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Adaptive Multistreaming Over Network Via SCTP

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ABSTRACT: *The idea of this paper is related to the transmission of streaming media passed through a stream control transmission protocol (SCTP). This paper evaluates the performance of the SCTP with adaptive streams. This is done by adding new methods for setting the number of streams, that can be applied to an SCTP and that can utilize new, characteristic of SCTP features. A SCTP sender adaptively enables or disables multistreaming based on comparison between the estimates of available bandwidth and current congestion window size. It is desired to improve goodput under congestion. to evaluate the effect of communication through computer simulation using the INET framework for simulation tools OMNet++.This software will be setup under windows O.S, and finally will compare the variation between the proposed method and SCTP using normal streams.*

KEYWORDS*: Multistreaming, SCTP, OMNeT++, INET Framework*

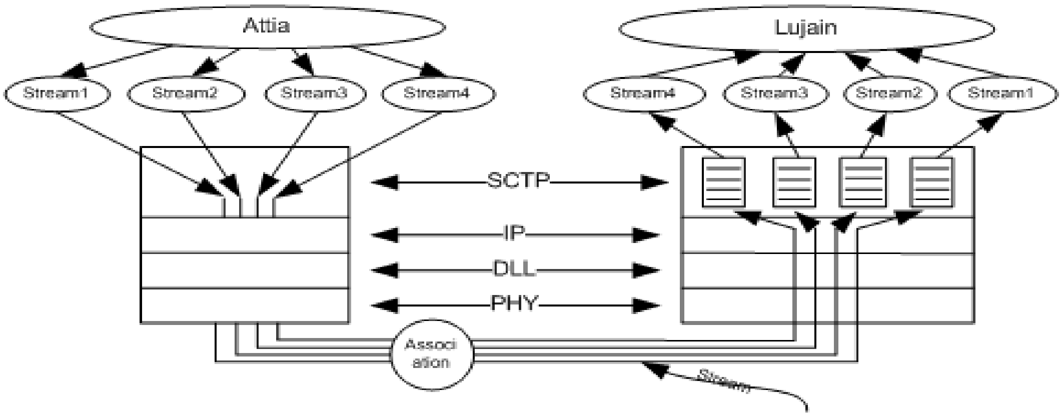
1. INTRODUCTION

Streaming media applications prefer timeliness over reliability. If data in these application is not delivered with some deadline it will not be useful at the receiver, on the other hand a reliable communication is essential if the delivered content is to be perceived as high quality [1]. The delivery of streaming media is achieved by transport protocols are transmission control protocol (TCP) and user datagram protocol (UDP) these protocols are most widely used at the transport layer, the stream control transmission protocol (SCTP) is the new transport protocol existing at the same layer as TCP and UDP [2]. Researches and studies took place to support best delivery of streaming media by looking for new protocols that combine the best features of these dominant protocols so that the existing and new application could easily use the to transfer timely data without destabilizing the network. The problem of the current study is the use of high bit rate services, it increases network traffic and leads to the delay of data. Recently the authors have proposed and modification of SCTP to get a high quality and performance so, in the proposed modification a SCTP sender adaptively enables or disables multistreaming based on the comparison between the estimate of available bandwidth and current congestion window size. However the performance of the proposed modification was evaluated by limited set of simulations called OMNeT++ is an open source discrete event simulation environment with a modular component, based architecture written in C++ [3]. The types of component are channels (described by the parameters delay, packet error rate and data rate), network definitions, simple and compound modules [4]. The components can be assembled into more complex modules via connected gates, network are the result of combined module types that communicate through messages. The paper is organized as follows: section II Overview of SCTP, while in section III, Adaptive stream based on the Available Bandwidth in section IV Network Simulation Model, in section V the objectives, the Expected results of the proposed: Adaptive streams mechanism in section VI, and finally, the Conclusions in section VII.

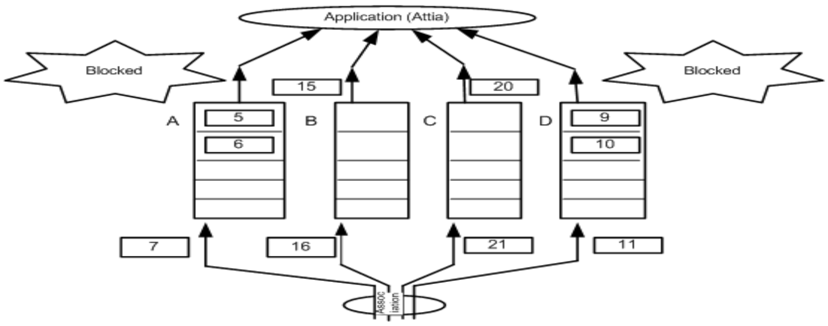
II. OVERVIEW OF SCTP

SCTP Offers a number of features not available in traditional TCP and UDP, such as multistreaming and multihoming these are important feature of SCTP [5]. Multistreaming allows data from the upper layer application to be multiplexed into one channel (called association in SCTP) as shown in figure (1). Sequencing of data is done within stream, if a segment belonging to certain stream is lost; (from that stream) following the lost one will be stored in the receiver's stream buffer until the lost segment is retransmitted from the source. However, data from other streams can still be passed to the upper layer application. This avoids the head of line (HOL) blocking problem found in TCP, where a single stream carries data from all the upper layer application. In other words, HOL effect is limited with the scope of individual streams, but does not affect the entire association. Multistreaming and HOL blocking are illustrated in figure (2).

