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A Simulative Comparison of DSDV and OLSR Routing Protocols

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Abstract : Mobile Ad hoc networks (MANets) include a collection of distributed nodes that communicate with each other through wireless connections. In this network nodes communicate with each other directly without any access point. The most important feature of these networks is the presence of a dynamic and variable topology, which is a result of node mobility. Due to this mobility routing protocol in MANets must be capable of adapting to these changes. In this study, two important routing protocols of MANets i.e. the OSLR and DSDV protocols were compared in terms of packet delivery ratio, delay and throughput by using the ns2 simulator.

Key words: Adhoc Wireless Networks, OLSR and DSDV Routing Protocols, Operational Power, Packet Delivery Rate.

INTRODUCTION

Adhoc networks constitute various nodes sharing one radio channel. There is no administration whether centralized or distributed in this sharing and the method of channel usage. Due to the non-stable nature of Adhoc networks, finding and maintaining a route is of great importance. In Adhoc networks, network nodes do not have previous knowledge of the network topology they reside in; therefore, in order to communicate with other nodes, they are forced to discover the location of the destination in the network (Nazari, V. and Ziyarati, 2006). Routing protocols between every node pairs of this network are difficult because each node can move randomly and even exit the network. In other words, a route that is optimal in one instance may not exist after a few seconds (Perkins C.E. and P. Bhagwat, 1994).

The DSDV protocol is a table-based set in which each node collects a list of all destinations and the number of hops to each destination, and each gateway in the list is numbered, and incremental packets are used to lower traffic volume due to network route updates. The only advantage of this protocol is preventing creation of routing loops in networks containing mobile routers. Hence, the order of route information is provided disregarding whether the node currently requires a route or not. The OLSR is form the set based on neighbor selection, which is a proactive routing (Draves, R., 2002; IEEE 802.11f Task Group 2003; Iannone, L. and S. Fdida, 2005; Iannone, L. and S. Fdida, 2005). Proactive protocols are characterized by all nodes maintaining routes to all destinations at all times through the periodic exchange of protocol messages. This gives them the advantage of having pre-computed routes available when needed and to propagate topology changes in bulk updates to many nodes. OLSR performs hop-by-hop routing, where each node uses its most recent topology information for routing. This routing method does not use flooding mode for information transmission, but using the MPR algorithm, attempts to select a series of points, and transmissions information using those nodes, and in this way, reduces network overhead and congestion (Baumann, R., 2007; IEEE 802.11e Task Group 2005; Draves, R., 2004).

In this article, we attempt to compare these two protocols, and then we compare and examine four parameters from the OSLR protocol for efficiency improvement.

Comparison Criteria:

The DSDV and OLSR protocols are compared based on a number of criteria. In this section, we will introduce these criteria.

Packet Delivery Criterion (PDF):

Packet Delivery Rate or PDF equals number of successful packets delivered to destination nodes to the total number of data packets sent from the source nodes.

Average Operational Efficiency Criterion (Throughput):

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Average Operational Efficiency or throughput is an operational efficiency showing the average protocol bandwidth.

Average End-to-End Delay Criterion (E2E):

End-to-end delay for packet *j* that is sent by node *i* (source node) and has successfully reached its destination is as follows:

$End\_to\_End\ delay_{ij} = start\_time_{ij} - End\_time_{ij}$

where start_timeij is the time of packet j transmission from node i, and End_timeij is the time of receiving this packet by the destination node. The average of this amount is the End-to-End delay of the network.

Packet Loss Criterion:

This criterion represents the percentage of sent packets that have not reached their destination successfully.

Protocol Comparison Results:

Parameters used for simulation are given in table 1. Comparison between the two protocols carried out with NS-2 software using the previously mentioned criteria is depicted using the following tables and figures.

Table 1: OLSR Protocol.

Throughput	*24.84*
Pdf	0.5471
End to end-delay	0.76
Paket loss	4838

Table 2: DSDV Protocol.

Throughput	*2.47*
Pdf	0.3968
End to end-delay	0.90
Paket loss	6343

Table 3: Simulation Parameters.

Examined Protocols	OLSR & DSDV
Channel Type	WirelessChannel
Propagation	TwoRayGround
Simulation Area (m x m)	1000m * 1000m
NS version	2.35
MAC	802_11
CBR Packet Size	40
Interface Queue	DropTail /PriQueue
Link layer	LL
Interface Queue Length	50
Routing Protocols	OLSR &DSDV
Simulation duration	50
Number of nodes	11
Traffic Type	CBR

