Hai Jin
Omer F. Rana
Yi Pan
Viktor K. Prasanna (Eds.)

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Preface

Parallel and distributed computing in the 1980s and 1990s had great influence on application development in science, engineering and business computing. The improvements in computation and communication capabilities have enabled the creation of demanding applications in critical domains such as the environment, health, aerospace, and other areas of science and technology. Similarly, new classes of applications are enabled by the availability of heterogeneous large-scale distributed systems which are becoming available nowadays (based on technologies such as grid and peer-to-peer systems). Parallel computing systems exploit a large diversity of computer architectures, from supercomputers, shared-memory or distributed-memory multi processors, to local networks and clusters of personal computers.

With the recent emergence of multi core architectures, parallel computing is now set to achieve "mainstream" status. Approaches that have been advocated by parallel computing researchers in the past are now being utilized in a number of software libraries and hardware systems that are available for everyday use. Parallel computing ideas have also come to dominate areas such as multi user gaming (especially in the development of gaming engines based on "cell" architectures) – often ignored by many "serious" researchers in the past, but which now are set to have a growing user base of tens of millions across the world. In recent years, focus has also shifted to support energy efficiency in computation, with some researchers proposing a new metric of performance based on Flops/Watt.

Another topic that has gained significant importance is work within distributed and wireless sensor networks – which provide the capability of data capture, along with actuation support in some instances. Grid computing has dominated much work being undertaken within parallel and distributed systems in recent years. The ability to group regional and national-scale resources to create computational infrastructure for grand-challenge problems has now been demonstrated effectively in Europe, the United States and in China. Grid computing research continues to play an active part in bringing together computational science and parallel computing communities.

ICA3PP is a premier conference series that brings together researchers and practitioners from academia, industry and governments around the world to advance the theories and technologies of parallel and distributed computing. Previous ICA3PP conferences have been successfully organized in Brisbane (1995), Singapore (1996), Melbourne (1997, 2005), Hong Kong (2000), and Beijing (2002).

ICA3PP 2007 featured a number of papers that address these themes, and selected papers for the conference also provide an insight into many emerging themes that have become important in parallel and distributed systems laboratories and groups around the world over recent years.

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ICA3PP 2007 was hosted in one of the most beautiful cities in the world, in Hangzhou – the capital of Zhejiang province in China. Hangzhou is known for its natural beauty and provides an atmosphere fostering creativity. We believe the conference in this city will encourage dialogue and interaction between world leaders in parallel and high-performance computing, and encourage greater collaboration between the researchers who attended the conference.

In total, the conference received 176 papers from researchers and practitioners from 9 countries. Each paper was reviewed by at least three internationally renowned referees, and selection was based on originality, significance, correctness, relevance, and clarity of presentation. Some of the papers were subsequently further reviewed by the Program Chairs to assess quality and relevance. From the submissions received, 40 papers were selected. All of the selected papers are included in the proceedings. To encourage and promote the work presented at ICA3PP 2007, we are delighted to inform the authors that some of the papers will be accepted in special issues of *Parallel Computing, Computer Communication, Journal of Supercomputing, and IJHPCN.* All of these journals have played a prominent role in promoting the development and use of parallel and high-performance computing and networking.

We are also delighted to have been able to host well-known international scholars, Reiner Hartenstein from the Computer Science Department, Kaiserslautern University of Technology, Germany, and Hai Zhuge from the Institute of Computing Technology, Chinese Academic of Science, China, who delivered the keynote speeches.

We would like to take this opportunity to thank all the authors for their submissions to the conference. Many of them traveled a considerable distance to participate in the conference. We also thank the Program Committee members and additional reviewers for their efforts in reviewing the large number of papers. Thanks also go to the local conference organizers for their great support.

Last but not least, we would like to express our gratitude to all of the organizations that supported our efforts to bring the conference to fruition. We are grateful to Springer for publishing the proceedings this year. Special thanks go to Wanlei Zhou (from Deakin University, Australia) and Yi Pan (Georgia State University, USA). Their guidance, hard work and support made ICA3PP 2007 possible. We are also grateful to Michael Hobbs (Deakin University), who served as Co-chair in 2005 and provided support for this event.

