Cloud Computing and Distributed Systems Laboratory and the Cloudbus Project

www.cloudbus.org

Annual Report - 2015

Department of Computing and Information Systems

Melbourne School of Engineering

The University of Melbourne, Australia

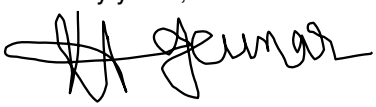
1. Director's Message

I am pleased to report on the key activities and outcomes of **Clou**d Computing and **D**istributed **S**ystems (CLOUDS) Laboratory at the University of Melbourne, Australia during the academic year 2015, which has been another extraordinary year in terms of research quality and international recognition of its members. The Lab has consolidated its position as one of the world-leaders in developing innovative solutions for Cloud Computing. The highlights of research activities and outcomes in 2015 are:

- The Lab successfully hosted four ARC research projects: Future Fellowship programme, Discovery Project, and 2 Industry Linkage Projects.
- Members of the CLOUDS Lab have authored 46 publications, which include 17 journal papers and 21 conference papers.
- The Lab's flagship Cloudbus Project has released various new modules for Aneka and CloudSim. The new CloudSim Toolkit now contains modules for DVFS, web modelling, MapReduce application and Containers modelling. It has been used by several researchers in academia and industries around the world including Ericsson!
- Members have presented over 25 invited talks that include 9 keynotes delivered at international conferences held in Australia, Cyprus, India, Iran, and Malaysia.
- The Lab successfully hosted research activities of over 22 scholars: 16 PhD students, 4 Research Fellows (2 at PostDoc level and 2 Software Engineers).
- "A Scientometric Analysis of Cloud Computing Literature" by German researchers (Leonard Heilig and Stefan Vo) from the University of Hamburg noted our University highly (#1) for cloud computing research impact. A similar investigation *"*International cloud computing literature*:* A scientometric analysis for 2004–13" *noted us as **#1** in Scientometric Profile of Top 20 Authors in Cloud Computing Research*.
- In 2015 alone, our papers have attracted over 7284 citations (ref: Google Scholar) and we hope this trend will continue!
- The Lab housed several (short and long term) international visitors (academic and PhD students) from India, China, Brazil, Estonia, and Spain.
- The Lab attracted funding for projects started in 2016: ARC Discovery Project focused on SDN-based Clouds Management.
- Our Lab's spin-off company, Manjrasoft has been recognised as one of the **Top 20 Cloud Computing companies** by the Silicon Review Magazine.
- Members of the Lab have led community efforts such as (a) the organisation of conferences (e.g., UCC 2015 and BDC 2015 in Cyprus), (b) Editor-In-Chief of IEEE Transactions on Cloud Computing, and (c) Co-Editor-In-Chief of Journal of Software: Practice and Experience, which was established 40+ years ago.

The Lab is always looking for talented, motivated, and dedicated "young" students and researchers to join its team. Please feel free to contact me with your ideas!

Sincerely yours,



Professor Rajkumar Buyya, PhD
Director, Cloud Computing and Distributed Systems (CLOUDS) Laboratory
Department of Computing and Information Systems
The University of Melbourne, Australia
Web: www.cloudbus.org

2. The Team

Director:

- Professor Rajkumar Buyya

Research Staff:

- Dr. Rodrigo N. Calheiros
- Dr. Amir Vahid
- Dr. Adel Toosi
- Ms. Diana Barreto

PhD Students

- Mr. Deepak Poola
- Ms. Atefeh Khosravi
- Mr. Nikolay Grozev
- Ms. Sareh Fotuhi
- Mr. Yaser Mansouri
- Ms. Maria Rodriguez
- Mr. Chenhao Qu
- Ms. Yali Zhao
- Mr. Jungmin Jay Son
- Mr. Farzad Khodadadi
- Mr. Bowen Zhou
- Mr. Safiollah Heidari
- Mr. Xunyun Liu
- Mr. Caesar Wu
- Mr. Minxian Xu
- Ms. Sara Kardani Moghaddam

Collaborators

- Colleagues holding research grants with the Director
- International Visitors
- Many collaborators involved in extending and using the Cloudbus software.

3. Competitive Grants Funded Projects and Programs - Active

Australian Research Council (ARC)

- R. Buyya, Dynamic resource provisioning for autonomic management of cloud computing environments, Future Fellowship, ARC, 2012-2016. Amount: $786,168.
- R. Buyya, A. Lachlan, and A. Wierman, Resource management algorithms and software systems for green cloud computing, Discovery Project, ARC, 2013-2015. Amount: $315,000.
- R. Kotagiri, R. Buyya, C. Leckie, and S. Versteeg, Business goals and analytics driven management of cloud computing based information technology infrastructure, Linkage Project, ARC, 2013-2016. Amount: $280,000.
- R. Buyya, Algorithms and Software Systems for Management of Software-Defined Clouds, Discovery Project, Australian Research Council (ARC), 2016-2020. Amount: $410,000.

Other National Grants

- R. Ranjan, R. Buyya, R. Shyamasundar, A. Zaslavsky, S. Nepal, R. Calheiros, S. Chen, R. Ghosh, A. Haller, and O. Dabeer, “Innovative Solutions for Deployment of BigData and Disaster Management Applications on Clouds”, Australia-India Strategic Research Fund (AISRF Round 7), Australian Department of Industry, 2013-2016. Amount: $400,000.
- Indian partners received direct funding from Dept. of Science and Technology (DST), Govt. Of India. Amount: INR 10,200,000.

Industry and Melbourne University Grants

- R. Buyya, Z. Xiao, Y. Cui, Y. Wu, J. Cao, U. Bellur, R. K. Shyamasundar, R. K. Pisipati, B. Sinha, S. K. Nandy, J. Lakshmi, and T. V. Prabhakar, “Melbourne-Chindia Cloud Computing (MC3) Research Network”, International Research and Research Training Fund (IRRTF), The University of Melbourne, 2013-2016. Amount: $150,000.
- R. Buyya and R. Calheiros, “A Platform for Green Cloud Computing”, Global Research Outreach (GRO) Program, Samsung, South Korea, 2014-2015. Amount: $100,000.
- R. Buyya and A. Vahid, "Data Science for Enabling Prediction and Classification of Pedestrians Flows in Melbourne City", Academic Research Grant-Equipment Access, Microsoft, Seattle, USA, 2015-2016. Amount Equivalent: Approx. US$20,000.

4. Publications

- The Lab publication record since its inception in 2002 highlighted in the Table below:

Year / Publication Type	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Books/Proceedings Edited	1	1	1	1	5	4	3	5	2	3	2	2	1	2
Journal Papers	6	1	4	5	6	4	10	13	8	9	15	17	17	17
Book Chapters	1	0	0	4	4	2	4	11	3	13	3	1	2	3
Conference Papers	4	7	9	16	15	24	22	27	15	14	12	6	14	21
Magazine/Other Articles	0	0	1	2	4	2	0	1	2	1	0	5	2	3
Total	12	9	15	28	34	36	39	57	30	40	32	31	36	46

Books/Proceedings Edited

1. Caesar Wu and Rajkumar Buyya, Cloud Data Centers and Cost Modeling, ISBN-13: 9780128014134, Morgan Kaufmann, USA, March 2015.
2. K.R. Venugopal, Rajkumar Buyya, and L.M. Patnaik, Proceedings of the 11th International Conference on Communication Networks (ICCN 2015, August 21-23, 2015, Bangalore, India), Procedia Computer Science, Volume 54, Elsevier Press, Amsterdam, The Netherlands, 2015.

Book Chapters

3. Rodrigo N. Calheiros, Henry Kasim, Terence Hung, Xiaorong Li, Sifei Lu, Long Wang, Henry Palit, Gary Lee, Tuan Ngo, and Rajkumar Buyya, Adaptive Execution of Scientific Workflow Applications on Clouds, "Cloud Computing with E-Science Applications", O. Terzo and L. Mossucca (eds), ISBN 9781466591158, CRC Press, Boca Raton, FL, USA, Jan 2015.
4. Md Hasanul Ferdaus, Manzur Murshed, Rodrigo N. Calheiros, an Rajkumar Buyya, Network-Aware Virtual Machine Placement and Migration in Cloud Data Centers, Emerging Research in Cloud Distributed Computing Systems, 42-91pp, S. Bagchi (ed), ISBN13: 9781466682139, IGI Global, Hershey, PA, USA, March 2015.
5. Sena Seneviratne, David C. Levy, and Rajkumar Buyya, A Taxonomy of Performance Prediction Systems for Parallel and Distributed Computing Systems, Grid Computing: Techniques and Future Prospects, J. Barbosa and I. Dutra (eds), ISBN: 978-1-63117-704-0, Nova Science Press, USA, 2015.

Journal Editorials

6. Rajiv Ranjan, Rajkumar Buyya, Surya Nepal, and Dimitrios Georgakopoulos, A Note on Resource Orchestration for Cloud Computing, Concurrency and Computation: Practice and Experience, Volume 27, No. 9, Pages: 2370-2372, Wiley Press, New York, USA, June 2015.
7. Rajkumar Buyya, A status report on IEEE Transactions on Cloud Computing, IEEE Transactions on Cloud Computing (TCC), Volume 3, No. 2, Pages: 100-100, IEEE CS Press, USA, April-June 2015.

8. Jie Tao, Joanna Kolodziej, Rajiv Ranjan, Prem Prakash Jayaraman, Rajkumar Buyya, A Note on New Trends in Data-aware Scheduling and Resource Provisioning in Modern HPC Systems, Future Generation Computer Systems, Volume 51, Pages: 45-46, ISSN: 0167-739X, Elsevier Press, Amsterdam, The Netherlands, Oct 2015.

