Effect of Throughput in MANET for Static and Dynamic Network For IEEE 802.11

S. C. Sharma, Kumar Manoj

***Abstract*— A wireless Ad-hoc network consists of wireless nodes communicating without the need for a centralized administration. In this paper, an ad hoc network model has been set up for different scenario. The performance comparison of the network has been analyzed for different protocol such as AODV & DSDV. For validation the results are compared with reported experimental data of AODV protocol. The performances of proposed network are evaluated in terms of throughput. Channel speed 11 Mbps and simulation time 600 sim-seconds have been taken for all different scenarios.**

It is observed that the simulation results are closely resembles with the experimental results and DSDV shows better performance compared with AODV, which is more than 5.01%. The performance will be degrade with mobility of the dynamic (giving mobility) network.

Index Terms— **aodv, dsdv, OPNET, MANET,QoS**

I. INTRODUCTION

Wireless Local Area Networks (WLANs) now enjoy wide spread popularity as they can provide network connectivity for the mobile users. A collection of autonomous nodes or terminals that communicate with each other by forming a multihop radio network and maintaining connectivity in a decentralized manner is called an ad hoc network. There is no static infrastructure for the network, such as a server or a base station. The idea of such networking is to support robust and efficient operation in mobile wireless networks by incorporating routing functionality into mobile nodes [1].

Fig.1 shows an example of an ad hoc network, where there are numerous combinations of transmission areas for different nodes. From the source node to the destination node, there can be different paths of connection at a given point of time. But each node usually has a limited area of transmission as shown in Figure 1 by the oval circle around each node. A source can only transmit data to node *B* but *B* can transmit data either to *C* or *D*. It is a challenging task to choose a really good route to establish the connection between a source and a destination so that they can roam around and transmit robust communication.

In this paper, OPNET simulator has been used to simulate the network in which 5 node have been taken for the analysis with four mode of operation viz; first baseline scenario only node_2 and node_4 are involved in the communication, second scenario node_2 and node_3 are set up to send TCP traffic to node_4, third scenario node_5, node_3, and node_2 are communicating simultaneously with node_4 and fourth scenario node_2 is sending traffic to node_5 to check the effect of having any of the other nodes acting as a relay node between the source and the destination.

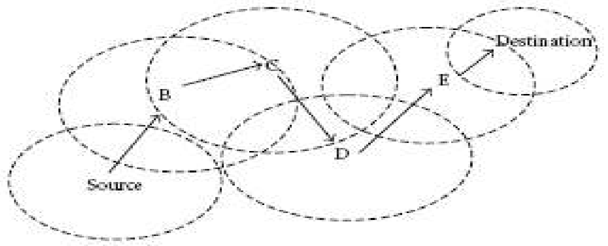

Figure 1. Ad hoc networking model.

The channel speed 11 Mbps and simulation time 600 sim-seconds are taken for the simulation of the entire above scenario. The comparative study of static and dynamic (given node mobility) behavior of the network has been analyzed for IEEE 802.11 in terms of throughput. AODV & DSDV routing protocols proposed by [3-4] has been used above analysis.

To the best of our knowledge, very few papers are reported in the literature, which compares the simulation results with the experimental results under the same networks scenarios for different protocol. This work is the first major comprehensive performance evaluation of ad hoc routing protocols using OPNET Modeler, which is based on the experimental data as reported by H. Hallani and showed their corresponding performance differences. The variation has been observed in terms of throughput. In Section-II, a summary of the Ad hoc routing protocols have been reported. The simulation software and the network simulation setup are described in section III. The comparison of simulation results with the experimental is presented in section IV. The conclusion is reported in section V.