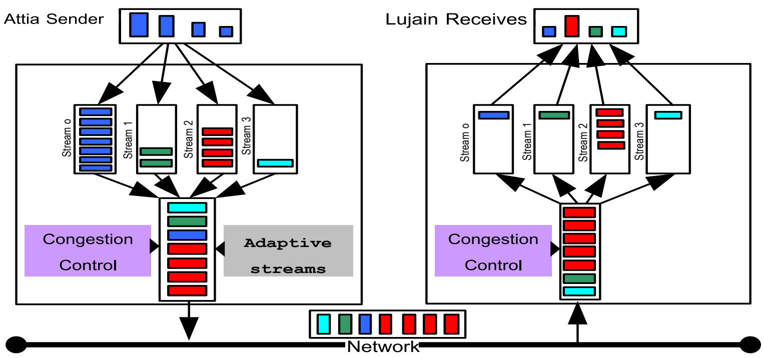
Where an SCTP association consisting of four streams (A, B, C and D) squares with digits in the figure mean segments, and digits in squares indicate stream sequence numbers (SSNs). SSNs are unique number in stream, and segment in the stream are identified by SSNs. Although both segment 15 in stream B and segment 20 in stream C are delivering to the application, two segments are queued in the buffers of stream A and D, respectively. This is because that segment 4 in stream A and segment 8 in stream D are lost in network, and these are waiting for retransmission of the lost segments until the lost segment segments are arrived, these streams are remained blocked and cannot send segments to the application. On the anther hand, stream band C can continue to send segments to the application because of independence of streams. This feature makes SCTP a proper transport for signaling messages [6]. The extensible protocol design allows adding new features to SCTP easily. One of the extensions has been standardized and implemented. The stream reset is an extension allows a user on either side to reset the stream sequence numbers used by any or all streams. Many applications that use SCTP as defined in [RFC4960] want the ability to reset a stream. The intention of resetting a stream is to set the SSNs of the stream back to zero with a corresponding notification to the application layer that the reset has been performed [7].



Figure(1). Data transfer using four streams with a SCTP association



Figure(2). Avoidance of head of blocking using multiple streams



Figure(3). Multistreaming with adaptive streams mechanism

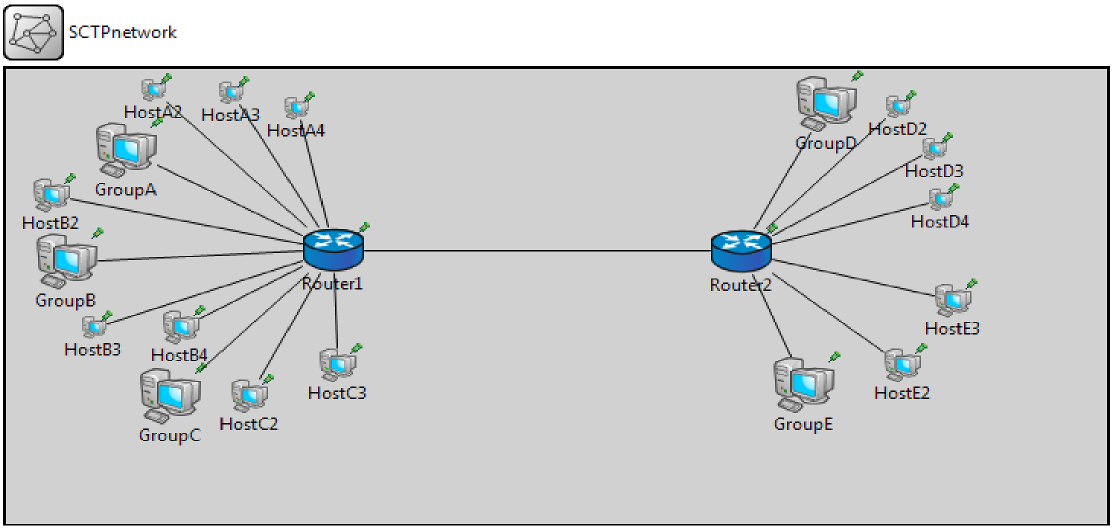
III. ADAPTIVE STREAM BASED ON THE AVAILABLE BANDWIDTH

In the proposed method called SCTP with adaptive stream the change of the number of streams is depend on the traffic and congestion control behavior over the entire association. Illustrated in fig3 SCTP multistreaming with adaptive streams mechanism, also SCTP supports multiple streams with an association it ensures independently sequenced delivery among different streams while maintaining appropriate congestion control behavior over the entire association. The adaptive stream mechanism is setting the number of streams; a SCTP sender adaptively enables or disables multistreaming based on the comparison between the estimates of available bandwidth and current congestion window size.

