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# Comparative Study of AODV & AOMDV Routing Protocol

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**ABSTRACT**

Mobile ad hoc network (MANET) is the collection of wireless nodes. The wireless nodes communicate with each other without any fixed infrastructure. One of the major challenges in ad hoc network is to construct the efficient routing protocols which deal with the dynamic topology of the network. This paper presents the working of AODV and AOMDV routing protocol. In this paper the AODV and AOMDV reactive routing protocol is simulated and their performance is compared with the help of performance metrics. The results show that AOMDV has better performance than AODV in terms of packet delivery ratio, throughput and packet loss. NS-2 is used for the simulation.

***Index Terms:*** MANET, Routing Protocols, AODV, AOMDV

## 1. INTRODUCTION

MANET is the infrastructureless network without any access point or base station. It consists of the mobile nodes and has dynamic topology [3]. MANET is self configured and self organizing network [2]. In the ad hoc network nodes are free to move anywhere and any pair of nodes can communicate directly if they are in the transmission range of each other otherwise the communicating nodes depend upon the other nodes present in the network for the communication. So, MANET follows the multi-hop pattern for the communication. In the ad hoc network, the nodes can act as the router as well as host. The nodes in the network dynamically exchange the data without their dependency on any wired backbone network. The nodes in the network are differentiated by their processing, energy consumed, memory resources and most important by their high degree of mobility [3].

Routing protocols play an important role in order to transmit the data from one node to another. The goal of the ad hoc network routing protocols is to establish the valid and efficient routes between the nodes so that the messages are delivered within time. The routing protocols must be able to deal with high degree of mobility. Depending upon their network structure the routing protocols are classified into three types [4]: Proactive protocols, Reactive protocols and Hybrid protocols.

Proactive protocols are table-driven routing protocols. Each node stores the network topology information and routing information is exchanged periodically. When any node needs a path to any destination then path is obtained from the routing table. Reactive protocols are on-demand routing protocols. The nodes do not store any routing information and no information is periodically exchanged. When any node needs a path to any destination then the source node initiate the route discovery process to find the path then use that path for transmission of data packets. Hybrid routing protocols combine the best features of both proactive and reactive routing protocols. These reactive and proactive routing protocols are further distinguished into single path routing protocols and multipath routing protocols [5].

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Single path routing protocols discovers the single path between the source and the destination. Single path routing protocols consist of two components [4]. One is route discovery-the route is discovered between the source and the destination and second is route maintenance-the new route is determined to recover the broken route. Dynamic Source Routing (DSR), Destination Sequence Distance Vector (DSDV) and Ad hoc On-demand Distance Vector (AODV) are most commonly used single path routing protocols. Multipath routing protocols discover the multiple paths between the source and the destination. Multipath routing protocols consist of three components. One is route discovery-the multiple node-disjoint, link-disjoint routes are discovered between the source and destination, second is traffic allocation-once the multiple routes are discovered the source node selects the set of paths then send the data packet through the selected paths to the destination and third is route maintenance-the new path is determined to recover the broken link or failure node. AODV-BR (Ad hoc On-demand Distance Vector-Backup Routing) and AOMDV (Ad hoc On-demand Multipath Distance Vector) are most commonly used multipath routing protocols.

## 2. RELATED WORKAND FONTS

The recent discovery focused on the development of multipath routing protocols [6]. The multipath routing protocols has advantage over the single path routing protocols in two directions [7]: (i) In case of path failure alternate paths are available and (ii) Over the multiple paths, the traffic is spreaded as a result packet delivery ratio increases. This section gives the brief review on unipath and multiple path protocol.

