Luxembourg 2016

8th IEEE International Conference on Cloud Computing Technology and Science

12-15 December 2016 • Luxembourg, Luxembourg

IEEE

IEEE computer society

Cloud Computing Association

TCSC IEEE

IEEE CLOUD COMPUTING

STC CLOUD COMPUTING

Fonds National de la Recherche Luxembourg

SnT securityandtrust.lu

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Time	Tuesday, December 13			Wednesday, December 14			Thursday, December 15		
08:15 - 08:45	**REGISTRATION**			**REGISTRATION** *Conference Lobby*			**REGISTRATION** *Conference Lobby*		
08:45 - 09:30	**OPENING CEREMONY** *Room: Europe*								
09:30 - 10:30	**Plenary Session 1** ***Keynote:***Prof. Mischa Dohler *Room: Europe*			**Plenary Session 3** ***Keynote:***Prof. Lizhe Wang *Room: Europe*			**Plenary Session 6** ***Keynote:***Dr. Reinhard Schneider *Room: Europe*		
10:30 - 11:00	**COFFEE BREAK**			**COFFEE BREAK**			**COFFEE BREAK**		
11:00 - 12:15	**Session 1A** Architecture & Virtualization I	**Session 1B** Cloud Services & Applications I	**Session 1C** IoT & Mobile on Cloud	**Session 4A** Architecture & Virtualization III	**Session 4B** Cloud Services & Applications III	**Session 4C** HPC in/with the Cloud	**Session 6A** Architecture & Virtualization V	**Session 6B** Distributed Cloud / Edge Computing II	**Session 6C** Short Papers II
12:15 - 13:30	**LUNCH**						**LUNCH & POSTER/DEMO SESSION**		
13:30 - 14:30	**Plenary Session 2** ***Keynote:***Prof. Dhabaleswar K. Panda Room: Europe			**Plenary Session 4** ***Plenary Panel:*** *The role of HPC & Cloud Computing in Financial Services and Technologies* *Moderator:*Mazin Yousif, PhD **Keynotes:** CloudCom Sponsors & Satelite events *Room: Europe*			**Session 7A** Security and Privacy	**Session 7B** Cloud Services & Applications V	**Session 7C** PhD Consortium
14:30 - 15:30	**Posters and Demos Session** *Conference Lobby*		**Session 2C** Short Papers I						
15:30 - 16:00	**COFFEE BREAK & POSTER/DEMO SESSION**			**COFFEE BREAK**			**CLOSING CEREMONY** *Room: Europe*		
16:00 - 17:15	**Session 3A** Architecture & Virtualization II	**Session 3B** Cloud Services & Applications II	**Session 3C** Big Data	**Session 5A** Architecture and Virtualization IV	**Session 5B** Cloud Services & Applications IV	**Session 5C** Distributed Cloud / Edge Computing I			
17:15 - 18:00	*Bus Transportation*			**Plenary Session 5** ***Keynote:***CloudCom Sponsors					
18:00 - 19:00	**WELCOME RECEPTION** **Philharmonie Luxembourg** 1, place de l'Europe, L-1499 Luxembourg T +352 26 02 271			*Bus Transportation*					
19:00 - 23:00	Bus Transportation			**CONFERENCE BANQUET AND CRUISE** **Boat Trip on the Moselle River / NaviTours** Bording @7pm: Quai de la Moselle, 5553 Remich http://www.navitours.lu/ T +352 75 84 89 M +352 621 130 054					
				Bus Transportation					

Conference Rooms	
Plenary:	Europe
Sessions *A:	Vianden+Wiltz
Sessions *B:	Fishbach
Sessions *C:	Diekirch+Echternach

8th IEEE International Conference on

Cloud Computing Technology and Science

IEEE CloudCom 2016

12 – 15 December, 2016

Luxembourg

Conference Program

Message from the General Chairs

Welcome to the 8th IEEE International Conference on Cloud Computing Technology and Science!

CloudCom 2016 will be held this time at the heart of Europe from December 12th to December 15th, 2016 in Luxembourg at the Parc Alvisse Hotel. The capital of one of the world's smallest countries is a vibrant, dynamic city nestled within a romantic, peaceful countryside. Headquarters for several major European institutions, Luxembourg city is a modern, open and friendly place with a human dimension. We thus hope you will have a memorable stay during this conference which will feature world-class keynotes, technical papers, tutorials and business panels addressing the key theme of "Cloud Computing".

CloudCom is the premier conference on Cloud Computing worldwide, attracting researchers, developers, users, students and practitioners from the fields of big data, systems architecture, services research, virtualization, security and privacy, high performance computing, distributed and fog computing, always with an emphasis on how to build cloud computing platforms with real impact. It provides a major forum for engineers and scientists from academia, industry and government to share their views on many challenging research problems, and to present and discuss their novel ideas, research results, new applications and experience on all aspects of the Cloud Computing. CloudCom 2016 is co-sponsored by IEEE, IEEE Computer Society, IEEE Cloud Computing Initiative (CCI), the University of Luxembourg (www.uni.lu), the Luxembourg National Research Fund (fnr.lu) and several industrial sponsors. The conference is steered by the Cloud Computing Association (www.cloudcom.org), and draws on the excellence of its world-class Program Committee (supported also by IEEE Technical Committee on Scalable Computing (TCSC) and its participants. IEEE CloudCom 2016 is expected to attract more than 300 of industry professionals, scientists, and academics from all over the world.

This year, CloudCom 2016 consists of a main conference, five workshops, several panels, symposiums and technical tutorials, with over 117 presentations in total from more than 55 countries around the world. In addition, the conference program includes five distinguished keynotes. CloudCom 2016 is turning to be one of the largest conferences in the series since its birth in terms of both the number of participants and the number of technical sessions. For the successful organization of an international conference of this size and diversity, we counted on the great support of many people and organizations.

First of all, we would like to sincerely thank the Steering Committee for giving us the opportunity to organize the conference and for their support. Then, the Technical Program Committee, under the outstanding leadership of the program chairs, Dr. Grégoire Danoy and Dr. Sathish Gopalakrishnan, and the respective Track Co-chairs, have put in a tremendous amount of efforts to assemble an excellent technical program, for which we show our sincere appreciation. Of course, this technical program was made possible by the high-quality submissions from the authors and the rigorous reviews by the reviewers and TPC members, for which we are also truly grateful.

We would like to express our appreciation to Mischa Dohler (King's College London, UK), Dhabaleswar K. Panda (Ohio State University, US), Lizhe Wang (Chinese Academy of Sciences, CN) and Reinhard Schneider (LCSB, Luxembourg), for accepting our invitation and contributing their valuable time to share their unique perspectives of cloud computing as keynote speakers.

Special thanks go to our Corporate Sponsors - their financial contributions allowed us to plan an outstanding conference program. Delegates should not miss the three social events we organized throughout the conference: The Cocktail Reception at the Parc Alvisse Hotel on Monday, the Welcome Reception at

Philharmonie Luxembourg on Tuesday, and finally the Conference Banquet and Cruise on the Mosel river on Wednesday.

We would also like to thank all organizing committee members: Drs Grégoire Danoy and Sathish Gopalakrishnan for managing the technical program, Valentin Plugaru and Dr. Henry Chan for putting together the workshop and tutorial program; Drs. Xavier Besseron and Martin Rosalie for handling the short papers, demos and posters; Dany Donnen and Mazin Yousif for handling industry sessions; Dr. Lin Wang for organizing the PhD Consortium and the Student grants; Hyacinthe Cartiaux for taking care of the conference website and the publication issues; Drs Xavier Besseron, Joseph Emeras and Dzmitry Klaziovich for looking after sponsors; Magali Martin and Laurent Betry for handling financial matters; Magali Martin (again), Stephanie Annet, Daniel Gugan and Bertrand Dessart for local arrangement and registration. We also own a debt of gratitude to Randall Bilof of IEEE Computer Society Conference Publishing Services for his help to produce the proceedings in a very tight schedule.

Finally, we would like to take this opportunity to thank all the authors, participants and session chairs for their valuable efforts, many of whom traveled long distances to attend this conference and make their valuable contributions.

We sincerely hope that you will find the conference and the networking opportunity rewarding and interesting for your research and professional activities. We are in all cases more than delighted to organize this year's edition. We do hope you will appreciate your time here in Luxembourg!

Sébastien Varrette, *University of Luxembourg, Luxembourg*
Pascal Bouvry, *University of Luxembourg, Luxembourg*
Albert Y. Zomaya, *University of Sydney, Australia*

IEEE CloudCom 2016 General Chairs

Message from the Program Chairs

We have the pleasure to present the Proceedings of CloudCom 2016, the eighth IEEE International Conference on Cloud Computing Technology & Science.

The conference was held in Luxembourg, from December 12th to 15th, 2016, and was organized by the University of Luxembourg/SnT, Luxembourg, under the auspices of the IEEE, IEEE Computer Society, Cloud Computing Association (www.cloudcom.org), IEEE Technical Committee on Scalable Computing (TCSC), and the IEEE STC Cloud Computing.

The interest in Cloud computing in both academia and industry keeps increasing. With a total of 273 submissions, IEEE CloudCom reflects this tendency and remains the main regular event in the field worldwide. 193 papers were submitted to the main conference, 37 to the PhD consortium, and the posters & demonstrations session and the five different workshops received a total of 43 submissions. 51 high quality full papers were selected by the program committee for presentation at the main conference and inclusion in the proceedings (26% acceptance rate) with an average of more than 3.5 reviews per paper.

The Technical Program Committee was organized in seven different tracks, each of them representing a key research topic in Cloud Computing. Each track was co-chaired by two leading researchers in their corresponding field assisted by 264 PC members in total. We would like to deeply thank all of them for their hard work, and the rigorous and high quality reviews they provided.

We are also very thankful to the Steering Committee Chairs, Prof. Chunming Rong and Dr. Martin Gilje Jaatun for their time and very valuable support. We additionally would like to express our gratitude to the General chairs, Prof. Albert Y. Zomaya, Prof. Pascal Bouvry and Dr. Sébastien Varrette, for their continuous effort in making CloudCom 2016 another great and successful event in the CloudCom series. Finally, special thanks also goes to Hyacinthe Cartiaux and IEEE CPS for preparing and publishing these proceedings.

Grégoire Danoy, *University of Luxembourg, Luxembourg*
Sathish Gopalakrishnan, *The University of British Columbia, Canada*

IEEE CloudCom 2016 Program Chairs

Message from the Cloud Computing Association Organizing Committee

The Cloud Computing Association initiated the annual "International Conference on Cloud Computing (CloudCom)" in 2009, which since 2010 has been known as the "IEEE International Conference on Cloud Computing Technology and Science". CloudCom was successfully held in Beijing, China (2009), Indianapolis, USA (2010), Athens, Greece (2011), Taipei, Taiwan (2012), Bristol, UK (2013), Singapore (2014) and Vancouver (2015).

