Enhanced Multipath Ad-Hoc Routing With Indirect Key Based Architecture

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Abstract—
ad hoc networks contain a collection of wireless nodes which communicate among themselves without the exigency of fixed infrastructure. Limited transmittal span of wireless network nodes causes multiple hops to share information with any other node in the network. The multipath routing scheme provides better performance and scalability .In this research, we target on implementing a mechanisms for ad hoc networks by using resources of both traditional and innovative addressing scheme.

To contribute a expansible mapping between transient addresses and node identifiers, we adopt a novel routing paradigm, the dynamic way based on key search. In this paper, we address to significant message overhead and redundancy issues by integrating both traditional way of routing direct routing and key-based indirect routing at the network layer. Unlike procedures used in traditional routing that, at the best, single out a unique route, we also explore the feasibleness of multi-path routing, which consists of proactively discovering several alternative routes towards the same destination. In this paper we define an analytical framework to evaluate the performance gain achieved by multi-path routing resorting to the hierarchical routing.

Keywords—ad hoc networks; Multipath routing; Proactive; Dynamic routing; dynamic addressing; AOMDV.

1.INTRODUCTION

Ad hoc networks are characterized by dynamic topology, high node mobility, and low channel bandwidth. Research in Ad hoc networks seems to have downplayed the concern of scalability. Mobile nodes are grouped randomly and act as router and a host that transmit the data packet to other node stochastically [1].

Mobility causes complication in routing due to frequent changes in network topology. To search and maintain route a mechanism is required to be flexible to frequent changes in topology. the routing protocols must search for other feasible routes dynamically.

Several routing methods have been proposed [2] [3].Reactive methods are based on demand for data transmission. Routes are determined when an explicit need for forwarding packets between hosts is created. Proactive methods maintain a constantly updated route to all nodes; including nodes those are not sharing packets. One observation of routing protocols is that, though the source actually explores multiple paths over the process of route discovery, it elects only the best route and reject the rest route [4]. Due to non availability of alternate path to the destination, route breaks frequently and causes the drop in packet by intermediate nodes. This affects the overall throughput and may reduce packet delivery ratio. Moreover, frequent route discoveries in high mobility scenarios create high average end-to-end delay.

Current multipath routing protocols cache multiple routes obtained during the route discovery process [1].The best path is chosen and considered as the primary path for data transfer. As maintenance of the alternate paths is no not performed by these protocols, the alternate path is likely to also be invalid. Multipath routing protocols initiate route discovery only when all alternate paths fail.

This paper examines how dynamic addressing can be a feasible way toward a scalable ad hoc routing architecture. With dynamic addressing, addresses of nodes changes more than once hence nodes addresses have topological meaning. Routing with dynamic approach become simple but problem of address allocation and its lookup is important to solve. we present an effective multipath route discovery and maintenance mechanisms KBMR: key-Based Multipath Routing Protocol that present address allocation and address lookup mechanisms. In this protocol nodes are not updated periodically , instead node's neighbour node information is maintained and updated frequently. Thereby each node can have the appropriate information regarding its neighbor nodes accurately. Hence the information minimize the rate of traffic for transmitting the update messages.

We focus our attention on the problem of implementing a key-based routing mechanism that helps in data forwarding to the sink node by searching through a key value of address , whose performances are competitive with those of other widely adopted protocols.

The rest of the paper is organized as follows. In section 2, we review related prior work. In section 3, detailed protocol is described. Simulation results are presented in section 4 , while conclusions are offered in section 5.

2.RELATED WORK:

An extension AOMDV [6]to AODV is developed which computes multiple paths with loop free link to provide adequate fault tolerance and recovery from route failures .In AOMDV different instances of RREQs provide potential alternate paths information hence intermediate nodes does not discard different instances of RREQs. In [7] proposed protocol is AODVM which is an extension for finding node-disjoint paths. In this intermediate nodes do not send a route reply directly to the source and do not discard duplicate RREQ packets. But all received RREQ packets are recorded in RREQ table at the intermediate nodes. For all the received RREQ packets an RREP is send by destination. An intermediate node forwards a received RREP packet to the neighbour in the RREQ table that is along the shortest path to the source. To ensure that nodes are not participating in more than one route, whenever a node overhears one of its neighbours broadcasting an RREP packet, it deletes that neighbour from its RREQ table. Because a node cannot participate in more than one route, the discovered routes must be node-disjoint.

In most common ad hoc routing protocols [8] [9] [10], IP addresses are used as pure identifiers. There is no structure in the address space, it works with two choices: either maintain routing entries for every network node or refer to flooding route requests throughout the network based on connection structure. Other protocols try to achieve scalability by using information based on geographic location to assist in the routing. As availability of location information is not sure sometime it can be misleading in, among others, non-planar networks. For a survey of ad hoc routing, Studies on Proactive Route maintenance has received significant attention as it would save the cost involved in frequent Route Discoveries. To anticipate route failures many approaches have been used and therefore switch to a better path. A solution [11] is given that pre-emptively finds other paths by switching to an alternative good path before a path breaks, minimizing both the latency and jitter and avoiding inefficiencies due to unnecessary TCP back off and congestion avoidance.

