An Extensive Simulation Analysis of Flat Routing Protocols with 802.11 MAC Using NS-3

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Abstract— The field of Ad hoc network has gained an important part of the interest of researchers and become very popular in last few years. A mobile Ad hoc network (MANET) represents system of wireless mobile nodes that can self –organize freely and dynamically into arbitrary and temporary network topology. Routing is the task of directing data packets from a source node to a given destination .There are many routing protocols in MANETs basically classified as Flat routing, Hierarchical and Geographical position assisted routing, in which performance of AODV & OLSR flat routing protocols has been evaluated. The main method for evaluating the performance of MANETs is simulation. They can be studied formally as graphs in which the set of edges varies in time. This paper is subjected to Ad hoc on demand distance vector (AODV) routing protocol, performance with IEEE 802.11 MAC protocol in chain topology for various number of nodes and evaluated its performance. We investigated the performance metrics namely throughput, PDR (Packet delivery ratio), average delay and average jitter by varying network size up to 80 nodes through NS-3 simulation. Almost always the network protocols were simulated as a function of mobility, but not as a function of network density in chain topology. The main interest of this paper is to test the ability of AODV over OLSR routing protocol to react on chain network topology as number of nodes changes. The simulation is performed through the simulation tool NS-3(Network simulator-3) due to its open source simplicity and free availability. With the help of NS-3, result shows that AODV's performance in average delay and average jitter metrics is better than OLSR.

Index Terms— AODV, OLSR, NS-3, MAC, MANET , PDR, Performance Metrics.

1 INTRODUCTION

Mobile Ad-Hoc Networks are autonomous and self-configuring wireless systems. MANETs consist of mobile nodes that are free to move in and out of the network. These node can be mobile phone, system etc. Mobility affects the power indulgence of the nodes in a MANET. This is because of the high overhead incurred in Route Discovery and Route Maintenance in mobile nodes. Due to higher mobility of nodes they form random topologies depending on their connectivity with each other in the network. The dynamic topology makes the routing protocol design complex. Routing protocols in MANETs are classified into three different categories according to their functionality

A. Reactive protocols
B. Proactive protocols
C. Hybrid protocols

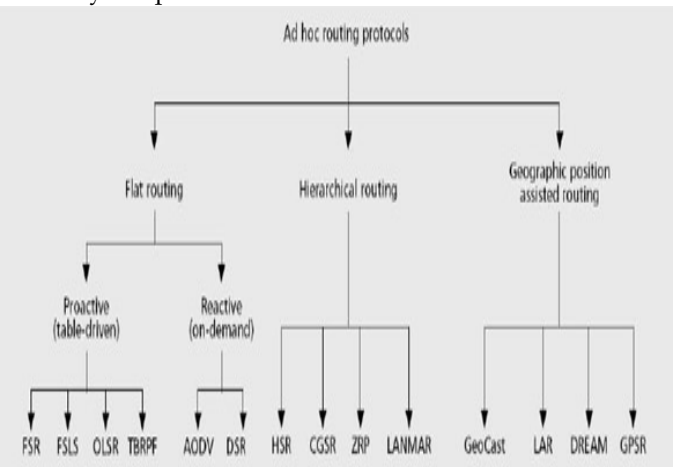

Fig 1 : Classification of Ad hoc routing protocols

A. Reactive Protocols Reactive protocols are also known as On-demand driven reactive protocols. These Protocols do not initiate route discovery by themselves, until or unless a source node request to find a route. That is why these protocols are called reactive protocols. These protocols setup routes when demanded [4], [3]. When a node wants to communicate with another node in the network, and the source node does not have a route to the node it wants to communicate with, reactive routing protocols will establish a route for the source to destination node. Normally reactive protocols

Don't find route until demanded.

Uses flooding technique to propagate the query, to find the destination —On-Demand.

Do not consume bandwidth for sending information.

They consume bandwidth only, when the node start transmitting the data to the destination node.

Some of the most used on demand routing protocols are DSR [5], [6], AODV [4], [12] and Admission Control enabled On demand Routing Protocol(ACOR).

