IEEE 802.11KT MAC Protocol: A New Proposed IEEE 802.11 Mac Protocol for Wireless Communication

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ABSTRACT
IEEE 802.11KT MAC protocol is a new proposed wireless network protocol for wireless communication and wired communication. It is an energy efficient and high throughput wireless communication protocol with less delay. This paper is subjected to comprehensive l performance analysis between IEEE 802.11 MAC protocol and a new proposed IEEE 802.11KT Mac protocol with DSDV routing protocol for random topology using Network Simulator-2.This paper have experimental and analytical simulation observation for important parameters for existing IEEE 802.11 Mac protocol and proposed IEEE 802.11KT Mac protocol. This papers observed that a proposed IEEE 802.11KT Mac protocol is superior in performance than existing IEEE 802.11 MAC protocol. A proposed IEEE 802.11KT Mac protocol can be used as wireless communication network protocol with any type of routing protocol for any type of network topology.

Keywords
DSDV, IEEE 802.11, NS-2 Simulation.

1. INTRODUCTION
A Mobile Ad hoc Networks is a wireless communication network that represents a system of wireless mobile nodes which can be freely and dynamically self-organize into arbitrary and temporary network topologies, allowing people and devices to seamlessly communicate without any pre-existing communication architecture. Every mobile node in this network acts as a router, forwarding data packets information from one node to other nodes. A DSDV routing protocol is used to find routes between two communicating nodes efficiently. The goal of this paper is to carry out a systematic experimental and analytical comparative study of performances of existing IEEE 802.11 MAC & proposed IEEE MAC protocol i.e. IEEE 802.11KT Mac protocol for Random topology for mobile ad hoc networks.. The rest of the paper is organized as follows: The work contributed in this area is provided in section II. The IEEE 802.11 MAC protocol, DSDV routing protocol & IEEE 802.11KT MAC protocol description is summarized in section III. The simulation environment and performance metrics are described in Section IV .The simulation results and observation are described in section V and the conclusion is presented in section VI.

2. RELATED WORK
A Several researchers have done the qualitative and quantitative analysis of Ad Hoc Routing Protocols by means of different performance metrics. They have used different simulators for this purpose. *Rafi U Zamam et.al* [1] studied & compared the performance of DSDV, AODV and DSR routing protocols for ad hoc networks using NS-2 simulations. In this paper, author observed that the competitive reactive routing protocols, AODV and DSR, both show better performance than the other in terms of certain metrics. It is still difficult to determine which of them has overall better performance in MANET. *Vahid Garousi et.al* [2] studied an analysis of network traffic in ad-hoc networks based on the DSDV protocol with an emphasis on mobility and communication patterns of the nodes. In this paper, he observed that simulations measured the ability of DSDV routing protocol to react to multi-hop ad-hoc network topology changes in terms of scene size, mobile nodes movement, number of connections among nodes, and also the amount of data each mobile node transmits. *Das,S.R., Perkins,C.E. et.al* [4] studied & compared the performance of DSDV, AODV and DSR routing protocols for ad hoc networks using NS-2 simulations. In this paper, they observed that DSDV uses the proactive table-driven routing strategy while both AODV and DSR use the reactive on-demand routing strategy. Both AODV and DSR perform better under high mobility simulations than DSDV. High mobility results in frequent link failures and the overhead involved in updating all the nodes with the new routing information as in DSDV is much more than that involved AODV and DSR, where the routes are created as and when required. *Chao,C-M. et.al [5]* studied the performance comparison based on packet delivery fraction and normalized routing load. In the future, extensive complex simulations could be carried out in gain a more in-depth performance analysis of the ad hoc routing protocols. This would include delay of data packet delivery and performance comparison on location-based ad hoc routing protocols.

3. DESCRIPTION OF THE PROTOCOLS
This section briefly describes the key features of IEEE 802.11 protocol, DSDV routing protocol & a new proposed IEEE 802.11KT Mac protocol.

