

Investigation of Power aware and rate control in CSMA/CA based Mobile Ad-Hoc Communication

Ajay Kumar Golait¹, Dr. Poonam Sinha²

Department of Digital Communication Engineer

B.U.I.T., Barkatullah University, Bhopal, India

ajaygolait@gmail.com¹, poonamuit@yahoo.com²

Abstract— In this paper find out various power aware and data packet rate control with-collision-avoidance (CSMA/CA)-based ad hoc wireless network communication. And identifies that CSMA/CA based technique are more flexible for wireless mobile ad-hoc communication that gives congestion information to all senders' nodes and if anywhere congestion found in the network then minimize the data packet rate control the congestion from the network. In his approach also find out the number of collision packets at the time of communication. With the help of MAC and 802.11 standards resolve the problem of collision and congestion in MANETs. And main focus of enhance the network performance like throughput, packet delivery ratio, transmission power consumption and congestion minimization using MAC layer based CSMA/CA approach. The above approach is simulated through network simulator.

Keywords— Ad hoc network, IEEE 802.11, power/rate Control, MAC.

I. INTRODUCTION

In the design of wireless ad hoc networks, various techniques are applied to efficiently allocate the scarce resources available for the communication links. Using an appropriate medium access control (MAC) protocol is one such technique. Taking into account the system's quality of service (QoS) requirements, a MAC protocol for ad hoc networks shares the medium and the available resources in a distributed manner,

data rate control, power management, and allows for efficient interference management [2]. Nowadays, the growing demands for numerous bandwidth-hungry applications have created it additional and additional necessary to extend the network throughputs of wireless unintended networks. Considering the wireless unintended networks that adopt the IEEE 802.11 distributed coordination function (DCF) [9] and support multiple transmission rates with one single channel, in this synopsis aim to extend the network throughputs by standardization the transmission power and data rate power aware and requirement of transmission power per packet based. DCF will enforce the carrier sense multiple access with collision rejection (CSMA/CA) mechanism to coordinate the channel access among competitor transmitters in a distributed contention-based manner. There were two transmission power management (TPC) schemes for wireless networks in [10] and [11]. The TPC theme in [10] tries to find transmission power for a group of transmission pairs in order that their signal-to-interference-plus-noise magnitude relation (SINR) necessities square measure satisfied (hence, concurrent transmissions of them square measure admitted). However, the specified transmission power doesn't essentially exist. On the opposite hand, the TPC theme in [11] will decide if a replacement transmission combine are often admitted in order that the SINR necessities of all current transmission pairs (and the

new pair) square measure glad. Wireless MANET suffers from collisions and interference due to the broadcast nature of radio communication and thus requires special medium access control (MAC) protocols. These protocols employ control packets to avoid such collisions but the control packets themselves and packet retransmissions due to collisions reduce the available channel bandwidth for successful packet transmissions with minimum power requirement based. At one extreme, aggressive collision control schemes can eliminate the retransmission overhead but at the cost of large control overhead. At the other extreme, the lack of control over collisions offers zero control overhead but it may need to expense large amount of channel bandwidth for retransmissions. Distributed coordination function (DCF) is the basic medium access method in IEEE 802.11, which is the most popular wireless standard, and it makes prudent tradeoffs between the two overheads. DCF supports best effort delivery of packets at the link layer and is best described as the Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) protocol. While DCF works reasonably well in infra-structured wireless environment, this is not necessarily true in a mobile ad hoc network (MANET) environment. A MANET is an infrastructure-less multi-hop network that consists of autonomous, self-organizing and self-operating nodes, each of which communicates directly with the nodes within its wireless range or indirectly with other nodes via a dynamically computed, multi-hop route. In this synopsis focus that existing work under carrier sense multiple access method, power and rate control technique and proposed Power aware and rate control for better utilization of channel as well as increased network performance parameter.

