Queue Management Policies – An Experimental Approach

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Abstract: In networking environment, packets are queued up into the memory buffers of network devices like routers and switches. Packets in a queue are usually arranged in first-in, first-out order, but various techniques may be used to prioritize packets or ensure that all packets are handled fairly. While travelling a packet from origin to destination, many problems like Low Throughput, Dropped packets, Errors, Time to reach to Destination, Jitter, Out-of-order delivery may arises. Hence to route it efficiently queue management plays an important role. Although early dropping of incoming packet is an effective technique to avoid congestion and to minimize the packet latency, apart from that we have to consider other factors affecting for efficient queue management techniques. This paper focuses on an experimental approach for efficient queue management.

Keywords: Congestion, Jitter, Latency, Throughput, Queue Management.

I. INTRODUCTION TO QUEUE MANAGEMENT

Queuing is performed for packets leaving the router through an interface. Queuing [6] [7] is a mechanism that controls bandwidth allocation, delay variability, timely delivery and delivery reliability. Therefore queues should always be configured on the outgoing interface regarding the traffic flow.

1.1 Types of Queue Management

A. FIFO (First-in First-out) - It is the simplest, most common and default queuing mechanism for any interface with more than 2 MB bandwidth. First job entered in queue is processed first. Fig.1 shows how queue of jobs is processed depending on FIFO policy.
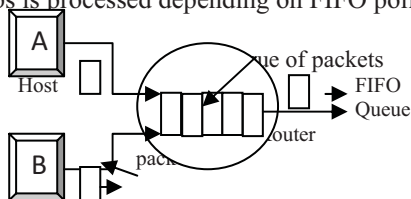

Figure 1. FIFO Queue Processing

B. PQ (Priority Queuing) - It allows network managers to prioritize the network. It uses multiple queues, but queues are serviced with different levels of priority, with the highest priority queues[12] being serviced first. Here one particular kind of network traffic can dominate all others. When congestion occurs, packets are dropped from lower-priority queues. Fig.2 indicates priority queuing policy

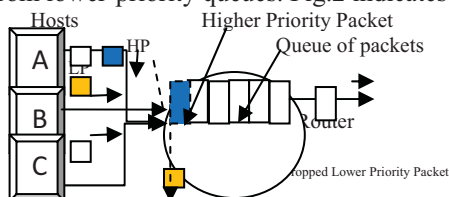HP – Higher Priority Packet   LP – Lower Priority Packet
Figure 2. Priority Queuing Processing

C. FQ (Fair Queuing) – It helps to process queues which are not serviced due to high-priority queues . A

round-robin approach is used to service all queues in a fair way. This prevents any one source from overusing its share of network capacity.

D. CQ (Custom Queuing) – It reserves a portion of the bandwidth of a link for each selected traffic type. If a particular type of traffic is not using the bandwidth reserved for it, then other traffic types may use the unused bandwidth.

II. PROBLEMS IN QUEUE MANAGEMENT

Following listed are drawbacks in various queue management techniques :

i. Bandwidth Management – In FIFO technique when a station starts a file transfer, it can consume all bandwidth of a link. Also it works well if links are not congested, otherwise packets gets dropped and is effective for large links having little delay and minimal congestion.

ii. Traffic Management – In Priority Queuing [12], lower-priority queues may not get serviced at all if high-priority traffic is excessive.

iii. Time Management - In Fair Queuing problems can occur when packets are variable in length and each queue is allowed to release one packet at a time.

There are different types of techniques, policies to process queues for proper queue management.

Active Queue Management (AQM) [2][3] is one of the queue management technique, considered as a congestion control method that identifies congestion at router buffers in an early stage, which means before the router buffers have overflowed. It drops incoming packets before the queue is full in contrast to traditional queue management which starts dropping only when the queue in overflowed.

Random Early Detection (RED) is an AQM algorithm considered as a congestion control method. The basic idea of RED is that a router detects congestion early by computing the average queue length and sets two buffer thresholds maximum threshold (maxth) and minimum threshold (minth) for packet drop. But it can degrade the network's performance due to increase in arrival rate aggressively, thus the RED's router buffers may overflow. Therefore, every arriving packet will be lost.

