**Network Simulation with Netkit**

**Total points: 100**

**Your name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

# Introduction

Netkit is a freely available lightweight network emulator based on User-Mode Linux. Netkit allows users to experiment with a large number of network technologies and provides tools for a straightforward setup of complex network.

# Objectives

After successful completion of this lab, you will be able to:

* build virtual networks using NetKit;
* monitor ARP traffic;

# Available Support Materials

This lab is based on NetKit (© Computer Networks Research Group Roma Tre)

NetKit is a network emulation environment that allow building a network from virtual devices. Documentation is available at <http://wiki.netkit.org/netkit-labs/netkit_introduction/netkit-introduction.pdf>

### Submission and Grading Guideline

|  |  |  |
| --- | --- | --- |
| Deliverables | Description | Points |
| D1. | Create lab report in a MS Word compatible file and name it as “Lab\_ 2\_ Your NetID”. | 8 points |
| D2. | Using NetKit to perform following tasks. Includes the screens shots of completing the tasks in the lab report. Each task worth 0.5 point. Detailed instruction on completing the task can be in the lab manual below.   1. create an empty file myfile.txt 2. edit file myfile.txt. Add only one line echo "inside the file"; 3. display the contents of the myfile.txt file on the screen 4. create copy of myfile.txt 5. rename file myfile.txt to script.pl 6. make file script.pl executable by users who are members of the file's group 7. execute script.pl 8. delete script.pl file 9. list contents of the current directory 10. create directory newOne in current directory 11. delete directory newOne 12. change to the parent directory 13. change to the root directory 14. display the user name for the logged on user 15. print the working directory's name 16. what is the command to display on-line manual for *touch* command (assume no Internet connection) | 16\*2=32 points |
| D3 | Using Netkit to perform following tasks. Include the screen shots of completing each tasks in the lab report. Each task worth 1 point. Detailed instruction on completing the task can be in the lab manual below.  1. A NetKit command to start a single guest VM.  2. A NetKit command to start a lab  3. A NetKit command(s) to stop and delete lab files  4. What is the purpose of the following code:  pc1[0]=tap,10.0.0.2,10.0.0.1  route add default gw 10.0.0.2 dev eth0  5. What is the purpose of resolv.conf file?  6. What is nk\_tap\_user1?  7. What is the purpose of netkit.conf file?  8. What is the purpose of lab.conf file?  9. What is the purpose of pc1.startup file?  10. What difficulties did you have while completing Part II Using NetKit section of the lab and how did you resolve them. | 6\*10=60 points. |
| Total Points: |  | 100 points |

