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

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Abstract – MANET [1] is a cluster of wireless mobile computer where node shift in self-directed manner in any way .The developments in wireless technology in the present age have created networks with low cost and low power consumption. MANET is a type of multi-hop system, communications less and the most significant self-organizing. Due to wireless and spread nature there is an immense challenge for system protection designers. One of such networks which subsist is called as Mobile Ad-hoc network which is characterized by wirelessly connected nodes with frequent change in network topology. As the nodes are connected wirelessly a routing mechanism (routing protocols) is required for successful transmission of packets. Sometimes two or more nodes sending the information simultaneously results in collisions. Hence medium access controls (MAC protocols) are required for efficient transmission and avoiding collision. In this survey paper we study about different Routing protocols (AODV,DSR and WRP)over TDMA and CSMA and we study about work performance of various attributes like throughput, packet delivery ratio and end-to-end delay for three Routing protocols (AODV,DSR and WRP) .The performance of these three routing protocols will perform on Glomosim Simulator[6].

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

1. INTRODUCTION

A Mobile Ad Hoc Network (MANET)[1] is a collection of mobile nodes which interact over bandwidth confined. Multi hop routing scheme is property of MANET. Because of this the network topology can change quickly and uncertain over time, each node must united within a communication routing protocol that make easier network discovery, assures message delivery, and detects failed message delivery attempts. In MANET each node should interact with other nodes if it is in range and distribute all information across the network. The main advantage of this type of network is the self-organizing property which discards the need of fixed infrastructure. The applications of MANETs are different, ranging from small networks, static networks that are confined by power sources, large-scale, mobility, and highly dynamic networks. Since MANETs are excessively pliable and scalable, they are ideal for set up communications in script where there is no existing connection infrastructure. Since, the range of the communications network is limited appears to be a perfect solution for military applications. MANET work without a centralized supervision where nodes communicate with each other on the support of cooperative trust. This feature makes MANET more vulnerable to be browbeaten by an attacker which is surrounded by the network. Wireless associations also make the MANET more prone to attacks which build it easier for the attacker to go within the network and search out for access to the current message. Mobile nodes here within the series of wireless link can eavesdrop and even contribute in the

The Mobile Adhoc Network is describe by random movement of mobile nodes in wireless circumstances 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 approach is helpful in exploring the shortest path. The wireless networks are generally composed of two types 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 notepad computer or a laptop).The routing procedure is also forbidden 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 due to their reactive nature in topology change may. A lot of works on this network is done by researchers in order to have energy efficient routing protocols [3].

2. MOBILE AD HOC NETWORK ROUTING PROTOCOLS

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

2.1 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.

2.2 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.

2.3 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.

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

AODV [2,3] 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 cacheentries 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.

2.5 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, Scan 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.

2.6 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).

3. PERFORMANCE PARAMETERS

In order to evaluate the performance of ad hoc network routing protocols, the following metrics were considered:

A. Packet delivery Ratio (PDR)

PDR [5] is the ratio of the number of data packets successfully delivered to the destinations to those generated by CBR sources.

B. Average End-to-End delay

It is the average time from the beginning of a packet transmission at a source node until packet delivery to a destination. This includes delays caused by buffering of data packets during route discovery, queuing at the interface queue, retransmission delays at the MAC [2], and propagation and transfer times.

C. Throughput

Throughput [2] is the average rate of successful transmission of packet from source to destination.

Table 1. Parameters for simulation evaluation

Parameter	**Value**
Protocols	AODV, DSR and WRP
Traffic Type	CBR
Simulation Duration	500 seconds
Packet Size	512 bytes
Pause Time	40 sec
Number of Nodes	50
TERRAI-DIMENSIONS	2000 * 2000
Mobility model	Random way point

4. PERFORMANCE PARAMETERS FOR COMPARISON SIMULATION RESULTS

To analyses and simulate the different scenarios for comparison, the Glomosim network simulator [8] is being used. For this firstly the scenario is created then after simulation the results are analyses from the analyses option. Simulation parameter is shown in table 1.

In order to compare AODV, DSR and WRP by correlating the MAC layer protocols [1], a scenario is created having 4 different wireless subnets sending packets to a single destination node.

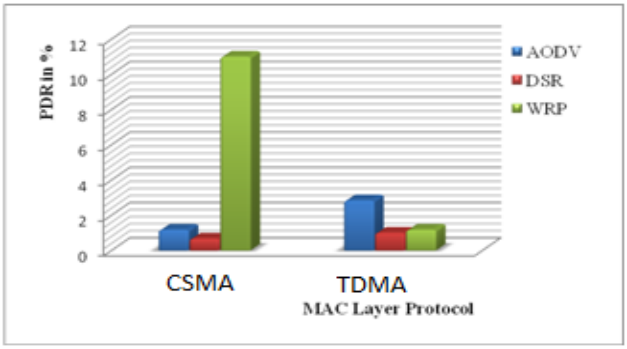

Fig 1. Packet Delivery Ratio vs. MAC Layer Protocol

The above comparison is done on a scenario having multiple wireless zones and single destination. That is way the packet traffic on this destination node is very high and the rate of collision is also increased so a medium access is required to improve the performance hence MAC layer protocol is considered for comparison.

