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SATELLITE CLOCK SYNCHRONIZATION PROTOCOL FOR SCHEDULER-RELATED DELAYS

Abstract

The College of Engineering, Pune (COEP) Satellite Initiative is a team of undergraduate students that launched Swayam in 2016 and is currently working on their second mission, COEPSAT-2. The satellite and ground station consist of a system of controllers running on crystal oscillators of different frequencies. The absolute value of the deviation is constantly increasing, thus necessitating a time synchronization mechanism to keep the clocks synchronized throughout the mission. Time synchronization is crucial in satellites for accurate navigation, communication, data gathering, and network coordination. Even minor timing errors can have significant consequences, making precise time synchronization essential for satellites' reliable and efficient operation. Challenges for time synchronization can be attributed to the propagation delay of messages between the ground station present on the earth and the satellite, which can be corrected using several algorithms. Still, none of the algorithms consider the delay issues in time synchronization resulting due to the responses' life cycle in the controller to perform time synchronization on it. Stages of scheduling a response at the controller to perform synchronization, which mainly include error checking, depacketization, decoding, and scheduling of the response, create significant delays during synchronization that are more prominent with systems requiring more than millisecond-level precision and need to be prevented. An algorithmic way to solve the problem of additional delay caused by the onboard scheduler is presented in the paper.