Journal Papers

9. Nikolay Grozev and Rajkumar Buyya, Performance Modelling and Simulation of Three-Tier Applications in Cloud and Multi-Cloud Environments, The Computer Journal, Volume 58, Number 1, Pages: 1-22, ISSN 0010-4620, Oxford University Press, UK, January 2015.
10. Ejaz Ahmed, Adnan Akhunzada, Md Whaiduzzaman, Abdullah Gani, Siti Hamid, and Rajkumar Buyya, Network-centric Performance Analysis of Runtime Application Migration in Mobile Cloud Computing, Simulation Modelling Practice and Theory, Volume 50, Pages: 42-56, Elsevier Press, Amsterdam, The Netherlands, January 2015.
11. Amir Vahid Dastjerdi, Saurabh Kumar Garg, Omer F. Rana, and Rajkumar Buyya, CloudPick: A Framework for QoS-aware and Ontology-based Service Deployment Across Clouds, Software: Practice and Experience, Volume 45, Number 2, Pages: 197-231, ISSN: 0038-0644, Wiley Press, New York, USA, February 2015.
12. Anton Beloglazov, Dipyaman Banerjee, Alan Hartman, and Rajkumar Buyya, Improving Productivity in Design and Development of Information Technology (IT) Service Delivery Simulation Models, Journal of Service Research (JSR), Volume 18, Number 1, Pages: 75-89, ISSN: 1094-6705, SAGE Publications, Thousand Oaks, CA, USA, February 2015.
13. Jieyao Liu, Ejaz Ahmed, Muhammad Shiraz, Abdullah Gani, Rajkumar Buyya, and Ahsan Qureshi, Application Partitioning Algorithms in Mobile Cloud Computing: Taxonomy, Review and Future Directions, Journal of Network and Computer Applications (JNCA), Volume 48, Number 2, Pages: 99-117, ISSN: 1084-8045, Elsevier, Amsterdam, The Netherlands, February 2015.
14. Huber Flores, Pan Hui, Sasu Tarkoma, Yong Li, Satish Srirama, and Rajkumar Buyya, Mobile Code Offloading: From Concept to Practice and Beyond, IEEE Communications Magazine, Volume 53, Number 3, Pages: 80-88, ISSN: 0163-6804, IEEE Press, USA, March 2015.
15. Anton Beloglazov and Rajkumar Buyya, OpenStack Neat: A Framework for Dynamic and Energy-Efficient Consolidation of Virtual Machines in OpenStack Clouds, Concurrency and Computation: Practice and Experience (CCPE), Volume 27, No. 5, Pages: 1310-1333, ISSN: 1532-0626, Wiley Press, New York, USA, April 2015.
16. Marcos Assuncao, Rodrigo Calheiros, Silvia Bianchi, Marco Netto, and Rajkumar Buyya, Big Data Computing and Clouds: Trends and Future Directions, Journal of Parallel and Distributed Computing (JPDC), Volume 79, Number 5, Pages: 3-15, ISSN: 0743-7315, Elsevier Press, Amsterdam, The Netherlands, May 2015.
17. Ejaz Ahmed, Abdullah Gani, Muhammad Khurram Khan, Rajkumar Buyya, and Samee U. Khan, Seamless Application Execution in Mobile Cloud Computing: Motivation, Taxonomy, and Open Challenges, Journal of Network and Computer Applications, Volume 52, Pages: 154-172, ISSN: 1084-8045, Elsevier, Amsterdam, The Netherlands, June 2015.
18. Mehdi Sookhak, Abdullah Gani, Hamid Talebian, Adnan Akhunzada, Samee U. Khan, Rajkumar Buyya, and Albert Y. Zomaya, Remote Data Auditing in Cloud Computing Environments: A Survey, Taxonomy, and Open Issues, ACM Computing Surveys, Volume 47, No. 4, Article No. 65, ISSN 0360-0300, ACM Press, New York, USA, July 2015.
19. Adel Nadjaran Toosi, Kurt Vanmechelen, Kotagiri Ramamohanarao, and Rajkumar Buyya, Revenue Maximization with Optimal Capacity Control in Infrastructure as a Service Cloud Markets, IEEE Transactions on Cloud Computing (TCC), Volume 3, Number 3, Pages: 261-274, ISSN: 2168-7161, IEEE Computer Society Press, USA, July-Sept. 2015.

20. Bhanu Sharma, Ruppa Thulasiram, Parimala Thulasiraman, and Rajkumar Buyya, Clabacus: A Risk-Adjusted Cloud Resources Pricing Model using Financial Option Theory, IEEE Transactions on Cloud Computing (TCC), Volume 3, Number 3, Pages: 332-344, ISSN: 2168-7161, IEEE Computer Society Press, USA, July-Sept. 2015.
21. Deborah Magalhaes, Rodrigo N. Calheiros, Rajkumar Buyya, and Danielo G. Gomes, Workload Modeling for Resource Usage Analysis and Simulation in Cloud Computing, Computers and Electrical Engineering: An International Journal, Volume 47, Pages: 69-81, ISSN: 0045-7906, Elsevier Science, Amsterdam, The Netherlands, October 2015.
22. Toktam Ghafariana, Bahman Javadi, and Rajkumar Buyya, Decentralised Workflow Scheduling in Volunteer Computing Systems, International Journal of Parallel, Emergent and Distributed Systems (IJPEDS), Volume 30, Number 5, Pages: 343-365, ISSN: 1744-5760, Taylor & Francis Publication, UK, October 2015.
23. Amir Vahid Dastjerdi and Rajkumar Buyya, An Autonomous Time-Dependent SLA Negotiation Strategy for Cloud Computing, The Computer Journal, Volume 58, No. 11, Pages: 3202-3216, ISSN 0010-4620, Oxford University Press, UK, November 2015.
24. Mehran Garmehi, Morteza Analoui, Mukaddim Pathan and Rajkumar Buyya, An Economic Mechanism for Request Routing and Resource Allocation in Hybrid CDN-P2P Networks, International Journal of Network Management, Volume 25, No. 6, Pages: 375-393, ISSN: 1099-1190, Wiley Press, New York, USA, November/December 2015.
25. Rodrigo N. Calheiros, Enayat Masoumi, Rajiv Ranjan, and Rajkumar Buyya, Workload Prediction Using ARIMA Model and its Impact on Cloud Applications QoS, IEEE Transactions on Cloud Computing, Volume 3, Number 4, Pages: 449-458, ISSN: 2168-7161, IEEE Computer Society Press, USA, Oct.-Dec. 2015.

Conference Papers

26. Farzad Khodadadi, Rodrigo N. Calheiros, and Rajkumar Buyya, A Data-Centric Framework for Development and Deployment of Internet of Things Applications in Clouds, Proceedings of the 10th IEEE International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP 2015), Singapore, April 7-9, 2015.
27. Farzad Khodadadi, Amir Vahid Dastjerdi, and Rajkumar Buyya, Simurgh: A Framework for Effective Discovery, Programming, and Integration of Services Exposed in IoT, Proceedings of the 2015 First International Conference on Recent Advances in Internet of Things (RIoT 2015), Singapore, April 7-9, 2015.
28. Fabio Rossi, Israel de Oliveira, Cesar De Rose, Rodrigo Calheiros, and Rajkumar Buyya, Non-Invasive Estimation of Cloud Applications Performance via Hypervisor's Operating Systems Counters, Proceedings of the 14th International Conference on Networks (ICN 2015), Barcelona, Spain, April 19-24, 2015.
29. Jungmin Son, Amir Vahid Dastjerdi, Rodrigo N. Calheiros, Xiaohui Ji, Young Yoon, and Rajkumar Buyya, CloudSimSDN: Modeling and Simulation of Software-Defined Cloud Data Centers, Proceedings of the 15th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing (CCGrid 2015), Shenzhen, China, May 4-7, 2015.
30. Chenhao Qu, Rodrigo N. Calheiros, and Rajkumar Buyya, SLO-aware Deployment of Web Applications Requiring Strong Consistency using Multiple Clouds, Proceedings of the 8th IEEE International Conference on Cloud Computing (Cloud 2015, IEEE CS Press, USA), New York, USA, June 27 - July 2, 2015.
31. Bowen Zhou, Amir Vahid Dastjerdi, Rodrigo N. Calheiros, Satish Narayana Srirama, and Rajkumar Buyya, A Context Sensitive Offloading Scheme for Mobile Cloud Computing Service, Proceedings of the 8th IEEE International Conference on Cloud Computing (Cloud 2015, IEEE CS Press, USA), New York, USA, June 27 - July 2, 2015.
32. Jing Liu, Jiantao Zhou, and Rajkumar Buyya, Software Rejuvenation Based Fault Tolerance Scheme for Cloud Applications, Proceedings of the 8th IEEE International Conference on Cloud Computing (Cloud 2015, IEEE CS Press, USA), New York, USA, June 27 - July 2, 2015.

