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MULTICAST LOAD BALANCED ROUTING PROTOCOL IN MOBILE AD-HOC NETWORK

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ABSTRACT-A Mobile Ad hoc NETwork (MANET) is an interconnected of mobile nodes without any fixed base station in the network. Broadcasting is used in most of the reactive routing protocols for route discovery. Broadcasting increases the routing overhead and end-to-end delay as well as decreases packet delivery ratio. To solve this, the load balanced routing protocol have been proposed, and compare with the performance of Ad Hoc On-Demand Distance Vector(AODV) Routing, Probabilistic Counter-Based Route Discovery for Mobile Ad Hoc Networks, Dynamic Core Based Multicast Routing Protocol(DCMP) and Congestion Adaptive Routing in Mobile Ad Hoc Networks.

KEYWORDS: MANET, LBMRP, AODV, Mobile node, Packer delivery ratio (PDR)

I INTRODUCTION

Due to the rapid development in the mobile devices technology, wireless networks are becoming more popular. Wireless networks can be broadly classified into two types infrastructure-based networks (for e.g., cellular networks) and Ad hoc networks. The former one uses fixed base stations, which are responsible for co-ordinating the communication between the mobile hosts (nodes). These base stations are interconnected by wired backbones, whereas, mobile nodes communicate with the base stations through the wireless medium. The latter one consists of mobile nodes that communicate with each other through the wireless medium, without any fixed infrastructure. Hence, there is no centralized mechanism to control the communication among the group of mobile nodes.A MANET is an autonomous collection of mobile users that communicate over relatively bandwidth constrained wireless links. Since the nodes are mobile, the network topology may change rapidly and unpredictably over time which makes unicast nodes have limited battery power, it is therefore very important to use energy in a MANET efficiently. Due to the dynamic topology and limited resources of mobile nodes, the routing scheme in MANETs presents important challenges [7]. Due to various constraints in MANETs, there are various issues and challenges which should be taken into consideration while designing multicast routing protocols. This paper compares the multicast protocols namely Ad Hoc On-Demand Distance Vector (AODV) Routing [1], Probabilistic Counter-Based Route Discovery for Mobile Ad Hoc Networks[2], Load Balanced routing protocols unsuitable if number of receivers are more. So, multicast routing protocols are preferred in that case. Multicasting is used in various applications such as military operations, audio and video conferencing, telematics applications, disaster situations, sport events and integration with cellular systems. Applications of MANETs are in areas where rapid deployment and dynamic reconfiguration are necessary[5], but the wired network is not available. These include military battlefields, emergency search, rescue sites, classrooms, and conventions where participants share information dynamically using their mobile devices. These applications lend themselves well to multicast operation. In addition, within a wireless medium, it is even more crucial to reduce the transmission overhead and power consumption. Multicasting[6] can be used to improve the efficiency of the wireless link when sending multiple copies of messages to exploit the inherent broadcast property of wireless transmission. So multicasting plays an important role in MANETs. Because mobile Multicast Routing Protocol, Dynamic Core Based Multicast Routing Protocol(DCMP) [4] and Congestion Adaptive Routing in Mobile Ad Hoc Networks[3]. The main contributions of this paper are ,to identify best protocol among mentioned and to compare multicast protocols, based on the identified metrics.

The rest of this paper is organized as follows. Section II describes the existing routing protocols. Section III proposes our new routing protocol. The conclusion is given in Section IV

II EXISTING ROUTING PROTOCOLS

Applications of MANETs are in areas where rapid deployment and dynamic reconfiguration are necessary[5], but the wired network is not available. These include military battlefields, emergency search, rescue sites, classrooms, and conventions where participants share information dynamically using their mobile devices. These applications lend themselves well to multicast operation. In addition, within a wireless medium, it is even more crucial to reduce the transmission overhead and power consumption. Multicasting[6] can be used to improve the efficiency of the wireless link when sending multiple copies of messages to exploit the inherent broadcast property of wireless transmission. So multicasting plays an important role in MANETs.

