Congestion based Route Discovery AOMDV Protocol

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***Abstract*--- MANET is used to provide communication between nodes. There is no central authority which control communication session between nodes means there is not any defined infrastructure. Nodes moves frequently in the network which generate some issues like routing, coverage, congestion and security issues. To provide optimization in network different routing protocols are used in MANET. We propose a load balancing approach in AOMDV (Adhoc On-Demand Multipath Distance Vector Routing) protocol that use Queues, which are used for congestion monitoring. Route establishment are based on that queues result. We used for network simulation NS2 to simulate our work. The simulation result shows that proposed work is improved to basic protocol. The proposed solution is work better in delay, throughput and packet lost.**

Keywords--- Mobile Adhoc Network (MANET); multipath routing protocol; load balancing; congestion control; AOMDV; Quality of service (QOS); Queue length; disjoint paths.

I. INTRODUCTION

Adhoc network is a network consists of mobile nodes which are communicated with each other through access points. It is autonomous self configured networks which have not any defined infrastructure. Each node act as Relay node they receive and pass the information to other nodes. Due to mobility they form arbitrary topology. Nodes participate and leave network dynamically. Numbers of hops are required to exchange information to other nodes. Main application areas of adhoc network are Military, Border area and rescue sites [1].

Routing protocols are used to provide connectivity to other nodes and also responsible for communication. Adhoc network have two major problems link failure and node mobility. The bandwidth used for communication is limited. Packets are influenced to interference present in wireless channel. Limited power of nodes, congestion, limited bandwidth, and mobility of nodes will cause link breakage. Another major issue of network is Load balancing. Some Protocols will not distribute traffic uniquely among the other nodes in the network. Buffer over flows due to excess load on nodes and packets are dropping with high ratio. Multipath protocols are efficient for load balancing and congestion control. It provides link break protection and effective congestion technique [2].

In section II we present the protocol description. Complete overview present in this part. This section also describes the two phases of the protocol. In section III we present related work of protocol which has done by different authors. All approaches which are applied to protocol presents in this section. In section IV describes given approach. This is the main section of the paper. This section gives the proposed solution for load balancing and how can we effectively manage congestion at each node. Each node uses queues. We uses queues to check congestion state of each node, if queue is not full we choose that node for communication.

In section V we present the detailed implementation part of our protocol and compare it with to previous one. Simulation result obtained to this part and we analyze that result. We finish paper with conclusion.

II. AOMDV PROTOCOL

AOMDV (Adhoc On-demand Multipath Distance Vector) protocol is an enhance version of AODV protocol. It finds multiple routes from source to destination. It chooses the best route which has lower hop count as primary path and rest of the paths are secondary paths for backup. They work on two phases.

A. Route Discovery

Route discovery phase source establishes a route to destination. Beginning of the procedure source sends route request message (RREQ message) to its adjacent nodes. The adjacent nodes receive RREQ's and send to their adjacent nodes. They act as relay nodes. In the end destination node receive route request (RREQ) message. They reply back route reply (RREP) message to that paths through different path from which RREQ have been received. Source node receives multiple route request (RREP) messages from multiple paths. They chooses best path on basis of lower hop count and set that path as primary path. Rest of the paths are used as secondary paths for backups if primary path breaks. AOMDV protocol find

out Link disjoint and Node disjoint path from source to destination. No path or node repeated. They make a loop free path. Figure1 shows the topology of network in which dark arrows shows RREQ message and light arrows shows RREP message.

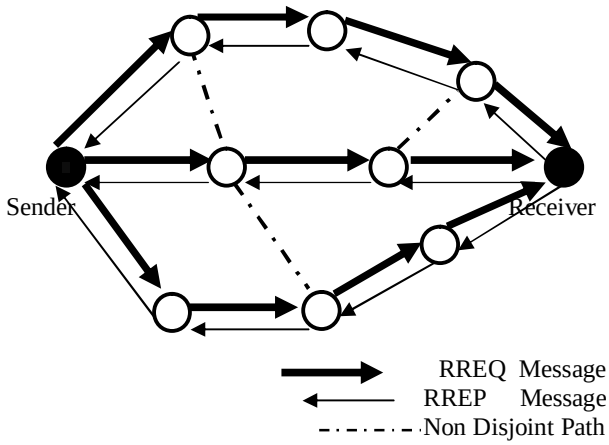

Fig. 1 Flooding of messages Source to Destination

Figure2 shows the path selection. Dark line represents primary path which have lower hop count and rest of the lines are used as secondary paths. They can be used as backup if primary path fails.

