



### 3. Source Tree Adaptive Routing (STAR)

#### ii. Reactive or On-demand routing protocol

The reactive routing protocols look for the routes and are created as and when required. When a source wants to send to a destination, it invokes the route discovery mechanisms to find the path to the destination. It does not need to search for and maintain the routes on which there is no route request. Reactive routing protocols are very pleasing in the resource-limited environment. However the source node should wait until a route to the destination is discovered. This approach is best suitable when the network is static and traffic is very light.

For example,

1. Ad-Hoc On-demand Distance Vector (AODV) [9]
2. Dynamic Source Routing (DSR)

#### iii. Hybrid Protocols

These protocols are using the best features of both the on-demand and table driven routing protocols. The Ad Hoc network can use the hybrid routing protocols that have the advantage of both proactive and reactive routing protocols to balance the delay and control overhead (in terms of control packages). The difficulty of all hybrid routing protocols is the complexity of organizing the network according to network parameters. The common disadvantage of hybrid routing protocols is that the nodes that have high level topological information maintains more routing information, which leads to more memory and power consumption.

For example

1. Temporally ordered routing algorithm (TORA)
2. Zone Routing Protocol (ZRP)

There are two approaches to evaluate routing protocols:

- Network Environment Parameters like network size, connectivity, mobility, link capacity etc.
- General Performance Metrics of Routing Protocols like message delivery ratio, control overhead, hop count, end to end delay, etc. [2,4]

In this paper packet delivery ratio and average end to end delay performance parameters are considered.

### 3. Overview of AODV

Ad-hoc On Demand Distance Vector Routing Protocol (AODV) is one of the reactive protocol in which source node initiates data packet to destination node only when requires the route discovery is occur. there are no periodical exchanges of routing information.[9] The Protocol consist of two phases:

- i) Route Discovery
- ii) Route Maintenance.

#### i. Route Discovery

AODV routing protocol uses a broadcast route discovery mechanism and it depends on dynamically established route. AODV builds routes by using a route request (RREQ)/ route reply (RREP) query cycle. When a source node requires a destination route for which it does not have a route already, it broadcasts RREQ packet across the network [1], [2] The

nodes receiving this packet update the information for the source node and sets up backward pointer information for the source node in the routing table. A lifetime is associated with each reverse route entry, i.e. if the route entry is not used within the lifetime it will be removed. As shown in fig.1[6]

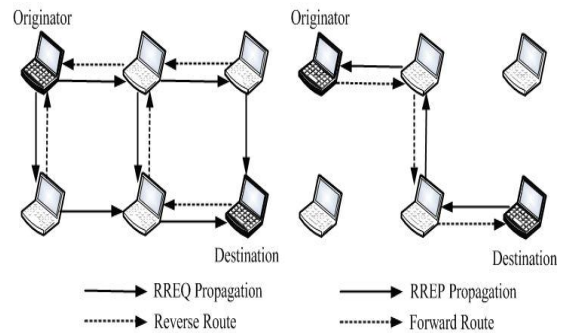


Figure 1: AODV route discovery process

#### ii. Route Maintenance

The second phase of the protocol is called route maintenance. It is performed by the source node and can be subdivided into: i) source node moves: source node initiates a new route discovery process, ii) destination or an intermediate node moves: a route error message (RERR) is sent to the source node. Intermediate nodes receiving a RERR update their routing table by setting the distance of the destination to infinity. If the source node receives a RERR it will initiate a new route discovery. To prevent global broadcast messages AODV introduces a local connectivity management. This is done by periodical exchanges of so called HELLO messages which are small RREP packets containing a node's address and additional information.[9]

### 4. Related Work

Several researchers have done the qualitative and quantitative analysis of Ad Hoc Routing Protocols by means of different performance metrics. They have used different simulators for this purpose.

*J Broch et al.* [11] performed experiments for performance comparison of both proactive and reactive routing protocols. In their simulation, a network size of 50 nodes with varying pause times and various movement patterns were chosen. The simulation was done with ns-2 simulator.

*Arun Kumar B R et al.* [12] in this paper they present their observations regarding the performance comparison of the routing protocols for variable bit rate (VBR) in mobile ad hoc networks (MANETs). They perform extensive simulations, using NS-2 simulator [13]. Their studies have shown that reactive protocols perform better than proactive protocols.

