Routing Algorithm in MANET : A survey

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Abstract: A Mobile Ad-hoc Network (MANET) is a network designed in wireless environment by various mobile nodes to establish communication during mobility. In other word we can say if various mobile nodes from a network without any infrastructure, such kind of network is known as Mobile Ad-hoc Network. In MANET communication between mobile devices are performed by routing protocol. This paper presents an extensive survey on routing algorithm of ad hoc mobile networks, concentrating on serving a reference to the current research issues in ad hoc networking. In this survey paper we proved an overview of various routing protocols proposed by various researchers. The literature will provide a comparative study of all routing protocol to find out the performance of protocol for large MANET.

Keywords: - MANET, Mobile Ad-Hoc networks

I. INTRODUCTION

In this section we have described about mobile ad-hoc mobile networks. It is a collection of mobile nodes, the nodes are dynamically connected in a arbitrary manner. Ad-hoc mobile networks are self-configuring network there is no any pre-existing infrastructure. There is no designated router on this network and all nodes are able to serve each other as a router and drive the data packets forward. Thus each node act both as host and a router and each node can communicate to other nodes within its transmission range. To communicate with nodes out of its range, a node uses the help from other nodes which play a bridge role to receive and forward messages. These kinds of networks are very flexible and suitable for different situations and applications. For instance, those networks can be applied for military fields, search and rescue operations, and any remote area where is no base station for communications. Due to some mobility of nodes, and infrastructure less environment, routing is significant task in MANETS. Routing protocols are thus responsible for maintaining and reconstructing the routes in timely basis

II.CLASSIFICATION OF ROUTING PROTOCOLS

In all networks, the routing of data packets from source and destination are controlled by routing protocols. The design of algorithm for static topologies network is simple but when there is no fixed topology exist then it is a big challenge to design a routing algorithm. Routing protocols designed for MANETs can be broadly classified as position based routing protocols and topology-based routing protocols [1] (also shown in Fig. 1). **II. ROUTING PROTOCOLS**

Depending on the application, different architectures and design goals/constraints have been considered for adhoc networks. Performance of a routing protocol is closely
related to the architectural model. So, routing protocols have been categorized under different sections shown in fig. Routing protocols are categorized under following headings but they are interrelated or dependent on each other

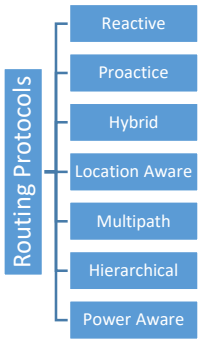

Fig 1: taxonomy of routing protocol

Although aim of all the protocols is same: i.e Maximize throughput while minimizing packet loss, control overhead and energy usage still they give different results in different
scenarios.

*A. **Reactive** or **Source-initiated routing protocols***

Source-initiated routing as the name suggest is a routing protocols in which the route is created only when the source requests a route to a destination. The process is subdivided into route discovery and route maintenance. In route discovery network is flooded with route request packets. The route discovery process ends when the initiate node is having one route or multiple routes to the destination, after it A route maintenance procedure maintains the continuity of the route while transfer of packet. Route discovery process contains route request packet that a source broadcasts on the network. In

route maintenance phase route error and acknowledgement packets are used. Few of the reactive protocols are under listed:

- Dynamic Source Routing (DSR)
- Adhoc on demand distance vector (AODV)
- Temporally ordered routing algorithm (TORA)
- Signal stability based adaptive routing (SSBR)
- Ant colony based routing algorithm(ARA)

There are many other protocols that come under this category which are variations of one or the other protocol such as

- Space content adaptive time routing (SCATR)
- Forwarding Dilemma Game(FDG) which are based on AODV.
- Distributed Ant Routing (DAR) algorithm based on ant behavior in colonies. Etc.

B. Proactive Routing protocols(Table driven)

The proactive protocols as their name suggest always maintains the updated information of routes at every node about the source and destination of a packet. Also, it propagated this information throughout the network to keep the routing state information up to date. The disadvantages of proactive protocols is that it keep information about all the routes which may not be used for transferring so increase the overhead to the network and also increases the cost of transferring the packet. Few of the proactive protocols are as follows.

- Destination-Sequenced Distance vector(DSDV)
- Optimized link state routing(OLSR)
- Cluster head gateway switch routing(CGSR)
- Wireless routing protocol(WRP)
- Hierarchical proactive routing mechanism for mobile adhoc networks (HOLSR) algorithm which builds upon the OLSR protocol by introducing a hierarchical architecture with multiple ad hoc networks [10]

C. Hybrid Protocols:

The hybrid routing schemes combine the strengths of reactive and proactive protocols. It has been perceived that the real time applications in which link changes relatively slowly are more appropriate for the use of proactive protocols whereas the high mobility applications are proper for reactive protocols.[1] ,by combining these two concepts, we get hybrid protocols which results in increasing the overall performance while reducing the cost of transmission of routing. Hybrid protocols are as follows:

- Zone routing protocol(ZRP)
- Fish eye state routing(FSR)
- Landmark adhoc routing(LANMAR)
- Distributed dynamic routing(DDR)
- Hybrid ant colony optimization(HACO)
- Adhoc networking with swarm intelligence(ANSI)

Ant Colony Optimization (ACO) and zone routing protocols which are based on hybrid routing have also been proposed in [11]. These protocols considers the state of ants travelling from one zone to the other with local proactive route discovery within a zone and reactive communication between zones

D. Location Aware Routing:

Location Aware protocols represent the pool of protocols in which by Global positioning system is used to determine the coordinates of the respective nodes and the location of every node is known to every other node. This class of protocols participates in predictive routing. As the position of a node changes due to mobility, routes from source to destination needs to be updated. In [8] authors have used the concept of location aware routing to predict the nodes mobility to find optimized route from source to destination.

