

# Behavior of various Routing Protocols in Mobile Adhoc Networks



<sup>1</sup>N.Sainath , <sup>2</sup>Dr.D.Vasumathi

<sup>1</sup>Research Scholar , Department of CSE , JNTUH

<sup>2</sup>Professor , Department of CSE , JNTUH

**Abstract:** Mobile Adhoc networks (MANETs) are wireless networks where a collection of mobile nodes may dynamically vary and change the topological structure. With respect to the more widely used mobile cellular networks (GSM), MANETs do not have any form of fixed infrastructure or central co-coordinator. The characteristics of MANETs are dynamic in nature with dynamic topology, bandwidth-constrained variable-capacity links, limited physical security and energy-constrained operations. Since MANETs are self-configured, and allow ubiquitous service access, anywhere, anytime without any fixed infrastructure they can have several types of applications like rescue operations, military, law enforcement and security operation, home network and conferencing . The challenging issues of MANETs are routing, where in many different protocols have been proposed in the literature, each one based on different characteristics and properties. Basically MANETs protocols are classified based on routing table maintenance i.e., Table driven and on demand. Table driven Maintain routes with every host at all time, where on demand Creates routes to remote hosts on-demand. Therefore focus in this paper is to compare the performance of four routing protocols DSDV, OLSR ,DSR and AODV for CBR, FTP traffic by varying number of nodes in terms of throughput and end to end delay with packet loss.

**Keywords:** MANET, Routing Protocols, DSDV, OLSR, DSR, AODV.

## INTRODUCTION

Mobile ad-hoc networks operate in the absence of fixed infrastructure. They offer quick and easy network deployment in situations where it is not possible otherwise. Ad-hoc is a Latin word, which means "for this or for this only." Mobile ad-hoc network is an autonomous system of mobile nodes connected by a number of wireless links where each node operates as an end system and a router for all other nodes in the network.

A mobile ad-hoc network is a collection of mobile nodes forming an ad-hoc network without the Support of any centralized structures. These networks introduced a new art of network establishment and can be well suited for an environment where either the infrastructure is lost or where deploy an infrastructure is not very cost effective.

The popular IEEE 802.11 "WI-FI" protocol is capable of providing ad-hoc network facilities at low level, when no access point is available. However in this

case, the nodes are limited to send and receive information but do not route anything across the network. Mobile ad-hoc networks can operate in a standalone fashion or could possibly be connected to a larger network such as the Internet.

Mobile ad-hoc networks can create the dream of getting connected "anywhere and at any time" into reality. Typical application examples include a disaster recovery or a military operation. Not bound to specific situations, these networks may equally show better performance in other places. As an example, we can imagine a group of people with laptops, in a business meeting at a place where no network services is present. They can easily network their machines by forming an ad-hoc network. This is one of the many examples where these networks may possibly be used.

## OVERVIEW

The restricted number of resources in MANETs have made designing an efficient and reliable routing strategy a very challenging problem. A very intelligent routing strategy is required to efficiently use the limited resources while at the same time be adaptable to the changing network conditions such as network size, traffic density, and network partitioning. In parallel with this, the routing protocol may need to provide different levels of standards for maintaining the QoS to different types of applications and users.

A number of routing protocols have been proposed for MANETs. These protocols can be classified into three different groups: proactive, reactive, and hybrid routing protocols . In proactive routing protocols, the routes to all the destinations (or parts of the network) are determined at the start-up and maintained by using a periodic route update process. In reactive protocols, routes are determined when they are required by the source using a route discovery process. Hybrid routing protocols combine the basic properties of two classes of protocols into one. That is, they are both reactive and

proactive in nature. Fig.1 shows various routing protocols that come under three types.

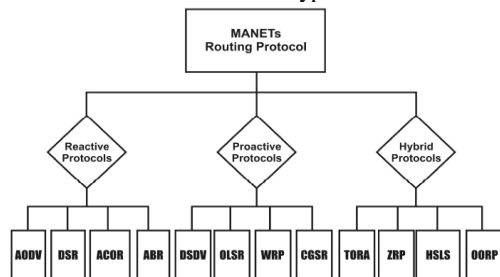


Fig-1: MANET Routing protocols

The ad hoc routing protocols DSDV, OLSR, DSR and AODV are the promising routing protocols. They can be used in mobile ad hoc networks to route packets between mobile nodes. The main objectives are:

