1. Director’s Message

I am pleased to report on the key activities and outcomes of Cloud Computing and Distributed Systems (CLOUDS) Laboratory at the University of Melbourne, Australia during the academic year 2010, which has been an extraordinary year in terms of research quality and international recognition of its members. The Lab has emerged as one of the world-leaders in developing innovative solutions for Cloud Computing. The highlights of research activities and outcomes in 2010 are:

- The Lab successfully completed two large research projects: (i) ARC (Australian Research Council) Discovery Project “InterGrid: Peering Architecture and Policies for Internetworking Disparate Grids” and (ii) post-funding activities of DIISR International Science Linkage (ISL) project on “Autonomic and Utility-oriented Global Grids for Powering Emerging E-Research Applications” connecting Australian researchers those in USA, Europe, India, and China.
- The Lab successfully assisted its spin-off company, Manjrasoft, which has released Aneka 2.0 software and filed its PCT patent application to national phase in USA & India.
- One of our Lab members (Dr. Broberg) has ventured into commercialisation of Content Delivery Networks over Clouds (MetaCDN) R&D carried out during his stay with us.
- Members of CLOUDS Lab have authored 30 publications, which include 8 journal papers, and 15 conference papers.
- The Lab's flagship Cloudbus Project has released “open source” CloudSim 2.0 Toolkit, which is used by several researchers in academia and industries around the world.
- Members have presented over 37 invited talks that include 7 keynotes delivered at international conferences held in USA, Australia, India, Vietnam, China, and Korea.
- The Lab successfully hosted research activities of over 20 scholars: 9 PhD students, 7 Research Fellows (5 at PostDoc level and 2 Software Engineers), and couple of Masters/honours students. Three Ph.D students have graduated.
- Lab members have been recognised for their outstanding contribution to the field of distributed computing by awards such as “Scopus Young Researcher of the Year 2010 Award: Finalist”, “Google Australia Eureka Prize for Innovation in Computer Science: 2010 Finalist”, and “2010 Asia Pacific Frost & Sullivan New Product Innovation Award”.
- Received “Best Paper Award” from the 24th IEEE International Conference on Advanced Information Networking and Applications (AINA 2010), Perth, Australia, April 20-23, 2010.
- The Lab housed several (short and long term) international visitors (academic and PhD students) from USA, Canada, and India.
- Members of the Lab have led community efforts by (a) involving in the organisation of conferences (e.g., CCGrid 2010 in Melbourne), (b) served on the Steering Committee of 5 international conferences and (c) served as the Chair of the Advisory Board of the IEEE Technical Committee on Scalable Computing.

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!

Professor Rajkumar Buyya, PhD
Director, Cloud Computing and Distributed Systems (CLOUDS) Laboratory
Department of Computer Science and Software Engineering
The University of Melbourne, Australia
Web: www.cloudbus.org
2. The Team

Director:

• Professor Rajkumar Buyya

Research Staff:

• Dr. James Broberg
• Mr. Xingchen Chu
• Dr. Christian Vecchiola
• Dr. Javadi Bahman
• Dr. Rodrigo N. Calheiros
• Mr. Dileban Karunamoorthy
• Dr. Mukaddim Pathan
• Dr. Adam Barker
• Dr. Saurabh Garg

PhD Students

• Mr. Mustafizur Rahman
• Mr. Suraj Pandey
• Mr. Michael Mattess
• Mr. William Voorsluys
• Mr. Mohsen Amini
• Mr. Anton Beloglazov
• Mr. Amir Vahid
• Ms. Linlin Wu
• Mr. Adel Toosi

Masters by Research Students

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

**Australian Research Council (ARC)**

- J. Broberg and Z. Tari, Coordinated and Cooperative Load Sharing between Content Delivery Networks, Discovery Project, Australian Research Council (ARC), Australia, 2008-2010. Amount: $315,000

**Industry and Melbourne University Grants**

4. Publications

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Publication Type</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Books/Proceedings Edited</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Journal Papers</td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Book Chapters</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Conference Papers</td>
<td>4</td>
<td>7</td>
<td>9</td>
<td>16</td>
<td>15</td>
<td>24</td>
<td>22</td>
<td>27</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Magazine/Other Articles</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>12</td>
<td>9</td>
<td>15</td>
<td>28</td>
<td>34</td>
<td>36</td>
<td>39</td>
<td>57</td>
<td>30</td>
</tr>
</tbody>
</table>

Book Chapters

Proceedings Edited

Journal Papers


Magazine Papers


Conference Papers


5. Invited Presentations and Outreach

By the Lab Director:

**Keynote Talks at International Conferences**


**National Conferences**


**Seminars - in Cloud Computing area:**

1. Infosys, Hyderabad, India, Jan. 4, 2010.
2. Hyderabad University, Hyderabad, India, Jan. 4, 2010.

**Conference Tutorials**


**By Other Members:**

**Conference Tutorials**


**Research Presentations**


**Seminars**

6. Selected Community Services

By the Lab Director:

IEEE Computer Society

1. Chair of Advisory Board, IEEE Technical Committee on Scalable Computing

Journal Editorials

2. Editorial Board Member, International Journal of Parallel, Emergent and Distributed Systems (IJPEDS), ISSN: 1744-5760, Taylor & Francis Group, UK.
4. Editorial Board Member, Software: Practice and Experience, ISSN: 0038-0644, Wiley Press, New York, USA, 2009-to date.

Conference Steering Committee

2. Co-Chair, International Conference on e-Science (e-Science) series, 2005- to date.
3. Member, IEEE International Conference on Cluster Computing (ClusterXY), 1999-to date.

Conference Chair


Misc. Services Chair


Technical Program Committee Memberships

3. 10th International Conference on Computational Science (ICCS 2010), May 31-June 2, 2010, Amsterdam, The Netherlands.
6. 19th International Heterogeneity in Computing Workshop (HCW 2010), April 19, 2010, Atlanta, USA.
9. 11th International Conference on Distributed Computing and Networking (ICDCN 2010), Jan. 3-6, 2010, Kolkata, India.