March 2007

Hai Jin
Omer Rana

Organization

The ICA3PP 07 conference was organized by the Cluster and Grid Computing Lab, Huazhong University of Science and Technology, and undertaken by Hangzhou Dianzi University. It was held in cooperation with *Lecture Notes in Computer Science* (LNCS) of Springer.

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Table of Contents

Keynote Speech

RSM-Based Gossip on P2P Network 1
Hai Zhuge and Xiang Li

Invited Papers

AnyServer: Ubiquitous Real-Time Multimedia Communication System 13
Weijia Jia

Performance Analysis of Interconnection Networks Under Bursty and Batch Arrival Traffic 25
Yulei Wu, Geyong Min, and Lan Wang

Protocols for Traffic Safety Using Wireless Sensor Network 37
Yi Lai, Yuan Zheng, and Jiannong Cao

Track 1: Parallel Algorithms

A Lazy EDF Interrupt Scheduling Algorithm for Multiprocessor in Parallel Computing Environment 49
Peng Liu, Guojun Dai, Tingting Fu, Hong Zeng, and Xiang Zhang

Efficient Representations of Row-Sorted 1-Variant Matrices for Parallel String Applications 60
Carlos Eduardo Rodrigues Alves, Edson Norberto Cáceres, and Siang Wun Song

PHC: A Rapid Parallel Hierarchical Cubing Algorithm on High Dimensional OLAP 72
Kongfa Hu, Ling Chen, and Yixin Chen

A Time and Interaction Model for Open Distributed Timing Computation 83
Limin Shen, Shangping Ren, Feng Li, and Yunfeng Mu

Efficient Linkable Ring Signatures and Threshold Signatures from Linear Feedback Shift Register 95
Xiangxue Li, Dong Zheng, and Kefei Chen

An Implementation of Parallel Eigenvalue Computation Using Dual-Level Hybrid Parallelism 107
Yonghua Zhao, Xuebin Chi, and Qiang Cheng

An Improved Algorithm for Alhusaini's Algorithm in Heterogeneous Distributed Systems 120
Jianwei Liao and Jianqiao Yu

Track 2: Parallel Architecture

Fuzzy-Grey Prediction Based Dynamic Failure Detector for Distributed Systems 131
Dong Tian, Shuyu Chen, and Taiping Mao

A Two-Level Directory Organization Solution for CC-NUMA Systems 142
Guoteng Pan, Qiang Dou, and Lunguo Xie

A Framework of Software Component Adaptation 153
Xiong Xie and Weishi Zhang

A Parallel Infrastructure on Dynamic EPIC SMT 165
Qingying Deng, Minxuan Zhang, and Jiang Jiang

The Thread Migration Mechanism of DSM-PEPE 177
Federico Meza and Cristian Ruz

EH*RS: A High-Availability Scalable Distributed Data Structure 188
Xueping Ren and Xianghua Xu

Optimizing Stream Organization to Improve the Performance of Scientific Computing Applications on the Stream Processor 198
Ying Zhang, Gen Li, Xuejun Yang, and Kun Zeng

A Parallel Architecture for Motion Estimation and DCT Computation in MPEG-2 Encoder 210
Jian Huang and Hao Li

EOP: An Efficient Object Placement and Location Algorithm for OBS Cluster 222
Changsheng Xie, Xu Li, Qinqi Wei, and Qiang Cao

Track 3: Grid Computing

Data Interoperation Between ChinaGrid and SRB 231
Muzhou Xiong, Hai Jin, and Song Wu

Redundant Parallel File Transfer with Anticipative Recursively-Adjusting Scheme in Data Grids 242
Chao-Tung Yang, Yao-Chun Chi, Tsu-Fen Han, and Ching-Hsien Hsu

