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Defining Efficient Business Models for Grid-enabled Applications

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Abstract: Driven by the increasing demand, Grid technology is entering the business market in form of utility computing, Grid middleware and Grid-enabled applications. However, the business market is interested in complete Grid solutions. Thus, a successful take up of Grid technology on the business market requires the establishment of Grid value networks. This again can only be achieved by implementation of sound business models for each player providing part of a Grid solution. This paper discusses the business models of providers of Grid-enabled applications.

Keywords: Grid Business Models, Business Grids, Grid-enabled Application

1 Introduction

Newest market research studies report a growing awareness for the potential of Grid technology by industry and increased interest for utility computing and Grid solutions for business application. This trend has been enforced in particular by well-established Internet companies, for example WebEx, Amazon, AOL, who offer their services in form of utility computing [1]. Other players driving utility computing are the telecommunication companies such as T-Systems in Germany. A growing interest for Grid computing can also be observed with Independent Software Vendors (ISV) [1]. This is mostly evident in vertical markets with strong Grid interest for applications that are suitable for Grid (for example data mining).

Driven by the growing interest and demand on the market, Grid technology is entering a new level of maturity and is offered on the business market in three forms [3]: 1) as open source or packaged Grid middleware; 2) as utility computing, that is as hardware and software infrastructure provided according to the Software as a Service (SaaS) paradigm, and 3) in the form of Grid-enabled applications. However, business customers are interested in complete Grid solutions. This means that for a successful take up of Grid technology on the business market the establishment of Grid value networks [15] is required that will be able to provide complete solutions and a critical mass of offerings on all levels of the value network. This again can only be achieved by implementation of sound business models for each player providing part of a Grid solution. While there is a growing body of literature on business models or specific components of them for the utility computing market [3], [15], there is less consideration of business models from the perspective of the providers of Grid applications. This paper provides a contribution in this context and discusses the main

aspects of business models of ISV evolving their products from pre-packaged applications towards Grid-enabled application.

The content of the paper is structured as follows: Section 2 provides an overview of state-of-the-art research related to grid-enabled application and the research approach. Section 3 provides an analysis of business models of pilot applications developed as part of the BEinGRID project and their challenges and obstacles driven from those. Section 4 provides a set of guidelines and considerations for the development of business Models for the provision of Grid-Enabled Applications. Finally, Section 5 concludes the paper with a summary and outlook.

2 State-of-the-art and Research Approach

The term “Grid-enabled application” is used in this research paper to denote a software application that has been offered on the market as pre-packaged software and that is being extended in a way that it can run in a distributed manner in a Grid environment. To Grid-enable a pre-packaged software product therefore means that a previously pre-packaged centralized application is enabled or modified to run either on a distributed Grid infrastructure or to be offered as an online service based on the Software as a Service paradigm (SaaS) (see also [4]).

At the first glance the business models of ISVs offering Grid-enabled applications seem similar to the well-known business models of Application Service Providers (ASPs). However, there is a significant difference. The core competence of the ISP is the development of the application itself and not its distribution. On the contrary, the core competence of the ASP is the online provision of applications that are mostly developed by other ISV. Despite of the difference regarding their business models, key learning's from the experiences with the ASP business model can be applied during the development of business models for Grid-enabled applications. Even though ASP was foreseen to be successful, it did not take up on the market and its adoption has been very slow [7]. The main reasons for the failure have been: the inability of early ASPs to produce customized services, the centralized approach for computing, which requires the sending of input and output data and the general lack of trust in the ASP paradigm [6], [7], [9].

At present, the business models for the provision of Grid-enabled applications and ASPs are converging. The convergence of web services and Grid computing technologies is expected to solve current ASP delivery problems [6], [9].