Community Information Sources

- Maintained a Grid Computing Information Centre at: [http://www.gridcomputing.com](http://www.gridcomputing.com), whose newsletter mailing list has over 2500 members. This website is often ranked as #2 source for grid computing by Google search engine.
- Maintained a Cluster Computing Information Centre at: [http://www.buyya.com/cluster](http://www.buyya.com/cluster)

By Other Members:

Chairs and Memberships


Technical Program Committee Memberships


Conference Tutorials

7. International Visitors

1. Prof. T. Selvi, Anna University, Chennai, India, May 2010.
2. Dr. Srinivasa K G, MSRIT, Bangalore, India, Aug 2010-Jan 2011 - on BOYSCAST Fellowship of Govt. of India.
3. Dr. R. Thulasiram, University of Manitoba, Sept. 2010.
8. Continuing Members Profile and Activities

Member Self Profile: Dr. Christian Vecchiola

I am part of the CLOUDS Lab since 2008 when I joined as a Postdoctoral Research Fellow working on Distributed Evolutionary Computation and Global Grids. I completed my Ph.D. at the University of Genova, Italy with a thesis on "Providing Support for Evolvable System: An Agent-based Approach". My research now is mostly focused on tools and technologies for Cloud Computing and development of Platform as a Service solution frameworks and solutions for distributed computing applications over the Cloud. Besides research I also taught Distributed Systems subject and co-lectured Cluster and Grid Computing subject.

Genetic algorithms are compute intensive and time consuming optimization algorithms that can be applied to different real life scenarios such as airfoil dynamic design, protein structure prediction, and virtually any problem that can be characterized by a single or multi-objective function that needs to be optimized. We supported distributed execution of evolutionary algorithms, initially on Grids and then on Clouds. I have also developed a software prototype – called Offspring – for helping research scientists in quickly prototype-distributed implementations of evolutionary algorithms. This prototype leverages Aneka. In 2010, I focused in improving the features of Offspring and, together with Mr. Abedini, integrated new algorithms for Co-evolutionary classification.

Cloud Computing is an interesting new opportunity for companies to leverage on demand third parties for IT infrastructure, services, and applications. It allows dynamically provisioning virtual hardware, scale applications according to their needs and integrating new services to existing application. The scenario envisioned by Cloud Computing poses new interesting challenges ranging from infrastructure management, quality of service, application management and scheduling, and dynamic provisioning. Platform as a Service (PaaS) solutions provide a scalable and elastic middleware for executing applications on the Cloud, provides the right venue where to experiment many of the aspects introduced before. In particular, in 2010 we have focused in improving the dynamic provisioning infrastructure within Aneka and devising more intelligent policies for dynamic resource provisioning. Together with Prof. Buyya, I am also writing a book on High Performance Cloud Computing.

In 2011, I will deepen my research on the models and the technologies that enable Cloud Computing and make it an available resource for everyone. In particular I will focus on improving the support for MapReduce and completing the book co-authored with Prof. Buyya.


Member Self Profile: James Broberg

In 2010 I was employed as an Australian Postdoctoral Fellow (APD, Content Delivery Networks). 2010 was the final year of my fellowship, and my 4th year in the department. My primary responsibility was performing research activities around a Discovery Grant, “Coordinated and Cooperative Load Sharing between Content Delivery Networks” (DP0881742, 2008-2010).

I have been developing a framework called MetaCDN [1] that enables coordinated and cooperative load sharing amongst different Content Delivery Network (CDN) and Cloud Storage providers, with emphasis on measuring and disseminating load information, performing request assignment / redirection, and enabling content replication amongst participating CDNs on a wide-area “Internet” scale. I have addressed these core issues from theoretical, simulation and software engineering perspectives to test the performance and computational demands of competing and newly developed algorithms, and have published research papers and created software documenting these findings.

In 2010 I placed a larger focus on engineering aspects of MetaCDN, developing a proof of concept implementation to bring the MetaCDN platform to a commercial grade. A provisional patent application was also filed around key novel aspects of the MetaCDN technology.

Other key activities in 2010 were teaching a masters-level subject, “Internet Technologies”, in Semester 1, and co-editing a book called “Cloud Computing: Principles and Paradigms” [2] (to appear, 2011) with Prof. Rajkumar Buyya and Prof. Andrzej Goscinski. I also contributed to two chapters to this book.

Member Self Profile: Dileban Karunamoorthy

I joined CLOUDS Lab in August 2009 in the capacity of a Research Fellow contributing primarily to the on-going research and development of a platform for building cloud applications. Aneka, one of the flagship projects in the research group, is an infrastructure for developing cloud-based applications capable of utilizing resources on the desktop, clusters, and on-demand resources from infrastructure-as-a-service providers.

Prior to pursuing a Masters in Distributed Computing (MEDC) at the University of Melbourne in July 2008, I was employed at IFS R&D, an ERP software vendor, since 2000. In the fall of 2008, after finishing my first semester at University of Melbourne, I began working as a part-time Research Assistant with the CLOUDS Lab group. In August 2009 after completing my degree, I joined the group as a full-time Research Fellow.

Throughout the year 2010 I continued to work on the Aneka platform, designing and implementing a number of features. Fault-tolerance through redundancy is a key feature in any distributed computing platform. I worked on implementing a multi-master failover mechanism for Aneka that employed the Bully Election algorithm to deterministically select an active master with a group of masters in the event of failure. This design was based on the mechanism used in the popular Oracle Grid Engine. I also made a few optimizations on the platform which reduced the data transferred for tasks on the platform by an order of magnitude resulting in lower latency, increased bandwidth efficiency and overall throughput of the system.

Capturing analytical data is vital in grid and cloud platforms giving useful insights on a number of aspects including the execution of applications, performance bottlenecks, failures, data transfers and resource utilization. I spent a fair amount of time implementing and integrating monitoring and reporting services in the platform which provided a means to capture such real-time data while applications were being executed.

Other areas that I worked on include securing communication within a group of Aneka containers in the network. The platform currently uses symmetric-key encryption where the key is preconfigured on all nodes that will form part of the Cloud. In future, the shared key will be exchanged at runtime using public-key cryptography. I also added support for: staging files from Amazon S3 repositories; managing and installing Aneka Daemons and Containers on Linux systems; began implementation for Share File Systems in order to better support running Aneka on clusters; certifying Aneka on HP clusters and Windows Server 2008 RC2; releasing Aneka 2.0 (a major release since Aneka 1.0 in the previous year) and engaged with customers and individuals interested in the platform. I also contributed to the following publications.

