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Network based Packet Transmission Congestion Control Using Enhanced Leaky Bucket Index Algorithm

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Abstract:- In this research paper, congestion control in the network node packet transmission is presented. It is increasing immensely due to the growth of usage of application. It leads to unresponsive and misbehaving congestion flows. There are few primitive scheduling schemes to control the congestion in the network node, which worked only at end-to-end network due which they were unable to prevent the congestion collapse and unfairness created by applications. The existing algorithm for packet transmission is similar to switch based algorithm for packet transmission. Whenever the number of packet increases from one node to another node, it creates congestion control situation. To overcome the existing problems and improvements to make a more flexible solution for building a congestion control scheme in network using Enhanced Leaky Bucket Index Algorithm. The proposed Enhanced Leaky Bucket Index Algorithm receives much number of packets from the node and is able to travel the node due to packets regulations. The proposed algorithm calculates the total packet transmission. The proposed algorithm shows the packet switching and congestion control mechanisms in the network node to detect and restrict unresponsive congestion flows before they enter into the network node, thereby preventing congestion within the network node. Finally, the existing method and the proposed method is compared to regulate the overall packet transmission.

Keywords:- *FIFO, Queuing, Bandwidth, Throughput, Congestion Detection.*

I. INTRODUCTION

Congestion control research work is motivated by the performance of the packet transmission and to control the congestion mechanism at the network node that connected through the subnet in the packet switched network. Many packet switching is running around the world and to transmit the billions of the packet everyday through the network. The Internet plays a major role of a global infrastructure for the information exchange. It performs not only how to build the network node and uses to control the congestion while the packet are passing the node through the link of the network in the packet switched networks.

A situation which performance of the packet transmission degrades in a subnet is called as congestion [1]. The number of packets delivered is proportional to the number of packets received. But if traffic increases too much, routers are no longer able to handle all the traffic [9] and packets will get lost.

At each node, the packet is received, stored briefly and passed on to the next node according to the header information and other criteria, such as traffic congestion, error conditions, the shortest end-to-end path, etc., until it reaches to the destination. At the destination, packets are assembled as a logical message for the presentment to the end user.

➢ *Advantages of Packet Switching*

- The alternative routing scheme improves the reliability of the network.
- Special packet switching computers and algorithms can be designed to minimise delay between end users.
- The technology can use the existing telephone network for the path, therefore provided a value-added service for the end user.
- Packets containing a portion of user data are more secure than a complete message.

Congestion Control refers to the collections of techniques used to limits the impacts of periods of congestion on network performance. An important issue that is used in the packet switched networks is Congestion. It may occur if the load on the network (i.e. the number of packet sent to the network) is greater than the capacity of the network (i.e. the number of a packets a network can handle).

It refers to the mechanisms and techniques to control the congestion and keep below the capacity.

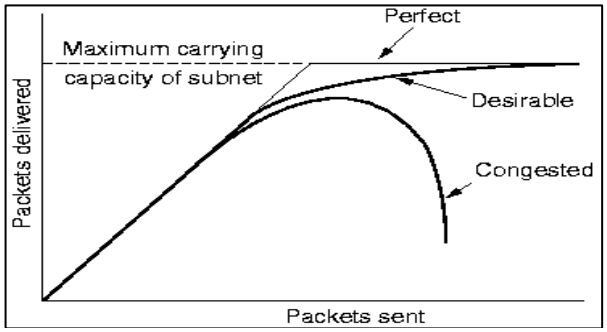

Fig 1:- Concept of Congestion

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Congestion control is an interface and is concerned with how hosts and network interacts. This causes the switches or links to become free traffic. Whenever a traffic surge exceeds the limit, it will congest the network, and bring about undesirable consequences: creating long transfer delays, causing packet losses, or even blocking up the path of the node that are not available for passing through the network node. It is to regulate and to avoid congestion collapse

Congestion Control mechanism is used to design the network and to perform the packet transmission by the metric calculation through the simulation experiment.

In summary, the following characteristics distinguish the packet switched network from other systems:

- It is usually to connect and supports a diverse set of nodes that are connected with the end system through the network.
- It may contain the measurement of the packet transmission which can be measured the burst length, delay time of the transmission, packet and link transmission delay of the packets in a network.
- It may contain the incoming and outgoing packet rate of the packets can be measured to regulate the flow of packets.

