Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 2, Issue. 6, June 2013, pg.151 – 155

RESEARCH ARTICLE

Performance Analysis of Routing Protocols in MANETs

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Abstract— In a MANET, the aggressive progress of research is running continuously after the important study of AODV, DSR, TORA and OLSR routing protocols. Many studies and researches are done by using different methods on these routing protocols in manner of performance evaluation. By this study every different method and simulation environment gives the different results, means every applied method give different result. So there is need to expand the spectrum to account for impact and not think about in a particular environment. In this thesis we analysis the performance of AODV,OLSR,DSR and TORA ad hoc routing protocols with the help of OPNET technology.

Key Terms: - MANETs; AODV; OLSR; DSR; TORA

I. INTRODUCTION

The Mobile Ad hoc Network (MANET) providing the user interfaces without the wire functionally. A MANET functionally works on mobile nodes and or by both fixed and mobile nodes. All nodes are randomly allies with each other to develop arbitrary topology. The nodes act like a both routers and hosts. The caliber of mobile routers to self-configure, it makes this topology eligible for provisioning communication. For example, in condition of the disaster hit areas, where the communication or network connection is urgently required, the need of mobility in wireless networks is demanded. The formation of MANET work with group to develop The Internet Engineering Task Force (IETF) for developing consistent IP routing protocols by using both static and dynamic topologies.

After many years of research there is a need to complete and develop internet standard too. There only one thing is done that is identification of experimental request for comments (RFCs) since 2003 [1]. On this stage there is a character that answer of question is still remaining. About either execution or deployment of the protocols but the introduced algorithms is identical as a probation technology or there is a high chance that they will develop into a standard [1]. The research in this area is running aggressively since then with prominent studies on mobile ad hoc On-demand Distance Vector (AODV), Dynamic Source Routing (DSR), Temporally Ordered Routing Algorithm (TORA) and Optimized Link State Routing (OLSR) [1].The mobile nodes are always supposed to have the material meaning for a high antenna which is able to do transmit and get the routes between communication nodes proficiently.

II. RELATED WORK AND PROBLEM STATEMENT

The comparison of performance of DSDV, AODV, DSR and TORA is done under [3] by using the NS2 platform [3] and resultant that the AODV generally out performs DSR and TORA. One more study was introduced in [4] on the basis of the performance of an easy link state protocol, AODV and DSR, The authors conclude that AODV and DSR both perform well if the network load is intermediate while link state out

performs the reactive protocols when traffic load is very heavy. There is another study that provides the solution of simulation between the link state and reactive state platform performance. The author describes that the factor of problems may occur when using similar gateways, so they propose some solutions to mitigate this effect the performance evaluation in [1].

The first objective of this is to study three ad-hoc network routing protocols and get the systematic performance by using NS-2 [3] tool simulated open source network. The investigation by the three routing protocols is Ad-hoc On-Demand Distance Vector (AODV) protocol [4], Destination-Sequenced Distance-Vector (DSDV) [5], and Optimized Link State Routing (OLSR). In this research, we address three main questions.

I. Which routing protocols give a better performance in Mobile Ad hoc Networks?
II. What factors that influence the performance of these routing protocols?
III. What are the major differences in the routing protocols under study?

III. ROUTING PROTOCOLS IN MANETS

During the routing packets traversing MANET between devices an ad hoc routing protocols become a standard for controlling. In a network or trying to join, a node does not have knowledge about the network topology. Listening to broadcast from others nodes, it discovers the topology by its presence in a network. In the discovery process, the route performed differently depending of routing protocol implementation in a network.

In wireless ad hoc networks, there are designed many different protocols. The routing protocols may be reactive or proactive [8]. And other is hybrid ad hoc routing protocols that are the combination of both reactive and proactive protocols.

A. Optimizes Link State Routing (OLSR)

OLSR is used WiMAX Mesh (Backhaul) in any ad hoc network lately. By its nature the OLSR is classifies as proactive. In the network, nodes use topology information derivative from HELLO packets and their neighbors discovered by Topology Control (TC). All nodes do not broadcast packets in the network route. The Only Multiple Relay (OMR) nodes route broadcast packets. The route is built before use from source to intended destination. In the network, each node keeps a routing table. By this the routing table shallow for OLSR higher than any other reactive routing protocols as AODV or DSR. The routing overhead keeps number of route same means it does not increase it in use since there is need not to build a new route when it needed. The route discovery delay reduced by this.

