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Grid Computing – GRID 2000

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GRID 2000

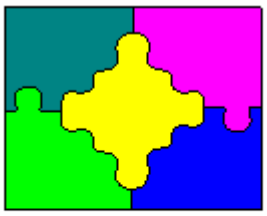
Grid Computing

The first IEEE/ACM International Workshop on Grid Computing

Bangalore, India, December 17, 2000

Editors:

- **Rajkumar Buyya**
- **Mark Baker**



GRID 2000

Preface

Welcome to GRID 2000, the first annual IEEE/ACM international workshop on grid computing sponsored by the IEEE Computer Society's Task Force on Cluster Computing (TFCC) and the Association for Computing Machinery (ACM). The workshop has received generous sponsorship from the European Grid Forum (eGrid), the EuroTools SIG on Metacomputing, Microsoft Research (USA), Sun Microsystems (USA), and the Centre for Development of Advanced Computing (India).

It is a sign of the current high levels of interest and activity in Grid computing that we have had contributions to the workshop from researchers and developers in Australia, Austria, Canada, France, Germany, Greece, India, Italy, Japan, Korea, The Netherlands, Spain, Switzerland, UK, and USA. It is our pleasure and honor to present the first annual international Grid computing meeting program and the proceedings.

The Grid: A New Network Computing Infrastructure

The growing popularity of the Internet along with the availability of powerful computers and high-speed networks as low-cost commodity components are helping to change the way we do computing. These new technologies are enabling the coupling of a wide variety of geographically distributed resources, such as parallel supercomputers, storage systems, data sources, and special devices, that can then be used as a unified resource and thus form what is popularly known as the "Grids". The Grid is analogous to the power (electricity) grid and aims to couple distributed resources and offer consistent and inexpensive access to these resources irrespective of their physical location. The interest in creating Grids (by pooling resources from multiple organizations) is growing due to the potential for solving large-scale problems that typically cannot be solved with local resources. Internationally there are a large number of projects actively exploring the design and development of different Grid system components, services, and applications. Pointers to these projects can be found at the following sources:

- Grid Infoware – http://www.gridcomputing.com
- IEEE Distributed Systems Online – http://computer.org/channels/ds/gc

It is projected that Grids are expected to drive the economy of the 21st century in a similar fashion to how electrical power grids drove the economy of the 20th century.

Grid systems need to hide complexities associated with the management and usage of resources across multiple administrative institutions. The following are some of the key features of Grid infrastructures:

- Flexibility and extensibility
- Domain autonomy
- Scalability
- Global name space
- Ease of use and transparent access

- Performance
- Security
- Management and exploitation of heterogeneous resources
- Interoperability between systems
- Resource allocation and co-allocation
- Fault-tolerance
- Dynamic adaptability
- Quality of Service (QoS)
- Computational Economy

The grid must be designed and created in such a way that their components (fabric, middleware, and higher-level tools) and applications handle the key design issues in a coordinated manner. For instance, Grid middleware offers services for handling heterogeneity, security, information, allocation, and so on. Higher level tools, such as resource brokers, support dynamic adaptability through automatic resource discovery, trading for economy of resources, resource acquisition, scheduling, the staging of data and programs, initiating computations, and adapting to changes in the Grid status. In addition, they also need to make sure that domain autonomy is honored but still meets user requirements such as QoS in coordination with other components. The papers accepted for inclusion in these proceedings address various issues related to the design, development, and implementation of Grid technologies and their applications.