A) IEEE 802.11 Mac Protocol

The basic access method in the IEEE 802.11 MAC protocol is DCF, which is based on carrier sense multiple access with collision avoidance (CSMA/CA). Before starting a transmission, each node performs a backoff procedure, with
the backoff timer uniformly chosen from [0, CW − 1] in terms of time slots, where CW is the current contention window. When the backoff timer reaches zero, the node transmits a DATA packet. If the receiver successfully receives the packet, it acknowledges the packet by sending an acknowledgment (ACK). If no ACK is received within a specified period, the packet is considered lost; so the transmitter will double the size of CW, choose a new backoff timer, and start the above process again. When the transmission of a packet fails for a maximum number of times, the packet is dropped. To avoid collisions of long packets, the short request to send/clear to send (RTS/CTS) frames can be employed. Note that the IEEE 802.11 MAC also incorporates an optional access method called PCF, which is

only usable in infrastructure network configurations and is not supported in most current wireless cards.

B) Destination Sequenced Distance Vector (DSDV) protocol

Destination Sequenced Distance Vector Protocol (DSDV) is a proactive, distance vector protocol which uses the Bellmann -Ford algorithm. DSDV is a hop-by hop distance vector routing protocol, wherein each node maintains a routing table listing the "next hop" and "number of hops" for each reachable destination. This protocol requires each mobile station to advertise, to each of its current neighbors, its own routing table (for instance, by broadcasting its entries). The entries in this list may change fairly dynamically over time, so the advertisement must be made often enough to ensure that every mobile computer can almost always locate every other mobile computer of the collection. In addition, each mobile computer agrees to relay data packets to other computers upon request. This agreement places a premium on the ability to determine the shortest number of hops for a route to a destination we would like to avoid unnecessarily disturbing mobile hosts if they are in sleep mode. In this way a mobile computer may exchange data with any other mobile computer in the group even if the target of the data is not within range for direct communication.

C) MAC 802.11KT protocol

The MAC 802.11KT protocol modifies the IEEE 802.11 RTS/CTS handshake on transmitter (RTS) and receiver (CTS), respectively. This protocol have various inter frame space, new contention window for minimum and maximum size to obtain high system throughput and small end to end delay, new small time duration frame for RTS and CTS control frame. This protocol proposes the security mechanism, power management mechanism, synchronization mechanism, association and reassociation mechanism of nodes with access point. It also proposes a new management information base required for network management purpose for external entities. The goal of this paper is to experimentally and analytically study the performance of a new proposed IEEE 802.11KT Mac protocol and compared its performance with existing IEEE 802.11 Mac protocol for wireless communication. The observation of this paper indicates that the proposed IEEE 802.11KT Mac protocol have better performance than existing IEEE 802.11 Mac protocol for any type of topology in MANET.

4. SIMULATION ENVIRONMENT

A. Simulation Model

This section have given the emphasis for the simulation of performance of IEEE 802.11 MAC protocol and IEEE 802.11KT MAC protocol with DSDV as routing protocol varying the mobility of mobile nodes. The simulations have been performed using network simulator NS-2 [12]. The network simulator ns-2 is discrete event simulation software for network simulations which means it simulates events such as sending, receiving, forwarding and dropping packets. The latest version, ns-allinone-2.34, supports simulation for routing protocols for ad hoc wireless networks such as AODV, TORA, DSDV, and DSR. Ns-2 is written in C++ programming language and Object Tool Common Language (OTCL). Although ns-2.34 can be built on various platforms, we chose a Linux platform [FEDORA 7] for this paper, as Linux offers a number of programming development tools that can be used along with the simulation process. To run a simulation with ns-2.34, we have written the simulation script in OTCL, got the simulation results in an output trace file. The performance metrics are calculated using AWK file and the result graphically visualized. Ns-2 also offers a visual representation of the simulated network by tracing nodes movements and events and writing them in a network animator (NAM) file.

