 points)

• the file then contains the large sized text banner of "Enjoy CS216" (2 points)

Bonus: Demonstrate your program to your TA and answer TA's questions. (3 points)

(Late assignment will be reduced 10% for each day that is late. The assignment will not be graded (you will receive zero) if it is more than 3 days late. Note that a weekend counts just as regular days. For example, if an assignment is due Friday and is turned in Monday, it is 3 days late.)