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ARTICLE

EXPERIMENTAL LOAD ANALYSIS OF AODV, OLSR IN MANETS

Rachna Jain[1*], Indu Kashyap[2]

[1,2]*Manav Rachna International Institute of Research and Studies, Faridabad, Haryana, INDIA*

ABSTRACT

Routing Protocol selection is the major challenging task in any Adhoc network. In Mobile Adhoc Networks protocol selected should have best results in terms of various QoS (Quality of Service) parameters such as better throughput, better Packet Delivery Ratio, to minimize end to end delay, and to minimize energy requirement for data transmission from source to destination. In this work, AODV and OLSR routing protocols are compared for different number of nodes with different values of pause time of nodes .Different Scenarios with varying number of nodes have been generated and simulated using NS-2 simulator and further default energy model has been implemented for evaluating node energies. After regress simulation OLSR proved to be better in comparison to AODV in case of minimum end to end delay as route searching from routing table takes lesser time but memory overheads are larger in case of OLSR due to large number of routing tables.

KEY WORDS
Energy, AODV, OLSR, PDR, Throughput.

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***Corresponding Author**
Email:
rachnajain@jssaten.ac.in
Tel.: +919910318665

INTRODUCTION

Due to fast progress of Wireless Communication Adhoc networks has become very popular during last two decades. A Mobile Adhoc network (MANET) is set of mobile nodes without any infrastructure. It does not have any central controller. Each node in a MANET is free to move in any direction. For communication of information inside the network there is a requirement to define a protocol or some set of rules /regulations in order to communicate effectively from source to destination. In MANETS these protocols has been categorized into reactive, proactive and hybrid routing protocols. Proactive routing protocols are those in which each node maintains routing table entries. OLSR (Optimized Link State Routing Protocol) [1,2] come under this proactive category. Reactive routing protocols search route on demand basis. AODV (Ad hoc On Demand Distance Vector) routing protocol come in this category. In this paper, we have compared AODV and OLSR routing protocols for different QoS parameters.

Another important feature of MANETS is that independent nodes have very limited battery power. So this is the major thrust area of researches to further optimize QoS parameters of the network. With the above discussion it has been found that power of nodes is limited and if an overloaded node comes down then whole network collapses .In this work energy required to transmit data from source to destination is compared for varying number of nodes for both AODV [3] and OLSR.

Further in this paper, scalability factor of MANET routing protocols has been exemplified. The network should be scalable also i.e. for ready to use for large as well as small network. Simulation results show that OLSR is better scalable as compared to AODV. Section II discusses about routing protocols in MANETS. Section III gives illustrative scenarios. Section IV gives simulation results, discussions and conclusions.

ROUTING IN MANETS

Based on the topology of the network routing protocol has been broadly divided into proactive, reactive and hybrid routing protocols as shown in [Fig.1].

