A Survey Paper on Throughput Improvement on RTS/CTS Methods in WLANs

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Abstract: In Wireless ad hoc networks the data is transmitted from source to destination using Request-to-Send and Cleat-to-Send (RTS/CTS) mechanism. RTS/CTS reduce packet collisions due to hidden node; solves problem over carrier sense multiple access (CSMA) and hence achieves high throughput. But some additional problem arises like Exposed Node Problem, Masked Node Problem, RTS-induced Problem and CTS-induced Problem. This survey paper represents the modification of RTS/CTS mechanism which improves the throughput and increases the network performance.

Index Terms – Infrastructure, wireless network, Ad-hoc network, CSMA/CA and RTS/CTS.

I. INTRODUCTION

Wireless communication system is more preferred over wired communication system, so mobile ad hoc networks are in higher interest for research community. MANET is self configured kind of network, where wireless nodes can move in arbitrary direction with varying speed. Wireless Local Networks (WLANs) uses standard protocol IEEE 802.11 specifies Medium Access Control (MAC).

Medium Access Control (MAC) protocol and Carrier Sense Multiple Access (CSMA) protocol is used in Wireless ad hoc networks which affects the network performance. Hidden node problem causes packet collisions and thus degrade the performance of the network. To avoid hidden node problem, RTS/CTS handshake mechanism is often used. Initially The RTS/CTS mechanism was proposed in [7] named as Multiple Access with Collision Avoidance (MACA). The modified MACA is proposed in [2] named as MACA for Wireless (MACAW), which includes a MAC level acknowledgment (ACK). The standard IEEE 802.11 protocol uses the variant of MACAW along with CSMA.

Frequent packet collision may occur in a network which leads network congestion; this is the reason to use the RTS/CTS mechanism in a communication network. The RTS/CTS mechanism generally works well in infrastructure based networks, even though it may lead to unfairness in some situations [6]. This is the reason that various methods are developed and enhanced for RTS/CTS mechanism to achieve higher throughput.

The remaining paper is organized as follows. In section II RTS/CTS mechanism is discussed with associated problem. In section III literature survey is discussed in which various modifications in RTS/CTS mechanism along with advantages and disadvantages. Finally section IV concludes the survey paper.

II. RTS CTS MECHANISM

Wherever RTS/CTS handshake was acquainted with decrease the impacts because of concealed hubs in CSMA/CA convention. The part of Seder Hub and Beneficiary Hub begin before real information exchange; they need to hold the channel for transmission of information by trading RTS/CTS bundles. This is purported virtual transporter detecting since in this system hubs get the data about the condition of channel by trading a couple of control parcels (RTS/CTS) as opposed to detecting the channel physically. Assume hub A needs to send information to hub B; it initially sends RTS control bundle to hub B in which hub A reviews the address of hub B and time required to finish information transmission. In the wake of getting RTS bundle from hub A, hub B answers with CTS control parcel.

Consider the accompanying figure 1 to comprehend the RTS/CTS instrument. The RTS of A is additionally gotten by hub C since hub C is likewise in transmission scope of A. The RTS of An is likewise gotten by hub C since hub C is additionally in transmission scope of A. Hub C discovers that it isn't simply the expected recipient so it obstructs from getting to the channel by setting a clock known as System Distribution Vector (NAV). Amid this blocking state hub C can neither begin any information transmission nor answer to any RTS parcel of some other hub in its neighborhood. D is a hub that is in transmission scope of hub B and gets the CTS parcel of B. So D will likewise set a NAV clock to keep any information transmission amid the transmission of information from hub A to hub B. NAV is a counter that abatements always and introduced to an esteem put away in RTS or CTS parcel. The clock set by hub C is called RTS NAV clock and the clock set by hub D is called CTS NAV clock. Presently hub A begins real information transmission to B. In the wake of getting the total information precisely, hub B answers with affirmation ACK bundle to demonstrate the accomplishment of transmission. Presently hub C and D will unblock themselves.

