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Challenges of Multicasting and Overhead Using Spanning Tree in Manet

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Abstract— MANET is an autonomous distributed system in which mobile nodes are of random nature. Establishing Connection among the nodes is a challenging issue. In this paper we have done a study on the various challenges of MANET which affects the performance of the network and by using spanning tree how it can be controlled. Spanning tree concept provides a loop free network where peer to peer connection is establishes very easily. This paper has study of Multicasting and overhead challenges in network and various methods to handle it using spanning tree.

Keywords — Minimum Spanning Tree, Mobile Adhoc Network (MANET), Multicast, Overhead, Scalability, Spanning Tree.

I. INTRODUCTION

Mobile Adhoc Network is self establish infrastructure less network. It is an autonomous system. It is the type of wireless Adhoc network which has routable networking environment on the top of a Link Layer of ad hoc network. This is a type of peer-to-peer system which supposed that each node in the network can act as a data endpoint or intermediate repeater. Thus, all the mobile nodes work together to improve the reliability of network communications. These types of networks mainly form mesh topology. The network wireless topology may change rapidly and unpredictably because routers can move and organize themselves randomly. These types of network may operate in a standalone fashion, or may be connected to the larger Internet. MANET has Minimal configuration and quick deployment for emergency situations. Mobile ad hoc network has following applications such as natural or human induced disasters, military conflicts, emergency medical situations etc [1]. MANET faces many challenges to maintain an energy efficient network. These are some of issues which occur mainly in network; Link breakage among nodes during transmission of messages, Data diversity over unstable mobile nodes, Restricted bandwidth in network, High mobility of nodes in network, Spatial diversity in large network, Path length increase among transmitting and receiving nodes, Nodes out of Battery and security[2].

MANET has challenges as Overhead, Multicasting, Fairness, Dynamic Multihop Topology, Reliability and Security, Power Consumption, Quality of Service, mobility, scalability etc which are discussed in next section in details. In this paper we have discussed various methods to overcome MANET from these issues using Spanning tree.

II. CHALLENGES WITH MOBILE ADHOC NETWORK

Mobile Adhoc network is highly dense network in which mobile devices are movable in nature. Efficient transmission in network is very difficult. Various challenges of MANET are as follows:

- *Fairness:* Unfairness could result from different opportunities of channel access. In MANETs, there are two major sources for unequal channel access opportunities one is Backoff mechanism which is widely used in MAC protocols for MANETs to reduce collisions and achieve high channel efficiency. And another is Location and traffic might not be uniformly distributed in the network [3].
- *Overhead:* On each transmission packets get includes additional information, called overhead, that is required to route the data to the proper location. To maintain routes when nodes are mobile it decreases higher transmission power of number of forwarding hops between source-destination pairs, therefore reducing the signalling load necessary. The signalling overhead of routing protocols can consume a significant percentage of the available resources at the network layer, reducing the end user's bandwidth and power availability [4].
- *Dynamic Multihop Topology:* In MANET nodes can move arbitrarily, the network topology which is typically multihop, can change frequently and unpredictably resulting in route changes and frequent network partitions and possibly packet losses.
- *Power Consumption:* Power consumption is a critical issue in MANET it is because of limited battery power. Another reason of power consumption is during transmission collisions of packets get happens it also consumes power of network.
- *Reliability and Security:* It has particular security problems due to vulnerabilities on wireless connection and wireless nodes. Because of limited wireless transmission range, the broadcast nature of the wireless medium (e.g.

hidden terminal problem), mobility-induced packet losses, and data transmission errors. It has security problems easily snooping of data. Attacks on network makes dropping of packet, data modification, fabrication, and password based attacks or denial of service, etc.

- *Quality of Service:* QoS provisioning will not be easy given that MANETs are characterized by their distributed and bandwidth-limited channel access in the network**.** End to End delay, bandwidth, probability of packet loss, delay variance (jitter), processing power, buffer space etc are some parameters that are used to measure efficient transmission of packets in the network [3].
- *Mobility:* Mobility of nodes results frequent network partition and induced route changes in routing problem.
- *Scalability:* Mobile Adhoc network are designed for fixed and relatively small wireless networks but many MANET applications involves in large network with tens of thousands of nodes. So, scalability is critical issue to maintain insertion and deletion of nodes in large network.
- *Multicasting:* It is desirable to support multiparty wireless communications. Since the multicast tree is no longer static, the multicast routing protocol must be able to cope with mobility including multicast membership dynamics.

