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Performance Analysis of Routing Protocols in Mobile Ad Hoc Networks (MANET)

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Abstract: A Mobile Ad Hoc Networks (MANET) is a collection of mobile nodes that can communicate with each other using wireless links without utilizing any fixed based station infrastructure and centralized management. In the present advanced technology there are many developments in Mobile Ad-hoc Networks (MANET) protocols. MANET is the wireless technology used in various applications like military, mobile devices etc, so improving the performance is an advantage in it. The research oriented works are been developed by many research persons in improving the protocols by taking the presently used protocols. There are different parameters taken from MANET like routing, power consumption, latency, bandwidth, traffic, packet loss etc. In this way there are many parameters taken as issue and new protocols are designed. This paper discusses the performance and comparison of different routing protocols of Mobile ad hoc networks with the different simulation model and metrics using trace graph.

Keywords: MANET, AODV, DSR, DSDV, Trace graph.

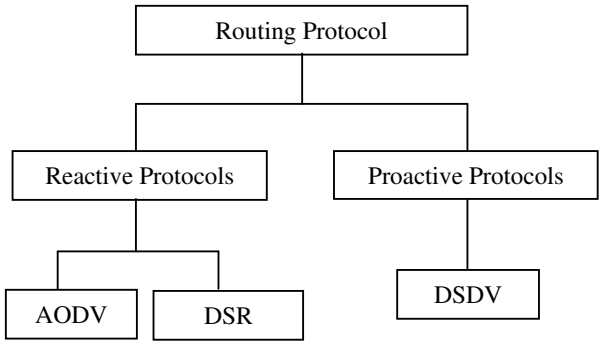
I. INTRODUCTION

A Mobile Ad Hoc Networks are wireless networks which do not require any infrastructure support for transferring data packet between two nodes. It is very necessary for MANETs to have an efficient routing to support different applications. Routing protocols are generally divided into two types; they are proactive and reactive routing protocols. There are many protocols proposed for MANET and the most popular routing protocols are Ad hoc on demand Distance Vector (AODV)[4], Destination-Sequenced Distance-Vector Routing protocol (DSDV)[7], Dynamic Source Routing Protocol (DSR)[6].

The goal of this paper is to study the performance of routing protocols and comparing the performance of proactive and reactive routing protocols in mobile ad hoc networks. The rest of the paper is organized as follows. Section 2 describes the introduction about the different routing protocols. Section 3 describes the simulations using trace graph software and section 4 describes the conclusion and future work.

II. RELATED WORKS

Routing protocols used in wired networks cannot be used for mobile ad-hoc networks because of node mobility. The goal of the routing protocol [9] is to have an efficient route establishment between a pair of nodes, so that messages can be delivered in a timely manner. Bandwidth and power constraints are the important factors to be considered in current wireless networks. In Mobile Ad hoc Networks, the ad-hoc routing protocols [10] are divided into two classes: Reactive protocols (on demand) and proactive protocols (table driven).



A. Reactive Routing Protocols.

Protocols that fall under this category do not maintain the network topology information. They obtain the necessary path when it is required, by using a connection establishment process. Hence these protocols do not exchange routing information periodically. Some of the

existing protocols that belong to this category are discussed below.

AODV Protocol: Ad hoc On demand Distance Vector (AODV) protocol [4] uses an on demand approach for finding routes, that is, a route is established only when it is required by a source node for transmitting data packets. It employs destination sequence numbers to identify the most recent path. In AODV, the source node and the intermediate nodes store the next hop information corresponding to each flow for data packet transmission. In on demand routing protocol, the source node floods the Route Request packet in the network when a route is not available for the desired destination. It obtains multiple routes to different destinations from a single Route Request.

The major difference between AODV and other on demand routing protocols is that it uses a destination sequence number to determine an up to date path to the destination. A node updates its path information only if the destination sequence number of the current packet received is greater than the last destination sequence number stored at the node. When an intermediate node receives a Route Request, it either forwards it or prepares a Route Reply if it has a valid route to the destination. If a route request receives multiple times, the duplicate copies are discarded. All intermediate nodes can send Route Reply packet to source if it has a valid route to the destination. An important feature of AODV [8] 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 Route Error packets when the next-hop link breaks. Each predecessor node, in turn, forwards the Route Error to its own set of predecessors, thus effectively erasing all routes using the broken link.