C. Vecchiola, R. N. Calheiros, D. Karunamoorthy, R. Buyya “Provisioning Resources for Scientific Applications in Hybrid Clouds with Aneka”, Utility and Cloud Computing 2010 (UCC 2010), December 14-16, 2010, Chennai, India. An extended version of this paper was submitted to a special issue on FGCS.

Member Self Profile: Dr. Bahman Javadi

In June 2010, I entered into my new role as a Research Fellow in the CLOUDS Lab appointed to work on the ARC Discovery Project “InterGrid: Peering Architecture and policies for Internetworking Disparate Grids”. This project aims to provide a software system that allows the creation of execution environments for various applications on top of the physical infrastructure provided by the participating Grids. The allocation of resources from multiple Grids to fulfill the requirements of the execution environments is enabled by peering arrangements established between gateways.

Since I join the CLOUDS lab, I mainly worked on the reliability issues in the InterGrid where there is ability to borrow some resources from public Cloud providers. To do so, I developed a simulation environment in GridSim with ability to simulate resource failures from Failure Trace Archive (FTA). I also developed a new package in GridSim for a workload model of cluster systems (i.e. DAS-2 system). Both packages and related documents have been released as part of GridSim 5.2 in November 2010.

Before joining the CLOUDS lab, I was a post-doctoral fellow in MESCAL team at INRIA, Grenoble, France. I have been working on following projects during 2008-2010:

1. Clouds@home: A project funded by the national French science foundation (called ANR) for running complex services and applications over unreliable (Internet) resources. This project is in collaboration with the INRIA MOAIS, GRAAL and Grand-Large teams, and also UC Berkeley.

2. Failure Trace Archive: FTA is a centralized public repository of availability traces of parallel and distributed systems, and tools for their analysis. The purpose of this archive is to facilitate the design, validation, and comparison of fault-tolerant models and algorithms. This effort is in collaboration with INRIA Bordeaux and TU Delft. The project is funded by an INRIA project called ALEAE. (website: http://fta.inria.fr)

For the list of publications and details about my past and current work, please visit my webpage: http://people.eng.unimelb.edu.au/bahmanj
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. My main duties are related to the InterCloud project, which aims at developing an architecture and system for Federation of Clouds, comprising Brokers (acting on behalf of users), Cloud providers (including IaaS, PaaS, and SaaS providers), and a Cloud Exchange which mediates interaction between parties. So far, I have focused in two different aspects of the project: (I) development of the InterCloud software, and (II) development of resource provisioning policies. For the first aspect, previous work from the group (including InterGrid) is being used, together with a new service-oriented architecture for InterCloud. For the second aspect, I've been researching provisioning approaches based on performance modelling and workload prediction in a single data center level.

During my previous visit to the CLOUDS Lab, I worked in the CloudSim project, and also contributed in related works such as CloudAnalyst. Therefore, I still collaborating in the support for these tools whenever users from these tools contact us. I've been also involved in collaborations with researchers from Vienna University of Technology (Austria) and from Pontifical Catholic University of Rio Grande do Sul (Brazil) in a work related to management of Cloud infrastructures.

Before joining the group, I received my PhD degree from the Pontifical Catholic University of Rio Grande do Sul (PUCRS), working with virtualization-supported distribution systems emulation.

My research interest include Cloud Federation, Resource Management in Clouds and Grids, Simulation, Emulation, and Virtualization.


I am currently working as Research Fellow under the supervision of Dr. Rajkumar Buyya in Grid Computing and Distributed Systems (GRIDS) Laboratory of The University of Melbourne. I completed my 5-year Integrated Master of Technology in Mathematics and Computing from the Indian Institute of Technology (IIT) Delhi, India, in 2006. After completing my post graduate degree, I joined the IBM Indian Research Laboratory Delhi, where I worked in the area of High Performance Computing. I designed and optimized the FFT and Random Access benchmarks for Blue Gene/L, which is the fastest supercomputer from IBM. Here in Melbourne University, I have been awarded with various scholarships such as Nicta-Topup Scholarship, MIFRS, and MIRS for my PhD candidature.

After joining GRIDS Laboratory, I conducted research in various research areas of Grid computing such as utility and market principles in grid computing, SLA based resource allocation, Meta-Scheduling etc. I developed my expertise in simulation modelling particularly in Grid Simulation Toolkits such as GridSim, CloudSim and Gridbus Broker. I also developed a simple design of meta-broker while working on Gridbus Broker.

During my PhD, I have developed up to now various market- and SLA-based policies for meta-broker which will map multiple resources to multiple Cloud consumers to achieve the balance in demand and supply, improve the throughput while maximizing the utilities of Cloud consumers and providers. I also examined the problem of contention at a resource by introducing a third party meta-broker which allocates resources to users in a coordinated manner. Currently I am working in the area of green and cloud computing to provision resources based on SLAs, Virtualization and energy consumption of infrastructure.

During year 2010, I have proposed various scheduling policies\textsuperscript{1, 2} in Clouds. These works are submitted and published in to International Journals.


Member Self Profile: Suraj Pandey

I am a PhD student at the CLOUDS lab. My supervisor is Prof. Rajkumar Buyya. My core research focuses on Scheduling and Management of Data Intensive Applications on Clouds. The year 2010 has been very productive for me.

I submitted my PhD thesis titled: “Scheduling and Management of Data Intensive Application Workflows in Grid and Cloud Computing Environments”. I received an educational grant of $US 6000 from Amazon AWS for software demonstrations using Amazon Clouds. The Victorian Life Sciences Computation Initiative (VLSCI) sponsored my travel to SC10, New Orleans, November 15-18, 2010, for presenting my work. I demonstrated my research work and software development at the Third IEEE International Scalable Computing Challenge (SCALE 2010), which was held in conjunction with the 10th IEEE International Symposium on Cluster, Cloud and Grid Computing (CCGrid 2010), Melbourne, Australia / May 17-20, 2010.

I supervised two Masters students in their final year projects. They are:

2. ShivaKumar Buyya, Applications Scheduling and Management System for Cloud Infrastructure, Major Project (CS-899), Department of Computer Engineering, NITK, Surathkal, India, April 2010.

My publications, including a Best Paper award, are as follows:

Member Self Profile: William Voorsluys

I joined CloudsLab in February 2008, when I started my PhD studies in the University of Melbourne.