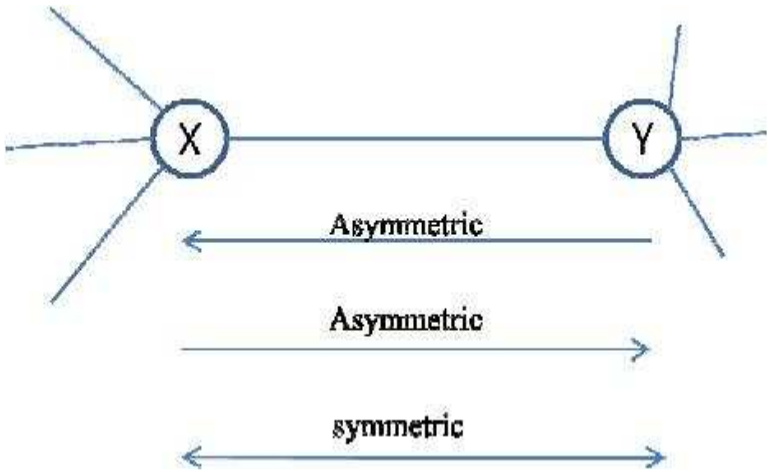

Fig. 1 HELLO messages in MANET using OLSR algorithm

B. Ad hoc On-demand Distance Vector (AODV)

In ad hoc network, AODV is used as on demand. Like any other on demand routing protocol, this algorithm facilitates a smooth adjustment to change in link condition. When a link failed, the affected nodes received a notification. By this information the affected nodes cancels the entire route through failed link. The network utilization is minimal from source to the destination builds unicast route because it has low memory overhead.

Since route is built on demand, there is minimal routing traffic in network. To keep routes that are not in use is not allowed. In ad hoc network, when two not want to establish a connection between each other, AODV will enable them to make multichip routes between the involved mobile nodes. AODV is loop free that is why it uses Destination Sequence Number (DSN) to postpone counting to infinity. This is one of the dissimilar features of the algorithm. In network the demand of requesting a node sends DSNs together with all routing information to the destination and based on the sequence number [11] it also select the optimal route. So this type of functionality depends on the path variety to move the node distance from source to the destination. But also specifies the current way of broadcasting a massage to destination.

C. Dynamic Source Routing Protocols (DSR)

For ad hoc wireless network DSR is a reactive routing protocol. Like AODV it also has on-demand characteristics but it is not table driven. DSR is based on the source routing. When a node wants to send a packet, it specifies the route of the packet. All the path information for the packet traversing the network is set in the packet by sender [1] from source to destination. This is the different routing from table driven and link state routing by the way routing decisions are made. Routing decisions are made by the source node in source routing.

