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An IEEE 802.11 Network Sense-based TDMA Registration Procedure

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Abstract: *To enhance the effectiveness of wireless network access to channels, it is proposed that, to reduce the transmission time of messages, a Time Division Multiple Access (TDMA) registration method of using network sense be based according to IEEE 802.11. Due to their fixed time-slots and unawareness to on-going transmissions, the traditional TDMA techniques often have problems with dynamism. The proposed technique, TDMA registration is enhanced by sensing active channels using IEEE 802.11 network and reassessing slot allocation accordingly. This adaptive method prompts higher usage of the bandwidth and decreases latency by avoiding collision and heightening synchronization in the registration process. Simulation findings indicate that the sense-based registration is fairer on the issues of network loading capacity and access latency as compared to other traditional systems and therefore acceptable in wireless communication networks that are dense and inorganic.*

Keywords: *IEEE 802.11, TDMA, WLAN*

I. Introduction

A solid medium access control is essential to wireless networks in dynamic environments in general, especially in busy networks. The most popular way of avoiding collisions is Time Division Multiple Access (TDMA) that divides channel into time slots. Nevertheless, this situation may render common TDMA registration processes ineffective due to fixed slot timespan and the absence of real-time information regarding the status of those channels. IEEE 802.11, one of the most popular standards of wireless LANs, have the so-called network sensing features, which can be utilized to enhance TDMA performance. To detect on-going transmissions and adjust slot allocation accordingly, this paper proposes a distinctive TDMA registration procedure that utilizes IEEE 802.11-based sensing. The proposed method attempts to achieve higher synchronization, fewer access collisions and improved network performance overall.

II. Previous Work

Previous studies into TDMA registration in wireless networks have focused chiefly on channel access management methods where access is characterized by reservation, centralized scheduling and predetermined slot assignment. They often fail in dynamic environments in which traffic conditions and user mobility vary. First TDMA systems were more latency-sensitive and had slot under-utilisation, because they operated with less flexibility. Based on control messages to negotiate slots, other researchers developed adaptive TDMA methods; however, it created more complexity and overhead. To make things more flexible, they investigated the hybrid MAC protocols that incorporate both contention-based access and TDMA. Despite that IEEE 802.11 has widely employed channel access and sense, there has been insignificant incorporation of IEEE 802.11 into TDMA registration. This gap underlines the need of practical, sensing-aware registration procedures capable to adjust to the varying network situations on-the-fly.

III. Registration Control Procedure

Registration Control Procedure The Registration Control Procedure in IEEE 802.11 Network Sense-based TDMA Registration Procedure is the process which controls the process of Node joining and synchronization within the TDMA structure. Before the nodes are ready to identify available time slots and recognize sustained transmissions, the nodes botch network sensing that involves the IEEE 802.11 carrier sensing strategy. Depending on this sensing,

nodes select the most optimal slots to channel communication as a means of reducing interference and collisions. A node shows that it wants to enter the network and queries slot assignment in the registration request section of the process. Via allocation of specific TDMA slots to nodes, the network coordinator or the base station over-watch these requests, ensures that there is sufficient space to be used by these slots, and process to authorize registration. Registrations messages keep every node with a set time frame of constant slot use. This type of management dynamically adapts to changes in network conditions, and can reduce the number of collisions and maximize overall network throughput and latency, by constantly monitoring channel activity. Consequently, TDMA registration performance is more superior and in fact, it is applicable in dynamic IEEE 802.11 scenarios.

