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Routing Protocols for Congestion Avoidance and Control in Adhoc Network

A.Ambika , Dr.R.Arunprasath

M.tech Research Scholar , Professor
Department of Information Technology
SRM University , Chennai

Abstract— **A major aspect of ad-hoc networks is that the nodes can move randomly, which requires the routing protocols in ad-hoc network to quickly respond to the network topology change in order to guarantee successful data packet delivery. Routing Protocols in ad-hoc create and maintain routes between pairs of communication nodes. Ad-hoc network has mainly used for military, disasters and small offices, where quick routing is so important for reliable communication between network devices. In this paper we will show effective congestion avoidance techniques for ad-hoc network as used in infrastructure networks. The paper will show the on-demand routing related issues for ad-hoc network. First we added the dynamic change prediction method to the reactive multi-hop protocol DSR. The source can smoothly update the currently used route to avoid any soon-to-be-broken link. Here the congestion handling parameters has controlled by dynamic source routing protocols (DSR) mechanisms. Which are also efficiently used by DSR approach .**

Keywords- Adhoc networks, Routing algorithms, Mobility, Congestion, and Congestion handling parameters.

I. INTRODUCTION

Adhoc networks are defined as where, communication is performed through wireless links and there is no need any predefined architecture of network i.e. infrastructure less network. In the absence of a base station, the computers can communicate would just send the data packets to one another directly[2]. The primary characteristic of adhoc network is, there is no centralized control over network. In adhoc network there is no need router or switch for routing of data because here each node acts as router. Nodes in adhoc network communicate directly with one another. In a peer to peer fashion. To facilitate communication directly between distant nodes [1].Each node has capability storing and forwarding of data packets on the behalf of the other node or intermediate nodes are also called the proxy nodes. In adhoc networks if one node fail due to some reason such as congestion or overloaded it can not more affect the whole network. Each adhoc node must be aware of what is going on in its environment and cooperate with other nodes i.e. nodes should be helpful for forwarding the data packets and achieving the channel access for competing nodes. Co-operation is established between mobile nodes through time and bandwidth constraints. In adhoc network there is many factors which can affect the network performance such as routing, bandwidth utilization, mobility, transmission range and congestion. With an adhoc network, the topology may be changing all the time, so the desirability and even validity of paths can change spontaneously, without warning, these circumstances make a routing in adhoc network is quite different from routing in fixed wired network [2].

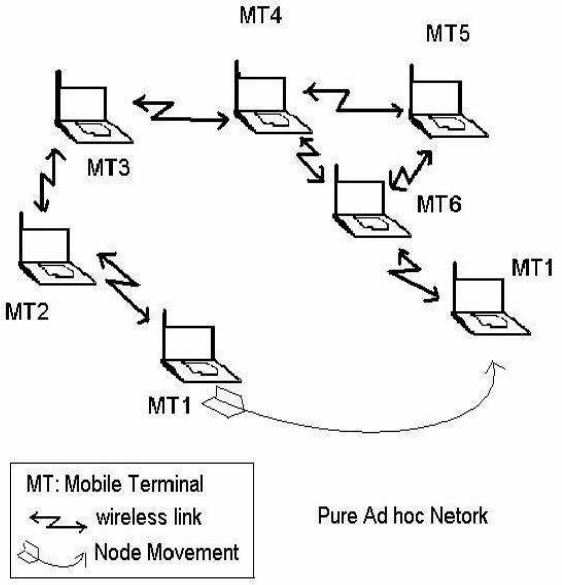

Figure1.Pure adhoc network [5].

II. ROUTING PROTOCOLS IN ADHOC NETWORK

Routing is the main function of the network layer, Routing is performed through routing protocols, these are two types reactive approach and proactive approach. Reactive approach is on demand basis routing but in proactive approach is table driven. Reactive approaches are useful for adhoc network and on other hand proactive approaches are useful for wired network. Routing protocols in adhoc network create and maintain routes between pairs of source and destination nodes. Routing must be handle dynamic mobility of nodes, transmission errors and entrance and exit of nodes. Routing protocols must be provide end-to-end delivery of data packets between source to destination i.e. it must be hold the properties reliabilities and robustness[3].
Routing protocols for ad hoc networks must discover such paths and maintain connectivity when links between nodes in these paths break due to factors such as node motion or

wireless propagation interference changes and due to obstacles such as buildings and mountain.
The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless adhoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two mechanisms of Route Discovery and Route Maintenance. We have modified the Route Discovery and Route Maintenance phase in order to provide more security features [4].

