

Algorithm Research of Congestion Control in Wireless Router

Xiang Li and Xirong Ma

Abstract With the continuous improvement of social economy as well as science and technology, along the continuous development of Internet technology, Internet has become an indispensable and important part of the learning life and social work of people; moreover, with the increase of network ports, the giant network traffic will lead to network congestion, that is also the main reason which affects the network performance and restricts the development of the network. In this paper, the author puts forward that a kind of routing algorithm which may optimize the routing could be obtained by means of combining with correlation function, calculating the hop number of nodes as well as occupation situation of cache, which is able to reduce the network transmission delay and network congestion via combining with alternate routing.

Keywords Wireless network • Network congestion • Wireless network routing algorithm

1 Introduction

On account of the coverage of terminal wireless network is limited, those further nodes are incapable of having direct communication with each other and they need to retransmit the communication content in virtue of intermediate node, which will occupy the cache space of middle node and need to adopt corresponding routing protocols [1]. The above-mentioned content is the main factor which causes the network congestion; therefore, it is of great significance to research the routing algorithm of the optimized path.

Following are mainly several kinds of existing optimization algorithms: first, alleviating the congestion status of network by changing the topology structure,

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namely, by adding or deleting nodes and link [2, 3], but its feasibility is not high; second, by increasing the path to forward the data package from different next hop; however, this kind of method only considers the static network feature when it optimizes the algorithm [4, 5], and fails to achieve the global optimization in the aspect of routing selection; third, by calculating the routing protocol of shortest-path first algorithm: on the one hand, its advantage is that it is loop-free and has fast convergence speed [6, 7]; on the other hand, its disadvantage is that data packets are always sent in accordance with the optimal path during transmission, therefore, when multiple optimal paths overlap together, the link will be frequently utilized, which will lead to excessive load of local network so as to cause congestion [8, 9]; fourth, serving node between-ness as connection weights, and reducing the computation complexity of between-ness by means of weighting the network shortest-path routing algorithm; fifth, by detecting the occupancy rate of buffer zone to predict whether congestion will occur. When the occupancy rate reaches a certain threshold, the backup routing should be activated [10]; due to it needs to compute the global routing table, this method is more suitable for the wired network.

In order to solve the shortage of the above methods, the author, on the basis of the research about existing routing algorithm, puts forwards that a kind of routing algorithm which may optimize the routing could be obtained by means of associating with correlation function, calculating the hop number of nodes as well as occupation situation of cache [11, 12], which is able to reduce the network transmission delay and network congestion via combining with alternate routing.

2 Wireless Routing Node Load

Nowadays, wireless routing protocol calculates the link cost only in virtue of time delay and hop number and without considering congestion state; therefore, it is unable to avoid congestion nodes, and finally parts of links would occur congestion [13, 14].

Detecting the occupancy rate of cache (ROC) (ratio between number of packets which are ready to send and buffer capacity), anticipation node as well as link state may be helpful to avoid congestion during transmission and improve the success rate packet delivery. For this purpose, this paper calculating net-into rate (NR) (the ratio between difference value of inbound and outbound node packets at per unit time and maximum capacity of buffer zone, which reflects the occupation trend of cache; the bigger the ratio, the larger the congestion risk) and cache occupancy rate (which reflect the occupancy status of node cache) to measure the congestion rate, thus predicting congestion degree; it periodically detects the congestion rate (CR), then combines it with the default cache threshold and congestion unit (CU) (divided into free stage, normal stage, warning stage and congestion) and data to measure the node and link load. The formula is as follows:

$$CR_i(t) = ORC_i(t) + NR_i(t) \quad (1)$$

Constraint conditions:

$$\begin{cases} CR_i(t) = 0, CR_i(t) < 0 \\ CR_i(t) = CR_i(t), 0 \leq CR_i(t) \leq 1 \\ CR_i(t) = 1, CR_i(t) > 1 \end{cases} \quad (2)$$

$$\begin{cases} CU = 0, CR < \frac{1}{4} \\ CU = 8, (CR - \frac{1}{4}), \frac{1}{4} \leq CR \leq \frac{3}{4} \\ CU = 1 + 5^4 * (CR - \frac{3}{4}), CR > \frac{3}{4} \end{cases} \quad (3)$$

