Modified Packet Scheduling Algorithm using Real-time Service

Ha-sung Koo
Department of Computer and Information
Hanseo University
360 Daegok-ri, Haemi-myun, Seosan-si, Chungcheongnam-do
South Korea
hskoo@hanseo.ac.kr

Abstract: In this paper analyzes various scheduling algorithms applied to multi-media streaming system for providing real-time service in Internet and proposed a scheduling algorithm that can meet the QoS requirements of delay-sensitive traffic and loss-sensitive traffic for specific services. First, the concept of QoS drafted from the recommendation of ITU-T is defined and the requirements for packet multiplexer in Internet are examined. Then the scheduling algorithm to satisfy various QoS based on functional architecture of packet multiplexer for streaming system bound to real-time service and QoS levels of input source traffic is designed. Finally, the performance of the algorithm is evaluated thru experiments that measure the packet loss and average delay time of the proposed algorithm.

Key-Words: - Packet Scheduling Algorithm, QoS, Multiplexer, Real-time service, Multi-media streaming

1 Introduction
In IETF suggest from existing best effort internet system to expended multiplex services that including a realtime services[1,2]. Many systems that provides a real-time services uses a traffic control module to provide a many different services following quality of internet, composed by Packet classifier, Packet scheduler, Call control and traffic control module using by RSVP(Resource Reservation Protocol). The scheduling algorithm that used in packet scheduler makes a difference between the packets and gives a most important effects to many streaming systems. Suggested algorithms till now devide into Priority control algorithm and bandwidth guaranteed algorithm[3]. The weak points of Priority scheduling algorithm and bandwidth guaranteed algorithm are complex of sorting and can not support right QoS in busted traffic[4,5]. Therefore many experiments that traffic control algorithm for real time internet service is going on so far. In this paper we experiment and suggest Packet multiplex, Priority algorithm applied multiplexer, and Modified packet scheduling algorithm using threshold of scheduler queue to satisfy the quality of real time service.

2 Packet scheduling algorithm using real-time service
In this chapter we listed existing packet scheduling algorithms for real time service. Based on this, defines new packet scheduling algorithm that easy for QoS guarantee and realizing.

2.1 FIFO Queuing
FIFO Queuing algorithm is very basic packet scheduling algorithm that processing a single FIFO Queue that occurs in every packet in every sessions. Below [Fig.1] is basic packet scheduling system using FIFO Queuing.
This method is easy to realize in the other hand weak point of this method is long delay-time from Queue because every packet is processed in single a Queue. Occur delay time in processing single Queue

2.2 FQ(Fair Queuing)
FQ algorithm fixed problems of FIFO Queuing algorithm, FQ algorithm provide a FIFO Queues to each
sessions and scheduling using Round-Robin system. Below [Fig.2] is packet scheduling system using FQ algorithm.

[Fig.1] Scheduler using FIFO Queuing

[Fig.2] Scheduler using FQ algorithm

2.2 WFQ (Weighted Fair Queuing)

WFQ is including a priority system in basic FQ that classify every packet by priority and provide a queue to each priority so can process a high priority packets with more speed. [Fig.3] is packet scheduling system using WFQ algorithm. Because WFQ added priority to the FQ method, make more effective in processing but as a weak point, also can lowering the scheduler system if many of packets occurs in priority region.

[Fig.3] Scheduling system using WFQ algorithm.

3 Packet scheduling algorithm based on threshold

In this chapter we suggest you scheduling algorithm which guaranteed by QoS of real time internet streaming service. To this, classify every packets occurs in traffic into Guaranteed realtime service, Load control and Best effort and suggesting you more effective scheduling algorithm.

3.1 Classify traffics to apply for scheduling algorithm

To classify every traffics occurs in real time service by characters and use guaranteed QoS scheduling algorithm that require in real time service, devide each traffics into three differences which is Guaranteed realtime service, Load control and Best effort.

First, Guaranteed realtime service is sensitive to real time that inputted from RTP/UDP, second Load control traffic is inputted from RTP/UDP that allowing a some amounts of loss and delay. Lastly Best effort traffic is data packet, inputted from TCP protocol that sensitive to loss and delay but allows some amount of delay.

Below Table.1 is internet traffic type by traffic characteristics.

