

Evaluating the Performance Speed of Multiple Protocols for Ad Hoc Network

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Abstract— In work this discussed about analysis of various protocols used in Ad Hoc Network. This study provides a realistic qualitative and quantitative comparison of the six routing protocols described. The current study gave a fundamental understanding of the variation of specific performance parameters with mobility for a wide spectrum of MANET routing algorithms. For our further work, we intend to study the scalability aspect of these protocols to assess the impact on network performance as the network size and coverage increases. The proposed model was tested using QualNet 5.0.2 simulator, by which analyze the performances of these protocols with by creating a scenario of 25 nodes with RWP mobility model.

IndexTerms— Routing Protocol, Ad hoc Network, QualNet, Packet Delivery Ratio

I. INTRODUCTION

One of the important characteristics of this Ad Hoc network is the node mobility, which will change the network topology very frequently, hence making the network dynamic. Thus achieving an efficient routing protocol with frequent mobility becomes a challenging issue in MANETs. We analyze the effect of the mobility on different routing protocols using **QualNet Simulator**. The mobility model for nodes is being captured by Random Waypoint Mobility Model (RWP). The performance of these protocols AODV, DSR, ZRP, FSR, LANMAR & OLSR are compared and analyzed with variation in node speed. The metrics used for the performance evaluation include packet delivery ratio, average jitter, throughput and average end-to-end delay. Experimental results illustrate that performance of the routing protocol varies with variation in node speed. Recently, the progress in communication technology has made wireless devices smaller, easily available, less expensive and more powerful. Availability of such devices has spurred a great interest in wireless networks such as MANETs.

A MANET is a collection of wireless mobile nodes which communicate with each other without the need of any pre-defined network infrastructure. Each node in the networks also acts as a router, forwarding data packets for other nodes [153]. The nodes are generally mobile; they are free to move arbitrarily resulting in frequently and drastic changes in the network topology. Because of the freedom of this mobility, the set of application for MANETs is diverse, ranging from small networks like conference rooms, meetings etc. to large-scale, sensitive networks like military communications by soldiers, search and rescue operations. A key challenge in ad hoc network design is to develop a correct, effective, efficient and reliable routing protocol to have communication between mobile nodes. The routing protocol must be capable to handle the high degree of node mobility that frequently changes the network topology dynamically and unpredictably.

For that the protocols must be adaptive and able to maintain routes despite the change in the topology of the network, caused by the mobility of nodes. There are many ways to classify MANET routing protocols, depending on how the packet is delivered from source to destination. They can be broadly classified as proactive, reactive and hybrid routing [139]. In the proactive routing approach, every node maintains one or more tables to provide information about the routes to establish the perfect communication between any two nodes of the network.

II. SIMULATION ENVIRONMENT

The main focus is to analyze the performance of different routing protocols in a mobile ad-hoc environment. The simulations have been performed using QualNet 5.0.2. The mobility model for nodes is being captured by Random Waypoint Mobility Model (RWP). In RWP, each node chooses a random destination within the simulated area and a speed between some minimum and maximum bounds. The node pauses for a fixed period of time and then moves towards the destination. We have done comprehensive simulation of routing protocols by varying the speed of nodes using RWP mobility model. We created different mobility scenarios with different mobility speed for each protocol. Mobility is the main thing which is affecting the performance and scalability of MANETs. To investigate the effect of node mobility, we ran simulation of 6 different protocols by varying speed, with the following parameters; these are denoted in the following table,

Parameters	Value
Protocols	AODV, DSR, ZRP, FSR, LANMAR & OLSR
Simulation Area	500 x 500 m
Simulation Time	300 sec
Number of Nodes	30
Traffic pattern	CBR
Mobility Model	Random Waypoint
Pause Time	20 s
Speed of nodes	2, 4, 6, 8, 10 mps

Table.1 Simulation parameters

III. RESULTS AND DISCUSSIONS

We have investigated the performance measuring of different routing protocols by varying speed from 2mps to 10mps. The results obtained from simulations are presented in figures 1 to figure 4. To evaluate the efficiency of a routing protocol in MANET, we have evaluated the following metrics,

Throughput

It is the ratio of the total amount of data that reaches a receiver from a sender to the time it takes for the receiver to get the last packet. It measures the effectiveness of a routing protocol. As seen in figure 1, the throughput value of both AODV & DSR is constant throughout as the speed of the node increases. However, there is a decline in the throughput of OLSR, ZRP & FSR, as the speed increases; this is due to their proactive nature. Hence, DSR shows better performance with respect to throughput among these protocols as it delivers data packets at higher rate.

Average End-to-End Delay

The end-to-end delay is the average time a packet takes to traverse through the network. It includes all possible delays such as buffer queues, transmission time and delays caused by routing activities. It is averaged over all successfully received data packets. It represents the reliability of the routing protocol. It is clear that (figure 2) FSR has the highest average end-to-end delay. As the node traverses with higher speed, OLSR shows the shortest delay. However, the speed variation has shown a negative effect on end-to-end delay of AODV & DSR.