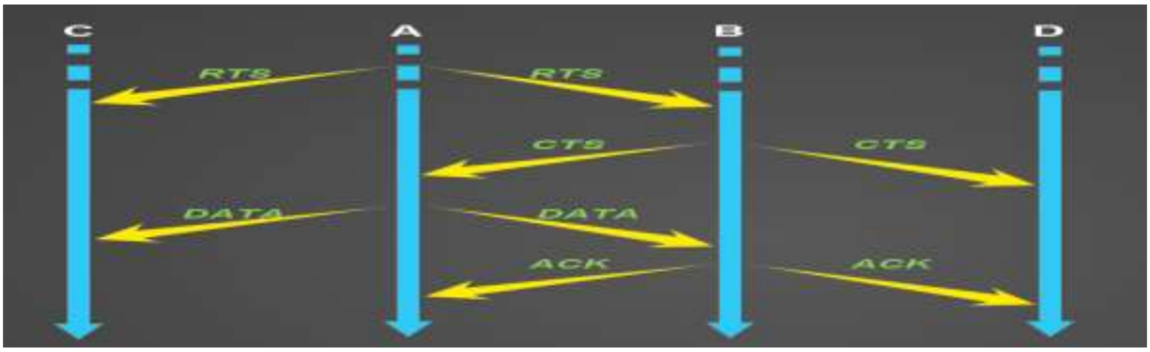

Fig 1: RTS/CTS component

The RTS/CTS component gives some extra issues that are examined beneath:

2.1. Exposed Node Problem

An uncovered hub is one that is inside the scope of sender yet out of the scope of collector. These hubs cause underutilization of transfer speed. Accept that there are four hubs A, B, C, and D as appeared in Figure 2.1. The dabbed circle indicates their correspondence ranges. Give us a chance to expect that hub C is imparting to hub D. Furthermore, assume hub B needs to transmit to hub A. Hub B detects the channel to be occupied and couldn't transmit to A. In spite of the fact that this transmission would not cause an impact at D, but rather B is kept from transmitting. The hub B is an uncovered hub. It comes about wasteful transfer speed usage at hub B. This issue is called uncovered issue. Covered up and uncovered issues can happen every now and again in impromptu system causing a critical debasement in the system throughput.

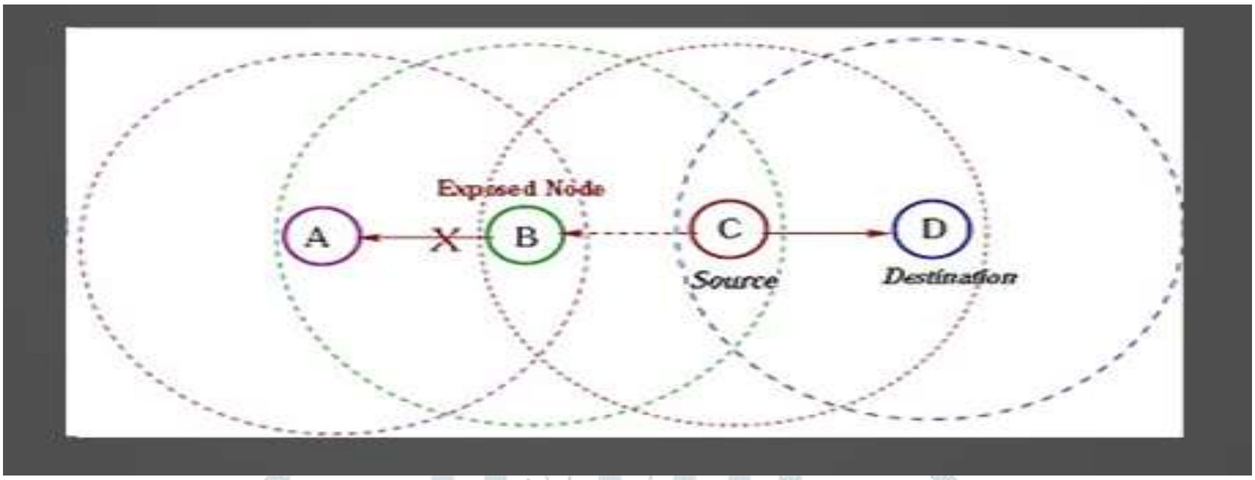

Fig 2: Exposed Node Problem

2.2 Masked Node Problem

This is the situation in which RTS/CTS instrument neglects to take care of the shrouded hub issue. The purpose behind this circumstance depends on the way that CTS sent by a hub may not generally be heard by its neighbor on the grounds that the later may be now hindered because of any beforehand began transmission in its neighborhood. This is outlined in following figures:

