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An Improved Network Performance of Mobile Ad Hoc Network Using Multipath Routing With AODV

Sudha Patel¹, Ashish Gupta², Manisha Pathak³

Research Scholar, Dept. of Computer Science & Engineering, NITM, Gwalior India¹

Asst. Professor, Dept. of Computer Science & Engineering, NITM, Gwalior India²

Asst. Professor, Dept. of Computer Science & Engineering, MITS, Gwalior India³

Abstract: MANET is an infrastructure-less communication system. So have to face high challenges dynamically changing of topologies, low transmission power, and asymmetric links. Due to link instability, node mobility and frequently changing topologies routing becomes one of the core issues in MANETs. Continuous change in mobility creates a problem of link break, therefore link stability is a major issue in ad hoc network. Routing is a critical issue in MANET and hence the focus of this thesis along with the performance analysis of routing protocols. A suitable and effective routing mechanism helps to extend the successful deployment of mobile ad-hoc networks. Most effort has recently been reported to improve the reliability and performance of ad hoc networks. So the multipath routing protocol has been implemented to achieve higher throughput and reliability than the current single-path routing algorithm. Multipath extension of ad hoc on-demand distance vector protocol can provide reliable and adaptable routes for communication. Currently existent routing protocols provide routing solutions up to a certain level and most of them are designed and implemented in small areas. Many researchers are still working on the development of MANET routing protocols. Simulation results show better performance in terms of Packet Delivery Ratio and Normalized routing Load in comparison to AODV routing protocol. The simulation work is verified using network simulator version 2.

KEYWORDS: AODV, Multipath AODV, MANET, Performance Matrices.

I. INTRODUCTION

The internet engineering task force created a mobile ad-hoc network Ad-hoc is a Latin word, which means "for this or for this only". Mobile Ad hoc network is a group of wireless mobile nodes and connected by wireless links. It is a network of independent nodes, which are mobile, connected through the wireless medium and highly dynamic by nature, and exemplified by the absence of physical infrastructure. Each mobile node dynamically changes the network topology without relying on any wired backbone network or fixed base station. In MANETs, many routing protocols have been suggested to make communications among mobile nodes. A wireless node can be the source, the destination, or an intermediate node of data transmission. When a wireless node plays the role of intermediate node, it serves as a router that can receive and forward data packets to its neighbor closer to the destination node. Due to the nature of an ad-hoc network, wireless nodes tend to keep moving rather than stay still. Therefore the network topology changes from time to time [5- 7].

In MANETs, another classification of routing protocols can be made in terms of the number of paths one protocol delivers per source destination pair. There exist unipath and multipath routing protocols. For a unipath routing protocol, a single route is used to deliver data from the source node to the destination node. Most of the routing protocols in MANETs form a single-path, such as DSR and AODV. So we have focus on the design of a multipath routing protocol for wireless network, in which the data is transmitted through the available multipath simultaneously.

The objective of designing a multipath routing protocol is to provide enhanced robustness to node or link failures. If one could provide multiple paths from a source to a destination, one could envision that the transmission of redundant information on various paths would help the receiver reconstruct the transmitted information even if a few of

the paths were to fail. Single-path or link stability need to repair routes each time the route is broken, therefore these type of issues solve by using multipath. So we implemented a multipath routing algorithm based on the AODV protocol in our work. In addition, multipath routing has the advantages of balancing load, minimizing end to end delay, increasing fault-tolerance, reducing the frequency of route inquiries and achieving a lower overall routing overhead. The main goal in the design of the algorithm is to receive the maximum packet for routing and find out efficient metrics. Furthermore, in this thesis the performance of AODV in terms of packet delivery fraction and NRL is analyzed by varying the mobility and node density parameters through simulation results using NS-2 simulator.