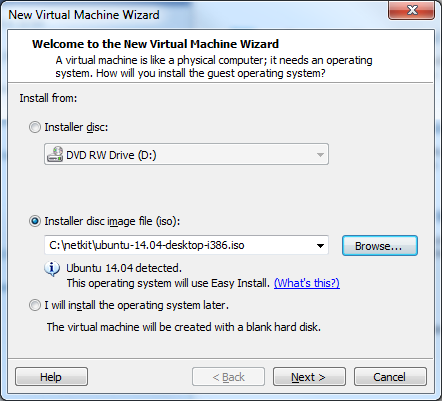
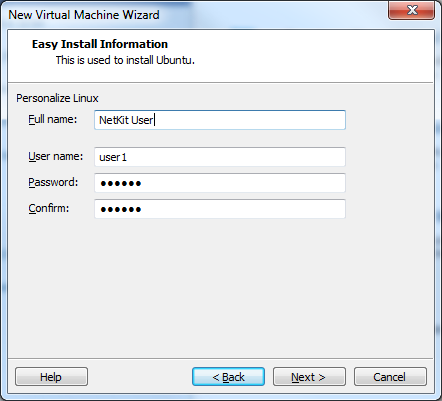
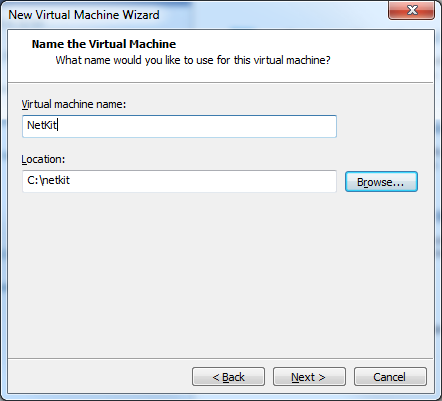
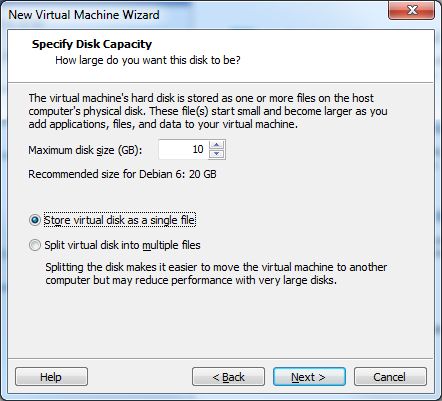
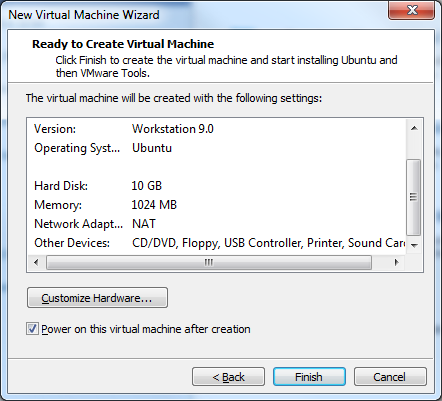
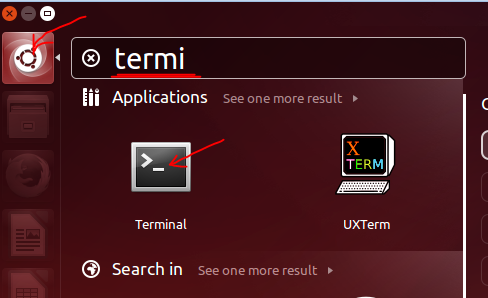
# Lab Manuals

Time to complete 2-4 hours

## Part I Installation Instructions

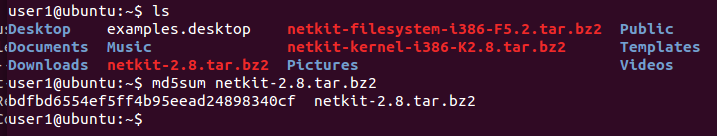
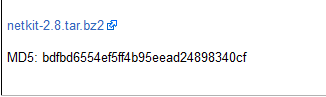
1. Create new directory and call it ***Netkit***.
2. Go to <http://releases.ubuntu.com/14.04/> and download 32 bit ***ubuntu-14.04.02-desktop-i386.iso*** file. Save the iso file in the directory, you created in #1.
3. You already have a VM player installed in your course VM (Accessible from CSEView), OR, you can use your personal computer to do the lab, in that case, downlod player from. <http://www.vmware.com/products/player/>
4. Start ***VM Player,*** choose Create a New Virtual machine



