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Routing Algorithms for Mobile Ad-Hoc Network

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Abstract

MANET is a gathering of wireless mobile nodes that actively form a network lacking any support of principal management. Routing in Mobile ad hoc network is very daunting because of its restricted bandwidth, battery constraints, routing expenses, asymmetric link, speed, scalability, packet loss and quality of services. The widely accepted existing routing protocols are designed to accommodate the needs of such self-organized networks. The protocol to be chosen must cover all states of a specified network and never is allowed to consume too much network resources by protocol overhead traffic. This paper deals with the existing routing protocols and scale all techniques together.

Keywords: Adhoc Networking, MANET, Proactive Routing, Reactive Routing, Hybrid Routing.

1. INTRODUCTION

Mobile Ad-hoc Network (MANET) are wireless network which may characterized by dynamic topologies and have no fixed infrastructure. Each MANET node has much smaller frequency spectrum requirements that for a node in a fixed infrastructure network. A mobile ad-hoc network is a gathering of wireless nodes that can dynamically be setup anywhere and anytime without using pre-existing fixed network that's why it plays an important role for communications in military operations, emergency operation for disaster recovery, and for missions like search and rescue [1]. To form an efficient and effective MANET, there are numerous applicable protocols available which are designed to perform its task. It should have peer-to-peer connectivity among themselves. It should be distributed in manner such that in order to increase its reliability. MANET should be access point free. MANET nodes has the

ability to discover a neighbouring mode and service. A routing protocols should be aware of quality of service. Various research communities working in the field of MANET are trying to adopt the protocols and technology in other applications as well. One of the important research areas in MANET is establishing and maintaining the ad hoc network with the use of routing protocols.

2. ROUTING ALGORITHMS

Routing is the process of finding a path from a source to some arbitrary destination on the network. A routing protocol is needed whenever a packet needs to be transmitted to a destination via number of nodes and numerous routing protocols have been proposed for such kind of ad hoc networks. These protocols find a route for packet delivery and deliver the packet to the correct destination. The studies on various aspects of routing protocols have been an active area of research for many year. The key issue in MANETs is that the routing protocols must be able to respond rapidly to topological changes of the network [2]. Routing algorithms are divided into three categories:

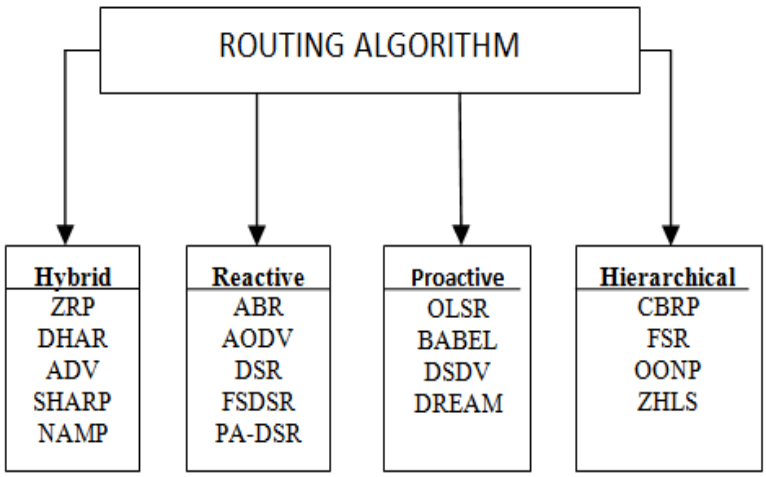

Figure 1. Examples of Routing Algorithms

2.1. Proactive Algorithms

It maintains fresh lists of destinations and their routes by frequently distributing routing tables throughout the network. These are of following types [3]:

2.1.1. Dynamic Destination-Sequenced Distance-Vector Routing Protocol (DSDV)

In this algorithm each node exchanges its neighbor table periodically with its neighbours. Changes at one node in the network propagate slowly through the network. Each node maintains a table which stores next hope, cost metric towards

each destination. Suppose three nodes A,B,C in the network when A receives information from B about a route to C following steps will occur:

Step 1 Let destination sequence number for C at A be S(A) and S(B) is sent from B.

