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Optimized Energy Conservation in WLAN Using Dynamic Sleep Scheduling

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Abstract: WLAN (Wireless Local Area Network) is used to connect more than one devices using some wireless distribution method and usually providing a connection through an access point to the wider Internet. Wireless LAN becomes popular at home as good as commercial complexes because of its easy installation and it gives the power to move about within a coverage region and still be linked to the network. In WLAN most of the hosts are using battery as their energy resource so energy efficiency is an important consideration for the long lifetime of the devices. The mechanisms such as IEEE 802.11 Power Save Mode (PSM), Unscheduled Automatic Power Save Delivery (U-APSD), WMM Power Save (WMM-PS), Dynamic MIMO Power Save and Wake-on-Wireless and Green Call Algorithm are based on the sleep scheduling principle. But the problem is extra delay is added in the absence of proper sleep scheduling, that will affect the delay-constrained applications. The existing system uses an energy-efficient sleep-scheduling protocol and maximizing the sleep period of each node, but the existing mechanism is less energy efficient and reduces the throughput. So, in the proposed system an innovative technique is introduced called Optimized energy conservation for improving energy efficiency.

Keywords: Energy efficiency, dynamic sleep scheduling, optimized energy conservation, Delay-constrained application, Wireless Local Area Networks (WLAN'S).

1. Introduction

When In early 1990s, Wireless networking is rarely used because implementation of WLAN is very expensive. By the late 1990s, most WLAN solutions and proprietary protocols were replaced by IEEE 802.11 standards in various versions (versions "a" through "n"). WLAN prices also began to decrease significantly. WLAN and Wi-Fi are not similar, some situations people misunderstand both are similar. Wi-Fi is defined as a superset of IEEE 802.11 and it is not a technical term. Wi-Fi is used by more than 700 million people through about 750,000 Internet connection hot spots. Every component that connects to a WLAN is considered a station and falls into one of two categories: access points (APs) and clients. APs are devices that are capable for transmit and receive radio frequency signals ant the main function of AP is packet forwarding. The device that connected to the AP is called client [1] such as Personal computers, PDA, Smart Phones, IP Phones, Cell Phones, Servers Etc.

Improving the energy efficiency is an important concern in Wireless local area networks. Various techniques can be used for improving the energy efficiency. In this Paper we are using Sleep Scheduling mechanism for improving the energy efficiency. IEEE 802.11 standard have been applied in many areas in which most of the applications are delay sensitive. For example, current smart phones are normally equipped with WLAN interfaces that can support real-time multimedia data offloading. WLANs also facilitate online calls through the voice over Internet protocol (VoIP). These applications usually impose strict delay constraints on the data transmitted in the networks. Each packet needs to arrive at its destination before a prescribed deadline otherwise it will be dropped. However, an energy-efficient design should also meet the network quality-of-service (QOS) requirements such as end-to-end delay. Extra delay is introduced in the absence of proper sleep scheduling; it may cause the packet to be dropped, which is objectionable condition in delay-constrained applications. Therefore, these power-saving techniques need to be enhanced to better accommodate sensitive delay constraints.

In the existing system, an energy-saving technique is developed for delay constrained applications over WLANs [2] by dynamically switching a node to sleep mode, where our goal is to maximize the length of sleep time with respect to deadline constraints, also minimize the ideal listening time of the nodes. Take a delay- constraint application such as VoIP for example. Normally a VoIP packet can arrive at the destination ahead of its play out deadline [3]. The Green Call algorithm takes advantage of this fact and puts the node into sleep mode according to the amount of spare time before the play out deadline. At the time of sleep the downlink packets to the nodes are buffered at the access point .When a node wakes up, it immediately start downloading the buffered packets from the AP and plays them out. The length of sleep time is calculated to ensure timely retrieving of the packets. To maximize energy savings, the length of the sleep period is to be chosen so that the packets are played out right before the deadline. With such an algorithm, a sleep/wakeup schedule can be computed that allows the node to remain in sleep mode for significant periods of time. The existing algorithm gives maximum sleep period without affecting delay constraint, but the problem associated with the existing system is it introduces additional ideal listening time in non sleeping nodes. Thus, in the proposed system an innovative technique is introduced which called Optimal energy conservation for reducing the ideal listening time hence improving the energy efficiency.

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2. Related Works

Improving energy efficiency is an important concept in the wireless local area networks. For avoiding collision the MAC protocol requires the node need to be in listening (sensing) mode whenever nodes complete the transmission. This sensing mode consume large amount of energy. IEEE 802.11 PSM technique [5] was introduced for overcome this problem. In PSM the mobile nodes periodically enter to sleep mode by turning off the Wireless Network Interface Card (WNIC) and wake up for downloading the buffered packets from the AP. QOS requirements are a challenging issues in PSM, because the fixed length sleep period introduces additional delay which is undesirable for delay constraint applications such as VoIP and video streaming. Dynamic sleep scheduling was proposed for overcome the problems associated with the fixed length sleep period.