1. IMPORTANT ISSUES IN MOBILE AD-HOC NETWORK

There are several important issues in ad hoc wireless networks. Most ad hoc wireless network applications use the Industrial, Scientific and Medical (ISM) band that is free from licensing formalities. Since wireless is a tightly controlled medium, it has limited channel bandwidth that is typically much less than that of wired networks. Besides, the wireless medium is inherently error prone. Even though a radio may have sufficient channel bandwidth, factors such as multiple accesses, signal fading, and noise and interference can cause the effective throughput in wireless networks to be significantly lower. Since wireless nodes may be mobile, the network topology can change frequently without any predictable pattern. Usually the links between nodes would be bi-directional, but there may be cases when differences in transmission power give rise to unidirectional links, which necessitate special treatment by the Medium Access Control (MAC) protocols. Ad hoc network nodes must conserve energy as they mostly rely on batteries as their power source. The security issues should be considered in the overall network design, as it is relatively easy to eavesdrop on wireless transmission. Routing protocols require information about the current topology, so that a route from a source to a destination may be found. However, the existing routing schemes, such as distance-vector and link-state based protocols, lead to poor route convergence and low throughput for dynamic topology. Therefore, a new set of routing schemes is needed in the ad hoc wireless context [12, 13]. MAC layer, sometimes also referred to as a sub layer of the Data Link layer, involves the functions and procedures necessary to transfer data between two or more nodes of the network. It is the responsibility of the MAC layer to perform error correction for

anomalies occurring in the physical layer. The layer performs specific activities for framing, physical addressing, and flow and error controls. It is responsible for resolving conflicts among different nodes for channel access. Since the MAC layer has a direct bearing on how reliably and efficiently data can be transmitted between two nodes along the routing path in the network, it affects the Quality of Service (QoS) of the network. The design of a MAC protocol should also address issues caused by mobility of nodes and an unreliable time varying channel [14].

2. NEED FOR SPECIAL MAC PROTOCOLS

The popular Carrier Sense Multiple Access (CSMA) [15] MAC scheme and its variations such as CSMA with Collision Detection (CSMA/CD) developed for wired networks, cannot be used directly in the wireless networks, as explained below. In CSMA-based schemes, the transmitting node first senses the medium to check whether it is idle or busy. The node defers its own transmission to prevent a collision with the existing signal, if the medium is busy. Otherwise, the node begins to transmit its data while continuing to sense the medium. However, collisions occur at receiving nodes. Since, signal strength in the wireless medium fades in proportion to the square of distance from the transmitter, the presence of a signal at the receiver node may not be clearly detected at other sending terminals, if they are out of range. As illustrated in Fig. 1.1, node B is within the range of nodes A and C, but A and C are not in each other's range. Let us consider the case where A is transmitting to B. Node C, being out of A's range, cannot detect carrier and may therefore send data to B, thus causing a collision at B. This is referred to as the hidden-terminal problem, as nodes A and C are hidden from each other [5].

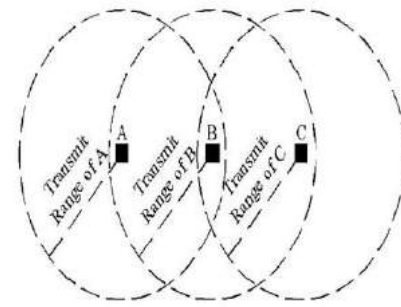


Figure 1.1: Illustration of the hidden and exposed terminal problems

Let us now consider another case where B is transmitting to A. Since C is within B's range, it senses carrier and decides to defer its own transmission. However, this is unnecessary because there is no way C's transmission can cause any collision at receiver A. This is referred to as the exposed-terminal problem, since B being exposed to C caused the latter to needlessly defer its transmission. MAC schemes are designed to overcome these problems.

II. LITERATURE SURVEY

In this section describe about related work in the field of MAC layer protocol based MANET and transmission power and rate control mechanism. Han-Chuan Luo, Eric Hsiao-Kuang Wu et al, has proposed [1] "A Transmission Power/Rate Control Scheme in CSMA/CA-Based Wireless Ad Hoc Networks" In this work, a new transmission power and rate management theme is planned to increase the network throughputs of carrier-sense-multiple access with collision avoidance (CSMA/CA)-based wireless unexpected networks with multiple transmission rates. The look principle of the scheme is to utilize the space-time resource expeditiously. For this purpose, a new live that evaluates the space-time resource consumption per bit transmission is introduced. Simulation results show that the planned scheme is effective in up

network throughputs beneath the two-ray ground reflection model and also the Ricean model Mariam Kaynia et al. proposed “Improving the Performance of Wireless Ad Hoc Networks through MAC Layer Design [2]” In this work, they study and analyze performance of the ALOHA and CSMA MAC protocols are analyzed in spatially distributed wireless networks. Researcher objective is correct reception of data packets, and thus the analysis is performed in terms of outage probability. In network model, packets belonging to specific transmitters arrive randomly in space and time according to a 3-D Poisson point process, and are then transmitted to their intended destinations using a fully-distributed MAC protocol. In his work they analyze that packet transmission successful if the received SINR is above a predefined threshold for the duration of the packet. Accurate bounds on the outage probabilities are derived as a function of the transmitter density, the number of back offs and retransmissions, and in the case of CSMA. Lu Zheng, Yingwei Yao et al. has been focus the work in the title” Decentralized Detection in *Ad hoc* Sensor Networks With Low Data Rate Inter Sensor Communication [3]” They propose a consensus based detection scheme where sensors exchange their local decisions, update their own decisions based on the exchanges and finally reach a consensus about the state of nature. They analyze the error probability and convergence of this decision consensus scheme. They show that with their scheme, the detection performance in ad-hoc networks is asymptotically equivalent to that of a parallel sensor network where all the local decisions are processed by a central node (fusion centre) in the sense that the error exponents are the same. The probability distribution of the consensus time is also studied. Kai-Ten Feng et al. has been proposed “Design and Analysis of Adaptive Receiver

