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**RESEARCH ARTICLE**

# Performance Evaluation of AODV and AODV-LR in terms of Route Maintenance

**R. Vijayadharshini***
M. Phil Research Scholar
Department of Computer Science & Engineering
Alagappa University, Karaikudi
TamilNadu, India
r.vdharshini@gmail.com

**Dr. A. Padmapriya**
Assistant Professor
Department of Computer Science & Engineering
Alagappa University, Karaikudi
TamilNadu, India
mailtopadhu@yahoo.co.in

***Abstract – The Idea at the back of ad hoc network is multi-hop broadcasting in which packets are sent from the source node to destination node. It does not have any infrastructure based network. In ad hoc network distributed routing is available. Because of mobility in nodes, there are recurring path breakages. In ad hoc network, the primary goal of routing is to detect paths between source to destination with minimum routing overhead. Applications of ad hoc network are military applications as well as emergency operations. In ad hoc networks this work focused on AODV route maintenance. This paper suggests a new approach of route maintenance scheme AODV-LR in AODV which reduces the data transmission time of AODV as well as makes better performance with minimum bandwidth utilization and maximum packet delivery ratio. This concept has been implemented and tested on OMNet++.***

***Keywords — MANET, AODV, Route Discovery, Route Maintenance, AODV-LR***

## I. INTRODUCTION

Mobile Ad hoc networks (MANETs) [13] are decentralized and also mobile nodes are act like as router and also as host. It does not have any standard services. MANET allows frequent node movements as well as topology changes. In MANET data must be forwarded via intermediate nodes. MANETs allows portable mobile devices to establish communication path without having any central infrastructure [16].

The difference between fixed networks and MANET is that the nodes in MANET are mobile. A mobile ad-hoc network (MANET) is a self-configuring network made up exclusively of mobile hosts connected by wireless links to form an arbitrary topology [8]. Ad hoc network is one of the special types of wireless mesh networks. The path set up between two nodes is completed by the help of intermediate node [17]. The Idea of MANET is also called infrastructure less networking [18].

There are many reactive routing protocols in ad hoc networks. Ad hoc on demand distance vector routing protocol is one of the important on demand routing protocol in MANET [9].

 

*A. Ad hoc On-Demand Distance Vector Routing:*

AODV [4] is one of the reactive protocols. It is designed for ad hoc mobile networks. It allows unicast as well as multicast routing. The AODV protocol is a loop free and avoids the counting to infinity problem, which were typical to the classical distance vector routing protocols, by the usage of the sequence numbers [6]. AODV is related to the Bellman-Ford distance vector algorithm [3]. Mainly there are two important phases in the AODV implementation. They are Route Discovery phase and Route Maintenance [5].

*B. Route Discovery:*

In The route discovery process, the RREQ packet flooded throughout the network. Then the node waits for the route reply. In case, the RREP is not received within a specific time, the corresponding RREQ maybe retransmitted. Because the node that assumes there is no path to the destination node.

In AODV, each and every node has its own sequence number and broadcast ID. Many distance vector routing protocols suffer from a condition called Count to infinity [15]. This can be solved by AODV using sequence number scheme. For every RREQ the broadcast ID is incremented. The source node initiates in the RREQ with its sequence number and the broadcast ID. The receiving node checks the table [10] whether it contains the destination node's information.

If a node gets the RREQ packet, first it checks the sequence number as well as broadcast ID. Because, if the RREQ is new or old. If it is old, the node will discard the message. Otherwise it setup the reverse path for send the data.

*C. Route Maintenance:*

For maintaining paths and neighbour node's connections this AODV routing protocol needs that every node will periodically send a local message. Such a message called HELLO packets.

By default the Hello packets transmissions is set into one per second. Always a node gets a HELLO packet from a neighbour node it must update the routing information about the neighbour node in the routing table. The failure of receiving the HELLO packets is an indication that is the node is moved away from its position on the network. Then, the link is marked as broken. These nodes will broadcasts the RERR to their upstream node. Then the source node may reinitiate the route discovery process.

## II. RELATED WORK

The literature suggests that number of routing protocols is attempting to make the performance of AODV routing protocol. From that more number of protocols constructs more than one path from the source node to destination node. In LRAODV-LP Routing protocol [12], each node maintains two tables, they are, NPL (Neighbour Power List) and PDT (Power Difference Table), Link Failure Threshold (LFTHRESH) and LFF (Link Failure Flag).

