CS-666 Advanced Distributed System

Homework Assignment #2

Due: 19 March 2018 in Class

- Please type the solutions using a word processor such as WORD, or write by hand very neatly and legibly, comparable to typing*.
- Please pay special attention to the due date – no late turn ins or special case consideration.
- Please do the following problems from the text, and submit solutions:

1. Problem 12.5; 12.10

2. Problem 10.4; 10.5

3. Problem 14.1; 14.2; 14.4, 14.13

4. Problem 15.2; 15.9

Note: The text of HW2 is attached to this document.

10.4 The guarantees offered by conventional servers may be violated by:

i) physical damage to the host;

ii) Errors or inconsistencies by system adminstrators or their managers;

iii)successful attacks on the security of the system software;

iv)hardware or software errors.

Give two examples of possible incidents for each type of violation. Which of them could be described as a breach of trust or a criminal act? Would they be breaches of trust if they occurred on a personal computer that was contributing some resources to a peer-to-peer service? Why is this relevant for peer-to-peer systems?

10.5 Peer-to-peer systems typically depend on *untrusted* and *volatile* computer systems for most of their resources. Trust is a social phenomenon with technical consequences. Volatility (i.e. unpredicatable availability) also is often due to human actions. Elaborate your answers to Exercise 10.4 by discussing the possible ways in which each of them is likely to differ according to the following attributes of the computers used:

i) ownership

ii) geographic location

iii) network connectivity

iv)country or legal jurisdiction

What does this suggest about policies for the placement of data objects in a peer-to-peer storage service?

12.5 To what extent does Sun NFS deviate from one-copy file update semantics? Construct a scenario in which two user-level processes sharing a file would operate correctly in a single UNIX host but would observe inconsistencies when running in different hosts.

12.10 After the timeout of an RPC call to access a file on a hard-mounted file system the NFS client module does not return control to the user-level process that originated the call. Why?

14.1 Why is computer clock synchronization necessary? Describe the design requirements for a system to synchronize the clocks in a distributed system.

14.2 A clock is reading 10:27:54.0 (hr:min:sec) when it is discovered to be 4 seconds fast. Explain why it is undesirable to set it back to the right time at that point and show (numerically) how it should be adjusted so as to be correct after 8 seconds has elapsed.

14.4 A client attempts to synchronize with a time server. It records the round-trip times and timestamps returned by the server in the table below.

Which of these times should it use to set its clock? To what time should it set it? Estimate the accuracy of the setting with respect to the server's clock. If it is known that the time between sending and receiving a message in the system concerned is at least 8 ms, do your answers change?

Round-trip (ms)	*Time (hr:min:sec)*
22	*10:54:23.674*
25	*10:54:25.450*
20	*10:54:28.342*

14.11 Show that $V_j[i] \leq V_i[i]$

14.11 Ans.

Rule VC2 (p. 609) tells us that p_i is the 'source' of increments to $V_i[i]$, which it makes just before it sends each message; and that p_j increments $V_j[i]$ only as it receives messages containing timestamps with larger entries for p_i. The relationship $V_i[i] \leq V_i[i]$ follows immediately.

14.13 Using the result of Exercise 14.11, show that if events e and e' are concurrent then neither $V(e) \leq V(e')$ nor $V(e') \leq V(e)$. Hence show that if $V(e) < V(e')$ then $e \rightarrow e$.

15.2 If all client processes are single-threaded, is mutual exclusion condition ME3, which specifies entry in happened-before order, relevant?

15.9 Suggest how to adapt the Bully algorithm to deal with temporary network partitions (slow communication) and slow processes.