33. Sareh Fotuhi Piraghaj, Amir Vahid Dastjerdi, Rodrigo N. Calheiros, and Rajkumar Buyya, Efficient Virtual Machine Sizing For Hosting Containers as a Service, Proceedings of the 11th World Congress on Services (Services 2015, IEEE CS Press, USA), New York, USA, June 27 - July 2, 2015.
34. Raghavendra S, Geeta C M, Shaila K, Rajkumar Buyya, Venugopal K R, S S Iyengar, L M Patnaik, MSSS: Most Significant Single-keyword Search over Encrypted Cloud Data, Proceeding of the 6th Annual International Conference on ICT: Big Data, Cloud and Security (ICT BDCS 2015), DOI: 10.5176/2382-5669_ICT-BDCS15.22, Singapore, July 27-28, 2015.
35. Yali Zhao, Rodrigo Calheiros, Graeme Gange, Kotagiri Ramamohanarao, and Rajkumar Buyya, SLA-Based Resource Scheduling for Big Data Analytics as a Service in Cloud Computing Environments, Proceedings of the 44th International Conference on Parallel Processing (ICPP 2015, IEEE CS Press, USA), Beijing, China, September 1-4, 2015.
36. Maria A. Rodriguez and Rajkumar Buyya, A Responsive Knapsack-based Algorithm for Resource Provisioning and Scheduling of Scientific Workflows in Clouds, Proceedings of the 44th International Conference on Parallel Processing (ICPP 2015, IEEE CS Press, USA), Beijing, China, September 1-4, 2015.
37. Nitisha Jain, J. Lakshmi, Rajkumar Buyya and Nikolay Grozev, PriDynSim: A Simulator for Dynamic Priority Based I/O Scheduling for Cloud Applications, Proceedings of the 4th International Conference on Cloud Computing for Emerging Markets (CCEM 2015, IEEE Press, USA), Bangalore, India, November 25-27, 2015.
38. Raghavendra Kune, Pramod Kumar Konugurthi, Arun Agarwal, Raghavendra Rao Chillaregi and Rajkumar Buyya, XHAMI - Extended HDFS and MapReduce Interface for Image Processing Applications, Proceedings of the 4th International Conference on Cloud Computing for Emerging Markets (CCEM 2015, IEEE Press, USA), Bangalore, India, November 25-27, 2015.
39. Adel Nadjaran Toosi and Rajkumar Buyya, A Fuzzy Logic-based Controller for Cost and Energy Efficient Load Balancing in Geo-Distributed Data Centers, Proceedings of the 8th IEEE/ACM International Conferencce on Utility and Cloud Computing (UCC 2015, IEEE CS Press, USA), Limassol, Cyprus, Dec. 7-10, 2015.
40. Sareh Fotuhi Piraghaj, Amir Vahid Dastjerdi, Rodrigo N.Calheiros, and Rajkumar Buyya, A Framework and Algorithm for Energy Efficient Container Consolidation in Cloud Data Centers, Proceedings of the 11th IEEE International Conference on Green Computing and Communications (GreenCom 2015, IEEE CS Press, USA), Sydney, Australia, Dec. 11-13, 2015.
41. Amir Vahid Dastjerdi, Mahdi Sharifi, and Rajkumar Buyya, On Application of Ontology and Consensus Theory to Human-Centric IoT: an Emergency Management Case Study, Proceedings of the 8th IEEE International Conference on Internet of Things (iThings 2015, IEEE CS Press, USA), Sydney, Australia, Dec. 11-13, 2015.
42. Linlin Wu, Saurabh Kumar Garg and Rajkumar Buyya, Service Level Agreement (SLA) based SaaS Cloud Management System, Proceedings of the 21st IEEE International Conference on Parallel and Distributed Systems (ICPADS 2015, IEEE CS Press, USA), Melbourne, Australia, December 14-17, 2015.
43. Rajkumar Buyya, Kotagiri Ramamohanarao, Chris Leckie, Rodrigo N. Calheiros, Amir Vahid Dastjerdi, and Steve Versteeg, Big Data Analytics-Enhanced Cloud Computing: Challenges, Architectural Elements, and Future Directions, Proceedings of the 21st IEEE International Conference on Parallel and Distributed Systems (ICPADS 2015, IEEE CS Press, USA), Melbourne, Australia, December 14-17, 2015. - Invited Paper.
44. Rajkumar Buyya and Diana Barreto, Multi-Cloud Resource Provisioning with Aneka: A Unified and Integrated Utilisation of Microsoft Azure and Amazon EC2 Instances, Proceedings of the 2015 International Conference on Computing and Network Communications (CoCoNet 2015, IEEE Press, USA), Trivandrum, India, December 16-19, 2015. - Invited Paper.
45. Raghavendra S; Girish S, Geeta C M, Rajkumar Buyya, Venugopal K R, S S Iyengar, and L M Patnaik, IGSK: Index Generation on Split Keyword for Search over Cloud Data, Proceedings of the 2015 International Conference on Computing and Network

Communications (CoCoNet 2015, IEEE Press, USA), Trivandrum, India, December 16-19, 2015.
46. Raghavendra S, Geeta C M, Rajkumar Buyya, Venugopal K R, S S Iyengar, and L M Patnaik, MSIGT: Most Significant Index Generation Technique for Cloud Environment, Proceedings of the 2015 Annual IEEE India Conference (INDICON 2015), Delhi, India, Dec. 17-20, 2015.

5. Invited Presentations and Outreach

By the Lab Director:

Keynote Talks at International Conferences

1. Market-Oriented Cloud Computing and Big Data Applications, 2nd International Conference on INformation systems Design and Intelligent Applications (INDIA 2015), Jan 8-9, 2015, Kalyani, West Bengal, India.
2. Market-Oriented Cloud Computing and Big Data Applications, 4th International Conference on Software Engineering & Computer Systems, August 19-21, 2015, Kuantan, Pahang, Malaysia.
3. Cost-Efficient Deployment of Big Data Science Applications on Computing Clouds,15th International Conference on Accelerator and Large Experimental Physics Control Systems (ICALEPCS 2015), Oct 17-23, 2015, Melbourne, Australia.
4. New Innovations in Cloud Computing for Big Data Applications, 4th International Workshop on Clouds and (eScience) Applications Management (CloudAM 2015), 6th IEEE/ACM International Conference on Utility and Cloud Computing, December 7-10, 2015, Limassol, Cyprus.
5. New Innovations in Cloud Computing for Big Data Applications, International Conference on Power, Control, Communication and Computational Technologies for Sustainable Growth (PCCCTSG), Dec. 1112, 2015, Kurnool, India.
6. New Innovations in Cloud Computing for Big Data Applications, International Symposium Computational Science, Dec. 1315, 2015, Puttaparthi, India.
7. New Innovations in Cloud Computing for Big Data Applications, International Conference on Emerging Research in Electronics, Computer science and Technology (ICERECT-2015), Dec. 1719, 2015, Mandya, India.
8. Content Distribution Networks: Trends, Architectures, and Strategies, Conference on Strategies for Development of Content Distribution Networks, Ministry of ICT, Tehran, Iran, Dec. 27, 2015.
9. New Innovations in Cloud Computing for Big Data Applications, Conference on Strategies for Development of Content Distribution Networks, Ministry of ICT, Tehran, Iran, Dec. 28, 2015.

National Conferences

1. New Innovations in Cloud Computing for Big Data Applications, TEQIP-II Workshop on Cloud and Nano Computing, Andhra University, Visakhapatnam, India, Dec. 18, 2015.
2. New Innovations in Cloud Computing for Big Data Applications, National Workshop on Cloud Computing, Karnataka College, Bidar, India, Dec. 19, 2015.
3. New Innovations in Cloud Computing for Big Data Applications, TEQIP-II Workshop on Cloud and Nano Computing, JNTU, Hyderabad, India, Dec. 21, 2015.
4. Innovative Solutions for Deployment of Big Data Applications on Computing Clouds, International Research Workshop on Cloud Computing, Jawaharlal Nehru University (JNU), Delhi, India, Dec. 22-23, 2015.

Seminars - in Cloud Computing area:

1. Recent Innovations in Cloud Computing, Huawei, Shenzhen, China, May 7, 2015.
2. Market-Oriented Cloud Computing and Big Data Applications, Beijing University of Posts and Telecommunications (BUPT), Beijing, China, May 8, 2015.
3. Market-Oriented Cloud Computing and Big Data Applications, Huazhong University of Science and Technology (HUST), Wuhan, China, May 13, 2015.
4. Market-Oriented Cloud Computing and Big Data Applications, Wuhan University, Wuhan, China, May 14, 2015.

5. Market-Oriented Cloud Computing and Big Data Applications, National University of Defense Technology (NUDT), Changsha, China, May 15, 2015.
6. Market-Oriented Cloud Computing and Big Data Applications, Hunan University, Changsha, China, May 18, 2015.
7. Market-Oriented Cloud Computing and Big Data Applications, National Cheng Kung University (NCKU), Tainan, Taiwan, May 20, 2015.
8. Market-Oriented Cloud Computing and Big Data Applications, Khalifa University, Abu Dhabi, UAE, June 9, 2015.
9. Market-Oriented Cloud Computing and Big Data Applications, Zayed University, Abu Dhabi, UAE, June 11, 2015.
10. Market-Oriented Cloud Computing and Big Data Applications, University of Malaya, Kuala Lumpur, Malaysia, Aug. 12, 2015.
11. New Innovations in Cloud Computing for Big Data Applications, University of Cyprus, Nicosia, Cyprus, Dec. 4, 2015.
12. New Innovations in Cloud Computing for Big Data Applications, GLA University, Mathura, India, Dec. 23, 2015, India.

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6. Selected Community Services

By the Lab Director:

IEEE Computer Society

1. Advisory Board, IEEE Technical Committee on Scalable Computing
2. Coordinator (Australia and New Zealand), Technical Committee on Parallel Processing (TCPP)
3. Editor-in-Chief, IEEE Transactions on Cloud Computing (TCC), IEEE Press, USA, Dec. 2012-March 2015.

Software: Practice and Experience (Wiley)

1. Editor in Chief (EiC), 2014-to date.

Journal Editorials

1. Editorial Board Member, *International Journal of Parallel, Emergent and Distributed Systems* (IJPEDS), ISSN: 1744-5760, Taylor & Francis Group, UK.
2. Editorial Board Member, *Multiagent and Grid Systems: An International Journal*, ISSN: 1574-1702, IOS Press, Amsterdam, The Netherlands, 2005 onwards.
3. Associate Editor, *IEEE Internet of Things Journal*, IEEE, USA, 2013-2015.
4. Editorial Board Member, *International Journal of Parallel, Emergent and Distributed Systems (IJPEDS)*, ISSN: 1744-5760, Taylor & Francis Group, UK, 2006-2013. IJPEDS), ISSN: 1744-5760, Taylor & Francis Group, UK, 2013-to date.
5. Editorial Board Member, *International Journal of Autonomous and Adaptive Communications Systems*, ISSN: 1754-8632, Inderscience Publishers, Geneva, Switzerland, 2007-to date.

Conference Steering Committee

1. Founder and Chair, IEEE/ACM International Symposium on Cluster, Cloud, and Grid Computing (CCGrid), 2001-to date.
2. Advisory Committee Member, International Conference on e-Science (e-Science), 2011-to date.
3. Advisory Committee Member, IEEE International Conference on Cluster Computing (ClusterXY), 2011-to date.
4. Member, International Symposium on Computer Architecture and High Performance Computing, Brazil, 2005-to date.
5. Founder and Chair, IEEE/ACM International Conference on Utility and Cloud Computing (UCC) series, 2009-to date.

Technical Program Committee Memberships

1. 21st IEEE International Conference on Parallel and Distributed Systems (ICPADS 2015), December 14-17, 2015, Melbourne, Australia.
2. 11th IEEE International Conference on eScience (eScience 2015), Aug 31-Sept 04, 2015, Munich, Germany.
3. 11th International Conference on Distributed Computing and Internet Technologies (ICDCIT 2015), February 05-08, 2015, Bhubaneshwar, India.