II. AD HOC ROUTING PROTOCOLS

A. Ad-hoc On Demand Distance Vector Algorithm (AODV):

The AODV algorithm [3] is a confluence of both DSR and destination sequenced distance vector (DSDV) protocols. It shares on-demand characteristics of DSR, and adds the hop-by-hop routing, sequence numbers, and periodic beacon from DSDV. It has the ability to quickly adapt to dynamic link conditions with low processing and memory overhead. AODV offers low network utilization and uses destination sequence number to ensure loop freedom. It is a reactive

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protocol implying that it requests a route when needed and it does not maintain routes for those nodes that do not actively participate in a communication. An important feature of AODV is that it uses a destination sequence number, which corresponds to a destination node that was requested by a routing sender node. The destination itself provides the number along with the route it has to take to reach from the request sender node up to the destination. If there are multiple routes from a request sender to a destination, the sender takes the route with a higher sequence number. This ensures that the ad hoc network protocol remains loop-free. AODV keeps the following information with each route table entry [1-2]:

- destination IP address (IP address for the destination node),
- destination sequence number,
- valid destination sequence number flag,
- network interface,
- hop count, that is, number of hops required to reach the destination,
- next hop (the next valid node that did not rebroadcast the RREQ message),
- list of precursor,
- life-time, that is, expiration or deletion time of a route.

B. Destination Sequenced Distance Vector (DSDV)

Destination Sequenced Distance Vector (DSDV) [4] is a Proactive routing protocol that solves the major problem associated with the Distance Vector routing of wired. The DSDV protocol requires each mobile station to advertise, to each of its current neighbours, its own routing table (for instance, by broadcasting its entries). The entries in this list may change fairly dynamically over time, so the advertisement must be made often enough to ensure that every mobile computer can almost always locate every other mobile computer. In addition, each mobile computer agrees to relay data packets to other computers upon request. At all instants, the DSDV protocol guarantees loop-free paths to each destination.

III. SIMULATION SETUP

OPNET simulator is used to construct models for two different purposes: to study system behavior and performance. A network model may contain any number of communicating entities called nodes as shown in Fig.-2. OPNET supports predefined statistics that are typically of interest in simulation studies.

A. Network Model Overview

In the present work the network model as proposed in Fig.2, consists of five nodes which includes an application and a profile definition. The application and profile definition are used to define the type of traffic sent between the nodes. The network model using AODV & DSDV routing protocol is taken for validation and comparison of our result with the similar type experimental reported by H.Hallani et al. In this work, the throughput between two nodes is measured by generating TCP packets from the first node and sending them to the second node. The throughput is calculated based on the distance it takes these packets to get to the second node. The simulation study consists of four scenarios. In the baseline scenario only node_2 and node_4 are involved in the communication. TCP traffic is sent from node_2 to node_4 and the throughout is measured at node_2. As before, in the first scenario node_2 and node_3 are set up to send TCP traffic to node_4. While in the second scenario node_5, node_3, and node_2 are communicating simultaneously with node_4. In the third scenario node_2 is sending traffic to node_5 to check the effect of having any of the other nodes acting as a relay node between the source and the destination.

B. Simulation Results and Analysis

The simulations are carried out for throughput for the entire scenario as reported above. The variation in throughput in the entire scenario is shown in Figs. 3-6. All simulations run for 600 sim-seconds. Figs.3-6, show the throughput, of node_2 for baseline, first, second and third scenario respectively.