III. SPANNING TREE

One of the topology which is used to construct the network is spanning tree topology. In this topology network is considered as a graph with vertices and edges (V, E). A spanning tree T of a connected, undirected graph G is the tree which is the collection of all the vertices and some of the edges of G. Or in other words, a spanning tree of G is a selection of edges of G that form a tree spanning with every vertex. In this every vertex should lies in the tree, but no cycles will be (or loops) are formed [5]. There are two algorithms which are used for searching spanning tree *T* of a loop free connected undirected graph *G* such as breadth first search and depth first search.

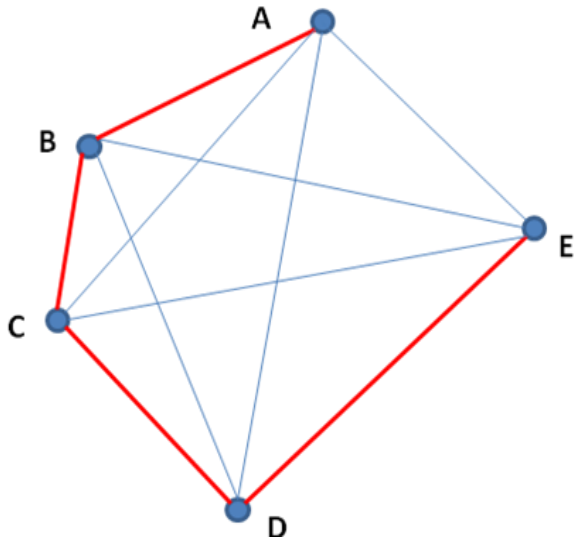

Fig. 1 Spanning Tree in graph

IV. SPANNING TREE USED NETWORK IN MANET

Spanning Tree helps the network to provide point to point configurations and isolates faults easily. When one link is fails in network then communication among that point affects, not the whole network is being affected. Dedicated link shares its own data, thus ridding traffic problems would have been encountered if the connection or link was shared. Not only Node to Node data is transmitted in the network, but also serves as a relay for other nodes Mobile Adhoc network used spanning tree in different form such as multicasting or in clustering.

A. Multicasting with Spanning Tree

Mobile Adhoc Network where network resources are limited Multicasting is a challenge which leads to an un-even utilization of network resources. In this network consists of a single tree, in which only a few internal nodes contribute most resources and are involved in performing the multicast functionality. There are many possible solutions by various researchers in MANET. Some of them are studied in these papers.

ROUTE FAILURE TOLERANT MULTICAST IN MOBILE AD HOC NETWORKS USING DISJOINT MINIMUM SPANNING TREES [6] in this proposed algorithm works in conjunction with OLSR protocol. The Edge Disjoint Minimum Spanning Tree protocol being guarantees robustness, it achieves good performance since OLSR provides topology information allowing constructing an optimal multicast tree. This algorithm helps to tolerant route failure in the network. The EDMSTs adopts the mechanism for robust multicast routing by selecting the path having optimal link stability. If the current multicast route fails, multicast could be continued by using next optimal link disjoint spanning tree stored in EDMSTs Table. This algorithm works in fully distributed spanning tree if any node wants to join or leave the network it broadcast join or leave message to entire network. Multicasting minimum spanning tree mechanism is an application of Prim's algorithm to the given edge-weighted undirected, connected graph.

