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Efficient and Power Conservative Routing Protocol for MANET

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Abstract: A Mobile Ad Hoc network (MANET) is a collection of digital devices that can communicate with each other without any fixed networking infrastructure. Since the devices in MANET are mobile, so their routing and power management become a major challenge. The mobile Ad-hoc network are more susceptible to attack then a wired network due to its limited physical security, power constraints operations, volatile network topology, intrinsic requirements of mutual trust between all nodes and lack of centralized monitoring and management point. The work in paper proposed a new protocol for optimistic routing of data packets in MANET with node density and also saves energy for mobile nodes. This approach is quite simple and it will also reduce the computational overhead to a lot extent. In our proposed protocol Re (Remaining energy) of a node is saved for future use.

Keywords: Mobile Ad-hoc Network (MANET), Remaining energy (Re)

I. INTRODUCTION

A network consists of group of two or more hosts or computer systems that are interconnected by communication channel and allow sharing of information and resources. Wired network and wireless network are the two main category of network. Wired network the devices are connected through a physical link like optical fibers, cross pair wires etc. Wireless networks the devices are not connected through physical link [1]. Wireless networks are made by using the radio waves. Wireless networks are implemented on the IEEE 802.11 standards. Wireless network consists of infrastructure based or Ad-hoc based network. A mobile ad hoc network is an autonomous system consisting of mobile hosts that do not depend on presence of any fixed infrastructure. MANET is a type of one of the ad-hoc network. Ad hoc word is derived from Latin and its meaning is "For this Purpose". This network is based on the ability of devices to directly communicate with each other known as ad-hoc. The device can communicate with the devices within range of each other and communicate in peer-to-peer mode without involving central access points [2]. Every node took part in routing by forwarding data for other nodes. It is autonomous system in which every node is free to move and often act as router at the same time. Communication in this is done via multi-hop path. The data is transfer in the form of packets. Each packet may have different path or follow the same path. Packet's path selection process is known as routing [3]. Routing is the feature that enables packets to pass from one computer to another and eventually reach the destination. Each intermediate node also performs routing by passing the packet to the next computer. Power efficient or optimistic routing becomes a critical challenge of MANET. So this paper will propose a new routing protocol, which efficiently manages the routing of network and also provide optimistic path towards destination. It proposes reliable and optimistic routing with the help of node density.

II. RELATED WORK

The energy Conservation is major concern in mobile ad-hoc network (MANETs). There is limited life time of batteries. Great effort should be devoted for designing energy aware routing protocol. Some protocols have been proposed in order to provide power aware routing. *Energy Aware Routing Protocol in MANET using Power Efficient Topology Control Method* [4]. In this paper energy efficiency is considered as an important design consideration to extend the life time of networks. This paper shows how the topology of network can adjust by controlling the transmission power. Sleep based approach is used for energy conservation [5]. In this paper Author uses the methods to reduce the energy consumption. Routes are selecting by considering residue energy. Reducing the communication overhead of control messages. Qualnet 4.5 Simulator is used for show the results. The result shows the purposed approach has good energy conservation and performs better in context of energy end to end delay without affecting the throughput. It is difficult to find out the distance between the nodes which lies in geographical region. *Optimal path Selection Routing Protocol in MANET [6]*.This paper presents the DSR. The disadvantage of DSR protocol is that source node contains at most one route to destination at any moment of time [7]. There are N ways of choice of optimal path for different applications like

Multimedia, Voice mail etc. It contains a new protocol DSR-A which select route from source to destination depending upon bandwidth request of source node and battery life of all the nodes which presents on a path from source to destination. According to Simulation Experiment result shows 64.38% of saving in total time to send packets from source to destination. If the Node in Network are far away from each other more energy are wasted for calculation of bandwidth.

*Attacker Identification in Mobile Ad-hoc Networks [8].*This paper proposes an artificial neural network to find misuse detection in MANETs. Proposed method detects the attacks corresponding to pattern at the mobile nodes. At each mobile node whether the known attack is present or not is detected by comparing it by known patterns. These patterns are trained to ANN. So Back Propagation algorithm is used to train the network. Training is done to the neural network by adjusting the synaptic weights. Compare to traditional method of intrusion detection, neural network based learning is more complicated. As number off nodes increases the complexity in weight adjustment increases.

