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A Survey on Hybrid Routing Protocols to Deploy Mobile Ad-hoc Networks

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Abstract: Mobile ad-hoc networks is self-configurable temporary network for information interchange which is set up in emergency and need based situation. With dynamic movement of nodes routing became critical issue in MANET. In this paper various routing protocols available for MANET are discussed with their particular merits and demerits and exclusively discussed about hybrid routing protocols such as ZRP, ZHLS, M-ZHLS, SURZE and SHARP. The architecture of the ZRP is presented in detailed describing intra-zone, inter-zone, boarder cast routing.
Keywords: MANET, Routing, ZRP, M-ZHLS, SURZE

1. Introduction

Ad-hoc networks are portable remote systems without settled framework, hubs are not fixed rather every hub goes about as a switch and advances activity from different hubs. Ad-hoc networks systems fundamentally utilized for military works such to set up temporary networks at battle field. Mobile Ad-hoc Network is a sort of Ad-hoc connects quickly with dynamic topology [3]. The hubs in a MANET are very versatile, the topology changes much of the time and the hubs are powerfully associated in a discretionary way. The rate of progress relies upon the speed of the hubs. In this classification of system every hub demonstrations both as a host and a switch which advances the information expected for some other hub. In addition, gadgets are little and the accessible transmission control is constrained. The low transmission control restrains quantity of neighbor hubs, which additionally expands the rate of progress in topology as the hub moves. The paper is organized in the following way, chapter-1 introduces routing mechanism and routing protocols of the MANET, chapter 2 describes hybrid routing protocols and ZRP in detail, chapter 3 gives the conclusion of the paper and chapter 4 list outs the references.

A. Routing mechanism in MANET

The MANETs are distinguished by a multi hop network topology that can alter rottenly due to mobility, well organized routing algorithms are required to for effective communications between the nodes. A variety of solutions have already been proposed. These protocols exchange routing messages in specified time intervals on dynamic network changes [1] [2]. Different of routing protocols are proposed for the Mobile Ad-hoc Network they can be broadly categorized as: table-driven routing protocols, On-demand routing protocols and Hybrid routing Protocols [3] as shown in following Figure.1.

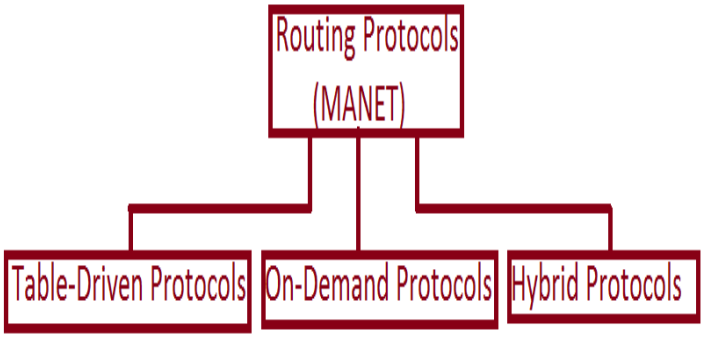

Figure-1: Types of routing protocols.

B. Types of Routing Protocols

(i) Table-driven routing Protocols:

This routing protocol is also called proactive routing protocol which maintains stable, update routing messages of hubs s in network by broadcasting, route updates at fixed specified gaps. These protocols dynamically examine the route update in regular intervals and update the nodes with latest information regarding routes and status of the nodes. These protocols are best suited for the in the network where there is active participation of all the nodes. But if any node became idle after specified period then that node is unnecessarily updated with latest routing information this wastes much of the band width and time of the network, this drawback can be resolved by proposing on demand routing protocols. [17] [13] Some of the table driven routing protocols are Destination Sequenced Distance Vector Routing Protocol, Zone based Hierarchical Link State Routing Protocol, Wireless Routing Protocol, Global State Routing, Fisheye State Routing, Cluster head Gateway Switch Routing Protocol, Hierarchical State Routing,

(ii) On-Demand routing Protocols:

This routing protocol is also called Reactive protocols. These protocols establish the routes to the destination when there is a need for it; normally it is initiated by the source node using node discovery process within the network. When compared to proactive routing, reactive routing does not endeavor to continuously determine network connectivity. Instead, a route determination method is invoked on demand when a packet needs to be forwarded. Some of the on demand routing protocols are [17] [3] , Dynamic Source Routing Protocol, Cluster based Routing Protocol, Ad hoc On-demand Distance Vector Routing Temporally Ordered Routing Algorithm, Associatively Based Routing, Signal Stability Routing

(iii) Hybrid Protocols:

Table driven and on demand routing protocols works well within specified region and are limited for fewer applications having merits and demerits but if these protocols are combined they can be applied for better applications. In this mechanism nearby routes are updated proactively and for far-away routes reactive routing mechanism is applied. This kind of approach is called hybrid routing protocols. This routing protocol brings the advantages of the proactive and reactive approaches together [2]. Some of the hybrid protocols are: Zone Routing Protocol (ZRP), Zone Based Hierarchical Link State Routing Protocol (ZHLS) routing protocol.

