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Performance Comparison of Packet Queuing Algorithm in Wireless Networks

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Abstract*:*

The development in wireless network has changes the fundamental of data communication and networking. However, the increasing data users have caused network congestion. Therefore, a good strategy of packet queuing algorithm is very important to avoid packets drop. This paper aims to propose an effective queuing scheme in wireless network environment. The implementation consider the unfairness problem for the per flow throughput in IEEE 802.11 without the modification of the MAC protocol. We simulate the enhanced packet queuing algorithm using OMNET++. The simulation shows that our algorithm achieves a better result as compared to the existing schemes in enhancing the performance of data communication.

Keywords-component; *Wireless Networks, Congestion, Packet Queuing Algorithm, Fairness*

I. INTRODUCTION

A wireless network is located at physical layer or layer 1 in Seven OSI layer. Development in wireless network have changed the fundamental to data communication and networking. Various type of wireless Networks include Wireless PAN, Wireless LAN, MAN, WAN, Wireless Mesh Network and Cellular Networks. The mobility of wireless networks make life easier as it is not rely on cable connection. Thus, it will reduce networking cost. Wireless networks utilize radio waves or microwave to maintain communication between two devices. Everyone can use their devices comfortably from anywhere and further increases the demand on mobile application. As a result, the increase use of data communications has made network congestion.

Nowadays, network congestion is one of the global issues and becomes a major problem for wireless network users. Congestion can occur in Wireless Networks due to simultaneous event detection at multiple nodes, link failure or node failure [1]. Other factors that cause congestion in network such as packet arrival rate exceeds the outgoing link capacity, insufficient memory to store arriving packets, burst traffic, or slow processor. There are many common complaints about network congestion. So, various methods were deployed to control the network congestion with different levels of effectiveness.

Congestion control concerns the efficient use of network at high load which causes performance degradation due to the saturation of network resources such as communication links, processor cycles, and memory buffers. This situation causes some problems which include a long delay of message delivery, waste of system resources, and possible of network collapse when all communication in the entire network stops [2]. Congestion control in networks became a high priority issue in networks design and research due to evergrowing network bandwidth and intensive network applications. Dozens of various congestion control strategies have been proposed, and more are forthcoming. More attention being paid in reserving resources so that chances of congestion are reduced and the quality of service can become more reliable. For example, [3] provides a high fidelity in terms of high delivery ratios. It is an effective congestion detection mechanism which monitors the factors and conditions that result in packet drops in order to infer the possible on set of congestion. Moreover, some researches [4] and [5] have presented the mechanism to reduce the problems in wireless network congestion.

II. RELATED WORKS

The study on congestion control drove to the development of a big number of packet scheduling algorithms with their own way of architecture. Congestion can be controlled at gateways through routing and queuing algorithm [6]. The goal of buffer management for packet scheduling algorithm is to maximize the total value of transmitted packets [7]. To improve the packet throughput, [8] used One Sender Multiple Receiver (OSMR) technique to make a decision when packet should be sent. [9] designed a fair scheduling algorithm using novel analogy ranked election problem. They define packets as a voters and schedules as candidates. The result of the simulation show their algorithm achieve optimal throughput and get a better fairness.

However, most of the existing schemes focused on reducing the congestion by introducing a fair architecture. Two greedy scheduling algorithms with polynomial time complexity are developed by [10] to solve a maximum throughput and proportional fair scheduling problem. According to [11], priority of packet scheduling are based on three conditions. Highest priority will be the emergency real time packets and the lowest priority will be the packets that are waiting for a certain time.

Most of these existing algorithms neglect the efficiency issue of the algorithm written in simulation which is also one of the main factors that contribute in giving the fairest way to schedule packets. Indeed, an efficient implementation of packet scheduler and buffer management will help to increase the capability of the algorithm proposed to its optimum [12].

III. PROPOSED SCHEME

The efficiency of queuing algorithms contributes to the effectiveness of the challenging networking environment nowadays. Figure 1 illustrates an overview of Wireless Multi-hop Environments. The routes of message in data transmission from sender node to receiver node are normally go through several hops due to limitation of transmission radius. Meanwhile, Figure 2 shows that each node has three queues. Each queue stores all packets that reach the node while waiting packets sent to the next node on the route. If an intermediate queue of node are full, then the queue manager will intelligently backward the packets to the previous node. This strategy avoids packet lost. Loss or dropped packets will decrease packet throughput. Hence, a more detailed strategy and description of queue management in avoiding packet drops is represented in flow chart shows in Figure 3.

