MANET: Multi-hop Routing using Zone based Multi-Agent

Nafiza
Asst. Prof.
Siddhartha Institute of Technology and Sciences
Narapally, Hyderabad, Telangana, India

***Abstract* - The Mobile Ad hoc Network (MANET) is made up of thousands of mobile nodes that are distributed throughout the network. These nodes are extremely mobile and have inherent features such as node reliability, resource heterogeneity, and so on. We suggested a Multi-Agent Based Multi-hop Routing (MAMR) protocol for MANETs in this paper. Multiple agents, including static and dynamic mobile agents, are used in our proposed MAMR protocol. The following is how our proposed plan works: I Zone leaders are discovered first; (ii) these zone leaders are connected to communication nodes; (iii) backbones are built by employing communication and zone leaders to achieve multicast routing; (iv) multicast zone members are connected to the backbones; and (v) backbone and zone managements are initiated if the nodes are highly mobile. Path agent, Network control agent, and Multicast control agent are static agent nodes in the MAMR protocol; Network launch agent and Multicast control agents are mobile agent nodes. The proposed system's performance is measured under a variety of network situations, including packet delivery ratio, latency, and throughput. Multicast Routing Protocol Based on Zone Routing (MZRP) and On-Demand Multicast Routing Protocol are compared to the proposed protocol (ODMRP). The simulation results clearly show that the MAMR protocol outperforms the MZRP and ODMRP protocols. This also provides more versatility and multicast services.**

Index Terms- Mobile Ad hoc Network (MANET), Multicast routing, Multi-Agent Based Multi-Hop Routing (MAMR) protocol, MZRP, ODMRP and Backbones

Nalla Ajay Kumar
Asso. Prof.
Department of CSE
Siddhartha Institute of Technology and Sciences
Narapally, Hyderabad, Telangana, India

1. INTRODUCTION

Mobile Ad hoc Networks (MANET) are self-contained networks of network routers and associated hosts connected over wireless pathways. MANETs do not have base stations. Instead, each and every mobile node admits the purpose of routing, and many hops may be required to allow one mobile node to interact with any other mobile node throughout the network due to the limited transmission range [1, 2]. Multicast routing is required for group communications such as collaborative tasks and video conferencing, and it has numerous advantages because it operates within the network [3]. Multicast routing has the advantage of lowering communication costs by transmitting the same information to several receivers. It also minimizes bandwidth consumption, packet delivery latency, and source and router processing time. As a result, multicast routing has gotten a lot of attention in the academic community, and numerous multicast routing methods have been published in MANET [4, 5]. In mobile networks, multicast is a common mechanism for zone-oriented communication. Some of the multicast routing protocols used in MANET are Multicast Routing Protocol Based on Weight-Based Multicast Protocol (WBM) [10], On-Demand Multicast Routing Protocol (ODMRP) [7], Preferred Link-Based Multicast (PLBM) Protocol [9], On-Demand Overlay Multicast Protocol (ODOMP) [11], Zone Routing (MZRP) [6] and Multicast Ad hoc On-Demand Distance Vector (MAODV) [8]. ODMRP and MZRP are two well-known multicast routing techniques that are being used to compare the performance of the proposed protocol.

The MAMR protocol is designed to address the shortcomings of existing multicasting protocols, such as lower reliability and robustness during frequent topology changes, poor scalability, and lower QoS. (QoS). The following are the contributions of our suggested work:

- The multi-agent mechanism is responsible for discovering multicast paths.
- Backbones are formed by multi-agents to achieve dependable multicast routing.
- The agents adapt to frequent topological changes.
- In comparison to MZRP and ODMRP, the proposed MAMR has a higher packet delivery ratio.

2. PROPOSED TECHNIQUE

We presented the Multi-Agent Based Multi-hop Routing (MAMR) protocol for MANETs with both static and dynamic mobile nodes in this research. This section goes through the network configuration and operating principles in great detail.

2.1. Network Arrangement

MANET is a network made up of thousands of mobile nodes that are randomly distributed over the network's geographical region, as seen in Figure 1. Network backbones are built with the help of communication nodes and zone leaders. Some communication nodes can be used as a zone leader's communication node. Each zone leader has a connection to the members of his or her zone. The zone leaders support multicast operations, whereas the communication nodes simply operate as forwarders, passing packets between the zone leaders. Zone members are referred to as "child nodes" by the zone leader. Zone members have had dependable and communication nodes thanks to mobility. When there is a lot of mobility, the multicast pathways will be recreated often by using different pairs of zone leaders and communication nodes. The mobile agent platform is set up with all of the network's participating nodes so that it can support all of the network's functionalities.