This year's conference, CloudCom 2016, has confirmed its position as one of the foremost international cloud computing conferences, with continued interest and contributions from many academic and industrial research groups. We thank the local organizers, University of Luxembourg, for an impeccable job – and the sponsors IEEE, IEEE CS, IEEE TCSC, IEEE Cloud Computing, Luxembourg National Research Fund, the Interdisciplinary Centre for Security, Reliability and Trust, and the UL HPC Centre for their unwavering support.

The number of submissions confirms the enduring interest in cloud computing from the international research community. We are immensely grateful to the contributing authors, and offer special thanks to our technical program committee members and external reviewers who did a great job in reviewing the large amount of high-quality papers.

We also extend our thanks to the keynote speakers, tutorial speakers, panelists, and the members of the CloudCom Steering and Advisory Committees. Special thanks to those who helped promote the conference, particularly the program chairs, track chairs and workshop chairs. Last, but not least, we are immensely grateful for the efforts of the local organizing team members. Academic conferences like CloudCom rely on such hard-working volunteers for their existence!

Chunming Rong
Steering Chair, CloudCom.org
Martin Gilje Jaatun
Steering Vice Chair, CloudCom.org

The Cloud Computing Association (www.cloudcom.org) is a global, nonprofit member organization that shall promote the development of cloud computing technology and related matters. The Cloud Computing Association is registered in Norway and was founded by a global group of experts interested in cloud computing technology. You may join us through LinkedIn (gid=1864932) and follow us on Twitter (@CloudCom_Org).

Organizing Committee

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Pascal Bouvry, University of Luxembourg, Luxembourg
Albert Y. Zomaya, University of Sydney, Australia

Steering Committee

Chunming Rong (chair), University of Stavanger, Norway
Martin Gilje Jaatun (vice-chair), SINTEF, Norway
Albert Y. Zomaya, University of Sydney, Australia
Stephen L. Diamond, IEEE Cloud Computing Initiative, USA

Program Chairs

Gregoire Danoy, University of Luxembourg, Luxembourg
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Magali Martin, University of Luxembourg, Luxembourg
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Technical Program Committee

Track 1: Architecture and Virtualization

Track Chairs

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Dr. Javid Taheri, Karlstad University, Sweden

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Track 2: Cloud Services and Applications

Track Chairs

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Prof. Shih-Chia Huang, National Taipei University of Technology, Taiwan

Program Committee Members

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Carmela Comito, ICAR-CNR, Italy
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Abdallah Ali Zainelabden Abdallah Ibrahim, University of Luxembourg, Luxembourg
Valentin Plugaru, University of Luxembourg, Luxembourg
Guan-Pu Pan, National Taipei University of Technology, Taiwan
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Ming-Kai Jiau, National Taipei University of Technology, Taiwan
Jialei Liu, Beijing University of Posts and Telecommunications, China
Yujiong Liu, Beijing University of Posts and Telecommunications, China
Jinliang Xu, Beijing University of Posts and Telecommunications, China

Track 3: Internet of Things (IoT) and Mobile in the Cloud

Track Chairs

Dr. Yan Zhang, Simula Research Laboratory, Norway
Prof. Jiannong Cao, The Hong Kong Polytechnic University, Hong Kong

Program Committee Members

Puneet Jain, HP Labs, United States
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Enzo Mingozzi, University of Pisa, Italy
Feng Wang, The University of Mississippi, USA
Jelena Misic, Ryerson University, Canada
Apivadee Piyatumrong, National Electronics and Computer Technology Center (NECTEC), Thailand
Sébastien Varrette, University of Luxembourg, Luxembourg

Track 4: Big Data

Track Chairs

Dr. Jinjun Chen, University of Technology, Sydney, Australia
Dr. Tomasz Wiktorski, University of Stavanger, Norway

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Jay Lofstead, Sandia National Laboratories, USA
Osamu Tatebe, University of Tsukuba, Japan
Domenico Talia, University of Calabria, Italy
Heiko Schuldt, Universitat of Basel, Switzerland
Apivadee Piyatumrong, National Electronics and Computer Technology Center (NECTEC), Thailand

Track 5: High Performance Computing (HPC) in/with the Cloud

Track Chairs

Dr. Sébastien Varrette, University of Luxembourg, Luxembourg
Dr. Matei Ripeanu, University of British Columbia, Canada

Program Committee Members

Frederic Deprez, INRIA Rhone-Alpes, France
Denis Trystram, INRIA Rhone-Alpes, France
Georges Da Costa, IRIT, France
Jean-Marc Pierson, IRIT, France
Rafael Mayo Gual, Universitat Jaume, Spain
Laurent Lefevre, ENS Lyon, France
Jorge Barbosa, Universidade do Porto, Portugal
Roberto Rey Expósito, University of A Coruna, Spain

Alexey Lastovetsky, UCD School of Computer Science, Ireland
Jing Gong, KTH Royal Institute of Technology, Sweden
Javid Taheri, Karlstad University, Sweden
Bernabé Dorronsoro Díaz, University of Cadiz, Spain
Lutz Schubert, University of Ulm, Germany
Ivona Brandic, TU-Wien, Austria
Sergio Nesmachnow, Universidad de la República, Uruguay
Malgorzata Sterna, Poznan University of Technology, Poland
Jesus Carretero Pérez, Universidad Carlos III de Madrid, Spain
Silvina Caíno Lores, University Carlos III of Madrid, Spain
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Jean-Louis Roch, INRIA Grenoble, France
Andrei Tchernykh, CICESE Research Center, Mexico
Suzanne Shontz, University of Kansas, USA
Samer Al-Kiswany, The University of British Columbia, Canada
Yung-Hsiang Lu, Purdue University, USA
Tom Hacker, Purdue University, USA
Qing He, Institute of Computing Technology
Huashan Yu, School of Electronic Engineering and Computer Science, Peking University, China
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Paul Watson, Newcastle University, UK
Ioan Raicu, Illinois Institute of Technology, USA
Florina M. Ciorba, University of Basel, Switzerland
Eric Matson, Purdue University, USA
Xavier Besseron, University of Luxembourg, Luxembourg
Valentin Plugaru, University of Luxembourg, Luxembourg
Ekasit Kijsipongse, NECTEC, Thailand

Track 6: Security and Privacy

Track Chairs

Prof. Nuno Ferreira Neves, Universidade de Lisboa, Portugal
Dr. Wenbo He, McGill University, Canada

Program Committee Members

Michele Colajanni), University of Modena and Reggio Emilia, Italy
Kim-Kwang Raymond Choo, University of South Australia, Australia
Zahir Tari, RMIT University, Melbourne, Australia
Paulo Verrissimo, University of Luxembourg, Luxembourg
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Rakesh Bobba, Oregon State University, USA
Vanishree Rao, PARC, a Xerox Commpany, USA
Cong Wang, City University of Hong Kong, China
Yu Hua, Huazhong University of Science and Technology, China
Wei Gong, Department of Computer Science and Technology - Tsinghua University - Beijing, China
Yuan He, Tsinghua University, China

Anderson Santana De Oliveira, SAP, France
Alireza Shameli-Sendi, McGill, USA
Bogdan Carbunar, Motorola Labs, USA
Alexander Pretschner, Technische Universitat Munchen, Germany
Ryan Henry, Indiana University, USA
Raphael M. Reischuk, ETH Zurich, Switzerland
Noman Mohammed, University of Manitoba, Canada
William Harris, Georgia Institute of Technology, USA
Trent Jaeger, The Pennsylvania State University, USA
Yinqian Zhang, The Ohio State University, USA
Karthick Jayaraman, Microsoft, USA

Track 7: Distributed Cloud / Cloud Brokering / Edge Computing

Track Chairs

Prof. El-ghazali Talbi, University of Lille, France
Dr. Adrien Lebre, Ecole des Mines de Nantes, France

Program Committee Members

Yongwei WU, Tsinghua University, China
Frederic Deprez, INRIA Rhone-Alpes, France
Jacek Blazewicz, Poznan University of Technology, Poland
Dana Petcu, West University of Timisoara, Romania
Thierry Coupaye, Orange Labs, France
Guillaume Pierre, IRISA, France
Omer Rana, Cardiff University, UK
Rafael Mayo García, CIEMAT, Spain
Ali Shoker, HASLab/INESC TEC & University of Minho, Braga, Portugal
Helen Karatza, Aristotle University of Thessaloniki, Greece
Zahir Tari, RMIT University, Melbourne, Australia
Javid Taheri, Karlstad University, Sweden
Ivona Brandic, TU-Wien, Austria
Christine Morin, INRIA Rennes - Bretagne Atlantique, France
Pieter Simoens, Ghent University, Belgium
Gilles Fedak, University of Lyon, France
Beniamino Di Martino, Seconda Università degli Studi di Napoli, Italy
Franciszek Seredynski, Cardinal Stefan Wyszynski University in Warsaw, Poland
Nouredine Melab, LIFL, France
Patricia Stolf, IRIT, France
Andrei Tchernykh, CICESE Research Center, Mexico
Pierre Manneback, Polytech-Mons, Belgium
Bernabé Dorronsoro, University of Cadiz, Spain
Peter Korosec, Jozef Stefan Institute, Slovenia
Shyam Wagle, University of Luxembourg, Luxembourg

Ph.D. Consortium

Track Chairs

Dr. Lin Wang, Technische Universität Darmstadt, Germany
Magali Martin, University of Luxembourg, Luxembourg

Program Committee Members

Qing Wang, TU Delft, Netherlands
Lei Jiao, Bell Labs, Ireland

Posters, Demos & Short Papers

Track Chairs

Dr. Xavier Besseron, University of Luxembourg, Luxembourg
Dr. Martin Rosalie, University of Luxembourg, Luxembourg

Program Committee Members

Dhabaleswar (D. K.) Panda, The Ohio State University, USA
Jerome Vienne, Texas Advanced Computing Center, USA
Jedrzej Musial, Poznan University of Technology, Poland
Hao Wang, Virginia Tech, USA
Swann Perarnau, Argonne National Laboratory, USA
Johnatan Pecero, University of Luxembourg, Luxembourg
Grégoire Danoy, University of Luxembourg, Luxembourg

Keynotes

The Tactile Internet – IoT, 5G and Cloud on Steroids

Prof. Mischa Dohler, King's College London, UK

Tuesday, Dec. 13th, 2016 | 09:30am - 10:30am

Abstract: Currently we can see and hear through the Internet, but we cannot touch. We have a vision to create the Tactical Internet, where we would be able to touch through the median of the internet. This would transform some very basic but vital tasks, like online shopping where the user might want to touch and feel the texture of a dress or jacket before buying it, but, most importantly, this has the potential to transform the way that healthcare, engineering and wealth is delivered globally. We will be able to convey physical, tactile experiences remotely and thus invoke a fundamental shift from content-delivery to skillset-delivery networks. This talk will summarize the potentials, building blocks and challenges which lay ahead for designing the Tactile Internet.