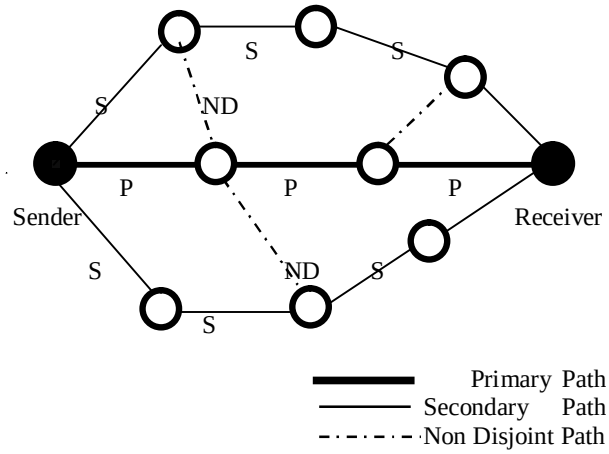

Fig. 2 Path establishment between source to destination choose Primary path

B. Route Maintenance

In a route maintenance phase when route breaks due to congestion or less power, RERR message will be generated from node to the source node. Source node selects another secondary path for packet transmission. They choose best path among all paths and start transmission to that route and that path select as primary path. HELLO messages are flown to use to check the liveability of other routes. When there is no path available from source to destination then route discovery process again start. [3]

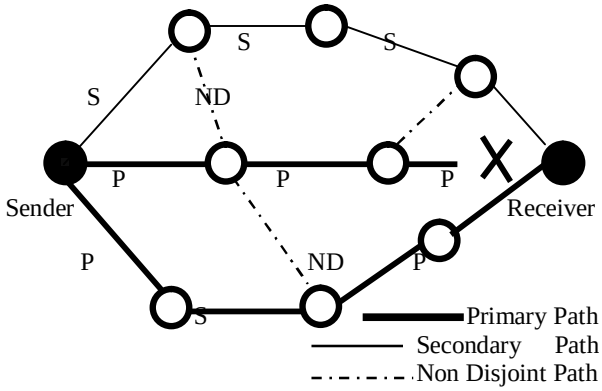

Fig. 3 Primary Path Failure and selects Secondary Path as Primary Path

III. RELATED WORK

Ali M. Stewart B. G, Shahrabi A and Vallavaraj A (2012) have presented an load balancing approach. They find a Node disjoint and Link disjoint path. They select a path which has no loop. Source node initiates route request procedure. They broadcast RREQ messages to its adjacent nodes. Adjacent node each time save the request number and compare the number to previous RREQ message if it finds the number of request is small to previous one they accepted that request otherwise discards that RREQ message. They basically compares the advertise hop count number and selects lower advertise hop count number for path establishment. In backbone network they used Quality of service parameters like Neighbourhood quality, Static resource capacity, Dynamic resources availability, Link Quality and stability. They used HELLO message to broadcast QOS information to neighbouring nodes and choose that path which have highest priority [4].

Soundararajan, S. and Bhuvaneswaran R.S. (2012) have presented load balancing mechanism. They used a concept of battery power of each node in their approach. They used threshold concept to calculate battery power of each node. They defined some threshold value for power if power is above defined threshold value then that node take part in communication and if the power is less than the defined threshold value simply that node rejected. In the end source to destination multiple paths are build. The energy level of those paths is above threshold value. Source select best path for data sending and set as a primary path and rest of that paths are secondary paths. If primary path is

congested or break during communication then load distribute to the alternate paths. [5]

Tekaya Mohamed, Tabbane Nabil and Tabbane Sami (2010) have proposed mechanism for load balancing. They apply changes in route discovery phase. In starting when source initiates route request. They chooses route which have less hop count, means traversing of nodes is less and congestion on that nodes is also less and high throughput performance. They chooses that path as primary path and rest of paths are secondary paths used for backups. They used same route maintenance procedure as in AOMDV protocol. [6]

Li Xia, Zhi Song, Xin Su, Zhiyuan Wang and Qilong Li (2009) have proposed an approach for load balance and location information. They applied their concept in route discovery phase. Source node when send RREQ message to their neighbours, some of the neighbour nodes reply back earlier and some of the neighbour nodes reply later. They used delay algorithm to calculate delay on each node. If a node do not reply early consider as congested node. They do not take part in communication. Delay algorithm describes if source choose that path delay increase with proportion. To calculate delay they used parameters like denseness of nodes, liveability of node and buffer queue [7].

