# Table of Contents


<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Co-Chairs' Message</td>
<td>xiii</td>
</tr>
<tr>
<td>PC Chair's Message</td>
<td>xv</td>
</tr>
<tr>
<td>Symposium Chairs and Committees</td>
<td>xvi</td>
</tr>
<tr>
<td>Symposium Reviewers</td>
<td>xix</td>
</tr>
<tr>
<td>Workshop Reviewers</td>
<td>xx</td>
</tr>
<tr>
<td>Sponsors and/or Supporting Organizations</td>
<td>xxi</td>
</tr>
<tr>
<td><strong>Tutorials</strong></td>
<td></td>
</tr>
<tr>
<td>The Globus Toolkit for Grid Computing</td>
<td>2</td>
</tr>
<tr>
<td>I. Foster (Argonne Nat. Lab. and Univ. of Chicago)</td>
<td></td>
</tr>
<tr>
<td>An Introduction to OpenMP</td>
<td>3</td>
</tr>
<tr>
<td>T. Mattson (Intel Corp.)</td>
<td></td>
</tr>
<tr>
<td><strong>Keynotes</strong></td>
<td></td>
</tr>
<tr>
<td>The Anatomy of the Grid: Enabling Scalable Virtual Organizations</td>
<td>6</td>
</tr>
<tr>
<td>I. Foster (Argonne Nat. Lab. and Univ. of Chicago)</td>
<td></td>
</tr>
<tr>
<td>Making Parallel Processing on Clusters Efficient, Transparent and Easy for Programmers</td>
<td>8</td>
</tr>
<tr>
<td>A. Goscinski (Deakin University)</td>
<td></td>
</tr>
<tr>
<td>Programming High Performance Applications in Grid Environments</td>
<td>10</td>
</tr>
<tr>
<td>D. Laforenza (CNUCE)</td>
<td></td>
</tr>
<tr>
<td>Global Internet Content Delivery</td>
<td>12</td>
</tr>
<tr>
<td>B. Maggs (Akamai Technologies)</td>
<td></td>
</tr>
<tr>
<td>Grid RPC meets Data Grid: Network Enabled Services for Data Farming on the Grid</td>
<td>13</td>
</tr>
<tr>
<td>S. Matsuoka (Tokyo Inst. of Tech.)</td>
<td></td>
</tr>
<tr>
<td>The Promise of InfiniBand for Cluster Computing</td>
<td>16</td>
</tr>
<tr>
<td>G. Pfister (IBM)</td>
<td></td>
</tr>
<tr>
<td><strong>Invited Talks</strong></td>
<td></td>
</tr>
<tr>
<td>The World Wide Computer: Prospects for Parallel and Distributed Computing on the Web</td>
<td>18</td>
</tr>
<tr>
<td>G. Agha (Univ. of Illinois at Urbana-Champaign)</td>
<td></td>
</tr>
<tr>
<td>Terraforming Cyberspace</td>
<td>19</td>
</tr>
<tr>
<td>J. Bradshaw (Univ. of West Florida)</td>
<td></td>
</tr>
</tbody>
</table>
Industry Track

High Performance Computing at Intel: The OSCAR Software Solution Stack for Cluster Computing
T. Mattson (Intel Corp.)

MPI/FT: Architecture and Taxonomies for Fault-Tolerant, Message-Passing Middleware for Performance-Portable Parallel Computing
R. Batchu, J. Neelamegum, Z. Cui, M. Beddhu, A. Skjellum, Y. Dandass, and M. Apte
(MPI Software Tech. Inc. and Mississippi State Univ.)

Effective Internet Grid Computing for Industrial Users
M. Xu (Platform Computing Corp.)

Sun Grid Engine: Towards Creating a Compute Power Grid
W. Gentzsch (Sun Microsystems)

Main Symposium Sessions

Component and Agent Approaches

Design of a Generic Platform for Efficient and Scalable Cluster Computing Based on Middleware Techniques
S. Vunhastel, F. De Turck, and P. Demeester (Ghent Univ.-IMEC)

Declarative Flow Control for Distributed Instrumentation
B. Parvin, G. Fontenay, J. Taylor, and D. Callahan (Lawrence Berkeley Nat. Lab.)

