L-AOMDV- An Efficient Proposed Approach in MANETs

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Abstract— **Mobile Ad hoc Network (MANET) is a collection of mobile devices and is self configuring, dynamically changing, multi-hop wireless network which forms a communication network via multi hop wireless network connection, it is a self-organizing network, without any central control. Nodes in the network communicate with another node only if it lies within its transmission range. Every node acts as both source and router in the network. MANETs are one of the most challenging and growing research field because of their demand and challenges in providing services because of its dynamic nature. Load balancing is one of the key problems in MANETs as load balancing in network is essential for better lifetime of network, Qos, congestion control. The proposed approach in the research emphasises on the stability of the paths and distributing the traffic in the network based on the energy of the nodes.**

Keywords—MANET, Qos, PDR etc

I. INTRODUCTION

Recent year's mobile communication has increased in usage and popularity. Devices get smaller, batteries live longer and communication protocols get more robust and offer more throughput. Tasks earlier handled by wired communication can now be done using wireless devices and technology, thus giving users the advantage of mobility. The vision of mobile ad-hoc networking is to support robust and efficient operation in mobile wireless networks, by incorporating routing functionality into mobile nodes.

A wireless ad hoc network [1] is a decentralized type of wireless network. The network is called ad hoc because it does not rely on a pre existing infrastructure, such as access points in managed (infrastructure) wireless networks or routers in wired networks. Instead, every node participates in routing by forwarding data for other nodes, so the determination of which node forwards data is made dynamically on the basis of network connectivity.
Adhoc Networks do not rely on any infrastructure to work. Every node can communicate directly with other nodes inside network, so no access point controlling medium access is necessary. Nodes within an ad-hoc network only communicates only if they can reach each other physically, i.e., if nodes are within each other's radio range or if other nodes can forward the message. In ad-hoc networks, the complexity of each node is higher because every node has to implement medium access mechanisms, mechanisms to handle hidden terminal or exposed terminal problems, and perhaps priority mechanisms are required, to provide a certain quality of service to them. This kind of wireless network exhibits the greatest possible flexibility as it is, for example, needed for quick replacements of infrastructure, unexpected meetings or communication scenarios far away from any infrastructure. Sometimes fixed structure exits but cannot relied upon, such as during disaster recovery.

II. Literature Survey

S.R. Das et al. have compared the performance of DSR and AODV, two prominent on-demand routing protocols for ad hoc networks. DSR and AODV both use on-demand route discovery, but with different routing mechanics. In particular, DSR uses source routing and route caches and does not depend on any periodic or timer-based activities. DSR exploits caching aggressively and maintains multiple routes per destination. AODV, on the other hand, uses routing tables, one route per destination, and destination sequence numbers, a mechanism to prevent loops and to determine freshness of routes. They used a detailed simulation model to demonstrate the performance characteristics of the two protocols. The general observation from the simulation is that for application oriented metrics such as delay and throughput, DSR outperforms AODV in less "stressful" situations, i.e., smaller number of nodes and lower load and/or mobility. AODV, however, outperforms DSR in more stressful situations, with widening performance gaps with increasing stress (e.g., more load, higher mobility). DSR, however, consistently generates less routing load than AODV. We learned that AODV work more better than DSR in highly mobility as well as for large number of nodes present in the network.
Mandeep Kaur Gulati et al. surveyed different types of qos routing protocol. The contributions of the paper are as follows:
• The basic concepts and challenges of QoS routing in MANETs have been reviewed.
• The classification of the protocols has been done on the basis of multi-path, cross layer, stability, bandwidth reservation, load balancing and power efficiency based approaches.
• The protocols are selected in such a way so as to highlight many different approaches to QoS routing in MANETs, while simultaneously covering most of the important advances in the field. For each protocol, the functionality and main features are described briefly.
• The strengths and weaknesses of these protocols have also been provided and, finally, a comparison of all the QoS

routing protocols has been done so as to explore the future areas of research.

