International Journal of Advanced Computer Technology (IJACT)

ISSN:2319-7900

# A Comparative Study of Routing Protocol Techniques for MANET

T.Dhamodharan, Head, Department of Computer Science, AVS College of arts and science, Salem 1;
Dr.C. Chandrasekar, Assistant Professor, Department of Computer Science, Periyar University, Salem 2

## Abstract

A Mobile Ad-Hoc Network (MANET) is a kind of temporary network with collection of wireless mobile nodes without using any fixed access point, infrastructure, or any centralized administration. . MANETs are generating lots of interest due to their dynamic topology and decentralized administration. To establish a data transmission between two nodes, typically multiple hops are required due to the limited transmission range. Mobility of the different nodes makes the situation even more complicated. There are different routing protocols proposed for MANETs which makes it quite difficult to determine which protocol is suitable for different network conditions as proposed by their Quality of service offerings. The scope of this paper was to test routing performance of three different routing protocols (OLSR, DSR, AODV) and also provides a comparison between them and identified the strength and weakness.

Index terms— Routing, OLSR, DSR, AODV, Manet

## Introduction

The fundamental objective of wireless networks is provide service to the user acceptable level, which can be achieved only if a proper performance modeling and evaluation process is designed to monitor those processes to ensure successful deployment of a network. Therefore network traffic and its characteristics must be analyzed and properly controlled in order to achieve the desired level of service. The specific modeling and tools can help to achieve this design goal is MANET.

A significant number of research efforts have been devoted to investigate Mobile Ad Hoc Networks (MANETs) over the past few years. Interest in MANETs is due to their promising ubiquitous connectivity beyond that is currently being provided by the Internet. Firstly, MANETs are easily deployed allowing a plug-and-communicate method of networking. Secondly, MANETs need no infrastructure. Eliminating the need for an infrastructure reduces the cost for establishing the network. Moreover, such networks can be useful in disaster recovery where there is not enough time or resources to install and configure an infrastructure. Thirdly, MANETs also do not need central management. Hence, they are used in military operations where units are moving around the battle field and a central unit cannot be used for synchronization. Nodes forming and Ad Hoc network are required to have the ability to double up as a client, a server, and a router simultaneously.

Moreover, these nodes should also have the ability to connect to and automatically configure to start transmitting data over the network. It is impractical to expect a MANET to be fully connected, where a node can directly communicate with every other node in the network. Typically, nodes are obliged to use a multihop path for transmission, and a packet may pass through multiple nodes before being delivered to its intended destination. A number of MANET routing protocols were proposed in the last decade. These protocols can be classified according to the “routing strategy” that they follow to find a path “route” to the destination. These protocols perform variously depending on type of traffic, number of nodes, rate of mobility, etc…

This paper gives the various routing protocol techniques and a comparison between them and identified the strength and weakness.

## Routing Protocol Techniques for Manet

This section contains the MANET routing protocols techniques implemented and evaluated. Three standard and widely implemented routing protocols are selected for review, the Optimised Link State Routing (OLSR), Dynamic Source Routing (DSR), and Adhoc On Demand Distance Vector (AODV) routing protocols.

## A. OLSR Routing Protocol

The Optimised Link State Routing (OLSR) protocol may be a Table-Driven protocol based mostly on the normal Link State algorithm. The point-to-point OLSR routing protocol may be a nonuniform proactive protocol. beneath the OLSR routing protocol strategy, nodes within the network exchange periodical topology data with one another and choose a collection of neighbouring nodes known as Multi-Point Relays (MPRs) to retransmit their packets. this system minimizes the dimensions of management messages and therefore the range of rebroadcast nodes throughout a route update. to clarify the producer of choosing MPRs, Fig. 1 illustrates how node A selects its MPR set. Periodic Hello messages are going to be broadcasted from node A to all or any immediate neighbours to swap neighbor lists and calculate the MPR set. Node A deduces from neighbour lists the nodes that are 2 hops away and computes the minimum set (MPR set) of 1 hop relay points very important to achieve the two-hop neighbours. for instance, in Fig.1, node A selects nodes E, F, and G to be the MPR set. Since the nodes selected cowl all the nodes that are 2 hops away. every node notifies its neighbours concerning its MPR set within the Hello message. when receiving the Hello message, every node records the chosen nodes and calls them MPR selectors. The frequency of link state updates is adjusted looking on the changes detected within the MPR set. With a stable MPR set, the amount is increased till it reaches a refresh interval worth, whereas with a changing MPR set, the amount of link state exchange is about to a minimum worth. Through link state messages, every node obtains network topology data and constructs its routing table. Routes employed in OLSR solely embrace MPRs as intermediate nodes, whereas every node determines, in terms of hops, an optimal route to each known destination using its topology data (from the topology table and neighbouring table), and stores this data in an exceedingly routing table. Therefore, routes to each destination are immediately on the market when information transmission begins. Any node that isn't MPR will browse and method every packet, however cannot retransmit.

