

Election algorithms

Principle

An algorithm requires that some process acts as a coordinator. The question is how to select this special process **dynamically**.

Note

In many systems the coordinator is chosen by hand (e.g. file servers). This leads to centralized solutions \Rightarrow single point of failure.

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Teasers

- 1 If a coordinator is chosen dynamically, to what extent can we speak about a centralized or distributed solution?
- 2 Is a fully distributed solution, i.e. one without a coordinator, always more robust than any centralized/coordinated solution?

Basic assumptions

- All processes have unique id's
- All processes know id's of all processes in the system (but not if they are up or down)
- Election means identifying the process with the highest id that is up

Election by bullying

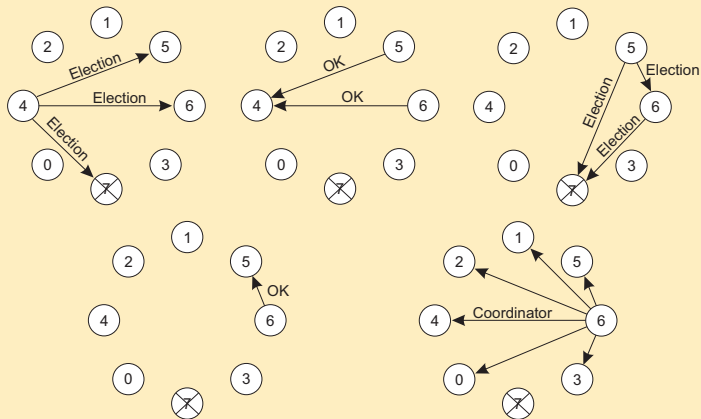
Principle

Consider N processes $\{P_0, \dots, P_{N-1}\}$ and let $id(P_k) = k$. When a process P_k notices that the coordinator is no longer responding to requests, it initiates an election:

- 1 P_k sends an *ELECTION* message to all processes with higher identifiers: $P_{k+1}, P_{k+2}, \dots, P_{N-1}$.
- 2 If no one responds, P_k wins the election and becomes coordinator.
- 3 If one of the higher-ups answers, it takes over and P_k 's job is done.

Election by bullying

The bully election algorithm



Election in a ring

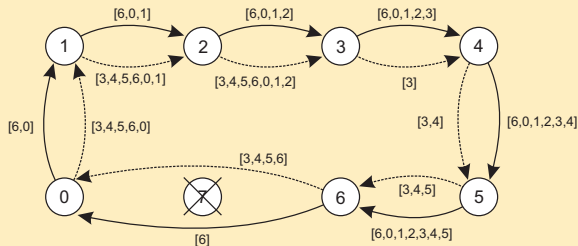
Principle

Process priority is obtained by organizing processes into a (logical) ring. Process with the highest priority should be elected as coordinator.

- Any process can start an election by sending an election message to its successor. If a successor is down, the message is passed on to the next successor.
- If a message is passed on, the sender adds itself to the list. When it gets back to the initiator, everyone had a chance to make its presence known.
- The initiator sends a coordinator message around the ring containing a list of all living processes. The one with the highest priority is elected as coordinator.

Election in a ring

Election algorithm using a ring



- The solid line shows the election messages initiated by P_6
- The dashed one the messages by P_3

A solution for wireless networks

A sample network