*N Vetrivelan & Dr. A V Reddy* [13] analyzed the performance differentials using varying network size and simulation times. They performed two simulation experiments for 10 & 25 nodes for simulation time up to 100 sec.

Nilesh. P. Bobade & Nitiket. N. Mhala et. al.[14] evaluate the performance of routing protocol with varying network size and simulation time. They use 10 nodes for simulation time up to 200 seconds. They use NS-2.34 as simulator.

Parma Nand & Dr.R.C.Sharma et.al.[7]study the performance of AODV,DSR & DYMO routing protocol. AODV perform better in term of packet delivery ratio in increased traffic load & mobility.They use Qualnet 5.0.2 simulator.

Amandeep & Gurmeet Kaur et.al.[15]analyse the Performance of AODV Routing Protocol in MANET.AODV perform better in term of packet delivery ratio but delay & some packet loss is happen. The Simulation is done in MATLAB

### 5. Simulation of AODV Routing Protocol

Many of Researchers evaluate AODV routing Protocol Performance in NS-2. We use Java as a simulating tool to evaluate AODV simulator in java. It simulates an Ad-hoc network with AODV algorithm; it uses a high level view and only works in Routing layer. it has a user-friendly graphical user interface and has been written in java language. Platform independent because of implementation in java language.[8] interactive user interface (user can change nodes arrangement during the simulation). Drag & Drop feature. Searching nodes by their name.

Automatic parameter setter: user can specify each node parameters: at least should see how many nodes and if their connection is bidirectional. Then the application fills automatically the nodes power, IP and name. Independence of UI and simulation engine. So developers can use another user interface for that engine.

- Logging the state of each node
- Animated UI

#### i. Node Creation

To create a node, click on the “new node drag” icon and drag it to the map. By default it has IP address 192.168.10.1 and no name: You can set the name, IP and power of each node individually or use “Auto parameter setter tools” to set them see.[8] Note the name of a node cannot be changed. The position of the node can be changed by drag & drop the node or “Node Properties” panel.

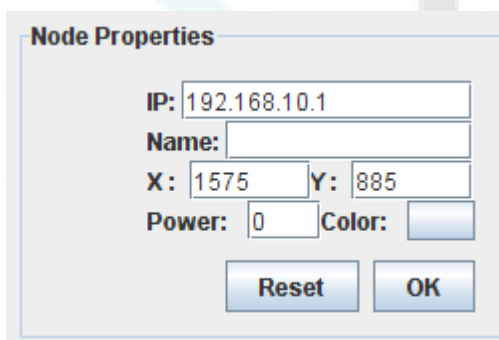


Figure 2: Node Creation

#### ii.Auto Parameter Setter

Auto parameter setter tools are positioned in the toolbar. It sets node’s name, IP, and power automatically. Min neighbors and Double Direction parameters control the auto power setter algorithm.[8] The first specifies number of node’s neighbors. The neighbors connection can be either one directional or bidirectional (double direction) based on the second parameter.

#### iii. Node’s range Circle

Usually first you position the nodes on the map, and then fill the parameters using this tool. To set the parameters click on “Fill Parameter” button.[8] After that if you select a node you can see the parameters and set range on the map as a circle

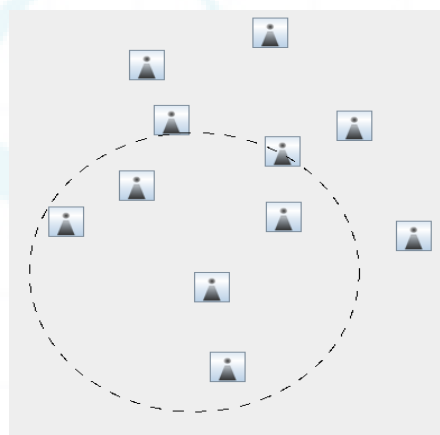


Figure 3: Node’s range Circle

The main method of evaluating the performance of MANETs is simulation. The simulation of AODV routing protocol is done in JAVA. The network is taken as 3000m \* 3000m .The performance is recorded taking different number of nodes. The nodes are placed randomly in the network. The packet size is taken as 512 bytes and the traffic type is Constant bit rate (CBR).

The parameters taken for simulation are listed below in the Table 1.