There is a considerable body of literature related to components of business models as well. The definitions range from very broad ones (see for example the definitions proposed by [10] or [11]) to very specific ones (see for example [12] or [13]). While such definitions try to delimit the scope of the meaning of the concept business models, they do not provide insights into components of business models in such a way that it can be used for assessing the activities of a company in more detail. A more concrete definition is the definition of Timmers [14]. According to Timmers, a business model is "*…an architecture for the products, services and information flows, including a description of various business actors and their roles, a description of the potential benefits for the various business actor, and a description of the sources of revenues.*" [14]. Our study of business models for the Grid sector has been performed following this definition i.e. the analysis of all these components and the interactions among them.

To be more precise, for the purpose of our study the business models of technology and application providers were analyzed based on case studies of Grid pilots from the BEinGRID project (www.beingrid.eu – www.gridipedia.eu), an Integrated Project (IP) funded by the European commission under FP6. One of the main objectives of the project is to evaluate the applicability of Grid technology in business through Grid business

experiments. In the heart of the project there are 18 business experiments that are piloting Grid technology in various key industrial sectors.

In this paper the business models of the BEinGRID real-life pilots focusing on Grid-enabling applications were analyzed. The findings of the analysis were aggregated to a generic business model for providers of Grid-enabled application. The resulting business model can be applied by providers of Grid-enabled applications as a checklist for developing successful business models.

3 The Business Models for Grid-Enabled Applications in the BEinGRID Project: Challenges and Obstacles

Based on the results of our investigation and cross-analysis of the BEinGRID business experiments, out of the 18 pilots six are aiming towards business models for providing Grid-enabled applications:

- Business experiment (BE) BE16 has developed a Grid-enabled extension of an existing application for ship design and simulation so that it can be offered in cooperation with an infrastructure provider in a SaaS manner.
- BE18 Grid-enabled an existing application for processing of seismic data and plans to offer the service over the Internet in particular to small and medium size enterprises.
- BE07 Grid-enabled an existing application for generation of global aerosol maps using information coming from different satellite sensors.
- BE03 has Grid-enabled an application for 3D rendering and animation.
- BE12 and BE17 are Grid-enabling existing application for supply chain management.

The in-depth analysis of the business models of the above BEs has revealed several advantages and obstacles that need to be considered during the design of the business model. The main advantages are: From the perspective of the ISV the enhancement of an existing application clearly provides a valuable extension of the existing application portfolio. In addition to that, most of the above BEs can achieve a broad competitive advantage, as most of them can leverage a first-mover advantage. In particular for the small ISV (BE12 and BE17) to Grid-enable their application provides a clear competitive advantage and also a needed precondition to stay on the market. To offer the Grid-enabled version of the application also results in an image gain for the companies. For most of the companies the Grid-enabled version of the application is applied to approach a new category of target customers - small and medium size companies.

The main obstacles that need to be overcome are the following: At present all providers of Grid-enabled applications need to establish sound business relationships with utility computing providers, in order to be able to offer a complete solution. This means that the establishment of the whole value chain is necessary. Another major obstacle is the fear of cannibalization effects for the existing centralized application. As the described applications demonstrate, the applications that are being Grid-enabled are those that are needed by the customer companies occasionally. This means that by talking advantage of the SaaS scenario, the customers might try to optimize the usage and pay less than for the licenses for the centralized application. Thus, the existing licensing strategies involving in general a fixed license fee and a variable license fee per user or per CPU needs to be transferred in pay-per-use pricing model that on the one hand meets the expectation of the customers that SaaS should imply lower prices and at the same time enable the ISV to justify the financial risk and sunk costs for development of the application and making it available.

The above findings have been considered for the development of generic business models presented below.

4 Guidelines and Considerations for the Development of Business Models for the provision of Grid-Enabled Applications

Based on the findings from the case studies, general guidelines for the development of the business models were developed. Considering the above obstacles the main emphasis in this paper was on the following components of the business model: design of the product, pricing and legal aspects. The findings are explained in more detail in the sections below.

