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CCN- Based Congestion Control Mechanism In Dynamic Networks

[1] K.Rangaswamy, [2] Dr. C.Rajabhusanam
[1] [2] Research Scholar, Dept.of CSE,BIHER,Chennai,INDIA

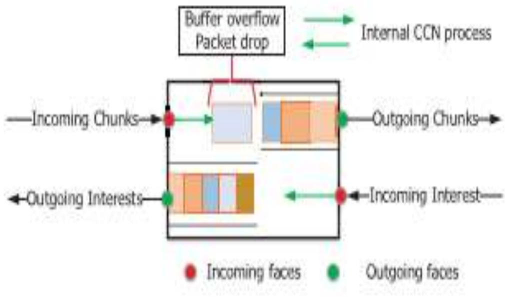
Abstract: ***The router's buffer accommodates transient packets to guarantee that the network's links do not become idle. However, buffer overflow causes packet loss, which is a signal of congestion. In content centric networking (CCN), the interest packet, which is used for requesting content, may be dropped due to such congestion. Each interest packet is assigned a specific lifetime, and when the lifetime expires without obtaining the requested content, the consumer needs to resend the Interest. However, waiting for the expiration of an Interest's lifetime for retransmission is only appropriate for best effort traffic rather than services that are delay sensitive .In order to provide delay sensitive application swith better quality of service, we propose a congestion control mechanism for CCN, in which, we prevent congestion before it happens through monitoring buffer size. Upon reaching the buffer threshold, the node notifies its downstream node. On receiving the notification, the downstream node adjusts traffic rate by allocating new incoming Interests to other face(s).However, when the downstream node fails to reduce trafficrate, the same procedure continues until the consumer node reduces sending rate. The simulation results show that the proposed mechanism is capable of significant performance improvements, with higher throughput.***

Keywords: Content centric networking (CCN), congestion control mechanism, memory-efficient token bucket, Trafficontrol.

I. INTRODUCTION

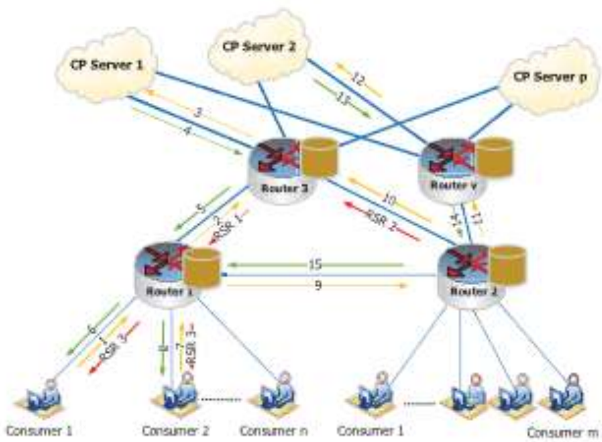
Content central Networking (CCN) is one in every of theforemost Network architectures, that considers content to be primitive within the communicative method, where content is requested and retrieved by name rather than by the specific IP address. In CCN, there area unit 2 styles of packets: the Interest packet, that is employed for requesting content, and also the information packet, conjointly referred to as Chunk, that is transmitted in response to the Interest packet within the reverse path of Interest packet. within the resultant analysis, unless otherwise explicit , we are going to sit down with information packet and Chunk interchangeably. For Interest and informationpackets forwarding, CCN uses 3 main information structures :(1) the Content Store(CS),(2) the unfinished Interest Table (PIT), (3) and also the Forwarding info Base (FIB). to urge content, client sends Interest packet. once a router receives the Interest, it checks whether or not the requested content is cached in its metallic element.If the requested content is on the market within the metallic element, the router returns the information packet to the buyer within the reverse path of the Interest packet. If the content isn't cached within the metallic element, the router checks in PIT, that contains records of Interests that are forwarded upstream and also the faces/interfaces from that the Interests area unit received from. just in case of the Interest packet for a similar content has been forwarded before, the node appends the face on that the Interest arrives to the list of faces of matched PIT entry. within the absence of any matching PIT entry, a replacement entry is made within the PIT. The router checks within the FIB, that has outgoing faces, to see wherever to forward the Interest packet.

In CCN, each Interest packet has a specific lifetime, and once the life expires whilenot getting the requested information object, the Interest is off from infernal region, and also the client must carry the Interest packet. Interest life could expire because of congestion, or its length is shorter than the network delay, etc., which ends in packet loss and retransmission. However, looking forward to the expiration of the Interest life so as to resend the Interest isn't acceptable for delay-sensitive applications that need high turnout and minimum delay. so as to produce delay-sensitive applications with higher Quality of Service (QoS), early network congestion hindrance is extremely vital in CCN. For the congestion control mode defined, in receiver driven proposals congestion detection and traffic shaping area unit administrated solely at client nodes/receivers, that have disadvantages of not considering multi-source feature of CCN. On the opposite hand, hop-by-hop proposals have the advantage of detecting congestion and adjusting traffic rate more effectively than the receiver-driven proposals, where congestion control and traffic shaping are carried out at each intermediate node. However, hop-by-hop control mechanism without receiver-driven control mechanism is not sufficient to control congestion and traffic rate accurately. to beat this challenge, hybrid congestion control approaches combine both receiver-based and hop-by-hop approaches that can be used to adjust the traffic rate more accurately than separated receiver-driven and hop-by-hop proposals. yet, in hybrid congestion management, the coordination of receiver-driven congestion management at client nodes and hop-by-hop congestion management at intermediate nodes haven't been addressed thus far in CCN.



