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New Scheme of Adaptive Zone Routing Protocol

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ABSTRACT

This paper proposed a routing protocol named adaptive Zone Routing Protocol (NSAZRP) that is more stable and has achieved better routing performance than ZRP in Mobile Ad-hoc Networks by taking into consideration that nodes are mobile with a non-uniform speed. NSAZRP allows different nodes to choose different zone radius according to each node's discrete mobility. NSAZRP modifies the ZRP and speed of the nodes in a MANET can be determined within a reasonable approximation by utilizing the signal strengths received from the neighboring nodes. Three protocols that are used in ZRP i.e. IARP, IERP and BRP are also used in our protocol. Only difference is that the radius of each node will be adapted to the mobility and traffic pattern. Any proactive routing protocol like DSDV can be used as IARP and any reactive routing protocols e.g. DSR, TORA etc can be used as IERP, and BRP will control the flooding of control packets in the network and utilizes the information maintained by IARP to find routes to distinct nodes. Simulation results show that NSAZRP can adapt well to the more complicated and practical Ad hoc applications.
Keywords: Ad Hoc, ZRP, AZRP, NSAZRP, Routing Zone, Single Strength

1. INTRODUCTION

Wireless ad hoc network is a self-organized network or multi-hop wireless network in which every node can serve as router to forward packet for other nodes. Zone routing protocol ZRP [2] is a typical routing protocol for mobile ad hoc network. ZRP assumes all nodes move with uniform speeds. Each node is set a same zone radius which leads to tremendous different protocol performances for network with different node moving speed.

To gain better and more stable routing performance in scenarios where mobile nodes move with non-uniform speeds, New Schemes Adaptive Zone Routing Protocol (NSAZRP) is proposed which allows different nodes choose different zone radius according to each node's distinct speeds. In NSAZRP protocol, the intrazone active routing protocol and bordercast resolution protocol of ZRP are redesigned. Several examination control mechanisms to reduce the routing lookup overhead are also included [1]. Simulation results of NSAZRP and ZRP on OMNET 4.0. Show that NSAZRP performs better than ZRP in the circumstances where nodes move non-uniformly.

Considering the readability and internality, the rest of this paper is organized as follows. Section 2 introduces the theory basis of ZRP protocol. Section 3 describes the New Schemes Adaptive ZRP (Mobility/ traffic pattern). Section 4 Proposed Protocol and algorithm 5 Section presents and analyzes the simulation results of NSAZRP protocol. Section 6 concludes this paper and gives the future prospects.

2. ZONE ROUTING PROTOCOL

ZRP (Zone Routing Protocol) is a wireless Ad hoc routing protocol using both active routing and on-demand routing policies. It divides the whole network into several node-centred routing zones whose radii are the same certain number of hops. ZRP has high zone-overlapping degree. Many nodes may belong to multiple zones at the same time. Setting an optimum zone radius is an important factor which determines the efficiency of ZRP [1].

ZRP protocol includes three sub-protocols, i.e. IARP (IntrAzone Routing Protocol); BRP (Bordercast Resolution Protocol) and IERP (IntErzone Routing Protocol).

IARP sub-protocol can use any kind of active routing protocols which maintain the route of entire routing zone. Traditional active link-state protocols which maintain routing of the entire network can be restructured as IARP.

BRP uses the intrazone routing information provided by IARP to construct a bordercast tree. The query packet from the source node is efficiently forwarded along the bordercast tree to the regions of the network which haven't been queried before.

IERP is responsible for discovering the route to the destination nodes outside the region on demand [1].

3. NSAZRP (MOBILITY/TRAFFIC PATTERN)

Each node has its own mobility pattern:

- Speed ranges from 0-40 m/s.

Each node is assigned a zone radius depending upon its mobility pattern.

- Nodes with high mobility are assigned smaller zone radii and stationary nodes are assigned highest radii.

Three protocols that are used in ZRP i.e. IARP, IERP and BRP are used as such in such in our protocol.

