AODV Local Route Innovation (AODV_LRI) to Increase the Network Performance by Reducing Congestion Problem on MANET

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Abstract : Mobile Ad hoc mobile Network. (MANET) consist of self-configuring mobile devices without infrastructure that connect together without the use of cables. In MANET, any device is free to move independently in any direction, so you can frequently change your connections with other devices. A node can change its position very frequently and therefore we need a routing protocol that adapts quickly to changes in topology. AODV is a promising and popular routing protocol in MANET. But traditional AODV does not address the problem of the lack of reliability of the nodes. In this paper, we proposed a novel Local Route Innovation (LRI) scheme with traditional AODV. A node will start to discard the packet if it cannot forward it correctly if a node discards the packet most of the time instead of sending it again, so these nodes are not a reliable node and can be the cause of a long delay, high loss of packages and loss of use of resources. In this case, the proposed novel AODV_LRI scheme verifies the reliability of each node based on the package delivery report and if an unreliable node is found, it applies a local path identification process, to find a reliable node in the network for this purpose. The node must not inform the sender to establish the route, but renews the new route in the network from the same end where the node is not reliable, means that the proposed LRI mechanism provides the possibility of establishing the route to each node of the network. By obtaining a reliable route in the network, the efficiency of the entire network increases. It is also useful to reduce the congestion problem that occurs within the network.

***Index Terms*—Congestion, MANET, Reliability, Local Route, AODV, Routing.**

I. Introduction

Mobile Ad hoc Network (MANET) is designed to overcome the natural limitations of these wired backbone networks and infrastructure-based wireless networks. A special mobile network is an independent group of mobile users who communicate through unstable wireless channels [1,2]. In situations where a temporary network connection is required, and in areas where it is impossible to develop a default infrastructure, a mobile ad hoc network is very useful, for example, for disaster relief, when the existing infrastructure is damaged or military applications where a tactical network is required. You must redirect traffic that is not related to your own use, and therefore these devices also function as routers. All devices can move freely in MANET, thanks to the movements of nodes the network topology is dynamic. Due to these characteristics, MANET is weak in communication continuity compared to a traditional network. How to ensure reliability MANET attracts a lot of attention [3]. But the first step in making MANET reliable is the ability to analyze reliability. Reliability analysis always refers to the reliability of the terminal, which means the ability of some or all devices to remain connected, assuming that a failure has occurred in the line and node (the wireless device is always called a node in MANET). All network activity, such as message delivery and topology search, must be performed by the nodes themselves. Therefore, the routing functionality for transmitting information from a source to a destination must be integrated into mobile nodes. Therefore, reliable routing is one of the most important issues at MANET. For proper traffic routing, each device constantly maintains the necessary routing information. They may contain one or more different transceivers between nodes. Because hosts are mobile, network topology can change quickly and unpredictably over time. Special wireless networks offer unique advantages and versatility for certain environments and certain applications [4].

- Existing fixed infrastructure and base stations are not required for such networks.
- These networks do not work within the limits of a fixed topology.
- Since all nodes can be mobile, the composition of these networks changes over time. Adding and removing nodes occurs only when interacting with other nodes, no other agency is involved.

Congestion [5, 6] can occur on a network if the network load (the number of packets sent over the network) exceeds the network bandwidth (the number of packets that the network can process).) Consequently, network congestion can significantly increase packet delay and loss and reduce network performance. Network congestion means that a node at any time interval has become congested and has begun to lose packets. The main purpose of congestion control is to minimize the delay and buffer overflow caused by network congestion, and therefore allow the network to function better.

II. MANET Routing Protocols

In order to provide intranet interaction between these nodes, a routing protocol is used to detect routes between nodes [7, 8]. The purpose of the mentioned special network routing protocol is to determine the route between a pair of nodes so that messages can be delivered efficiently and reach the correct destination within a limited time.

