Lecture Notes in Computer Science 2965

Edited by G. Goos, J. Hartmanis, and J. van Leeuwen

Springer
Berlin
Heidelberg
New York
Hong Kong
London
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Performance Tools and Applications to Networked Systems

Revised Tutorial Lectures

Springer

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Library of Congress Control Number: 2004104315

CR Subject Classification (1998): C.2, C.4, E.1, D.2

ISSN 0302-9743
ISBN 3-540-21945-5 Springer-Verlag Berlin Heidelberg New York

Typesetting: Camera-ready by author, data conversion by PTP-Berlin, Protago-TeX-Production GmbH
Printed on acid-free paper SPIN: 10998946 06/3142 5 4 3 2 1 0

Preface

This volume is dedicated largely to the performance-oriented design of modern computer networks, both wired and wireless. It is the consequence of the Tutorial Session which was held on 12th October 2003, preceeding the IEEE Computer Society's Symposium on Modeling, Analysis and Simulation of Computer and Telecommunication Systems, held in Orlando, Florida. In addition to the core tutorial presentations, which covered both advances in network quality of service (QoS) and in performance evaluation methodology, we felt that it would be useful to assemble a volume in the Lecture Notes in Computer Science series which would also include specific application areas of performance modeling and measurements. Thus the current volume includes three parts:

- a first part that specifically addresses performance and QoS of modern wired and wireless networks;
- a second one that discusses current advances in performance modeling and simulation; and
- a final part that addresses other specific applications of these methodologies.

The network-oriented portion of the volume itself comprises three complementary topics:

- a first group of chapters deals with novel designs and new issues related to broad-based network performance and QoS, without limitations concerning the connection technologies that are being used;
- a second group addresses the wireless context; and
- a final grouping of contributions considers the topic of wireless ad hoc networks more specifically.

The part of the volume dealing with methodologies discusses the software specification of models, the use of certain formalisms such as Petri nets, and some recent advances in simulation. Finally, the third part of the volume discusses other performance applications related to scheduling and to specific architectures.

The first paper in the part on general networking issues provides a useful survey of Content Delivery Networks which is of great current interest. The second paper also addresses a question of major importance concerning the modeling of computer virus propagation. Electronic mail still remains central to the role of networks, and the performance of mail systems is addressed in a third paper. The research represented in these three contributions was supported via the national Italian research project FIRB–PERF on computer and network performance. These papers are followed by a novel packet network protocol design, the Cognitive Packet Network (CPN), which provides QoS-driven routing in wired and wireless networks; this paper also gives detailed measurement results concerning user performance and QoS obtained in an experimental CPN testbed. Issues of

network reliability and path restoration in mesh networks are discussed in the fifth paper.

The integration of wireless and wired networks and the use of novel wireless systems as they become available is discussed first in a contribution on the wireless internet and then also in a contribution on the performance of systems that exploit 2.5/3G wireless. The role of the IP protocol in the wireless context is also examined in a separate paper.

Ad hoc wireless networks are discussed in a set of three papers, the first of which examines the role of peer-to-peer computing in this context, followed by another contribution that studies the role of multipath routing. A review of ad hoc wireless algorithm designs is presented in the third paper covering this area.

The section on performance evaluation methodologies begins with a paper on performance management which discusses certain general issues related to QoS in systems. The combination of UML and Petri nets is discussed in a second paper, while a novel extension to the performance evaluation tool PEPA so as to include the possibility of evaluating computer networks is discussed in the third paper of this group. A contribution on the use of simulation within a visually "true" augmented reality environment completes the set of methodologically oriented papers.

This volume closes with two papers on significant scheduling problems, the first in the area of distributed systems, and the second on mass memories and disk arrays.

We believe that this volume constitutes a very useful tool for both the practitioner and the researcher. To the practitioner we offer a set of comprehensive pointers to performance and QoS issues and we feel that the didactic style and the numerous references provided in each paper can be of great use in understanding how the field can help solve practical problems. For the researcher, we have consciously selected a set of contributions not only for their research value but also for their novelty and use in identifying areas of active research where much further work can be done.

February 2004

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