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STUDY ON MOBILE ADHOC NETWORKS ROUTING PROTOCOLS TO ENHANCE THE END-USER EXPERIENCE

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Abstract: This research article represents an evaluation study of three major mobile adhoc networks routing protocols. It is necessary to provide the network operators and mobile applications developers with such a study to help them decide which mobile adhoc networks routing protocols can help to enhance the end-user experience. A mobile adhoc network is a kind of wireless adhoc network, random mobility and is a self configuring network of mobile routers connected by wireless links. Mobile adhoc networks network gets too much attraction of researchers due to its mobility, reliability, self-repairing and without depend any infrastructure. Therefore routing discovery and preservation are significant issues in these networks. Performance investigation was carried out on adhoc on-demand distance vector, dynamic source routing and optimized link state routing protocols using network simulator. We have analysis of throughput and packet delivery ratio and average end-to-end delay are measured for the comparison of the performance of above protocols.

Keywords: Routing Protocol, MANET, DSR, DSDV, TORA, ZRP

INTRODUCTION

The emergence of wireless networks has gone a long way in solving the growing service demands. The focus of research and development endeavor has almost shifted from wired networks to wireless networks. The limitations of wireless network techniques such as high error rate, power restrictions, bandwidth limitations and other constraints have not deterred the growth of wireless networks [1-4]. Mobile adhoc network (MANET) is one of the most demanding field in the area of wireless network MANET consist of mobile devices or users which are generally known as nodes, and each one of which is equipped with a radio transmitter and a receiver. MANET was created for this purpose. Unlike wired networks, MANETs are void of any kind of infrastructure support, including switches or cables. This causes the network topology to change very rapidly as the number of nodes, the location

of these nodes and the metric, all vary a greatly within a short amount of time [5-8]. Additionally, this variation requires MANETs to be self- configuring and adaptable in order to maintain a consistent data transmission speed. Furthermore, the limited transmission range of mobile devices is overcome by utilizing intermediate nodes as router for other nodes. These characteristics of MANETs render interior routing protocols, like distance-vector and link-state, inefficient due to high storage requirement and loop formation, respectively [9-12]. In their stead, ad hoc routing protocols were developed specifically for MANETs, which include Adhoc On-demand Distance Vector (AODV), Optimized Link State Routing (OLSR), Dynamic Source Routing (DSR), Zone Routing Protocol (ZRP), Temporary Ordered Routing Algorithm (TORA) etc. MANETs are useful in various application areas such as: Communication in the battlefields, institutions and colleges, military areas, disaster recovery areas, law and order maintenance, traffic control areas, medical field and conferences [13-16]. The performance of AODV, DSR and OLSR are evaluated and the performance like throughput, Packet Delivery Ratio (PDR) and average end to end delay. The performance of AODV was best for all performance metrics. DSR throughput and packet delivery ratio was better than OLSR and ZRP. OLSR shows the worst performance for average jitter and average end-to-end delay with the varying pause time. DSR shows the worst performance for average jitter and average end-to-end delay [17-20]. They compared AODV, OLSR and DSR using network simulator 2 and analyzed various performance parameters such as packet delivery fraction, or throughput, and end-to-end delay. The observed results states that for constant model, AODV outperforms OLSR and DSR. Though TORA performed better at high mobility, it had lower throughput in other cases. AODV shows the best overall performance in their simulation. DSR output performs the other protocols in terms of overhead. Modal Mass Acceleration Curve (MAC) load is evaluated of effective utilization of the wireless medium by data traffic. The poor delay and throughput performances of DSR are mainly attributed to aggressive use of caching, and lack of any mechanism to expire on stale routes or to determine the freshness of routes when multiple choices are available [21-25].

ROUTING TYPES

Routing protocols for mobile adhoc networks can be subdivided into 2 types such as proactive and reactive routing.