### 2.1. AODV

Ad hoc on-demand distance vector routing protocol is similar to DSR but AODV maintains the routing table at each node instead of route cache. AODV routing protocol works in two parts one is Route discovery

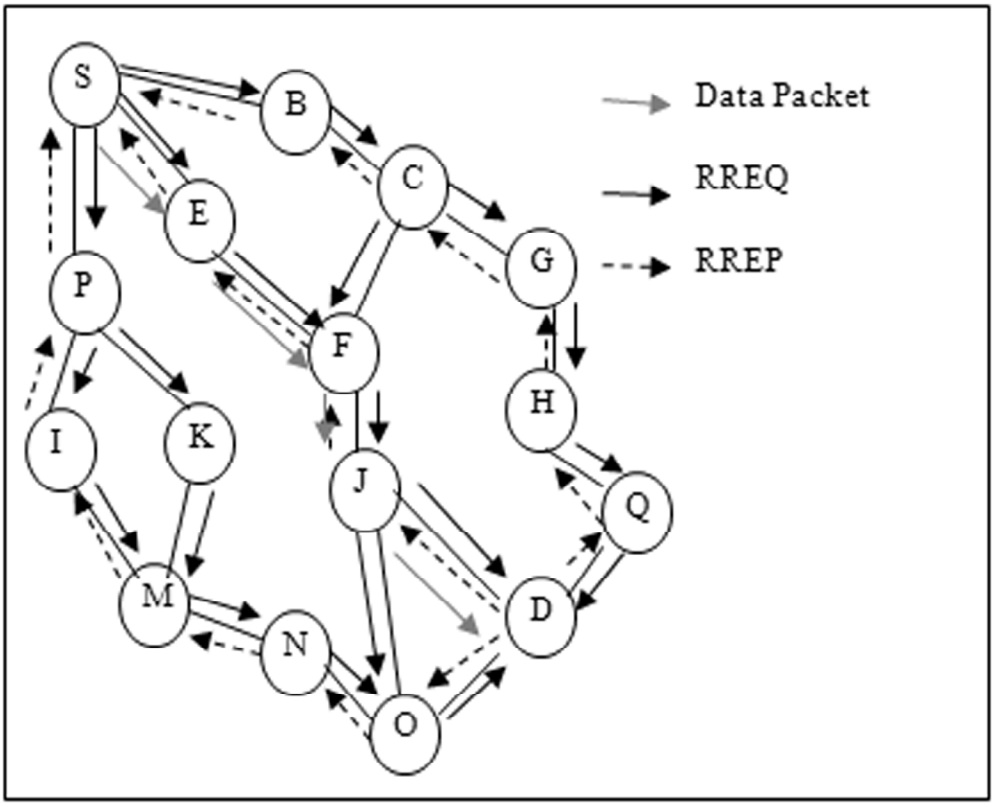



**Figure 1: AODV routing protocol**

and other is Route maintenance. In route discovery phase, when the source node wants to send the data packet to destination node and does not have the valid route then source node generate the route request (RREQ) message and broadcast to its neighbour nodes. When the nodes receive the RREQ message, create a reverse entry to source in its routing table and forward the RREQ message. When RREQ message arrive at destination or the intermediate node containing the valid route then generate the route reply (RREP) message and unicast it to source. When the source node receives the RREP message it start sending the data along that path. In route maintenance, a periodic hello message is advertised by the node to show its presence. When a node does not receive the hello message from its neighbor in some specified time then broken link is detected. The node which sensed the broken link generates the route error (RERR) message and sends to source node [7-9]. In figure 1, the source node S sends the RREQ packet to its neighbours. The intermediate node receives the RREQ and forward to their neighbours. When the RREQ packet reaches the destination, it generates the RREP and send back to source. The source node may receive more than one reply; in this case source chooses the path with minimum hop count.

## 2.2. AOMDV

Ad hoc on-demand multipath distance vector is the most widely used multipath routing protocol [5]. AOMDV is the extension of AODV routing protocol. In AOMDV the loop-free and disjoint multiple paths are formed. When source node wants to send data packet to the destination node, then the route discovery process is initiated by the source node by sending the RREQ packet. The process of transferring the multiple paths from the source to destination forms the multiple reverse paths. In AOMDV the duplicate RREQ message is not immediately discard by the nodes like in AODV in order to form the multiple paths. For every destination the routing table contains the next hop along with the hop count. All the next hops have the same sequence number which keep track of route. The duplicate RREQs do not immediately discarded by the node. The RREQ messages received from the dissimilar nodes ensure the node disjoint path. To obtain the link-disjoint the destination node replies to only those copies of RREQ which is received from different neighbours. The routing table in AOMDV maintains the multiple entries. One path is chosen as primary path and other as alternate paths. When the primary paths fail the alternate path is used to transmit the date to destination [10, 12, 13]. In Figure 2, node S sends the RREQ to find path to destination. The duplicate RREQ message is received at node H but H does not ignore this duplicate request like AODV but use this for making another path.

