

# **2016 IEEE/ACM 9th International Conference on Utility and Cloud Computing (UCC 2016)**

**Shanghai, China  
6-9 December 2016**



**IEEE Catalog Number: CFP16UCC-POD  
ISBN: 978-1-5090-4467-2**

**Copyright © 2016, The Association for Computing Machinery (ACM)  
All Rights Reserved**

***\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

|                         |                   |
|-------------------------|-------------------|
| IEEE Catalog Number:    | CFP16UCC-POD      |
| ISBN (Print-On-Demand): | 978-1-5090-4467-2 |
| ISBN (Online):          | 978-1-4503-4616-0 |
| ISSN:                   | 2373-6860         |

**Additional Copies of This Publication Are Available From:**

Curran Associates, Inc  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: (845) 758-0400  
Fax: (845) 758-2633  
E-mail: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

CURRAN ASSOCIATES INC.  
**proceedings**  
.com

# 2016 IEEE/ACM 9th International Conference on Utility and Cloud Computing

## UCC 2016

### Table of Contents

|                                                                  |       |
|------------------------------------------------------------------|-------|
| Message from the UCC 2016 General<br>and Organizing Chairs ..... | xii   |
| Message from the UCC 2016 Technical<br>Program Co-Chairs .....   | xiv   |
| UCC 2016 Organizing Committee .....                              | xv    |
| UCC 2016 Technical Program Committee .....                       | xvii  |
| SCCTSA 2016 Organizing Committee .....                           | xix   |
| CloudAM 2016 Organizing Committee .....                          | xx    |
| BIUC 2016 Organizing Committee .....                             | xxi   |
| SD3C 2016 Organizing Committee .....                             | xxii  |
| IDP 2016 Organizing Committee .....                              | xxiii |
| RTDPCC 2016 Organizing Committee .....                           | xxiv  |

---

## 9th IEEE/ACM International Conference on Utility and Cloud Computing

### Session 1: Hardware-as-a-Service and Energy

|                                                                                                            |    |
|------------------------------------------------------------------------------------------------------------|----|
| High Performance in the Cloud with FPGA Groups .....                                                       | 1  |
| <i>Anca Iordache, Guillaume Pierre, Peter Sanders, Jose Gabriel De F. Coutinho,<br/>and Mark Stillwell</i> |    |
| A Unified Model for Holistic Power Usage in Cloud Datacenter Servers .....                                 | 11 |
| <i>Peter Garraghan, Yaser Al-Anii, Jon Summers, Harvey Thompson, Nik Kapur,<br/>and Karim Djemame</i>      |    |
| A Methodology for Full-System Power Modeling in Heterogeneous Data<br>Centers .....                        | 20 |
| <i>Mauro Canuto, Raimon Bosch, Mario Macias, and Jordi Guitart</i>                                         |    |

## Session 2: Emerging Topics in Cloud Computing

|                                                                                                    |    |
|----------------------------------------------------------------------------------------------------|----|
| CL-SLAM: Cross-Layer SLA Monitoring Framework for Cloud Service-Based Applications .....           | 30 |
| <i>Mohan Baruwal Chhetri, Quoc Bao Vo, and Ryszard Kowalczyk</i>                                   |    |
| Predicting Cloud Resource Utilization .....                                                        | 37 |
| <i>Michael Borkowski, Stefan Schulte, and Christoph Hochreiner</i>                                 |    |
| Towards an Emerging Cloudware Paradigm for Transparent Computing .....                             | 43 |
| <i>Wei Wang, Jingxuan Zhang, Dong Guo, Qiao Xiang, Chenxi Huang, Jinda Chang, and Liqing Zhang</i> |    |
| Optimizing Back-and-Forth Live Migration .....                                                     | 49 |
| <i>Kuan-Hsin Lee, I-Cheng Lai, and Che-Rung Lee</i>                                                |    |
| A Flexible Scheduler for Workflow Ensembles .....                                                  | 55 |
| <i>Thiago A.L. Genez, Luiz F. Bittencourt, Rizos Sakellariou, and Edmundo R.M. Madeira</i>         |    |
| Experiences Creating a Framework for Smart Traffic Control Using AWS IOT .....                     | 63 |
| <i>William Tärneberg, Vishal Chandrasekaran, and Marty Humphrey</i>                                |    |

