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Chapter 1

Introductory Chapter: The Newest Research in Parallel and Distributed Computing

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http://dx.doi.org/10.5772/intechopen.69201

The parallel and distributed computing is concerned with concurrent use of multiple compute resources to enhance the performance of a distributed and/or computationally intensive application. The compute resources may be a single computer or a number of computers connected by a network. A computer in the system may contain single-core, multi-core and/or many-core processors. The design and implementation of a parallel and distributed system may involve the development, utilization and integration of techniques in computer network, software and hardware. With the advent of networking and computer technology, parallel and distributed computing systems have been widely employed for solving problems in engineering, management, natural sciences and social sciences.

There are six chapters in this book. From Chapters 2 to 6, a wide range of studies in new applications, algorithms, architectures, networks, software implementations and evaluations of this growing field are covered. These studies may be useful to scientists and engineers from various fields of specialization who need the techniques of distributed and parallel computing in their work.

The second chapter of this book considers the applications of distributed computing for social networks. The chapter entitled "A Study on the Node Influential Capability in Social Networks by Incorporating Trust Metrics" by Tong-Ming Lim and Hock Yeow Yap provides useful distributed computing models for the evaluation of node influential capacity in social networks. Two algorithms are presented in this study: Trust-enabled Generic Algorithm Diffusion Model (T-GADM) and Domain-Specified Trust-enabled Generic Algorithm Diffusion Model (DST-GADM). Experimental results confirm the hypothesis that social trust plays an important role in influential propagation. Moreover, it is able to increase the rate of success in influencing other social nodes in a social network.

Another application presented in this book is the smart grid for power engineering. The chapter entitled "A Distributed Computing Architecture for the Large-Scale Integration of

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Renewable Energy and Distributed Resources in Smart Grids" by Ignacio Aravena, Anthony Papavasiliou and Alex Papalexopoulos analyzes the distributed system for the management of the short-term operations of power systems. They propose optimization algorithms for both the levels of the distribution grid and high voltage grids. Numerical results are also included for illustrating the effectiveness of the algorithms.

This book also contains a chapter covering the programming aspect of parallel and distributed computing. For the study of parallel programming, the general processing units (GPUs) are considered. GPUs have received attention for parallel computing because their many-core capability offers a significant speedup over traditional general purpose processors. In the chapter entitled "GPU Computing Taxonomy" by Abdelrahman Ahmed Mohamed Osman, a new classification mechanism is proposed to facilitate the employment of GPU for solving the single program multiple data problems. Based on the number of hosts and the number of devices, the GPU computing can be separated into four classes. Examples are included to illustrate the features of each class. Efficient coding techniques are also provided.

The final two chapters focus on the software aspects of the distributed and parallel computing. Software tools for the wikinomics-oriented development of scientific applications are presented in the chapter entitled "Distributed Software Development Tools for Distributed Scientific Applications" by Vaidas Giedrimas, Anatoly Petrenko and Leonidas Sakalauskas. The applications are based on service-oriented architectures. Flexibilities are provided so that codes and components deployed can be reused and transformed into a service. Some prototypes are given to demonstrate the effectiveness of the proposed tools.

The chapter entitled "DANP-Evaluation of AHP-DSS" by Wolfgang Ossadnik, Benjamin Föcke and Ralf H. Kaspar evaluates the Analytic Hierarchy Process (AHP)-supporting software for the use of adequate Decision Support Systems (DSS) for the management science. The corresponding software selection, evaluation criteria, evaluation framework, assessments and evaluation results are provided in detail. Issues concerning the evaluation assisted by parallel and distributed computing are also addressed.

These chapters offer comprehensive coverage of parallel and distributed computing from engineering and science perspectives. They may be helpful to further stimulate and promote the research and development in this rapid growing area. It is also hoped that newcomers or researchers from other areas of disciplines desiring to learn more about the parallel and distributed computing will find this book useful.

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