Biography: Mischa Dohler is full Professor in Wireless Communications at King's College London, driving cross-disciplinary research and innovation in technology, sciences and arts. He is the Director of the Centre for Telecommunications Research, co-founder of the pioneering smart city company Worldsensing, Fellow of the IEEE and the Royal Society of Arts (RSA), and a Distinguished Member of Harvard Square Leaders Excellence.

He is a frequent keynote, panel and tutorial speaker, and has received numerous awards. He has pioneered several research fields, contributed to numerous wireless broadband, IoT/M2M and cyber security standards, holds a dozen patents, organized and chaired numerous conferences, was the Editor-in-Chief of two journals, has more than 200 publications, and authored several books. He has a citation h-index of 44.

He acts as policy, technology and entrepreneurship adviser, examples being Richard Branson's Carbon War Room, David Willetts' 8 Great Technology Fund, Regulator Ofcom, UK Ministries, EPSRC ICT Strategy Advisory Team, European Commission, Tech London Advocate, ISO Smart City working group, and various start-ups. He is also an entrepreneur, composer & pianist, and fluent in 6 languages. He has talked at TEDx. He had coverage by national and international TV & radio, and his contributions have featured on the BBC and the Wall Street Journal.

HPC Meets Cloud: Opportunities and Challenges in Designing High-Performance MPI and Big Data Libraries on Virtualized InfiniBand Clusters

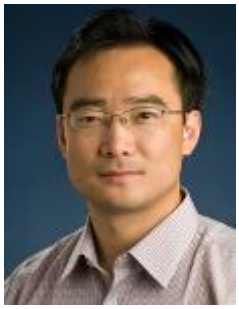
Prof. Dr. Dhabaleswar K. Panda, Ohio State University, USA

Tuesday, Dec. 13th, 2016 | 13:30pm - 14:30pm

Abstract: Significant growth has been witnessed during the last few years in HPC clusters with multi-/many-core processors, accelerators, and high-performance interconnects (such as InfiniBand, Omni-Path, iWARP, and RoCE). To alleviate the cost burden, sharing HPC cluster resources to end users through virtualization for both scientific computing and Big Data is becoming more and more attractive. The recently introduced Single Root I/O Virtualization (SR-IOV) technique for InfiniBand and High Speed Ethernet provides native I/O virtualization capabilities and is changing the landscape of HPC virtualization. However, SR-IOV lacks locality-aware communication support, which leads to performance overheads for inter-VM communication even within the same host. In this talk, we will first present our recent studies done on MVAPICH2-Virt MPI library over virtualized SR-IOV-enabled InfiniBand clusters, which can fully take advantage of SR-IOV and IVShmem to deliver near-native performance for HPC applications. In the second part, we will present a framework for extending SLURM with virtualization-oriented capabilities, such as dynamic virtual machine creation with SR-IOV and IVShmem resources, to effectively run MPI jobs over virtualized InfiniBand clusters. Next, we will demonstrate how high-performance solutions can be designed to run Big Data applications (like Hadoop) in HPC cloud environments. Finally, we will share our experiences of running these designs on the Chameleon Cloud testbed.

Biography: Dhabaleswar K. (DK) Panda is a Professor of Computer Science and Engineering at the Ohio State University. His research interests include parallel computer architecture, high performance networking, InfiniBand, Exascale computing, Big Data, programming models, GPUs and accelerators, high performance file systems and storage, virtualization and cloud computing. He has published over 300 papers in major journals and international conferences related to these research areas. Dr. Panda and his research group members have been doing extensive research on modern networking technologies including InfiniBand, High-Speed Ethernet and RDMA over Converged Enhanced Ethernet (RoCE). The MVAPICH2 (High Performance MPI over InfiniBand, iWARP and RoCE) and MVAPICH2-X (Hybrid MPI and PGAS (OpenSHMEM and UPC)) software packages, developed by his research group, are currently being used by more than 2,100 organizations worldwide (in 71 countries). This software has enabled several InfiniBand clusters to get into the latest TOP500 ranking during the last decade. More than 200,000 downloads of this software have taken place from the project's website alone. This software package is also available with the software stacks of many network and server vendors, and Linux distributors. Recently, Dr. Panda and his team have also developed a high performance RDMA-enabled Apache Hadoop software package to accelerate Hadoop with RDMA for Big Data. Dr. Panda's research has been supported by funding from US National Science Foundation, US Department of Energy, and several industry including Intel, Cisco, Cray, SUN, Mellanox, QLogic, NVIDIA and NetApp. He is an IEEE Fellow and a member of ACM.

Big Trajectory Data Processing on GPUs: Handle the Positional Streams



Prof. Lizhe Wang, Chinese Academy of Sciences, CN

Wednesday, Dec. 14th, 2016 | 09:30am - 10:30am

Abstract: Recently there has been increasing development of positioning technologies in various Big Data applications, such as smart city computing. This enables us to collect trajectory streaming big data for moving objects. Efficient processing and analyzing of trajectory streaming big data have thus become an emerging and challenging task. The Graphics Processing Unit (GPU) is a promising platform for processing streaming data. This talk will highlight our GPU-aided approaches to improving the performance of continuous queries, compression, and clustering for streaming big trajectory data.

Biography: Dr. Lizhe Wang is a “ChuTian” Chair Professor at School of Computer Science, China Univ. of Geosciences (CUG), and a Professor at Inst. of Remote Sensing & Digital Earth, Chinese Academy of Sciences (CAS). Prof. Wang received B.E. & M.E from Tsinghua Univ. and Doctor of Eng. from Univ. Karlsruhe, Germany. Prof. Wang is a Fellow of IET, Fellow of British Computer Society. Prof. Wang serves as an Associate Editor of IEEE Trans. on Computers, IEEE Trans. on Cloud Computing, IEEE Trans. on Sustainable Computing. His main research interests include Cloud Computing, Big Data Computing, and remote sensing data processing.

Cloud Computing in the Life Sciences

Dr. Reinhard Schneider, Luxembourg Centre for Systems Biomedicine (LCSB), University of Luxembourg

Thursday, Dec. 15th, 2016 | 09:30am - 10:30am

Abstract: The life sciences became a data driven research area, with high demands in compute power and storage infrastructure. The talk will give an overview how cloud computing is used in the life sciences. We will discuss the current situation, current bottlenecks and limitations as well as data security and protection issues.

Biography: Dr. Reinhard Schneider is the Head of the Bioinformatics Core facility at the Luxembourg Centre for Systems Biomedicine (LCSB) at the University of Luxembourg. Between 1994-2010 he worked as a Team Leader at the European Molecular Biology Laboratory (EMBL) in Heidelberg, Germany, where he led the "Data Integration and Knowledge Management". Before joining the EMBL he was co-founder of LION bioscience AG, Heidelberg where he served as Chief Information Officer being responsible for the worldwide software development. Before that, he was CEO of LION bioscience Research Inc., Cambridge, Massachusetts, establishing an IT based knowledge management system for Bayers gene based research and development efforts. Before founding LION bioscience, he worked as a scientist in the biocomputing department at the EMBL, Heidelberg, where he studied various aspects of protein structures. He co-developed a large-scale automated sequence analysis system which became the foundation of LION's software offering and is an expert in the use of massive parallel computers in biology. Dr. Schneider received his Ph.D. in biology at the University of Heidelberg, Germany and has over 120 research papers published. He is a member of the board of Directors of the International Society for Computational Biology where he served 7 years as the treasurer. Beside his academic career, he is involved in several start-up projects in Germany and Luxembourg.

Grid’5000, Running a Large Instrument for Parallel and Distributed Computing Experiments

Assoc. Prof. Lucas Nussbaum, Université de Lorraine, France

Monday December 12th | 13:30pm - 14:30pm

Asbtract: Grid’5000 is a large-scale and versatile testbed for experiment-driven research in all areas of computer science, with a focus on Cloud, HPC and Big Data. In this talk, we will first provide an overview of Grid’5000, then focus on presenting the features that are the more relevant to experimenters working on virtualization and clouds, such as: support for deployment of custom software stacks, support for network isolation, tools for the automated deployment of an OpenStack cloud, etc. Some use cases will illustrate what it is already possible to perform using those features. Finally, the talk will end with an overview of planned evolutions of the testbed in that area, and discuss requirements for reproducible research on clouds.

Biography: Associate professor at Université de Lorraine. Researcher in the MADYNES team, at LORIA laboratory, a joint laboratory with INRIA Nancy - Grand Est and CNRS.
My research activities focus on experimentation for the evaluation of distributed systems in the context of High Performance Computing and Clouds. I work on the design of experimental testbeds (Grid'5000), emulation (Distem emulator), and Open Science and reproducible research.

Tutorials

Reproducible Research at the Cloud Era

Dr. Sébastien Varrette, Research Associate
Parallel Computing and Optimization Group, University of Luxembourg

Monday December 12th | 09:00am - 12:15pm

Synopsis

The term Reproducible Research (RR) refers to "the idea that the ultimate product of academic research is the paper along with the full computational environment used to produce the results in the paper such as the code, data, etc. that can be used to reproduce the results and create new work based on the research." [Source: Wikipedia].

The need for reproducibility is increasing dramatically as data analyses become more complex, involving larger datasets and more sophisticated computations. Obviously, the advent of the Cloud Computing paradigm is expected to provide the appropriate means for RR. This tutorial is meant to provide an overview of sensible tools every researcher (in computer science but not only) should be aware of to enable RR in its own work. In particular, and after a general talk presenting RR and the existing associated tools and workflow, this tutorial will propose several practical exercises and hands-on meant to be performed on each attendee's laptop, to cover the management of sharable Development environment using Vagrant. Resources of this tutorial will be available on Github.

Topics

- Overview of Reproducible Research (RR) and Open Challenges
- Relevant Tools for RR: git, make & Co., knitr, continuous integration using Travis/Gitlab-CI.
- Creation and configuration of lightweight, reproducible and portable environments using Virtual Machines
- Installation, configuration and generation of Vagrant boxes
- Box Provisioning using puppet
- Vagrant providers

Biography of Presenter

Sebastien Varrette is research associate in the Parallel Computing and Optimization Group at the University of Luxembourg (UL). His main research interests lie in the security and performance of parallel and distributed computing platforms, such as HPC clusters or Cloud Computing infrastructures. Since he joined Prof. Pascal Bouvry in 2007, he is also leading the management of the UL HPC Platform and the associated expert team of system administrators. He’s also active in various scientific committees (IEEE CloudNet, CloudCom, OPTIM, Europar, PCGrid etc.) and technical workgroups.