2.2. Node Definitions

In our suggested protocol, three sorts of nodes are used: zone members, zone leaders, and communication nodes.

i. Zone members

The entire network is divided into various zones, with zone membership determined by location, i.e., zones are constructed depending on the geographical position of nodes. A zone leader, zone members, and a communication node must all be present in each zone. The communication nodes are situated at the far end of any two-zone coverage area. These communication nodes serve as forwarders, allowing internal communication (zone top zone communication) to take place. Zone members are often referred to as zone leader's offspring.

ii. Zone leader

Each network zone must have a zone leader who acts as a parent to the zone's members. These zone leaders are chosen based on their trustworthiness. If a node has the highest dependability factor, it is chosen to be the zone leader. The zone leader is in charge of all zone obligations, including zone member connection provision. If a node wishes to join a zone, it must first be authorized by the zone's reliable bode. When the current link fails, these zone leaders keep a responsibility table to provide an alternate link.

iii. Communication node

The network's nodes are all movable. When a zone leader leaves the zone coverage area in which it serves, all of its connections to other zone leaders are severed. Communication nodes are created in order to enable such linkages. These nodes can help zone leaders make new connections as well as reconnect with old ones. The primary functions of communication nodes are packet forwarding and connection management. It also keeps track of lost connections in a connection table.

2.3. Agent Definition

In our proposed technique, we use five agent nodes, which are described in this section. The network comprises a shared cognition base that contains the information of all five agents. Furthermore, these agents communicate with one another via this cognitive base, which provides network information such as node type, zone ID, forwarding and responsibility tables, a list of connection nodes with connectivity status, and zone member status.

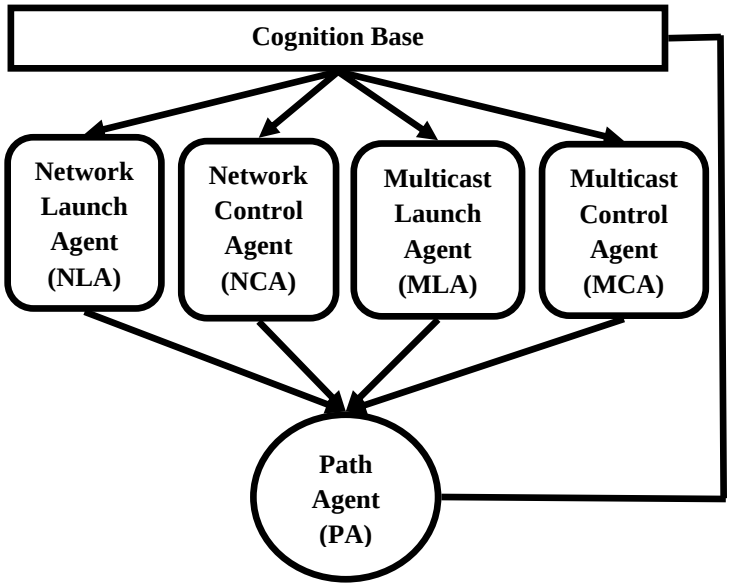

Figure 2: Routingmodel using agents

i. Path Agent (PA)

Path agents are static nodes that serve a key role in the network, i.e. the PA is used to build the other four agents. It also synchronizes the activities and cognition basis of the agent nodes. The PA calculates the reliability factor of all nodes, which it then broadcasts to all of its adjacent nodes or neighbor nodes on a regular basis. Path agents find their child nodes, which they use to communicate with other agents and to update the responsibility table in the cognitive base.

ii. Network Launch Agent (NLA)

Network Launch Agents are mobile nodes that gather reliability advertisement packets from their peers. If an NLA has the highest measure of reliability factor among the studied advertisement packets after studying these dependability advertisements, it declares itself a zone leader. Path agents build network launch agents on a regular basis, the length of which is determined by node mobility.

iii. Network Control Agent (NCA)

Network Control Agents are stationary nodes that give connection management control in order to prevent mobility concerns.

iv. Multicast Launch Agent (MLA)

These are the mobile nodes in charge of establishing multicast network zones. MLA distributes a multicast key to each member of a zone. It sends a message to every zone leader inviting them to join a zone. For zone membership, a basic survey is completed initially, which includes all of the necessary information about zone members. The MLA then creates a multicast tree utilizing zone leaders, zone members, and communication nodes. Each tree member who participates in multicast receives a zone ID.

v. Multicast Control Agent (MCA)

The Multicast Control Agent is a static node that manages the multicast tree's upkeep. This MCA is present in all multicast zones and is used to reconstruct broken links between zone nodes, particularly between members and zone leaders. The MCA in a multicast zone generates tokens, which are communicated periodically within the zone. These tokens are received by each zone member, who then adds one to each data packet. A child node maintains its network connection by obtaining a connectivity token on a regular basis. If it does not get the token, this child node activates the recovery process. The MCA establishes a connection with its zone leader or any token receiving nodes via cry calls throughout this recovery process.

4. SIMULATION RESULTS

Network Simulator-2 (NS-2) is used to evaluate the proposed system in a variety of network settings. The simulation network configuration and simulation parameters, as well as the findings, are described in full here. The proposed network model consists of 50

mobile nodes that are randomly distributed throughout the network and are free to roam around. The speed of the movable node varies from A to B meters per second. Based on the network's geographical area, the entire network is divided into four zones. Each zone is a square meter in size. Zone members and a zone leader make up each zone. At the intersection of any two zones, a communication node is placed. Assume 50 nodes, a network size of 1000×1000 meter^2, a zone area of 250×250 meter^2, and a node speed of 0 to 30 meters/second. The following performance parameters are used:

Delay: Delay is the time interval between packets sent by a group member (sender) and packets received by a group member (receiver).