4.1 Design of the product and licensing

The design of the Grid-enabled application needs to address in particular the cannibalization problem. A careful strategy is necessary, in order to keep existing customers that do not want or cannot use the Grid-enabled application and to meet the requirements of new customers (see also [16]). An important question is: Are different versions for different customer segments and licensing strategies possible and in which form? The problem can be illustrated on the following example:

One ISV offers an application with a given set of functions to the market. A Grid-enabled version of the application is also developed. However, not all of the existing customers have a Grid infrastructure and cannot apply the new functionality. They would like to stay with the centralized version of the application. A small number of the customers already owns a Grid infrastructure and would like to take advantage of the new functionality. These are also the customers that have a high volume of transaction and would also be willing to pay more for the enhanced application. The ISV gets furthermore requests by smaller companies for an occasional use of the application based on the SaaS paradigm. After a certain time a cooperation with a Grid infrastructure provider is agreed upon and the application is also available on a SaaS basis.

The question now is how the different categories of the products should be defined and which licensing and pricing strategy should be defined? A low price for the SaaS application might result in the effect that existing customers of the centralized application - in particular those that use the application occasionally - switch to the SaaS application and save on the licensing costs for the central version of the application. In order to avoid such effects, a carefully designed packaging of the functionality of the different versions of the application together with the licensing and pricing strategy is necessary. The different options regarding versioning of the products are discussed below.

- **Versioning option 1:** Offering the application in the form of pre-packaged software with and without Grid enhancement and without SaaS option (c.f. 2):

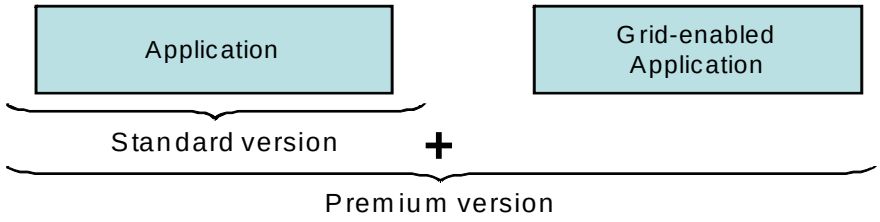

Figure 1: Standard and premium version of a Grid-enabled application sold as commercial product

The versioning example given in Figure 1 enables to keep the existing customer base and the established licensing models for the existing application and provide a premium version for customers that have an own Grid infrastructure. This versioning option provides the opportunity to keep the licensing strategies (for example per user or CPU) and request different prices for the two different versions, to target customers with different needs as well as for additional revenues as the Grid-enabled application, i.e. version can be offered with licenses involving higher prices for it.

- **Versioning option 2:** In case the application is available as a centralized application, Grid-enabled application and SaaS, several different options for versioning and packaging are possible. One possible example is given in figure 2 below.