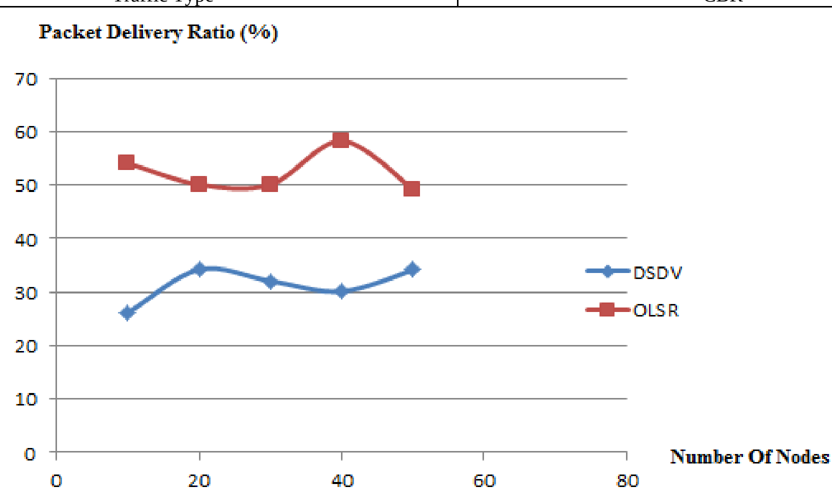

Fig. 1: Packet Delivery Criterion (PDF).

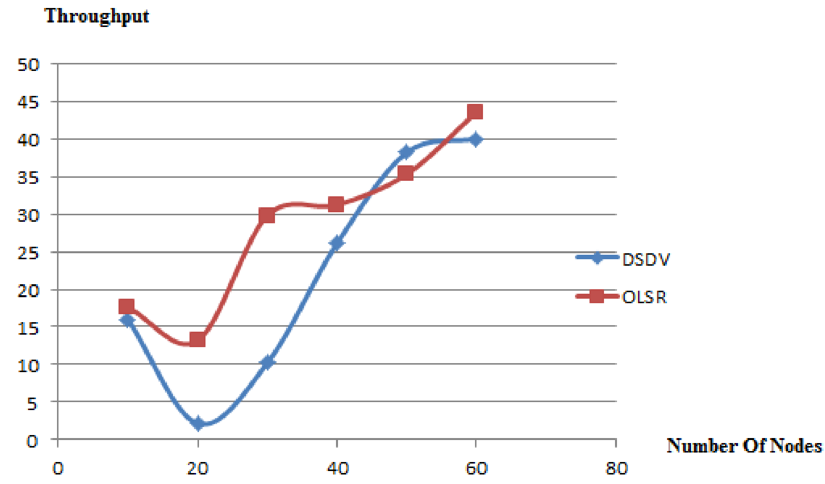

Fig. 2: Throughput.

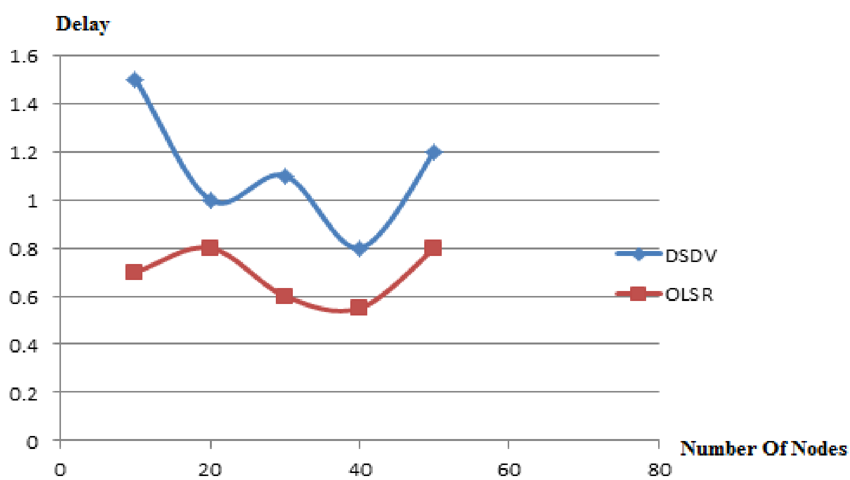

Fig. 3: End-to-End Dela.

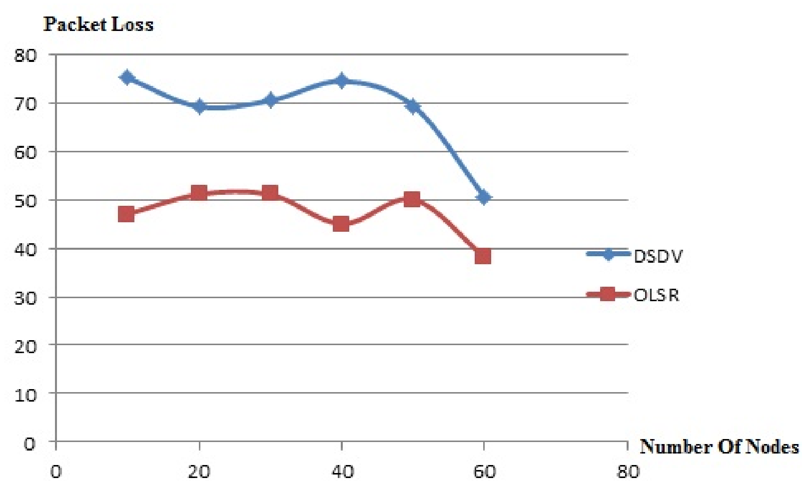

Fig. 4: Packet Loss.