In the past few years, before coming to Melbourne, I’ve been involved with aspects of grid and cloud computing, virtualization technologies and load balancing in distributed systems. This interest started back in the year 2000 during my undergraduate studies, when I developed load-balancing algorithms for heterogeneous clusters. Later, in my master’s research in the University of Sao Paulo, I’ve studied memory-related metrics that allow a precise evaluation of a system’s memory-usage, with the objective of aiding cluster load balancing policies to make better decisions.

From 2005 to 2008 I have worked as a researcher in the OurGrid project, a Brazilian grid computing initiative, which is dedicated to research and development of a peer-to-peer grid computing solution.

My PhD research aims at creating a provisioning and allocation mechanism for virtualised data centres. A key feature of my research is the concept of workload mobility. I’m taking advantaged of live migration and replication of virtual machines to achieve load balancing and fault tolerance capabilities.

More specifically, my research involves devising a mechanism that uses detailed information about resource utilization in each virtual machine to intelligently consolidate and redistribute the workload in a datacenter. I’m also working on fault tolerant policies to allow executing high performance computing application on variable pricing cloud resource (spot market).

My achievements in 2010 included: the publication of the first chapter of the book “Cloud Computing: Principles and Paradigms”, which is a survey of Cloud Computing technologies; a application-oriented work on ECG monitoring and analysing using cloud computing; and the advancement of my PhD studies towards the interesting topic of variable pricing cloud resources in high performance computing, which will yield results in 2011.

Member Self Profile: Anton Beloglazov

My name is Anton Beloglazov; I am from Novosibirsk, Russian Federation. I am a second year PhD candidate under the supervision of Prof. Rajkumar Buyya at the Cloud Computing and Distributed Systems (CLOUDS) Laboratory within the Department of Computer Science and Software Engineering, The University of Melbourne, Australia. I have joined the CLOUDS Lab in 2009 to pursue my PhD studies funded by Endeavour International Postgraduate Research Scholarship and Melbourne International Research Scholarship. Prior to my PhD, I have graduated from Novosibirsk State Technical University in 2006 with Bachelor’s degree followed by Master’s degree in 2008 in Computer Science and Engineering.

My PhD research topic is “Energy and performance efficient resource management in virtualized data centers for Cloud computing”. My current work is done under the Green Cloud Computing Project, http://cloudbus.org/greencloud/. It is focused on the development of policies and algorithms for continuous consolidation of virtual machines in virtualized Cloud data centers in order to minimize energy consumption, while maintaining the required Quality of Service. I have contributed to the development of CloudSim, an open-source Java framework for modeling and simulation of Cloud computing infrastructures and services.

In 2010, I have been awarded an internship at IBM Research India and spent three month in Bangalore working on a framework for IT service delivery simulation models. The research has aimed at understanding a variety of IT service delivery contexts and simulation models, extracting common elements, and implementing a library of reusable parts, to demonstrate the feasibility of this approach and its efficiency in generating new models of service variants. The work has leveraged the initial models created by the IBM Research teams in Watson and India and resulted in a product line structure for the family of models required by IBM's Global Delivery teams.

In 2010, I have completed a taxonomy and survey of energy-efficient data centers and Cloud computing systems. The taxonomy discusses major research challenges in energy-efficient resource management and covers four main management levels: hardware and firmware, operating system, virtualization and data center levels. The paper has been accepted to “Advances in Computers” edited by M. Zelkowitz. In 2010, my research work on energy-efficient dynamic consolidation of virtual machines has resulted in the following publications:


For the full list of publications and details of my past and current work, please visit my web-page: http://beloglazov.info/
Member Self Profile: Amir Vahid Dastjerdi

I am a second year PhD student, and conducting my research on “QoS-aware Service Deployment in Federated Clouds” under supervision of Prof. Rajkumar Buyya. In year ten 2010, I have been mainly studying optimization techniques and QoS management for web service selection which was resulted in a book chapter that is a taxonomy and survey of QoS management and service selection methodologies for Cloud Computing. Then, I have applied those techniques to find a way to deploying network of virtual appliances across multiple clouds. That work was completed and was submitted to CCGRID 2011 conference. In addition, I attended 2010 EII PhD School in Brisbane, where I have met students in the same area of research and enjoyed discussing our research problems and have also fun visiting some of other friends in ZOO(as depicted)!! My publication in year 2010 comes below:

Conference papers:

Book chapter:
Member Self Profile: Michael Mattess

I joined the CLOUDS lab at the beginning of 2008, when I commenced my masters by research at The University of Melbourne under the supervision of Professor Rajkumar Buyya. With this I returned to the department where I completed my undergraduate studies. During this Bachelor of Computer Science (with Honors) I investigated file systems and storage layer aspects of email systems.

Between the bachelor degree and commencing my masters I worked as a Software Engineer. In this role I develop an embedded system for the healthcare sector, which allowed for the integration of multiple systems found in hospitals. I also worked, amongst other things, on an IP based TV system.

For the most part of 2009 I was on leave-of-absence from my masters and worked as a consultant performing a diverse range of tasks. From building a virtualization cluster to reverse engineering legacy systems to writing a data migration application.

During 2010 I continued my research work, which is centered on the problems of offloading some processing of tasks to commercial cloud providers when the local infrastructure is overloaded. In late 2009 Amazon introduced ‘Spot Instances’, which have a varying, market driven price. Spot Instances were incorporated into my work, which was presented at the HPCC 2010 conference. This work was then further extended and additional workloads were investigated.

At the end of 2010 I also converted from a masters by research degree to a PhD. In 2011 entering the third year of the PhD as a confirmed candidate.

Member Self Profile: Mohsen Amini Salehi

I am Mohsen Amini Salehi, I have a Bachelor (2003) and Master degree (2005) in Computer Science, from Azad University of Mashhad and Ferdowsi University of Mashhad, Iran respectively. Currently I am a second year PhD student at the University of Melbourne, Australia. My main research interests are resource provisioning in resource sharing environments such as InterGrid and Combining Grid and Cloud computing resources.