Community Information Sources

- Maintained a Grid Computing Information Centre at: http://www.gridcomputing.com, whose newsletter mailing list has over 2500 members. This website is often ranked amongst top #4 sources for grid computing by Google search engine.
- Maintained a Cluster Computing Information Centre at: http://www.buyya.com/cluster

By Other Members:

Technical Program Committee Memberships

1. Rodrigo N. Calheiros, 30th Symposium On Applied Computing (ACM SAC 2015) – Operating Systems Track, April 13-17, Salamanca, Spain.
2. Rodrigo N. Calheiros, 8th ACM/IEEE International Conference on Utility and Cloud Computing (UCC 2015), December 7-10, Limassol, Cyprus.
3. Rodrigo N. Calheiros, 21st IEEE International Conference on Parallel and Distributed Systems (ICPADS 2015), December 14-17, Melbourne, Australia.

7. International Visitors

1. Patricia Arroba Garcia, Universidad Politecnica de Madrid, Spain: Oct 2014-Jan 2015.
2. Tian Wenhong, University of Electronic Science and Technology of China, Chengdu, China: July 2014-June 2015.
3. A/Prof. Jing Liu, Inner Mongolia University, China: Sep. 2014-Sep. 2015.
4. Mr. Hongyou Li, Sichuan University, China: Sep. 2014-Sep. 2015.
5. Fábio Diniz Rossi, Pontifical Catholic University of Rio Grande do Sul, Brazil: Nov. 2014-Aug. 2015.
6. Satish Narayana Srirama, University of Tartu, Estonia: Jan 2015.
7. Nitisha Jain, Indian Institute of Science, Bangalore, India: March-May 2015.
8. Harshit Gupta, Indian Institute of Technology Kharagpur, India: May-July 2015.

8. Continuing Members Profile and Activities

Member Self Profile: Rodrigo N. Calheiros

I joined the CLOUDS Lab as a Research Fellow in June 2010, after being a research visitor between 2008 and 2009.

In 2015, as a Research Fellow for an ARC Linkage Project with CA Technologies as industrial partner, I'm working on business goals and analytics driven management of cloud computing. I worked with anomaly detection in cloud data centres, specifically on anomalies in low-level resource consumption by servers and virtual machines. Also aligned with this project, I worked with application workload prediction.

I am also co-CI in a grant from the Department of Industry about Big Data for disaster management. This project involves partners from CSIRO, University of Melbourne and institutions from India.

I am also working, along with PhD students, in problems in the areas of energy-efficient cloud computing, mobile computing, container virtualization, and Big Data.

Other activities I was involved in 2015 were program committee memberships, and supervision of PhD students.

Member Self Profile: Amir Vahid Dastjerdi

I am currently a research fellow at CloudsLab in the University of Melbourne and my research interests include SLA-aware resource management in SDN-based Cloud environments, service coordination for IoT, and Big data analytics. Please refer to the following publications for more information.

Journal Articles

1. *An Autonomous Time-Dependent SLA Negotiation Strategy for Cloud Computing. The Computer Journal. 58.*
2. *CloudPick: a framework for QoS-aware and ontology-based service deployment across clouds. Software-Practice and Experience. 45.*

Conference Papers

1. *A Context Sensitive Offloading Scheme for Mobile Cloud Computing Service.*
2. *A Framework and Algorithm for Energy Efficient Container Consolidation in Cloud Data Centers.*
3. *Big Data Analytics-Enhanced Cloud Computing: Challenges, Architectural Elements, and Future Directions.*
4. *CloudSimSDN: Modeling and simulation of software-defined cloud data centers.*
5. *Efficient Virtual Machine Sizing for Hosting Containers as a Service.*
6. *Simurgh: A framework for effective discovery, programming, and integration of services exposed in IoT.*

Member Self Profile: Adel NadjaranToosi

In August 2015, I attended my graduation ceremony at the University of Melbourne, where my PhD degree was awarded and I can officially use the title "Dr".
I have been working as a research assistant and sessional lecturer at the University of Melbourne in 2015. From early 2016, I will become a full-time research fellow and continue my research with CLOUDs lab team.
My current research interests include *energy efficiency* and *green computing* on cloud environments in particular I work on geographical load balancing for sustainable data centers.
Last year, I have published several articles and conference papers and also attended 8th IEEE/ACM International Conference on Utility and Cloud Computing (*UCC 2015*) where I could present my latest paper and met *Ian Foster* and many other brilliant researchers in the field.
Below you can find list of published and submitted papers in 2015:

1. **Adel Nadjaran Toosi**, Farzad Khodadadi and Rajkumar Buyya, "SipaaS: Spot instance pricing as a Service framework and its implementation in OpenStack". Concurrency and Computation: Practice and Experience, 10.1002/cpe.3749, Dec. 2015.
2. **Adel NadjaranToosi**, Kurt Vanmechelen and RajkumarBuyya "An Auction Mechanism for Cloud Spot Markets", ACM transactions on Adaptive and Autonomous Systems, volume. 11, Issue 1, Oct., 2015.
3. **Adel Nadjaran Toosi** and Rajkumar Buyya, "A Fuzzy Logic-based Controller for Cost and Energy Efficient Load Balancing in Geo-Distributed Data Centers", Proceedings of the 8th IEEE/ACM International Conferencce on Utility and Cloud Computing (UCC 2015, IEEE CS Press, USA), Limassol, Cyprus, Dec. 7-10, 2015.
4. **Adel Nadjaran Toosi**, Kurt Vanmechelen, Kotagiri Ramamohanarao, and Rajkumar Buyya, Revenue Maximization with Optimal Capacity Control in Infrastructure as a Service Cloud Markets, IEEE Transactions on Cloud Computing (TCC), Volume 3, Number 3, Pages: 261-274, ISSN: 2168-7161, IEEE Computer Society Press, USA, July-Sept. 2015.

My PhD thesis, full list of publications, and other information are available on my web-page: http://adelnadjarantoosi.info/

Member Self Profile: Deepak C Poola

I joined Cloudbus lab in July 2011 as a PhD Student under the supervision of Prof Rajkumar Buyya and Prof Rao Kotagiri. My chosen area of research is "*Robust and Fault-Tolerant Scheduling for Scientific Workflows in Cloud Computing Environments*". My area of interests includes Cloud Computing, Workflows, Scheduling Algorithms, Streaming Applications and Data Warehousing. I completed my PhD in 2015.

As a part of my research, I investigated into scientific workflow scheduling focusing on robust and fault-tolerant schedules. My research was primarily focussed on Cloud computing environments. I investigated workflow scheduling with heterogeneous Cloud resources also working considering different Cloud pricing models (i.e spot and on-demand).

Prior to Joining Cloudbus Lab, I was working as an Application Developer in J P Morgan Chase, India. I have worked in Java, Spring, Struts, UNIX and web services as a part of my job profile. I have been in J P Morgan for two years from 2009 to 2011.

I have also worked as an Intern in Citrix R&D, Bangalore from Jan 2009 to Jun 2009. During which I worked on the implementation to WBXML parser for their home product Net scalar. Citrix gave me exposure and knowledge of working in a networking company.

I am a proud Alumina of BITS-Pilani, India. I have completed my M.E Computer Science from BITS-Pilani. Prior to which I completed my graduation in B.E Computer science from VISVESWARAIAH TECHNOLOGICAL UNIVERSITY, Karnataka.
Apart from this I nourish interests in Poetry, Philosophy and Sports.

For more information on my current and past projects please visit my website:
http://www.deepakpoola.com

Member Self Profile: Nikolay Grozev

I joined CLOUDS Lab as a PhD candidate in 2012. I hold a bachelor's degree in Informatics and a master's degree in Software Engineering from the University of Sofia "St. Kliment Ohridski". I have also specialised at the Mälardalen University in Sweden, where I worked on my master's thesis.

My industry experience includes working as a Software Engineer at various companies participating in projects ranging from large scale enterprise systems to R&D products. During my PhD, I also took an Internship at Microsoft, Operating Systems Group in Redmond, Washington.

In my PhD research I investigated how to architect 3-tier applications so they can utilise multiple Cloud data centres. This will make them more resilient to data centre outages and provide end users worldwide with high Quality of Experience (QoE). Moreover, it will allow for building cost efficient systems that are legislation compliant in multiple regulatory regions.

Besides publishing academic papers, I also try to disseminate my research through blogging to reach a wider audience. Additionally, I participated in the development and maintenance of several open source projects like CloudSim and CloudSimEx, which include prototypes based on my research work.

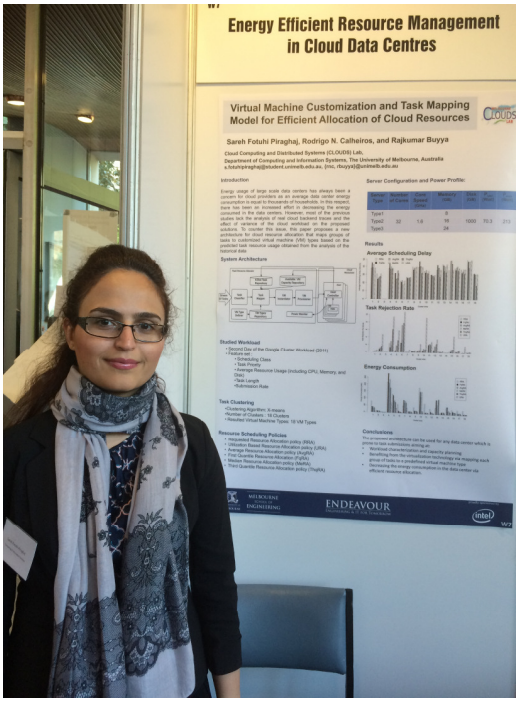
I completed my PhD in 2015.

- Web Site - http://www.nikgrozev.com/
- Blog - https://nikolaygrozev.wordpress.com/
- GitHub - https://github.com/nikolayg
- Twitter - https://twitter.com/nikolaygrozev
- LinkedIn - https://www.linkedin.com/in/nikolaygrozev

Member Self Profile: Sareh Fotuhi Piraghaj

I joined CLOUDS Lab at the beginning of 2012 as PhD student. Prior to joining The University of Melbourne, I received my B.Sc. and M.Sc. degree in Electrical engineering from Gilan University and Iran University of Science and Technology (IUST) respectively. My research focus in PhD is on 'Autonomic Energy Efficient Resource Management in Cloud data centres'.