This research is considered the design and analysis of congestion control system for packet switched networks. Packet Switching network [2] is a technology is used for the purpose for the data transmission over the network. And it is also based on the congestion control and the resource management of the network.

II. LITERATURE REVIEW

In Literature review, the problem of Congestion has been studied widely in the context of high speed network, wireless network etc. The following are the review of the Literature that is related to my research work.

Year	Paper Title	Approach	Measure of congestion	Performance Metrics of the congestion
2008	A robust proportional controller for AQM based on optimized second-order system model	AOPC (control theoretic)	Queue length+packet loss ratio	responsiveness, best tradeoff between utilization and delay, convergence rate, queue oscillations, robustness
2009	Effective RED: An algorithm to improve RED's performance by reducing packet loss rate	Effective-RED (heuristic)	Queue length (both instantaneous + average)	throughput, packet drops, fully compatible with RED, easily upgrade/replace the existing RED
2011	Active Queue Management for Flow Fairness and Stable Queue Length(fairness-enforcing AQM)	P-AQM	Input rate + loss rate	Fairness (intra/inter), stable queue.
2011	Design of optimal Active Queue Management controllers for HSTCP in large bandwidth-delay product networks (HSTCP-H2 controller)	HSTCP-H2(control theoretic)	Queue length input rate	good put , intra protocol fairness
2013	A robust active queue management scheme for network congestion control	RC (control theoretic)	robustness, queue stability	

Table 1:- Existing Literature Survey Table

III. THEORETICAL FOUNDATION

A. Function of Leaky Bucket Procedure

A function of Leaky Bucket Procedure is used for the flow of the packets using the queue to regulate the output. An input variable packet is entered into the queue and it is used for FIFO queueing [5] process as to enter the first packet to deliver the packet.

The queue is used for the packet queueing for the purpose of the regular output rate or fixed rate as a packet transmission of the network. A Leaky Bucket Procedure is used the function of the FIFO queueing is process is to regulate the fixed rate of the packet.