In 2004, when I was still an undergraduate, I started to get interest on research management and scheduling. In that year, I joined a new research centre on high performance computing (Simorgh), in Computer center of Ferdowsi University. During the period of 2003-2005, I worked with resource management and load balancing in Grid computing under supervision of Dr. Hossein Deldari. In that period I developed tools, wrote research papers, and patents. In 2005, I moved back to Azad University of Mashhad as a faculty member and lecturer. Since 2005 up to 2008 I was teaching in Azad University of Mashhad in Operating System Concepts and Computer Networks. As a researcher I was working on Text Summarization Systems during that period and I could get a research grant on that area.

In 2008, I joined CLOUDS Lab, at the University of Melbourne, Australia, to pursue my PhD under supervision of Dr. Rajkumar Buyya. My research has been focused on resource provisioning in InterGrid, which extends my background in Master degree. However, different from my previous research, at this time I am considering environments which support lease-based resource provisioning. My thesis is on preemption-based resource provisioning in resource sharing environments such as InterGrid.

During 2009 and 2010, I worked with the scheduling of Bag-of-Tasks applications on local resources that can be extended to cloud resources. I proposed market-oriented scheduling policies, namely time-optimization and cost-optimization, along with considering other user constraints such as deadline and budget. I extended Gridbus Broker to be able to lease resources from Amazon EC2 (as a Cloud provider) and applied the proposed policies in Gridbus broker context. The paper published based on this research work got accepted in ICA3PP 2010 conference in Busan, South Korea. I attended the conference and present the paper there. Moreover, the research idea proposed and implemented got 3rd rank in IEEE Expo 2009, Melbourne.

I have also worked on providing resources for local users in InterGrid where there are different types of user requests. More specifically, we consider two major types of user requests namely, local users’ requests and Grid users’ requests. However, Grid users’ should be preempted in the case that there are not enough resources for coming local requests. The research paper resulted from this study was accepted and going to be published in Australian Computer Science Week 2011 Conference in Perth, Australia.

I am currently working on a scheduling policy in InterGrid Gateway (IGG) level. This scheduling policy schedules user requests on different sites of a Grid in a way that the minimum number of preemption occurs. The research paper resulted from this study has been submitted to Cluster Cloud and Grid conference (CCGRID2011) in US.

For the list of publications and details about my past and current work, please visit my webpage: http://www.csse.unimelb.edu.au/~mohsena
Member Self Profile: Linlin Wu

Linlin Wu is a PhD candidate under the supervision of Professor Rajkumar Buyya in the CLOUDS Laboratory at the University of Melbourne, Australia. She received Master of Information Technology from the University of Melbourne and then worked for CA (Computer Associates Pty Ltd) as Quality Assurance Engineer. Then she joined National Australia Bank (NAB) as a Knowledge Optimization Officer. Here in Melbourne University, she has been awarded with APA scholarship supporting PhD studies. She received the Best Paper Award from AINA 2010 conference for her first publication. Her current research interests including: Service Level Agreement, QoS measurement, Resource Allocation, and Market-oriented Cloud computing. She is the Vice Chair of IEEE committee at the University of Melbourne organizing industry and social activities for IEEE members.

Publications:


**Member Self Profile: Adel Toosi**

I started my PhD studies under supervision of Dr. Rajkumar Buyya in the Department of Computer Science and Software engineering at the University of Melbourne in July 2010. I received my B.Sc. degree in 2003 and M.Sc. degree in 2006 both in Computer Software Engineering from Ferdowsi University of Mashhad, Iran. Throughout my master degree, I mainly focused on the areas of network security, especially intrusion detection systems, and soft computing system such as fuzzy systems and genetic algorithms.

Before coming to Melbourne, I was working in Azad University of Mashhad as a lecturer, which I was responsible for teaching courses like Internet Engineering, Formal Languages and Automata Theory. During that time, I found various aspects of distributed systems fascinating so I decided to continue my education in this area. Finally, I joined the CLOUDS Lab to pursue my PhD studies. My PhD studies are funded by Melbourne International Research Scholarship (MIRS) and Melbourne International Fee Remission Scholarship (MIFRS).

Currently, I am studying different aspects of Cloud Federation particularly economic and market oriented issues to characterize my PhD thesis topic. My research interest is developing advanced reservation based on real option pricing in Cloud Federation. After joining CLOUD lab, I have contributed to the development of the InterCloud project, which is a service-oriented framework for Cloud Federation. During last 6 months of 2010, my contribution to this project can be summarized as follows:

1. Connecting Aneka (a platform-as-service Cloud Computing project) to InterCloud through new .Net connectors inside Aneka container.

2. Installing OpenNebula in local infrastructure and developing a Java interface for connecting InterCloud to OpenNebula resources.

3. Collaborating with Rodrigo N. Calheiros in writing codes and preparing experiments on an upcoming paper on InterCloud design and architecture.

For detail information about my current research and past publications, please visit my homepage:

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
- Application Targets include: ECG Monitoring and Analysis, Data Mining and Business Analytics, Brain Imaging (Dartmouth Medical School), and Geophysics (Intrepid).
- Open SensorWeb Architecture
- InterCloud – Peering and Federation of Clouds
- Content Delivery Networks
Gridbus: Middleware for Utility-based Grid Computing

Web: http://www.gridbus.org/

An Inaugural Knowledge Transfer Award Winning Project at the University of Melbourne

One of the flagship projects of the Cloud Computing and Distributed Systems (CLOUDS) Laboratory is the Gridbus Project, which covers various research sub-projects that look into the management of distributed resources and scheduling of applications on global Grids. The Gridbus Project is unique in that it explores the practical application of well-known economic theories to solve resource management problems in Grids. In addition to fundamental R&D, the Gridbus Project has also partnered with various scientific, engineering, and business communities in applying Grid technologies to solve various challenging problems in e-Science and e-Business domains. The Gridbus Project has advanced the discipline of Grid computing in the following ways:

- Carried out fundamental research in distributed resource management and application scheduling on global Grids.
- Pioneered the principles of Grid economy as well as techniques and mechanisms that enable the delivery of Grid services as utility-like services.
- Proposed several adaptive scheduling algorithms for deploying applications on global Grids based on users’ quality of service (QoS) requirements.
- Co-developed fundamental Grid technologies that enable the creation of scalable Grid environments as well as support the rapid development of Grid-enabled applications.
- Applied Grid technologies to several applications in collaboration with domain scientists, and deployed them both on national and international Grid infrastructure.

