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Congestion Control Mechanism in Wireless Networks

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***Abstract* - Congestion is a major problem in all types of network. Now a day's large amount of data transmission takes place every day that leads to congestion. To increase capacity of the network is not a solution. One solution for the successful data transmission can be based on the current available capacity of the network. This paper explains two algorithms which ensure that, the available queue length of all the nodes are known to each other. So based on the availability of queue space the data transmission can be done. RTT (Round Trip Time) plays a major role in understanding the current congestion status of the network. RTT helps the proposed algorithm to understand the network status and then to forward the queue length availability to all other nodes in the network. The aim of this paper is that, the queue lengths of all the nodes are known to all other nodes. The data transmission is done only when the destination node and the intermediate node have enough queue length.**

***Keywords* - Congestion Control, Wireless Network, Queue Length Based Algorithm.**

I. Introduction

One of the biggest problems in the Internet world today is the huge amount of data transmission in the network beyond the capacity that has created congestion. Now, something should be done to control the problem of congestion. To control congestion, it's not possible to ask everyone to stop the data transmission between the networks.

A. *What Can Be Done To Control Congestion?*

One of the simplest ways is to increase the capacity of the network but, that cannot be a solution since, that will become very much expensive and if we increase the bandwidth without increasing the processor capacity then it's of no use since the processor is very slow in generating the data so the data rate will be less in the network so to transfer the data it will require lesser bandwidth. There are two basic methods to control congestion [1]

- Open loop congestion control
- Closed loop congestion control

Open Loop Congestion Control

The basic idea of open loop congestion control is to create a good system so that congestion does not take place. To prevent the network from getting congested, necessary action is taken earlier itself.

Closed Loop Congestion Control

In this closed loop congestion control method the action for congestion control is taken after the network ends up with congestion. Once congestion takes place, the data will be dropped and there will be delay in the data transmission since to remove congestion, it will take some time.

B. *Routing*

Routing is the function of the node in the network to identify the best path to forward the packet. When congestion related information has to be transmitted it has to consider a routing algorithm that selects the shortest path to deliver the packets. Some of the optimized algorithms to select the best optimized path are

- Ant Based algorithm.
- Dijkstra's routing algorithm

A survey on both the algorithms proves that Dijkstra's shortest path routing algorithm is the optimized algorithm to select the best shortest path [5].

II. Literature Survey

Queue length plays an important role in congestion control. The queue length mentioned here is the amount of empty space that is available in the buffer to carry the incoming packet of all the nodes in the network. There are many reasons that lead to congestion; one of the major reasons is that, unawareness of the queue length of the destination node and the intermediate nodes in the network.

When the user need to transfer any data, first it has to refers to the congestion table (Ref. Table 1) to verify the availability of the queue length along with the update time. If the queue length of the destination is more than the threshold and if the update is recent update then the data transmission will be successful. If the congestion table update is not a recent update then the source host, immediately sends a request to the destination host to ask about the queue length [3]

Active node IP	Update Time	Queue Length
192.168.100.2	08:26:54	130
192.168.100.3	08:26:30	50

Table 1: Congestion Table

The problem with the above system is that when the queue length is not updated and if the network is already congested then the request packet may get dropped or the packet itself may make the congestion worse.

A. *Routing*

To forward the queue length update, the node needs to select the best path to transfer the update. Compared to different routing algorithm the above paper has analyzed the ant algorithm and the Dijkstra's shortest path routing algorithm.

a. *Ant Colony Algorithm*

This algorithm is aims at searching an optimal path in a graph, based on the behavior of ants seeking a path between their colony and a source of food. The original idea comes from observing the exploitation of food

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resources among ants, in which ants' individually limited intellectual abilities have collectively been able to find the shortest path between a food source and the nest. The first ant finds the food source via any way, and then returns to the nest, leaving behind a trail pheromone. Ants indiscriminately follow four possible ways, but the strengthening of the runway makes it more attractive as the shortest route.

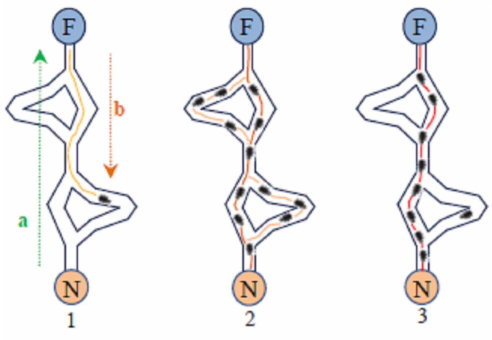

Fig.1. Ant Colony Routing Algorithm [6]

b. Dijkstra's Algorithm

This algorithm creates the shortest path tree from the graph. The Algorithm divides the nodes in to two sets: Tentative & Permanent. It finds the neighbors of a current node, makes them tentative, examines them, and if they pass the criteria, makes them permanent.

