Design of Geocasting in MANET using the Improved LBM

Cheol-seung Lee* · Joon Lee*

ABSTRACT

MANET(Mobile Ad-hoc network) have recently attracted a lot of attention in the research community as well as in industry. Although the previous research mainly focused on various of MANET in routing, we consider, in this paper, how to efficiently support applications such as variable geocasting basd on MANET. The goal of a geocasting protocol is deliver data packet to a group of nodes that are located within a specified geocasting region. Previous research that support geocast service in mobilie computing based on MANET have the non-optimization problem of data delivery path, overhead by frequent reconstruction of the geocast tree, and service disruption problem. In this paper, we propose the mobility pattern based geocast technique using variable service range according to the mobility of destination node and resource reservation to solve this problem. The experimental results show that our proposed mechanism has improved performance of Accessibility & Network Overhead than previous research.

Keywords

MANET(Movile Ad-Hoc Network), Geocast, LBM(Loacation Based Multicast), Mobility Pattern

Ⅰ. Introduction

A MANET(Mobile Ad-hoc Network) is a wireless network that is comprised of mobile computing devices for wireless communication, without the help of fixed infrastructures. Wireless interfaces pose a unique challenge in designing efficient broadcasting in MANET[1].

The goal of a in this paper, We use improved LBM(Location Based Multicasting) for transmit packet data to mobile nodes within Geocasting region. Establish Geocasting region as variable according to mobility of mobile node and when mobile node moves outside Geocasting region through transfer direction information of mobile node, moile node use together resource reservation technique. Through this method, when minimizes Geocasting group's reconfiguration number of disconnect times and service. and When resource reservation, could reduce network overhead that happen.

II. Related Work

2.1 MANET Geocasting

MANET Geocasting is special method of Multicasting that transmit packet data to mobile nodes within Geocasting area using position information (GPS : Global Position System) of mobile nodes[2].

MANET Geocasting protocol parts by two methods. First, method that reduce spread of data by shrinking area that become Forwarding by reconfiguration method of Flooding. and Second, method

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that send forming route to destination node in multicasting area from sourece node using control packet[3].

2.2 LBM

The LBM(Location Based Multicast) protocol is a restricted flooding approach to geocasting. LBM is derived from a previous unicast protocol by the same authors, i.e., the LAR(Location Aided Routing protocol[4].

a. Multicast Region : Consider a source node that needs to multicast a message to all nodes that are currently located within a certain geographical region. We call this specific area as "Multicast Region". The multicast region would be represented by some closed polygon such as a circle or a rectangle.

b. Forwarding Zone : Again, consider source node that needs to multicast packets to a multicast region. The proposed location-based multicast algorithm use multicast flooding with one modification. source node defines (implicitly or explicitly) a "Forwarding Zone" for the multicast data packet. A node forwards the multicast packet only if it belongs to the forwarding zone. Forwarding zone should decides by the considering efficiency of communication path and network overhead.

LBM is essentially identical to flooding data packets. with the modification that a node determines whether to forward a geocast packet via one of two schemes[5].

2.2.1 LBM Scheme 1 (or LBM-box)

LBMS-1 is consisted of Multicast region and Forwarding zone. and When transmits packet from source node to destination node, reduce network overhead using Forwarding zone and heightens transfer efficiency. Also, can reduce a lot of overheads comparing with occasion that use flooding. If node more than one is moved to Multicast region the node is added at multicast group[6].

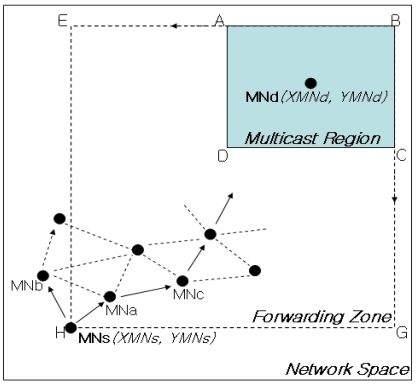

Fig. 1 Location-Based multicast scheme 1

MNs is source node, and mulitcast region is "ABCD" ($300unit \times 300unit$ square) in Fig. 1.

When sauce node tries to transmit packet to neighborhood node, can not transmit more packet in case of neighborhood node is not in Forwarding zone. In this case, we use Parameter (δ) to extend Forwarding zone.