Step 2 if S(A)>S(B), then A ignore routing information received from B.

Step 3 S(A)=S(B), cost of going through B is smaller than the route known to A, then A set B as the next hop to C.

Step 4 If S(A)<S(B), A sets B as the next hop to C, and S(A) is updated equal to S(B).

2.1.2. Optimized Link State Routing (OLSR)

It reduces the overhead control packet size and numbers. In this each node creates a list of its one hop neighbours. Neighbours nodes exchange their list with each other. Based on the received list, each node creates its MPR. Timeout values and validity information is contained within the message conveying information allowing for differing timer values to be used at differing nodes.

2.1.3. BABEL

It is a distance-vector routing protocol for Internet Protocol packet-switched networks that is designed to be robust and efficient on both wireless mesh networks and wired networks. Babel has provisions for using multiple dynamically computed metrics; by default, it uses hop-count on wired networks and a variant of ETX on wireless links, but can be configured to take radio diversity into account or to automatically compute a link's latency and include it in the metric. In October 2015, Babel was chosen as the mandatory-to-implement protocol by the IETF Homenet working group, albeit on an Experimental basis.

2.1.4. DREAM

DREAM is an ad hoc location-based routing protocol. DREAM stands for Distance Routing Effect Algorithm for Mobility.

2.2. Reactive Algorithm

In on-demand routing, as the name indicates routes are created as and when required rather than continuously maintaining up to date topology of network. It follows the technique of flooding a control message throughout the network while discovering a route [4]. It requires less routing information and focuses on minimizing the network traffic overhead but produces huge control packets during route discovery as topology changes occur frequently in MANET.

2.2.1. Associatively-Based Routing (ABR)

This defines a new tyoe of matric “degree of association stability” for mobile ad-hoc network. Here, a route is selected based on the degree of association stability of mobile nodes. Each node periodically generates beacon to announce its existence to its neighbours.

2.2.2. Ad Hoc On-Demand Distance Vector Routing (AODV)

AODV is capable of both unicast and multicast routing. AODV uses sequence numbers to ensure the freshness of routes and to prevent routing loop [5]. In AODV the source node and the intermediate nodes store the next-hop information for each data packet transmission whereas DSR uses source routing in which a data packet carries the complete path to be traversed. The major advantages of AODV are it is loop-free, self-starting, and scales to large numbers of mobile nodes.

2.2.3. Dynamic Source Routing (DSR)

It allow the network to be completely self organizing, this protocols uses two main mechanisms “Route Discovery” and “Route Maintenance” which work together to allow nodes to discover and maintain routes to arbitrary destinations in the as-hoc network.

2.2.4. Flow State in the Dynamic Source Routing (FSDSR)

It is a set of extensions that provide all of the benefits of source routing, without most of the per-packet overhead that is associated with source routing. It works by allowing most packets to be sent without a source route header, thus substantially reducing overhead.

2.2.5. Power-Aware DSR-Based

2.3. Hybrid Algorithms

In hybrid routing a well combination of proactive and reactive routing methods are used which are better than the both used in isolation. It includes the advantages of both protocols. As an example facilitate the reactive routing protocol such as AODV with some proactive features by refreshing routes of active destinations which would definitely reduce the delay and overhead so refresh interval can improve the performance of the network and node. So these types of protocols can incorporate the facility of other protocols without compromising with its own advantages [6]. Hybrid protocols are as below:

2.3.1. Zone Routing Protocols (ZRP)

This protocol is mainly suitable for wide variety of MANET. Each node proactively maintains routes within a local region, which is termed as routing zone. In this protocol route creation is done using a query-reply mechanism. For creating different zones in the network, a node firstly has to know who its neighbor are. A neighbor is a node with whom direct communication can be established. Neighbour discovery information is used as a basis for intra-zone routing protocols.

2.3.2. Dual-Hybrid Adaptive Routing (DHAR)

This routing algorithm uses the distributed dynamic cluster algorithm (DDCA). DDCA dynamically partition the network into some non-overlapping clusters of nodes consisting of one parent and zero or more children. To send a packets to its desired destination, a source node uses the dynamic binding protocol and discover the current cluster ID associated with the destination.