1. Locate installer ***ubuntu-14.04.02-desktop-i386.iso*** file and click Next.  
   
2. Use name ***NetKit User*** and user ***user1*** with password ***abc123*** and click Next.  
   
3. Change the name of the VM to NetKit and location to your Netkit directory. Click Next.  
   
4. Choose 10Gb disk as a single file and click Next.  
   
5. On the next screen click Finish  
   
6. This will start the VM and Ubuntu installation  
   
7. Wait when all files are copied and packets are installed.
8. When prompted login as Netkit User (password abc123)
9. On the Ubuntu Desktop click ***Search***, start typing ***terminal*** and click on the terminal icon to a new terminal window.
10. Unix commands <http://cheat-sheets.s3.amazonaws.com/for-mobile/linux-commands-cheat-sheet-new.pdf> : provide **commands and screenshots on the submission page to prove that you successfully run all required commands**
11. create an empty file myfile.txt
12. edit file myfile.txt. Add only one line echo "inside the file";
13. display the contents of the myfile.txt file on the screen
14. create copy of myfile.txt
15. rename file myfile.txt to script.pl
16. make file script.pl executable by users who are members of the file's group
17. execute script.pl
18. delete script.pl file
19. list contents of the current directory
20. create directory newOne in current directory
21. delete directory newOne
22. change to the parent directory
23. change to the root directory
24. change your password
25. display the user name for the logged on user
26. print the working directory's name
27. what is the command to display on-line manual for *touch* command (assume no Internet connection)
28. Go to <http://www.netkit.org/> and download netkit-2.8.tar.bz2   
    MD5: bdfbd6554ef5ff4b95eead24898340cf  
    You can copy the link to the download and use wget command

wget http://wiki.netkit.org/download/netkit/netkit-2.8.tar.bz2

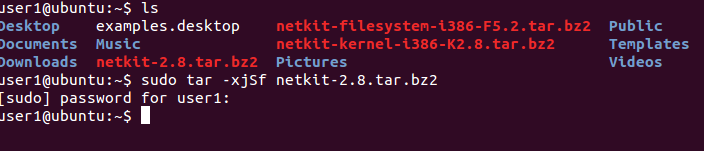
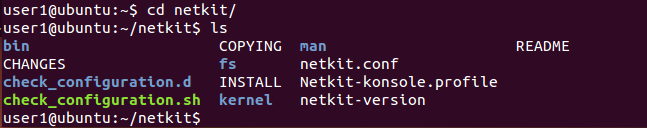
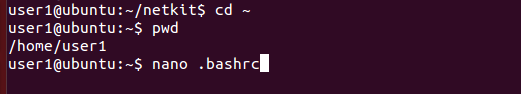


1. Download [http://wiki.netkit.org/download/netkit-filesystem/*netkit-filesystem-i386-F5.2.tar.bz2*](http://wiki.netkit.org/download/netkit-filesystem/netkit-filesystem-i386-F5.2.tar.bz2)
2. Download [http://wiki.netkit.org/download/netkit-kernel/*netkit-kernel-i386-K2.8.tar.bz2*](http://wiki.netkit.org/download/netkit-kernel/netkit-kernel-i386-K2.8.tar.bz2)
3. After all three files are downloaded use ***md5sum*** utility to compare hashes of files you downloaded with hashes listed on NetKit site. Below is an example for the first file.  
     
   It matches md5 sum listed on the site  
    
4. Unpack three files you downloaded

sudo tar -xjSf netkit-2.8.tar.bz2

sudo tar -xjSf netkit-filesystem-i386-F5.2.tar.bz2

sudo tar -xjSf netkit-kernel-i386-K2.8.tar.bz2

1. Below is an example of running the first command.  
   
2. Change to the ***netkit*** directory. Your directory structure should match directory structure below:  
   
3. Configure your shell to set values of environment variables listed below. You can modify ***.bashrc*** file by running nano .bashrc  
   

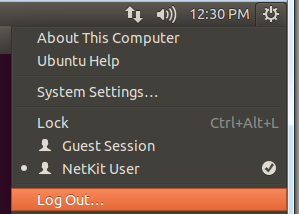
Add lines below to the end of the file and save the file (Ctrl+X Yes).

export NETKIT\_HOME=/home/user1/netkit

export PATH=$PATH:$NETKIT\_HOME/bin

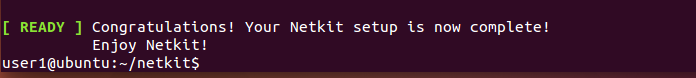
export MANPATH=:$NETKIT\_HOME/man

export NETKIT_HOME=/home/user1/netkit
export PATH=$PATH:$NETKIT_HOME/bin
export MANPATH=:$NETKIT_HOME/man