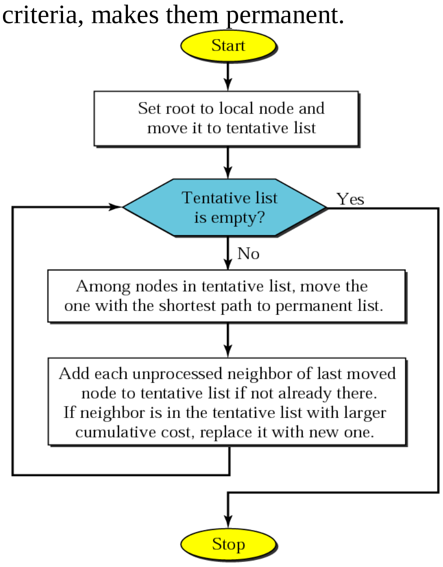

Fig.2. Dijkstra's Routing Algorithm [2]

Algorithm-1 forwards the queue length status periodically. The periodic time limit can be set by the user, based on the type of network. Each node in the network forwards its queue length update (the current empty space in the buffer) periodically to all the destination nodes which are available in the network.

B. Measure RTT [4]

RTT (Round-trip time) can indicate the state of the network to a certain extent. The RTT is used to estimate the actual and expected throughputs to set the congestion control parameters. Let Δ be the rate of change of RTT, then we get

$$\Delta = RTT_{i+1} - RTT_i \text{ ----------------------------- } (1)$$

RTT_{i+1} & RTT_i is the RTT of packet i+1 and packet *i*, the Δ can denote the rate of the network. At certain extent, if Δ>0, the network is likely to go in to the congestion state, Δ<0, the network is free. From the expressions we can know that the estimate of RTT_{i+1} *is* crucial, it determined the right state of the network. The RTT_{i+1} is shown as

$$RTT_{i+1} = \alpha RTT_i + (1-\alpha) RTT_{i+1} \text{ --------- } (2)$$

Where α is the filtrate constant, 0 <α < 1, RTT_i is the RTT of the current packet, RTT_{i+1} is the *RTT* of last packet.

In algorithm-1 periodic update takes place, but if the network is already congested then the periodic updates will make the congestion worse. The use of RTT plays an important role in the algorithm-2. In algorithm-2 the periodic update is done but before the update is done the RTT value is calculated to identify the congestion status of the network. If the RTT calculated is less than the threshold then it is an indication that the network is not congested. So based on the RTT value the update is done periodically.

Algorithm 1

1. Create the node & edges.
2. Assign the initial queue length to all the nodes.(100)
3. Set the threshold value of the queue length.
4. Set the timer for periodic update.
5. Dijkstra's Routing algorithm to calculate the shortest path.
6. Periodically send the updated queue length to all the nodes
7. Interrupt the process by entering the source node, the destination node.
8. Now for the destination node and the intermediate node it has to check the queue length, if the queue length greater than threshold then it has to select the best path and forward the packet.

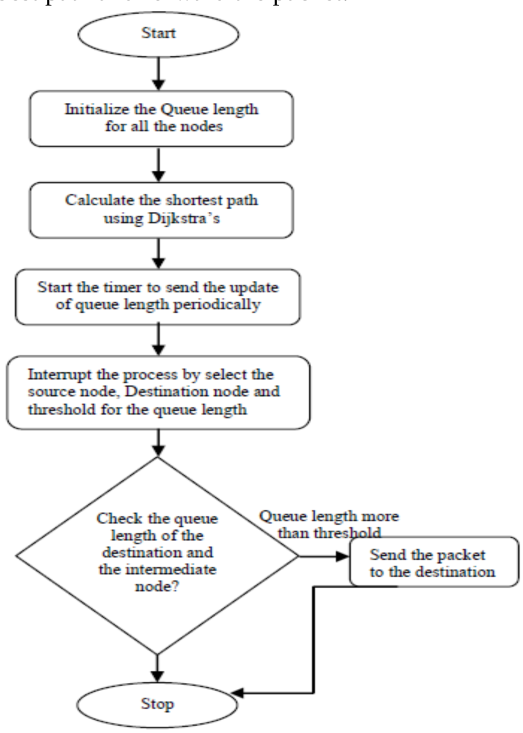

Fig.3. Congestion control Algorithm with periodic update of queue length

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Algorithm 2

1. Create the node & edges.
2. Assign the initial queue length to all the nodes.(100)
3. Set the threshold value of the queue length.
4. Set the timer for periodic update.
5. Set the threshold value of the Round Trip Time.
6. Dijkstra’s Routing algorithm to calculate the shortest path.
7. Before sending the update calculate the RTT ,if RTT is less than the threshold then send the update else skip and go to the next node.
8. Interrupt the process by entering the source node, the destination node & threshold value of queue length.
9. Now for the destination node and the intermediate node it has to check the queue length, if the queue length greater than threshold then it has to select the best path and forward the packet.