D. Temporally Ordered Routing Algorithm (TORA)

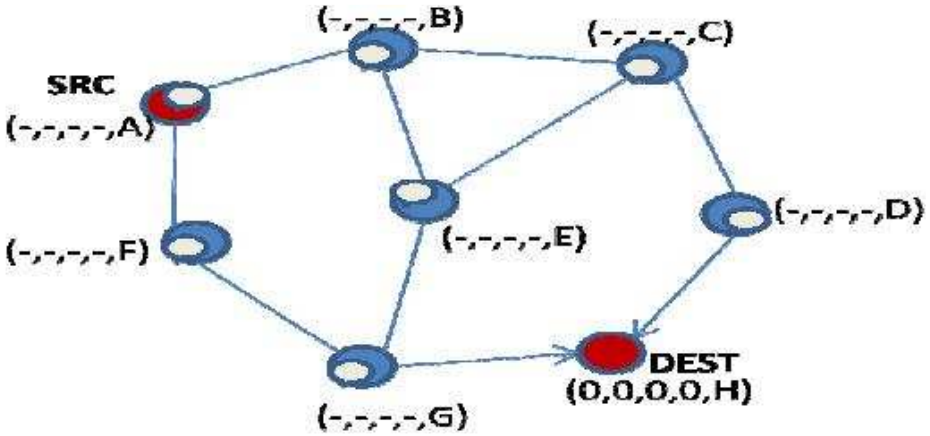

Fig. 2 Route discovery in TORA – QRY message

As its name suggest TORA is a routing algorithm. In MANET, it is mainly used to increase the scalability. This is an adaptive routing protocol. So TORA used in Multi-Hop network. In TORA a source and destination nodes are set. The established and enlarged route between source and the destination using Directed Acyclic Graph (DAG) built in destination node [12] by TORA. TORA considered secondary and not use the 'shortest path'. In this algorithm the routes are building and optimized using four massages [12]. In starting a query massage followed by an update massage then clear massage and after that finally optimization massage. Each node sends various parameters between the source and destination node by performing this operation. In TORA a parameters included the originator id (oid), reflection indication bit (r), time to break the link (t), the node id (i) and frequency sequence (d). The parameters (t), (oid) and (r) are called reference level and others two complete for the respective reference level. In TORA a link built referred to as "heights" and the flow is high to low. At the starting level the height of all the nodes is set to NULL (-,-,-,-,i) and that of the destination is set to (0,0,0,0,dest). Whenever there is need of change in topology the height is adjusted.

IV. RESULT AND PERFORMANCE METRICS

In this section we present the parameters design of our system and different metrics considered in performance analysis of routing protocols. We start with an overview of performance metrics considered in the comparison analysis. Then we present the software platform used in this briefly. How good the route in the network are, is the measurement of Quality of Service (QoS). As delivery of a set of pre-specified service attributes such as bandwidth and delay variance (jitter), the routes should guaranteed.

Several performance metric are used in the analysis of routing protocols. These metrics represents several characteristics of the overall network performance. In this report we analysis four types of metrics used in the comparison to study and the effect on the overall network performance. These metrics are packet delivery ratio, routing overhead, packet end to end delay and network throughput.

A. Routing Overhead

The design of mobile ad hoc network is scalable. Various routing protocols perform differently as the network grows. As the network grow, the amount of routing traffic increases. The most important measure of the scalability of routing protocols and network is its routing overhead. This is defined that the total number of routing packets are transmitted over the network in bits per second or packets per second. In the network, we execute that, followed by TORA; the OLSR sends the highest amount of routing traffic. With DSR and AODV, the least amount of routing traffic sent following the TORA. This observation is valid that is, a combination of 5, 20 and 50 traffic source moving at the constant speed 10m/s and 28m/s for the entire scenario.

B. Packet Delivery Ratio

Suppose the packet delivery ratios of protocols at the 10m/s and 28m/s speed respectively. In the considered scenario, we execute the low packet delivery ratios for all the protocols. All the protocols show the packet delivery ratios less than 50% excepting TORA. TORA show speed of 10m/s at 5 nodes. The main reason of low packet delivery ratios are use of TCP traffic. On the comparison of ad hoc routing protocols performance, the constant bit rate sources used. Because of rampant retransmission in the ad hoc networks, TCP suffers extensive degradation in its performance. Due to mobility, the unstable network connections further enhance these.

$$\text{Packet Delivery Ratio} = \frac{\Sigma \text{ total packets received by all sinks}}{\Sigma \text{ total packets sent by all sources}}$$

C. Packet End-to-End Delay

The average speed of protocols to packet end to end delay is the characteristics of protocols. In the considered scenario, we execute that OLSR has the lowest delay. OLSR is a proactive routing protocol. In the ad hoc network, the route always ready whenever the application layer has traffic to transfer. The periodic routing updates maintain route fresh available for use. The introduced absence of high quality latency by route discovery processes in OLSR describes its relatively low delay. The performance of OLSR completes with that of AODV and higher number of nodes. In the considered networks, due to proactive characteristics the OLSR had a consistent end-to-end delay.

D. Throughput

Throughput [15] is referred as the ratio between the total amounts of data reaches a receiver from a sender and the time taken for the receiver to get the last packet. DSR marginally outperformed TORA and AODV at 10 m/s and 20 m/s speeds despite having higher delay in the network with five traffic sources. This deviation can be explained by observing the DSR has the least amount of routing overhead. The prevalence of link failures and other factors such as the hidden terminal problem and congestion do not come much into play after the network is small. So than delay at low network loads, throughput is more a factor of routing traffic.

V. CONCLUSION

In this study we concluded that there are no single protocols with overall superior performance among the considered protocols. We can say that one may be superior in terms of routing overhead while others in packet delivery ratio, packet end-to-end, delay and throughput. So choice of a particular routing protocol will depend on intentional use of the network.

In this research the considered factor affecting the performance of ad hoc protocols are network load and speed. Speed affects the performance only in some instances whereas network load has a deeply effect on the performance.

Finally at last, whether a routing protocol is proactive or reactive has deeply effect on how the performance of protocol in various scenarios. Thus the major difference in order to find route discovery and route maintenance is achieved in the protocols largely dictated their behavior.

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