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Enhancement in Priority Queuing using NS2

Payal[1], Richa Gupta[2]

[1]Haryana Engineering College, Kurukshetra University
Jagadhri, Haryana, India
payal.monga05@gmail.com
[2] Haryana Engineering College, Kurukshetra University,
Jagadhri, Haryana, India
reechaaggarwal8@gmail.com

Abstract: *During the last few years, users all over the world have become accustomed to the availability of broadband access. This has enhanced the use of a wide variety both of established and recent multimedia applications. The Quality of Service research investigations in Wired and Wireless networks have been conducted mostly in isolation. Recently, a need for an end to end quality of service over hybrid networks (containing wired and wireless segments) has become evident. Delay, jitter and reliability are also important properties for the quality of network connection. This is because different applications has different needs, and therefore require different properties from the network. In our proposed work the focus was on the Queuing scheme: Priority Queuing (PQ) and its Enhancement. The implementation of the schemes will be carried out using NS2. The results were evaluated by making the comparison of the performance of the two queuing schemes.*
Keywords: *Quality of Service, Priority Queuing, Delay, reliability*

1. INTRODUCTION

Networks are now dealing with high-bandwidth traffic & applications having strict requirements of successful packet delivery with minimal delay and delay variations. Major applications may include Voice over IP (VoIP) and Video Conferencing (VC) which are highly sensitive to loss, delay and jitter. When high-bandwidth and delay sensitive services are the part of network, some Quality of Service (QoS) mechanism is applied to guarantee successful packet delivery with reduced latency and jitter according to assigned priority of packets.[3] Quality of service is the ability to provide different priority to different applications, users, or data flows to guarantee a certain level of performance to a data flow. For eg, a required bit rate, delay, jitter, packet dropping probability and/or bit error rate may be guaranteed. Various queuing disciplines can be used to control which packets get transmitted (bandwidth allocation) and which packets get dropped (buffer space). The queuing discipline affects the latency experienced by a packet, by determining how much time a packet waits to be transmitted. Examples of the common queuing disciplines are first-in first-out (FIFO) queuing, priority queuing (PQ), and weighted-fair queuing (WFQ).[1]

In this paper, we implemented the CMU Priority Queue. The CMU priority queue system available with the default DSR algorithm is being used in wireless sensor network. Our analysis and simulation studies show that our policies can be used to save all critically important packets.[2]

1.1 Queuing Schemes

FIFO QUEUING-: Packets are forwarded in the same order in which they arrive at the interface. As long as queue depth remains short, this queuing provides simple contention resolution for network resources without adding significantly to the queuing delay experienced at each hop.

PRIORITY QUEUING (PQ)-: Priority queuing assures that during congestion the highest priority data does not get delayed by lower priority traffic. However, lower priority traffic can experience significant delays. PQ is designed for environments that focus on mission critical data, excluding or delaying less critical traffic during periods of congestion.

CUSTOM QUEUING (CQ)-: Custom queuing assigns a certain percentage of the bandwidth to each queue to assure predictable throughput for other queues. It is designed for environments that need to guarantee a minimal level of service to all traffic.

WEIGHTED FAIR QUEUING (WFQ)-: Weighted Fair Queuing allocates a percentage of the output bandwidth equal to the relative weight of each traffic class during periods of congestion.

2. RELATED STUDY

In [1], T. Velmurugan, in 2009 discussed that various queuing disciplines can be used to control which packets get transmitted (bandwidth allocation) and which packets get dropped (buffer space). The queuing discipline affects the latency experienced by a packet, by determining how much time a packet waits to be transmitted. Examples of the common queuing disciplines are first-in first-out (FIFO) queuing, priority queuing (PQ), and weighted-fair queuing (WFQ).

In [2], Weihuan Shu, in 2009 discussed that in wireless sensor node battery power and memory is available in limited amount.

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The computing devices available in the sensor nodes are not capable enough to execute complex algorithm. Moreover, several retransmissions of data packets are done to compensate lost packet due to buffer overflow. The algorithm of buffer management policies of conventional data network cannot be applied in sensor network, because they are too complex to be implemented in low computation capable sensor nodes. There are many aspect of this paper, firstly we proposed to classify the packets into different categories and then we proposed the prioritized buffer management policy for different category uniquely. Currently, the CMU priority queue system available with the default DSR algorithm is being used in wireless sensor network. Our analysis and simulation studies show that our policies can be used to save all critically important packets.

