A Proficient Approach to Amplify Packet Delivery Ratio Adapting Shortest Path Algorithm

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ABSTRACT

In so far as technological progresses are concerned, expansion in wireless networking has been incontestably swift. In recent years, there has been noteworthy effort put into understanding the real world implications, applications, and constraints of the technology. Mobile ad hoc networks are highly dynamic networks exemplified by the absence of physical infrastructure. In such networks, nodes are able to stir, evolve concurrently and synchronize continuously with their neighbors. Due to mobility, connections in the network can change animatedly and nodes can be enter or depart at any time. Providing high data rates to wireless users has long been a goal that has driven the development of new technologies and standards in the past decade.

In this paper an attempt is made to develop an approach to solve the problem of dropped packets and increase the "Packet Delivery Ratio" using the Dijksta method to find shortest and optimal route for forwarding the packets.

Key words: *MANET(Mobile Adhoc Network), PDR(Packet Delivery Ratio), Dijkstra algorithm, Euclidean Distance*.

INTRODUCTION

A Mobile Adhoc Network (MANET) is one that nodes come collectively as needed, not essentially with any sustain from the active Internet infrastructure or any other kind of permanent stations. We can say that an ad hoc network is an autonomous system of mobile hosts connected by wireless links. The combination of hosts form a communication network modeled in the form of an arbitrary graph over relatively bandwidth constrained wireless links. This is in distinction to the well known single hop cellular network model that wires the need of wireless communication by installing base stations as access points.

In MANET no infrastructure exists and the network topology may dynamically change in an unpredictable manner since nodes are free to move. This network is not centralized, where all network activity including discovering the topology and delivering messages must be executed by the nodes themselves, i.e., routing functionality will be inculcated into mobile nodes [1].

The set of applications for MANETs is miscellaneous, ranging from small, static networks that are restricted by power sources, to large-scale, mobile, highly dynamic networks. The design of network protocols for such networks is a complex issue. In spite of the applications, MANET need efficient distributed algorithms to establish network organization, link

scheduling, and routing. However, establishing feasible routing paths and delivering messages in a decentralized environment where network topology fluctuates is not a well-defined problem. While the shortest path (based on a given cost function) from a source to a destination in a static network is usually the optimal route, this idea is not easily extended to MANETs. Factors such as variable wireless link quality, propagation path loss, fading, multiuser interference, power expended, and topological changes, become relevant issues [2].

A. Characteristic of MANET:

- Nodes act as host as well as router.
- MANET is capable of multihop routing.
- Nodes can join or depart from the network at any point of time, it make network topology dynamic in nature.
- In MANET mobile nodes are considered with less money, power and light weight feature.
- Transitional node connectivity.
- Wireless links are predominantly more susceptible to eavesdropping, spoofing and denial of service (DOS) attacks.
- It has high concentration mobility for number of users.
- It has robust and low cost network.
- Wireless connectivity among nodes considers the bandwidth for transmission.

B. Challenges in MANET:

- It has limited transmission range.
- Wireless link attributes are time altering by nature.
- It has Packet losses due to error and node mobility in transmission.
- Mobility induced route changes in routing problem.
- Broadcast nature of wireless medium has hidden and exposed problems.
- It has security problem as it is simply snoop.
- It has frequent network partitions.
- It has Battery constraint energy efficiency problem [3]

QOS PARAMETERS IN MANET

In computer networking and other packet switched telecommunication networks, the term quality of service (QoS) refers to resource reservation control mechanisms rather than the achieved service quality. **QoS** (Quality of Service) consigns to a broad collection of networking technologies and techniques. The objective of QoS is to offer guarantees on the ability of a network to deliver expected results. Elements of network performance within the scope of QoS often include availability (uptime), bandwidth (throughput), latency (delay), and error rate. QoS involves prioritization of network traffic. QoS can be apply at a network interface, toward a given server or router's performance, or in terms of specific applications.
Many things can happen to packets as they travel from origin to destination, resulting in the following problems as seen from the point of view of the sender and receiver in MANET:

1. Packet Delivery Ratio

The routers might fail to deliver (drop) some packets if their data is corrupted or they arrive when their buffers are already full. The ratio of Delivered packet and Sent packet is called PDR which is directly related to the efficiency and throughput of the network.

2.Low throughput

In communication networks throughput or network throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot. The system throughput or aggregate throughput is the sum of the data rates that are delivered to all terminals in a network

3. Errors

Sometimes packets are corrupted due to bit errors caused by noise and interference, especially in wireless communications

4. Latency

It might take a long time for each packet to reach its destination, because it gets held up in long queues, or takes a less direct route to avoid congestion. This is different from throughput, as the delay can build up over time, even if the throughput is almost normal.

5. End to end delay

A packet's delay varies with its pose in the queues of the routers along the path flanked by source and destination and this position can vary impulsively. This variation in delay is known as jitter and can gravely affect the quality of streaming audio and/or video. End-to-end delay is the time which takes a packet to travel across the network from source to destination. Delay jitter is the rise and fall of end-to-end delay from packet to the next packet.

