ADVANCED ROUTING PROTOCOL FOR WIRELESS SENSOR NETWORK

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ABSTRACT

Routing in MANET is a critical task due to highly dynamic environment. A routing protocol is needed whenever a packet needs to be transmitted to destination via number of nodes and numerous routing protocols have been proposed for ad-hoc network. In this paper we try to judge the impact of both reactive as well proactive type protocols by increasing the nodes in the network. In this case, the performances of the routing protocol have been analyzed to improve and select efficient routing protocol for network setup and it is designing for practical scenario. The performance matrix includes packet delivery fraction, throughput and end to end delay.

Index Terms: Manet, Ns-2, Aodv, Dsdv, Dsr, Aomdv, Olsr

I. INTRODUCTION

A Mobile ad-hoc network is a self-configuring infrastructure less network of mobile devices connected by wireless. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to larger Internet. MANET'S are a kind of wireless ad-hoc networks that usually has a routable networking environment on top of a Link Layer ad-hoc network.

There are several ways to study MANET'S. One solution is the use of simulation tools like OPNET, Netsim and NS2. Our goal is to carry out a systematic performance study of five routing protocol for ad-hoc networks such as Ad Hoc On-Demand Distance Vector (AODV), Dynamic Source Routing (DSR) and Destination Sequenced Distance Vector (DSDV),Ad Hoc On-Demand Multipath Distance Vector (AOMDV) and Optimized Link State Routing (OLSR).

Mobile Ad hoc Network is an autonomous system of mobile nodes connected by wireless links. Each node operates as an end system and a router for all other nodes in the network. An Ad hoc network is often defined as an "infrastructure less" network means that a network without the usual routing infrastructure, link fixed routers and routing backbones. However, following protocols that is used for mobile ad-hoc networks:

II. ROUTING PROTOCOLS IN MANET

2.1 On-Demand (Reactive Routing)

This type of protocols finds a route on demand by flooding the network with Route Request Packets. It does not maintain a routing table. Each node in a network discovers or maintains a route based on-demand. The main advantage is that this protocol needs less routing information but the disadvantage are that produces huge control packets due to route discovery during topology changes which occurs frequently in MANET'S and it has higher latency. Ex: AODV, DSR and AOMDV

2.2 Table-Driven (Pro-Active Routing)

This type of protocols maintains fresh lists of destinations and their routes by periodically distributing routing tables throughout the network. It maintains a routing table. Each node in a network maintains one or more routing table which is updated regularly. Each node sends a broadcast message to the entire network if there is a change in the network topology. Additional overhead cost due to maintaining up-to-date information and as a result; throughput of the network may be affected but it provides the actual information to the availability of the network.

This routing protocol maintains different number of tables. The proactive protocols are not suitable for larger networks, as they need to maintain node entries for each and every node in the routing table of every node. This causes more overhead in the routing table leading to consumption of more bandwidth.

Ex: DSDV and OLSR

2.3 Ad hoc On-Demand Distance Vector (AODV) Routing Protocol

AODV is a reactive routing protocol which is basically a combination of DSR and DSDV algorithms. It uses the advantageous feature of both these algorithm. Dynamic, self-starting and multi-hop routing is allowed between participating mobile nodes. The basic on demand routing mechanism of route discovery and route maintenance of DSR and the use of hop by hop routing sequencing number and periodic update packets of DSDV are both available in AODV. It employs destination sequence numbers to identify the most recent path. In AODV, the source node and the intermediate nodes store the next-hop information corresponding to each flow for data packet transmission

Route Requests (RREQs), Route Replies (RREPs) and Route Errors (RERRs) are message types defined by AODV

2.3.1 Route Discovery

A source node send a broadcast message to its neighboring nodes if no route is available for the desired destination containing source address, source sequence number, destination address, destination sequence number, broadcast ID and hop count. Two pointers such as forward pointer and backward pointer are used during route discovery. Forward pointers keep track of the intermediate nodes while message being forwarded to destination node. Eventually, when route request message reached the destination node, it then unicast the reply message to the source via the intermediate nodes and the backward pointer keeps track of the nodes.

