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Anurag Mishra
Anirban Basu
Vipin Tyagi *Editors*

Silicon Photonics & High Performance Computing

Proceedings of CSI 2015

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Preface

The last decade has witnessed remarkable changes in IT industry, virtually in all domains. The 50th Annual Convention, CSI-2015, on the theme "Digital Life" was organized as a part of CSI@50, by CSI at Delhi, the national capital of the country, during December 2–5, 2015. Its concept was formed with an objective to keep ICT community abreast of emerging paradigms in the areas of computing technologies and more importantly looking at its impact on the society.

Information and Communication Technology (ICT) comprises of three main components: infrastructure, services, and product. These components include the Internet, Infrastructure-based/infrastructure-less wireless networks, mobile terminals, and other communication mediums. ICT is gaining popularity due to rapid growth in communication capabilities for real-time-based applications. The Silicon Photonics & High Performance Computing includes design and analysis of parallel and distributed systems, embedded systems, and their applications in scientific, engineering, and commercial deployment. CSI-2015 attracted over 1500 papers from researchers and practitioners from academia, industry, and government agencies, from all over the world, thereby making the job of the Programme Committee extremely difficult. After a series of tough review exercises by a team of over 700 experts, 565 papers were accepted for presentation in CSI-2015 during the 3 days of the convention under ten parallel tracks. The Programme Committee, in consultation with Springer, the world's largest publisher of scientific documents, decided to publish the proceedings of the presented papers, after the convention, in ten topical volumes, under ASIC series of the Springer, as detailed hereunder:

1. Volume # 1: ICT Based Innovations
2. Volume # 2: Next Generation Networks
3. Volume # 3: Nature Inspired Computing
4. Volume # 4: Speech and Language Processing for Human-Machine Communications
5. Volume # 5: Sensors and Image Processing
6. Volume # 6: Big Data Analytics

7. Volume # 7: Systems and Architecture
8. Volume # 8: Cyber Security
9. Volume # 9: Software Engineering
10. Volume # 10: Silicon Photonics & High Performance Computing.

We are pleased to present before you the proceedings of Volume # 10 on "Silicon Photonics & High Performance Computing." Presently, the data is growing exponentially. This data is an outcome of continuous research and development, demanding our serious concerns toward its safety. Computing is all about processing data in a meaningful manner; hence, it assumes a significant space in today's research arena. The present CSI-2015 track, Silicon Photonics and High Performance Computing, is even more relevant due to this specific reason. It is our pleasure and honor to serve as the editor of the proceeding of this track. This is a constant and consistent activity organized and conducted by the Computer Society of India, and it is a matter of satisfaction that the Springer has agreed to publish all its proceedings.

This volume is unique in its coverage. It has received papers from all research domains—from photonics/optical fiber communication systems used for different applications to high-performance computing and cloud computing for social media analytics and other very relevant high-ended applications such as supply chain analysis and underwater signal processing. The articles submitted and published in this volume are of sufficient scientific interest and help to advance the fundamental understanding of ongoing research, applied or theoretical, for a general computer science audience. The treatment of each topic is in-depth, the emphasis is on clarity and originality of presentation, and each paper is adding insight into the topic under consideration. We are hopeful that that this book will be an indispensable help to a broad array of readers ranging from researchers to developers and will also give significant contribution toward professionals, teachers, and students.

A great deal of effort has been made to realize this book. We are very thankful to the team of Springer who have constantly engaged us and others in this process and have made the publication of this book a success. We are sure this engagement shall continue in future as well and both Computer Society of India and Springer will choose to collaborate academically for the betterment of the society at large. Under the CSI-2015 umbrella, we received over 100 papers for this volume, out of which 15 papers are being published, after rigorous review processes, carried out in multiple cycles.

On behalf of organizing team, it is a matter of great pleasure that CSI-2015 has received an overwhelming response from various professionals from across the country. The organizers of CSI-2015 are thankful to the members of *Advisory Committee, Programme Committee, and Organizing Committee* for their all-round guidance, encouragement, and continuous support. We express our sincere gratitude to the learned *Keynote Speakers* for support and help extended to make this event a grand success. Our sincere thanks are also due to our *Review Committee Members* and the *Editorial Board* for their untiring efforts in reviewing the manuscripts, giving suggestions and valuable inputs for shaping this volume.

We hope that all the participated delegates will be benefitted academically and wish them for their future endeavors.

We also take the opportunity to thank the entire team from Springer, who have worked tirelessly and made the publication of the volume a reality. Last but not least, we thank the team from Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi, for their untiring support, without which the compilation of this huge volume would not have been possible.

New Delhi, India — Anurag Mishra
Belgaum, India — Anirban Basu
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Dr. Anurag Mishra has more than 23 years of research and teaching experience. He is presently working as Associate Professor of Electronics, Deen Dayal Upadhyaya College, University of Delhi, India. He is actively involved in research in information security and digital watermarking of images and video in particular, intelligent systems employed for image processing using soft computing techniques such as artificial neural networks, fuzzy systems, support vector machines, and extreme learning machines. He has developed fuzzy inference system-based models for coded image transmission over wireless channels. Additionally, he also extensively uses hybrid techniques such as neuro-fuzzy systems and GA-BPN systems for different image processing applications.

