EVALUATING THE PERFORMANCE OF MANET PROTOCOLS CONSIDERING VARIOUS PARAMETERS

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Abstract- MANET Mobile ad-hoc networks - are fully distributed networks that comprise of mobile nodes resulting in dynamic topology. Since it is infrastructure less architecture , nodes have to cooperate in order to provide the necessary network functionality. MANET technology can provide an really flexible method for establishing communications for military battlefield operations or other scenarios requiring rapidly-deployable communications with survivable, efficient dynamic networking. There are three types of routing protocols in MANET such as Proactive, Reactive, and Hybrid. In this paper, we report results of NS2 simulation of three important routing protocols: AODV, AOMDV, DSR (Proactive Protocols), DSDV (Reactive Protocol) .We have extended the work done in previous paper and also have analyzed performance using Packet delivery ratio , average throughput and average end to end delay, and also their varying mobility . For node movement, a popular model, random waypoint is considered while Constant Bit Rate (CBR) traffic pattern is assumed.

Keywords- MANET, Routing Protocol, Packet Delivery Ratio, Node Mobility, Average Throughput, Average Delay, NS2.

I. INTRODUCTION

With the fast growing technological advancements in computer and wireless communicationn, advanced mobile wireless computing is predicted to see increasingly extensive use and application. Future generation wireless systems will need easy and quick deployment of Mobile ad-hoc networks .Mobile ad hoc networks has robust and efficient operations in wireless networks by incorporating routing functionality into mobile nodes. Accordingly, such networks have dynamic, sometimes rapidly-changing, topologies. The nodes are likely to have limited power availability, while the wireless links may be bandwidth constrained.

As communication is through radio waves, nodes which are in radio range can directly communicate while others need intermediate node to forward packet. Each node thus acts not only as source and destination but also as a relay node in for the multi-hop routing..

Many routing protocols have been proposed for the mobile ad hoc network and classified as Proactive or Table Driven routing Protocol, Reactive or On Demand Routing Protocol [1-2]. In the table driven routing protocols, also called proactive protocols, node maintains routing information in a routing table.

The table is periodically updated as the network topology changes. In the on demand, or reactive protocols paths are discovered only when they are needed. Each routing table entry contains the following data: Destination, Next hop, Number of hops, Destination sequence number, and Active neighbors for this route.

Proactive protocols, necessitate fewer number of overall control packets overall as each node maintains route to all destinations, keeping routing overheads to minimum. However, when frequency of link breakage is high, which is expected to be case when nodes are mobile, these protocols need a higher rate of routing table updates.

Routing information is distributed between nodes by sending full dumps (whole table is send) and smaller incremental updates (only those information are sent which has change since last update). All the nodes try to find out all paths to possible destination node and number of hops to each destination and save these in their routing table.

A. Routing Protocols

Ad hoc On demand Multipath Distance Vector (AOMDV) It is an extension to the AODV protocol AOMDV protocol used for calculation of multiple loop free and link disjoint routes. [8]In a single route discovery process multiple routes are discovered. For route discovery process route request packets are propagated all over the network in this manner establishing multiple paths at destination node and at the intermediate nodes. Multiples Loop-Free paths are obtained using the advertised hop count method at each node. The route entry table at each node also contains a list of next hop as well as the corresponding hop counts. Also every node maintains an advertised hop count for the destination. Route advertisements of the destination are sent using this hop count. An alternate path to the

destination is accepted by a node if the hop count is less than the advertised hop count for the destination. DSR [4,5] DSR makes use of source routing and route caching. When there is no direct route from source to destination, the source send demand of routing with a unique identifier (includes source & destination node address). When node receives demand message and it is repetitive, the node will abandon it directly

If the node is not the destination & there is no routing information to the destination node in its buffer memory, the node will send the source packet with its ID to the next node. If it is a destination node or it has information about it in its buffer the node will send a response message to the source node including routing information from source to destination.

