THE EMULATOR OF UNDERWATER ACOUSTIC COMMUNICATIONS AND POSITIONING SYSTEM FOR DEVELOPMENT AND VERIFICATION OF USER-SPECIFIC APPLICATIONS

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ABSTRACT

Production and operation of many underwater acoustic systems and devices demand spending much time and resources. Therefore specialists develop and introduce specific (user) upper layer protocols by means of advanced simulation software. Thus both function emulation of a given underwater acoustic device and simulation of main effects of acoustic signal propagation medium are organized. The objective of this study that is essential is to describe the functionality of a real-time emulator of an integrated device of digital underwater acoustic communications and ultra-short baseline positioning system EaNEF (EvoLogics Network Emulation Framework). We concentrate on an underwater acoustic modem emulator. The emulator enables all features of the data-link protocol layer, and includes a simplified simulator of the physical layer that allows to take into account the main aspects of signal propagation underwater - namely, it simulates propagation delays with user-defined topology of the data transmitter/receiver, simulates multipath propagation, and allows to set the intensity of data packet collisions during data reception, synchronization errors during data reception, to define bit- and packet-error rates, as well as to take into account the trajectory and Doppler shifts as the transmitter/receiver moves. Thus the emulator can replace modem hardware during development of user-specific scenarios, as well as at development and testing stages of upper-layer protocols and applications design. Moreover, the emulator provides full support of the device's cross-layer synchronization mechanisms, and allows to design user-specific positioning protocols, as well as hybrid protocols for positioning and communication, controlled by upper layer protocols.

Key words: underwater acoustic communications, underwater acoustic positioning, underwater acoustic modem, underwater acoustic modem emulator.

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