Proactive Routing: Proactive routing or table-driven routing protocols allow all the nodes to circulate continuously and it updates periodically throughout the network topology. OLSR is the most suitable example of a table driven proactive routing protocol for mobile ad hoc networks. It is an optimization version of a pure link state uses the concept of multipoint relay to generating and forwarding topology information and reduces the generated overhead to all nodes in to the entire network by limiting the number of broadcasts. OLSR protocol uses four types of messages they are HELLO packets message, Topology Control (TC), multiple interface declaration messages and Host Network Association message to discover the neighbor's and gaining information about them. Multipath Relay (MPR) nodes it is the only responsible of route broadcast packet in the network in order to reduce the size of broadcast. OLSR is more suitable for large and dense networks than AODV and DSR.

Reactive Routing: Reactive routing protocols create routes on demand. They do not transmit periodical signals, like proactive protocols, but compute and discover routes as and when they are required. This makes it more suitable for ad-hoc networks, since the nodes in these networks are always fluctuating. These protocols utilize the flooding technique to find routes. AODV is a combination of on-demand and distance vector. AODV minimizes the number of required broadcasts by creating routes in an on-demand manner. When a source node desires to send data to other destination node, it needs to initiate a path discovery process to locate the other node. AODV performs two operations Route Discovery and Route Maintenance. Route discovery is done in AODV by broadcasting the Route Request (RREQ) message from the source node to neighbor nodes, which then forward the request to their neighbors, and so on, until the destination is located. When the RREQ reaches a node with route to destination, the destination node is responds and creates again a

Route Replay (RREP) back to the source node and contains the number of hops that are require reaching the destination. AODV maintains all the route information in the form of routing table and also uses the destination sequence number to keep its information updated and to try to be loop free and avoidance any broken routes. DSR is a reactive routing protocol for ad-hoc wireless networks. DSR uses source routing algorithm. A Dynamic Source Routing network can configure and organize itself independently. The protocol can also function with cellular telephone systems and mobile networks. The two main phases in DSR are the route discovery phase and the route maintenance phase. The route discovery phase is depends on the flooding. The source node generates RREQ packet, which contains addresses of both the source and the destination and a unique number to identify the request, and it is flooded throughout the network. Each node that receives this packet appends its own address into the packet header. At the same time, whenever RREQ reaches either the destination or a node that knows a route to the destination, a RREP packet, which contains the addresses of nodes that the RREQ has traversed, is sent in reverse route. Source node might receive many RREP signals. It chooses the route with the smallest distance, and the rest of the routes are captured. If a selected route gets detached then, a route from captured can used as a substitute to speed up the process.

PERFORMANCE METRICS

The performance metrics were considered to compare the three routing protocols are average end-to-end delay the average time taken by the data packets to be transmitted from the source to the destination across the MANET. It includes transmission delay, propagation delay, processing delay and queuing delay throughput is the rate of transmission of data packets in unit time and PDR is the ratio of number of packets delivered to the destination to the number of packets generated at the source.

RESULTS AND DISCUSSION

The execution is approved out using a mobile node environment of 50 mobile nodes over a simulation area of 1000 meters x 1000 meters level gap in service for 10 seconds of simulation time. The network based data processing or most expensive and data communication level on their performance on the network. Hence, the simulation experiments do not account for the overhead produced when a multicast members leaves a group. Multiple sources create and end sending packets; each data has a steady size of 512 bytes. Each mobile node to move randomly on their network, it's more and most expectable on their networks. The simulation results for various parameters are given in Table 1.

Table 1. Simulation results

Parameter	Values
Simulator	2.34
MAC Protocol	IEEE 802.11
Area of Simulation	1000 x 1000 m
Mobile Nodes	20, 60, 100
Node Speed	20 m/s
Pause Time	0, 10, 30, 50, 70, 100 seconds
Mobility Model	Random Waypoint
Packet Size	64 byte
Rate of Transmission of Packets	4 packets per second
Routing Protocols	AODV, DSR, OLSR
Traffic Sources	Constant Bit Rate
Simulation Time	200 seconds

Throughput: Throughput is used as the performance metric to measure the message delivery system in the established communication channel and the values of throughput of MANET protocols are shown in Figure 1.

Average End-To-End Delay: End-to-end delay calculates the delay of the packet which is successfully transmitted from the source to the destination. This end-to-end delay includes all possible delays caused by buffering during route discovery latency, queuing in the interface queue, retransmission delays at the MAC, propagation and transfer times. It is the duration of the time a packet travels from the application layer of the source to the destination. End-to-end delay is one of the most important metrics when analyzing the performance in quality of service (QoS) aware routing protocols. The average end-to-end delay is averaged out of all the end to end delay of successfully transmitted packets is shown in Figure 2.