Transmission Protocols for Receiver Blocking Problem in Wireless Ad Hoc Networks [4]” in this work, they focus the work in the multiple receiver transmission (MRT) and the fast NAV truncation (FNT) mechanisms and alleviate the receiver blocking problem without the adoption of additional control channels. The adaptive receiver transmission (ART) scheme is enhance the throughput performance with dynamic adjustment of the selected receivers. Analytical model is also derived to validate the effectiveness of the ART protocol. They can be observed that their proposed ART protocol outperforms the other schemes by both alleviating the receiver blocking problem and enhancing the throughput performance for the wireless multi hop ad hoc networks. Sunil Kumar , Vineet S. Raghavan et al, proposed “Medium Access Control protocols for ad hoc wireless networks: A survey [5]” in this paper describe about MAC protocols, the various issues involved in have mostly been presented in isolation of each other. Sunil Kumar et al present a classification of MAC protocols and their brief description, based on their operating principles and underlying features. In conclusion, they present a brief summary of key ideas and a general direction for future work. Khaled Abdullah Mohd Al Soufy et al, proposed “A Quality of Service Aware Routing for TDMA-Based Ad hoc Networks[6]” In this paper, they propose a QoS aware routing for *time division multiple access* (TDMA) based ad hoc networks. Their protocol tries to identify multiple paths each of which is capable of providing the QoS in terms of the number of time slots at its own or by combining it to a group of paths. The protocol incorporates a procedure to determine the available time slots in a localized and distributed fashion. Kuei-Ping Shih et al. proposed” A Physical Virtual Carrier-Sense-Based Power Control MAC Protocol for

Collision Avoidance in Wireless Ad Hoc Networks [7]” in his work they utilizes physical and virtual carrier-sensing schemes to avoid the POINT problem. They analyze the relationships among the transmission range, the carrier-sensing range, and the interference range in case power control is adopted, and based on their results; they propose four mechanisms to prevent the POINT problem from occurring in wireless ad hoc networks. This work further analyzes the superiority of each mechanism under certain situations and they propose an adaptive range-based power control (ARPC) MAC protocol to make use of the advantages of the four mechanisms to avoid the POINT problem from happening. Their proposed protocol cannot only prevent collisions caused by the POINT problem, but it can also reduce the energy consumption of STAs. Nikolaos A. Pantazis et al. has been proposed “Energy-Efficient Routing Protocols in Wireless Sensor Networks: A Survey [8]” In this work, energy efficient routing protocols are classified into four main schemes: Network Structure, Communication Model, Topology Based and Reliable Routing. The routing protocols belonging to the first category can be further classified as flat or hierarchical. The routing protocols belonging to the second category can be further classified as Query-based or Coherent and non coherent based or Negotiation based. The routing protocols belonging to the third category can be further classified as Location based or Mobile Agent based. The routing protocols belonging to the fourth category can be further classified as QoS-based or Multipath based. Then they take analytical survey on energy efficient routing protocols for WSNs is provided. Author is, the classified initially proposed by Al-Karaki, is expanded, in order to enhance all the proposed papers since 2004 and to better describe

which issues operations in each protocol illustrate enhance the energy efficiency issues.

1. PROBLEM STATEMENT AND MOTIVATION

In MANET Multiple sender compete channel with transmission and rate control based mechanism, it’s a challenging task, so in this paper define the problem to Enhanced Power aware and rate control in CSMA/CA based Mobile Ad-Hoc Communication. With the help of MAC (media Access control) and 802.11 standards resolve the problem of collision and congestion in mobile ad-hoc network. And analyze the performance based on the total transmission power utilization, rate based congestion and collision control etc. In his approach find out the number of collision packets at the time of CSMA/CA and proposed technique and resolve collision through enhanced CSMA/CA mechanism. In proposed work simulate under the AODV (Ad-hoc on demand distance vector) protocol and analyze result in the form of routing overhead minimization, throughput, packet delivery ratio and TCP (transfer control protocol), UDP (User datagram protocol). The above approach is simulated through network simulator (NS-2). In that work try to minimize transmission power consumption, rate based congestion control of the network. Mobile ad-hoc network is dynamic in nature with no centralized control. Each node is capable of routing table maintenance but a major problem is the rapid change of topology and without lack of knowledge about node motion. So, if more than one sender sends data packet to multiple destinations or simultaneously data packets arrive at intermediate nodes, packets collide and data packets are discarded by the node. That work motivates to design the collision-free transmission and rate control mechanism and get enhanced outcomes.

