Simulation of Measurement Based Admission Control using NS2

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ABSTRACT
Admission control is an important component for end-to-end Quality of Service (QoS) delivery in IP networks using resource reservation and determines how bandwidth and latency are allocated to streams with various requirements. Admission control schemes therefore need to be implemented between network edges and core to control the traffic entering the network. This paper compares the performance of four measurement based admission control Algorithms for controlled-load service. The measurement based algorithms are based on measured bandwidth, acceptance region, and equivalent bandwidth [1].

Simulation was done on several network scenarios for video transmission to evaluate the link utilization and adherence to service commitment achieved by these four algorithms and HB gave better result when IP network support smaller packet and ACTO and ACTP gave the best bandwidth when packet size is more than 1250 bytes.

Keywords
MBAC, Quality of Service (QoS), Resource Reservation Protocol (RSVP).

1. INTRODUCTION

Admission control is a network Quality of Service (QoS) procedure and determines how bandwidth and latency are allocated to streams with various requirements. Admission control mechanisms therefore need to be implemented between network edges and core to control the traffic entering the network. An application that wishes to use the network to transport traffic with QoS must first request a connection, which involves informing the network about the characteristics of the traffic and the QoS required by the application.

This information is stored in a traffic contract. The network judges whether it has enough resources available to accept the connection, and then either accepts or rejects the connection request. This is known as Admission Control.

The role of any admission control algorithm is to ensure that admittance of a new flow into a resource constrained network does not violate service commitments made by the network to admitted flows. The service commitments made could be quantitative (e.g., a guaranteed rate or bounded delay), or it could be more qualitative (e.g., a "low average delay"). There are two basic approaches to admission control

The first, is the parameter-based approach, computes the amount of network resources required to support a set of flows given a priori flow characteristics;

The second, the measurement-based approach, relies on measurement of actual traffic load in making admission decisions.

Each algorithm has two key components: a measurement process that produces an estimate of network load, and a decision algorithm that uses this load estimate to make admission control decisions.

2. MEASUREMENT BASED ADMISSION CONTROL ALGORITHM

Measurement-based admission control algorithms can only be analyzed through experiments on either real networks or a simulator. The overall strive is to make the simulation environments under which the behavior of the various algorithms as comparable as possible, but this does not mean the operating conditions would not be unfairly disadvantageous to any particular algorithm.

The simulation is done on several network scenarios to evaluate the link utilization and adherence to service commitment achieved by these four algorithms.

Measured Sum: The "Simple Sum" algorithm ensures that the sum of existing reservations plus a newly incoming reservation does not exceed capacity.

Let v be the sum of reserved rates, μ the link bandwidth, α name of a flow requesting admission, and rα the rate requested by flow α. This algorithm accepts the new flow if the following check succeeds:

$$v + r\alpha < \mu$$

Whereas the "Measured Sum" algorithm uses measurement to estimate the load of existing traffic.

$$V' + r\alpha < v\mu$$

Where v is a user-defined utilization target and V' the measured load of existing traffic. Upon admission of a new flow, the load estimate is increased using:

$$V'' = V' + r\alpha$$

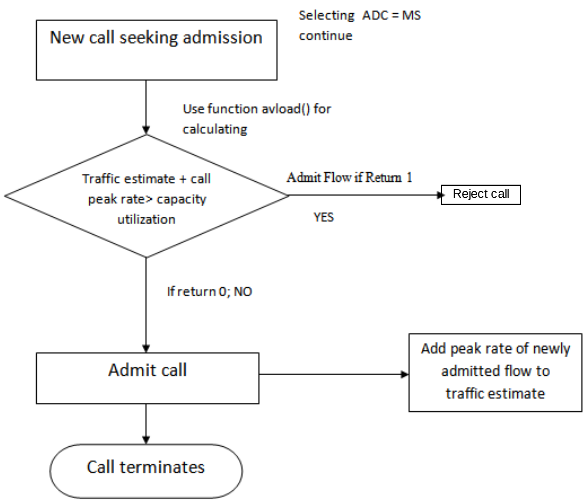

Figure1: Flow chart of measured sum

Acceptance Region tangent at origin. The second measurement-based algorithm, it computes an acceptance region that maximizes the reward of utilization against the penalty of packet loss.

Given link bandwidth, switch buffer space, a flow's token bucket filter parameters, the flow's burstness, and desired probability of actual load exceeding bound, one can compute an acceptance region for a specific set of flow types [5], beyond which no more flow of those particular types should be accepted.

The computation of the acceptance region also assumes Poisson call arrival process and independent, exponentially distributed call holding times. The measurement-based version of this algorithm ensures that the measured instantaneous load plus the peak rate of a new flow is below the acceptance region. The measured load used in this scheme is not artificially adjusted upon admittance of a new flow.

For flows described by a token bucket filter (r; b) but not peak rate, derives their peak rates (p') from the token bucket parameters using the equation [3] where U is a user-defined averaging period:

$$p' = r + b / U ;$$

Acceptance region tangent at peak. A new flow is admitted by the network if the condition stated under satisfies [3]:-

$$\eta p\ (1\text{-}e\text{-}sp)\ + e\text{-}spv' \leq \mu ;$$

Equivalent Bandwidth / Hoeffding Bounds (HB). The third measurement-based algorithm computes the equivalent bandwidth for a set of flows using the Hoeffding bounds.