6. Out-of-order delivery

When a group of allied packets is routed through a network, different packets may take different routes, each resulting in a different delay. The result is that the packets reached in a different order than they were sent. This difficulty necessitates special additional protocols liable for rearranging out-of-order packets to an isochronous state once they reach their destination [4].

CONCEPTS USED IN NEW TACTIC OF DESIGING THE NETWORK

A. Dijkstra's algorithm

Dijkstra's algorithm developed by a Dutch computer Scientist "Edsger Dijkstra" in 1956 and published in 1959. Dijkstra's algorithm discovers shortest paths along certain type of graphs. It belongs to the DP, Dynamic Programming family, and as such its logic rests within the Optimality criterion of Richard Bellman. The main aim of Dynamic Programming created by mathematician Richard Bellman in 1953 could be seen as faint tradeoffs in computing, a tight conciliation between computing process power and memory to solve problems efficiently

by overlapping sub problems and optimal base. It means that optimal overall solutions for a given problem could be undertaken via optimal solutions of sub problems of it [5].

Dijkstra's algorithm resolves the single-source shortest-path problem when all edges have non-negative weights. This algorithm is often used in routing and as a subroutine in other graph algorithms. This algorithm finds the lane with lowest cost between that vertex and every other vertex. ex: if the vertices of the graph represent cities and edge path costs represent driving distances between pairs of cities connected by a direct road, Dijkstra's algorithm can be used to find the shortest route between one city and all other cities.

Dijkstra's Algorithm

1. INITIALIZE SINGLE-SOURCE (G, s)
2. S <= { } // S will ultimately contains vertices of final Shortest-path weights from s
3. Initialize priority queue Q i.e., Q <= V[G]
4. while priority queue Q is not empty do
5. u <= EXTRACT_MIN(Q) // Pull out new vertex
6. S <= SU{u} // Perform relaxation for each vertex v adjacent to u
7. for each vertex v in Adj[u] do
8. Relax (u, v, w)

B. Distance calculator between two nodes

MANET is constructed with the help of Random Geometric Graph (RGG) Model in this model the nodes which are close has higher probability of being connected as compare to the node at farther distance. Let arbitrary two nodes M (x_m , y_m) and N (x_n , y_n) the Euclidean distance among these two nodes is $\sqrt{((x_n^2-x_m^2)-(y_n^2 - y_m^2))}$. If the distance is less than or equal to transmission range (TR) of MANET then they are said to be neighbours [6].

METHODOLOGY PROPOSED FOR DESIGNING NETWORK

With the help of concepts defined above we can design a network with high performance or throughput in terms of high PDR ratio. We have to follow the steps:

1. Firstly we have to design the connection of the network in form graph
2. Then we have to calculate the distance using Euclidean distance formula between the nodes
3. Now we will connect all the nodes with respect to distances and apply Dijkstra algorithm for routing table entries to find shortest route discovery
4. The network is ready to transmit the messages.

A. Generation of Network in form of graph

To generate the network at first we will take all nodes as individual (Refer Fig 2). After it we will calculate the distance between every node using Euclidean distance formula i.e. $\sqrt{((x_n^2-x_m^2)-(y_n^2 -y_m^2))}$ (Refer Fig 3). This process will be taken under the route discovery for message forwarding purpose in the network. With the help of these gathered distances we will arrange the network to find the shortest path. As a result we got graph as mesh topology where every node is connected with other all nodes of network and store the information of all nodes as routing table entry with distance. The IP addressing can be done in the network in any order.

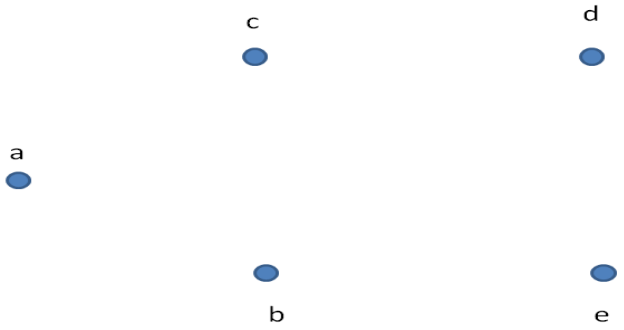

Fig 2: Individual nodes to form a network

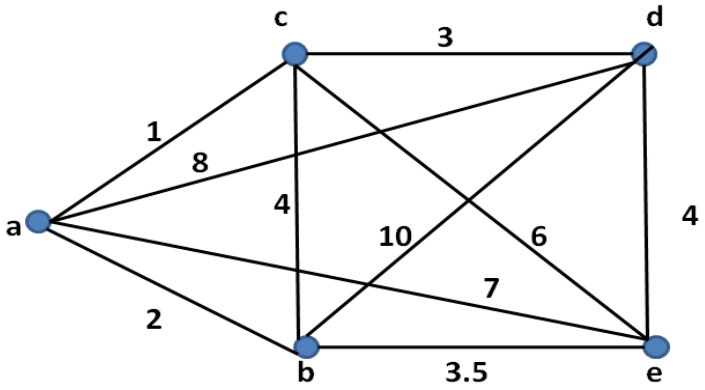

Fig 3: Nodes with respective distances

For example we take the network defined above with the distances given in the graphical form. Suppose node "a" wants to send the message to node "d", now node "a" will run the Dijkstra algorithm on network to find the shortest path to reach the node "d".