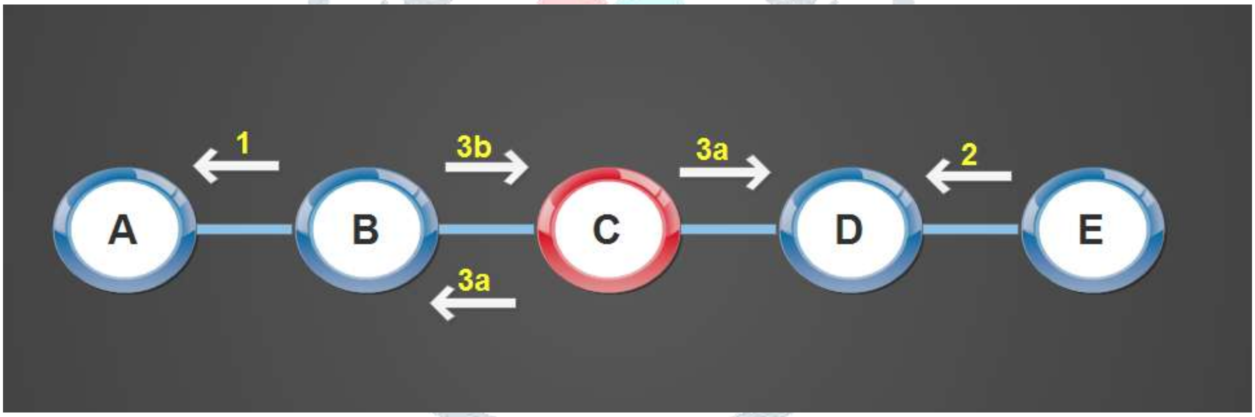

Fig 2.2: Masked node Problem

To begin with, hub B begins sending information to hub A. Amid this transmission hub C is blocked. In the event that hub E sends information to hub D in the meantime then hub C won't have the capacity to hear CTS of hub D. Hub C is conceal to information transmission of hub D. In the mean time, if information transmission of hub B closes then hub C is allowed to do any transmission. This may cause impact at hub D. In the event that hub C begins its correspondence with hub B then after some time hub D may intrude on this transmission. Presently hub D will be conceal hub.

2.3 RTS-induced and CTS-induced Problem

To overcome the hidden and exposed node issue, IEEE 802.11 DCF, utilizes an instrument called System Designation Vector (NAV) [1, 2, 8]. Hubs catching either RTS or CTS set their NAV individually, and concede their channel access for the normal time to complete the parcel transmission. Issues emerge when the RTS or CTS bundle isn't accurately gotten at collector or sender hub separately, which causes underutilization of channel data transmission because of NAV setting. These are named as RTS-incited and CTS-prompted issue [9].

The RTS-incited issue happens when the RTS parcel isn't effectively gotten at the beneficiary hub. Expect that there are four hubs A, B, C, and D as appeared in Figure 2.3.1 Hub C starts its transmission by sending a RTS bundle to hub D. After hearing RTS from hub C, hub B sets its NAV to the normal time required to complete the transmission. On the off chance that the gathering of RTS comes up short at D, the transmission from hub B is superfluously conceded for a period as set in its NAV. The RTS-instigated issue is portrayed in Figure 2.3.1. So also, CTS-prompted issue happens when the CTS parcel isn't effectively gotten at the sender hub. Expect that there are four hubs A, B, C, and D as appeared in Figure 2.3.2 Hub A starts its transmission by sending a RTS parcel to hub B. The hub B sends CTS to hub An, as a reaction to the RTS bundle. After hearing the CTS parcel from hub B, hub C sets its NAV to the normal time required to complete the transmission. In the event that the gathering of CTS falls flat at hub A, transmission from hub C is pointlessly conceded for a period equivalent to the setting in NAV.