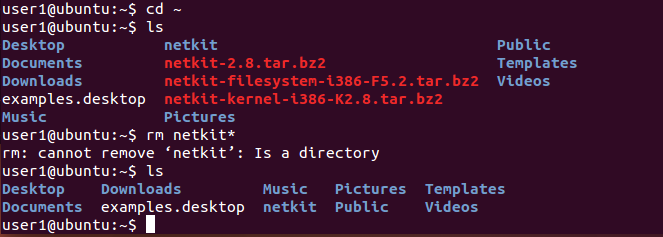
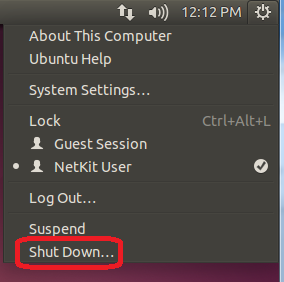

1. Log out  
   
2. Log back in and open a new terminal window.
3. Use cd $NETKIT\_HOME to check that your environment variables are saved.   
   cd $NETKIT_HOME 
4. Run ***check\_configuration.sh*** script

./check\_configuration.sh

You should receive **READY** message



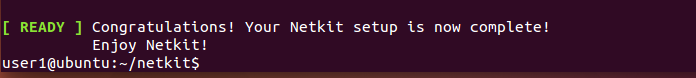
If you have errors or warnings, you have to resolve them before going to the next step.

1. After you successfully unzipped files go to your home directory and remove zipped files by running rm netkit\* command. It will not remove the directory  
   
2. If all checks were successful, then you are ready to use ***NetKit***. I recommend you to Shut Down your VM, create a backup copy of the ***NetKit*** directory on your host system and then start NetKit VM again.  
   

## Part II Using Netkit

1. Start NetKit VM.
2. Login as NetKit User (user1/abc123).
3. Open a new terminal window and change directory to ***netkit.***
4. Open a new terminal window and Run ***check\_configuration.sh*** script

./check\_configuration.sh You should see **READY** message again.

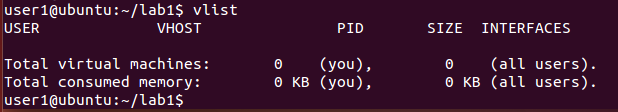
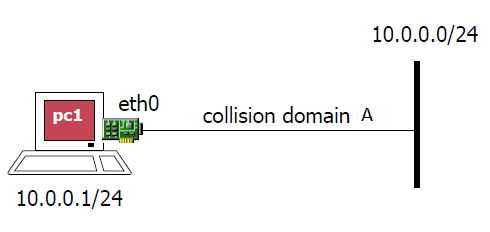


1. Now you are ready to build your first network. NetKit provides users with two sets of commands

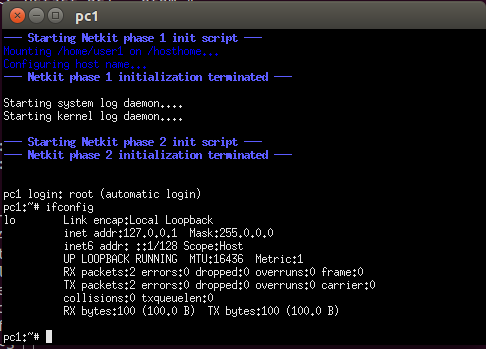
* v-prefixed commands (vcommands)
* l-prefixed commands (lcommands)

***vcommands*** are used for configuring and starting up single virtual machines

***lcommands*** are used to set up complex labs consisting of several virtual machines. First, we will use vcammands to check the list of virtual hosts and to configure our first virtual host.

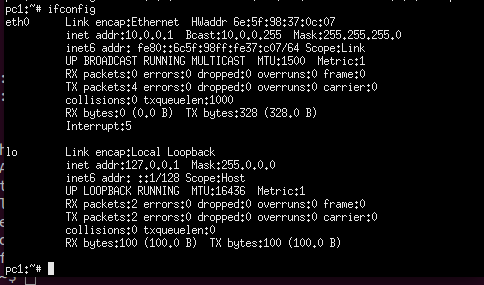
1. Change to the parent directory cd .. You should run commands from ***/home/user1*** directory.
2. Create new directory ***lab1*** mkdir lab1
3. Switch to ***lab1*** cd lab1
4. Check your that working directory is ***/home/user1/lab1*** pwd
5. In a terminal window run ***vlist*** command to see the list of all existing virtual hosts. You should not have any machines.  
   