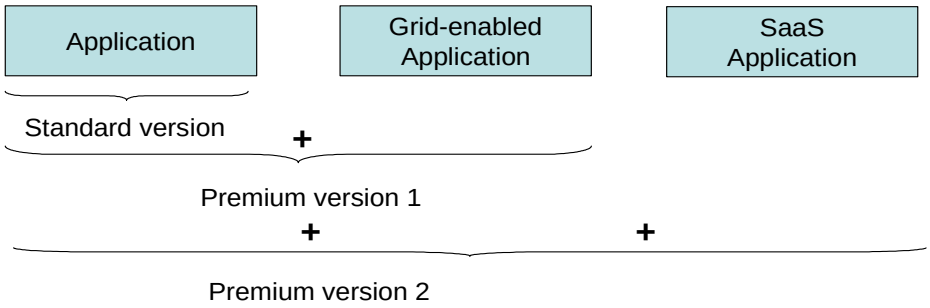

Figure 2: Example of versioning strategies based on three product categories

As in versioning option 1 there might be a standard and a premium version if it is bought by the customer together with the Grid enhancement. The question here is how the SaaS version can be included in a way that it might be suitable to also attract new customers, for example SMEs that cannot afford the premium 1 version, but at the same time not provoke a massive switch from the lucrative licenses for the central pre-packaged application by existing customers. One option is that customers opting for the premium version 1 can add also access to the SaaS version and pay additionally per use, if in addition to their own Grid they use also the SaaS. A similar option might be available for the customers with the standard version of the application. The question is how to differentiate the SaaS version and to prevent cannibalisation of the centralised pre-packaged application. Depending on the target customers, one possibility would be to differentiate the pre-packaged application and the grid enabled application offered as SaaS based on the functionality. For example, if the target customers for the SaaS Grid-enabled application are SMEs than one possibility would be to limit the functionality of the SaaS version or to differentiate a "light" version with respect to the output options or other functionality that are available. For example, an SME that wants the functionality as SaaS might get the output data only in a basic format, while premium customers of the pre-packaged version get it with an option to create different formats. Similar differentiation of the quality of the service can be made also based on other features of the product and service (see also [16]).

How exactly the existing functionality can be packaged in the three product categories and which versions are possible depends on the modularity of the software, the existing customer base, the target customers and the potential for segmentation of the customers depending on their willingness to pay and their specific needs. A good knowledge of the usage patterns of customers as well as their willingness to pay is therefore a clear advantage in determining the right versioning and pricing strategy.

4.2 The Price Strategies of the BEinGRID Business Experiments

The pricing strategy involves two components: the pricing model and the definition of the prices. The major general pricing models for Grid enabled applications are the Pay-per-use pricing models. Thereby, in general the price includes two components: a price per use for the utility computing and a price per use for the Grid-enabled application. A benchmark for pricing the first component of the pricing model might be the published price of SUN of 1$/hour computing resources or the pricing strategy of Amazon: 0.20$ per GB stored or to hire a complete virtual PC for $0.10 per hour. The second pricing component, i.e. the pay-per-use price for the Grid-enabled application includes also the license. Towards the

customer this pricing model is either expresses as a single all-in-one price or as a price consisting of two components.

The definition of concrete pricing depends on the specific product. In case where different versions of the product are involved, pricing should not affect the product strategies. For example: BE01 found during the competitive analysis that a license for computational fluid dynamics software can vary from £10'000 to £15'000 per single CPU license and go up to £100'000 for 64 CPUs. In case such an application is Grid-enabled, the question is what the right price might be. Several aspects need to be considered: The typical usage patterns of an average customer, the market prices for similar services and the costs of the provider. For example let's assume that in case of SaaS the same number of CPUs is used. How can the license per CPU be expressed per hour of usage? If a price that is too low is chosen then the ISV does not have interest to provide the application as SaaS as he will lose revenue. In case data about the usage patterns of customers are available the actual average usage per year could be transformed in a price. For example, the provider knows that an average customer is using the application 50% of a person's yearly working time per user. This would mean that the application is used by a typical user for 840 working hours (assuming a yearly total of working hours of 1680). Thus, in order to get the same revenue from the user based on a SaaS version of the application a price of £12 per hour for the application would be required (assuming a basic license of £10'000 for a single CPU) in addition to the pay per use price for the computing infrastructure on which the application runs. In a similar way based on average usage patterns and total number of users a potential price might be calculated.

4.3 Legal Aspects

The analysis of the project's cases shows that in addition to business aspects, major legal issues have to be addressed as well [18].

It is pivotal to address, as starting point, what is, in legal terms, the agreement that encompasses the provision of SaaS. This, of course, depends on the applicable national legal framework but, in general it means to set up an ASP contract. The provision of SaaS implies that there is no physical item delivered to the end user and that, unlike in the contract between a customer and a software house for the writing of a specific computer programme, the software provider keeps the ownership of the application. In case of due diligence, for instance, this element has to be taken into account, as the software can be considered as an asset (and not a liability) of the targeted company only if this undertaking has the ownership of the software.

The service provider will limit as much as possible the rights of the client, which could use the SaaS only during its ordinary course of business, thus he will be liable for breach of contract if, in practice, he sublicenses the supplier's applications. It is pivotal to say that the parties, by virtue of their contractual freedom, would have the possibility to adapt the above clause to their exigencies. As regards the code provided to the client, in a typical SaaS scenario the object of the contract will concern the object code and not the source code.