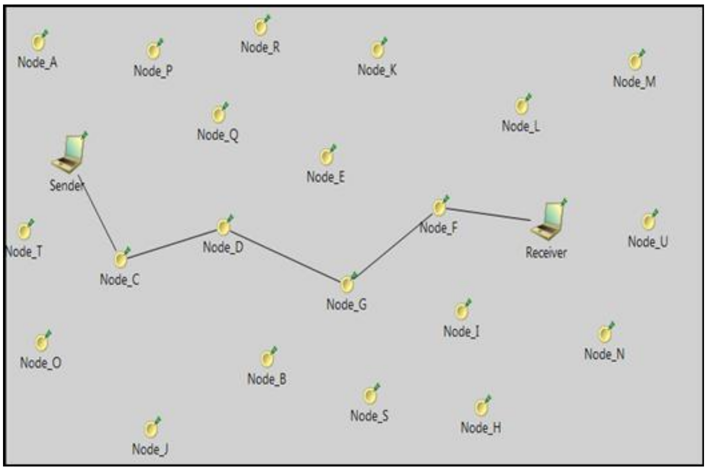

Figure 1. Simulation Wireless Multi-hop Environments

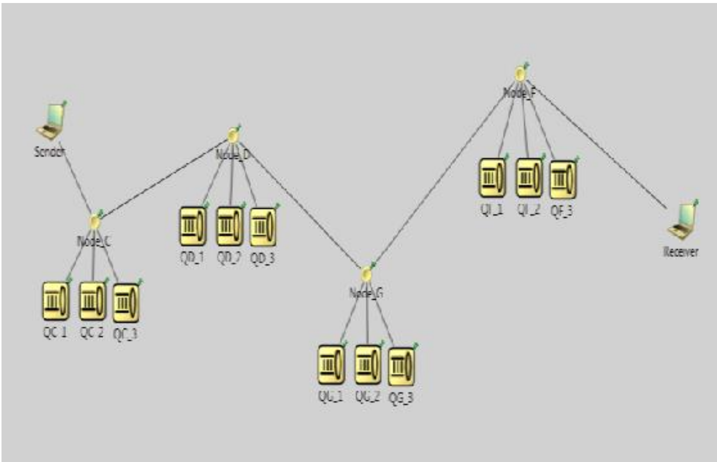

Figure 2. Queue Model in Wireless Multi-hop Environments

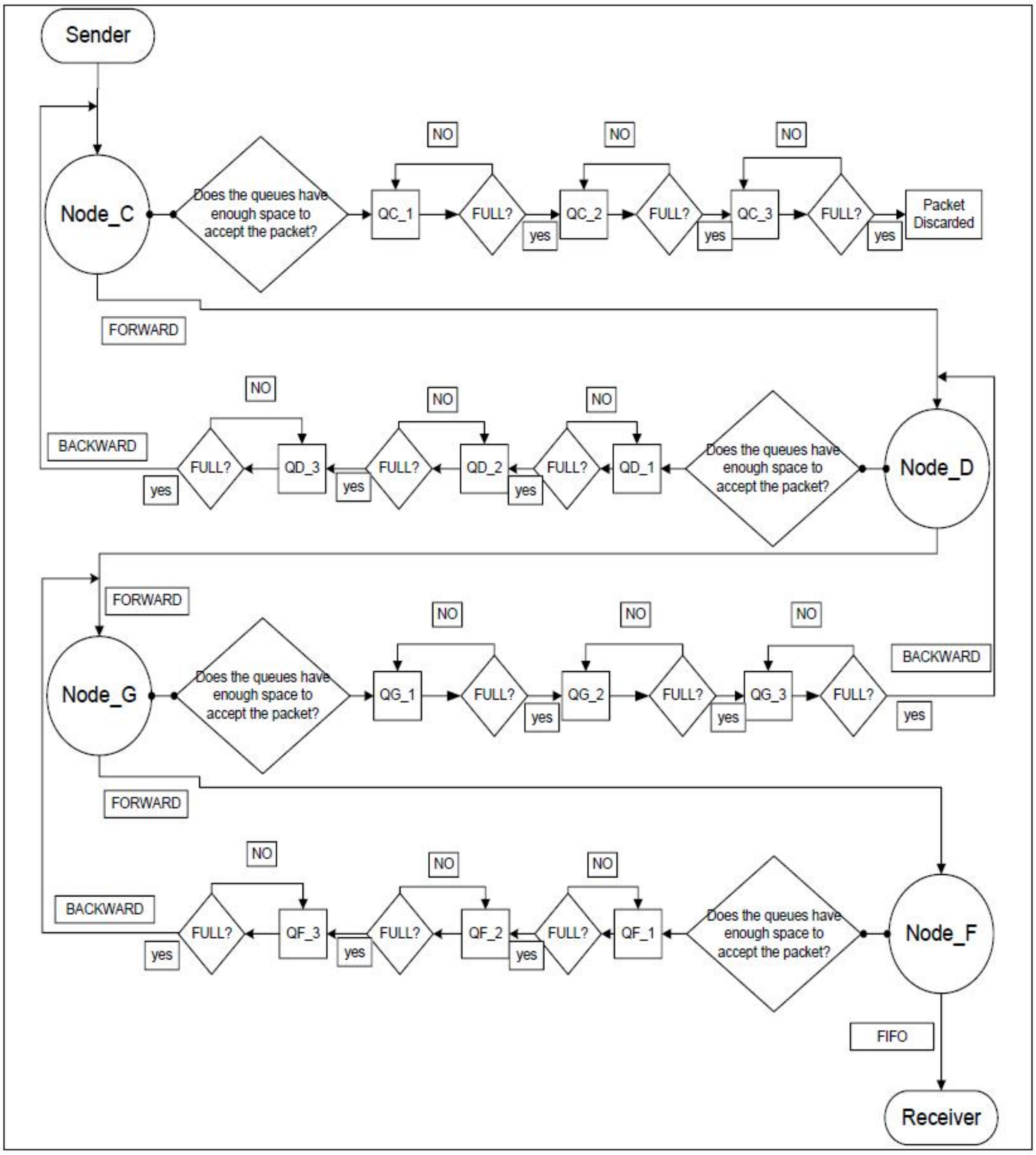

Figure 3. Flow Chart of Queue Model

TABLE I. INPUT PARAMETER FOR SIMULATION

Parameter	Value
Total Node	50
Queue Size	150
Packet Size	1900[byte]
Bandwidth	11Mbps

IV. PERFORMANCE EVALUTION

A discrete event simulator has been developed to simulate the algorithm carefully. This session discusses and analyzes the results of the simulation output according to the parameter and simulation environment defined in Table I. The measurement of the experiment focuses on the throughput of each workload handled throughout the number of queue size, i.e. 150[packets], packet size 1500[byte] and channel data rate is 11Mbps. The following figures (Figure 4 and Figure 5) show the measurement of fairness performance and packet lost. Fairness formula is based on [13]. As expected, the simulation result improves the fairness and decreases the packet lost ratio.

To show more clearly, we compare the fairness indices with [14] scheme. We observe that the proposed scheme always keep high per-flow fairness, while ARPQ scheme started with low fairness until load is greater 900[byte]. Obviously, it can be seen that proposed scheme shows a better performance as compared to previous work.