2.3.2 Route Maintenance

Three types of messages exchanged between source and destination such as route error message, hello message and time out message. Route error message ensures that this message will be broadcasted to all nodes because when a node observes a failed link, it will propagate this message to its upstream nodes towards source node only. Hello message ensures the forward and backward pointers from expiration. Time out message guarantees the deletion of link when there is no activity for a certain amount of time between source and the destination node.

2.3.3 Advantages

It is an efficient algorithm for mobile ad-hoc networks and it is scalable.It takes short time for convergence and is a loop free protocol. Messaging overhead to announce the link failure is less compared DSR. Lower setup delay for connections and detection of latest route to the destination. Its adaptability to highly dynamic networks and reduced overhead.

2.3.4 Disadvantage

It requires periodic updates. If the source sequence number is very old it leads to inconsistent routes. Unnecessary bandwidth consumption occurs in response to periodic beaconing

2.4 Dynamic Source Routing (DSR) Protocol

DSR is an on demand routing protocol in which a sender determines the exact sequence of nodes through which a packet is propagated. The packet header contains a list of intermediate nodes for routing. Route cache is maintained by each node which caches the source route that it has learned.

The major components of DSR are “Route Discovery” and “Route Maintenance” which work together for determining and maintaining routes to arbitrary destinations It is designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table-update messages required in the table-driven approach. A route is established by flooding Route Request packets in the network

2.4.1 Route Discovery

As it is an on-demand routing protocol, so it looks up the routing during transmission of a packet. At the first phase, the transmitting node search its route cache to see whether there is a valid destination exists and if so, then the node starts transmitting to the destination node and the route discovery process end here. If there is no destination address then the node broadcasts the route request packet to reach the destination. When the destination node gets this packet, it returns the learned path to the source node.

2.4.2 Route Maintenance

It is a process of broadcasting a message by a node to all other nodes informing the network or node failure in a network. It provides an early detection of node or link failure since wireless networks utilize hop-to-hop acknowledge.

2.4.3 Advantages

Aware of existence of alternative paths that helps to find another path in case of node or link failure. It avoids routing loops.Less maintenance overhead cost as it an on-demand routing protocol. A route is established only when it is required.

2.4.4 Disadvantages

The connection setup delay is higher than in table-driven protocols. It is not suitable for large number of nodes where speed may suffer.

2.5 Destination-Sequenced Distance-Vector (DSDV) Routing Protocol

Destination-Sequenced Distance-Vector Routing (DSDV) is a table-driven routing scheme for ad hoc mobile networks based on the Bellman-Ford algorithm. It eliminates route looping, increases convergence speed, and reduces control message overhead. In DSDV, each node maintains a next-hop table, which it exchanges with its neighbors.

There are two types of next-hop table exchanges: Periodic full-table broadcast and event-driven incremental updating. The relative frequency of the full-table broadcast and the incremental updating is determined by the node mobility. In each data packet sent during a next-hop table broadcast or incremental updating, the source node appends a sequence number. This sequence number is propagated by all nodes receiving the corresponding distance-vector updates, and is stored in the next-hop table entry of these nodes.

A node, after receiving a new next-hop table from its neighbor, updates its route to a destination only if the new sequence number is larger than the recorded one, or if the new sequence number is the same as the recorded one, but the new route is shorter. In order to further reduce the control message overhead, a settling time is estimated for each route.

A node updates to its neighbors with a new route only if the settling time of the route has expired and the route remains optimal.

2.5.1 Advantages

This protocol guarantees loop free path. Count to infinity problem is reduced in DSDV. Avoid extra traffic with incremental updates instead of full dump updates.

2.5.2 Disadvantages

Wastage of bandwidth. Not support for larger network. Wastage of battery power.

