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Development of Multipath Routing Protocol in MANET

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Abstract

Mobile Adhoc networks are a wireless network consists of number of nodes. The nodes consist of sending packets from source to destination via path connection. The path connection is of multipath routing and it is very unstable and goes down at any time and making the connection on Adhoc network is difficult. If primary path fails to send the packet to destination then the secondary path is used to send the packets. In multipath routing from the route failures that provides fault tolerance and load balancing. The path connection establishes the link from source to destination via intermediate nodes. In mobile Adhoc network the path is unstable due to mobility of nodes. The multipath routing protocol provides fault tolerance and load balancing. This fault tolerance is used to quickly recover from route failures.

Keywords: MANET, ad hoc networks, Routing protocols, QoS.

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1. Introduction

Mobile Ad Hoc Networks (MANETs) are not centralized means in the network the nodes are operating in distributed manners. These are self-organized networks. MANETs are infrastructure less networks because the nodes are mobile. All the nodes can move in any direction while communicating and these nodes can act as both router and host. So, these networks are dynamic in nature means can change their topology. MANET are created dynamically and maintained by individual nodes comprising the network. In MANET all communication occurs through a wireless medium. MANETs also possess multi hop routing means packets are allowed to forward to destination through multiple nodes thus creating each node act as terminal as well as router. Routing is task of transferring data from source to destination while maximizing network performance. So it becomes a challenge in MANETs. Because of changing topology and network density, limited resources changes paths which were initially efficient but can quickly become inefficient and infeasible.

In such networks, nodes are typically distinguished by their limited power, processing, and memory resources as well as high degree of mobility. Due to the limited transmission range of wireless network nodes,

multiple hops are usually needed for a node to exchange information with any other node in the network.

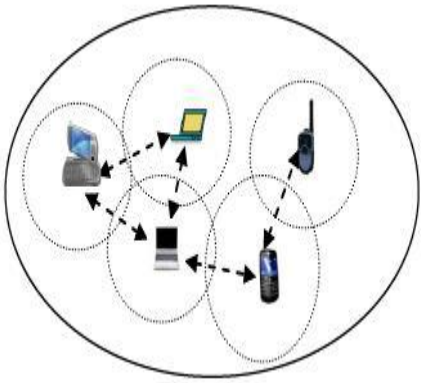


Fig 1 MANET infrastructure

Thus routing protocols play an important role in ad hoc network communications. Since all nodes in an ad hoc network can be connected dynamically in an arbitrary manner it is usually possible to establish more than one path between a source and a destination.

Mobile Ad Hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Consideration, **t**his describes the characteristics of MANET and their idiosyncrasies with respect to traditional, hardwired packet networks. It then discuss the effect these differences have on the design and evaluation of network control protocols with an emphasis on routing performance evaluation considerations

Split Multipath Routing with Maximally Disjoint Paths in Adhoc Networks, This describes in recent years, routing has been the most focused area in ad hoc networks research. On-demand routing in particular, is widely developed in bandwidth constrained mobile wireless ad hoc networks because of its effectiveness and efficiency. Most proposed on-demand routing protocols however, build and rely on a single route for each data session. Whenever there is a link disconnection on the active route, the routing protocol must perform a route recovery process. In QoS routing for wired networks, multiple path routing is popularly used. Multiple routes are however, constructed using link-state or distance vector algorithms which are not well-suited for ad hoc networks. The on-demand routing scheme called Split multipath routing (SMR) that establishes and utilizes multiple routes of maximally disjoint paths. Providing multiple routes helps minimizing route recovery process and control message overhead. To distribute data packets into multiple paths of active sessions. The traffic distribution efficiently utilizes available network resources and prevents nodes of the route from being congested in heavily loaded traffic situations. Thus evaluate the performance of our scheme using extensive simulation.

A path availability model for wireless ad hoc networks, a common characteristic of all popular multi-path routing algorithms in mobile ad-hoc networks, such as AOMDV, is that the end to end delay is reduced by utilization of parallel paths. The competition between the neighbouring nodes for obtaining a common channel in those parallel paths is the reason for end to end delay increment. In fact, due to medium access mechanism in wireless networks, such as CSMA/CA, data transmissions even through two node-disjoint paths are not completely

independent and each path will affect the other one. In this paper have modified the AODV protocol which results in selection of zone-disjoint paths, to the extent feasible, and as a result we achieve less end to end delay. The efficiency of the proposed protocol has been evaluated on different scenarios and there has been a noticeable improvement in the packet delivery ratio and also in the reduction of end-to-end delay comparing to AOMDV.