B. Simulation Parameters

We consider a network of nodes placing within a 2200m X 500m area. The performances of IEEE 802.11 MAC and 802.11KT MAC are evaluated by keeping the network payload constant and varying the mobility of mobile nodes. Table 1 shows the simulation parameters used in this valuation.

TABLE 1
PARAMETERS VALUES FOR SIMULATION

Simulation Parameters	
Simulator	ns-2.34
MAC Protocols	IEEE 802.11 Mac ,IEEE802.11KT Mac
Simulation duration	200 seconds
Simulation area	2200 m x 1000 m
Number of nodes	50
Transmission range	250 m
Movement model	Random topology
Routing Protocol	DSDV
Maximum speed	5,10,15,20,25,30m/s
Packet rate	6 packets/sec
Traffic type	CBR
Data payload	1024 bytes/packet

C. Performance Metrics

While analysing IEEE 802.11 MAC protocol and 802.11KT MAC with random topology, we focused on performance metrics such as Generated Packets vs. No. of nodes, Received Packets Vs. no. of nodes, Packet delivery ratio Vs. no. of nodes, Total dropped packets Vs. no. of nodes, Average end to end delay Vs. No. of nodes.

5. SIMULATION RESULTS & OBESRVATION

The simulation results are shown in the following section in the form of line graphs. The performance of IEEE 802.11 MAC and 802.11KT MAC protocol are done based on the mobility of the node. The perform matrix consists of parameters like Total packets generated, Packets dropped, Packets Delivery ratio & Average End to End delay,. "Fig. 1" shows the creation of 50 numbers of mobile nodes in random topology. "Fig.2" highlights the movement of nodes in the with the mobility of 5 m/s. It is observed that the nodes are communicating with each other.