B. Proactive Protocols Proactive routing protocols work as the other way around as compared to Reactive routing protocols. These protocols constantly maintain update-to-date topology of the network. Every node in the network knows about the other node in advance, in other words the whole network is known to all the nodes making that network. All the routing information is usually kept in tables. Whenever there is a change in the network topology, these tables are updated according to the change. The nodes exchange topology information with each other; they can have route information any time when they needed. Some of the existing proactive routing protocols are DSDV [7], OLSR [8] and Wireless Routing Protocol (WRP).

C. Hybrid Protocols Hybrid protocols exploit the strengths of both reactive and proactive protocols, and combine them together to get better results. The network is divided into zones, and use different protocols in two different zones i.e. one protocol is used within zone, and the other protocol is used between them. Zone Routing Protocol (ZRP) is the example of Hybrid Routing Protocol. ZRP uses proactive mechanism for route establishment within the nodes neighborhood, and for communication amongst the neighborhood it takes the advantage of reactive protocols. These local neighborhoods are known as zones, and the protocol is named for the same reason as zone routing protocol. Each zone can have different size and each node may be within multiple overlapping zones. The size of zone is given by radius of length P, where P is number of hops to the perimeter of the zone [9]. Some of the existing hybrid protocols are ZRP [10], TORA [11] and Hazed Sighted Link State Routing Protocol (HSLS).

Dsdv- Destination Sequenced Distance Vector (DSDV) 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 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. 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 [1].

AODV- AODV offers low network utilization and uses destination sequence number to ensure loop freedom. It is a reactive 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 [1].

OLSR- Optimized Link State Routing (OLSR) is a link state routing protocol. OLSR is an adoption of conventional routing protocols to work in an ad hoc network on top of IMEP. The novel attribute of OLSR is its ability to track and use multipoint relays. The idea of multipoint relays is to minimize the flooding of broadcast messages in the network by reducing/optimizing duplicate retransmission--ns in the same region. Each node in the network selects a set of nodes in its neighborhood that will retransmit its broadcast packets. This set of selected neighbor nodes is called the multipoint relays of that node. Each node selects its multipoint relay set in a manner to cover all the nodes that are two hops away from it. The neighbors that are not in the multipoint relay set still receive and process broadcast packets, but do not retransmit them [13].

2 Methodology

2.1 Simulation Environment:

Simulations are done to compare these routing protocols. Simulator NS-3 is used for performance comparison. During interpretation two files trace files and nam files are to be generated. Network Animator (.nam) file, records all the visual events that happened during the simulation. Trace files (.tr), records the entire network event that occur duringthesimulation.

TABLE 1
SIMULATION PARAMETERS

Parameter	value

Simulation Time	30 Sec
No. of Nodes	50 ,60,70& 80
Traffic Type	CBR
Pause Time	10 Sec
Packet Size	3976 bytes
MAC Protocol	802.11
Mobility Model	Random Waypoint
Routing Protocols	AODV,OLSR,
Observation Parameters	AverageDelay,Average Jitter, Throughput& PDR

2.2 Performance Metrics:

The estimation of performance of AODV and OLSR is done on the basis of following Performance metrics:
Packet Delivery Ratio: It is the ratio of the packets received by destination to those generated by the sources.
CBR traffic type is used by source. It specifies the packet loss rate, which limits the maximum throughput of the network. The routing protocol which have better PDR, the more complete and correct. This reflects the usefulness of the protocol. And provide good performance.
Packet Delivery Ratio = (Received Packets/Sent Packets)
Average Delay: Average end-to-end delay is the average time it taken by the packet to reach to destination in seconds.
Throughput: No. of packet passing through the network in a unit of time.

