A Survey on Zone Routing Protocol Techniques

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***Abstract* — In Mobile Ad-hoc Networks (MANET), the nodes intercommunicate through single-hop and multi- hop paths in a peer-to-peer fashion. Intermediate nodes between two pairs of communication nodes act as routers. For constructing the mobile ad-hoc network the routing algorithm play an important role. The performance evaluations of the routing protocol for MANET are evaluated via simulation. Routing protocols for mobile ad- hoc networks have to face the challenge of frequently changing topology, low transmission power and asymmetric links.. The Zone Routing Protocol (ZRP) is a combination of the proactive and reactive routing protocol and maintaining an up-to-date geography map on each node of a zone centred. The routes are instantly available within the zone. The destination node which are outside the zone in the zone routing protocol, this protocol employs a route discovery procedure that can benefit from the local routing information of the zones.**

Keywords:MANET,ZRP,DSDV,CGSR,TBRPF,OLSR,WRP

I. INTRODUCTION

In ad-hoc networks there are no fixed infrastructure. There are no fixed routers instead each node acts as a router and forwards traffic from other nodes. Firstly, the ad-hoc networks were used for military applications. Since then, they have become increasingly more popular within the computing industry. Applications include emergency search-and rescue operations, deployment of sensors, conferences, exhibitions, virtual classrooms and operations in environments where construction of infrastructure is difficult or expensive. Because of the lack of infrastructure ad-hoc networks can be rapidly deployed
.The topology changes very often as the nodes in a MANET are highly mobile and the nodes are dynamically connected in an arbitrary manner. The rate of change depends on the velocity of the nodes. Likewise the devices are small and the available transmission power is limited. Therefore, the radio coverage of a node is small. When the nodes move the rate of change in the topology increases due to the low transmission power it limits the number of neighbour nodes.. As long as there are differences in transmission capacity, few links may be unidirectional. Due to the link instability, node mobility and the topology changes frequently the routing becomes difficult.

The Ad hoc wireless network routing protocols are basically divided into pro-active routing and re-active protocols. The Proactive routing algorithms maintain up-to-date routing information between every pair of nodes in the network by proactively propagating route updates at fixed time intervals. When a request comes in before forwarding it this protocol learns the network topology. Since the proactive routing algorithms maintain up-to-date routing information for all nodes in the network, a route is found immediately it is requested. This protocol is having an advantage of low latency in discovering new routes and minimizes the end-to-end delay. Examples of proactive protocols are Destination-Sequenced Distance Vector (DSDV) [15], Optimized Link-State Routing (OLSR) [17], Cluster- Head Gateway Switch Routing Protocol (CGSR) [16], Wireless Routing Protocol(WRP)[16] and Topology- Based Reverse Path Forwarding (TBRPF) [8] Protocols.

While on the other hand, the Reactive algorithms are also called on-demand routing algorithms establishing a route when a request comes by initiating a route discovery process. Once the path has been established the nodes keeps it until the destination is no longer accessible. When a node is willing to forward a request, the re-active routing protocol becomes active. The re- active protocols are having an advantages over pro- active .The re-active protocols are more efficient in terms of control overhead and power consumption because routes are created dynamically when required Some of the re-active routing protocols are Dynamic Source Routing Protocol (DSR) [11], Ad Hoc On- Demand Distance-Vector Routing Protocol (AODV) [8] [10], Temporally Ordered Routing Algorithm (TORA) [15], Associatively-Based Routing (ABR) and Preferred Link-Based Routing Protocol (PLBR) [14] [15].

Regardless a reactive protocol gives the low overhead of control messages, it has higher latency in discovering routes the routes are determined by using flooding route request packet in the network and builds the route on demand from the responses it receives. On the other hand, proactive protocols need periodic route updates to keep information updated and valid, also many available routes might never be needed all these increases the routing overhead and consume large amounts of bandwidth [13].