2. Hybrid Protocols

The Hybrid Routing Protocol can also be defined in term of routing protocols that it is a network routing protocol that brings the features of Distance Vector Routing Protocol (DVRP) and Link State Routing Protocol (LSRP) together. It is used to get the best route in terms of cost and reliability to the destination routes and for updating network changes. This routing protocol is also called as Balanced Hybrid Routing. In the following section ZRP and ZHLS Hybrid routing protocols discussed in detailed.

A. Zone Routing Protocol (ZRP) [11]

This protocol structure is composed the following three modules:

- Intra-zone [12]
- Inter-zone [13]
- Bordercasting [14]

In ZRP, every node has a zone which is defined to be the nodes within the distance of *n* hops. Within the zone, intra zone routing protocol, which is a proactive protocol, is adopted to maintain the local topology. When a path between different zones is require, Intra zone routing protocol, which is a reactive protocol, is used to find the route between the source and destination. Border cast is efficient broadcast methods which minimize number of duplicate forwarding in route discovery of inter zone routing protocol.

(i) ZRP Architecture:

The Zone Routing Protocol, as its name implies, is built on the notion of zones. A routing zone is defined for each node separately, and the zones of neighboring nodes overlap. The routing zone has a radius ‘r’ expressed in hops. The zone thus includes nodes, whose distance from the node in the network at most r hops.

(ii) Routing in ZRP:

A node that has a packet to send first checks whether the destination is within its local zone using information provided by Intra-zone routing. In that case, the packet can be routed proactively. Inter zone routing protocol is used if the destination is outside the zone, It has the route request phase and route reply phase to accomplish inter zone routing.

(iii) Intra-Zone Routing Protocol:

It can be any link state or distance vector routing protocol, maintained only within a zone. During the network establishment its zone size can be decided. There may be more updates of the networks are required if its size is too large. If it is too small, often resort to reactive methods. The routing of Inter-zone protocol is depicted in Figure 2.

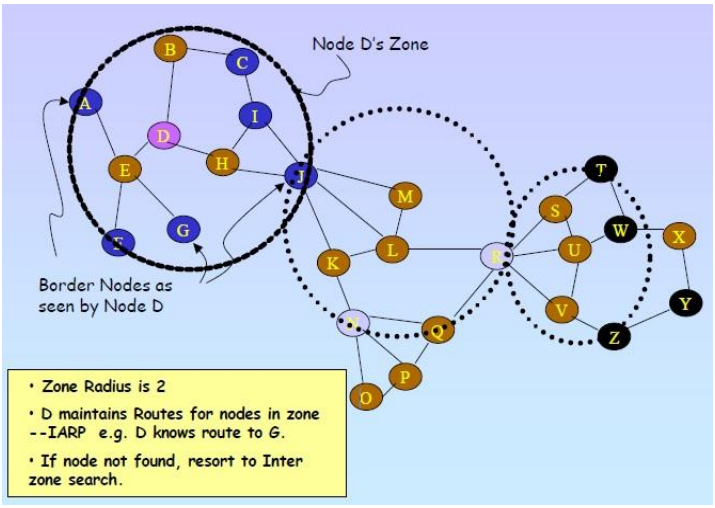

Figure 2: The routing of Intra-zone protocol

(iv) The Inter Zone Routing Protocol:

If the intra zone routing protocol cannot find the destination, i.e., the destination is further a node's zone, then Inter zone routing protocol is invoked. It is a reactive protocol that initiates the discovery of the destination node. The routing of Inter-zone protocol is depicted in Figure 3.