1st service slot	
1st frame beacon	Access point idle state, listening to registration request

(a)

2nd service slot				
1st frame broadcast reply on node 1 request	2nd frame broadcast reply on node 2 request	.....	nth frame broadcast reply on node n request	(n+1)th frame broadcast message about deleted node

(b)

Fig 1: a and b are types of service slots

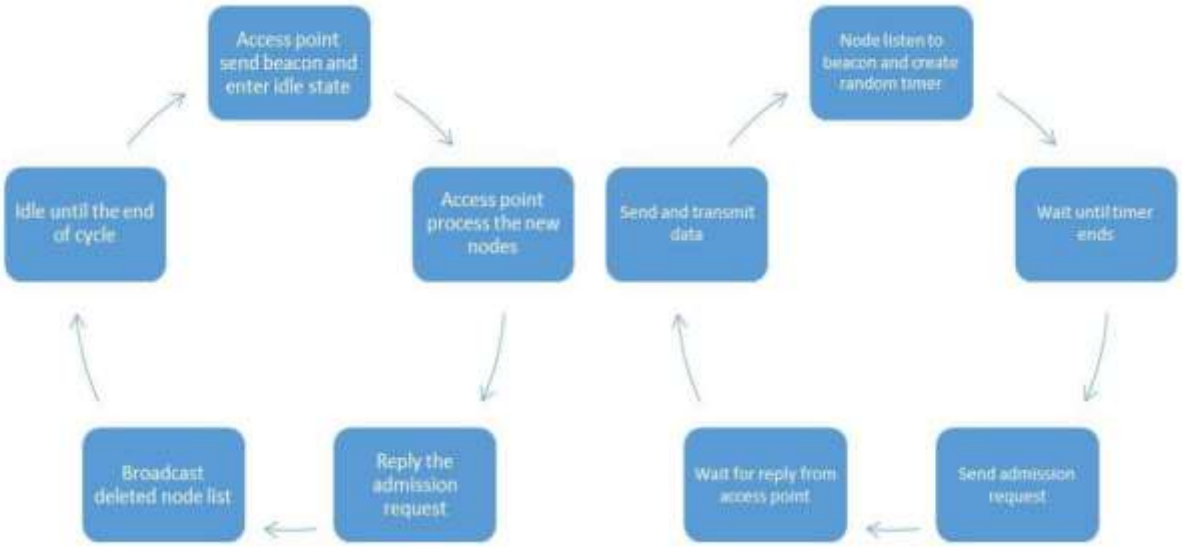

Fig 2: Types of service plots

IV. Simulation Evaluation

The simulation evaluation of the IEEE 802.11 Network Sense-based TDMA Registration Procedure aims at using a complete simulation model to gauge the performance of the procedure in various network scenarios. Such relevant parameters are throughput, synchronization accuracy, collision rate, and registration delay. Based on the proposed TDMA registration scheme in the sense sense, the simulation configuration represents a wireless network in which multiple nodes attempt to use the medium by registering with the system. Evaluation and comparison of the IEEE 802.11 network sensing to traditional fixed-slot TDMA methods, the results indicate that there is significant reduction in the number of collisions on registration. Through sensing that are on-going transmissions, nodes can intelligently select the use of time slots thereby leading to a more efficient use of time slots and the occurrence of fewer access collisions. This dynamic adjustment accelerates the process of adding new nodes to the network because it minimizes the registration latency. Also, the sense-based process enhances node synchronization which is a consistent slot time and reduces transmission errors. As a result of better slot-allocation and reduction in contention, throughput trials indicate that there has been a general increase in network capacity. So as to test the effectiveness and robustness of the protocol, the protocol is tested using different node densities and traffic loads in the simulation. The IEEE 802.11 sensing-based approach is suitable in the dense and dynamic wireless scenarios, where the channel conditions keep on changing since it offers improved performance as compared to the traditional TDMA registration protocols.

V. Conclusion

Conclusively, it appears that the IEEE 802.11 Network Sense-based TDMA Registration Procedure is effective in enhancing medium access control by exploiting network sensing to optimum time slot allocation. This negates the short-comings of standard TDMA techniques by reducing collisions, by improving synchronization during a registration process, and by detecting a busy channel dynamically. Simulation evidence indicates that the sense-based process is highly responsive to density alterations of the network, and changes in traffic conditions much less time-consuming to delay registration, and it enhances throughput many times. The proposed solution offers a flexible and more effective registration solution that fits dynamic wireless context properly when integrated with IEEE 802.11 sensing features and TDMA. This is a potential solution to modern IEEE 802.11-based networks with scalable and collisions free medium access since it has the overall effect to improve both the network performance and reliability.

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