## Session 3: Scheduling and Scalability

|                                                                                                      |    |
|------------------------------------------------------------------------------------------------------|----|
| Deadline Distribution Strategies for Scientific Workflow Scheduling in Commercial Clouds .....       | 70 |
| <i>Vahid Arabnejad, Kris Bubendorfer, and Bryan Ng</i>                                               |    |
| Elasticity Debt: A Debt-Aware Approach to Reason about Elasticity Decisions in the Cloud .....       | 79 |
| <i>Carlos Mera-Gómez, Rami Bahsoon, and Rajkumar Buyya</i>                                           |    |
| Handling the Uncertainty in Resource Performance for Executing Workflow Applications in Clouds ..... | 89 |
| <i>Hamid Mohammadi Fard, Sasko Ristov, and Radu Prodan</i>                                           |    |

## Session 4: Virtualisation

|                                                                                                              |     |
|--------------------------------------------------------------------------------------------------------------|-----|
| Quick Eviction of Virtual Machines through Proactive Live Snapshots .....                                    | 99  |
| <i>Dinuni Fernando, Hardik Bagdi, Yaohui Hu, Ping Yang, Kartik Gopalan, Charles Kamhoua, and Kevin Kwiat</i> |     |
| An Improved Model for Live Migration in Data Centre Simulators .....                                         | 108 |
| <i>Vincenzo De Maio, Gabor Kecskemeti, and Radu Prodan</i>                                                   |     |
| Reverse Replication of Virtual Machines (rRVM) for Low Latency and High Availability Services .....          | 118 |
| <i>Muyang He, Shaoning Pang, Denis Lavrov, Ding Lu, Yuan Zhang, and Abdolhossein Sarrafzadeh</i>             |     |

## **Session 5: Monitoring and Tuning**

|                                                                                                           |     |
|-----------------------------------------------------------------------------------------------------------|-----|
| Data-Driven Monitoring for Cloud Compute Systems .....                                                    | 128 |
| <i>Dániel Géhberger, Péter Mátray, and Gábor Németh</i>                                                   |     |
| Resource Boxing: Converting Realistic Cloud Task Utilization Patterns<br>for Theoretical Scheduling ..... | 138 |
| <i>Bernhard Primas, Peter Garraghan, Karim Djemame, and Natasha Shakhlevich</i>                           |     |
| Program Autotuning as a Service: Opportunities and Challenges .....                                       | 148 |
| <i>Oleg Sukhoroslov, Sergey Volkov, and Alexander Afanasiev</i>                                           |     |

## **Session 6: Services and Federation**

|                                                                                           |     |
|-------------------------------------------------------------------------------------------|-----|
| Fast Algorithms for Optimal Coalition Formation in Federated Clouds .....                 | 156 |
| <i>Yash Khandelwal, Suresh Purini, and Puduru V. Reddy</i>                                |     |
| Modelling and Managing Deployment Costs of Microservice-Based Cloud<br>Applications ..... | 165 |
| <i>Philipp Leitner, Jürgen Cito, and Emanuel Stöckli</i>                                  |     |
| My Ever Changing Moods: Sentiment-Based Event Detection on the Cloud .....                | 175 |
| <i>Richard O. Sinnott, Natasha Thomas, Himanshu Bansal, and Zeyu Zhao</i>                 |     |