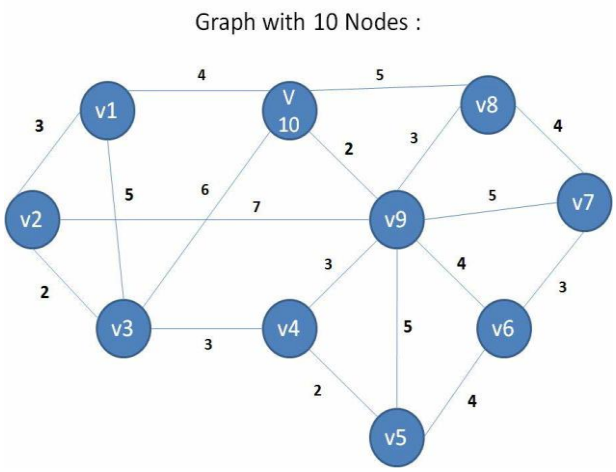

Fig. 2 Network with 10 nodes and 18 edges (links) represented using Graph [6]

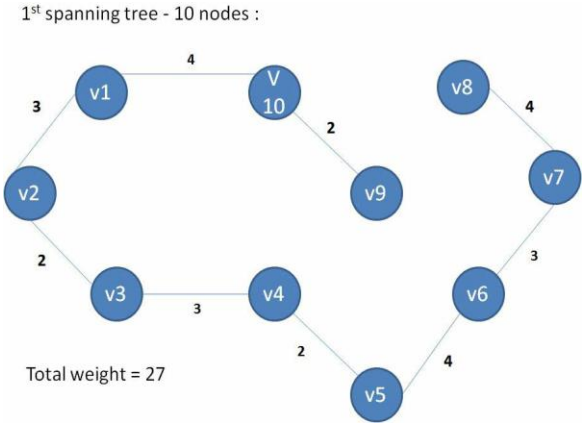

Fig. 3 Minimum Cost Spanning Tree -1 with 9 edges for the graph in Fig. 2

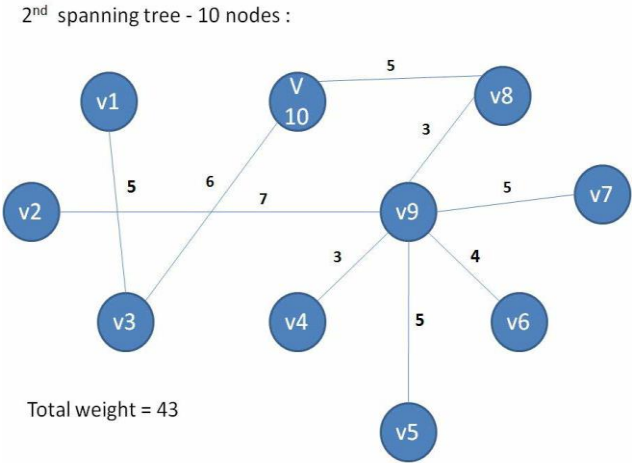

Fig. 4 Minimum Cost Spanning Tree-2 with 9 edges for the graph in Fig. 2

Once a weighted graph has been constructed at source the source node applies Prim's algorithm to obtain I optimal cost spanning tree. In this Flooding is used in routing mechanism in which the source node broadcasts the packets to all its neighbour nodes. On receiving a packet, each neighbour node transmits again to its' neighbour nodes except to the source node. Every N-1 connected graph G is complete, where each node of G has an association with N-1 other nodes. In this way Link stability as a cost of the link, approach finds the most stable spanning tree. By this route tolerance problem in the network easily resolves.

ROUTE FAILURE TOLERANT MULTICAST IN MOBILE AD HOC NETWORKS USING DISJOINT MINIMUM SPANNING TREES BASED ON CONNECTIVITY INDEX WITH BANDWIDTH CONSTRAINT [7] For constructing a minimum cost multicast trees by selecting a link having minimum connectivity Index and comparing application required bandwidth with of the link. It was observed that the Increase in total connectivity Index of the entire network increases number of spanning trees. Due to the lack of redundancy in multi-path and multicast structures, the

multicast routing protocols are vulnerable to the failure in ad-hoc networks. So it is the dire need to come across the fault tolerant solution. A new approach is developed edge disjoint spanning tree Multicasting based on connectivity index with bandwidth constraint. In this approach, spanning tree analysis provides significant input to design quality of service multicast routing algorithms in mobile ad hoc networks. In this QoS requirement is taken as soft assurance rather than hard guarantee from network for bandwidth.