II. SYSTEM MODEL

In this section, we describe in detail our system model established as the foundation for the proposed Congestion Control mechanism in CCN.



Content Provider (CP) Server: In our system model depicted in Fig. 2, we consider P = {1,...,P} as a set of CP servers that are responsible for the actual distribution of contents from the content providers. Consumers and Interest packets generation: Let us consider M = {1,...,M} as a set of all consumers, where consumer node m ∈Mis associated with cache of capacity Cm for caching the content. Each consumer node m ∈ M uses FDCC algorithm for generating and adjusting Interest packets. The consumer node starts generating, and sending Interest packets in the network with initial window size wm. For the chunk i belongs to the content catalog 0 requested for the first time, the consumer node gets i from CP server, and i gets copied in the caches associated with the nodes availableinthetransmissionpathasitreturnstotheconsumer Similar requests from other consumers can be served from caches available in the transmission path with minimized delay rather than retrieving the content from the CP server (step 7 to 8). Router: We denote V = {1,...,V}as a set of all routers available in the transmission path between consumer and CP server, where each router v ∈ V is associated with cache of capacity Cv for caching the content. Moreover, each router is connected to some other node(s) via intermediate link(s). We denote Jv = {1v,...,Jv} as a set of links associated to node v, where each link has capacity Cj, for j ∈ Jv. Furthermore, we denote Kv = {1v,...,Kv} as the set of the faces associated to router v, connecting v to other neighboring node(s) through the use of intermediate link(s) j∈Jv.

Router Buffer: We think about that every router v features a buffer/ memory Bv shared among its kV face(s).As represented in every router must allot buffer size fairly to every outgoing face. We denote Bk as the buffer associate to the outgoing face k ∈ Kv, and Tk because the buffer threshold. The incoming packets area unit appointed to the buffer and served within the order they arrive through theemployment of 1st return 1st Serve(FCFS)network hardware, wherever thepacket hardware arranges the transmission sequence of incoming packets. once all buffers associated to kV face(s) reach the edge, the node sends

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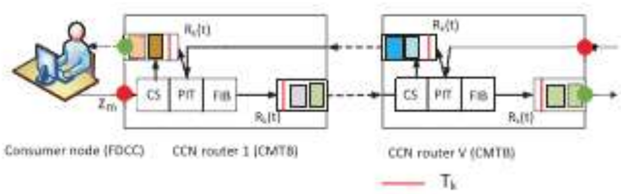
congestion alert message (RSR) to its downstream node. On received congestion alert message, the downstream node reduces the traffic rate on affected outgoing face through the use CMTB.

III. NOVEL COOPERATIVE AND FULLY-DISTRIBUTED CONGESTION CONTROL MECHANISM

In this section, we discuss in details our NCFCC, which combines inseparable hop-by-hop (CMTB) and receiver-based (FDCC) congestion control algorithms into one hybrid congestion control mechanism. CMTB controls the rate (Rk(t)) at which packets are injected into the network in the intermediate nodes, while FDCC controls the traffic (zm) rate in consumer nodes based on Chunks and congestion information received. We conclude the section with communication between CMTB and FDCC, through the use of RSR, which serves as the link between CMTB and FDCC algorithms for exchanging congestion information between neighboring nodes.



IV. CONCLUSION AND FUTURE DIRECTIONS

In this paper, we given Novel Cooperative and absolutely distributedCongestion management (NCFCC) mechanism for CCN, that prevents congestion before it happens. NCFCC combines indivisible hop-by-hop CMTB, which is a modified version of the Dynamic Token Bucket, and receiver based congestion control FDCC (as modified version of Additive-Increase/Multiplicative-Decrease) into one hybrid congestion control mechanism, that will increase network output and reduces delay intimate by packets. within the absence of FDCC (through the employment of CMTB only), congestion is inevitable in intermediate nodes, thus consumers continue to generate more traffic. However, in combining each algorithms, once all intermediate nodes fail to stop congestion through the employment of CMTB, CMTB calls (through sending RSR messages) FDCC for reducing traffic rate. On receiving RSRmessage, FDCC takes the lead by adjusting the causation rate in shopper nodes. Our simulation results show that our projected theme, over differing types of simulation environments, achieves significant improvements with higher throughput than other similar proposals in the literature. within the future, we tend to aim to increase our proposal to more minimizing delay, and examine in details the quality and quantifiability of our algorithms.

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