Optimizing Execution of Component-Based Applications Using Group Instances
M. Beynon, A. Sussman, and J. Saltz (Univ. of Maryland), and T. Kurc (Johns Hopkins Med. Inst.)

Distributed Shared Memory

Containers: A Sound Basis for a True Single System Image
R. Lottiaux and C. Morin (IRISA)

View-Based Consistency and its Implementation
Z. Huang, S. Cranefield, and M. Purvis (Univ. of Otago) and C. Sun (Griffith Univ.)

Coupling DSM-Based Parallel Applications
Y. Jégou (IRISA)

Grid Computing

QoS-Aware Discovery of Wide-Area Distributed Services
D. Xu, K. Nahrstedt, and D. Wichadakul (Univ. of Illinois at Urbana-Champaign)

Effective Metacomputing Using LSF MultiCluster
M. Xu (Platform Computing Corp.)

Replica Selection in the Globus Data Grid
S. Vazhkudai (Univ. of Mississippi), S. Tuecke and I. Foster (Argonne Nat. Lab.)

User Preference Driven Multiobjective Resource Management in Grid Environments
K. Kurowski, J. Nabrzyski, and J. Pukacki (Poznan Supercomputing and Networking Ctr.)
Data Staging Effects in Wide Area Task Farming Applications

W. Elwasif, J. Plank, and R. Wolski (Univ. of Tennessee)

Early Experiences with the EGrid Testbed

T. Kiellmann and K. Verstoep (Vrije Univ.), Z. Balaton, P. Kacsuk, and F. Szalai (MTA SZTAKI),
J. Gehring, A. Keller, and A. Streit (Paderborn Ctr. for Parallel Comp.),
L. Matyska, M. Ruda, and A. Křenek (Masaryk Univ.),
H. Knipp, A. Merzky, A. Reinefeld, and F. Schintke (Konrad Zuse Zentrum fur Inform.),
B. Ludwigzak, J. Nabrzycki, and J. Pilaacki (Poznan Supercomputing and Networking Ctr.),
H. Kersken (DLR), G. Aloisio and M. Cafaro (Univ. of Lecce), W. Ziegler (GMD),
and M. Russell (Univ. of Chicago)

Input/Output and Databases

Document Distribution Algorithm for Load Balancing on an Extensible Web Server Architecture

B. Ng and C. Wung (The Univ. of Hong Kong)

KelplO: A Telescope-Ready Domain-Specific I/O Library for Irregular Block-Structured Applications

B. Broom, R. Fowler, and K. Kennedy (Rice Univ.)

Cluster Computers and Grid Processing in the First Radio-Telescope of a New Generation

C. De Vos, K. van der Schaaf, and J. Bregman (ASTRON)

A Cluster Architecture for Parallel Data Warehousing

F. Dehne (Carleton Univ.), and T. Eavis, A. Rau-Chaplin (Dalhousie Univ.)

Manageable Storage via Adaptation in WiND

R. Arpací-Dusseau, R. Arpací-Dusseau, J. Bent, B. Forney,
S. Muthukrishnan, F. Popovici, and O. Zaki (Univ. of Wisconsin, Madison)

