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Intelligent Traffic Management Service for High-Speed Networks by Using Fuzzy Logic Control

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ABSTRACT:In view of the invasive web traffic, this paper propose a distributed traffic management framework, in which routers area unit deployed with intelligent rate controllers to tackle the traffic mass. in contrast to different express control protocols that ought to estimate network parameters (e.g., link latency, bottleneck information measure, packet loss rate, or the amount of flows) so as to cipher the allowed supply causing rate, our fuzzy-logic-based controller will live the router queue size directly; therefore it avoids varied potential performance issues arising from parameter estimations whereas reducing a lot of consumption of computation and memory resources in routers. As the network parameter, the queue size will be accurately monitored and accustomed proactively decide if action ought to be taken to regulate the supply causing rate, so increasing the resilience of the network to traffic jam. The communication QoS(Quality of Service) is assured by the great performances of our theme like min-max fairness and low queueing delay and good strength to network dynamics.The simulation results and comparisons are verified the effectiveness and showed that our new traffic management theme are able to do higher performances than the prevailing protocols that suppose the estimation of network parameters.

Index words: web traffic, quality of service,traffic management.

INTRODUCTION:

NETWORK traffic management will forestall a network from severe congestion and degradation in throughput delay performance. Holdup management is one in every of the effective approaches to manage the network traffic [1], [2]. Historically, protocol (Transmission management Protocol) city [3], [4] could be a wide deployed congestion management protocol that tackles the web traffic. It's the necessary feature that the network is treated as a recorder and therefore the supply adjusts its window size supported packet loss signal [5]. However, as an implicit management protocol, protocol encounters numerous performance problems (e.g., utilization, fairness and stability) once the web BDP (Bandwidth-Delay Product) continues to extend. These are wide investigated with numerous projected solutions like the AQM (Active Queue Management) schemes [6]–[10] whose management protocols also are implicit in nature. As another, a category of specific congestion management protocols has been projected to signal network traffic level more exactly by victimisation multiple bits. Examples area unit the XCP [6], RCP [11], JetMax [12] and MaxNet [13]. These protocols have their controllers reside in routers and directly feed link information back to sources so the link information measure might be expeditiously used with sensible quantifiability and stability in high BDP networks. Specifically, JetMax and MaxNet signal network congestion by providing the specified truthful rate or the maximum link worth, then the ultimate causing rate is determined by sources per some demand functions or utility functions. XCP feeds back the specified increment or decrement of the causing rate, whereas RCP directly signals sources with the admittable causing rate per that sources pace their output. The benefits of those router-assisted protocols area unit that 1) they'll expressly signal link traffic levels while not maintaining per-flow state, and 2) the sourcescan converge their causing rates to some social optimum and achieve a precise improvement objective [12]. However, most of these specific congestion management protocols got to estimate the bottleneck information measure so as to cypher the allowed source causing rate or link worth. Recent studies show that miscalculation of link information measure (e.g., in link sharing networks or wireless networks) might simply occur and might cause important fairness and stability issues [14], [15]. There area unit some latest protocols on wireless applications like QFCP (Quick Flow management Protocol) [16] and therefore the 3 protocols referred to as Blind, ErrorS and mack[17]. They need improved on the mestimation error whereas

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having high link utilization and truthful throughput. However, they still have the elemental drawback of inaccurate estimation leading to performance degradation. In addition, their information measure inquisitory speed is also too slow when the information measure jumps plenty. Also, they can not keep the queue size stable thanks to oscillations, that successively affects the stability of their causing rates. There area unit some specific protocols that seem to cypher the sending rates primarily based only on the queue size, however in reality they still ought to estimate the quantity of active flows in an exceedingly router, and this consumes central processing unit and memory resources. Examples area unit the rate-based controllers [18]–[20] for packet switch networks and the ER (Explicit Rate) allocation algorithmic rule [21] for ATM (Asynchronous Transfer Mode) networks. For the API-RCP controller [19], each the initial methodology (a truncated network model) and therefore the improved methodology [22] face a memory drawback when addressing several flows (that numbers in millions) arriving to a core router each hour [23]. In another controllers (e.g., [21]), the TBO (Target Buffer Occupancy) is designed to be as high as three times of the BDP, which can cause giant queueing delay and so degrading network performance, and this becomes even worse within the high-speed networks. traditionally, the ER allocation algorithms in ATM networks conjointly share identical issues (e.g., [21], [24]) because they have to guage the link information measure and or the numbers of active VCs (Virtual Circuits). Some others (e.g., [25]) regulate the supply causing rates in binary-feedback switches or specific feedback switches per some queue thresholds, which can cause unfairness in addition as high cell loss rate From the attitude of network and repair management, the said congestion management approaches have QoS(Quality of Service) issues therein they can't guarantee a certain level of performance beneath some things owing to design drawbacks. There square measure many alternative approaches to improve QoS. For instance, admission management, as a network traffic management approach, will guarantee QoS by checkingthe availability of network information measure before establishing a connection, e.g., [27]–[29]. Service priority as another approach can be wont to improve QoS by providing completely different service priorities to completely different users, e.g., [30]–[32]. Pricing or routing policies are found to handle QoS issues e.g., [33]–[35]. However, they're outside the scope of this paper that focuses on congestion management as associate approach to handle the QoS management drawback.FLC (Fuzzy Logic Control) [36] has been thought of forIC (Intelligence Control). it's a strategy wont to style robust systems that may traumatize the common adverse synthesizing factors like system nonlinearity, parameter uncertainty, measure and modeling inexactness [37]. In addition, mathematical logic theory provides a convenient controller design approach supported professional information that is shut to human deciding, and pronto helps engineers to model a sophisticated non-linear system. In fact, mathematical logic control has been wide applied in process management and showed extraordinary and mature management performance in accuracy, transient response, lustiness and stability [38], [39].FLC has found its applications to network congestion managementsince 1990. In early stage, it absolutely was wont to do rate management in ATM network, e.g., [40], [41], to ensure the QoS. These control algorithms square measure specific in nature, and that they depend upon absolute queue length (the most buffer size) rather than the TBO to regulate the allowed causation rate. nonetheless, these early styles have numerous shortcomings as well as cell loss (even although cell loss is employed as a congestion signal to compute the speed issue, e.g., [42]), queue size fluctuations, poor network latency, stability and low utilization. Later, FLC was employed in RED (Random Early Detection) algorithmic rule in TCP/IP networks, e.g., [43], [44], to scale back packet loss rate and improve utilization. However, they're still providing implicit or general congestion signal, and so cannot overcome the output fluctuations and conservative behaviour of TCP sources.In lightweight of the higher than review of various protocols and their shortcomings, we might prefer to style a distributed traffic management theme for the present informatics (Internet Protocol) networks (and following generation networks wherever applicable), during which routers square measure deployed with specific rate based congestion controllers. We might prefer to integrate the merits of the prevailing protocols to enhance the present specific traffic

