Congestion Control Algorithm: A Survey

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Abstract: **A computer network is a group of computers interconnected to share the resources. When the offered load approaches the carrying capacity burst of traffic occasionally fill up the buffers inside routers and thus network congestion occurs here. So we must control the congestion. A congestion control is the state of occurring in network layer when the message traffic is so heavy it slows down network response time. To overcome the traffic occurred by the congestion we have different algorithms and techniques. In this paper we are going to discuss about the survey of major congestion control mechanisms, characteristics and their algorithms.**

Keywords: **Congestion, traffic, communication, network**

1. Introduction

The computer network is a digital telecommunication network which is the collection of autonomous computers interconnected by a single technology which allows nodes to share resources in the computer network, computing devices exchange data with each other using connection between nodes. These connections are established over cable media such as wires or optic cables or wireless media such as Wi-Fi. The advantage of network is that file can be easily shared between the users. Network users can communicate by mail and instant messages. The disadvantage of network is it lacks independent, it possesses security difficulty, it lacks robustness, it allows for more presence of computer viruses and malware. Its light policing usage promotes negative acts and it requires an expensive setup. An amount of data moving across the network at a given point of time is known as network traffic. Network data is mostly encapsulated in the network package which provide load in the network. The network congestion is data networking and queuing theory is the reduced quality of service that occurs when a network node or link is carrying more data than it can handle. Network use congestion control algorithms and congestion control technique to avoid collapse. Load balancing is a technique of disturbing the user request over a network when your server is maximum out the CPU\disk\database IO rate. In load balancing setup clients send their request to the IP address of a virtual server configured on the net scalar application. The algorithms already used in the congestion control are leaky bucket algorithm and token bucket algorithm.

A. Congestion control

Congestion control modulates traffic entry into a telecommunication network in order to avoid collapse resulting from over subscription. A consequence of congestion control is that an incremental increase in offered load leads either only to a small increase or even a decrease in network throughput. Flow control is a data link issue, and concerns only one sender outrunning a single receiver (e.g. a point to point link). Congestion control is a network layer issue, and thus concerned with what happens when there is more data in the network that can be sent with reasonable packets delays, no lost packets, etc. Many congestion control algorithms have been designed namely:

- Random Early Detection (RED)
- Back pressure and choke packet Technique,
- Implicit Congestion Signaling,
- Additive Increase and Multiplicative Decrease(AIMD)
- Explicit Congestion Notification(ECN)
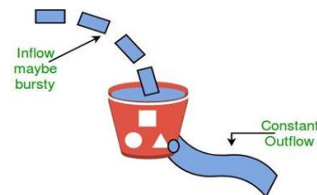- Binary Congestion Notification (BCN).

Fig. 1. Congestion control

2. Literature survey

Changdae Lim (2017). This paper is used to resolve the limitation of address based communication in TCP/IP network. An efficient congestion control technique is used. Information Centric Network (ICN) that uses content based communication is emerged and this architecture is used. As in this architecture, the data is transmitted by NDN (Named Data Network) which is used to perform by address based content pulling. To pull content, packets that contains content name are forwarded to content repositories through multi path. This data pulling based transmission is led by data receiver and existing congestion control algorithms are not enough to deal with this unfamiliar architecture. So in this paper they suggest a real performance based congestion control algorithm that can be used in NDN. Using this technique, we can act towards high performance regardless of forwarding strategy by monitoring real performance of network. Since RTT based congestion controls are vulnerable to multi path, a NACK packet is used as experimental evidence to achieved high performance. This paper has suggested congestion control algorithm which is used

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Table 1
Literature survey

S.No.	Title	Year	Author	Algorithm	Advantages	Disadvantages
1	Performance-based congestion control in information Centric network.	2017	Changdae Lim	Network performance in NDN(Named Data Networking)	To resolve mixture of packets and to achieve high performance over RTT congestion control.	There is no much support available in terms of hardware and software in CCN.
2	Congestion control mechanism in software defined network by traffic rerouting.	2018	Akash Srikanth	SDN (Software-Defined Network) architecture	Suitable in all topologies where multiple routers are required.	Can be more complex to initially implement.
3	A Survey on Congestion Control.	2010	E.Chandra	TCP-Friendly congestion Control Algorithm	To achieve higher levels of congestion control protocols and algorithms.	More research work is needed in this area.
4	Enhanced congestion control method for servers and network lines with DPI technology.	2017	Shinya Kato	DPI based congestion control(Deep Packet Inspection)	To estimate a network line more easily and resolve more rapidly in DPI technology.	It cannot detect who exactly is causing the congestion.
5	Congestion Control Techniques in a computer network.	2015	Sanjay Jamwal	Back propagation algorithms	Techniques are based on queue management and path routing.	Optimal utilization is not discussed.

by experimental network performance in NDN. The future work will be the high performance on various forwarding strategy without any modification on a NDN router.