*A Location Aided Power Aware Routing Protocol (LAPAR) [9].*Location-Aided power-aware routing protocol takes local routing decisions randomly so that the optimal power efficient route is formed for forwarding data packets. This new protocol is distributed in which location information of neighboring nodes are sent to each routing node. This protocol is power efficient and solves many problems. Power-Aware Routing in Mobile Ad-Hoc Networks (PARMAN) [10].This paper represents a new power aware metrics for routes determination. This paper showed that by using shortest-cost routing algorithm reduces the cost/packets by 5% to 30% as compare to shortest-hop routing. The writer also promised that the mean time to node failure also increases. The important is that it reduces cost/packet and maximum node cost by using shortest-cost routing.

An Entropy-based Fuzzy Controller QoS Routing Algorithm in MANET (EFQRM) [11]. The key idea of EFQRM algorithm is to construct the new metric-entropy and fuzzy controllers with the help of entropy metric to reduce the number of route reconstruction so as to provide QoS guarantee in the ad-hoc network. But, due to lack of cooperativeness it fails sometimes to construct the new metric-entropy and fuzzy controllers. The relation of this approach to our proposed protocol is they worked on MANET and tried to provide the QoS guarantee in MANET.

Optimization of Routes in MANET using Artificial Neural Networks [12]. This paper proposes an effective and efficient protocol for backup and disjoint path set in ad-hoc wireless network. This protocol converges to highly reliable path set very fast with no message exchange overhead. For the evaluation of performance Simulation experiments are conducted. LET is used for link reliability estimates between two nodes. Database is used for predicting the probability of proper operation of links. Multilayer Perception is used to train with back propagation error algorithm. Simulation results shows the MLP net can be a good choice to predict reliability of links between the mobile nodes with more accuracy. In this paper there are two links are given undirected link or directed link. Long path are less reliable then short path. Long path is divided into Node Disjoint path. This paper proposed a split multipath routing algorithm for select a maximally disjoint path. LET is calculated with Mathematical assumption. LET max is the biggest time period through which nodes are connected .Select the nodes which are more reliable. This algorithm converges to highly reliable path set very fast. MLP is a good choice to predict the reliability of links between mobile nodes with more accuracy neural network is very complicated with itself. For a large network it is difficult to predict LET with the help of neural network.

III. PROPOSED WORK

Nodes can move arbitrarily, network topology can change frequently and unpredictably. So optimistic routing becomes a major concerned and bottleneck in applications of MANET. There is great need to concentrate optimistic routing by one protocol for mobile ad -hoc network. In proactive routing protocol when there are dense network is available in that situation problem of high traffic occurs. In case of Reactive routing protocol the main disadvantage is route acquisition latency. When a route is needed by source node there is some finite latency while route is being discovered. In contrast with a proactive protocol routes are typically available the moment they are needed implying that there is no delay to begin the data session. In On Demand protocol if a node desire to send a message to destination node it initiates a route discovery to locate the destination. Due to this congestion occurs in network. The work proposes in this paper will overcome the congestion/message overhead problem by designing a New Routing protocol which performs routing based on node density. According to this protocol, by sending beacon signal all the nodes will probe to understand which nodes are in its neighborhood and they will broadcast a request. After getting reply they will make their friend list. All nodes maintain the table of all neighbors. Instead of forwarding data packet to all nodes, Source node will only select the intermediate node for forwarding data packets which having higher density. This routing protocol will reduce the total no. of messages used for broadcasting from source to destination. It will also preserve energy and try to reduce the flooding in network and provides reliable path toward the destination. By this routing optimistic path is selected for packet forwarding towards destination.

This paper provides reliable and optimistic routing in MANET with the help of node density. Node density is a new approach to provide optimistic routing.

Nd: - It is an integer number which associate with each node. The selection of intermediate nodes for forwarding packet is done on the bases of node Density. Node Density contains how many neighbor nodes are connected with a particular node. When we observe that node density of particular node is greater than that of another node then we conclude that one having greater node density is most durable node .The node having higher density is most responsible node and transmit data packet most dutifully in the network as comparison with other nodes. It will overcome message overheads/congestion due to data packets in the network.