Practical Grid'5000: Getting started & IaaS deployment with OpenStack

Clément Parisot, System and Network Engineer, INRIA
Hyacinthe Cartiaux, HPC System Administrator, University of Luxembourg

Monday December 12th | 14:30m – 18:00pm

Synopsis

Grid'5000 is a large-scale and versatile testbed for experiment-driven research in all areas of computer science, with a focus on parallel and distributed computing including Cloud, HPC and Big Data.

This tutorial will walk you through your first steps on the Grid'5000 experimental platform and demonstrate the key features of the platform, connection, reserving resources, reconfiguring and redeploying computing nodes, etc.

Finally, it will lead you to set-up a working OpenStack environment, in different configurations, by making a heavy usage of the core functionalities of the platform.

Topics

- SSH connection to the platform
- Reserving resources with the OAR batch scheduler
- Practical deployment on Grid'5000
- Experimental environment
- OpenStack - short introduction on IaaS architecture and components
- Deployment scenarios and tools

Biography of Presenters

Clément Parisot works as Network & System engineer for the Grid'5000 distributed computing platform, at Inria, Nancy. He graduated with an engineering degree in Computer Science from TELECOM Nancy in 2014.

Hyacinthe Cartiaux works as a system administrator at the High Performance Computing department of the University of Luxembourg, since he graduated with a bachelor degree in network and system administration in 2011.

Panels and Symposiums

2016 China-EU Symposium on Big Data and Green Informatics (CEBGS 2016)

Monday December 12th | 09:00am – 12:15pm

Scope

Managing and processing large volumes of data, or "Big Data", and gaining meaningful insights is a significant challenge facing the distributed computing community. The goal of CEBGS 2016 is to provide a forum for scientists, engineers, and researchers to discuss and exchange their new ideas, novel results, work in progress and experiences on all aspects of Big data, Green and sustainable computing, Communications, etc.

Topics

Papers or reports from researchers in academic institutions and R&D organizations on current research, new trends, latest developments, emerging technologies and new industrial standards, come under the following primary areas but not limited to:

- Green Cloud Computing
- Green High Performance Computing
- Efficient And Green Data Science
- Smart Grid And Green Energy
- Information Fusion And Smart Applications
- IoT Applications

Program

Panel discussion - Merge or Split: Mutual Influence among Big Data, Green Computing and Security.

Moderator: Prof. Xianghan Zheng, Fuzhou University, China

Members:

- Chunming Tang, Guangzhou University, China
- Tahar Kechadi, University College Dublin, Ireland
- Chunming Rong, University of Stavanger, Norway
- Hai Jin, Huazhong University of Science and Technology, China
- Lizhe Wang, Chinese Academy of Science, China

The panel will discuss on the following three important questions the Big Data, Green computing, and Security are facing today:

- What is the impact of Big Data techniques on Green Informatics?
- What is the impact of Green Informatics techniques on Big Data?
- What is the security Challenge and future solutions in Big data and Green Informatics?
- How to strengthen big data research collaboration in academia between EU and China?

Presentations

- Deep Learning based Fast and Accurate Sentiment Analysis.
  Prof. Xianghan Zheng, Fuzhou University, China.
- Secure Outsourcing in Big Data.
  Prof. Chunming Tang, Guangzhou University, China.
- Accountability based secure service in Big Data.
  Prof. Chunming Rong, University of Stavanger, Norway.
- PSO based task scheduling in cloud computing resource Arrangement.
  Prof. Wenzhong Guo, Fuzhou University, China.
- Agricultural Internet of things and its application.
  Prof. Riqing Chen, Fujian Agriculture and Forestry University, China.
- Presentation by *Prof. Tahar Kechadi, University College Dublin, Ireland.*
- Panel summary.

Committee

Chair

Xianghan Zheng, Fuzhou University, China

Program Chairs

Chunming Tang, Guangzhou University, China
Riqing Chen, Fujian Agriculture and Forestry University, China

Program Committee

Chunming Rong, University of Stavanger, Norway
Hai Jin Huazhong, University of Science and Technology, China
Yan Zhang, University of Olso, Norway
Bingsheng He, Nanyang Technological University, Singapore
Tahar Kechadi, University College Dublin, Ireland
Wenzhong Guo, Fuzhou University, China
Vladimir Oleshchuk, University of Agder, Norway
Yi Ren, National Chiao Tung University, Taiwan
Martin Gilje Jaatun, SINTEF, Norway
Thomas J Hacker, Purdue University, USA
Guolong Chen, Fuzhou University, China
Henry Chan, The Hong Kong Polytechnic University, Hong Kong, China
Jiannong Cao, The Hong Kong Polytechnic University, Hong Kong, China
Victor Leung, UBC, Canada
Chung-Ming Hwang, National Cheng-Kun University, Taiwan

Panel session: The role of HPC & Cloud Computing in Financial Services and Technologies

Monday December 12th | 13:30pm – 14:30pm

Moderator: Dr. Mazin Yousif, T-Systems International, IEEE, USA

Panelists:

- Pascal Bouvry, University of Luxembourg, Luxembourg
- Marco Houwen, LU-CIX Asbl. Chairman, Luxembourg
- Lizhe Wang, Chinese Academy of Sciences, China
- Chunming Rong, University of Stavanger, Norway

Biography: Mazin Yousif

Dr. Yousif is the Chief Technology Officer and Vice President of Architecture for the Royal Dutch Shell Global account at T-Systems, International. Before joining T-Systems, he spent some time with IBM Canada GTS, Avirtec and Intel. He was also a Professor at Louisiana Tech University. Dr. Yousif serves as a Technology Advisor, Board Member and investor for Simudyne Corporation. He is also a Board Member for Stafford & Associates. He chairs the Advisory Board of the European Research Consortium for Informatics and Mathematics (ERCIM). He is also the Editor-In-Chief of the IEEE Cloud Computing Magazine. He founded the NSF Industry/University Cooperative research Center for Autonomic Computing. He was a principal leader defining the InfiniBand Architecture and co-chaired the management working group in the InfiniBand Trade Association. He was an adjunct professor in several universities including Duke, NCSU, OGI and Arizona. He has served as the General Chair or Program Chair for many conferences and serves in the editorial board of many journals. He is a frequent speaker in academic and industry conferences on topics related to cloud computing, big data and autonomic computing. He has also published extensively and was an IEEE Distinguished Visitors Program speaker from 2008 – 2013. Dr. Yousif finished his Master (Electrical Engineering) and Ph.D. (Computer Engineering) degrees from the Pennsylvania State University in 1987 and 1992, respectively.

Biography: Pascal Bouvry

Dr. Bouvry earned his undergraduate degree in Economical & Social Sciences and his Master degree in Computer Science with distinction (‘91) from the University of Namur, Belgium. He went on to obtain his Ph.D. degree ('94) in Computer Science with great distinction at the University of Grenoble (INPG), France. His research at the IMAG laboratory focussed on Mapping and scheduling task graphs onto Distributed Memory Parallel Computers. Next, he performed post-doctoral researches on coordination languages and multi-agent evolutionary computing at CWI in Amsterdam.

Dr. Bouvry gained industrial experience as manager of the technology consultant team for FICS (belonging to S1 corp) a world leader in electronic financial services. Next, he worked as CEO and CTO of SDC, a Saigon-based joint venture between SPT (the second telecom operator in Vietnam), Spacebel SA (a Belgian leader in Space, GIS and Healthcare), and IOIT, a public research and training center. After that, Dr Bouvry moved to Montreal as VP Production of Lat45 and Development Director for MetaSolv Software, a world-leader in Operation Support Systems for the telecom industry (e.g. AT&T, Worldcom, Bell Canada, etc).

Dr. Bouvry is currently "Chargé de Mission auprès du Recteur" in charge of the University High Performance Computing, heading the ILIAS laboratory, directing the doctoral school DS-CSCE, directing the certificate SmartICT for Business innovation, and serving as Professor. Pascal Bouvry is also faculty of the Interdisciplinary Center of Security, Reliability and active in various scientific committees and technical workgroups (IEEE CIS Cloud Computing vice-chair, IEEE TCSC GreenIT steering committee, ERCIM WG, ANR, COST TIST, etc.).

Pascal Bouvry is also member of the editorial boards of IEEE Transactions on Sustainable Computing, IEEE Cloud Computing Magazine, and Elsevier journal in Swarm and Evolutionary Computation.

Biography: Marco Houwen

Before getting involved in the thrilling FinTech and Virtual Currencies industry and co-founding BHS-Services, Marco founded LuxCloud S.A. in 2010. A market leading provider of cloud service brokerage enablement. Prior to that in 2000, Marco co-founded Datacenter Luxembourg S.A., now recognised as one of the biggest Internet success stories in Luxembourg. Marco also co-founded EuroDNS, e-Brand Services, VoipGate and other ventures

Marco successfully launched the cross-industry initiative LU-CIX and has the honor to serve as President of LU-CIX A.s.b.l. As such he contributes actively on the construction and promotion of the Luxembourgish internet eco-system. In addition to the above Marco is an active investor in several internet ventures like Doctena.

Luxembourgish born and fluent in English, German and French, Marco has built an international profile by participating in numerous industry forums and advisory groups. With a background in Sales and Marketing, he is passionate about human excellence and contact and strives to get the best out of himself and others.

Biography: Lizhe Wang

Dr. Lizhe Wang is a “ChuTian” Chair Professor at School of Computer Science, China Univ. of Geosciences (CUG), and a Professor at Inst. of Remote Sensing & Digital Earth, Chinese Academy of Sciences (CAS). Prof. Wang received B.E. & M.E from Tsinghua Univ. and Doctor of Eng. from Univ. Karlsruhe, Germany. Prof. Wang is a Fellow of IET, Fellow of British Computer Society. Prof. Wang serves as an Associate Editor of IEEE Trans. on Computers, IEEE Trans. on Cloud Computing, IEEE Trans. on Sustainable Computing. His main research interests include Cloud Computing, Big Data Computing, and remote sensing data processing.

Biography: Chunming Rong

Prof. Chunming Rong is head of the Center for IP-based Service Innovation (CIPSI) at the University of Stavanger (UiS) in Norway. The CIPSI has the mission to promote cross-fertilization between several research fields to facilitate design and delivery of large-scale and complex IP-based services required by many application areas. He is also visiting chair professor at Tsinghua University and served also as an adjunct professor at the University of Oslo 2005-2009. He spent one sabbatical year as visiting professor at the Stanford University 2009-2010. His research interests include cloud computing, big data analysis, security and privacy. He is co-founder and chairman of the Cloud Computing Association (CloudCom.org) and its associated conference and workshop series. He is member of the IEEE Study Group on Cloud Standard and co-chairs the IEEE Technical Area of Cloud Computing, in TCSC (Technical Committee on Scalable Computing). He is the co-Editors-in-Chief of the Journal of Cloud Computing by Springer. He received award Editor's Choice in Discrete Mathematics in 1999. He coauthored a book titled "Security in Wireless Ad Hoc and Sensor Networks" published by John Wiley and Sons in 2009. Prof. Rong has extensive experience in managing research and development projects funded by both industry and funding agencies, such as the Norwegian Research Council and the EU Framework Programs.

