Review Based on the basis of Routing Protocols in MANET scenario

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ABSTRACT

A Mobile Ad-Hoc Network (MANET) is a collection of wireless mobile nodes setting up a lasting network without using any centralized access point, infrastructure, or centralized administration. In MANET's Data transmission from one node to another nodes is requires multiple hops as nodes transmission range is limited which does not extend. Routing in MANETs is a challenging task and has received a tremendous amount of attention from researchers around the world. To overcome this problem a number of routing protocols have been developed and the number is still increasing day by day. It is quite difficult to determine which protocols may perform well under a number of different network scenarios such as network size and topology etc. In this paper we provide an overview of a wide range of the existing routing protocols with a particular focus on their characteristics and functionality. Also, the comparison is provided based on the routing methodologies and information used to make routing decisions. The performance of all the routing protocols is also discussed. Further this study will help the researchers to get an overview of the existing protocols and suggest which protocols may perform better with respect to varying network scenarios.

Keywords: MANET, Routing Protocols, Proactive protocols, Reactive Routing Protocol and Hybrid Routing Protocol.

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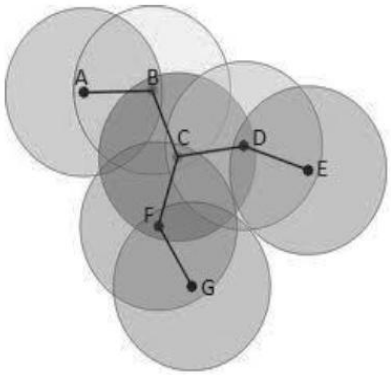
INTRODUCTION:

A Mobile ad hoc network is a group of wireless mobile computers (or nodes); in which nodes collaborate by forwarding packets for each other to allow them to communicate outside range of direct wireless transmission. Ad hoc networks require no centralized administration or fixed network infrastructure such as base stations or access points. A MANET is an autonomous group of mobile users that communicate over reasonably slow wireless links. The network topology may vary rapidly and unpredictably over time, because the nodes are mobile. Such a network may operate in a standalone fashion, or may be connected to the larger Internet. MANETs possess certain characteristics like Bandwidth-constrained, variable capacity links, Energy constrained Operation, Limited Physical Security, Dynamic network topology, Frequent routing updates. Figure 1 shows a mobile ad hoc network with 6 nodes.

Figure1: A Mobile ad hoc network



ROUTING IN MANETS

A Mobile Ad Hoc Network or spontaneous network is an infrastructure less, self-organized and multi-hop network with rapidly changing topology causing the wireless links to be broken and re-established on-the-fly [1]. A key issue is the necessity that the Routing Protocol must be able to respond rapidly to the topological changes in the network.

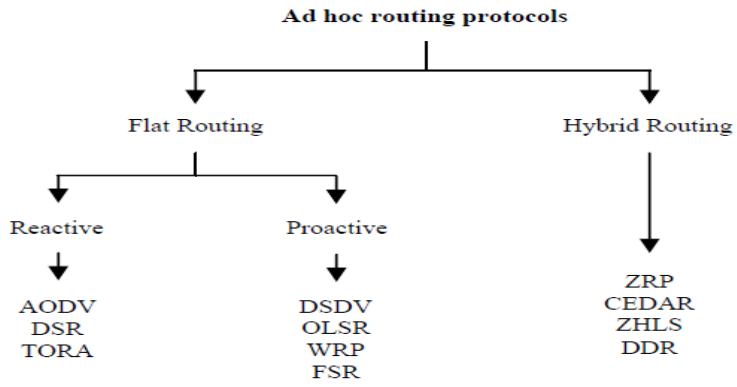
In these networks, each node must be capable of acting as a router. As a result of limited bandwidth of nodes, the source and destination may have to communicate via intermediate nodes [2]. Major problems in routing are Asymmetric links, Routing Overhead, Interference, and Dynamic Topology. Routing in MANETs has been an active area of research and in recent years numerous protocols have been introduced for addressing the problems of routing, reviewed in later sections. These protocols are divided into two broad classes – Reactive and Proactive [3]. In Reactive or on demand RPs the routes are created only when they are needed. The application of this protocol can be seen in the Dynamic Source Routing Protocol (DSR) and the Ad-hoc On-demand Distance Vector Routing Protocol (AODV). Wherein Proactive or Table-driven RPs the nodes keep updating their routing tables by periodical messages. This can be seen in Optimized Link State Routing Protocol (OLSR) and Destination Sequenced Distance Vector Protocol (DSDV). All these protocols are quite insecure because attackers can easily obtain information about the network topology [4]. In Section 2, first we focus on security aspects of MANET Routing Protocols and later in Section 3 we will present classification of the existing RPs, their types and review their characteristics. It also explores some of the proposed secure Routing Protocols, and Section 4 gives the qualitative comparison of their characteristics & categorizes them accordingly to their routing strategies & relationships [5]. Section 5 shows some

assumptions in form of a chart based on the performance of Routing Protocols in terms of mobility and network size.

