A Comparative Study of Topology and Position Based Routing Protocols in Mobile Ad Hoc Networks

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Abstract

Mobile Ad hoc Network is a wireless network consist of collection of mobile nodes that changes its topology very soon and communication between mobile nodes is based on the wireless links. MANET works in dynamic environment with no fixed infrastructure and topology. Due to dynamic topology of the network, routing in MANET is a challenging task. So to design an efficient routing protocol depends on various techniques and algorithm. Different strategies and scenarios are taken in order to propose an efficient routing protocol to enhance the network performance. It is not easy task to determine that which protocol is best suited for our network. The objective of this paper is to focus on various topology based and position based routing protocols. In position based routing protocol we determine the location of destination node as well as its neighbour node by using the position information. By the use of location services and forwarding strategies, it provides reliable as well as efficient routing for certain applications.

Keywords

Mobile Ad hoc Networks, Topology Based Routing protocols, Position Based Routing Protocols.

I. Introduction

A Mobile Ad hoc Network is an autonomous collection of mobile nodes and communicated through wireless links. It is a temporary network without having any centralized access point, infrastructure, or centralized administration. It is an wireless network that perform multi hop communication between mobile nodes, without the reliance on a fixed base station. It is a self configuring, self organizing, self administering wireless network whose topology changes dynamically. Each node acts as router and as a host. The applications of MANET are communication, conference meeting, creating virtual classrooms and military and in the wireless sensor network. While changing the network condition at the same time through the strategy of routing used as the limited resources such as: network size, partitioning and traffic size. It provides a different quality of services to a different users and applications. A routing protocol is needed while a packet is needed to be transmitted to a destination. These protocols to find a route for packet delivery and transferred the packet to the destination. This paper discusses the classification of routing protocols are based on two types: Topology based and position based routing protocols in briefly.

II. Routing Protocols In Manet

To route the packet from one end to another end is the crucial task. The main goal of any routing protocol is to establish an optimal and efficient path between mobile nodes. There are several routing algorithm is proposed for efficient routing. Earlier routing protocol are based on the topological information, which consist of path establishment and path maintenance. It uses link information that exists in the network for packet forwarding. But now a day routing protocols are designed which utilizes position information to locate the exact locations of destination node as well as its neighbor node It uses position information to provide more reliable as well as efficient routing for certain applications.

Classification of Routing Protocols in Manet

Routing protocols are divided into two categories: Topology based Routing and Position based Routing. Topology based Routing is further classified into Reactive or on- demand while others are proactive. In general, Proactive protocol always has to update

its network topology. It finds routes in advance while a reactive protocol finds routes to the destination until it is demanded. It uses flooding technique to forward the packets. The major advantage of using this protocol is that it is designed to save the bandwidth space.
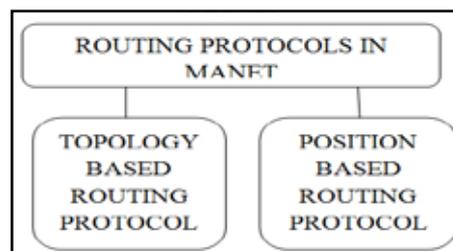

Fig: Classification of Routing Protocols in MANET

III. Topology Based Routing Protocols in Manet

The protocol are based on the topology of various routing protocol are based on three ways: Reactive or on demand protocol, Proactive or table driven protocol and Hybrid protocol.

A. Reactive Routing Protocols

This protocol is also known as the on-demand routing protocol which they don't maintain the routing information or activity of routing at the network nodes which there is no communication. In this protocol, the node wants to send a packet to the other node while for the route in an on-demand routing manner and establish the connection of route to transmit and receive the packet in order to manner. A packets will forward throughout the network by the flooding of the route occurs by the route discovery. The examples of reactive or on-demand routing protocols are: AODV (Ad-hoc On-demand Distance Vector routing), DSR (Dynamic Source Routing).

Ad hoc On-demand Distance Vector (AODV)

This protocol will perform route request (RREQ) and route reply (RREP) through the route discovery which a node will send packets to the destination. To handle the process of the routing which does not need any central administrative that is a flat routing protocol. When we reinitiate the route will the route error receives

message from the source node. It broadcasts the hello message from the neighborhood information. This protocol is tends to reduce the traffic messages overhead at the low cost is to finding the routes of latency increased. It provides a loop free routes while the breakage of repairing link, but DSDV does not have to require the global periodic of routing advertisement. It aims to reduce the number of broadcast messages forward throughout the network by discovering routes on-demand instead of keeping of up-to-date information of the route [8].

