

# Lecture Notes in Computer Science

1911

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

**Springer**

*Berlin*

*Heidelberg*

*New York*

*Barcelona*

*Hong Kong*

*London*

*Milan*

*Paris*

*Singapore*

*Tokyo*

Dror G. Feitelson Larry Rudolph (Eds.)

# Job Scheduling Strategies for Parallel Processing

IPDPS 2000 Workshop, JSSPP 2000  
Cancun, Mexico, May 1, 2000  
Proceedings



Springer

## Series Editors

Gerhard Goos, Karlsruhe University, Germany  
Juris Hartmanis, Cornell University, NY, USA  
Jan van Leeuwen, Utrecht University, The Netherlands

## Volume Editors

Dror G. Feitelson  
The Hebrew University  
School of Computer Science and Engineering  
91904 Jerusalem, Israel  
E-mail: [feit@cs.huji.ac.il](mailto:feit@cs.huji.ac.il)

Larry Rudolph  
Massachusetts Institute of Technology  
Laboratory for Computer Science  
Cambridge, MA 02139, USA  
E-mail: [rudolph@lcs.mit.edu](mailto:rudolph@lcs.mit.edu)

Cataloging-in-Publication Data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Job scheduling strategies for parallel processing : proceedings /  
IPDPS 2000 workshop, JSSPP 2000, Cancun, Mexico, May 1, 2000.  
Dror G. Feitelson ; Larry Rudolph (ed.). - Berlin ; Heidelberg ; New York ;  
Barcelona ; Hong Kong ; London ; Milan ; Paris ; Singapore ; Tokyo :  
Springer, 2000  
(Lecture notes in computer science ; Vol. 1911)  
ISBN 3-540-41120-8

CR Subject Classification (1998): D.4, D.1.3, F.2.2., C.1.2, B.2.1, B.6, F.1.2

ISSN 0302-9743

ISBN 3-540-41120-8 Springer-Verlag Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag Berlin Heidelberg New York  
a member of BertelsmannSpringer Science+Business Media GmbH  
© Springer-Verlag Berlin Heidelberg 2000  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Steingraber Satztechnik GmbH, Heidelberg  
Printed on acid-free paper SPIN: 10722727 06/3142 5 4 3 2 1 0

# Preface

This volume contains the papers presented at the sixth workshop on Job Scheduling Strategies for Parallel Processing, which was held in conjunction with the IPDPS 2000 Conference in Cancun, Mexico, on 1 May 2000. The papers have been through a complete refereeing process, with the full version being read and evaluated by five to seven members of the program committee. We would like to take this opportunity to thank the program committee, Andrea Arpaci-Dusseau, Fran Berman, Steve Chapin, Allen Downey, Allan Gottlieb, Atsushi Hori, Phil Krueger, Richard Lagerstrom, Virginia Lo, Reagan Moore, Bill Nitzberg, Uwe Schwiegelshohn, and Mark Squillante, for an excellent job. Thanks are also due to the authors for their submissions, presentations, and final revisions for this volume. Finally, we would like to thank the MIT Laboratory for Computer Science and the Computer Science Institute at the Hebrew University for the use of their facilities in the preparation of these proceedings.

This was the sixth annual workshop in this series, which reflects the continued interest in this field. The previous five were held in conjunction with IPPS'95 through IPPS/SPDP'99. Their proceedings are available from Springer-Verlag as volumes 949, 1162, 1291, 1459, and 1659 of the Lecture Notes in Computer Science series. The last two are also available on-line from Springer LINK.

In addition to papers on traditional core areas of the workshop, such as gang scheduling and the effect of workload characteristics on performance, we experienced a return to basics. This was manifested in two recurring topics. One was the issue of system valuation (as in *value*), which included a report on the ASCI valuation project, a paper on the ESP system-level benchmark proposal, and a lively discussion that forced us to rearrange the division of papers into sessions. The other was advance reservations for meta-scheduling, which is similar to ideas such as backfilling on MPPs, but different enough to require new ideas, mechanisms, and policies.

We hope you find these papers interesting and useful.

June 2000

Dror Feitelson  
Larry Rudolph

# Table of Contents

Effect of Job Size Characteristics on Job Scheduling Performance .....	1
<i>Kento Aida</i>	
Improving Parallel Job Scheduling Using Runtime Measurements .....	18
<i>Fabricio A.B. da Silva and Isaac D. Scherson</i>	
Valuation of Ultra-scale Computing Systems .....	39
<i>Larry Rudolph and Paul H. Smith</i>	
System Utilization Benchmark on the Cray T3E and IBM SP .....	56
<i>Adrian Wong, Leonid Oliker, William Kramer, Teresa Kaltz, and David Bailey</i>	
A Critique of ESP .....	68
<i>Dror G. Feitelson</i>	
Resource Allocation Schemes for Gang Scheduling .....	74
<i>Bing Bing Zhou, David Walsh, and Richard P. Brent</i>	
A Tool to Schedule Parallel Applications on Multiprocessors: The NANOS CPU MANAGER .....	87
<i>Xavier Martorell, Julita Corbalán, Dimitrios S. Nikolopoulos, Nacho Navarro, Eleftherios D. Polychronopoulos, Theodore S. Papatheodorou, and Jesús Labarta</i>	
Time-Sharing Parallel Jobs in the Presence of Multiple Resource Requirements .....	113
<i>Fabrizio Petrini and Wu-chun Feng</i>	
The Performance Impact of Advance Reservation Meta-scheduling .....	137
<i>Quinn Snell, Mark Clement, David Jackson, and Chad Gregory</i>	
The Influence of the Structure and Sizes of Jobs on the Performance of Co-allocation .....	154
<i>Anca I.D. Bucur and Dick H.J. Epema</i>	
Load Balancing for Minimizing Execution Time of a Target Job on a Network of Heterogeneous Workstations .....	174
<i>S.-Y. Lee and C.-H. Cho</i>	
Adaptive Selection of Partition Size for Supercomputer Requests .....	187
<i>Walfredo Cirne and Francine Berman</i>	
Author Index .....	209