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congestion management protocols (like XCP, RCP, APIRCP and their enhancements) and type a proactive theme based on some prudent style ideas specified the performance problems and excessive resource consumption in routers owing to estimating the network parameters may well be overcome. In this respect, a mathematical logic controller is kind of engaging owing to its capability and coming up with convenience as mentioned higher than. Specifically, the objectives of this paper are: 1) to style a new rate-based specific congestion controller supported FLC to avoid estimating link parameters like link information measure, the number of flows, packet loss and network latency, whileremaining stable and strong to network dynamics (Hence, we create this controller "intelligent"); 2) to produce max min fairness to realize an efficient information measure allocation and utilization; 3) to come up with comparatively sleek supply output, maintain an inexpensive network delay and accomplish stable noise performance by dominant the queue size; 4) to demonstrate our controller incorporates a higher QoS performance through case study.To achieve the higher than objectives, our new theme paysattention to the subsequent methodologies further because the deservesof the prevailing protocols. Firstly, so as to stay the implementation simple, like TCP, the new controller treats the network as a recording machine within the sense that queue size is that the only parameter it depends on to regulate the supply causation rate. The adoption of queue size because the distinctive congestion signal is galvanized by the planning expertise of some previous AQM controllers (e.g., RED and API-RCP) therein queue size will be accurately measured and is ready to effectively signal the onset of network congestion. Secondly, the controller retains the deserves of the prevailing rate controllers like XCP and RCP by providing specific multi-bit congestion info without having to stay per-flow state info. Thirdly, we have confidence the mathematical logic theory to style our controller to form a traffic management procedure. Finally, we'll use OPNET creator to verify the effectiveness and superiority ofour scheme.

TRAFFIC MANAGEMENT PRINCIPLE AND MODELING

We take into account a backbone network interconnected by a number of geographically distributed routers, during which hosts are connected to the access routers that work with the core routers to modify end-to-end communications. Congestion occurs once several flows traverse a router and cause its IQSize(Instantaneous Queue Size) to exceed the buffer capability, thus creating it a bottleneck within the net. Since any router may become bottleneck on associate degree end-to-end knowledge path, we would like every router to be ready to manage its traffic. Below is that the general operation principle of our new traffic management control algorithmic rule. Inside every router, our distributed traffic controller acts as a data rate regulator by activity and observation the IQSize. As per its application, each host (source) requests a causing rate it wishes by depositing a worth into a passionate field Req_rate within the packet header. This field may be updatedby any router on the way. Specifically, every router on the data path can reason associate degree allowed supply transmission rate according to the IQSize and so compare it with the speed already recorded in Req_rate field.

DESIGN PARAMETERS

From our style higher than, one will see the area unit totally different parameters that ultimately can have an effect on the performance of our traffic controller. Below area unit the discussions of some important style problems we've got old. A number of them were determined via our in depth experiments.

TBO:

From the attitude of the queueing delay, the TBO price should be as little as potential. This can be very true below the significant traffic conditions once the queue is to be stable at TBO. Therefore, a much bigger TBO can end in longer steady state queueing delay, that isn't fascinating to some net applications like the period of time video.

PERFORMANCE EVALUATION

The capability of the IntelRate controller is incontestable by performance evaluations through a series of experiments. We will 1st describe the simulated network

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and performance measures of a case study in Section A. Section B demonstrates the system hardiness upon giant network changes. Queueing noise management and therefore the impact of ephemeral traffic will be mentioned in Sections C and D. Section E evaluates the information measure utilization and packet loss rate of the IntelRate controller. Finally, Section F discusses the alternatives of some design parameters.

CONCLUSION

A novel traffic management theme, referred to as the IntelRatecontroller, has been planned to manage the web congestion in order to assure the standard of service for various service applications. The controller is intended by being attentive to the disadvantages also because the benefits of the prevailingcongestion management protocols. As a distributed operation innetworks, the IntelRate controller uses the instant queue size alone to effectively throttle the supply causation rate with max-min fairness. In contrast to the prevailing specific control protocols that doubtless suffer from performance issues or high router resource consumption as a result of the estimation of the network parameters, the IntelRate controller will overcome those elementary deficiencies. To verify the effectiveness and superiority of the IntelRate controller, in depth experiments have been conducted in OPNET creator. additionally to the feature of the FLC having the ability to showing intelligence tackle the nonlinearity of the control systems, the success of the IntelRate controller is additionally attributed to the careful style of the symbolic logic parts.

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