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Performance Evaluation and Analysis of Qos Routing using OLSR and DSDV Protocol in Manets under Different Scenario using NS-2

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Abstract: In recent years, mobile computing has enjoyed a tremendous rise in popularity. The continued minimization of mobile computing devices and the extraordinary rise of processing power available in mobile laptop computers combine to put more and better computer-based applications into the hands of a growing segment of the population. At the same time, the markets for wireless telephones and communication devices are experiencing rapid growth. Projections have been made that, in nowadays there are more than billion wireless devices in use. Therefore, the wireless mobile computers or *Mobile Ad Hoc Networks* (MANET) have become very necessary.

As the real-time applications used in today's wireless network grow, we need some schemes to provide more suitable service for them. We know that most of actual schemes do not perform well on traffic which is not strictly CBR. Therefore, in this paper we try to judge the impact, respectively, of mobility models and the density of nodes on the performances (End-to-End Delay, Throughput and Packet Delivery ratio) of routing protocol (Optimized Link State Routing) OLSR and (Destination-Sequenced Distance Vector) by using in the first a real-time VBR (MPEG-4) and secondly the Constant Bit Rate (CBR) traffic using NS-2 Simulator. Experimentally, we considered the three mobility models as follows Random Waypoint, Random Direction and Mobgen Steady State. The efficient model should be chosen after analysis. The experimental results illustrate that the behavior of OLSR and DSDV change according to the model and the used traffics.

To compare the performance of OLSR and DSDV routing protocol, the simulation results were analyzed by graphical manner and trace file based on Quality of Service (QoS) metrics: such as throughput, drop, and delay. Quality of Service (QoS) support in mobile ad hoc networks (MANETs) is a very challenging task because of the dynamic topology, limited resources and wireless link characteristics. Finally, the performance differentials based on network load, mobility, and network size have been analyzed. Finally, we compare the performance on both cases under different scenario and got an exact idea that which routing protocol is well suitable under different condition and what measure should be kept in mind before deploying any type of routing protocol for any network design.

This paper will give an idea for proper selection of routing protocol to improve QoS so, that the overall efficiency of the network improve with less effort and time. The simulation result will prove to be beneficial for the engineering and researcher from network designing and selection point of view and effort has been make to calculate and judge the result as good as possible.

Key Words: MANET, Mobility Models, NS-2 etc.

1. 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].

Fig1. 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.

2. Related Work

The performance of two prominent routing protocols in MANET: OLSR and DSDV are compared in this paper. **OLSR** is developed for mobile ad-hoc networks. It operates as a table-driven, proactive protocol, that is, it exchanges topology information with other nodes of the network regularly. Each node select a set of its neighbour nodes as “Multipoint Relays” (MPR). In OLSR, only nodes, selected as such MPRs are responsible for forwarding control traffic, intended for diffusion into the entire network. MPRs provide an efficient mechanism for flooding control traffic by reducing the number of transmissions required. Nodes, selected as MPRs, also have a special responsibility when declaring link state information in the network. Indeed, the only requirement for OLSR to provide shortest path routes to all destinations is that MPR nodes declare link state information for their MPR selectors. Additional available link state information may be utilized, for example for redundancy[12].

A node selects MPRs from among its one-hop neighbors with “symmetrical” (i.e., bidirectional) linkages. Therefore, selecting the route through MPRs automatically avoids the problems associated with data packet transfer over unidirectional links (such as the problem of not getting link-layer acknowledgments for data packets at each hop, for link layers employing this technique for unicast traffic). OLSR is developed to work independently from other protocols. Likewise, OLSR makes no assumptions about the underlying link layer. OLSR inherits the concept of forwarding and relaying from HIPERLAN (a MAC layer protocol), which is standardized by European Telecommunications Standards Institute (ETSI). The protocol is developed in the IPANEMA project (part of the Euclid program). It is well suited to large and dense mobile networks, as the optimization achieved using the MPRs works well in this context. The larger and more dense a network, the more optimization can be achieved as compared to the classic link state algorithm. OLSR uses hop-by-hop routing, that is, each node uses its local information to route packets[12].
OLSR is well suited for networks, where the traffic is random and sporadic between a larger set of nodes rather than being almost exclusively between a small specific set of nodes. As a proactive protocol, OLSR is also suitable for scenarios where the communicating pairs change over time: no

additional control traffic is generated in this situation because routes are maintained for all known destinations at all times.