The Sixth Workshop on Network Infrastructure Services as part of Cloud Computing (NetCloud 2016)

Monday December 12th | 09:00am – 12:15pm

Preface

Welcome to the sixth international workshop on Network Infrastructure Services as part of Cloud Computing organised within CloudCom 2015, Luxembourg, December 12th-15th, 2016. The previous workshops mostly held in conjunction with CloudCom have been a steady success stories creating an environment that reenforces team efforts and activities, research, and international collaborations between several projects leading to broad dissemination of the work presented.

NetCloud workshops attempt to address the problem of how the underlying network infrastructure is capable of supporting advanced cloud computing use cases, big data power users for an example. The workshop regularly brings together people from the network research community, commercial network operators and industry with the major cloud computing players, including IT specialists, researchers and commercial providers. NetCloud covers an area that can transform theory into practice and the outputs of the workshop can provide organizations with several useful recommendations, proofs-of-concepts and demonstrations to improve current cloud related networking practices.

The selected papers in NetCloud 2016 present the collaborative efforts of researchers from 11 different countries focusing on different aspects of the cloud related networking issues. The hot topics of this years' workshop include discussions about intercloud and inter-datacenters networks designed using the Software Defined Networks (SDN) paradigm in combination with newly proposed architecture frameworks and automated on-demand network infrastructure provisioning. Also, the general service provisioning in clouds is investigated and new architecture developments are presented. With service delivery and on-demand provisioning frameworks being in the spotlight, there are also contributions that focus on network infrastructure optimization in combination with high performance virtual resources usage that provide means to achieve the required Service Level Agreements and QoS guarantees as perceived by the user. Other contributions discuss the policy based infrastructure services management and demonstrate the creation, usage and management of experimentation test-beds in the cloud supported by solutions that offer holistic cloud and network self service provisioning and performance monitoring.

We hope the sixth NetCloud workshop will continue to foster collaborations of projects, research publications and funding opportunities at the international setting in Luxembourg. The Workshop Organizing Committee would like to thank CloudCom organizers for their fullest support committee.

NetCloud 2016 Organizing Committee

Program Chairs

Eduard Escalona, I2CAT, Spain
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Paola Grosso, University of Amsterdam, The Netherlands
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Begüm Ilke Zilci, TU Berlin, Germany

The Third RDA Workshop on Curricula and Teaching Methods in Cloud Computing, Big Data, and Data Science (Data Teaching 2016)

Monday December 12th | 14:30pm – 18:00pm

Preface

The emergence of Cloud Computing, Big Data, and Data (Intensive) Science as specialized fields in computing is motivating development of new books and courses to provide education in the techniques and technologies needed to extract knowledge from large datasets in virtualized environment. In current literature there is a lack of centralized learning resource for beginners that would integrate administrative, programing, and algorithm design aspects of related domains. We believe it is important to allow students, researchers, and professionals to understand cross-domain aspects of these challenges before they embark on further exploration of these fields.

Topics

Include but are not limited to the following areas applied to one of the Cloud Computing, Big Data, Data Science fields, or closely related to them:

- novel or updated curricula;
- novel or updated teaching methods, e.g. Bloom's taxonomy for new types of Computer Science and Big Data courses, flipped learning, etc;
- review and presentation of novel teaching materials;
- review of methodologies;
- characterization of domain knowledge (Body of Knowledge);
- adoption as a part of institutional strategies;
- review and analysis of existing practices in the design, implementation, and evaluation;
- multimedia and interactive components in residential and online education, educational platforms, MOOCs and others;
- cooperation between universities/academia and industry in delivering advanced education and leadership programs;
- implementation reports and lessons learnt;
- future trends and issues.

Data Teaching 2016 Organizing Committee

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Steve Brewer, University of Southampton, UK
Andrea Manieri, Engineering, Italy

The Second International Workshop on Quality of Service Assurance in the Cloud (QAC 2016)

Monday December 12th | 09:00am – 12:15pm

Preface

Cloud computing offers a computational model where network, storage, and compute domains can be abstracted into virtual resources offered on demand. While these abstractions offer opportunities to significantly simplify the management and optimize the use of resources, they impose additional challenges on assuring the quality of service (QoS).

In the context of multi-tenancy, the same physical resources are shared by different users that do not necessarily share the same service level agreements; hence the QoS distinction has to be enforced at a finer grain. Moreover, certain attributes of the QoS may contradict with others, for instance, high availability favors replication and distributed redundancy while energy efficiency favors de-duplication and consolidation. The multi-layered architecture of the distributed cloud requires not only a thorough orchestration between layers to ensure the required QoS, but also makes the root cause analysis even more complicated in case of the SLA violation. Continuous changes and migrations of the resources allocated at all layers of abstraction pose further challenges to detecting problems, identifying their location and reasoning about causality.

The aim of this workshop is to raise awareness of the challenges of the QoS assurance in the cloud, and bring together practitioners and researchers to discuss potential solutions.

The workshop solicits high-quality papers authored by both industry and academic contributors that address (but not limited to) the following topics:

- Security assurance, and regulations compliance in the Cloud
- Multi-level isolation orchestration for the Cloud tenants
- High Availability and fault tolerance approaches and techniques in the Cloud
- Dynamic performance assessment and prediction
- Telemetry and smart metering in the Cloud
- Managing Carbon Footprint versus QoS trade---offs
- Requirement modeling and specification for the QoS
- Orchestration and refinement for cloud QoS policies
- Dynamic verification and validation of cloud service quality
- Automated generation of multi-layer QoS test cases
- Autonomic approaches for assurance of cloud service quality
- Real-time analytics integration with QoS control loops
- Evaluations of cloud QoS impact on application or service QoE
- Automatic generation of workflows related to assuring QoS in cloud
- Machine learning and data mining techniques for optimizing QoS assurance processes
- The effect of virtualization (VMs vs. Containers, NFV vs. specialized HW) on QoS

QAC 2016 Organizing Committee

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Hai Huang, IBM Research, USA
Catalin Meirosu, Ericsson Research, Sweden
Ricardo Koller, IBM Research, USA

The Second International Workshop on Cloud Security and Data Privacy by Design (CloudSPD'16)

Monday December 12th | 09:00am – 15:45pm

Preface

Welcome to the 2016 CloudSPD Workshop - 2nd International Workshop on Cloud Security and Data Privacy by Design to be held as part of CloudCom 2016 in Luxembourg, December 12, 2016. The first international workshop held in Limassol, Cyprus has succeeded to plant the seed for formulating a highly focused community of researchers and experts that address the several different dimensions of cloud security and data privacy by design. CloudSPD'16 aims to grow that community and highlight the importance of this research for the cloud computing adoption.

Enterprises increasingly recognize the compelling economic and operational benefits of Cloud Computing. Virtualizing and pooling IT resources in the cloud enables organizations to realize significant cost savings and accelerates deployment of new applications, simultaneously transforming business and government at an unprecedented pace. However, those valuable business benefits cannot be unlocked without addressing new data security challenges posed by Cloud Computing.

Deploying confidential information and critical IT resources in the Cloud raises concerns about vulnerability to attack, especially because of the anonymous, multi-tenant nature of cloud computing. Applications and storage volumes often reside next to potentially hostile virtual environments, leaving information at risk to theft, unauthorized exposure or malicious manipulation. Governmental regulation of data privacy and location presents the additional concern of significant legal and financial consequences if data confidentiality is breached, or if Cloud providers inadvertently move regulated data across international borders.

This workshop aims to provide a fertile ground for creative debate and presentation of research results, practical experiences, and innovative ideas in all security aspects related to cloud computing. CloudSPD'16 focuses on Cloud Computing security, and has attracted research efforts from both the academia and industry in order to facilitate the dissemination of research and development of the next generation cloud platforms, applications and methods that will lead to better and more secure by design cloud-based systems.

CloudSPD'16 Organizing Committee

Program Chairs

Assoc. Prof. Christian Gehrmann, SICS, Sweden
Prof. Gregoris Mentzas, National Technical University of Athens, Greece
Assist. Prof. Antonios Michalas, University of Westminster, UK
Prof. Dr. Jörn Müller-Quade, KIT, Germany
Dr. Yiannis Verginadis, National Technical University of Athens, Greece

Technical Program Committee

Isaac Agudo, University of Malaga, Spain
Jens-Matthias Bohli, Hochschule Mannheim, Germany
Simone Braun, CAS Software AG, Germany
George Dimitrakopoulos, Harokopio University of Athens, Greece
Christos Douligeris, University of Piraeus, Greece
Rafael Dowsley, KIT, Germany
Matthias Gabel, KIT, Germany
Panagiotis Gouvas, Ubitech, Greece
Spyros Mantzouratos, Intrasoft, Greece
Nikos Komninos, City University, UK
George Moldovan, Siemens SRL, Romania
Septimiu Nechifor, Siemens SRL, Romania
Ioannis Patiniotakis, National Technical University of Athens, Greece
Iraklis Paraskakis, SEERC, Greece
Andreas Schaad, Huawei Technologies, Germany
Andreas Schoknecht, KIT, Germany
Antonia Schwichtenberg, CAS Software AG, Germany
Simeon Veloudis, SEERC, Greece

The First Workshop on Business Process Monitoring and Performance Analysis in the Cloud (CloudBpm 2016)

Monday December 12th | 14:30pm – 18:00pm

The International Workshop on Business Process Monitoring and Performance Analysis in the Cloud (CloudBpm) 2016 aims to provide researchers and practitioners a forum to exchange information on theories, methods, emerging technologies, tools and practical experiences related to business process monitoring and performance analysis in the context of cloud computing.

Preface

Cloud computing allows the provision of ICT resources to remote users. The illusion of access to a limitless pool of resources, elimination of up-front cost, and fine-grained billing give cloud computing the potential to transform a considerable part of the IT industry, making software attractive as a service and modeling the way IT hardware is purchased. Full lifecycle business process management cloud services are now available. Although Business Process Management (BPM) matured as a scientific field and as an industry practice, this field is not yet fully exploiting the possibilities provided by cloud computing.

Cloud computing provides new opportunities for sharing and configuration of business processes and services. For example:

- business process management knowledge available through monitoring services could be useful to enhance resource prediction of IaaS auto-scalers,
- configurable process models provide support in dealing with variability across organizations and cross-organizational process mining can be used to benefit multi-tenancy environments provided through SaaS and cloud computing.

The opportunities introduce novel challenges for monitoring and analyzing business processes and services executed in the cloud.

The International Workshop of Business Process Monitoring and Performance Analysis in the Cloud (CloudBpm) 2016 was held in conjunction with the 8th IEEE International Conference on Cloud Computing Technology and Science (CloudCom) on December 12, 2016 in Luxembourg. The main goal of the CloudBpm 2016 workshop was to bring together researchers and practitioners to exchange ideas, present and discuss their most recent achievements and lessons learned addressing challenges related to business process monitoring and performance analysis in a cloud environment.