## **SCCTSA: The 3rd International Workshop on Smart City Clouds: Technologies, Systems, and Applications**

### **Session 1: Systems and Application**

|                                                                                                              |     |
|--------------------------------------------------------------------------------------------------------------|-----|
| Towards a Smart Learning Environment for Smart City Governance .....                                         | 185 |
| <i>Rawad Hammad and David Ludlow</i>                                                                         |     |
| Towards Provisioning of Real-Time Smart City Services Using Clouds .....                                     | 191 |
| <i>Kamran Soomro, Zaheer Khan, and Khawar Hasham</i>                                                         |     |
| Enrichment of Machine Learning Based Activity Classification in Smart Homes<br>Using Ensemble Learning ..... | 196 |
| <i>Bikash Agarwal, Antorweep Chakravorty, Tomasz Wiktorski, and Chunming Rong</i>                            |     |
| Service Topic Model with Probability Distance .....                                                          | 202 |
| <i>Yu Lei and Philip S. Yu</i>                                                                               |     |

### **Session 2: Security and Safety**

|                                                                                                             |     |
|-------------------------------------------------------------------------------------------------------------|-----|
| Cloud-Based Parametrized Publish/Subscribe System for Public Safety<br>Applications in Smarter Cities ..... | 208 |
| <i>Aljawharah Al-Muaythir and M. Anwar Hossain</i>                                                          |     |
| Security in Container-Based Virtualization through vTPM .....                                               | 214 |
| <i>Shohreh Hosseinzadeh, Samuel Laurén, and Ville Leppänen</i>                                              |     |

|                                                                            |     |
|----------------------------------------------------------------------------|-----|
| FaaS-eC: Enabling Forensics-as-a-Service for Cloud Computing Systems ..... | 220 |
| <i>Bksp Kumar Raju, Bhupendra Moharil, and G Geethakumari</i>              |     |

## **CloudAM: The 2016 International Workshop on Clouds and (eScience) Applications Management**

### **Session 1: Service Composition, Scheduling, & Performance**

|                                                                                                                  |     |
|------------------------------------------------------------------------------------------------------------------|-----|
| TCloud: A Transparent Framework for Public Cloud Service Comparison .....                                        | 228 |
| <i>Bilkisu Larai Muhammad-Bello and Masayoshi Aritsugi</i>                                                       |     |
| Robust Cloud VoIP Scheduling under VMs Startup Time Delay Uncertainty .....                                      | 234 |
| <i>Jorge M. Cortés-Mendoza, Andrei Tchernykh, Alexander Yu. Drozdov, and Loic Didelot</i>                        |     |
| Performance-Efficient Service Deployment and Scheduling Methods for Composite Cloud Services .....               | 240 |
| <i>Kuo-Chan Huang, Yu-Chun Lu, Meng-Han Tsai, Ying-Jhih Wu, and Hsi-Ya Chang</i>                                 |     |
| The Effects of Relative Importance of User Constraints in Cloud of Things Resource Discovery: A Case Study ..... | 245 |
| <i>Luiz H. Nunes, Jlio C. Estrella, Alexandre N. Delbem, Charith Perera, and Stephan Reiff-Marganiec</i>        |     |

### **Session 2: Resource Management**

|                                                                                                           |     |
|-----------------------------------------------------------------------------------------------------------|-----|
| Capacity Management for Streaming Applications over Cloud Infrastructures with Micro Billing Models ..... | 251 |
| <i>Rafael Tolosana-Calasanz, Javier Diaz-Montes, Luiz F. Bittencourt, Omer Rana, and Manish Parashar</i>  |     |
| Modelling Performance & Resource Management in Kubernetes .....                                           | 257 |
| <i>Vctor Medel, Omer Rana, Jos Angel Baares, and Unai Arronategui</i>                                  |     |
| Latency-Based Benchmarking of Cloud Service Providers .....                                               | 263 |
| <i>Vojtech Uhler, Ondrej Tomanek, and Lukas Kenc</i>                                                     |     |