OLSR is designed to work in a completely distributed manner and does not depend on any central entity. The protocol does not require reliable transmission of control messages: each node sends control messages periodically, and can therefore sustain a reasonable loss of some such messages. Such losses occur frequently in radio networks due to collisions or other transmission problems. Also, OLSR does not require sequenced delivery of messages. Each control message contains a sequence number, which is incremented for each message. Thus the recipient of a control message can, if required, easily identify which information is more recent- even if messages have been reordered while in transmission. Furthermore, OLSR provides support for protocol extensions such as sleep mode operation and multicast routing.

Such extensions may be introduced as additions to the protocol without breaking backwards compatibility with earlier versions. OLSR does not require any changes to the format of Internet Protocol (IP) packets. Thus any existing IP stack can be used as is; the protocol only interacts with routing table management. The larger and more dense a network, the more optimization can be achieved as compared to the classic link state algorithm. **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].

According to this paper, DSDV protocol will perform better in the networks with static traffic. It uses fewer resources than OLSR Routing protocol, because the control message is kept small requiring less bandwidth for maintaining the routes and the route table is kept small reducing the computational power. The DSDV protocol can be used in resource critical environment the OLSR is more efficient in networks with high density and high sporadic traffic. But the best situation is when there is a large number of hosts. OLSR requires that it continuously ha some bandwidth in order to receive the topology updates messages. We have increase the number of nodes in both CBR and VBR (MPEG-4) scenario with different mobility model and put your best effort to get the efficient throughput for future work application. Here we have considered two mobility model Random Way Point and Random Direction for analysis. Since the optimal delay is achieved by Random Way Point in weak densities of nodes also the optimal throughput is achieved by Random Way Point during the weak and big densities of nodes. Generally, the DSDV protocol has shown a sensitive behavior for the type of used traffic. This change of behavior of DSDV enables to do this comparative study using an OLSR routing protocol under the two types of traffic constant bit ration (CBR) and constant bit ratio (VBR). As QoS must guarantees performance for different application.

3. Problem Formulation

Among major challenges of the axes of research in Ad-Hoc networks with a density of nodes, we must have to take some smart way to improve congestion issue, packet drop, overhead decrement etc.

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].

4. Simulation tool and its environment

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 OLSR 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. Multimedia traffic VBR (MPEG-4) and CBR are used. In Table 1, we provide all simulation parameters.

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	**VBR and MPEG-4**
Maximum Speed	**5m/s**
Mobility Model	**Random Waypoint and Random Direction**

5. Simulation Result and Discussion

The throughput, packet loss and end to end delay analysis for DSDV and OLSR routing protocol using above simulation parameter is shown below.

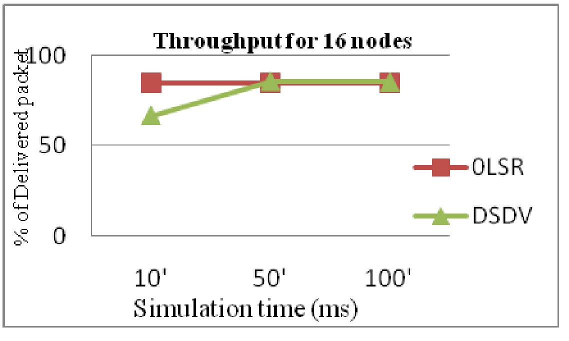

Fig 2.

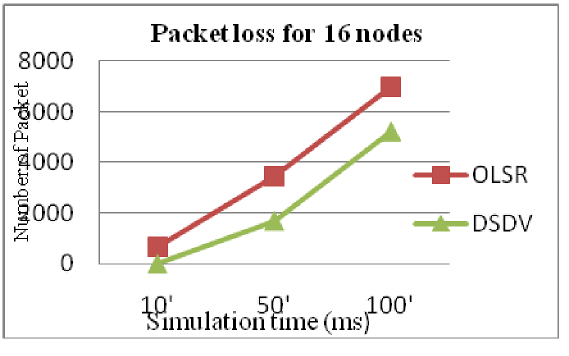

Fig 3.