2. OBJECTIVE

Mobile ad-hoc network is dynamic decentralized network where each node feels free to communicate with the help of intermediate nodes. But it's a crucial for manage with reference of collision and congestion free communication, because multiple sender node compete the single channel and resource so aim to design the network with following objective

- Proposed scheme provides efficient and fast data transmission with collision free communication and maximum channel utilization.
- It's provides congestion control technique through contention mechanism.
- Proposed mechanism is transmission power control and minimum utilization of the power of network.
- It's provide rate control technique and decreased data drop and collision from the define network
- Proposed work better perform in all aspect of network parameter.

III. PROPOSED WORK

Media access control layer play the major role to provide the communication between different devices, that sense the medium and allocate the channel to the transmitter based on the mode (ideal, busy). The layer is collectively connected from sender to the destination and transform packet into frame with medium and channel availability based. Wireless mobile ad-hoc communication uses the different media access technique but know a day efficient channel utilization based media access mechanism is CSMA/CA. in this section describe about the principle of proposal that enhance the performance of the network with transmission and rate control mechanism under CSMA/CA, according to define problem statement initially create TCL script for simulation and set the

parameters for each layer, then set physical property, channel type, antenna type and transmission, receiving power requirement of each mobile nodes etc. in the proposal define the omni directional antenna that provides radio range equally to all directions. After setting physical property, set the MAC as a CSMA/CA for carrier sensing multiple accesses with collision avoidance. In next step network layer protocol as AODV (ad-hoc on demand distance vector routing) used for route establishment between communicator nodes. During the routing execution sender broadcast the routing packet and identifies the minimum power consumption path as well as maximum channel utilization from source to destination that work reduce the transmission and receiving power utilization of network. Here CSMA/CA also enhanced by the rate based congestion control technique in that case if any route path node in between the path and congestion occur in that node than congested node send the congestion acknowledgment packet to the sender so sender minimize the data rate and control the congestion from the network. Proposed work aim to enhance the network performance like throughput, packet delivery ratio, transmission power consumption and congestion minimization using MAC layer based CSMA/CA approach. In CSMA/CA technique, from a network point of view, one of the primary reasons for using the RTS/CTS mechanism is to avoid network congestion. According to RTS/CTS mechanism, sender node sends RTS packet ("request to send" packet) to destination. The destination that receives the RTS packet, broadcasts to all neighbors, including sender node, the "clear to send" message so that only first RTS sender node communicates to destination node. All other nodes must wait for next round-trip-time. These mechanisms provides collision free communication of

nodes and get better output on the bases of throughput, power consumption and packet delivery ratio etc.

VI. SIMULATION ENVIRONMENT AND RESULT

DISCUSSION

Simulation will be done in Network Simulator- 2 (NS-2). The description about simulation environment is as follows:

Network simulator 2 (NS2) is the result of an on-going effort of research and development that is administrated by researchers at Berkeley [16]. It is a discrete event simulator targeted at networking research. It provides substantial support for simulation of TCP, routing, and multipath protocol. The simulator is written in C++ and a script language called OTcl2. NS uses an Otcl interpreter towards the user. This means that the user writes an OTcl script that defines the network (number of nodes, links), the traffic in the network (sources, destinations, type of traffic) and which protocols it will use. This script is then used by ns during the simulations. The result of the simulations is an output trace file that can be used to do data processing (calculate delay, throughput etc) and to visualize the simulation with a program called Network Animator.

1. Simulation Parameters: - Further take the experiments based on given parameter with the help of network simulator. According to below table 1 the simulate network.

2. Performance Evaluation Metrics: - There are following different performance metrics have been considered to make the comparative study of these routing protocols through simulation.

Table 1: Simulation parameter

Number of nodes	30
Dimension of simulated area	800×600
Routing Protocol	AODV
Simulation time (seconds)	100
MAC Layer	CSMA/CA
Transport Layer	TCP ,UDP
Traffic type	CBR , FTP
Packet size (bytes)	1000
Number of traffic connections	10
Maximum Speed (m/s)	Random

1) Routing overhead: This metric describes how many routing packets for route discovery and route maintenance need to be sent so as to propagate the data packets.