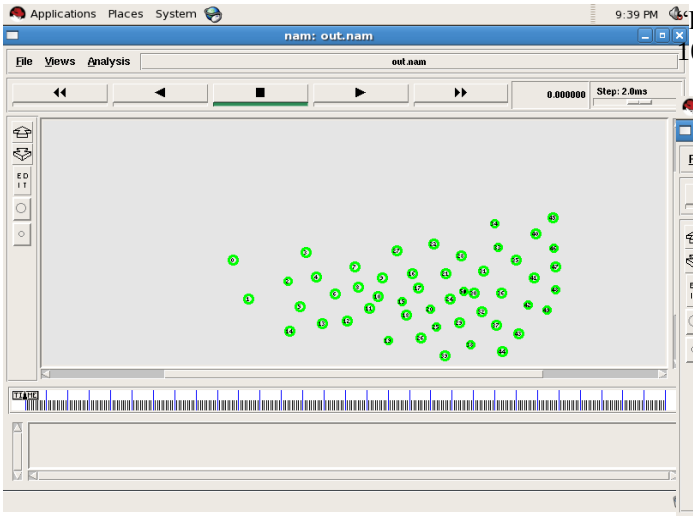

Fig 1. 50 numbers of nodes in rural village in random Topology

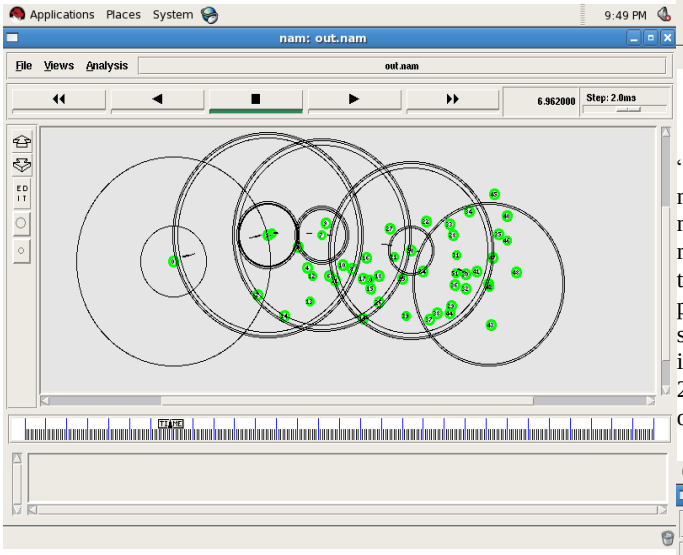

Fig 2. Mobility of nodes with 5 m/s

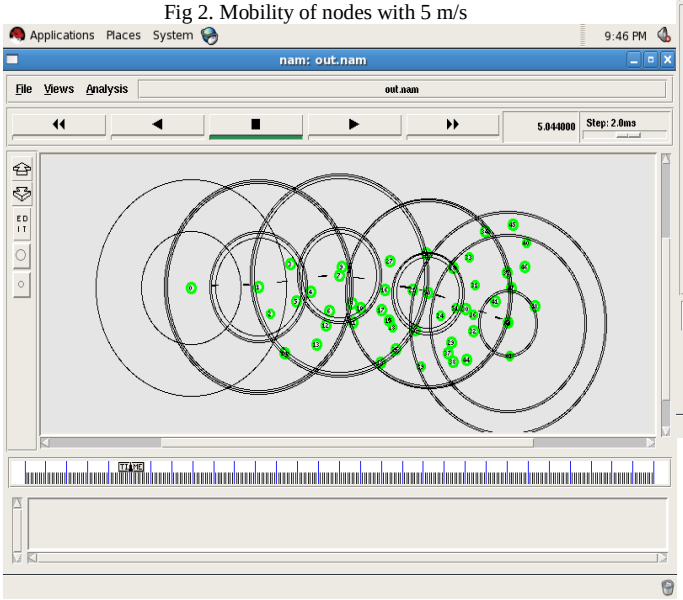

Fig 3. Mobility of nodes with 10 m/s

"Fig. 3" highlights movement of nodes with mobility of 10 m/s.

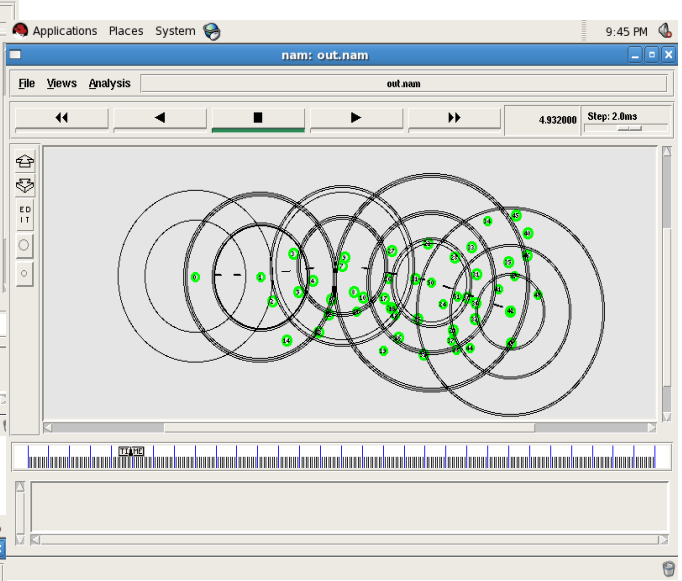

Fig 4. Mobility of nodes with 15 m/s

"Fig.4" illustrates data packet communication between nodes at mobility at 15 m/s.. It represent that at this mobility, nodes are maintaining synchronisation between them. "Fig.5" highlights movement of mobile nodes with mobility of 20 m/s . It illustrate that at high mobility, nodes are changing their position with proper coordination between them. There is a perfect synchronisation and communication between them. "Fig. 6" illustrate the position of various node reached with a mobility of 25 m/s. It highlights those nodes able to communicate with each other with minimum data packets dropped.

