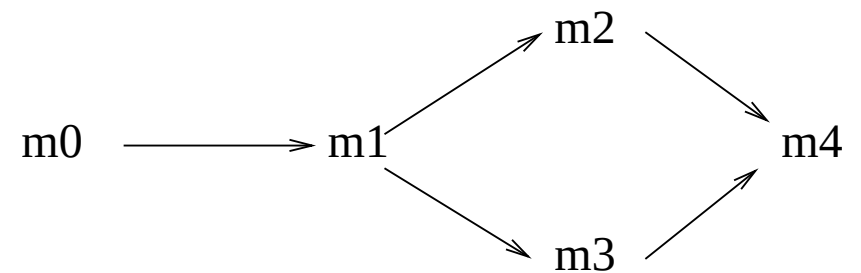
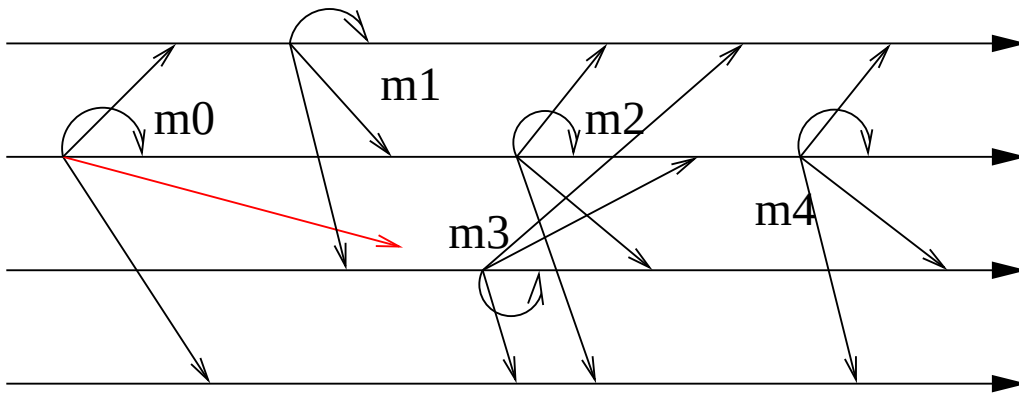

Quasi-Causal Communication

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Causality

- Causal communication means to see the causes before the effects



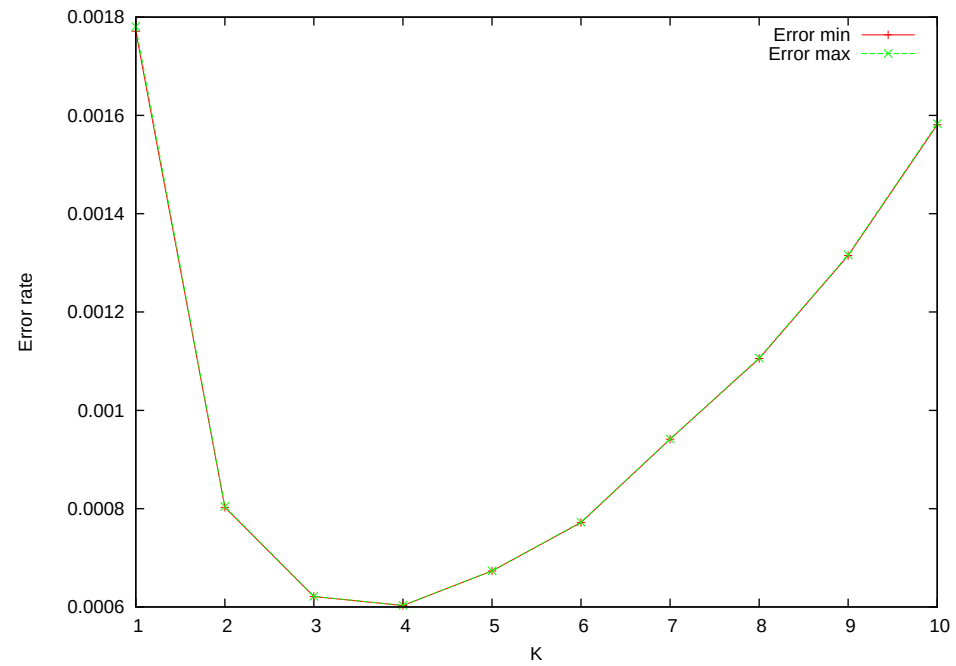
Causality

- Causality is mandatory for some applications (e.g. collaborative work)
 - ★ **It is very costly**: A vector with one entry per process
 - ★ Need to piggyback an information of size $O(n)$ for n processes
 - ★ Proved to be necessary in the worst case
- **Plausible clocks**
 - ★ several processes can share the same entry
 - ★ **Collision** as soon as two processes sharing a same entry communicate "simultaneously"

Quasi-Causality

- Another approach would be to use a logical structure: ring, tree, central coordinator (star structure), etc.
- Proposed approach
 - ★ (Intuitively) could be seen as a use of several coordinators
 - ★ Fix the size of the vector to r ($r \ll n$)
 - ★ Each process chooses k entries ($3 < k < r/2$)
 - ★ k should not be too small/big $\Rightarrow$ there is a trade-off

Varying k



Algorithm

Broadcast of a message m by a process i

m : message to broadcast

$\forall x \in f(i), V_i[x] = V_i[x] + 1$

$m.V = V_i$

Broadcast(m)

Upon reception of message m by process i

m : message received by process i from process j

waitUntil $((\forall x \in f(j), V_i[x] \geq m.V[x] - 1) \wedge \forall k \notin f(i) \cup f(j), V_i[k] \geq m.V[k])$

$\forall x \in f(j), V_i[x] = V_i[x] + 1$ if $V_i[x] = m.V[x] - 1$

deliver(m)

Quasi-Causality

- Pros:

- ★ No need to know **how many processes** are in the system.
- ★ No need to know a priori **who are the process**
- ★ No need of **join and leave** procedures
- ★ No need for a process to know a priori **which k entries** each process chooses
- ★ No need for processes to have the **same value k**
- ★ ... this value may be **changed on the fly**

- Cons

- ★ In some situations deliveries **do not respect causal ordering**

Perspectives

- **Tuning tool**: Need of a **metric (preferably local)** that allows to measure the quality of the causality coding (preferably on the fly).
- **If things go wrong ...**: Need of a **recovery procedure** (e.g. state transfert, undo, anti-entropy).
- **Improvement**: Study the possibility of making a relation between the k chosen entries and the **valuated communication graph**.