When δ is positive, the rectangular forwarding zone is extended in positive and negative X and Y directions by δ (thus each side increases by 2δ). When we use δ = *100units*, the size of the forwarding zone *"EBGH"* will be larger *500unit x 500unit* square region.

Source node does multicast packet *(X, Y Data + Packet)* that four corner coordinate value of Forwarding zone is included to neighborhood node flooding. *MNa* does flooding to neighborhood nodes because is in Forwarding zone, and achieve flooding process repeat until destination node *(MNd)* receives packet data in Multicast region.

Destination node confirms whether compares *(X, Y Data + Packet)* that is included for packet and is in Forwarding zone. This time, Because *MNb* is on Forwarding zone outside, discards the receive packet.

If there is source node inside Multicast region, Forwarding zone and Multicast region are same *(δ =0).*

2.2.2 LBM Scheme 2 (LBM-step)

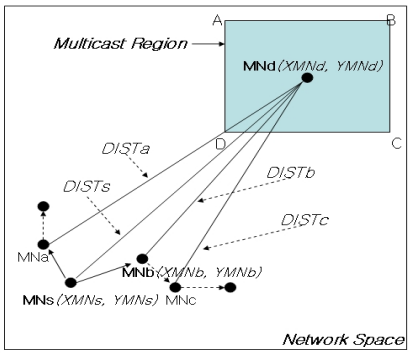

Fig. 2 Location-Based multicast scheme 2

In the LBM scheme 1 described above, the source node explicitly specifies the Forwarding zone in its multicast data packet. In the LBM scheme 2, without including the Forwarding zone explicitly, source node includes three pieces of information with its multicast packet.

First, the multicast region specification. Second, location of the geometrical center, *MNd (XMNd, YMNd)* of the Multicast region. Distance of any node *MNa* from *MNd (XMNd, YMNd)* will be denoted as *DISTa* in the rest of this discussion. Third, the coordinates of node *MNs, (XMNs, YMNs).*

When a node *MNb* receives the multicast packet from node *MNs, MNb* determines if it belongs to the multicast region. If node *MNb* is in multicast region, it accepts the multicast packet. Then, node *MNb* calculates its distance from location *(XMNd, YMNd)*, denoted as *DISTb*, and for some parameter δ if *DISTb + δ >= DISTb,* then node *MNb* forwards the packet to its neighbor nodes. Before forwarding the multicast packet, node *MNb* replaces the *(XMNs, YMNs)* coordinates received in the multicast packet by its own coordinates *(XMNb, YMNb).*

Else *DISTs + δ < DISTb.* In this case, node *MNb* sees whether or not node *MNs* is within the multicast region. If node *MNs* is in the multicast region, then node *MNb* forwards the packet to its neighbor nodes. Otherwise, node *MNb* discards the packet.

2.3 Problem of LBM

LBM forms Forwarding zone between Source node and Multicast region. However, source node can not transmit packet to destination node despite roundabout way path exists because of obstacle. Although We can find roundabout way path changing δ value.

However, packet data transmission overhead very increases by Forwarding zone extension. Also, transmit packet data to do not expect mobile node by error value of GPS information in case of LBM scheme 1, 2. We can solve this method by adjusting delta value. However, all network bandwidths are increased as that unused node receives data.

III. Improved Variable Geocasting

The goal of a in this paper, We use improved LBM(Location Based Multicasting) for transmit packet data to mobile nodes within Geocasting region. Establish Geocasting region as variable according to mobility of mobile node and when mobile node moves out Geocasting region through transfer direction information of mobile node, moile node use together resource reservation technique. Through this method, when minimizes Geocasting group's reconfiguration number of disconnect times and service. and When resource reservation, could reduce network overhead that happen.

In this paper, Because of various mobility of transfer nodes, it is inefficient to use Geocasting region as fixed. So, we select locally and decide transmission

cycle in the advance. And we use together resource reservation technique and when destination node moved, destination node received geocasting packet consecutively. *Rt* decides geocasting region by time in table 1.