Dynamic Source Routing (DSR)

This protocol based on the source node floods to as a route request to all nodes are in the range of wireless transmission. In this protocol is based on the two mechanisms to allow the route discovery and maintenance the route in the networks. Each route request packet is defined by the route discovery of the source and destination. The source node will provide a unique id request number to its route request packet. When no route is found, the destination node will discover the route mechanism in order to reach the source node. The route maintenance is used when the source node is unable to use its current route the destination due to changes in the topology of network. In that case, the source node will need to select another route to the destination node. It will invoke the route discovery from the source node again to discover a new route to transmit packet to a destination. A source node puts the entire routing path will sending the packet of data and the data is sent through the intermediate nodes in the specified path of the route. If the source node does not have a routing path to the destination, it will discover the route request (RREQ) packet. The advantages of this protocol to provide the multiple routes and to avoid the loop formation and disadvantages are large end-to-end delay, scalability problems caused by flooding and source routing mechanisms [9].

B. Proactive Routing Protocols

This protocol is also known as a table driven protocol and each node maintains a routing table will consists of the information of routing to every node in the network. Since the nodes are mobile, they keep on the changing their location. It maintained the routing tables which are periodic or whenever a change occurs, are updated provide a number of proactive routing protocols. It differ in the various areas like number of routing table will maintained and how the changes are propagate in the network. The examples of proactive routing protocols are: Optimized Link State Routing (OLSR) and DSDV (Destination-Sequenced Distance Vector).

Optimized Link State Routing (OLSR)

This protocol is a proactive routing protocol where runs are always available the needed is there. In this protocol is an optimized version of a link state protocol. We are possible to reduce the possible overhead in the network which MPR (Multipoint Protocol Relays) are used. This will changes a topological will cause the flooding of the information of topology to all available hosts in the network. To reduce the interval of time for the control of the messages will be transmission bring more reactivity to the topology will be changes. This protocol uses two kinds of the control messages are: hello and topology control. The hello messages are used for the finding information about the status of link and the host's neighbors. Topology control messages are used for broadcast the information with its own advertised neighbors, which are included at the least of the MPR selector list [10].

Destination-Sequenced Distance Vector (DSDV)

This protocol is a hop-by-hop based on the distance vector on the bellman-ford mechanism. In this protocol, each node will maintain a routing table which contains the entry information for the destination node in the network. The routing table contains entries such as: next hop address, metric or the number of hop counts and the sequence number. Which we will assign the sequence numbers by the destination node for the identification of the routes. This sequence number of every route is assigned by the destination and it is incremented for every route discovery. In MANETS, the DSDV enable the sequence numbers is to maintain the up to date routing information at the nodes which we are ensuring the routing data will across of the routing information tables. This protocol will maintain the routing information is initiated by the periodic and the triggered route updates [12].

C. Hybrid Routing Protocols

This is the combination of the proactive and reactive protocols which work well for the networks with a small number of nodes. While the hybrid reactive/proactive protocols are used to achieve the high performance as the number of nodes increases. It is a key of idea to use a reactive routing at the global network level while the employing a proactive in a node's local neighborhood. The examples of hybrid routing protocol are: ZRP (Zone Routing Protocol) and ZHLS (Zone-based Hierarchical Link State.

Zone Routing Protocol (ZRP)

This protocol has defined the zone of routing which the nodes have define a range in hops that each node is required to maintain the network connectivity. The nodes are within the routing zone, which routes are immediately available. Which lie outside the zone of routing, that it is determined an on-demand routing protocol to determine a route to the required destination. This protocol can significantly reduce the amount of the communication overhead will compared to the pure proactive protocols. It also reduced the delays that associated with the pure reactive protocols such as DSR, by allowing to the routes discovered faster. To determine the route to a node outside the zone of the routing edge of the routing zone of the destination required. The disadvantage of this protocol is that for the large values of the routing protocol can behave like a proactive protocol, it behaves like a reactive protocol for small values [15].

Zone-based Hierarchical Link State (ZHLS)

It is a hierarchical structure. This protocol that the network is divided into non-overlapping zones, each node has own node ID and a zone ID, which is calculated by using the GPS. This topology made up to two levels: node level topology and zone level topology. The advantage of this protocol is that it will reduce the communication overhead when compared to pure reactive protocols such as DSR and AODV. The another way of this protocol is that the routing path is adaptable to the changing topology only for the node ID and zone ID of the destination is required for the routing. It means that is no further location search is required as long as destination is not migrate to the another routing zone. The disadvantage of this protocol is that all nodes must have a pre-programmed to the map of static zone in order to a function. It is not feasible in the applications where the geographical boundary of the network is dynamic. This is highly adapt to dynamic topology and it is generates far less overhead of pure reactive protocols, which mean that it may scale well to

a large networks [16].

IV. Position Based Routing Protocols In Manet

Position based routing protocol use additional information about the position of mobile nodes. It uses location services to determine the exact position of source node, neighbor node and the destination node. By the use of GPS or some kind of location services, it maintains the position information about the nodes and determines the exact co-ordinates of the nodes in any geographical direction, and thus leads in route discovery mechanism. It doesn't require the establishment and maintenance of the route, neither it has to update the routing table. It does all its activity by the use of location services and some kind of forwarding strategy, which is used in forwarding the packets from source node. The advantage of this protocol can supports the delivery of packets to all nodes in a given region of geographic this type of service is known as a geo-casting. It can distinguish three main forwarding the packets strategy for position based routing: Greedy forwarding, restricted directional flooding and hierarchical approach [2,3].