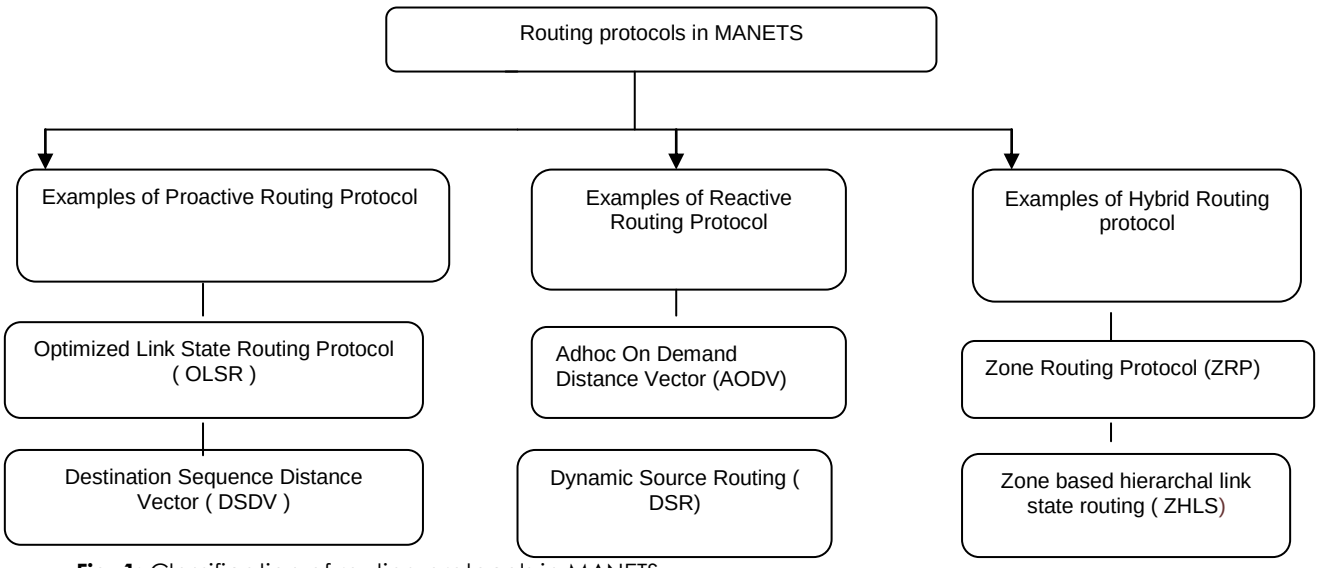

Fig. 1: Classification of routing protocols in MANETS

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Proactive Routing protocols: In these routing protocols each node maintains a routing table. If there is high mobility among nodes then it requires large overhead to maintain the table. DSDV [4], OLSR are examples of proactive routing protocols.

DSDV (Destination Sequenced Distance Vector): It uses distance vector algorithm. It avoids loop problem by periodically sending routing updates [5]. Since each node uses a sequence number to tag itself. As topology of network changes frequently so a new sequence number is essential before network reconverge itself. So it is suited for small Adhoc networks with low mobility [6].

OLSR (Optimized Link State Routing Protocol): This protocol works well for large number of nodes with sporadic traffic. Instead of each node maintaining routing table, MPR (Multi Point Relays) are selected which maintains information for their 1-hop and 2-hop neighbors. Hello Messages and TC (Topology Control) [7] messages are used to control the transmission.

Reactive Routing protocols: In this category route is searched after receiving route request to forward data. There is no maintenance of routing at each node as in AODV [8].DSR, AODV [9-10] are most popular examples of reactive routing protocols.

DSR (Dynamic Source Routing): This protocol initiates a request from source which is passed to neighboring nodes and then each node adds itself to the address till destination is reached. After reaching at the destination complete address is passed to source and a route is established. As source node sends data packet to destination in which complete route is there in packet header so it is called source initiated routing.

AODV (Ad hoc on demand distance vector routing protocol): In DSR each packet carry complete information of intermediate routes whereas in AODV packets carry only the address of destination node. AODV [11] route replies carry only destination IP address and its sequence number. AODV is suitable for dynamic environment but as the network grows extra delay is introduced in the network [12].

Hybrid Routing Protocol: It combines the benefits of both table driven and Reactive routing protocols. In ZRP (Zone Routing Protocol) [13] inside radius of zone it maintains table entries just like proactive while outside the zone reactive protocol is adopted.

Associativity based Routing: proposed by C.K.Toh [14], he preferred stable link over transient links. If link exists for a threshold time period it is considered to be stable. This threshold time is given as Tth = (2* r)/s where r is the radio range of node and s is the relative speed of two nodes. This proposed scheme considers that after threshold time devices will be together for long duration but that is not practically possible.

Signal Stability Adaptive Routing (SSA): It tries to differentiate between strongly connected links with weak links [15]. A link is stable if it remains active for some specific time duration. This approach eliminates the use of weak link as that link is having more signal fluctuation.
Route lifetime Associativity based routing (RABR): This approach finds the time when received signal falls below threshold value [16]. It only considers movement pattern of nodes but does not consider various losses involved with wireless such as fading, path loss etc.

WORKING METHOD OF AODV, OLSR

AODV does not maintain routing table at every node. Route is searched when necessary. Routing table of AODV stores destination address, next hop address, destination sequence number and life time field. life time field is updated after every usage of route otherwise if route is not used this field expires. Route request RREQ packet is forwarded by source node which is acknowledged by RREP packet.

