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Impact of Node Movement on MANET Using Different Routing Protocol for QoS Improvement under Different Scenario

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Abstract- As in real world the movement of nodes are almost always random. And the most important characteristics is the dynamic topology which is a consequence of node mobility, nodes can change position quite frequently, which means we need a routing protocol that quickly adapts to topology changes. Now, days there are more than billion wireless devices in use. And every devices are topology independent. Therefore, the wireless mobile computers or Mobile Ad Hoc Networks (MANET) have become very necessary.

Index Terms - MANET, DSDV, DSR, Mobility Models.

I. INTRODUCTION

A mobile ad-hoc network (MANET) is a collection of mobile nodes which consist of temporary network without the aid of any centralized infrastructure and it acts as a both host and routers. It is an autonomous system of mobile hosts connected by wireless networks links which does not required any wired support for intercommunications. Collaborative computing and communications in smaller areas can be set up using MANET, such as office buildings, organizations, conferences etc. The network's wireless topology may be unpredictable. This has been an area of active research, and progress has been reported in several directions [1]. This type of network play very important role at the time of emergency as it can build their network in few hour and people can quickly share information and data acquisition operations in inhospitable terrain. The MANETs routing protocols are characteristically subdivided into three categories: Table Driven Routing Protocol (Proactive), On Demand Routing Protocol (Reactive) and Hybrid Routing Protocol.

***Table-Driven Routing Protocols*:** In table driven routing protocols, consistent and up-to-date routing information to all nodes is maintained at each node.

***On-Demand Routing Protocols*:** In On-Demand routing protocols, the routes are created as and when required. When a source wants to send to a destination, it invokes the route discovery mechanisms to find the path to the destination [2].

Hybrid Routing Protocols: It is a combination of both reactive and proactive routing protocols i.e. temporary ordered routing algorithm (TORA), zone routing protocol (ZRP), hazy sighted link state (HSLS) and order one routing protocol (OOPR) [3]. The different MANETs routing protocols is shown in Figure (1).

With the increasing need for QoS in evolving applications, it is also desirable to support QoS in MANET. It is clear that the service quality QoS [4] in MANET is not guaranteed because of the inherent dynamic nature of a mobile ad hoc environment. In general, the performances depend on the routing mechanism and nature of mobility. In order to guarantee the QoS we should process to deepened studies of evaluation regarding to find the routing protocol and the mobility model that are more adapted to an application. The QoS call for some of the performance metrics as the throughput, the end-to-end delay and the jitter etc. Therefore many researches were carried out on evaluation performances of the MANETs as, the performance analysis of the different routing protocols and the effect of the random mobility models on Ad Hoc networks [5]-[10].

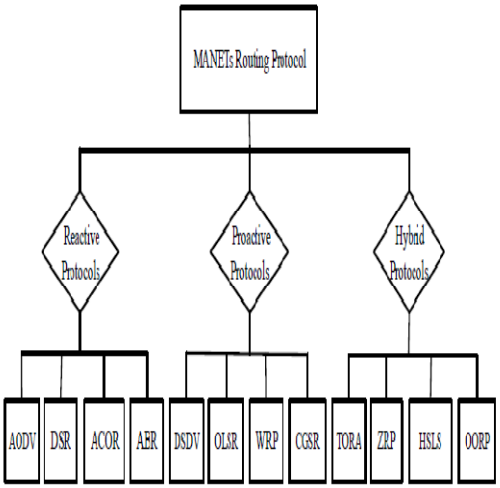

Fig. 1: MANETs Routing Protocols

The aim of a routing protocol is to discover the best route that links up two nodes while guarantying a

QoS in communication [11]. The quick change and unpredictable of the topology. The rest of this paper is organized as follows: In the next section 2, we survey literature and related work. The problem formulation is discussed in section 3, followed by the simulation environment and simulation tool used in this study. The results obtained in this simulation are also discussed in section 4. In the end, section 5 completes the paper.

II. RELATED WORK

The performance of two prominent routing protocols in MANET: DSDV and DSR are compared in this paper. **DSDV** is a proactive unicast mobile ad hoc network routing protocol. Like WRP, DSDV is also based on the traditional Bellman-Ford algorithm. However, its mechanisms to improve routing performance in mobile ad hoc networks are quite different. In routing tables of DSDV, an entry stores the next hop toward a destination, the cost metric for the routing path to the destination, and a destination sequence number that is created by the destination. Sequence numbers are used in DSDV to distinguish stale routes from fresh ones and avoid the formation of route loops.