## **BIUC 2016: Workshop on Bright Internet-Based Utility Computing**

|                                                                                                                  |     |
|------------------------------------------------------------------------------------------------------------------|-----|
| (t,p)-Threshold Point Function Secret Sharing Scheme Based on Polynomial Interpolation and Its Application ..... | 269 |
| <i>Dazeng Yuan, Mingxing He, Shengke Zeng, Xiao Li, and Long Lu</i>                                              |     |
| Privacy-Preserving Location-Based Service Based on Deniable Authentication .....                                 | 276 |
| <i>Shengke Zeng, Shuangquan Tan, Yong Chen, Mingxing He, Meichen Xia, and Xiao Li</i>                            |     |

|                                                                                       |     |
|---------------------------------------------------------------------------------------|-----|
| Statistic-Based CRM Approach via Time Series Segmenting RFM on Large Scale Data ..... | 282 |
| <i>Meina Song, Xuejun Zhao, Haihong E, and Zhonghong Ou</i>                           |     |

## **SD3C: The 2nd Workshop on Sustainable Data Centers and Cloud Computing**

|                                                                                                      |     |
|------------------------------------------------------------------------------------------------------|-----|
| Enterprise IoT Security and Scalability: How Unikernels can Improve the Status Quo .....             | 292 |
| <i>Bob Duncan, Andreas Happe, and Alfred Bratterud</i>                                               |     |
| Enhancing Cloud Capabilities for SLA Enforcement of Cloud Scheduled Applications .....               | 298 |
| <i>Mustapha Ait-Idir and Nazim Agoulmine</i>                                                         |     |
| Interface Diversification in IoT Operating Systems .....                                             | 304 |
| <i>Petteri Mäki, Sampsa Rauti, Shohreh Hosseinzadeh, Lauri Koivunen, and Ville Leppänen</i>          |     |
| Exploiting Novel Software Development Paradigms to Increase the Sustainability of Data Centers ..... | 310 |
| <i>A. Carrega and M. Repetto</i>                                                                     |     |
| Latency Analysis of Cooperative Caching with Multicast for 5G Wireless Networks .....                | 316 |
| <i>Xiangyue Huang, Zhifeng Zhao, and Honggang Zhang</i>                                              |     |

## **IDP: The 5th International Workshop on Intelligent Data Processing**

### **Session 1: Recognition and Prediction**

|                                                                                                                       |     |
|-----------------------------------------------------------------------------------------------------------------------|-----|
| Real-Time Target Detection and Recognition with Deep Convolutional Networks for Intelligent Visual Surveillance ..... | 321 |
| <i>Wen Xu, Jing He, Hao Lan Zhang, Bo Mao, and Jie Cao</i>                                                            |     |
| Web-Based Similarity for Emotion Recognition in Web Objects .....                                                     | 327 |
| <i>Valentina Franzoni, Giulio Biondi, Yuanxi Li, and Alfredo Milani</i>                                               |     |

### **Session 2: Intelligent Processing**

|                                                                                                |     |
|------------------------------------------------------------------------------------------------|-----|
| Image Compression Based on Restricted Wavelet Synopses with Maximum Error Bound .....          | 333 |
| <i>Xiaoyun Li, Shizhong Huang, Huanyu Zhao, Xueyan Guo, Libo Xu, Xingsen Li, and Youjia Li</i> |     |
| The Research of MapReduce Load Balancing Based on Multiple Partition Algorithm .....           | 339 |
| <i>Suzhen Wang and Haowei Zhou</i>                                                             |     |

# **RTDPCC: International Symposium on Real-Time Data Processing for Cloud Computing**

## **Session 1: Data Processing**

|                                                                                                                 |     |
|-----------------------------------------------------------------------------------------------------------------|-----|
| Multi-Level Topical Text Categorization with Wikipedia .....                                                    | 343 |
| <i>Nan Guo, Yuan He, Chungang Yan, Lu Liu, and Cheng Wang</i>                                                   |     |
| A Monocular Video-Based Facial Expression Recognition System<br>by Combining Static and Dynamic Knowledge ..... | 353 |
| <i>Jun Yu and Zengfu Wang</i>                                                                                   |     |
| Reducing Packet Delay through Filter Merging .....                                                              | 358 |
| <i>Paul Comerford, John N. Davies, and Vic Grout</i>                                                            |     |