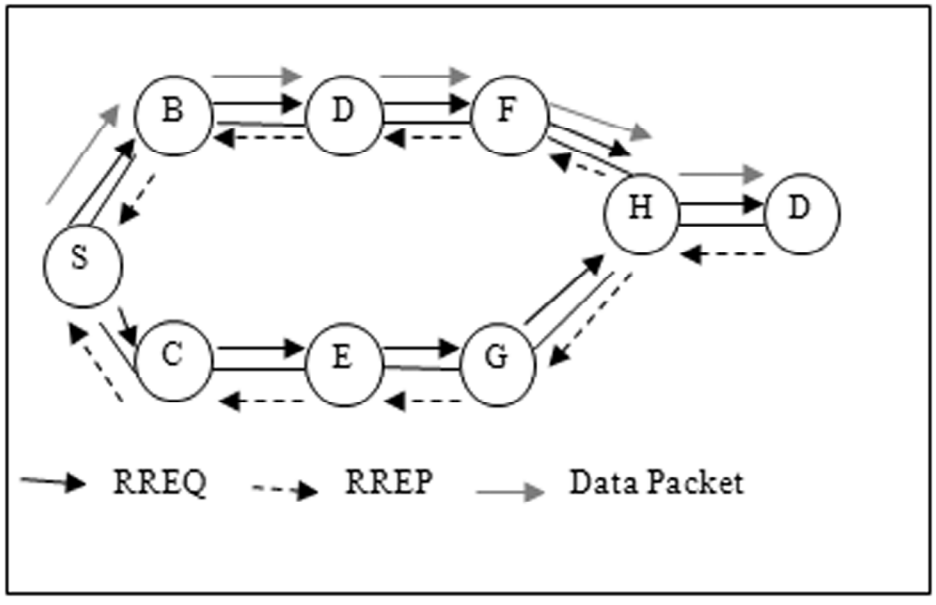



**Figure 2: AOMDV Routing Protocol**

## 3. PERFORMANCE EVALUATION

The objective of our experiments is to investigate the performance of AODV and AOMDV on-demand routing protocols. The comparison results are also shown with the help of graphs. To simulate the performance of protocols NS-2.34 simulator is used.

NS is an object oriented simulator. NS uses two different languages. NS is written in C++ and in frontend use tcl interpreter. NS uses two different languages because simulator has to perform two different kinds of things. On one hand, for the detailed simulation of protocols, system programming language is required and on other hand, a huge part of research is done by varying the pamareter or configuration.

The tcl language is used for configuration and setup. When the tcl file is run, it generates two more files: trace file and nam (network animation) file. Nam is the tcl based animation tool which is used to view simulation traces and data packet flow. To use the nam, firstly the trace file should create. Trace file contains the topology information such as nodes, links and packet flow. The process of simulating the routing protocols in NS-2.34 is shown in Figure 3.