DSR Protocol: The DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR [6] allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure. When a source node has data packets to be sent to the destination node, first it initiates a Route Request packet. This Route Request is flooded throughout the network. Each node upon receiving a Route Request packet rebroadcasts the packet to its neighbors if it has not forwarded already or if the node is not the destination node. Each Route Request carries a sequence number generated by the source node and the path it has traversed. A node, upon receiving a Route Request packet, checks the sequence number on the packet before forwarding it. The packet is forwarded only if it is not a duplicate Route Request. A destination node after receiving the first Route Request packet, replies to the source node through the reverse path the Route Request packet had traversed. The major difference between AODV and DSR is that DSR [11] uses source routing in which a data packet carries the complete path to be traversed. However, in AODV, the source node and the intermediate nodes store the next hop information corresponding to each flow for data packet transmission.

B. Proactive Routing Protocols.

Proactive Protocols maintain consistent and up to date routing information about each node in the network. These protocols require each node to store their routing information and when there is a change in network topology updating has to be made throughout the network. These protocols are also called as Table driven routing protocols.

***DSDV Protocol*:** Destination-Sequenced Distance-Vector Routing protocol (DSDV) [7] is a table-driven proactive protocol, based on the classical Bellman-Ford routing mechanism. The basic improvements made include freedom from loops in routing tables, more dynamic and less convergence time. Every node in the MANET maintains a routing table which contains list off all known destination nodes within the network along with number of hops required to reach to particular node. Each entry is marked with a sequence number assigned by the destination node. The sequence numbers are used to identify stale routes thus avoiding formation of loops.

To maintain consistency in routing table data in a continuously varying topology, routing table updates are broadcasted to neighbour's periodically or when significant new information is available. In addition to its time difference between arrival of first and arrival of the best route to a destination is also stored so that advertising of routes, which are likely to change soon, can be delayed. Thus avoiding the advertisement of routes, which are not stabilized yet, so as to avoid rebroadcast of route entries that arrive with node is supposed to keep the track of settling time for each route so that fluctuations can be damped by delaying advertisement of new route to already known and reachable destination thus reducing traffic. Fluctuating routes occurs as a node may always receive two routes to a destination with same sequence number but one with better metric later. But new routes received which take to a previously unreachable node must be advertised soon. Mobiles also keep track of the settling time of routes, or the weighted average time that routes to a destination will fluctuate before the route with the best metric is received.

III. PERFORMANCE EVALUATION

A. Simulation Setup.

In this work, simulation is performed using network simulator (ns-2). we have drawn graphs using trace graph

software. [5] Trace graph is a free tool for analyzing the trace files generated by ns2. Trace graph can support any trace format if converted to its own or ns2 trace format. Trace graph runs under Windows, Linux, and UNIX and MAC OS systems. We have taken different parameters like throughput of sending packets, packet drop ratio and end to end delay.

B. AODV Routing Protocol.

Fig. 1 describes about the relation between the simulation time (in sec.) and the throughput of sending packets. When the simulation time reaches 100sec. the number of sending packets will be increased. The number of sending packets will be decreased suddenly when the simulation time reaches 200sec. Throughput of sending packets will be high when the simulation time between 100sec and 200sec.

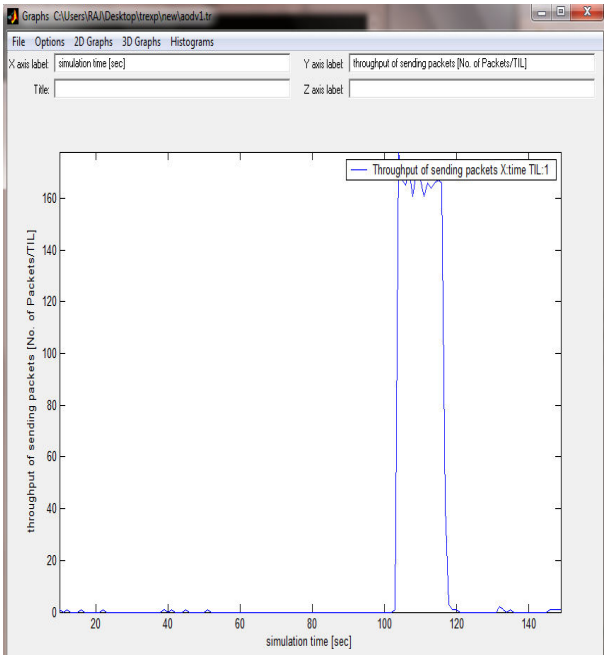


Fig. 1 Throughput of sending packets.