In [3], Muhammad Aamir, et al, in 2012 discussed QoS analysis in a wired IP network with more realistic enterprise modeling and presents simulation results. Quality of Service (QoS) techniques are applied in IP networks to utilize available network resources in the most efficient manner to minimize delays and delay variations (jitters) in network traffic having multiple type of services. Multimedia services may include voice, video and database. Researchers have done considerable work on queuing disciplines to analyze and improve QoS performance in wired and wireless IP networks. This paper highlights QoS analysis in a wired IP network with more realistic enterprise modeling and presents simulation results of a few statistics not presented and discussed before. Four different applications are used i.e. FTP, Database, Voice over IP (VoIP) and Video Conferencing (VC). Two major queuing disciplines are evaluated i.e. 'Priority Queuing' and 'WeightedFair Queuing' for packet identification under Differentiated Services Code Point (DSCP). The simulation results show that WFQ has an edge over PQ in terms of queuing delays and jitters experienced by low priority services. For high priority traffic, dependency of 'Traffic Drop', 'Buffer Usage' and 'Packet Delay Variation' on selected buffer sizes is simulated and discussed to evaluate QoS deeper.

In [4] ,Dr.Sattar B.Sadkhan, in 2012, presented how to use NS2simulation for designing wireless networks and using Cryptography algorithm as to security information. It briefly describes the basic wireless networks categories, analyzes wireless LAN networks, briefly describes their components and technologies, explains the Wi-Fi technology and analyzes property sources related to wireless networks simulators and its detailed description

In [5], Mohammad Mirza, in 2010 presented that Queuing is one of the very vital mechanisms in traffic management system. Each router in the network must implement some queuing discipline that governs how packets are buffered while waiting to be transmitted. This approach gives a comparative analysis of three queuing systems FIFO, PQ and WFQ. The study has been carried out on some issues like: Traffic dropped Traffic Received and packet end to end delay and the simulation results shows that WFQ technique has a superior quality than the other techniques.

3. PROPOSED WORK

Queuing schemes provide predictable network service by providing dedicated bandwidth, controlled jitter and latency, and improved packet loss characteristics. The basic idea is to pre-allocate resources (e.g., processor and buffer space) for sensitive data. We have enhanced the performance of Wireless Networks by improving the Simple Priority Queue.

3.1 Proposed Algorithm

The proposed algorithm is implemented in NS2. The following objectives are achieved:

1. Study of Priority Queuing to analyze the performance.
2. Enhancement and implementation of proposed algorithm.
3. Comparison of different parameters like packets lost, packets received etc. using two Queuing Schemes.

4. RESULT ANALYSIS

These were the following parameters which were analysed:-

1) NO. OF PACKETS RECEIVED
2) NO. OF PACKETS LOST

4.1 Priority Queuing

Priority queuing assures that during congestion the highest priority data does not get delayed by lower priority traffic. However, lower priority traffic can experience significant delays. Priority Queue is implemented and the performance is analyzed by performance metrics as no. of packets received and no. of packets lost.

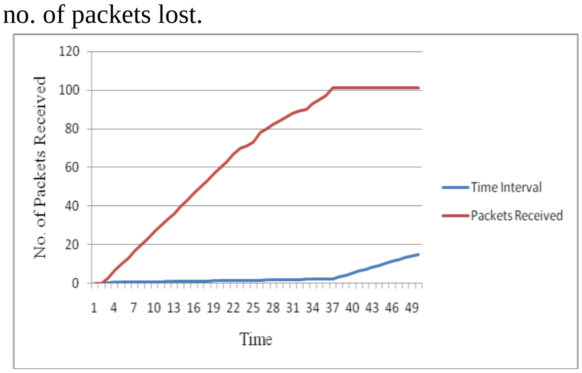

Fig 1: No. of Packets Received Vs Time

Fig 1 shows no. of packets received at different time intervals. The communication is shown among 50 nodes. The total no. of received packets is 101 at time 14 sec.

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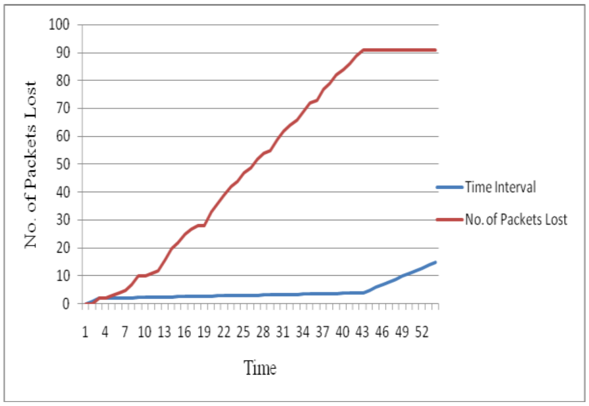

Fig 2: No. of Packets Lost Vs Time

Fig 2 shows the no. of packets lost at different time intervals. The total no. of lost packets is 91 at time 14 sec.