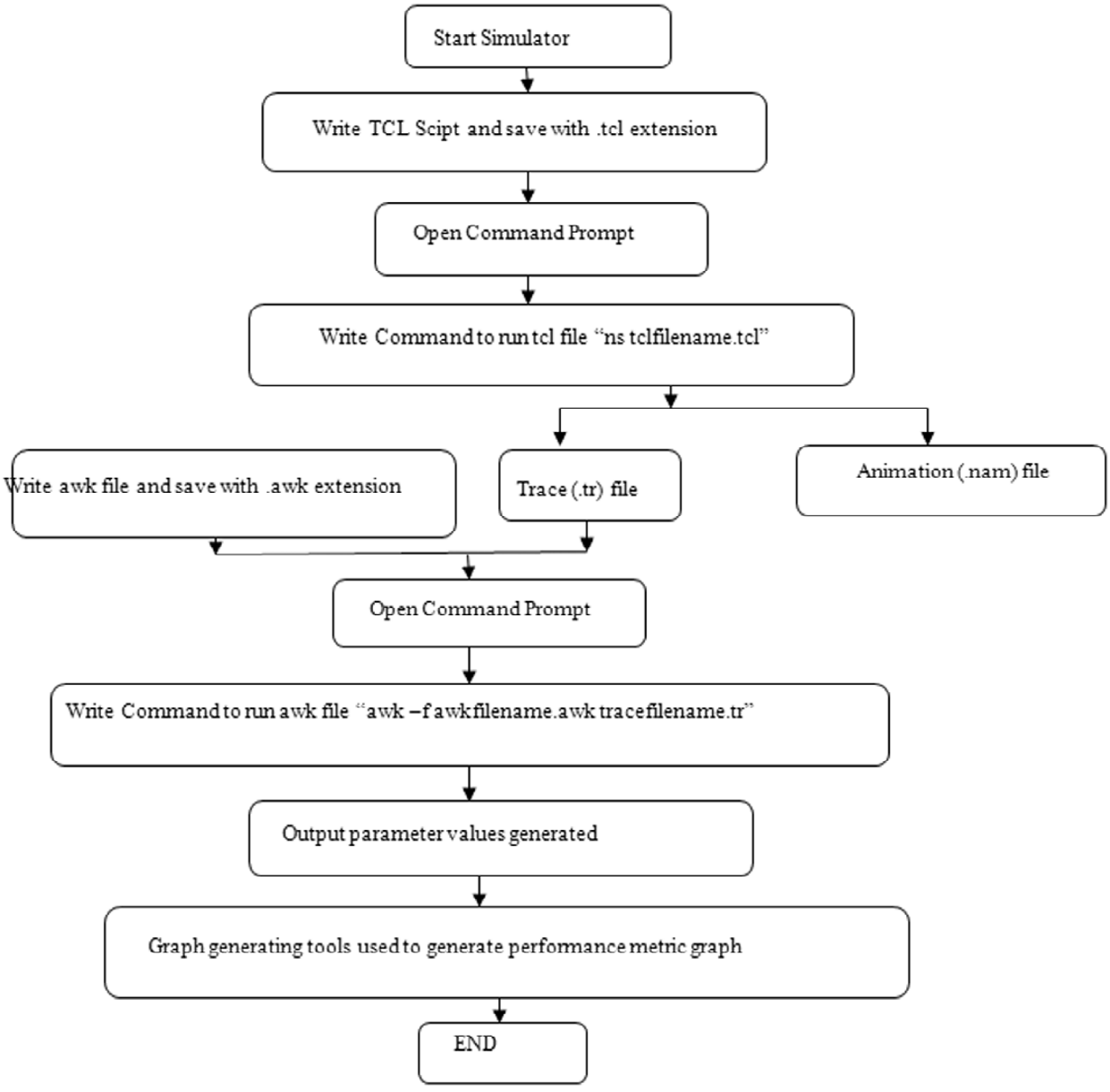



**Figure 3: NS-2 Simulation Flowchart**

We simulate the mobile nodes over a rectangular area of size 500m × 500m. The LINUX environment is used for simulation. The mobility model used is two-ray ground propogation model to simulate the movement of nodes, with 0 seconds pause time. In our simulation, the number of connection between the nodes is six and ten. We used file transfer protocol (FTP) in both scenarios. The TCP connection is used in different scenarios to evaluate the performance of AODV and AOMDV. We investigate the performance of AODV and AOMDV by varying the number of source and destination node pairs. The simulation parameters are shown in Table 1.

The sample screen shot of 25 mobile nodes scenario is shown in figure 3. For the performance metrics, we use packet delivery ratio, throughput and packet loss ratio.