3 The Link Cost

Link cost (LC) refers to the cost that needs to pay while transmitting packets from one node to another node, and the formula is

$$LC_{ab}(t) = metric_{ab} + CU_b * CR_b(t) \quad (4)$$

If the path from node A to node B is expressed as $P \rightarrow S$, then its path cost if as follows:

$$LC_{ps}(t) = \sum_{i=1}^{n-1} LC_{i,i+1}(t) = metric_{ps} + \sum_{i=2}^n CU_i * CR_i(t) \quad (5)$$

In the formula, $metric_{ps}$ represents the hop number from node A to node B. According to the formulas 4 and 5, when the node takes place congestion, it can determine the shortest path according to congestion status in the network, so that to ensure that the algorithm may always choose global optimal path with minimum cost value to serve as updated routing.

4 The Improved Algorithm Description About Congestion Control Routing

According to the load of network node and link cost model, counting the global routing of nodes for sending the data packets; at the same time, when the nodes take place congestion, the main line should be replaced by alternate route so as to obtain the congestion control routing algorithm that proposed in this paper.

5 Simulation Experiment

In this paper, the author conducts the experiment by utilizing the NS2.35; among which, this simulation network is equipped with 100 nodes which randomly distributed in the plane region of $1000 * 1000$; the communication patterns adopts 20 data sources, and the starting time of the data source is uniformly distributed between 0 and 5 s; MAC layer employs a kind of protocol that with channel bandwidth of 2 Mb/s of IEEE 802.11 MAC. The transmission range of node 250 m and its simulation time is 400 s. At the beginning of the simulation, each node keeps static p seconds, and then randomly selects destination and to constantly move towards the destination at a speed between 0 and max; after arriving the destination, keeps static p seconds again, then randomly selects another destination and to move on according to the aforementioned methods. This process will be circulating all the time until the end of the simulation.

According to Figs. 1 and 2 shows that when the source node sends a packet per second without congestion, when the Pause Time ≤ 150 s algorithm optimized packet delivery success rate increased significantly. Because of the same fracture mechanism to link, so the results are close to the after. Because of the moving time of nodes significantly reduce the network load and smaller, link fault impact on the network data transmission reduced significantly, and the algorithm itself has the ability to update cycle route, so when the Pause Time ≥ 200 s, the calculation result is close to the after.

Fig. 1 Optimized packet delivery success rate change with mobile rate curve

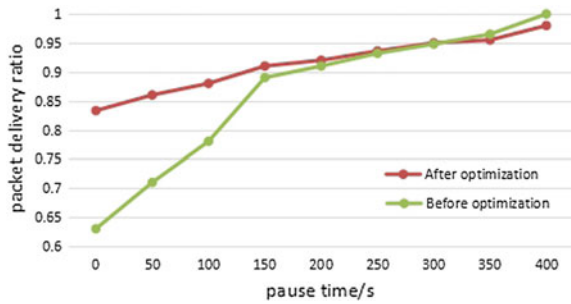
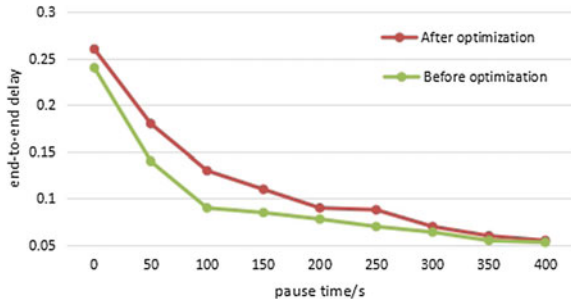


Fig. 2 The end-to-end delay after optimization algorithm with the curves of node mobility



6 Conclusion

In this paper, by studying the node load, link cost, local routing and global routing, the author puts forward congestion degree periodic-detected node and link on the basis of network congestion phenomenon; in addition, according to the congestion status of node buffer zone, this paper adopts the processing strategy by combining local routing with global routing, so that to reduce the packet loss caused by the link fracture and node congestion. The simulation results show that this kind of algorithm can reduce the packet loss caused by congestion nodes and improve the success rate of packet delivery.

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