Program Organization and Acknowledgements

The response to the workshop's call for papers has been excellent and we expect that attendance at the actual workshop will be equally impressive. The GRID 2000 program consists of a keynote speech (by Wolfgang Gentzsch on "DOT-COMing the GRID: Using Grids for Business"), an invited talk, and refereed technical paper presentations. We have accepted papers from authors of fifteen countries from among submissions from eighteen countries. We would like to thank all authors for submitting their research papers for consideration. We have grouped the contributed papers into five distinct categories, although inevitably there is some overlap:

- Network enabled server systems for the Grid (invited paper)
- Grid resource management
- Grid middleware and problem solving environments
- Grid testbeds and resource discovery
- Application-level scheduling on the Grid

The GRID 2000 meeting would not have taken place without the efforts of Viktor Prasanna, who has been the main driving force behind the international conference on High Performance Computing (HiPC). It is our pleasure to acknowledge his efforts and thank him for encouraging us to organize this annual international meeting on Grid computing. The success of the workshop is wholly due to the hard work of the program committee members and external reviewers. They have donated their precious time for reviewing and offered their expert comments on the papers. All

submitted papers have been peer reviewed by the technical program committee members and external referees. We requested four reviews for each paper and ensured that each paper received a minimum of three reviews. All highly recommended and promising works have been selected for presentation at the meeting.

We thank our keynote speaker Wolfgang Gentzsch (Director of Network Computing, Sun Microsystems) and invited speaker Satoshi Matsuoka (Tokyo Institute of Technology, Japan) for presenting their vision on Grid technologies.

We owe a debt of gratitude to all our sponsors and contributors. In particular, we would like thank R.K. Arora (C-DAC, Pune), Mohan Ram (C-DAC, Bangalore), and Wolfgang Gentzsch (Sun Microsystems) for responding to our request for financial support enthusiastically and being instrumental in obtaining generous donations from their respective organizations. Our special thanks go to Todd Needham (Microsoft Research, USA), who has voluntarily come forward to support our Task Force activities. We would also like to thank Hilda Rivera (ACM) for handling our request for ACM "in-cooperation" status. We thank Jarek Nabrzyski for his help in gathering the European Grid forum support for this workshop. Finally, we would like to thank the Springer-Verlag team, particularly Jan van Leeuwen (LNCS series editor), Alfred Hofmann (Executive Editor), Antje Endemann, and Karin Henzold. They are wonderful to work with!

We hope these proceedings serve as a useful reference on Grid computing. We wish you all the best and hope you enjoy your visit to the Silicon Valley of India!

December 2000
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- Peter Sloot, University of Amsterdam, The Netherlands

GRID 2000 Additional Referees

We acknowledge the following external referees for reviewing papers (the list does not include members of the program committee, who did most of the review work):

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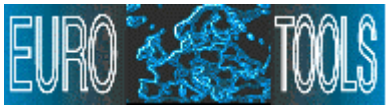
EuroTools SIG on Metacomputing http://www.eurotools.org/	
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Table of Contents

Preface ……... V

Keynote and Invited Papers

DOT-COMing the GRID: Using Grids for Business ……. 1
Wolfgang Gentzsch

Design issues of Network Enabled Server Systems for the Grid …….. 4
Satoshi Matsuoka, Mitsuhisa Sato, Hidemoto Nakada, Satoshi Sekiguchi

Grid Resource Management

Architectural Models for Resource Management in the Grid ……. 18
Rajkumar Buyya, Steve Chapin, David DiNucci

JaWS: An Open Market-Based Framework for Distributed Computing over the Internet …….. 35
Spyros Lalis, Alexandros Karipidis

MeSch - An Approach to Resource Management in a Distributed Environment …. 46
Gerd Quecke, Wolfgang Ziegler

Resource Management Method for Cooperative Web Computing on Computational Grid …… 54
Hye-Seon Maeng, Tack-Don Han, Shin-Dug Kim

Architecture for a Grid Operating System …….. 64
Klaus Krauter, Muthucumaru Maheswaran

Data Management in an International Data Grid Project ……. 76
Wolfgang Hoschek, Javier Jaen-Martinez, Asad Samar, Heinz Stockinger, Kurt Stockinger

Grid Middleware and Problem Solving Environments

XtremWeb: building an experimental platform for Global Computing …….. 90
Cecile Germain, Vincent Neri, Gille Fedak, Franck Cappello