RESTORING THE CONNECTIVITY IN K-CONNECTED MANET WHEN ALL EDGE DISJOINT MINIMUM SPANNING TREES FAIL [8] to avoid poor performance of a multicast/ unicast routing protocol and to curb the adverse affect on an application performance, it is essential to restore the network connectivity. Due to random mobility of mobile nodes connectivity among the nodes is very serious issue. Sometimes network suffers from the simultaneous failure of multiple multicast paths and it gets partitioned into disjoint segments to avoid this strategy, a network is designed and implemented to restore the connectivity in MANET as well as to compute Steiner minimum spanning tree. Whenever any node in the network gets disconnected (that is if the Euclidean distance $\sqrt{((x_n^2 - x_m^2) - (y_n^2 - y_m^2))}$ between the two nodes is less than or equal to transmission range T_r of the nodes) may be due to high degree of mobility, its neighbour shall flood the packets, called "Neighbour-Disconnected Packet" in the network. As soon as the source finds this packet, it initiates the action to scan the network to ensure that network is disconnected. If network is disconnected and all edge disjoint multicast paths are broken simultaneously, then it signals the corresponding pair of nodes to increase the transmission power till the connectivity is restored and then the source computes Steiner minimum spanning tree on the reconnected network. In this applications network offers robust, multipath multicasting with high packet delivery ratio.

RESOURCE ALLOCATION USING MULTIPLE EDGE-SHARING MULTICAST TREES [9] a new concept is introduced to handle multicasting in MANET in that split the multicast content over a number of trees. Multiple trees provide several paths for the multicast content and get more nodes involved in implementing the multicast functionality. However, in such a setup, not all the trees get to use the best weight edges, thus the overall multicast latency increases. MEST is introduced, which is a distributed algorithm to construct multiple edge-sharing trees for small group multicast. MEST balances the resource allocation and delay constraints by choosing to overlap certain edges that have low weights. MEST is easy to implement and can work with any distributed algorithm for generating minimum spanning trees. MEST is efficient for lower delay in the network.

K-EDGE-CONNECTIVITY: A NEW APPROACH OF FINDING MINIMUM SPANNING TREE ORDERED MINIMUM SPANNING TREE (OMST) [10]
After failure of node or link, the existing network still allows communication between all other nodes by choosing alternate path which gives strict requirement on the connectivity of the corresponding graph. In this paper a method is presented called as Ordered Minimum Spanning Tree (OMST) used to parallelize efficiently Kruskal's Minimum Spanning Forest algorithm. It is known for exhibiting inherently sequential characteristics. Particularly, the strict order by which the algorithm checks the edges of a given graph is the main reason behind the lack of explicit parallelism. This approach executes sequentially in a faster way, so data can be access very efficiently.

B. Overhead with Spanning Tree

Power control impact the signalling overhead of routing protocols used in MANET. Higher transmission power decreases the number of forwarding hops between source-destination pairs, therefore reducing the signalling load necessary to maintain routes when nodes are mobile. The signalling overhead of routing protocols can consume a major percentage of the available resources at the network layer, reducing the end user's bandwidth and power availability.
USING VARIABLE-RANGE TRANSMISSION POWER CONTROL IN WIRELESS AD HOC NETWORKS [4] in this paper two concepts are derived; firstly an expression is derived for the average traffic carrying capacity of variable-range-based multihop networks. And Secondly, a model is derived that approximates the signalling overhead of a routing protocol as a function of the transmission range and node mobility for both route discovery and route maintenance. They have showed that there is an optimum setting for the transmission range, not necessarily the minimum, which maximizes the capacity available to nodes in the presence of node mobility. And the result is that there is a need to design future MAC and routing protocols for wireless ad hoc and sensor networks based, not on common-range which is prevalent today, but on variable-range power control. In this concept minimum spanning tree is taken that can lead toward a lower total weight than a tree based on common-range transmission links that minimally avoids network partitions. There is an optimum setting for the transmission range, not necessarily the minimum, which maximizes the capacity available to nodes in the presence of node mobility. This approach helps to increase capacity and energy efficiency of the network.

V. CONCLUSIONS

In this paper a deep study is done on various challenges in MANET and how it can be overcome by using Spanning tree. We have taken two challenges; multicasting and signalling overhead where mainly spanning tree has been used for creating the network. By the use of spanning tree delay in network, multicasting, mobility, efficiency and QoS are increased. In future Spanning tree can be used to provide secure and reliable network.

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