The CloudBpm 2016 keynote of Prof. dr. ir. Wil van der Aalst (Eindhoven University of Technology, The Netherlands) focused on comparative process mining in the cloud. After introducing basic process mining concepts, explaining a particular discovery technique (inductive process mining) and elaborating on collaboration with industry, in this keynote, it was then argued that process mining can be used for learning about the actual usage of cloud services.

CloudBpm 2016 Organizing Committee

Program Chairs

Assist. Prof. Claudia-Melania Chituc, Eindhoven University of Technology, The Netherlands
Assist. Prof. Farideh Heidari, Eindhoven University of Technology, The Netherlands

Technical Program Committee

Adrian Mos, Xerox Research, France
Axel Kupper, Technical University of Berlin, Germany
Barbara Pernici, Politecnico di Milano, Italy
César A.F. de Rose, Pontifical Catholic University of Rio Grande do Sul, Brazil
Christian Janiesch, Universität Würzburg, Germany
Dirk Fahland, Eindhoven University of Technology, The Netherlands
George Feuerlicht, University of Technology Sydney, Australia
Giancarlo Fortino, University of Calabria, Italy
Ilia Petrov, TU Darmstadt, Germany
John Erik Wittern, IBM T.J. Watson Research Center, USA
Marco Comuzzi, Ulsan National Institute of Science and Technology, Republic of Korea
Massimo Macella, Sapienza Universita di Roma, Italy
Rui Jorge de Almeida, Eindhoven University of Technology, The Netherlands
Vincent E. Emeakaroha, The Irish Center for Cloud Computing and Commerce, Ireland
Yuhong Yan, Concordia University, Canada

Technical Program

Monday, December 12th, 2016

Time	Monday, December 12				
08:15 - 09:00	**REGISTRATION** *Conference Lobby*				
09:00 - 10:30	**Workshop** ***CloudSPD'16*** Session I *Room: Wiltz*	**Workshop** ***QAC 2016*** Session I *Room: Fischbach*	**Workshop** ***NetCloud 2016*** Session I *Room: Schengen I*	**2016 China-EU Symp. on Big Data, Green Comp. & Security** - Session I *Room: Europe*	**Tutorial:** Reproducible Research at the Cloud Era I *Room: Diekirch*
10:30 - 11:00	**COFFEE BREAK**				
11:00 - 12:15	**Workshop** ***CloudSPD'16*** Session II *Room: Wiltz*	**Workshop** ***QAC 2016*** Session II *Room: Fischbach*	***Workshop*** ***NetCloud 2016*** Session II *Room: Schengen I*	**2016 China-EU Symp. on Big Data, Green Comp. & Security** - Session II *Room: Europe*	**Tutorial:** Reproducible Research at the Cloud Era II *Room: Diekirch*
12:15 - 13:30	**LUNCH**				
13:30 - 14:30	**Plenary Session:** Grid'5000: a Large-Scale Instrument for Parallel and Distributed Computing Experiments *Room: Europe*				
14:30 - 15:45	**Workshop** ***CloudSPD'16*** Session III *Room: Wiltz*	**Workshop** ***CloudBpm 2016*** Session I *Room: Fischbach*	***2016 Data Teaching Workshop*** Session I *Room: Schengen I*	***Tutorial:*** Practical Grid'5000: Getting Started, Environments creation using Kameleon and Puppet *Room: Europe*	
15:45 - 16:15	**COFFEE BREAK**				
16:15 - 18:00		**Workshop** ***CloudBpm 2016*** Session II *Room: Fischbach*	***2016 Data Teaching Workshop*** Panel discussion *Room: Schengen I*	***Tutorial:*** Practical Grid'5000: IaaS Deployment with OpenStack (Liberty, Mitaka) *Room: Europe*	
18:00 - 19:00	**COCKTAIL RECEPTION / Parc Alvisse**				

Monday, December 12th, 2016 | 9:00am - 10:30am

CloudSPD'16 - Session I

Room: Wiltz

1. Paper CloudSPD_7 ***An empirical analysis of vulnerabilities in virtualization technologies***
   Antonios Gkortzis, Stamatia Rizou and Diomidis Spinellis.
2. Paper CloudSPD_4 ***LocLess: Do you Really Care Where Your Cloud Files Are?***
   Antonis Michalas and Kassaye Yitbarek Yigzaw.
3. Paper CloudSPD_1 ***Data Distribution and Encryption Modelling for PaaS-enabled Cloud Security***
   Yiannis Verginadis, Ioannis Patiniotakis, Gregoris Mentzas, Simeon Veloudis and Iraklis Paraskakis.

QAC 2016 - Session I

Room: Fischbach

1. Paper QAC_1 ***Performance Implications of Resource Allocation during the Live Migration***
   Sogand Shirinbab and Lars Lundberg.
2. Paper QAC_2 ***QoS Assurance with Light Virtualization - A Survey***
   Parisa Heidari, Yves Lemieux and Abdallah Shami.
3. Paper QAC_3 ***Containers or Hypervisors, Which is Better for Database Consolidation?***
   Asraa Abdulrazak Ali Mardan and Kenji Kono.

NetCloud 2016 - Session I

Room: Schengen I

1. Paper NetCloud_5 ***Assuring QoS Guarantees for Heterogeneous Services in RINA Networks with ΔQ***
   Sergio Leon Gaixas, Jordi Perelló, Davide Careglio, Eduard Grasa, Miquel Tarzan-Lorente, Neil J. Davies and Peter Thompson.
2. Paper NetCloud_8 ***Dynamic Routing and Virtual Machine Consolidation in Green Clouds***
   Giovanni Fioccola, Pasquale Donadio, Roberto Canonico and Giorgio Ventre.
3. Paper NetCloud_9 ***Customer-centric Service Provider Architecture for the R&E Community***
   Sonja Filiposka, Anastas Mishev, Frank Wein and Jerry Sobieski.

Monday, December 12th, 2016 | 11:00am - 12:15pm

CloudSPD'16 - Session II

Room: Wiltz

1. Paper CloudSPD_2 ***A Database Adapter for Secure Outsourcing***
   Rafael Dowsley, Matthias Gabel, Kateryna Yurchenko and Valentin Zipf.
2. Paper CloudSPD_3 ***A Distributed Key Management Approach***
   Rafael Dowsley, Matthias Gabel, Gerald Hübsch, Gunther Schiefer and Antonia Schwichtenberg.
3. Paper CloudSPD_5 ***Modelling the Structure of Reusable Solutions for Architecture-based Quality Evaluation***
   Axel Busch, Yves Schneider, Anne Koziolek, Kiana Rostami and Jörg Kienzle.

QAC 2016 - Session II

Room: Fischbach

1. Paper QAC_4 ***Self-Healing Redundancy for OpenStack Applications through Fault-Tolerant Multi-agent Task Scheduling***
   Fereydoun Farrahi Moghaddam, Abdelouahed Gherbi and Yves Lemieux.
2. Paper QAC_5 ***Mitigating the Risk of Cloud Services Downtime Using Live Migration and High Availability-Aware Placement***
   Manar Jammal, Hassan Hawilo and Abdallah Shami.

NetCloud 2016 - Session II

Room: Schengen I

1. Paper NetCloud_10 ***Creating Automated Wide-Area Virtual Networks with GTS – Overview and Future Developments***
   Susanne Naegele-Jackson, Jerry Sobieski, Jakub Gutkowski and Michal Hažlinský.
2. Paper NetCloud_12 ***Adaptive Network Resource Reallocation for Hot-spot Avoidance on SDN-based Cluster System***
   Masaharu Shimizu, Yasuhiro Watashiba, Susumu Date and Shinji Shimojo.
3. Paper NetCloud_13 ***Runtime application performance management for multi-cloud CYCLONE environment***
   Miroslav Zivkovic, Charles Loomis and Yuri Demchenko.

Monday, December 12th, 2016 | 14:30pm - 15:45pm

CloudSPD'16 - Session III
Room: Wiltz

1. Paper CloudSPD_8 ***Using SMT Solving for XACML Policy Evaluation***
   Fatih Turkmen and Yuri Demchenko.
2. Paper CloudSPD_9 ***Privacy-Preserving Outsourcing of Pattern Mining of Event-Log Data - A Use-Case from Process Industry***
   Alessandro Marrella, Anna Monreale, Benjamin Kloepper and Martin W Krueger.
3. Paper CloudSPD_6 ***IoT Protection Through Device to Cloud Synchronization***
   Christian Gehrmann and Mohamed Ahmed Abdelraheem.

CloudBpm 2016 - Session I
Room: Fischbach

- ***Keynote: Comparative Process mining in the cloud***
  Prof. Wil van der Aalst.

Data Teaching - Session I
Room: Schengen I

1. Paper DataTeaching_1 ***EDISON Data Science Framework: A foundation for Building Data Science Profession for European Research and Industry***
   Yuri Demchenko, Adam Belloum, Wouter Los, Tomasz Wiktorski, Steve Brewer, Andrea Ranieri, Holger Brocks, Jana Becker, Dominic Heutelbeck and Matthias Hemmje.
2. Paper DataTeaching_2 ***A Tailored Training Program using Gamification in Data Science***
   Hee Kim, Roberto Zicari and Karsten Tolle.
3. Paper DataTeaching_4 ***Quantitative and Qualitative Analysis of Current Data Science Programs from Perspective of Data Science Competence Groups and Framework***
   Tomasz Wiktorski, Yuri Demchenko, Adam Belloum and Anoosheh Shiraz.

Monday, December 12th, 2016 | 16:15pm - 18:00pm

CloudBpm 2016 - Session II
Room: Fischbach

1. Paper CloudBpm_1 ***Detecting operator errors in cloud maintenance operations***
   Arthur Vetter.
2. Paper CloudBpm_5 ***Process Discovery in the Cloud - A Scalable, Distributed Implementation of the Flexible Heuristics Miner on the Amazon Kinesis Cloud Infrastructure***
   Joerg Evermann, Jana-Rebecca Rehse and Peter Fettke.
3. Paper CloudBpm_6 ***A Framework for BPMS Performance and Cost Evaluation on the Cloud***
   Guillaume Rosinosky, Samir Youcef and François Charoy.

