

A Comprehensive Study of Fuzzy Logic Method for Cluster Head Selection In MANET

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ABSTRACT:

Formation of Cluster in mobile network applications is one of the major problems and can extensively have an effect on the network's communication energy indulgence. In this paper we propose a multicast routing protocol in which cluster-based multi-source with fuzzy logic technique to decide on the cluster head instead of the standard weight based technique to choose the cluster head. To solve the similar issues many protocols have been proposed before such as MADOV, ODMRP and CBMRP. With respect to performance and efficiency, the optimal protocol CBMRP. Hence we take CBMRP to be selected for further implementation.

Keywords

Mobile Adhoc Network, Clustering, Fuzzy Logic, MADOV, ODMRP, CBMRP.

1. INTRODUCTION

A multicast protocol to distribute the multicast data with a high degree of reliability from a single sender to each of the receivers of a dynamic multicast group in a mobile ad hoc network. The protocol should have proactive as well as reactive components to increase the applicability to a variety of circumstances[8][9]. RoMR's proactive component calculates multiple multicast trees based on the prediction of future availability of the links

and the assumption that the trees will become disconnected over time. The reactive components respond to changes in the network topology due to the mobility of the nodes and to changes in the multicast group's membership.

Multicasting can efficiently support a variety of applications and services. Most of existing multicast routing protocols in MANETs[10] consider only one source in a multicast group and become inefficient when the protocol is extended to multi-source multicasting[11].

Clustering is a familiar technique for grouping nodes that are close to each other in the network which prevents the flood of unnecessary packets and avoids wasting network bandwidth. In this technique, a large network can be divided into several sub-networks with only a few cluster heads maintains the local information with few packet losses. Cluster Head (CH) plays with superior power in the intra-cluster network which elected by the other member nodes. In our self-organized clustering scheme the cluster head only serves the purpose of providing a unique Integer Identification Number (ID) for the cluster, limiting the cluster boundaries.

Table 1 : Comparison of ODMRP, MAODV and CBMRP

S.No	PROTOCOL	ADVANTAGE	DISADVANTAGE
1.	ODMRP (On-Demand Multicast	a)Mesh based approach b)Periodically send JOIN REQUEST message to all node	a) All these receiving and sending messages caused a lot of traffic in the traffic.

	Routing Protocol)	c)Forwarding group used to forward data packet d)Record the IP address of the upstream node while JOIN REQUEST	b)If there is a fault in the node then there is need to send JOIN REQUEST and again update the JOIN TABLE
2.	MAODV(Multicast Ad-hoc On-Demand Vector)	a)Tree based approach b)One leader every group with GROUP HELLO message to maintain sequence number. c)Sequence number indicate the freshness of the routing information. d)On demand to form the tree which can include all group and non group member.	a)With the use of RREQ and RREP when a node want to join it consume more time b)Increases network traffic c)Tree breakage is possible due to node movement and topology
3.	CBMRP (Cluster Based Multicast Routing Protocol)	a) Node closed to each other are made into a group thus prevent the flood. b)Avoid the wasting network bandwidth. c)Large network divide into smaller sub network thus with few packet loss. d) Cluster head provide unique identification number.	a)As such there is no such disadvantage of CAMP as is really fast as compared to the other protocol. b)On increase the number of source and receiver CBMRP achieve better efficiency due to cluster structure than MAODV and ODMRP.

2. RELATED WORK

A mobile ad hoc network (MANET) [1] is a distributed self-configuring network which consists of a number of mobile devices connected by wireless links. Each mobile device acts as a router and is free to move randomly, thus changing the topology rapidly and unpredictably. Based on the structure used for data delivery, most of existing multicast routing protocols can be classified into two categories tree-based or mesh-based approaches. In a clustered network, the communication of nodes can be classified into two types: intra-cluster routing and inter-cluster routing.

The literature survey has been done to analyze the performance of two on-demand multicast routing protocols with the proposed routing protocol in mobile ad hoc network. Already a number of eminent researchers carried out some experiments to study the performance of multicast routing protocols such as MAODV, AMRoute, CAMP and ODMRP in mobile ad hoc environments. Clustering is a familiar technique for grouping nodes that are close to each other in the network which prevents the flood of unnecessary packets and avoids wasting network bandwidth. In this technique, a large network can be divided into several sub-networks with only a

few cluster heads maintains the local information with few packet losses [2].

