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LIST OF ABSTRACTS

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Heuristic Methods for Virtual Trunk Assignment Control within a Virtual Path

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Virtual Trunk (VT) is the total number of connections (VCs) assigned to a service class within a Virtual Path (VP). At the connection level (call level), the control objective is to minimize the maximum Call Blocking Probability (CBP) of the service classes, or, equivalently, to equalize the CBP among the service classes. This is done by modifying, at each control interval, the VT boundaries of each service class. We examine this modification relying only on measurement, either of the CBP of the service classes (VT window control) or of the number of the concurrent connections of each service class (VT instantaneous control).

In the VT window control, the new VT boundaries are considered a function of the measured CBP within a time window. Several functions have been defined heuristically, and several VT window control schemes are presented in this paper. In the VT instantaneous control, the VT boundaries of the service classes are assumed to change each time a call arrives. Taking into account the number of VCs an arrival call asks for and the number of VCs its service class eventually receives from the service class with the least load, several VT instantaneous control schemes have been defined and presented. The VT instantaneous control can be handled together with a kind of trunk reservation. Each time a service class asks for some VCs from another service class, the bandwidth requirements per call of these two service classes are compared and if the second service class is found to have bigger requirements, it reserves some VCs.

Evaluation of the above VT assignment control schemes has been done through simulation and is presented. The results show that the VT instantaneous control with trunk reservation performs best if the instantaneous trunk reservation number is properly chosen. The VT window control is generally more reliable than the VT instantaneous control without reservation. The above controls have the advantage of the applicability to any service class, since they do not take into account specific traffic characteristics.

Performance Analysis of a Page-and-Answer Protocol in a Broadcast Packet-Switched Channel

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In this work we present the theoretical performance analysis of a page-and-answer protocol that has been previously proposed as a power saving protocol for mobile data networks. This page-and-answer protocol is based on a centralized environment (having a single base station and a number of portable terminals) and its main objective is to conserve valuable battery energy at the portable terminals. For this purpose it employs a paging mechanism in the downlink channel. The portable terminals, instead of continuously monitoring the downlink channel are free to power on and off their receive units to reduce the average consumed power. The key feature of the protocol is that it does not require system synchronization, which means that a portable terminal can turn on and off its receiver based on its own necessities and not on network commands. This asynchronous, intermittent operation of the receivers raises considerable engineering challenges, mainly because of the conflicting relationship between system throughput and power saving gain.

Considering the statistical nature of the downlink traffic, system analysis is based on queuing theory and we have constructed a "multiple queues with a common server" model. In this model, the base station maintains a number of separate queues; one queue for each portable terminal. These queues are served by a single server. However, this server is not always available because it is also engaged in the paging process. That is, the server continuously sends pages to awake the terminals that have pending traffic in the base station. It suspends the paging process only when one (or more) terminal announces its reception availability (by sending an ACK message). In that case, the server starts servicing exhaustively the queue(s) corresponding to the terminal(s) that have sent ACK.

From the queues' point of view, there is one server that periodically takes vacations (we refer to the periods of paging transmission as vacations). The instant that a vacation occurs as well as the duration of the vacation are considered random variables. A major part of our work is devoted to finding the statistical characteristics of these random variables.
Studying the above model we derive closed formulas for the most important figures of merits of the protocol. More precisely, we find expressions for the mean packet delay, the packet delay variance and the power saving gain of the protocol under various operating conditions. We also demonstrate how the downlink performance is affected by the paging process. We show that a performance degradation is taking place and this is the cost we pay for conserving battery in an asynchronous packet-switched environment. However, we also discuss how we can minimize this performance degradation.

Besides the theoretical work we have also carried out an extensive simulation of the protocol. In this paper we use these simulation results to demonstrate the validity of our theoretical results. We show that, in spite of the simplifying assumptions which were considered in the analysis of our queuing model, the theoretical results follow the simulation results quite closely. In specific situations also, they are almost exactly the same.

In the final part of the paper, we express some notable implementation issues and we end up with considerations regarding the employment of this protocol in microcellular mobile data networks and wireless LANs. We also discuss the prototype network that we prepare to set up in the University campus. This network will utilize the page-and-answer protocol and will form an experimental ground for the evaluation of our work.

A PCI-Bus Based ASN.1 Accelerator

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The challenge to increase performance of processing of ASN.1/BER coded network protocols by hardware implementation is still valid. A PCI-based ASN.1 accelerator is presented to support the evaluation of the hardware implementation of ASN.1/BER standards.

Control II
Chair: W. R. Wells

Control of Structures Subjected to Earthquake Excitations

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The basic objectives of control of structures subjected to earthquake excitations are (1) to prevent injury to the occupants and damage to contents and (2) to protect the integrity of the structure. These objectives can be achieved through control and base isolation. Cost considerations call for hybrid control, a blend of active and passive control. Active control implies feedback control forces acting on the base and on the structure. On the other hand, passive control involves the use of damping materials dispersed throughout the structure. The idea of base isolation is to reduce the effects of the moving ground on the structure. A good strategy is to stabilize the base relative to the inertial space and to suppress the structural vibration relative to the base.

This paper presents a base-isolation control design capable of reducing the motion of structures relative to the inertial space during and after earthquakes, thus achieving the basic objectives of preventing injury to occupants and damage to the contents, as well as protecting the integrity of structures. The control is a modified on-off with a two-tiered dead zone, a nonlinear control more economical and easier to implement than linear control. The control design is very satisfactory, indicating that significant reductions in the accelerations of the structure (of the order of 80% to 90%) can be achieved with base isolation and control compared to the uncontrolled structure using control forces smaller than 1% of the weight of the structure.