6. We will create a simple network that consists of only one PC with IP address 10.0.0.1 network mask 255.255.255.0 with collision domain A. To create a new virtual machine use ***vstart*** command 

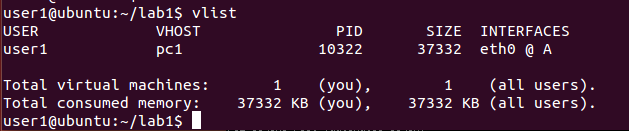
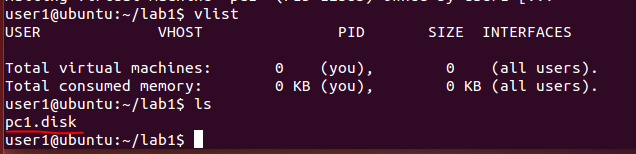
vstart pc1 --eth0=A

You will see a new terminal window for the new PC1. NetKit will also create ***pc1.disk*** file for this virtual host. If you run ifconfig, you will see only loopback interface   


1. Change network configuration of the ***PC1***.

ifconfig eth0 10.0.0.1 netmask 255.255.255.0 broadcast 10.0.0.255 up

Then run ifconfig command to check your configuration.

1. Use ***vlist*** command to check virtual hosts. It shows one running virtual host
2. You can stop virtual machine using one of three methods
   1. halt inside PC1
   2. vhalt from NetKit VM terminal
   3. vcrash from NetKit VM terminal
3. Run ***vhalt*** command from NetKit VM terminal vhalt pc1  
   vhalt pc1
4. If you run ***vlist*** again, no virtual hosts are running, but disk created for PC1 will be saved, but all network configuartion settings are lost.   
   
5. Delete ***pc1.disk*** file.
6. Create file ***pc1.startup*** with the following content

ifconfig eth0 10.0.0.1 netmask 255.255.255.0 broadcast 10.0.0.255 up

1. Create file ***lab.conf*** with the following content

LAB\_DESCRIPTION="One host lab"

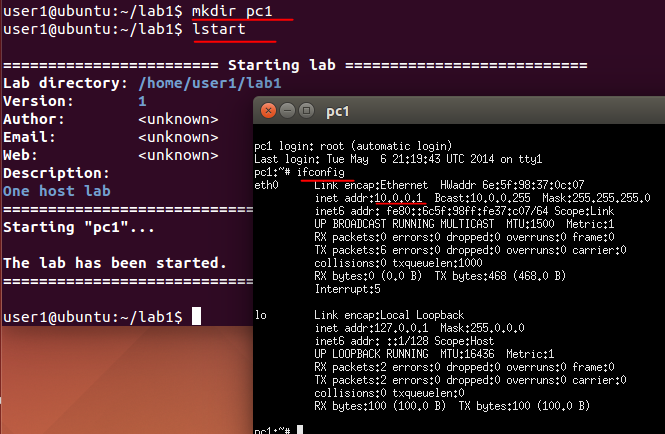
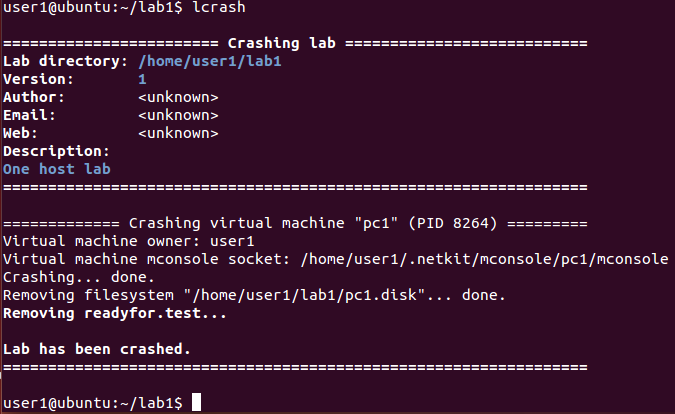
LAB\_VERSION=1

pc1[0]="A"