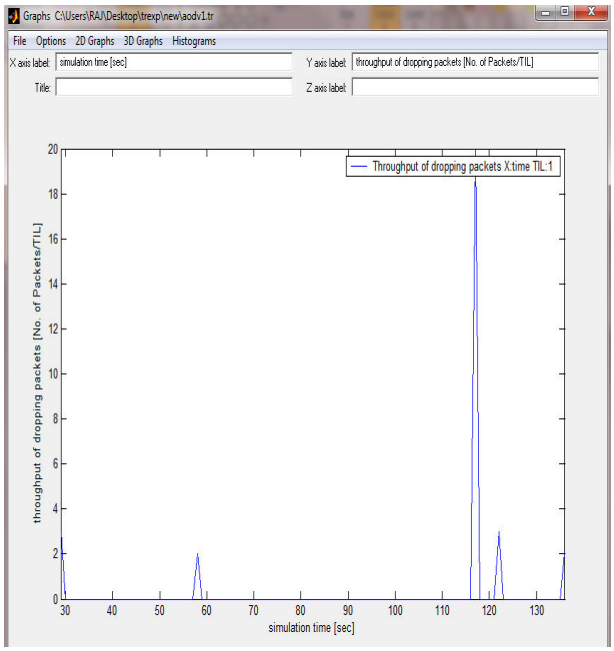


Fig. 2 Throughput Of Dropping packets.

When we draw the graph between simulation time and throughput of dropping packets using tracegraph software, the packet dropping ratio will be slightly increased between the simulation time 50 and 60. The packet drop ratio will be high when the simulation time is between 110 and 120sec.

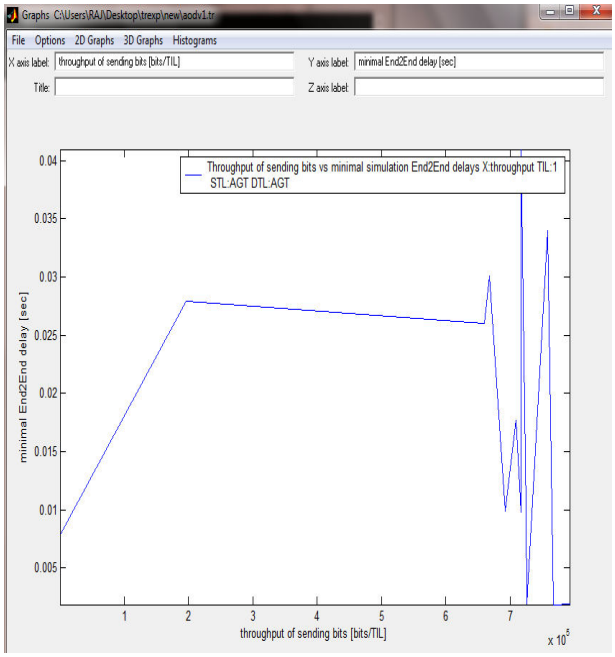


Fig. 3 End To End Delay

C. DSDV Routing Protocol.

Fig. 4 describes about the relation between the simulation time (in sec.) and the throughput of sending packets. The throughput of sending packets ratio will be high when the simulation time is between 80sec and 120sec.