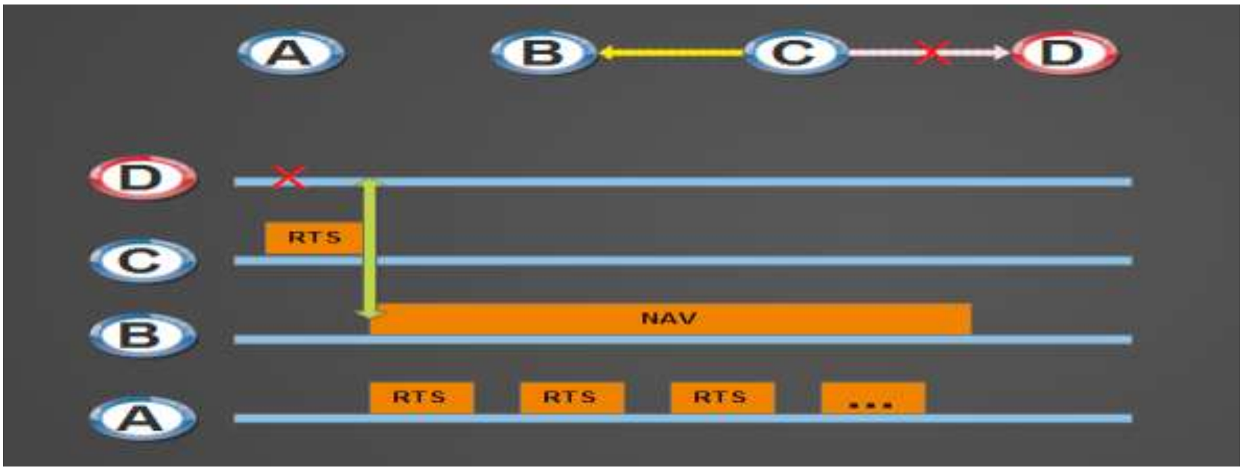

Fig 2.3.1 RTS-induced Problem

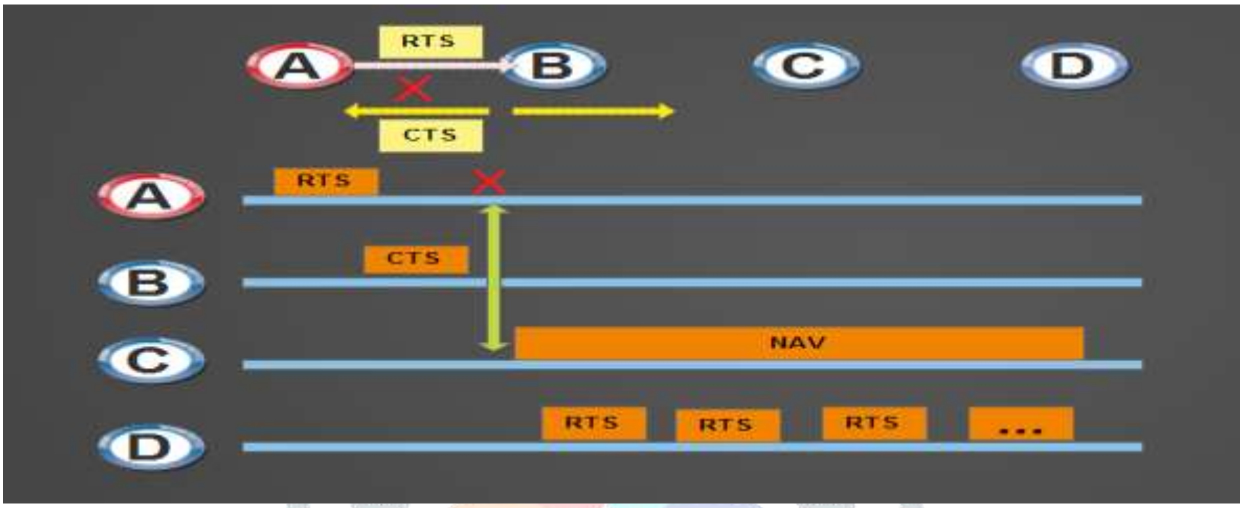

Fig 2.3.2 CTS-induced Problem

III. LITERATURE SURVEY

The This overview manages different adjustments done in RTS/CTS component and furthermore centers around the disadvantages of these changed RTS/CTS instrument.