The route updates of DSDV can be either time driven or event driven. Every node periodically transmits updates, including its routing information, to its immediate neighbors. While a significant change occurs from the last update, a node can transmit its changed routing table in an event-triggered style. Moreover, the DSDV has two ways when sending routing table updates. One is the "full-dump" update type in which the full routing table is included inside the update. An Incremental update, in contrast, contains only those entries with metrics that have been changed since the last update was sent. Additionally, the incremental update fits in one packet. The DSDV protocol requires each mobile station to advertise, to each of its current neighbors, 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 of the collection. In addition, each mobile computer agrees to relay data packets to other computers upon request. This agreement places a premium on the ability to determine the shortest number of hops for a route to a destination; we would like to avoid unnecessarily disturbing mobile hosts if they are in sleep mode. In this way a mobile computer may exchange data with any other mobile computer in the group even if the target of the data is not within range for direct communication. If the notification

of which other mobile computers are accessible from any particular computer in the collection is done at layer 2, then DSDV will work with whatever higher layer (e.g., network-layer) protocol might be in use [12].under the two types of traffic constant bit ration (CBR) and variable bit ratio

(VBR). As QoS must guarantees performance for different application.

DSR is a reactive mobile ad hoc protocol. Routing protocols DSR uses explicit source routing, which means that each time a data packet is sent, it contains the list of nodes it will use to be forwarded. In other words, sent packet contains the route it will use. Routes are stored in memory, and data packets contain source route in packet header. Mechanism allows nodes to specify the route that will be used, depending on criteria. This mechanism, also, avoids routing loops [18].

If a node has to send a packet to another one, and it has no route, it initiates a route discovery process. This process is similar to AODV route discovery process. In other words, the network is being flooded with RREQ packets. Each node that receives RREQ packet, broadcasts it, expect for destination node or nodes that have route to destination node in their memory. Route through network is built by RREQ packet, and RREP packet is being routed backward to the source. Route that returns RREP packets is cached on the source node for further use. There can be multiple RREP packets on one RREQ packet.

In DSR, when broken link is detected, RRER packet is sent backward to the source node. After receiving RRER packet, source node initiates another route discovery operation. Additionally, DSR protocol aggressively uses source routing and route caches [18].

Example illustrated in Fig. 2, node A wants to route to node E. it broadcasts RREQ packet to its neighbors with an arbitrary chosen ID. Neighbors forward this broadcasts, and at each node, the reverse node entry is added into the RREQ packet. When node E receives this RREQ, it can send RREP to node A using reverse route included in the packet. RREP packet contains the request ID and reverse route.

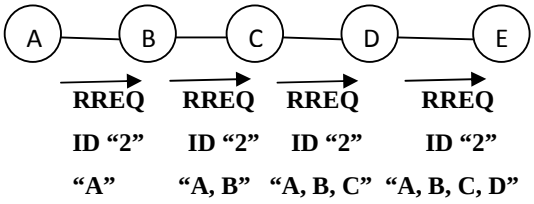

Fig. 2: DSR route discovery process.

Legend: DSR (Dynamic Source Routing); ID (Identification); RREQ (Route Request)

Route maintenance process in DSR is illustrated in Fig. 3. Node A is responsible for the flow between nodes A and B, node B is responsible for the flow between nodes B and C, and so on. If node A is sending data to E, with previously cached route, and node C didn't receive any acknowledge from

D, then node C deduces the link is broken and sends RRER packet to node A and any other node that had previously used this link [18]. Concerned nodes will remove this route from their table, and use another one, or initiate route discovery process.

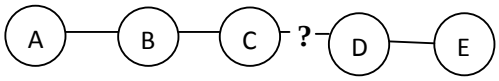

Fig. 3: DSR route maintenance process.

This paper shows comparative performance evaluation of one prominent on-demand reactive routing protocol in mobile ad-hoc networks Dynamic Source Routing (DSR) with the traditional proactive routing protocol Destination Sequenced Distance Vector (DSDV). Comprehensive analysis has been carried out based on the results obtained by running simulation with different simulation time and mobility scenario in Network Simulator version. Used comparative parameters are Packet Delivery Ratio (PDR), Average E2E (End- to-End Delay), Packet Loss (PL).