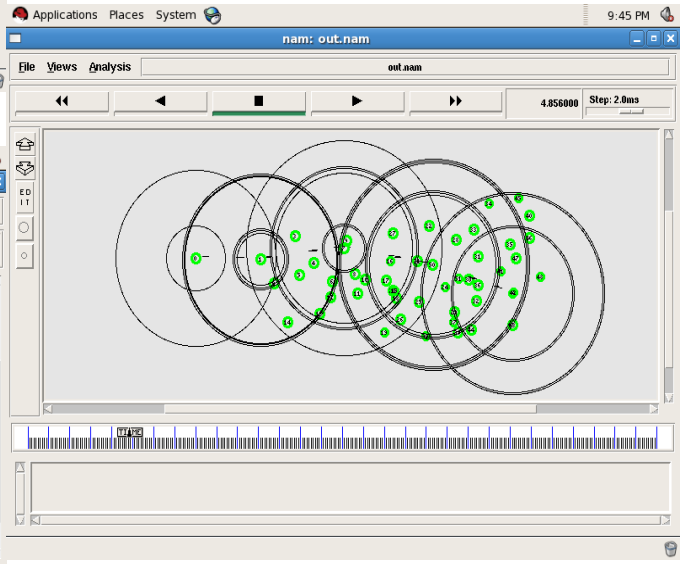

Fig 5. Mobility of nodes with 20 m/s

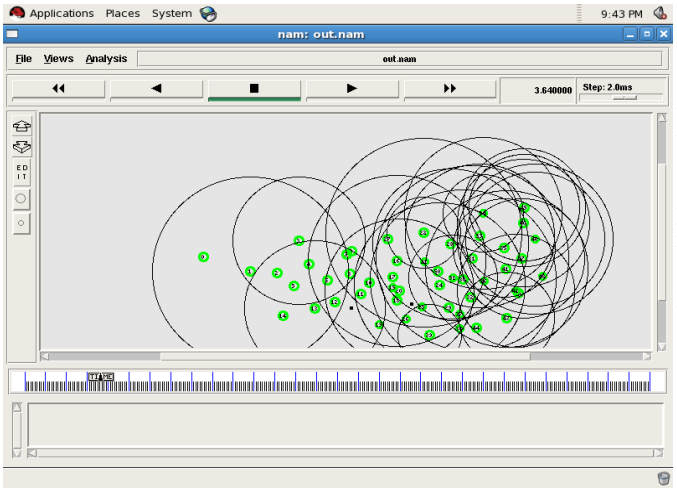

Fig. 6. Mobility of nodes with 25 m/s

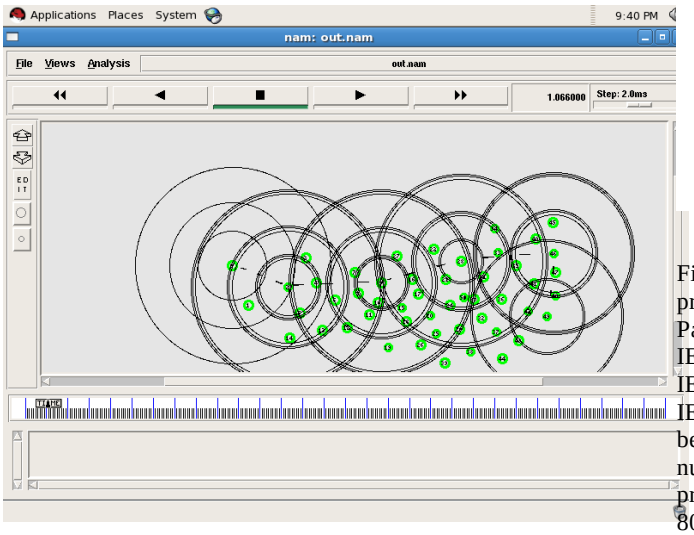

Fig. 7. Mobility of nodes with 30 m/s

"Fig. 7" illustrates the final position of location of 50 nodes a with a mobility movement of 30 m/s. At such high mobility (approximately 90 Km/hr.),mobile nodes are maintaining proper synchronisation with minimum numbers of data packet dropped, minimum end to end delay and high packet delivery ratio i.e. high throughput.