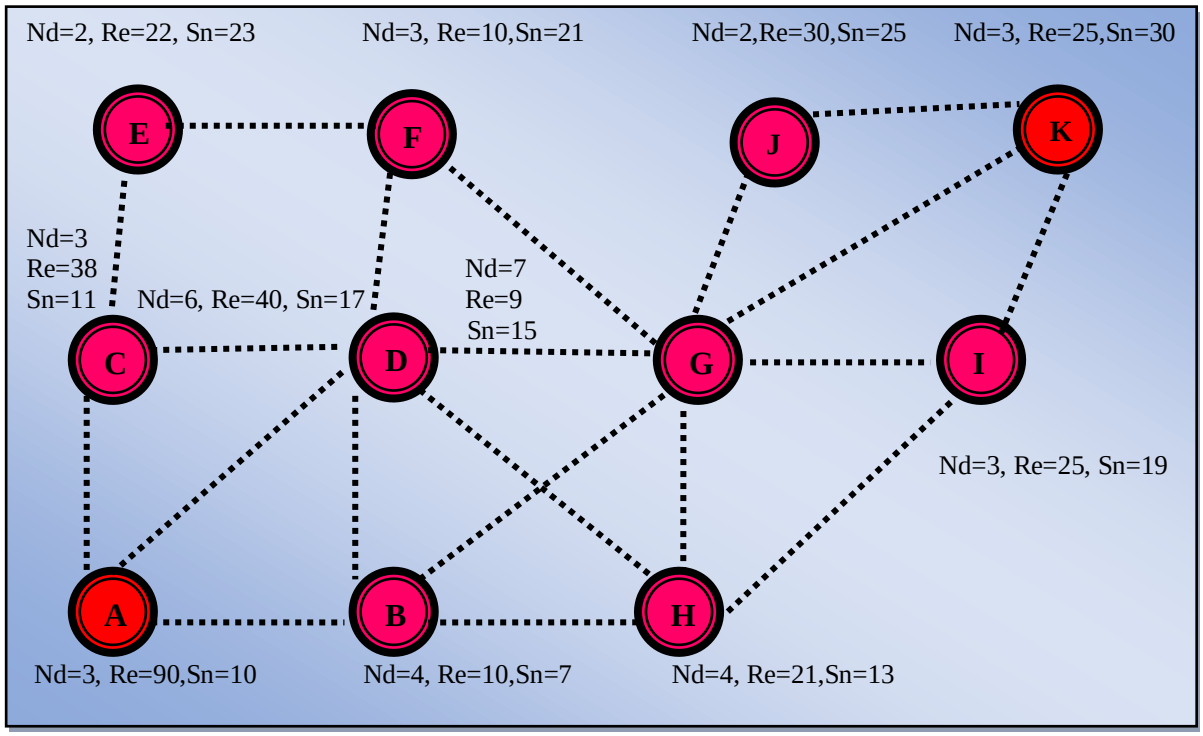


Figure1. Initial Network Topology.

Sn is sequence number of packet each node gets a packet it checks the buffer for packet sequence number of that sender. If match occurs it means that the data packet is duplicated and receiver node discards it. This will prevent from flooding attack. Each node in network sends beacon to checks which nodes are currently associative with it. Beacon frame is one of the management frames in IEEE 802.11 based WLANs. It contains all the information about the network. Beacon frames are transmitted periodically to announce the presence of a Wireless LAN network. By sending beacon signal all the nodes will probe to understand which nodes are in its neighborhood and they will broadcast a request. All nodes maintain a table which contain list of neighbor's with their node density (Nd), Remaining energy (Re), Sequence number (Sn). When a particular node want to send data packet to Destination it first of all check table and select the intermediate node which having higher node density. Figure1. Shows initial Network Topology. All nodes maintain the table of its neighbor nodes.Now node A wants to send data packet to node K in Figure2. Node A generate "Hello message" and set its status as busy. The Sequence number is send along with message and checked by all the destination nodes. In any case match occurred by node that means data already sent by sender. In this case Receiver node discards data packet and sends NACK. Now in network topology node K is not directly reachable from node A. Node A having neighbor nodes (B, C, D). Node A forwards data packet to node D because it having highest node density. It will check that Node D itself as a destination node or not. If not then it will further check its neighbor nodes. Node B having node density 4, node C having (Nd 3), Node D has (Nd 6). So node D contains largest node density so we select node D for packet forwarding. Node D receives data packet from node A and set its status as busy.