Figure 1: General Architecture of Ad-Hoc Network

II. PROBLEM STATEMENT

In this work we have addressed the problem of link stability to a network topology where the nodes can move continuously mobility, leading to frequent route changes, link break problem occur. I had study the literature review and find that most of the routing protocols are follow the single path for data transfer. If single path is failed that will not send the data in network, in this situation quality of services provisioning for network becomes a challenge. The main aim of this research work is to improve the Quality of Services against path or link break problem in wireless Ad hoc network. To solve this type of problem we used multipath routing scheme. Multipath routing has been a promising technique in MANETs. As opposed to their single path AODV, on-demand routing protocols with multipath capability can effectively deal with dynamic mobility induced link failures in mobile ad hoc networks. The outcome of this fact is the multipath routing protocols that have been proposed for mobile ad hoc networks throughout the decades. The goal of our work is to implement and simulate the design of a multipath routing protocol for MANETs. The objective of this research is to use multi-path routing protocol to achieve higher packet ratio, throughput and reliability over mobile ad hoc network than the current one path routing protocol. Due to dynamic topology or continuously change the mobility that creates a link break or route failure problem. To overcome these problems, we present an AODV based multipath routing solution. In this research work efficient multipath routing algorithms based on AODV routing protocol with QoS provisions have been developed. Multipath routing establishes multipath routes between source and destination nodes. For the fault tolerance purpose, even if one route failure occurs, source nodes can maintain connections by using other routes. By using multipath routing protocols will find the efficient network performance in terms of packet data transmission and delay.

III. PROBLEM STATEMENT

MANET is more vulnerable to security attacks by malicious nodes because it does not have a clear defense mechanism. Openness, dynamic and infrastructure-less nature make it prone to security threats. As the biggest security threat of all these attacks, one of the biggest security threats in MANET is the wormhole attack. This is a very damaging attack. These attacks are caused by malicious nodes, so the ad hoc wireless network is vulnerable to malicious node attacks. In which two or more malicious nodes form a virtual tunnel in the network. The main problem is to change the status to a malicious node by tunneling the neighboring node and change the status repeatedly so that it is very harmful to the network. The attacker then modifies the packet address to initiate a data drop using the link break issue.



IV. PROBLEM SOLUTION

So we have decided to solve this above issue in our work using AODV based Multipath Routing Scheme. We have implemented the multipath based on AODV protocol. This algorithm uses node-disjoint routes between source and destination pairs. By using this reduces the transmission delay using backup route when the main route is broken while the backup route is stable. In the suggested algorithm by this research, the source node maintains more than one path to each destination. Thus, the AODV routing table must be changed. We modified the AODV routing table so that a route entry is able to maintain information of the main and the backup routes of the neighbors or previous nodes. In this research author have analyzed this problem and compared in different network scenarios using network simulator.

We have implemented this approach in AODV Routing Scheme. According to multipath approaches which needs to modify the code as below. The solve out link break problem and efficient data transmission and reduced delay used this modification in AODV routing scheme.

- STEP-1 In the route table file, create a new type of object called multiple route entry. The multiple route entry is an array to keep route entries. The objective of multiple route entry is to keep the routes to the same destination.
- STEP-2 Every method in the AODV main file should change “finding route to the destination” to “finding multiple routes” to the destination.
- STEP-3 The receive request method should be modified to receive the RREQ with the same ID as previous one in order to create the multiple reverse routes.
- STEP-4 The receive reply method should be modified to accept the multiple route reply to create the multiple forward routes.
- STEP-5 The receive reply method should be modified to forward RREP packet to every reverse routes
- STEP-6 The receive error method should be modified to check if the node still has another active route to the destination. If the node still has another active route to the destination, the node no needs to forward the RERR packet.
- STEP-7 Route resolve method for source node should be set to switch from one active path to another active path and switch back in next transmission. The multiple paths will be used to transmit the data packet.

V. SIMULATION PARAMETERS

Simulation Parameters is as follows:

PARAMETERS	VALUE
	NS-2
Routing protocol	AODV, Multipath Based AODV
Number of Nodes	10,20,30,40,50
Area	1000mx1000m(Constant)
Packet size	512 byte
Simulation time	500s (Constant)
Pause time	1.0s(Constant)
Traffic type	CBR
Mac protocol	Mac/802.11
Maximum Speed	10m/s
propagation model	Two Ray Ground
Channel	Wireless



VI. SIMULATION RESULT AND DISCUSSION

NS is an event driven network simulator developed at University of California at Berkeley, USA, as a REAL network simulator projects in 1989 and was developed at with cooperation of several organizations. Now, it is a VINT project supported by DARPA. NS is not a finished tool that can manage all kinds of network model. It is actually still an on-going effort of research and development. The users are responsible to verify that their network model simulation does not contain any bugs and the community should share their discovery with all. There is a manual called NS manual for user guidance.