2.6 Ad hoc On-Demand Multipath Distance Vector (AOMDV) Routing Protocol

Among the on-demand protocols, multipath protocols have a relatively greater ability to reduce the route discovery frequency than single path protocols. On demand multipath protocols discover multiple paths between the source and the destination in a single route discovery. So, a new route discovery is needed only when all these paths fail. In contrast, a single path protocol has to invoke a new route discovery whenever the only path from the source to the destination fails.

2.7 Optimized Link State Routing OLSR Protocol

OLSR is an IP routing protocol optimized for mobile ad-hoc networks, which can also be used on other wireless ad-hoc networks. OLSR is a proactive link-state routing protocol, which uses hello and topology control (TC) messages to discover and then disseminate link state information throughout the mobile ad-hoc network. Individual nodes use this topology information to compute next hop destinations for all nodes in the network using shortest hop forwarding paths.

III. SIMULATION BASED ANALYSIS USING NETWORK SIMULATOR (NS-2)

In this section we have described about the tools and methodology used in our paper for analysis of ad hoc routing protocol performance i.e. about simulation tool, Simulation Setup(traffic scenario, Mobility model) performance metrics used and finally the performance of protocols is represented by using excel graph.

3.1 Simulation Tool

In this paper the simulation tool used for analysis is NS-2.NS is a discrete event simulator targeted at networking research. Ns provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks. NS is an object oriented simulator, written in C++, with an OTcl interpreter as a frontend. NS meets both of these needs with two languages, C++ and OTcl. C++ is fast to run but slower to change, making it suitable for detailed protocol implementation. OTcl runs much slower but can be changed very quickly, making it ideal for simulation configuration.

In NS-2, the frontend of the program is written in TCL. The backend of NS-2 simulator is written in C++ and when the tcl program is compiled, a trace file and nam file are created which define the movement pattern of the nodes and keeps track of the number of packets sent, number of hops between 2 nodes, connection type etc at each instance of time.

3.2 Simulation Setup

NS version	Ns –allinone-2.29
Traffic	CBR(Constant Bit Rate)
CBR Packet size	512 bytes
Mobility model	Random Way point mobility
Antenna Type	Omni Antenna
Channel Type	Wireless channel
Propagation Type	Two ray ground
MAC layer Protocol	IEEE 802.11
Routing Protocol	AODV,DSR,DSDV,AOMDV, OLSR
CBR Rate	100Kb
CBR Interval	0.1

3.3 Performance Metrics Used

3.3.1 Packet Delivery Ratio

It is a ratio of the number of packets received by the destination to the number of packets send by the source

3.3.2 End to End Delay

It is defined as the time for a data packet which is received by the destination minus the time for a data packet which is generated by the source

3.3.3 Throughput

It is a ratio of the number of packets received by the sink to the number of packets sent by the source.

IV. SIMULATION RESULTS

4.1 Nodes Vs.Packet Delivery Ratio

NODES	AODV	DSR	DSDV
20	96.0082	99.876	64.9949
30	100	100	90.8905
40	99.4882	100	100
50	99.8976	100	64.6878

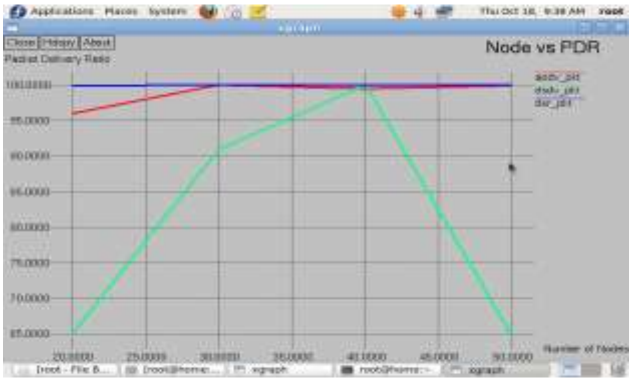

Fig.1. Node vs. pdf

4.2 Nodes Vs. End to End Delay

NODES	AODV	DSR	DSDV
20	0.0627376	0.00914423	0.00901532
30	0.0118011	0.00576586	0.00769682
40	0.0988914	0.00575494	0.0058643
50	0.00930005	0.00576553	0.00900171