ZD-AOMDV: A New Routing Algorithm for Mobile Ad-Hoc Networks, this describes the MANET is a collection of mobile nodes that can communicate with each other using multihop wireless links without utilizing any fixed based station infrastructure and centralized management. It is very necessary for MANETs to have an efficient routing and QoS mechanism to support diverse applications. Multipath routing allows the establishment of multiple paths between single source and single destination node. This paper discusses the Multipath routing problem of MANETs with multiple QoS constraints, which may deal with the delay, bandwidth and reliability metrics, and describes a network model for researching the routing problem. It presents a Node-Disjoint Multipath routing protocol with multiple QoS constraints (NDMRP). The NDMRP successfully solves the QoS routing problems when nodes change dynamically in the networks. It only requires the local state information of the link but does not require any global network sate to be maintained. It can effectively decrease the overhead for the network lifetime, and improve the success ratio of seeking links. Simulation results show that the NDMRP provides an available means to implement routing, and adapt to all kinds of the topology networks, and have better expansibility.

A new approach to on-demand loop-free multipath routing, in this on-demand multipath source routing scheme in mobile ad hoc networks called "split multipath - dynamic source routing" (SMP-DSR) is proposed. The proposed protocol establishes and utilizes multipath maximally disjoint routes in order to improve fault tolerance and to provide load balancing via multipath routing. Based on simulation results, our protocol performs well over a variety of environmental conditions such as host density and movement rates; particularly it achieves a high rate of successful packet delivery in all cases.

Redundant source routing for real-time services in ad hoc networks, Quality-of-service in ad hoc networks is becoming more important with progress of the ad hoc networking research and development. In this paper, we proposed a new routing protocol named RSR for ad hoc networks. RSR is one type of redundant disparity routing protocol. Through the judicious use of packet replication in RSR, the performance of network applications in ad hoc network is significantly enhanced. This enhancement is of great meaning for mission-critical applications with stringent delay requirement, especially in networks with frequently changing topologies. Both TCP and UDP traffic are used to evaluate the performance of RSR using DSR as the benchmark. The simulation results show that RSR improves the packet drop rate and end-to-end delay for UDP traffic and improves the end-to-end good put for TCP traffic. RSR is a good candidate for QoS routing and fault-tolerant real-time services in ad hoc networks.

The main design criteria for the routing protocols in
MANETs are as follows:

- Scalability and reliability
- Simplicity and ease of implementation

- Fault tolerance
- Dynamic topology maintenance
- Distributed and lightweight

In most cases, the ability of creating multiple routes from a source to a destination is used to provide a backup route. When the primary route fails to deliver the packets in some way, the backup is used.

1.1. Routing of MANETs:

In routing user data is send from sender to destination through network. The routing functions are:

- Path Generation
- Path Selection
- Data transmission
- Path Maintenance

1.1.1. Path Generation- In this, path is generated from scattered environment of network. There are multiple path generated from sender to destination.

1.1.2. Path Selection- In the previous phase, there were multiple path and from them suitable path is chosen for data transmission so that time, memory and overhead will be less and performance is better.

1.1.3. Data transmission- In this data is transmitted from sender to destination on the selected path

1.1.4. Path Maintenance- The suitable path must have to maintain using control messages like Hello. If the link is broken and not active then using hello messages, maintenance of the route is done.

1.2. Characteristics of Routing Protocols

The Routing protocols should be:

- Adaptable of an grouping data
- Application specific
- Adaptable of improving energy consumption

1.3. Route discovery

When a node wants to communicate with another node in the network a unique communication path is established between the sender and the receiver nodes. The source node scans the neighbourhood vector for the destination. If the destination node is identified to be the single hop neighbour of the source, the source nodes starts transmitting data packets. The transmission of data will be uninterrupted until there is no change in the geographical positions of the source and the destination nodes.

Greedy forwarding uses the positions of neighbour nodes and a packet's destination to make packet forwarding decisions. Specifically, if a node knows its neighbours' positions, the locally optimal choice of the next hop is the neighbour that is geographically closest to the packet's destination. In this, each RREQ packet has the same structure, including the ID and position of the destination, the ID, position and velocity of the current node Ni, and the link lifetime calculated by Ni (the RREQ sent by S does not include the link lifetime, so the initial value of the link lifetime in the RREQ is set as 0).