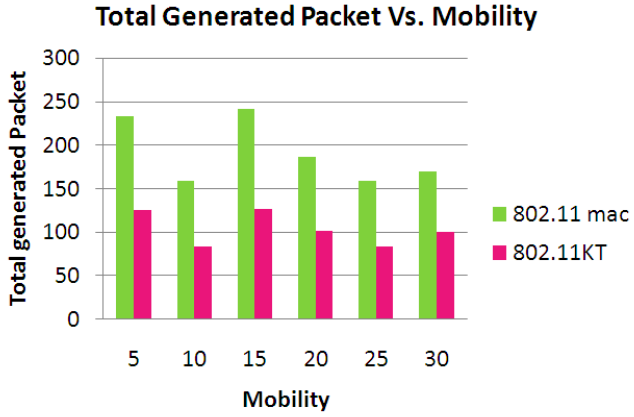

Fig 8.Total Generated Packets vs. Mobility

"Fig. 8" highlights the relative performances of IEEE 802.11 MAC protocol and 802.11KT MAC protocol for Generated Packets with varying mobility of nodes. Green color coloumn indicates IEEE 802.11 Mac protocol and pink color coloumn indicates IEEE 802.11KT Mac protocol. From figure it is observed that data packet required to transfer information from source to destination is small for IEEE 802.11KT MAC protocol than IEEE 802.11 MAC protocol. IEEE 802.11KT Mac required approximately 20% less data packet than IEEE 802.11 Mac to transfer information. This saves considerable amount of power of transmitter.

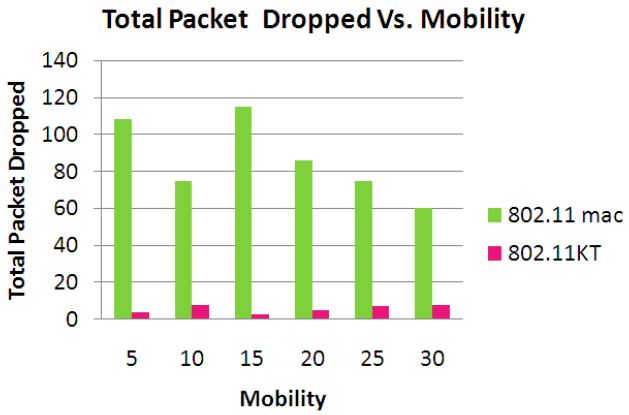

Fig 9. Total Dropped Packets Vs. Mobility

Fig.9 highlights the relative performance of IEEE 802.11 MAC protocols and IEEE 802.11KT MAC protocol for Total Dropped Packet with mobility of nodes. Green color coloumn indicates IEEE 802.11 Mac protocol and pink color coloumn indicates IEEE 802.11KT Mac protocol. From figure it is observed that IEEE 802.11KT MAC protocol provides better synchronisation between nodes than IEEE 802.11 MAC. Therefore, there is less numbers of data packet losses for IEEE 802.11KT MAC protocol. IEEE 802.11KT Mac protocol have approximately 80% less total dropped packet than IEEE 802.11 protocol This helps in providing better redundancy of information transmission between nodes of rural village area and complete information is communicated between them. Fig.10. highlights the relative performance of IEEE 802.11 MAC protocol and IEEE 802.11KT MAC protocol for Packet Delivery Ratio with mobility of nodes. Green color coloumn indicates IEEE 802.11 Mac protocol and pink color coloumn indicates IEEE 802.11KT Mac protocol. From figure it is observed that IEEE 802.11KT Mac protocol have better performance over IEEE 802.11 MAC protocols in term of Packet Delivery Ratio. IEEE 802.11KT MAC protocol have better synchronisation between nodes, dropped less number of data packets and delivered more data packets to the destination than IEEE 802.11 MAC protocols. Hence, IEEE 802.11KT protocol have more throughput of system network than IEEE 802.11 MAC protocol. IEEE 802.11KT Mac protocol have approximately 50% more packet delivery ratio than IEEE 802.11 Mac protocol.

