

Performance Evaluation of Fuzzy based Congestion Control for TCP/IP Networks

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Abstract: It by and large acknowledged that the trouble of system congestion control stays a basic issue and a high need, particularly given the developing size, request, and speed (transfer speed) of the inexorably coordinated administrations systems. In spite of the examination endeavors spreading over several decades and accordingly the sizable measure of different plans proposed, there are no generally worthy control arrangements. Current arrangements in existing systems are progressively getting insufficient, and it's commonly acknowledged that these arrangements can only with significant effort extent even with different proposed "fixes". In this paper, a Fuzzy based congestion control is talked about to manage the congestion control issue. The exhibition of the controlled framework is assessed by means of reenactment.

Keywords: Congestion, distributed network, Fuzzy Logic, QoS.

1. Introduction

Congestion is a significant issue in a router based exchange system. Congestion during a system or internetwork happens in light of the fact that switches and switches have lines supports that hold the bundles when handling. Thus it are frequently seen that congestion is anything but a static asset stockpiling issue, yet rather a unique asset distribution issue. Congestion control alludes to the component and systems to manage the blockage and keep the heap underneath the limit. There's an intrinsic fuzzyness during a system framework since it might be a huge dispersed complex framework, with troublesome regularly profoundly non direct, time changing and riotous conduct thus emblematic rationale controllers (FLCs) might be seen as option in contrast to the typical procedures of blockage control [1].

Traditional models typically endeavor to keep away from dubious, loose or questionable data. Fuzzy frameworks, on other hand, intentionally utilize this sort of information which brings about less complex, progressively appropriate models, which are simpler to deal with and are

increasingly commonplace to populace. Structuring a FLC includes determination of reasonable numerical portrayals for t-standard, s-standard, de-fuzzification administrators, fuzzy ramifications capacities, and states of participation capacities among an upscale arrangement of competitors. The significant parameters changing which one can achieve clog control are by presenting delay between the parcels, expanding transmission capacity and by expanding line length.

2. Switching networks

Congestion is an important issue that can arise in any switched network. Hence it becomes essential to discuss about various types of switching networks before proceeding congestion control methods. Figure 1 shows a typical network structure and the network may consists any of the following. In this case either Circuit switching or Packet switching is used to establish end to end communication

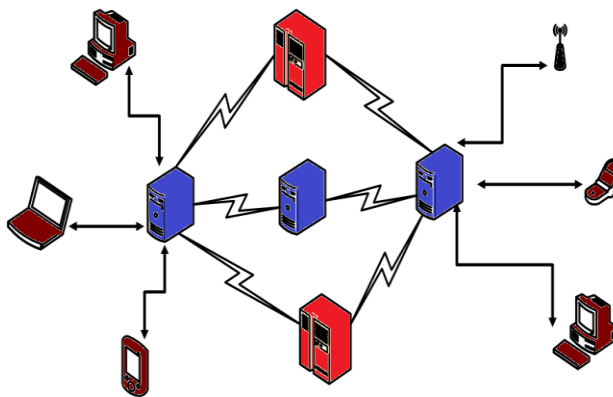


Figure 1. Block Diagram of a typical network structure

2.1 Circuit switching

In circuit switching networks, a fanatical path is established between two stations for communication. it's developed to handle voice traffic but it also can handle digital data. However, handling digital data using circuit switching generally proves inefficient. In circuit switching the routing decision is formed when the trail is about up across the network. After the link has been set between the sender (caller) and therefore the receiver, the knowledge is forwarded continuously over the link. After the link has been found out no addition address information about the receiver or caller/sender is required.

The circuit switched networks operate in three phases viz setup phase, Data transfer phase and Tear down phase. Due to the allocation of resources during the entire duration of the

connection, the efficiency of circuit switched networks is lower than the other two types of the switching [1].

2.2 Packet switching

In packet switching, messages are chopped into packets, each of which incorporates a header with source, destination and intermediate node address information. Individual packets take different routes to succeed in the destination. Due to this one can observe two major advantages: the bandwidth is reduced by splitting onto different routes in a busy circuit and if a certain link in the network goes down during the transmission, the remaining packets can be sent through another route. In packet switching, the packet length is restricted to a maximum length. This length is brief enough to permit the switching devices to store the packet data in memory without writing any of it to disk. [1]

3. Literature survey

Congestion may be a situation in Communication Networks during which too many packets are present in a part of the subnet, performance degrades. Congestion during a network may occur when the load on the network (i.e. the amount of packets sent to the network) is larger than the capacity of the network (i.e. the amount of packets a network can handle.)