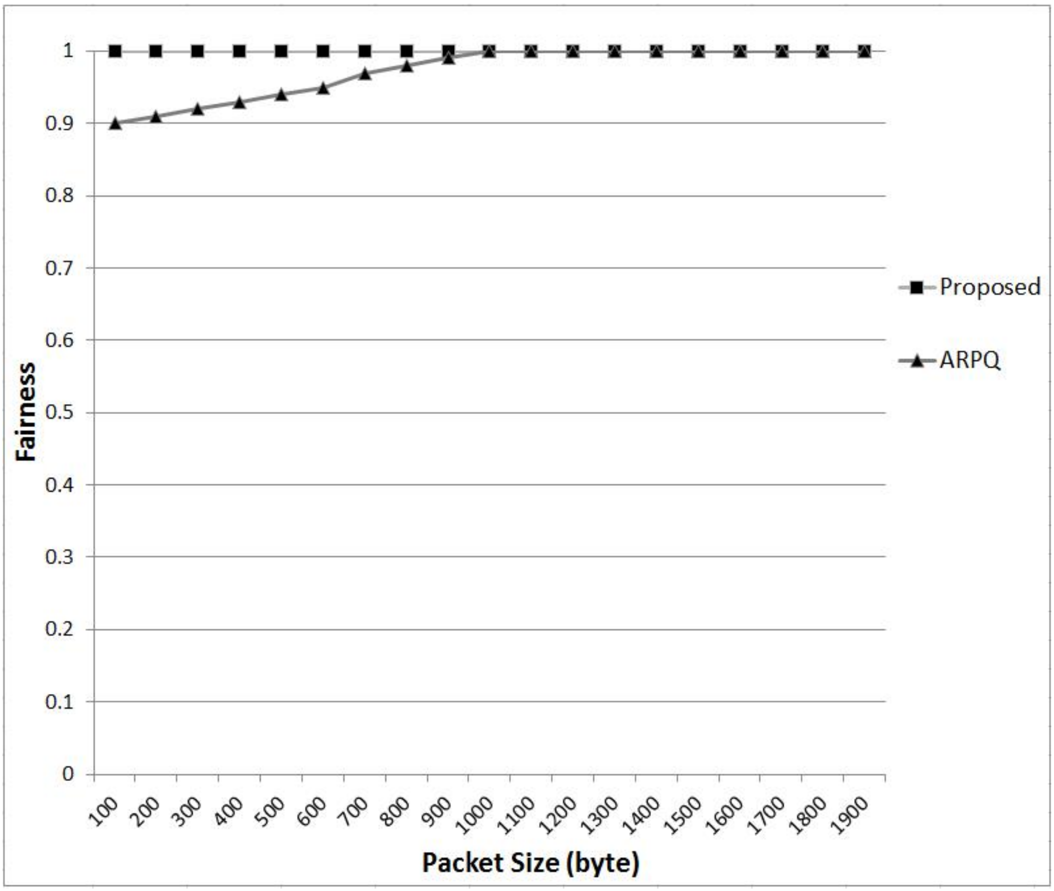

Figure 4. Performance Comparison – Fairness

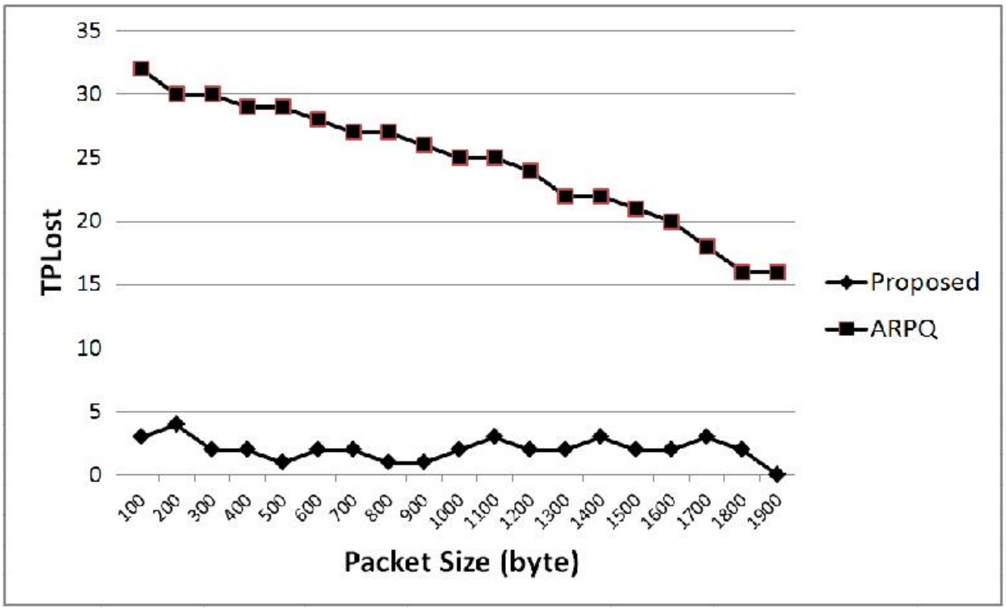

Figure 5. Performance Comparison – Total Packet Lost

The performance measure for packet lost in Figure 5 clearly shows that total packet lost ratio of proposed scheme are smaller as compared to ARPQ scheme. The simulation result indicates that the strategy of algorithm to avoid packet drop is succeed.

V. CONCLUSION

This paper considers the issue of unfairness for the per flow throughput in IEEE 802.11 in Wireless Networks. The study is started by analyzing the existing scheme of packet queuing algorithm in Wireless Networks before designing a model of packet queuing. To measure the performance of the proposed model, we simulate the model by using OMNET++ simulation tool. Then, the results of simulation are compared to the previous work using the same parameter set and environment. Finally, we conclude that our proposed scheme is better in providing fairness and the algorithm strategy to avoid packet drop. The proposed algorithm can be an alternative solution to achieve a better performance metrics.

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