In PSR[12] nodes repeatedly interchange network topology information. Each node has a spanning tree that maintains the shortest routing paths to all other nodes. PSR give better data transportation. for network's operation to be robust It uses beacon and differential message upgrades and reduces overhead. The LPSR each nodes minimize the routing tree during the network topology changes to reduce the size of differential upgraded message thus reduces the communication overhead.

The Destination-Sequenced Distance-Vector routing (DSDV) is a Proactive routing protocol and alteration of Bellman

Ford algorithm [16]. Table entries labeled with many number of nodes, destination node information, sequence number and neighbor node information to reaches the destination [18]. For maintaining changes on topological information routing updates are repeatedly transmitted to all nodes instantly [16, 17].

OLSR is a proactive routing protocol [19]. The protocol uses the Multi point relays. The shortest path algorithm is used for optimizing the discovered route. MPRs has link state information and its route [13]. As the packet sent via MRP the traffic and the routing overhead will be degraded, also provide optimized flooding distance [14]

Some work has been done on using clustering in ad hoc networks. In multilevel-clustering approaches such as Landmark , and Hierarchical State Routing (HSR) [16], certain nodes are elected as cluster heads (also called Landmarks). These cluster heads in turn select higher level cluster heads, up to some desired level. A sequence of cluster head identifiers is used to define node's address, allowing the size of routing tables to be reduced in the size of the network, but easily resulting in long hierarchical addresses. All of the above schemes have explicit cluster heads, and all addresses are therefore relative to these, and are likely to have to change if a cluster head moves away. This reliance on cluster head nodes makes the above schemes best suited to scenarios involving group mobility.

5. Proposed method:

The paper proposes a key search based multi-path routing based on the distance vector concepts with hierarchical approach for scalable *ad hoc* networks. route discovery and route selection is based on network layer architecture. An approach is used in which the routing address and the node identity are considered separately. Node's routing address changes with movement of node shows the node's location. The identifier is a globally unique number remain same throughout the node lifetime. a network node is identified by its permanent unique id and node's topological location is find out by transient network address. In this protocol nodes update their network address periodically by hearing routing update packets and maintaining information by neighbour node only. Due to this routing state information stored by each node is reduced.

overview of new method

Address allocation : an approach based on multiple disjoint allocation is used. For acquiring valid of available address, a node listen for the packet exchanged by neighbour node. A string of i bits is used for the network address hence a binary tree with i+1 level is formed. Address allocation procedure become simple and manageable with tree based structure.

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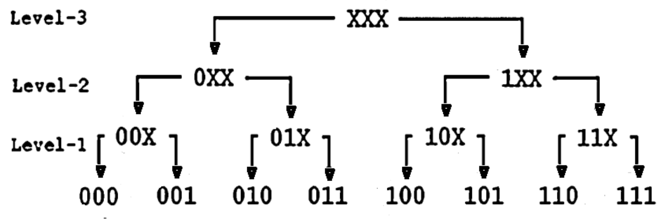


Figure 1: Address space overlay

Path Discovery: each node maintains a routing state information in routing table.to keep this information consistent node exchanged periodic routing updates with neighbour node.

A routing table consist of L section, where L represents length of network address and the kth section contains several path toward a node belonging to the level-k sibling. Each section contain five fields: sibling ID, the next hop, network ID path cost, route log.

packet forwarding : When a packet is to be forwarded, a hop by hop search of network address is done. node compares its network address with destination address. it compare addresses bit by bit starting with most significant bit that differs between two addresses. the neighbor having longest address prefix with the destination is opted as next hope.

the whole routing process is based on the transient network addresses, they have to be efficiently distributed across the network. The mapping between node identities and network addresses is provided by a DHT.

The performances of KBMR have been evaluated by means of numerical simulations across a wide range of environments and workloads. The results show that KBMR performs comparable with respect to widely adopted routing protocols in all the considered scenario.

6.**Simulation Environment**:

We used ns2 simulator. Network Simulator which uses the tool command language and C ++ language. The simulation area is a square field of 500m x 400m size, where nodes are placed randomly. The two ray ground model is used, The parameters considered for the simulation are listed in the table 1. we have measure and compare the performance of multipath reactive routing protocol AOMDV and KBMR using different parameters that are Packet Delivery Ratio, Routing Load, and End to End Delay in MANETS .The results are summarized with graphs.