Different causes to occur congestion in any network may facing any of the situation listed.

If at a sudden, a stream of packet start arriving on three or four input lines and all need the same output line. This results in a queue overflow and congestion may occur. The other cause is the routers which routes packets are too slow to perform book keeping tasks or its buffer is too limited. Congestion is also caused by slow links or if multiple transmissions of packets present in the network will force the congestion to take place [2-4].

In the research carried out C. Chrysostomou and A. Pitsillides discussed about a new AQM scheme namely Fuzzy Explicit Marking (FEM)[2] which provides congestion control in TCP/IP best-effort networks using a fuzzy logic control approach. Whereas Chung-Ju Chang and Ray-Guang Cheng applied the fuzzy set theory and proposed a fuzzy traffic controller to deal with the traffic control problem in an ATM network [5] . The principle disadvantage of these congestion control strategies is that a fitting and sensible model, which precisely portrays the framework conduct, is hard to be investigated and the diagnostic outcomes have the issue of computational obstinacy. Abualhaj Mosleh, Adel Ahmad and Tahrawi Mayy focused on congestion due to increase in delay and packet loss [6]. In this paper, they discussed about a unique method namely fuzzy logic random early detection (FLRED), which extends RED by integrating fuzzy logic to overcome congestion.

4. Overview of The Proposed Algorithm

A system framework might be a huge circulated complex framework, with troublesome frequently exceptionally non-direct, time differing and turbulent conduct. there's an inborn

fuzziness inside the meaning of the controls (pronounced destinations and host). Estimations on the condition of the system are deficient, frequently moderately poor and time postponed. Its sheer numerical size and geographic spread are incredible. for example, clients (dynamic administrations) inside the 10s of millions, organize components inside the 100s of million, and worldwide inclusion.

Along these lines, in planning the system framework, an organized methodology is significant. the typical procedures of traffic designing, lining analysis, choice hypothesis, and so on ought to be enhanced with a spread of novel control strategies, including (nonlinear) unique frameworks, computational insight and canny control (versatile control, learning models, neural systems, fuzzy frameworks, transformative/hereditary calculations), and artificial knowledge.

Fuzzy Logic Controllers (FLCs) could likewise be seen as option, non-customary method for structuring input controllers where it's helpful and compelling to make an effect calculation without relying on formal models of the controlled framework and control theoretic instruments. The control calculation will be embodied as a gathering of realistic standards. FLCs will be applied to the undertaking of controlling frameworks that diagnostic models aren't effectively reachable or the model itself, if accessible, is simply excessively mind boggling and exceptionally nonlinear.

For the most part, to characterize the etymological standards of a fuzzy variable, Gaussian like, triangular or trapezoidal molded enrollment capacities are utilized. Determination of Gaussian like enrollment capacities brings about smoother control surfaces. At that point, the standard base is alright tuned by watching the advancement of recreation, similar to cell misfortune events and request versus throughput bends. The tuning are regularly through in view of various targets. for example, any addition in throughput must be exchanged off by a potential increment inside the defer experienced at the terminal lines. Be that as it may, since the tuning of the fuzzy standards is natural, and might be connected in straightforward semantic terms with client's understanding, it ought to be a simple intrigue accomplish a proper harmony between a middle of the road start to finish delay, and in this way the expansion in throughput. Then again a versatile emblematic rationale control technique are frequently utilized which may tune the parameters of the representative rationale controller on line, utilizing estimations from the framework. Figure 2 shows a basic structure of proposed work.