Packet Delivery Ratio

It is the ratio of the number of packets transmitted by a traffic source and the number of packets received by traffic sink. It is a measure of both the correctness as well as efficiency of routing protocols. Figure 3 illustrates the effect of node speed on packet delivery ratio (PDR). It has been observed that DSR and AODV maintain a stable PDR value with variation in node speed. Similarly, the PDR value of ZRP increases initially and decreases as the speed increases. However, LANMAR has shown a decline in packet delivery ratio.

Average Jitter

As the packets from source to destination will reach the destination with different delays, a packet's delay varies with its position along the path between source and destination and this position can vary unpredictably. This variation in delay is known as Jitter. The effect of variation of node speed on the average jitter of the six routing protocols described earlier is shown in figure 4. As seen in the figure, jitter of FSR is worst. It is higher than that of AODV, DSR, ZRP, LANMAR & OLSR. The value of jitter remains constant initially for ZRP & LANMAR & increases with increase in speed. From figure 8.4, it has been observed that with respect to jitter performance of AODV is better at smaller values of speed but as the node traverses with higher speed OLSR is better.

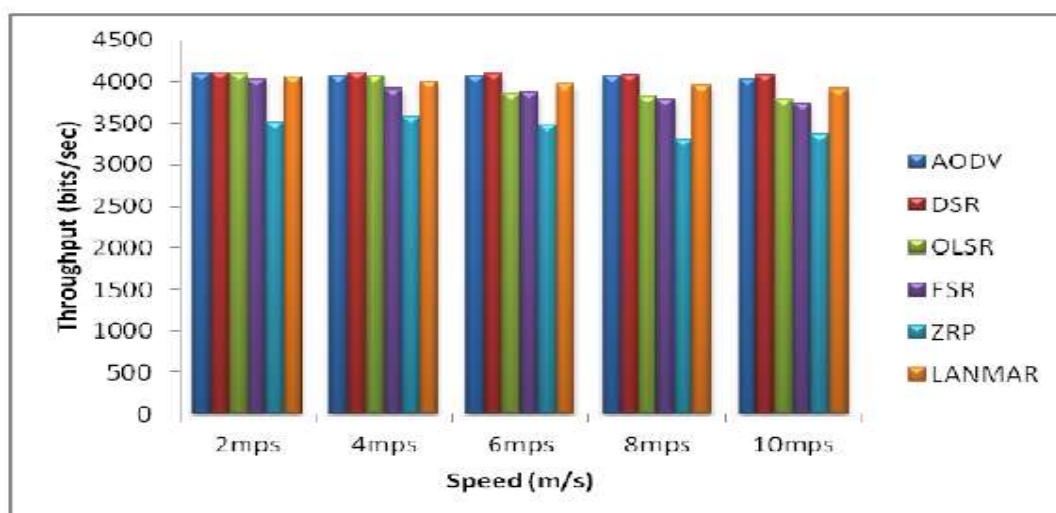


Figure 1 Effect of node speed on throughput of AODV, DSR, OLSR, FSR, ZRP, LANMAR

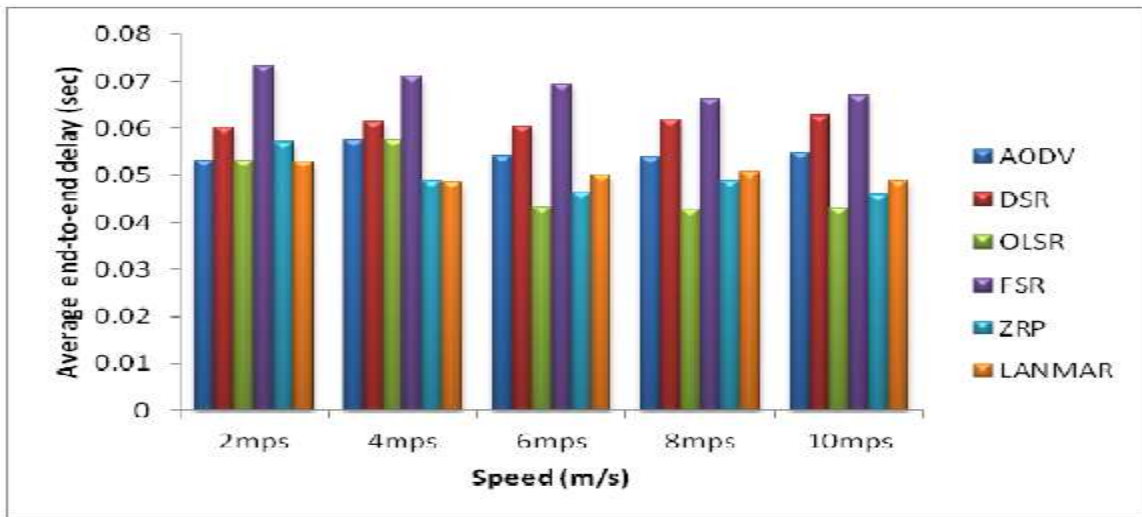


Figure 2 Effect of node speed on Average end to End Delay of AODV, DSR, OLSR, FSR, ZRP, LANMAR