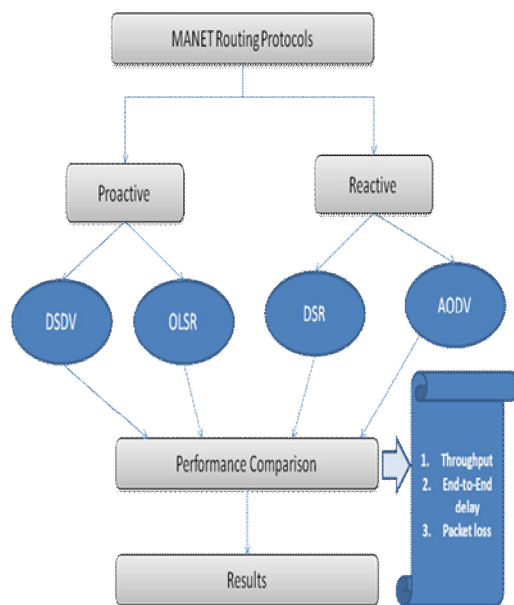
(1) Implementing the DSDV, OLSR, DSR and AODV routing protocols in NS2.

(2) Comparing the performance of four protocols under following metrics:

- Throughput
- End-to-End Delay
- Packet Loss

(3) Traffic conditions considered:

- Constant Bit Rate(CBR) with TCP and UDP source Routing
- FTP with TCP and UDP routing.



## 2. Types of Routing Protocols

### A. Destination Sequence Distance Vector Protocol (DSDV)

This protocol is based on classical Bellman-Ford routing algorithm designed for MANETS. Each node maintains a list of all destinations and number of

hops to each destination. Each entry is marked with a sequence number. It uses full dump or incremental update to reduce network traffic generated by route updates. The broadcast of route updates is delayed by settling time. The only improvement made here is avoidance of routing loops in a mobile network of routers. With this improvement, routing information can always be readily available, regardless of whether the source node requires the information or not.

DSDV solved the problem of routing loops and count to infinity by associating each route entry with a sequence number indicating its freshness. In DSDV, a sequence number is linked to a destination node, and usually is originated by that node (the owner). The only case that a non-owner node updates a sequence number of a route is when it detects a link break on that route. An owner node always uses even-numbers as sequence numbers, and a non-owner node always uses odd-numbers.

The list which is maintained is called routing table. The routing table contains the following:

- (1) Available destinations' IP address
- (2) Next hop IP address
- (3) No of hops to reach the destination
- (4) The Sequence number assigned by the destination node
- (5) Installation time

### B. Optimized Link State Routing Protocol (OLSR):

The Optimized Link State Routing (OLSR) is a table-driven, proactive routing protocol developed for MANETS. It is an optimization of pure link state protocols in that it reduces the size of control packet as well as the number of control packets transmission required.

OLSR reduces the control traffic overhead by using Multipoint Relays (MPR), which is the key idea behind OLSR. A MPR is a node's one-hop neighbor which has been chosen to forward packets. Instead of pure flooding of the network, packets are just forwarded by a node's MPRs. This delimits the network overhead, thus being more efficient than pure link state routing protocols. OLSR is well suited to large and dense mobile networks. Because of the use of MPRs, the larger and more dense a network, the more optimized link state routing is achieved. MPRs helps providing the shortest path to a destination.

The network topology information is maintained by periodically exchange link state information. If more reactivity to topological changes is required, the time

interval for exchanging of link state information can be reduced.

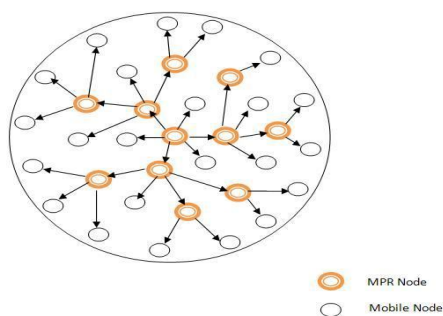


Fig-3: MPR node sends the TC message

### Topology Information

Information about the network topology is extracted from topology control (TC) packets. These packets contain the MPR Selector set of a node, and are broadcasted by every node in the network, both periodically and when changes in the MPR Selector set is detected. The packets are flooded in the network using the multipoint relaying mechanism. Every node in the network receives such TC packets, from which they extract information to build a topology table.

### C. Dynamic Source Routing Protocol (DSR)

The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. Dynamic Source Routing, DSR, is a reactive routing protocol that uses source routing to send packets. It uses source routing which means that the source must know the complete hop sequence to the destination.