Only difference is that the radius of each node will be adapted to the mobility and traffic pattern.

Any proactive routing protocol like DSDV can be used as IARP and any reactive routing protocol e.g. DSR, TORA etc can be used as IERP, and BRP will control the flooding of control packets in the network and utilize the information maintained by IARP to find routes to distant nodes.

4. NSAZRP PROTOCOL

- The nodes will proactively record the signal strength from its neighbours in a circular queue.
- As the signal strength inversely proportional to d where >= 2 depending upon the environment. We usually take as 3
- We can calculate the speed of the node depending upon the recent changes in signal strengths from the neighbours by using the equation.

Depending upon the calculated speed we assign the zone radii to the nodes as shown below.

1. >= 40 m/s : radii 0;
2. 30-40 m/s : radii 1;
3. 20-30 m/s : radii 2;
4. 10-20 m/s : radii 3;
5. 05-10 m/s : radii 4;
6. < 05 m/s : radii 5.

1. The radii of each node will adapt to the mobility pattern of each node.
2. Then the ZRP is used as routing protocol according to the radii of nodes.

5. SIMULATION AND ANALYSIS

We simulate NSAZRP and ZRP on OMNET 4.0 and then measure up to and analyze their performance. In the simulation, nodes are at random circulated in a rectangle area with a size of 1500m×1500m. A node at a random location travels to a goal with a speed and an angle, after a pause time at the goal, the node at random chooses a new direction and move back when it reaches the boundary of the area. This movement will not stop until the end of the simulation. Each node uses the same transceiver tools.

The antenna is Omni directional with a stable emission radius. The MAC layer adopts the 802.11b protocol. The ability of radio channel is 2Mb/s. The node uses the exponential back off algorithm to avoid confliction. Data is generating in the mode of CBR. All the simulations last for 300 seconds. Each point on the simulation result figure is the average of five simulations using dissimilar random seeds.

We extract following performance values: Packet Delivery Ratio; Normalized Routing Overhead; Routing Discovery Delay. We do two groups of simulation on three network views shown in Table 1. The difference between these two simulation environments mainly lies in the traffic load and pause time of mobile nodes.

Table 1
Parameters for the Three Views

View Name	*number of nodes*					
	< 5 m/s	*5-10 m/s*	*10-20 m/s*	*20-30 m/s*	*30-40 m/s*	*40 m/s =<*
View -1	50	50	50	50	50	50
View -2	90	75	60	45	30	15
View -3	15	30	45	60	75	90

A. The First Group of Simulation and Result Analysis

To the three scenes of Table 1, we set the first group of simulation parameters as shown in Table 2. In Fig.2, the abscissa 0, 1, 2, 3, 4, 5 correspond to ZRP with three different radii; "hybrid" corresponds to VBAZRP with hybrid-radius.