Few Location aware protocols are

- Location Aided Routing(LAR)
- Distance Routing Effect Algorithm for Mobility(DREAM)
- Greedy perimeter state routing (GPSR)
- Dynamic route maintenance (DRM) for geographic forwarding

E. Multi-path Techniques:

Collection of nodes scattered over a large area form an adhoc network and are connected through wireless links. Multipath algorithm assumes that multiple routes occurs between one source and destination and all are available for data packets transmission. So the shortest or optimal path for packet delivery should be chosen. The main advantage of this scheme is the path with less number of hops or less congested may be chosen in order to deliver the packet in time securely. Protocols developed under this section are:

- Caching and multipath routing protocol(CHAMP)
- Split multipath routing (SMR)
- Secure multipath routing(SecMR)

F. Hierarchical Protocols:

The idea behind hierarchical routing protocols is to reduce the overhead of a large networks by clustering it into manageable limited size groups .As the size of network increases, routing table sizes and control packet overhead also

increase. Hierarchical ad hoc routing clustering techniques is used to form tree like structure of nodes. Nodes at the higher levels of the hierarchy provide special services, improving the scalability and the efficiency of routing. [1] Hierarchical state routing (HSR), Core extraction distributed adhoc routing and hierarchical landmark routing are few protocols under this category.

Clustering is one of the most popular techniques preferred in routing operations. In paper[7], clustering mechanism, are used on artificial bee colony algorithm, is proposed to increase the duration of links in network. The performance of the proposed approach in this paper is compared with protocols based on particle swarm optimization, which are studied in several routing applications.

G. *Multicast Protocols:*

Real time applications like video streaming, teleconferencing require the concept of multicasting, where one sender transmits the data to many receivers simultaneously [1]. Although the protocols under this class are source initiated

- Dynamic core based multicast routing(DCMP)
- Energy efficient multicast routing
- Genetic algorithms for group multicast
- Content based multicasting(CBM)
- Geographical Multicast:

This type is the deviations of multicast protocols in the way that the location of nodes is assumed to be in a particular geographical region. The position is obtained by GPS systems. Protocols of this class are generally based on set of location aware protocols. They also have to face the challenge of defining the geographical area from which the nodes are taken. The protocols of this class are

- Directional guided routing (DGR)
- GeoTORA etc.

H. *Power Aware Protocols*:

In this group of protocols the routing decision is based on available power of the nodes other than number of hops. It is observed that generally the shortest path usually consumes less energy. The protocols under this group are device and energy aware routing(DEAR), interface aware cooperative routing etc.

III. COMPARISON

In contrast to source initiated routing (reactive), table driven routing (proactive) has extensive precedents in the research done for routing in the wired network. Reactive protocols have the overhead of route maintenance so the main goal of proactive protocols is to reduce this overhead. Also proactive protocols are not suitable for highly dynamic routes due to extra control overhead generated to keep the table updated. Proactive protocols such as OLSR only evaluate hop counts to search for the shortest path. As for reactive protocols, AODV only checks hop counts to determine if the routing table entry should be updated; DSR relies on hop counts for automatic route shorting and preventing route reply storms. But the fact that shortest route may not prove to be the optimal one as, it may face high overall congestion and inefficient packet delivery rate, cannot be neglected. [6] In MANETs variable length links is threat for timely delivery of packet so a greedy routing algorithm has been proposed, which selects the next hop node having the highest link lifetime. Greedy and Contention-based forwarding schemes perform hop-by-hop transmission of data, without discovering the end-to-end route to the destination [2]. Greedy algorithms select the nearest hop from source to destination and contention based methods broadcasts the packets to its immediate neighbors which forward the packet after competing with each other. GPSR protocol (representative of location aware protocols) is greedy in nature as it selects nearest neighbor to forward its packet. Multipath protocols like CHAMP, SMR are reactive in nature. The route metric of CHAMP is shortest path and for SMR its delay.Also, some nodes in MANET are selfish in nature i.e. they may accept the node forwarded to them but may not transfer it in order to save their battery life. Routing in such an environment is based upon hiding the identity of destination node from each participant hop. [3] Node behavior is affected by social selfishness too. The authors in [4] have explained the concept of social selfishness as the nodes will not forward the packet received by them to whom they were not connected in the past. They will not participate in new route discovery due to limited resources available to them. They priorities the nodes among the neighbors and have developed social selfishness aware routing algorithm using multiple knapsack problem with assignment restrictions as the base of their algorithm. Most of the traditional protocols consider hop count as best metric to identify best packet route in [5] Nenad S. Kojie etal have proposed a routing protocol based on Hopfield neural network.

IV. CONCLUSION AND FUTURE SCOPE

Routing protocols has to consider the problems that take place due to node mobility. Most of the current protocols assume that nodes are stationary. However, the nodes change their positions frequently. In such cases, the frequent update of the position of nodes and the

propagation of that information through the network consumes the energy of nodes. New routing algorithms are needed in order to handle the overhead of mobility and topology changes in such energy constrained environment.

The limitations of this paper are it lacks to cover each category of routing protocol in detail. Routing using bee colony or ant colony may prove to be much more reliable so these techniques with other routing methods should be exploited in order to achieve maximum throughput and minimum overhead for packet delivery. Also prediction of routes based on different predicting techniques is open area of research for more assured packet delivery.

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