### 3.1. Packet Delivery Ratio (PDR)

PDR is obtained by the dividing the number of packets received by the number of packets sends by the source nodes.

$$PDR = \frac{\sum_{p=1}^{n} R_p}{\sum_{p=1}^{n} S_p} \tag{1}$$

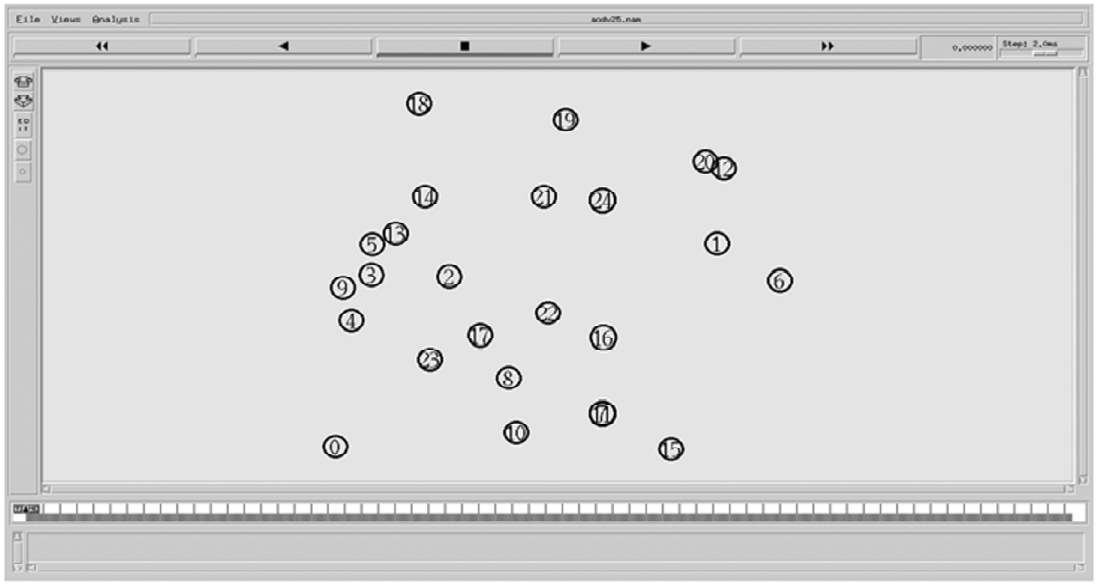


**Figure 4: Sample Simulation Scenario of 25 nodes**

**Table 1**
**Simulation Parameter for AODV & AOMDV**

| *S No.* | *Parameters* | *Values* |
|---|---|---|
| 1 | Area | 500m × 500m |
| 2 | Number of Nodes | 25-100 |
| 3 | Radio Propagation Model | Two ray ground |
| 4 | Simulation time | 200s |
| 5 | Pause time | 0 |
| 6 | No. of experiments | 4 |
| 7 | Node Speed | 10m/s |
| 8 | Traffic Type | CBR or FTP |
| 9 | Traffic Source Rate | 16 kbps |
| 10 | Packet Size | 512 bytes |

where $R_p$ is the number of packets received at the destination and $S_p$ is the number of packets send by the source.

### 3.2. Throughput

It is defined as the total number of packets received per unit time.

$$Throughput = \frac{\sum_{p=1}^{n} R_p}{Total\ Time} \tag{2}$$

### 3.3. Packet Loss Ratio (PLR)

PLR is defined as the difference between the number of packets sent by the source and the number of packets received at the destination.

$$PLR = \frac{\sum_{p=1}^{n} S_p - \sum_{p=1}^{n} R_p}{\sum_{p=1}^{n} S_p} * 100 \tag{3}$$

## 4. RESULTS

In the simulation we use two scenarios to evaluate the performance of AODV and AOMDV protocols. The simulation time is 500s n both scenario. In scenario 1, the CBR/UDP connections are formed between the source and destination pair. The number of nodes varies from 25 to 100 in the simulation. The number of connections formed is six and ten. The figure shows that the AOMDV outperform the AODV.

