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Grid Economics and Business Models

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Preface

The Grid computing concept, which allows users to integrate administratively and geographically dispersed computing resources, has been gaining traction in a number of application areas during the past few years. By interconnecting many – heterogeneous, though usually virtualized – computing resources, virtual computer centers or supercomputers can be created, providing a seamless supply of computing resources. Grid computing provides benefits not only for scientific computing (e.g., SETI@home, which interconnects one million computers across 226 countries with a total processing power of 711 TFLOPS) but also in a commercial environment. It is projected that computing Grids can lower the total IT costs of businesses by 30%.

The report "Grid Computing: A Vertical Market Perspective 2005–2010" (by The Insight Research Corporation) estimates an increase of worldwide Grid spending from $714.9 million in 2005 to approximately $19.2 billion in 2010. One of the most prominent activities in academia is the EGEE project being funded with 30 MEuro by the European Commission. EGEE brings together researchers from over 27 countries with the common aim of developing a service Grid infrastructure, which is suited for scientific computing with very high demand for processing power.

Despite existing Grid technology and commercial needs, up to now, not many Grid service offerings exist. One of the few examples is Amazon. It has floated the idea of Cloud Computing with the Elastic Compute Cloud service, which has introduced a business model based on virtualized Grid infrastructures. More sophisticated market places such as zimory.com or strikeiron.com have emerged, selling more complex Cloud services dynamically.

However, even though there are some examples in the commercial area and Grid technology has been adopted strongly in academia (eScience), the general adoption by companies has been slow. The reasons are mainly due to the lack of viable business models coupled with chargeable Grid services and commercial transactions on them. What is needed is a set of mechanisms that enable users to discover, negotiate, and pay for the use of Grid services. According to a report by The451Group, the application of resource trading and allocation models is one of the crucial success factors for establishing commercial Grids.

The 5th International Workshop on Grid Economics and Business Models, GECON 2008, served as a forum for the presentation of current and innovative research results pertaining to the above-mentioned issues with special focus on business models and Grid computing technology. The review process attracted prime research papers on amendments to existing technologies, aiming at the successful deployment of global, commercial service-oriented Grid systems. The workshop received a great deal of attention, obtaining 27 high-quality research papers from researchers and practitioners worldwide. Of those, 10 were accepted, constituting an acceptance rate of 37 %. Each paper was reviewed 3 times at least and in average 3.6 times.

The first paper, "Business Value Chains in Real-Time On-line Interactive Applications" by Mike Surridge, Justin Ferris, and E. Rowland Watkins, presents an in-depth

analysis of value chains for the application areas of online gaming and e-learning, an initial implementation, and the implications for constructing value chains using bipartite and bi-directional Service Level Agreements.

The second contribution, entitled "Cost Analysis of Current Grids and its Implications for Future Grid Markets" by Marcel Risch and Jörn Altmann, analyzes the question whether using the Grid is financially advantageous over owning resources. Amazon's EC2 service is used as a reference. The comparison of the costs reveals that Grid is cheaper in the short run but not so in the long run.

In the third paper, "Business Relationships in Grid Workflows" written by Ioannis Papagiannis, Dimosthenis Kyriazis, Magdalini Kardara, Vassiliki Andronikou and Theodora Varvarigou, an approach for modeling strategic business relationships is described. As these relationships affect the offered Quality of Service (QoS) level, a metric for characterizing a service provider's "friendliness" is introduced.

Lior Amar, Ahuva Mu'alem and Jochen Stößer showcase "The Power of Preemption in Economic Online Markets" settings by extending the decentralized local greedy mechanism. This mechanism is known to be 3.281-competitive with respect to the total weighted completion time. The authors show that the preemptive version of this mechanism is even 2-competitive. In addition to this, they provide an in-depth empirical analysis of the average case performance of the original mechanism and its preemptive extension based on real workload traces.

In the fifth contribution "Market Mechanisms for Trading Grid Resources", Costas Courcoubetis, Manos Dramitinos, Thierry Rayna, Sergios Soursos, and George Stamoulis present a market for hardware providers and consumers, who are interested in leasing Grid resources for a certain time period. The proposed market mechanism comprises a stock-market-like mechanism that enables the trading of computational resources on a spot and a futures market. This Grid market is more complicated than the standard spot/futures markets of storable commodities, because of the fact that the computational services traded are perishable and need to be described in terms of quantity and duration.

The contribution of Nikolay Borissov, Arun Anandasivam, Niklas Wirström, and Dirk Neumann titled "Rational Bidding Using Reinforcement Learning: An Application in Automated Resource Allocation" proposes an agent-based bidding procedure for participating in Grid markets. The paper introduces a scenario, which demonstrates the components and methodologies for automated bid generation. In addition to this, the authors introduce a reinforcement learning strategy for agents enabling agents to generate bids and asks rationally. This strategy is evaluated against a truth-telling bidding strategy.

In the seventh contribution, Davidi Maria Parrilli discusses tax issues in decentralized computing environments in his paper titled "Grid and Taxation: the Server as a Permanent Establishment in International Grids". Taxation can be a barrier to the development of international Grids. Based on his analysis of the current taxation approaches, he makes suggestions for amendments.

The eighth paper, "The Pricing Strategy Analysis for the Software-as-a-Service Business Model" by Ma Dan and Abraham Seidman, presents an analytical model of the competition between software-as-a-service and the traditional commercial off-the-shelf software. The authors find that the two distribution channels could coexist in a

competitive market in the long run. However, they show that under certain conditions software-as-a-service could gradually take over the whole market for software.

Carmelo Ragusa, Francesco Longo, and Antonio Puliafito describe in their contribution "On the Assessment of the S-Sicilia Infrastructure: a Grid-Based Business System" the S-Sicilia project, a 2-year collaboration between Oracle and the COMETA consortium that targets at setting up a Grid-based business infrastructure to provide business services with guaranteed QoS to companies. It is intended to make it a benchmark infrastructure, with which other scenarios can be compared.

Omer Rana, Martijn Warnier, Thomas Quillinan, and Frances Brazier identify in their paper "Monitoring and Reputation Mechanisms for Service Level Agreements" a lack of research on SLAs. This paper addresses how SLOs may be impacted by the choice of specific penalty clauses. It is devoted to the specification of penalties within the Web Services Agreement (WS-Agreement) negotiation language and how clauses can be enforced based on monitoring the SLAs.

In addition to these papers, we received many paper submissions from research projects on Grid economics, giving an overview of current and ongoing research in this area. Out of these submissions, we selected papers from nine projects (ArguGrid, AssessGrid, BEinGrid, BREIN, D-Grid, Edutain@Grid, Grid4All, GridEcon, and SORMA). These papers can be grouped into three categories. The first category comprises papers on business modeling. The paper contributions in this category come from BEinGrid, Edutain@Grid, and Brein. The second category, which addresses Grid markets, includes papers from SORMA, GridEcon, and Grid4All. In particular, these papers describe market places, market mechanisms, and market-based resource allocation schemes. D-Grid, ArguGrid, and AssessGrid contributed papers to the third category. This category is characterized by papers on Grid architectures.

Finally, we would like to thank the organizers of the 2008 Euro-Par conference, in particular Emilio Luque, for their support in hosting the GECON 2008 workshop in Las Palmas, Spain. We would also like to thank Alfred Hofmann and Ursula Barth from Springer, who ensured a very efficient publication process. Finally, our highest gratitude goes to Sonja Klingert. Without her dedication and substantial efforts in preparing the manuscript, these proceedings would not have been ready on time.

August 2008

Dirk Neumann
Jörn Altmann
Thomas Fahringer

Organization

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