Advanced Science and Technology Letters
Vol.28 (CIA 2013), pp.116-120
http://dx.doi.org/10.14257/astl.2013.28.22

# A Contention Based Medium Access Scheme for Energy Saving in WiMiedia Networks

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**Abstract.** As UWB devices are used widely, data traffic by UWB devices increases dramatically. However, when transmitting device and receiving device are communicate with each other, the remaining WiMedia devices maintains active mode for the time to complete the transmission MSDU, and there is a problem that unnecessary power consumption occurs. Therefore we propose new energy saving scheme to reduce unnecessary power consumption of WiMedia devices.

**Keywords:** UWB, WiMedia, Energy Saving, HR-WPAN, Home Network

## 1 Introduction

Recently, due to the integration of applications such as Wireless USB, Wireless Display, and Wireless Video / HDTV streaming, data transfer rates up to hundreds of Mbps is required. To meet these requirements, various wireless communication standards to support high data rate have been proposed and one of them is WiMedia standard [1-5].

WiMedia devices include the sync information in beacon frame and broadcast beacon frame to neighbor devices. In addition, WiMedia devices transmit data frames using reserved time slots.

Figure 1 shows the active period and idle period of transmitting device C and receiving device B. In figure 3, device A reserves MAS (Medium Access Slot) 0 and MAS 1 to transmit data frames to device B.

To transmit data frames to WiMedia device B, WiMedia device C maintains active state in reserved time slots, MAS 0 and MAS 1. Also, to receive data frames from device C, WiMedia device B maintains active state in reserved time slots, MAS 0 and MAS 1. However, WiMedia device C may be able to transfer all necessary data frames in MAS 0 and MAS 1. In addition, the situation that WiMedia device C does not transmit necessary data frames can occur by the deterioration of wireless channel between device C and device B or other conditions. Thus, WiMedia device C can maintain active state in MAS 2 and MAS 3 to check the availability of the adjacent time slot. If MAS 2 and MAS 3 do not use by other devices, device C can transmit

ISSN: 2287-1233 ASTL

data frames in MAS 2 and MAS 3. However, to save energy, device B maintains active state in MAS 0 and MAS 1 and switches idle state in MAS 2 and MAS 3. Therefore, if device C maintains active state in MAS 2 and MAS 3 regardless of the status of device B, it wastes the power. Also, when other devices use MAS 2 and MAS 3, device c wastes radio resource.


**Fig. 1.** The example of power dissipation in WiMedia protocol

Therefore, to solve this problem, we propose the contention based medium access scheme to save the energy in WiMedia networks.

## 2 Proposed Scheme

When WiMedia device detects data traffic received from other WiMedia device, it maintains active state in the proposed energy saving scheme. The detection of data traffic transmitted from other WiMedia device can be determined by the information of the received beacon frame. At this time, the information which WiMedia device receives and refers is TIM IE (Traffic Indication Map Information Element).

The TIM IE is used to indicate that an active mode device has data buffered for transmission. The TIM IE is illustrated in figure 2.

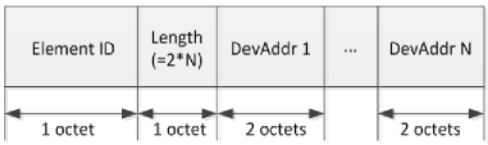


**Fig. 2.** The format of TIM IE

Each DevAddr field is set to a valid target device address for which PCA traffic is buffered.

When WiMedia device does not detect data traffic transmitted from other devices, it maintains idle state. In other words, when the received beacon frame does not include the TIM IE or DevAddr field in TIM IE does not include device's address, WiMedia device operates on idle state.

On the other hand, when WiMedia device has data traffic to transmit to other devices, it maintains active state in PCA slot. In this way, the proposed scheme does

 

not always maintain active state. If there is any other WiMedia device that transmits data frames, WiMedia device maintains active state in PCA slots. Otherwise it maintains idle state in PCA slot. Therefore, the proposed scheme can save the device's power.

## 3 Performance Evaluation

In this section, we analyze and evaluate the performance of the proposed energy saving scheme. The simulations are run for 1000 seconds.

Figure 3 shows the dissipated power consumption of WiMedia devices. The dissipated power consumption of the proposed scheme is less than that of device that uses the legacy WiMedia protocol as seen in this figure. Because the proposed scheme switches the power mode to low power mode as soon as a WiMedia device does not detects the TIM IE included in beacon frame, it is possible to save the energy of device for the transmission of MSDU. Thus, the perfomance of the proposed scheme is more superior to that of the legacy WiMedia standard.

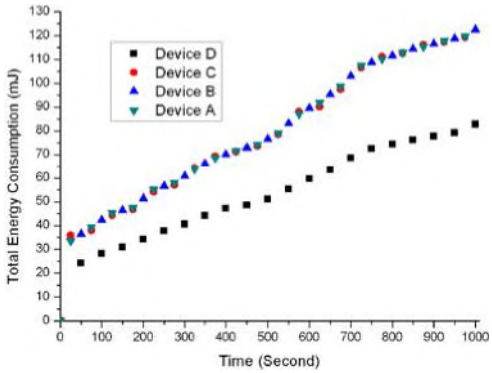


**Fig. 3.** Energy consumption of device according to the operating time of WiMedia device

Figure 4 illustrates communication energy consumption of the whole network. It can be seen that the energy saving increases as the number of WiMedia device increases. This is because devices that do not exchange data frames maintain idle state and prevent unnecessary energy waste. In summary, the device-level energy-saving scheme is more energy efficient than the traditional one, and as the number of WiMedia devices increases, this effect will be more obvious.

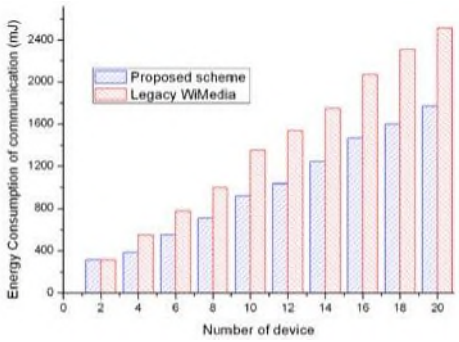


**Fig. 4.** Communication energy consumption of the WiMedia network with different scales

## 4 Conclusion

In this paper, we propose noble energy saving scheme to reduce unnecessary power consumption of WiMedia devices. Because devices that do not exchange data frames maintain idle state, the proposed scheme can prevent unnecessary energy waste. Also, using the proposed scheme, the efficiency of energy saving increases as the number of WiMedia device increases. The simulation results show the performance of proposed scheme is more superior to that of the legacy WiMedia protocol. Also, the simulation results show that proposed scheme can use device's power efficiently.

**Acknowledgments.** "This research was supported by the MKE (The Ministry of Knowledge Economy), Korea, under the ITRC (Information Technology Research Center) support program supervised by the NIPA (National IT Industry Promotion Agency)"(NIPA-2012-H0301-12-2005), This work was supported by Priority Research Centers Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (2009-0093828).

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