1) ON-DEMAND ROUTE DISCOVERY MECHANISM IN AODV

On-demand routing protocols [1] construct a path to a given destination only when it is required. Thus, they do not maintain topological information about the whole network. Since the focus of our study is on the route discovery part of the protocol, we present a brief overview of the route discovery process in AODV in the remainder of this section. When a source node **S** needs a route to some destination **D**, it broadcasts a RREQ packet to its

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immediate neighbours. Each neighbouring node rebroadcasts the received RREQ packet only once if it has no valid route to the destination. Each intermediate node that forwards the RREQ packet creates a reverse route pointing towards the source node **S**. When the intended destination node **D** or an intermediate node with a valid route to the destination receives the RREQ packet, it replies by sending a route reply (RREP) packet. The RREP packet is towards the source node **S** along the reverse path set-up by the forwarded RREQ packet. Each intermediate node that participates in forwarding the RREP packet creates a forward route pointing towards the destination **D**. The state created in each intermediate node along the path from **S** to **D** is a hop-by-hop state in which each node remembers only the next hop to destination nodes and not the entire route, as in DSR

2) PROBABILISTIC COUNTER-BASED ROUTE DISCOVERY (PCBR)

In Probabilistic counter-based approach[2], we maintain a counter at each node for every received broadcast packet. Whenever a copy of the packet is received the counter is increase by 1. A high counter values implies that the nodes number of neighbours is high while a low counter value relates to a small number of neighbours. Thus, we use packet counter as density estimates as against using "Hello" packets[11] to gather neighbour information which induces more communication overhead. As in fixed probability approach, use a rebroadcast probability *p* for forwarding the packet based on the counter value at the current node. This minimises the number of redundant retransmission in the network. Moreover, the value of packet counter does not necessarily correspond to the exact number of neighbours from the current node, since some of its neighbours may have suppressed their rebroadcasts according to their local rebroadcast probability. This allows a node in sparse region (i.e. with low counter value) to forward a packet with a probability *p*, while nodes in dense region (i.e. high counter value) are inhibited from forwarding the packets.

3) CONGESTION ADAPTIVE ROUTING

Congestion Adaptive Routing (CRP)[3] is a congestion adaptive routing protocol for MANETs. In CRP, every node appearing on a route warns its previous node when prone to be congested. The previous node uses a "bypass" route for bypassing the potential congestion area to the first non congested node on the primary route.

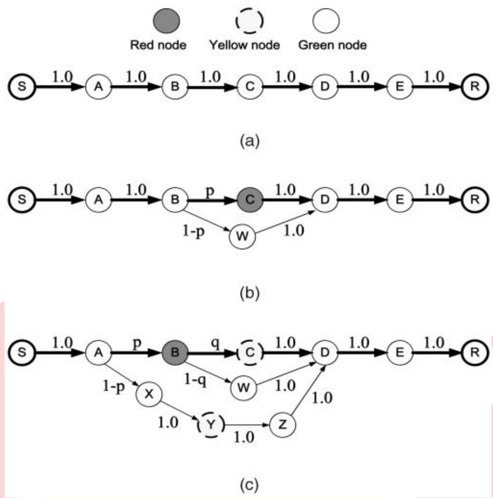

Fig. 1. Use of Bypass to Reduce Congestion

Traffic is split probabilistically over these two routes, primary and bypass, thus effectively lessening the chance of congestion occurrence. CRP is on-demand and consists of the following components:

1. congestion monitoring,
2. primary route discovery,
3. bypass discovery,
4. traffic splitting and congestion adaptivity,
5. multipath minimization, and
6. failure recovery.

4) DYNAMIC CORE BASED MULTICAST ROUTING PROTOCOL (DCMP)

In DCMP protocol [4], when the source has data to send, it floods the Join Request control packet. The Join Req packet also contains an additional flag called as Core Acceptance flag, the use of which is as follows. A core node may or may not be able to support more Passive sources due to the Max- Pass Size parameter restriction. The Core Acceptance flag is reset in the Join Request packet if it (core node) cannot support more Passive source nodes. By checking this flag, near by Active source nodes come to know whether this core node can support them or not. This prevents unwarranted requests by nearby source nodes (which desire to change from Active to Passive) to the core node. When any node receives a non-duplicate JoinReq control packet[12], it broadcasts the packet after storing the upstream node identification number (ID). A unique identification number is assumed for every node.

