

Homework #6

Due Time: 2017/5/28 (Sun.) 22:00

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Submission

- Compress all your files into a file named **HW6_[studentID].zip** (e.g. HW6_bxx902xxx.zip), which contains two folders named **[studentID]_NA** and **[studentID]_SA** respectively.
- **Folder [studentID]_NA** should contain a pdf file named **na.pdf** of all your answers in *Network Administration Part*.
- **Folder [studentID]_SA** should contain a pdf file named **sa.pdf** of all your answers in *System Administration Part*.
- Submit your zip file to ceiba.
- You will get 5 points if you follow the assignment format specified above. Failure to follow any of the above requirements will result in deductions from your assignment mark.

Instructions and Announcements

- Discussions with others are encouraged. However, you should write down your solutions **in your own words**. In addition, for **each and every** problem you have to specify the references (the URL of the web page you consulted or the people you discussed with) on the first page of your solution to that problem.
- Problems below will be related to the materials taught in the class and may be far beyond that. Try to search for additional information on the Internet and give a reasonable answer.
- Some problems below may not have standard solutions. We will give you the points if your answer is followed by reasonable explanations.
- **NO LATE SUBMISSION IS ALLOWED.**

Network Administration

1.

Explain what NAT is and how it works IN YOUR OWN WORDS. (10%)

2.

List some advantages and disadvantages of NAT. (10%)

3.

Your home server is behind a NAT router which is the Wi-Fi router in your house. The home server gets an IP address by DHCP and that IP address may change. On the other hand, the Wi-Fi router acquires a dynamic IP address from your ISP. What should you do to ensure that you can always connect to your home server from outside your home network? (Hint: adjust the DNS a little bit?) (10%)

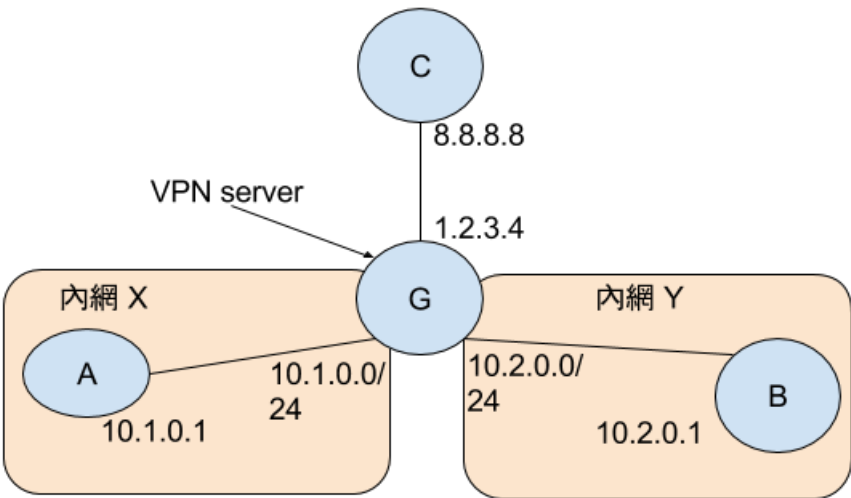
4.

You want to connect to your home server's HTTP service. The server is behind NAT and your IP address is 141.59.2.6. Write down the commands to set up a reverse SSH tunnel on your home server. (5%)

5.

Consider the following network topology (on next page). Node G is the NAT gateway of private network X and Y. G also acts as a VPN server which can create a tunnel accessing network Y. Node C and G both have public IPs. Please answer the following questions by writing down how packets pass through these nodes. Your answer should include the locations of the packet, the source IP address and the destination IP address of the packet in each location.

1. Suppose that node C wants to communicate with node B. Node C has an IP address 10.2.0.2 on the Y network, which is assigned by the VPN server 1.2.3.4 (node G). (5%)
2. Suppose that node A wants to communicate with node B. Node A has an IP address 10.2.0.3 on the Y network, which is assigned by the VPN server 1.2.3.4 (node G). (5%)



System Administration

FHS (15%)

Most UNIX software provides an `autoconf` script `configure` that can be run to determine the local build environment. It usually generates a Makefile so you can use the following commands to install a software in a **portable manner** (That's why you can build the same software on FreeBSD, MacOS X, Linux, etc.):

```
./configure
make
make install
```

The `--prefix` argument determines the installation path. The default installation path is `/usr/local` instead of `/usr`. For example, the following commands will install the `iperf` executable to `/usr/local/bin/iperf` and the associated libraries into `/usr/local/lib`:

```
wget https://iperf.fr/download/source/iperf-3.1.3-source.tar.gz
tar xzf iperf-3.1.3-source.tar.gz
cd iperf-3.1.3
./configure; make; sudo make install
```

Describe possible rationales for the decision of the default installation path, which is `/usr/local` instead of `/usr`. Assume you are using CentOS 7. You can quote FHS if needed.

Doge's doom day (35%)

In NASA midterm problem 4, you have seen how Mr. Doge hacked Ms. Meow. Now, for fairness measure, I just messed up Mr. Doge's own website, too.

You are given a clone of the broken virtual machine, in which Mr. Doge runs a website accessible by `http://localhost:8080/q.dog/`. The website contains a hyperlink to Doge's favorite CSIE website.

Now I have messed up the VM so it is your task to help Doge fix it.
The success criteria are:

- You can access Doge's website by the command `elinks http://localhost:8080/q.dog/`.
- Once you are able to view the web page, you should be able to visit the hyperlink, which links to Doge's favorite CSIE website.

Take a screenshot of each criterion as proof of completion and briefly describe what happens and what you have done to fix it. Please don't steal others' screenshots. Cheating is a major crime!

- The VM is at <http://oasis2.csie.ntu.edu.tw:9999/nasa-doge-broken.qcow2>.
- Boot the VM with the following commands:

```
# if you don't have root privilege on the running machine
qemu-system-x86_64 -drive file=nasa-doge-broken.qcow2,format=qcow2,\
if=virtio -net nic -net user -m 1024 -nographic
```

```
# Might require root privilege on the running x86-64 machine.
# This will use KVM to accelerate execution.
qemu-system-x86_64 -enable-kvm -drive file=nasa-doge-broken.qcow2,format=qcow2,\
if=virtio -net nic -net user -m 1024 -nographic

# on some older CentOS ...
/usr/libexec/qemu-kvm -drive file=nasa-doge-broken.qcow2,format=qcow2,\
if=virtio -net nic -net user -m 1024 -nographic
```

- The commands are available on CSIE workstations, and please, read the second tip here. Once you have finished this problem, it is wise to remove the disk image to save disk space. Please.
- Upon first boot, You are able to log in only when the script `firstboot.sh` has been run. If you don't have KVM acceleration, this will be a bit slow, so wait patiently at login prompt until you see messages like these:

```
...
[ 114.011975] firstboot.sh[1076]: hello, my name is Doge
[ 114.081861] firstboot.sh[1076]: my personal homepage is at http://localhost:8080/q.dog/
[ 114.373270] firstboot.sh[1076]: access it with "elinks http://localhost:8080/q.dog/"
[ 114.580865] firstboot.sh[1076]: if you see anything abnormal, please help fix it, because I ...
[ 114.799595] firstboot.sh[1076]: because I am stupid
[ 114.870771] firstboot.sh[1076]: the root password is "root" ( :
...
```

- Use `ctrl-a x` to quit the QEMU window.
- **Hint:** read the network configuration of [QEMU user-mode networking](#) carefully.
- **Hint:** use `systemctl` to see if there is any failing service, or view log with `journalctl`.