[Table.1] Internet traffic type by traffic characteristics

<table>
<thead>
<tr>
<th>Priority</th>
<th>QoS</th>
<th>QoS Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>QoS1</td>
<td>Guaranteed</td>
<td>RPD &lt; 1ms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QPD &lt; 100ms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BW &lt; 30kbps</td>
</tr>
<tr>
<td>QoS2</td>
<td>Lord Controlled</td>
<td>RPD &lt; 1ms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QPD &lt; 500ms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BW &lt; 64kbps</td>
</tr>
<tr>
<td>QoS3</td>
<td>Best Effort</td>
<td>RPD &lt; 10ms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QPD &lt; 1sec</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BW &lt; 5kbps</td>
</tr>
</tbody>
</table>

3.2 The idea of structure of scheduling algorithm based on critical value
In this paper we suggested a new packet scheduling algorithm to improve weak point of scheduling algorithm by real time traffic. [Fig.4] is basic model of scheduling method that we suggest.

[Fig.4] Packet multiplexer and scheduler based on QoS scheduling algorithm.

After classified packets by priority grades of traffic characters, apply threshold to scheduler queue to service the real time traffic preferentially. We upgraded QoS guaranteed ability by processing scheduler queue using threshold scheduling system that sent to scheduler. The traffic type that will use in this algorithm is classified into four types according to QoS guaranteed ability.

Suggested multiplexer devise into two blocks which is regulator block and scheduler block. Regulator block is composed of priority grade discriminator, which classify input traffics according to QoS level requirements and priority buffer which saves packet that classified according to priority grade. Scheduler block is composed of scheduling order controller which creates scheduling order by suggested algorithm and scheduler.

① When set the connection, QoS parameter that negotiated to multiplex control, remains in reference table.
② Priority classifier classify service grades according to QoS's level requirements of input packets and save that packets to the priority buffers.
③ Scheduling order controller decide the scheduling orders according to buffer status and scheduling algorithm.
④ Sends priority buffer packets to output link according to the decided scheduling order from scheduling order controller.

3.3 Scheduling algorithm based on priority threshold

We shows you realization of scheduling algorithm in [Fig.4] and moves of steps are:
① step 0: Receive the packets from each of input lines. Packet priority parser decide the priority grade of packets by using each IP packet header.
② step 1: Save the input packets to the each priority buffers by using QoS required value.
③ step 2: Send each of packets in the priority buffers to the scheduler queue by using buffer status reference table.
④ step 3: If packet is exist in threshold region of scheduler queue, send that packet to output link following the priority. If threshold region is exceeded, discard that packet.
⑤ step 4: Update buffer status reference table by using scheduler queue status information.
⑥ step 5: The next packet of priority buffer moves to the very front.

4 Experiment and result

In this paper used world wide network simulator NS-2(Network Simulator-II)[8,9]. Simulation system that used in this paper is OTCL(Object Tool Command Language) in Linux6.0 and type of input data and algorithm are composed in C language. We have done comparative and analysis our method (Scheduling algorithm based on threshold) with HOL scheduling type and FQ type. [Fig.5] shows average delay of scheduling algorithm based on threshold that we suggested in this paper. As the result, we improved quality of average delay of real time traffic by giving priority to each of traffics. Average delay time of relatively low priority service also upgraded by applying threshold of queue to priority classified packet. In case of input traffic is low loaded, as the result of [Fig.6] suggested algorithm and HOL type
shows lower average delay value than FQ algorithm. As amount of traffic load is getting bigger the average delay time of real time service is also increase and in case of FQ algorithm got higher average delay value than other algorithms because of irregular quota of bandwidth. The average delay value in real time service of suggested scheduling algorithm decreased compare with other algorithms. It is result of gives priority to real time service to send it first, it decreased average delay value and increased real time internet service quality. [Table.2] shows average delay and variation of each priority grades. Following the simulation result on [Table.2] suggested algorithm shows better characteristic of delay than other scheduling algorithm and also in delay variation. As you can see in [Table.2] the real time service of QoS1 which is important in side of QoS provide, the quality of average delay of suggested algorithm is better than FQ algorithm. In this paper suggested 2step of scheduling algorithm and packet multiplexer which based on software that supports real time service. After comparison, suggested algorithm shows better quality in processing real time priority packets than existing static priority algorithms. We planed to improve the quality of queue scheduler by comparing with many existing methods.

[Table 2.] Average delay time by QoS grade.

<table>
<thead>
<tr>
<th>QoS Grade</th>
<th>QoS1 delay time</th>
<th>QoS2 delay time</th>
<th>QoS3 delay time</th>
</tr>
</thead>
<tbody>
<tr>
<td>FQ algorithm</td>
<td>0.128</td>
<td>0.261</td>
<td>0.574</td>
</tr>
<tr>
<td>WFQ algorithm</td>
<td>0.128</td>
<td>0.266</td>
<td>0.520</td>
</tr>
<tr>
<td>proposed algorithm</td>
<td>0.125</td>
<td>0.219</td>
<td>0.485</td>
</tr>
</tbody>
</table>

References:

