Ain Shams University

Faculty of Engineering

Computer and Systems Engineering Department

Computer Network Management
A Sustain Cell Rate In Source Policy Mechanism of ATM Networks

A Thesis

Submitted in Partial Fulfillment of the Requirements of the Degree of Master of Science in Electrical Engineering (Computer and Systems Engineering)

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Submitted by

Hany Abd El-Messeih Kamel

B. Sc., Electrical Engineering
(Computer and Systems Engineering)
Ain Shams University, 1992

Supervisors:

Prof. Dr. : Osman Badr.

Dr. : Yasser Dakroury.

Cairo - 1997

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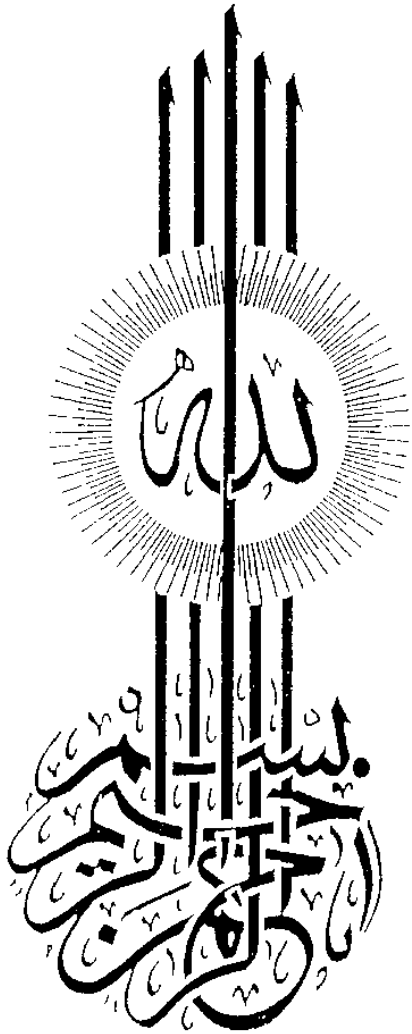

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Examiners Committee

Name : Hany Abd El-Messeih Kamel.

: "A Sustain Cell Rate In Source Policy mechanism of ATM Networks".

Degree : Master of Science in Electrical Engineering (Computer and System Engineering).

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Date: / / 1997

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Statement

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Electrical Engineering (Computer and System Engineering).

The work included in this thesis was carried out by the author at the Computer and System Engineering Department, Ain Shams University.

No part of this thesis has been submitted for a degree or qualification at other university or institution.

Date : / /1997

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I wish to thank:

1- My supervisors : **Prof. Osman. A. Badr.**

Dr. Yasser Dakroury.

Dedication

For My Mother

Who Shares me this.

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M. Sc. thesis abstract

Presented By : Eng. Hany Abd El-Messeih Kamel.

Research Title : "A Sustain Cell Rate In Source Policy Mechanism of ATM Networks".

Supervisors:

Prof. Dr. : Osman Badr.

Dr. : Yasser Dakroury.

Abstract: ATM is the possibility to transport any service irrespective of its characteristics, such as the bit rate; its quality requirements; or its bursts nature with parameter control. This high advantage has been one of the main motivations for CCITT to decide that ATM will be the transfer mode for the future BISDN. Due to the higher degree of resource sharing compared to the conventional "Synchronous Transfer Mode" STM, it raises a number of new problems. Some of those problems are highly dependent on the user or the traffic source characteristics. The coincidence of peak bit rate or buffer requests of many connections sharing the same transmission, switching, or buffer resource may cause excessive delays or even information loss which must be kept within strict limits to meet the overall "Quality of Service" QoS objectives in a B-ISDN. The increased flexibility, in respect to the bandwidth requirements of the calls makes necessary extended signaling procedures for call establishment.

A "Traffic Contract", including the relevant service attributes that characterize the call has to be negotiated with the network at call setup. The relevant attributes are, the maximum and mean cell rate as well as the "Quality of Service" QoS requirements of the call in respect to the cell loss, delay, and delay jitters.

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A "Call Acceptance Control" has to decide whether the new call can be accepted or not. This decision has to be made in a real-time based on knowledge about the traffic characteristics and QOS requirements of the new call, and of the already existing calls sharing the same network resources.

Due to the flexibility in respect to the bandwidth requirements of the different services in ATM, ATM will support variable bit rates within a connection. The packetized information transfer without flow control between the user and the network in combination with the asynchronous multiplexing principle, leads to a need to control the individual call streams during the entire calls. This is to ensure an acceptable quality of service for all existing calls sharing the same network resources. This kind of control will be provided by a "policing" or "Usage Parameter Control" UPC function. The police function should be fair , fast , cost-effective. Some of those control mechanisms are : Leaky Bucket(LB), Jumping Window(JW), Triggered Jumping Window(TJW), Moving Window(MW) and Exponentially Weighted Moving Average(EWMA). The comparison of the policing mechanisms and their dimensioning shows that the LB and EWMA are the most promising mechanisms The other window mechanisms are not flexible enough to cope with the short-term statistical fluctuations of the source traffic. Moreover, the MW mechanism is comparatively expensive to implement for a realistic parameter dimensioning. For real time services with very long bursts, such as still picture service, policing close to the mean cell rate requires unrealistically long sampling periods. For this type of services, dynamic bandwidth allocation schemes might be useful to avoid peak rate policing and consequently peak rate bandwidth allocation.

This thesis presents a proposed model based on a dynamic allocation of bandwidth to the sources, which need to connect to the ATM network. This model can be called bandwidth on demand or we can think of it as a renegotiation algorithm. The set of parameters that can be used for control are the mean rate, peak rate, peak duration. A true mean rate can not be policed for statistical reasons for example:

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* The mean rate can fluctuate on short time-scales, which means that the policer has to be tolerant so as not to treat the user unfairly(e.g. use a large bucket depth). But this means that the network cannot respond quickly to contract violations, the time lag is too great, which could compromise the network. The ITU has defined a "Sustainable Cell Rate" with associated tolerance, which is like a short-term mean rate.

The proposed model starts with choosing the Sustain Mean Cell Rate as the new dynamic parameter that will be used in reallocating, then policing the source. The Sustain Cell rate can be calculated by introducing a new counter, that will count number of cells received by the model from a certain source every T time (window). This mean value changes based on the source dynamics, so we can use it as a parameter of reallocating bandwidth to the source, which gives the model the advantages to follow up source behavior and produce a higher utilization as possible. But also this mean value will depend on the window size, so a more closer study is done about the effect of the window size on the utilization of the network, CLR and delay of the source cells. Also the model has to be tolerant, as we just describe, so the model use a new value to be used in the control at mean fluctuations, which is the effective bandwidth. The effective bandwidth is calculated by multiplying the sustain cell rate by a factor. The effect of this factor on the proposed model is also studied.

At call setup, the model uses the same principle of leaky bucket model to accept the new call. This means that using the equation of : $\sum$Peak rates $\leq$ Capacity of network. If this equation is valid after adding the new call, this call will be accepted. The model starts to use the mean value after first window time, as the mean value will be available, Then the model renegotiates the allocated bandwidth to that source based on the mean value. The model keeps calculating mean value every window, then renegotiates with the source. Based on the actual cell rate, the model keeps the allocated bandwidth to the sources equal to the actual needed bandwidth by these sources.

The proposed model maintains the QoS obtained by the Leaky model by adding an adaptive logical control part on the buffer to avoid buffer overflow.

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