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Licensing Opportunity

TTO – Technology Transfer Office

Quarts: Quick Agreement for Real-Time Control Systems

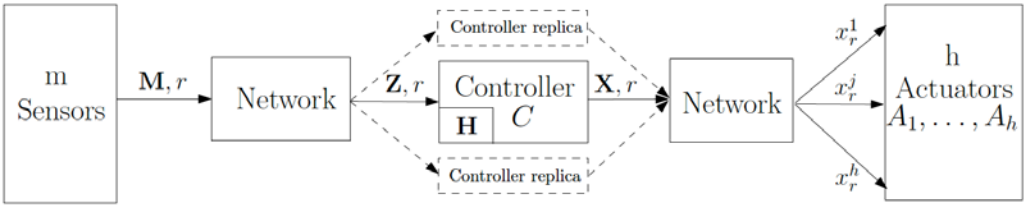

Figure 1: architecture of a real-time control system for which Quarts can guarantee consistency and bounded latency

Ref. Nr

6.1748

Keywords

Real-time systems, consistency, latency, faulty networks

Intellectual Property

WO2018184699, PCT patent application with priority date 2017-04-07

Publications

"Quarts: Quick Agreement for Real-Time Control Systems" in 22nd IEEE International Conference on Emerging Technologies And Factory Automation (ETFA), Limassol, Cyprus, September 12-15, 2017

Description

Real-time control systems (RTCSs) play an increasing role in today's world, from controlling electric grids, to robots in automated assembly lines, to driving autonomous cars, and powering communication networks. RTCSs tolerate delay and crash faults in the controller by replicating it. Each replica of the controller computes and issues setpoints to actuators over a network that might drop or delay messages. Thus, the actuators might receive an inconsistent set of setpoints from multiple controllers. Such inconsistency is avoided either by having a single primary replica compute and issue setpoints (in passive replication) or by a consensus algorithm that selects one sending replica (in active replication). However, due to the impossibility of a perfect failure-detector, passive replication schemes can have multiple primaries, causing inconsistency, especially in the presence of intermittent delay faults. Moreover, the impossibility of bounded-latency consensus causes both schemes to have poor real-time performance.

The Quarts technology covered by this patent application is based on plurality voting on the measurements. It relates to a system for generating setpoints for actuators, and an agreement protocol or a method for generating those setpoints.

Advantages

The two main advantages of the Quarts technology for RTCSs are consistency and low bounded latency. Consistency is guaranteed in the presence of any number of delay- or crash-faulty replicas. Latency of an RTCS depends on propagation delay due to the network between the sensors and the controller, and the network between the controllers. Quarts guarantees a low and bounded latency when the RTCS issues a setpoint, thereby improving the end-to-end latency performance.

Applications

- Real-time control systems
- Manufacturing
- Smart electric grids
- Autonomous cars
- Software defined networks (SDN)