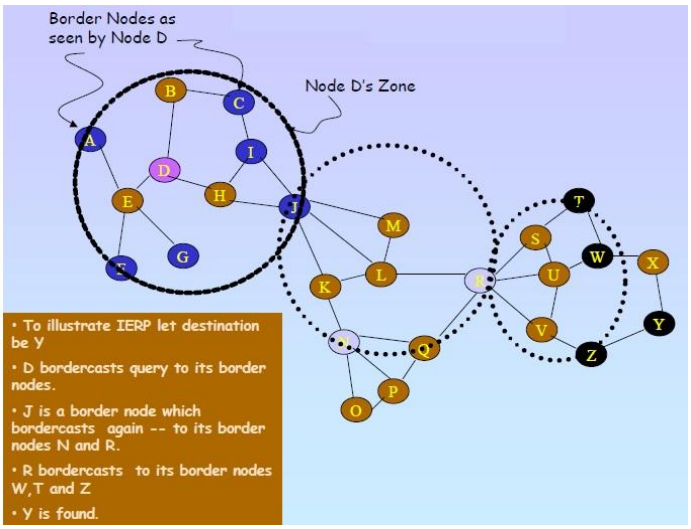

Figure 3: The routing of Inter-zone protocol

(v) Border casting Routing Protocol:

The hub would coordinate the inquiry message out just to its fringe hubs. These hubs would execute a similar calculation that the essential hub executed which is verify whether the goal can be found inside its zone, If yes, send a route reply back to the source, showing the route to the goal. If not, forward the route request demand to its fringe hubs which execute a similar technique

(vi) The advantages of ZRP:

- Because intra zone routing protocol is proactive, the route towards the node within the zone is available before it's needed, thus the delay and overhead of route discovery is avoided;
- Because the periodic broadcast of topology information is confined within the zone, the change of link status at one end of the network will not affect the other end of the network;
- Since both reactive and proactive methods are used, it gives good performance. Since hierarchical routing is used, route to a destination is optimal.
- It minimizes the control traffic with periodic flooding of routing message packets.
- It minimizes the wastage of bandwidth and overhead control compared to reactive methods.

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(vii) The Disadvantages of ZRP:

- There is higher amount of memory required as node has maximum topological information.
- There is a overlapping of routing zones.

B. Scalable Unidirectional Routing with ZRP Extensions (SURZE):

There may be unidirectional links in the networks; if it exists it is difficult to find the nodes in the zones. To describe this assume (Figure 2) node A does not know of the presence of node B, as there is a unidirectional link from B to A and the large inclusive cycle. Then B will insert its in-bound tree which informs A that the nodes, G, H and I have a route to B. When enquiring for B, A inserts this information in its query packet. Thus, when a border node for example D is three hops away from A and hence is a border node searches for the destination (in this case B), it inserts the alternate destinations G, H and I in its query packet. This recursive method is predicted to help in faster node discovery. Disadvantage is outdated message may be broadcasted when there is high mobility

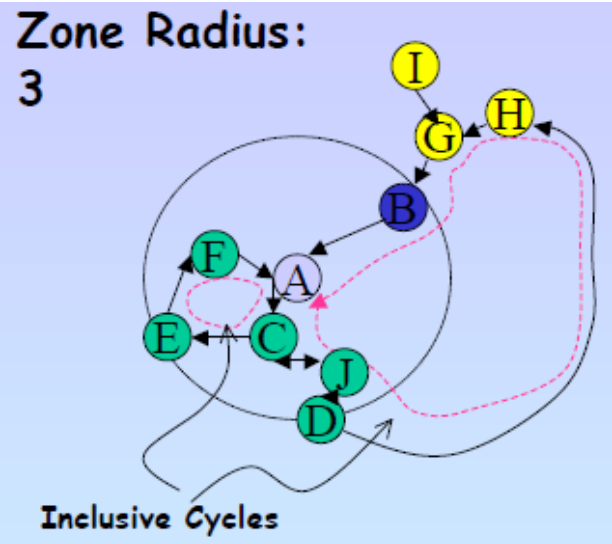

Figure 4: Unidirectional routing in ZRP.

C. Zone Based Hierarchical Link State Routing Protocol (ZHLS) [3]

It is a hierarchical protocol, where the network is divided into non-overlapping zones. Moreover, mobile nodes need to acquire their physical locations with the help from a locating system like GPS. Each node only knows the node connectivity within its zone and the zone connectivity of the whole network.

