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High Performance Computing – HiPC'99

6th International Conference
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Proceedings

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Preface

These are the proceedings of the Sixth International Conference on High Performance Computing (HiPC'99) held December 17-20 in Calcutta, India. The meeting serves as a forum for presenting current work by researchers from around the world as well as highlighting activities in Asia in the high performance computing area.

The meeting emphasizes both the design and the analysis of high performance computing systems and their scientific, engineering, and commercial applications.

Topics covered in the meeting series include:

- Parallel Algorithms
- Parallel Architectures
- Parallel Languages & Compilers
- Distributed Systems
- Programming Environments
- Memory Systems
- Multimedia and High Speed Networks
- Scientific Computation
- Visualization
- Network and Cluster Based Computing
- Signal & Image Processing Systems
- Supercomputing Applications
- Internet and WWW-based Computing
- Scalable Servers

We would like to thank Alfred Hofmann and Ruth Abraham of Springer-Verlag for their excellent support in bringing out the proceedings. The detailed messages from the steering committee chair, general co-chair and program chair pay tribute to numerous volunteers who helped us in organizing the meeting.

October 1999

Viktor K. Prasanna
Bhabani Sinha
Prithviraj Banerjee

Message from the Steering Chair

It is my pleasure to welcome you to the Sixth International Conference on High Performance Computing. I hope you enjoy the meeting, the rich cultural heritage of Calcutta, as well as the mother Ganges, “the river of life”.

This meeting has grown from a small workshop held five years ago which addressed parallel processing. Over the years, the quality of submissions has improved and the topics of interest have been expanded in the general area of high performance computing. The increased participation and the continued improvement in quality are primarily due to the excellent response from researchers from around the world, enthusiastic volunteer effort, and support from Indian-based IT industries and academia.

It was a pleasure to work with Bhabani Sinha, our general co-chair. He provided me with invaluable input regarding meeting planning and execution and coordinated the local activities of the volunteers in handling numerous logistics.

Prith Banerjee, our program chair, put together a balanced high-quality technical program. Over the past year, I have interacted with him in resolving many meeting-related issues. Vipin Kumar invited the keynote speakers and coordinated the keynotes. Sartaj Sahni handled the poster/presentation session. Nalini Venkatasubramanian interfaced with the authors and Springer-Verlag in bringing out these proceedings. Manav Misra put together the tutorials. I would like to thank all of them for their volunteer efforts.

I am indebted to Sriram Vajapeyam for organizing a timely panel entitled: *Whither Indian Computer Science R&D?*. In addition, he provided thoughtful feedback in resolving many meeting-related issues. R. Govindarajan coordinated the industrial track and exhibits as well as interfacing with potential sponsors.

Over the past year, I have interacted with several volunteers who shared their thoughts with me to define the meeting focus and emphasize quality in building a reputed international meeting. I would like to thank Sriram Vajapeyam, R. Govindarajan, C.P. Ravikumar, D. N. Jayasimha, A.K.P. Nambiar, Sajal Das, and K. R. Venupogal. Their advice, counsel, and enthusiasm have been a major driving force behind this meeting.

Major financial support for the meeting was provided by India-based IT industries. I would like to thank Alok Aggarwal (IBM SRC, India), Suresh Babu (Compaq), Kushal Banerjee (Cisco), S. Dinakar (Novell), Anoop Gupta (Microsoft Research), K. S. Ramanujam (SUN Microsystems India), Karthik Ramarao (HP India), Uday Shukla (IBM India), for their support and participation. I am indebted to Narayana Murthy of Infosys for his continued support.

Finally, my special thanks go to my student Kiran Bondalapati for his assistance with meeting publicity and to my assistant Henryk Chrostek for his efforts in handling meeting-related activities throughout the past year.

Viktor K. Prasanna
University of Southern California
October 1999

Message from the General Co-chair

It is my great pleasure to extend a cordial welcome to all of you to this Sixth International Conference on High Performance Computing (HiPC'99). This is the first time that the conference on High Performance Computing is being held in Calcutta, the heart of the culture and the economy of Eastern India. I am sure, as in the past five years, this meeting will provide a forum for fruitful interaction among all the participants from both academia and industry. I also hope that you will enjoy your stay in Calcutta, the city of joy.

I express my sincerest thanks to all the keynote speakers who have kindly agreed to attend this conference and deliver keynote lectures on different facets of High Performance Computing.

I am thankful to Prith Banerjee for two reasons: first, for providing his continuous support in holding this conference and second, for performing an excellent job as the program chair of the conference. I would also like to thank Sartaj Sahni for his moral support in holding this meeting and his great service as the poster/presentation chair of the conference.

