A Survey on Performance Evaluation of AODV, DSR and WRP over (TDMA) and (CSMA)

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Abstract – Mobile Ad hoc Networks (MANETs) have seen phenomenal growth of group communications and quality of service (QoS)-aware applications over the internet has accelerated the need for scalable and efficient network support. Ad-hoc Mobile/802.11 networks are those networks which has got no fixed topology due to the movement of end nodes. TDMA is a digital wireless telephony transmission technique. TDMA allocates each user a different time slot on a given frequency. TDMA divides each cellular channel into three time slots in order to increase the amount of data that can be carried. CDMA is a digital wireless technology that uses spread-spectrum techniques. CDMA does not assign a specific frequency to each user. Instead, every channel uses the full available spectrum. Individual conversations are encoded with a pseudo-random digital sequence. In this survey paper we study about MAC layer protocol TDMA and CDMA and different Routing protocols (WRP, DSR and AODV) over this. we also study about work performance of various attributes like throughput, packet delivery ratio and end-to-end delay for three Routing protocols (WRP, DSR and AODV) over TDMA and CDMA .The performance of these three routing protocols will perform on Glomosim Simulator[5].

Index Terms – CDMA,TDMA,WRP,DSR, AODV, MAC, MANET.

1. INTRODUCTION

The Mobile Adhoc Network is described by random movement of mobile nodes in wireless scenario, in order to find the best possible path between sources to destination; routing protocols are used in wireless communication. As there is no dedicated path between the nodes a routing strategy is helpful in exploring the shortest path. The wireless networks are mainly composed of two type's infrastructure based network and Ad-hoc network. In case of infrastructure based networks there is a central station called access point (AP) which provide a wireless link between AP and a mobile data terminal equipment having antenna (can be a laptop or notepad computer).The routing procedure is also controlled by these access points, in such environment range of transmission is fixed. While in case of Ad-hoc networks the base station or access point is absent. Every node present in the network performs all the functions of base station and routing decisions are also taken by them. MANET or the mobile ad-hoc network is a flexible and self-configuring network containing large number of wirelessly connected independent nodes. The most widely used routing protocol in ad-hoc network is AODV, DSR and WRP . A lot of works on this network is done by researchers in order to have energy efficient routing protocols [4]. This paper further extends the research work in different scenario as discussed below. Figure 1 shows a simple ad hoc network with three mobile hosts using wireless interfaces. Host A and C are out of range from each other's wireless transmitter. When exchanging packets, they may use the routing services of host B to forward packets since B is within the transmission range of both of them.

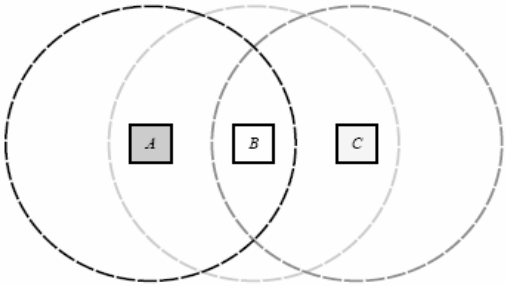

Fig 1. Mobile Ad hoc networks with 3 mobile nodes

2. MAC LAYER PROTOCOL

Time Division Multiple Access (TDMA) **:**TDMA is a digital wireless telephony transmission technique. TDMA allocates each user a different time slot on a given frequency. TDMA divides each cellular channel into three time slots in order to increase the amount of data that can be carried.TDMA technology was more popular in Europe, Japan and Asian countries, whereas CDMA is widely used in North and South America. But now a days both techologies are very popular through out of the world.

Code Division Multiple Access (CDMA): CDMA is a digital wireless technology that uses spread-spectrum techniques. CDMA does not assign a specific frequency to each user. Instead, every channel uses the full available spectrum. Individual conversations are encoded with a pseudo-random

digital sequence. CDMA consistently provides better capacity for voice and data communications than other commercial mobile technologies, allowing more subscribers to connect at any given time, and it is the common platform on which 3G technologies are built.

3. MOBILE AD HOC NETWORK ROUTING PROTOCOLS

Routing protocols for Mobile ad hoc networks can be broadly classified into three main categories:

3.1 Proactive (table driven) Routing Protocols

Each node in the network has routing table for the broadcast of the data packets and want to establish connection to other nodes in the network. These nodes record for all the presented destinations, number of hops required to arrive at each destination in the routing table [4, 5]. The routing entry is tagged with a sequence number which is created by the destination node. To retain the stability, each station broadcasts and modifies its routing table from time to time.

The proactive protocols are appropriate for less number of nodes in networks, as they need to update node entries for each and every node in the routing table of every node. It results more Routing overhead problem. There is consumption of more bandwidth in routing table.

3.2 Reactive (on-demand) Routing Protocols

In this protocol, a node initiates a route discovery process throughout the network, only when it wants to send packets to its destination. This process is completed once a route is determined or all possible permutations have been examined [2, 3]. Once a route has been established, it is maintained by a route maintenance process until either the destination becomes inaccessible along every path from the source or the route is no longer desired. A route search is needed for every unknown destination. Therefore, theoretically the communication overhead is reduced at expense of delay due to route search.

