

The need to study cyber-physical power systems (CPPS) such as shipboard power systems (SPS) using system-level controls has increased over the years. Controls are vital to SPS operation and depend on the communication system to exchange information. Communication protocols at the application layer enable communication between system-level controls and SPS and may offer features that change the behavior of the network. As the dependence of the SPS on protocols expands, further research must be conducted to understand the impact protocols may have on the communication network. Recent developments include the implementation of a co-simulation platform using a real-time simulator (RTS) for SPS simulation, a communication network emulator, and a central controller to test communication network performance. While the co-simulation platform provides a method to analyze the communication network, this is limited to the impact of the network infrastructure on the SPS network performance.

This work proposes a method to evaluate application layer communication protocols in the communication system of system-level SPS controls using RTS. The evaluation framework compared two protocols, Modbus TCP and Data Distribution Service (DDS), using network utilization and scalability as metrics to characterize the impact on network performance. The evaluation is applied to the energy management of a notional SPS using the energy management control (EMC) as the system-level control to demonstrate that an evaluation can be performed.