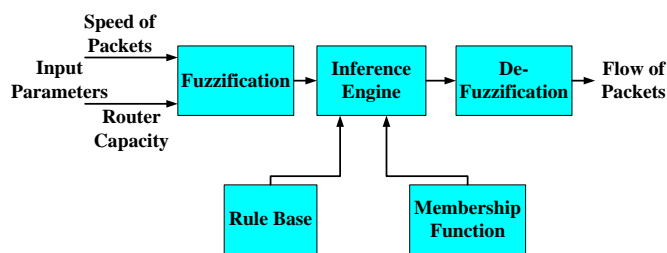


Figure 2. Block Diagram of proposed algorithm

As shown in figure 2, the proposed algorithm is implemented with the help of different blocks viz fuzzifier, inference engine, membership function, rule base and defuzzifier. The data sources given are speed of packets landed at switch and limit of the switch dependent on which the progression of packets to be directed is determined. Fuzzification is the way toward changing a genuine scalar incentive into a fuzzy world. This is accomplished with the various sorts of fuzzifiers, for example, Singleton fuzzifier, Gaussian fuzzifier and Trapezoidal fuzzifier [7]. Though Defuzzification is the way toward delivering a quantifiable outcome in fuzzy rationale, given fuzzy sets and relating enrollment degrees. It is ordinarily required in fuzzy control frameworks. These will have various guidelines that change various factors into a fuzzy outcome, that is, the outcome is portrayed regarding enrollment in fuzzy sets. Here the inference engine really does the counts as per the data gave in the Fuzzification and Rule base part. It acts like the focal preparing unit utilized in the PC frameworks. inference engine procedures the client given data as indicated by the fuzzy strategy chose by the client. The choice is assumed the premise of activated fuzzy standard which are the client characterized IF-THEN sort rules. These guidelines are set by the client as indicated by his ability of the conduct of the framework in different various conditions. These principles the client can change as needs be. Enrollment capacities are utilized to graphically depict the circumstance (Fuzzification). The support limit of a fuzzy set is a theory of the pointer work in old style sets. In fuzzy basis, it addresses the degree of truth as an increase of valuation. Degrees of truth are every now and again confused with probabilities, regardless of the way that they are sensibly undeniable, in light of the fact that cushioned truth addresses interest in regrettably portrayed sets, not likelihood of some event or condition [6].

5. Performance Evaluation

The proposed system is executed in various phase of operations:

1. Network Capacity
2. Speed of packets arrived at network

5.1. Network Capacity:

In this phase (also called information gathering), as shown in figure 3, the known limit of the network / router capacity is continuously compared with number of packets arriving at the network. Based on the network capacity, its higher limit is dynamically incremented to the maximum threshold. It also monitors total number of packed arrived and placed in a queue which helps the channel to take further decision. Here based on packets in queue the number of packets sent is decided. If arrived packets are more in number and there is no place in queue, the next packet will be discarded to avoid further congestion in network

5.2. Speed of packets arrived at network:

In this phase each and every packet arriving at the network are placed in a queue and transmitted to the next hop with the help of First In First Out (FIFO) method as shown figure 4.

Based on the size of queue, it has restriction of number of packets saved in its buffer. It is a traffic shaping mechanism that controls the amount and the rate of the traffic sent to the network. If more number of packets arrived and cause a burst in traffic then it can be averaged into fixed rate data traffic. Though the rate at which packets arrived at router are not fixed, with the help of this algorithm the rate at which packets are transmitted can be controlled which reduces flooding of the packets in the network.