During my research I participated in deploying OpenStack on the available hardware using the KVM Hypervisor. This results in a technical report as a step by step installation guide for OpenStack. In addition, I have been working on workload characterisation of Google workloads and the impact of efficient resource allocations on energy consumption of a data center. During 2015, my main focus was on energy efficient container hosting and management in the newly introduced Container as a Service (CaaS) cloud service model.



Member Self Profile: Maria Alejandra Rodriguez

My name is Maria Alejandra Rodriguez; I have a bachelor's degree in Computing and Systems Engineering from Los Andes University in Bogota, Colombia. In 2011 I completed a master degree at the University of Melbourne (Master of Engineering in Distributed Computing) with first class honors. In October 2012 I joined the Cloud Computing and Distributed Systems (CLOUDS) Laboratory as a PhD student under the supervision of Prof. Rajkumar Buyya.

I have over three years of industry experience gained while working as a software engineer in Colombia and in Tata Consultancy Services in Bangalore, India.

During my master's research project, I investigated the execution of scientific workflows on distributed environments, specifically on grids and clouds. I have now expanded on this topic and my knowledge of cloud computing. I have researched resource provisioning and scheduling algorithms for large-scale scientific workflows on clouds and developed several heuristics that target IaaS providers. They consider the pay-as-you-go pricing model and take advantage of some of their more prominent characteristics: resource elasticity, heterogeneity and auto-scaling. I have also improved and extended the capabilities of the Cloudbus Workflow Management System used to deploy scientific workflows in cloud computing environments. I am now approaching the end of my PhD candidature and plan to complete the course by April 2016.

Member Self Profile: Chenhao Qu

I joined the CLOUDS lab in Feb 2013 under the supervision of Professor Rajkumar Buyya and Dr Rodrigo N. Calheiros. Before came to Australia, I graduated from Fudan University, China in 2012 with a bachelor degree on Software Engineering. In my research, I investigate how to deploy and manage applications on multi-clouds, which involves service discovery and selection, application monitoring, auto scaling, and SLA management. The aim of the research is to facilitate cost-efficient usage of cloud resources and in the meantime ensure high quality of service for application end users. This year I completed two works:

1. Chenhao Qu, Rodrigo N. Calheiros, and Rajkumar Buyya, SLO-aware Deployment of Web Applications Requiring Strong Consistency using Multiple Clouds, Proceedings of the 8th IEEE International Conference on Cloud Computing (Cloud 2015, IEEE CS Press, USA), New York, USA, June 27 - July 2, 2015.

In this work, we optimized the deployment of web applications requiring strong consistency across multiple clouds in terms of response time and migration effort using a genetic-based algorithm.

2. Chenhao Qu, Rodrigo N. Calheiros, and Rajkumar Buyya, A Reliable and Cost-Efficient Auto-Scaling System for Web Applications Using Heterogeneous Spot Instances, Technical Report CLOUDS-TR-2015-1, Cloud Computing and Distributed Systems Laboratory, The University of Melbourne, Sept. 17, 2015.

We proposed and developed a prototype system that exploits the diverse market behaviours of different spot types to reliably and cost-efficiently auto-scale web applications using spot instances. The system can save operational cost for cloud users up to 80%.

Currently, I am working to extend the second work to multi-cloud environment to further reduce the deployment cost.

- Blog - http://chenhaoqu.blogspot.com.au/
- LinkedIn - https://au.linkedin.com/in/quchenhao
- GitHub - https://github.com/quchenhao

Member Self Profile: Yaser Mansouri

I am a Ph.D. student under supervision of Prof. Rajkumar Buyya in the Department of Computing and Information, University of Melbourne. I joined Cloud Computing and Distributed Systems (CLOUDS) laboratory in August 2012. I received the B.Eng. and M.Sc. degrees from Shahid Beheshti University and Ferdowsi University of Iran, respectively.

My research interests cover the broad area of Distributed Systems, with special emphasis on data replication and management in data grids and data cloud systems. Specifically, I am interested in designing new data placement algorithms and analysing their performances.

Member Self Profile: Atefeh Khosravi

I joined CLOUDS Lab in March 2012 to pursue my PhD studies under the supervision of Prof. Rajkumar Buyya at the University of Melbourne. My PhD studies is funded by the Australian Postgraduate Award (APA).

Before entering the University of Melbourne, I received my M.Sc. degree of Computer Engineering in 2011 and my B.Sc. degree of Information Technology Engineering in 2008, both from the Amirkabir University of Technology (Tehran Polytechnic), Iran.

As part of my industry experience, I worked as a Researcher and Consultant on Iran National IP/MPLS Core Network project at Iran Telecommunication Research Center (ITRC). Currently, I am working as a Research Scientist Intern at Amazon Web Services, Sydney.

My PhD research is on “Energy and Carbon-Efficient Resource Management in Geo-Distributed Cloud Data Centers”. It is mainly focused on the development of policies and algorithms for placement and migration of virtual machines by considering data centers’ energy sources, carbon footprint, power consumption, and network distance, while meeting the required quality of service for Cloud users.

For more information, please visit http://people.eng.unimelb.edu.au/atefehk

Member Self Profile: Jungmin Son (Jay)

I started my PhD degree in Clouds lab since 2014, following a master thesis project conducted under the supervision of Prof Buyya and Dr Calheiros in 2013.

I hold a master's degree in Information Technology from the University of Melbourne and a bachelor's degree in Information and Computer Engineering from Ajou University, South Korea. After completing my bachelor's degree in 2006, I had worked in Samsung Electronics as a software engineer for several years where I was in charge of researching and developing the multimedia software for various Samsung mobile phones.

In my current research, main topic includes how to apply SDN to cloud data centres to ensure SLA and energy efficiency. I investigate VM placement policies that aware network resources and network flow control for providing QoS. This work can help to design cloud data centre in energy-efficient fashion, while guaranteeing SLA. Also, I am interested in network flow management using SDN controller which will provide users efficient network performance while cloud providers can still save costs.

- Web site: https://sites.google.com/site/jungminjayson/
- Github: https://github.com/fogony/cloudsimsdn
- LinkedIn: http://au.linkedin.com/pub/jungmin-jay-son/4b/369/bab/

Member Self Profile: Bowen Zhou

My name is Bowen Zhou and I am from Harbin, China. I joined CLOUDS Lab in the Department of Computing and Information System in University of Melbourne in February 2014 under the supervision of Prof. Rajkumar Buyya and Dr. Rodrigo N. Calheiros and an external supervisor Prof. Satish Narayana Srirama in university of Tartu.

I received my Bachelor degree on information security in Harbin Institute of Technology in 2013. I had an internship in network security lab in HIT during the last year to develop pattern recognition algorithms for network traffic, and then joined CLOUDS lab in February 2014.

Currently, I am in second year of my PhD and doing research in Mobile cloud computing area. One of my research interests is providing solutions for seamless mobile cloud services in the heterogeneous mobile cloud environment that requires new platforms, scheduling algorithms, models, etc. I am also interested to look into the area of mobile device hosted IOT systems in the recent future. My recent publications are as follows:

[1] Bowen Zhou, Amir Vahid Dastjerdi, Rodrigo N. Calheiros, Satish Narayana Srirama, and Rajkumar Buyya, A Context Sensitive Offloading Scheme for Mobile Cloud Computing Service, Proceedings of the 8th IEEE International Conference on Cloud Computing (Cloud 2015, IEEE CS Press, USA), New York, USA, June 27 - July 2, 2015.

[2] Bowen Zhou, Amir Vahid Dastjerdi, Rodrigo N. Calheiros, Satish Narayana Srirama, and Rajkumar Buyya, mCloud: A Context-aware Offloading Framework for Heterogeneous Mobile Cloud, IEEE Transactions on Services Computing (TSC), Volume ?, Number ?, Pages: ??, ISSN: 1939-1374, IEEE Computer Society Press, USA (in press, accepted on Dec 15, 2015).

Member Self Profile: Yali Zhao

I joined Clouds lab in December 2013 to pursue my PhD studies under the supervision of Prof. Rajkumar Buyya. My current research focuses on SLA-based resource management for big data Analytics as a Service (AaaS) platforms in Cloud computing environments. My PhD studies are funded by Melbourne International Research Scholarship (MIRS) and Melbourne International Fee Remission Scholarship (MIFRS).

I obtained my bachelor degree of Software Engineering from Harbin Institute of Technology (HIT) in July 2011. I joined the international master program between HIT and University of Bordeaux 1 (UB1) and obtained my master degree of Software Engineering from HIT and master degree of Enterprise Computing and Engineering (Master Productique International) from UB1 in October 2013.

I joined the Research Center of Intelligent Computing for Enterprise & Service (ICES) in my first master year at HIT. I participated in the Intelligent Home Service System (IHSS) Project and accomplished the design and implementation of the subproject Health Service System (HSS). I conducted research on Service Brokering Mechanism at UB1, which is based on the wisdom of Service Composition. During my second master year, I undertook half year internship at Distributed System Group in Vienna University of Technology (TUWIEN) and derived my master thesis on "Design and Implementation of Workflow Scheduling Mechanism based on Resource Allocation".

In 2015, besides publishing academic papers, I also attended conferences and visited universities to present my research work and communicate with different research groups to broaden my vision and improve my research work. I attended 2015 ACM SIGMOD/PODS, 2015 International Conference on Parallel Processing, and 2015 Google Grace Hopper Celebration for Women in Computing. I visited Tsinghua University, Peking University, Hong Kong Polytechnic University, and University of California, Berkeley.

Member Self Profile: Farzad Khodadadi

I joined CLOUDS laboratory in February 2014 and started my PhD career under supervision of Prof. Rajkumar Buyya. After performing some experiments and gaining hands-on experiences with the Aneka platform, CloudSim, and several other tools, due to my passion for following recent technology trends I opted to work on Internet of Things.

Initially, my research focus was designing and developing solutions for optimal integration of IoT and cloud computing through API chaining, service exposition and composition, and other necessary aspects such as load balancing and data analytics. As time moved forward, I started to extend my previous work by adding semantic and ontology to API definition to facilitate service sharing and increase interoperability among entities. A taxonomy and survey on Internet of Things has been also completed and will be published as a book chapter soon.

