Session 2: Exercises

M2 MOSIG: Large-Scale Data Management and Distributed Systems

Thomas Ropars

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1 Lamport clocks

Show through an example that Lamport Clocks cannot be used to decide whether a cut is consistent.

2 Vector Clocks

a) Consider an execution in which the events are time stamped using vector clocks. Define a function $\mathcal{F}$ which takes the vector clock of an event e and convert it to a scalar value SC, so that $e \rightarrow e' \Rightarrow SC(e) < SC(e')$. Prove that your function $\mathcal{F}$ ensures the targeted property.

b) Let C be a consistent cut defined by the tuple $(c_1, c_2, .., c_n)$. Let $VC(e_i^{c_i})$ be the vector clock of event $e_i^{c_i}$. What condition, expressed in terms of $VC(e_i^{c_i})$, ensures that C is consistent?

3 Back to Chandy-Lamport algorithm

Recall that the Chandy-Lamport snapshot algorithm requires FIFO-channels to work. Modify the algorithm to also work without that assumption. **NB** Consider only a single instance of the algorithm.

1. Propose an algorithm that only computes a consistent global state (it does not save the state of the channels).
   Note : Do not implement FIFO order of messages.
   Hint: Use piggybacking (piggyback the adquate information on application messages).
2. Extend your algorithm to also record the state of the channels.