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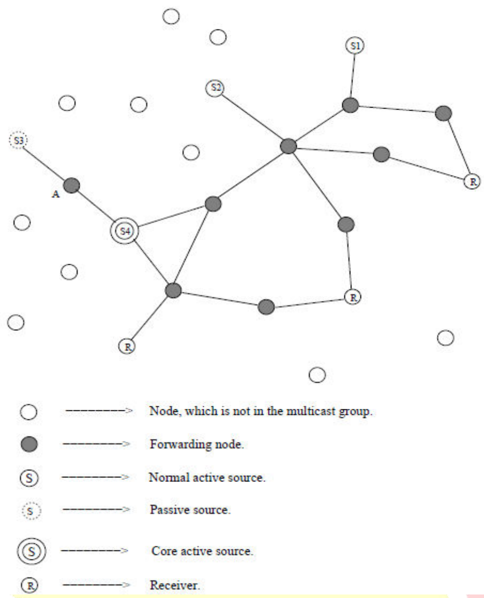

Fig 2 Mesh Topology in DCMP

When the Join- Req control packet is received by the receiver, it builds a Reply packet and sends it along the reverse path to the source. When intermediate nodes along the reverse path receive this Reply packet, they check the Next Node ID field in the Reply packet. If the node's ID matches with any of the entries of the field, then it sets its forwarding flag (Fg Flag) and becomes a forwarding node for that particular multicast group. This node then builds a Reply packet and broadcasts it. In this way a route is established by the transmission of the Join Req and the Reply packets.

III PROPOSED WORK

In this section, a load balanced multicast routing protocols (LBMRP) has been proposed. We have deployed the mobile nodes in a specific area and some initial energy $Einitial$ is define on each node randomly. LBMRP has been directly get out from MAODV. Load balance based multicast routing protocols (LBMRP) is energy aware protocol that renovate the route stability of multicast routing and it is based on multi-tree-based routing protocol that achieves the load balance in the wireless network during the data packet transmission[8]-[9]. LBMRP is a three-tree-based routing protocol; however, LBMRP transmit the multicast data packets over different tree. It was assumed that all nodes in the wireless network have been randomly classified into three types, group-1, group-2 and group-3. Then there are three trees could be build (TREE-1 for group-1, TREE-2 for group-2 and TREE-3 for group -3) for data packet transmission. Each node in the wireless network maintained two routing tables: the neighbouring table and the multicast routing table. The neighbouring table was easily obtained by the periodic broadcast of the hello packet. These tables are described below:

A) **Neighbouring table:** A node contained the information of other nodes that are within the transmission range when it could hear the hello packet. The format of the table was (node ID, distance).

B) **Routing table:** This table contains the routing paths that are used for the transmission of data in the wireless network. The format of the multicast routing table are (source ID, destination ID, sequence number, route class, next node). The source ID and destination ID fields recorded the unique addresses of the source node and the destination nodes, respectively. The sequence number field contained the sequence number of the source node (guaranteeing the loop freedom of all routes to the destination node). The route class field recorded the class of route for group-1, group-2 or group-3. The next hop field contained the address of the neighbouring host to which data packets could be forwarded.