II. THE ZONE ROUTING PROTOCOL

As seen, to maintain routing information the proactive routing uses excess bandwidth, while reactive routing comprise long route request delays. Reactive routing also inadequately floods the entire network for route determination. The Zone Routing Protocol (ZRP) [4][5] aims to address the problems by combining the best properties of both approaches. ZRP can be classed as a hybrid reactive/proactive routing protocol [3].

Te largest part of the traffic is directed to nearby nodes in an mobile network. For this reason, ZRP slow down the proactive scope to a zone centred on each node. It is easier to maintain the routing information in an limited zone. Further, the amount of routing information that is never used is minimized. Still, nodes farther away can be reached with reactive routing. Since all nodes proactively store local routing information, Route requests can be more efficiently performed without querying all the network nodes [3].

ZRP has a flat view over the network irrespective

the use of zones,. In this way, the other overhead related to hierarchical protocols can be avoided. Hierarchical routing protocols depend on the strategic assignment of gateways or landmarks, so that every node can access all levels, especially the top level. Nodes belonging to different subnets must send their communication to a subnet that is common to both nodes.

Hence, optimal routes can be detected and network congestion can be reduced [5].

Further, the behaviour of ZRP is adaptive. The behaviour depends on the current configuration of the network and the behavior of the users [3].

A. Architecture

The Zone Routing Protocol is based on the concept of zones. For each node and their overlapped neighbouring nodes routing zone is defines. The routing zone has a radius Φ expressed in hops. The zone thus includes the nodes, whose distance from the node in question is at most Φhops. Figure 1 shows the example of routing zone, where the routing zone of S includes the nodes A–I, but not I. In the illustrations, the radius is marked as a circle around the node in question. The zone is defined in hops, not as a physical distance [3].

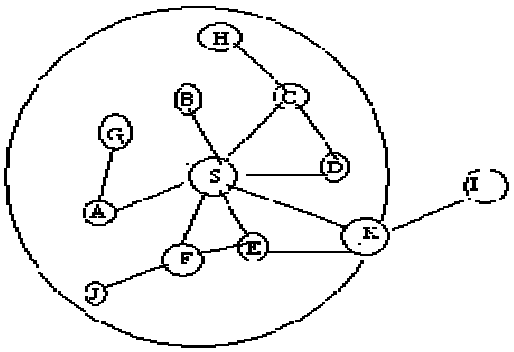

Figure 1: Example routing zone with Φ =*2*

There are two types of nodes in the zone, peripheral nodes and interior nodes. In case of Peripheral nodes the minimum distance to the central node is exactly equal to the zone radius Φ. The nodes whose minimum distance is less than Φ are interior nodes. In Figure 1, the nodes A–F are interior nodes, the nodes G,J,K,H are peripheral nodes and the node I is outside the routing zone. There are two paths from S to H, one with length 2 and one with length 3 hops. The node is within the zone and the shortest path is less than or equal to the zone radius [3] [4].

By adjusting the transmission power of the nodes, the number of nodes in the zone can be regulated. The number of nodes within direct reach and vice versa can be reduced by lowering the power. To provide adequate reach ability and redundancy the number of neighbouring nodes should be sufficient. On the other hand, a too large coverage results in many zone members and the update traffic becomes excessive. Further, large transmission coverage adds to the probability of local contention [3].

To detect a new neighbour nodes and link failures, the ZRP relies on a Neighbour Discovery Protocol (NDP) provided by the Media Access Control (MAC) layer. NDP transmits "HELLO" beacons at regular intervals. When a beacon is received, the neighbour table is updated. Within a specified time there has been no beacon received, are removed from the table. If the MAC layer does not include a NDP, the functionality must be provided by IARP [6].

The relationship between the components is illustrated in Figure 2. Route updates are triggered by NDP, which notifies IARP when the neighbour table is updated. IERP uses the routing table of IARP to respond to route queries. IERP forwards queries with BRP. BRP uses the routing table of IARP to guide route queries away from the query source [5].

