

A Bio inspired energy efficient techniques in MANET- A Review

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Abstract—Mobile ad hoc network is the self-organizing network of mobile nodes which are connected by wireless links having no centralized access point and also no fixed infrastructure. The dynamic topology of MANET permits nodes to leave or join the network at any time they wish. The nodes in mobile ad hoc networks follow the broadcasting procedure to find a route from the source side to the destination. The selection of a path in the traditional routing protocols is made based on the hop count of the paths. Various authors' schemes are discussed for choosing the optimal path from source to destination.

Keywords—MANET, AODV, cuckoo search, LEACH, multi cast routing, MAODV, Multipoint relay.

I. INTRODUCTION

A new paradigm is introduced which is increasingly becoming demanding in multi-hop wireless networking is Ad-hoc wireless networks. A network which is generated by gathering numerous small-sized and light-weighted sensors is known as a wireless sensor network. The cost of these nodes is very less along with less energy and number of processing capabilities. Today with the increase in the technology wireless sensor networks are developing with new updates. The wireless sensor networks are deployed within various applications in order to gather important information from the surroundings. The various measures such as temperature, pressure and humid of the surroundings are calculated by the sensors deployed in those regions. There are numerous applications such as in military areas, intelligent communications, wildlife monitoring, observing critical infrastructures and so on in which these networks have been deployed in order to observe surroundings and take appropriate actions. It will become a mandatory part for the computing environment, which consists of fully infrastructure and infrastructure-less networks of mobile [1]. In MANET, nodes communicate with one other in direct form or indirect form via intermediate nodes. As a rule, route between nodes in a mobile ad hoc network may incorporate various hops and, thus, it is suitable to call such systems "multi-hop" manets. MANET is one which operates without any support from any kind of fixed stations and from existing infrastructure. This statement can be formalized by defining an ad hoc network as an autonomous system of mobile hosts (MHs) connected by

wireless links, the union of which forms a communication network modelled in the form of an arbitrary communication graph. This is comparable to the cellular network with well-known single hop communication which supports the requirements of wireless communication by introducing BSs (base stations) as access points. In the cellular network, interchanges between 2 mobile hubs entirely depend on the fixed base station and wired backbone. In a MANET, no such framework exists, and the system topology may change dynamically in an unusual way since hubs are allowed to move freely.

Ad hoc network is essentially multi-hop peer-to-peer wireless mobile network where packets of information are transmitted in a "store-and-forward" way from a source to a random destination, by using intermediate node as appeared in Figure 1.1. As the MHs move, the subsequent change in system topology must be known to other nodes so that old topology data can be either removed or updated. For instance, MH2 in Figure 1.1 changes its connection from MH3 to MH4. Various nodes in the system could now utilize this new route to forward packets to MH2.

In Figure 1.1, it is accepted that to include all MHs inside the scope of each other is impossible. Figure 1.1 raises another issue of asymmetric and symmetric links. As it will be seen later on, a portion of the protocols about symmetric links having associative radio range, i.e., if (in Figure 1.1) MH1 is inside MH3 radio range, at that point MH3 is likewise inside radio scope of MH1.

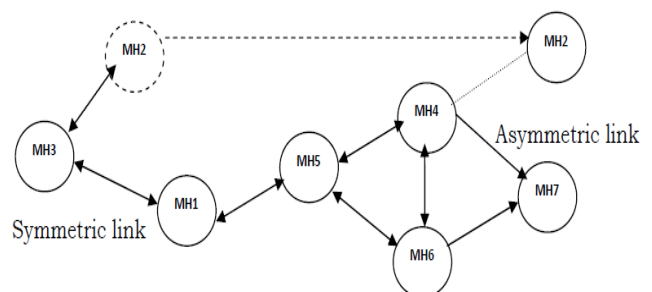


Figure 1.1: Mobile Ad-Hoc network [1]

This is to state that the links of communication are symmetric. Although this assumption isn't always valid, it is usually made so because the network of asymmetric routing is a generally tough task. In specific cases, it is likely to discover routes that can avoid asymmetric links. As almost surely, these links fail.