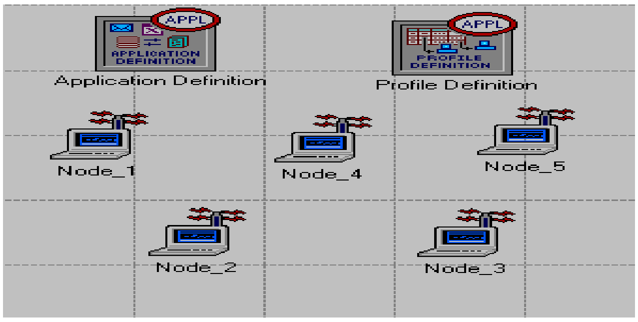

Figure 2 Simulation setup for the proposed network

It is observed from the figure 3 and measured the throughput at node_2 at around 4.74 & 4.99Mbps for AODV and DSDV protocol respectively, when the first scenario (node_2 and node_4 are involved in the communication). TCP traffic is sent from node_2 to node_4. During second scenario, node_2 and node_3 are set up to send TCP traffic to node_4**. F**rom the figure 4, it is observed that the throughput at node_2 at around 2.54 & 2.93Mbps respectively for AODV and DSDV protocol respectively. **S**mall fluctuations are observed in the throughput during the simulation as shown in figure 4. This can be attributed to the nature of the TCP protocol, which ensures that data is delivered from sender to receiver correctly, in order, and error-free. Such characteristics can cause delay at node_4 which is trying to respond simultaneously to both node_2 and node_3. When the simulation is carried out for third scenario (node_5, node_3, and node_2 are communicating simultaneously with node_4), it is observed from figure 5 that the throughput at node 2 at around 1.84 & 2.13Mbps for AODV and DSDV protocol respectively. Fluctuations in throughput are more in figure 5, it is because of more nodes are involved in the communication. During the fourth scenario (node_2 is sending traffic to node_5 to check the effect of having any of the other nodes acting as a relay node between the source and the destination). It is observed from the figure 6 that the throughput of node_2 has dropped to nearly 1.43 & 1.77Mbps for AODV and DSDV protocol respectively. As noted before this is due to the increased latency, as packets have to be forwarded to node_4 first and then delivered to node_5. The drop in the throughput between the first, second, third and

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fourth scenario may be due to the high congestion and the overwhelming of node_4. Further we analyze the effect of throughput for dynamic network by giving mobility to the node. The speed of node is 5m/s has been taken for analysis and measure the effect of throughput for AODV and DSDV protocol. It is observed that from figure 7 & 8. The throughput degrades when mobility has been applied.