Parallel Processing of “GroupBy-Before-Join” Queries in Cluster Architecture

D. Tanir (Monash Univ.) and J. Rahayu (La Trobe Univ.)

Parallel I/O Support for HPF on Clusters

P. Brezany and V. Sipkova (Univ. of Vienna)

Armada: A Parallel File System for Computational Grids

R. Oldfield and D. Kotz (Dartmouth College)

Software Environments for Cluster-Based Display Systems

Y. Chen, H. Chen, D. Clark, Z. Liu, G. Wallace, and K. Li (Princeton Univ.)

Message Passing and Communication

OVM: Out-of-Order Execution Parallel Virtual Machine

G. Bosilca, G. Fedak, and F. Cappello (Lab. de Rech. en Informatique)

A New Software Architecture for the BIP/Myrinet Firmware

R. Westelin (INRIA)

An Adaptive, Reconfigurable Interconnect for Computational Clusters

A. Shafarenko (Univ. of Hertfordshire) and V. Vasekin (Telecom MODUS Ltd.)
xBSP: An Efficient BSP Implementation for cLAN 237
Y. Kee and S. Ha (Seoul National Univ.)

Implementing Virtual Interface Architecture on top of the GM Message Passing Interface 245
G. Chelius (Ecole Normale Sup. de Lyon)

TACO — Exploiting Cluster Networks for High-Level Collective Operations 253
J. Nolte, M. Sato, and Y. Ishikawa (Real World Computing Partnership)

OPIOM: Off-Processor IO with Myrinet 261
P. Geoffray (INRIA)

Gekko: A Metalevel for Adaptation in Nexus 269
D. Webb and A. Wendelborn (Univ. of Adelaide)

Supporting Disconnectedness — Transparent Information Delivery for Mobile and Invisible Computing 277
P. Sutton, R. Arkins (The Univ. of Queensland), and B. Segall (CRC Enterprise Distr. Sys. Tech.)

Performance Evaluation

Evaluating the Performance of CORBA for Distributed and Grid Computing Applications 288
T. Es-sqalli, E. Fleury, J. Gujard, and S. Bhiri (LORIA)

The Characteristics of Workload on ASCI Blue-Pacific at Lawrence Livermore National Laboratory 295
A. Yoo and M. Jette (Lawrence Livermore Nat. Lab.)

Lessons Learned While Operating Two Large SCI Clusters 303
A. Keller and A. Krawinkel (Univ. of Paderborn)

Performance Evaluation of an Agent-Based Resource Management Infrastructure for Grid Computing 311
J. Cao, D. Kerbyson, and G. Nudd (Univ. of Warwick)

Scheduling and Load Balancing

Evaluation of Strategies to Reduce the Impact of Machine Reclaim in Cycle-Stealing Environments 320
E. Heymann, M. Senar, E. Luque (Univ. Autonomia de Barcelona), and M. Livny (Univ. of Wisconsin-Madison)

Scheduling Aspects for Image Retrieval in Cluster-Based Image Databases 329
O. Kao, G. Steinert, and F. Drews (Tech. Univ. of Clausthal)

Sabotage-Tolerance Mechanisms for Volunteer Computing Systems 337
L. Sarmenta (Ateneo de Manila Univ.)

Latency Hiding in Dynamic Partitioning and Load Balancing of Grid Computing Applications 347
S. Das, D. Harvey (The Univ. of Texas at Arlington), and R. Biswas (NASA)

Developing a Cost/Benefit Estimating Service for Dynamic Resource Sharing in Heterogeneous Clusters: Experience with SNL Clusters 355
D. Katramatos, M. Humphrey (Univ. of Virginia), and C. Hwang, S. Chapin (Syracuse Univ.)

Preferential Load Balancing for Distributed Internet Servers 363
M. Rumsewicz (Ericsson) and M. Dwyer (Univ. of Melbourne)
A Group-Based Load Balance Scheme for Software Distributed Shared Memory Systems

Y. Zhuang, C. Shieh, T. Liang, J. Lee (National Cheng Kung Univ.), and L. Tseng (National Central Univ.)

Using Consensus for Solving Conflict Situations in Fault-Tolerant Distributed Systems

N. Nguyen (Wroclaw Univ. of Tech.)

**Tools for Management, Monitoring and Debugging**

M3C: Managing and Monitoring Multiple Clusters

M. Brim, A. Geist, B. Luethke, J. Schwidder, and S. Scott (Oak Ridge Nat. Lab.)

Efficient Tracing for On-the-Fly Space-Time Displays in a Debugger for Message Passing Programs