Data Teaching - Session II
Room: Schengen I

- **Panel Discussion**
  Tomasz Wiktorski, Yuri Demchenko and Raymond Hansen

Tuesday, December 13th, 2016

<table>
<tr><th>Time</th><th colspan="3">Tuesday, December 13, 2016</th></tr>
<tr><td>08:15 - 08:45</td><td colspan="3">REGISTRATION - Conference Lobby</td></tr>
<tr><td>08:45 - 09:30</td><td colspan="3">OPENING CEREMONY
Room: Europe
- General Chairs Welcome
- UL/SnT opening
- MESR opening</td></tr>
<tr><td>09:30 - 10:30</td><td colspan="3">Keynote:"The Tactile Internet – IoT, 5G and Cloud on Steroids"
by Prof. Mischa Dohler, King's College London, UK
Room: Europe</td></tr>
<tr><td>10:30 - 11:00</td><td colspan="3">COFFEE BREAK</td></tr>
<tr><td>11:00 - 12:15</td><td>Session 1A
Architecture & Virtualization I
Room: Vianden/Wiltz</td><td>Session 1B
Cloud Services & Applications I
Room: Fishbach</td><td>Session 1C
IoT & Mobile on Cloud

Room: Diekirch/Echternach</td></tr>
<tr><td>12:15 - 13:30</td><td colspan="3">LUNCH</td></tr>
<tr><td>13:30 - 14:30</td><td colspan="3">Keynote:"HPC Meets Cloud: Opportunities and Challenges in Designing High-Performance MPI and Big Data Libraries on Virtualized InfiniBand Clusters"
by Prof. Dhabaleswar K. Panda, Ohio State University, US</td></tr>
<tr><td>14:30 - 15:30</td><td colspan="2">Posters and Demos Session

Conference Lobby</td><td>Session 2C
Short Papers I
Room: Diekirch/Echternach</td></tr>
<tr><td>15:30 - 16:00</td><td colspan="3">COFFEE BREAK & POSTER/DEMO SESSION</td></tr>
<tr><td>16:00 - 17:15</td><td>Session 3A
Architecture & Virtualization II
Room: Vianden/Wiltz</td><td>Session 3B
Cloud Services & Applications II
Room: Fishbach</td><td>Session 3C
Big Data

Room: Diekirch/Echternach</td></tr>
<tr><td>17:15 - 18:00</td><td colspan="3">Bus Transportation</td></tr>
<tr><td>18:00 - 19:00</td><td colspan="3" rowspan="2">PHILHARMONIE
WELCOME RECEPTION
Philharmonie Luxembourg
1, place de l'Europe, L-1499 Luxembourg
T +352 26 02 271</td></tr>
<tr><td>19:00 - 23:00</td></tr>
<tr><td></td><td colspan="3">Bus Transportation</td></tr>
</table>

Tuesday, December 13th, 2016 | 11:00am - 12:15pm

Session 1A: Architecture and Virtualization I

Room: Vianden/Wiltz

1. Paper 188 ***Goodbye to Fixed Bandwidth Reservation: Job Scheduling with Elastic Bandwidth Reservation in Clouds***
   Haiying Shen, Lei Yu, Liuhua Chen and Zhuozhao Li.
2. Paper 96 ***Disaggregated FPGAs: Network Performance Comparison against Bare-Metal Servers, Virtual Machines and Linux Containers***
   Jagath Weerasinghe, Francois Abel, Christoph Hagleitner and Andreas Herkersdorf.
3. Paper 184 ***Failure-Resilient Routing for Server-Centric Data Center Networks with Random Topologies***
   Ye Yu and Chen Qian.

Session 1B: Cloud Services and Applications I

Room: Fishbach

1. Paper 91 ***Service Performance Pattern Analysis and Prediction of Commercially Available Cloud Providers***
   Shyam S. Wagle, Mateusz Guzek and Pascal Bouvry.
2. Paper 100 ***CloudTax: A CloudSim-Extension for Simulating Tax Systems on Cloud Markets***
   Benedikt Pittl, Werner Mach and Erich Schikuta.
3. Paper 60 ***Towards a Cost-Optimized Cloud Application Placement Tool***
   Olivier Belli, Charles Loomis and Nabil Abdennadher.

Session 1C: IoT and Mobile on Cloud

Room: Diekirch/Echternach

1. Paper 22 ***Nested Buddy System: A New Block Address Allocation Scheme for ISPs and IaaS Providers***
   Michael Crouse and H.T. Kung.
2. Paper 163 ***Towards Green Transportation: Fast Vehicle Velocity Optimization for Fuel Efficiency***
   Chenxi Qiu, Haiying Shen, Ankur Sarker, Vivekgautham Soundararaj, Mac Devine and Egan Ford.
3. Paper 15 ***Device-Level IoT with Virtual I/O Device Interconnection***
   Jun Suzuki, Akira Tsuji, Yuki Hayashi, Masaki Kan and Shinya Miyakawa.

Tuesday, December 13th, 2016 | 14:30 - 15:30pm

Posters and Demos Session

Room: Conference Lobby

1. Paper 245 ***A Demo of IoT Healthcare Application Provisioning in Hybrid Cloud/Fog Environment***
   Ons Bibani, Carla Mouradian, Sami Yangui, Roch Glitho, Walid Gaaloul, Nejib Ben Hadj-Alouane, Monique Morrow and Paul Polakos.
2. Paper 233 ***Cloud4IoT: a heterogeneous, distributed and autonomic cloud platform for the IoT***
   Daniele Pizzolli, Giuseppe Cossu, Daniele Santoro, Luca Capra, Charalampos Doukas, Corentin Dupont, Francesco De Pellegrini, Fabio Antonelli and Silvio Cretti.
3. Paper 241 ***TCRM: Telco Cloud Resource Management Using Real-time Data Analysis***
   Wei Zhou.
4. Paper 229 ***SEED: Enabling Serverless and Efficient Encrypted Deduplication for Cloud Storage***
   Youngjoo Shin, Dongyoung Koo, Joobeom Yun and Junbeom Hur.
5. Paper 236 ***NDN-based Pub/Sub System for Scalable IoT Cloud***
   Sungwon Han and Honguk Woo.
6. Paper 246 ***Performance Prediction of Memory Access Intensive Apps with Delay Insertion: A Vision***
   Soramichi Akiyama, Takahiro Hirofuchi and Hirotaka Ogawa.

Session 2C: Short Papers I

Room: Diekirch/Echternach

1. Paper 250 ***Variability management in Infrastructure as a Service***
   Ateeq Khan, Johannes Hintsch, Klaus Turowski and Gunter Saake.
2. Paper 52 ***Deadline-aware Energy Management in Data Centers***
   Cengis Hasan and Zygmunt J. Haas.
3. Paper 240 ***Using Virtual Desktop Infrastructure to Improve Power Efficiency in Grinfy System***
   Abdallah Ali Zainelabden Abdallah Ibrahim, Dzmitry Kliazovich, Pascal Bouvry and Ariel Oleksiak.
4. Paper 247 ***A Pub/Sub-Based Fog Computing Architecture for Internet-of-Vehicles***
   Sejin Chun, Sangjin Shin, Seungmin Seo, Sungkwang Eom, Jooik Jung and Kyong-Ho Lee.

Tuesday, December 13th, 2016 | 16:00 - 17:15pm

Session 3A: Architecture and Virtualization II

Room: Vianden/Wiltz

1. Paper 170 ***Design and Analysis of Deadline and Budget Constrained Autoscaling (DBCA) Algorithm for 5G Mobile Networks***
   Tuan Phung-Duc, Yi Ren, Jyh-Cheng Chen and Zheng-Wei Yu.
2. Paper 157 ***Instance Type Selection in Proactive Horizontal Auto-Scaling***
   Fábio Morais, Raquel Lopes and Francisco Brasileiro.
3. Paper 211 ***Dependency-aware and Resource-efficient Scheduling for Heterogeneous Jobs in Clouds***
   Jinwei Liu and Haiying Shen.

Session 3B: Cloud Services and Applications II

Room: Fishbach

1. Paper 152 ***Algorithms for Optimising Heterogeneous Cloud Virtual Machine Clusters***
   Long Thai, Blesson Varghese and Adam Barker.
2. Paper 171 ***QWatch: Detecting and Locating QoE anomaly for VoD in the Cloud***
   Chen Wang, Hyong Kim and Ricardo Morla.
3. Paper 183 ***Semantic Aware Online Detection of Resource Anomalies on the Cloud***
   Arnamoy Bhattacharyya, Ali Jokar, Stelios Sotiriadis and Cristiana Amza.

Session 3C: Big Data

Room: Diekirch/Echternach

1. Paper 205 ***e-designing CNTK Deep Learning Framework on Modern GPU Enabled Clusters***
   Dip Sankar Banerjee, Khaled Hamidouche and Dhabaleswar Panda.
2. Paper 203 ***Designing Virtualization-aware and Automatic Topology Detection Schemes for Accelerating Hadoop on SR-IOV-enabled Clouds***
   Shashank Gugnani, Xiaoyi Lu and Dhabaleswar Panda.
3. Paper 56 ***Exploring Controlled RDF Distribution***
   Raqueline R. M. Penteado, Rebeca Schroeder and Carmem Hara.

Wednesday, December 14th, 2016

Time	Wednesday, December 14		
08:15 - 08:45	**REGISTRATION**		
08:45 - 09:30	*Conference Lobby*		
09:30 - 10:30	**Plenary Session 3** ***Keynote:***Prof. Lizhe Wang *Room: Europe*		
10:30 - 11:00	**COFFEE BREAK**		
11:00 - 12:15	**Session 4A** Architecture & Virtualization III *Room: Vianden/Wiltz*	**Session 4B** Cloud Services & Applications III *Room: Fishbach*	**Session 4C** HPC in/with the Cloud *Room: Diekirch/Echternach*
12:15 - 13:30	**LUNCH**		
13:30 - 14:30	**Plenary Session 4** ***Plenary Panel:*** *The role of HPC & Cloud Computing in Financial Services and Technologies* *Moderator:*Mazin Yousif, PhD		
14:30 - 15:30	**Keynotes:** CloudCom Sponsors & Satelite events *Room: Europe*		
15:30 - 16:00	**COFFEE BREAK**		
16:00 - 17:15	**Session 5A** Architecture and Virtualization IV *Room: Vianden/Wiltz*	**Session 5B** Cloud Services & Applications IV *Room: Fishbach*	**Session 5C** Distributed Cloud / Edge Computing I *Room: Diekirch/Echternach*
17:15 - 18:00	**Plenary Session 5** ***Keynote:***CloudCom Sponsors		
18:00 - 19:00	*Bus Transportation*		
19:00 - 23:00	**CONFERENCE BANQUET AND CRUISE** **Boat Trip on the Moselle River / NaviTours** Bording @7pm: Quai de la Moselle 5553 Remich http://www.navitours.lu/ T +352 75 84 89 M +352 621 130 054 		
	Bus Transportation		

Wednesday, December 14th, 2016 | 11:00am - 12:15pm

Session 4A: Architecture and Virtualization III

Room: Vianden/Wiltz

1. Paper 46 ***Optimizing Virtual Machine Consolidation in Virtualized Datacenters Using Resource Sensitivity***
   Robayet Nasim, Javid Taheri and Andreas Kassler.
2. Paper 37 ***Location Based Cloud Resource Management for Analyzing Real-Time Video from Globally Distributed Network Cameras***
   Anup Mohan, Ahmed Kaseb, Yung-Hsiang Lu and Thomas Hacker.
3. Paper 34 ***A Configurable Energy Aware Resource Management Technique for Optimization of Performance and Energy Consumption on Clouds***
   Adam Gregory and Shikharesh Majumdar.