There are two languages used in NS2 C++ and OTcl (an object oriented extension of Tcl). The compiled C++ programming hierarchy makes the simulation efficient and execution times faster. The OTcl script which written by the users the network models with their own specific topology, protocols and all requirements need. The form of output produce by the simulator also can be set using OTcl. The OTcl script is written which creating an event scheduler objects and network component object with network setup helping modules. The simulation results produce after running the scripts can be use either for simulation analysis or as an input to graphical software called Network Animation (NAM).

As shown in Figure, an OTcl script written by a user is interpreted by NS. While OTcl script is being interpreted, NS creates two main analysis reports simultaneously. One of them is NAM (Network Animator) object that shows the visual animation of the simulation. The other is the trace object that consists of the behavior of all objects in the simulation. Both of them are created as a file by NS. Former is .nam file used by NAM software that comes along with NS. Latter is a “.tr” file that includes all simulation traces in the text format. NS project is normally distributed along with various packages (ns, nam, tcl, otcl etc.) named as “all-in-one package”, but they can also be found and downloaded separately. In this study we have used version 2.31 of ns all-in-one package and installed the package in the Windows environment using Cygwin. After version 2, NS is commonly using a NS-2 and in our thesis we shell refer to it as NS-2. We have written the “.tcl” files in text editor and analyzed the results of the “.tr”.

In this simulation shows the differences in the protocol highlighted major differences with the protocol performance. These differences have been analyzed with variation of mobility parameters like as nodes. These section also covers the avoid path break problem using multi path based AODV scheme because this scheme to provide a muliple path for escape a path break or link stability. The find the overall results compare the performance with AODV and multipath based AODV with variations of No. of Nodes from 10 to 50. And the average results shown in below in graphical form