The research probes include:
- Service-Oriented Grid Architecture
- Grid Economy and Resource Management.
- Grid Service Broker
- Grid Workflows and Scheduling
- Service Level Agreements (SLA)-based Resource Allocation Systems (Libra).
- Grid Simulation Toolkit (GridSim).
- Resource Usage Accounting (GridBank).
- Grid Application Development Environment
- Open SensorWeb Architecture.
- InterGrid for peering and internetworking between islands of Grids
- Application Targets: Drug Discovery (WEHI), Neuroscience (HFI & Osaka Uni), Kidney Modelling, Natural Language Processing, High-Energy Physics, Catchment Hydrology (eWater CRC), and Financial Investment Risk & Portfolio Analysis (Spain).

The software developed as part of the Gridbus Project has been released as open source, which enables practitioners around the world to benefit from the products of the Grid research, carried out at the University of Melbourne. The Grid software technologies developed by the Gridbus Project such as Gridbus Broker, GridSim, and Alchemi have helped a broad range of people, from research students and established academics to industrial practitioners in institutions and enterprises around the world. Other activities such as training of students on real Grid projects, and tutorials and seminars in conferences around the world have produced benefits both in Australia and around the world. Therefore, by developing, sharing and teaching fundamental Grid technologies, the project has been able to make immense impact on scientific, engineering, and business communities around the world. Recently, the project received a large International Science Linkage (ISL) grant from the Commonwealth DEST to establish strategic research linkages with international projects based in Europe, USA, and Asia.
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.
Gridbus Broker: A Scheduler for Automatic Deployment of Applications on Global Grids

Web: http://www.gridbus.org/broker

The Gridbus broker is an advanced service-oriented meta-scheduler for compute and data Grids, with support for a wide range of Grid middleware and services. It takes care of many functions that Grid applications require including discovering the right resources for a particular user application, scheduling jobs in order to meet deadlines and handling faults that may occur during execution. In particular, the broker provides capabilities such as resource selection, job scheduling, job management and data access to any application that requires distributed Grid resources for execution. The broker handles communication with the resources running different Grid middleware, job failures, varying resource availability, and different user objectives such as meeting a deadline for execution or limiting execution within a certain budget. Hence, it makes Grids more appealing and approachable to user communities who want to access the increased computing power but are not familiar with using distributed systems.

The Grid Resource Broker has been used in a variety of scenarios and application domains by different scientific and business organizations. These include executing data mining programs on grid resources (European Union Data Mining Grid led by DaimlerChrysler and University of Ljubljana); integrating different kidney models and visualizing them (Melbourne Medical School and Université d’Evry, France); business applications (Infosys and HCL) and exploring semantics-based composition and trust in Grids (Anna University as part of the Indian National Grid), to name a few. The broker is hosted as an open-source project on Sourceforge.net, a website where any interested developer can join a project they are interested in, download the source code and contribute to it. This ensures that the latest source code from the Project is directly available to the public and partners/users are able to contribute towards further enhancement of our technologies.
QoS-Oriented Grid 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.


Fig. 1: Architecture of QoS-based workflow management and resource allocation system.
GridSim: A Toolkit for Modelling and Simulating Grid Computing Environments

Web: http://www.gridbus.org/gridsim

GridSim is a software platform that enables users to model and simulate the characteristics of Grid resources and networks with different configurations. GridSim is of great value to both students and experienced researchers who want to study Grids, or test new algorithms and strategies in a controlled environment. By using GridSim, they are able to perform repeatable experiments and studies that are not possible in a real dynamic Grid environment. Key features of GridSim are:

- Various allocation or scheduling policies can be made and integrated into GridSim easily, by extending them from one of the classes.
- Has the infrastructure or framework to support advance reservation, auction and Data Grid functionalities of a Grid system.
- Has the ability that reads workload traces taken from supercomputers for simulating a realistic Grid environment? This functionality is useful for testing a resource-scheduling problem.
- Incorporates a background network traffic functionality based on a probabilistic distribution. This is useful for simulating over a public network where the network is congested.

Research students in the CLOUDS Laboratory are themselves heavy users of GridSim and extend it whenever necessary for their own research needs. In the last 5 years, GridSim has been continuously extended in this manner to include many new capabilities and has also received contributions from external collaborators. In particular, National University of Singapore has contributed a QoS-based network module, and The University of Ljubljana has contributed a DataGrid module. Academic and industrial users of GridSim include: IBM, Unisys, HP, University of Southern California, France Telecom, Indian Institute of Technology, and Sweden’s Umeå University. The table below lists some of the more prominent users of GridSim.

Table 1: Various users of GridSim and their targeted application domain for simulation.

<table>
<thead>
<tr>
<th>Application Domain</th>
<th>Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Workflows</td>
<td>The University of Southern California, USA</td>
</tr>
<tr>
<td>Business Grids</td>
<td>IBM Research Lab</td>
</tr>
<tr>
<td>Grid Resource and Virtual Organisation</td>
<td>Umeå University, Sweden</td>
</tr>
<tr>
<td>Network modelling</td>
<td>National University of Singapore</td>
</tr>
<tr>
<td>Grid Security Studies</td>
<td>France Telecom</td>
</tr>
<tr>
<td>Scheduling Studies</td>
<td>University of Malay</td>
</tr>
<tr>
<td>Grid economics</td>
<td>Technical University of Catalunya, Spain</td>
</tr>
<tr>
<td>Grid Market Studies</td>
<td>Indian Institute of Technology</td>
</tr>
<tr>
<td>Semantic Grid Studies</td>
<td>Monash University</td>
</tr>
<tr>
<td>Utility-based Resource Management</td>
<td>The University of Manchester, UK</td>
</tr>
<tr>
<td>DataGrid Simulation</td>
<td>The University of Ljubljana, Slovenia.</td>
</tr>
<tr>
<td>Data Centre Modelling</td>
<td>Unisys, USA</td>
</tr>
<tr>
<td>Multi-Criteria Grid Scheduling</td>
<td>Poznan Supercomputing Center, Poland</td>
</tr>
<tr>
<td>Hierarchical Scheduling</td>
<td>Universidad Complutense de Madrid, Spain</td>
</tr>
<tr>
<td>Grid Network Buffer</td>
<td>The University of Castilla La Mancha, Spain</td>
</tr>
</tbody>
</table>
InterGrid: Peering Architecture and Policies for Internetworking Disparate Grids

Web: http://www.gridbus.org/intergrid

Grid computing enables the creation of Cyberinfrastructure for e-Research applications. Several nations around the world including Australia have developed their own national Grids based on the notion of virtual organisations. These dispersed Grid initiatives have resulted in islands of Grids without any support for peering arrangements between them. This limitation will impede realisation of full potential of the Grid computing paradigm. This InterGrid project aims to revolutionise Grid computing by investigating and developing (a) architectural principles for interlinking Grids, (b) mechanisms for resource provisioning and allocation within and across Grids and (c) peering policies and algorithms for inter-Grid resource management.