I am thankful to S. B. Rao, Director of the Indian Statistical Institute, for co-sponsoring this conference providing both financial and infra-structural support. My sincerest thanks also go to all other sponsors including Cisco Systems, Cognizant Technology Solutions, Compaq Computer India Pvt. Ltd., Computer Maintenance Corporation of India (CMC) Ltd., Hewlett-Packard India Ltd., Millenium Information Systems Pvt. Ltd., NIIT Ltd., Novell Software Development (India) Pvt. Ltd., PriceWaterhouseCoopers Ltd., Satyam Computer Services Ltd. and Tata Consultancy Services, but for whom the conference could not have been organized on this scale.

I am grateful to all the members of the local arrangements committee of the conference consisting of Mihir K. Chakraborti (chair), Nabanita Das (convener), Bhargab B. Bhattacharya, Jayasree Dattagupta, Malay K. Kundu, Nikhil R. Pal, Aditya Bagchi, Subhomay Maitra, Rana Dattagupta, Debasish Saha, Rajarshi Chaudhuri, Biswanath Bhattacharya, Tirthankar Banerjee, Subhashis Mitra, Amitava Mukherjee, and Somprakash Bandyopadhyay, who have provided their support in organizing this conference. My special thanks go to Mihir K. Chakraborti for taking active interest in arranging sponsorship for the conference. I am also thankful to Srabani Sengupta and Krishnendu Mukhopadhyaya for extending their help in different aspects related to the conference.

I would like to acknowledge the assistance from A. K. P. Nambiar, finance co-chair of the conference.

I am thankful to R. Govindarajan and Sriram Vajapeyam for their kind co-operation in arranging sponsorship for the conference.

Last but not the least, I would like to thank Viktor Prasanna for his continuous support and advice on all sorts of details in various phases throughout the last year and a half, in order to organize another successful conference on High Performance Computing in India. It was a real pleasure to work with him.

Bhabani P. Sinha
Indian Statistical Institute
General Co-Chair

Message from the Program Chair

I am pleased to introduce the proceedings of the 6th International Conference on High-Performance Computing to be held in Calcutta, India from December 17-20, 1999. The technical program consists of ten sessions, organized as two parallel tracks. We also have six keynote speeches, one panel, two industrial sessions, a poster session, and six tutorials.

The technical program was put together by a distinguished program committee consisting of 49 members and six vice-program chairs. We received 112 papers for the contributed sessions. Each paper was reviewed by three members of the program committee and one program vice-chair. At the program committee meeting, which was attended by the program chairs and program vice-chairs, 60 papers were accepted for presentation at the conference, of which 20 were regular papers (acceptance rate of 18%) and 40 were short papers (acceptance rate of 35%). The papers that will be presented at the conference are authored by researchers from 12 different countries; this is an indication of the true international flavor of the conference.

The technical program consists of three special sessions, two on *Mobile Computing* which were arranged by Sajal Das, and one on *Cluster Computing* which was arranged by Anand Sivasubramaniam and Govindarajan Ramaswamy. While these special session organizers solicited papers for the conference, all papers were subject to the same review process described above.

The program consists of six exciting keynote speeches arranged by the keynote chair, Vipin Kumar. The keynote speeches will be presented by Jack Dongarra on *High-Performance Computing Trends;* by Dennis Gannon on *The Information Power Grid*; by Ambuj Goyal on *High Performance Computing - A Ten Year Outlook*; by H. T. Kung on *Computer Network Protocols That Can Guarantee Quality of Service*; by Jay Misra on *A Notation for Hypercubic Computations*; and by Burkard Monien on *Balancing the Load in Networks of Processors*.

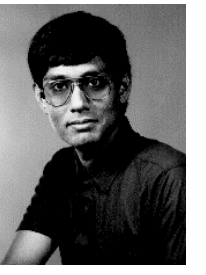
I wish to thank the six program vice chairs who worked very closely with me in the process of selecting the papers and preparing the excellent technical program. They are Alok Choudhary, Sajal Das, Vipin Kumar, S. K. Nandy, Mateo Valero, and Pen Yew. Viktor Prasanna and Bhabani Sinha provided excellent feedback about the technical program in their role as general co-chairs. I am grateful to Vipin Kumar for organizing the six excellent keynote speeches. I would like to express my gratitude to Nalini Venkatasubramanian for compiling the proceedings of the conference.

Finally, I also wish to acknowledge the tremendous support provided by my assistant Nancy Singer without whose constant help I could not have performed the job of program chair. She single-handedly did all the work relating to the acknowledgment of the papers, arranging the electronic reviews, collecting the reviews, organizing the

reviews in summary tables for the program committee meeting, and informing all authors of acceptance/rejection decisions.

I wish to welcome all the delegates to the conference and wish them an excellent program.

Prith Banerjee
Program Chair



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