In network all nodes performs either 3 activity. Data Send, Data Receive and Data Forward. 1 unit of energy is used for data send and receives. For forwarding data packet 2 units of energy are used because this task is completed in two steps. Firstly receive data packet and then forward. This change is shown in Figure2.with bold letter. In Figure 4.3 node A sends data packet to node D then Data Send activity is performed so it will deduct 1 unit of energy.

The Neighbor Nodes of node D are (A, B, C, F, G and H). We can't traverse the nodes which already have been traversed. So we avoids node ABC. Node F contain (Nd 3), Node G having (Nd 7), node H having (Nd 4). Node G having remaining energy Re<Mt. It has remaining energy 9 which is less than that of Minimum threshold. Node G had done a lot of work now we have to save its energy for future use. This node is most important node in network which acts like a bridge in network. In future if no alternate path is available then we can use this node for sending data packet.

Node H is selected for data transfer. Node H receives data packet from node D and set its status as busy. Node H performs two actives Data Receive and Data Forward. So 2 units of energy is used and its remaining energy becomes (Re19). Neighbor nodes of node H are (B, D, G, I). Now check whether destination is directly reachable or not. If destination is directly reachable then forward data packet otherwise check its neighbor nodes. Now it sends packet to node I. It will check whether destination is directly reachable or not and finds it is directly reachable. Now forwards data packet to destination.

