

ATM Networks: Performance Modelling and Evaluation Volume 2

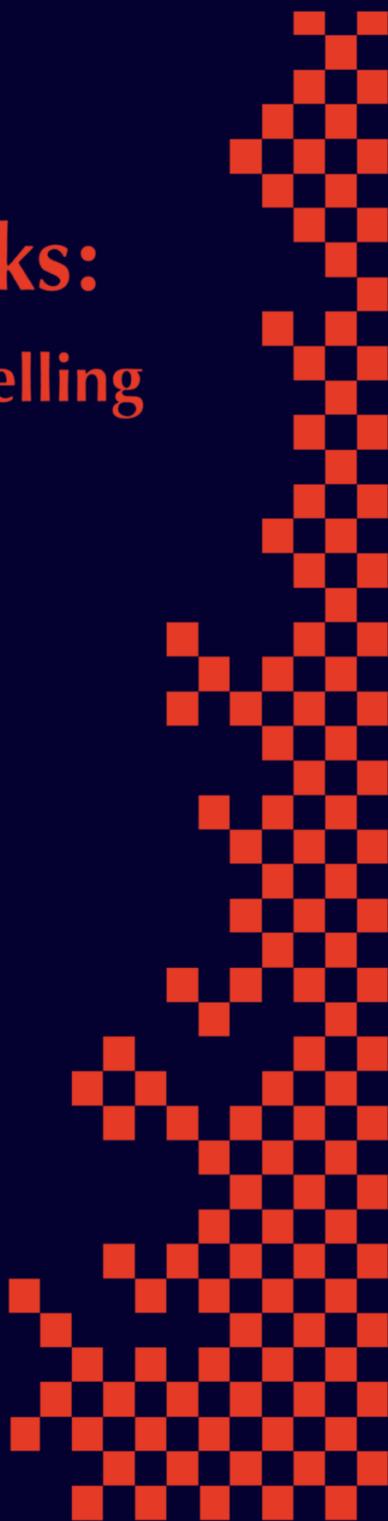
Edited by
Demetres Kouvatsos



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ATM Networks

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IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- the IFIP World Computer Congress, held every second year;
- open conferences;
- working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

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ATM Networks

Performance Modelling and Analysis

Volume 2

Edited by

Demetres D. Kouvatsos

*Computer System Modelling Research Group
University of Bradford
UK*



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To Mihalis and Maria

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Preface

Asynchronous Transfer Mode (ATM) networks are widely considered to be the new generation of high speed communication systems both for broadband public information highways and for local and wide area private networks. Over recent years there has been a great deal of progress in research and development of ATM technology, but there are still many interesting and important problems to be resolved such as traffic characterisation and control, routing and optimisation, ATM switching techniques and provision of specified quality of service.

This book presents twenty-three research papers, both from industry and academia, reflecting latest original contributions in the theory and practice of performance modelling and analysis of ATM networks worldwide. These papers were selected, subject to peer review, from those submitted as expanded and revised versions out of eighty-nine shorter papers presented at the Third IFIP Workshop on “Performance Modelling and Evaluation of ATM Networks”, July 2-6, 1995, Craighlands Hotel, Ilkley, West Yorkshire, UK. At least three referees drawn from the Scientific Committee and externally were involved in the evaluation process of each paper.

The research papers were classified into seven parts covering the following topics: Traffic Models and Characterisation, Traffic and Congestion Control, Routing and Optimisation, Adaptation Layer and Protocols, Network Management, Models of ATM Switches, Bandwidth and Admission Control and Performance Modelling Studies.

Part One on “Traffic Models and Characterisation” includes three papers and is concerned with modelling and performance implications of multiplexed streams of bursty and correlated traffic in ATM networks. New analytic traffic models are proposed, focusing, respectively, on the characterisation of ATM traffic generated by Variable Bit Rate (VBR) video applications and the determination of output burst length of an ATM switch via entropy maximisation. Moreover, a validation study is presented relating to Markovian models replicating real ATM traffic flows.

Part Two on “Traffic and Congestion Control” addresses fundamental objectives such as guaranteed network performance, traffic prediction and management and contracted quality of service. This part brings together four papers describing analytic and simulation studies on ATM traffic and congestion control mechanisms. The works are based on flow control at connectionless layer combined with dynamic bandwidth allocation, Finite Impulse Response (FIR) neural networks, User Parameter Control (UPC) functions and the strategy of traffic dispersion.

Part Three on “Routing and Optimisation” focuses on the inherent problems of many services envisaged for ATM networks involving information transfer from one to one or one to many recipients for multimedia applications. It includes two papers which devise appropriate performance metrics and carry out rigorous comparisons involving pre-planned routing techniques for virtual path restoration as well as control schemes on virtual path bandwidth and dynamic routing under both static and dynamic traffic conditions.

Part Four on “Adaptation Layer and Protocols” reports a single study discussing detailed simulation experiments on the adaptability and performance issues of the Transport Control Protocol (TCP) when running over high speed ATM networks. **Part Five** on “ATM Management” presents one paper concerning with the provision of traffic loss guarantees in economically efficient ATM networks by means of an iterative pricing algorithm incorporating, as a dynamic feedback signal, a load dependent price per usage unit of network resources.

Part Six on “Models of ATM Switches” consists of five papers which describe analytic methodologies and cost-effective algorithms for the performance evaluation of various ATM switch architectures such as Multistage Interconnection Networks (MINs), shared output buffer queues and 3-stage Clos switching networks. The methodologies are based on discrete-time Markovian analysis, diffusion approximation approach, maximum entropy principle and traffic flow formalism for non-blocking operations. Such robust and reliable tools and techniques are of great value towards the derivation of new closed-form expressions and bounds for typical performance measures such as queue length distributions, cell-loss (and blocking) probabilities and end-to-end delays.

Part Seven on “Bandwidth and Admission Control” is concerned with novel methodologies for ATM bandwidth and performance optimisation, call connection control and traffic shaping. This part includes three papers which apply numerical simulations and also analytical techniques using theoretical arguments and an iterative Markov chain scheme.

Finally, **Part Eight** on “Performance Modelling Studies” includes four papers dealing with various ATM performance modelling and evaluation issues. The first two papers apply, respectively, analytical methods relating to a composite technique for an ATM Clos switching network and Markov Chain solutions for fast reservation protocols. The last two papers deal with the important topic of accelerated simulation techniques for ATM networks.

I would like to end this forward by expressing my thanks to IFIP TC6 and Working Groups WG 6.3 and WG 6.4 for sponsoring the 3rd Workshop on the Performance Modelling and Evaluation of ATM Networks and to British Computer Society Performance Engineering Specialist Group, Performance Engineering Section of BT Labs., UK, Telematics International Ltd., UK, Departments of Computing, of Electrical Engineering and of Mathematics, University of Bradford, Engineering and Physical Sciences Research Council (EPSRC), UK, for their support. My thanks are also extended to the members of the Scientific Committee and external referees for their invaluable and timely reviews.

Demetres Kouvatzos

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