III. PROBLEM FORMULATION

One of the important issues affecting the performance of mobile ad hoc networks is node mobility. Since mobile ad hoc networks are currently not deployed on large scale, research in evaluating the impact of node mobility is mostly based and usually employs certain node mobility models such as Random Waypoint, Random Direction, and Group Mobility. Node mobility results in a time- varying network topology and hence prior research has focused on evaluating the impact of node mobility on the performance of various routing protocol proposed by mobile ad hoc networks. Dealing with the effect of mobility to support different application one need to consider the fundamental physical layer parameters such as the average BER on a multihop route and minimum required node spatial density.

It is evident that the QoS must guarantees a certain level of performance for different applications. However, the ad-hoc network is used in applications with different levels of QoS. The network traffic is classified into time sensitive traffic. In this category we find the applications real time traffic that requires the minimal guarantee of delay. Generally it must work without losing the data (e.g. voice conferencing) [13]. Some applications in real time process limits of the delays that must be guaranteed, but these bounds can be slightly exceeded. In this category many applications can also tolerate a small amount of packet loss [14]. The second category, its data traffic which has no delay requirements but short average delay is desired. Data traffic requires lossless transmission [13].

From bit rate point of view, we have got two classes of traffic CBR and VBR. In the first class some applications generates the traffic in fixed rate. As regards practicing, some applications generate traffic CBR. In the second class most of the applications generates variable bit rate streams (VBR). This traffic is characterized by changing of the amount of information transmitted by unit time, (i.e. the bit rate). The degree of variation in bit rate is different from one application to another [15]. For this work CBR is used. Different scenario has been taken by increasing number of nodes with variation in speed.

IV. SIMULATION TOOL & SCENARIO

The simulations where performed using Network Simulator-2 (NS-2) [16], which is particularly popular in the ad-hoc networking family. NS-2 is an object-oriented, discrete event driven network simulator written in C++ & OTcl [10]. NS-2 is useful for simulating local and wide area networks. Although it is easy to use once one can get to know the simulator. NS-2 interprets the simulation scripts written OTcl. The user has to set the different components libraries up in the simulation environment. The user writes his simulation program as an OTcl scripts. The main aim of choosing NS-2 as a simulation tool among the other simulation tool because it supports networking research and education. It is also suitable for designing a new protocol, and comparing different protocol in different environment.

NS-2 is distributed freely and open source. A large number of institutes and people in development and research use maintain and develop NS-2, which increases the confidence in it. NS-2 also provides substantial support for simulation of TCP, UDP, routing and multicast protocol over wired and wireless network [17].The traffic sources are CBR (Constant Bit-Rate). The source-destination is randomly spread over the network [16].

In order to achieve our aim we need to investigate how the DSDV and DSR protocol behaves when load of nodes increases with different Mobility Models (Random Waypoint and Random Direction). Simulations have been carried out by Network Simulator 2.27 NS-2. In Table 1, we provide all simulation parameters.

A. Otcl Script:

```
#Create a simulator object
Set ns [new Simulator]
#Open the trace file(s)
set nf [open out.nam w]
$ns namtrace-all $nf
   #Define a 'finish' procedure
   proc finish {} {
```

global ns nf

$ns flush-trace

close $nf; #Close the trace file

exec nam out.nam & #Execute nam on the trace file

 # (optional)

exit 0

}

Table 1**:** Simulation Parameter.

Parameter	**Value**
Simulation Time	**10, 50, 100 sec**
Number of nodes	**16, 20, 32, 64**
Simulation Time	**100 ms**
Environment Size	**800m × 800m**
Traffic Type	**CBR**
Maximum Speed	**5m/s**
Mobility Model	**Random Direction**

B. Scenario

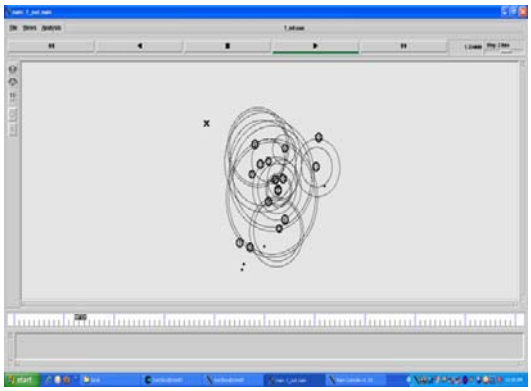

Fig. 4: Considered 1st scenario having 16 nodes.