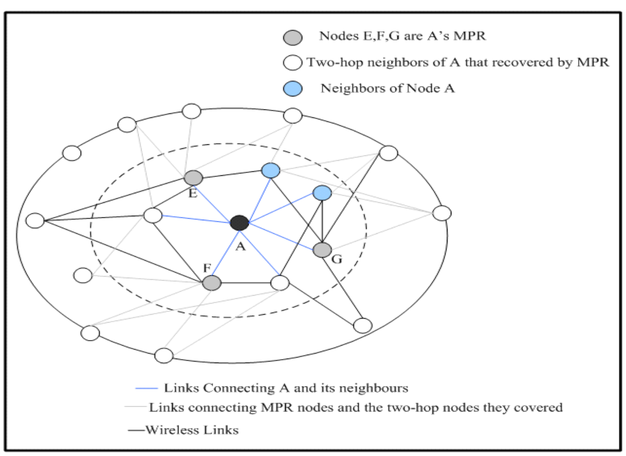


**Figure 1. An illustration of MPR nodes in the OLSR routing protocol**

## B. DSR Routing Protocol Technique

The Dynamic supply Routing (DSR) protocol may be a easy On Demand routing protocol for the needs of supply routing. A reactive routing protocol, DSR permits senders to manage the routes employed in routing their packets and additionally permits multiple routes to any destination. All packets that are sent using DSR protocol contain the whole list of nodes that the packet can traverse. Every node ought to maintain a route cache that features all known supply routes. The route caches are going to be regularly updated as new routes are learned. When the source's packets should be sending to some destination, the supply initial checks its route cache. If it's an unexpired route to the destination, it'll utilise this route to send the packet, however if the node doesn't have such a route, it initiates the Route discovery procedure mentioned in Chapter a pair of. As shown in Fig. 2, the supply node broadcasts throughout Route discovery method a route request packet with a novel identification variety. The route request packet encloses the addresses of the destination and therefore the supply nodes. The node that's not the destination node or doesn't see an equivalent route request packet as before can attach its IP address to the route request packet and rebroadcast the packet. The IP Time to measure (TTL) field is going to be incremented in every Route discovery so as to manage the distribution of the route request packets. The route request packets still unfold till they reach the destination node or the other node that incorporates a route to the destination node.

