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Optimised layered approach on congestion control with efficient energy and QOS improvement for wireless network

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ABSTRACT

Internet is widely used in the fast growing world and there are many limitations in the network. There are two main failures that occur in the network they are wireless packet loss and congestion. The performance of SCTP in wireless network is considered as the active area. Finding the failure in the wireless network is very important and it is analysed in this paper. So in this paper the route is established by on demand routing technique in which many features like the energy of the node, location, bandwidth of the packet are analysed. So when the packets need to be send it analyses all the features and establishes the route with the efficient node that has one hop count by using the SCTP transport protocol. On transmitting the packets some energy from the node gets reduced so there is a high chance of congestion since the capacity of the node is reduced. This can be avoided by the proactive approach by reducing the traffic send by the source when the node level reaches threshold. By using the multi-homing technique in the SCTP approach the packets can be sending till the alternate route is re-established. Thus the packet loss rate and end-end delay is reduced and QOS is increased in the system.

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Introduction

A mobile ad hoc network (MANET) is a type of wireless network which connects mobile device by wireless links. In adhoc networks every device has a build in router set up so that it communicates with other devices which are reachable. The mobile devices can freely move irrespective of the base station and it can establish the connection with the available network. Because of the limited transmission range of wireless multiple networks may be needed. The main criterion that needs to be taken care is the information should be properly transmitted in the network. The mobile nodes in ad hoc network keeps moving and because of the movement of the nodes link breakage occur so, several routing algorithms are introduced in order to increase the efficiency and to transmit the data. Several routing algorithms are present proactive and on demand, in proactive protocol the link between the source and destination is established and the information is transmitted and it has a constant network design and disadvantage is the change in network topology [5]. On demand routing protocol is reactive protocol in which it establishes the link only when it needs to send the packet. The route discovery is done till it reaches the destination. The protocol is considered to be efficient because the route is discovered only when the data need to be transmitted. But the main failure that occurs in the wireless network is the traffic block and the congestion. Congestion occurs because of limited amount of resources but excess number of packet transmission.

In the wireless network two types of data are send one is the data packets and other is the control packets. Because of this traffic occurs in the network. Nowadays multimedia is very much used in the real time applications due to high bandwidth congestion occurs. Due to this packets get lost and the energy of the nodes get reduced and wasted unnecessarily. In many existing networks the congestion control is not properly given. So in this paper we are proposing a layered approach on congestion control with proper energy and bandwidth usage and improve the quality of service of the system.

The motive of this approach is to reduce loss in the network which is mainly because of congestion that happens in the network layer. Because of congestion many problems occurs in the system. Some of the problems that occur in the network because of congestion are:

1. Delay: when more number of packets are send because of the control packets in the network traffic occurs and large number of packets are dropped. So in-order to maintain the global synchronisation the packets are resend so it causes delay in the network.

2. Collision: In the network many transactions are being performed so when using the same nodes collision occurs.

3. Energy wastage: some amount of energy is required for sending the packets. On resending the packets again energy of the node is wasted, conserving the energy properly is very important for the wireless network.

The network bandwidth should be properly utilised in-order to maintain the good network. So when we reduce the energy conservation and use the bandwidth properly then the system is vice allocation. This congestion control mechanism is done along with routing.

The main aim of this paper is to utilise all the layers in the network properly as a co-operative approach and avoid the congestion as soon as possible. As a co-operative approach it deals with the routing, energy of the node as the threshold value where is controls the number of packets getting transmitted as in transport layer, the data link layer is used to transmit properly and avoid collision, and in the network layer when one route has lost its energy alternate route is established and efficient route gets selected. The rate, energy, bandwidth of the packet, location, and hop count are the terms that need to be considered while establishing the route.

Related work

As given in the paper [1] the admission of the packets to the network, power control, and congestion are the main aspects of the paper. The admission control is done in order to maintain the packet delivery ratio to be high. So control algorithms are introduced in order to maintain the QoS of the system the host channel adapters (HCA) and network interface cards (NIC) are used to find the effectiveness of the system. The admission and congestion control is done by probing method on getting the request the router compares the available bandwidth with the bandwidth of the packet that is going to be sent. If it is accepted then the destination node is checked whether the packet is send to proper destination or not. Thus by this method it initially checks the bandwidth available and then send the packet so we are adapting this mechanism in our system. Cross layer hop by hop congestion control scheme [9] is proposed to improve TCP performance in multi hop wireless networks which coordinates the congestion response across the transport, network, and transport layer protocols. The method determines the main reason of the packet loss and coordinates the layers of Mac layer, transport and network layer. The congestion control mechanism is done when the alternate route is also chosen in order to avoid the congestion in future.

Many failures occur in the system like less link utilization, queuing delay, packet loss. So in this paper [2] the proactive approach of active queue management in TCP transmission control protocol wherein the adaptive dynamically changing the traffic is done so it detects and controls the transmission. The main challenge in the flow start-up after the node is idle for a long time and after connection setup. The main objective of the fast start-up is to fully utilize the path and the available bandwidth in the node. So large amount of packets is transmitted and RTT is also reduced. The end systems normally run the end to end congestion control. In addition to speedup, fast start up congestion control can also overcome other problems of the Slow-Start, such as a faster convergence to equal sharing of resources as in the paper [3] end systems can determine an allowed sending rate by querying the routers on the path, using a new Internet Protocol (IP) option, for instance during the connection setup. The fast start up increases the congestion in the network it leads to delay or packet losses this can be avoided by have active queue management. The admission is controlled in the routers by approving the rate request. In the congestion window is increased moderately for selected applications is concluded in the paper. The works of [4] [5] provides a framework based on optimization for Internet congestion control and derives a differential equation which is based on distributed solution. Works of [6] studies the stability of end-to-end controllers with the inclusion of feedback delay technique. In [7], using a simulation based approach; a hop by hop control algorithm is proposed and proves that the hop by hop schemes react faster than the end to-end schemes, thus reducing buffer requirements at receiver end. Related work includes [8], where the authors consider max-min fair scheduling in the context of a wireless network using a similar model as that considered here for media access control (MAC).