A New AODV Routing protocol provides AODV-BA (AODV with Break Avoidance) Routing protocol [1], the danger of the link break to the upstream node is detected by each intermediate node. The Improved AODV-BL (Backup List) [7] algorithm provides the easy way to rebuild the broken connections from source to destination. The new Reactive routing protocol [2] provides two approaches. Namely, they are AAODV (Advance AODV) and PM-AODV (Multipath Preemptive AODV). PPAODV [14] approach is used in the phase of route maintenance. This algorithm has an enhancement with AODV using a prediction function. This modified AODV protocol [11] is used for route maintenance.

## III. PROPOSED WORK

In AODV-LR, in case there is path breakage occurs, the detecting node will inform to its neighbour node. So, the intermediate node will send the route break message to its successor node only. This route break message needs not to send all other neighbour nodes in the network.

In AODV, in case of path breakages occurs, the RREQ message can be broadcasted. This can leads to control overhead as well as maximum utilization of bandwidth on the network. Then the node will waits for RREP for a specific time. Again it will send the data through the alternate path; it depends on the RREP message. Thus, the unnecessary RREQ message and the huge amount of transmission time can be reduced in AODV-LR approach.

 

## IV. SIMULATION ENVIRONMENT

This section estimates that the performance of AODV-LR in opposition to existing AODV. The simulation has been carried out using OMNet++ 4.4.1 [19]. This process has been checked by changing the number of nodes as well as and their mobility. The default values for AODV protocol can be used by Omnet++ have been employed for the study. The network is organized and examined as per the simulation parameter.

Fig. 1 exhibits the MANET scenario used for this simulation where nodes are having one and the same form distribution on the area of 1000 m * 1000m, with random movement of the nodes.

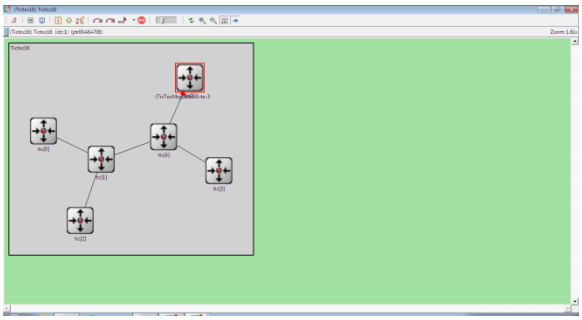

Fig.1 Simulation environment of Omnet++

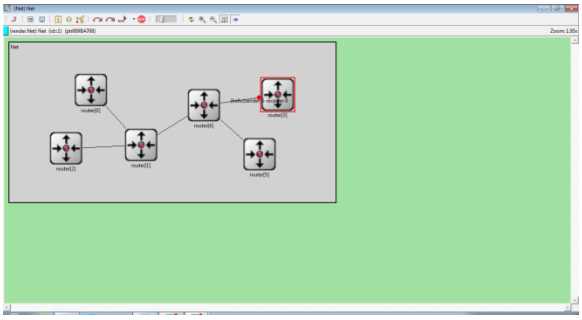

Fig.2 Simulation environment of OMNet++

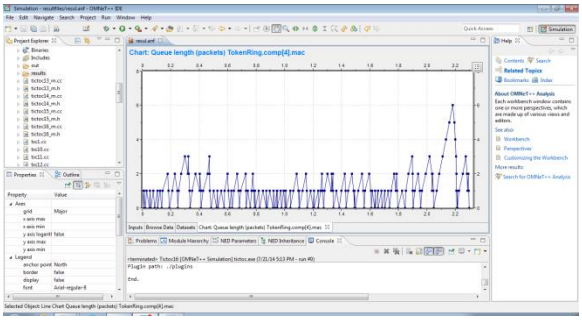

Fig.3 Simulation environment of OMNet++ (Queue Length)

 

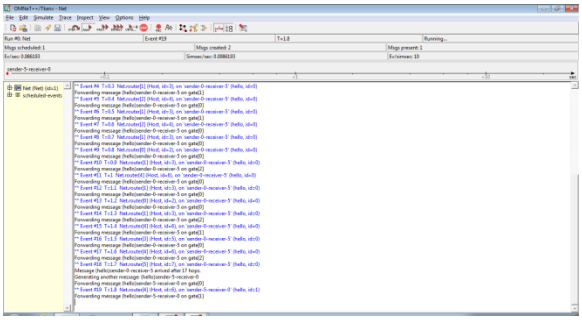

Fig.4 Simulation environment of OMNet++

*A. Packet Delivery Ratio (PDR):*

Packet Delivery Ratio is the ratio of total number of packets generated on the source node and the number of packets received at the destination node.