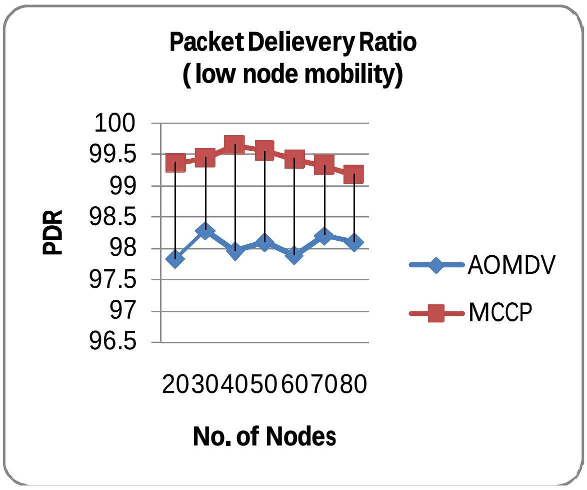
Table 1.Simulation parameters

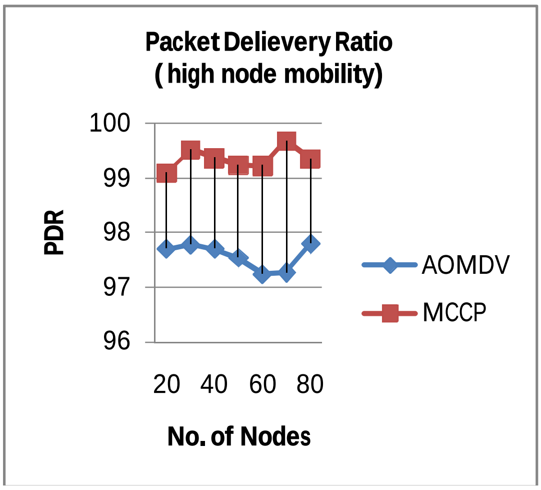
Parameter	Value
Simulator	NS 2.34
Simulation area	500m*400m
Routing Protocol	AOMDV, KBMR
Node Placement	Random
No. Of Nodes	20, 30, 40, 50, 60, 70, 80
No of Source	1(node 0)
No. of Sink	6(node 1 to 6)
Simulation Time	100s
Traffic Type	FTP

Results and analysis:

Packet delivery ratio : It is the ratio of the number of delivered data packet to the destination. This illustrates the level of delivered data to the destination.

PDR=Number of packet receive / Number of packet send





(a) **(b)**

Figure 2 : Measurement of Packet delievery ratio, with varying number of nodes and node mobility

The greater value of packet delivery ratio means the better performance of the protocol. As shown in Figure 2, KBMR has better PDR than AOMDV for low and high mobility. It shows

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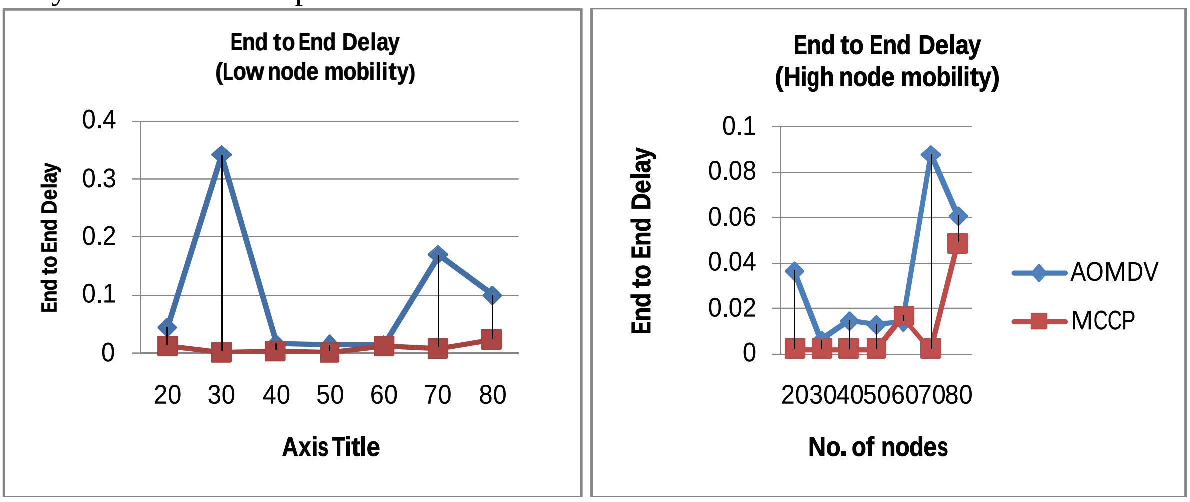
that mobility affects the PDR of AOMDV and KBMR differently. For randomly changing topology, the possibility of link failures increases. This causes the average PDR to decreases of AOMDV.KBMR is able to select multiple paths with less time to achieve more loads balancing in a high mobility to deliver packets.