An Application Driver: Scientists from U.S.A, France, New Zealand and Australia have developed mathematical models of kidney functions and have been sharing these models via Grids. It is easy to extrapolate this to sharing of different models related to other organs that are developed within Grids dedicated to them. In order to build a complete model of the human physiology (e.g. IUPS Physiome Project) one needs the capability that supports composition of models from different Grids. These models may be discovered through distributed information services enabled by peering of such Grids, which are controlled by the respective communities. Realising this scenario requires participants to allocate resources from different islands of Grids in a seamless manner, and permit peering among Grids, which are under different administrative policies and political boundaries – as indicated in Figure 1.


Fig. 1: InterGrid-based Integrated Human Physiome Environment.
iCDN: Internetworking of Content Delivery Networks

Web: http://www.gridbus.org/cdn

Content Delivery Networks (CDNs) replicate content over several mirrored Web servers, strategically placed at various locations to deal with flash crowds and to enhance response time. The requirements for providing high quality service through global coverage might be an obstacle for new providers, as well as affecting commercial viability of the existing ones. Although many CDN providers exist, they do not cooperate in delivering content to end-users in a scalable manner. This project aims to provide a means for distinct CDNs to coordinate and cooperate with other CDNs, by investigating and developing (a) an architecture for an open and decentralized system to support effective internetworking between CDNs achieved through peering arrangement; (b) protocols for service delivery in a cooperative environment of CDNs; (c) economic models for an effective content replication policy; and (d) policies for autonomic management of service level through resource negotiation in an on-demand basis.

An Application Driver: An internetworking of CDNs is formed by a set of autonomous CDNs, which cooperate through a mechanism that provides facilities and infrastructure for cooperation in order to virtualize multiple providers. Architecture of a system to assist the creation of internetworking between CDNs is shown in Figure 1. Such a constellation permits flexible resource sharing and dynamic collaboration between autonomous CDNs in the form of Virtual Organizations (VOs). The 'resource sharing' approach in the internetworked CDNs model endeavours to balance a CDN's service requirements against the high costs of deploying customer-dedicated and therefore over-provisioned resources. Proper management and cooperation will enable a CDN to avoid violating SLAs even when the service demands could not have been predicted ahead of time.

Key Reference:

![Fig. 1: Architecture of a system to assist the creation of internetworked CDNs](image-url)
1. Grid Service Broker (v.3.1) Software
The Gridbus Project at the University of Melbourne (Australia) released a new version of the Grid Service Broker. The broker provides capabilities such as resource selection; job scheduling, job management and data access to any application that requires distributed grid resources for execution. The broker handles communication with the resources running different grid middleware, job failures, varying resource availability and different user objectives, such as meeting a deadline for execution or limiting execution within a certain budget.

With the current release, version 3.1, a new organizational structure is provided for the broker, wherein the core is separated from additional capabilities provided as plug-ins that can be selected according to usage requirements. A new Ant build file has been provided to enable selection of plug-ins and the automatic configuration of the broker thereof. Also available is a new external plug-in that uses the capabilities of the Gridbus broker to schedule grid workflows.

New features include:

- Plug-in structure for middleware and programming models.
- Ant build file for automatic downloading and configuration of broker installation.
- Workflow engine plug-in.
- Thread programming model plug-in (similar to Alchemi Grid Threads).

Gridbus in e-Science Enablement
The Gridbus Broker has been used in Grid enabling several e-Science and e-Business applications. The most recent usages include:

- European Union-funded Data Mining Grid Project, which developed set of grid-based data-mining tools and used Gridbus Broker in managing execution of data mining computations on global grids: www.datamininggrid.org/.
- KidneyGrid partners, including Melbourne Medical School and Université d'Evry (France), created a grid portal that integrated distributed kidney models.
- As part of the Australian National Grid (APACGrid), a portal for docking of molecules from CDB with protein target with the aim of discovery potential drug candidates: http://grid.apac.edu.au/OurUsers/MolecularDocking.

Base Technologies
The Gridbus Broker v3.1 supports/uses the following middleware: Globus 2.4.x, Globus 4.0.2, Alchemi 1.0.6, Condor 6.8.4, OpenPBS 2.3, SGE, NWS 2.8, SRB (Storage Resource Broker) 3.x
The Gridbus Broker v3.1 supports/uses the following programming model:

- Task/Job model.
- Gridbus Workflow.
- Grid Threading Programming Model.

The Gridbus Broker v3.1 can utilize a resource via SSH for submitting and executing grid jobs on: OpenPBS 2.3, Condor 6.8.4, SGE, Fork (on Unix-like OSes). The broker source code, binaries, documentation and manual can be downloaded from www.gridbus.org/broker/.
2. GridSim Toolkit 5.2

The Cloud Computing and Distributed Systems (CLOUDS) Laboratory at the University of Melbourne, Australia has released the next-version of Grid simulation software, the GridSim Toolkit 5.2.

This new version of GridSim brings a new package (i.e. gridsim.fta) that provides:

- A failure generator based on the Failure Trace Archive (FTA) format. The provided packages read the tabbed version of the failure traces and generate a list of events that show the availability/unavailability pattern for each machine in a grid resource. For more details, see the FTA web site (http://fta.inria.fr) and the following publication:
- one allocation policy for scheduling of bag of tasks on cluster systems in the presence of resource failures.
- An implementation of the parallel jobs workload model of DAS-2 for modelling the workload of clusters. Details about the workload model are available in the following publication:

The version 5.0 of GridSim brings a new package (i.e. gridsim.parallel) that provides:

- A graphical user interface for debugging resource allocation policies.
- Several allocation policies for scheduling parallel jobs on clusters and supercomputers. The policies include aggressive backfilling, conservative backfilling, advance reservation with conservative backfilling, selective backfilling and aggressive backfilling with multiple resource partitions. The allocation policies implemented are based on the following research papers:
- An implementation of the workload model by Lublin and Feitelson for modelling the workload of clusters and supercomputers. Details about the workload model are available in the following publication:
- A data structure to facilitate the scheduling of jobs and advance reservations. This data structure is described as an appendix on Marcos Assuncao's PhD thesis.
- Logging features using Java logging API.