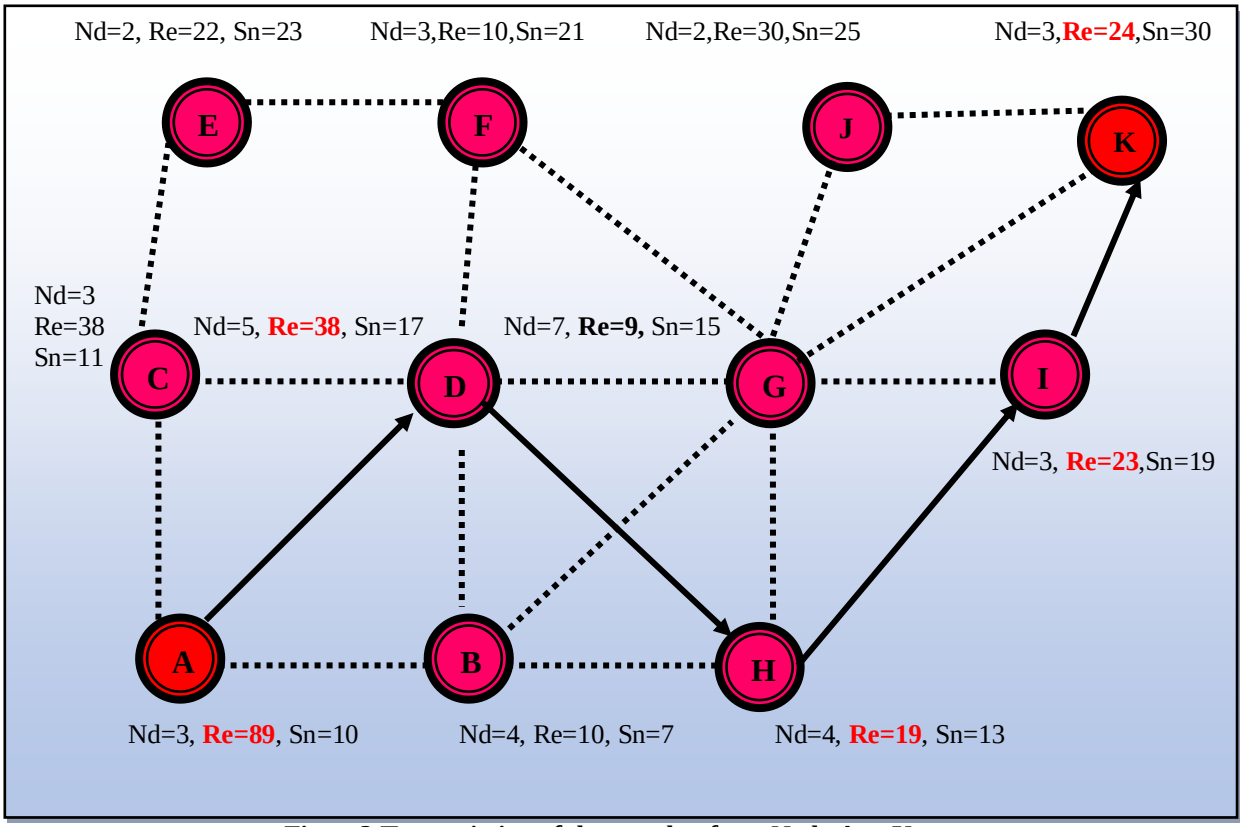


Figure2.Transmission of data packet from Node A to K.

In MANET nodes are moves independently. In network topology node H is move away as shown in Figure3. This node is not under the transmission range of node D. If node D sends data packets to node H it cannot receive. Now node D cannot get acknowledgement back from node H. When timeout period has been expired Node D tried some other node. If ACK is not received this mean either node move away, switched off. The node D contains neighbor nodes (A, B, C, F, and G). Nodes (A, B, C, and F) were already visited. Through node H we can visit node K but node H is not in the transmission range of node D. Now node G having node density 7 but it is having low remaining energy. There is no alternate path is available in the network so we select node G for packet forwarding. Node G contain neighbor list (B, D, F, H, I, J, K). Nodes (B, D, F, and H) were already visited. So we discard these nodes. Now Node Density (Nd) of node I is 3, Nd of node J is 2 and Nd of node K is 3

Node G firstly checks whether destination is directly reachable or not. It finds that destination is directly reachable from node G. Figure3. Shows network when data packet reached at destination. Node K sends acknowledgment back to node G. Node G receive acknowledgement and forward to node D. Node D receive acknowledgement and forward it to node A. Node A receives acknowledgement from node D and knows that data packet send successfully.

Algorithm: - Following steps are followed by Source node to successfully send data packet to destination.