First we will choose the node "a" and find all the possible routes from "a" to any other then we will choose the shortest to traverse it further in the direction of "d"(Refer Fig 4). Now we choose the node "b" because of its minimal distance from "a" (Refer Fig 5). After choosing "b" we repeat the process as previous and traverse towards "c" and then "d". Now we got the final route as a-b-c-d and distance as 7 which is minimal (Refer Fig 6).

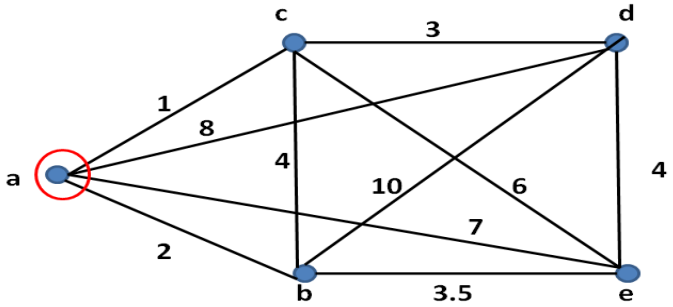

Fig 4: Network with Source as "a"

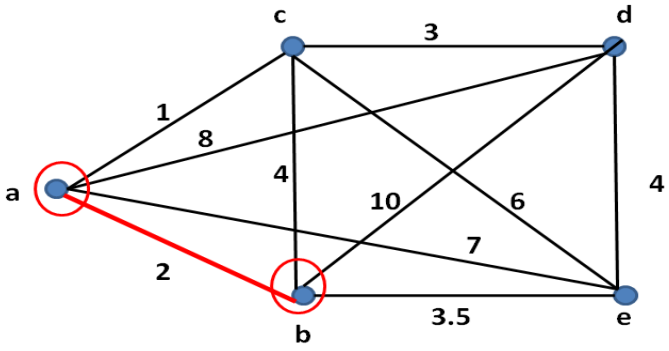

Fig 5: Traversing from a to b towards minimal distance

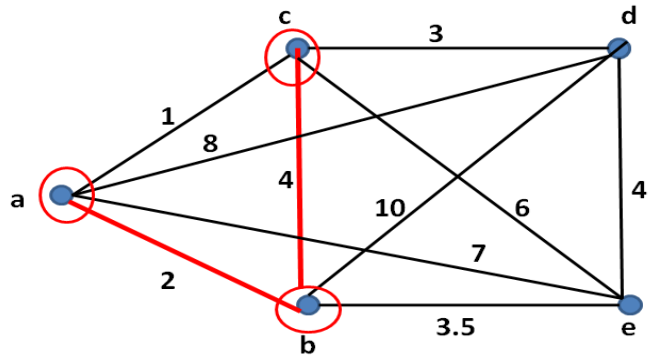

Fig 6: Final Minimal route from a to d

B. Insertion of Node into the network

When a new node came into the network and wants to join it, the complete network will be redesigned or restructured as generation of new network using the concept of graph and routing table updated as Dijkstra algorithm and the transmission will be start.

C. Deletion of Node from the network

When the node departs from the network because of any reason like battery end, out of reach, shutdown etc., the network will redesigned this time. The node informs the previous node about the departure and the previous node inform to other previously connected node and so on, like this the information circulated to whole network.

D. Restructuring of network

The complete network restructured periodically (after 20 packets sending) because the nodes are moved, entered and departed from the network continuously. This affects the complete network performance so the restructuring join all the nodes again.

CONCLUSION

In modern years, mobile computing and wireless networks have observed a incredible rise in popularity and technological advancement. The basic routing problem in MANET deals with methods to transport a packet across a network from source node to destination node. In most

mobile ad hoc network routing protocols, sources will use a route until a link is broken or a shorter route is found. A link failure will cause packets to be dropped and results in transmission delays while a new route is found.

To overcome such problem new approach is proposed in this paper, in this approach the network is designed in the graph format with the distance measure concept. Through this newly approached concept the problems will be removed in such a way:

- Dropped Packet: This problem will be solved because of sending the packet from the shortest route and restructuring of network periodically.
- Link breakage due to Node departure: This problem will be solved because the node will inform the connected node and these nodes inform the other connected node and so on.
- Scalability: This problem will be solved because the insertion and deletion of node is easy in this new approach with minimum problem of addressing and connection.

Packet Delivery ratio of the network will be increased after implementation of this concept because of its route discovery and periodically redesigning of the network.

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