Thus there are some drawbacks in above stated techniques, hence to improve it we have proposed an experimental approach for efficient queue management.

III. EXPERIMENTAL APPROACH TO AVOID PROBLEM IN QUEUE MANAGEMENT

To observe effect of various factors affecting queue management techniques, we will focus on few parameters showing their effect on queue management.

We will focus on following parameters :

i. Queue Length(QueL)
ii. Incoming Packet Flow (PackF)
iii. Transmission Delay(TranD)

Among those QueL and PackF are input parameters and TranD is output parameter.
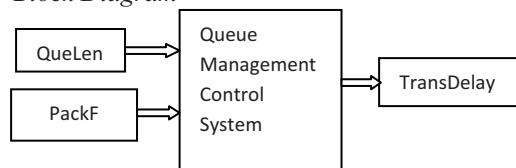
A. Block Diagram

Figure 3. Queue Management System

Our proposed Queue Management Control System works on two input parameters i.e. QueLen and PackF and produces one output parameter i.e. TransDelay. To verify its working we will use look up table to verify our result.

B. Working GUI

Practically we observe that for larger queue length with low incoming packet flow, transmission delay is high whereas for small queue length with high incoming packet flow, transmission delay is comparatively low. Considering these aspects we have implemented following GUI in Microsoft Visual Basic 6.0 (as front end) with Microsoft Access 2007 (as back end):
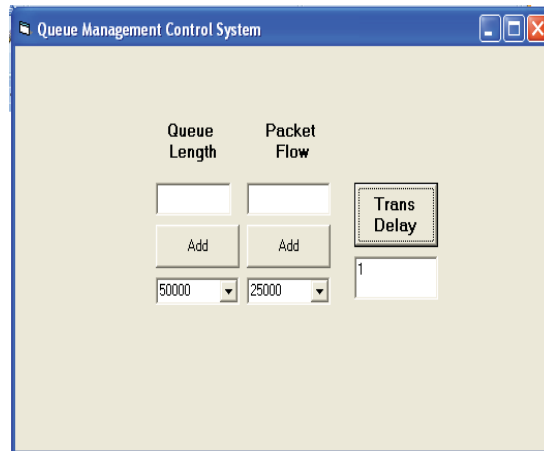
C. Look Up Table

As we know that, Queue Length is measured in terms of packets (or bytes). By default queue length is 65536, whereas is generally ranges from 256 (minimum range) to 1073741824 (maximum range).

Packet Flow is measured in terms of packets/sec. It ranges from 15000 to 2,00,000.

Transmission Delay is measured in milliseconds. Generally it is less than 5 milliseconds.

By considering it, we will categorize each parameter into 3 different values considering its lower range, medium range and boundary value.

Table - I: Input Parameter Values

Input Parameter	Lower Range Value	Medium Range Value	Boundary Value
QueLen	50000	55000	60000
PackF	15000	20000	25000

As mentioned in Table - I maximum queue length is 60000 packets, smallest queue length is 50000 packets and medium queue length is 55000 packets. Whereas maximum incoming packet flow rate is 25000 packets/sec, minimum packet flow rate is 15000 packets/sec and medium packet flow rate is 20000 packets/sec.

Table - II Output Parameter Values

Output Para.	Low	Medium	High
TransDelay	1	3	5

Similarly stated maximum transmission delay 5ms whereas minimum transmission delay is 1ms and medium transmission delay is 3ms.

D. Result

By Experiment we observe the following output :

Table III. Experimental Result

PackFlow / QueLen	15000	20000	25000
50000	3	1	1
55000	5	3	3
60000	5	5	3

Thus it shows how efficient queue mechanism will be implemented.

IV. CONCLUSION

Queuing is an important mechanism controlling link utilization, bandwidth allocation, delay variability, timely delivery and delivery reliability which may degrade system performance in terms of security of network, network performance. Therefore queues should always be configured on the outgoing interface regarding the traffic flow. Above stated experiment shows an efficient queue mechanism improving system as well as network performance by focusing on few important parameters related to queue management techniques.

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