MAC Vs Routing Protocols in Mobile Adhoc Network

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ABSTRACT
The Mobile adhoc network (MANET), is a collection of mobile wireless nodes that self-organize without the aid of centralized control or any preexisting infrastructure. This paper presents the effect of MAC protocols (MAC 802.11, MAC/TDMA) on various routing protocols in order to choose the best routing protocol and MAC protocol to enhance the performance. The simulation compared three adhoc routing protocols on various routing protocols named DSDV,DSR and AODV implemented through NS2.With the help of performance metrics such as throughput and average delay it is shown that MAC 802.11 gives better performance than MAC/TDMA.

General Terms
Calculation of Throughput, Average Delay, IEEE 802.11, TDMA
.

Keywords: MANET, DSDV, MAC, DSR, AODV

1. INTRODUCTION
A mobile ad hoc network (MANET) is comprised of mobile hosts that communicate with each other using wireless links and based on the peer-to-peer paradigm. A MANET is a self-configuring network that can have an arbitrary topology along the time. Each mobile host works as a router and it is free to move randomly and connect to other host arbitrarily. Thus, the network topology can change quickly and unpredictably since there may exist a large number of independent ad hoc connections. In fact, it is possible to have different applications running on the same MANET. In a MANET a route between two hosts may consist of hops through one or more nodes. An important problem in a MANET is finding and maintaining routes since host mobility can cause topology changes. Several routing algorithms for MANETs have been proposed in the literature such as ad hoc on-demand distance vector routing (AODV), dynamic source routing protocol (DSR). These algorithms differ in the way new routes are found and existing ones are modified. To analyse the performance of MAC protocol for various routing protocol, three protocols were selected for study such as Destination Sequence Distance Vector (DSDV), Dynamic Source Routing (DSR) and Adhoc On demand Distance Vector.

2. ROUTING PROTOCOLS
An easy way to comply Destination Sequence Distance Vector (DSDV) routing is an enhancement to distance vector routing for ad-hoc networks. Each node exchanges its neighbour table periodically with its neighbours.

Dynamic Source Routing performs route Discovery and route Maintenance. The basic principle of source routing is also used in fixed networks; e.g. token rings. Dynamic source routing eliminates all periodic routing updates. The Intermediate nodes use the source route included in a packet to determine to whom a packet should be forwarded. **AODV (Adhoc on demand distance vector)** is a reactive, distance-vector routing protocol suitable for highly dynamic networks. Like in DSDV, each node in AODV maintains a routing table but the routing table only contains active routing entries. Its route construction process and maintenance mechanisms are similar to those in DSR.

3. MAC PROTOCOLS
3.1 IEEE 802.11
The IEEE 802.11 MAC protocol specifies a Distributed Coordination Function (DCF) which is based on the same RTS/CTS message exchange for unicast data transmissions as the previous MAC protocols. Where 802.11 differs, however, there is a use of collision avoidance before RTS transmission, and its requirement of an acknowledgment (ACK) transmission by the receiver after the successful reception of the data packet. The inclusion of the ACK allows immediate retransmission if necessary by verifying that the data packet was successfully received. In the case of node mobility, the ACK may also aid in the detection of hidden-terminal interference that was not detectable when the CTS message was sent. Main functions of 802.11 MAC layer are scanning, Authentication, Association, RTS/CTS, power save mode.

3.2 TDMA MAC Protocol
Unlike contention based MAC protocol (802.11, for example), a TDMA MAC protocol allocates different time slots for nodes to send and receive packets. The superset of these time slots is called a TDMA frame. With this protocol, a TDMA frame contains preamble besides the data transmission slots. Within the preamble, every node has a dedicated sub slot and uses it to broadcast the destination node id of outgoing packet. Other nodes listen in the preamble and record the time slots to receive packets. Like other common TDMA protocols (GSM, for example), each node has a data transmission slot to send packets. To avoid unnecessary power consumption, each node turns its radio on and off. The radio only needs to be on when: in the preamble phase (takes one slot time) and there is a packet to send and receive.