All system nodes in ZHLS develop two routing tables, an intra-zone routing table and a between zone routing table. ZHLS utilizes hierarchical address scheme address plot which contains zone ID and hub ID. It is accepted that a virtual connection associates two zones if there exists no less than one physical connection between the zones. A two level system topology structure is characterized in ZHLS-the hub level topology and the zone level topology. Similarly, there are two sorts of connection state refreshes the hub level Link State Packet (LSP) and the zone level LSP. A hub intermittently communicates its hub level LSP to every other hub in a similar zone. In ZHLS, portal hubs communicate the zone LSP all through the system at whatever point a virtual connection is broken or made. Therefore, every hub knows the present zone level topology of the system. Before sending packet, a source right off the bat checks its intra-zone routing table.

If the destination is in the same zone as the source, the routing information is already there. Otherwise, the source sends a location request to all other zones through gateway nodes. After a gateway node of the zone, in which the destination node resides, receives the location request, it replies with a location response containing the zone ID of the destination. The zone ID and the hub ID of the goal hub will be indicated in the header of the information bundles started from the source. Amid the bundle sending strategy, halfway hubs aside from hubs in the goal zone will utilize between zone routing tables, and when the message arrives the goal zone, an intra-zone routing table will be utilized [6].

(i) ***Advantages:*** It has no overlapping zones. The zone-level topology information is distributed to all nodes. It reduces the traffic and avoids single point of failure.

(ii) ***Disadvantages***: The additional traffic produced by the creation and maintenance of the zone-level topology

E. Sharp Hybrid Adaptive Routing based protocol (SHARP)

Sharp Hybrid Adaptive Routing Protocol (SHARP), which make use of this basic trade-off between proactive versus reactive routing to search balance between route messages broadcasted proactively and route messages that is left up to on demand discovery. SHARP use of both a proactive and a reactive protocol to perform routing. Each SHARP node obtains the network neighborhood, known as proactive zone, in which routing information related to itself is communicated proactively. This relies on a novel proactive routing algorithm that is both efficient and analytically tractable. However, it can utilize any reactive routing algorithm whose costs can be measured analytically like AODV. It finds the “sweet spot” between the two routing zones by dynamically adjusting the range of proactive and reactive routing. This limit is dictated by a analytical model determined in this and guided by powerfully performed experimental estimations from the physical system. Prerequisites for arrange execution change among applications.

Multi-media applications can tolerate high loss rates, but are sensitive to variations in delay. TCP traffic is sensitive to loss in the network, while gadgets running on battery power are concerned with the routing overhead. However, applications have no control over the performance of traditional routing protocols. In contrast, SHARP enables each application to pursue different metrics for guiding the inherent trade-off between increased overhead for proactive information dissemination versus minimized latency and loss rate. Each SHARP node can separately pursue different application-specific performance guarantees. For instance, one node may direct SHARP to adjust its route information to reduce delay, while another node concurrently uses SHARP to reduce packet overhead.

F. Multilevel Zone-Based Hierarchical Link State Routing (M-ZHLS)

To reduce communications overhead and location search overhead and to realize a hierarchical network, multilevel zone-based hierarchical link state (M-ZHLS)[18] routing is proposed with a location search technique applying hierarchical request for mobile ad hoc networks. The proposed protocol reduces the communication overhead by hierarch zing the network into multilevel zones. In this protocol, a high-level zone consists of several low-level zones. To reduce location search overhead, location search is performed by each higher-level gateway node searching its own lower-level zones. The proposed protocol enables the source node to request the zone ID of the destination node for each zone

3. Conclusion

This paper explored hybrid routing protocols for Mobile Ad-hoc Networks. Based on the study of different routing protocols it is concluded that each of them are having merits and demerits with their

circumstances of applications. The ZRP protocol is studied in detailed by emphasizing the intra, inter and broadcast modules of ZRP. The extensions of ZRP protocol Scalable Unidirectional Routing with ZRP Extensions (SURZE) is discussed in case of uni-directions in the routing area. The Zone Based Hierarchical Link State Routing Protocol (ZHLS) is hierarchical routing protocol used for non-overlapping zones is briefed. The routing protocol using the mixture of good capabilities of proactive and reactive routing protocol called Sharp Hybrid Adaptive Routing based protocol (SHARP) is discussed, it works perfectly when the zone radius is zero but rise in zone radius also increases the overhead in this protocol. Hence when the zone size is smaller than SHARP protocol is preferred; finally the paper described Multilevel Zone-Based Hierarchical Link State Routing (M-ZHLS) which is used to reduce communications overhead and location search overhead. In future there is still lot much of work need to done in ZRP, different proactive and reactive routing protocols can be used to improve performance and routing overhead of ZRP.

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