In LBMRP, each node periodically broadcast the route request (RREQ) packet to neighbouring nodes. When source node want to send multicast data packet to destination nodes, the route request (RREQ) packet was broadcasted by the source node in the network. After getting the suitable path by the destination nodes, it sends a route reply (RREP) packet to the source node[10]. A multicast group is composed of source nodes and destination nodes. For sending the data from source nodes to destination nodes, each protocol constructs a tree as the routing structure. During the data transmission in the network some nodes treats as intermediate nodes called forwarding nodes in the routing structure. Group members (source nodes and destination nodes) and forwarding nodes are also called tree nodes. In the proposed protocol, energy level threshold $Ethreshold$ is defined. When the source node wants to send the data packet to the destination nodes, it broadcasts the route request (RREQ) packet to the neighbouring nodes in its transmission range. When route request(RREQ)packet broadcast it carries the following information in its header: {TYPE, Source, Destination List, SourceSeq, Path Traversed, Class}. "Type" refers to the packet type: RREQ or RREP. "Source" is the source node. "SourceSeq" is a monotonically increasing sequence number. "Source" and "SourceSeq" are used to uniquely identify each RREQ packet. It can be used to check duplicate copies of an old request and detect the stale cached routes. "Destination List" is a set of destinations. "Path Traversed" records the routing information. "Class" is the type of node: group-1, group-2, or group-3. When a node receives the data packet, it compares its initial energy $Einitial$ with threshold value $Ethreshold$. If the initial energy $Einitial$ of receiving node is more than $Ethreshold$ value, receive and store the RREQ packet and re-broadcast the RREQ packet further in the network. The neighbouring node introduces its ID to the routing path field of the RREQ packet and the class field of the RREQ packet is assigned a type (group-1, group-2 or group-3) of neighbouring node. When the destination node receives the first RREQ packet with group-1, first RREQ packet with group-2 and first RREQ packet with group-3, the destination node selects the last hop of each RREQ packet as its upstream node to send the route reply packet to the source node. When the RREP packet has been transmitted towards the source node, it carries the following information in its header: {TYPE, Source, Destination, Reverse Path, Class, RREP Type}. Here "Type" is certainly RREP. "Source" is the source node. "Destination" is the destination node. The field "Reverse Path" in each RREP packet includes the reverse path, "Class" is the type of node: group-1, group- 2 or group-3.

When the destination node receives the first RREQ packet with group-1, group-2 and group-3, the destination node selects the last hop of each RREQ packet as its upstream node to send the route reply (RREP) packet to the source node. Let us consider an example. It is assumed that the $Ethreshold$ is 25 Joule (J). In Fig. 3, the source node S wants to send data to some destination nodes P, Q and R. The source node S broadcasts a route request (RREQ) packet to its neighbouring nodes. Nodes A, B, and D receive the RREQ packet because their $Einitial$ is greater than $Ethreshold$ and therefore forward the route request (RREQ) packet and append their own information, such as their own ID and the type of class when they receive RREQ packet, node C discard the RREQ packet as its $Einitial$ is less than $Ethreshold$. In Fig. 4, destination node P selects nodes I, H and J as upstream node for TREE-1, TREE-2 and TREE-3, respectively. The Destination node R selects node L, H and J as upstream node for the TREE-1, TREE-2 and TREE- 3 respectively and finally the node Q select the nodes I, H and J as upstream node for the TREE-1, TREE-2 and TREE-3 respectively. Each destination node sent the route reply (RREP) packet to its upstream nodes. Let the node P send the RREP packet to the node I, J and H respectively, While receiving the RREP packet, the node I select upstream node F to send RREQ packet for the TREE-1, node H select E as upstream node for TREE-2 and finally node J select G as upstream node for TREE-3. In Fig. 4, the red dotted path indicates TREE-1, black dotted path indicate TREE-2 and green dotted path indicate TREE-3. Lastly source node S receives three multicast paths for TREE-1, TREE-2 and TREE-3, as shown in Fig. 5, these routing paths are used to send multicast data packet to destination nodes.

