Distributed and Pervasive Systems. Exercises 05/02/22, 23:24
Session 02: Synchronization
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1 Exercise: Lamport time-stamps

1. Explain (e.g. via pseudo-code, code and/or text+illustrations) how Lamport's algorithm may correct a wrong event ordering.
2. Discuss a practical example of the usefulness of Lamport time-stamps
3. Implement the Lamport time-stamp algorithm in Python (use e.g. the Message Passing Interface) and demonstrate that your implementation can rectify a wrong event ordering across at least two processes (optional: the processes may reside on different nodes in a distributed system)

2 Exercise: Vector clocks

1. Explain (e.g. via pseudo-code, code and/or text+illustrations) how the Vector Clock algorithm may correct a wrong event ordering.
2. Discuss and explain what the notion of "strong clock consistency" adds to Vector Clocks over Lamport Timestamps that only satisfy "clock consistency"
3. Discuss a practical example of the usefulness of Vector Clocks
4. Implement the Vector clock algorithm in Python (use e.g. the Message Passing Interface) and demonstrate that your implementation can rectify a wrong event ordering across at least two processes (optional: the processes may reside on different nodes in a distributed system)

3 Exercise: Precision Time Protocol

1. Discuss whether the Precision Time Protocol (PTP) is deterministic
2. Discuss what a packet-switched network is
3. Discuss to what extent the PTP is tailored for packet-switched networks only
4. Discuss whether the PTP works on Ethernet only
5. Discuss how the PTP can support real-time operations on Ethernet
6. Discuss the offset correction and delay correction in the PTP
7. Discuss whether it is fair to assume a symmetric line delay in the delay correction
8. Discuss how the PTP can play a role in the White Rabbit Project
9. Discuss how the PTP can play a role in 5G (5th generation mobile networks)