An Energy-Efficient Cross-Layer Approach for Cloud Wireless Green Communications

Ali Safa Sadiq[*], Turfah Zeyad Almohammad[*], Rabiatul Adawiah Bt Muhamed Khadri[*], Abdulghani Ali Ahmed[*], and Jaime Lloret[+]
[*]Faculty of Computer Systems & Software Engineering, Universiti Malaysia Pahang Kuantan, Lebuhraya Tun azak 26300 Gambang, Pahang, Malaysia
[+]Universidad Politecnica de Valencia, 46022 Valencia, Spain
e-mail : alisafasadiq at ump.edu.my /alisafa09 at gmail.com

Abstract— **In wireless sensor networks (WSN), energy consumption is one of the crucial issues. It is very important to conserve energy at each sensor node to prolong a network lifetime. The main challenge in WSN is to develop an energy efficient algorithm to minimize energy consumption during transmitting information from deployed sensors up to the cloud resources. Many researches have been studied the designing of energy efficient technique based on one-layer stack model approach. In this study, we propose Energy-Efficient Cross-Layer (EECL) approach by using the interaction of MAC layer and physical layer information to be exploited by a network layer to achieve energy efficient communication. More precisely, network layer could utilize the MAC layer and physical layer information to establish an energy efficient route path to be used in forwarding data. The proposed EECL approach uses X-MAC protocol in support of duty cycle which introduces short preambles that switches to wake-up/sensing mode only for nodes belonging to routing path while the other nodes set to be in sleep mode. The distance between nodes that influences energy consumption and Bit Error Rate (BER) are set to be the parameters which they are help in indicating the required power for each hop during route path selection in WSN and avoid the rely-hops that suffering from high average BER and with farther distance. We conduct the experiment using Matlab to evaluate the effectiveness of our proposed approach in terms of power consumption and obtained data rate. The results show that our proposed EECL approach outperforms its representatives in the ability of tuning the power utilized in respect with required data rate that could satisfy the desired Quality-of-Service (QoS).**

Keywords— Cross-layer approach; Energy efficiency; X-MAC protocol; Network layer