Akash Srikanth (2018) In this paper they used SDN algorithm. This algorithm tries to minimize the load on a single link by choosing alternate paths of same length that will eventually increase the throughput of the system and also enable to extend the lifetime of the various elements used in the design. Software Defined Network (SDN) also enables the user to program the various network element. Since the congestion in the networks is caused by a heavy surge of packets at one particular region on the topology. The congestion can be avoided using the SDN framework with the shortest path algorithm where several shorter parts of similar lengths are found and the traffic is redirected based on the obtained traffic details. The congestion control mechanisms used in the design tries to find a path that will lead to a better balanced load layout for the topology. This mechanism uses the presence of the Open Daylight controller to have a holistic view of the entire topology to control various aspects including pushing the flows and taking routing decisions. The presence of REST API's enables us to obtain operational decisions. The mininet environment provides us with the required simulation details. The various results obtained give us the proof that the transfer throughput and the bandwidth has increased to a good extent by using the algorithm. The ways of combining the software defined approach with the could structure could be vital in allowing us to use the various congestion control features and also helping the cloud servers and business organizations that use them. This could be looked upon as a potential future work of the congestion control mechanism discussed.

E. Chandra (2010). In this paper TCP algorithm is used. A computer can be connected to the network either by both wired and wireless communications, internet are being designed for fast transmission of large amounts of data, for which Congestion Control is very important. In order to avoid congestion, collapse the in the network while transferring the

data, some congestion control mechanisms are suggested in this paper. Its a challenge for transferring a streamed data in the network. This test has inspired the analysts in the course of the most recent decade to build up various clog control conventions and systems that suit the traffic and gives reasonable upkeep to both unicast and multicast interchanges. The congestion control mechanisms used in the design tries find a path that will lead to a better balanced load layout for the topology. The algorithm tries to minimize the load on a single link by choosing alternate paths of same length that will eventually increase the throughput of the system and also enable to extend the lifetime of the various elements used in the design. This paper also gives a survey of major congestion control algorithms and its mechanisms, its characteristics and also it tells about TCP-friendliness designed for network. The paper points the advantages and disadvantages of the congestion control mechanism, and evaluates their characteristics. It is also possible in future network architectures will agree to or necessitate different definitions of fairness. Likewise, the reasonableness definitions for multicast and numerous strategies are as yet subject to inquire about.

Shinya Kato (2017) This paper proposes to enhance the existing DPI-based congestion control. This paper could simplify the conventional work load for system management and accelerate the control action by using the Deep Packet Inspection (DPI) equipment. This paper uses a congestion control method, that uses a DPI device installed in a network to estimate overload conditions of servers or network links and, also in detecting an overload condition. This algorithm resolves congestion by moving some virtual machines to other servers or rerouting some communication flows. In order to select a solution optimal for the current conditions for cases where there are multiple candidates. The paper uses the server congestion for cases where computing power congestion and bandwidth congestion occur simultaneously in a server. Link congestion for cases where the maximum allowable network delay of each communication flow is taken into consideration. Finally, the

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feasibility of the proposed methods is demonstrated by using an evaluation system with real DPI equipment. In the future it will be necessary to study a virtual machine moving method that simultaneously takes the bandwidth usage rate and network quality of each route into consideration. It will be also necessary to study how to determine the optimal control parameter values.

Mirza Wareem Hussian (2015). This paper is based on the survey of the congestion control techniques in the computer network. Congestion is caused due to the increase in the traffic on the internet. Several congestion techniques have been proposed. In this paper the summary of several congestion and methods over the years has been discussed. One the latest approaches to control the congestion is based on neutral network is also included in this paper. The neutral network can be used to predict the congestion in the network before the quality of service degrades. The neural network system is divided into sub neural network to deduce the complexity of the system and to enhance the computational capabilities by making the sub parts to work in parallel. In this paper the techniques for the congestion control are generally based on queue manage and path routing. A few conventions have been formulated to control the blockage with the progression of time, it was discovered that some clever methods are required to take care of this issue of clog. Therefore, to solve this problem one of the approach is neutral network, due to high computational nature. In the future we will use the neutral network for finding the best route from source to destination in the network. The ultimate goal of congestion control is to make optimal utilization of network resources. Therefore, congestion must be avoided an it leads to degrade in the performance of the network.

3. Conclusion

In this paper, we presented a survey on current trends and advancements in the area of congestion control and its mechanics. High traffic in websites, servers are quite common these days because of the fast developing world. So in order to avoid collapse Congestion control modulates traffic entry into a telecommunication network, resulting from over subscription which will be further proven that the congestion is reduced. Here we have discussed about congestion control mechanics and its algorithm in detail and also did a literature survey on various congestion control algorithms and comparison table. The table shows that many algorithms have equal disadvantages. We have also discussed the necessity for traffic and multicast communication and thus provided an overview of the design space for such congestion control mechanisms. So our future work is to discover an efficient congestion control algorithm which avoids all those mentions disadvantages.

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