B. Flowchart for Leaky Bucket Algorithm

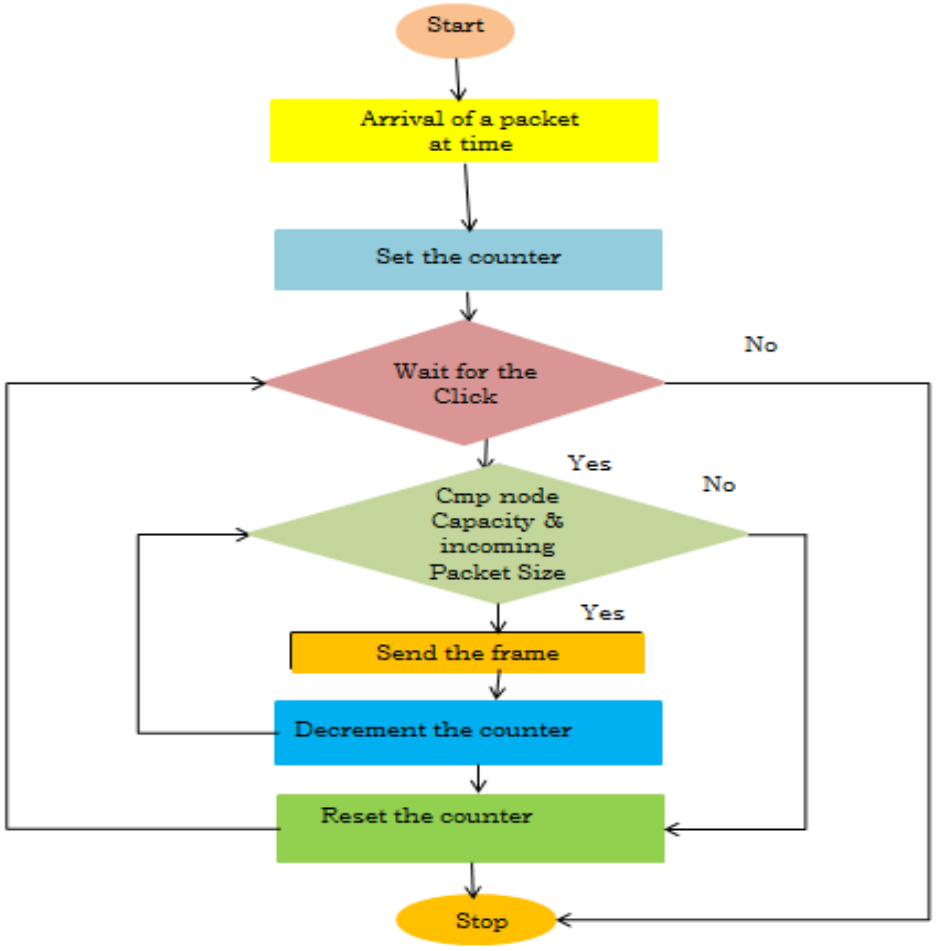

Fig 2:- Flowchart

C. Function of Leaky Bucket Algorithm

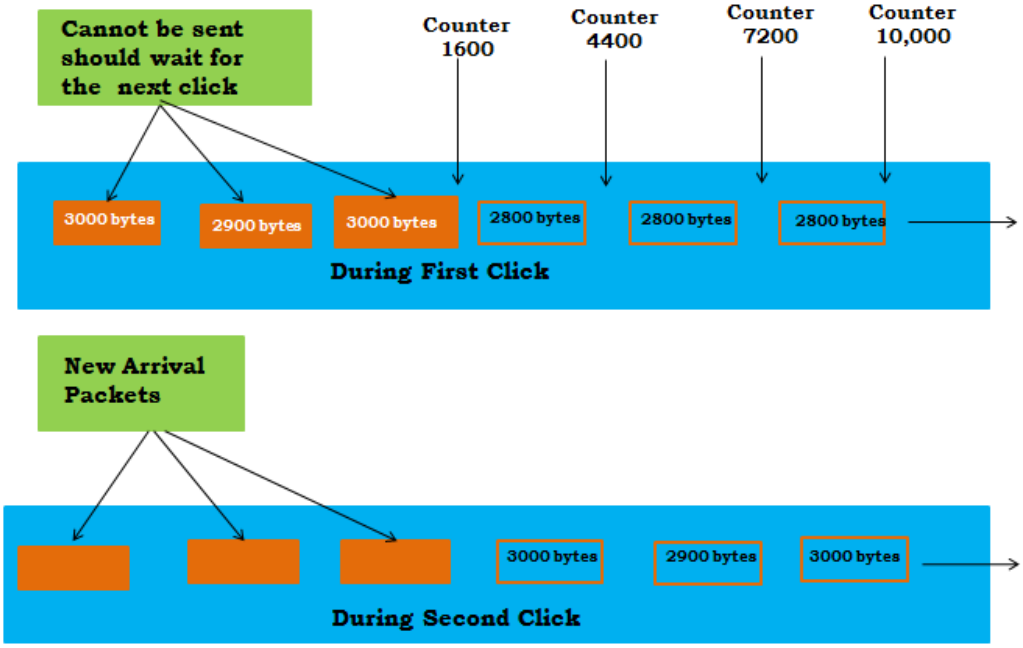

Fig 3

D. Existing Leaky Bucket Algorithm

- *Input :Variable/packet size with unregulated flow*
- *Output :Fixed size packet with regulated speed rate*

- ***Step 1 :*** *Consider large size internal buffer as a bucket (water)*
- ***Step 2 :*** *If the buffer is empty, no output*
- ***Step 3 :*** *If the buffer is full, outflow is at a constant rate ρ*
- ***Step 4 :*** *If additional packet entering,the packet is discarded or stored under the safe*
- ***Step5 :*** *Each host is connected to the network by the interface containing leaky bucket a finite internal queue*
- ***Step 6 :*** *If variable sized packets are used,convert fixed number of bytes per click*
- ***Step 7 :*** *If a packet arrives and it checks whether a room on the queue or not*
- ***Step 8 :*** *If room is available,arrival packet is entered into FIFO queuing Else Packet is stored temporary buffer and transmission stops until the next click*
- ***Step 9 :*** *Repeat step 2 to step 8 until all the transmission is over on the network*
- ***Step 10 :*** *Stop*

E. Enhanced Leaky Bucket Algorithm Using Index Management

- *Input : Get Variable size packets from user through host computer*
- *Output : Release one packet based on the index which is generated by clock at the rate of every Δt*

- ***Step 1 :*** *Host computer or any node gets variable size packets from source*
- ***Step 2 :*** *Access all packets for 't' time*
- ***Step 3 :*** *Calculate Total packets and its maximum size*
- ***Step 4 :*** *Generate Index by clock at the rate of every Δt time and store Index counter*
- ***Step 5 :*** *Counter is incremented by one every Δt and decrement one whenever packet is sent*
- ***Step 6 :*** *Check whether Index counter is possible or not*
- ***Step 7 :*** *If possible,send a packet from bucket and destroy one Index Else Wait for Index generation or packet arrival*
- ***Step 8 :*** *Repeat Step 6- Step 7 until last Index*
- ***Step 9 :*** *Stop*

IV. EXPERIMENTAL RESULTS

In this section the goals of the congestion control experiments; the network model used for the test, the test plan, and then presents the congestion control results. Details of the congestion control construction and congestion control experience will not be mentioned unless they are relevant to the experimental results.