4. RELATED WORK
Royer and Perkins[4] has presented the performance comparison of WRP,FSR,AODV routing protocols when combined with varying MAC protocols .The performance of these protocols doesn't show notable variation when run over different MAC protocols.

Abdul Hadi and Ahmed [1] has presented the performance of AODV, DSDV, I-DSDV protocol were measured with respect to metrics like packet delivery fraction, end to end delay and routing

overhead. Here it is proved that I-DSDV has improved PDF and end to delay when the node is high still it has lower performance compared to AODV.

Aaron and jieWeng [2] showed that network lifetime is significant issue for the performance of a multihop adhoc network .DSR outperforms DSDV at high node density. It is obvious that this is not a complete study of all the major protocols.

V.C.Patil and V.Biradar [8] has presented that the use of a particular routing protocol in mobile adhoc networks depends upon factors like size of the network, load, and mobility requirement etc.It is showed that the choice of DSDV is preferable which uses source routing.

T.G.Basavaraju and Shankar [7] has presented the performance evaluation of routing protocol over three kinds of MAC protocol for adhoc networks IEEE 802.11, E-TDMA, CSMA.This showed that table driven protocols act similarly with different MAC protocols .DSR suffers with more control overhead packets when compared to AODV. It also showed that the end-to-end delay is very less in case of AODV and generated less control overhead.

5. SIMULATION ENVIRONMENT

We simulated three different protocols (AODV, DSDV, DSR).This study is necessary to choose the best routing protocol for particular MAC protocol. We have compared and analyze the MAC 802.11, MAC TDMA for each routing protocol. This study outperforms six combination of routing protocols. From that we can choose the appropriate combination to enhance the performance of a network. The Fig1 depicts the system model of the study. In addition to above assumption we defined adhoc network with certain attributes. Throughput is the measure of how fast we can actually send through network. The number of packets delivered to the receiver provides the throughput of the network. The Table 1 shows that parameters and the values used for simulation. The entire simulations were carried out using NS2 network simulator which is a discrete event driven simulator developed at UC Berkeley as a part of the VINT project. The goal of ns2 is to support research and education in networking. It is suitable for designing new protocols, comparing different protocols and traffic evaluation.NS2 is developed as a collaborative environment. It is distributed as open source software. A large number of institutes and researchers use maintain and develop NS2. NS2 versions are available for Linux, Solaris, windows and MAC os.NS2 is built using object oriented language c++ and otcl. NS2 interprets the simulation script written in otcl. The user writes his simulation as an otcl script. Results are obtained by NS2 . It has to be processed further by other tools like network animator (NAM), Perl, awk script etc.

