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Packet Rejection Based on Packet Rank for Congestion Control

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Abstract*— In this paper various congestion control techniques are discussed with their merits and demerits. As the biggest problem over any type of wide area network i.e. wired or wireless is congestion, because of congestion bandwidth utilization decreases and a lot of processing time is wasted over congestion debugging. One of the solutions that is proposed in this paper is ranking the packet and discarding lower ranked packets .This ranking can be done based on various properties of packet such as packet type, timestamp value, destination address and hop count. If the proper order of checking properties is followed, the processing time can be reduced.

***Keywords:*-Packet Discarding Congestion Control (PDCC), Interface Message Processor (IMP), Cell Loose Priority (CLP).**

I. INTRODUCTION

Basically this idea is proposed for packet discarding congestion control (PDCC) algorithm. In this algorithm rank of the packet and the priority is set on the basis of properties of packets. In PDCC when incoming packets crosses threshold value, then IMPs starts discarding of packets in arbitrary manner. The main disadvantage of PDCC is it does not see the type of the packet and many time ACK and NAK control packets are transmitted in the channel which decreases the bandwidth utilization, it also increase the number of retransmission, so overall we can say that PDCC algorithm provide less bandwidth utilization and increases delay in transmission. However the advantage of PDCC algorithm is that it controls the congestion in very less time because of arbitrary discarding. The approach proposed in this paper is based the ranking of packet on the basis of some properties of packets to improve the performance of network by using PDCC algorithm. This concept is likely to be used in ATM network to decide the Cell Loose Priority (CLP) of cell. Cell Loss Priority (CLP) is a flag bit in the ATM cell header that determines the probability of a cell being discarded if the network becomes congested. Cells where the CLP = 0 are insured traffic and unlikely to be dropped. Cells with CLP = 1 are best-effort traffic, which may be discarded in congested conditions in order to free up resources to handle insured traffic.CLP is used as a control for a network traffic "policing mechanism". Policing is a process that determines if the cells meet pre-defined restrictions as they enter an ATM network. These restrictions include traffic rates and "burst sizes" that are agreed upon by the customer and the network provider. In ATM network single bit is used to rank the packet to decide the importance of the packet. In internet protocol this concept is used for congestion control through packet discarding.

II. NEED OF RANKING

TCP congestion control typically has some defects such as high-error rate, long-latency, low-bandwidth and frequent-movement, etc. In the wireless network, the implementation difficulty of congestion control mechanism is the degree of congestion, which is not only relevant to the length of the queue, but also the wireless channel around the node is busy. [1]

Ranking of packets have many benefits, because once the properties of any person is known then the behavior toward them can be decided , similarly in network the packet are categorized to give the priority according to its properties. For example if any ACK or NAK packet travel long route and it is very close to its destination and any IMP discard that packet causing retransmission resulting in reduced bandwidth utilization and increased round-trip time.

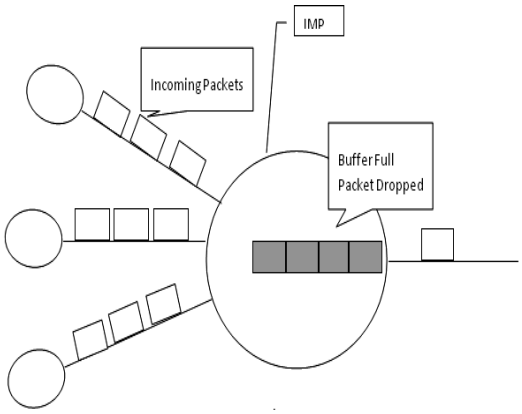

Fig. 1.IMP

As shown in above fig.1 the IMP with packet discarding method buffer is completely full, now algorithm trigger and starts discarding the packets in arbitrary manner, without checking hop count , its type ,and other important factors. If a TCP packet has travelled for long time and after few hop count it would have reached its destination, but due to arbitrary discarding the IMP discards it then the time taken during its journey is wasted and retransmission occurs until successful transmission.

