

## Homework #5

Due Time: 2017/5/14 (Sun.) 22:00

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### Submission

- Compress all your files into a file named **HW5\_[studentID].zip** (e.g. HW5\_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

### DHCP

1.

DHCP can instruct a client to use a specific gateway. Therefore, it comes to Eve that she can set up her own DHCP server and redirect all network data to her side, and then she can eavesdrop everything. As a network administrator, what should you do to prevent this from happening? (10%)

### DNS

1.

You can set up your own authoritative DNS server for csie.ntu.edu.tw and modify it whatever you like, but nobody except you will query it. Why? (5%)

2.

A special domain name is reserved to facilitate reverse IP lookup (i.e. IP 反解) for IPv4 addresses. Therefore, "dig -x 140.112.30.21" equals to "dig -t PTR 21.30.112.140.A\_SPECIAL\_DOMAIN\_NAME". What is that domain? (5%) Also, in the above command, why is 140.112.30.21 reverted to 21.30.112.140? (5%)

3.

How (Where) can you find the information of a domain, such as the domain registrant's name, the administrator's email address, and so on? (2%) Use your aforementioned method to find out the registrant contact's email address for the domain icann.org. (Reminder: zone file's SOA record is NOT enough for this purpose.) (3%)

4.

What is "DNS propagation time"? (5%) For the following example zone file, assume this zone belongs to you (you operate an authoritative DNS server of this zone), and assume TTL is honored by every server on the Internet. If you change 192.168.1.1 to 192.168.1.2, how long does it take for this modified record to "propagate"? Explain your answer. (5%)

```
@ 86400 IN SOA ns.example.com. admin.example.com. (
    2017041100 ; serial
    21600 ; refresh after 6 hours
    1800 ; retry after 30 minutes
    86400 ; expire after 1 day
    600 ); minimum TTL of 10 minutes

@ 10800 IN NS ns.example.com.
ns 7200 IN A 192.168.1.254
@ 3600 IN A 192.168.1.1
```

**5.**

For DNS, what is open resolver? (5%) What problem may it pose? (5%)

## System Administration

In CentOS, we usually use `yum` to manage packages. For question 1-3, briefly describe your answers. For question 4-7, write down the commands you use. For question 8-10, write down your answers based on CentOS 7. You can assume that `yum-utils` is pre-installed.

1. What is the difference between `yum update` and `yum upgrade`? (3 %)
2. Are there any flags you can add to `yum update` to make it the same as `yum upgrade`? (3%)
3. What is the difference between `yum remove` and `yum autoremove`? (3%)
4. How to prevent `yum autoremove` from removing a specific package? (3%)
5. How to search for a package, say `vim`? (3%)
6. Sometimes the program name differs from the package name. For example, program `nfsstat` is packaged in the `nfs-utils` RPM. How to perform such search, given **only the program name**? (3%)
7. How to **recursively** list all dependencies of a package? (3%)
8. Aside from system-wide package manager like `yum`, many programming language communities have their own package managers. Rust has Cargo; Python has Pip; Node.js has NPM, etc. Both system-wide and language-specific package managers produce modules for the language in concern. For example, Sphinx, a popular documentation generator written in Python, can be installed in CentOS 7 by either `sudo yum install python-sphinx` or `sudo pip install sphinx`. If you want to install a Python module that are provided by both CentOS 7 repository and PyPI, what are the pros and cons of each method? (8%)
9. What's wrong with the following sequence of commands, assuming that `pip` has been installed from EPEL repository? Please show any warnings issued by `pip` or `yum` and explain the reason. (8%)

```
sudo yum install -y python-jinja2
... some weeks later ....
sudo pip list | grep jinja
sudo pip uninstall -y jinja2
... some weeks later ...
sudo yum remove -y python-jinja2
```

10. Some Ruby Gems build “native extensions”, C codes embedded in Ruby, when installed by `gem install`. The build process includes generating a Makefile and uses that to invoke C or C++ compiler. But what if you are on a minimal CentOS without `make`, `gcc`, `gcc-c++` being installed? Or a library is missing? Another issue of using `gem` is that some Gems expect the Ruby version different from the one provided by the `ruby` RPM. Compare installing [Wikicloth](#) via `yum` (in the EPEL repository) and `gem`. Describe what happens when you are on a minimal CentOS 7 without aforementioned build tools or on a hardware device with poor CPU. Describe version conflicts you meet, if any. Finally, list the installation destination of each package manager and compare with that of Python in the previous problem (Hint: `rpm -q1`). (8%)

Note: The scenario described here is realistic because aforementioned build tools are generally excluded from production server to minimize attack surface. Except for proprietary DKMS kernel modules like

VirtualBox, Linux distributions (except for Gentoo-like distros) ship built binary packages for each target architectures so that users do not need to compile anything by themselves. However, language-specific package managers like `gem` or `pip` are designed to serve packages for all architectures, thus resulting in the situation described above. Note that when you intend to install DKMS packages, the development tools required for building it will be installed as dependencies automatically; but in the case of `gem`, it simply fails in a miserable way. This is the beauty of tight-integration in every Linux distribution.