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An Efficient Packet Loss Avoidance Mechanism in MANETs

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Abstract: ***Mobile Ad-Hoc Networks (MANETs) is a type of Ad-Hoc network consisting of nodes which are free to move individually in any direction resulting in dynamically changing topology. Frequent link failure due to mobility of nodes results in the major problem of packet loss in the Mobile Ad-Hoc Networks. This project proposes a mechanism to avoid packet loss in two phases, in first phase selecting a strong reliable route based on received signal strength indicator (RSSI) metric at IEEE 802.11Medium Access Control (MAC) layer if there is no route then switch to second phase means work like as normal Destination Sequenced Distance Vector (DSDV) protocol. This mechanism performs better to avoid packet loss in Mobile Ad-Hoc Networks (MANETs).***

Keywords: MANETs, link failure, packet loss, reliable routing, RSSI, DSDV.

1. Introduction

Mobile ad-hoc networks (MANETs) are self-arranging infrastructure-less networks consisting of nodes which independently free to move in all directions and are linked with each other through wireless medium. There are various routing mechanisms that have been proposed and many of these have been already well simulated or implemented. The leading applications of such networks are disaster rescue efforts, battlefield of military and environmental sensing. There are many routing algorithms for ad-hoc networks by this time that handle information of topology to decide routing mechanism at each device. A mobile ad-hoc network (MANET) is a group of mobile wireless devices, these devices for instant establishing a temporary network does not rely on central administration and infrastructure. Broadcasting of packets from node to node on time-fluctuating channels and topologies is required by all MANET applications. A routing protocol is required for communication and longer live transmission requires a consistent and efficient routing mechanism. The mobile nodes in ad-hoc networks suffer from positioning in a scattered way. In MANET, all nodes are free to move in all directions so the network topology is changing regularly which results to frequent link failure between the nodes from source node to destination node. The routing protocols are classified into two: reactive or on-demand routing protocol and proactive or table-driven routing protocol. In proactive protocols (such as DSDV), every node maintains a routing table having entries for all other nodes in the network. Periodically the routing table is updated and the distance to all other nodes is recalculated at each node. In reactive protocols (such as AODV and DSR), the source node calculates the route to destination when the route is required. The routes which provide high connectivity in mobile network and not intervene the data transfer is defined as a stable route.

2. Related Work

Establishing a stable route between source to destination to avoid packet loss in highly mobile network is a very challenging issue.

A. Packet loss Avoidance in Content Centric Mobile Adhoc Networks

In [1] node detecting the link failure causing data loss uses broadcast to find nodes that may have pending Interest with similar name of content. Other intermediate nodes or newly found nodes will broadcast further the data packets to their neighboring nodes, increasing the possibility of reaching nodes that are present in the path of the initial Interest request. The scheme here addresses two mobility possibilities that cause packet loss: an intermediate node moving away from its initial location in this case packet loss is avoided by using the alternative path and broadcast, and movement of destination node in this case the destination node will receive the broadcasted data packet from the nearby node as the data is cached by the nodes in the broadcast.

B. Mobility Based Route Selection on the Basis of ndoes for Stable Link Management

In [2] author proposed a SLM-AODV protocol, which selects the stable path if the result of comparison between signal strength and the RSSI value is higher than signal threshold value otherwise the path is selected based on the normal working of AODV protocol. The benefit of this scheme is that it increases the lifetime of the network by selecting the strong stable route from source to destination.

C. Step by Step Procedural Comparison of DSR, AODV and DSDV Routing Protocol

In [3] author has stated step by step procedure to compare 3 most common routing protocols in MANETs, DSR, AODV and DSDV based on performance metrics packet delivery fraction, end to end delay and routing load while fluctuating the number of nodes, speed and pause time. The simulation

results show that among the three protocols, DSDV protocol has a higher packet delivery fraction as compared to other two routing protocols in mobility as it is a proactive or table-driven protocol and is more reliable than others.

D. M-MAC: Mobility Based Link Management Protocol for Mobile Sensor Network

In this paper [4] author mentions that the RSSI table is maintained by every node in the network, the signal strength value of all neighbor's node is maintained in RSSI table at a node. The node predicts that its neighbor node is moving away when changes occur in RSSI value of table. The node on detecting the link failure performs following steps:

1. **Dropping:** The packets are dropped if link is broken or signal strength is not good and retransmission may occur.
2. **Relaying:** In this technique, a node can become a forwarding node if its neighbor table consists of both sender and receiver and forward the data between source and destination, if there is link failure between source and destination.
3. **Selective forwarding:** The intermediate node will drop the packets if it come from bad link

E. A Reliable Route Selection Algorithm using Global Positioning systems in Mobile Ad-hoc Networks

In this paper, author proposed a technique to select the most reliable route that is immune to failures by topological changes by mobility of nodes in mobile ad-hoc networks. To select a reliable route, the concept of stable zone and caution zone is introduced, and then apply it to the route discovery procedure of the existing AODV protocol. The concept of the stable zone and caution zone which are located in a mobile node's transmission range is based on a mobile node's location and mobility information received by Global Positioning System (GPS).