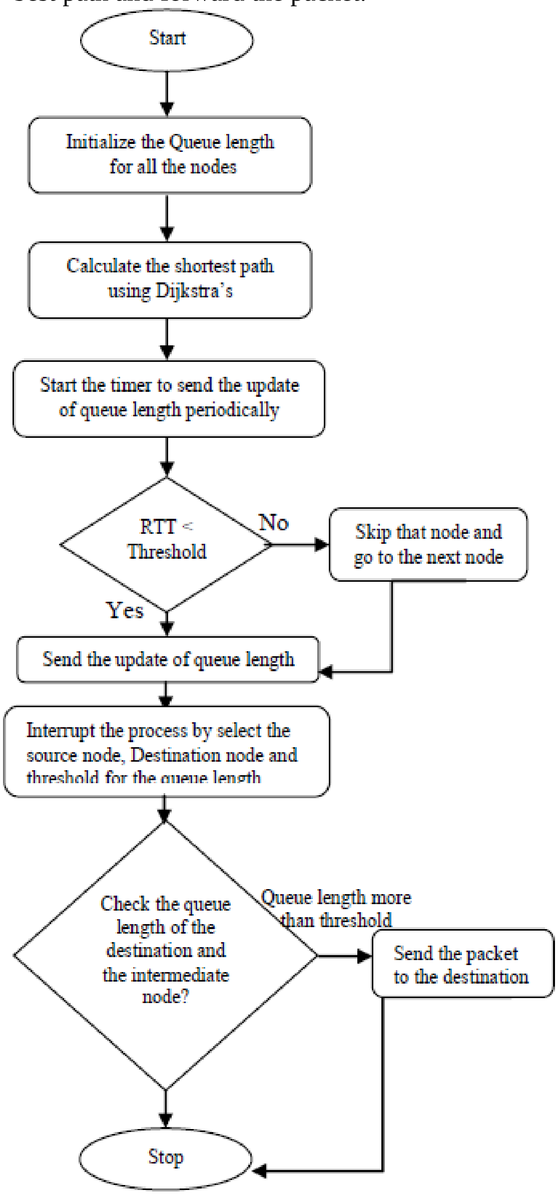

Fig.4. RTT based Congestion control Algorithm with periodic update of queue length

III. Conclusion & Future Scope

Both the algorithms end with an advantage and disadvantage. The algorithms ensure that the current update about the queue length of all the nodes is known to each other. So based on the update, every node takes the decision to forward the data. The problems with both the algorithms is periodic transmission of update to all the nodes takes more processing time & occupy the queue space and the main problem is that the update itself makes the network congested. In algorithm 2 along with periodic update transmission it even need to calculate RTT that even use the processing time.

The future scope is to make an algorithm that sends a single update when the queue length reaches the threshold. This algorithm will reduce the number of packets transmitted in the network related to the queue length update.

References

[1] Computer Network, Andrew S.Tanenbaum, Fourth edition.
[2] Data Communication and Networking , Forouzan, Fourth edition.
[3] The Research Of Active Network Congestion Control Algorithm Based On Operational Data Jingyang Wang, Xiaohong Wang, Huiyong Wang, Min Huang, Lina Ma, Zhengtao Pan College of Information Science and Engineering, Hebei University of Science and Technology Shijiazhuang Hebei 050054, China, ever21 1163.com
[4] A congestion control algorithms based on network measurement in Next-Generation Networks Liu Wei-yan, Jiangsu City Vocational College, Nanjing, China Chen bi-chen, Nanjing University of Technology, Nanjing, China Zou Xue-lan, Zhejiang Institution of Media and Communications, Hangzhou, China Liu Bin, Jiangsu City Vocational College, Nanjing,China
[5] Performance Analysis of Dijkstra, A* and Ant Algorithm for Finding Optimal Path Surabaya City Map, Leo Willyanto Santoso, Alexander Setiawan, Andre K. Prajogo Informatics Department, Faculty of Industrial Engineering, Petra Christian University Jl. Siwalankerto 121-131 Surabaya, 60236leow@petra.ac.id
[6] An efficient solving of the traveling salesman problem: the ant colony system having parameters optimized by the taguchi method Musa PEKER1, Baha ŞEN2, Pınar Yıldız KUMRU3 Karabuk University, Computer Engineering Department, 78050, Karabuk, Turkey, Yildirim Beyazit University, Computer Engineering Department, Ulus, Ankara, Turkey, Kocaeli University, Industrial Engineering Department, Kocaeli, Turkey

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