Homework #2

Due Time: 2017/3/26 (Sun.) 22:00
Contact TAs: `vegetable@csie.ntu.edu.tw`

Submission

- Compress all your files into a file named **HW2_[studentID].zip** (e.g. `HW2_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.

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. (10%)

We have studied in class about CSMA/CD, which is a MAC protocol specified in the IEEE 802.3 (Ethernet) standard. However, such protocol is now obsolete for modern Ethernet networks, and is even removed in the new 10 Gigabit Ethernet standard. Briefly explain why CSMA/CD is rarely used in modern applications.

2. (15%)

Recall that with the CSMA/CD protocol, the adapter waits K * 512 bit times after a collision, where K is drawn randomly. After the 5th collision, what is the probability that a node chooses K = 4? The result K = 4 corresponds to a delay of how many seconds on a 10Mbps Ethernet? Please write out your calculations for full credit.

3. (25%)

Build and install `iperf` on both your PC and 217 Workstation. Measure the bandwidth between your PC and 217 Workstation under different network media (e.g. wired/wireless network of CSIE, wired/wireless network in your home and even mobile network such as 4G). To prove your work, you should provide screenshots of your `iperf` result and briefly explain the commands you use to measure the bandwidth.

System Administration

Install Arch Linux (not Manjaro or whatever) on a machine, either physical machine or virtual machine (with any hypervisor, e.g. VirtualBox). Hopefully installing Linux manually will help you understand the concepts of bootloader, partition, and filesystem better.

Your Arch should satisfy the following requirements (tasks in order):

1. Have one partition for `/boot`. (So you can boot with GRUB latter.) (5%)
2. Have two partitions and filesystems for `/home` and `/var` respectively based on LVM. Note that you may want to leave some space so you can do the last task (enlarge `/home`). (10%)
3. Set "the percentage of the filesystem which may only be allocated by privileged processes" to 10% for `/var` (so the filesystem of `/var` should be of ext family). (5%)
4. A special partition for "swap". (5%)
5. Successfully installed Arch base packages with `pacstrap`. Hint: Since `pacstrap` requires internet to work, you may need to use command `dhclient [dev]` to get DHCP.
6. Be able to boot into Arch normally with GRUB (MBR or namely legacy mode). You should explain what those GRUB commands actually do. Hint: You can use `pacman -S grub` to get those GRUB-related commands. (15%)
7. All filesystems should be automatically mounted properly after booting. You should do it in a robust way and there exist some tools to help you. (5%)

Now you should have a working Arch.

8. Then show how to enlarge your `/home` filesystem online (namely without shutting down machine). Note that it is not encouraged in production! (5%)
9. Bonus: Be able to boot in `EFI` mode and explain the mechanism of `EFI`. Also, you should explain what those grub commands actually do. (10%)

Note that:

- Do not use any GUI tools in your Arch to finish the above tasks. That is, all tasks should be done with command line.
- You should write down what you do step by step, and explain what you are doing to get full credit.
- You should mark each task clearly in your report.
- The process is as important as the result. Therefore, if you do things in some incorrect or nasty ways, such as manually editing a file that should be generated by tool or writing a script that mounts filesystem as a user login, you will not get full credit.
- You should always check "reliable" documents such as official wiki (though sometimes is wrong), man page, even after you find a solution on stackoverflow, stackexchange, serverfault, superuser, askubuntu or whatever.