3. Proposed Work

In MANETs, one of the major issues is how to avoid packet loss due to frequent link failure caused by the mobile nodes in network, selecting a reliable route in mobile networks is required which is more stable. A route which is selected for an adequate amount of period for transmission is defined as a stable route in MANETs. In this paper, we propose a new mechanism for routing in MANETs that selected routes having more stability. There are two phases in proposed mechanism, in first phase a strong reliable route is selected based on the received signal strength indicator metric at IEEE 802.11 MAC (Medium Access Control) layer and minimum hop count using Destination Sequenced Distance Vector (DSDV) protocol at routing layer otherwise if there if there is route then switch to second phase means work like as normal DSDV protocol, since in signal strength based protocol node select those nodes which have signal strength higher than predefined signal threshold value.

RSSI is an universal radio receiver technology metric in a wireless environment known to users of IEEE 802.11 protocol family. The 802.11 standard indicates a common medium access control (MAC) Layer, which maintains a various type of functions that support the operation of 802.11-based wireless LANs. In general, the MAC Layer manages and maintains communications between 802.11 stations (radio network cards and access points) by coordinating access to a shared radio channel and handling protocols that upgrade communications over a wireless medium.

A. Route Discovery

When the source node is ready to send the data packet it broadcasts the HELLO packet to his entire neighbors [12], then node selects the route on the basis of signal strength of the HELLO packet means it compares the signal strength of HELLO packet of the sender's node with the signal threshold if it is greater then intermediate node receive this packet otherwise it will discard this packet with the help of this approach routing protocol search the stable path to the destination, on the basis of signal strength if there is no route to the destination then it switch to normal DSDV and find the route on the basis of minimum hop count so it can always find the best path from source to destination.

The RSSI value is calculated at each node. Each node maintains the RSSI table [4], RSSI table contain the signal strength value of node's neighbor, with the help of RSSI table node. Table contains three fields [6]:

- **Node ID**: when a node receives a packet from a same neighbor node, it replaces the previous entries of the table, related to that node, with the more current one.
- **RSSI neighbor node packet**: The RSSI values of neighbor node are maintained with the idea of using it afterwards for differentiating if neighbor nodes are available or not i.e. the strong signal denotes that the neighbor node is in communication range and link will be possible for longer time duration and the weak signal denotes that the neighbor node moving away and link will be failed soon.
- **Timestamp**: The overhead packet timestamp can be used to detect the broken links due to mobile nodes because due to mobility the receiver is not reachable and its packet has not been overhead since long time.

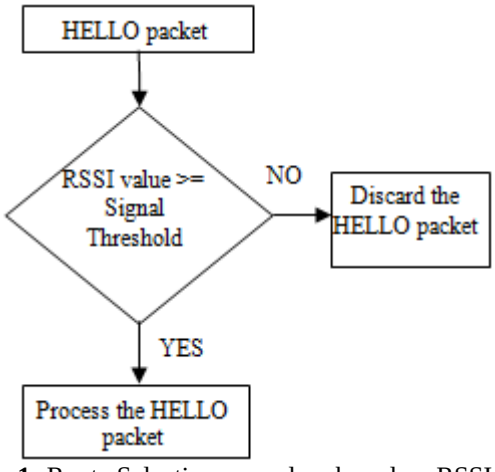

Figure 1: Route Selection procedure based on RSSI value

4. Performance Evaluation

In this section, the performance of proposed mechanism is evaluated using NS2 [8]. First we illustrate how the RSSI value at MAC layer is calculated then the simulation

environment is mentioned and the simulation results are analyzed with comparison.

A. Calculation of RSSI value

The RSSI value is calculated with the help of two ray ground model [2], [7]:

$$P_r(d) = \frac{P_t * G_t * G_r * h_t^2 * h_r^2}{d^4 * L}$$

Where, P_r is received power from transmitter at distance d, P_t is the signal power transmitted by the node, G_t & G_r is the gain for transmitter & receiver antenna respectively (default value is 1.0 for all antennas), h_t & h_r is the height of transmitter & receiver antenna respectively (default value is 1.5m for all antennas), **d** is the distance of receiver from the transmitter, **L** is the loss among the path between transmitter and receiver (default value is 1.0 for all antennas)

B. Simulation Parameters

The simulation parameters are illustrated in Table 1.

