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Comparison between CSMA and TDMA Technique for 802.11 based Long distance network

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ABSTRACT

Wi-Fi-based Long Distance (WiLD) networks have the potential to provide connectivity at substantially lower costs than traditional approaches. However, it is well known that the standard CSMA/CA MAC protocol used by Wi-Fi is not well suited for long distances. To achieve better performance, some researchers have proposed replacing the standard CSMA/CA MAC with a TDMA based MAC, so
In this paper going to show the difference and limitations between using CSMA and TDMA technique.

Key word: CSMA, TDMA, WI-FI

1. INTRODUCTION

Despite the promise of Wi-Fi networks as a low-cost solution for long distance point-to-point networks, the real-world performance of such networks while using the standard 802.11 MAC protocol is often abysmal. The main reasons behind this poor performance are certain shortcomings of stock 802.11 protocol that manifest only in WiLD environments. In particular, the 802.11 link-level recovery mechanisms causes low utilization and the use of CSMA/CA at long distances results in more frequent collisions. In addition, nodes with multiple radios are faced with inter-link interference.

CSMA

Carrier senses multiple accesses (CSMA) are a channel access mechanism which was originally designed to resolve contention in indoor conditions. In CSMA mechanism, nodes contend for the shared channel for a specified time before transmission of data, thus ensuring that the channel is free. Only after making sure that the channel is free, a node starts its transmission. If the channel is sensed busy, the node defers its transmission until it becomes idle. Collision avoidance is used to improve the performance of the CSMA method by attempting to be less "greedy" on the channel. If the channel is sensed busy before transmission then the transmission is deferred for a "random" interval. This reduces the probability of collisions on the channel.

How CSMA/CA work?

In CSMA/CA, as soon as a node receives packet that is to be sent, it checks to be sure the channel is clear (no other node is transmitting at the time). If the channel is clear, then the packet is sent. If the channel is not clear, the node waits for a randomly chosen period of time, and then checks again to see if the channel is clear. This period of time is called the back off factor, and is counted down by a back off counter. If the channel is clear when the back off counter reaches zero, the node transmits the packet. If the channel is not clear when the back off counter reaches zero, the back off factor is set again, and the process is repeated.

Time division multiple access

TDMA is a channel access method for shared medium networks. It allows several users to share the same frequency channel by dividing the signal into different time slots. The users transmit in rapid succession, one after the other, each using its own time slot.

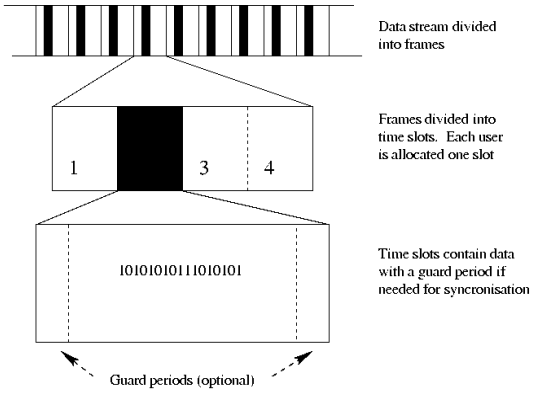

Figure 1. TDMA frame structure showing a data stream divided into frames and those frames divided into time slots.

How TDMA work?

Time division multiple access (TDMA) is a channel access method (CAM) used to facilitate channel sharing without interference. TDMA allows multiple stations to share and use the same transmission channel by dividing signals into different time slots. Users transmit in rapid succession, and each one uses its own time slot. Thus, multiple stations (like mobiles) may share the same frequency channel but only use part of its capacity.

2. METHOLOGY

In this section going to show summary comparison between CSMA and TDMA, and illustrates the limitation in CSMA and how solved in TDMA.

Limitation in CSMA

1- Low utilization.
2- Collisions at long distances
3- Inter-link interference.
4- Delay
5-Low throughput
6-Congestion

The solve by TDMA

Addresses the problem of low utilization by use of bulk packet acknowledgments. To mitigate loss from collisions at long distances as well as inter-link interference, WiLD-MAC (Wi-FI long distance) replaces the standard CSMA/CA MAC with a TDMA-based MAC protocol.

1-Bulk ACKs: The stock 802.11 stop-and-wait protocol is replaced by a sliding-window based flow-control approach in which the receiver transmits a bulk acknowledgment (bulk ACK) for a whole window of packets. The bulk ACK is generated as an aggregated acknowledgment for all the packets received within the previous slot. This way, a sender can rapidly transmit a burst of packets rather than wait for an ACK after each packet

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2- Designing TDMA in lossy environments: The stock 802.11 CSMA/CA mechanism is inappropriate for WiLD settings since it cannot assess the state of the channel at the receiver. 2P (point to point) proposed a basic TDMA mechanism (instead of CSMA/CA) that explicitly synchronized transmissions at each node to prevent inter-link interference. However, in the face of packet losses (especially high-loss rates), explicit synchronization can lead to deadlock scenarios due to loss of synchronization marker packets. In WiLD, to deal with this problem, we resort to an implicit approach, using loose time synchronization between nodes to determine a TDMA schedule that is not affected by packet loss.

3. Handling high packet loss-rates: In WiLD network deployments, finds that external Wi-Fi interference is the primary source of packet loss. The emergence of many Wi-Fi deployments, even in developing regions, will exacerbate this problem. In WiLDNet, uses an adaptive loss-recovery mechanism that uses a combination of FEC (Forward error correction) and bulk acknowledgments to reduce significantly the perceived loss rate and to increase the end-to-end throughput.

3. RESULT

This section illustrates the result from comparison between CSMA and TDMA. From performance analysis finds that the performance of TDMA is far better than that of CSMA/CA. Summarize this in table illustrates comparison between CSMA and TDMA based channel access mechanisms.

Performance Metrics	CSMA	TDMA
Bandwidth Utilization	Low	Maximum
Traffic volume Support	Low	High
Network Scalability	Good	Poor
Node Synchronization	Not Applicable	Required
Power Consumption	High	Low
Delay	High	Low
interference	High	Low
Throughput	Low	High
Collision	High	low

Table 1.CSMA vs. TDMA

4. DISCUSION

In this section, going to introduce a brief description about the TDMA as a solve to the important problem in Wi-Fi long distance, find that, TDMA has high bandwidth utilization, low delay, high throughput, low interference, low congestion, and collision. However TDMA better Than CSMA.

5. CONCLUSION

In this paper conclude that, from Comparing between CSMA/CA and TDMA, find TDMA is the best.

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