Several clustering methods such as weighted clustering, hierarchal clustering and dynamic clustering algorithms have been proposed to organize nodes as a cluster. Most algorithms elect leaders based on certain weights or iteratively optimize a cost function or use heuristic to generate minimum number of clusters [5]. The Distributed Clustering Algorithm (DCA) assumes quasi-stationary nodes with real-valued weights. The Weighted Clustering Algorithm elects a node based on the number of neighbors, transmission power and so on. The Max-Mind-Clustering Algorithm generates d-hop clusters with a run time of $O(d)$ rounds. This algorithm does not minimize the communicating complexity of sending information to the information center.

In mobile wireless personal area networks (WPAN), the position of each node changes over time. A network protocol that is able to dynamically update its links in order to maintain strong connectivity is said to be "self-reconfiguring." In this paper, we propose a mobile wireless personal area networks (WPAN) design method with self-reconfiguring protocol for power efficiency. The WPAN is self-organized to clusters using an unsupervised clustering method, fuzzy c-means. A fuzzy logic system is applied to

master/controller election for each cluster. A self-reconfiguring topology is proposed to manage the mobility and recursively update the network topology[6]. We also modify the mobility management scheme with hysteresis to overcome the ping-pong effect. Simulation results show that our scheme performs much better than the existing algorithm.

3. FLCHS Algorithm for cluster head selection

The proposed solution uses the fuzzy logic method for the cluster head selection in cluster based multicast routing protocol.

The proposed solutions have four steps:

Step-1: Considering the 3 input parameter for the algorithm

Remaining power of the node (CP)

Network traffic (NT)

Distance from the cluster centroid (D)

Step-2: These parameter are subdivided into further type

$T(D) = \{Near, Moderate, Far\}$

$T(CP) = \{Low, Moderate, High\}$

$T(NT) = \{Light, Moderate, Heavy\}$

Step-3: After calculating all these parameter for the all the different node we have certain condition which defined which combination to be selected i.e(PCHS) using the formula $|T(D)| + |T(NT)| + |T(CP)|$

Step-4: Thus after calculating all these value for the each node we compare it with Fuzzy Rule Base.

4. DESIGN OVERVIEW

The steps involved are:

- Node formation
- Cluster formation
- Cluster head selection

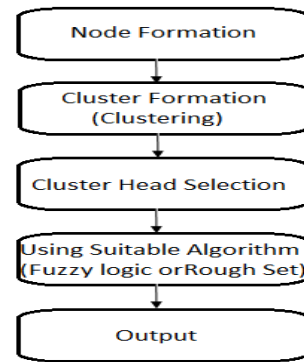


Fig-1

SYSTEM ARCHITECTURE DESIGN

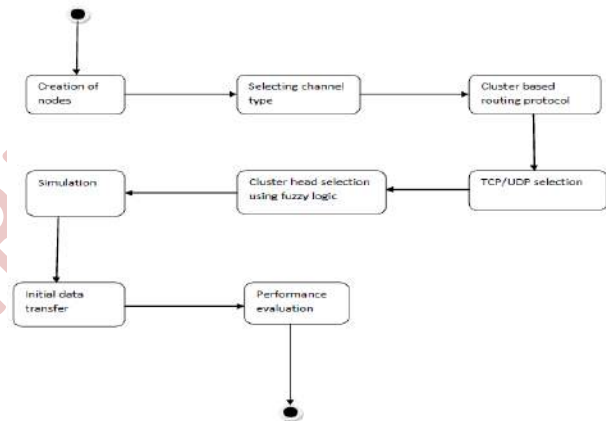


Fig-2 System Architecture

4.1 Performance analysis:

The following three performance metrics are used:

- (1) Average delivery delay: the average time taken for data packets to be transmitted across a network from source to destination.
- (2) Control overhead: total number of control packets and total number of bytes of control information.
- (3) Average recovery time: the average time taken to recover tree from root failure.