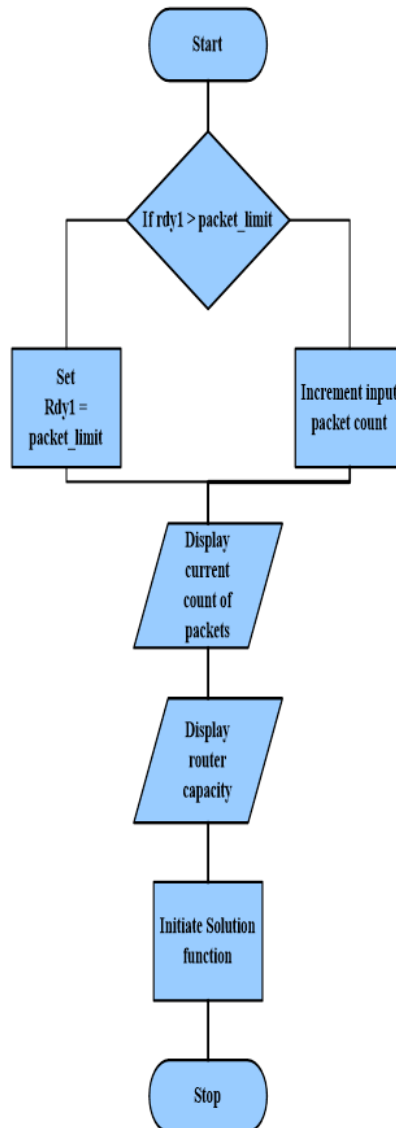


Figure 3. Calculation of Network Capacity

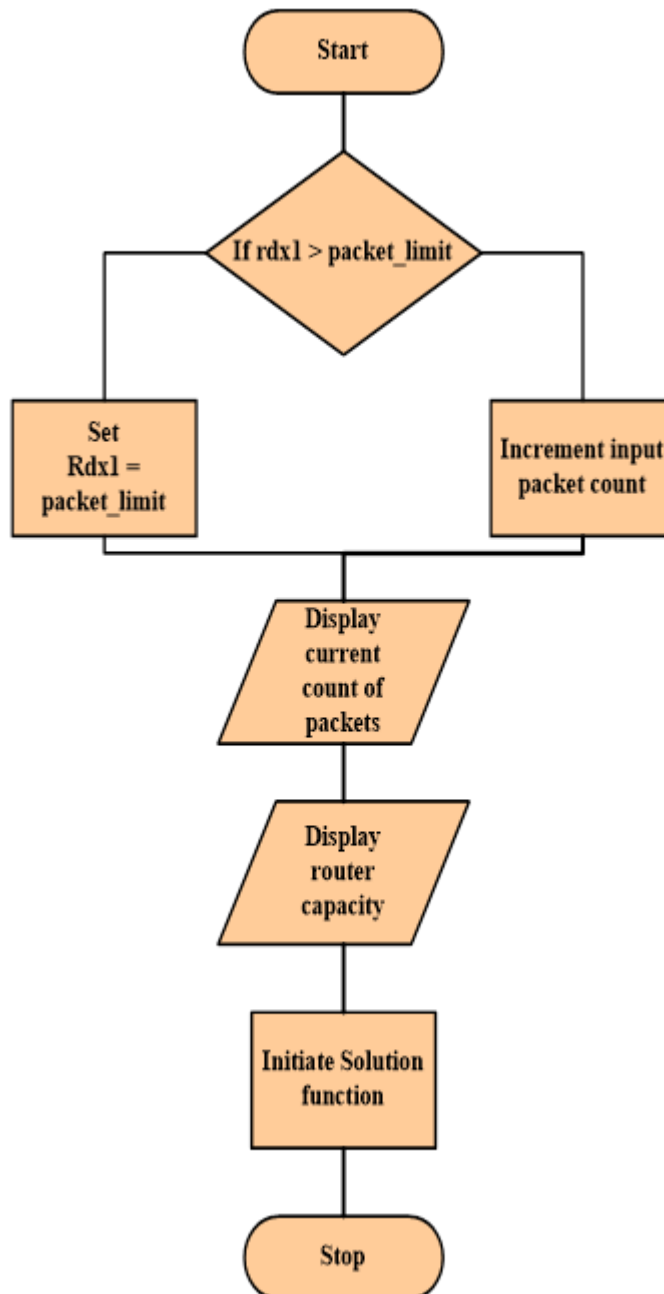


Figure 4. Calculation of Speed of Packets

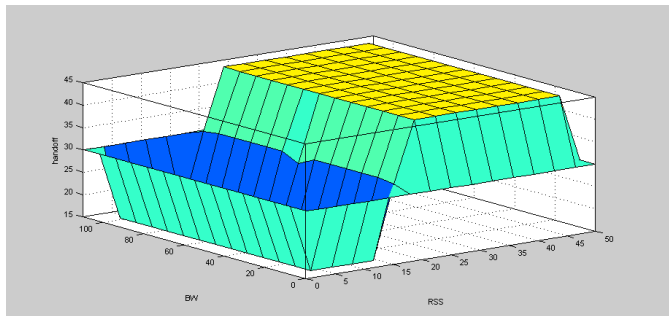


Figure 5. Simulation Results

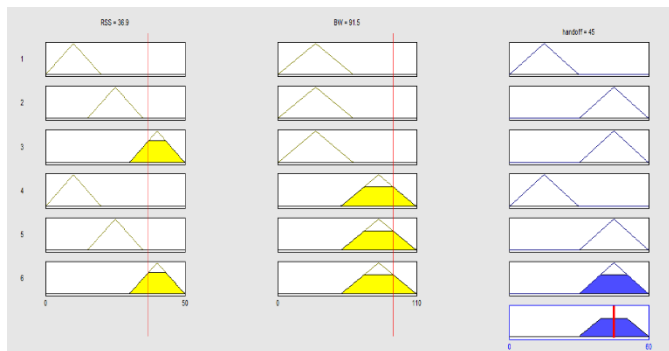


Figure 6. Membership functions

5. Conclusion

From figure 5 and Figure 6, the congestion control factor was determined using fuzzy logic. Parameters to determine it are network capacity and speed of packets. These parameters from a network model and rules are be evaluated. The output membership functions are then aggregated and the packet flow factor was calculated using de-fuzzification. It is observed that with the help of fuzzy based traffic flow controller will be a good alternative to implement various algorithm used to control flow of packets in network. The network may include go back -N, Repeat block and leaky bucket algorithms.

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Acknowledgements

The author declare that they have no conflict of interest.

Conflict of interest

The author declare that they have no conflict of interest.

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