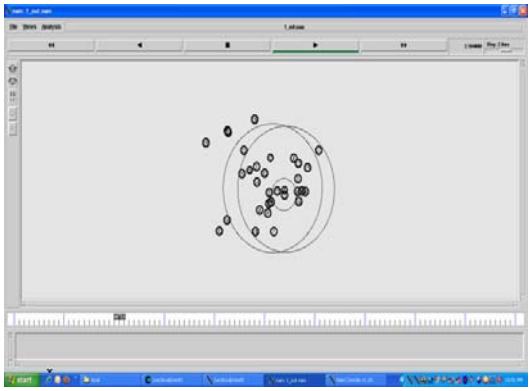

Fig. 5: Scenario having 32 nodes.

Packet received will be = 4926

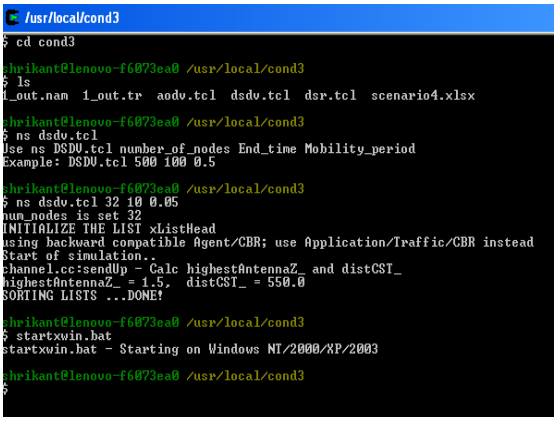

Fig. 6: NS-2 use command startxwin.bat.

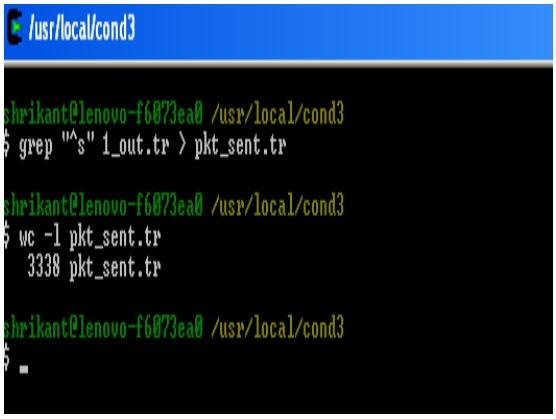

Fig. 7: NS-2 use grep command.

The first scenario have been simulated using NS-2 having 16 nodes having simulation time 10 sec as shown in figure (4). The number of nodes increases from 16 to 32 as shown figure (5) having simulation time 50 sec. Similarly, for 20 nodes and 64 nodes.

Cygwin provide Linux environment in window and using ns.tcl the program is executed to give simulated result as shown figure (6). The startxwin.bat command is use to initial graphical mode. The grep command is used to calculate packet loss, throughput, delay (QoS parameter). Like "tcp" space 1_out.tr > any file name used search and execute that line having "tcp" word in it and put that line in new file as shown in figure (7).

V. SIMULATION RESULT & DISCUSSION

The throughput, packet loss and end to end delay analysis for DSDV and DSR routing protocol using above simulation parameter is shown below. The calculation is done in the following manner for DSDV and DSR. The simple calculation is done DSR routing protocol:

A. Caculation: DSR

Number of nodes considered = 20

Simulation time = 10sec.

Therefore original packet received = 4926-1235(Routing Packet) = 3691
Packet sent will be = 4312
Therefore Packet Delivery Fraction (PDF) = 85.59%
And packet loss = 5662
Now sent routing packet = 612
Received routing packet = 1235
Therefore total routing packet = 1847
Finally, routing load fraction will be = 37.49%
Similarly, the same calculation is done for DSDV routing protocol.