AODV

The Ad hoc On-Demand Distance Vector (AODV) algorithm perform dynamic, self-starting, multi-hop routing between participating mobile nodes wishing to set up and maintain an ad hoc network. It allows nodes to acquire routes quickly for the new destinations, and does not require nodes to maintain routes to destinations that are not in active communication. AODV uses destination sequence number for each route entry. AODV allows mobile nodes to respond to link breakages and changes in network topology in a periodically. The destination sequence number is created by the destination which is to be included along with the route information it sends to requesting nodes. If there are two routes to a destination, a requesting node select the one having greatest sequence number. Destination sequence numbers also ensures loop freedom [4,5] When the source node does not know route to the destination it will broadcast a RREQ (contains node's IP address, current sequence no., the reverse route to the source node and see if itself is the destination node or its routing table has an effective route to destination node , if it is, then it will send a RREP to the source node & then each intermediate node which receive RREQ, record the reverse route to the source node and see if itself is the destination node or its routing table has an effective route to destination node , if it is then it will send a RREP to the source if not then it will rebroadcast RREQ. In case of link failure, a route error (RERR) packet is sent to the source and destination.

DSDV

Routes to all nodes in the network are discovered in advance .Every node store one or more routing table (which contains the information about all the available destination & no. of intermediate nodes) which is broadcast after a fixed interval of time independent of any route changes or not.

In DSDV, each mobile node of an ad hoc network maintains a routing table, which contains the lists of all available destinations, next hop to each destination and a sequence number generated by the destination node.

Using such routing table stored in each mobile node, the packets are transmitted between the nodes of an ad hoc network. Each node of the ad hoc network updates the routing table with advertisement from time to time or when vital new information is available to maintain the consistency of the routing table with the dynamically changing topology of the ad hoc network.

B. Simulation parameters

For all the simulations we took the results of the same scenario varying number of nodes and node mobility. We ran the simulations for the three protocols: AODV, DSR and DSDV. We observe variation in Average throughput and average delay under these different conditions.

Throughput

It shows the total number of packet that has been successfully delivered to the network and thus improves with increasing node density.

Delay

It can be calculated as a difference between send time and received time for a specific packet transmitted from source to destination.

Packet dropped

Number of data packets that are not successfully sent to the destination.

Routing Overhead

The ratio of routing and control packets to the total no. of packets.

Packet delivery ratio

It is ratio of number of packets originated by the source to the number of packet received by the destination.

Broadcasting method in MANET

Self Pruning: Each node broadcast hello message to its neighboring node, the receiving node will compare its neighbor list to its sender's list & it will rebroadcast if it find additional nodes could be reached otherwise the message will be dropped. Scalable Broadcasting approach: All the nodes are require having the knowledge of their neighbors up two hop distance.

Ad hoc broadcasting approach: only nodes that are selected as a gateway node and a broadcast message header are allowed to rebroadcast the message.

C. Random waypoint Model

[3] It's a 3- tuple and tuple is (Vmax,T,Vi); T is the pause time and Vi is the direction or advance vector All nodes are uniformly distributed over [0,Vmax], where 0 is the initial speed when node is stationary and Vmax is the maximum velocity. A node randomly chooses a destination, called a waypoint, moves towards it in a straight line with a constant velocity, which is selected randomly from 0 to Vmax. After reaching waypoint, the node pauses for some time and then repeats the same procedure. If the node is currently at point d(x-1,y-1) then next waypoint is: d(x,y)= d(x-1,y-1)+ Vi

II. NETWORK SIMULATOR

All simulations have been carried out using the NS simulator version 2.35 under Linux platform. NS2 is a popular open source package with considerable flexibility to select simulation environment by selecting appropriate parameters.

Our choice was:

· Traffic sources are constant bit rate (CBR). The five source-destination pairs are spread randomly over the network.

· Size of the data packet used is 512-byte.

· The interval between packets sent is .015 sec.

