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A Highly Efficient Broadcast Algorithm for Computer Networks

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Abstract : A wave is a distributed execution, often made up of a broadcast phase followed by a feedback phase, requiring the participation of all the system processes before a particular event called decision is taken. Wave algorithms with one initiator such as the 1-wave algorithm have been shown to be very efficient for broadcasting messages in tree networks. Extensions of this algorithm broadcasting a sequence of waves using a single initiator have been implemented in algorithms such as the m-wave algorithm. However as the network size increases, having a single initiator adversely affects the message delivery times to nodes further away from the initiator. As a remedy, broadcast waves can be allowed to be initiated by multiple initiator nodes distributed across the network to reduce the completion time of broadcasts. These waves initiated by one or more initiator processes form a collection of waves covering the entire network. Solutions to global-snapshots, distributed broadcast and various synchronization problems can be solved efficiently using waves with multiple concurrent initiators. In this paper, we propose the first stabilizing multi-wave sequence algorithm implementing waves started by multiple initiator processes such that every process in the network receives at least one sequence of broadcasts. Due to being stabilizing, the proposed algorithm can withstand transient faults and do not require initialization. We view a fault as a transient fault if it perturbs the configuration of the system but not its program.

Keywords : distributed computing, multi-node broadcast, propagation of information with feedback and cleaning (PFC), stabilization, wave algorithms
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