2.3.3. Adaptive Distance Vector Routing (ADV)

It is a distance-vector routing algorithm that shows some on-demand features by varying the frequency and the size of routing updates in response to the network load and mobility patterns.This routing protocol uses an adaptive mechanism to mitigate the effect of periodic transmissions of the routing updates. It advertises and maintains routes for the active receivers only. A node is active if it is the receiver of any currently active connection. This uses a receiver flag in the routing entry, which keeps the information about the status of a receiver whether it is active or inactive.

2.3.4. Sharp Hybrid Adaptive Routing Protocol (SHARP)

This routing algorithm adapts between the reactive and proactive routing by dynamically varying the amount of routing information shared proactively. Sharp defines the proactive zone around some nodes. Node-specific zone radius determine the number of nodes in a proactive zone. The member of that practive zone for any node will be the all nodes within the zone radius of that particular node. Suppose for a given destination a node is not present within a particular proactive zone, reactive routing mechanism is used to establish the route to that node.

2.3.5. Neighbour-Aware Multicast Routing Protocol (NAMP)

This routing protocol uses a tree-based hybrid routing protocol, which utilizes neighbourhood information, as the tree structure is better in terms of packet transmission. This protocol targets to achieve less end –to-end delay of packets, so it uses the tree structure. The source node sends a flood request packet to destination for creating the multicast tree. Data payload is also attached with the flood request

packet. This packet is flooded in the network using dominant pruning method, the main goal to do this is that it actually minimizes the number of transmissions in the network for a particular flood request packet.

2.4. Hierarchical Algorithms

In this, choice of proactive and of reactive routing depends on the hierarchic level in which a node resides. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding on the lower levels [7].

2.4.1. Cluster-Based Routing Protocol (CBRP)

It is an on-demand routing protocol, in this nodes are divided into clusters. When a new node comes up in the network, it has the undecided state. Firstly it starts a timer and to broadcast a HI message. When a cluster-head receives this HI message, then it replies immediately with a triggered HI message. When the node receives this answer, it changes its state into the member state.

2.4.2. Fisheye State Routing (FSR)

It uses a special structure of the network called the fisheye. It reduces the amount of traffic for transmitting the update messages. The basic idea of this is that each update message does not conatin information about all nodes. But it contains update information about the nearer nodes.

2.4.3. Order One Network Protocol (OONP)

It is an algorithm for computers communicating by digital radio in a mesh network to find each other, and send messages to each other along a reasonably efficient path. It was designed for, and promoted as working with wireless mesh networks.

2.4.4. Zone-Based Hierarchical Link State Routing Protocol (ZHLS)

ZHLS, where whole network divided into non overlapping zones as in cellular networks. Each node knows the node connectivity of its own zone and the zone connectivity information of the entire network. This uses the two levels for routing: node level and global zone level. It does not have any cluster head in the network. Only zone ID and node ID of a destination are needed for routing, the route from a source to a destination [8].

3. DIFFERENTIATION OF ROUTING ALGORITHMS

Specifications	Hybrid	Proactive	Reactive
Structure	Hierarchical	Flat and Hierarchical	Flat
Information	Rely upon requirement	Saved in Table	Don't Save
Availability	Rely upon destination location	Continually Available	As per Need
Requirements	Rely upon size of the cluster	Huge	<Proactive
Periodic Route Updates	Necessary inside each zone	Required	No
Traffic Control Volume	Under two types	High	Low
Delay Level	For local destinations small & high for interzone	Low	High
Scalability	>1000	<100	>100

4. CONCLUSION

This paper explains and differentiate in most of routing protocols which are categorized broadly in proactive, reactive, hybrid and hierarchical routing protocols. As proactive routing protocols maintains routes to all the nodes in the network all the time. Making routes all the time makes proactive as the excessive routing overhead transmitted. On the other hand reactive protocols search the route only when they are needed but they stll may generates huge amount of traffic when network changes frequently. It is better tp apply a hybrid or hierarchical protocol instead of proactive and reactive because these often poses the advantages of both proactive and reactive protocols.

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