CSCI 251: Concepts of Parallel and Distributed Systems

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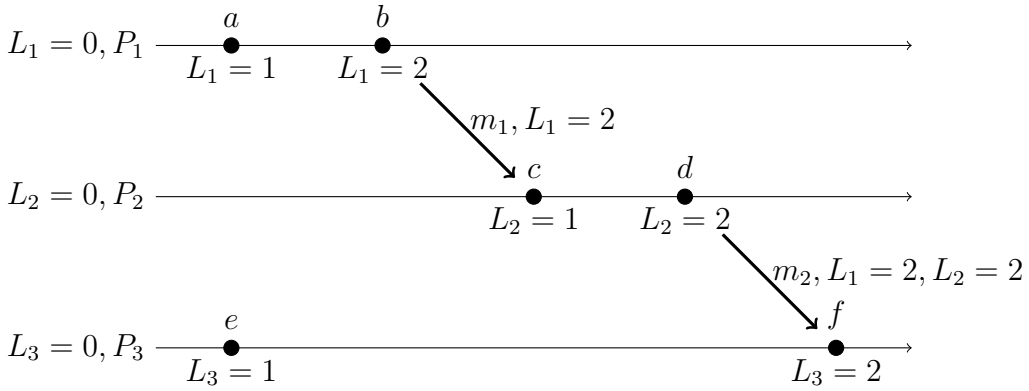
Clocks in Distributed Systems

Topics:

- Clocks - Physical, Logical, Vector
- Events
- Processes

Clocks

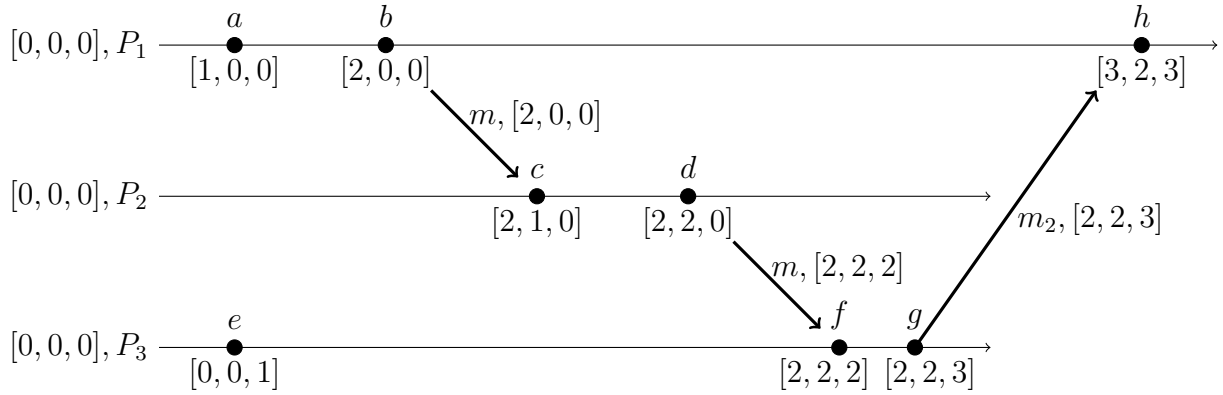
Skew: the difference between two clocks.
Drift: the change in the frequency of the oscillation of a clock.
UTC: Coordinated Universal Time
Logical clocks: for any process $p_i : e \rightarrow_i e'$ implies event e happens before e' on process i. For any message $m_1 : send(m) \rightarrow receive(m)$. When a process p_i sends a message 'm' to another process, it piggybacks on 'm' the value $t = L_i$. If $e \rightarrow e'$ and $e' \rightarrow e''$, then $e \rightarrow e''$.



Vector Clocks

$$V = [V_1, V_2, V_3]$$

$V_i = [j]$ represents the vector clock on process i with the entry for process j. Each clock maintains what it knows of the state of other clocks.



Initially, $V_i[j] = 0$ for $i, j = 1, 2, \ldots N$. Just before P_i timestamps an event it increments $V_i[i]$. P_i includes the value $t = V_i$ in every message it sends. When P_i receives a timestamp t in a message it sets $V_i[j] = max(V_i[j], t[j])$ for $j = 1, 2, \ldots N$.

Reminders

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