CLASSIFICATION OF ROUTING PROTOCOLS

We will discuss the classification of existing wireless ad hoc routing protocols, their characteristic features & types. The Routing Protocols for ad hoc wireless networks can be divided into three categories based on the routing information update mechanism. They could be Reactive (On-demand), Proactive (Table-driven) or Hybrid [6]-[15]. Figure 2 shows the three categories of Ad hoc RPs and various proposed Protocols under each category [7, 8, 9]. The table-driven ad hoc routing approach is similar to the connectionless approach of forwarding packets, with no regard to when and how frequently such routes are desired.

Figure 2: Classification of Ad hoc Routing Protocols



This is not the case, however, for on-demand routing protocols. When a node using an on-demand protocol desires a route to a new destination, it will have to wait until such a route can be discovered. On the other hand, because routing information is constantly propagated and maintained in table-driven routing protocols, a route to every other node in the ad hoc network is always available, regardless of whether or not it is needed [10]. In this paper we have presented a critical analysis of the above mentioned secure routing protocols. First we present a comparison between the two broad classes of routing protocols based on their routing methodology and other network.

Proactive Protocols

These protocols always maintain up-to-date information of routes from each node to every other nodein the network.

These protocols continuously learn the topology of the network by exchanging topological information among the network nodes. Thus, when there is a need for a route to a destination, such route information is available immediately. Different protocols keep track of different routing state information [11]. These protocols require each node to maintain one or more tables to store up to date routing information and to propagate updates throughout the network. As such, these protocols are often also referred to as table-driven. These protocols try and maintain valid routes to all communication mobile nodes all the time, which means before a route is actually needed. Periodic route updates are exchanged in order to synchronize the tables. Some examples of table driven ad hoc routing protocols include Dynamic Destination Sequenced Distance-Vector Routing Protocol (DSDV) [12], Optimized Link State Routing Protocol (OLSR) [13] and Wireless Routing Protocol (WRP) [14]. These protocols differ in the number of routing related tables and how changes are broadcasted in the network structure.

Destination-Sequenced Distance-Vector (DSDV)

DSDV is proposed by Perkins and Bhagwat. The Destination-Sequenced Distance-Vector (DSDV) [14] Routing protocol is based on the idea of the classical Bellman-Ford Routing Algorithm with certain improvements such as making it loop-free. The distance vector routing is less robust than link state routing due to problems such as count to infinity and bouncing effect. In this, each device maintains a routing table containing entries for all the devices in the network. In order to keep the routing table completely updated at all the time each device periodically broadcasts routing message to its neighbor devices. When a neighbor device receives the broadcasted routing message and knows the current link cost to the device, it compares this value and the corresponding value stored in its routing table. If changes were found, it updates the value and re-computes the distance of the route which includes this link in the routing table.

Optimized Link State Routing Protocol (OLSR)

Clausen and Jacquet proposed the Optimized Link State Protocol, a point-to-point proactive protocol that employs an efficient link state packet forwarding mechanism called multipoint relaying [16, 17]. It optimizes the pure link state routing protocol. Optimizations are done in two ways: by reducing the size of the control packets and by reducing the number of links used for forwarding the link state packets. Here each node maintains the topology information about the network by periodically exchanging link-state messages among the other nodes. OLSR is based on the following three mechanisms: neighbor sensing, efficient flooding and computation of an

optimal route using the shortest-path algorithm. Neighbor sensing is the detection of changes in the neighborhood of node. Each node determines an optimal route to every known destination using this topology information and stores this information in a routing table. The shortest path algorithm is then applied for computing the optimal path. Routes to every destination are immediately available when data transmission begins and remain valid for a specific period of time till the information is expired.

Ad-hoc On Demand Distance Vector Routing Protocol (AODV)