In case of CSMA [1], WRP has better PDR in comparison to AODV and DSR and in case of TDMA[7], AODV has better PDR as shown in fig ,.

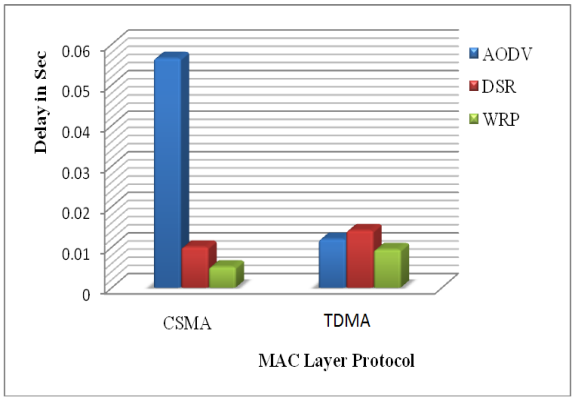

Fig 2. End to End Delay vs. MAC Layer Protocol

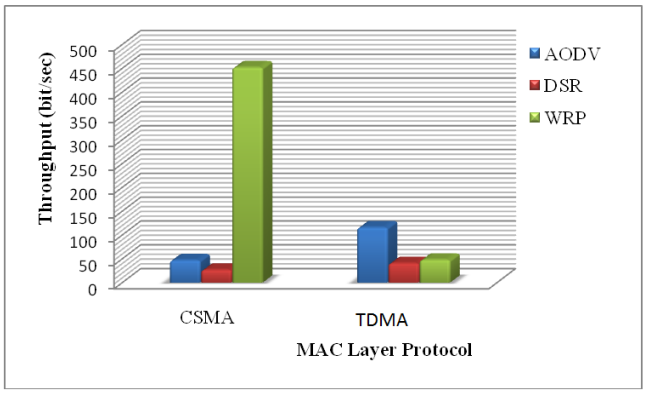

Fig 3. Throughput vs. MAC Layer Protocol

From fig 2, it is seen that DSR and WRP has minimum delay in comparison to AODV. CSMA has minimum delay in comparison to TDMA MAC layer protocol [2].

From fig 3, it seen that WRP has better Throughput in CSMA and AODV has higher throughput in TDMA. CSMA has higher throughput than TDMA.

5. CONCLUSION

In this paper, analysis of AODV, DSR & WRP routing protocols is done to understand that which one performs well in which set of conditions. Focus is mainly done on the network parameters like packet delivery ratio, end to end delay, throughput and routing overhead. By changing the mobility, scenario & MAC protocol it is seen that as the mobility is increased AODV performs well in comparison to DSR and WRP. And it is also observe that as the mobility increases their PDR and Throughput decreases and their delay increases. Secondly, in the scenario with multiple zones & single destination for CSMA & TDMA MAC layer protocols, DSR is far better. In the scenario with single source & multiple destinations, WRP outperforms in case of CSMA and in TDMA AODV performs well.

REFERENCES

[1] Uma Rathore Bhatt, Abhishek Dangarh et al , "Performance analysis of AODV & DSR Routing protocols for MANET" in 2014 Fourth International Conference on Communication Systems and Network Technologies 978-1-4799-3070-8/14 $31.00 © 2014 IEEE DOI 10.1109/CSNT.2014.

[2] J. Geetha, and G. Gopinath, "Ad Hoc Mobile Wireless Networks Routing Protocols Review", Journal of Computer Science, vol. 3, issue 8, pp.574-582, 2007.

[3] C. Perkins, E. Belding-Royer, S.Das, Ad hoc On-Demand Distance Vector (AODV) Routing, RFC 3561, 2003.

[4] Chansu Yu, y Ben Lee and Hee Yong Youn," Energy efficient routing protocols for mobile ad hoc networks", wireless communications and mobile computing, vol.3, pp. 959–973, 2003.

[5] Akshai Aggarwal, Savita Gandhi; "PERFORMANCE ANALYSIS OF AODV, DSDV AND DSR IN MANETS**"** International Journal of Distributed and Parallel Systems (IJDPS), November 2011 ,pp: 167-177.

[6] GloMoSim: Global Mobile Information Systems Simulation Library. http://pcl.cs.ucla.edu/projects/glomosim/.

[7] Akhilesh Misra, Aradhana Singh, #A Survey on Performance Evaluation of AODV, DSR and WRP over (TDMA) and (CSMA)". in Journal of Network Communications and Emerging Technologies (JNCET) Volume 6, Issue 8,August (2016)

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