1. Create a new directory ***pc1***

mkdir pc1

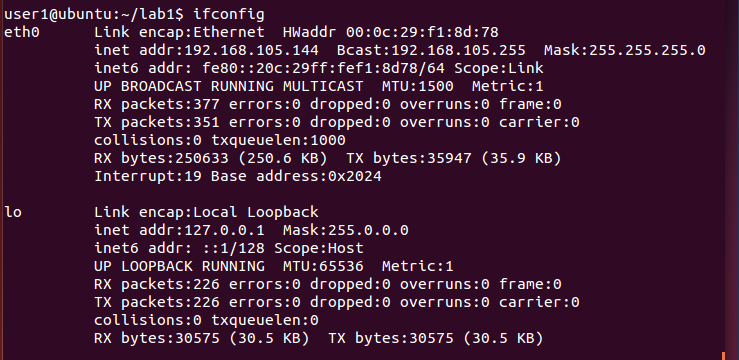
mkdir pc1

1. Run ***lstart*** to start the lab. lstart It will start PC1, create ***pc1.disk*** file and also configure ***eth0*** interface. To check ***eth0*** interface configuration, run ***ifconfig*** inside PC1 terminal window. 
2. Try to ping 8.8.8.8. You should receive message that network is unreachable. Next we willconfigure Internet access inside NetKit.
3. Run ***lcrash*** to stop the lab. lcrash It will stop PC1, remove PC1 disk and temporary files.
4. Check IP addresses for all interfaces on your NetKit VM. I have 192.168.105.144, to allow PC1 to connect to the Internet I have to configure two IPs:

TAP-ADDRESS is the IP address of a new host side interface that is used to route traffic to and from the external network.

GUEST-ADDRESS is the address that is automatically assigned to the interface inside the virtual machine.

Neither of them can overlap or be in the same subnet with any interfaces on your host (in my case with 192.168.105.144.

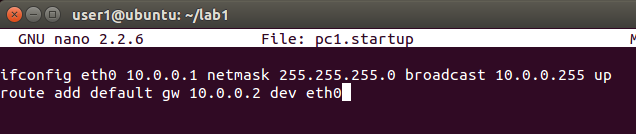
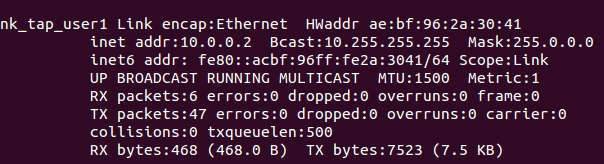
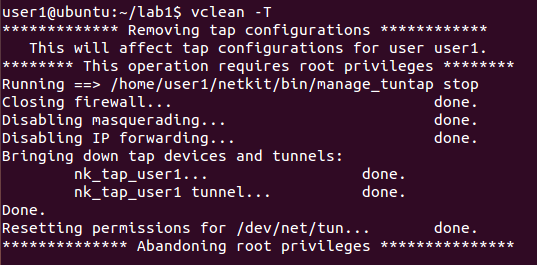
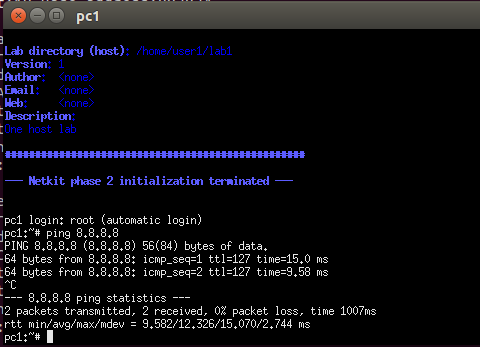