Emilia Weyulu ; Masaki Hanada ; Moo Wan Kim [1]-IEEE 802.11 WLANs utilize transporter sense different access with crash evasion (CSMA/CA) to start the Demand to Send/Clear to Send (RTS/CTS) handshaking system that tackles the concealed hub issue. However RTS/CTS likewise causes the uncovered hub issue where a hub is pointlessly kept from getting to the remote channel notwithstanding when such access won't upset another hubs progressing transmission. In this paper, we display proceeding with assessment of a technique for diminishing uncovered hubs in 802.11 impromptu WLANs utilizing deviated transmission ranges for RTS and CTS outlines. NS-2 reproductions demonstrate that the proposed strategy enhances general system throughput in a topology situation of a 3-D organize looked with roof/floor hindrances.

Mustafa Al-Bado ; Cormac J. Sreenan ; Kenneth N. Darker [2] -In thick remote arrangements, for example, Venture WLANs (EWLANs) and home WLANs, obstruction may happen as a result of neighboring WLANs having the same unlicensed range. Components to halfway oversee WLAN arrangements can't adequately alleviate the impedance caused by concealed terminals (HTs) in WLANs that have a place with various associations. Moreover, the effect of impedance is opened up in the event that it is joined with enduring TCP activity streams, which are ending up progressively ordinary. In this paper, we center around relieving the effect of HTs on extensive TCP streams in home WLANs. Specifically, we consider the impact of five key factors on seemingly perpetual TCP streams under the effect of HTs: parcel blasting, backoff components, most extreme number of RTS endeavors, catch influence and the quantity of related customers with a similar Access Point (AP). Broad reproduction comes about demonstrate that a blend between RTS/CTS messages and blasting builds the throughput up to 8× within the sight of HTs. In this manner, we build up a system called joint RTS/CTS with Blasting (RCBurst) that use RTS/CTS messages and bundle blasting to alleviate the effect of HTs. The reproduction comes about demonstrate that RCBurst accomplishes a change of up to 0.3 in Jain's reasonableness record over the customary CSMA/CA, without lessening the general throughput.

Gul Zameen Khan ; Ruben Gonzalez ; Eun-Chan Stop [3]-This paper gives a knowledge into IEEE 802.11ac by breaking down its execution as far as framework throughput thinking about the key highlights of Macintosh and PHY layers. Throughput at Macintosh layer is ascertained from transmission likelihood, conflict window and transmission arrange. In like manner, the new basic characteristics of 802.11ac PHY (i.e. regulation and coding plans, spatial streams, and channel transmission capacity) are utilized to decide the throughput. To this end, a hypothetical model is created trailed by recreation investigation. The outcomes think about hypothetical and recreation discoveries for various arrangement of parameters. Besides, imperative patterns and tradeoffs are recognized between framework throughput and (Macintosh + PHY) includes as a component of number of fighting stations and payload estimate.

Baher Mawlawi ; Jean-Baptiste Doré [4]-The quantity of Machine to Machine (M2M) applications is expanding quickly particularly in cell correspondence frameworks. These applications should bolster a high number of stations (STAs) and encourage correspondence with no human mediation. To satisfy these prerequisites arbitrary access conventions are a conceivable decision. Bearer sense various access impact evasion (CSMA/CA) convention with demand to send and clear to send (RTS/CTS) component shows high corruption of the throughput and parcel drop likelihood execution particularly when the bundles measure are little. The medium access control (Macintosh) overhead caused by the RTS and CTS messages is high contrasting with the aggregate term of effective transmission. With a specific end goal to decrease the Macintosh overhead we propose in this work another methodology to serve numerous clients progressively. This procedure comprises on sending numerous RTS in parallel by various stations on various recurrence sub-groups. Once the RTS messages don't crash into each other, there will be no compelling reason to resend the RTS and sit tight for a CTS to pick up the channel get to. In this paper, this proposed methodology is explored and we exhibit that it achieves better immersion throughput and bundle drop likelihood particularly in stacked systems.