Table 1: Simulation Parameters

Simulation Area	3000m * 3000m
Simulation Time	300 sec
No of Nodes	10,15,20,25,30,35,40,45,50
Packet Size	512 bytes
Traffic Type	CBR
Type of Protocol	AODV

#### Performance Evaluation Metrics :

The Performance is measured on the basis of some parameter which are described as follows:

Packet delivery ratio (PDR): the ratio of total number of packets received by destinations to total number of packets sent by sources.

The formula for calculation of Packet Delivery ratio is as follows:

Packet Delivery Ratio= (total no. of received packets/total no. of sent packets)\*100

End-to-End delay: the average amount of time to take all packets to reach destination.

End-to-end delay = Packet Received time- Packet Sent time

## 6. Conclusion

In this paper, We have evaluated the performance of existing routing protocol Ad-hoc On Demand Distance Vector (AODV) Routing Protocol in MANET. We take general performance evaluation metric parameters such as Packet Delivery Ratio & end-to-end delay. Simulation work has been done in Java. we have provided a vast information regarding AODV protocol and its various modifications. The work done in this survey research aims to develop a good understanding of AODV protocol and improvements done to it to enhance its performance.

## References

- [1] E. M. Royer and C. K. Toh, "A Review of Current Routing Protocols Ad Hoc Mobile Wireless Networks", IEEE Personal Communications, April 1999, Volume 6, Number 2, pp: 46-55.
- [2] C. E. Perkins and E. M. Royer, "Ad-hoc On-Demand Distance Vector Routing", Proceedings of the second IEEE Workshop on Mobile Computing Systems and Applications, New Orleans, L.A., 1999, pp: 90-100.
- [3] C.-K. Toh. Ad hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall PTR. 2002:55-77.
- [4] Samir R. Das, Charles E. Perkins, Elizabeth M. Royer and Mahesh K. Marina. "Performance Comparison of Two On demand Routing Protocols for Ad hoc Networks." IEEE Personal Communications Magazine special issue on Adhoc Networking, February 2001, p. 16-28.
- [5] Elizabeth M. Royer and Charles E. Perkins. "An Implementation Study of the AODV Routing Protocol." Proceedings of the IEEE Wireless Communications and Networking Conference, Chicago, IL, September 2000.
- [6] Kunagorn Kunavat "Performance Evaluation of Routing Protocols for Heterogeneous Mobile Ad-Hoc Network" ISSN : 4799-0545 April 2013 IEEE.
- [7] Parma Nand & Dr.R.C.Sharma "Performance study of Broadcast based Mobile Adhoc Routing Protocols AODV, DSR and DYMO" International Journal of Security and Its Applications Vol. 5 No. 1, January, 2011
- [8] Computer Network course in summer 2006 by Masoud Moshref Javadi & AliDabirmoghaddam.
- [9] Charles Perkins, Elizabeth Royer, and Samir Das. "Ad hoc on demand distance vector (AODV) routing". IETF RFC No. 3561, July 2003.
- [10] C. E. Perkins, "Ad hoc Networking", Addison Wesley, 2001.
- [11] J. Broch, D. A. Maltz, D. B. Johnson, Y. C. Hu, and J. Jetcheva, "A Performance Comparison of Multi-Hop Wireless Network Routing Protocols," Proceedings of the Fourth Annual ACM/IEEE International Conference on Mobile Computing and Networking (MobiCom'98), October 25-30, 1998, Dallas, Texas, USA, pp.25-30.
- [12] Arun Kumar B. R., Lokanatha C. Reddy, Prakash.S.Hiremath, "Performance Comparison of Wireless Mobile Ad-Hoc Network Routing Protocols" IJCSNS International Journal of Computer Science and Network Security VOL.8 No.6, June 2008.
- [13] N Vetrivelan, Dr. A V Reddy, "Performance Analysis of Three Routing Protocols for Varying MANET Size", Proceeding of the International Multi Conference of Engineers and Computer Scientists 2008 Vol II, IMECS 2008, 19-21 March, 2008, Hong Kong.
- [14] Nilesh. P. Bobade and Nitiket. N. Mhala, "Performance Evaluation of AODV for Mobile Ad Hoc Network with Varying Network Size" International Journal of Computer Communication and Information System (IJCCIS) – Vol2. No1. ISSN: 0976-1349 July – Dec 2010
- [15] Amandeep & Gurmeet Kaur "Performance analysis of AODV protocol in MANET" International Journal of Engineering Science and Technology (IJEST) Vol. 4 No.08 August 2012 ISSN : 0975-5462