R. Hood and G. Matthews (NASA)

NwsAlarm: A Tool for Accurately Detecting Resource Performance Degradation

C. Krintz (Univ. of California, San Diego) and R. Wolski (Univ. of Tennessee)

XML-Based Visual Specification of Multidisciplinary Applications

A. Al-Theneyan, A. Jakatdar, M. Zubair (Old Dominion Univ.), and P. Mehrotra (NASA)

A Preliminary Topological Debugger for MPI Programs

S. Huband and C. McDonald (The Univ. of Western Australia)

Simgrid: A Toolkit for the Simulation of Application Scheduling

H. Casanova (Univ. of California, San Diego)

**CCGrid 2001 Workshops**

**Agent Based Cluster and Grid Computing**

Organized by: O. Rana (University of Wales, UK)

Reflections on Qualitative Attributes of Mobile Agents for Computational, Data, and Service Grids

D. Marinescu (Purdue Univ.)

On the Use of Mobile Code Technology for Monitoring Grid System

O. Tomarchio and L. Vita (Univ. of Catania)

Modelling and Simulation of Aggregation Nets

A. Poylisher (Univ. of Warwick) and M. Luck (Univ. of Southampton)

Enhancing a Multi-Agent System’s Performance: From Implementation to Simulation Analysis

F. Andriamasinoro, R. Courdier, and E. Piquet (Univ. of Reunion Island)

While You’re Away: A System for Load-Balancing and Resource Sharing Based on Mobile Agents

N. Suri, P. Groth, and J. Bradshaw (Univ. of West Florida)

**Cluster Computing Education**

Organized by: D. Hyde (Bucknell Univ.) and B. Wilkinson (University of North Carolina at Charlotte)

Cluster Computing in the Classroom: Topics, Guidelines, and Experiences

A. Apon (Univ. of Arkansas), R. Buyya (Monash Univ.), H. Jin (Univ. of So. Calif.) and J. Mache (Lewis & Clark College)
Teaching Distributed and Parallel Computing with Java and CSP
C. Nevison (Colgate Univ.) 484

A Distributed Shared Memory Programming Course
B. Wilkinson, T. Pai, and M. Miraj (Univ. of North Carolina at Charlotte) 492

ORESPICS: A Friendly Environment to Learn Cluster Programming
G. Capretti, M. Loganà, L. Ricci, P. Castellucci, and S. Puri (Univ. di Pisa) 498

**Distributed Shared Memory on Clusters**
Organized by: L. Lefevre (Universite Claude Bernard Lyon, France)

Teamster: A Transparent Distributed Shared Memory for Cluster Symmetric Multiprocessors
J. Chang and C. Shieh (Nat. Cheng Kung Univ.) 508

A Two Level Checkpoint Algorithm in a Highly-Available Parallel Single Level Store System
C. Morin, R. Lottiaux (IRISA), and A. Kermarrec (Microsoft) 514

Adaptative Prefetching Technique for Shared Virtual Memory
S. Lee, H. Yun, J. Lee, and S. Maeng (Korea Adv. Inst. of Science and Tech.) 521

An Efficient Lock Protocol for Home-Based Lazy Release Consistency
S. Lee, H. Yun, J. Lee, and S. Maeng (Korea Adv. Inst. of Science and Tech.) 527

Parallel Pull-Based LRU: A Request Distribution Algorithm for Clustered Web Caches
Using a DSM for Memory Mapped Networks
E. Cecchet (INRIA-SIRAC) 533

Mosaic: A Non-Intrusive Complete Garbage Collector for DSM Systems
D. Munro, K. Falkner, M. Lowry, and F. Vaughan (Univ. of Adelaide) 539

A DSM Cluster Architecture Supporting Aggressive Computation in Active Networks
P. Graham (Univ. of Manitoba) 547