2) Average Delay: This metric represents average end-to-end delay and indicates how long it took for a packet to travel from the source to the application layer of the destination. It is measured in seconds.

3) Throughput: This metric represents the total number of bits forwarded to higher layers per second. It is measured in bps

4) Packet Delivery Ratio: The ratio between the amount of incoming data packets and actually received data packets.

5) Transmission Power consumption: That is total power consumption for data transmission in given simulation time.

IV. RESULT ANALYSIS

The simulation results of normal CSMA/CA and proposed improved channel access method is mentioned in this result section

1. *Summarized Performance Analysis:* - The simulation results of old and proposed scheme is mentioned in table2 and we observe that the performance of proposed scheme is better in network. The packets sending are more because the channel utilization in proposed scheme is better.

Table 2 Summarized Analyses

Parameter	Old	Proposed
SEND	9141	15819
RECV	6756	15507
ROUTINGPKTS	774	550
PDF	73.91	98.03
Average e-e delay(ms)	5.45	1.14
NRL	0.11	0.04

2. *Drop Analysis:* - The number of packets drop in network is improves the possibility of performance degradation in dynamic network. The number of packets drops analysis in case of normal carrier access control scheme is less but in proposed scheme it is improves and provides better network performance with minimizes the drop of data.

Table 3 Drop Analysis of Old and Proposed Scheme

Drop Reasons	All Type Packet Drop Analysis Old		All Type Packet Drop Analysis Proposed	
	Count	Percentage	Count	Percentage
Drop from Contention	1		3	
Drop from Queue	89		50	
Drop from Timeout & Call back	0		0	
Total Drop Via Congestion	2465		317	
Total Drop	2555	13.29%	370	1.15%
Actual Performance	16671	86.71%	31876	98.85%

3. *Data send Analysis:* - The data sending in dynamic network is completely depending on the data receiving in network. In this analysis the data sending in proposed scheme is about 40% more in proposed

scheme that is the sigh of better and vigorous network performance.

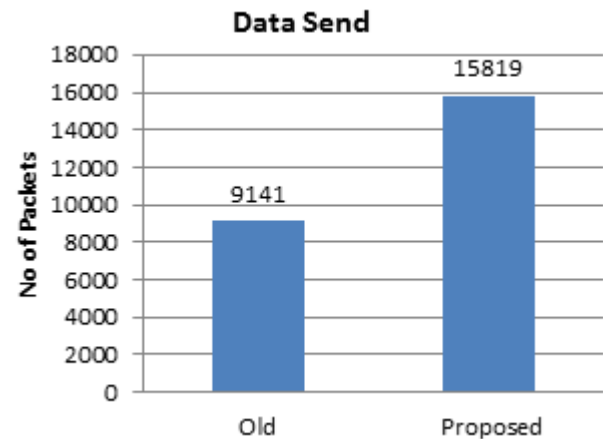


Fig.5.1 Data sending Analysis

4. *Data Receives Analysis:* - The data sending with respect to data receiving is better in proposed scheme. In this scheme the data drop in old carrier sense scheme is clearly visible more although the data sending is also less than proposed scheme. The data loss is about more than 2000 in old scheme but in improves performance the loss is under 1000 packets.

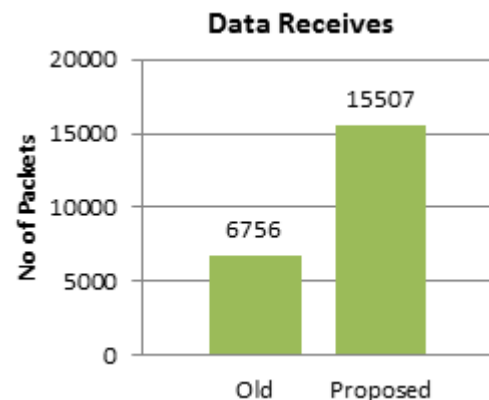


Fig.5.2 Data Receiving Analysis

5. *Routing Load Analysis:* - The performance of routing packets flooding in network is evaluated in this graph and observes that the performance of proposed scheme is better in network. The more routing packets flooding is shows degradable routing performance but the proposed scheme lower routing packets flooding shows better routing overhead performance.