Classification of routing protocols

There are several routing protocols designed for special mobile networks. All of these protocols are faced with typical limitations of these networks, such as high power consumption, low bandwidth and high error rate, etc. Basically, routing protocols were divided into routing protocol for MANET, classified as:

2.1 Table driven routing protocol (proactive)

Proactive protocols are also called table-driven routing protocols for determining network topology by exchanging topological information between network nodes. It is based on the procedure for updating the base routing table, in which routing information is distributed at a fixed interval. Each node in the network has one or more possible routes to any possible destination; these routing protocols try to maintain recent and consistent routing information on each node. In order to fully accomplish these tasks, each node in the network supports one or more routing tables so that in one instant it contains information about recent routing for all possible routes.

2.2 Routing protocol on demand (Reactive)

The reactive routing protocols, also known as the on-demand routing protocol, are based on a type of request-response dialog. The reactive protocols try to keep the path between the source nodes and the destination node only when the need arises. Each time the source node has to send data to the receiving node, these protocols generate efficient routes for which the source first makes the route request, as its name suggests. When a node needs a route to a destination, a route discovery process begins on it. This process is completed once a route is found or all possible permutations have been examined. After that, there is a route maintenance procedure to maintain valid routes and eliminate invalid routes. Therefore, these protocols do not need periodic transmission of topological information from the network. The ad hoc distance vector (AODV) is the example of the reactive routing protocol.

2.3 Hybrid routing protocol

Often, a reactive or proactive feature of a particular routing protocol may not be enough; Instead, a mixture could give a better solution. The combination of the two protocols is called a hybrid protocol, which takes advantage of reactive and proactive protocols, but may require additional hardware, such as a separate GPS or integrated communication devices. The Zone Routing Protocol (ZRP) is an example of the hybrid routing protocol.

III. PROCEDURE FOR ROUTING THE AODV ROUTING PROTOCOL

The Distance-Distance Adaptive Routing (AODV) protocol [9] allows the routing of multiple hops between participating mobile nodes that wish to establish and manage an ad-hoc network. . The algorithm uses different types of messages to discover and manage links. When a node wants to try to find a route to another node, it transmits a route request to all its neighbors. The RREQ propagates on the network until it reaches the destination or the node with a route recent enough to reach the destination. Then, the route is made available by decomposing a RREP at the source. The algorithm uses greeting messages (a special RREP) that are periodically transmitted to immediate neighbors. These greeting messages are local announcements that indicate that the continuous presence of the node and neighbors who use routes through the transmission node will continue to mark the routes as valid. If the greeting messages cease to come from a particular node, the neighbor can assume that it is broken and notify the set of nodes in question by sending a link failure notification (a special RREP) to that set of nodes. The node has moved away and marks this link as broken and notifies the set of nodes in question by sending a link failure notification (a special RREP) to this set of nodes.

IV. LITERATURE SURVEY

The work done by various authors in field of congestion is mentioned in this section.

T. Senthilkumaran and V. Sankaranarayanan et al [1] proposed a method for congestion detection and congestion control in ad hoc networks. His work is based on the preliminary calculation of the approximate length of the tail. For this purpose, they calculate the average length of the queue in the node. The characteristics of the network, such as congestion and road failure, must be detected and repaired using a reliable mechanism. To solve the congestion problem, a new technique for dynamic congestion estimation has been proposed to analyze traffic fluctuations. When evaluating the average queue length, a node can find that there is a likelihood of congestion and send a warning message to its neighbors. When the neighbors receive the warning message, they try to find another route without clutter to the destination. If another route is available, the predecessor nodes initiate additional communication through an alternative route. in the network Therefore, this dynamic congestion estimation procedure attempts to provide reliable communication within MANET by controlling congestion in ad hoc networks. The proposed DCDR uses an unobstructed route discovery mechanism to avoid network congestion, thereby reducing the packet loss rate and, therefore, reducing end-to-end delay, thereby improving performance.

Reeta Bourasi and Professor Sandeep Sahu [10] proposed a new technique to detect packet receiving nodes in the network using a reliability factor. In MANET, each node has limited resources, such as charging the battery; A packet subscriber node is that node of the network that may not cooperate properly with network operations to save its resources. In this work, the reliability factor field is increased based on the recipient's acknowledgment and all senders who decide to send a packet through a node that has a higher reliability factor. By including the field of the reliability factor in the packet header, it is possible to identify the nodes that lose packets, because these nodes do not transmit the packet to the next hop, but leave data packets and, therefore, do not receive the acknowledgment of receipt of the next node. its reliability factor field never increases. Therefore, depending on the reliability factor of the nodes, a packet receiving node can be detected and can also be isolated from the network, which not only improves performance, but also increases network performance.