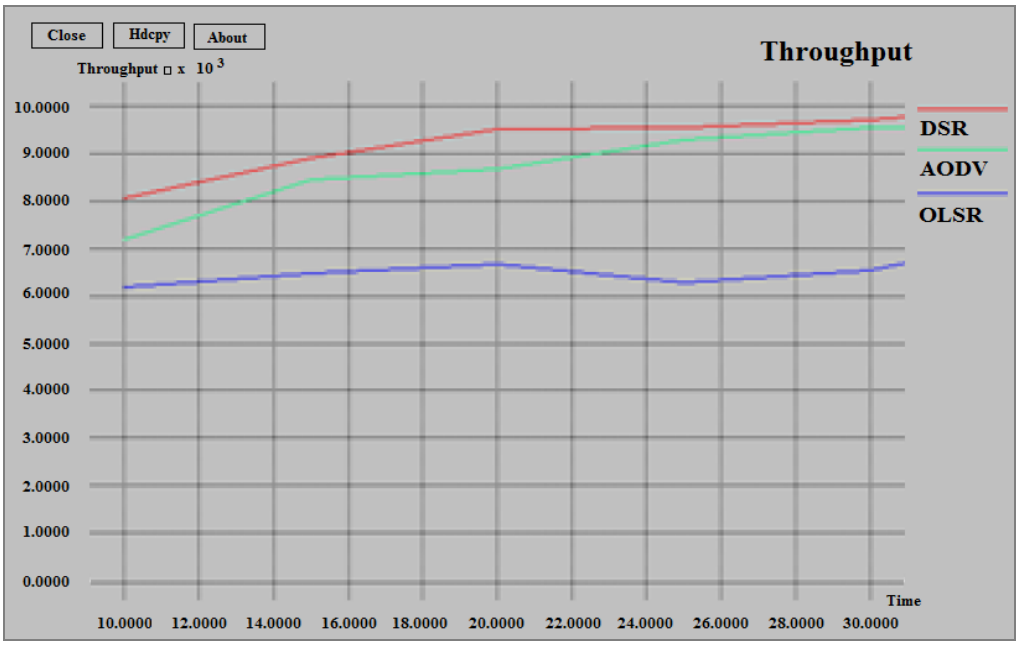

Figure 1. MANET protocols Throughput

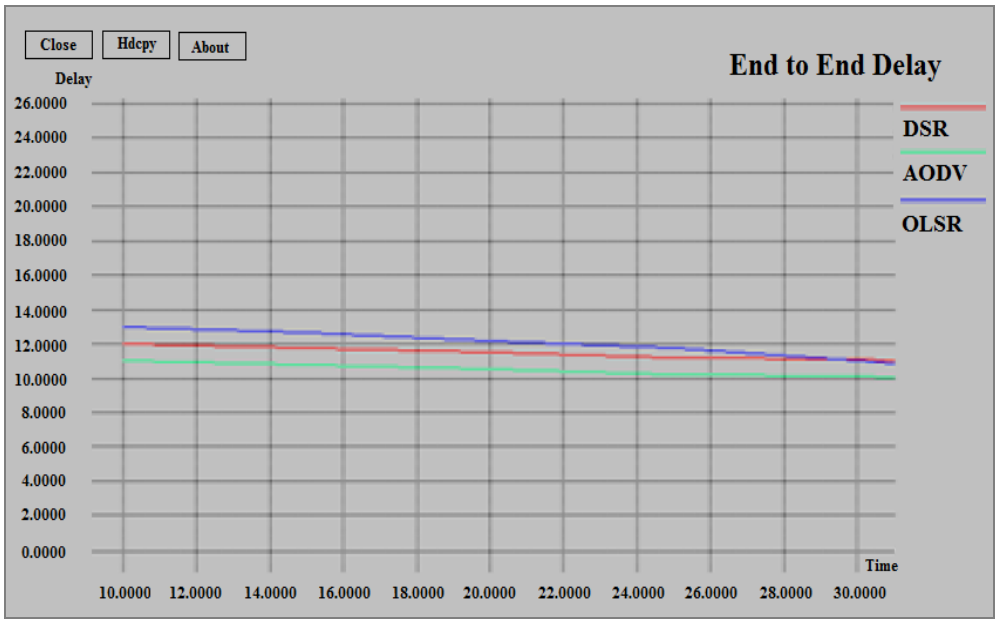

Figure 2. MANET protocols Average end to end delay

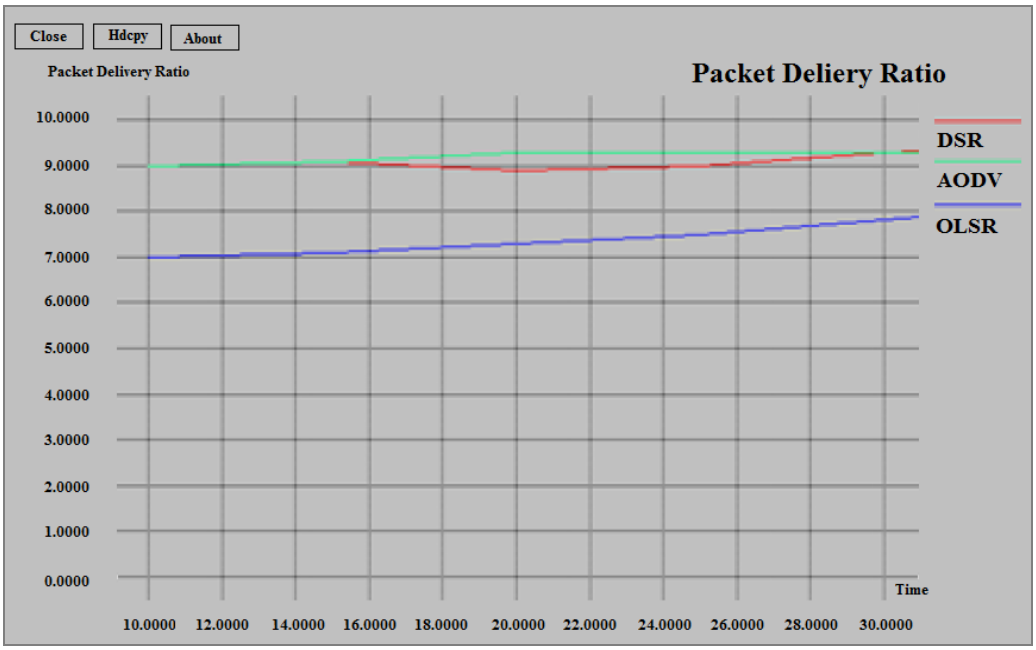

Figure 3. MANET protocols PDR

PDR: It is the ratio of the successfully delivered packets to those generated by constant bit rate (CBR) sources as shown in the formula of the following part. The PDR values of MANET protocols are shown in Figure 3. The higher the PDR, the lower the packet loss rate, the more efficient the routing protocol from the data delivery point of view. In real time communications, the routing protocol with higher PDR may not be considered better than the one with lower PDR, since packets which arrive late could be useless although they destination.

CONCLUSION

The objective of study on mobile adhoc networks routing protocols to enhance the end-user experience was done. It is necessary to provide the network operators and mobile applications developers with such a study to help them decide which MANET routing protocols can help to enhance the end-user experience. Based on the results the following conclusions were made.

- In addition, routing protocols have an important effect on the overall performance of the mobile applications which use MANET as a business network.
- Comprehensive simulation results of average end-to-end delay, throughput, and packet delivery ratio over the routing protocols OLSR, DSR and AODV by varying network size, simulation time was carried out.
- OLSR is a proactive routing protocol and suitable for limited number of nodes with low mobility due to the storage of routing information in the routing table at each node.
- Comparing DSR with OLSR and AODV protocol, byte overhead in each packet will increase whenever network topology changes since DSR protocol uses source routing and route each.
- This attribute is very much required for cutting-edge mobile applications that need high throughput and less delay and besides, the results support the perceptive expectations of OLSR behavior which has been proven result.

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