IV. NETWORK SIMULATION MODEL

Since simulation has become the evaluation method choice for many areas of computer networking research using the INET framework for simulation tools OMNet++ is more convenient to result in a good control in every point of the network and a fine precision on the metrics to be computed [3]. Therefore for accuracy it is reasonable to create a simulation of a small to moderate scale topology. In most simulation cases there are limitations creating complex topologies which result in a slow system and a consumption of a significant amount of disk space. The Network Simulation Model in this research is presented in two scenarios. The network topology is chosen the same for the two scenarios except for the protocol used. The network topology used in using the INET framework for simulation tools OMNet++ for performance evaluation is a bottleneck link topology in which edge nodes connect to two routers. The bandwidth between the two routers is much lower than the other links, which causes the link between the routers to be a bottleneck. The assumption for the network that is simulated in this study is considered as follows: three groups of students; Group A, Group B, and Group C in a university campus are communicating with Group D and Group E in another university campus through internet.

Group A which consists of four students communicates with Group D, also consists of four students, using a video conference in which video data is transmitted and received between them. Group B which consists of four students also communicates with Group D transmitting and receiving voice data between them. Group C consists of three students and communicates with Group E which also consists of three students transmitting and receiving text files between them. The video conference data transmitted between group A and Group D is simulated in using the INET framework for simulation tools OMNet++ as variable bit rate (VBR) traffic. The voice data transmitted between Group B and Group D is simulated as constant bit rate (CBR) traffic. The text files transmitted between Group C and Group E are simulated as file transfer protocol (FTP). VBR and FTP are chosen as background traffic and are transmitted over stream control transmission protocol (SCTP) in all scenarios. The testing for the study is made only for CBR traffic. Since the testing is on CBR traffic, in the first scenario Group B transmits the CBR traffic to Group D over the stream control transmission protocol (SCTP). In the second scenario the Stream Control Transmission Protocol (SCTP) set up a connection between Group B and Group D and CBR traffic is transmitted over the Stream Control Protocol Transmission (SCTP) with adaptive streams mechanism. The values of CBR and VBR transmission rates and the ftp files cause congestion in the bottleneck link and the behavior of each protocol is observed. Simulation environment is kept the same for two scenarios to evaluate the performance of the two protocols in transmitting streaming media. For queuing which means packets that are waiting in time to be sent through a route are dropped so that every user gets equal access to the Network, the most simple and more prevalent queue management mechanism, the drop-tail (FIFO) is used in all links. Edge links and bottleneck link bandwidths are chosen to agree with Ethernet LAN and network backbone routers specifications respectively. Simulation time should be enough to obtain reasonably accurate results. Although the topology used does not represent a realistic path, it is sufficient for this particular experiment.



Figure(4). Network topology- testing the transmission of CBR traffic with background traffic VBR and FTP over SCTP and then over SCTP with adaptive streams mechanism

V. OBJECTIVES

We would like to design and implement new methods for setting the number of stream, that can be applied to an SCTP and that can utilize new, characteristic SCTP features. It aims to achieve the following specific contributions [8].

- To get a high quality and performance of streaming media applications.
- To identify the limitations of SCTP implementation.
- To measure the reliability of transport protocols over the network.
- To evaluate the transport layer protocols for delivering streaming media applications.

VI. EXPECTED RESULTS OF THE PROPOSED "ADAPTIVE STREAMS MECHANISM"

When the sizes of the data increase under narrow bandwidth and adjust the time of sending 5 seconds, this will lead up to divide data into small sizes according to bandwidth size. In this case, the congestion expected to occur. Then the type of congestion control mechanism: Slow Start, Congestion Avoidance, Fast Retransmit and Fast Recovery will start to work. If such mechanisms do not solve the problem of congestion, and the transmission time has become in the last second. The proposed method, after 15 seconds will start to work to reduce the number of streams, which will be sent to the receiver. The expected results of the proposed mechanisms are as follow: SCTP with adaptive multistreaming is ahead of SCTP with normal multistreaming in its goodput. This means that SCTP with adaptive multistreaming have the highest goodput values. The SCTP with normal multistreaming is better than SCTP with adaptive multistreaming in its delay .This is because of the restriction the data streams in adaptive streams mechanism to ensure high transmission to receiver. Moreover, the SCTP with adaptive multistreaming is ahead of SCTP with normal multistreaming in its percentage value of packet losses this means that SCTP with adaptive multistreaming have lower values of packet losses which makes it on top of SCTP with normal multistreaming.

VII. CONCLUSIONS

These results indicate that it is difficult to decide the appropriate number of streams in advance of communication because the appropriate number varies depend on the environment. Thus I proposed to increment or decrement the number of streams according to bandwidth utilization in network and current congestion window size. Moreover, it supports congestion control algorithms to utilize variable bandwidth size efficiently and fairly. Therefore, I propose a further modification enabling a sender to increment and decrement the number of streams according to the condition of wireless links.

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