All the QoS routing protocols discussed above can further be explored in the areas of bandwidth/delay estimation, route discovery, resource reservation, route maintenance and cross-layer design to improve their performance. Many areas of research in this field provide considerable challenge and potential to enhance the growth and proliferation of MANETs and their applications. These areas include power consumption, resource availability, location management, inter-layer integration of QoS services, support for heterogeneous MANETs as well as stability, robustness and security. Effective and efficient solutions to these issues require the design and development of new QoS routing protocols in MANETs. So on the basis of survey we choose multipath routing approaches to provide QoS in MANET because in multipath routing approaches the protocol provides bandwidth aggregation, minimizing end-to-end delay, increasing fault tolerance, enhancing reliability, load balancing.On the basis of that features we try to provide qos in MANET.

Sung-Ju Lee et al. proposed AODV-backup routing. The mesh configuration provides multiple alternate routes and is constructed without yielding any extra overhead. Alternate routes are utilized only when data packets cannot be delivered through the primary route. They applied their algorithm to AODV and measured performance improvements. Simulation results indicated that our technique provides robustness to mobility and enhances protocol performance. They also show that however, their scheme does not perform well under heavy traffic networks. Form this technique we learned that if we have always an alternative route from the source to destination then our protocol achieves more throughput than only maintaining single path. On the basis we will also try to implement backup routing in our proposed methodology.

Mohammed Tarique et al. presented a survey of most recent multipath routing protocols for MANETs. The surveyed protocols showed that multipath routing can improve network performance in terms of delay, throughput, reliability and lifetime. Yet it is hard to find a single protocol or a set of protocols that can improve all these performance parameters. Selection of a multipath routing protocol depends on a particular application and trade-offs. Some of the objectives are energy efficiency, low overhead, reliability and scalability. With this survey paper, researchers can acquire what has been investigated, and network designers can identify which protocol to use, and what is the trade-offs.

Xuefei Li et al. proposed NDMR to overcome the shortcomings of unipath routing protocols. NDMR has two novel aspects in that it reduces routing overhead dramatically and achieves multiple node-disjoint routing paths. It is evident from simulation results that NDMR outperforms both AODV and DSR because multiple node disjoint routing paths provide robustness to mobility. This protocol is best suitable for small network and not more efficient in large network due to control overhead in the reply packet.

Lei wang et al. proposed Multipath Source Routing (MSR) is an extension of the on-demand DSR protocol. It consists of a scheme to distribute traffic among multiple routes in a network. MSR uses the same route discovery process as DSR with the exception that multiple paths can be returned, instead of only one.

When a source requires a route to a destination but no route is known (in the cache), it will initiate a route discovery process by flooding a RREQ packet throughout the network. A route record in the header of each RREQ records the sequence of hops that the packet passes. An intermediate node contributes to the route discovery by appending its own address to the route record. Once the RREQ reaches the destination, a RREP will reverse the route in the route record of the RREQ and traverse back through this route.

Each route is given a unique index and stored in the cache, so it is easy to pick multiple paths from there. Independence between paths is very important in multipath routing; therefore disjoint paths are preferred in MSR. As MSR uses the same route discovery process as DSR, where the complete routes are in the packet headers, looping will not occur. When a loop is detected, it will be immediately eliminated.

Since source routing is used in MSR, intermediate nodes do nothing but forward the packet according to the route in the packet-header. The routes are all calculated at the source. A multiple-path table is used for the information of each different route to a destination. This table contains for each route to the destination: the index of the path in the route cache, the destination ID, the delay and the calculated load distribution weight of a route. The traffic to a destination is distributed among multiple routes. The weight of a route simply represents the number of packets sent consecutively on that path.

Mahesh K. Marina et al. have proposed an on-demand, multipath distance vector protocol AOMDV that extends the single path AODV protocol to compute multiple paths. There are two main contributions of this work:1. They use the notion of an advertised hop count to maintain multiple *loop-free* paths at each node.2. They show how route discovery mechanism in the AODV protocol can be modified to obtain *link-disjoint* multiple paths from source and intermediate nodes to the destination. They have studied the performance of AOMDV relative to AODV under a wide range of mobility and traffic scenarios. They observe that AOMDV offers a significant reduction in delay, often more than a factor of two. AOMDV is considered more efficient in terms of creating less overhead Number of paths in any given source and destination is directly proportional to the number of nodes in entire network. AOMDV works more efficiently in dense and heavy networks. AOMDV does not consider to provision of QoS power management and security support.