3.3 Hybrid routing protocols

This protocol incorporates the merits of proactive as well as reactive routing protocols. Nodes are grouped into zones based on their geographical locations or distances from each other. Inside a single zone, routing is done using table-driven mechanisms while an on-demand routing is applied for routing beyond the zone boundaries [2]. The routing table size and update packet size are reduced by including in them only art of the network (instead of the whole); thus, control overhead is reduced.

3.4 Ad-Hoc On Demand Distance Vector (AODV) Routing Protocol

AODV [2,3, 6] shares DSR's on-demand characteristics in that it also discovers routes on an *as needed* basis via a similar route discovery process. However, AODV adopts a very different mechanism to maintain routing information. It uses traditional routing tables, one entry per destination. This is in contrast to DSR, which can maintain multiple route cache entries for each destination. Without source routing, AODV relies on routing table entries to propagate an RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops [4]. These sequence numbers are carried by all routing packets.

An important feature of AODV is the maintenance of timer based states in each node, regarding utilization of individual routing table entries. A routing table entry is *expired* if not used recently. A set of predecessor nodes is maintained for each routing table entry, indicating the set of neighboring nodes which use that entry to route data packets. These nodes are notified with RERR packets when the next-hop link breaks. Each predecessor node, in turn, forwards the RERR to its own set of predecessors, thus effectively erasing all routes using the broken link. In contrast to DSR, RERR packets in AODV are intended to inform all sources using a link when a failure occurs. Route error propagation in AODV can be visualized conceptually as a tree whose root is the node at the point of failure and all sources using the failed link as the leaves.The recent specification of AODV [4] includes an optimization technique to control the RREQ flood in the route discovery process. It uses an *expanding ring search* initially to discover routes to an unknown destination. In the expanding ring search, increasingly larger neighborhoods are searched to find the destination. The search is controlled by the Time-To-Live (TTL) field in the IP header of the RREQ packets. If the route to a previously known destination is needed, the prior hop-wise distance is used to optimize the search. This enables computing the TTL value used in the RREQ packets dynamically, by taking into consideration the temporal locality of routes.

3.5 Dynamic Source Routing (DSR) Protocol

The Dynamic Source Routing protocol (DSR) [1, 4] is an on demand routing protocol. DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. The DSR protocol is composed of two main mechanisms that work together to allow the discovery and maintenance of source routes in the ad hoc network:

Route Discovery is the mechanism by which a node S wishing to send a packet to a destination node D

- Obtains a source route to D using ROUTE REQUEST and ROUTE REPLY messages. It is used only when S attempts to send a packet to D and does not already know a route to D.
- Route Maintenance is the mechanism by which a node S is able to detect if the network topology has changed

because a link along the route no longer works. On detecting link break, DSR sends ROUTE ERROR message to source node for finding a new route. In that case, S can attempt to use any other route it happens to know to D, or it can invoke Route Discovery again to find a new route for subsequent packets to D.

3.6 Wireless Routing Protocol (WRP)

The Wireless Routing Protocol (WRP) is a proactive unicast routing protocol for MANETs. WRP uses an enhanced version of the distance-vector routing protocol, which uses the Bellman-Ford algorithm to calculate paths. Because of the mobile nature of the nodes within the MANET, the protocol introduces mechanisms which reduce route loops and ensure reliable message exchanges

The wireless routing protocol (WRP), similar to DSDV, inherits the properties of the distributed Bellman-Ford algorithm. To solve the count-to-infinity problem and to enable faster convergence, it employs a unique method of maintaining information regarding the shortest path to every destination node and the penultimate hop node on the path to every destination node in the network. Since WRP, like DSDV, maintains an up-to-date view of the network, every node has a readily available route to every destination node in the network. It differs from DSDV in table maintenance and in the update procedures. While DSDV maintains only one topology table, WRP uses a set of tables to maintain more accurate information. The tables that are maintained by a node are the following: distance table (DT), routing table (RT), link cost table (LCT), and a message retransmission list (MRL).

4. PERFORMANCE PARAMETERS FOR COMPARISON

We will take three performance parameters for study on AODV, DSR and WRP which are End-to End delay, Packet Delivery Ratio, Throughput for both the mac layer protocol CSMA and TDMA which are described as below:

4.1 End-to-End Delay

The average end-to-end delay of data packets is the interval between the data packet generation time and the time when the last bit arrives at the destination. A low end-to-end delay is desired in any network.

The average time required for transmitting a data packet from source node IP layer to the destination IP layer, including transmission, propagation and queuing delay.

Average End-to-End Delay = Σ (Time when Packets enters in the Queue) - Σ (Time when the Packet is **received)**

4.2 Packet Delivery Ratio

Packet Delivery Ratio (PDR) is the ratio between the number of packets transmitted by a traffic source and the number of packets received by a traffic sink. It measures the loss rate as seen by transport protocols and as such, it characterizes both the correctness and efficiency of ad hoc routing protocols. A high packet delivery ratio is desired in any network.

4.4 Throughput

Throughput is the number of packet that is passing through the channel in a particular unit of time. This performance metric show the total number of packets that have been successfully delivered from source node to destination node and it can be improved with increasing node density.

5. CONCLUSION

In this paper we have studied about the MAC layer protocol TDMA and CSMA and the various routing protocols like AODV,DSR and WRP and various performances metric like end to end delay, packet delivery ratio, and throughput .

In future we can simulate the above mentioned routing protocols with the same performance metrics with varying the mobility model and other MAC layer protocols and conclude their performance that how they behave with mobility model and packet sizes.

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