## **Session 2: Strategy and Applications**

|                                                                                |     |
|--------------------------------------------------------------------------------|-----|
| A Load Balancing Strategy Based on Data Correlation in Cloud Computing .....   | 364 |
| <i>Guilin Shao and Jiming Chen</i>                                             |     |
| Efficient Estimation and Control of WSANs for the Greenhouse Environment ..... | 369 |
| <i>Xingzhen Bai, Maoyong Cao, Lu Liu, John Panneerselvam, and Qiao Sun</i>     |     |
| Public Auditing Scheme for Cloud-Based Wireless Body Area Network .....        | 375 |
| <i>Song Li, Zhong Hong, and Cui Jie</i>                                        |     |

## **Session 3: Network Access and Control**

|                                                                                                                            |     |
|----------------------------------------------------------------------------------------------------------------------------|-----|
| A Fined-Grained Privacy-Preserving Access Control Protocol in Wireless<br>Sensor Networks .....                            | 382 |
| <i>Jie Cui, Hong Zhong, Xuan Tang, and Jing Zhang</i>                                                                      |     |
| Video Authentication Based on Statistical Local Information .....                                                          | 388 |
| <i>M. Al-Athamneh, F. Kurugollu, D. Crookes, and M. Farid</i>                                                              |     |
| Attribute-Based Solution with Time Restriction Delegate for Flexible<br>and Scalable Access Control in Cloud Storage ..... | 392 |
| <i>Wang Shoukun, Wu Kaigui, and Wu Changze</i>                                                                             |     |

## **PhD Symposium**

|                                                                                            |     |
|--------------------------------------------------------------------------------------------|-----|
| Towards a Software Product Line-Based Approach to Adapt IaaS Cloud<br>Configurations ..... | 398 |
| <i>Carlos Ruiz, Hector A. Duran-Limon, and Nikos Parlavantzas</i>                          |     |
| A Reference Architecture for a National E-Learning Infrastructure .....                    | 404 |
| <i>Salim Saay and Alex Norta</i>                                                           |     |

|                                                                                                                       |     |
|-----------------------------------------------------------------------------------------------------------------------|-----|
| A QoS and Energy Aware Load Balancing and Resource Allocation<br>Framework for IaaS Cloud Providers .....             | 410 |
| <i>Yatheendraprakash Govindaraju and Hector Duran-Limon</i>                                                           |     |
| Clinical and Genomics Data Integration Using Meta-Dimensional Approach .....                                          | 416 |
| <i>Moez M. Subhani, Ashiq Anjum, Andreas Koop, and Nick Antonopoulos</i>                                              |     |
| <br><b>Posters Papers</b>                                                                                             |     |
| QuARAM Service Recommender: A Platform for IaaS Service Selection .....                                               | 422 |
| <i>Sima Soltani, Khalid Elgazzar, and Patrick Martin</i>                                                              |     |
| Adaptive Application Scheduling under Interference in Kubernetes .....                                                | 426 |
| <i>Víctor Medel, Omer Rana, José Ángel Bañares, and Unai Arronategui</i>                                              |     |
| Testing-as-a-Service Approach for Cloud Applications .....                                                            | 428 |
| <i>Gleb Radchenko, Dmitry Savchenko, and Nikita Ashikhmin</i>                                                         |     |
| Titian2: A Scalable System-Level Emulator with All Programmability<br>for Datacenter Servers in Cloud Computing ..... | 430 |
| <i>Ke Zhang, Ran Zhao, Hongxia Zhang, Lei Yu, Yisong Chang, Zhao Zhang,<br/>and Mingyu Chen</i>                       |     |
| Reducing the VM Rental Cost in the Cloud Spot Market .....                                                            | 432 |
| <i>Jianxiong Wan, G. Zhang, Xiang Gui, and Ran Zhang</i>                                                              |     |
| <br><b>Author Index</b> .....                                                                                         | 434 |