Choreographing Cyber-Physical Distributed Control Systems for the Energy Sector

Energy Systems are facing a significant change in the way their management and control is conceived. With the introduction of distributed and renewable energy based resources, a shift to a more distributed operation paradigm is emerging, overturning the conventional top-down design and operation principles. This shift creates a demand for distributed control systems (DCS) to facilitate a more adaptive and efficient operation of power networks. One key challenge here is to ensure the required reliability of distributed control systems. Whereas proven strategies exist for reliable control for coordination of physical actions, with increasing distribution of such control, the reliability and degradation properties in response to communications issues become more important. We build on the notion of Quality Choreographies, a formal model for the development of failure-aware distributed systems, and discuss how quality choreographies respond to the needs presented by DCS. We demonstrate their applicability by modelling the Bully Algorithm, one of the de-facto election algorithms used in coordination of DCS.

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