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Improving the Performance of Hybrid Multiple Access Scheme in Millimeter Wave Wireless Personal Area Networks

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Abstract

IEEE 802.15.3c standard for millimeter wave (mmWave) wireless PAN (WPAN) specifies a hybrid medium access control (MAC) protocol consisting of contention based and contention free channel access schemes, with corresponding durations termed as contention access period (CAP) and channel time allocation period (CTAP). While CTAP is used for the transmission of isochronous data streams, CAP is used for the transmission of control messages such as channel time allocation (CTA) requests. In this paper, we propose an improvement for the hybrid MAC protocol specified by 802.15.3c, considering transmission of asynchronous data streams over the uplink from the devices (DEVs) to the pico net coordinator (PNC). The proposed scheme advocates transmission of asynchronous data frames during CAP as well as CTAP. The CTA requests which are normally transmitted during CAP would be piggybacked on the data frames. Using the theory of discrete time Markov chain (DTMC), we present an analytical model to evaluate the network throughput and average frame delay under the proposed scheme. The results establish that the proposed scheme improves the network throughput while reducing the average delay considerably. The analytical results are corroborated by extensive simulation studies.

Keywords: Hybrid multiple access scheme; Millimeter wave(mmWave)

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