The equivalent bandwidth of a set of flows is defined in references as the bandwidth C(£) such that the stationary bandwidth requirement of the set of flows exceeds this value with probability at most £. Calling £ the "loss rate" in the remainder of the paper; however, in an environment where large portion of traffic is best-effort traffic, real time traffic rate exceeding its equivalent bandwidth is not lost but simply encroaches upon best-effort traffic. In reference [4] the measurement based equivalent bandwidth based on Hoeffding bounds (Ch) assuming peak rate (p) policing of flows is given by:

$$(Ch)\ (v, \{pi\}\ 1 \leq i \leq n, £\ ) = v' + \sqrt{}\ (\ln(1/£)\ \textstyle\sum(pi)2)\ /2$$

3. ANALYSIS OF ALGORITHMS

The entire four Measurement Based algorithm (MBACs) are analyzed for transmission of multimedia video packet in Network Simulator [6].

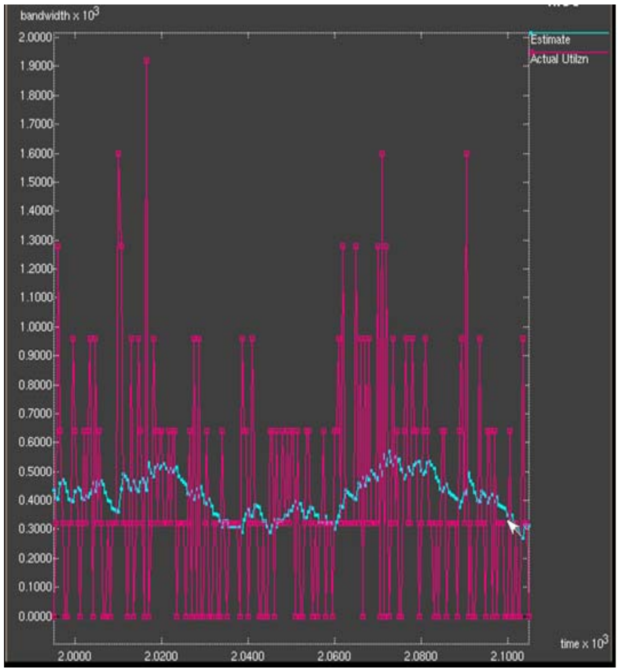

Figure2: X-graph for Video transmission in Hoeffding Bounds (HB).

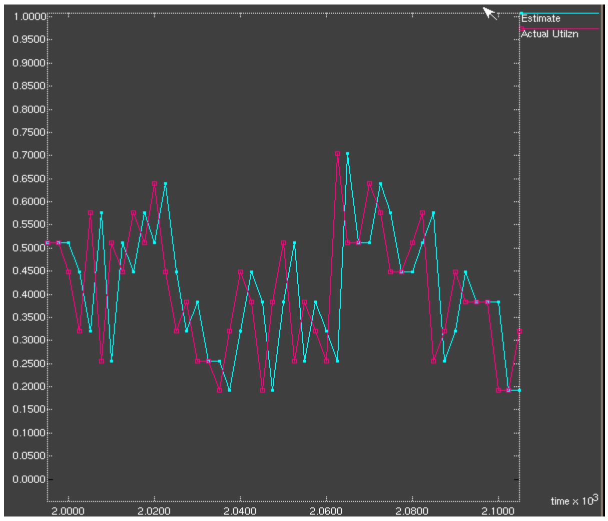

Figure3 : X-graph for Video transmission in Acceptance Region Tangent at Peak (ACTP).

Graphs are drawn using the tool X-graph for finding out the deviation between the actual and estimate utilization. The graph for the Hoeffding Bounds (HB) algorithm is shown in Fig. 2..

Similarly, for all other admission control algorithms graphs are drawn and are analyzed. On the basics of analysis of the utilization of different algorithms, it is found that ACTO and ACTP algorithms give a higher utilization for transmission of video packet (1250bytes) over network.

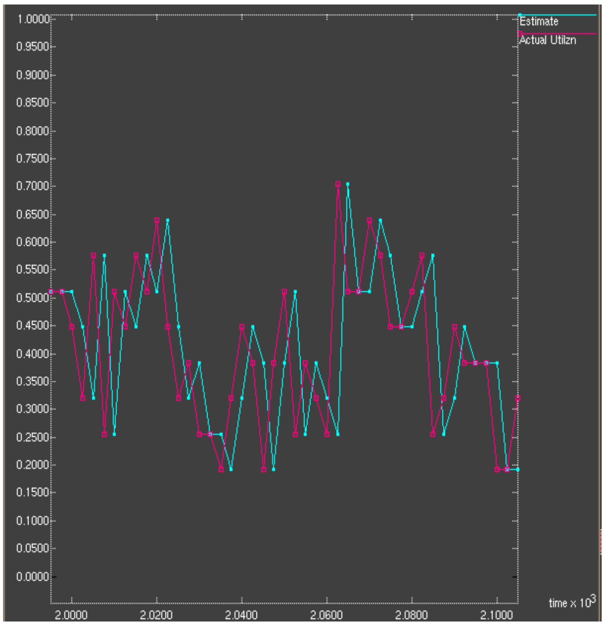

Figure4: X-graph for Video transmission in Acceptance Region Tangent at Origin (ACTO).

4. CONCLUSION

Similarly, for all other admission control algorithms graphs are drawn and are analyzed. On the basics of analysis of the utilization of different algorithms, it is found that ACTO and ACTP algorithms give a higher utilization for transmission of video packet (1250bytes) over network. The implementation of the priority based measurement algorithm can be a recommendation for the further enhancement implementing a hybrid model i.e. the model can be made by the combination of priority based algorithm over the measurement based algorithms. As the video transmission is succeeded on the network using admission control but this degraded the utilization of the bandwidth. So it can be a further challenge to implement the video packets without the degradation of the bandwidth utilization.

For this purpose a bandwidth broker is used. In this way the throughput of the overall system can be increased to a greater extent. These admission control algorithms can applied to VoIP (Voice over Internet Protocol) for the efficient transmission of the traffic over the internet.

5. REFERENCES

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