In this document [11], to solve the problem of congestion in mobile ad hoc networks, a queue model in the current work is suggested. A queue system includes one or more servers that provide any service to incoming clients. Clients that find all busy servers generally join one or more queues (lines) in front of the servers, hence the name of the queue systems. The waiting mechanism is developed based on the probability distribution in a different communication range. Therefore, the queuing mechanism improves network metrics, such as overall network performance, reduces routing delay, overhead and traffic blocking probability. The approach is generated in a routing scheme in an ad hoc network.

Majid Ahmad and Durgesh Kumar Mishra [12] define and formulate an efficient technique to calculate the reliability of large-scale MANET. The terminal pair reliability is defined as the probability of a successful communication between two (selected) terminals in a network. The reliability of the terminals therefore depends on the participating terminals and the connection link. Reliability calculation methods have an exponential growth factor for the complexity of time as the number of nodes increases, making it impossible to calculate the reliability of large-scale mobile networks. Calculate the reliability of large-scale mobile networks. The proposed scheme takes critical nodes as the calculation assumptions and thus this method should be able to limit reliability calculation complexity within practical reach.

In this document, [13] proposed a method to avoid traffic congestion in a MANET environment using the bandwidth estimation technique. In our approach, we use recognition time intervals to estimate bandwidth in a TCP sequence. In our diagram, we monitor the space between the acknowledgments received.) on the sending node and discover the available bandwidth of the connection between the sender and the destination, if the available bandwidth is smaller than the actual size of the data, so that we reduce the size of the data according to the Transfer band available and avoid congestion. to communicate any destination by the same route available as that used by the previous senders, the new sending node and all other previously transmitted sending nodes send data according to the available bandwidth of the intermediate nodes, in order to Increase network performance and ensure uncomplicated communication.

Xibin Zhao, Zhiyang You and Hai Wan [14] present a method to analyze reliability in MANET. They proposed that the number of neighboring nodes of each node is the most important factor that influences the reliability of the node in MANET. The effects of node mobility and node reliability based on a true MANET platform are proposed and analyzed. . In their work, they demonstrated that the capacity of the wireless network was limited and that the speed of the wireless network assigned to each user decreased to zero as the number of users increased. The performance will affect the transmission capacity of the wireless network and the reliability of the MANET terminal. Congestion means the arrival of an excessive number of packets in a network, resulting in a large number of packets. .

Srinivas Sethi and Siba K. Udgata [15] have proposed an optimized Ad-Fi Relay Vector (ORAODV) scheme that offers rapid adoption of dynamic link conditions, under processing and low utilization of the ad hoc network. The proposed protocol (ORAODV) is designed to optimize route discovery and the reliability of package delivery. A new Blocking-ERS blocking concept is used to prevent transmission throughout the network. Blocking-ERS does not start its route search procedure from the source node every time a repeat is required. The retransmission may be initiated by any appropriate intermediate node on behalf of the source node that acts as a relay node or agent. The retransmission of data packets in ORAODV provides satisfactory performance in terms of packet delivery ratio (PDR), standardized routing load (NRL) and delay for different network densities in terms of number of nodes, different Mobility rate.

In this document [16], the existing solution for loss classification and congestion control is based on network parameters such as request timeout (RTT), retransmission timeout (RTO) bandwidth and the number of times. nodes used for communication between target sources in MANET. These techniques depend entirely on the receiving ACK and the sending ACK for each receiving package. The most existing technique does not differentiate the fault link to another type of fault. This document examines the problem in depth by determining whether or not there is a link loss. The failure of the link and the network partition, created primarily by a failure such as mobility and battery depletion, have a negative impact on MANET. To solve this problem, a new approach is proposed, which uses the change of speed and the angle of change in a spherical coordination system to classify and control congestion before the loss of packages in MANET.

