Efficient Power Management Scheme Considering Inter-user QoS in Wireless LAN

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Abstract

We propose the efficient power management scheme to support inter-user QoS and reduce the power consumption in wireless LAN. In the proposed scheme, the node with high priority transmits PS_ POLL earlier than that with low priority, so the node with high priority receives the buffered packet faster than that with low priority, and reduces the power consumption by converting the mode from Active Mode(AM) to Power Saving (PS) for remaining beacon interval (BI). Through the analysis and simulation, we show that the proposed scheme reduces power consumption and guarantees inter-user QoS compared to conventional scheme.

I. INTRODUCTION

For the advent of IEEE 802.11b WLAN standard, we have been experienced many wireless devices which have the feature of mobility. Owing to the characteristic of mobility, the device operates without any line such as power cable, that means the device operates depending on the limited battery. Therefore, the power saving is the important factor in wireless LAN [1]. To diminish the power consumption of node, many researches have been carried in WLAN. Ning Li *et al.* proposed the scheme which the nodes allow their Network Interface Card (NIC) to sleep mode if the data packet length included in the RTS or CTS is larger than certain threshold length [2]. In [3], they proposed a scheme that adjusts the ATIM window size to optimize the power saving scheme.

In IEEE 802.11b wireless LAN [4], in order to reduce the power consumption, the nodes can change from Active mode (AM) to the Power Saving (PS) mode by setting the power management (PM) bit to 1 in the MAC header if they don't have any packet to transmit or receive for a certain period. Then, the PS nodes wake periodically to check the Traffic Indication Map (TIM) field in the beacon frame since the TIM field contains extant information about receiving packet that is buffered by AP. If the TIM field is set in beacon frame, they must transmit PS_POLL to the AP for receiving the buffered packet. When the node transmits the PS_POLL to the AP, the node sends the PS_POLL to AP after a random delay so that they should avert the collision from other nodes which transmit the PS_POLL. If the collision will happen, the node has backoff procedure again. On the contrary, if the any node succeeds in transmitting the PS_POLL to the AP, the AP will transmit the buffered packet to the node which transmitted the PS_POLL. After finishing packet reception, the node can save the power consumption by changing mode from AM to PS during remaining Beacon Interval (BI). If a certain PS node is receiving the buffered packet now, any other PS nodes which can't transmit PS_POLL must wait until the node that transmits the PS_POLL early finishes receiving the buffered packet. On the other hand, if the TIM field is not set, the nodes change the mode from AM to PS and keep PS mode until another beacon frame is received.

However, when the PS nodes transmit the PS_POLL, any transmission order doesn't exist. In other word, without any decided sequence, all PS nodes try to transmit the PS_POLL competitively since all the nodes share the radio resource, and there is not any policy that supports the Quality of Service (QoS) in IEEE 802.11b WLAN. For this reason, when any one tries to transmit the PS_POLL, the node must perform a random-backoff procedure to avoid the collision among other nodes.

Therefore, we propose a new power management scheme to support inter-user QoS and reduce the power consumption in current 802.11b WLAN. Here, inter-user QoS means that users' service policy is prioritized in accordance to the initial service contract level [5]. When the nodes register on the network, AP retrieves user profile information from AAA (Authentication, Authorization and Accounting) server and decides the suitable priority such as Gold, Silver, and Bronze. Then, in the proposed scheme, the node with high priority(Gold) transmits PS_ POLL earlier than that with low priority(Bronze). Consequently, the node with high priority receives the buffered packet faster than that with low priority, and reduces the power consumption by converting the mode from AM to PS for remaining beacon interval(BI). In