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Design and Development in Research of Adaptive Multipath Routing for Burden Harmonizing in MANET

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***Abstract* - In mobile ad hoc network (MANET), congestion is one of the most important limitations that affect the performance of the whole network. Multi-path routing protocol can balance and share the load better than the single path routing protocol in ad hoc networks, thereby reducing the congestion possibility by dividing the traffic in alternative paths. The performance of the network can be improved by using a burden harmonizing mechanism. Such a mechanism transfers load from overloaded nodes to under loaded nodes. The objective of multipath routing is to improve the reliability and throughput and favors burden harmonizing. Multipath routing allows the establishment of multiple paths between a pair of source and destinationnode. It is typically proposed in order to increase the reliability of data transmission or to provide burden harmonizing and has received more and more attentions. In this paper, some of the congestion removing and burden harmonizing routing schemes have been surveyed. The relative strengths and weaknesses of the protocols have also been studied which allow us to identify the areas for future research.**

***Keywords:* MANET, multipath routing, burden balance and sharing.**

I. INTRODUCTION

In Ad hoc networks, it is essential to use efficient routing protocols that provide high quality communication. To maintain portability, size and weight of the device this network has lot of resource constrain. The nodes in MANET have limited bandwidth, buffer space, battery power etc. So it is required to distribute the traffic among the mobile host. A routing protocol in MANET should fairly distribute the routing tasks among the mobile host. An unbalanced traffic/load distribution leads to performance degradation of the network. Due to this unbalancing nature, few nodes in the network are highly loaded with routing duties which causes the large queue size, high packet delay, high packet loss ratio and high power consumption. Now we provide a solution of burden harmonizing routing algorithm for MANET. The advantages of burden harmonizing can be optimal resource utilization, increased throughput, and lesser routing overload. The load can also be unequally distributed over multiple links by manipulating the path cost involved.

MANET consists of mobile hosts equipped with wireless communication devices. The main characteristics of MANET is, it operate without a central coordinator ,Rapidly deployable, self-configuring, Multi-hop radio communication, Frequent link breakage due to mobile nodes ,Constraint resources (bandwidth, computing power, battery lifetime, etc.) and all nodes are mobile so topology can be very dynamic. So that the main challenges of routing protocol in MANET is , it should be Fully distributed, Adaptive to frequent topology change ,Easy computation & maintenance, Optimal and loop free route, Optimal use of resources, It provide QoS and Collision should be minimum. A critical challenge in the design of ad hoc networks is the development of efficient routing protocols that can provide high-quality communication between two mobile nodes. Numerous routing protocols have been developed for ad hoc mobile networks. These protocols may generally be categorized as table-driven and on-demand routing. Table driven routing protocols are [1, 2] attempt to maintain up-to-date routing information of each node.

Such protocols, and although a route to every other node is always available, incur substantial signalling traffic and power consumption. Since both bandwidth and battery power are scarce resources in mobile computers, this becomes a serious limitation to table-driven routing protocols. On the other hand, on-demand routing protocols [6, 7] overcome this limitation. This type of routing protocols does not maintain routing information at every node, but create routes only when desired by the source node. When a source has a packet to transmit, it invokes a route discovery mechanism to find the path to the destination. The route remains valid until the destination is reachable or until the route is no longer needed. In fact, on demand routing is dominating the tendency for wireless ad hoc communication.Figure 1 represents the ad hoc network, here first connection will established in between sender S and destination D then transfer data through intermediate nodes.

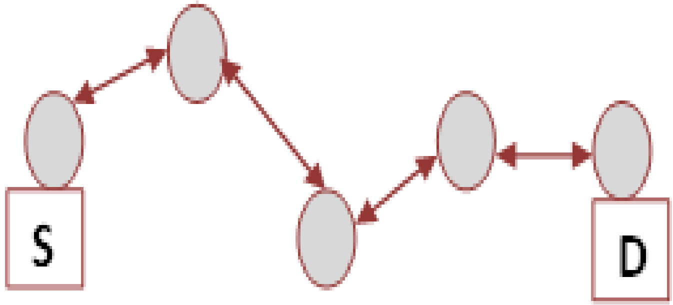

Fig.1 Adhoc Network

It has been long believed that the performance of ad hoc networks routing protocols is enhanced when nodal mobility is reduced. This is true when considering performance measures such as packet delivery fraction and routing overhead. This may not be the case, however, when we consider packet delay. It was shown in [11] that the packet delay for both AODV and DSR increases as the nodal mobility is reduced. This is because there is a tendency in ad hoc networks routing protocols to use a few "centrally located" nodes in a large number of routes. This causes congestion at the medium access control (MAC) level, which in turn may lead to high packet delays, since few nodes have to carry excessive loads. Such nodes may also suffer from high battery power consumption. This is an undesirable effect, which is compounded by the limited battery power of the mobile terminals. In fact, a major drawback of all existing ad hoc routing protocols is that they do not have provisions for conveying the load and /or quality of a path during route setup. Hence they cannot balance the load on the different routes.

