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Bandwidth and Buffer allocation in a Multiservice environment for Multirate signals

by

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Abstract : Resource allocation aspects are considered in cases of random contention for M identical resources from 2 statistically different customer types. In particular attention is focuced on sharing bandwidth among customer classes or allocating packets in a buffer before a multiserver system. These two problems can be commonly formulated as will be showed in this article.

The general problem is to determine the optimal policy for accepting or rejecting a call when the type of the requesting customer is known as well as the state vector with components the numbers of customers of each type that are in service. The optimal choice of buffer size and bandwidth is involved in the design of service facility as well as the rules of sharing resources among users.

The objective of this study is to develop analytical models and computational algorithms for the determination of the optimal state subset for slotted time systems with call traffic modeled as stationary independent arrival processes and with service time modeled as a general discrete time distribution. The parameters optimized are the ones generally accepted as throughput, utilization and blocking of the system. In addition quantitative estimates for the relative optimum throughput, utilization and blocking are obtained.

SUMMARY

Buffer and bandwidth allocation problems are under consideration in this study. It is a well known aspect in a computer communication network that a limited number of resources are shared among customer communities. The specific implementations that are considered hear are bandwidth allocation and buffer when it is used as a waiting room before a multiservice system. These two problems are manipulated as a unity because of the common mathematical modeling possibility.

Aspects of buffer and bandwidth allocation are in the core of researching interest in the computer communications community. The usual goal of such studies is the determination of the optimal policy for a specific allocation scheme or the choise of the policy with better characteristics among a number of them, and the development of computational methods for making all these possible. The term policy is usually reffered to the determination of the acceptable states of the system or in other words the operation of accepting or rejecting a call when the type of requesting customer is known as well as the system state characterized by the allocation policy. The state is a vector with components the number of customers of each type that are in service.

Consider a multiservice system with a common waiting area, or a channel's bandwidth. These resources are shared between customer classes. We consider discrete time systems. The service time for any customer type is constant in the multiservice system. A number of customers can be served in parallel in a time slot. This number is modeled as a general discrete time distribution. In the bandwidth allocation problem, service time isn't constant. As service time in here is meant the duration of a virtual circuit or in other words the time between the call set up and call clear packets. As we perceive from the above there is in bandwidth allocation problem the possibility in a time slot, a number of virtual circuits to receive call clear packets and to stop to exist. This number is also modeled as a general discrete time distribution. The arrivals of packets in buffer allocation system and the arrivals of call set up packets in bandwidth allocation problem are also modeled as general discrete time distributions. The developed model gives general equation common for these two problems. This equation is specifically formulated to hold under every policy.

At the beginning of a time slot we assume that server chooses by chance one of the waiting customer types and serves a number of its packets during the slot, which is translated for the bandwidth allocation problem to the assumption that call clear packets arive at the beginning of the slot. We assume also that to both problems all new arrivals (packets or call set up packets respectively) arrive exactly at the end of the slot. This assumption leads to the conclusion that the policy must be a coordinate convex set of the admissible states. The method that developed can be implented and gives results (evaluation of performance characteristics) to every policy that gives a coordinate convex set of admissible states.

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