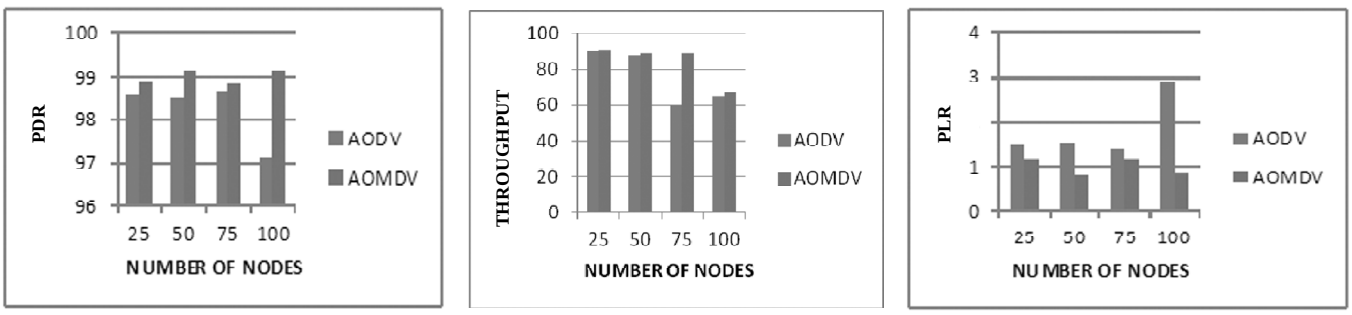
Figure 5 shows the performance of AODV and AOMDV protocols for six number of connection. Figure 4(a), shows the higher packet delivery ratio for AOMDV as compare to than AODV. Figure 5(b), shows that AODV has less throughput in comparison to AOMDV. Figure 5(c), shows the less packet loss for AOMDV in comparison to AODV.

In scenario 2, there is ten TCP/FTP connections are formed between the source and destination pair. The number nodes vary from 25 to 100. In this scenario, AOMDV shows better performance as compare to AODV.

Figure 6(a) and 6(b) shows, that AOMDV has higher packet delivery ratio and throughput as compare to AODV respectively. Figure 6(c) shows that packet loss ratio is less for AOMDV as compare to AODV.

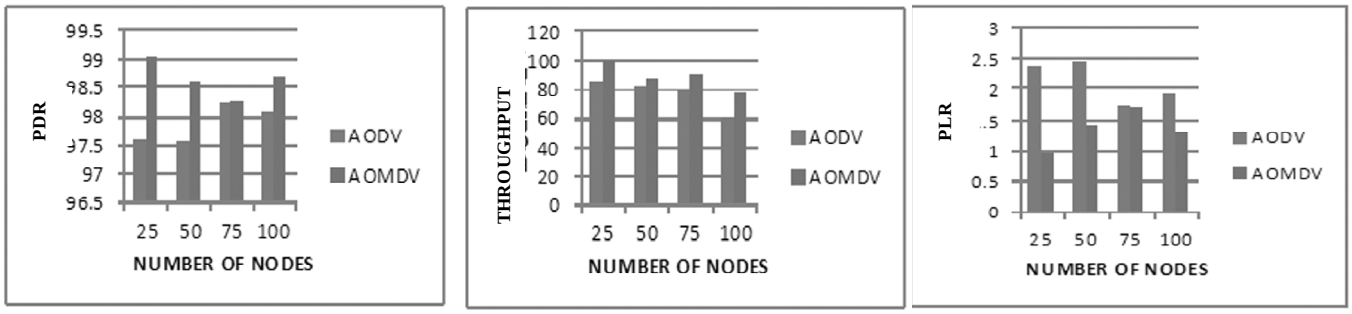
## 5. CONCLUSION

This paper presents the single path AODV routing protocol and multipath AOMDV routing protocol. In this paper, the AODV and AOMDV routing protocol performance is analysed and compared with the help




**(a)** **(b)** **(c)**

**Figure 5: (a) Packet Delivery Ratio (b) Throughput (c) Packet Loss Ratio**




**(a)** **(b)** **(c)**

**Figure 6: (a) Packet Delivery Ratio (b) Throughput (c) Packet Loss Ratio**

of NS-2.34 simulator. The comparison result shows that the AOMDV protocol has higher throughput and better packet delivery ratio than AODV. The loss of the data packet is also less in AOMDV as compared to AODV. In the route maintenance, when any node detect the path failure then it send the route error (RERR) message to source node. The source node again discovers the route if still required. In future route can also repair locally.

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