There are a lot of congestion control algorithms, which initiate active network technology in the wireless network congestion control, and the intermediate router participate in congestion control rather than the terminal-to-terminal solutions of TCP [2, 3]. For example, the current active network congestion control (ACC: Active Network Congestion Control) mechanism reduces the congestion detection and control delay [4, 5], but it filters some packets to elevate congestion passively, and TCP congestion control

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mechanism is still playing a leading role. Some active queue management algorithms, such as RED and its variants [6, 7], adjust the probability of packets discarded by forecasting the length of the queue. The length of the queue is directly related to the state around the node, but it is still difficult to determine threshold of the queue rationally according to the wireless network environment.

A. Category of Packets

Connections are broadly categorized in two category i.e. Wired and Wireless, the packets can be divided according to the messages, packets are broadly categorized in Connection Oriented Packets or TCP Packets like data packets ,Piggybacked Packets and Connection Less Packets like data packet, video audio , piggybacked ACK, ACK , NAK etc and Wireless Packets.

B. Parameter of Packets

Discarding of packets is based on some parameters like source address, destination address. TTL (Time to Live), Hop Counting. These parameters can be represented using some unused bits in packets. The algorithm of IMPs reads out these bits and calculate the value of priority and decide that whether that packets should discarded or not or stored in the buffer. If buffer has less priority packets then they are replaced by high priority packets.

III. Analysis of Packet Discarding Method

In previous packet discarding method the packets are discarded in arbitrary manner if all buffers of IMP's are full. So for this reason retransmission increase and finally it can be said that retransmission decreases the bandwidth utilization, by increasing the overall transmission time of packets.

In this paper the proposed technique will help in reducing retransmission of packets. Two cases: connection oriented and connectionless. In datagram (connectionless) networks, the sending host (transport layer) retransmits discarded packets (if appropriate). In virtual circuit networks, the previous-hop router retransmits the packet when it fails to receive an acknowledgment.

Advantages

- The advantage of this method is easy to implement.

Disadvantages

- Wastes resources The network may have expended considerable resources processing a packet that is eventually discarded.
- Non-deterministic. There are fewer guarantees than with virtual circuits that packets will ever reach their destination.
- Requires that sending hosts pay attention to congestion.
- In the extreme case, congestion collapse occurs.

IV. Proposed Method

In this paper some changes are made in old packet discarding method. Similarity is that the packets are discarded but on the basis of the rank of the packets. Some parameters of packets are decided to fix the priority along with queuing strategy with some modifications.

In a computer network, when data packets are sent out from a host, they enter in a queue where they wait for processing by the operating system. The operating system then decides which queue and which packet(s) from that queue should be processed. The order in which the operating system selects the packets to process can affect network performance. So network bandwidth is made sharable between different applications, users, and computers.

In queuing strategy scheduler is used to decide which queues to process and in what order. By default, Open BSD uses a First in First out (FIFO) scheduler. If the queue becomes full, and newly arriving packets are dropped. This is known as tail-drop.

Open BSD supports two additional schedulers:

A. Class Based Queuing

Class Based Queuing (CBQ) is a queuing algorithm that divides a network connection's bandwidth among multiple queues or classes. Each queue then has traffic assigned to it based on source or destination address, port number, protocol, etc. A queue may optionally be configured to borrow bandwidth from its parent queue if the parent is being under-utilized. Queues are also given a priority such that those containing interactive traffic, such as SSH, can have their packets processed ahead of queues containing bulk traffic, such as FTP [8].

B. Priority Queuing

Priority Queuing (PRIQ) assigns multiple queues to a network interface with each queue being given a priority level. A queue with a higher priority is *always* processed ahead of a queue with a lower priority. If two or more queues are assigned same priority, then those queues are processed in a round-robin fashion.

The queuing structure in PRIQ is flat one cannot define queues within queues. The root queue is defined, which sets the total amount of bandwidth that is available, and then sub queues are defined under the root [8].

V. Comparison

There are many congestion control methods like Pre-allocation of buffers, Leaky bucket, Token bucket, Isarithmic Congestion Control, Flow Control, and Choke Packets etc.