Zhenqiang Ye et al. proposed Ad hoc On-demand Distance Vector Multipath Routing (AODVM) is an extension to AODV for finding multiple node disjoint paths. Instead of discarding the duplicate RREQ packets, intermediate nodes are required to record the information contained in these packets in the RREQ table. For each received copy of an

RREQ message, the receiving intermediate node records the source that generated the RREQ, the destination for which the RREQ is intended, the neighbor that transmitted the RREQ, and some additional information in the RREQ table. Furthermore, intermediate relay nodes are precluded from sending an RREP message directly to the source. When the destination receives the first RREQ packet from one of its neighbors, it updates its sequence number and generates an RREP packet. The RREP packet contains an additional field called "*last hop ID*" to indicate the neighbor from which the particular copy of RREQ packet was received. This RREP packet is sent back to the source via the path traversed by the RREQ When the destination receives duplicate copies of the RREQ packet from other neighbors; it updates its sequence number and generates RREP packets for each of them. Like the first RREP packet, these RREP packets also contain their respective last hop nodes' IDs. When an intermediate node receives an RREP packet from one of its neighbours, it deletes the entry corresponding to this neighbour from its RREQ table and adds a routing entry to its routing table to indicate the discovered route to the originator of the RREP packet (the destination). The node, then, identifies the neighbour in the RREQ table via which, the path to the source is the shortest, and forwards the RREP message to that neighbor. The entry corresponding to this neighbour is then deleted from the RREQ table. In order to ensure that a node does not participate in multiple paths, when nodes overhear any node broadcasting an RREP message, they delete the entry corresponding to the transmitting node from their RREQ tables. Intermediate nodes make decisions on where to forward the RREP messages (unlike in source routing) and the destination, which is in fact the originator of these messages, is unaware as to how many of these RREP messages that it generated actually made it back to the source. Thus, it is necessary for the source to confirm each received RREP message by means of a Route Confirmation message (RRCM). The RRCM message can, in fact, be added to the first data packet sent on the corresponding route and will also contain information with regards to the hop count of the route, and the first and last hop relays on that route.

Fubao Yang et al. [16] propose a Ad hoc On-demand Distance Vector Multipath Routing Protocol with Path Selection Entropy (AODVM-PSE). The key idea of AODVM-PSE algorithm is to construct the new metric-entropy with the help of entropy metric to reduce the number of route reconstruction so as to provide route packets in the ad hoc network.

Mohamed Tekaya et al.[17] present a new multipath QoS routing with load balancing. There are two main contributions in this work. One is load balancing mechanism to fairly distribute the traffic on different active route, the other is route discovery mechanism based on QoS parameter such as delay and throughput. Firstly they proposed a new multipath routing protocol called LB-AOMDV with a new metric which is the buffer size the less congested routes. Then they add QoS to their proposal LB-AOMDV protocol which includes delay and throughput parameters. It takes the advantage of the RREQ message to exchange the essential information to achieve the QoS requirements. Enabling a QoS constrained from source to destination is acquired in new protocol QLB-AOMDV.

Stephen Mueller et al. [18] developed an extended version of AODVM called AODVM/PD that can find paths with lower correlation factors. They then showed that AODVM/PD can achieve smaller end-to-end delay compared to AODVM in networks with low mobility rates. AODVM/PD can also provide better route resilience in the presence of correlated failures as we verified through simulation.