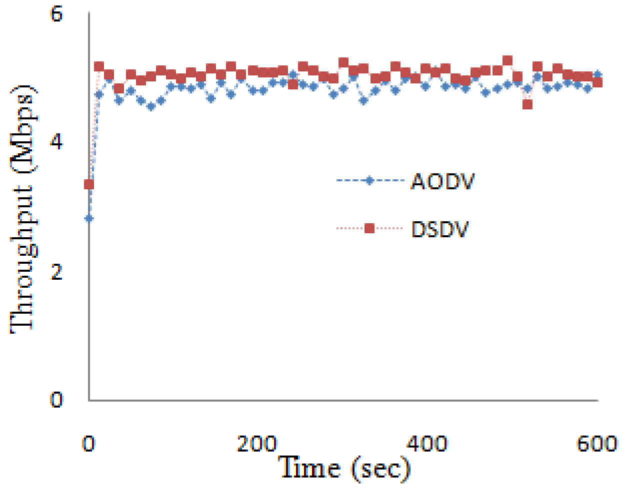

Figure 3 Throughput at node_2 for first scenario

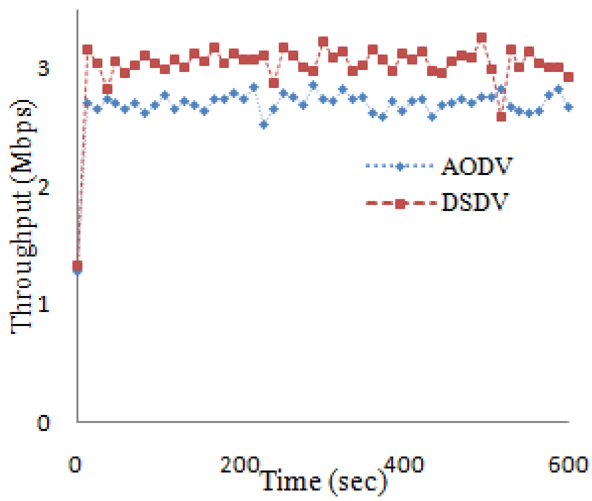

Figure 4 Throughput at node_2 for second scenario

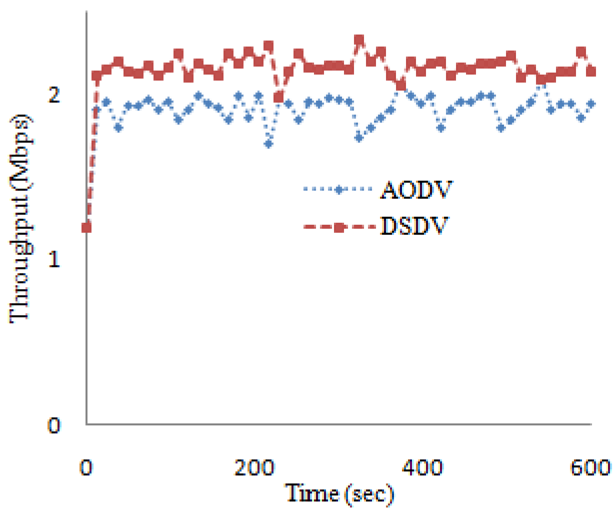

Figure 5 Throughput at node_2 for third scenario

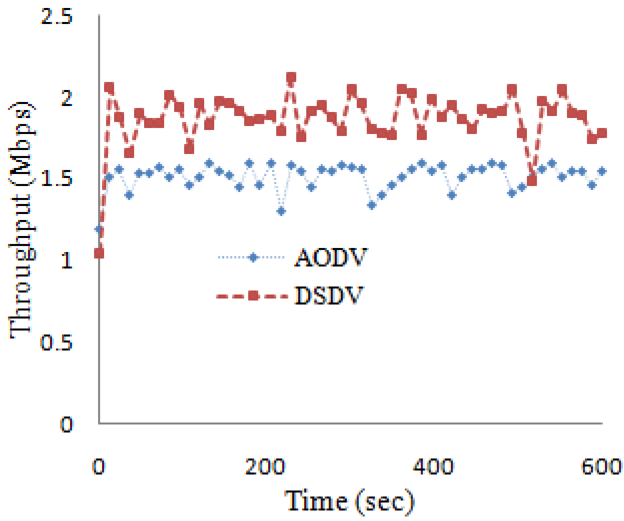

Figure 6 Throughput at node_2 for fourth scenario

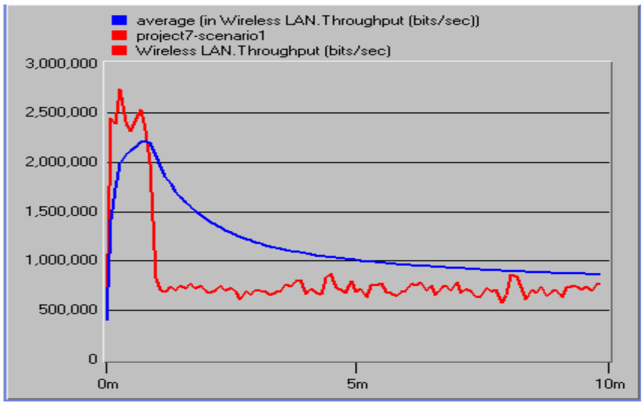

Figure 7 Throughput at node_2 for AODV protocol with mobility 5 m/s

Because the established route for communication is changed with mobility or out of transmission range.

