UNIVERSITÄT SIEGEN

Fakultät IV
Betriebssysteme und verteilte Systeme
Prof. Dr. rer. nat. Roland Wismüller

Excercise Sheet 7

(To be processed until 11.12.)

Lecture Distributed Systems Winter Term 2025/26

Exercise 1: Process Migration

Some multicomputers allow the migration of running processes from one node to another. Is it sufficient to stop the process, freeze the memory image, and transfer the whole thing to another node? Specify two non-trivial problems that must be solved for the model to work.

Exercise 2: Policies of Dynamic Load Balancing Systems

a) Describe the four policies (strategies) that are usually components of a dynamic load balancing system. Specify for each strategy:

- an intuitive description of the purpose of this strategy,
- an example of a specific implementation of this strategy.

b) Why are receiver-initiated procedures for dynamic load balancing sometimes undesirable?

Exercise 3: Clock Drift

a) Describe briefly a situation in which the clock drift in a distributed system can lead to problems.

b) Justify why leap seconds are inserted at certain intervals in the corrected UTC. If necessary, inform yourself about this via literature or the Internet.

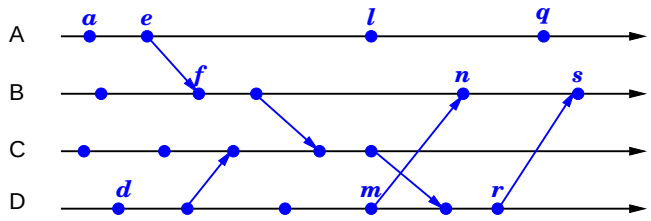
Exercise 4: Clock Synchronisation

How can the clocks in two computers connected via a network be synchronized without using an external time source (e.g. GPS)? What can be said about the achievable accuracy? Which factors limit it?

Why is it impossible to realize perfectly synchronized clocks on two remote computers, even when using GPS?

Compulsory Exercise 5: Lamport and Vector Time
Submit via moodle!

A distributed computer system is given with four computers as well as the following sequence of receive, send and local events:



a) Specify pairs of events for which a causal order (in the sense of Lamport's *happened-before* relation) is not defined, i.e., which are concurrent. Can you make a statement as to whether the event d (actually) causally influenced the event n?

b) Now assume that the system realizes Lamport clocks for each computer. Enter the corresponding Lamport timestamps for each event in the diagram above.

c) What can you infer from the Lamport timestamps of the events e and r?

d) Now enter the vector times for the events a, f, l, m and s.

e) What can you infer from the vector timestamps of the events l and m or from the vector timestamps of the events f and s?

Compulsory Exercise 6: Programming: Chandy/Lamport Algorithm
Submit via moodle!

In this exercise, you will use the distributed systems simulator to implement the Chandy/Lamport algorithm (see Section 6.4 of the lecture slides).

To do this, complete the task „Chandy Lamport algorithm[1]“ in the wiki (accessible only from within the Uni-VPN!).

[1] `https://git.bs.informatik.uni-siegen.de/dsbox/exercises/wiki/4-chandy-lamport`