1. We set earlier IP address for PC1 10.0.0.1, we will use 10.0.0.2 as a TAP-ADDRESS. Open lab.conf file and edit
2. Edit ***lab.conf*** file. Modify pc1[0] settings. It should be

pc1[0]=tap,10.0.0.2,10.0.0.1

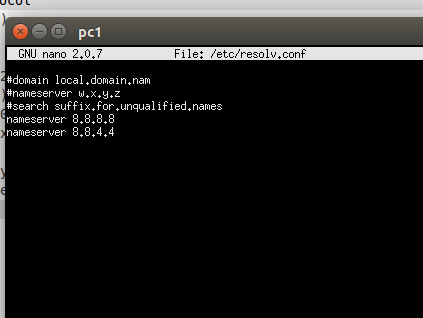
1. Edit file ***pc1.startup***, add line

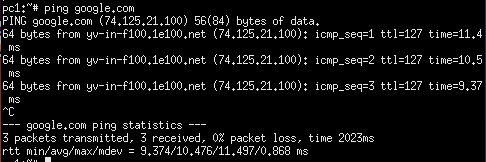
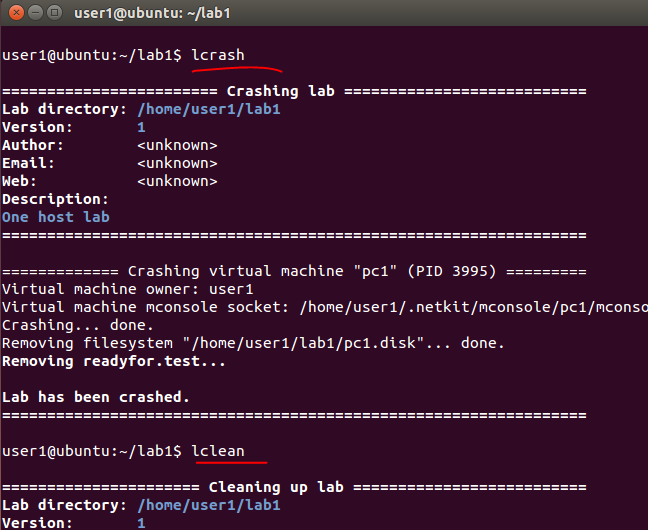
route add default gw 10.0.0.2 dev eth0

1. Save changes. 
2. Use lstart to start the lab, it will ask for the password because it will add nk\_tap\_user1 interface to the NetKit VM host. To check that the interface was added use sudo ifconfig  
     
   To delete this interface, you have to use vclean -T. NetKit allows only one TAP interface. NOTE: if you have to make any changes to the interface we created, you have to run vclean -T. **Do not run this command unless you have problems with connecting *PC1* to the Internet**.  
   
3. Ignore the " Warning: collision domain name for interface eth0 (tap,10.0.0.2,10.0.0.1 )" You should see PC1 terminal window and should be able to ping 8.8.8.8. IP 8.8.8.8 belongs to [Google](https://developers.google.com/speed/public-dns/)   
   
4. To be able to ping google.com, we have to modify ***/etc/resolv.conf*** file and add nameservers:

nameserver 8.8.8.8

nameserver 8.8.4.4



1. Save the file and try to ping google.com. You should see a similar output.  
   
2. Use lcrash and lclean commands from NetKit VM to stop the lab. 
3. We will modify ***pc1.startup*** file to always add nameservers at strat up. Open the file and add the following two lines

echo "nameserver 8.8.8.8" >> /etc/resolv.conf

echo "nameserver 8.8.4.4" >> /etc/resolv.conf

echo "nameserver 8.8.8.8" >> /etc/resolv.conf
echo "nameserver 8.8.4.4" >> /etc/resolv.conf


These lines will append namesrvers' IPs to the ***/etc/resolv.conf*** file.

1. Save the file.
2. Use lstart to start the lab.
3. Ping google.com in the pc1 window.
4. Stop the ping. Answer questions on the submission page and use lcrash and lclean to stop the lab.
5. Run vclean -T to remove tap information.