A Grid Computing Environment for Enabling Large Scale Quantum Mechanical Simulations ……. 100
Jack J. Dongarra, Padma Raghavan

A Web-based Metacomputing Problem Solving Environment for Complex Applications …… 109
Ranieri Baraglia, Domenico Laforenza, Antonio Lagana'

FOCALE: Towards a Grid View of Large-Scale Computation Components …… 121
G. Scotto di Apollonia, C. Gransart, J. M. Geib

Web enabled client-server model for development environment of distributed image processing …… 133
Haresh S. Bhatt, V. H. Patel, A. K. Aggarwal

An Advanced User Interface Approach for Complex Parameter Study Process Specification on the Information Power Grid …… 144
Maurice Yarrow, Karen McCann, Rupak Biswas, Rob F. Van der Wijngaart

Grid Test-Beds and Resource Discovery

Mini-Grids: Effective test-beds for Grid Application …… 156
John Brooke, Martyn Foster, Stephen Pickles, Keith Taylor, Terry Hewitt

Configuration Method of Multiple Clusters for the Computational Grid …….. 168
Pil-Sup Shin, Won-Kee Hong, Shin-Dug Kim

A Parameter-based Approach to Resource Discovery in Grid Computing Systems …… 179
Muthucumaru Maheswaran, Klaus Krauter

Application-level Scheduling on the Grid

Evaluation of Job-Scheduling Strategies for Grid Computing ……189
Volker Hamscher, Uwe Schwiegelshohn, Achim Streit, Ramin Yahyapour

Experiments with Migration of Message-Passing Tasks …… 201
K. Iskra, Z. Hendrikse, G. van Albada, B. Overeinder, P. Sloot, J.Gehring

Adaptive Scheduling for Master-Worker Applications on the Computational Grid …… 212
Elisa Heymann, Miquel A. Senar, Emilio Luque, Miron Livny

Authors Index …… 227

Authors Index

Achim Streit, 189
Akshai K. Aggarwal, 133
Alexandros Karipidis, 35
Antonio Lagana', 109
Asad Samar, 76
B. Overeinder, 201
C. Gransart, 121
Cecile Germain, 90
David DiNucci, 18
Domenico Laforenza, 109
Elisa Heymann, 212
Emilio Luque, 212
Franck Cappello, 90
G. Scotto di Apollonia, 121
G. van Albada, 201
Gerd Quecke, 46
Gille Fedak, 90
Haresh S. Bhatt, 133
Heinz Stockinger, 76
Hidemoto Nakada, 4
Hye-Seon Maeng, 54
J. M. Geib, 121
J.Gehring, 201
Jack J. Dongarra, 100
Javier Jaen-Martinez, 76
John Brooke, 156
K. Iskra, 201
Karen McCann, 144
Keith Taylor, 156
Klaus Krauter, 64, 179
Kurt Stockinger, 76
Martyn Foster, 156
Maurice Yarrow, 144
Miquel A. Senar, 212
Miron Livny, 212
Mitsuhisa Sato, 4
Muthucumaru Maheswaran, 64, 179
P. Sloot, 201
Padma Raghavan, 100
Pil-Sup Shin, 168
Rajkumar Buyya, 18
Ramin Yahyapour, 189
Ranieri Baraglia, 109
Rob F. Van der Wijngaart, 144
Rupak Biswas, 144
Satoshi Matsuoka, 4
Satoshi Sekiguchi, 4
Shin-Dug Kim, 168
Spyros Lalis, 35
Stephen Pickles, 156
Steve Chapin, 18
Tack-Don Han, 54
Terry Hewitt, 156
Uwe Schwiegelshohn, 189
V. H. Patel, 133
Vincent Neri, 90
Volker Hamscher, 189
Wolfgang Gentzsch, 1
Wolfgang Hoschek, 76
Wolfgang Ziegler, 46
Won-Kee Hong, 168
Z. Hendrikse, 201