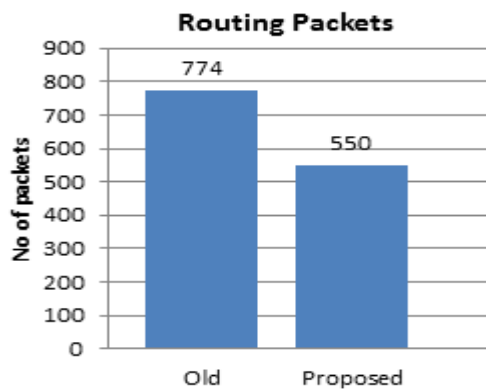


Fig.5.3 Routing Packets Analysis

6. *Packet Delivery Ratio analysis:* - The Packet Delivery Ratio (PDR) performance is shows the percentage ratio of packets receiving by sending in network. The packets percentage performance of proposed scheme is better about 98% in network but the performance of normal carrier sense scheme is about 73 % in network.



Fig: 5.4 PDF Analyses

7 *Average Ends-to End Delay:* - The measurement of delay analysis in required identifying the how much time is more taken by in network by any protocol or technique to sending and receiving data in network. In this graph the delay performance of old scheme is about more than four times as compare to proposed scheme. It implies that the packets receiving in old case are affected due to retransmission that is the main cause of delay. But in proposed the carrier utilization is better by that performance is also better.

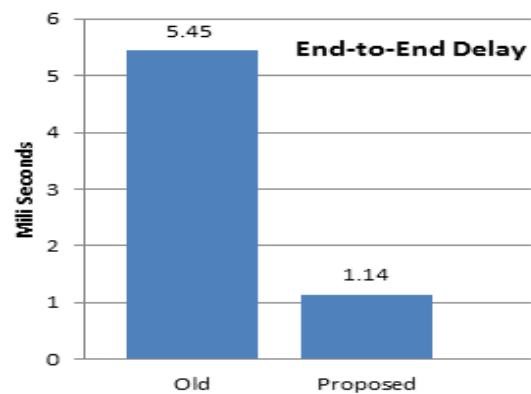


Fig: 5.5 Delay Analyses

8. *Throughput Analysis:* - In this graph the throughput performance is evaluated and if throughput is high, it means that the network performance is very good. Here we compare the simulation result on the basis of throughput graph with these media access techniques. According to deployment CSMA/CA gives better throughput nearly 900 but proposed throughput is nearly 2700. The proposed scheme is really effective because performance gap is really more as compare to normal carrier scenes technique.

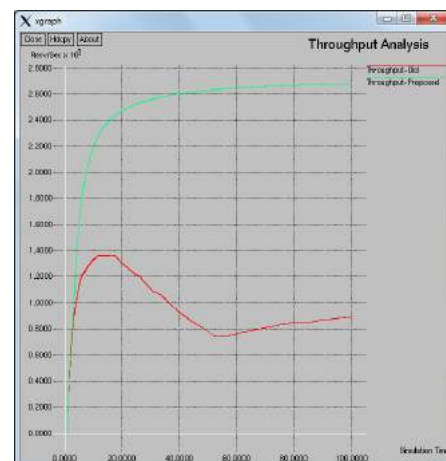


Fig.5.6 Throughput Analysis

9 *Packet Delivery Ratio Analyses (Starting to End)*

Packet delivery ratio is a ratio between the number of packets received by the authentic receiver and the number of genuine packets sent by sender at current time. If packet delivery ratio is high, it means performance is very good. Here in this graph we analyze the packet delivery ratio and we conclude that

in proposed scheme and normal CSMA/CA case. The packet delivery ratio is 98% .i.e. about full data is delivered to the destination in proposed scheme and old performance is less.

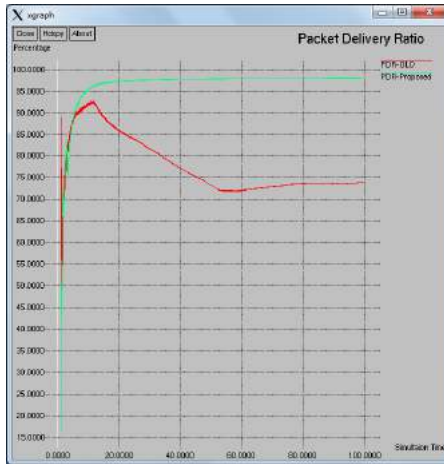


Fig.:5.7 PDR Analysis of Simulation

10 UDP Data Send Analysis:- In this graph we analyze UDP result through gnu-plot at the time of proposed collision control scheme and CSMA/CA. Basically, the results shows that the packets sending of proposed scheme is better and provides better communication. The performance of old scheme is also is not satisfactory means only 220 packets are sending in network.