A Strategy-Proof Combinatorial Auction-Based Grid Resource Allocation System 254
Yi Liang, Jianping Fan, Dan Meng, and Ruihua Di

Method for Computational Grids Resources Allocate Based on Auction and Utility Analyses 267
Dong-E Chen and Yang Yang

Service Dependency Model for Dynamic and Stateful Grid Services 278
Li Qi, Hai Jin, Yaqin Luo, Xuanhua Shi, and Chengwei Wang

Automatic Conceptual Indexing of Web Services and Its Application to Service Retrieval 290
Dunlu Peng

Design and Implementation of Computational Bioinformatics Grid Services on GT4 Platforms 302
Chao-Tung Yang, Tsu-Fen Han, Ya-Ling Chen, Heng-Chuan Kan, and William C. Chu

On-Demand Capacity Framework 314
Chi-Hung Chi and Chao Wang

Track 4: Peer-to-Peer Technologies

An Interest-Based Intelligent Link Selection Algorithm in Unstructured P2P Environment 326
Hao Ren, Nong Xiao, and Zhiying Wang

Keyword Search in DHT-Based Peer-to-Peer Networks 338
Byungryong Kim and Kichang Kim

Implementing Digital Right Management in P2P Content Sharing System 348
Yang Liu, Chun Yuan, and Yu-Zhuo Zhong

IPBGA: A Hybrid P2P Based Grid Architecture by Using Information Pool Protocol 356
Deng Li, Hui Liu, Zhigang Chen, Zhiwen Zeng, and Jiaqi Liu

Understanding Peer Behavior and Designing Incentive Mechanism in Peer-to-Peer Networks: An Analytical Model Based on Game Theory ... 368
Min Xiao and Debao Xiao

An Efficient Source Peer Selection Algorithm in Hybrid P2P File Sharing Systems 380
Jingyuan Li, Weijia Jia, Liusheng Huang, Mingjun Xiao, and Jun Wang

A New k-Graph Partition Algorithm for Distributed P2P Simulation Systems 391
Chunjiang Wu, Shijie Zhou, Linna Wei, Jiaqing Luo, Yanli Wang, and Xiaoqian Yang

Track 5: Advanced Network Technologies

A Dominant Input Stream for LUD Incremental Computing on a Contention Network 403
Cho-Chin Lin

A Double-Objective Genetic Algorithm for Parity Declustering Optimization in Networked RAID 415
Xiaoguang Liu, Gang Wang, and Jing Liu

Hybrid Diffusion Schemes for Load Balancing on OTIS-Networks 421
Chenggui Zhao, Wenjun Xiao, and Yong Qin

A Dynamic Localized Minimum-Energy Agent Tree-Based Data Dissemination Scheme for Wireless Sensor Networks 433
Ping Ding and JoAnne Holliday

THIN: A New Hierarchical Interconnection Network-on-Chip for SOC 446
Baojun Qiao, Feng Shi, and Weixing Ji

Architecture of Adaptive Spam Filtering Based on Machine Learning Algorithms 458
Md Rafiqul Islam and Wanlei Zhou

On the Power-Law of the Internet and the Hierarchy of BGP Convergence 470
Peidong Zhu, Jinjing Zhao, Yan Wen, and Kaiyu Cai

GDED-X Schemes for Load Balancing on Heterogeneous OTIS-Networks 482
Yong Qin, Wenjun Xiao, and Chenggui Zhao

Added

A Generalized Critical Task Anticipation Technique for DAG Scheduling 493
Ching-Hsien Hsu, Chih-Wei Hsieh, and Chao-Tung Yang

Author Index 507

RSM-Based Gossip on P2P Network*

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Abstract. Classification is a kind of basic semantics that people often use to manage versatile contents in daily life. Resource Space Model (RSM) is a semantic model for sharing and managing various resources using normalized classification semantics. Gossip-based peer-to-peer (P2P) techniques are reliable and scalable protocols for information dissemination. Incorporating RSM with gossip-based techniques forms a new decentralized resource sharing mechanism with the improved performance of unstructured P2P systems. Theoretical analysis and experiments validate the feasibility of the mechanism. Such incorporation is a way to synergy normalization and autonomy in managing decentralized large-scale complex resources.