IV. ANALYTICAL AND SIMULATION COMPARISON

The throughput for the proposed network as shown in figure 2 are calculated based on the distance it takes these packets to reach the second node. Compare the throughput between the different node and results are reported in table 1. The first step in this investigation is the establishment of some first scenario, which forms a basis for comparison with other conditions and scenarios. This is accomplished by separately measuring the throughput between every pair of nodes in the network. Table 1 shows the average throughput between all the nodes of the network. The throughput for transmission from node_5 to node_1 is 4.74Mbps and that of node_5 to node_4 is 2.18Mbps. There are two hops between node_5 and node_4 and only one hop between node_1 and node_5. It indicates that the throughput will degrade when number of node increase. So, by comparing the two mentioned levels of throughput, it can be observed that the addition of one hop has had a dramatic effect on the throughput (i.e. reduction from 4.74Mbps to 2.18Mbps). This is due to the increased latency as a result of more nodes being involved in the transmission of data packets. The throughput has dropped around 53.30% for the above scenario.

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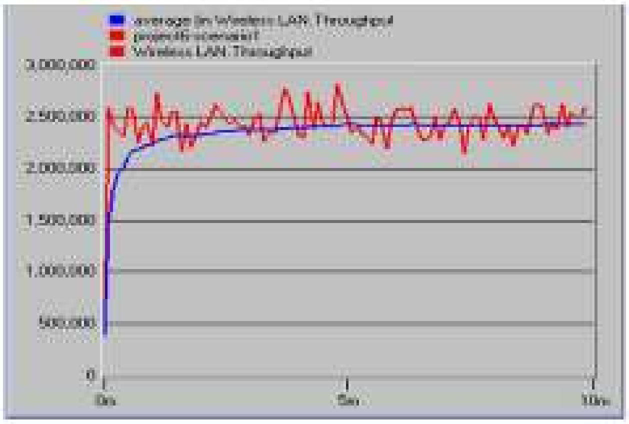

Figure 8 Throughput at node_2 for DSDV protocol with mobility 5 m/s

It is observed from the table 2, for first scenario, the throughput is 4.74 & 4.99Mbps for AODV & DSDV protocols respectively. For second scenario the throughput degrade at around 46.41% and 41.28% for AODV & DSDV protocols respectively. For third scenario the throughput degrade at around 27.55% and 27.30% for AODV & DSDV protocols respectively. For fourth scenario the throughput degrade at around 22.28% and 16.90% for AODV & DSDV protocols respectively. The comparative analysis of the dynamic (giving mobility to the node) network in terms of throughput has been analyzed. From the figure 7 & 8, it is indicate that the performance of the AODV protocol degrades at around 59.82% compared with DSDV protocol with mobility at 5 m/s. It indicates that DSDV perform better as compare to AODV.

Table 1 Throughput Values between the Nodes (Mbps)

From / To	Node_ 1	Node_ 2	Node_ 3	Node_ 4	Node_ 5
Node_ 1	----	4.14	3.37	3.71	3.50
Node_ 2	2.65	----	2.86	2.48	0.98
Node_ 3	2.11	2.50	----	2.66	2.60
Node_ 4	2.44	2.64	2.57	----	2.30
Node_ 5	4.74	2.31	2.33	2.18	----

The simulation results reported above are compared with the experimental results reported by H. Hallani et at. and given in the table 2. The comparison of the simulation with experiment shows better improvement in the throughput.

Table 2 Throughput (Mbps) comparison with different scenario with Experiment results at node_2

	First scenario	Second scenario	Third Scenario	Forth Scenario
Experiment	4.53	2.35	1.55	1.28
Simulation				
AODV	4.74	2.54	1.84	1.43
DSDV	4.99	2.93	2.13	1.77

V. CONCLUSIOIN

In this paper, the performance analysis of wireless ad-hoc networks for different scenario as mention in Table-1 has been studied using OPNET simulator [5]. The throughput of different scenario has been evaluated and analyzed for all the scenario as shown in Figs 3-6. The results of throughput (Table-6) are compared with the experimental results reported by H. Hallaini et al. [6] for similar type of scenario and the protocols. The simulation result shows good agreements with the reported experimental results. The throughput has been evaluated and analysis of different scenario for different protocols. The results indicated throughput decreases as the no. of hopes increases. For dynamic network, DSDV perform better (59.82%) compared with AODV protocol.

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