Performance of Position Based Routing Protocol

The following performance of position based routing strategy of the protocol can be according to their important design parameters are:

- Loop Free
- Distributed Operation
- Path Strategy
- Packet Forwarding
- Path Selection Metric
- Memory (State)
- Guaranteed Message Delivery
- Scalability
- Overhead
- Adaptive to Mobility

A. Location-aided Routing Protocol (LAR)

This protocol is based on the use of location information about the mobile nodes by using location services like GPS and many more to reduce the route discovery overhead, the two regions are defined i.e. Request zone and Expected zone. Request zone is the area in which the node forwards the route request only when the node is inside the zone. When the nodes does not belongs to request zone then it simply discards the message. Expected zone is the area in which there is the maximum probability of finding the destination nodes. Since the destination node is mobile, We can calculate its probabilistic position by assuming its average velocity multiplied by difference in time interval. We assume the expected zone to be circular with the radius v (t1-t0). Difference between at time t0 the location of destination node and at time t1 the location of destination node multiplied by its average velocity [1].

B. Distance Routing Effect Algorithm for Mobility Protocol (DREAM)

This protocol proposed which also used information from GPS systems for the communication by the node location. It is a part of proactive and reactive protocol where source node sends the data packet in the direction of the destination node by the selective flooding. Control packets are used to determine the node distance from source to destination which the direction is given by the distance line source to destination and the angle of alpha. It is based on the direction approach a recovery method is needed

necessary when the destination node is not in the given direction. The performance of the basic techniques which can influence by the flooding, recovery procedure but it is not included in the specifications [4].

C. Adaptive Location-aided Mobile ad hoc Network Routing Protocol (ALARM)

This protocol uses feedback for adaption and location information for improvement the performance. It is a hybrid, adaptive to mobility protocol 'which uses LAR and directed flooding. It introduces the number of hops to be flooded past the mobility hot spot by the flood horizon. It uses the link the duration of the feedback at each node to determine the appropriate forwarding method and it adapts the operation on the current network mobility conditions and it will increases the mobility of the packet overhead [6].

D. Greedy Perimeter Stateless Routing Protocol (GPSR)

This protocol uses the location of the node to selectively a forwarded the packets based on the distance. The node closest to the destination by forwarding is carried out on the basis by selecting the greedy approach. This process will continue until the destination is reached. This protocol uses two methods for data forwarding: greedy forwarding and perimeter forwarding. A node sends the packet to its neighbor nodes closed to its region of perimeter. In the route discovery the states are collected and cached in the nodes after the region of perimeter forwarding. For the study of mobility, we used a random waypoint model [5].

E. Grid or Geographic Location Service Protocol (GLS)

It is based a location service for the geographic locations. We can be simulated with the simple geographic routing and the GPSR. It breaks up the network area into a hierarchical forming of the system of squares a quad-tree, where each n-order squares contain four (n-1) order squares. It will make use of the location information and it can be a unique, permanent and random allocated node IPs, the local first order square that each node stores a table of all nodes. it use of the periodic broadcasts as the location which updates increase with the network size [7].

Table 1: Comparison of Position Based Routing Protocols in Mobile Ad hoc Networks

Protocol	Path Strategy	Path Selection	Scalability
LAR	Multipath	Hop Count	Medium
ALARM	Multipath	Link duration	High
DREAM	Multipath	Hop Count	Medium
GLS	Single Path	Hop Count	Medium
GPSR	Single Path	Hop Count	Medium

Table 2: Comparison of Topology Based Routing Protocols in Mobile Ad hoc Networks

Protocol	Routing Structure	Routing Metric
AODV	Flat	Shortest Path
DSR	Flat	Shortest Path
OLSR	Flat	Shortest Path
DSDV	Flat	Shortest Path
ZRP	Flat	Shortest Path
ZHLS	Hierarchical	Shortest Path

V. Conclusions

In this paper, we have introduced of taxonomy of the routing protocols. We have divided the routing protocols into two based routing protocols which are based on topology and position based routing protocols. The topology routing protocols that can be divided into three categories which are: reactive, proactive and hybrid and the position based routing protocols that can classified into a location service, geographic and hierarchical. The routing protocol must be efficient to address the performance of the drawback of variation, instead of developing an existing and scheme of another new routing protocol to handle this problem. The position based algorithms for both ad-hoc and wireless sensor networks, in both for dynamic and static scenarios. This paper shown that the task of routing packets from a source to destination which can be separated into the two distinct ways: which we can discover the position of the destination and another way is to actual the forwarding of packets based on this information. We have discussed a comparative study between the topology and the position based routing protocol in mobile ad hoc networks. The common goal to reduce the control packet overhead, maximize throughput and minimize the end-to-end delay. The main factoring differentiating between the protocols is the way of finding and maintaining the routes between the source and the destination pairs. We hope that the taken taxonomy of the protocol presented in this paper will be helpful for making the best decision protocol.

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