

Please read Sections 3.6 and 3.7 of your textbook, and then answer the following. For the questions relative to Networking, consult for instance the wikipedia article on TCP-IP, *Network+ Guide to Networks* by Tamara Dean, or any other source that you think is reliable. Quiz #4, on Thursday 19th October, will consist exclusively of questions taken from the Part I of this homework.

Part I — Short Questions

Question 1

Is the ring topology more or less fault-tolerant than the bus topology? Why?

Question 2

Why is it useful to have protocols?

Question 3

What type of devices stands at the “gateway” between WAN and LAN?

Question 4

What is the benefit of a switch over a hub?

Question 5

How many layers have the OSI models? What are the name of the lowest and highest levels?

Question 6

In the TCP-IP model, at which layer(s) are the HTTP and FTP protocols?

Question 7

What is flow control and what layer(s) implement it?

Question 8

Briefly describe the 3-ways handshake of TCP.

Question 9

Why is it a good idea to enclose a checksum in the header of a segment?

Question 10

Which one has the more complex header, a TCP segment or a UDP segment?

Question 11

Name three advantages of hosting virtual machines on a server.

Question 12

Briefly describe and name the two kinds of hypervisors.

Question 13

Why does a system have many ports?

Question 14

What are the well known ports? Who can use them?

Question 15

What are the differences between named pipes and ordinary pipes?



Part II — Problems

This time, the two problems requires a computer. I'll assume that you will have successfully completed them by the time Homework #5 is released (Thursday 19th October), so don't wait and let me know if you had difficulties doing them.

Problem 1

Run your virtual machine, open a terminal, and answer the following.

(a) MAC address

- i. What is the MAC address of your NIC device? Use `/sbin/ifconfig` to find out, the address will be given after "HWaddr", it is a 12-digit hexadecimal number.
- ii. What is the MAC address of your hosting Operating System? On Windows, open a command prompt and enter `ipconfig/all`. On MacOS, open a terminal and enter `ifconfig`.
- iii. Using <http://standards-oui.ieee.org/oui/oui.txt>, find the corresponding constructor(s).
- iv. Read Section 6.1 and 6.2 of VirtualBox's manual (<http://download.virtualbox.org/virtualbox/UserManual.pdf>) or https://www.vmware.com/support/ws55/doc/ws_net_basics.html, depending on the Virtualizer you use.

(b) Pinging

- i. In your terminal, enter `ping -c 5 127.0.0.1` to send yourself five IP packets, using the loopback IP address.
- ii. Now, enter `ping -c 5 localhost`, and `host localhost`. What is the IPv6 address of the loopback IP address?
- iii. Now, let's try to access the outside world, using `ping -c 5 www.w3schools.com`. What is the IP of this website? Can you ping that website directly using its IP address?
- iv. Enter `traceroute` followed by the IP address that you discovered at the previous step. What is the output of that command? Using `man traceroute`, explain in a few words what this program do.

(c) Sending simple TCP segments

- i. Open two terminal. In the first one, enter `nc -l -p 10000`. In the second one, enter `nc localhost 1000`.
- ii. Type something in the second terminal and hit "enter". What do you observe? Hit "control" and "c" to quit the program on one terminal, and then in the other.
- iii. Now, try the following:
 - α) Listen and send using another port. Try 22, 1194 and 10000000.
 - β) Enter `nc localhost 1000` before entering `nc -l -p 10000` in the other terminal. What do you observe?
 - γ) Terminate (i.e., quit) `nc -l -p 10000` before terminating `nc localhost 1000`. Can you explain what just happened?

Problem 2

Run your virtual machine, created a "03" folder in your "Desktop/HW/" folder, and copy the code located at "Desktop/osc9e-src/ch3/unix_pipe.c" in it. Optionally, you may want to install a nicer IDE using

```
sudo apt-get install geany
```

and typing "osc" as password.

(a) Examine the code `unix_pipe.c`, compile it, and run it. What do you observe?

(b) Now, let us look at the code again:

- i. What does `pipe(fd)` do? What value does it return? Use `man pipe` to answer those questions.

- ii. Change the value of the constant `BUFFER_SIZE` to 6, compile and execute the program. What do you observe? Change it back to 25.
- iii. Switch the values of `READ_END` and `WRITE_END`. Compile and execute the program: what happened?
- iv. Try to modify your program, so that it actually check that the pipe is still open before writing in it or reading from it. You can get inspiration from this question: <https://stackoverflow.com/a/19020926/>.