DSR uses source routing, i.e. the source determines the complete sequence of hops that each packet should traverse. This requires that the sequence of hops is included in each packet's header. A negative consequence of this is the routing overhead every packet has to carry. However, one big advantage is that intermediate nodes can learn routes from the source routes in the packets they receive. Since finding a route is generally a costly operation in terms of time, bandwidth and energy, this is a strong argument for using source routing. Another advantage of source routing is that it avoids the need for up-to-date routing information in the intermediate nodes through which the packets are forwarded since all necessary routing information is included in the packets. Finally, it avoids routing loops easily because the complete route is determined by a single node instead of making the decision hop-by-hop. The protocol is composed of the

two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network.

### D. Ad-hoc on demand Distance Vector Protocol (AODV)

AODV is an on-demand routing algorithm in that it determines a route to a destination only when a node wants to send a packet to that destination. It is a relative of the Bellman-Ford distant vector algorithm, but is adapted to work in a mobile environment. Routes are maintained as long as they are needed by the source. AODV is capable of both unicast and multicast routing.

AODV differs from other on-demand routing protocols in that it uses sequence numbers to determine an up-to-date path to a destination. Every entry in the routing table is associated with a sequence number. The sequence number act as a route timestamp, ensuring freshness of the route. Upon receiving a RREQ(route request) packet, an intermediate node compares its sequence number with the sequence number in the RREQ packet. If the sequence number already registered is greater than that in the packet, the existing route is more up-to-date.

Because the AODV protocol is a flat routing protocol it does not need any central administrative system to handle the routing process. In addition, AODV tries to keep the overhead of the messages small. 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.

### IMPLEMENTATION

To evaluate the performance of MANET routing protocols DSDV, OLSR, DSR and AODV simulation is carried out in NS2.35 with Linux operating system. The aim of the simulation is to analyze the performance of routing protocols for its efficiency in terms of throughput, delay and packet loss. The following table shows the parameters chosen for the NS2 simulation:

Table-1: Simulation parameters

Simulation Parameter	Value
Simulator	NS 2.35
Simulation Area	1000mx1000m
Simulation Duration	10sec, 20sec
Number of nodes	5,8,10,15,20
Traffic Type	CBR,FTP
Source Type	UDP,TCP
Routing Protocols	DSDV,OLSR,DSR and AODV
Mobility	Random
Packet Size(in bytes)	512,1024

Data rate(in kbps)	200,600,1024, 0.5mbps, 1mbps
Channel Type	Channel/Wireless Channel
Radio-propagation model	Propagation/TwoRayGround
Network interface type	Phy/WirelessPhy
MAC type	Mac/802_11
Interface queue type	Queue/DropTail/PriQueue
Link layer type	LL
Antenna model	Antenna/OmniAntenna
Max packet in ifq	50

### A. Performance Parameters:

→ **Throughput performance**, Throughput is measured by sending data from the source to destination using ping. Throughput increases with increases in packet size up to some particular level and then increases in packet size not effected on throughput . But at the same time large packet size cause a higher probability of packet corruption. The beaconing interval has no significant impact on throughput performance .moving data packet over multiple links results in greater delay, hence affecting the communication throughput.

Throughput can be calculated as:

$$\text{Throughput} \leq \frac{\text{Number of packets Reached/Round Trip Time} * 8 \text{Mbytes}}$$

→ **End-to-End Delay (EED)** The delay experienced by the packet from it was sent by source to destination till it was received at destination. It depends on packet size and beaconing interval and route length. Varying the packet size is directly depending on the EED of MANET. In the case when beaconing is performed in at very high frequencies at that situation EED increases.

End-to-end delay refers to the time taken for a packet to be transmitted across a network from source to destination.

$$d_{\text{end-end}} = N [ d_{\text{trans}} + d_{\text{prop}} + d_{\text{proc}} ]$$

where

$d_{\text{end-end}}$  = end-to-end delay

$d_{\text{trans}}$  = transmission delay

$d_{\text{prop}}$  = propagation delay

$d_{\text{proc}}$  = processing delay

N= number of links (No. of routers + 1)

→ **Packet loss performance**, In MANET the channel is subjected to noise, fading; interference and less bandwidth cause packet loss. Packet loss tends to increase at large packet size; at the same time at low beaconing frequencies packet size has a lesser effect on packet loss performance .At high beaconing frequencies packet loss performance almost independent of packet size.

Calculate the packet loss ratio using the following formula to determine your packet loss ratio:

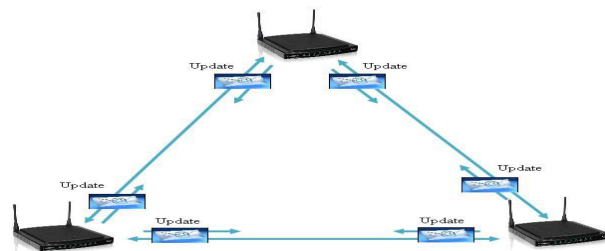
$$\text{Number of lost packet} / (\text{Number of lost packet} + \text{Number of packets received successfully.})$$

### B. Routing types

Routing has two basic types, which are as under.