In Pre-allocation of buffers method buffers are reserved before communication by Terminals so the chances of congestion are negligible. But this method has a major disadvantage i.e. it requires large number of buffers which make it very costly. If the buffer is idle for too long, it is very difficult to release it and then to reacquire it when the next packet arrives which makes it a time consuming method.

In Isarithmic Congestion Control congestion is controlled to limit the packets in to the subnet. In subnet packets are known as Permits due to which they exist for limited time period, and each subnet is assigned with number of permits they are allowed to entertain. These rules ensure that the number of packets in the subnet will never exceed permitted

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limit initially assigned. This method ensures that the subnet as a whole will never become congested but it does not ensure that the IMP will not suddenly be swamped with packets. Another drawback of it is distribution of permits because no algorithm is design for distribution of permits.

Choke packet is based on avoidance scheme. In this scheme IMP continuously checks the threshold value, and whenever value moves above threshold IMP generates a choke packet to source host to control the flow of packets. In the whole process finally congestion is controlled by source \which is time consuming. If source does not receive any choke packet due to any reason or it may be lost then congestion will occur.

In Flow control, Leaky Bucket and Token Bucket methods are handled by terminals not by IMPs. In all three methods if terminals generate the packets in bulk then it is simply discarded. These all methods are very restrictive which makes these methods time consuming.

Table I: Comparison between different congestion control methods

Properties → Algorithms ↓	Re-transmission rate	Reliab-ility	Ability to control congestion on IMPs
Pre allocation of Buffers	Medium	High	No
Flow Control	Medium	High	No
Isarithmic Congestion Control	Medium	High	Yes
Load Shedding/ Discarding Packets	High	Less	Yes
Leaky Bucket	Less	Less	No
Token Bucket	Less	Less	No
Choke Packets	High	Less	Yes

Table II: Comparison between different congestion control methods

Properties → Algorithms ↓	Connection Oriented/ Connecti o- nless	Bandwidth utilization	Packets drop rate in high packets density
Pre allocation of Buffers	Connection Oriented	Less	High in Network
Flow Control	Connection Oriented	average	High in Network
Isarithmic Congestion Control	Connection Oriented	average	High in Network
Load Shedding/Discarding Packets	Connectionless	More as compare to Connection Oriented	High in Network
Leaky Bucket	Connectionless	average	High in Network
Token Bucket	Connectionless	average	High in Network
Choke Packets	Connectionless	average	High in Network

Table III: Comparison between different congestion control methods

Properties → Algorithms ↓	Extra Resources Reservation	Extra Time	Delay	Cost	Incoming Packets Limita-tions
Pre alloca-tion of Buffers	Yes	Yes	More	Expensive	Yes
Flow Control	No	No	More	Expensive	Yes
Isarithmic Congestion Control	Yes	Yes	More	Expensive	Yes
Load Shedding/ Discarding Packets	No	No	More	Less Expensive	No
Leaky Bucket	Yes	No	More	Expensive	Yes
Token Bucket	Yes	Yes	More	Expensive	Yes
Choke Packets	No	Yes	More	Less Expensive	Yes

In all the above discussed methods there is a common problem i.e. their implementation is difficult in comparison to Packet Discarding method. In all the above methods congestion is handled by terminals so time requirement is more for congestion control but in packet discarding the IMP itself decide to discard the packet so it overcomes of congestion quickly as compare to other methods. Table I, II, III shows the comparison between different congestion control methods.

VI. Conclusion

In this paper various congestion control mechanism are discussed and it is found that all the method lacks in proper functioning in one or another aspect because in each method congestion is controlled by the Terminals. In network packets are introduced from different sources so it becomes very difficult to handle congestion by terminals. This paper proposes Packet Discarding method that discards packet by self evaluation of priority by taking some parameter as input that have been discussed above.

VII. Future Work

Future work will be developing a system that will discard packet on the basis of its properties. This approach might result in better bandwidth utilization and the system can be called genetic based packet discarding system.

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