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JOINT RELATIVE LOCALIZATION AND CLOCK SYNCHRONIZATION FOR A SATELLITE ARRAY

Abstract

Our motivation in particular is OLFAR (Orbiting Low Frequency Antennas for Radio astronomy), which is a Dutch funded program which aims to design and develop a detailed system concept for an interferometric array (> 10) of identical, scalable and autonomous nano satellites in space to be used as a scientific instrument for ultra low frequency observations (0.3KHz - 30MHz). The OLFAR cluster could either orbit the moon, whilst sampling during the Earth-radio eclipse phase, or orbit the Earth-moon L2 point, sampling almost continuously or Earth-trailing and leading orbit. Due to its distant deployment location (far from the earth orbiting global positioning systems) and the large number of satellites, autonomous network synchronization and localization is one of the key issues in OLFAR

Accurate time synchronization is a key component of many wireless networks. To perform synchronization nodes time-stamp the departure and/or arrival time of the message. Different delays exist between the actual message departure/arrival and the time-stamping moment. Also propagation delay of the message becomes significant with the increase of distances and clocks resolutions. In order to perform accurate time synchronization these delays must be estimated. In this paper the network capable of short range wireless communication is presented. The different time stamp exchange models are implemented in order to synchronize the networks clocks. To estimate the phase offsets, frequency offsets and communication latencies the closed form least square solution estimator is used. We show that only sender-receiver exchange model can be used to estimate communication latencies in the network. Pairwise estimation of the synchronization parameters results in less accurate synchronization compared to full-mesh synchronization.