Automatic Power Saving Delivery (APSD) [5] and Green Call algorithms are based on the dynamic sleep scheduling. In scheduled APSD the AP determines the service period (SP) of each node, this centralized scheduling reduces the overlapping of SP. For minimizing the possible overlap between multiple nodes Lee and Hsieh propose an APSDbased algorithm [6], but this algorithm only gives less priority for the delay constraints. Unscheduled APSD is based on a distributed scheduling method in which each node triggers the downlink process from AP by uplink packets. Green call algorithm [7] was proposed by Namboodiri and Gao, this algorithm use dynamic sleep scheduling for satisfying the delay constraint. Green call algorithm is well designed for single user scenario, but in multi node scenario this algorithm is less efficient. When one node wake up and try to download the buffered packet from the AP channel may not be free due to the transmission between Some other nodes and AP, this will introduce additional delay to the packet and cause playout time violation. Lu Liu, , Xianghui Cao, Yu Cheng takes the advantage of Green call algorithm and design a Energy Efficient Sleep scheduling algorithm [2] for supporting the multi node scenario.

3. Problem Statement

Energy saving in the wireless local area network is an important concern. Some of the power saving methods reduces energy consumption by switching the node from idle sensing mode to sleep mode. However, an energy-efficient design should also meet the network quality-of-service (QOS) requirements such as end-to-end delay [8]. If sleep time is not properly scheduled it may cause overlapping of service period of different node in the WLAN, also improper sleep scheduling introduce additional delay, which will affect the proper working of delay-constrained applications. Therefore, these power-saving techniques need to be enhanced to accommodate sensitive delay constraints.

Furthermore, the energy is consumed for the idle listening process. The energy consumed by a wireless module in listening to the network is only slightly lower than that of transmitting and receiving data. To achieve better energy efficiency the ideal listening is reduced and maximizes the sleep period without affecting the QOS requirement such as end-to-end delay.

4. Architecture



5. Exiting System

In the existing system, an energy-saving technique is developed for delay constrained applications over WLANs by dynamically switching a node to sleep mode, where the goal is maximize the length of sleep time under packet deadline constraints.



Figure 2: Sleep scheduling in Multi node scenario using Energy Efficient Sleep Scheduling Algorithm

Take VoIP for example. Normally a VoIP packet can arrive at the destination ahead of its play out deadline. The Green Call algorithm takes advantage of this fact and puts the node into sleep mode according to the amount of spare time before the play out deadline. While sleeping, the downlink packets to the nodes are buffered at the access point (AP).When a node wakes up, it then retrieves the buffered packets from the AP and plays them out. The length of sleep time is calculated to ensure timely retrieving of the packets. To maximize energy savings, the length of the sleep period is to be chosen so that the packets are played out right before the deadline. With such an algorithm, a sleep/wake-up schedule can be computed that allows the node to remain in sleep mode for significant periods of time.

6. Proposed System

The existing system significantly increase the length of sleep period, but the problem associated with the existing system is, it will increase the ideal listing time of nodes. In WLAN 90 percentage of energy is consumed for the ideal listening mode. So, in the proposed system, in order to enhance energy efficiency and improve throughput by reducing the ideal listening time an innovative technique is introduced called Optimized Energy conservation algorithm for wireless LANs.



Figure 3: Sleep scheduling in Multi node scenario using Optimized Energy Conservation algorithm

In the existing multi-user scenario, during the reserved period of one node reaming nodes are in idle listening state. The energy depleted by a wireless module in listening to the network is only slightly lower than that of transmitting and receiving data. If there are seldom transmissions destined to the station, idle listening would waste significant amount of energy. So, in order to improve the energy efficiency, whenever the AP start a reserved session for a particular node, AP multicast a control message to other nodes. The control message includes the length of the downloading period (reserved period) of the active node (Node that ready to start a reserved session with the AP). When the nodes receive a control message it will immediately go from listening state to sleeping mode. The duration of sleep period is equal to the length of the reserved session of the active node. After the Reserved session the AP and active node will return to the normal mode, at the same time the remaining sleeping nodes will also return to the normal mode. So the data loss rate is less when comparing to the existing system. In this way the proposed system reduces the ideal listening time and save more energy than the existing system.

7. Conclusion

In the existing work, an energy-efficient sleep scheduling algorithm is used for delay-constrained applications over WLAN. Each node calculates its sleep period under packet delay constraint and requests that the AP reserve a future period for exclusive transmission. The AP examines the scheduling of all the nodes and make sure that there are no overlapping of reservation periods. But the existing system does not reduce the ideal listening time of nodes. For most of the time the nodes in WLAN are in listening mode which is unnecessary this result in energy wastage. So, we develop an optimized energy conservation protocol for reducing the ideal listening time for the nodes. By using this protocol energy consumption is significantly reduced.

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