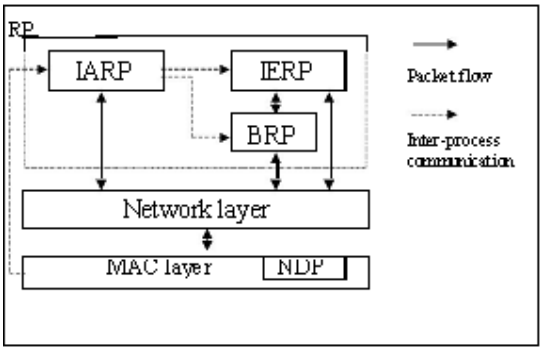

Figure 2: ZRP architecture

III. ZRP LIMITATIONS

Although ZRP is a combination of the proactive and reactive routing algorithms .some of the major issues are outlined below

• Power Management – The packets are forwarded with full power without considering the Node's position inside the zone. Since according to Inverse Square Law, the power received by the receiving node is inversely proportional to square of the distance between the nodes

$$\gamma = Pt / 4\pi(r*r) \quad (1)$$

The node could waste power if the distance between the sender and the receiver node is less.

• Bandwidth Utilization – When the distance between the sender and border nodes increases the zone area will also increase, that means the border nodes will not be reachable in the zone. For this reason, the number of broadcasts will increase by the sender node to find the border nodes in the zone, which will obviously increase the bandwidth utilization.

IV. NEED FOR ENERGY MANAGEMENT IN MANETS

The nodes in an ad hoc wireless network are constrained but limited battery power for their operation.. Energy management deals with the process of managing energy resources by means of controlling the battery recharge,

adjusting the transmission power, and scheduling of power sources so as to increase the lifetime of the nodes of an ad hoc wireless network. The energy efficiency of a node is defined as the ration of the amount of data delivered but the node to the total energy expended.

The reasons for energy management in ad hoc wireless networks are:
1. As the field of mobile computing and communication advances, there is an increasing gap between the power consumption requirements and power availability and it adds to the importance of energy management.
2. In war like situations, it is difficult to recharge the batteries. Hence, energy conservation is necessary.
3. To utilize the battery capacity in the best possible way, energy management techniques are necessary.
4. The transmission power increases the number of simultaneous transmissions.
5. Power control is essential to maintain the required signal to interference ratio (SIR) at the receiver and to increase the channel reusability.
6. If the relay traffic allowed through a node is more,
then it may leads to a faster depletion of the power source for that node.

Based on the operations mode the power consumption can be measured. These modes can be categorized into following: (i) transmit mode, (ii) receive mode, (iii) idle mode, and (iv) sleep mode [7].

V. COMPARISION OF ZRP WITH OTHER PROTOCOLS

Dynamic source Routing(DSR)	Zone Routing Protocol(ZRP)	Temporally Ordered Routing Algorithm(TORA)
Uses source routing	Fast convergence and very flexible algorithm	Distributed execution
Provides loop-free routes	Provides multiple loop free routes increasing robustness and performance	Loop-free routing
Supports unidirectional links and asymmetric routes	Uses flat-routing instead of hierarchical and so it reduces the organization overhead	Multi-path routing,
With the optimizations available it is a good choice for an ad hoc network	The protocol finds fast optimal routes, reducing the threat of congestion and minimizes route acquisition time	Reactive or proactive route establishment and maintenance

VI CONCLUSION

Frequently changing topologies, low transmission power and asymmetric links are the major challenge in the routing protocol. It has been observed that both proactive and reactive routing protocols are inefficient under these circumstances. The Zone Routing Protocol (ZRP) combines the advantages of the proactive and reactive approaches by maintaining an up-to-date topological map of a zone centered on each node. The routes are immediately available within the zone,. The routes are instantly available within the zone. The destination node which are outside the zone in the zone routing protocol, this protocol employs a route discovery procedure that can benefit from the local routing information of the zones. Based on the evaluations studied in this paper, we can conclude that ZRP is a Fast convergence and very flexible algorithm. It provides multiple loop free routes increasing robustness and performance. It is important to utilize the battery capacity in the best possible way by using energy management techniques. The future scope of this protocol is to study the performance and efficiency of the ZRP protocol and implement it for a large network with voice application.

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