During the past year, I was elected as chair of the Third Computing and Information Systems Doctoral Colloquium, which is an annual conference for all CIS student and staff members. We successfully managed to invite and host academic and business partners from Microsoft, Google and IBM Research. Overall it was a unique experience for me to improve my leadership skills and to interact with wide range of people, from students to professors and those engaged in industry.

Additionally, with 3 other students from our university, we had a chance to represent the university's IEEE student branch in the IEEE Region 10 Congress that was held in Sri Lanka. This fantastic opportunity helped us extend our network of friends and colleagues who are doing voluntary work in one of world's largest organizations and later on, we were awarded the best student branch in Victoria.

Linkedin profile: https://au.linkedin.com/in/farzad-khodadadi-2201b128

Member Self Profile: Safiollah Heidari

I joined CLOUDS Lab in Jun 2014 at the University of Melbourne as a PhD student under the supervision of Prof. Rajkumar Buyya and Dr. Rodrigo N. Calheiros.

Previously I have graduated from K. N. Toosi University of Technology, Tehran, Iran, with First Class Honors degree in M.Sc. in Information Technology and I have published a number of papers during my studies. I am also member of Iran's National Elites Foundation, a prestigious organization for recognize, organize and support Iran's elite national talents. I have about two years of experiences working as a software engineer in different companies in Iran and also as a university lecturer.

As a first year PhD student I'm investigating resource provisioning, workflow scheduling and network aspects of large-scale graph-processing systems, Big Data and social networks on cloud environments. We have developed iGiraph which is a Pregel-like graph processing framework for minimizing the monetary costs of processing on huge graph datasets. iGiraph's paper will be appeared in CCGrid 2016 conference.

Member Self Profile: Xunyun Liu

I joined Clouds lab in Sept. 2014 pursuing my PhD under the supervision of Professor Rajkumar Buyya and Dr Rodrigo N. Calheiros at University of Melbourne.

Before coming here I graduated from National University of Defense Technology with a master and a bachelor degree on Computer Science and Technology. At that time my research mainly focused on High Performance Computing such as MPI applications and fault-tolerance issues on TH supercomputer.

After transferring to Cloud computing research area for a few months, I am now interested in stream processing of big data on cloud and the resource provisioning and scheduling topic related to it. Starting with Apache Storm I have been actively working towards using cloud resources more efficiently and wisely.

Member Self Profile: Caesar Wu

I am one of the telecommunication veterans. I worked for Telstra Corporation over 18 years. Before I joined Telstra, I had worked for many companies and crossed many different industries: software (Intelligent System Research group limited), naval architecture (Ship Design & Management P/L and Sigma Marine P/L), Electronics Goods (Email Electronic Ltd), telecommunication (Visionstream Pty Ltd), civil engineering (Lincoln Scott) and space industry (Shanghai Space Bureau). I received my B. Eng. degree in 1983 in Shanghai Jiao Tong University China for Electrical Electronic and Mechanics Engineering. I was also a part time student of Monash University in 1993 for Master of Engineering Science.

In July 2015, I joined Computing and Information Systems/School of Engineering/The University of Melbourne as a PhD student under the supervision of Professor Ramamohanarao Kotagiri and Professor Rajkumar Buyya.

My research interests include cloud data center cost modeling, IT vendor management, IT capacity planning, data mining, machine learning, artificial intelligence, IT solution architecture, IT service delivery and project management.

In Mar/2015, I was able to publish the book: Cloud Data Center Cost Modeling based on my many years experiences in Telstra as one of two co-authors (Professor Rajkumar is other co-author) http://www.amazon.com.au/Cloud-Data-Centers-Cost-Modeling-ebook/dp/B00UJBCSA0

In 2016, I will be able to publish a book chapter: Big Data Analytics = Machine Learning + Cloud Computing" as one of three co-authors

Member Self Profile: Sara Kardani Moghaddam

I joined CLOUDS Lab as a PhD student in September 2015, under the supervision of Prof. Buyya and Prof. Kotagiri at the University of Melbourne.

Prior to joining the CLOUDS Lab Group, I received my Bachelor's degree with First Class Honors from Shiraz University of Technology and after that I completed a master degree in Information Technology at Sharif University of Technology. Before starting my PhD studies, I also worked for 3 years as a Software Designer and Developer in Iran.

Currently, as a first year PhD student, I'm investigating the concepts of Big Data analytics and how we can exploit these capabilities to find better ways of Resource Provisioning and Auto scaling in Clouds computing environment

Member Self Profile: Minxian Xu

I joined CLOUDS lab in October 2015, pursuing my PhD position under the supervision of Prof. Rajkumar Buyya and Dr. Amir Vahid Dastjerdi at University of Melbourne.

Before coming to Melbourne, I obtained both my bachelor and master degree at University of Electronic Science and Technology of China (UESTC), majoring in Software Engineering. During my graduate time, my research mainly focused on resource scheduling and load balancing in Cloud data centers.

In my PhD research, I'm still working on resource scheduling, especially investigating energy-efficient scheduling for Clouds.

For more information:
My LinkedIn page: https://au.linkedin.com/in/minxian-xu-535525108
My Chinese blog page: http://blog.sina.com.cn/xianecisp

Member Self Profile: Diana Barreto

I started my work with CloudLabs in 2013 while I was pursuing my Master in Information Technology (Distributed system stream). Under the supervision of Professor Rajkumar Buyya and Dr. Rodrigo N. Calheiros I completed satisfactorily my master's project and learned many aspects related with cloud computing foundations and resource provisioning. After finished the master I started to work as a Researcher in CloudLabs and during 2015 I have extended Aneka, which is a multi-cloud platform that allow developing and deploying of distributed applications in multiple cloud providers. During this time I also worked as tutor of the master's subject Distributed Algorithms.

Prior my Masters I finished a graduate diploma in Software Construction in 2008 in La Universidad de los Andes and I got my bachelor's degree in system engineering in 2006 in La Pontificia Universidad Javeriana, both of them in Bogota Colombia. Moreover, I worked in the industry as software consultant for around 6 years, performing roles of software developer, business analyst and programming team leader.

Mainly I worked developing customized IT solutions for telecommunications and financial companies. I was involve with Java technologies and distributed applications in j2ee. Additionally I also gained some experience with Delphi and .Net and with the integration of different platforms. This experience makes me love middleware infrastructure and allow me to take the decision of starting new studies at The University of Melbourne.

Member Self Profile: Wenhong Tian

Since July 2014, Dr. Wenhong Tian is a visiting scholar with CLOUDS lab at the University of Melbourne. As part of his visit, he has been collaborating with Prof. Buyya in the Department of Computing and Information Systems on the Australian research project entitled “Dynamic resource provisioning for autonomic management of cloud computing environments”. Dr. Wenhong Tian is working with Prof. Buyya on manuscripts “On Minimizing Total Energy Consumption in the Scheduling of Virtual Machine Reservations”, “Analyzing Energy-efficiency of Scheduling Policies for Compute-Intensive Applications on Cloud” submitted, and a few related topics.

Member Self Profile: Jing Liu

I'm Jing Liu, an associated professor of Inner Mongolia University in China. From Sep. 2014 to Aug. 2015, I am a visiting researcher with professor Rajkumar Buyya in the Cloud Computing and Distributed Systems (CLOUD) Laboratory at the University of Melbourne. My one-year visit here is sponsored by Chinese Scholarship Council.

I am very lucky to start research works concerning cloud computing under the guidance of Prof. Raj in the CLOUD lab. My research interests mainly focus on fault tolerance for cloud applications, big data application development, formal model based software testing theory and applications based on cloud computing technologies.

Conference Papers:

Jing Liu, Jiantao Zhou, and Rajkumar Buyya. Software Rejuvenation Based Fault Tolerance Scheme for Cloud Applications, Proceedings of the 8th IEEE International Conference on Cloud Computing (Cloud 2015, IEEE CS Press, USA), New York, USA, June 27 - July 2, 2015.

I really enjoy every happy day in Melbourne, and wish everyone in our harmonious CLOUD lab to have more promising achievements.

Member Self Profile: Fabio Diniz Rossi

I joined to CLOUDS Lab in November 2014 to accomplish my partial doctoral under the supervision of Professor Rajkumar Buyya and Dr. Rodrigo Calheiros at The University of Melbourne. Before join the CLOUDS Lab, I received my MSc degree in Computer Science in 2008 from Pontifical Catholic University of Rio Grande do Sul (PUCRS). Currently, I'm PhD candidate at Pontifical Catholic University of Rio Grande do Sul (PUCRS) under the supervision of Professor César De Rose at High Performance Computing Lab. (LAD/PUCRS).

Moreover, I am professor at Farroupilha Federal Institute of Education, Science and Technology (IF Farroupilha). I have worked in cloud computing, energy-aware strategies,and applications performance.

My PhD research is on Cloud Instrastructure Management, improving the trade-off between energy savings and applications perfomance. Besides, I have contributed in research to other PhD candidates at LAD/PUCRS. My 2014 and 2015 publications come below:

- ROSSI, F.; DE OLIVEIRA, I.; DE ROSE, C.A.F.; CALHEIROS, R.; BUYYA, R. Non-Invasive Estimation of Cloud Applications Performance via Hypervisor's Operating Systems Counters. In: The Fourteenth International Conference on Networks (ICN 2015), Barcelona, Spain. p. 177-184.
- ROSSI, F.; STORCH, M; DE OLIVEIRA, I.; DE ROSE, C.A.F. Modeling Power Consumption for DVFS Policies. In: IEEE International Symposium on Circuits & Systems (ISCAS 2015), Lisboa, Portugal, p. 1879-1882.
- XAVIER, M.; DE OLIVEIRA, I.; ROSSI, F.; DOS PASSOS, R.; MATEUSSI, K.; DE ROSE, C.A.F. A Performance Isolation Analysis of Disk-intensive Workloads on Container-based Clouds. In: 23rd Euromicro International Conference on Parallel, Distributed and Network-based Processing (PDP 2015), Turku, Finland, p. 253-260.
- ROSSI, F.; XAVIER, M.; MONTI, Y.; DE ROSE, C.A.F.; On the impact of energy-efficient strategies in HPC clusters. In: 23rd Euromicro International Conference on Parallel, Distributed and Network-based Processing (PDP 2015), Turku, Finland, p. 17-21.