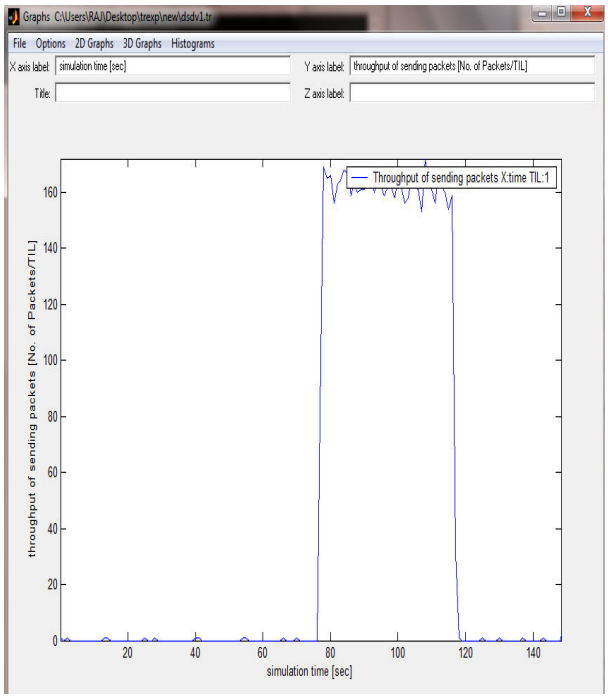


Fig. 4 Throughput of sending packets

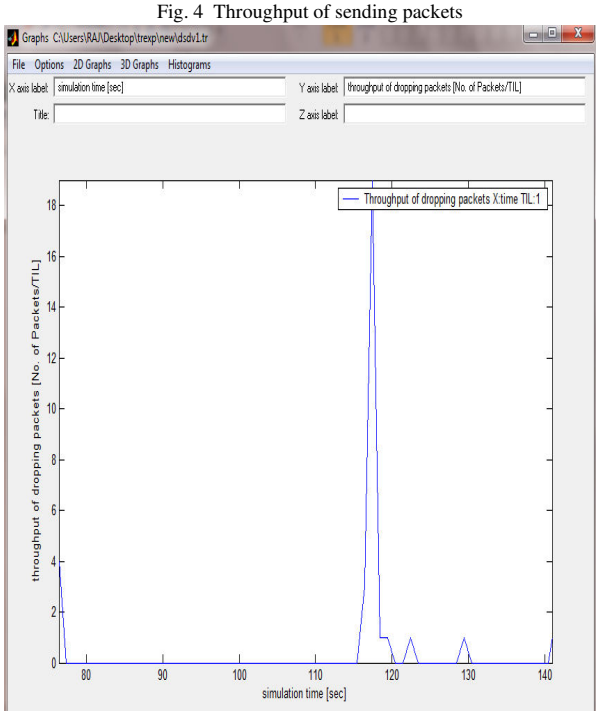


Fig. 5 Throughput Of Dropping Packets

When we draw the graph between simulation time and throughput of dropping packets, the packet dropping ratio will be high between the simulation time 110 and 120.

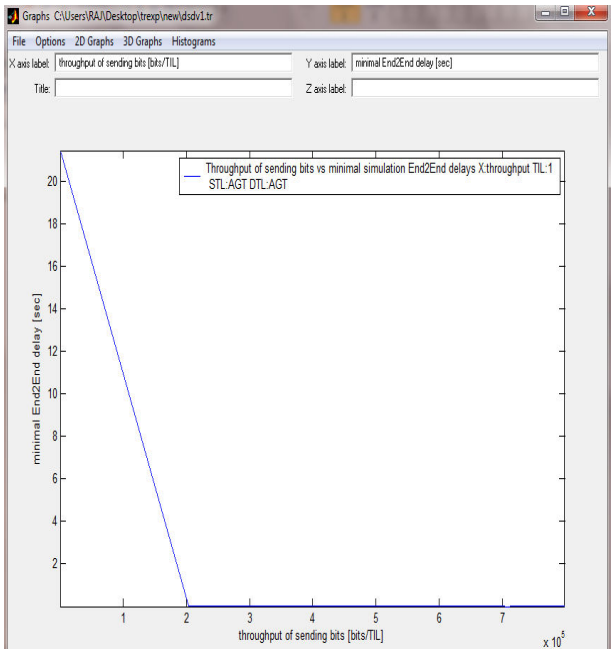


Fig. 6 End To End Delay

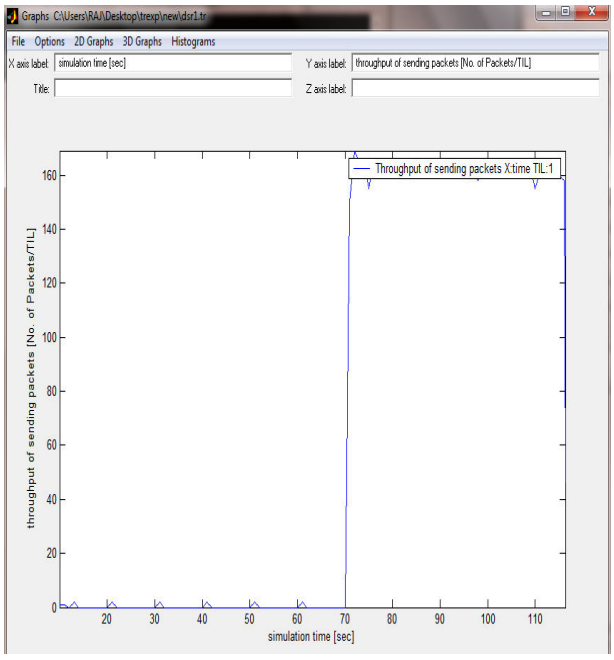


Fig. 7 Throughput of sending packets

D. DSR Routing Protocol.

In DSR routing protocol, Throughput of sending packets will be high when the simulation time reaches 70 sec then the throughput of sending packets will decrease suddenly when the simulation time reaches 120sec.