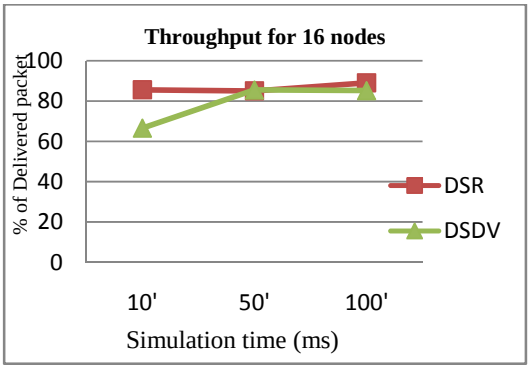

Fig. 8

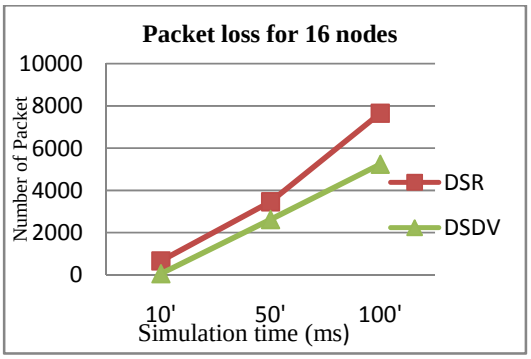

Fig. 9

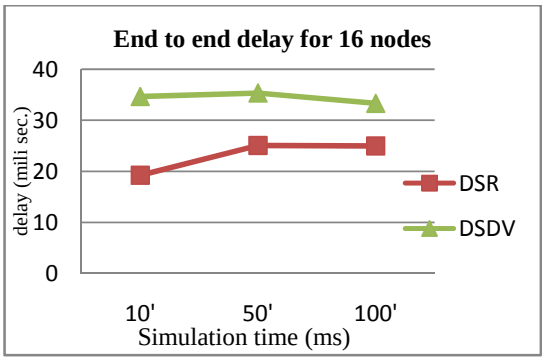

Fig. 10

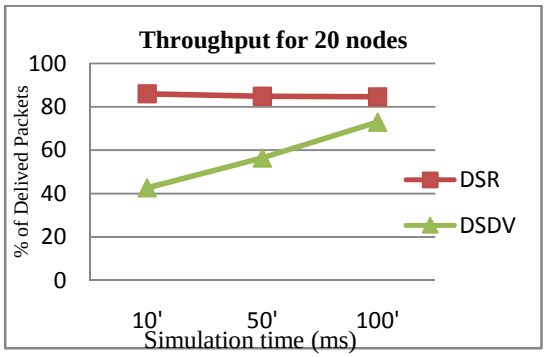

Fig. 11

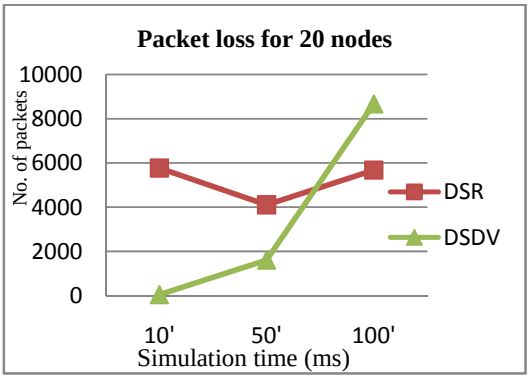

Fig. 12

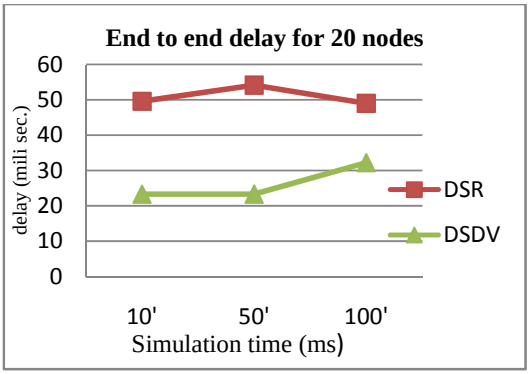

Fig. 13

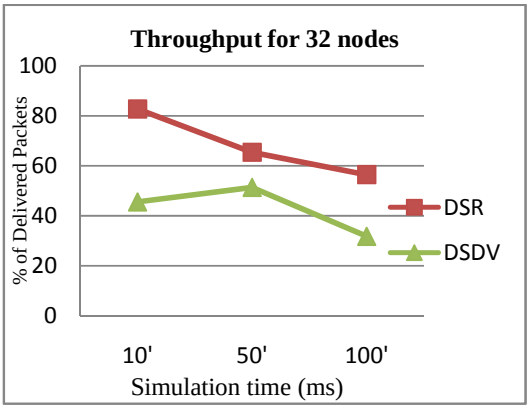

Fig. 14

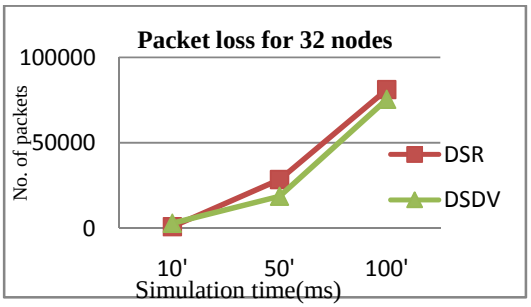

Fig. 15

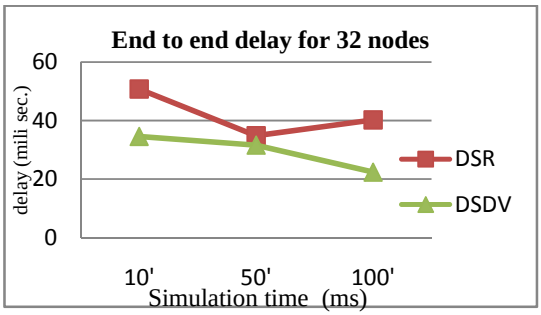

Fig. 16

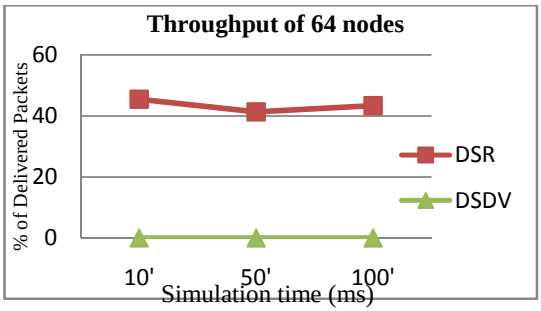

Fig. 17

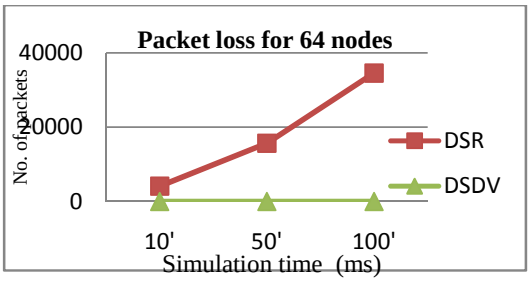

Fig. 18

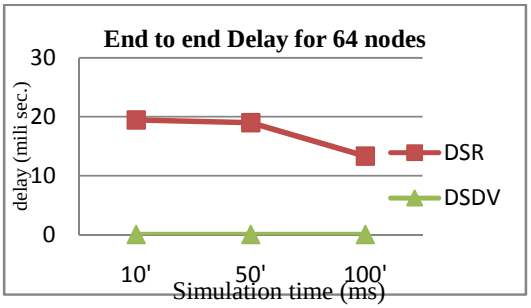

Fig. 19

The throughput analysis of 16 nodes for DSR and DSDV routing is nearly equal where as packet loss for DSR is much greater than DSDV but, end to end delay is much less in SR routing protocol so, QoS performance is quite similar from throughput point of view shown in figure (4), (5) and (6).

When the number of nodes increases from 16 to 20 then it clear from figure (7), (8) and (9) that the performance of DSR routing protocol improve compared to DSDV routing protocol as the throughput is better than DSDV and helps in improving QoS performance level.

When the number of nodes increases from 20 to 32 then the performance little degrades as the packet loss is much in DSR routing protocol compared to DSDV routing protocol shown in figure (10), (11) and (12).

Finally when the number of nodes double from 32 to 64 then the performance of DSDV routing protocol goes to zero. So, we conclude from this analysis is that if number of nodes increase in the network the performance of DSDV routing protocol poorly degrades. Under such scenario DSR routing performance is quite well and well suited for such scenario as it is very clear from figure (13), (14) and (15).

So, for QoS routing point of view DSR routing protocol is well suited for the network when the number of nodes increases. And QoS performance can be optimized using such routing protocol. The analysis has been done with proper simulation time and tries your level to give optimized result with the help of this paper to improve the QoS level for the real time scenario. Special care has been taken while choosing any parameter for the simulation to give efficient result using different bit ratio.

VI. CONCLUSION

The DSDV routing protocol performance degrades poorly nearly equals to zero when the number of nodes increases compared to DSR routing protocol with random movement of nodes in the network. So, DSR performs well when the number of nodes increases in the network. But the performance of DSR and DSDV routing protocol is nearly equal when the number of node is less. Also, DSR routing is well and efficient for large number of nodes and for near communication and for ad-hoc network setup at practical level DSR should be preferred. Therefore, DSR proves to be suitable from practical implementation in MANET with node variation in the network.

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