II. Routing in MANET

The Routing in a MANET depends on many factors including topology, selection of routers, and initiation of request and specific underlying characteristic that could serve as a heuristic in finding the path quickly and efficiently. The low resource availability in these networks demands efficient utilization and hence the motivation for optimal routing in ad hoc networks. Also, the highly dynamic nature of these networks imposes severe restrictions on routing protocols specifically designed for them, thus motivating the study of protocols which aim at achieving routing stability.

A. Classification of routing protocols in MANET

The routing protocols in MANET are classified depending on routing strategy and network structure. According to the routing strategy the routing protocols can be categorized as Table-driven and source initiated, while depending on the network structure these are classified as flat routing, hierarchical routing and geographic position assisted routing Based on the routing strategy the routing protocols can be classified into two parts:

B.Proactive (table driven) routing protocol

These routing protocols are similar to and come as a natural extension of those for the wired networks. In proactive routing, each node has one or more tables that contain the latest information of the routes to any node in the network. Each row has the next hop for reaching a node/subnet and the cost of this route. Various table-driven protocols differ in the way the information about a change in topology is propagated through all nodes in the network. There exist some differences between the protocols that come under this category depending on the routing information being updated in each routing table. Furthermore, these routing protocols maintain different number of tables. The proactive protocols are not suitable for larger networks, as they need to maintain node entries for each and every node in the routing table of every node. This causes more overhead in the routing table leading to consumption of more bandwidth. Examples of such schemes are the conventional routing schemes, Destination Sequenced Distance Vector (DSDV).

C.Reactive(On-Demand) routing protocol

Reactive routing is also known as on-demand routing protocol since they don’t maintain routing information or routing activity at the network nodes if there is no communication. These protocols take a lazy approach to routing. They do not maintain or constantly update their route tables with the latest route topology. If a node wants to send a packet to another node then this protocol searches for the route in an on-demand manner and establishes the connection in order to transmit and receive the packet. The route discovery usually occurs by flooding the route request packets throughout the network. Examples of reactive routing protocols are the dynamic source Routing (DSR) [3], ad hoc on-demand distance vector routing (AODV).

D.Hybrid routing protocol

These protocols try to incorporate various aspects of proactive and reactive routing protocols. They are generally used to provide hierarchical routing; routing in general can be either flat or hierarchical. In a flat approach, the nodes communicate directly with each other. The problem with this is that it does not scale well; it also does not allow for route aggregation of updates in a hierarchical approach, the nodes are grouped into clusters, within each cluster there is a cluster head, this acts as a gateway to other clusters, it serves as a sort of default route. The advantage of a hierarchical structure is that within a cluster, an on demand routing protocol could be used which is more efficient in small-scale networks. Example of a hybrid routing protocol is the Zone Routing Protocol (ZRP). Effective burden harmonizing has been a challenging task in Mobile Ad hoc Networks (MANET) due to their dynamic and un-predictable behaviour and topology changes. Multipath QoS Mobile Routing Backbones (MP-QMRB) for enhanced burden harmonizing in MANETs. The approach we propose employs multiple mobile routing backbones (MRB) between a pair of source and destination nodes using intermediate nodes which are rich in resources like bandwidth, processing power, residual energy etc. The protocol ensures that the available bandwidth in the network is utilised efficiently by distributing traffic evenly which ensures better burden harmonizing and congestion control [7]. Ad-hoc on demand multipath distance vector (AOMDV) selects a path with a lower hop count and discards routes with higher hop count. The new scheme can be applied in most on-demand routing protocols.

The first class of protocols evaluates the routes periodically and maintains routes for each node in the network. Thus every node keeps a full topological view of the network. One big disadvantage of this type of protocol is that it reduces the capacity of the system because a high percentage of transmitted packets are sent to carry information about the topology of the network. Some examples of table-driven protocols are DSDV [2], Destination Sequence Distance Vector Routing [3], CGSR [5], Cluster-head Gateway Switch Routing and, WRP Wireless Routing Protocol.