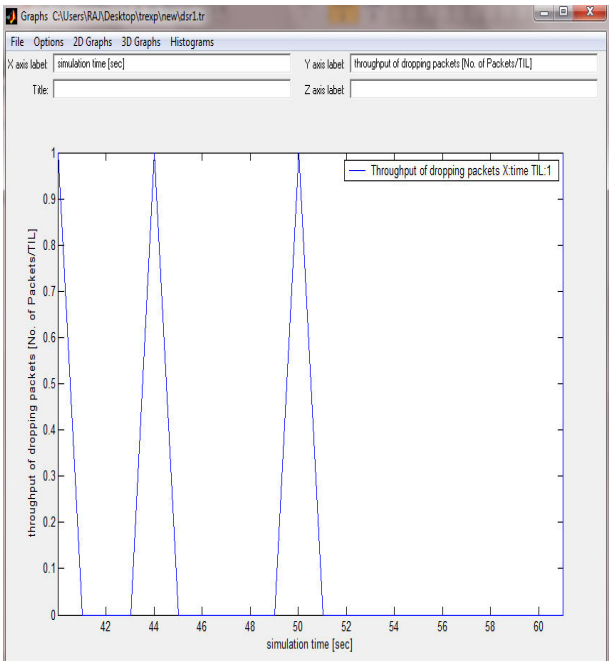


Fig. 8 Throughput Of Dropping Packets.

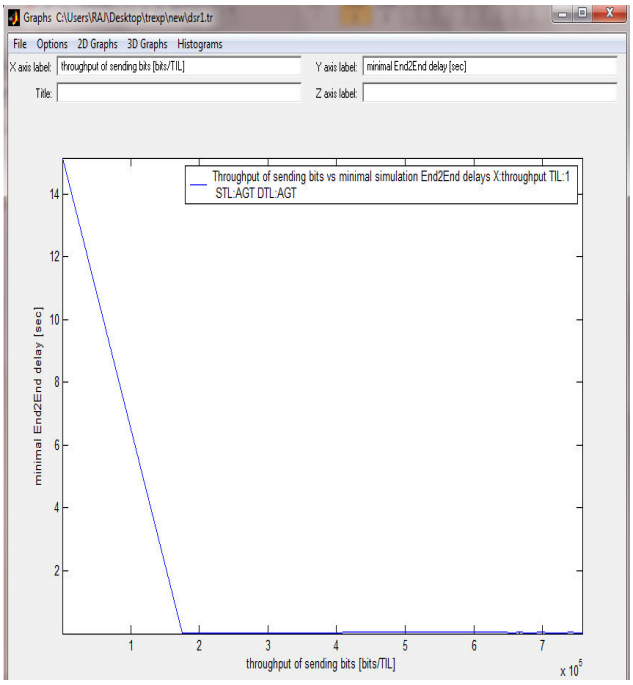


Fig. 9 End To End Delay.

Fig. 8 shows the relation between simulation time and throughput of dropping packets. From simulation time 0 to 40sec the packet drop ratio is decreasing and from 43sec to 44sec the packet dropping is high. In dsr protocol, the packet dropping ratio will be high compared to aodv and dsdv protocols. From fig. 3, the delay is increasing from sending bits 0 to 2. The delay is decreased slightly after sending bits equal to 2. From fig. 6, the end to end delay is decreasing when the sending bits from 0 to 2. From fig. 9, the end to end delay is low compared to dsdv routing protocol. When the sending packets equal to zero, the delay will be high.