$$PDR = \frac{Total\ number\ of\ packets\ received}{Total\ number\ of\ packets\ generated}$$

The above mentioned formula is used to calculate the packet delivery ratio. In AODV, simulation for 7 nodes, for example, we take 15 packets for data transmission. In existing AODV, For 7 nodes it takes the packet delivery ratio of 50%, for 15 nodes 37.5 %, for 30 nodes 33.33% and for 60 nodes it takes s the 29% packet delivery ratio. Similarly, in AODV-LR, simulation for 7 nodes, it takes the packet delivery ratio of 75%, for 15 nodes 68%, for 30 nodes 62.5% and for 60 nodes 54%.

TABLE I

TRANSMISSION TIME OF AODV AND AODV-LR

| Nodes | 7 Nodes | 15 Nodes | 30 Nodes | 60 Nodes |
|---|---|---|---|---|
| AODV | 50% | 37.5% | 33.33% | 29% |
| AODV-LR | 75% | 68% | 62.5% | 54% |

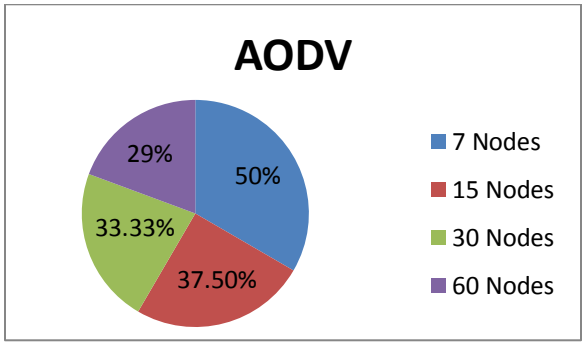


Fig.4 Packet Delivery Ratio of AODV

 

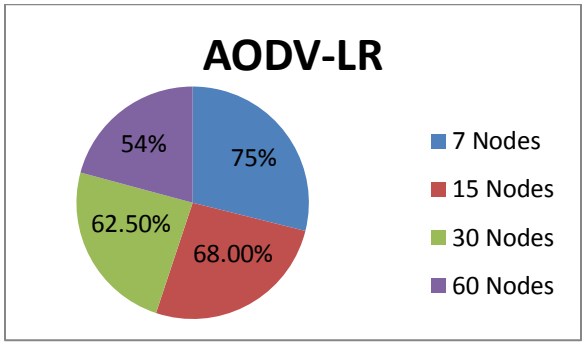


Fig.5 Packet Delivery Ratio of AODV-LR

TABLE II

SIMULATION PARAMETERS

| Parameter | Value |
|---|---|
| Number of Nodes | 7,15,30,60 |
| Simulator | OMNet++ 4.4.1 |
| Routing Protocol | AODV, AODV-LR |
| Traffic Source | CBR(Constant Bit Rate) |
| Environment Size | 1000m x1000m |
| Mobility Type | Random movements |
| MAC Layer | IEEE 802.11 |
| Simulation Time | 500 s |
| Antenna Type | Omni directional |
| Pause time | 10 s |
| Transmission Range | 250 m |
| Antenna height | 1.5 m |
| Packet Size | 512 Bytes |

After running the simulation that shows the increased performance of the proposed approach over the existing AODV.

## V. PERFORMANCE METRICS

There are many of the metrics which are useful for determining the value of the protocol. In this process the parameters are used to estimate the efficiency of a protocol are routing overhead, bandwidth consumption, and time as well as space complexity.

The protocols AODV and AODV-LR are tested opposition to these types of parameters for their performance. The movement of the mobile nodes changes with the packet delivery ratio of the network is also improved. The transmission time of AODV-LR is much better than AODV. When the number of nodes increases on the network, the AODV-LR performance is also increases.

 

## VI. CONCLUSION

In this work a local recovery based approach AODV-LR has been proposed, which can used to manage the connections of smashed links. It reduces the time to finds the alternate path. It allows transmitting the undisturbed data via the whole network. This approach is used to keep a better throughput performance of the network.

The HELLO packets creations are less than the existing AODV. So, the routing overhead as well as control overhead is less. The bandwidth consumption is also less, because this approach will provides backup path table which contains the better and efficient path based on the two metrics, they are namely hop count and the signal strength. From the results, the paper which concludes that the proposed approach increases the whole performance of the network and helps to keeping a better and speed performance when compared to classical AODV.

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