1 Introduction

P2P systems aim at decentralization, scalability, ad-hoc connectivity, reduced cost of ownership and anonymity [1]. Unstructured P2P networks allow peers to self-organize and resources to be randomly placed. Such networks have low maintenance cost and are robust against accidental failures. Simulating the propagation of contagious diseases, gossip mechanisms have attractive scalability, reliability and degradation properties in realizing information dissemination in large networks [2]. Every node that receives a message randomly selects a certain number of nodes from its neighbors to multicast the message. They scale well since the load of nodes grows logarithmically compared with the number of nodes in the network. The performance of the gossip mechanisms can be improved in semantic space by designing appropriate mapping from the network into semantic space [12]. Ontology has been used to improve structured P2P systems [10]. Classification is a kind of basic semantics that people often use to effectively manage versatile contents in daily life.

A Resource Space Model RSM is a semantic model for effectively sharing and managing various Web resources (information, knowledge and services) based on normalized classification semantics [11]. Incorporating resource space with gossip mechanisms is a way to improve the performance of P2P network.

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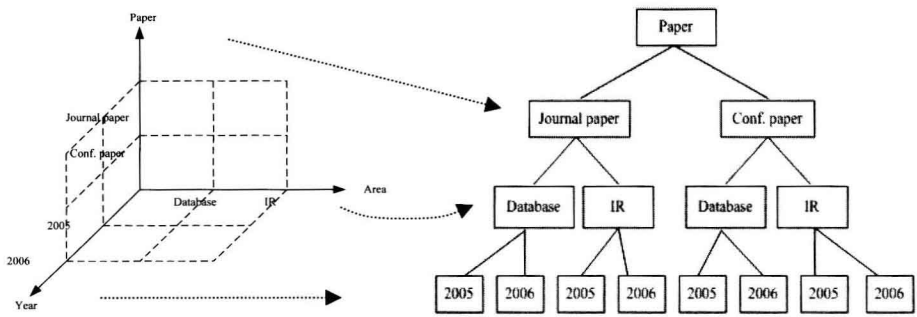
2 Incorporating RSM with P2P

An n-dimensional Resource Space represents n kinds of partition on a set of resources. A Resource Space can be mapped onto a partition tree (e.g., Fig. 1(a) can be mapped onto Fig. 1(b)). The classification semantics of a partition tree can be used to improve the performance of a P2P system because a peer could get the satisfied answer with high probability by interacting more frequently with the peers of the same community sharing common interests. Peers also need to communicate with peers of other communities.



(a) (b)

Fig. 1. (a) A 3-dimensional resource space. (b) The partition tree corresponding to Fig. 1 (a).

Each leaf corresponds to peers in the same category. The tree is a rather stable commonsense, and the whole system could use only a part of it. The communities in leaves of the partition could change with joining and departing of peers.

As shown in Fig. 2, peers can be classified into communities corresponding to the leaves of the semantic partition tree. Each peer maintains neighbors in a hierarchical structure. The number of layers of the hierarchical structure a peer maintains depends on the depth the peer lies in the partition tree. Taking a peer p in the bottom-left community of the partition tree for example, it should maintain four layers of its neighbors, denoted as View(i) where $0 \le i \le 3$. View(i) is a set/list containing the neighbors' information (address etc.) that shares the nearest common ancestor at ith level with p. p's View(3) maintains the information of some peers within the same community, while p's View(2) maintains the information of its neighbors having the nearest common ancestor at level 2, and so on.

When a peer sends a query, it will make a decision on which level(s) in its view should be selected to forward the query (category of the level are relevant to the query). Then, neighbor(s) at that level will be selected to forward the query. When a query reaches a community, a gossip-based mechanism will be adopted to disseminate the message. The peer that receives and could answer the query sends back the corresponding resources.

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