This document [17] proposes a simple transmission algorithm, called Broadcast Double Covered Broadcast (EDCB), that takes advantage of transmission redundancy to improve delivery speed in an environment with a relatively high transmission error rate. . When a sender broadcasts a packet, it selects a subset of jump neighbors as transfer nodes to transfer the packet based on a greedy approach. The selected transfer nodes meet the following criteria:

1. They cover all the neighbors 2 jumps of the sender

2. The 1 hop neighbors of the transmitter are transfer nodes or nodes that are not transferred but are covered by at least two transfer nodes. After receiving a new broadcast packet, each transfer node saves the packet, calculates it and returns to and rebroadcasts the packet as a new sender.

V. PROBLEM IDENTIFICATION

MANET is based on the node mobility model that uses dynamic topology, a composition of many configurations. Each configuration has its probability of existence. The transformation of data in ad-hoc environments has a lower network performance because link failures are the most common due to the movement of nodes, which is the main reason for road failures in MANET. There are many routing algorithms, but they have a congestion problem that decreases the overall performance of the network. In a self-organized network, the nodes are autonomous; they can free themselves and not cooperate properly with network operations to save their resources. Such nodes are called selfish or misbehaving nodes and their behavior is called selfishness or misconduct. If these types of unreliable nodes are used for subsequent communication, they have a significant impact on transport layer protocols, such as TCP, which are very sensitive to packet loss.

VI. PROPOSED AODV_LRI SCHEME TO REDUCE CONGESTION IN MANET

In this proposed work to increase network performance, the concept of local route discovery is used with the traditional AODV routing protocol. To control the congestion problem, a reliability factor field has been included. It is used to measure the climatic conditions during which the node is likely to be congested. The inclusion of a reliability factor makes it possible to detect packet transfer nodes and by selecting a different route, we can not only improve performance, but also increase network performance. To select a reliable route between the origin and the destination in traditional AODV, a local route discovery mechanism was applied to the intermediate nodes. Each node selected by AODV for data packet transmission tracks its reliability according to its "reliability factor" during data transfer. When a node communicates with another node in the network, it maintains a table in which it keeps a record of the incoming packets, the packets are successfully transmitted to the next node, its reliability factor and also stores the identity of the next hop loaded transfers The package to the destination. Here, the term reliability factor is estimated based on the result of the delivery. If a node has successfully transmitted the packet, its reliability factor is positively updated and if the packet is dropped, its reliability factor decreases. This means that the loss of packets from any node in the route will affect the reliability of the network and the performance of the node can be calculated using this reliability factor. To estimate the reliability of a node, we define a threshold value and, after the arrival of each number of data packets, the value of the node of the reliability factor is verified. If the reliability factor falls below the threshold, this indicates that this node is not as reliable and that it will probably be a congested node, so it will send a reliability status packet to all neighboring nodes to find another alternative route to transfer the data packet . In response, only the predecessor node invokes a local route discovery process to find a new route to the destination.

6.1 Assumptions:

The main purpose of this work focuses on the node reliability which is the resource constrained and have dynamic MANET environment. In order to focus on the key factors and simplify the analysis, we list the assumptions as follows:

(1)The source node and destination node which we refer to are known and constant.

(2)Every node is of the same type and with the same situation.

(3)Every node has the same wireless transmission range and every node pair within the wireless transmission range is considered to be connected.

(4)Every node keeps the same data transmission with each of its neighbors.

(5)The mobility of node is the random waypoint mobility model.

(6)The capacity of every link is binary, which means the link either exists or does not exist.

Proposed algorithm:

Equation: if rl > = threshold,

(node is reliable no action required)

Else node is unreliable

{Apply local route finding mechanism to find secondary path}

VII. Simulation Configuration

Network Simulator Version 2 also known as NS-2 [18]. NS-2 is an event driven packet level network simulator developed as part of the VINT project (Virtual Internet Testbed) [1]. This was a collaboration of many institutes including UC Berkeley, AT&T, XEROX PARC and ETH. Version 1 of NS was developed in 1995 and with version 2 released in 1996. Version 2 included a scripting language called Object oriented Tcl (OTcl).

The network consists of 50 nodes in a 800 *800 m terrain size. The radio range is 250 m with bandwidth 512 kbps. The MAC layer is based on IEEE 802.11 (WiFi) distributed coordination function. The channel propagation model we used was the 2- ray ground reflection model. An interface queue at the MAC layer could hold 50 packets before they were sent out to the physical link. Link breakage was detected as feedback from the MAC layer. The routing protocols we used are AODV. The data flow used constant bit rate (CBR) and File Transfer Protocol (FTP). The maximum speed of the node is 10 m/s and the simulation time is 100 seconds.

