

CS5352.751/752, Distributed Computing, Summer I, 2020
Assignment 2

Issued: 07/16/2020

Due: 07/23/2020

1. (5 + 5 + 10 = 20 pts) This problem is pertaining to the NTP protocol.
 - (1) Explain the meaning of offset o_i between two NTP servers.
 - (2) Why the values of t and t' cannot be measured? Why we can obtain the value of $t + t'$ accurately?
 - (3) The propagation delay d_i plays a significant role in the accuracy of NTP protocol. Explain using your own words why.

2. (12 + 13 = 25 pts) The problem is pertaining to the concepts of logical time and clocks.
 - (1) It was stated in class that for the vector timestamps, property P_3 (if $e \neq e'$ then $L(e) \neq L(e')$) may not always be true. Do you agree with this statement? Please explain your conclusion.

 - (2) For the diagram shown in Fig. 1, assume that each process starts with a vector $(0, 0, 0)$. Process p_1 always increases its component by 1, process p_2 always increases its component by 2, and process p_3 always increases its component by 10. Write down the complete vector timestamps for all the events in the diagram.

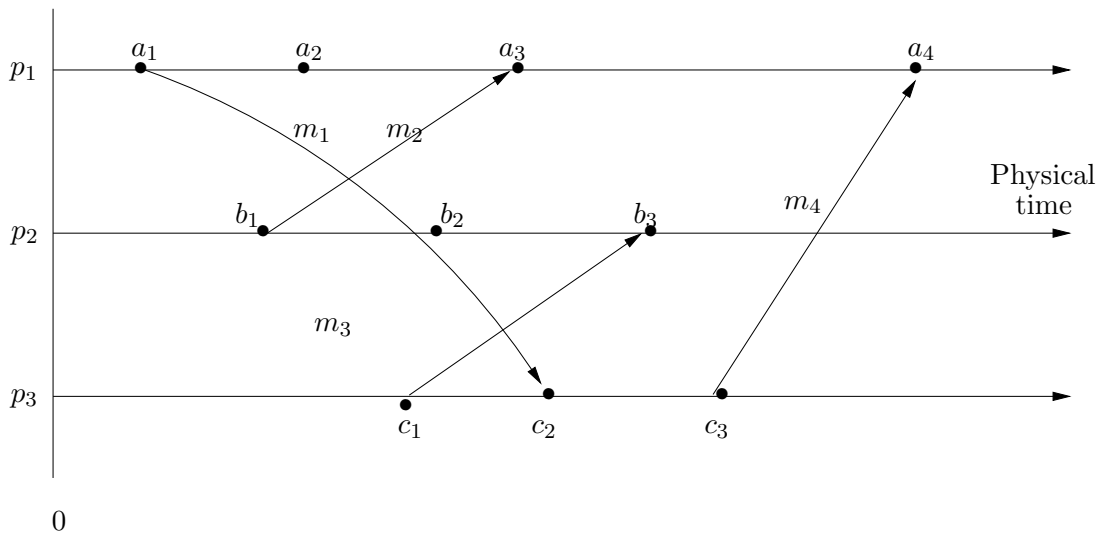


Figure 1: Three processes for Problem 2 and 3

3. (25 + 30 = 55 pts) Modify the Java UDP example given in Chapter 4, p.152-153 as follows.

- (1) The client will iterate in a loop. During each iteration, it will get a character string from standard input and send it to the server. The server will also iterate in a loop. During each iteration it will receive a character string and send it back to the client.
- (2) In this second modification, the client will still send a character string to the server. However, that character string is the name of a command. After receiving that command name, the server will try to execute that command and send output of the command back to the client. If the server cannot execute the command, it will issue an error message back to the client. The client should just print each line of replies, plus the IP number of replying computer on its standard output.

Notes: You should implement and test the programs on the department Linux machines. The client/server should be able to run on the same computer, or on different computers. For this problem, if you are not already familiar with Java programming language, you have to read a Java textbook or read the JDK1.8.0 (or the latest version) manual about basic control (iterations) and file I/O. The manual can be found from <http://www.oracle.com/technetwork/java/index.html>