- *Network Modeling*

A simple model of a network is designed with the nodes, links and the users of the end systems in the subnet for the packet transmission. The network model consists of 8 nodes connected with the links and the 4 end system is connected in the subnet to transmit the packets of the source through the links. The source system is store and forwards the packets to the node that are connected with the system in the subnet.

Let us consider
X Y, Z, and R ⟶ End system
A, B, C, D, E, F, G, H ⟶ Nodes name

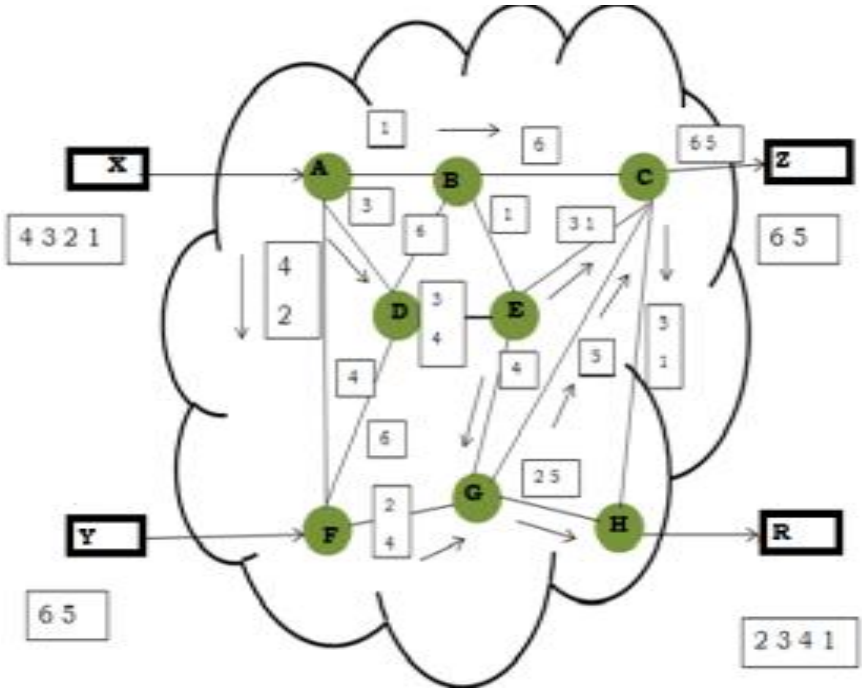

Fig 4:- A Simple Network Modeling

➢ *Packet number and the Packet Size Nodes number and its Capacity*

Packet Number	Packet Size(bytes)
1	10242
2	24586
3	45861
4	78423
5	36485
6	89032

Table 2

Node Number	Node Capacity (Bytes)
A	10244
B	20483
C	52382
D	34316
E	78424
F	98027
G	48663
H	64982

Table 3

The result of the measurement on the simple network modeling of the packet transmission is following below the table,

➢ *Packet Transmission between the Nodes*

During Click Set	From Source Node	Sink Node	Total no of packets	Packet Id	Total no of Packet Size(Bytes)	Start Time (msec)	Arrival Time (msec)	Transmission Time (msec)	Delay Time (msec)
1	X	A	4	1,2,3,4	159112	10.00	10.15	0.15	10.30
2	A	B	1	1	10242	12.30	12.42	0.12	0.27
2	A	D	1	3	45861	12.30	12.59	0.29	0.41
2	A	F	2	4,2	103009	12.30	12.60	0.30	0.59
3	B	C	1	6	89032	13.80	15.98	2.18	2.48
3	B	E	1	1	10242	13.80	14.45	0.65	2.83
4	D	E	2	3,4	124284	12.86	13.94	1.08	1.73
4	F	D	2	4,6	167455	14.72	16.35	1.63	2.71
4	F	G	2	2,5	61071	14.72	15.67	0.95	2.58
5	G	H	2	2,5	61071	15.30	17.64	2.34	3.29
5	G	C	1	5	36485	17.30	17.75	0.45	2.79
5	C	H	2	3,1	56103	16.72	18.78	2.06	2.51
5	C	Z	2	6,5	125517	16.12	18.61	2.49	4.55
6	E	C	2	3,1	56103	12.78	15.86	3.08	5.57
6	E	G	1	4	78423	12.78	15.76	2.98	6.06
7	H	R	4	2,3,4,1	159112	12.89	13.78	0.89	3.87