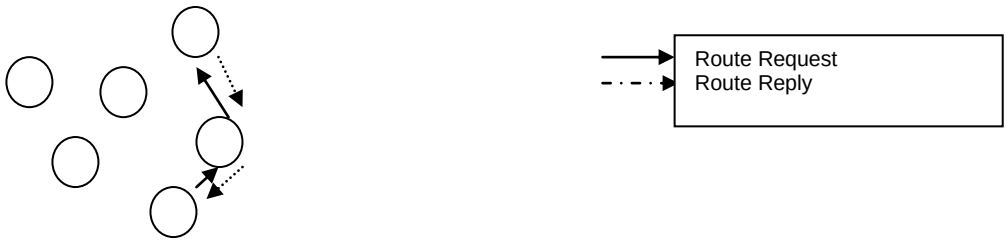

Fig. 2: Propagation of route request and route acknowledgement

In OLSR routing protocol MPR (Multi Point Relay) is responsible for data propagation among 1-hop and 2-hop neighbors.

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EXPERIMENTAL ANALYSIS AND RESULTS OBTAINED

In this work, different scenarios files are generated for varying number of nodes for both OLSR, AODV routing protocols. Simulation Runs were conducted for 120 seconds to analyze the performance of both AODV and OLSR. Different scenarios were generated for pause time 2s as well as for 5s. Initial energy of each node is assumed to be 100 Joule. QoS parameters such as through put, PDR ,End to End delay and total energy spent in data transmission using default energy model were measured .Network parameters are listed below in [Table 1].

Table 1: Network parameters

Network Parameters	Values
Channel Type	Wireless Channel
Radio Propagation Model	Two Ray Ground
Mobility Model	Random Way Point
MAC Type	IEEE 802.11 a
Interface queue type	Drop Tail
Antenna Model	Omni directional
Agent	UDP
Application	CBR
Topology	Dynamic
Speed of nodes	0.01m/s
Maximum Packet in ifq	50
Number of nodes	20,30,50,70,100
Simulation area (X)	1000
Simulation area (Y)	1000
Simulation time	120 s
Initial Energy	100 J per node

Table 2: Comparative analysis of AODV, OLSR for 30 nodes

	Results for 30 Nodes (Pause Time=2 s)		Results for 30 Nodes (Pause Time=5 s)	
Parameter	**AODV**	**OLSR**	**AODV**	**OLSR**
Packet Delivery Ratio(PDR)	15.4464	15.898	25.4874	47.4708
Throughput (Kbps)	575.059	1074.1	1023.61	1548.18
Delay(s)	3.89662	1.97	1.97976	1.36733
Remaining Energy (J)	960.035	1192.0	1330.9	1359.42

[Table 2] suggests that PDR is much better in case of OLSR as we increase the value of pause time. OLSR is showing better results for different QoS parameters as better throughput, higher values of PDR, minimizing. End to End delay as shown in [Fig. 2] and energy spent is almost same for pause time 5 s.

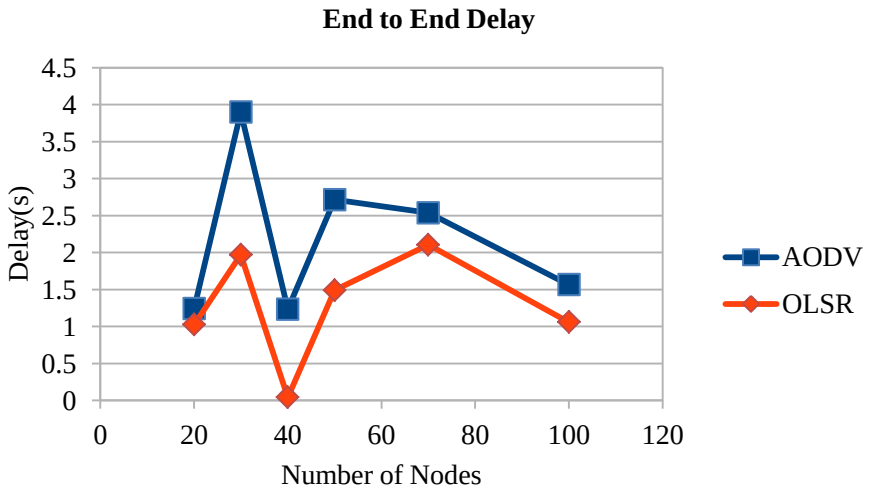

Fig. 2: End to End Delay (pause time=2 s)

Table 3: Comparative Analysis of AODV,OLSR for 50 nodes

Parameter	Results for 50 Nodes(Pause Time=2 s) AODV	OLSR	Results for 50 Nodes (Pause Time=5 s) AODV	OLSR
Packet Delivery Ratio(PDR)	18.7382	26.097	37.7005	44.8102
Throughput (Kbps)	775.975	1495.1	1496.31	1953.7
Delay(s)	12.7132	1.48816	2.18199	1.71962
Remaining Energy of Nodes(J)	2299.3	2495.68	1701.46	1842.49

[Table 3] suggests that PDR improves in case of OLSR as shown in [Fig. 3]. OLSR is showing better results for different QoS parameters as better throughput, higher values of PDR, minimizing End to End delay but energy spent is slightly more in case of OLSR.

