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Study of MANET Routing Protocols

TORA, LDR, ZRP.

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Abstract - Ad-hoc networks have opened a new dimension in wireless networks that allows wireless nodes to communicate in absence of centralized support. It doesn't use any fixed infrastructure due to high mobility of nodes and multipath propagations. It may connect hundreds to thousands of mobile nodes with changing topologies. Routing protocols for mobile ad-hoc networks differ from the existing internet protocols which are designed for the fixed structure based wireless networks. MANET protocols have to face more challenges due to dynamically changing of topologies, lack of resources like low transmission power, insufficient bandwidth. Routing becomes one of the main issue in MANETs due to link insecurity, node mobility and frequently changing topologies. A suitable and efficient routing mechanism helps to extend the successful deployment of mobile ad-hoc networks. Existent routing protocols provide routing solutions up to a certain level and most of them are designed and implemented and many researchers are still working on the developments of MANET routing protocols. In this paper MANET Routing protocols such as TORA, LDR and ZRA are discussed.

Key Words: Routing, MANET.

1. Introduction

Wired networks have many limitations in the practical implementation of large networks because of maintaining big network infrastructures. Although wireless networks have huge advantages over wired network, still they have limitations because of no fixed infrastructure. In MANETs the network infrastructure may breaks down due to any critical scenarios like adversity, military attacks, flood and cyclone, earthquake etc. To overcome these limitations researchers work on ad-hoc networks and Mobile Ad-hoc networks. Mobility of nodes is an important property of MANET [3]. One of the important features of this type of network is dynamically change of topologies due node leave or enter into the network. The routing strategy in MANET is not a simple issue. Performances of many routing protocols for MANET are already tested and measured using various simulators. But still it has some limitations due to its complexity. To know the importance of routing in MANET, this paper main focusing is on MANET routing protocols.

2. Routing protocols in MANET

Wireless mobile ad-hoc networks have no fixed infrastructure. A dynamic routing protocol is necessary to function properly on a frequently changing network topology. Here the node itself acts as both source and destination for forwarding and receiving packets to or from other nodes. Routing in MANETs has become a challenging issue. The Internet Engineering Task Force (IETF), MANET working group is working continuously to ensure standardization of routing protocols. The purpose of this working group is to standardize IP routing protocol functionality suitable for wireless routing application within both static and dynamic topologies [2].
There are many protocols already have developed for MANET environments. Based on the network structure the routing protocols can be classified as flat routing, Reactive, Proactive, hierarchical routing and geographic position assisted routing [1].

In flat routing, nodes communicate directly with each other. The flat routing protocols can be classified in three types such as proactive, reactive and hybrid routing protocols. Proactive protocols follow the strategies which are mostly followed by conventional routing protocols. On-demand routing is a new promising technology in MANETs. Hybrid protocols are includes the properties of both proactive and reactive types. MANET routing protocols follow different properties to conventional protocols.
Hierarchical routing plays a major role in large size networks where flat routing protocols are struggling with limitations. Now-a-days geographical location information protocols also provide better routing performance in MANETs.
In proactive scheme, a very small delay is needed to determine the route but a significant amount of delay is needed for creating a route by reactive routing protocols. Pure proactive scheme is not suitable for the ad-hoc networking environment, because it has to maintain the current routing information in a large network. Reactive protocols require considerable control traffic due to the long delay and excessive control traffic. Due to this, pure reactive routing protocols can't be implemented in large networks.

The focus of this paper is on-demand routing protocols that are suitable in MANET environments than proactive approach.

TORA

Temporally-Ordered Routing Algorithm (TORA) is a Hybrid routing protocol which is also known as link reversal protocol. It is efficient in solving the existing limitations in mobile ad-hoc networks. Due to the high mobility of nodes, congestion is severe problem in MANETs. Traditional routing algorithms which are used for wired networks (such as shortest path algorithm, adaptive shortest path algorithm, and link state routing) can not work properly in mobile networks. It is not easy to update the routing tables of dynamic nodes. In TORA routing protocol each node broadcasts a query packet and receives broadcast packet and update. It supports the loop-free; multiple routes services and provides better scalability. For discovering a route, it uses the DAG (Directed Acyclic Graph) and also uses a set of totally-ordered heights at all times. In this method, information may only in one direction. Hence it is only unidirectional; there is no chance to fall in infinite loop and uses four basic operations *route creation*, *route maintenance*, *route deletion* and optimizing routes ([6], [7]).

LDR

Label Distance Routing (LDR) protocol is an on-demand routing protocol. *Count to Infinity* problem is an important issue in on-demand routing protocols and this problem occurs when the routing falls in infinite loop due to failure of link or absence of destination node. To evade this problem it uses destination sequence numbers. It uses this sequence numbers in such a way that destination nodes need to reply less RREQs [10].D*estination sequence numbers* and *feasible distance* are two parameters that are used to perform operations: Destination sequence number and feasible distance (the lowest known distance from a router to a particular destination) are used to rearrange the distance to a destination node, which allows a node to recognize a next hop to report a distance larger than the node's feasible distance. Smallest distance to a destination node is retained by a node for its current sequence number for finding out the destination. In LDR, ordering of nodes has occurred based on the label of each destination, where the label contains value- *feasible distance*. Another main property of LDR is that it ensures always loop free properties [9]. To defeat the limitations of sequence numbers, it uses distance label and two unique parameters: *feasible distance* of DUAL and *sequence number* like AODV.

ZRP

Zone Routing Protocol (ZRP) was first introduced by Haas and Pearlman [8]. It is a hybrid protocol and to perform operations it divides the total network area into different zones. Zone size or radius depends on the number of hops and does not depend on the distance. It is applicable in a wide variety of mobile ad-hoc networks with different mobility across a large span. It uses separate approach to find out new routes for nodes which are lying inside or outside the zone. *MAC level function*, *IARP*, *IERP* and *BRP* are the four elements available in *ZRP*: IARP, proactive protocol is used to discover route inside zone and in links are considered as unidirectional. However in order to communicate with the nodes which locate in different zones and nodes use IERP, on-demand routing protocol. It also follows different approaches, such as routing zone topology and proactive maintenance and globally reactive route using query/reply mechanism is used for improving the efficiency and quality [4].

The ZRP has flexible properties and applications. Zone radius is an important parameter of ZRP and a large routing zone is more suitable for slowly moving nodes and high demand of route scenarios. Network zone would be infinitely large in fixed topology. Pure proactive routing protocols are best suited for fixed internet. Smaller routing zone is suitable for minimum nodes and where demand of route is low and ZRP works as a normal flooding protocol when zone size is one. It uses MAC protocol to identify the direct neighbor nodes, and to identify the other nodes within the zone it uses NDP (Neighbor Discovery protocol) [5].

3. CONCLUSIONS

This paper presents the *theoretical study* of routing protocols for MANETs. In this study it is clear that due to the random mobility of node, routing becomes a complex issue. Till now many routing protocols are used in MANET. Each routing protocol has unique features. Based on network environments, need to choose the suitable routing protocol. Proactive routing protocols are best suited in small networks. In large and dense network, proactive routing protocols can't perform well. Proactive routing protocols are table driven and maintaining thousands of routing tables properly in large network degrades the efficiency.Reactive routing approach plays a major role for large and dense networks. Reactive routing protocols use destination sequence number and feasible distance to ensure a loop free routing. Hybrid routing protocols use reactive and proactive approach in routing operations. The zone based routing protocol- ZRP uses the proactive approach for communication within zone. For the creation of global route it follows the reactive routing.

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