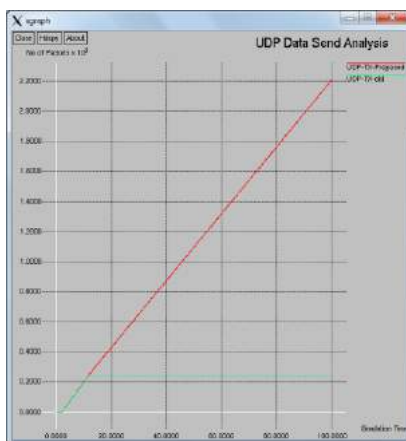


Fig: 5.8UDP End Sending Analysis

5.3.11 UDP Data Receives Analysis

UDP works as an agent between application and network layer and also provides un-reliable

communication because UDP cannot send acknowledgment. Here x-axis shows Time/second and y-axis shows number of packets. The red line shows the result at the time of proposed CSMA/CA packets receiving analysis and green represents normal CSMA/CA analysis. The total packets received by the receiver is 200 packets CSMA/CA (carrier sense multiple access with collision avoidance) time and in proposed scheme total packet received by the receiver is nearby 2200 packets. This concludes that our packet reception is better.

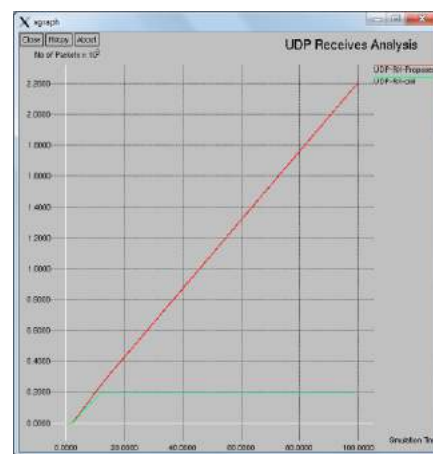


Fig: 5.9 UDP End Receiving Analyses

12. UDP Data Drop Analysis:- Collision problem comes in wireless communication if we are unable to use RTS (request to send) and CTS (clear to send) messages or time division multiple access technique. Here more than one sender nodes share common intermediate nodes that create collision problem thus leading to drop of data packet. We analyze collision through data drop while applying proposed scheme and old CSMA/CA scheme. Here huge number of data packets are being dropped i.e. nearly 40 packet drop in network. The proposed scheme resolves that problem by that negligible loss in network in proposed scheme.

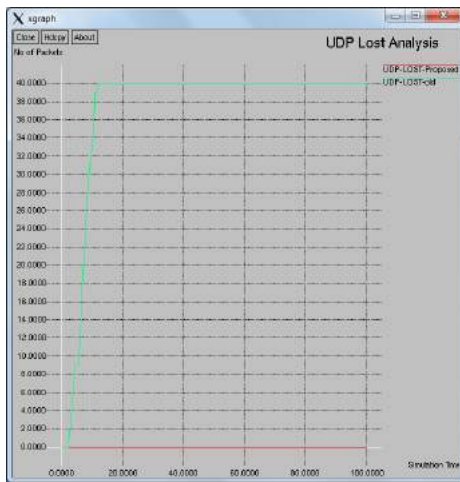


Fig: 5.10 UDP End Drop Analyses

13 Routing Load Analysis (Started to End):-

According to various definitions if routing overhead is minimum, our performance is very good. Whereas if the number of routing packets is very high, it can be concluded that the network performance is poor because maximum bandwidth and time is being used by the routing packets. According to resultant graph, the routing overhead is maximum in case of routing old (nearly 800 routing packets) and minimum in case of proposed approach (nearly 550 routing packets). The proposed performance is much better with minimum routing flooding.

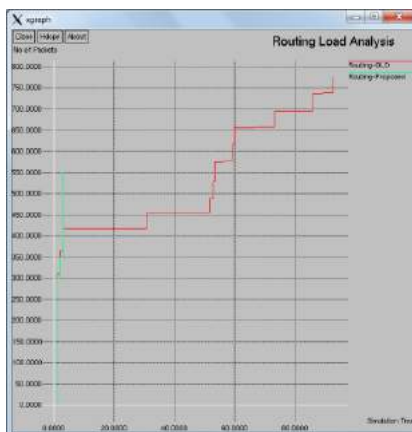


Fig: 5.11 Routing Load Analysis of Simulation

V. CONCLUSION & FUTURE SCOPE

In this paper, focus the survey about different technique of congestion control mechanism and