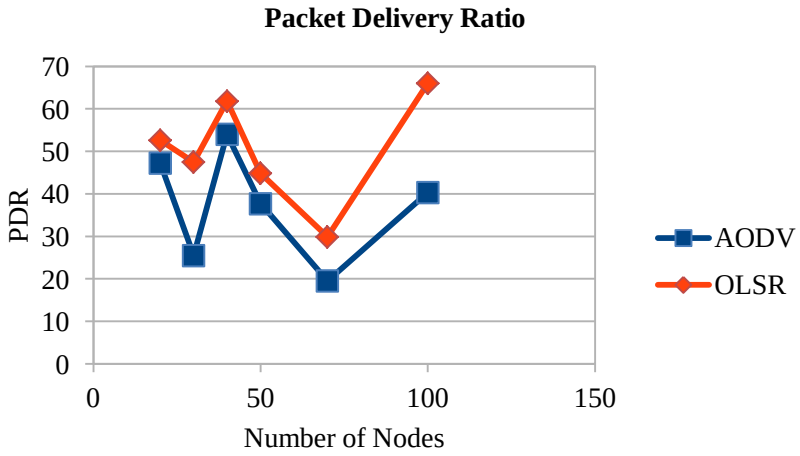

Fig. 3: Packet Delivery Ratio(pause time=5 s)

Table 4: Comparative Analysis of AODV,OLSR for 100 nodes

Parameter	Results for 100 Nodes(Pause Time=2 s) AODV	OLSR	Results for 100 Nodes(Pause Time=5 s) AODV	OLSR
Packet Delivery Ratio(PDR)	32.8541	57.614	40.2906	65.97
Throughput (Kbps)	1257.65	2877.5	1576.62	4710.3
Delay(s)	1.56513	1.0580	2.15506	1.4727
Remaining Energy(J)	3552.96	3739.4	2598.09	1707.4

As we increase scalability of the network as shown in [Table 4] , OLSR is still outperforming AODV with higher PDR, throughput, lesser end to end delay and energy consumption also reduces when we increase the number of nodes as shown in [Fig. 4].

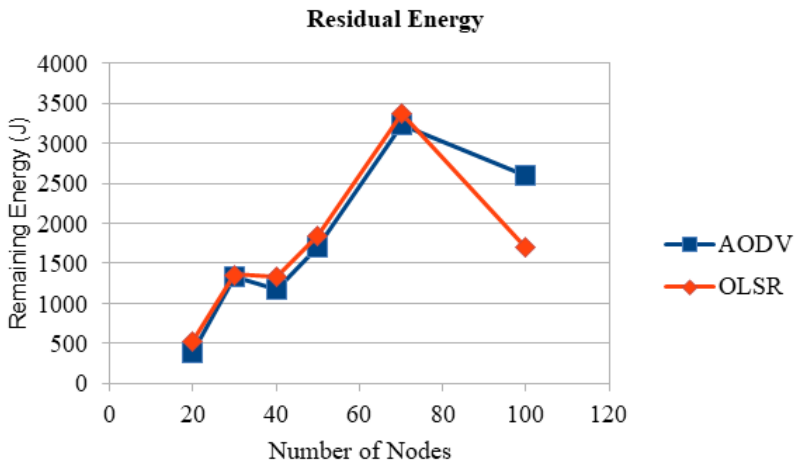

Fig. 4: Residual energy of Nodes (pause time=5 s)

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CONCLUSION AND FUTURE SCOPE

In this analysis it has been proved with the help of simulation results that OLSR outperforms AODV as it is more scalable, having always lesser end to end delay, showing better throughput, higher packet delivery ratio for different number of nodes. Searching takes lesser time as it is easier to search from routing table maintained by nodes. Energy spent by the nodes in case of OLSR can be further minimized by making it energy efficient link stable routing protocol.

CONFLICT OF INTEREST
None

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FINANCIAL DISCLOSURE
None

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