III. MOBILITY OF MOBILE NODES IN ADHOC NETWORK

Mobility has great impact on mobile adhoc network, if nodes are highly dynamic the performance of network is low, because due to highly dynamic property of mobile nodes the link between communicating may be failure. Adhoc network contains many mobile devices which have freedom of movement within the transmission range. These are also free to move any rate any time in the network. Mobile adhoc network (MANET) shows the characteristics like dynamic topology, bandwidth constraints, energy constraints and link instability. The protocols also need to be adaptive quickly, repair broken links and deal with efficiently with network partioning. There are two models which are mobility based which are random way point model and other is reference point group mobility model. Many routing protocols are used for route selection, which select the shortest path from source to destination that is routing protocols select the minimum number of hops to reach from sender to receiver. If transmission range is large they there is more probability of occurrence such as loss of data packets, interference and more energy required for communicating parties. As the range of a transmission increases, the quality of the wireless radio channel will also decrease giving slower and less reliable transmission. If transmission range is large and transmission rate is low then interference exist over an extended period of time. Nodes mobility has great impact on available routes due to movement of nodes different routes are breaks and different routes are available. If shortest path is find then transmission of data packets is done through this route, Over period of time this route is widely known used by other neighboring nodes and through this route more and more data packets are transmitted through this route and as passes of time this route become congested.

In adhoc network when nodes are highly mobiled and routes which were used these are frequently changed thus these routes are not widely known before breaking so this cause lead to use the invalid routes and reduces the performance of the network. In this situation whenever sender send the request for a route and unable to find the route due to frequent change or collapse of the routes [3].

IV. CONGESTION IN MOBILE ADHOC NETWORK

Congestion is important issue of the mobile adhoc network(MANET). Congestion arises in the network when the load of the network is greater than the network capacity S which is defined by Shannon capacity theorem, Which is defined below.

$$S=W\log^2(1+P/Q)\ Bits/second.$$

Where S=Channel Capacity [6].

W=Bandwidth of the channel. And P/Q signal to noise ratio. Congestion happens in any system or network that involves waiting, this cause arises due to any abnormality in the flow of the network such as rush period and collapses of routes [7].Congestion ***can*** be solved in two way first is congestion control and second is avoidance. Congestion Avoidance scheme handle whenever congestion about to occur, and reduces the sending rate at this time.
Congestion whatever occur in the network should be controlled by applying the congestion control mechanism such as open loop congestion control and closed loop congestion control. In open loop policy problem can be solved by the good design, to make sure that it does not occur in the first place .Once the system is up and running the correction is not possible. And closed loop solved this problem which is based upon the feedback loop. Congestion control takes most advantage whenever the sending rate is close to the network capacity. Congestion control has two factors that measure the performance of the adhoc network which are delay and throughput.

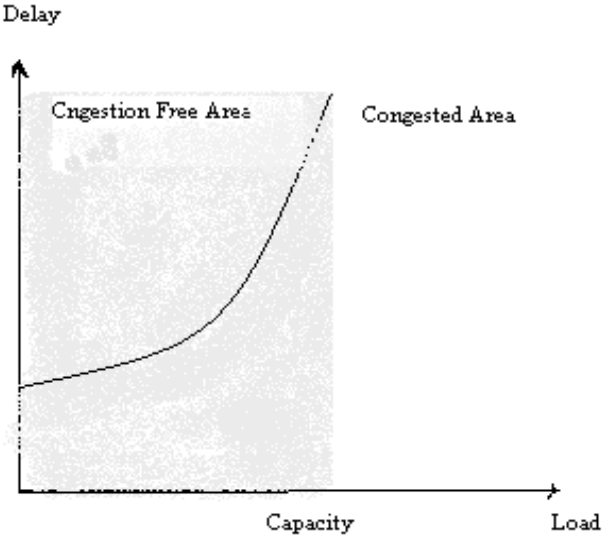

Figure.2 Packet delay and network load

In figure 2 shows when the load is much minimum than network capacity then the delay is minimum stage. However load reaches network capacity the delay increase sharply because due to increment load the waiting time also added in the queue. Here whenever load beyond the capacity of the network then network moves in congested stage. Whenever

the load close to capacity of network, the network is fully utilized and at this stage network also congestion free. Note that the delay becomes infinite when the load is greater than the capacity.