The issue of asymmetric and symmetric links is one among the few difficulties experienced in a MANET. Another essential issue is that distinctive nodes often have different patterns of mobility. Some MHs are exceedingly mobile, whereas others are principally stationary. Finding a movement pattern and MH's development is hard.

The dynamic nature of MANETs makes network open to unreliability and attacks. Routing is without any doubt the tremendous part for any network. Every node must not work for itself; it should be helpful with different hubs. MANETs are weak against different attacks of security. Thus, finding a reliable, secure end-to-end path in MANETs is an actual challenge.

II. AD HOC ON DEMAND DISTANCE VECTOR (AODV)

The current technological development in Digital image AODV. AODV routing algorithm is another popular on demand routing algorithm which can undertake unicast and multicast. AODV maintains routes till required by the sources. AODV uses sequence numbers to ensure route freshness and is loop-free, self-starting and scales too many mobile nodes.

AODV builds routes by route request/route reply cycle. For transmitting data from source to destination, the source floods the network with Route Request (RREQ) packet. This happens when a route is unavailable for a destination. When an intermediate/neighbor node gets a Route Request (RREQ) packet, it checks to see if it is the destination node otherwise it checks to see whether it has received this Route Request (RREQ) earlier by checking request and source node IDs.

Intermediate nodes send a request to neighbours till the destination receives the RREQ message. Otherwise, it ends at an intermediate node which has an updated route to the destination. When this happens, the node trashes the packet without sending the RREQ further. Every node maintains a sequence number in AODV along with a broadcast ID. An RREQ message has the source and destination's sequence numbers and is always recognised by the broadcast id and source node's address. The destination sequence number ensures loop-free routing and updated route information. A reply to the RREQ message by intermediate nodes is possible only when they have a destination route. Also, the sequence number should either be equal or greater to that in the RREQ.

When forwarding RREQ messages, an intermediate node routinely records the address of the neighbour from whom it got the first RREQ message copies. It becomes useful when a reverse path is required. At the point, when a RREQ is received, as revealed by the RREQ's duplicate message, BcastID-SrcID pair, copies are destroyed.

Intermediate nodes with a routing entry to the destination node or routes to a destination can send Route Reply (RREP) packets to the source. These nodes record BcastID and preceding node address when forwarding requests route. Timer consequently

removes such sections if route reply isn't gotten before the expiry of a time limit. At the point when the route reply closes at the intermediate/destination node with a new route, the intermediate/destination node returns a packet of RREP to a neighbour from whom it was first gotten the RREQ message. When the RREP is routed back on the reverse path then nodes on this route set up entries of forwarding path in their routing cache.

III. BACKGROUND

Hinds et al. examine a variety of MANET routing protocols available. They talk about the functionalities of many varying from early protocols (like DSDV) to more advanced (like MAODV). The protocol study concentrates upon works by Perkins in developing and improving MANET routing. A range of literature about the field of MANET routing was identified and reviewed. In this paper, they also reviewed the literature on securing AODV based MANETs as AODV may be the most popular MANET protocol. The literature review recognised many trends within research papers such as particular use of the random waypoint mobility model, eliminating fundamental metrics from simulation results and not comparing protocol performance toward available alternatives. [2].

Kout et al. introduce a novel routing protocol inspired by the cuckoo search method. The Network Simulator 2 is used to implement a routing protocol. Random Waypoint model is taken as the mobility model. To validate the work, they considered the comparison of the routing protocols such as an ad hoc on-demand distance vector (AODV), destination sequence distance vector (DSDV) and the bio-inspired routing protocol AntHocNet in terms of the quality of service parameters: packet delivery ratio and end-to-end delay (E2ED). [4].

Gupta et al. proposed an enhanced Cuckoo Search-based Clustering Algorithm (ICSCA). To design an energy-efficient data gathering protocol in a large-scale Wireless Sensor Networks (WSNs) has become a challenging research issue. The reason behind is limited energy resource of each sensor node. In the literature, to save energy, the clustering-based technique for data collection has been proved very efficient though it is indicated that energy-balanced clustering's design to maximise the network lifetime of WSNs is an NP-hard problem. For solving the NP-hard problem, several meta-heuristic approach based clustering protocols are introduced in recent years. These clustering protocols suffer from unbalanced energy consumption problem. In this problem, cluster heads are not uniformly distributed, and overloaded cluster heads die out faster than under-load cluster heads. To solve this problem, an enhanced Cuckoo Search-based Clustering Algorithm (ICSCA) is proposed in this research paper. Performance evaluation of the ICSCA and its comparison with the state-of-art clustering scheme regarding total energy consumption and residual energy are presented. [5].