E.AOMDV (AdHoc On-Demand Multipath Distance Vector) Protocol

AOMDV [9] is a multipath extension to AODV [4]. It uses link-disjoint, loop free paths. Loop freedom is ensured by accepting only lower hop-count alternate routes than the primary route. Intermediate nodes look at each copy of the RREQ to see if it provides a new node-disjoint path to the source. If it does, AOMDV updates its routes only if a reverse path can be set up. The destination then replies with k copies of RREQ where k is the number of disjoint routes. When all routes fail a new route discovery is broadcasted. The advantages are a fast and efficient recovery from failures. The main disadvantage is that path information used is often quite out of date because a new discovery process is initiated only when all the routes fail. The other type of multipath routing algorithms is burden harmonizing multipath protocol. AOMDV protocol to finds node-disjoint or link-disjoint routes between source and destination. Link breakdown may occur because of node mobility, node failures, congestion in traffic, packet collisions, and so on. For finding node-disjoint routes, each node does not immediately reject duplicate RREQs. A node-disjoint path is obtained by each RREQ, arriving from different neighbor of the source because nodes cannot broadcast duplicate RREQs. Any two RREQs arriving at an intermediate node through a different neighbor of the source could not have traversed the same node. To get multiple link-disjoint routes, the destination sends RREP to duplicate RREQs regardless of their first hop. For ensuring link disjointness in the first hop of the RREP, the destination only replies to RREQs arriving through unique neighbors. The RREPs follow the reverse paths, which are node-disjoint and thus link-disjoint after the first hop. Each RREP intersects at an intermediate node and also takes a different reverse path to the source to ensure link-disjoint ness.

III. RELATED WORK

Here a new approach [11] for multipath routing in mobile ad hoc networks is discussed. The source does not wait for its current path to break in order to switch to a different path. Instead, it constantly monitors each of its alternate paths and always selects the best among them for transmitting data. The primary characteristic of this approach is that it dynamically adapts to varying network topology by monitoring the quality of each path to the destination and always using the best path. It is able to eliminate old routes and thereby reduce the number of data packets dropped due to the use of these invalid paths. Though control overhead is introduced through the periodic update (Pu) packets, results prove that the overall overhead is still lower than other approaches. It makes use of a periodic maintenance mechanism considering signal strength information, Residual Energy and consistency parameter for determining ‘quality’ of path. Here a Periodic update packets measure Decision Value metric [DVM] and route maintenance is possible by means of the Signal strength between nodes, Residual energy and Consistency of each hop along the alternate paths, helps protocol to select the best scalable paths.

In this paper [12] enhances AODV protocol by minimizing its control messages overhead. Enhancements include developing two improved versions of AODV protocol. These two versions use Global Positioning System (GPS) to limit the routing discovery control messages. The first version (AODV-LAR) is a variation of the Location Aided Routing (LAR) protocol. The second version (AODV Line) limits nodes participating in route discovery between source and destination based on their distance from the line connecting source and destination. The results show that the two proposed protocols outperform the original AODV, where the results show a significant reduction of control overhead and delay compared to the original AODV. Results also show that the delivery ratio in the proposed protocols is comparable to the delivery ratio in the original AODV

In this paper [13] a scalable multipath on-demand routing protocol (SMORT), which reduces the routing overhead incurred in recovering from route breaks, by using secondary paths. SMORT computes fail-safe multiple paths, which provide all the intermediate nodes on the primary path with multiple routes (if exists) to destination. Exhaustive simulations confirm that SMORT is scalable, and performs better even at higher mobility and traffic loads, when compared to the disjoint multipath routing protocol (DMRP) and ad hoc on-demand distance vector (AODV) routing protocol. We modified AODV [11] protocol to compute a new class of multiple paths called fail-safe multiple paths, which are more abundant and hence provides better fault-tolerance to route breaks. We proved the loop freedom of the protocol. Performance evaluation of our protocol using simulations showed that an average of 50% reduction in routing overhead doubled the scalability of SMORT when compared with AODV. Also, average throughput of SMORT is improved by a maximum of 60% when compared to AODV.

In this work [14] author presents the results of a detailed simulation study of three multi-path routing protocols (SMR, AOMDV and AODV Multipath) obtained with the ns-2 simulator [36]. The simulation study shows that the AOMDV protocol achieves best performance in high mobility scenarios, while AODV Multipath performs better in scenarios with low mobility and higher node density. SMR performs best in networks with low node density, however as density increases, the protocol's performance is degrading. In addition, they demonstrate that the establishment and maintenance of multiple routes result in protocol performance degradation. We found that the use of two, maximum three, paths offers the best tradeoff between overhead and performance. Furthermore, protocols with high routing overhead perform badly since the routing messages fill the queues and generate data packet losses. Compared to single path routing, our results validate the better performance of multi-path routing, especially in networks with high node density. Despite the increased routing overhead per route, the total routing overhead is lower.