Table 4

Similarly, Y End system can be generated with the help of above transmission calculation.

➢ *Comparison between Existing and Proposed System*

The comparison of the existing and proposed algorithm is to differentiate with the parameters is to prove the proposed algorithm is the best way to transmit the packet transmission to control the congestion problem in the network.

Parameters	Existing Leaky Bucket Algorithm	Proposed Index Bucket Algorithm
Variable Packet Size(MB/sec)	25	32
Accessing Rate(MB/sec)	2	4
Delay Time(msec)	500	700
Uniform Output Rate(MB/sec)	2	1
Transmission Time(msec)	5	3

Table 5

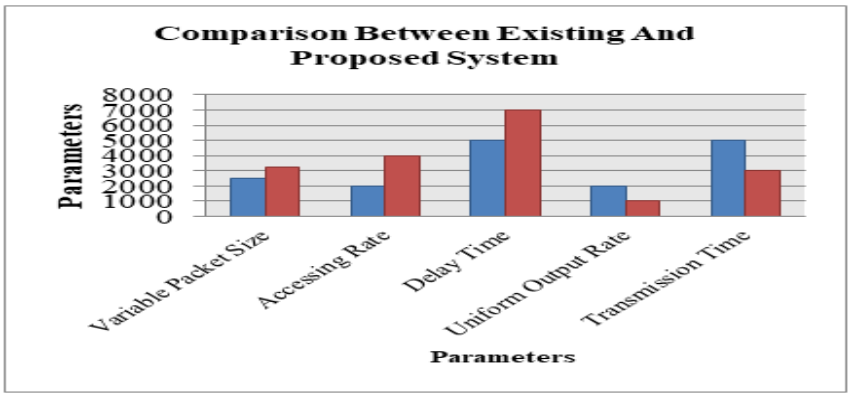

Fig 5

In figure, the comparison of existing and proposed system is represent the proposed system. From the above chart the proposed system is efficient to use in the system to control the congestion in the network.

V. CONCLUSION

In the network transmission, a node receives a packet beyond its storage capacity, some packets may be discarded. Congestion avoidance procedures are used at the onset of congestion to minimize the effect of the network.

In the proposed research work, Enhanced Leaky Bucket Index Algorithm is implemented to regulate the packet flow. The proposed algorithm receives the variable size packets so that packet transmissions smooth flow.

By using the Leaky Bucket Index Algorithm, it is used to overcome the existing problem. It is also to prevent the congestion problem in the packet switching. In the proposed work, the metric calculation of the packet transmission is done in the network to avoid and control the congestion that occurs in the network .The techniques are to regulate the packets to flow in the network using FIFO Queuing, and the Enhanced Leaky Bucket Index procedure is also used to avoid and to control the congestion to remove the overflow the packet transmission of the switch that are connected with the network.

The proposed Enhanced Leaky Bucket Index Algorithm is used in the network and transport layer to implement the congestion control in the standard protocols of the packet transmission.

FUTURE ENHANCEMENTS

By concluding with the research work, the congestion is avoided in the network at the time of the packet transmission. In the future enhancement, proposed algorithm is used to enhance the research work in future project work.

The following factors are used to enhance the research work. They are

- ✓ To improve the simulations is need to be conducted to investigate further to find whether there are scenarios in which unfairness occurs while, overall network performance characteristics are encouraging, more attention needs to be given to the performance of individual flows and how they compete on congested links.
- ✓ It is to be sense the link bandwidth to perform the particular target bandwidth, it's automatically tune itself for different bandwidth. This tuning will be probably being a function of the packet size and current transmission rate.
- ✓ To be the rate adjustment strategies, self-adjusting schemes based on the effective to integrate the congestion control for reliable to use the transfer protocol.
- ✓ To calculate the performance measurement parameters of considered network

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