A Flexible Group Membership Protocol for Time-Triggered Networks

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Abstract

This paper presents a processor group membership protocol for fault-tolerant distributed real-time systems that utilize periodic, time-triggered scheduling for sending messages over the system's communication network. The protocol allows fault-free nodes to reach agreement on the operational state of all nodes in the presence of *fail-silent* or *fail-reporting* node failures as well as network failures (lost or corrupted messages). The protocol is based on the principle that each message sent by a node in the membership is acknowledged by *k* other nodes in a system of *n* nodes, where *k* can be set to any number between *2* and *n-1*. Agreement on node failure (membership departure) and agreement on node recovery (membership reintegration) are handled by two different mechanisms. Agreement on departure is guaranteed if no more than *f=k-1* failures occur in the same communication round, while at most one node can be reintegrated into the membership per communication round.

Keywords: Membership agreement, fault tolerance, synchronous distributed systems, protocols.