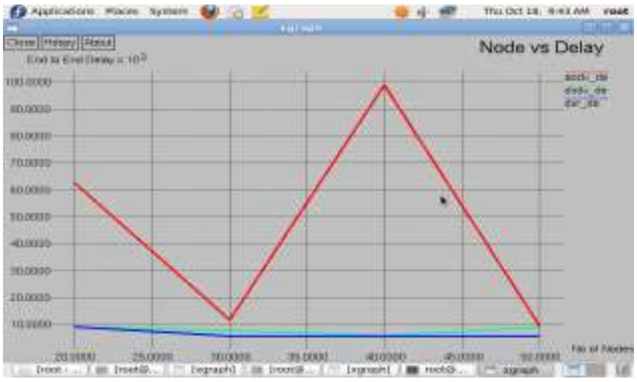

Fig.2. Node vs. delay

4.3 Nodes vs. Throughput

NODES	AODV	DSR	DSDV
20	99860.7	100000	67606.9
30	104013	100102	94541.7
40	103480	100102	104013
50	103906	100102	67283.6

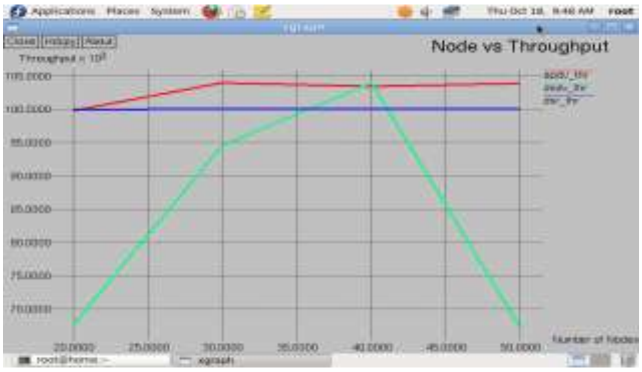

Fig.3. Node vs. throughput

4.4 Nodes Vs.Packet Delivery Ratio

NODES	AOMDV	OLSR
O	0	0
5	22	40
10	100	120
15	260	310
20	400	365
25	400	365
30	400	365

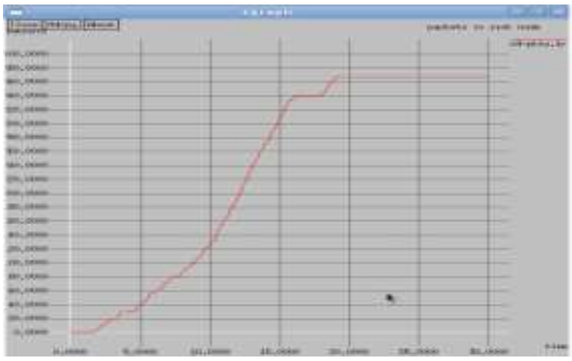

Fig. 4. Node Vs.Packet Delivery Ratio (Aomdv)

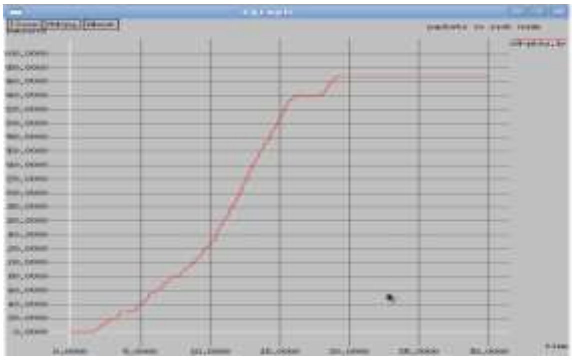

Fig.5. Node Vs.Packet Delivery Ratio (Olsr)

4.5 Nodes Vs. Delay

NODES	AOMDV	OLSR
0	**0**	**0**
5	**0.002**	**0.002**
10	**0.010**	**0.010**
15	**0.020**	**0.025**
20	**0.030**	**0.030**
25	**0.035**	**0.025**
30	**0.035**	**0.025**