Xu et al. (2009) have described load balancing concept. They apply load concept not only on the path, they distribute traffic along that path. They give load balancing algorithm for multipath which balance load effectively and congestion to the network. They give two matrix functions to calculate link and function index. They used defined threshold value to choose less congested link [8].

IV. PROPOSED SOLUTION

In this section we propose changes in AOMDV protocol. We apply these changes in Route discovery phase. Route maintenance phase is almost similar to AOMDV protocol.

A. Route Discovery

AOMDV protocol selects the lower hop count route for data sending and set as a primary path. Our proposed approach selects a route based on the queue size of nodes. Source node initiates route request message. Source node defines some value for congestion. When intermediate nodes receives RREQ message they check or compare that value to their queue, if queue size is sufficient then that node can participate in the communication if not fulfil condition simply node discards. Queue is used to detect the congestion present on that node. Source node calculates congestion at each node and select best route. Packets are transferred based on minimum congestion on the route. Source finds Link disjoint as well as Node disjoint path from source to destination. In the end one best path selected for communication and set that path as primary path. Another paths are set as secondary paths for backup which are used when primary path breaks up. Priorities are also set on paths to choose next primary path. When route gets congested source choose another paths for data sending.

B. Route Maintenance

Route maintenance is almost same as in AOMDV routing protocol. RERR message will generate when there is path failure. When the source receives the RERR message they choose another path which resides as backup path in routing table. HELLO messages are used to check whether secondary path is live or not and set as primary path. Transmission is done through on that path.

V. IMPLEMENTATION AND PERFORMANCE EVALUATION

We used Network Simulator (NS2) for implementation and simulate our proposed approach [9].We consider following parameters to simulate our result.

TABLE I
SIMULATION PARAMETERS

Parameters	**Value**
Topology Dimension	800*800 m^2
Routing Protocol	AOMDV
No. Of Nodes	27
Simulation Time	500 s
Traffic Type	CBR
Queue Size	70
MAC LAYER	802.11
Packet Size	512
Propagation Radio Model	Two Ray Ground
Channel Bandwidth	2Mb

All nodes have coverage area of 150meters. Node movement is random. We construct a topology of 27 nodes with constant bit rate traffic. Bandwidth of channel is set 2Mbps and 802.11 wireless LAN MAC layer used. It used to check the link breakage of network layer. Congestion based AOMDV protocol used in topology. Figure 4 shows the topology of nodes in network. NAM window shows the node in area of 800 X 800.

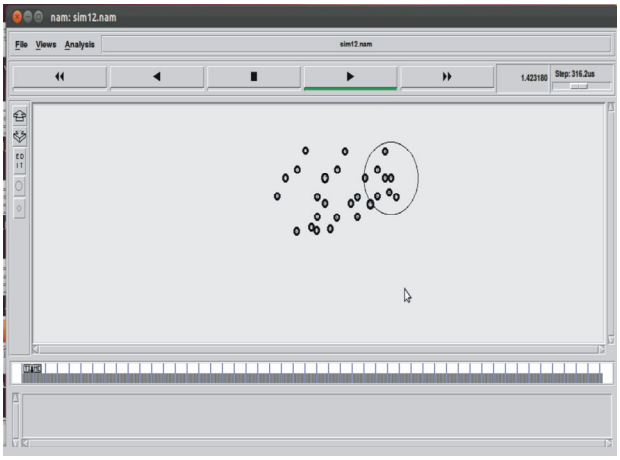

Fig. 4 Network topology of 27 nodes

During Communication, when node 4 moves from one direction to another, packets are dropped some interval. Topology get effected and the position of nodes changes. Figure 5 simulation shows the changes.

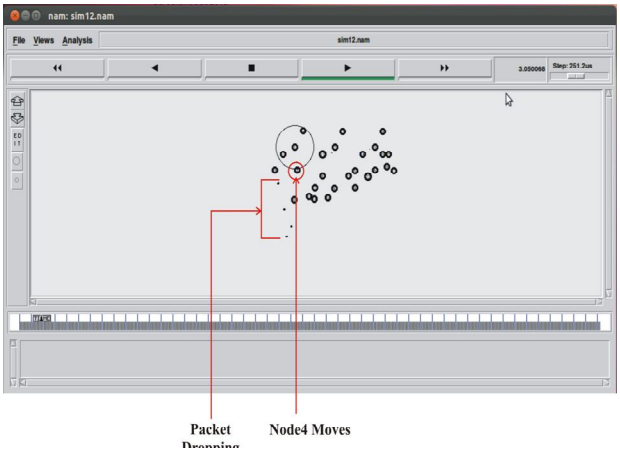

Fig. 5 Node4 moves due to mobility and network topology changes

Now we consider parameters which are used to simulate our protocol and previous one