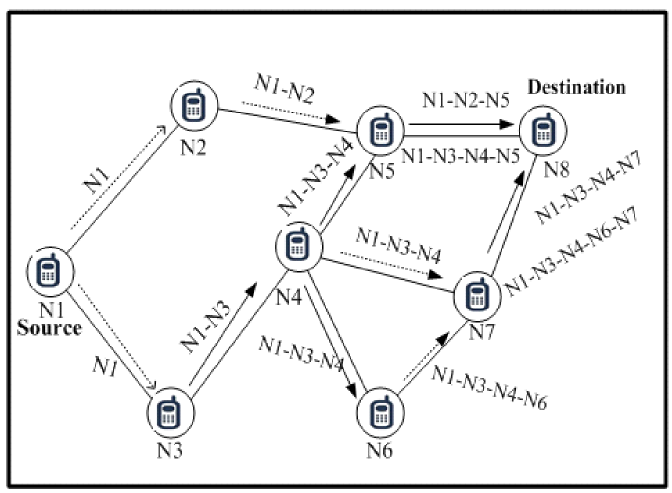


**Figure 2. Building of the route record during route discovery**

ISSN:2319-7900

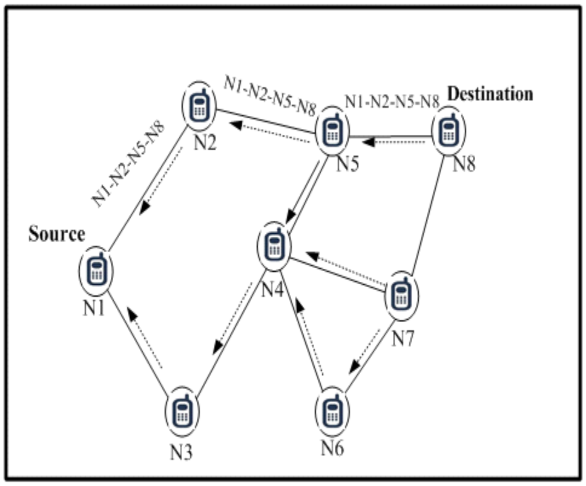


**Figure 3. Propagation of the route reply with the route record**

As shown in Fig. 3, the destination node responds to the incoming route request packets and creates a route reply packet that encloses the list of nodes that the route request packet has traversed. Then, based mostly on a minimal hop count or latency, the supply node might choose one or additional route reply packets for one target node. The DSR Maintenance mechanism consists of the route error packets and also the acknowledgments. When the information link is broken, the node generates these route error packets. Every node that receives a route error packet removes the hop in error from its route cache and shortens all routes contained by that hop at the limit. Additionally to route error messages, the acknowledgments from where the node will hear succeeding hop forwarding the packet along the route are helpful to verify the proper operation of the route links.

## C. AODV Routing Protocol Technique

The impromptu On Demand Distance Vector (AODV) Routing Protocol could be a reactive routing protocol. AODV borrows the essential Route discovery and also the Maintenance mechanisms from the DSR protocol, whereas AODV borrows the periodic beaconing and also the sequence numbering (the hop-to-hop routing vectors) from the Destination Sequenced Distance Vector (DSDV) routing protocol. Therefore, the On Demand routing protocol AODV is an optimised distance vector routing protocol that finds the routes solely when needed. Also, AODV employs extensively the sequence numbers on top of things packets to avoid the matter of routing loops. The AODV protocol is advantageous in that it offers fast adaptation to dynamic link conditions, low processing, low memory overhead, and low network utilization. When a supply node starts Route discovery to a destination that's not included in its routing table, the supply node broadcasts a route request packet, as shown in Fig. 4. every route request packet will contain the following: the ID field that represents a singular identification for the route request packet, the IP addresses for the supply node, the IP addresses for the destination node, the destination sequence variety that specifies the freshness of the management packets, the hop count that maintains the quantity of nodes between the supply and also the destination, and at last, the management flags. The route request starts with atiny low TTL price that will increase in following route requests when the destination isn't found. Every recipient of the route request packet that has not understand the destination IP address or doesn't maintain a fresher route to the destination (in another words, doesn't maintain larger destination sequence number), rebroadcasts an equivalent packet when monotonically incrementing the hop count. If further copies of an equivalent route request are later received, these packets are discarded to scale back overhead. Such intermediate nodes conjointly produce and preserve a reverse route to the supply node for an explicit interval of your time. When the route request packet reaches the destination node or any node that features a fresher route to the destination, a route reply packet, as shown in Fig. 4, is generated and unicast-travelled back to the supply of the route request packet. Every route reply packet contains the destination sequence variety, the IP addresses of the supply and also the destination, the route lifetime, the hop count, and also the management flags. This guarantees that the route path is being discovered bidirectional. Every intermediate node that receives the route reply packet, establishes a forward route to the source's packet, and transmits the packet in it. In cases where a node receives a replacement route (by a route request or by a route reply) and it's already a route 'as fresh' because the received one, the shortest route are the one updated.

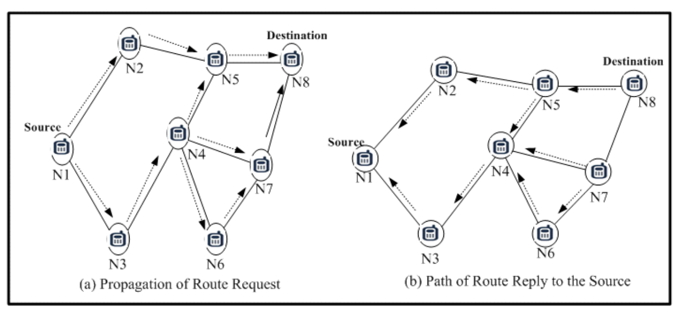


**Figure 4. AODV Route discovery**

For the upkeep mechanism, every node makes use of periodic Hello messages when it must detect link breakages on nodes that it considers as its immediate neighbours. within the case that a link break is detected for succeeding hop of a

ISSN:2319-7900

lively route, a route error message is distributed to its active neighbours using that individual route. Therefore, the mutable info included within the route error message is that the list of unreachable destinations and their counterparts.