Gopalan et al. anticipated Improved Cuckoo Search Optimization (ICSO) based Energy-Delay Aware Routing Algorithm to resolve the energy and delay issues particularly for the rescue and emergency applications. In this anticipated

system, the MANET nodes are optimally grouped with the cluster head selection procedure is done by means of an Improved LEACH (I-LEACH) protocol. Once the CH is elected, the intra and inter-cluster communication is recognized. The energy efficient and delay aware shortest paths are resolved by the ICSSO Algorithm. Investigational outcomes display that the anticipated ICSSO grounded Energy-Delay aware Routing system offers efficient routing with improved recital in rescue and emergency applications in terms of packet delivery ratio, bandwidth, end to end delay, energy utilization, throughput, network lifetime and consistency [6].

Nagaprasad et al. executed two distinctive directing conventions Destination sequenced Distance vector (DSDV) and Dynamic Source Routing (DSR) convention. The execution of these two conventions estimated with various situation like 1) parcel conveyance part 2) bundle delay at end to end point 3) directing burden. The reenactment results demonstrate that Dynamic Source Routing (DSR) convention is superior to DSDV. It is additionally seen that some time DSDV is likewise superior to DSR. In any case, when the delay time is higher, it is better execution of DSR contrasting with DSDV. And every one of these exhibitions is relies upon various seniors [7].

Kant et al. In this review paper, we present standard routing protocols grounded on unicast or multicast routing schema. This schema is chosen from the group of related approaches that can reflect the state-of-the-art of research work on mobile ad hoc network (MANET) routing. Hybrid unicast or multicast routing protocol seems to be a better candidate than pure proactive and reactive routing protocols. Many of the application use unicast protocol whereas in group communication Multicast routing gives comparatively better performance. [8].

Olagbegi et al. presents a thorough review of recent work about energy efficient multicast routing protocols and secure multicast routing protocols in Mobile Ad hoc Networks (MANETs). There are several issues and solutions which behold the need for energy management and security in ad hoc wireless networks. The purpose of a multicast routing protocol for MANETs is to assist the data propagation from a sender to all the receivers of a multicast group with available bandwidth efficiently with frequent topology changes. Multicasting can enhance the effectiveness of the wireless link while sending multiple copies of messages by utilising the inherent broadcast property of wireless transmission. Secure multicast routing has an essential role in MANETs. Though, giving energy efficient and secure multicast routing is a tough and challenging job. [9].

Adhvaryu et al represents a careful overview of current work tending to multicast directing conventions with low control overhead in MANETs. There are such a large number of various issues and arrangements which witness the need of gathering administration in impromptu remote systems. The goal for MANETs in multicast steering convention is to help spreading the information from the broker side to every one of the collectors for a multi-cast gathering while at same time endeavouring to utilize the accessible data transfer capacity productively within the sight of continuous topology changes. Presently multi day, different multicast directing conventions

have been proposed for MANETs. Every one of these conventions has their recognizing. Features and use different mechanisms to support the different Quality of Services parameters [10].

Vijayalakshmi et al. This paper focuses on discovering the link with the high probability of longer lifetime between the nodes. The crucial issues faced in the MANET are energy consumption, QoS (Quality of Services), exposure to attacks, link stability. Link stability is very important to improve communication. Link Stability is vital as radio links are usually varied due to the mobility of the node. This vulnerability begins rerouting which moreover increases routing overhead. One method of diminishing routing overhead is to use multicasting rather than unicast routing. Multicast Routing Protocol sends data concurrently to a destination nodes to obtain better resource utilisation. This paper present a multicasting routing protocol Link Stability based Multicast Adhoc on-demand routing protocol (LSMAODV) that utilises acquired signal strength as a metric to measure link stability and node stability. The correlation between AODV, MAODV and LSMAODV is estimated for link and node stability. [11].