Table 1: Simulation Parameter

Parameter	***Value***
Simulation duration	135s
Topology area	1800m x 1200m
Number of nodes	32
Mobility speed	2 to 16m/s
Mobility model	Random way point
Transmission range	250m
Packet rate	4 packets/s
Packet size	1000 b

C. Simulation Results

We simulated DSDV protocol at routing layer using NS2 is done to get simulation results of proposed mechanism. In this section, we present the simulation results and compare proposed mechanism using DSDV protocol with the existing system using AODV protocol.

Figure 2. shows as the speed of nodes increases packet delivery ratio in existing system using AODV protocol decreases rapidly as compared to proposed mechanism using DSDV protocol. The simulation results show that proposed system avoids unreliable mobile nodes from the route, it requires less rerouting and leads to less control overhead so in large network it performs better than existing system. Proposed system selects the most reliable path so number of packet loss is also low as compared to existing system. So packet delivery ratio is also better than existing system. The packet delivery ratio is mentioned in %(percentage).

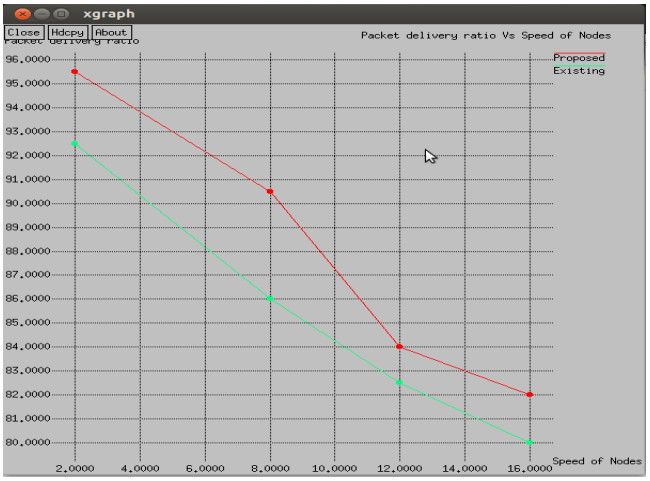

Figure 2: Speed of nodes versus Packet Delivery Ratio

Figure 3 shows as the number of nodes increases average delay in proposed system using DSDV protocol decreases rapidly as compared to existing system. The selective processing of signals is reason behind the reduction in average delay. The measurement unit of average delay is ms (milliseconds).

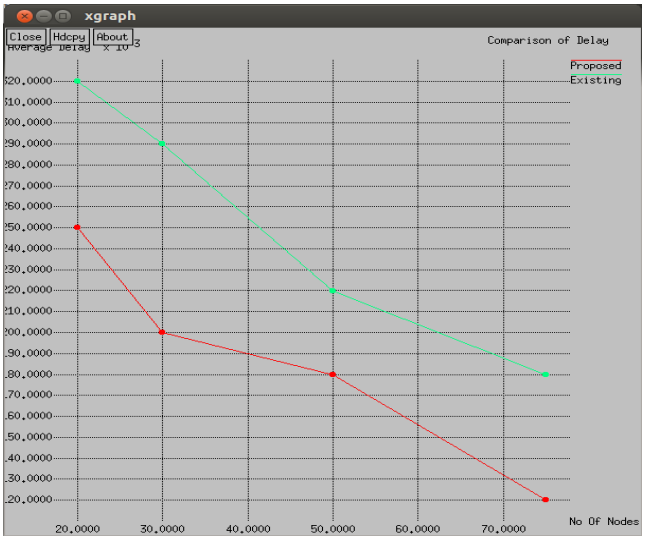

Figure 3: Number of nodes versus Average delay

5. Conclusion

In Mobile Ad-Hoc Networks (MANETs), the Packet Loss due to link failure is a significant issue. In proposed system, the stable route from source to destination is selected based on received signal strength indicator (RSSI), a measurement of the power present in a received radio signal, at IEEE 802.11 MAC layer and minimum hop count of DSDV protocol at routing layer. As the number of nodes increases, proposed system take smaller average delay than existing system due to smaller retransmissions. Proposed system always seems to offer better performance in terms of Packet Delivery ratio than existing system. Proposed system not only boost the network performance but also more reliable in data transmission as it reduces the network partition and packet loss in the networks. It also increases the lifetime of network.

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