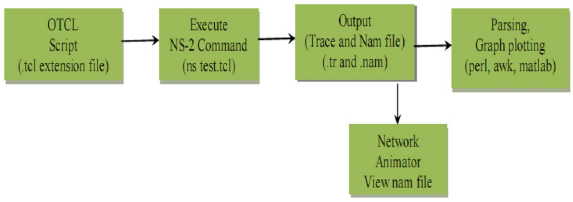
· The number of nodes and the rate in each pair is varied to change the offered load in the network.

· The mobility model uses the random waypoint model in a rectangular field. Field configurations used is 800 m x 400 m field with 20, 30,50,60, 80, 90, and 100 nodes.

· Here, each packet starts its journey from a random location to a random destination with a randomly chosen speed (uniformly distributed between 0 to max).Once the destination is reached, another random destination is targeted after a pause.

· Simulations are run for 500 simulated s for 20, 30, 50,60, 80,90 and 100 nodes.

· Identical mobility and traffic scenarios are used across protocols.



III. RESULTS

In our evaluation, we have compared the performance of three different routing protocols: AODV, AOMDV, DSDV& DSR. And also we presented the set of results: Average Throughput and average Delay under different scenarios.

Average throughput comparison:

[9]Average throughput Calculated and plotted against no. of nodes for AODV, DSR and DSDV with node speed is 10m/s and 40m/sec. Average Throughput increases quickly for DSR with increased number of nodes (node speed is 10m/s). It is observed that performance of AODV improves with increase in number of nodes because nodes become more stationary with speed 10m/s will lead to more stable path from source to destination. DSDV performance dropped as number of nodes increase because more packets dropped due to link breaks. When the number of nodes is greater than 20, AODV shows the better average throughput characteristic than DSR.

When the network size bigger than 60, AODV has the best average throughput than DSR. Considering the results, DSR & AODV has reliability in a high-speed and large-scale environment, and along with the increase number of nodes.

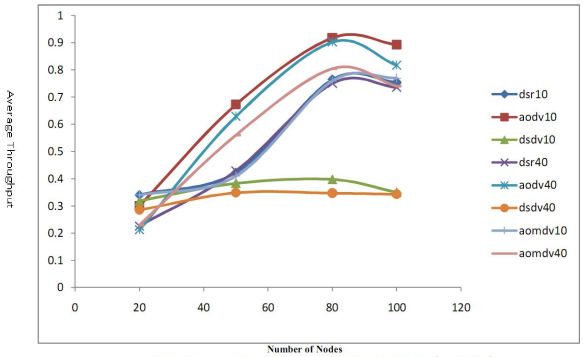


Figure 1 .Average throughput vs number of nodes with 10m/s and 40m/s

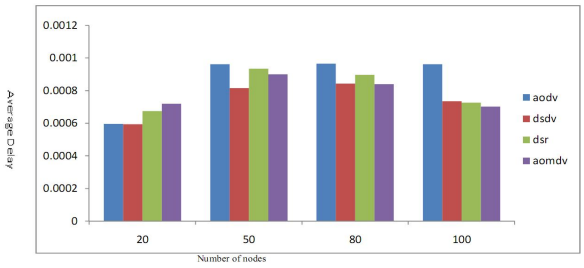


Figure.2. Average Delay(in sec) vs. no. of node for AODV DSR DSDV AOMDV for 5m/sec

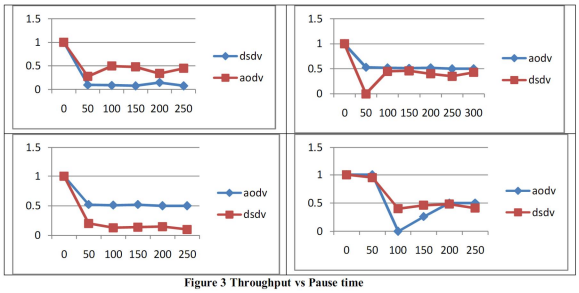


Figure 3 Throughput vs Pause time

Fig3 (a) 60 nodes with speed 10m/s 3(b)120 nodes ,speed 10m/s 3(c)60 nodes , speed 5m/s 3(d)120 nodes, speed 5 m/s

Challenges: Some of the key challenges in MANET include:

Efficient and Stable routing

Dynamic topology
Network Scalability
Network overhead
Quality of Service
Power Management
Security.