In figure 3 shown When the load is below the capacity of the network then the throughput of network increases proportionally with the load. We expect the throughput should be stable but it is not true the throughput decreases sharply. The main reason behind it the network node discard the data packets. When the load beyond the capacity, the buffer queue becomes full and node have to discard the some data packets due to overflow of data packets. Thus the throughput of the network can be defined as number of packets passing through the network in a unit of time [7].

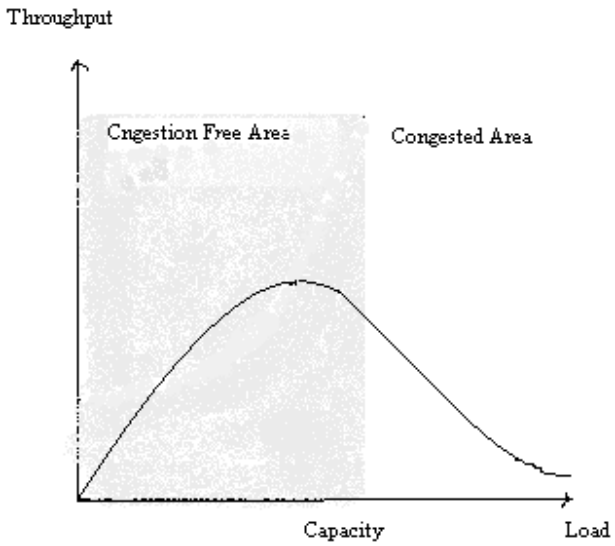

Figure.3 Throughput versus network load

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V. CONGESTION AVOIDANCE THROUGH DSR

Routing protocols plays important role in adhoc network such as make shortest route between two communicating nodes route is shortest the delay will be minimum thus more and more data can be delivered from source to destination, and also provide the efficient utilization of network bandwidth. Dynamic load awareness routing works as DSR where at each link the delay is defined as the weight of that link. These individual links weight are summed up and give the weight for a route. With the help of this scheme selects the links which have short delay and high bandwidth, if transmission time is shorter then the less power is require and less possibility of interference occurrence [3].

The modified version of DSR is used to handle the congestion control algorithm, and nodes follow a random waypoint mobility model [3] where one node moves within the transmission range. In this model each node contains two congestion handling parameters which are transmission limit and buffer(Queue limit).Each and every nodes monitor and record the volume of data that they are transmitting through each neighbour. If neighbored node send notification to the transmitting node, then transmitting node records transmitting limit for that neighbour. If such situation arises, the transmitting node must find the alternate route to the destination, avoiding the congested node. The three conditions arise when congestion handling parameters are used by modified version of DSR which are given below.

First is, If buffer space (Queue limit) is more than the transmitting limit then the congestion possibility is very low and at the other hand bandwidth is not fully utilized in this case i.e. it is drawback.

Second is, If transmitting limit is more and buffer is less at the receiving node, then this node become congested because due to lake of storing capability of data packets at receiving node, that is node can not receive more data packets.

Third is, if we increase transmitting limit of the node then we should also increase buffer (Queue limit) of the node for handling the forwarded packets. In modified version DSR if we also increase the buffer (Queue limit) then more and more packets will be received and thus we can avoid the congestion, thus we can save losses or dropping of packets.

VI. CONCLUSION AND FUTURE WORKS

In this paper we have presented an improvement of dynamic source routing approach, through by which we can handle the congestion .Here dynamic source routing used two congestion handling parameter, which are sending limit and receiving limit ,using these parameter congestion can be efficiently avoid. If we increase the sending limit we should also increase the receiving buffer for storing the received packets. If storing buffer is more and then more packets can be received on the side of receiving end. We showed that if load of the network increases then we should also increase the resources of the network with respect to load of the network that is, load is proportional to the resources of the network. Primary condition of the congestion control is that network load never more than the network capacity i.e. loads $\leq$ capacity (of the network). The congestion solution described in this paper is applicable to all ad-hoc network types.

Future extensions of this approach is include mechanisms to dynamically alter the values of the buffer and sending limit to suit network conditions taking into account factors such as the average number of neighbours, known alternate and congestion history. This information would help the approach to measuring congestion of the network.

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