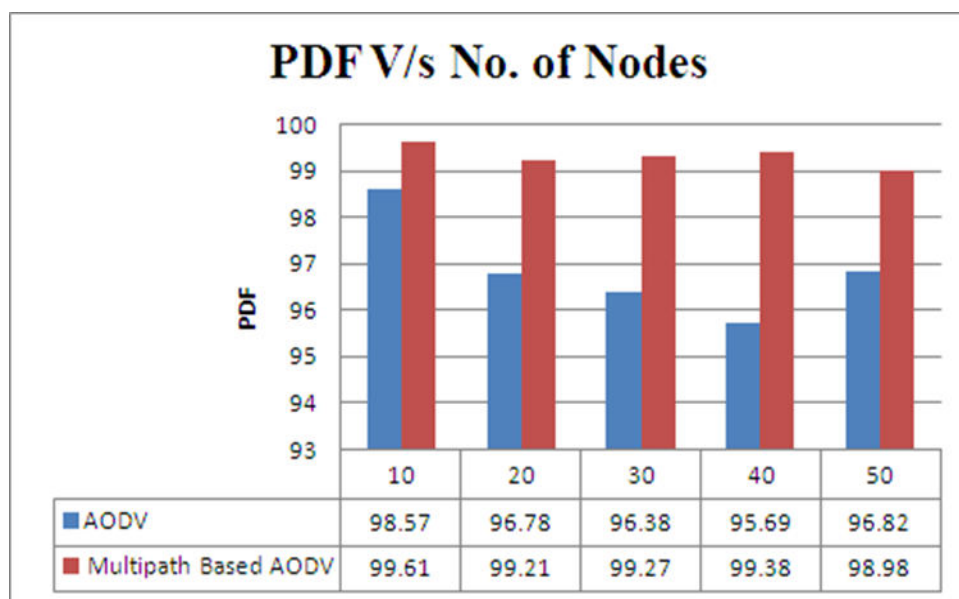


Figure-2 Packet Delivery Fraction with varying No. of Nodes

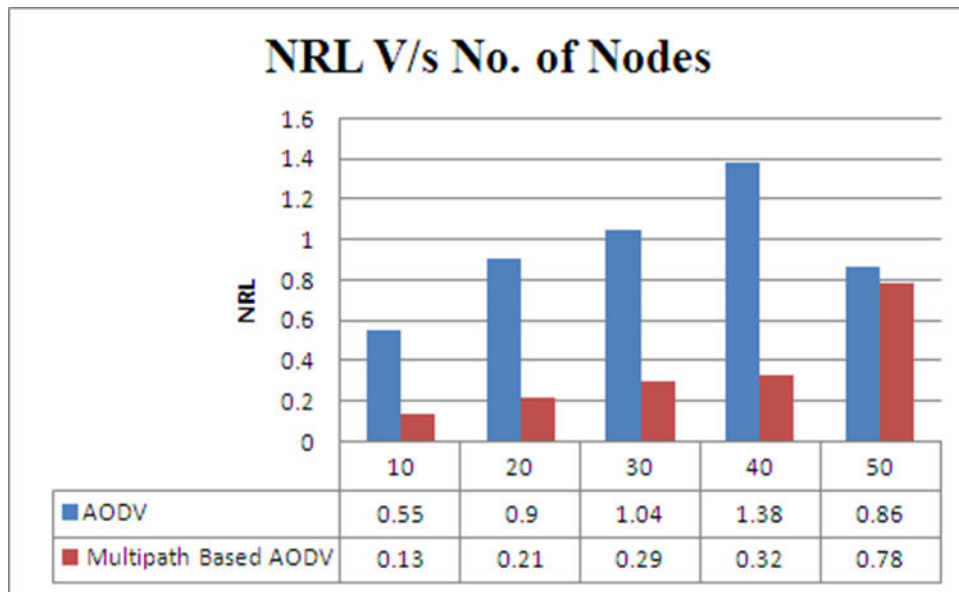


Figure 3 Normalized Routing Load with varying No. of Nodes

Here indicates the resulting graph, the simulation screen in which randomly placed from 10 to 50 mobile nodes packets sent and received properly we have demonstrated that and found the values of all scenarios. We now take a look at PDF and NRL calculated by our scripts. In this Simulation Covered the AODV (Single path or Uni path) and Multipath Based AODV. The numbers of nodes do not vary significantly with changes in mobility. Consider the following data from a low traffic low mobility scenario. When we measure the number of RREQ packets that were received since they were flooded we get a better idea about the benefits of our approach and its scalability, the number of control packets received and they are less than AODV by a factor for the same scenario.

In Multipath AODV, we know that source node start transmission when we find the proper route from source to destination and ensure that routes is available so that packets can reach destination on time, this help in the proper transmission of packets. From the above simulation outcome it is observed that the multipath-based AODV routing protocols improves the performance of real time traffic in case of efficient performance of in terms of PDF and NRL discussed above. The multipath based routing schemes have better results compare than existing AODV scheme. The average values of parameters give in above with Graph, Which shows that the maul path-based scheme results are better.

VII. CONCLUSION & FUTURE WORK

In this conclusion, we have presented an analysis after the study of the results presented in the previous chapter with the implemented technique, the implemented technique, and we have seen an increase the network performance if we use this technique that the traffic can be distributed and carried by multiple simultaneously available paths so that the available bandwidth can be better utilized by using multiple active transmission tasks, especially under low traffic load conditions. It also provides a better fault tolerance for the system if a path fails. The multipath routing is able to improve the reliability of the wireless ad hoc works, as alternate paths are made available in the initial phase. However, the majority of the existing multipath protocols still uses only one primary path for data transmission and consider other alternative paths as backups. In simulation part, in order to make a comparison, we have collected different simulation results which have already been done by others. We have designed the same MANET scenarios in NS-2.31. In terms of Packet Delivery Friction and throughput have found efficient results compared with conventional single path routing protocols.

In the future, Researcher also considers the time and space complexity of the algorithm and tries upon reducing it. We have designed the same MANET scenarios in other simulators like as QUALNET, OPNET, etc.

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