7.1 Performance Metrics

We considered the following important metrics in this evaluation:

7.1.1 Packet Delivery Ratio (PDR):

The ratio of packets received between the destination and the number of packets sent by the source.

7.1.2 End-to-end delay:

The delay a packet suffers from leaving the sender to arriving at the receiver.

7.1.3 Routing overhead:

The total number of control packets transmitted during the simulation time. For packets sent over multiple hops, each transmission over one hop is counted as one transmission.

7.1.4 Throughput:

This is the measure of how soon an end user is able to receive data. It is determined as the ratio of the total data received to required propagation time..

VIII. Result Description

Simulations results are evaluated on the basis of considered simulation parameters of protocols and performance of protocol is measured through metrics.

8.1 Routing Load Analysis

This graph represents the routing load analysis in case of normal AODV routing and proposed reliability based routing. The routing packets are required to established connection in between sender and receiver. In this graph the routing packets in case normal AODV routing about more than 3200 packets are deliver in network but in case of proposed reliability based scheme about only 1990 packets are deliver in network in a given simulation time. The proposed scheme is reduces the flooding of packets in network.

8.2 PDR Analysis

The PDR analysis in case of normal AODV and proposed AODV is mentioned in this graph. Here the percentage ratio of normal routing and proposed reliability based routing is mentioned. The PDR in case of normal AODV routing is about 84 %and in time between 40seconds to 60 seconds it is about 89%. The PDR incase of proposed AODV-LRI reliability scheme the PDR is about 91 % and in time between 40 to 60 seconds the PDR is reaches to 97%. It means the reliability based routing are improves routing capability of AODV protocol.