Table 1. Terms definition

R	Service extent (Range)
Rt	Service extent of time
Rn	Service extent of current time
B(MNs)	Source node edge value about R
B(MNs) = Rt + (1 - W(MNs))	
E(MNs)	Energy of source node
D(MNs)	Distance between source node and destination node
C(MNs)	Connection state between source node and neighborhood node
W(MNs)	Mobility weight of source node
$Rt = \lvert MNs \times W(MNs) \rvert$	
$Y = \alpha E(MNs) + \beta D(MNs) + \gamma C(MNs) + \delta W(MNs)$	

Y is way that give weight when select next hop node from source node. And "α,β,γ,δ" is a network constant for approach in actuality network environment. *E(MNs)* can not take part in communication *(E(MNS)=0). D(MNs)* finds *DISTs* in Forwardig zone, and transmits packet through multi hop in case *DISTs* is bigger than Geocasting region.

Current Geocasting region is *Rn*, and new service extent according to move of destination node is *Rn + 1*.

a. ***Rn = Rn+1*** : This destination node moving is small or will not need to reset Geocasting region.
b. ***Rn+1 > Rn*** : We should do so that can reduce reconfiguration number of tree in Geocasting region because mobility of destination node is that big.
c. ***Rn > Rn+1*** : To reduce Geocasting region of destination node is efficient.

If mobile node out of area exists by reducing Geocasting region establish destination node to representative node. Representative node offers geocasting service according to mobile node number in Geocasting region.

3.1 Path Routhing

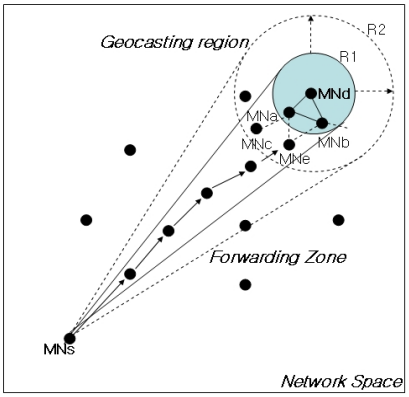

Fig. 3 Path routing

Source node and destination node are selected, Geocasting region *(R1)* is created as do destination node to the center and Forwarding zone is created source node to destination node. If mobility of destination node is big extends Geocasting region *(R2)* and reduces reconfiguration number of unnecessary tree. There is neighborhood node (*MNa, MNb)* in R1 area.

a. ***R1→R2*** : *MNc, MNe* is joined in geocasting tree and there is no path change to destination node. And establish whole route after add path of *MNc, MNe.*
b. ***R2→R1*** : Path change to destination node does not exists and delete mobile nodes that is added in *R2* area and reestablish tree. Select the best route after source node calculates *Y* value of mobile nodes within Forwarding zone and establish route to Geocasting region.

3.2 Resource Reservation

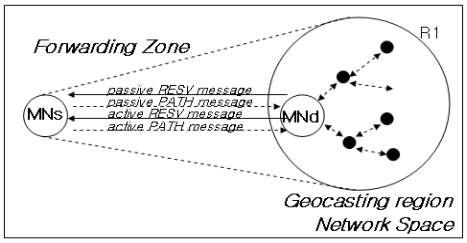

Fig. 4 Resource reservation

We use resource reservation technique *(MRSVP)* for persistent service offer of source node after path routing. Destination node transmits *passiveRESVmessage* and notifies resource reservation to source node. This time, source node transmits *passivePATHmessage* to destination node and establish route for resource reservation. Passive message is so that destination node keeps away unnecessary resource waste using resource reservation route. Destination node moves actuality and changes passive state to active state using passive message and transmit data in path that is resource reserved.

In this proposal, destination node in Geocasting region transmits *passiveRESVmessage* of once to source node and source node transmits *passivePATHmessage* of once to destination node. *passivePATHmessage* can take away unnecessary message switching between mobile nodes transfering on all paths of Geocasting region, and can reduce overhead about resource reservation charging between mobile nodes establishing Geocasting region to one group. When destination node moved to other area, because destination node changes passive state by active state, message switching number of times is reduced. and resource reservation of destination node is achieved and transmits data through active message because passive message has transfered on all paths of Geocasting region.

