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Dissertation Proposal Title: "Scheduling and Queueing models for dynamic resource environment, differentiated and mobile services"

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Dissertation Proposal Abstract:

Abstract
In the essential area of Network Management we have dealt with the subject of the scheduler reaction and adjustment in a dynamic resource environment. Different scheduling models from various areas of Computer Networks (wired and wireless) are presented. Better performance for all the cases via simulation is provided.

Many methods of packets? service have been developed, associated with the borrowing of credits technique for use in the next round. A new approach for adjustment of the weights of the Deficit Round Robin (DRR) is proposed. We are dealing with the service of various large size packets and we use gradual or direct weight increases that result to the decrease of the borrowing credits. The advantage of our method lies on both the elimination of the otherwise required repeated, unexpected and uncertain changes of the next round?s credits and the guarantee of the next packet?s service with no ?empty round?. A family of algorithms that use different and systematic weight request methods, such as: the Direct Increasing Weight (DIW), the Compound Round Robin (CRR) and the Proportionally Increasing Weight (PIW) are presented below with much better performance than the DRR related to the l-packets sequence?s arrival, given that the quantum size remains constant. All these algorithms are O(1) complexity and their relative fairness along with the delay bounds are derived. Simulation experiments support the algorithms? significance and useful results are also provided.
Our approach can be applied in the internet routers, achieving short time service for delay sensitive flows.

The problem of the design and adjustment of the weights is examined. Some flows have excess of quantum and therefore they are serviced quickly while others don?t and remain in the queues for a long time. Many different size packets supporting new applications move around the network. Working in a dynamic environment, periodical instantly changes of the size of quanta optimizes the performance of the RR scheduler. On the other hand the dynamic allocation of the weights analogous to the packet?s size diminishes the importance of some traditional input parameters of the flows (like MTU) in the routers. We are interested in finding better allocation of the flows? quanta in order to minimize the number of the rounds, of some flows, avoiding any unnecessary increase of the total quanta amount used. This solution basically enhances the service ability of the DRR server, avoiding the ?empty rounds? and additionally offers a framework for temporary economical adjustment of the weights at the routers using various types of RR schedulers such as DRR,WRR, ERR etc. Moreover, the latency parameter of the RR scheduler

is examined so that the larger size packets can be serviced without any further delay.

Lightweight mechanisms are included in the differentiated services architecture (diffserv) in order to provide differentiated services in the Internet. A lightweight scheme based on the delay ratio criterion is provided. The main profit of this scheme is that a conservative control mechanism is periodically developed to ensure the stability of the delay ratio. Our model can be considered as a scheme of Premium service. It consists of a M/M/1/K queue for the high priority (HP) packets and a finite queue birth death (b-d) model for the low priority streams. The mean service rate for the second queue depends on two phases of the system, the processing phase and the restoration one. In the processing phase for the b-d model, with finite buffer, we use a switch mechanism so that when no HP packets exist the server empties the LP queue. In the restoration phase the LP packets are serviced in order to reappoint the delay ratio to the appropriate value. We expand the model for three queues. Simulation experiments for different input parameter values based on the delay ratio criterion are presented. With the use of restoration method, under some load conditions and predefined service rate, we can guarantee that the delay ratio will be constant. After the restoration step an improvement of the loss ratio is noticed. Finally the ability of the Diffserv model for the protocols of Home domain (ADSL, Wireless Local Network, WLL, FTTH, VDSL, Optical Ethernet etc.) is examined.

In order to manage fairly the service of queueing elements, the support of QoS with a sophisticated packet scheduling algorithm that is a part of the Fair Queuing family can be considered essential. Various packet-scheduling policies have been invented in order to emulate the Generalized Processor Sharing (GPS) policy. Several algorithms of the Fair Queueing discipline have been created in order to reduce the complexity due to the computation of the virtual times. For the sake of avoiding the sorting operation, a new algorithm called the Left and Right Move Algorithm (LRMA) is proposed. The LRMA can be considered an implementation tool especially useful for sorted-priority algorithms. Cooperating with SFQ diminishes the complexity to O(1).
On the other hand, LRMA can work as frame-based server for ATM networks, avoiding the use of virtual times and servicing queues in a similar fashion to the Round Robin (RR) manner. Working in this way, it can diminish queuing delay from the burden flows and speed up service of the activated flows, avoiding "empty times" by using a scheduler table. Simulation experiments are provided. Moreover, it is easy to use and applicable to several parts of the network (switches, routers, gateways).

A new prediction scheme is developed with the support of the Data Mining technique. Based on the mobility prediction, the bandwidth is reserved for the paths with the maximum support, so that the service of the handoff calls can be guaranteed. The Steps Forward with Distance Algorithm (SFDA) uses two criteria, the one of support and the other of distance, and finds the most favorite user path. Moreover, the time factor for each move is also taken into account. A centralized collaborative system between nodes and BSs is developed, for taking global information of the cells at the congestion periods. First, the BSs send the initial information for each user to the nodes. Then the nodes elaborate (using temporal databases techniques), create and give

back the new aggregate bandwidth demand information, for each cell to the BS enabling them regulate the service priority. A CAC algorithm is developed for each cell according to the reservation operation in order to minimize the call dropping probability and increase the resource utilization. A second approach is based on the group mobility prediction. The Direct Group Method (DGM) is an impersonal method, that provides the nodes with the ability of supporting the BSs with the important aggregation bandwidth information so that they can avoid the congestion for the handoff users? sake. We are concerned about the system behavior only at exceptional congestion time periods (periodical events), given that it works smoothly on normal daily basis. Simulation results are provided.