Sanjeeb Shrestha ; Gengfa Tooth ; Eryk Dutkiewicz ; Xiaojing Huang [5]-We abuse the Degrees of Flexibility (DoF) coming about because of the arrangement of different reception apparatuses, both at the Entrance Focuses (APs) and the customers, to address the Shrouded Terminal issue in Multi Client (MU) Numerous Info Various Yield (MIMO) Remote Neighborhood (WLANs). This approach grants simultaneous transmissions and can keep up a consistent pick up in organize throughput in a Shrouded Terminal situation. We regard simultaneous transmissions as an indispensable piece of our outline, so we embrace and expand the customary Point Coordination Capacity (PCF) to oversee them. In particular, dispute free time of the customary PCF is utilized as a part of uplink and downlink. Also, in light of DoF at APs, our Macintosh chooses the Transmission Opportunity (TXOP) of APs/Transmitters as opposed to numerous conventional methodologies. Additionally, our Macintosh runs a simultaneous calculation at APs which frames an imperative part for the computation of pre-coding vectors (in light of the Zero forcing) in the Physical Layer (PHY). Also, a consistent channel sounding procedure is intended to help the ZF preceding at the PHY which has 98.67μs flagging overhead, lower than IEEE802.11ac. Recreation examines in a run of the mill 6-radio wire AP and customer situation demonstrate that our Macintosh gives a noteworthy steady system throughput pick up of 4-5 times in contrast with conventional RTS/CTS, and a lower flagging overhead than IEEE802.11ac. In addition, our basic decency calculation gives a decent amount in the throughput among APs, with the Jain Reasonableness Record more prominent than 90%.

Baher Mawlawi ; Jean-Baptiste Dore ; Nikolai Lebedev ; Jean-Marie Gorce [6]-Machine to machine correspondence (M2M) or machine compose correspondence (MTC) encourages correspondence with no human mediation. These applications will bolster a colossal number of stations (STAs). To relieve corruption of the throughput and postpone execution in remote neighborhood (WLAN) that utilize transporter sense numerous entrance impact shirking (CSMA/CA) convention with demand to send and clear to send (RTS/CTS) system, we propose to decrease the overhead presented by the hand shake component. The medium access control (Macintosh) overhead caused by the RTS and CTS messages is high contrasting with the aggregate length of fruitful transmission. So as to decrease the Macintosh overhead we propose in this work another technique to serve numerous clients progressively. This procedure comprises on sending numerous RTS in parallel by various stations on various recurrence sub-groups. Once the RTS messages don't crash into each other, there will be no compelling reason to resend the RTS and sit tight for a CTS to pick up the channel get to. In this paper, this proposed system is explored and we show that it achieves better immersion throughput and deferral particularly in stacked systems.

Kuruvilla Mathew ; Biju Issac ; Tan Chong Eng [7]-The CSMS/CA convention is utilized in remote systems with a specific end goal to defeat issues, for example, the shrouded hub issue. This instrument is relied upon to deal with impacts better utilizing the RTS/CTS component. This technique will enable a taking part hub to partake in correspondence just on the off chance that it gets an "Unmistakable to Send" message and in this way, hypothetically "dodging" crash. The target of this paper is to examine the change that the RTS/CTS mode brings over the Fundamental Access mode. The paper displays the investigation of remote hubs inside a particular zone with expanding hub focus to check the execution effect of a convention in remote systems, especially when the hub fixation increments.

Hiroaki Higaki [8]-In remote specially appointed systems where simultaneous transmissions of information messages by shrouded remote hubs ought to be maintained a strategic distance from, better exchange off amongst dependability and transmission delay is required. The creators have proposed the strategy to adaptively apply either BEC (In reverse Blunder Amendment) or FEC (Forward Mistake Redress) in view of bit mistake proportion and transmission ask for frequency. In FEC correspondence, it is workable for neighbor remote hubs to transmit information messages simultaneously under some limitation; in any case, the first RTS/CTS convention does not bolster such simultaneous transmissions. This paper proposes a broadened RTS/CTS convention which bolsters simultaneous FEC transmissions by presentation of interims amongst PRTS and PCTS and amongst PCTS and an information message. Since both the expanded and the first conventions can be connected in a remote impromptu system, it adds to the blend of BEC and FEC correspondences.