Table 2
Simulation Parameters for the First Group

Session Number	Data Generation Rate	Pause Time
15	2.0pkts/s per session	0s

I. Packet Delivery Ratio

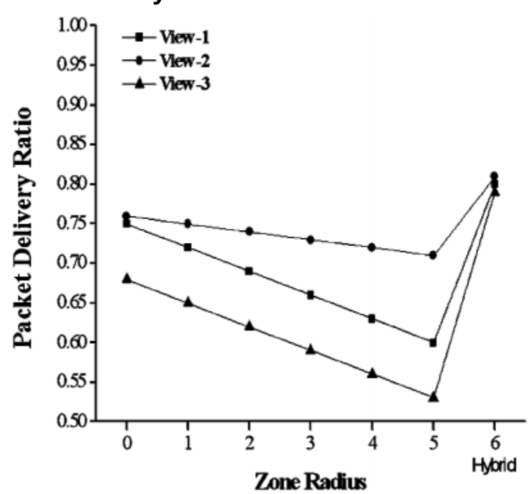

Fig.2: Comparison of Packet Delivery Ratio

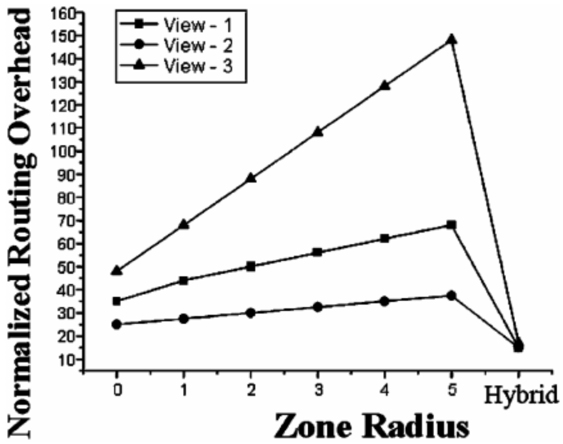

Fig.3: Comparison of Normalized Routing Overhead

Ratio has a downtrend with the zone radius increase in ZRP protocol. And the downtrend is not the same for the three views. A different speed of nodes in the network and a different radius for ZRP protocol will cause great variation of Packet Delivery Ratio.

But the difference of Packet Delivery Ratio in the three views for NSAZRP protocol is very small. Also all the three views have a higher Packet Delivery Ratio than ZRP protocol. The reason for this is that NSAZRP considers various node velocities. When the node moving velocities are different, we make a settlement for the zone radius.

We can find in the figure that the Packet Delivery Ratio of the NSAZRP is higher than ZRP when the radius is 3.

B. Normalized Routing Overhead

As shown in Figure 3, the Normalized Routing Overhead of ZRP protocol increases as the zone radius increases. After addition of the zone, although the routing overhead of the route discovery out of the zone is decreased, the overhead for maintaining the intrazone routing is increased faster which makes the full routing overhead increased. In NSAZRP, the overhead is almost the same for three different views. In other words, the different velocities of nodes have small collision on the routing overhead. It has a very good union.

C. Routing Discovery Delay

From Figure 3 we can find that for ZRP protocol, Routing Discovery Delay decreases as the radius increases in all the three views. At the same time as in the NSAZRP, the Routing Discovery Delay is all around 120ms. This is because the fast node will not send link packets. It only maintains its neighbors as its zone members. So the channel opposition of the route discovery and zone routing maintenance reduces.

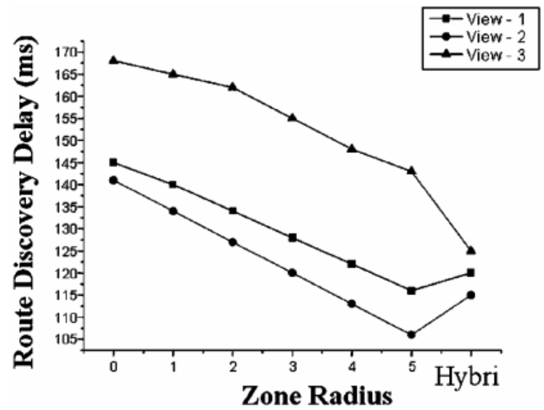

Fig.3: Comparison of Routing Discovery Delay

Because of the stability of the slow node, we can get the most up-to-date intrazone routing information from slow node. Usually speaking, sequences of slow nodes make up the common of the return route. So the route is more stable and more robust, also the delay is smaller.

6. CONCLUSIONS

NAAZRP makes an addition for ZRP protocol that can adjust well to the complex network with nodes moving non-uniformly. NSAZRP utilizes the outstanding performance of the hybrid-driven manner of ZRP and simultaneously overcomes the bad adaptability of ZRP which assumes each node move uniformly and presets the same zone radius. For the speed of nodes is changeable in the practical networks, our future work when certain object like wall, tree building appears between two nodes due to the mobility. Node moves to same location prone to more radio.This will be more accordant with the reality.

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