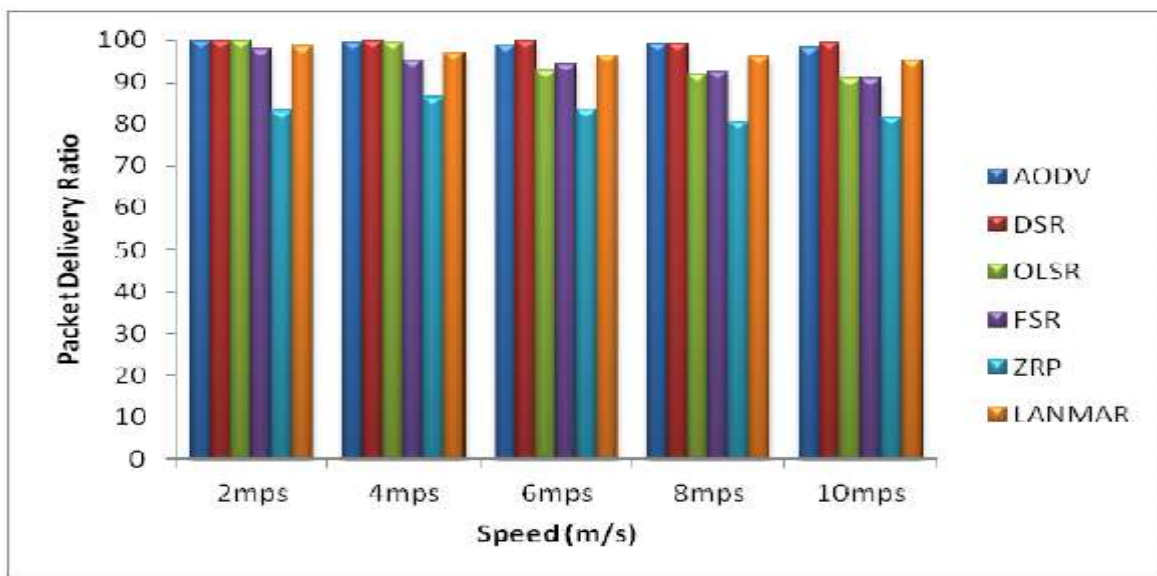


Figure 3 Effect of node speed on Packet Delivery Ratio of AODV, DSR, OLSR, FSR, ZRP, LANMAR

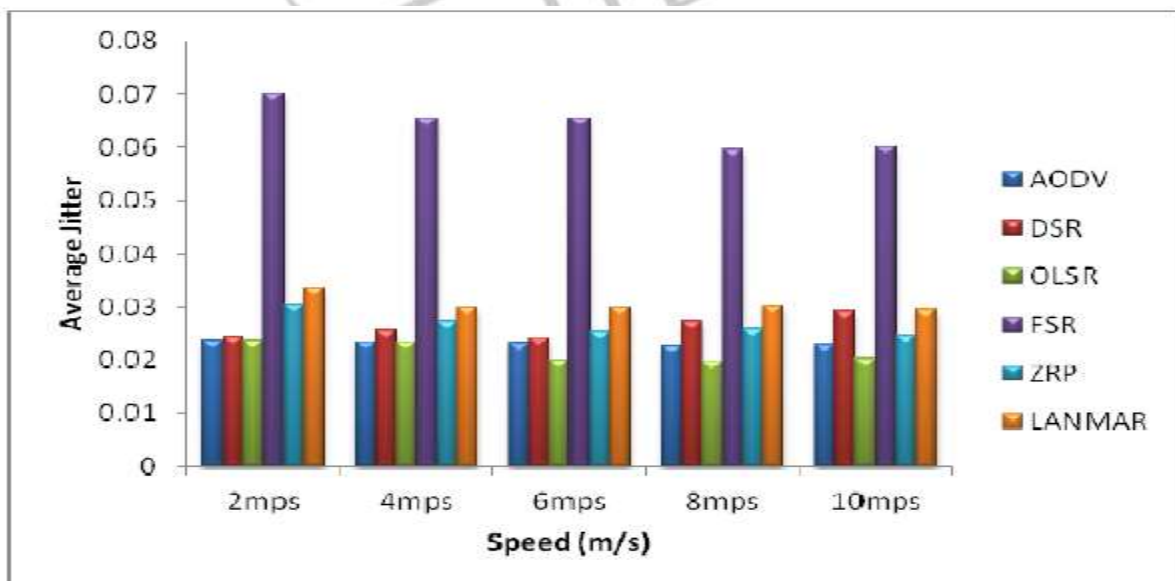


Figure 4 Effect of node speed on Average Jitter of AODV, DSR, OLSR, FSR, ZRP, LANMAR

IV. Conclusion

The simulation of this new proposed thing was carried out to analyze the performances of these protocols with QualNet 5.0.2 simulator by creating a scenario of 25 nodes with RWP mobility model. The observations are made with variation in node speed. This study provides a realistic qualitative and quantitative comparison of the six routing protocols described. The current study gave a fundamental understanding of the variation of specific performance parameters with mobility for a wide spectrum of MANET routing algorithms. For our further work, we intend to study the scalability aspect of these protocols to assess the impact on network performance as the network size and coverage increases. We plan to use different mobility models.

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