Norberto Barroca ; Luís M. Borges ; Fernando J. Velez ; Periklis Chatzimisios [9]-IEEE 802.15.4 Medium Access Control (Macintosh) layer does exclude the Demand To-Send/Clear-To-Send (RTS/CTS) handshake system, with a specific end goal to defeat the concealed hub issue that influences Remote Sensor Systems (WSNs). In this paper we propose and dissect the utilization of RTS/CTS in IEEE 802.15.4 for the non-beacon empower mode. The proposed arrangement demonstrates that by considering the RTS/CTS system joined with bundle connection we enhance the system execution as far as most extreme throughput, least deferral and transfer speed effciency. In IEEE 802.15.4 with RTS/CTS, the backoff methodology process isn't rehashed for every datum bundle sent dissimilar to the fundamental access method of IEEE 802.15.4, however just for each RTS/CTS set. Consequently, the channel use is augmented by diminishing the deferral day and age before transmission.

Md. Ruhul Amin ; Shafika Showkat Moni ; Shamim Ara Shawkat ; Mohammad Shah Alam [10]- Spatial diversity for wireless transmission requires more than one antenna at the transmitter. However, mobile devices are usually limited by size, so installation of multiple antennas increases the hardware complexity significantly. Due to the omni-directional nature of wireless signal, a data transmission between a source node and a destination node can be overheard by many other neighbor nodes. By exploiting this characteristic, a number of recent research activities on cooperative Medium Access Control (MAC) have been devised where low data rate stations are assisted by the high data rate stations in forwarding data traffics. Therefore, wireless devices with a single antenna can effectively form a virtual array of antennas by sharing each other's' antennas in a multiuser environment. To facilitate cooperative communication in the data link layer requires a great deal of attention. In designing a cooperative MAC, selection of relay stations is the most important criterion. In this paper, we propose a distributed cooperative MAC protocol where a potential relay node initiates itself to participate in the cooperation by calculating supported data transmission rate between source to relay and relay to destination links. A mathematical analysis of our proposed scheme is derived and throughput of the proposed scheme is then compared with that of the existing IEEE 802.11 DCF MAC. Numerical results show that our proposed scheme can increase the throughput of any IEEE 802.11 low data rate station comprehensively.

Following figure 2.4 shows the advantages and disadvantages of modified RTS/CTS mechanisms.

RTS/CTS Mechanism	Advantages	Dis-Advantages
MACA-BI	1. Increases network throughput in presence of hidden nodes. 2. helps to manage flow control, congestion control, and traffic regulation because of receiver initiated tendency.	1. This protocol is compatible with stationary network where every node knows how many packets it has to receive or how many senders are there. 2. Inspite of less control packet collision, performance degradation is still an issue.
MACA-RPOLL	1. This method solves the problem of unfair backoffs. 2. It gives better performance than MACA in some issues.	1. This protocol does not suitable for mobile networks because every node should know how many packets it has to receive or how many senders are there.
NAV Omitted	1. False-blocking problem due to unheard RTS and CTS packets is removed. 2.This modification improves IEEE802.11DCF throughput performance.	1. This mechanism works only in single hop technology.
RTS Validation	1. This mechanism prevents propagation of false blocking and also enhances the performance of RTS/CTS protocol in wireless networks. 2.This method is a back-ward compatible solution and thus can be implemented incrementally with traditional RTS/CTS mechanism.	1. This mechanism does not work well in multi hop topologies.
RTS/CTS + CCTS	1.This procedure solves false blocking problem due to both unheard RTS and CTS.	1. This mechanism degrades network performance due to additional control packets.

Figure 2.4: Advantages/Dis-advantages of Modified RTS/CTS.

IV. CONCLUSION

RTS/CTS instrument is extremely helpful in enhancing the throughput and system execution in nearness of shrouded hubs. Yet, regardless it endures with some extra issue like Exposed hub, Masked hubs, RTS-incited and CTS-instigated issue. These issues corrupt the execution of RTS/CTS system. In this review we have considered a few alterations done in RTS/CTS component which help to tackle issues related with it. We have likewise clarified their focal points and hindrances. However in our review, we infer that some exploration is still to be done to keep the circumstance of shrouded hubs.

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