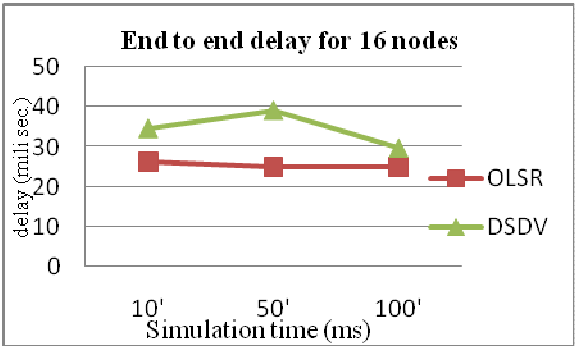

Fig 4.

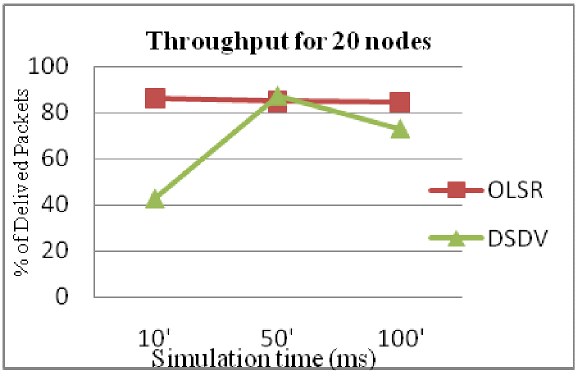

Fig 5.

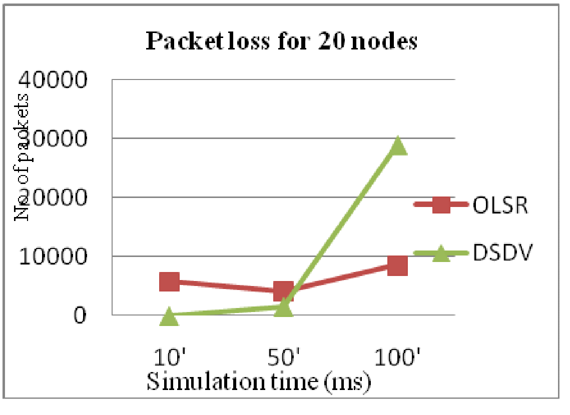

Fig 6.

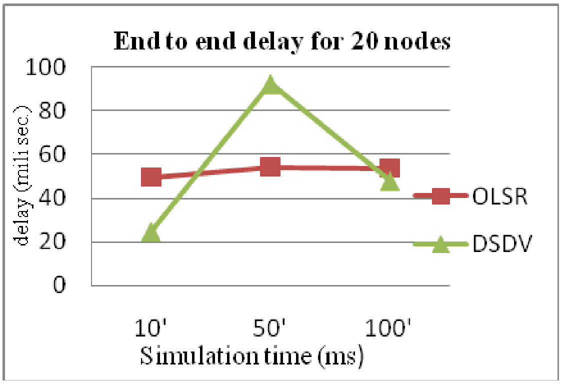

Fig 7.

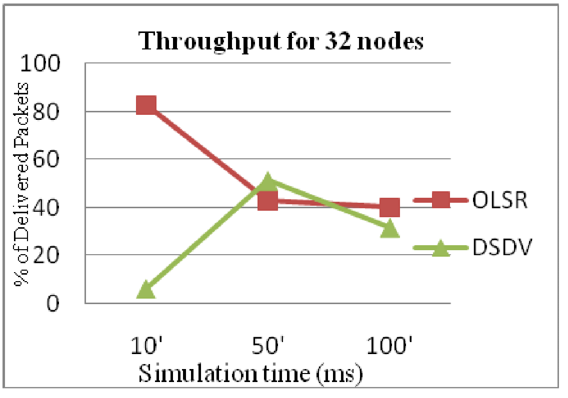

Fig 8.

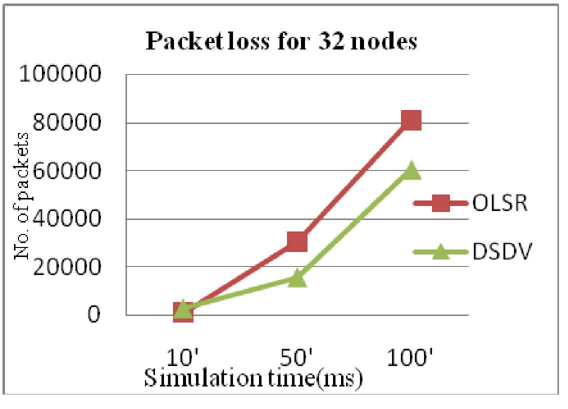

Fig 9.