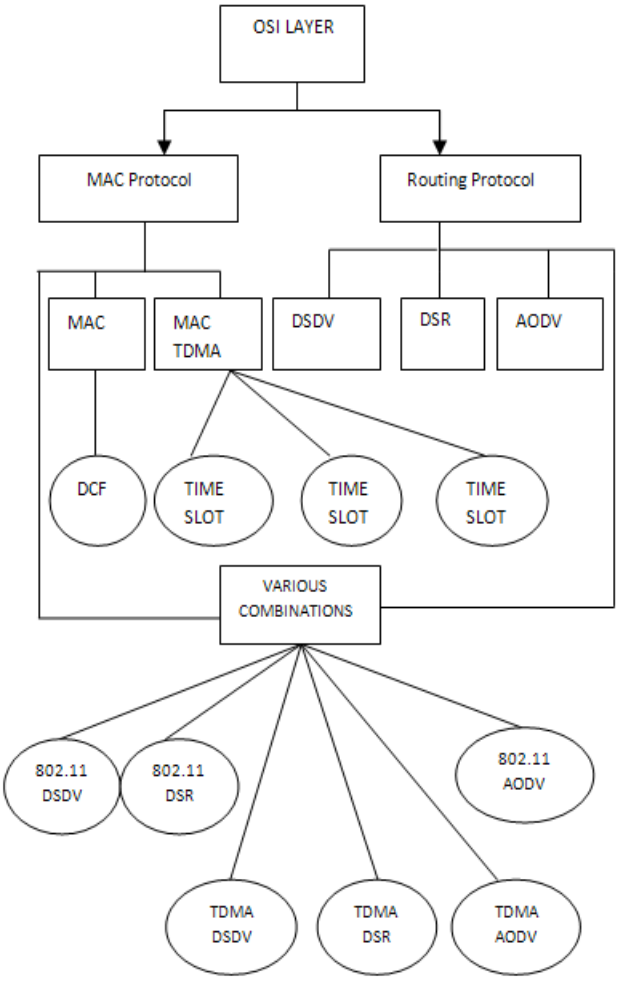

Fig 1: System Model

Table 1. Simulation Parameters

Parameters	Values
Bandwidth	11MB
Data Rate	11MB
Interval	0.005s
Packet Size	1000
Propagation Model	Two Ray Ground
Maximum Packet	50

6. RESULTS

To determine whether the selection of MAC protocols affect the relative performance of the protocols two results were examined.

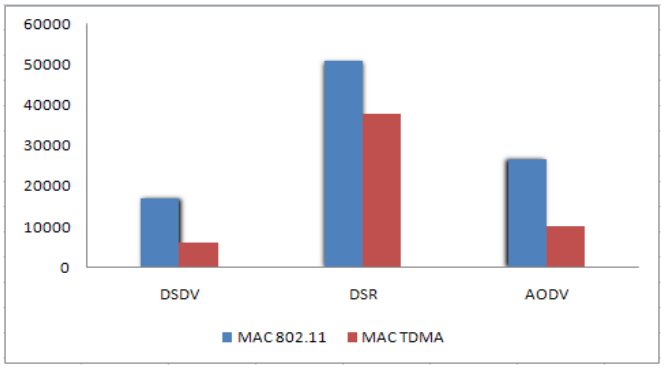

Fig 2:Routing Protocol Vs Throughput

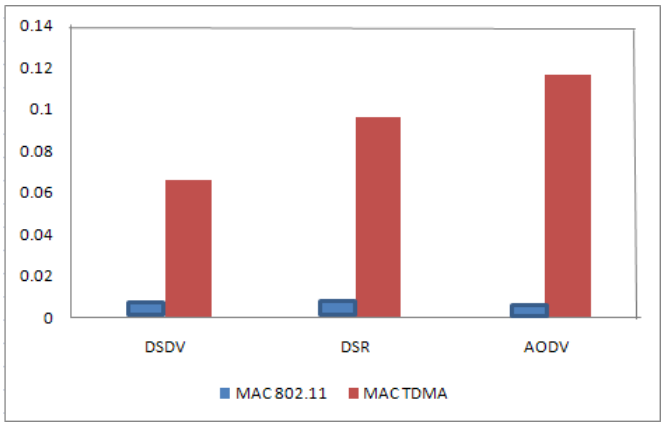

Fig 3: Routing Protocol Vs Average Delay

Throughput and average delay. The protocols DSDV, DSR, AODV prove to be sensitive to the functionality of the MAC protocol. Fig 2 illustrates the throughput of DSDV, DSR, and AODV for MAC 802.11 and MAC TDMA.DSR outperforms maximum throughput when compared to others. Fig 3 illustrates the average delay of three protocols for both MAC protocols.DSR also outperforms the minimum delay. Hence DSR protocol has better overall performance using MAC 802.11 than using TDMA. This results shows that there is a increase in throughput and decrease in delay. The collision avoidance mechanism incorporated in to IEEE 802.11 for the transmission of RTS packets aids in the reduction of the number of collisions. This mechanism includes three control packets for a transmission. Hence it gives better performance than TDMA.

7. REFERENCES

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