(1) **Static routing** is done by the administrator manually to forward the data packets in the network and it is permanent. Not any administrator can change this setting. These static routers are configured by the administrator, which means there is no need to make routing tables by the router itself.

(2) **Dynamic routing** is automatically done by the choice of router. It can route the traffic on any route depend on the routing table. Dynamic routing allows the routers to know about the networks and the interesting thing is to add this information in their routing tables. This is shown in the below figure 4. In dynamic routing the routers exchange the routing information if there is some change in the topology. Exchanging information between these dynamic routers learn to know about the new routes and networks. Dynamic routing is more flexible than static routing. In dynamic routing it have the capability to overcome the overload traffic. Dynamic routing uses different paths to forward the data packets. Dynamic routing is better than static routing.



**Fig-4:** Routes updates

### CONCLUSION

In the present Scenario the performance of MANET routing protocols could be examined with respect to the following parameters namely throughput, end-to-end delay and packet loss. DSDV and OLSR protocols come under proactive where as DSR and AODV come under reactive protocols. Every individual protocol has got its own advantages and disadvantages and performed well at their peer level, but for the purpose of efficiency when they are compared using the tool NS2 with the help of TCL scripts, the simulation results are observed as AODV has got higher performance in throughput and OLSR gives better performance

in both packet loss rate and also in delay. Although DSR and DSDV has got less end to end delay beyond to them OLSR performance is better than the rest. It can also be concluded from the simulation results that the efficiency of AODV and OLSR is better than DSDV and DSR.

## REFERENCES

- [1] Kapang Lego, Pranav Kumar Singh, Dipankar Sutradhar, "Comparative Study of Adhoc Routing Protocol AODV, DSR and DSDV in Mobile Adhoc Network", Indian Journal of Computer Science and Engineering Vol. 1 No. 4 364-371, 2011.
- [2] S.R. Birdar, Hiren H D Sarma, Kalpana Sharma, SubirKumar Sarkar , Puttamadappa C, Performance Comparison of Reactive Routing Protocols of MANETs using Group Mobility Model", International Conference on Signal Processing Systems, 2009.
- [3] G. Jayakumar and G. Gopinath, "Performance comparison of two on-demand routing protocols for ad-hoc networks based on random way point mobility model," American Journal of Applied Sciences, vol. 5, no. 6, pp. 649-664, June 2008.
- [4] S. Ahmed and M. S. Alam, "Performance Evaluation of important ad hoc networks protocols", EURASIP Journal on wireless Communications and networking, Vol: 2006, Article ID 78645, PP 1-11, 2006.
- [5] OLSR, internetdraft, <http://tools.ietf.org/html/draft-ietfmanet-olsr-00>
- [6] Rajiv Misra and C.R.Manda, "Performance Comparison of AODV/DSR On-demand Routing Protocols for Ad Hoc Networks in Constrained Situation", Indian Institute of Technology, Kharagpur (India).
- [7] H.D.Trung, W.Benjapolakul, P.M.Duc, "Performance evaluation and comparison of different ad hoc routing protocols", Department of Electrical Engineering, Chulalongkorn University, Bangkok, Thailand, May 2007
- [8] J.Broch, D.A.Maltz, D.B.Johnson, Y-C.Hu, J.Jetcheva, "A performance comparison of multi-hop wireless ad hoc network routing protocols", Computer Science Department, Carnegie Mellon University, Pittsburgh, USA. <http://www.monarch.cs.cmu.edu/>
- [9] S.R.Das, R.Casteneda, J.Yan, "Simulation based performance evaluation of mobile, ad hoc network routing protocols" in: ACM/Baltzer Mobile Networks and Applications (MONET) Journal, July 2000.
- [10] Sunil Taneja, Ashwani Kush, "A Survey of Routing Protocols in Mobile Adhoc Networks", International Journal of Innovation, Management and Technology, Vol. 1, No. 3, August 2010.
- [11] The Network Simulator-ns-2, <http://www.isi.edu/nsnam/ns/>
- [12] NS2 Trace format [http://nsnam.isi.edu/nsnam/index.php/NS2\\_Trace\\_Formats](http://nsnam.isi.edu/nsnam/index.php/NS2_Trace_Formats) .
- [13] T. Clausen and P. Jacquet "Optimized Link State Routing Protocol (OLSR)." RFC 3626, IETF Network Working Group, October 2003.