A Mobile Ad hoc Network (MANET) is a group of autonomous self-organised nodes. They utilise the wireless medium to communicate with each other. The two nodes can communicate directly if and only if they are inside the transmission radius of other in a multi-hop fashion. Many traditional routing algorithms have been introduced for MANETs. An emerging field that has recently gained much recognition in network routing researches is Swarm Intelligence (SI). Besides traditional methods, many new researches have suggested the selection of Swarm Intelligence for MANET routing. Swarm Intelligence (SI) indicates complex behaviours that emerge from very simple individual behaviours and interactions, which is usually perceived in nature, particularly amongst social insects such as ants, bees, fishes etc. Ants routing matches basic mechanisms from distributed Swarm Intelligence (SI) in biological systems and sets out to become an interesting solution where routing is a problem. Ants based routing is getting more demand due to its adaptive and dynamic nature. Many Swarm Intelligence (SI) based algorithms were suggested by researchers. In this article, we examine bio-inspired routing protocols for MANETs. [12].

Table 1: Comparative Analysis of Various Techniques

Author	Work Performed	Technique Used
Koutet al.	Proposed a novel routing convention propelled by the cuckoo search strategy.	Used cuckoo search strategy for routing in manet.
Gupta et al.	Used cuckoo search technique for expanding the system lifetime of	Cuckoo search clustering technique is used

	WSNs is a NP-difficult issue	for routing.
Gopalan et al.	Anticipated Improved Cuckoo Search Optimization (ICSO) based Energy-Delay Aware Routing Algorithm to resolve the energy and delay issues.	Used Cuckoo Search for cluster head selection in Improved LEACH routing protocol.
Nagaprasadet al.	DSR Dynamic Source Routing and DSDV Destination sequenced Distance vector protocols are implemented.	Used DSDV and DSR protocol for analysis of PDR and Packet delay.
Kant et al.	Suggested a technique OPHMR which uses an optimizing scheme via MPR (Multipoint Relay).	OPHMR used to reduce the number of control overheads.
Olagbegiet al.	Represents an exhaustive study of ongoing work tending to vitality proficient multicast steering conventions and secure multicast directing conventions in Mobile Ad hoc Networks (MANETs).	Survey of protocols in Manets
Hinds et al.	Review of Literature related to the routing of MANET was recognized, additionally literature regarding inspected AODV based MANETs as this might be the most well known MANET convention.	Talk over the performance of a few running from early conventions which is DSDV to further developed MAODV.
Adhvaryuet	Shows an intensive	Various

al.	overview of current work tending to multicast directing conventions where having control overhead is low in MANETs.	multicast routing protocols which are multicast in MANETs surveyed.
Vijayalakshmi et al.	presented a Link Stability based Multicast Adhoc on demand routing protocol (LSMAODV)	Used LSMAODV that uses got signal strength as a metric to assess interface stability and node security.

IV. RESEARCH GAPS

- The existing work considers basic AODV routing protocol as route discovery mechanism to create initial population for CS. This creates population that adheres to one fitness function, i.e. length of the path measured by hops. Hop count is not accurate measure for path length in constantly changing topology for MANETs.
- Some of the techniques modify the path selection criteria, for instance, a technique can incorporate mobility of the nodes to optimize the path selection process. These techniques are certainly better than traditional AODV but at the same time, they lack application of more than bio-inspired algorithm for optimizing the network’s performance.
- When number of nodes increases, the performance will go down. Routing for each host increases number of entries of route table. This may cause routing load on network.
- Topology is dependent on the way nodes behave on network. Topology changes due to mobility of nodes as not being tackled efficiently
- One of the challenging security problems in MANETs is the secure routing in presence of selfish or adversarial entities which drop the packets they agreed to forward; and in doing this selfish or adversarial entities can disrupt the network traffic and cause various communication problems.

V. CONCLUSION

In this paper, a comprehensive overview of routing protocols in MANET has been presented. Routing protocols are needed for synchronization and communication in Ad hoc networks in which it target timely and efficient delivery of message. In this way, to ensure communication, a proficient routing protocol is required that enable nodes to communicate in a convenient manner. The paper shows the survey of MANET and ongoing routing protocol for effective communication.

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