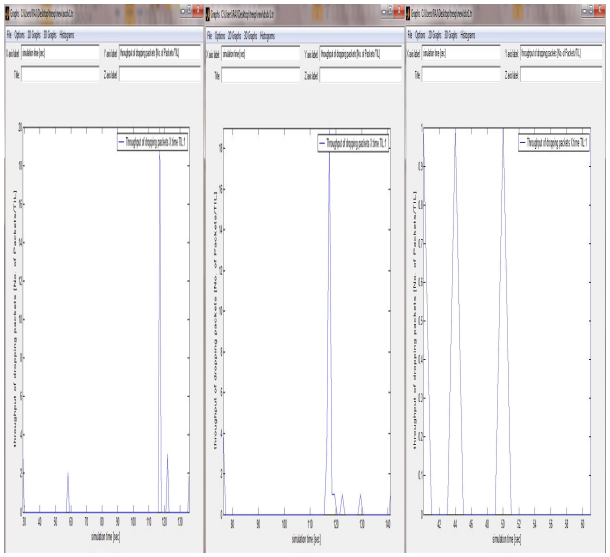


Fig. 10 Packet drop ratio of 3 prtocols.

From the above graphs we can say that the delay in sending packets is very low in aodv protocol compared to dsr and dsdv protocol. If we compare packet drop ratio of three protocols, packet dropping ratio is high in in dsr protocol compared to dsdv and dsr. So, we can say that AODV routing protocol performance is better than dsr and dsdv with respect to delay and packet drop ratio.

IV. CONCLUSION

In this work, we compare the routing protocols i.e. AODV, DSR and DSDV etc, the results of which could be useful in many situations. By considering various parameters end to end delay, simulation time, throughput of sending packets and throughput of dropping packets, we concluded that AODV is the most efficient protocol among all. However there are other protocols also in MANET. In addition to this, improving packet delivery efficiency and decreasing packet dropping ratio is the challenging area.

V. REFERENCES

[1] S.K.Soni and T.C.Aseri, "A review of current multicast routing protocol of mobile ad hoc network," in Proc.Second Int.Conf.Computer Modeling and Simulation ICCMS'10, vol.3, pp.207–211, 2010.

[2] L.Junhai, Y.Danxia, X.Liu, and F.Mingyu, "A survey of multicast routing protocols for mobile ad-hoc networks," IEEE Communications Surveys & Tutorials, vol.11, no.1, pp.78–91, 2009.

[3] Dongbin Wang,, Mingzeng Hu, and Hui Zhi, A survey of secure routing in ad hoc networks, The Ninth

International Conference on Web-Age Information Management, 978-0-7695-3185-4/08, 2008 IEEE.

[4] C.Perkins, Ad hoc On demand Distance Vector (AODV) Routing, RFC3561[S], July2003.

[5] Lukoit K., Wilde N, Stowell S, Hennessey T, Trace Graph: immediate visual location of software features, Proceedings International Conference on Software Maintenance ISBN: 0-7695-0753-0, 2000.

[6] DavidB.Johnson, DavidA.Maltz, Yih-ChunHu, The Dynamic Source Routing Protocol for Mobile Ad Hoc Networks, Internet-Draft, draft-ietf-manet-dsr-10.txt, July2004.

[7] CharlesE.Perkins, PravinBhagwat, Highly dynamic Destination-Sequenced Distance-Vector routing (DSDV) for mobile computers, in: Proceedings of the SIGCOMM'94 Conference on Communications Architectures, Protocols and Applications, August1994, pp.234–244.

[8] Ying-Kwei Ho; Ru-Sheng Liu; On-demand QoS-based routing protocol for ad hoc mobile wireless networks, Identifier: 10.1109/ISCC.2000.860696 ISCC 2000 fifth IEEE symposium on computers and communications, 2000.

[9] S.Corson, J.Macker, Mobile Ad hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Considerations[S], RFC2501,1999.

[10] Arun Kumar B. R., Lokanatha C. Reddy, Prakash.S.Hiremath, " A Survey of Mobile Ad Hoc Network Routing Protocols" Journal of Intelligent System Research, January-June 2008; pp. 49-64, Serials Publications, New Delhi, 2008.

[11] Samir R. Das, Charles E. Perkins, Elizabeth M. Royer, Performance comparison of two on-demand routing protocols for ad hoc networks, in: Proceedings of the IEEE Conference on Computer Communications (INFOCOM), TelAviv, Israel, March2000, pp.3–12.

[12] M.Younis and S.Z.Ozer, "Wireless ad-hoc networks: Technologies and challenges," Wireless Commun. Mobile Computing, vol.6, no.7,pp.889–892, Nov.2006.

[13] The Network Simulator - ns-2. Available from: http://www.isi.edu/nsnam/ns/index.html/.