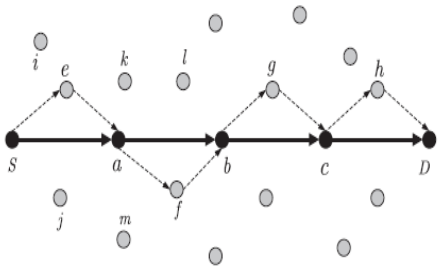
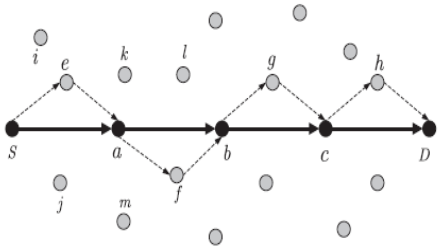


Fig 2 Primary path -Local-backup path

The neighbours in the neighbourhood vector are stored in the increasing order of their distances. The source node generates a RREQ packet and forwards it to n/k neighbours (where n is the total number of the neighbours and K1 – rateability parameter - a random Number between 3 and 7) from the neighbourhood vector targeting the farthest nodes from the source node. Greedy forwarding uses the positions of neighbour nodes and a packet's destination to make packet forwarding decisions. Specifically, if a node knows its neighbours' positions, the locally optimal choice of the next hop is the neighbour that is geographically closest to the packet's destination. In this, each RREQ packet has the same structure, including the ID and position of the destination, the ID, position and velocity of the current node Ni, and the link lifetime calculated by Ni (the RREQ sent by S does not include the link lifetime, so the initial value of the link lifetime in the RREQ is set as 0).



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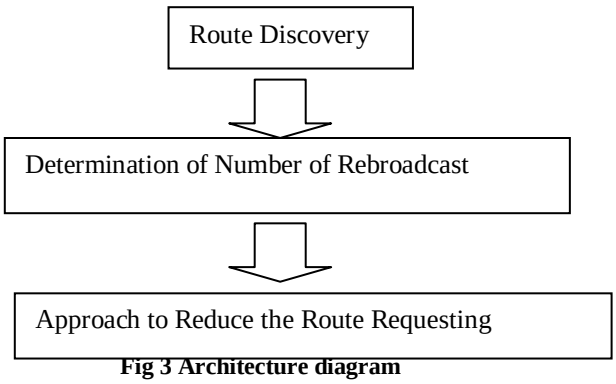

Fig 3 Architecture diagram

1.4. Determination of Number of Rebroadcast

The number of rebroadcasts is determined by the rehabilitee parameter K which ranges between 3 and 7. The number of route requests to be rebroadcast by each node to determine an optimal path depends on the chosen rehabilitee parameter and the local density of the network. Selecting half of the neighbors from the neighborhood vector in a dense network establishes a shortest path between the source and the destination nodes reducing the control overhead to half from the one that is actually required.

1.5. Approach to Reduce the Route Requesting Flooding

Route request flooding is a major concern in route request phase in AODV. It is possible that the destination is unreachable or request lost due to transmission errors. In these cases, source initiates the route discovery process again. Even though routing overhead is less compared to proactive protocols, route discovery overhead leads to wastage of the limited resources in the network .

When S is about to send data to D and no route for D is available, then route discovery is started. S selects the node nearest to D (here node a is selected) from its neighbour table as the next hop and sends RREQ (by RREQS, we denote the RREQ packet sent by S) to it. Here, the link (S, a) of primary path is established. Nodes a, e, i, and j may receive this RREQ simultaneously. When a receives RREQS, it records RREQS in its RREQ table and updates the corresponding fields of RREQ (RREQS) with its ID, position, velocity, and LET(S, a). Then, node a selects b as its next hop and sends RREQa to b (RREQa denotes the RREQ that has been updated by a). When e, i, and j receive RREQS, they add it to their respective RREQ tables. When e and j receive the same RREQ a, they calculate PET(S, e, a) and PET(S, j, a), respectively

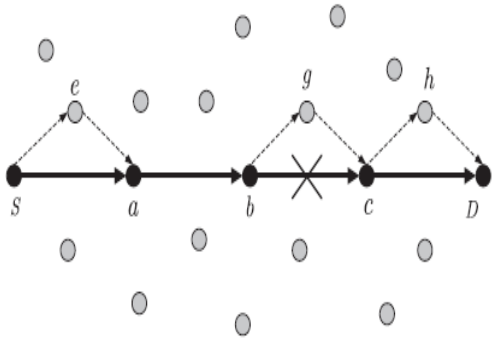

Fig 4 Route Maintenance

The main intention is to propose a simple method, having less overhead for route search in AODV. The proposal also has minimal computational complexity and communication overhead. This method considers the probability of success to connect to the destination. The probability depends on the previous behavior of a node to get the destination through an outgoing link. To calculate this probability, connectivity index (μ k) is used as the probability of choosing the neighbor to initiate a route request.