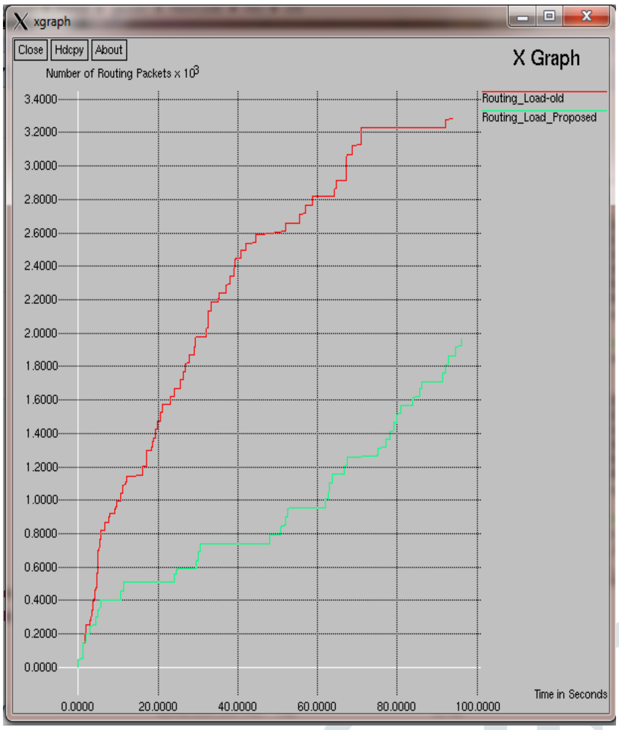

Fig. 1 Routing Load Analysis

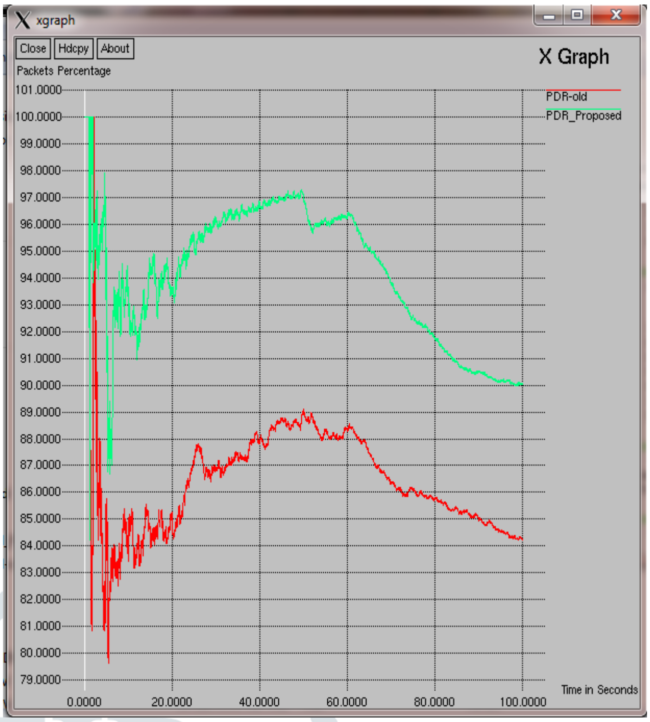

Fig. 2 PDR Analysis

8.3 UDP Received Analysis

The UDP packest received in case of proposed and normal AODV rotuing is mentioned in this graph. The packets received in case of proposed AODV-LRI reliability scheme is about 4000 and in case of normal AODV routing the packets are only received about 3550. The performance in case of proposed scheme improves the end to end deliver of data packets.

8.4 Overall Summarized Analysis

The overall performance in case of normal AODV and proposed AODV is mentioned in table 1. The performance in case of normal AODV is better but after modified it in to AODV-LRI reliability scheme the performance is enhanced.

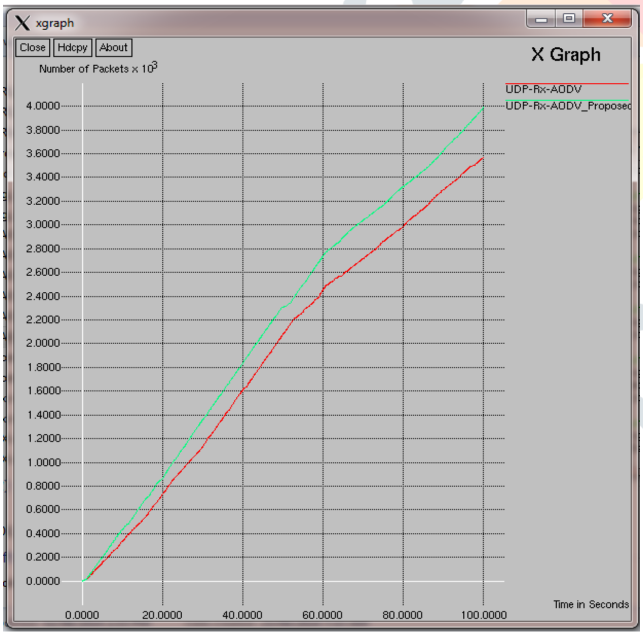

Fig.3 UDP received Analysis

Table 1 Overall Performance

Parameters	Old Scheme	Proposed (AODV_LRI)
Send	8976	9288
Recv	7560	8361
Routingpkts	3282	1964
PDF	84.22	90.02
NRL	0.43	0.23
Droprts	149	76
No. Of Dropped Data	1416	927

IX. Conclusion with Future Enhancement

Congestion in a network signifies that a node at any interval became congested and started to lose packets. A MANET network is to be defined as a network which will keep on stretching as the hops are added on. As MANETs support multi-hop communication, making it easy to realize a scalable network. Multi-hop communication but has certain challenges like the routing burden on intermediate nodes. The congestion possibility is occurring due to load on network. The proposed reliability based scheme is check the reliability of nodes on the basis of mobility of nodes. The link is break then in AODV the LRI is repair the link and the reliability of link is maintained. The proposed scheme is reduces network congestion by ways of reducing the unnecessary flooding of packets and finding a congestion free path between the source and the destination. The proposed AODV_LRI uses a new reliability based approach for detecting congestion dynamically. It uses a non-congested path discovery mechanism to prevent network congestion, and hence packet loss and end-to-end delay are reduced and throughput improved that also improves the routing performance.

In future we also modified the Local Route method on the basis of range of mobile nodes. The nodes that are slow in mobility and rage to neighbor or requestor node is less selected for routing.

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