## D. OLSR, DSR, and AODV Loop-Free Technique

The loop downside are often clarified through the subsequent state of affairs. Assume an existing route link between A and D, as shown in Figure four.6; next, the link between S and D, that A isn't alert to breaks. as an example, route error message sent by S is lost. Now, assume A desires to send packet to D. It then performs a route request that may be replied to via path (S-C-A). Node A can reply since it is aware of a route to D via node B. this might lead to a loop (S-C-A-B-S). For routing protocols OLSR and AODV, an incremental sequence variety can avoid the 2 protocols having the loops downside in their routing mechanism. Implementing the sequence variety technique within the previous example, the presence of the sequence numbers can let S discover that the routing info from A is outdated. Node S increments the sequence variety when it discovers that link S-D is broken. during this method, the new sequence variety are bigger than the one stored by A.

On the opposite hand, DSR, provides loop-free routing by requiring path data. DSR establishes a loop-free route to a destination by carrying the trail traversed in route request packets and having the reverse path piggy-back on (route reply) packets to guide the thanks to the supply, as shown in Fig 2,3. However, given a link failure, reliable error updates should be sent to the supply, in order that a replacement route may be searched.

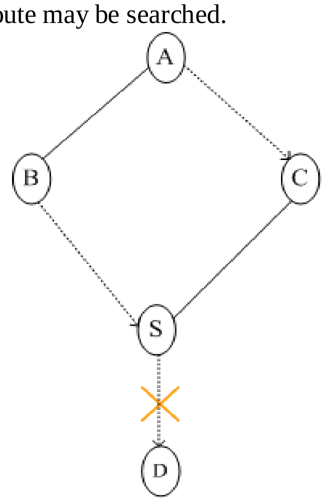


**Figure 5. Loop technique**

## E. Summary of Characteristics of OLSR, DSR, and AODV Routing Protocols

Table 1 characterizes every of the 3 protocols in terms of the routing protocol classifications mentioned in Chapter two and also the 3 routing protocol mechanisms mentioned in this.

| | | | |
|---|---|---|---|
| Routing Type | Reactive | Proactive | Reactive |
| Routing metric | Hop number | Hop number | Hop number |
| Network structure | Flat | Hierarchical | Flat |
| Periodic Hello message | Yes on need | Yes | No |
| Loop free | Yes | Yes | Yes |
| Multiple paths | No | Yes | No |
| Broadcasting method | Simple flood | Neighbour knowledge | Simple flood |

**Table 1. OLSR, DSR, and AODV routing protocol characteristics**

# Comparison of OLSR, DSR, and AODV Routing Protocols

In this section the most strengths and weaknesses of the three routing protocols, OLSR, DSR, and AODV, are reviewed. The protocols were evaluated primarily based on the techniques every one used, and their respective operation conditions.

## A. Strengths of OLSR, DSR, and AODV Routing Protocols

Here are some major points that delineate the strengths of every technique and outline the most effective operation areas for every protocol:

a. OLSR Strengths

- OLSR is suited notably to dense networks. this suggests that OLSR isn't to be used in sparse networks, as all node neighbours become MPR nodes. during this case, the OLSR becomes a pure Link State protocol and should operate because the original Link State algorithm, such that every node propagates its link state data to all or any different nodes within the network [1].
- Using the MPR technique minimizes the quantity of management messages and reduces the message

flooding overhead. OLSR, furthermore, reduces the quantity of nodes rebroadcasting link state data (updates). during this approach, when a node broadcasts a message, all its neighbours can receive the message and solely the MPR sets can ought to forward the link state data [2].

b. DSR Strengths

- The DSR protocol offers an appropriate performance and overhead in networks of little to moderate size. for big networks, however, there'll be longer supply-destination ways (long route cache in every node) and a rise within the source path route that piggy-backs on every packet travelling to its destination.
- DSR technique nodes will store multiple routes to destinations in their route cache, which suggests that there's no want for initiating Route discovery once a breakage if the supply node finds a legitimate route to constant destination in its route cache.
- DSR encompasses a satisfying delay since the nodes will store multiple routes in their route cache. The network nodes delay is that the time needed to go looking the node cache for a route before forwarding any knowledge packets. this is often terribly helpful during a network with low mobility [1].
- DSR doesn't need any periodic beaconing, or Hello message exchanges. Therefore, nodes will enter sleep mode to conserve their power and bandwidth [2].