Simulation Parameters

Parameter values

Number of mobile Nodes	: 10,20,30
Simulation run time	: 600 sec
Area	: 500x500 meters
Movement	: All Nodes
Mobility	: 10 m/s
Number of Malicious Nodes	: 1 to 2
Simulation Traffic	: CBR (Constant Bit Rate)
Routing Protocol	: AODV, DSR , ZRP
Network Interface	: Wireless
Queue Length	**:** 50
MAC Type	: MAC/802.11
Packet Rate 1.0 mbps	: 1.0 mbps

2. Related Works

Recently, there have been some works on multipath routing in ad hoc networks. Multipath-DSR (M-DSR) is a simple multipath extension of the popular DSR in which alternate routes are maintained so that they can be utilized when the primary route fails. Instead of replying only to the first received RREQ the destination node sends an additional RREP for a RREQ which carries a link disjoint route compared with the routes already replied. Split multi-path routing (SMR), proposed in, focuses on building and maintaining maximally disjoint paths, however, the load is distributed in two routes per session. However, M-DSR can't compute link disjoint paths in many cases because the intermediate nodes drop every duplicate RREQthat may comprise another link disjoint path. In AODV-

BR, an extension of AODV, multiple routes are maintained and utilized only when the primary route fails. However, traffic is not distributed to more than one path.

Multiple Source Routing protocol (MSR) proposes a weighted round-robin heuristic-based scheduling strategy among multiple paths in order to distribute load, but provides no analytical modeling of its performance.And have further compared on-demand routing protocols with one of the efficient table driven routing protocol DSDV to demonstrate that how and why on-demand protocols work better than table driven protocols under the identical conditions of traffic load and mobility pattern. The protocols were also studied under random mobility patterns. The present research work involves implementing of four routing protocols namely DSDV (Table driven), DSR, AODV and AOMDV (On-demand), and the comprehensive analysis of unipath on demand routing protocols like DSR, AODV and multipath on-demand routing protocol like AOMDV using NS-2 (version NS-2.31) simulator.These benefits make it appear to be an ideal routing approach for MANETs. However, these benefits are not easily explored because the data packet that is fragmented into smaller blocks must be reassembled at the destination node, it maybe lead to error and increase control overhead.

3. Existing System

As MANETs is a collection of wireless nodes without any infrastructure support and nodes in MANETs consumes energy from battery. The n odes in MANET can act as either the router or source and the control of the network is distributed among nodes. The nodes in MANETS are highly mobile and it maintains dynamic interconnection between those mobile nodes. MANTEs have been considered as isolated stand-alone network. In AODV the network is silent until a communication is needed. At that point the network node that needs a communication broadcasts a RRER. Other nodes forward this message, and record the node that they heard it from, creating an explosion of backward route to the needy node or node in the destination. When a node receives such a message and already has a route to the desired node. It sends a reply message backwards through this route to the requesting node. The needy node then begins using the route. Unused entries in the routing tables are recycled after a time. When a link fails, a routing error is passed back to a transmitting node and the process repeats. Flooding of route request message by all nodes imposes major concern in energy consumption.

The disadvantages are,

- Link failure during transmission.
- No acknowledgement sends by the receiver.
- Sometimes back up cannot be predicted.

4. Proposed System

The main intention is to propose a simple method, having less overhead for route search in AODV. The proposal also has minimal computational complexity and communication overhead.

4.1. Discover multiple paths:

To discover multiple paths from a source to a destination, the basic route discovery mechanisms used in DSR and AODV protocols need to be modified. In fact, one of the major reasons for using multipath routing is to discover multiple paths that should be node-disjointed or link disjointed. In the node-disjointed paths, nodes on the paths should not be common. In the link-disjointed paths, links on the paths should not be common. Hence, the route discovery mechanisms of the existing routing protocols need to be modified to discover a maximum number of node- disjointed or link-disjointed paths.