Member Self Profile: Hongyou Li

I am a lecturer in the college of computer science at Sichuan University, China. I received my Ph.D. degree in computer science in December 2014 from Sichuan University. I became a visiting researcher supervised by Professor Rajkumar Buyya in the Cloud Computing and Distributed Systems (CLOUDS) Laboratory at the University of Melbourne from Sep. 2014. My visit is sponsored by Sichuan University.

After completing my bachelor's degree in 2006, I have been working for more than 8 years at Sichuan University. And I am a core member of the Mobile and Distributed Computing Lab at the university. My current research focuses on resource management of cloud systems and mobile cloud computing.

Member Self Profile: Patricia Arroba

I received my B.Sc and M.Sc. degree in 2011 in Telecommunication Engineering and my M.Sc. in Electronic Systems Engineering in 2012 from the Technical University of Madrid (Universidad Politécnica de Madrid), Spain.

By the end of 2012 I started my PhD studies in the Department of Electronic Engineering from the same University, working in the areas of power modeling and energy optimization in Cloud data centers.

I joined CLOUDS Lab. in October 2014 as a visitor student at the University of Melbourne under the supervision of Professor Rajkumar Buyya. My research stay was sponsored by the *European Network of Excellence on High Performance and Embedded Architecture and Compilation* (HiPEAC).

My current research focuses on the design and development of algorithms and novel techniques that are also aware of non-traditional parameters, as frequency and temperature, to optimize the energy consumption of Cloud infrastructures.

Recently, I was able to publish the following co-authored articles:

P. Arroba, J. M. Moya, J. L. Ayala, R. Buyya: DVFS--Aware Consolidation for Energy--Efficient Clouds. Parallel Architectures and Compilation Techniques (PACT), San Francisco, CA, USA, 2015 (To Appear in 2016).

M. Zapater, **P. Arroba**, J. L. Ayala, K. Olcoz and J. M. Moya, “Energy-aware policies in ubiquitous computing facilities,” Cloud Computing with e-Science Applications, Edition 1, Chapter 12, CRC Press, Editors Olivier Terzo, Lorenzo Mossucca, pp.267-283, 2015.

I. Aransay, M. Zapater, **P.Arroba**, J. M. Moya, “A Trust and Reputation system for energy optimization in Cloud data centers,” in *IEEE International Conference on Cloud Computing,* IEEE CLOUD, New York, USA, 2015.

P. Arroba, J. L. Risco-Martín, M. Zapater, J. M. Moya and J. L. Ayala, “Enhancing Regression Models for Complex Systems using Evolutionary Techniques for Feature Engineering,” Journal of Grid Computing, 2014, DOI 10.1007/s10723-014-9313-8.

P. Arroba, J. L. Risco-Martín, M. Zapater, J. M. Moya, J. L. Ayala and K. Olcoz, “Server Power Modeling for Run-time Energy Optimization of Cloud Computing Facilities,” Energy Procedia, Volume 62, 2014, Pages 401-410, ISSN 1876-6102, DOI 10.1016/j.egypro.2014.12.402.

Member Self Profile: Nitisha Jain

I was a visiting student in CLOUDS Lab and worked under the guidance of Rajkumar Buyya in March-April 2015 as part of a collaborative initiative between the Indian Institute of Science in Bangalore, India and the University of Melbourne. I pursued my Masters in Research degree in the domain of Cloud Computing and Virtualization from the Indian Institute of Science which I recently completed. Presently, I work as a Research Software Engineer at IBM India Research Lab in Bangalore.

My project in the CLOUDS lab was primarily aimed at adding extensions to the CloudSim framework for enabling simulations of deadline constrained disk I/O workloads in a typical Cloud datacenter in order to facilitate research on the issues concerning the performance of I/O applications in multi-tenant environments. This work was done in conjunction and as an extension of my Masters' thesis work. With generous support from Prof Buyya and Nikolay Grezov, I was able to successfully implement deadline bases I/O scheduling in CloudSim framework.

This work resulted in a conference paper that was accepted for publication and recently presented at the 3rd IEEE International Conference on Cloud Computing in Emerging Markets (CCEM 2015) held on November 25 - 27, 2015 in Bangalore, India.

Member Self Profile: Harshit Gupta

I joined CLOUDS Lab in May 2015 as a Research Visitor under the supervision of Prof. Rajkumar Buyya. My area of interests includes Fog Computing, Internet of Things, and Cloud Computing.

I am currently pursuing my Master's degree in Computer Science and Engineering at Indian Institute of Technology Kharagpur, India. I have been involved in several research projects on cloud computing touching areas like resource management and cloud marketplace.

While at CLOUDS Lab, I worked on designing a distributed stream processing engine for a fog computing environment. The proposed system aims to minimize the network congestion and latency by processing voluminous data right near the source of it. I have co-authored a chapter on fog computing in Prof. Buyya's upcoming book "Internet of Things: Principles and Paradigms".

For more information, please visit my website : http://cse.iitkgp.ac.in/~harshitg/

9. Selected Projects/Programs

Cloudbus: A Toolkit for Market-Oriented Cloud Computing

Web: http://www.cloudbus.org/

The Cloud Computing and Distributed Systems (CLOUDS) Laboratory is a software research and innovation group at the University of Melbourne, Australia. The Lab is actively engaged in design and development of next-generation computing systems and applications that aggregate by dynamically leasing services of distributed resources depending on their availability, capability, performance, cost, and users' QoS requirements. The lab is working towards realising this vision through its two flagship projects: Gridbus and Cloudbus.

The Cloudbus project, an initiative that started in 2008 by the CLOUDS lab at the University of Melbourne, facilitates the realization of the above vision. The project developed innovative solutions for market-oriented Cloud computing. The current innovative developments include: (i) Aneka, a platform for developing and managing Cloud computing applications from market-oriented perspective; (ii) InterCloud, a framework for internetworking of Cloud service providers, dynamically creating federated computing environments, and scaling of distributed applications; (iii) CloudSim, a simulation framework that allows researchers to control every aspect of a Cloud environment: algorithms, platforms, and infrastructure; and (iv) Workflow Engine, a management platform that facilitates the creation, deployment and monitoring of complex applications modeled in a systematic and orderly manner in Cloud computing environments.

The Cloudbus project

The Cloudbus project is engaged in the creation of open-source specifications, architecture and a reference Cloud toolkit implementation of market-oriented cloud computing. Some of our technologies serve as foundation for industrial solutions offered by Manjrasoft to its customers worldwide.

The research probes include:

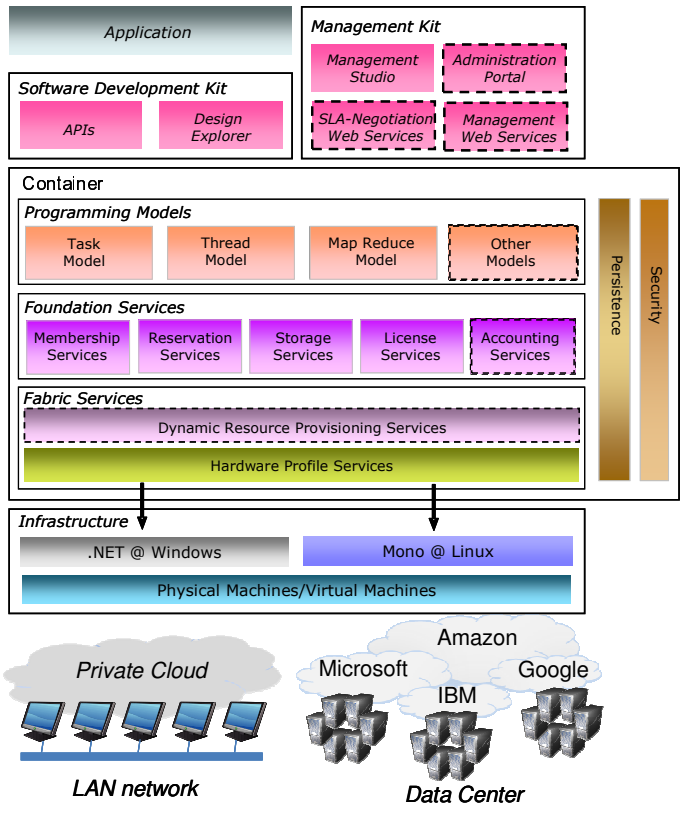
- Market Oriented Cloud Architecture
- Enterprise Cloud Application Platform (Aneka)
- Cloud Service Broker
- Cloud Workflows and Scheduling
- Service Level Agreements & Resource Allocation Systems (Libra).
- Energy-Efficient Data Centers and Clouds
- Cloud Simulation Toolkit (CloudSim).
- Application Development Environments
- Open SensorWeb Architecture
- InterCloud – Peering and Federation of Clouds
- Content Delivery Networks
- Software Defined Networks
- Big Data
- Internet of Things (IoT)
- Application Targets include: ECG Monitoring and Analysis, Data Mining and Business Analytics, Brain Imaging (Dartmouth Medical School), and Geophysics (*Intrepid*).

Aneka: .NET-based Cloud Computing

Web: http://www.manjrasoft.com

ANEKA provides a set of services that make construction and development of Clouds and their applications as easy as possible without sacrificing flexibility, scalability, reliability and extensibility. It is now commercialized through Manjrasoft, a startup company of the University of Melbourne. The key features supported by ANEKA are:

- A configurable and flexible execution platform (container) enabling -
  - Pluggable services;
  - Security implementations - multiple authentication / authorization mechanisms such as role-based security and Windows domain-based authentication;
  - Multiple persistence options including RDBMS, SQL Express, MySQL and flat files;
- SDK (Software Development Kit) supporting multiple programming models including –
  - Object oriented thread model,
  - Task model for legacy applications
  - Map Reduce model for data-intensive applications
  - Custom tools such as Design Explorer for parameter sweep studies
- Easy to use management tool for SLA and QoS negotiation and resource allocation.
- Cloudbrusting of application tasks across multiple Clouds (e.g., Azure and AWS)



Aneka Architecture

QoS-Oriented Cloud Workflow Engine

Web: http://www.cloudbus.org/workflow

The emerging e-Research paradigm enables researchers from different disciplines and organisations to engage in collaborative scientific investigation. They need to share geographically distributed resources owned by different organisations. e-Research applications need to negotiate with resource providers for guarantees on access time, duration and level of quality of service (QoS). To meet QoS requirements of e-Research application workflows, this project aims to develop Grid technologies that support (a) QoS-based scheduling of e-Research application workflows on distributed resources, (b) mechanisms for formulating, negotiating and establishing service level agreements (SLA) with resource providers and (c) SLA-based allocation and management of resources. Specifically, the project aims to:

- Define an architectural framework and principles for the development of QoS-based workflow management and SLA-based resource allocation systems,
- Develop QoS-based algorithms for scheduling e-Research workflow applications,
- Develop SLA-based negotiation protocols and resource allocation algorithms,
- Implement a prototype system by incorporating the algorithms and policies developed above, and
- Develop real world demonstrators in various scientific domains such as life sciences.