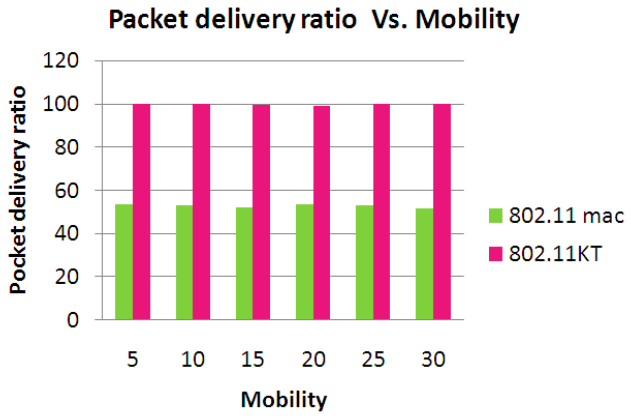

Fig.10. Packet Delivery Ratio Vs. numbers of nodes

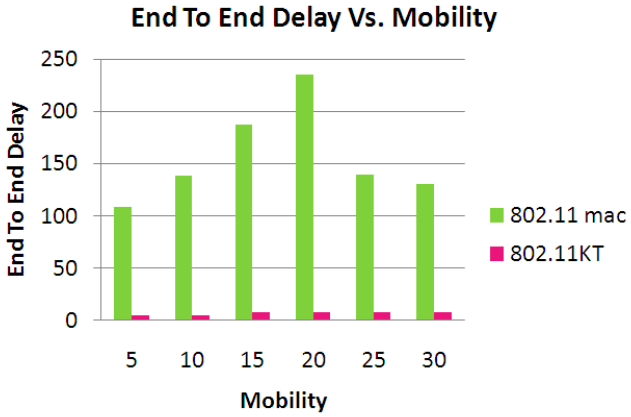

Fig.11. End to End delay Vs. Mobility

Fig.11 highlights the relative performance of IEEE 802.11KT protocol and IEEE 802.11 MAC protocol for Average End To End delay with mobility of nodes. Green color coloumn indicates IEEE 802.11 Mac protocol and pink color coloumn indicates IEEE 802.11KT Mac protocol. From figure it is observed that IEEE 802.11KT MAC protocol have better performance over IEEE 802.11 MAC protocol in terms of Average End To End delay. Beacon frame of IEEE 802.11KT MAC protocol provides efficient synchronization than IEEE 802.11 MAC between nodes. These results in better data transfer with minimum time required and improve the end to end delay. IEEE 802.11KT Mac protocol has approximately 90% better end to end delay than IEEE 802.11 Mac protocol.

6. CONCLUSION

The work presented in this paper gave an overview of relative experimental and analytical performance comparison of available IEEE 802.11 MAC protocol and IEEE 802.11KT MAC protocol in random topology. The experimental and analytical performance analysis indicate that IEEE 802.11KT MAC protocol have better performance than IEEE 802.11 MAC in terms of Total Data Packets generated, Total Packet Dropped, Packet Delivery Ratio and End to End delay parameters with mobility of node. IEEE 802.11KT MAC protocol have better synchronization mechanism, efficient link layer recovery mechanism, less numbers of collision and less inter link interference than IEEE 802.11 MAC. Based on experimental and analytical analysis, this paper have observed that a new proposed IEEE 802.11KT Mac protocol have superior performance than existing IEEE 802.11 Mac protocol and it is suitable to use as new wireless communication protocol for any type of routing protocol and for any type of topology.

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