3 Results and Discussion

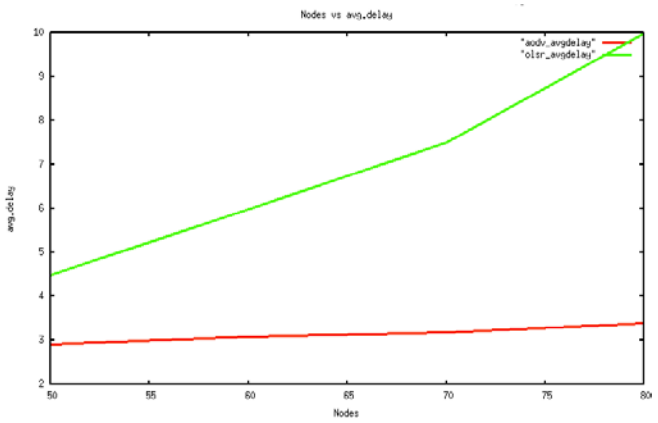

Fig 2. Average Delay Graph

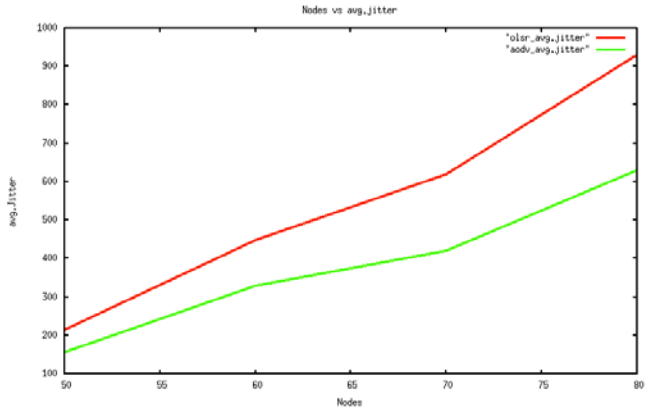

Fig 3 Average Jitter Graph

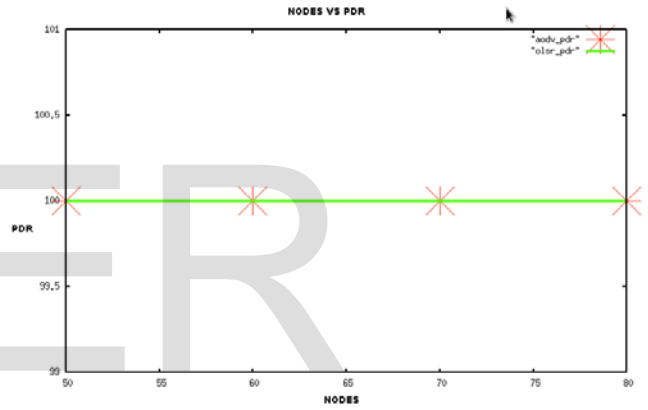

Fig 4 Packet Delivery Ratio Graph

Table:3
Performance Chart of AODV, OLSR

Performance metrics	*Routing Schemes*	*High Mobility*	*Low Mobility*
Avg. Delay	AODV	Medium	Low
	OLSR	High	Medium
Avg. Jitter	AODV	Medium	Low
	OLSR	High	Medium
Throughput	AODV	High	High
	OLSR	High	High
PDR	AODV	High	High
	OLSR	High	High

4 Conclusion

Mobile Ad-Hoc Networks has the ability to deploy a network where a traditional network infrastructure environment cannot possibly be deployed. With the importance of MANET comparative to its vast potential it has still many challenges left in order to overcome.

Performance comparison of routing protocol in MANET is one of the important aspects. In this paper, I have analyzed the behavior and different performance matrices for MANETs using different protocols. (AODV & OLSR) and compared their performance matrices, like Average delay, Average Jitter, Packet delivery Ratio and Throughput for 50,60,70&80 nodes . In Table.3 performance comparisons of routing protocols AODV & OLSR is shown using NS3 simulator. For Throughput and PDR, AODV & OLSR behaving the best and for Average delay & Average Jitter is concern AODV is taking less delay.

5 Future Work

In the future, It is possible to change the mobility and density of the network by directly modifying the speed and the number of nodes. It is also possible to change the characteristics of the network by changing the transmit power (as power increases, the impact of mobility decreases and the effective density increases). Also other new protocols performance could be studied.

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