End-to-end Delay : the average time taken by a data packet to arrive in the destination. It includes all delays during the data transmission, including the buffering of packets during a route discovery after a link failure, retransmission delays . The lower value of end to end delay means the better performance



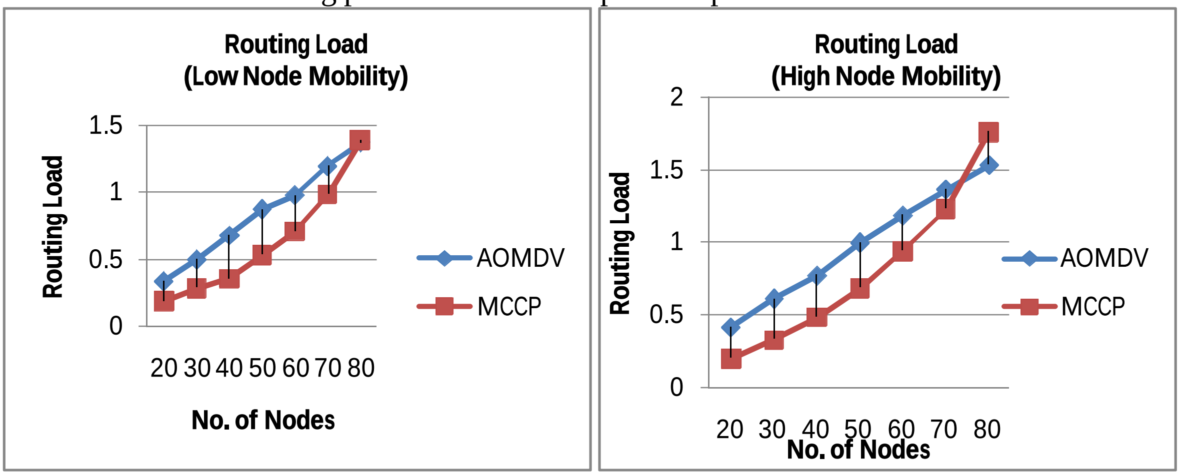
(a) (b)

Figure 3 : Measurement of End to end delay, with varying number of nodes and node mobility

Figure 3 illustrates a comparison among AOMDV and KBMR in terms of end-to-end delay based on low and high mobility scenario by varying number of nodes. Figure 3 (a) shows that the average end-to-end delay of KBMR stays much lower than AOMDV. The average end-to-end delay increases with the increased number of nodes and mobility. In heavy traffics load as the maximum number of connections increase, the number of packets delivery also increase. That's why queue is getting full. KBMR routing protocol finds new route with less search and also tries to drop the packets if it is not possible to deliver them. This cause less delay and most dropping packets are retransmitted over again. On the other hand, AOMDV routing protocol allow packets to stay in the send buffer for 30 seconds for route discovery and once the route is discovered, data packets are forwarded on that route to be delivered at the destination. In this graph, result shows that AOMDV performs significant more delay than KBMR. From 50,60 numbers of connections, the delay is almost similar in KBMR and AOMDV because of less queuing delay. When a links failure is occurred in mobility scenario, the route discovery process of AOMDV causes very long delays for large scale networks due to the amount of control packets transmitted.

Normalized Routing Load

It is the number of routing packets transmitted per data packet delivered at the destination



(a) **(b)**

Figure 4 : Measurement of normalized routing load , with varying number of nodes and node mobility

Figure 4 (a, b) illustrates a comparison among KBMR and AOMDV in terms of normalized

routing load by varying maximum number of connections (number of nodes). it is observed that AOMDV has more normalized routing load as compared to the KBMR. the NRL increases as number of connections increases.AOMDV is a multipath routing protocol and if the current route breaks it searches for alternate paths by flooding the network with RREQ packets.KBMR gives the low NRL, as it sends periodic updates which increase routing load in the mobility network.

7.Conclusion:

In this paper we studied the multipath routing protocol and compared the performance of two different multipath routing protocols that are AOMDV and KBMR and select the best one among them. The motivation behind this work was to challenge that dynamic addressing can be the basis for ad hoc routing. From the above analysis we can conclude that key based multipath routing supports scalability in various wireless networks as KBMR is an efficient protocol which gives improved performance in networks with high mobility.

We have also found that with number of nodes and with high mobility , the performance of AOMDV is not appropriate while KBMR is performing better in terms of PDR. In mobility network scenario, the value of Packet Delivery ratio of AOMDV is 97-98 while KBMR is at 99, which is higher as it switches to new route before a link fails. KBMR has stable End to End Delay despite mobility, and Routing Load increases as number of node increases, but having less routing load as compared to AOMDV .In future the work should be carried on some different traffic scenarios and others multipath protocols.

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