3.3 Regon Move

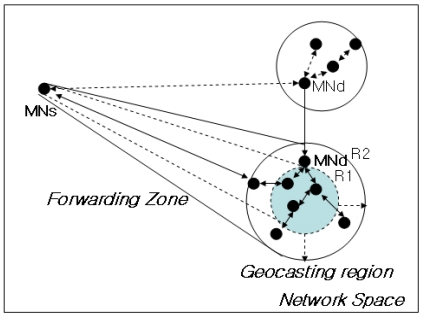

Fig. 5 Region move

When destination node moved to other Geocasting region, destination node changes *passivePATH* to *activePATH* and transmits data. Destination node acquires information for transfer direction and resource reservation to message transfer of once. If is located of Geocasting region's edge that destination node moves, destination node transmits own status information to neighborhood node. and destination node restablish Geocasting region or prepares for resource reservation. Geocasting region's edge value is same *B(MNs)* in table1. And path routing and resource reservation method are equal with 3.1, 3.2 paragraph method from source node until destination node.

Ⅳ. Performance Evaluation

In this paper compared all network overhead with accessibility between source node and destination node of proposing variable geocasting protocol and existing geocasting protocol(LBM). We used NS-2 [7] simulation for experiment and estimation.

4.1 Simulation Model

A. Network area : *1000m* × *1000m*
B. Number of all nodes : 100

C. *CBR (Constant bit rate) : 512Byte, 10KBrate*
D. *PDR (Packet Delivery Ratio)*
*total received packets of geocasting region / total send packets * the number of receivers*
E. Distance of mobile nodes : *150m*
F. Coordinate of source node : *(259, 250)* Fixing
G. total run-time of simulation : *100sec*

4.2 Simulation Results

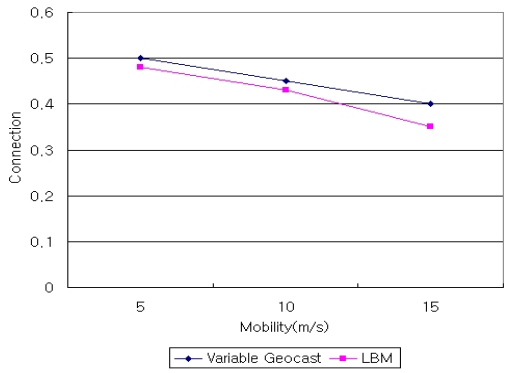

Fig. 6 Mobile node accessibility

When compared proposal variable geocasting protocol with existing LBM geocasting protocol, experiment result of accessibility and network overhead by mobility of mobile node is same Fig. 6, Fig. 7. When puts difference to *Mobilty/s* of mobile node and measured accessibility of destination node, proposed variable geocasting method displayed better access performance than LBM in case of *Mobility/s* increases.

We gave weight using Rt to mobile nodes in Geocasting region in establishment early. And propose variable geocasting method that when considered group's subscribe by motion of destination node and secession arithmetic could reduced reconfiguration number of times of unnecessary tree, and secure candidate node so much.

We serve to solve overhead problem by extension of Forwarding zone and decided transmission cycle locally, and reduce unnecessary resource waste between sender node and recever node taking advantage of resource reservation technique. Thus, when destination node moved, could be transmitted geocasting packets continuously. Certainly, results of all netework overhead measurements packet rate of LBM and proposal variable geocasting protocol decreases. This could used all network resource efficiently and reduce overhead more than LBM that is transformation of Fowarding zone.

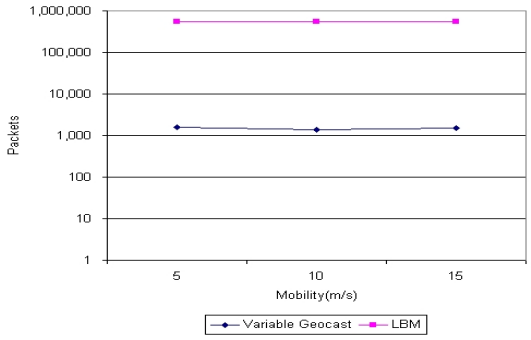

Fig. 7 Network overhead

V. Conclusion and Future Work

In this paper focuses on location-based multicasting problem in mobile ad hoc environments. Proposed technique establishes Geocasting region as variable and reduced reconfiguration number of times of tree by motion of destination node. Also, we could reduce all network overhead hand over and unnecessary resource waste between mobile nodes taking advantage of resource reservation technique.

Specially, variable geocasting protocol that is proposed in this paper could reduce accessibility and network overhead than existent LBM protocol by deciding Geocasting region according to motion of destination node.

Hereafter, when consider MANET user augmentation we can offer effectiveness and safe geocasting service, and will need additional study of security element for reliable geocasting.

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