Key Reference: Suraj Pandey, Dileban Karunamoorthy and Rajkumar Buyya, Workflow Engine for Clouds, Cloud Computing: Principles and Paradigms, 321-344pp, R. Buyya, J. Broberg, A.Goscinski (eds), ISBN-13: 978-0470887998, Wiley Press, New York, USA, February 2011.

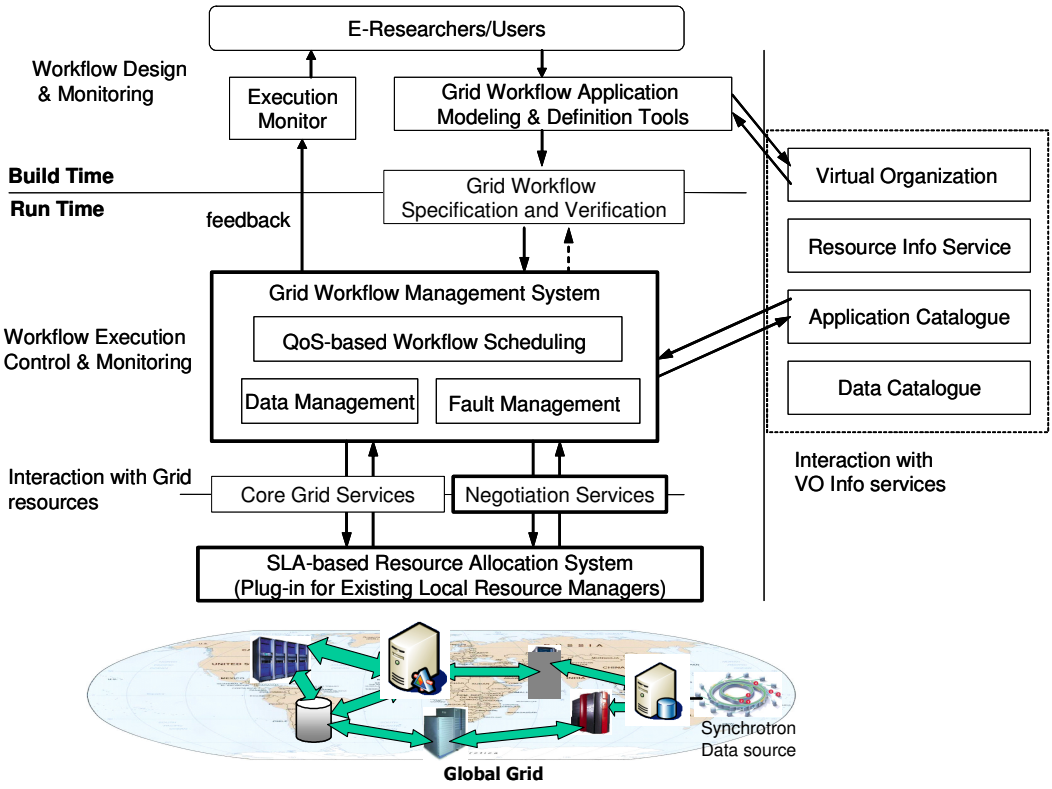


Fig. 1: Architecture of QoS-based workflow management and resource allocation system.

The Green Cloud Project: Innovative Solutions for Energy-Efficient Cloud Computing

Web: http://www.cloudbus.org/greencloud

Traditionally, high-performance computing (HPC) community has focused on performance (speed). Since early 2000, several companies have started building Data Centers inspired by commodity HPC (cluster computing) systems-architecture for hosting/powering industrial applications including search engines such as Google. At the same time microprocessor vendors have not only doubled the number of transistors (and speed) every 18-24 months, but they have also doubled the power densities. That is, the tremendous increase in computer performance has come with an even greater increase in power usage. As a result operational cost of HPC systems including industrial Data Centre is rapidly growing. This is reflected from a statement by CEO of Google (Eric Schmit): "what matter most to Google is not speed but power, because data centers can consume as much electricity as a city."

The aim of Green Cloud Project is to develop high-end computing systems such as Clusters, Data Centers, and Clouds that allocate resources to applications hosting Internet services (e-Services) to meet not only users' quality of service requirements, but also minimise consumption of electric power. That is to, to improve power management and consumption by dynamically managing and configuring power-aware ability of system devices, such as processors, disks, and communication links.

Selected Publications:

- Anton Beloglazov, Jemal Abawajy, and Rajkumar Buyya, Energy-Aware Resource Allocation Heuristics for Efficient Management of Data Centers for Cloud Computing, Future Generation Computer Systems, Volume 28, No. 5, Pages: 755-768, ISSN: 0167-739X, Elsevier Science, Amsterdam, The Netherlands, May 2012.
- Saurabh Garg and Rajkumar Buyya, Green Cloud Computing and Environmental Sustainability, Harnessing Green IT: Principles and Practices, 315-340pp, S. Murugesan and G. Gangadharan (eds), ISBN: 978-1-1199-7005-7, Wiley Press, UK, October 2012.
- Anton Beloglazov and Rajkumar Buyya, Managing Overloaded Hosts for Dynamic Consolidation of Virtual Machines in Cloud Data Centers Under Quality of Service Constraints, IEEE Transactions on Parallel and Distributed Systems (TPDS), Volume 24, No. 7, Pages: 1366-1379, IEEE CS Press, Los Alamitos, CA, USA, July 2013.
- Atefeh Khosravi, Saurabh Kumar Garg, and Rajkumar Buyya, Energy and Carbon-Efficient Placement of Virtual Machines in Distributed Cloud Data Centers, Proceedings of the 19th International European Conference on Parallel and Distributed Computing (Euro-Par 2013, Springer, Berlin, Germany), Aachen, Germany, August 26-30, 2013.
- Tom Guérout, Thierry Monteil, Georges Da Costa, Rodrigo Neves Calheiros, Rajkumar Buyya, Mihai Alexandru, Energy-aware Simulation with DVFS, Simulation Modelling Practice and Theory, Volume 39, No. 1, Pages: 76-91, ISSN: 1569-190X, Elsevier Science, Amsterdam, The Netherlands, November 2013.
- Sareh Fotuhi Piraghaj, Rodrigo N. Calheiros, Jeffrey Chan, Amir Vahid Dastjerdi, and Rajkumar Buyya, Virtual Machine Customization and Task Mapping Architecture for Efficient Allocation of Cloud Data Center Resources, The Computer Journal, Volume 59, No. 2, Pages: 208-224, ISSN 0010-4620, Oxford University Press, UK, February 2016.

CloudSim: A Framework for Modeling and Simulation of Cloud Computing Infrastructures and Services

Web: http://www.cloudbus.org/cloudsim

Recently, cloud computing emerged as the leading technology for delivering reliable, secure, fault-tolerant, sustainable, and scalable computational services, which are presented as Software, Infrastructure, or Platform as services (SaaS, IaaS, PaaS). Moreover, these services may be offered in private data centers (private clouds), may be commercially offered for clients (public clouds), or yet it is possible that both public and private clouds are combined in hybrid clouds.

These already wide ecosystem of cloud architectures, along with the increasing demand for energy-efficient IT technologies, demand timely, repeatable, and controllable methodologies for evaluation of algorithms, applications, and policies before actual development of cloud products. Because utilization of real testbeds limits the experiments to the scale of the testbed and makes the reproduction of results an extremely difficult undertaking, alternative approaches for testing and experimentation leverage development of new Cloud technologies.

A suitable alternative is the utilization of simulations tools, which open the possibility of evaluating the hypothesis prior to software development in an environment where one can reproduce tests. Specifically in the case of Cloud computing, where access to the infrastructure incurs payments in real currency, simulation-based approaches offer significant benefits, as it allows Cloud customers to test their services in repeatable and controllable environment free of cost, and to tune the performance bottlenecks before deploying on real Clouds. At the provider side, simulation environments allow evaluation of different kinds of resource leasing scenarios under varying load and pricing distributions. Such studies could aid the providers in optimizing the resource access cost with focus on improving profits. In the absence of such simulation platforms, Cloud customers and providers have to rely either on theoretical and imprecise evaluations, or on try-and-error approaches that lead to inefficient service performance and revenue generation.

The primary objective of this project is to provide a generalized and extensible simulation framework that enables seamless modeling, simulation, and experimentation of emerging Cloud computing infrastructures and application services. By using CloudSim, researchers and industry-based developers can focus on specific system design issues that they want to investigate, without getting concerned about the low level details related to Cloud-based infrastructures such as Virtual Machines and Containers.

CloudSim is powered by jProfiler.

Main reference: Rodrigo N. Calheiros, Rajiv Ranjan, Anton Beloglazov, Cesar A. F. De Rose, and Rajkumar Buyya, CloudSim: A Toolkit for Modeling and Simulation of Cloud Computing Environments and Evaluation of Resource Provisioning Algorithms, Software: Practice and Experience (SPE), Volume 41, Number 1, Pages: 23-50, ISSN: 0038-0644, Wiley Press, New York, USA, January, 2011.

11. Moments with Visitors, Colleagues and International Hosts

With organisers of CCGrid 2015 conference in Shen Zhen, China (May 2015)

A snap of CLOUDS lab members taken during Deepak's PhD completion seminar leading to a new milestone-20th PhD thesis (Aug 2015)

With organisers and keynote speakers of the 4th International Conference on Software Engineering & Computer Systems in Kuantan, Pahang, Malaysia (August 2015)

With organisers and attendees of Content Delivery Network Conference in Tehran (Dec 2015)

During UCC 2015 in Cyprus with Chairs and a Keynote speaker (Dec. 2015)

During a seminar at Beijing University of Posts and Telecommunications, China (May 2015)