In this paper [15] Multipath Dynamic Source Routing Protocol is implemented which is based on standard on demand routing protocol i.e. Dynamic Source Routing (DSR). It uses new power aware metric i.e. minimum node cost to find the optimal paths. Due to on demand nature, the maintenance of whole information about network topology in routing tables is eliminated and the dissemination of routing information throughout the network is also eliminated because that will consume a lot of the scarce bandwidth and power when the link state and network topology changes rapidly and it also works well when network size increases. It reduces the overhead during broadcasting of route requests using a novel approach, which in turn induces little bit overhead to carry node's cost in route quest. The Multipath Dynamic Source Routing Protocol significantly reduces the total number of Route Request packets, this result in an increased packet delivery ratio, decreasing end-to-end delay for the data packets, lower control overhead, fewer collisions of packets, supporting reliability and decreasing power consumption.

In this research [16] author propose an efficient routing scheme for Mars sensor networks exploiting the similarity of operations between the wireless, multi-hop communications network connecting instruments (sensors) and rover(s) and the packet radio network used in a typical ad hoc networking environment. A critical issue in routing strategy design that sets the Mars sensor network apart from conventional ad hoc networks is energy conservation and prolonging network lifetime while maintaining connectivity and satisfying latency constraints. To address this issue, we propose a multi-path routing scheme that builds a mesh structure for data reply which reduces the congestion and improves the energy efficiency and the reliability in data delivery. Each data packet is delivered to the base station using one of the multiple paths according to dynamic changing metrics. The balance among multiple paths that considers the energy usage at neighbors is further considered in path selection, which leads to efficient utilization of the relay nodes and prevents early death of heavily involved nodes. Simulation results show that with energy aware path selection, a more even distribution of energy consumption among nodes is developed and leads to longer network life time. Burden harmonizing routing algorithm in ad hoc networks based on a gossiping mechanism. This algorithm merges gossip based routing and burden harmonizing scheme efficiently. It adjusts the forwarding probability of the routing messages adaptively as per the load status and distribution of the nodes in the phase of route discovery. Their objective is to do use the ant based algorithm for burden harmonizing by calculating threshold value of each routing table through average number of requests accepted by each node. According to this threshold value, they can control the number of ants that has been sending. If the threshold value is less, it means the average number of requests to that particular node is low. Then they simply broadcast the ants for updating their pheromone table. If the average number of requests is high, then a data packet will be send according to the pheromone table of that particular node. Their work presents a new dynamic and adaptive routing algorithm for MANETs inspired by the ant colony paradigm. Here we are presenting survey about existing work done in the field of MANET routing protocol, congestion control and burden harmonizing mechanism. In this paper, they develop ecMTCP. ecMTCP moves traffic from the most congested paths to the more lightly loaded paths, as well as from higher energy cost paths to the lower ones, thus achieving load-balancing and energy-savings[23]. This paper focus congestion control with the help of energy base burden harmonizing mechanism, this work also modified via multipath routing technique for end-to-end delay minimization. They propose a novel congestion control algorithm, named TCP-FIT, which could perform gracefully in both wireless and high BDP networks [24]. The algorithm was inspired by parallel TCP, but with the important distinctions that only one TCP connection with one congestion window is established for each TCP session, and that no modifications to other layers (e.g. the application layer) of the end-to-end system need to be made. This work done only transport layer congestion control via TCP improvement method but congestion also occurs in routing time so that work enhance through routing base congestion control technique.

"Cluster" based congestion control (CBCC) protocol that consists of scalable and distributed cluster-based mechanisms for supporting congestion control in ad hoc networks". The clusters autonomously and proactively monitor congestion within its localized scope. The present approach improves the responsiveness of the system when compared to end-to-end techniques. After estimating the traffic rate along a path, the sending rate of the source nodes is adjusted accordingly. Thus this protocol look forward the injection of dynamic flows in the network and proactively adjusts the rate while waiting for congestion feedback. The proposed QoS architecture contains an adaptive bandwidth management technique which measures the available bandwidth at each node in real-time and it is then propagated on demand by the QoS routing protocol. The source nodes perform call admission control for different priority of flows based on the bandwidth information provided by the QoS routing. A rate control mechanism is used to regulate best-effort traffic, whenever network congestion is detected.

IV. CONCLUSION

There is no pre-existing communication infrastructure (no access points, no base stations) and the nodes can freely move and self-organize into a network topology. Such a network can contain two or more nodes. Hence, balancing the load in a MANET is important because the nodes in MANET have limited communication resources such as bandwidth, buffer space, and battery power. So it is essential to distribute the traffic among the mobile host. In MANET, to improve the performance, it is very essential to balance the load. Burden harmonizing is used to increase throughput of the network. Also it is possible to maximize nodes lifetime, packet delivery ratio, and minimize traffic congestion and load unbalance, as a result, end-to-end packet delay can be minimized, and network performance in term of load can be balanced. This paper discusses various load metric and various burden harmonizing routing techniques by that we aware about the different work that has been done in this field with their limitations.

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