Session 4B: Cloud Services and Applications III

Room: Fishbach

1. Paper 101 ***CloudFC: Files Clustering For Storage Space Optimization in Clouds***
   Haythem Yahyaoui and Samir Moalla.
2. Paper 191 ***Generalized Inter-Cloud Structured Data Sharing***
   Malek Athamnah and Krishna Kant.
3. Paper 26 ***Proactive Data Placement for Surveillance Video Processing in Heterogeneous Cluster***
   Haitao Zhang, Bin Xu, Jin Yan, Lujie Liu and Huadong Ma.

Session 4C: HPC in/with the Cloud

Room: Diekirch/Echternach

1. Paper 199 ***Game Theory-Based Nonlinear Bandwidth Pricing for Congestion Control in Cloud Networks***
   Abouzar Ghavami, Zhuozhao Li and Haiying Shen.
2. Paper 190 ***Metaheuristic approaches to multiobjective job scheduling in cloud computing systems***
   Jakub Gasior and Franciszek Seredynski.
3. Paper 86 ***Towards a Cloud Based Decision Support System for Solarmap generation***
   Nabil Abdennadher.

Wednesday, December 14th, 2016 | 16:00 - 17:15pm

Session 5A: Architecture and Virtualization IV

Room: Vianden/Wiltz

1. Paper 12 ***HARENS: Hardware Accelerated Redundancy Elimination in Network Systems***
   Kelu Diao, Ioannis Papapanagiotou and Thomas Hacker.
2. Paper 3 ***A Fresh Perspective on Total Cost of Ownership Models for Flash Storage in Datacenters***
   Zhengyu Yang, Manu Awasthi, Mrinmoy Ghosh and Ningfang Mi.
3. Paper 92 ***Dynamic Block Partitioning Strategy for Cloud-backed File Systems***
   Lung Hsiang Chung and Jerry Chou.

Session 5B: Cloud Services and Applications IV

Room: Fishbach

1. Paper 111 ***Efficiency Analysis of Provisioning Microservices***
   Hamzeh Khazaei, Cornel Barna, Nasim Beigi-Mohammadi and Marin Litoiu.
2. Paper 167 ***Dynamic Deployment of Scientific Workflows in the Cloud using Container Virtualization***
   Rawaa Qasha, Jacek Cala and Paul Watson.
3. Paper 168 ***Defining an Ontological Framework for Modelling Policies in Cloud Environments***
   Simeon Veloudis and Iraklis Paraskakis.

Session 5C: Distributed Cloud / Cloud Brokering / Edge Computing I

Room: Diekirch/Echternach

1. Paper 85 ***A Hybrid Deduplication for Secure and Efficient Data Outsourcing in Fog Computing***
   Dongyoung Koo, Youngjoo Shin, Joobeom Yun and Junbeom Hur.
2. Paper 61 ***Performance Analysis of Object Store Systems in a Fog/Edge Computing Infrastructures***
   Bastien Confais, Adrien Lebre and Benoît Parrein.
3. Paper 89 ***DRASH: A Data Replication-Aware Scheduler in Geo-distributed Data Centers***
   Moise Wendkuuni Convolbo, Jerry Chou and Yeh-Ching Chung.

Thursday, December 15th, 2016

Time	Thursday, December 15		
08:15 - 09:30	**REGISTRATION** *Conference Lobby*		
09:30 - 10:30	**Plenary Session 6** ***Keynote:***Dr. Reinhard Schneider *Room: Europe*		
10:30 - 11:00	**COFFEE BREAK**		
11:00 - 12:15	**Session 6A** Architecture & Virtualization V	**Session 6B** Distributed Cloud / Edge Computing II	**Session 6C** Short Papers II
12:15 - 13:30	**LUNCH & POSTER/DEMO SESSION**		
13:30 - 15:30	**Session 7A** Security and Privacy	**Session 7B** Cloud Services & Applications V	**Session 7C** PhD Consortium
15:30 - 16:30	**CLOSING CEREMONY** *Room: Europe*		

Thursday, December 15th, 2016 | 11:00am - 12:15pm

Session 6A: Architecture and Virtualization V

Room: Vianden/Wiltz

1. Paper 209 ***Impact of HPC Cloud Networking Technologies on Accelerating Hadoop RPC and Hbase***
   Xiaoyi Lu, Dipti Shankar, Shashank Gugnani, Hari Subramoni and Dhabaleswar Panda.
2. Paper 125 ***Seamless and Secure Application Consolidation for Optimizing Instance Deployment in Clouds***
   Kenichi Kourai and Kouta Sannomiya.
3. Paper 11 ***Predictive Model for Dynamically Provisioning Resources in Multi-Tier Web Applications***
   Saurav Nanda, Thomas J Hacker and Yung-Hsiang Lu.

Session 6B: Distributed Cloud / Cloud Brokering / Edge Computing II
Room: Fishbach

1. Paper 133 ***Animation Rendering on Multimedia Fog Computing Platforms***
   Hua-Jun Hong, Jo-Chi Chuang and Cheng-Hsin Hsu.
2. Paper 143 ***SEGUE: Quality of Service Aware Edge Cloud Service Migration***
   Wuyang Zhang, Yi Hu, Yanyong Zhang and Dipankar Raychaudhuri.
3. Paper 118 ***Virtual Machine Planning for Cloud Brokering Considering Geolocation and Data Transfer***
   Javier Alsina, Santiago Iturriaga, Sergio Nesmachnow, Andrei Tchernykh and Bernabe Dorronsoro.

Session 6C: Short Papers II
Room: Diekirch/Echternach

1. Paper 239 ***Supporting Model-based Privacy Analysis by Exploiting Privacy Level Agreements***
   Amir Shayan Ahmadian and Jan Juerjens.
2. Paper 231 ***Towards Transparent Information on Individual Cloud Service Usage***
   Martin Henze, Daniel Kerpen, Jens Hiller, Michael Eggert, David Hellmanns, Erik Mühmer, Oussama Renuli, Henning Maier, Christian Stüble, Roger Häußling and Klaus Wehrle.
3. Paper 249 ***A Bayesian System for Cloud Performance Diagnosis and Prediction***
   Emanuel Palm, Karan Mitra, Saguna Saguna and Christer Ahlund.

Thursday, December 15th, 2016 | 13:30 - 16:00pm

Session 7A: Security and Privacy
Room: Vianden/Wiltz

1. Paper 17 ***Estimating How Confidential Encrypted Searches are using Moving Average Bootstrap Method***
   Fujinoki Hiroshi and Alexander Towell.
2. Paper 160 ***AL-SAFE: A Secure Self-Adaptable Application-Level Firewall for IaaS Clouds***
   Anna Giannakou, Louis Rilling, Jean-Louis Pazat and Christine Morin.
3. Paper 187 ***A dynamic tree-based data structure for access privacy in the cloud***
   Sabrina De Capitani di Vimercati, Sara Foresti, Riccardo Moretti, Stefano Paraboschi, Gerardo Pelosi and Pierangela Samarati.
4. Paper 57 ***An architecture for practical confidentiality-strengthened face authentication embedding homomomorphic cryptography***
   Nabil Bouzerna, Renaud Sirdey, Stan Oana, Nguyen Thanh-Hai and Wolf Philippe.
5. Paper 123 ***On the Insecurity of a Method for Providing Secure and Private Fine-Grained Access to Outsourced Data***
   Alfredo Rial.

Session 7B: Cloud Services and Applications V

Room: Fishbach

1. Paper 193 ***Enabling Green Energy awareness in Interactive Cloud Application***
   Md Sabbir Hasan, Frederico Alvares de Oliveira and Thomas Ledoux.
2. Paper 64 ***Utility-Based Scheduling for Periodic Tasks with Multiple Parallelization Options***
   Dawei Li and Jie Wu.
3. Paper 136 ***Towards Knowledge-Based Assisted IaaS Selection***
   Kyriakos Kritikos, Kostas Magoutis and Dimitris Plexousakis.
4. Paper 129 ***Cloud resource allocation algorithms for elastic media collaboration flows***
   Rafael Xavier, Hendrik Moens, Jurgen Slowack, Wim Sandra, Steven Delputte, Bruno Volckaert and Filip De Turck.

Session 7C: PhD. Consortium

Room: Diekirch/Echternach

1. Paper 252 ***Using contextual data for smart patent analysis***
   Alexander Ivanov and Zeljko Tekic.
2. Paper 251 ***Network Access Control Towards Fully-controlled Cloud Infrastructure***
   Takuya Yamada, Keichi Takahashi, Masaya Muraki, Susumu Date and Shinji Shimojo.
3. Paper 224 ***Assessing Performance of Internet of Things-based Mobile Crowdsensing Systems for Sensing as a Service Applications in Smart Cities***
   Andrea Capponi, Claudio Fiandrino, Christian Franck, Ulrich Sorger, Dzmitry Kliazovich and Pascal Bouvry.
4. Paper 254 ***A hybrid MCDM model for Cloud service selection and relative importance of Component services in Service-oriented Architecture***
   Khubaib Amjad Alam.
5. Paper 238 ***Toward Hyper Interconnected IoT World using SDN Overlay Network for NGN Seamless Mobility***
   Walaa Farouk.
6. Paper 232 ***A Software-Defined Security Strategy for Supporting Autonomic Security Enforcement in Distributed Cloud***
   Maxime Compastié, Rémi Badonnel, Olivier Festor, Ruan He and Mohamed Kassi-Lahlou.
7. Paper 242 ***An Approach for Smart Management of Big Data in the Fog Computing Context***
   Farhoud Hosseinpour, Juha Plosila and Hannu Tenhunen.

Conference Venue Information

CloudCom 2016 will be held in the Parc Alvisse Hotel.

Parc Hotel Alvisse is set in quiet, green surroundings on the edge of Luxembourg. It is only a 5-minute drive from the city center and Luxembourg Airport. Guests can make use of the swimming pools and sauna for free. The modern rooms feature warm colours and luxury bedding. They come with free Wi-Fi, a private bathroom and a TV with cable channels. Guests can enjoy a complimentary breakfast every morning.

From Parc Hotel Alvisse, Luxexpo and the Kirchberg district with its European institutions are easily accessible by car within 10 minutes. The nearby bus stop offers frequent connections into Luxembourg city.

Parc Alvisse's further leisure facilities include tennis, jogging and bowling. The grounds also include a mountain bike circuit, table tennis and more. Restaurant La Veranda features a terrace and offers a menu of traditional Luxembourgian cuisine. The daily buffet breakfast includes both hot and cold dishes.

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