Ad-hoc on demand distance vector routing protocol: AODV is a very simple, efficient, and effective routing protocol for Mobile Ad-hoc Networks. In AODV there have no fixed topology for mobile ad-hoc networks. It is a loop free routing protocol. It enables multi-hop routing between the participating mobile nodes wishing to establish and maintain an ad-hoc network. This routing protocol is based on the distance vector algorithm. This algorithm uses different messages to discover and maintain links. Whenever a node wants to try and find a route to another node it broadcasts a Route Request (RREQ) to all its neighbors. The RREQ passes through the network until it reaches the destination or the node with a fresh enough route to the destination. Then the route is made available by uncasing a RREP back to the source. The algorithm uses hello messages (a special RREP) that are broadcasted periodically to the immediate neighbors. These hello messages are local advertisements for the continued presence of the node, and neighbors using routes through the broadcasting node will continue to mark the routes as valid. If hello messages stop coming from a particular node, the neighbor can assume that the node has moved away and mark that link to the node as broken and notify the affected set of nodes by sending a link failure notification (a special RREP) to that set of nodes. [4] The following fields exist in each route table entry of AODV [5]:

a. Destination IP Address: The IP address of the destination for which a route is supplied.
b. Destination Sequence Number: It is associated to the route.
c. Next Hop: Either the destination itself or an intermediate node designated to forward packets to the destination.
d. Hop Count: The number of hops from the Originator IP Address to the Destination IP Address.
e. Lifetime: The time in milliseconds for which nodes receiving the RREP consider the route to be valid.
f. Routing Flags: The state of the route; up (valid), down (not valid) or in repair.

Dynamic Source Routing (DSR)

DSR protocol comes under the category of an on-demand/reactive routing protocol. It is a simple and efficient routing protocol intended specifically for use in multi-hop wireless Ad- hoc networks of mobile nodes. DSR allows the network to be completely self-assembling and self-arrangement, without the need for any existing network infrastructure or administration [2]. This protocol uses explicit source routing which means that every time a data packet is sent, it accommodate the list of nodes it will use to be forwarded [6]. This protocol allows to dynamically discovering a route across multiple network hops to any destination. Source routing means that every packet in its header contains the complete sequential list of nodes through which the packet must pass. Two main mechanisms are used in DSR protocol that are: route discovery and route maintenance. These mechanism works together to allow nodes to discover and maintain routes to random destinations in the ad-hoc network. DSR protocol has many advantages over routing protocols like AODV and in small to moderately size networks. DSR protocol performs better than all the above mentioned routing protocols [2]. This allows to dynamically discovering a route across multiple network hops to any destination. Source routing means that each packet in its header carries the fully sequential list of nodes through which the packet must pass. There is no periodic routing of messages in DSR routing protocol, thereby reducing network bandwidth overhead, conservation battery power and avoiding large routing updates throughout the ad-hoc network [4]. In this data packet contains source route in packet header and routes are stored in memory. There is no routing loop in this protocol. If there is any data packet available to send, and it has no route, then route discovery process is initiated. DSR route discovery process is similar to AODV route discovery process.

Every node that receive route request packet, broadcast it, except for destination node or nodes that have route to destination node in their memory. Route through network is built by RREQ packet, and RREP packet is being routed backward to the source. Route that returns RREP packet is cached on the source node for further use. There can be multiple RREP packets on one RREQ packet [6]. During sending process whenever broken link is detected, RREQ packet has been sent backward to the source node. When RREQ packet has been received source node initiates another route discovery operation. The routes that has contains the broken link should be removed from the route cache.

Hybrid Routing Protocol (HRP)

Hybrid Routing Protocols is the combination feature of the two routing protocols that are proactive and reactive routing protocols. It combines the merits of proactive and reactive routing protocols to overcome their demerits. The protocols that come under the category of HRP are:

a. ZRP (zone routing protocol)

ZRP protocol combines the advantage of both reactive and proactive routing protocol into protocols into a hybrid scheme, taking advantage of pro-active discovery within a node's local neighborhood, and using a reactive protocol for communication between these neighborhoods, and using a reactive protocol for communication between these neighborhoods. In a MANET, it can safely be assumed that the most communication takes place between nodes close to each other [1]. The main concept is to use a proactive routing scheme within a limited zone in the r-hoop neighborhood of each node, the reactive routing protocol scheme is to use for nodes beyond this zone. In ZRP two different zone routing protocols are used i.e. inter-zone routing protocol (IERP), intra-zone routing protocol (IARP). An Intra-zone routing protocol (IARP*)* is used in the zone where particular node employs proactive routing and limited by the zones radius hops. This protocol is used by a node to communicate with the interior nodes of its zone whereas Inter-zone routing protocol (IERP*)* is used by a node to communicate outside the zone.

CONCLUSION

Day by day, as the applications of the ad hoc networks are increasing, a continuous research and development in required in the field of MANETs. There are various types of design challenges that need to be taken care of. According to the circumstances and scenarios, various types of MANET routing protocols, such that reactive, proactive and hybrid routing protocols are developed by the researchers. But according to the new scenarios and applications, still the developed protocols are under development for improvement and even new protocols are also under development to meet the challenges. There will always a scope of improvement in the working of the protocols and to make the protocols reliable for deployment, again and again intensive simulation based evaluation of the protocols will be required.

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