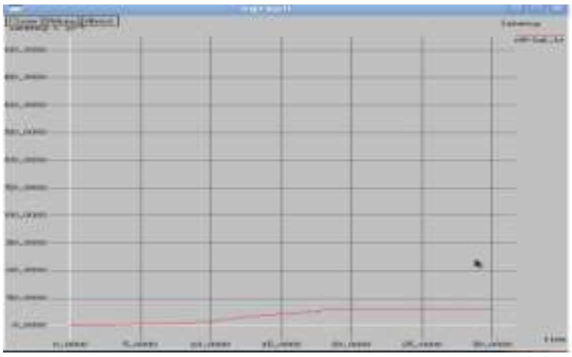

Fig.6.Nodes vs. Delay (AOMDV)

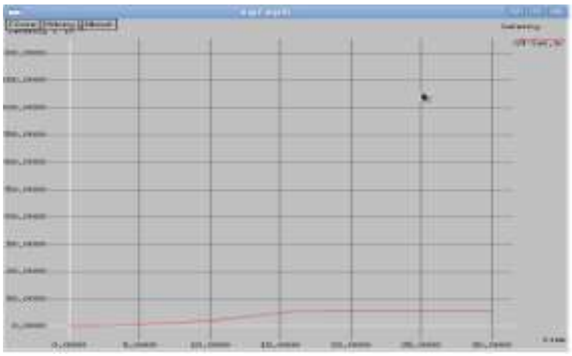

Fig.7.Nodes vs. Delay (OLSR)

4.6 Nodes Vs. Throughput

NODES	AOMDV	OLSR
0	0	0
5	20	22
10	62	84
15	180	218
20	280	260
25	280	260
30	280	260

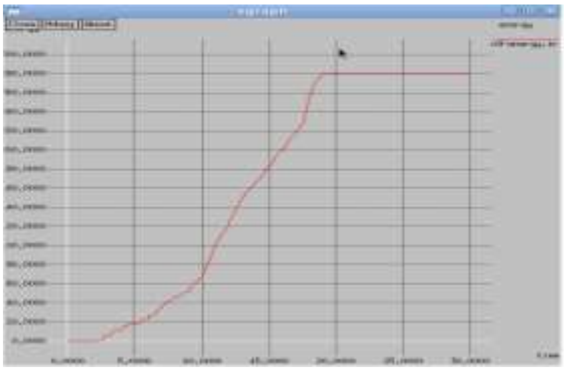

Fig.8.Nodes vs. Throughput (AOMDV)

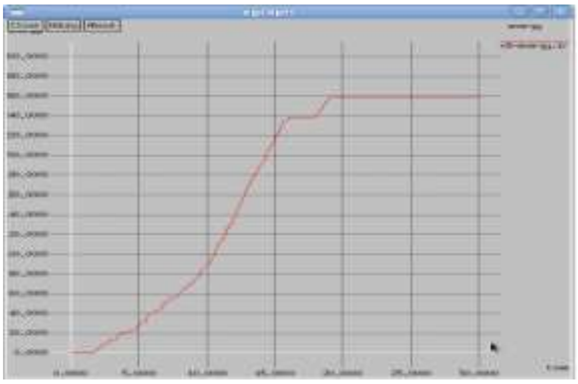

Fig.9.Nodes vs. Throughput (OLSR)

V. CONCLUSION

We have compared the performance analysis of packet delivery ratio, end to end delay and throughput using AODV, DSR, DSDV, AOMDV and OLSR.AOMDV is best for packet delivery ratio. If we increasing the nodes the packet delivery ratio should be constant. The greater value of packet delivery ratio means better performance of the protocol. AOMDV produces higher value compared with protocols. For end to end delay AOMDV is best protocol compared with AODV, DSR, DSDV and OLSR. For Throughput AOMDV is best compared with other protocols

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