Dr. Anirban Basu holds a master's and Ph.D. in Computer Science and has more than 35 years of experience in academia, advanced research and development, commercial software industry, consultancy, and corporate training. He has worked at the Indian Statistical Institute, Kolkata, in 1979 and joined CDAC, Pune, India, in 1989 to play a key role in the development of India's first supercomputer PARAM. He has also worked at Siemens Information Systems Ltd and Computer Associates TCG in senior/top management positions. He has published 80 research papers in respective national and international journals and authored 6 books including one on "Software Quality Assurance, Testing and Metrics" published by PHI.

Dr. Vipin Tyagi works at the Department of Computer Science and Engineering, Jaypee University of Engineering and Technology, Raghogarh, Guna (MP), India, and is the Regional Vice President of Region 3 of the Computer Society of India (CSI). He is also associated with the CSI Special Interest Group on Cyber Forensics. He has over 20 years of teaching and research experience. He was the President (Engineering Sciences) of the Indian Science Congress Association for the term 2010–2011. He is a Life Fellow of the IETE, New Delhi, India.

Tackling Supply Chain Management Through High-Performance Computing: Opportunities and Challenges

Prashant R. Nair and S. P. Anbuudayasankar

Abstract Conversion of a supply chain to value chain requires agility, adaptability, communication, collaboration, decision support, elasticity, robustness, sensitivity, and visibility. High-Performance Computing (HPC) and cloud computing systems bring additional benefits of scalability, integration, portability, processing power, storage, and interoperability for Supply Chain Management (SCM). Mega corporations and retail giants like Wal-Mart and Pratt & Whitney have deployed HPC for SCM and thereby achieved efficient and effective data administration and analysis. But the usages of HPC for SCM are restricted to a few large enterprises. Deployment challenges include difficulty in migrating from legacy to high-end systems, high cost, lack of skilled manpower, and application software. HPC along with the cloud computing paradigm integrated in the Social Mobile Analytics and Cloud (SMAC) stack can emerge as a game changer to integrate all stakeholders in the value chain into a social network real-time and actionable intelligence. The access to updates and timely information from all supply chain partners will also transform enterprises to be forecast-driven as opposed to their conventional demand-driven nature.

Keywords Supply chain management (SCM) · High-Performance Computing (HPC) · Cloud computing · SMAC

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1 Introduction

Conversion of a supply chain to value chain requires agility, adaptability, communication, collaboration, decision support, elasticity, robustness, sensitivity, and visibility. Enterprises are now grappled with greater competition due to the influence of Internet, social media, and information superhighway. This is further complicated by pricing pressures, outsourcing, and globalization. This has resulted in enterprises increasingly offshoring both service and manufacturing bases to low-cost and emerging geographies and economies.

ICT tools enable all processes of supply chain planning and execution. Deployment of ICT across the supply chain has become the reason behind the competitive edge for many enterprises [1]. Widespread adoption of technologies like ERP, RFID [2], intelligent agents [3], transportation systems, barcodes, and inventory control systems has brought about the outcome of better transparency, visibility, and communication at both intra- and inter-enterprise levels. This will in turn bring about better resilience, adaptability, responsiveness, and decision support and thereby help enterprises gain a competitive edge. Actionable intelligence and seamless information will be made available on demand and real time with the additional provision of analytics. One prime barrier is not having uniformity in the legacy information and transaction processing systems of suppliers and stakeholders in the supply chain. A lion share of data needed by enterprises for their supply chains is vested with suppliers, transporters, and warehouses, who have their distinct information technology and systems and proprietary ERP or supply chain software solutions. Another relevant issue is that enterprises are groping in the dark to get an integrated image of their inventory, operations, and work flow, as majority of them use legacy systems, which were usually intended for single branch and not across a network of branches, divisions, suppliers, and partners [4]. This paper provides an overview of the technologies of High-Performance Computing (HPC) and cloud computing systems and its usage, application areas, and challenges in the context of deployment in Supply Chain Management (SCM) settings.

HPC and cloud systems for SCM bring additional benefits of scalability, integration, portability, processing power, storage, and interoperability for SCM. Mega corporations and retail giants like Wal-Mart and Pratt & Whitney have deployed HPC for SCM and thereby achieved efficient and effective data administration and analysis.

Integration of disruptive technologies like Social, Mobile, and Analytics along with Cloud to form SMAC stack is poised to be the next wave of enterprise computing. By 2020, IDC estimates that corporate spending on buying or building IT/IS solutions worldwide could be north of the US$5 trillion mark. IDC estimates that 80% of the revenue will be motivated by the SMAC stack, which is the seamless combo of these SMAC technologies [5]. Technologies within SMAC complement and supplement each other and collectively bring a force multiplier effect to transform supply chains into value chains. The resultant value chain would boast of the advantages of resilience, agility, collaboration, scalability, and visibility [6]. This would benefit enterprises across all verticals and geographies.