The contractual freedom of the parties plays a fundamental role also as regards confidentiality obligations. This issue is particularly complex and the experience gained shows that the relative clause should address at least the following issues:

- Extension of the confidentiality obligations of the supplier and the client as regards, basically and respectively, the data of the customer and the executable code of the software;
- Duties of the parties;
- Contractual and Court remedies, taking into account that the latter are heavily influenced by the applicable national legal framework;
- Exceptions to the rule, i.e. situations in which there are no confidentiality obligations.

We have developed the following template that encompasses the abovementioned elements and that is suitable to be adopted in case of SaaS in a Grid environment: "Customer shall not sell, transfer, publish, disclose, display or otherwise make available any portion of the executable code of the Application to others. Client agrees to secure and protect the Application and the Service in a manner consistent with the maintenance of Supplier's rights therein and to take appropriate action by instruction or agreement with its users to satisfy its obligations hereunder. Client shall use its best efforts to assist Supplier in identifying and preventing any unauthorised access, use, copying or disclosure of the Application or the Service, or any component thereof, or any of the algorithms or logic contained therein. Without limitation of the foregoing, Client shall advise Supplier immediately in the event Client learns or has reason to believe that any person to whom Client has given access to the Service has violated or intends to violate the confidentiality of the executable code of the Application or the proprietary rights of Supplier, and Client will, at Client's expense, cooperate with Supplier in seeking injunctive or other equitable relief in the name of Client and Supplier against any such person.

Client agrees to maintain the confidentiality of the executable code of the Application using at least as great a degree of care as Client uses to maintain the confidentiality of Client's own confidential information (and in no event less than a reasonable degree of care). Client acknowledges that the disclosure of any aspect of the executable code of the Application, including the documentation or any other confidential information referred to herein, or any information which ought to remain confidential, will immediately give rise to continuing irreparable injury to Supplier inadequately compensable in damages at law, and Supplier is entitled to seek and obtain immediate injunctive relief against the breach or threatened breach of any of the foregoing confidentiality undertakings, in addition to any other legal remedies which may be available. In addition, Supplier may immediately terminate this Agreement, including all license rights granted herein, in the event Client breaches any of its confidentiality obligations regarding the Application or the Service.

Furthermore, Supplier agrees that it shall not disclose to any third party or use any information proprietary to Client including information concerning the Client and the users, trade secrets, methods, processes or procedures or any other confidential information of the other party which it learns during the course of its performance of the Service, except for purposes related to Supplier's rendering of the Service to Client under this Agreement or as required by law, regulation, or order of a court or regulatory agency or other authority having jurisdiction there over. In addition, Client may immediately terminate this Agreement in the event Supplier breaches any of its confidentiality obligations set forth herein. Notwithstanding the foregoing, the confidentiality obligations set forth in this Article will not apply to any information which the recipient party can establish to have: (i) become publicly available without breach of this Agreement; (ii) been independently developed by the recipient party outside the scope of this Agreement and without reference to the confidential information received under this Agreement; or (iii) been rightfully obtained by the recipient party from third parties which are not obligated to protect its confidentiality."

5 Conclusions and Further Work

The goal of the paper was the discussion and development of efficient business models for the providers of Grid-enabled applications. Based on five in-depth case studies first major advantages and obstacles for developing business models for Grid-enabled application were identified. Then, general guidelines for the design of the product, the pricing strategy and the legal issues related to provisioning applications in a SaaS manner have been developed. The core consideration has been the avoidance of cannibalization effects of Grid-enabled application offered based on the SaaS paradigm with pre-packaged applications. ISV opting

to extend their product portfolio with a Grid-enabled version of their application need to carefully version and price their applications depending on the target customers, existing customers and their needs as well as knowledge about the usage pattern of the applications. Finding the right licensing and pricing model is a major prerequisite for developing successful business models for Grid-enabled application.

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