A. Parameter to evaluate

In simulation, we evaluate Congestion based route Discovery protocol and compare it with AOMDV protocol. We consider three parameters metrics to evaluate:

- Throughput of node
- Delay of Packets during transmission
- Packet lost during transmission

B. Simulation Results

1) Throughput of nodes: Figure6 shows that throughput increase with time. Green line represents our protocol. In starting throughput is less to AOMDV protocol because source calculates congestion at each node with the help of Route Request message when it select path the throughput increases of each node. Compare it with AOMDV throughput increases. Fluctuations are because of packet receiving and processing on a node.

Fig. 6 Throughput of each Node v/s network load

2) Delay of packets during transmission: Figure7 shows that delay of packets. In starting of our protocol there is not any delay noted in starting but when node 4 moves to other side trace file note delay shown in the graph. Again when source selects another path, the delay continuously decreases. On the other side AOMDV protocol's delay is very high in starting.

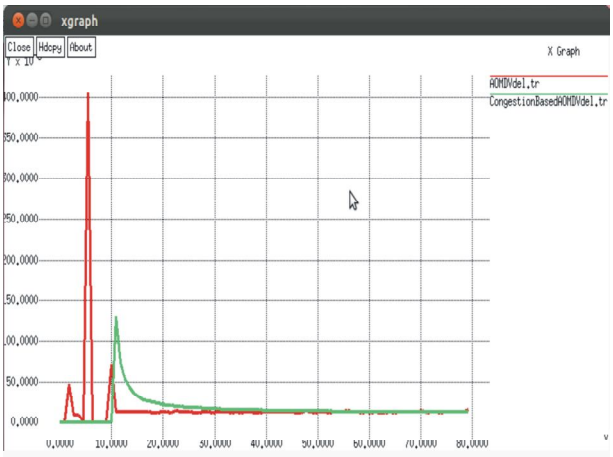

Fig. 7 Delay of each Node vs network load

3) Packet Loss during transmission: Figure8 shows the packet loss. In starting of transmission there is no packet loss because source node find path for transmission, when node 4 moves to another direction. Some packets are lost and line rises afterward. If we compare it to AOMDV we find that AOMDV packet loss rises in stating point after it also fluctuate.

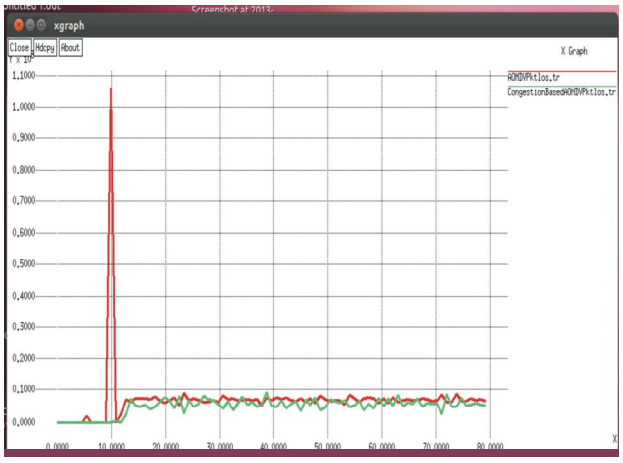

Fig. 8 Packet lost of each Node vs network load

VI. CONCLUSION

We give a new approach of load balancing to check congestion on each node working in multipath protocol used in Adhoc network. Main advantage of this work is to check congestion on node and then apply load balancing. We propose a new congestion based route discovery protocol in AOMDV which uses queues to check congestion on each node and source select only that path which have enough queue size and select as primary path. If it breaks then selects another secondary path for transmission. In implementation part we simulate our protocol and AOMDV protocol using parameters throughput, delay and packet lost at each node. Simulation result shows that our protocol works better than AOMDV.

VII. FUTURE WORK

AOMDV protocol is very much efficient protocol in adhoc network but there are lots of areas in AOMDV protocol in which we work in future. Load Balancing is not a small area. We can use threshold values, counters to check congestion at source node. Power is another area. The power of node drains while sending or receiving packets.

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