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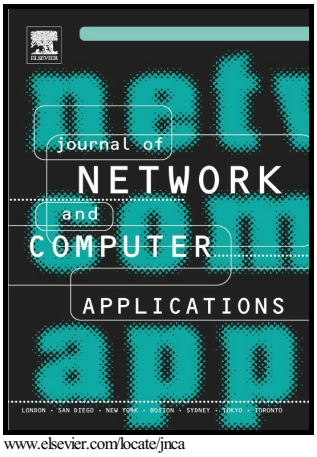

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An Efficient Power Saving Polling Scheme in the Internet of Energy

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ABSTRACT

A global WLAN standard which utilizes country specific carrier frequencies below 1GHz has been drafted by the IEEE 802.11ah (.ah) Task Group. This draft is highly useful in rural areas due to an improved wireless propagation characteristic and a large coverage. However, the .ah draft still adopts the CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) as its media access and collision resolution protocol, which is energy-consuming and not suitable for networks where STAs (STAtions) are generally battery supplied such as meters in a SG (Smart-Grid) network, one of the typical usecases of Internet of Energy in the .ah draft. In addition, since .ah could support up to at most 6000 STAs to be scheduled within one BSS, the introduced overheads and corresponding processing delay are non-trivial and need more considerations. In this paper, a power saving scheduling scheme is proposed which could greatly reduce the introduced overhead while successfully scheduling the uplink/downlink traffics of meters in the Internet of Energy. Considering the service model and special characters of .ah networks, our model could also extend the STAs battery life with best efforts thus making our protocol specifically suitable for SG networks where battery changing for a device is usually very difficult. Further, to make our model work well, a dynamic AID allocation scheme is also presented by which the AIDs of STAs are assigned according to the average service duration thus making those scheduled STAs with similar service characteristics occupy successive AIDs. In this way, the compressed Bitmap scheme proposed in our Power Saving polling scheme for SG in the Internet of Energy (PSSG), could greatly reduce the communication overheads. Numerical results show that our scheme is better than the Power Saving Mechanism (PSM) and Power Save Multi-Poll (PSMP) protocols in terms of overheads, throughput, average awaken time and energy consumptions.

Keywords:

Internet of Energy; Next Generation WLAN; Smart Grid; Power Saving; Polling Scheme

1. INTRODUCTION

SGs(Smart-Grids) are expected to spread the intelligence of the energy distribution and control system from some central core to many peripheral nodes, thus monitoring energy losses more accurate and controlling or adapting the system more precise[1]. The concept and targets of such intelligent nodes are similar to those of Internet of Things (IoT), where IoT means extending the web paradigm to the connecting, monitoring, and controlling of the objects of everyday life[2, 3]. It is worth noting that utility companies are going to equip their power line network infrastructure with additional IoT devices, such as sensors and meters [4-8]. The goal of the usage of these IoT devices is to make the entire utility grid greener by informing corporations and private end-users of their power usage[9], e.g., to reduce peak load which otherwise would lead to unstable operational network frequencies in the entire power line network[10, 11] .

One of the latest wireless communication technologies that has been proposed for SG applications is the Low Power Wi-Fi, i.e., the IEEE 802.11ah (.ah) standard [12]. The .ah standard group has put forward .ah to support Low Power Wi-Fi with intelligent IoT