Comparison Results:

As can be seen in the present figures, the OLSR protocol in all means operates better than the DSDV protocol, which shows that this protocol has certain capabilities and algorithms enabling it to have a much better performance. Therefore, in order to better recognize this protocol and the reason behind its better performance, we will examine the OLSR protocol and evaluate four of its algorithms for efficiency improvement.

OLSR Protocol:

The Optimized Link Status Routing Protocol (OLSR) is a protocol based on the routing table and utilizes MPR selection techniques for preparing a suitable broadcasting structure for reducing control messages. MPRs are the only point in the network that are allowed to broadcast information, and among neighbors with one hop, are selected in a way to be able to fulfill two neighboring hops (Akyildiz, I.F., 2005; Akyildiz, I.F. and X. Wang, 2005; Jou, T.S. and D.E. Eastlake, 2004; Sundaresan, K., 2003). MPRs reduce traffic control overhead and control packets (Akyildiz, I.F., 2005; Iannone, L. and S. Fdida, 2005; Sundaresan, K., 2003; Belding-Royer, E.M., 2003). An OSLR's work commences in a way that whenever a node creates a change in nodes in one or two hop distances, it broadcasts it at once. In any way, selecting MPRs can be troublesome in this system, because the criteria for selection is the distance between the nodes, and we want a simulation comparison between the four OLSR-MD, OLSR-MI, OLSR-ETX and OLSR-HOP algorithms, which improve this protocol. We will attempt to compare these four OSLR algorithms with a number of parameters.

Hop Count:

Hop count is the number of hops between source and destination. By minimizing the number of hops, the distance passed with each maximum hop, minimizes the signal and maximizes loss rate. Results showed that the number of hops in cases where the shortest route is the quickest route acted desirably.

Minimum Delay (MD):

The main idea behind minimum delay is measuring link delays between nodes. Therefore, all calculation of the routing table is done based on neighboring nodes. OLSR is a protocol with current between node route selection, and other nodes are in a network, which has the least sum of transmission delays from all links in the route.

Minimum Loss (ML):

The probability of selecting successful delivery rates are specified in the link. Delivery rate is the probability of a data packet in reaching the next hop. The expected probability is calculated from successful transmission, and selection validation is derived from forward delivery probability and reverse delivery.

Plink = df *dr

The best route from the source is the route with the highest probability of successful transmission, which is the minimum probability of packet loss.

Expected Transmission Count (ETX):

This criterion selects a route with the least number of expected transmissions for reaching the intended destination. A link's ETX is the number of data transmissions required to send a packet through a link, which includes resend attempts. The route ETX is the sum of all ETC links present in the route. An ETX of a link is calculated using send and receive rates for each link. The rate of sent packet delivery df equals the probability of a packet to successfully reach the intended destination, and reverse delivery dr equals the probability of an ACK packet being received successfully. The probability of successful transmission and its validation equals df*dr.

Simulation:

In this section of the article, we attempt to evaluate the OLSR protocol in terms of four recognized metrics including ETX, MD, ML, and Hop-Count. Simulation results are presented using NS-2 version 2.35 software.

Simulation Results:

End-to-End Delay(E2E):

The time it takes a packet to reach from source to destination in a network.

Table 4: End-to-End Delay.

Protocol	End To End Delay
OLSR – Hop Count	0.68
OLSR– ML	0.78
OLSR– MD	0.75

OLSR- ETX	0. 68

Average Operational Efficiency(Throughput):

Is an operational performance showing the protocol's average bandwidth.

Table 5: Average Operational efficiency.

Protocol	AVG Throughput
OLSR – Hop Count	118.86
OLSR– ML	66.56
OLSR– MD	52.44
OLSR- ETX	45.06

Packet Delivery Ratio(PDF):

Percentage of protocol's success in delivering the transmitted packet.

Table 6: Packet Delivery Ratio.

Protocol	PDF
OLSR – Hop Count	0.5525
OLSR– ML	0.6022
OLSR– MD	0.5608
OLSR- ETX	0.5393

Packet Loss Ratio:

Percentage of transmitted packets that did not reach their destination successfully.

Table 7: Packet Loss Ratio.

Protocol	Packet Loss
OLSR – Hop Count	4908
OLSR– ML	4251
OLSR– MD	4792
OLSR- ETX	4997

Conclusion:

Mobile Ad hoc networks are in fact the future of wireless networks. The reason for this is their low price, simplicity, flexibility and instant usage. In this paper, we attempted to compare OLSR and DSDV protocols in a network. Simulation results show that OLSR outperforms AODV in terms of delay and throughput. This simulation also shows that OLSR-ETX offers the best performance among OLSR extensions.

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