4.2 Enhanced (CMU) Priority Queuing

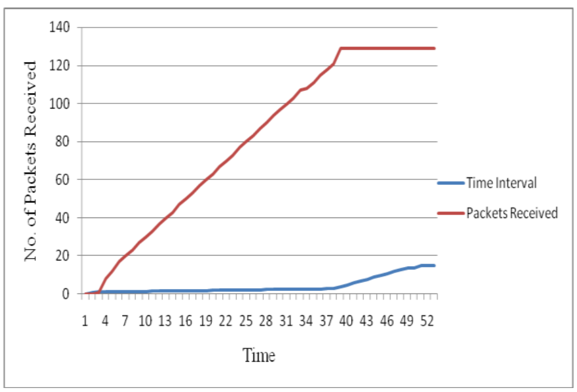

Fig 3: No. of Packets Received Vs Time

This graph shows the no. of packets received at different time intervals. The communication is shown among 50 nodes. The total no. of received packets is 129 at time 14 sec.

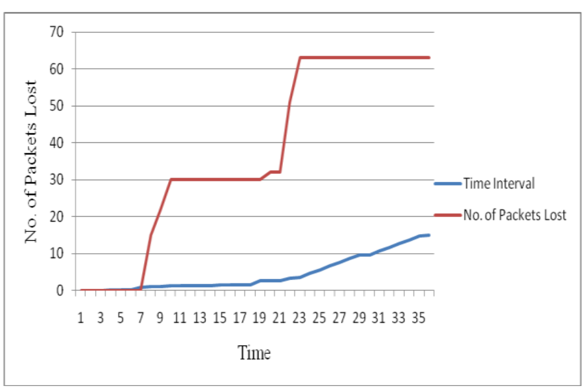

Fig 4: No. of Packets Lost Vs Time

This graph shows the no. of packets lost at different time intervals. The total no. of lost packets is 63 at time 14 sec.

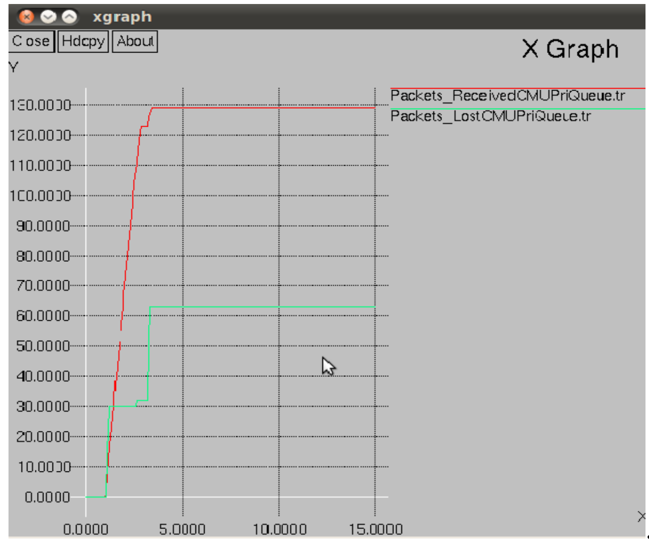

Fig 5: No. of Packets Vs Time in CMU Priority Queue

Figure 5 shows the Total no. of Packets Vs Time in the proposed algorithm. As the analysis shows, this CMU PQ technique is better than PQ technique as it has improved performance by reducing the no. of packets lost. The no. of packets received is 129 & the no. of lost packets is 63.So, this approach is better than PQ.

5. COMPARISON

Table 1: **Comparison between Priority Queuing & CMU Priority Queuing**

	Priority Queuing	**CMU Priority Queuing**
No. of Nodes	50	50
Packets Received	101	129
Packets Lost	91	63

No. of packets lost decreases in proposed algorithm. The communication of 50 nodes is shown. No of packets increased to a significant amount in CMU Priority Queuing technique. We have analyzed that no. of packets received increases, no. of packets lost decreases, so CMU Priority Queuing is better in performance than Simple Priority Queuing.

6. CONCLUSION

The main aim of the research is to provide better performance by reducing the no. of packets lost. Our proposed technique is compared with priority queuing and the different parameters were analyzed. In my work no. of received packets increases, no. of lost packets decreases. This shows that our research enhanced the performance by using the multiple priority queues. This approach for performance enhancement is to be one of the preferred methods used in practice today.

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