CONCLUSION

In this paper, we proposed a framework to analyze the impact of mobility pattern and node density on routing performance of different protocols AODV, AOMDV, DSDV and DSR in MANET through various simulation experiments. In our study, we observe that the mobility pattern and node density does influence the performance of MANET routing protocols. The experimental results show that by increasing the number of nodes, the network performance is enhanced in AOMDV and AODV. Choosing the best protocol is totally related to the size of the network and other conditions like the mobility of the nodes. AOMDV performance degrades as compared to AODV it performance goes down with increase in mobility and network size.

In Fig [1]. As no. of nodes increases from 20 to 80 the average no. of packet successfully delivered to the network also increases which in turn increases average throughput. But after that the average throughput start showing slight decrease when the no. of nodes are added to the network is too large.[6]The reason might be when the node density increases in large amount, no. of nodes tries to access the common path which increases the collision rate since the nodes are mobile, thereby increasing packet loss and decrease in average throughput. AODV and DSR give better Average throughput than DSDV. But, in terms of Average delay DSDV is better, whose Average delay is lesser than AODV and DSR. Since DSDV proactively keeps the routes to all destinations in its table it does not have to initiate the route request process as frequently as in AODV.

The on-demand route creation and maintenance process is a key reason for the excellent behavior of reactive AODV and DSR. Therefore, the performance of on- demand protocol AODV and DSR is found to be better than the table driven protocol that is DSDV

REFERENCES

[1] E. M. Royer and C. K. Toh, "A review of current routing protocols for ad hoc mobile wireless networks," IEEE Personal Communications magazine, April 1999, pp. 46–55.

[2] Asma Tuteja ,Rajneesh Gujral Mullana, Sunil Thalia "Comparative Performance Analysis of DSDV, AODV and DSR Routing Protocols in MANET using NS2", International Conference on Advances in Computer Engineering,2010IEEE.

[3] Tie-yuan Liu, Liang Chang, Tian-long Gu, "Analyzing the Impact of Entity Mobility Models on the Performance of Routing Protocols in the MANET," Third International Conference on Genetic and Evolutionary Computing, WGEC, pp.56-59, 2009.

[4] Charles E.Perkins, Elizabeth M.Royer, Samir R.Das, "Performance comparison of two on-demand Routing Protocols for Ad-hoc Networks", IEEE Personal Communications, pp. 16-28, February 2001.

[5] R. Misra, C. R. Manda, "Performance Comparison of AODV/DSR On-Demand Routing Protocols for Ad Hoc Networks in Constrained Situation", IEEE ICPWC 2005.

[6] Bhavyesh Divecha, Ajith Abraham, Crina Grosan and Sugata Sanyal" Impact of Node Mobility on MANET Routing Protocols Models "Journal of Digital Information Management,Vol. 5, Nr.1(2007), p. 19-23.

[7] C. E. Perkins and E. M. Royer, "Ad Hoc On-demand Distance Vector Routing," Proc. 2nd IEEE Wksp. Mobile Comp. Sys. and Apps., Feb. 1999, pp. 90-100.

[8] Geetha Jayakumar, and G. Gopinath," Ad Hoc Mobile Wireless Networks Routing Protocols – A Review" Journal of Computer Science 3 (8): 574-582, 2007© 2007 Science Publications

[9] Ramprasad Kumawat, Vinay Somani "Comparative Study of On-demand Routing Protocols for Mobile Ad-hoc Network"," International Journal of Computer Applications ", Volume 27– No.10, August 2011.

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