identifies that CSMA/CA MAC technique are better and feasible for recent trends of wireless mobile ad-hoc network. The new power and rate control scheme uses CSMA/CA mechanism and resolve the problem of congestion, contention as well as rate control for minimization the power utilization of the nodes and data drop from the network. Proposed work increases the network throughputs, packet delivery ratio of the network and decreased the routing overhead and gives efficient communication for participant nodes. In future uses network simulator-2 and analyzed all network behavior in event analyses based. In future, enhance the work using multipath and multiple channel based methodology, and for better efficiency, some of location aware mechanism applies and minimized the overhead of current offer load. Further proposed work useful for the bigger network like WiMAX zone and control the congestion, collision, congestion based data drop, while nodes are increases. Another issue of MANET is security, but in this dissertation cannot consider that security issue so far that some of security technique are apply and protect the network while any attacker node drop the data.

REFERENCES

- [1]. Han-Chiuan Luo, Eric Hsiao-Kuang Wu, Member, IEEE, and Gen-Huey Chen, A Transmission Power/Rate Control Scheme in CSMA/CA-Based Wireless Ad Hoc Networks, IEEE transactions on vehicular technology, vol. 62, no. 1, January 2013.
- [2]. Mariam Kaynia, Student Member, IEEE, Nihar Jindal, Member, IEEE, and Geir E. Øien, Senior Member, IEEE, Improving the Performance of Wireless Ad Hoc Networks through MAC Layer Design, IEEE transactions on wireless communications, vol. 10, no. 1, January 2011.
- [3]. Lu Zheng, Yingwei Yao, Member, IEEE, Mo Deng, and Stephen S. T. Yau, Decentralized

- Detection in Ad hoc Sensor Networks with Low Data Rate Inter Sensor Communication, IEEE transactions on information theory, vol. 58, no. 5, may 2012.
- [4]. Kai-Ten Feng, Member, IEEE, Jia-Shi Lin, Student Member, IEEE, and Wei-Neng Lei, Design and Analysis of Adaptive Receiver Transmission Protocols for Receiver Blocking Problem in Wireless Ad Hoc Networks, IEEE transactions on mobile computing, vol. 12, no. 8, august 2013.
- [5]. S. Kumar, V. S. Raghavan, and J. Deng, "Medium Access Control Protocols for Ad-Hoc Wireless Networks: A Survey," Elsevier Ad Hoc Networks, vol. 4, no. 3, pp. 326-358, May 2006.
- [6]. Khaled Abdullah Mohd Al Soufy, Ash Mohammad Abbas, A Quality of Service Aware Routing Using Multiple Paths for TDMA-Based Ad hoc Networks, International Journal of Web Applications, Volume 2 Number 1, March 2010
- [7]. Kuei-Ping Shih, Member, IEEE, Yen-Da Chen, and Chau-Chieh Chang, A Physical/Virtual Carrier-Sense-Based Power Control MAC Protocol for Collision Avoidance in Wireless Ad Hoc Networks, IEEE transactions on parallel and distributed systems, vol. 22, no. 2, february 2011
- [8]. Nikolaos A. Pantazis, Stefanos A. Nikolidakis and Dimitrios D. Vergados, Energy-Efficient Routing Protocols in Wireless Sensor Networks: A Survey, IEEE communications surveys & tutorials, vol. 15, no. 2, second quarter 2013.
- [9]. Supplement to IEEE Standard for Information Technology Telecommunications and Information Exchange between Systems Local and Metropolitan Area Networks-Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Higher-Speed Physical Layer Extension in the 2.4 GHz Band, IEEE Std. 802.11b, 2000.
- [10]. G. J. Foschini and Z. Miljanic, "A simple distributed autonomous power control algorithm and its convergence," IEEE Trans. Veh. Technol., vol. 42, no. 4, pp. 641-646, Nov. 1993.
- [11]. N. Bambos, S. C. Chen, and G. J. Pottie, "Channel access algorithms with active link protection for wireless communication networks with power control," IEEE/ACM Trans. Netw., vol. 8, no. 5, pp. 583-597, Oct. 2000.
- [12]. E.M. Royer, C.K. Toh, A review of current routing protocols for ad hoc mobile wireless networks, IEEE Personal Commun. 6 (2) (1999) 46-55, April.
- [13]. Charles E. Perkins, Ad Hoc Networking, Addison Wesley, Reading, MA, 2001.
- [14]. C. K. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice-Hall PTR, 2002.
- [15]. L. Kleinrock, F.A. Tobagi, Packet switching in radio channels: Part I carriers sense multiple access modes and their throughput-delay characteristics, IEEE Trans. Comm. Dec, 1975.
- [16]. The Network Simulator – ns-2
<http://www.isi.edu/nsnam/ns/>.