Lata et al. (2005) [19] proposes a new protocol TFRC (TCP Friendly Rate Control). TFRC is a protocol that implements equation-based congestion control. The primary goal of equation-based congestion control is not to aggressively find and use available bandwidth, but to maintain a relatively steady sending rate while still being responsive to congestion and the protocol that implements the TCP-equation based approach, TFRC (TCP Friendly Rate Control). In TFRC, The sender directly adjusts its sending rate as a function of the packet loss rate. The scheme depends on a "TCP throughput equation" which captures the TCP throughput over a network path with certain loss rate and round-trip time. In TFRC, the receiver measures the loss event rate (i.e., loss rate) and feeds this information to the sender. The sender uses the feedback messages to measure the RTT, and then inputs the loss rate and RTT to a TCP throughput equation to compute its acceptable transmission rate. TFRC is able to maintain smooth rate change; its throughput is often "beaten" down by competing TCP flows to a certain degree, especially under heavy background traffic and dynamic topology conditions. They also discover certain fundamental difficulties of equation-based flow control in MANET, such as loss rate estimation of the network. Therefore, although equation based flow control is a successful proposal for the Internet; it has serious limitations when applying to the MANET domain

III. PROBLEM STATEMENT

As per literature, problem is that the real time communication or audio and video transmission in MANET is quite difficult due to node mobility or congestion in the network or limited battery resources. The current existing routing protocols are not able to achieve the appropriate load balancing without increasing the overhead on the nodes. So our objective is to provide a load balancing approach with AOMDV as a routing protocol which can provide load balancing to the routing protocols so that the biasness in the network can be removed and the resources of the network can be utilized in a better manner. In normal scenarios the nodes falling in the middle of the networks are consumed more than the nodes in the less dense part of the network, which causes fast depletion of energy of the nodes falling in the mid of the networks.

Objectives

To provide stability and load balancing of energy in the AOMDV for Mobile Ad Hoc Networks, We define the following objectives.

1. To identify performance matrices for stable multipath routing.
2. To propose an extension in AOMDV for stable multipath routing.
3. To design appropriate framework scenario for evaluating extension of AOMDV.
4. To validate the proposed extension using NS2 test bed.

3.3 Assumptions

1. If node A can hear node B that implies that B can also hear node A.
2. Hello interval is appropriate in order to update the dynamics of the networks
3. Initial Route discovery latency is tolerable.

3.4 Proposed Algorithm

AOMDV stores multiple paths for data transmission in the networks, it uses on path for data transmission and keeps the other as backup in case of breakage of paths, but AOMDV does not considers the stability and energy of the nodes in the path.

```
Calculate_Node_Energy(Node_id )                    //for calculation of node energy
{return this->Node_energy}
If (path exists for destination)
{Distribute data amongst multiple paths}
Else
{initiate route discovery}
Route discovery process
Send RREQ ();
Packet reception routine
If (packet type is RREQ && signal Strength of link > Threshold )
{
If (I am Destination)
{
// existing AOMDV
{Send RREP()}
}
If (I am an intermediate node)
{
If(Calculate_Node_Energy() > Threshold)
{
If (I have a fresh route)
{        // existing AOMDV CODE
SendRREP()
}
Else
{
Forward RREQ()}
}
}
If(packet type is RREP){//existing AOMDV code}
```

The node sends the RREQ packet when it needs to transfer data to other node. The node which receives the request packet then checks the signal strength of the received packet, if the signal strength is above a threshold, it is further processed. By doing this we are ensuring the stability of the link, that it can withstand the mobility of the nodes. In the further processing of the request packet, if the request is received at the destination node, reply is sent back to the source and the transmission takes place. If the intermediate node receives the request packet then it calculates it's energy level, if the energy level is above a threshold, then only it will entertain a new request, otherwise it drops the request. By doing this we are able to spread the traffic towards the nodes with more power so that we can maintain the connectivity of the network.

Conclusion

The Adhoc mobile network (MANET) is a set of mobile devices. MANET is quite difficult due to node mobility or congestion in the network or limited battery resources. The current existing routing protocols are not able to achieve the appropriate load balancing without increasing the overhead on the nodes. So our objective was to provide a load balancing approach with AOMDV as a routing protocol which can provide load balancing to the routing protocols so that the biasness in the network can be removed & the resources of the network can be well-utilized in a better manner. We have proposed an Algorithm which is quite efficient and will definitely work well if implemented.

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