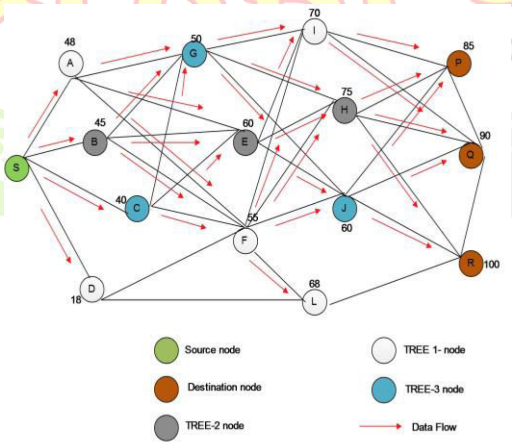

Fig 3 Routing Discovery Process

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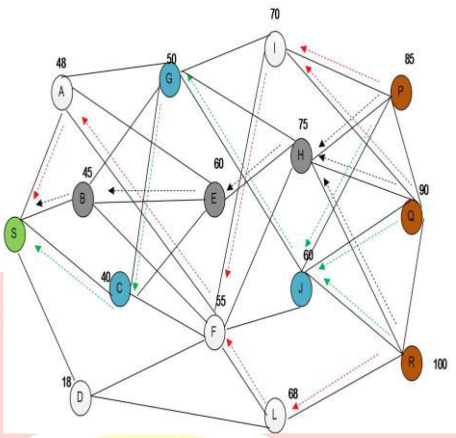

Fig 4 Route Reply Process

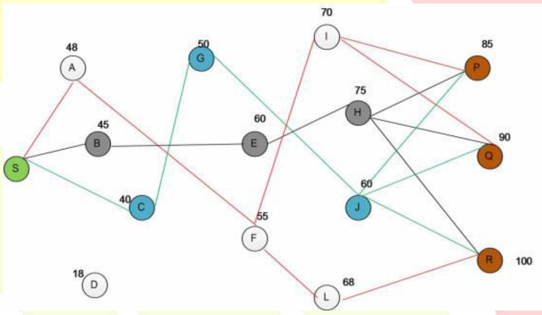

Fig 5 Multicast Tree

IV SIMULATION RESULTS

The LBMR and LUNAR protocols have been simulated for packet delivery ratio and to find the packet drop. The packet delivery ratio decreases, as mobility increases, because of fast mobility of nodes in the network that create communication gap among the nodes in the network. We can notice that the packet delivery ratio is high when the nodes have low mobility. Thus LBMRP achieves a much higher packet delivery ratio in compare to LUNAR.

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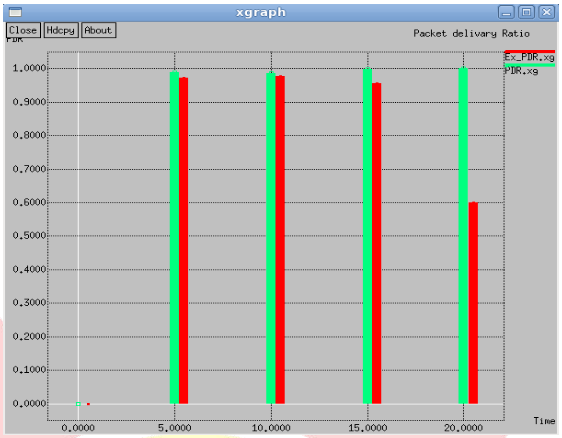