In CBMRP, control messages for clustering, constructing the multicast route, and maintaining the cluster structure are counted. Forwarding efficiency is also an important metric for multicast protocols. The measurement of forwarding efficiency is defined as follows.

$$\text{Forwarding efficiency} = \frac{\text{The number of data packets received by receivers}}{\text{The number of data packets transmitted by nodes}}$$

5. CONCLUSIONS AND FUTURE ENHANCEMENTS

This paper proposes a cluster-based multi-source multicast routing protocol with fuzzy logic method to select the cluster head instead of the usual weighted method for selecting the cluster head. By employing cluster structure and setting forwarding clusters, the proposed CBMRP is efficient and robust for multi-source multicasting. When there exists more than one multicast source, the shared forwarding clusters and cluster-based route construction prevent the flood of

route request messages incurred by individual source. Moreover, the soft state membership maintenance avoids yielding excessive control overhead for joining or leaving the multicast group. Even with the drawback of creating a longer route (approximate one hop), simulation results indicate that the proposed CBMRP had competitive advantages over ODMRP in packet delivery ratio, control overhead and forwarding efficiency.

6. REFERENCES

- [1] Shioh Fen Hwang, Yi-Yu Su, Kun Hsien Lu, Chyi Ren Dow "A Cluster-Based Approach for Efficient Multi-Source Multicasting in MANETs" published on 30 October, 2009.
- [2] R. Pandi Selvam and V.Palanisamy, Department of Computer Science and Engineering Alagappa University, Karaikudi, Tamil Nadu, India "An efficient cluster-based approach for multisource multicast routing protocol in mobile ad-hoc networks" vol.3 no.1 january 2011.
- [3] Fumiaki Sato, Dept. of Information Science, Toho University "An Efficient Shared-tree-Based Multi-Source Multicast Routing Protocol in Mobile Ad Hoc Networks" International Conference on Advanced Information Networking and Applications Workshops, 2009.
- [4] Yao Yu, Yu Zhou, and Sidan Du Department of Electronics Science and Engineering Nanjing University "Optimal Forwarding in Multi-Source Multicast over Mobile Ad Hoc Networks" Fifth International Conference on Wireless and Mobile Communications, 2009.
- [5] Junpei Anno, Leonard Barolli, Arjan Duresi, Fatos Xhafa, Akio Koyama "A Cluster Head Decision System for Sensor Networks Using Fuzzy Logic and Number of Neighbor Nodes".
- [6] Qilian Liang "Designing Power Aware Self-Reconfiguring Topology for Mobile Wireless Personal Area Networks Using Fuzzy Logic" in IEEE Transactions on systems, man, and Cybernetics—part c: applications and reviews, vol. 33, no. 3, August 2003.
- [7] Chia-Hui Huang, Chun-Ting Wu, Kai-Wei Ke, and Ho-Ting Wu, Department of Computer Science and Information Engineering, National Taipei University of Technology, Taipei, Taiwan, R.O.C. "MAODV-Based Multisource Multicast Routing with Fast Route Recovery Scheme in MANETs", 978-1-4244-7640-4/10/\$26.00 ©2010 IEEE.
- [8] Kumar Viswanath, Katia Obraczka, Member, IEEE, and Gene Tsudik "Exploring Mesh and Tree-Based Multicast Routing Protocols for MANETs", IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 5, NO. 1, JANUARY 2006.
- [9] Luo Junhai a,b,*, Xue Liu b, Ye Danxia a., "Research on multicast routing protocols for mobile ad-hoc networks", School of Computer Science and Engineering, University of Electronic Science and Technology of China, Chengdu 610054, December 2007
- [10] L.Junhai , Y. Danxia, Xue Liu and Fan Mingyu., "A survey of Multicast Routing Protocols for Mobile Ad-hoc Networks", IEEE Communications Surveys and Tutorials, vol. 11, No.1 First Quarter 2009.
- [11] Yi-Yu Su, Shioh-Fen Hwang, Chyi-Ren Dow, "An Efficient Multi-Source Multicast Routing Protocol in Mobile Ad Hoc Networks" Proceedings of the 2005 11th IEEE International Conference on Parallel and Distributed Systems (ICPADS'05)0-7695-2281-5/05 2005.