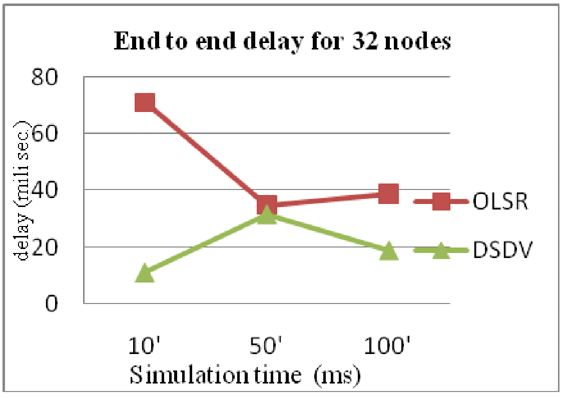

Fig 10.

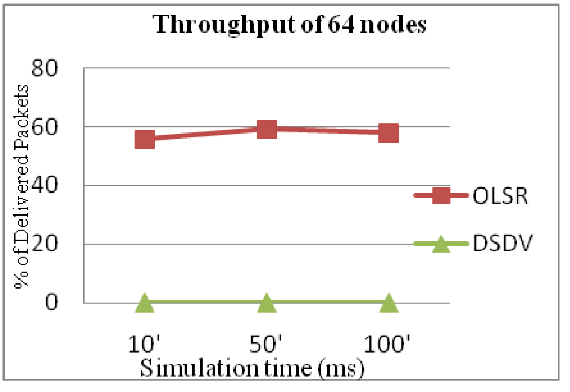

Fig 11.

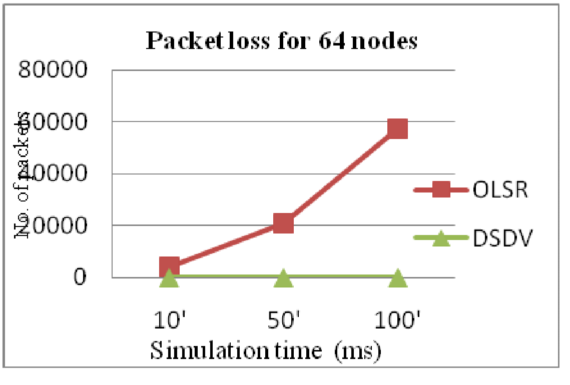

Fig 12.

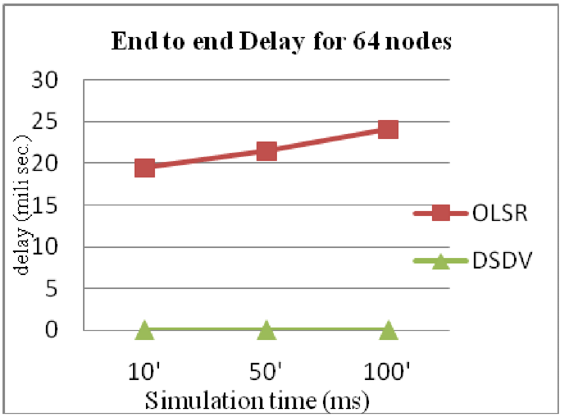

Fig 13.

6. Conclusion

The throughput analysis of 16 nodes for OLSR and DSDV routing is nearly equal where as packet loss for OLSR is much greater than DSDV but, end to end delay is much less in OLSR routing protocol so, for QoS performance is quite similar from throughput point of view shown in figure (2), (3) and (4).

When the number of nodes increases from 16 to 20 then it clear from figure (5), (6) and (7) that the performance of OLSR routing protocol improve compared to DSDV routing protocol as it helps in improving QoS level.

When the number of nodes increases from 20 to 32 then the performance of little degrades as the packet loss is much in OLSR routing protocol compared to DSDV routing protocol shown in figure (8), (9) and (10).

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 OLSR routing performance is quite well and well suited for such scenario as it is very clear from figure (11), (12) and (13).

So, for QoS routing point of view OLSR 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.

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