In addition, other improvements have made GridSim more compatible with Java 5 and 6. Some bugs have been fixed and some changes in SimJava were required to enable a simulation to be paused and resumed.
All components developed as part of the GridSim Toolkit are released as "open source" under the GPL license to encourage innovation and pass full freedom to our users.

The early version of our GridSim toolkit has been used/downloaded by several academic and commercial organizations around the world including:

- University of Southern California (USA), California Institute of Technology (USA),
- Argonne National Labs (USA), University of Manchester (UK), CERN,
- Universidad de Santiago de Compostela (Spain), Indian Institute of Technology,
- Tsinghua University (China), Sun Microsystems, IBM Research, Unisys, HP,
- Northrop Grumman Information Technology, British Telecom and EMC Corp.

The contributors to the GridSim software (from early to new versions) are:

- Rajkumar Buyya, CLOUDS Lab @ The University of Melbourne.
- Manzur Murshed, GSCIT @ Monash University, Australia.
- Anthony Sulistio, CLOUDS Lab @ The University of Melbourne.
- Gokul Poduval and Chen-Khong Tham,
- Dept. of Electrical & Computer Engineering @ National University of Singapore.
- Marcos Dias de Assuncao, INRIA Lyon @ Ecole Normale Superieure de Lyon
- Uros Cibej and Borut Robic, Faculty of Computer and Information Service,
- The University of Ljubljana, Slovenia.
- Agustin Caminero, Department of Computing Systems,
- Universidad de Castilla La Mancha (UCLM), Spain.
- James Broberg, CLOUDS Lab @ The University of Melbourne.
- Saurabh Garg, CLOUDS Lab @ The University of Melbourne.
- Bahman Javadi, CLOUDS Lab @ The University of Melbourne.

To download the GridSim software, please visit the CLOUDS Lab web site at

http://www.cloudbus.org/gridsim/

Join the GridSim mailing lists at

http://sourceforge.net/projects/gridsim
3. CloudSim Toolkit 2.0: A Framework For Modeling And Simulation Of Cloud Computing Infrastructures And Services

The Cloudbus Project at The University of Melbourne, Australia along with collaborators from the High Performance Lab (LAD) at Pontifical Catholic University of Rio Grande do Sul (PUCRS), Porto Alegre, Brazil is proud to announce the release of the new version of its Cloud simulation software, the CloudSim.

One year has passed since CloudSim beta was released. Since then, Cloud computing has gained more visibility, and a plenty of new projects, both in academia and in the industry, emerged.

To help developers of such projects to evaluate new strategies and ideas before actual development, CloudSim 2.0 contains support for model and simulation of hot topics in Cloud Computing, including green/power-aware Cloud Computing and federated Cloud Computing.

At the same time new features were added, major improvements in simulation core allowed enhanced scalability and performance of simulations and insertion and removal of simulation entities during simulation execution. It increases considerably scenarios that may be addressed in simulations, what we hope will contribute to a wider adoption of the tool by the research community.

These improvements were possible due to extensive support from the Cloud Computing research community around the world, which used CloudSim, appointed bugs, and provided us feedback on new features they would like to have in future versions the toolkit. Community is invited to keep contribution to CloudSim.

As in its previous version, all components developed as part of the CloudSim Toolkit are released as "open source" under the GPL license to encourage innovation and pass full freedom to our users.

To download the CloudSim software, please visit the Cloudbus Project web site at http://www.cloudbus.org/cloudsim/

Publications:


4. Aneka 2.0: A Software Technology to Simplify .NET-based Enterprise Clouds
Manjrasoft Pty Ltd, Australia

Aneka is a Cloud Application Development Platform (CAP) for developing and running compute and data intensive applications. As a platform it provides users with both a runtime environment for executing applications developed using any of the three supported programming models, and a set of APIs and tools that allow you to build new applications or run existing legacy code. The purpose of this document is to help you through the process of installing and setting up an Aneka Cloud environment. This document will cover everything from helping you to understand your existing infrastructure, different deployment options, installing the Management Studio, configuring Aneka Daemons and Containers, and finally running some of the samples to test your environment.

The Aneka 2.0 distribution comes with the following features:

- **Application Catalogue Service**
  - Implemented Platform independent management protocol
  - Central software repository for software installation and update
  - Implemented Node gateway to control the node services

- **Reservation Integration**
  - Integrated Reservation services into Aneka codebase
  - Integrated the existing Allocation services into Aneka codebase

- **Enterprise QoS**
  - Added Cost-Optimization Job Scheduling
  - Added Time-Optimization Job Scheduling
  - Added User Modules into Design Explorer enabling selection of QoS

- **Cloud Deployment**
  - Full support for Amazon EC2 (static deployment and dynamic deployment)
  - Full support for Xen Virtualization
  - Static deployment via Xen VM: Dynamic deployment via Xen API
  - Full support for GoGrid (static deployment and dynamic deployment)

- **Logging Service**
  - Added logging service that manage the log information in each node
  - Added logging management GUI to view the log information

- **Dynamic Resource Provisioning Scheduling**
  - Added intelligent algorithm to dynamic provisioning service to auto scale the resources based on QoS

- **Reporting Service**
  - Provided service capability to report its own properties to the Aneka container
  - Implemented the Reporting service that handles queries related to various reporting activities including billing, metering, and usage
  - Enhanced GUI to provide statistics for various reporting activities
  - Configuration Utilities: Implemented customizable configuration facilities that will be used when configuring various Aneka services

Download:
http://www.manjrasoft.com
11. Moments with Visitors, Colleagues and International Hosts

CLOUDS Lab members (most of them) in front of the ICT building.

Suraj receiving the Best Paper Award at AINA 2010 Conference.
During Eureka Award Dinner in Sydney with Srikumar

A seminar in Korea University, Seoul