c. AODV Strengths

- AODV has 2 necessary options which permit the protocol to be adaptable to highly dynamic networks. First, AODV adopts the destination sequence range technique utilized by the Destination Sequenced Distance Vector (DSDV) in an On Demand approach. Destination sequence numbers are necessary to make sure loop-free and up-to-date routes. Second, AODV maintains in every node a base time state relating to the use of the individual routing table entries, whereas routing table entries can expire if not recently used [1].
- AODV additionally reduces the flooding overhead. this happens as a result of AODV routing data is maintained within the node's next-hop routing tables containing the destinations that the node currently encompasses a route. A routing table entry expires if it's not been used or reactivated for a pre-specified expiration time. Therefore, the node has solely to take care of the routing data regarding the active ways. The path, then, are going to be the results of exchanging the parts of the routing table necessary for establishing the route [3].
- AODV has doubtless less routing overheads than DSR, as AODV packets solely carry the destination address ( A route request packet is little in size as a result of it doesn't contain data regarding the complete route path), in contrast to DSR packets that carry an array of addresses [4].
- A node operating AODV could offers connectivity data by broadcasting native Hello messages. A node ought to solely use Hello messages if it's a part of an energetic route. AODV doesn't need any periodic beaconing for inactive nodes. Therefore, the inactive nodes will enter sleep mode to conserve their power and save a substantial quantity of bandwidth within the network [5].

## B. Weaknesses of OLSR, DSR, and AODV Routing Protocols

This subsection points out the weaknesses of the Three routing protocols, as described below:

a. OLSR Weaknesses

OLSR may be a Table-Driven protocol that needs periodic beaconing (Hello message exchanges) to update the network data [2]. These messages can manufacture an overhead and cargo the network. The load can increase if the quantity of nodes within the network will increase. The OLSR routing protocol is in contrast to On Demand routing protocols: DSR or AODV, that don't rely on the periodic beaconing in Route discovery techniques. This additionally means OLSR overhead can grow during a network with high mobility thanks to the protocol's frequent topology table update.

b. DSR Weaknesses

DSR isn't applicable for an outsized network because the overhead could consume most of the bandwidth [6]. DSR uses supply routing that demands each packet ought to carry the total path address for each hop within the route from the supply to the destination. this suggests DSR won't be terribly effective in giant networks because the quantity of the trail carried within the packet can still increase when the network diameter will increase. Also, DSR route replies carry the address of each node along the route [2].

c. AODV Weaknesses

Nodes operating AODV routing protocol could expertise giant delays throughout route construction. like every On Demand routing protocols, AODV ought to establish Route discovery between supply and destination before sending the information packets. Also, if the link failure accrues, Route discovery ought to beinitiated, that

ISSN:2319-7900

involves further delays and bandwidth consumption specially when the scale of the network will increase [7].

## Conclusion

Mobile nodes mustn't be restricted to operating solely during a specific adhoc context. The routing protocl must be efficient to address the performance variation drawback. Instead of developing the phyloshopy and scheme of yet another new routing protocol to handle these problems. This paper gives an performance analysis of three popular routing OLSR, DSR, and AODV Loop-Free Technique routing protocols by simulation using NS-2. OLSR is suited notably to dense networks and it is not suited for sparse networks. The DSR protocol offers an appropriate performance and overhead in networks of little to moderate size. AODV permit the protocol to be adaptable to highly dynamic networks. As a continuation of this research work, it would be very interesting to evaluate other protocols that have been suggested for important operations in MANETs such as those for performing multicast and broadcast communication.

## References

[1]. Frederick Ducatelle, Gianni Di Caro and Luca Maria Gambardella, Using Ant Agents to Combine Reactive and Proactive Strategies for Routing in Mobile Ad Hoc Networks, International Journal of Computational Intelligence and Applications ., Technical Report No. IDSIA-28-04-2004, November 2004

[2]. 15. *Gianni Di Caro, Frederick Ducatelle and Luca Maria* Gambardella, Swarm Intelligence For Routing In Mobile Ad Hoc Networks, IEEE, 2005

[3]. LajosHanzo and rahimtafazolli, A survey of QoS routing solutions for mobile ad hoc networks, IEEE Communications Surveys & Tutorials 2nd quarter 2007, volume 9, NO. 2

[4]. S Gowrishankar , T G Basavaraju, and Subir Kumar Sarkar, Effect of Random Mobility Models Pattern in Mobile Ad hoc Networks, IJCSNS International Journal of Computer Science and Network 160 Security, Vol.7 No.6, June 2007

[5]. Jenn-Hwan TARNG, Bing-Wen Chuang, Fang-Jing Wu, A Novel Stability-Based Routing Protocol for Mobile Ad-Hoc Networks, IEICE Trans. Commun., Vol.E90–B, No.4 April 2007

[6]. 19. Arun Kumar, Lokanatha, Prakash, 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

[7]. 20. N Vetrivelan, Dr. A V Reddy, Performance Analysis of Three Routing Protocols for Varying MANET Size, Proceedings of the International MultiConference of Engineers and Computer Scientists 2008 Vol II