Congestion is main cause for packet drop in the network. The dropped packets requires retransmission across the network. Congestion occurs when the node does not have the necessary

buffer space to store the data packet and send. When the node is aware of the congestion problem it informs the previous node and it creates a bypass route with more buffer size and sends the packet without loss [9]. If the congestion is not taken care in the network then the data is not delivered to the destination. From this paper an idea of establishing reverse route is identified and also generating multiple routes between the upstream and downstream after the link breakage. The idea of generating the multiple routes between upstream and downstream node after link breakage is obtained from [8]. "Wireless links are often asymmetric due to heterogeneity in the transmission power of devices non-uniform environmental noise and other signal propagation phenomenon. BRA works by maintaining multi hop reverse routes for unidirectional links and provides three new abilities. Improved connectivity by taking advantage of the unidirectional links, reverse route forwarding of control packets to enable off-the-shelf routing protocols and detection packet loss on unidirectional links".

Layered Approach on Congestion Control

In the proposed technique a reliable, non congested and energy conservative routing protocol is developed. In this mechanism when the packets need to be send over the network the total bandwidth of the packets is calculated in-order to choose the efficient route so the bandwidth wastage is avoided over the network. Since it is the layered approach 3 layers are mainly used in the network they are the transport layer, network layer, and data link layer. The energy of the node is also determined before sending the packets and the rate is established as a predictive approach, so when the energy of the node reaches the threshold value it informs the transport layer. When there is large amount of packets in the node signal is given to the MAC layer. Based on this by using the network layer alternate route is established which satisfies the constraints. The transport protocol that is used is SCTP approach because it is the combination of UDP and TCP. It is message oriented like UDP and reliable routing technique and it also includes the congestion control mechanism like TCP. It has got extra feature like multihoming and multi-streaming technique. So when one connection is congested alternate socket can be connected which reduces the congestion caused by control packets as given in the Figure 1.



Figure 1. Congestion Control method Algorithmic Approach

The congestion is avoided in this system in which it is done by using this LACC Layered Approach Congestion Control the Begin

N number of nodes in the network;

Broadcast the RREQ, initialize timer;

Analyse the location, energy, hop count, bandwidth of all node;

If (BW of packet is high) Choose node with more energy; Else (BW of packet is low) Node with less energy; Energy analysis; $E(i) = \sum^{BW}$ (Energy/ Total energy (E(o)) Energy of nodes gets consumed E(u) = E(o) - E(a); E(u) = T (threshold); If (E(i) < T <= E(i)) Slow down the source node; Choose alternate route before congestion;

Stop;

In this the method is analyzed in which E (i) initial energy analysis of all the nodes. The energy of every node is analysed and determined. The E (u) is the consumed energy of all the nodes it is determined by the overall energy (o) of the network and the amount of energy E (a) used by each node in the network. This is given as the threshold value if the energy of the node is less than T then the packet is free to send. If the energy exceeds T then it informs the source node to slow down the process. And in the mean while it starts discovering the alternate route.

Result Analysis

The analysis is done using the NS 2.34 simulator with 30 nodes. The area size used is 1000x1000, MAC 802.11, routing protocol is AODV, simulation time 20 seconds, packet size 512 bytes, initial energy of the node is 10 joules, Rx power 3, Tx power 6, bandwidth low, min, max.

Energy

The node is chosen based on the energy and the bandwidth initially so the amount of energy utilized by each node is given in this. By this analysis when the packet of low bandwidth has to be send then the node with low energy is chosen. If more number of packets to be send then efficient energy node is chosen in the network while broadcasting as given in the Figure



Packet Delivery

Compares the packet delivery ratio of the existing methodology with the efficient methodology where the bandwidth is maximum when the energy of the node is more. It informs the source and automatically chooses a node that has more bandwidth so the packet delivery ratio is also very high. The loss of the packet is less because it initially analysis the capacity of the node so the packet delivery is more as given in the Figure 3.



Figure 3 Packet Delivery Ratios

Throughput

Throughput or network throughput is the average rate of successful message delivery over a communication channel. The amount of data that is moved successfully over the network with the time limit is the throughput. Thus the throughput of the system is also increased as shown in the Figure 4.



Figure 4 Throughput of the system

Conclusion

The congestion control in the layered approach is done by involving the transport, network and data link layer as the cooperative approach. The main metrics considered in this paper is the initial bandwidth of the packet, energy capacity of the node and location. So in-order to avoid the congestion caused by network node with one hop count is selected. To avoid congestion because of the control packets the SCTP transport protocol is chosen so that with the alternate socket in the node it can transfer the packet. The energy is repeatedly analysed because some amount of energy is used while transmitting so till the node reaches the threshold value the nodes are free to send. After it reaches the threshold values which is identified dynamically the information is given to slow down the process. By doing this congestion caused by packet overflow is reduced. So the quality of the network is also in good performance which is proved by the analysis given above. The future improvement of the paper will be given soon.

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