4.2. Path selection:

Once multiple paths are discovered, a multipath routing protocol should decide how to select a path for sending data packets. If a number of paths are discovered, there is a question to ask how many of these paths should be used? If only a few paths are used, the performance of a multipath routing protocol should be similar to that of the shortest path routing protocol. On the other hand, if all paths are used, there is a chance of selecting an excessively long path, which may adversely affect the performance of a multipath routing protocol.

4.3. Load distribution:

Once a path or a set of paths are selected, a good multipath routing protocol should decide how to use these multiple paths while sending data packets.

The advantages are,

- Paths can be selected at random.
- Can find a packet using sequence number.
- Paths can be selected to satisfy the reliability or the delay constraint of a network.

5. Conclusion

The need to design an efficient routing protocol for an ad hoc network. A good routing protocol needs to provide reliability and energy efficiency with low control overhead. To ensure reliability, load balancing and QoS, multipath routing protocols have been proposed for MANET. It also includes study of different protocols and simulation environments that is easy to analyze the system. The approach includes simulating MANET with AODV protocol and analyzing the network performances with respect to different parameters. The results shows the entire approach performance which keeps on decreasing with respective parameters specified such that the graphs help to identify the performance difference in both these approaches.

6. Future Enhancement

The main intention is to propose a simple method, having less overhead for route search in AODV. The proposal also has minimal computational complexity and communication overhead. In order to further improve accuracy in the adhoc network, we can go for the some additional features in the simulations parameters of the adhoc network. So that we can achieve the reliability and accuracy in the network & that will be the further

direction. Surveys investigate multipath routing protocols in efficient routing protocol for mobile ad hoc networks. The multipath routing protocols are to provide reliable communication and to ensure load balancing as well as to improve quality of service of MANETs. New protocol will focus the following issues simultaneous usage of paths, data forwarding mechanism considering the delay of the available paths, scalability and energy.

References

[1] Ranjeet Kaur, Rajiv Mahajan and Amanpreet Singh, *"A survey on Multipath Routing Protocols for MANETS " ,* IJETTCS.

[2] S. Corson and 1. Macker, *"Mobile Ad Hoc Networking (MANET): Routing Protocol Performance Issues and Evaluation Consideration* ", IETF WG Charter,

[3] Hui-Yao An, Ling Zhong, Xi-Cheng Lu, and Wei Peng, "A Cluster-Based Multipath Dynamic Source Routing in MANET", IEEE International conference WiMOB'2005, Volume-3, pp. 369-376, Aug. 2005.

[4] S.-J. Lee and M. Gerla, AODV-BR: Backup Routing in Ad hoc Networks, In Proceedings of IEEE WCNC 2000, Chicago, IL, Sep. 2000.

[5] Marina, M.K. and Das, S.R., "On-demand Multipath Distance Vector Routing for Ad Hoc Networks", Proc. of 9th IEEE Int. Conf. On Network Protocols, pp. 14-23, 2001.

[6] A. B. McDonald and T. F. Znabi, "A path availability model for wireless ad hoc networks," in *Proc. IEEEWCNC,* New Orlean, LA, Sep. 1999, pp. 35--40.

[7] Nastooh Taheri Javan, Reza Kiaeifar, Bahram Hakhamaneshi, Mehdi Dehghan, "ZD-AOMDV: A New Routing Algorithm for Mobile Ad-Hoc Networks", Eigth IEEE/ACIS International Conference on Computer and Information Science, 2009.

[8] J. Raju and J. J. Garcia-Luna-Aceves. A new approach to on-demand loop-free multipath routing. Proceedings IC3N, pages 522–527, 1999.

[9] Ranjeet Kaur, Rajiv Mahajan and Amanpreet Singh, *"A survey on Multipath Routing Protocols for MANETS " ,* IJETTCS.

[10] Shabnam Vahedi, Maryam Mohseni and Amir Darehshoorzadeh, "Design a multipath routing algorithm in ad hoc networks in order to improve fault tolerance", The 18th Annual IEEE International Symposium on Personal, Indoor and Mobile Radio Communications, 2007

[11] C. Siva Ram Murthy, B. S. Manoj, *Ad Hoc Wireless Networks: Architecture and Protocols*, Person Educ, ISBN 978-81-317-0688-6, 2004.