Packet delivery ratio (PDR): The ratio of the number of nodes transmitted by a group member to the number of nodes received by a group member is known as the packet delivery ratio.

Throughput: The total number of packets sent by all receivers over the entire simulation time is known as throughput. Throughput analysis compares the overall performance of the proposed and existing protocols.

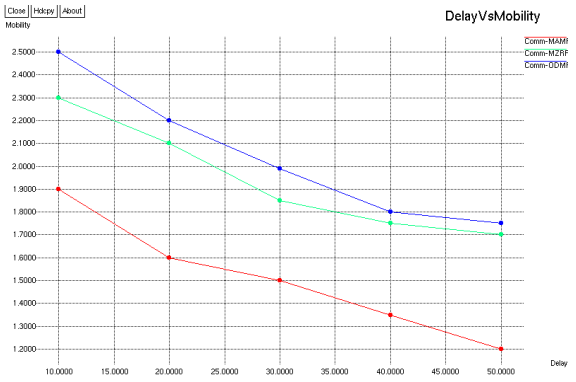

Figure 3: Delay vs. Mobility

Figure 3 compares the proposed MAMR protocol to the existing MZRP and ODMRP protocols in terms of delay and mobility. When compared to MZRP and ODMRP protocols, the suggested protocol obviously has higher performance in terms of reduced time, especially in high mobility.

Figure 4: PDR vs. Mobility

Figure 4 compares the packet delivery ratio and mobility. The proposed MAMR protocol is compared to the existing MZRP and ODMRP protocols. It demonstrates that the MAMR protocol has a greater PDR than MZRP and ODMRP.

5. CONCLUSION

As a result, we proposed the Multi-Agent Based Multi-hop Routing (MAMR) protocol for mobile ad hoc networks to improve network performance by increasing packet delivery ratio, decreasing delay, and increasing network resilience. The packet forwarding between intermediate and zone leader is the foundation of our proposed routing technology MAMR. Our suggested protocol has a better packet delivery ratio than MZRP and ODMRP because data packets are properly routed among group members even when there is considerable mobility. It also has more flexibility because the backbone is recreated by the agents once they detect movement. Some simulation characteristics, such as delay, packet delivery ratio, and throughput, are compared against node mobility in our proposed MAMR protocol, which demonstrates higher performance.

REFERENCES

[1] T.Sukumar, ‖Energy Efficient Multicast Routing Protocol for MANET‖ IJAET/Vol. I/ Issue I/April-June-2010.
[2] Sureshkumar.NVijayalakshmi.G, Natraj.N.A, Senthil.T and Prabu.P, ―Energy Efficient Routing Protocol for

MANET‖ International Journal of Computer Science Issues, Vol. 9, Issue 2, No 1, March 2012 .
[3] Dr. Annapurna P Patil, VarshaChandan B, Aparna S, Greeshma R, Akshatha H P, ―An Improved Energy Efficient AODV Routing Protocol for MANETs‖, IEEE, 2014.
[4] Shiva Prakash and JP Saini, ―A review of Energy Efficient Routing Protocols for Mobile Ad Hoc Wireless Networks‖, International Journal of Computer Information Systems, Vol. 1, No. 4, 2010, 2010
[5] VemanaChary.D,Padmanabham, P PrabhakaraRao.B, ―Energy Efficient Routing Protocol for Mobile Ad hoc Networks using Trust Based Security‖, International Journal of Advanced Research in Computer and Communication Engineering Vol. 1, Issue 9,November, 2012.
[6] X. Zhang and L. Jacob, ―MZRP: an extension of the zone routing protocol for multicasting in MANETs,‖ Journal of Information Science and Engineering, vol. 20, no. 3, pp. 535– 551, 2004.
[7] S.-J. Lee,W. Su, andM. Gerla, ―On-demand multicast routing protocol in multihop wireless mobile networks,‖ Mobile Networks and Applications, vol. 7, no. 6, pp. 441–453, 2002.
[8] E. M. Royer and C. E. Perkins, ―Multicast ad hoc on demand distance vector (MAODV) routing,‖ Internet-Draft, draft-ietfdraft- maodv-00.txt, 2000.
[9] R. S. Sisodia, I. Karthigeyan, B. S. Manoj, and C. S. R. Murthy, ―A preferred link based multicast protocol for wireless mobile ad hoc networks,‖ in Proceedings of the IEEE International Conference on Communications (ICC ’03), vol. 3, pp. 2213– 2217, 2003.
[10] S. K. Das, B. S. Manoj, and C. S. R. Murthy, ―Weight based multicast routing protocol for ad hoc wireless networks,‖ in Proceedings of the IEEE Global Telecommunications Conference (GLOBECOM ’02), vol. 1, pp. 117–121, 2002.
[11] O. Stanze and M. Zitterbart, ―On-demand overlay multicast in mobile ad hoc networks,‖ in Proceedings of the IEEEWireless Communications and Networking Conference (WCNC ’05), vol. 4, pp. 2155–2161, 2005.