

Contents

Preface	ix
Editors.....	xi
Contributors.....	xiii

PART VI Monitoring, Modeling, and Evaluation

27 Power-Aware Modeling and Autonomic Management Framework for Distributed Computing Systems	621
<i>Rajat Mehrotra, Abhishek Dubey, Sherif Abdelwahed, and Asser N. Tantawi</i>	
28 Power Measuring and Profiling: State of the Art	649
<i>Hui Chen and Weisong Shi</i>	
29 Modeling the Energy Consumption of Distributed Applications	675
<i>Georges Da Costa, Helmut Hlavacs, Karin Anna Hummel, and Jean-Marc Pierson</i>	
30 Comparative Study of Runtime Systems for Energy-Aware High-Performance Computing	687
<i>Chung-Hsing Hsu and Stephen W. Poole</i>	
31 Tool Environments to Measure Power Consumption and Computational Performance	709
<i>Timo Minartz, Daniel Molka, Julian Kunkel, Michael Knobloch, Michael Kuhn, and Thomas Ludwig</i>	
32 BlueTool: Using a Computing Systems Research Infrastructure Tool to Design and Test Green and Sustainable Data Centers	745
<i>Sandeep Gupta, Georgios Varsamopoulos, Anna Haywood, Patrick Phelan, and Tridib Mukherjee</i>	

PART VII Software Systems

33 Optimizing Computing and Energy Performances in Heterogeneous Clusters of CPUs and GPUs.....	761
<i>Stephane Vialle, Sylvain Contassot-Vivier, and Thomas Jost</i>	

34	Energy-Efficient Online Provisioning for HPC Workloads	795
	<i>Ivan Rodero, Manish Parashar, Andres Quiroz, Francesc Guim, and Stephen W. Poole</i>	
35	Exploiting Heterogeneous Computing Systems for Energy Efficiency.....	817
	<i>Wei Chen, Young Choon Lee, and Albert Y. Zomaya</i>	
36	Code Development of High-Performance Applications for Power-Efficient Architectures.....	835
	<i>Khaled Z. Ibrahim</i>	
37	Experience with Autonomic Energy Management Policies for JavaEE Clusters	855
	<i>Daniel Hagimont, Laurent Broto, Aeimam Gadafi, and Noel Depalma</i>	

PART VIII Data Centers and Large-Scale Systems

38	Power-Aware Parallel Job Scheduling	875
	<i>Maja Etinski, Julita Corbalan, and Jesus Labarta</i>	
39	Toward Energy-Efficient Web Server Clusters.....	899
	<i>Yu Cai and Xinying Zheng</i>	
40	Providing a Green Framework for Cloud Data Centers.....	923
	<i>Andrew J. Younge, Gregor von Laszewski, Lizhe Wang and Geoffrey C. Fox</i>	
41	Environmentally Opportunistic Computing	949
	<i>Paul Brenner, Douglas Thain, Aimee Buccellato, and David B. Go</i>	
42	Energy-Efficient Data Transfers in Large-Scale Distributed Systems	965
	<i>Anne-Cécile Orgerie and Laurent Lefèvre</i>	
43	Overview of Data Centers Energy Efficiency Evolution	983
	<i>Lennart Johnsson</i>	
44	Evaluating Performance, Power, and Cooling in High-Performance Computing (HPC) Data Centers	1029
	<i>Jeffrey J. Evans, Sandeep Gupta, Karen L. Karavanic, Andres Marquez, and Georgios Varsamopoulos</i>	

PART IX Green Applications

45	GreenGPS-Assisted Vehicular Navigation	1053
	<i>Tarek F. Abdelzaher</i>	
46	Energy-Aware Mobile Multimedia Computing	1077
	<i>Jianxin Sun, Dalei Wu, Jiucai Zhang, Xueyi Wang, and Song Ci</i>	
47	Ultralow-Power Implantable Electronics.....	1097
	<i>Seetharam Narasimhan and Swarup Bhunia</i>	

48 Energy-Adaptive Computing: A New Paradigm for Sustainable IT 1115
Krishna Kant

PART X Social and Environmental Issues

49 Evolution of Energy Awareness Using an Open Carbon Footprint Calculation
 Platform 1133
Farzana Rahman, Sheikh Iqbal Ahamed, Casey O'Brien, He Zhang, and Lin Liu

50 Understanding and Exploiting User Behavior for Energy Saving 1145
Vasily G. Moshnyaga

51 Predicting User Behavior for Energy Saving 1159
Mingsong Bi, Igor Crk, and Chris Gniady

52 Toward Sustainable Portable Computing 1179
Vinod Namboodiri and Siny Joseph

Index Index-1