Fig 6 Packet Delivery Ratio

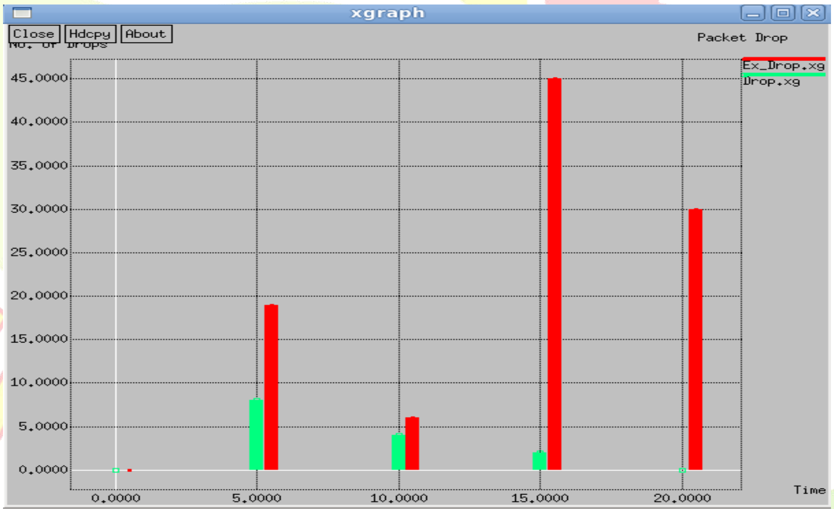

Fig 7 Packet Drop

V CONCLUSION

In this, the LBMRP propose for MANETs. The load balance scheme is used to increase the packet delivery ratio during the data packet transfer in the network. The packet delivery ratio decreases, as mobility increases, because of fast mobility of nodes in the network that create communication gap among the nodes in the network. The packet delivery ratio is high when the nodes have low mobility. Thus, LBMRP achieves a much higher packet delivery ratio in compare to LUNAR.The reason is that due to fast mobility of the nodes, there are more chances to break the communication among the mobile nodes during the data transfer from source node to a set of destination nodes.

Thus, we have to resend many times the same data again and again. Thus the LBMRP not only eliminates inefficient nodes to decrease the number of control packets, but also reconstruct the tree structure to balance the packet load in the network. Simulation result shows that the packet delivery ratio of the proposed protocol perform better than existing protocol.

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REFERENCES

[1] C. Perkins, E. Belding-Royer, and S. Das,*Ad Hoc On-Demand Distance Vector (AODV) Routing*, In:IETF RFC 3561, 2003.

[2] Mohammed, M. Ould-Khaoua, L.M. Mackenzie, C. Perkins, and J.D. Abdulai, *Probabilistic Counter-Based Route Discovery for Mobile Ad Hoc Networks*, In: Proc. Int'l Conf. Wireless Comm. and Mobile Computing: Connecting the World Wirelessly (IWCMC '09), pp. 1335- 1339, 2009.

[3] Duc A. Tran, Harish Raghavendra, Member, IEEE, *Congestion Adaptive Routing in Mobile Ad Hoc Networks*, In: IEEE Transactions On Parallel And Distributed Systems, Vol. 17, November 2006.

[4] Subir Kumar Das, B. S. Manoj, C. Siva Ram Murthy, *A Dynamic Core Based Multicast Routing Protocol for Ad hoc Wireless Networks*, In: IEEE Transactions, 2010.

[5] Kanwalpreet Kaur, Krishan Kumar Saluja, Rajdeep Singh, *Performance Analysis of Multicast Routing Protocols in Ad-Hoc Networks*, 5th International Conference on Computer and Communication Technology,2014.

[6] Luo Junhai, Ye Danxia, Xue Liu, and Fan Mingyu, *A Survey of Multicast Routing Protocols for Mobile Ad-Hoc Networks*, IEEE communications surveys & tutorials, vol. 11, no. 1, first quarter 2009.

[7] Abdulmalek AI-hemyari, Kasmiran Jumari, Mahamod Ismail, Sabri Saeed, *A Comparative Survey of Multicast Routing Protocol in MANETs*, International Conference on Computer & Information Science (ICCIS), 2012.

[8] H. Hassanein and A. Zhou, *Routing with Load Balancing in Wireless Ad hoc Networks,* Proc. 4th ACM MSWiM '01, Rome, Italy, 2001, pp. 89–96.

[9] S.Y. Ni, Y.C. Tseng, Y.S. Chen, and J.P. Sheu, *The Broadcast Storm Problem in a Mobile Ad Hoc Network*, Proc. ACM/IEEE MobiCom, pp. 151-162, 1999.

[10] Oussama Souihli, Mounir Frikha *, Mahmoud Ben Hamouda, *Load balancing in MANET shortest-path routing protocols*, In: Elseveir, Ad Hoc Networks 7 2009.

[11] Xin Ming Zhang, En Bo Wang, Jing Jing Xia, and Dan Keun Sung. *A Neighbor Coverage-Based Probabilistic Rebroadcast for Reducing Routing Overhead in Mobile Ad Hoc Networks*, IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 12, NO. 3 MARCH 2013.

[12] Oussama Souihli, Mounir Frikha *, Mahmoud Ben Hamouda, *Loadbalancing in MANET shortest-path routing protocols*, In: Elseveir, Ad Hoc Networks 7 (2009) 431–442.