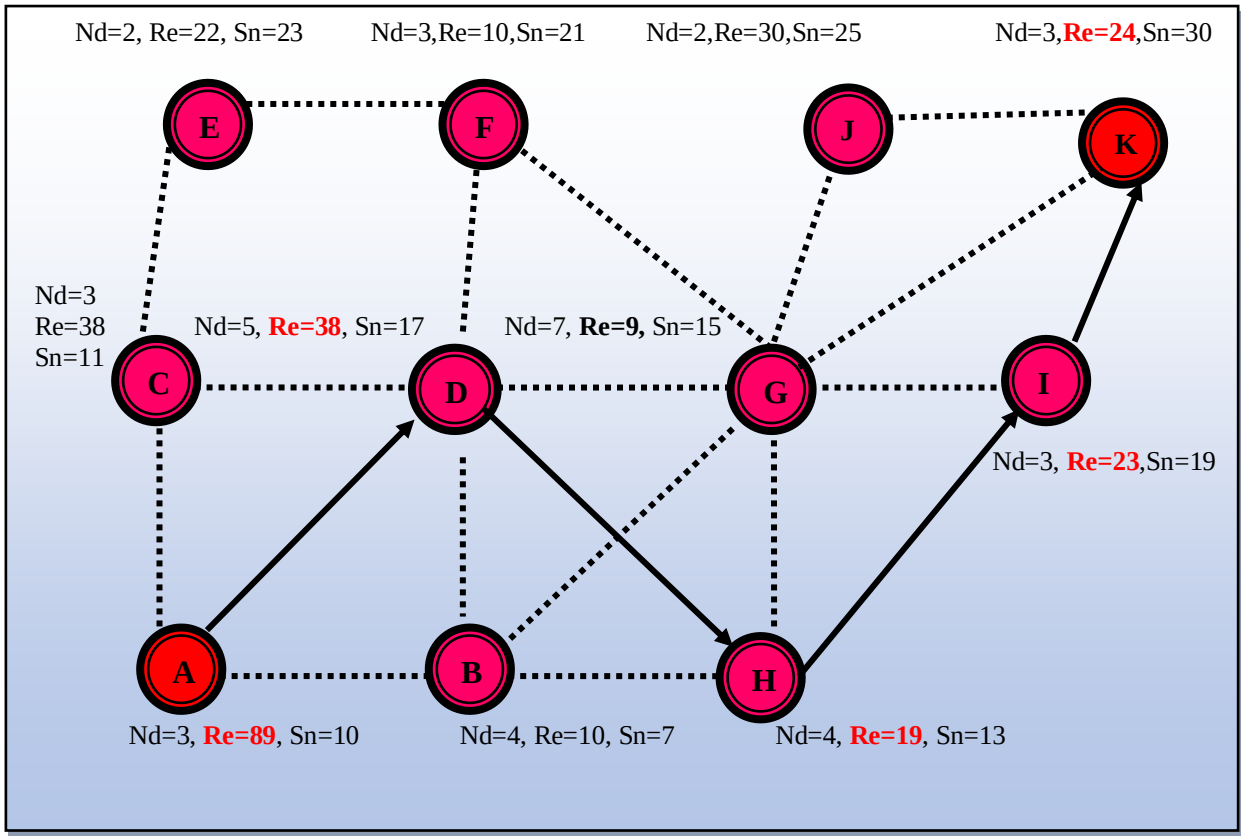
Update Neighbor list

At each beacon the following steps will follow for determining neighbor nodes and updating values of variables.

Step1. Broadcast beacon signal in network periodically

Step2. Receive reply from neighbor nodes

Step3. Update neighbor list



Source Node

The following are the steps followed by source node for successful transmission of data to the destination node.

Step1. Set all nodes with its neighbor list
Step2. Set my status=busy
Step3. If destination is directly reachable
Step4. Send data packet to destination
Step5. Wait for ACK
Step6. If ACK received considered as success
Step7. Set my status=idle
Step8. Else if Timeout occurs or FAIL message received, arrange data packet for resending
Step9. Else Send data packet to intermediate node having higher node density
Step10. Wait for ACK
Step11. If ACK received considered as success
Step12. Else if Timeout occurs or FAIL message received, arrange for resending data packet to the Intermediate node with next highest node density value (Nd)
Step13. Repeat step 11, 12 and 13 until ACK received

Intermediate Node

The following steps should be followed by receiver and intermediate nodes for processing the received data.

Step1. If my status=busy Send FAIL message to Sender
Step2. Else
Step3. Make my status=Idle
Step4. If my address=Destination
Step5. Accept data packet
Step6. Generate ACK
Step7. Send ACK to node from which it directly received the message
Step8. Forward data packet

Forward data packet

The following steps taken by intermediate node when receives a data packet.

Step1. If destination is directly reachable

Step2. Send data packet to destination

Step3. Wait for ACK

Step4. If ACK received consider as success

Step4. Else if Timeout occur or FAIL received, resend data packet to intermediate node having 2nd highest node density

Step5. Repeat 10, 11 and 12 until ACK received

Step6. If intermediate node having Re>Mt

Step7. Select node for packet forwarding

Step8. Else if Discard node and select node if no alternate path available

Step9. If data packet successfully reached at destination

Step10. Reverse path followed for sending ACK back

Step11. Go to step 14.

IV. CONCLUSION

A new routing protocol has been proposed that works on Reactive approach. This protocol behaves better than the existing protocol. This protocol is Power Conservative because instead of sending route request to all the nodes we will choose the node according to node density. It will also reduce total number of messages used for broadcasting from source to destination. There is no need of maintaining cache Table on every node. Reliable path selection process is followed in this protocol. For packet forwarding intermediate nodes are selected according to node density it will preserve energy. This will also preserve remaining energy of a particular node for future use. Proposed protocol overcomes the congestion / message overheads problems in the network. It will also provide reliable and optimistic path for routing. In future work can be done for solving other MANET challenges. It would study how proposed protocol performs with respect to other existing protocols.

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