Distributed and Parallel Execution of Java Programs on a DSM System
T. Hou, J. Lee, Y. Cheng, and F. Chen (Nat. Cheng Kung Univ.) 555

**Global Computing on Personal Devices**
Organized by: F. Cappello (Universite Paris-Sud, France) and
S. Lalis (Foundation for Research and Technology, Greece)

A Market-Based Protocol with Leasing Support for Globally Distributed Computing
G. Kakarontzas (Univ. of Thessaly) and S. Lalis (Inst. of Comp. Sci., Hellas) 562

A WOSTM-Based Solution for High Performance Computing
N. Abdennadher (Univ. of Applied Sciences), G. Babin (HEC-Montreal),
and P. Kropf (Univ. de Montreal) 568

Compute Power Market: Towards a Market-Oriented Grid
R. Buyya (Monash Univ.) and S. Vazkudai (Univ. of Mississippi) 574

XtreMWeb: A Generic Global Computing System
G. Fedak, C. Germain, V. Néri, and F. Cappello (Univ. Paris Sud) 582
Internet QoS for the Global Computing
Organized by: M. Hassan and S. Jha (Univ. of New South Wales, Sydney, Australia)

Charging Distributed Services of a Computational Grid Architecture
B. Stiller, J. Gerke, P. Flury, P. Reichl, Hasan (Swiss Federal Inst. of Tech.)

A Relative Bandwidth Differentiated Service for TCP Micro-Flows
T. Soetens, S. De Cnodder, and O. Elloumi (Alcatel Network Strategy Group)

Markovian Model of RED Mechanism
R. Lalaouna, T. Attacca (Inst. National des Telecomm.), and T. Czachórski (ITiS PAN)

Group Communication in Differentiated Services Networks
R. Bles and K. Wehrle (Univ. Karlsruhe)

Universal Network of Small Wireless Operators (UNSWo)
M. Chalmers, S. Jha, W. Lau, J. Hassan, S. Yap, and M. Hassan (The Univ. of New South Wales)

Object and Component Technologies for Cluster Computing
Organized by: R. Raju (Indiana University Purdue University Indianapolis) and B. Bryant (University of Alabama at Birmingham)

Automating the Construction of Replicated Objects in a Cluster of Workstations
W. Zhou (Deakin Univ.) and L. Wang (Phoneware Comm. Sys.)

On Component-Based Communication Systems for Clusters of Workstations
A. Frohlich (GMD-FIRST) and W. Schröder-Preikschat (Univ. of Magdeburg)

A CORBA-Based Architecture for Parallel Applications: Experimentations with the WZ Matrix Factorization
D. Dhoutaut (Ecole Normal Sup. de Lyon) and D. Latymani (IUT Belfort-Montbéliard)

Scheduling and Load Balancing on Clusters
Organized by: Y.K. Kwok (The University of Hong Kong)

A Benefit Function Mapping Heuristic for a Class of Meta-tasks in Grid Environments
Q. Ding and G. Chen (Univ. of Science and Technology of China)

Divisible Load Scheduling on a Hypercube Cluster with Finite-size Buffers and Granularity Constraints
X. Li, B. Veeravalli, and C. Ko (The National Univ. of Singapore)

A Protocol for Load Sharing among a Cluster of Heterogeneous Unix Workstations
D. Gupta, A. Gupta (Indian Institute of Tech.), S. Agrawal (Veritas Software), V. Agarwal (IBM), and P. Bepari (Ionic Microsystems)

A Bayesian RunTime Load Manager on a Shared Cluster
L. Santos and A. Proenca (Univ. do Minho)
A General Scheduling Framework for Parallel Execution Environments
G. Cavalheiro (PIP/CA/UNISINOS) 680

Cooperative Scheduling for Multimedia Services and Computation Intensive Applications for Cluster Server
H. Wan and X. Lin (The Univ. of Hong Kong) 688

A Fuzzy Approach to Load Balancing in a Distributed Object Computing Network
L. Cheung (The Univ. of Hong Kong) 694

Author Index 701