Providing an E-Learning Platform in a University Context – Balancing the Organisational Frame for Application Service Providing

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Content

Abstract

Universities have severe difficulties in using elearning applications successfully due to organisational problems to provide them. Providing a web-based learning environment is an enormous effort not only from the didactical and organisational perspective, but also from an administrative and technical point of view. In this paper we critically review two case studies for making software available in a university context by applying a model for application service providing.

ASP in the university context is a different business than ASP between companies. A much more flexible relation between service provider and consumer needs to be established. We describe the necessary process that is based on an evolutionary approach consisting of repeated loops that help to balance the organisational frame for application service providing on the four different levels: application domain, organization, services, and contracts.

1 Introduction

CommSy is a platform designed for asynchronous learning networks which has been developed at the University of Hamburg [22]. Due to its success and the enormous amount of people using it (more than 2500 accounts and 200 virtual project rooms on each of two servers running publicly) the provision of a CommSy server became a project of its own and is an example for application service providing in university contexts [4]. Although much research has been invested in frameworks for application service providing (ASP) of commercial off the shelf software (COTS) these approaches seldom take into account the special requirements and conditions observed in teaching environments like universities. We therefore developed a process for aligning the contract to the consumers' needs by at the same time fulfilling the provider's economic conditions.

In this paper we will first take a look at characteristics of existing ASP relations and introduce an evolutionary sight on ASP. Secondly, we briefly list the criteria for ASP in a university context, examine and compare two exemplary approaches for providing software at universities. Thirdly, we present our evolutionary approach for CommSy pointing at the special conditions taken care of and its applicability for other potential software in this area. In concluding we critically review the existing models and the progress gained. Finally, we take a look at the current activities for permanently providing CommSy for the University of Hamburg.

2 Characteristics of ASP Models

We found many different definitions of Application Service Providing in the ASP literature (see e.g. [1] [7] [10] [11] [13] [25] [26] [27]). In these sources ASP is described from different views, on different levels of detail and usually only Application Service Provid*ers* as organizations instead of Application Service Provid*ing* as the process are the main interest of the authors. We focus on Application Service Provid*ing* (ASP) and define ASP as the provision of an application (or many applications) as a service for many customers via internet technology. The following tasks must be performed to provide an application in an ASP model (see e.g. [1] [4] [11] [13] [23] [25] [26]):

- *Application development*: Meaning the production, bug fixing and further development of an application.
- *Hosting*: Referring to the provision of the application and the provision and maintenance of necessary technical infrastructure (e.g. server soft- and hardware).
- *Network access*: Meaning the establishment, configuration and maintenance of the connection between the application and the users.
- *Marketing*: The presentation of the offered services, market analysis and acquisition of customers.
- *Customer support*: accounting services used, integration of the application in the customer organization, negotiation of ASP agreements, development of financing models, …
- *User support*: User support means all arrangements that users allow to use the application adequately in their typical working situations. E.g. hotline, coaching, training, …
- *Hardware delivery*: There is a lot of hardware necessary to provide an application in an ASP model. Concerning the ASP model we abstract the production of the hardware needed but see the delivery as a field of activity.
- *Software delivery*: In addition to the core application other software (operation system and other server software) is needed. Concerning the ASP model we abstract the production of the software needed as well but see the delivery of the additional software also as a field of activity.

To link these tasks or terms of reference to actors we define the following roles referring to [4], [7] and [27] (see also [10] [13]):

- *Customer*: The customer buys services from the solution provider.
- *User*: The user uses the services bought from the customer – especially the provided application.
- *Solution provider*: The solution provider is the single point of contact for the customer and user. The solution provider is especially responsible for the customer support.
- *Software partner*: The software partner develops the application to be provided.
- *Infrastructure partner*: The infrastructure partner is responsible for all tasks concerning hosting aspects.
- *Network service partner*: The network service partner is responsible for the network access.
- *Support partner*: The support partner arranges the user support.
- *Marketing partner*: The marketing partner is responsible for all aspects of marketing and advertisement.
- *Hardware vendor*: The hardware vendor delivers necessary hardware to the other roles.
- *Software vendor*: The software vendor delivery additional software needed for the ASP.

In a concrete ASP model the roles will be taken on by real actors like the Application Service Provider and, if the Application Service Provider buys additional services, computer centers, Internet or telephone provider, service firms, advertising agency and other firms. Or these roles will be taken on by internal departments of the same organization [26].

Whoever the real existing actors are the co-operation between these roles in an ASP model should be defined clearly in some kind of contract. From the customer's point of view, the solution provider is the only cooperation partner. This is the reason why in the above mentioned literature the contract between the solution provider and the customer often will be considered alone.

To generate an integrated view on ASP we suggest in contrast to that taking into consideration all relations and contracts between the concerned actors – independently from actors as organizations or internal compartments. The question is how these contracts can be balanced so that the customer's request for service can best be met.

2.1 Characteristics of Existing ASP Contracts

The major feature of existing ASP contracts is the Service Level Agreement (SLA). The SLA objectifies the cooperation between the contractual partners. We define SLAs as follows: SLAs are agreements between contractual partners in an ASP model about the quality and quantity of services including the mutual rights and responsibilities for a defined period of time with the aim of defining services with measurable criteria, escalation procedures for problem resolution and jurisdiction's law that will be applied for disputes [11].

To address all possible aspects of ASP the SLA can be divided into four major categories (cf. [6] [11] [16]):

- *Network SLA*: The Network SLA defines the quality of network availability, network throughput, network security, data loss, latency, …
- *Hosting SLA*: The Hosting SLA defines the quality of server availability, backup, physical server security, …
- *Application SLA*: The Application SLA defines the quality of application availability, application performance, application security, upgrades and updates, …
- *Support SLA*: The Support SLA defines the quality of support availability, problem resolution time, …
- *Other aspects* are the definition of escalation procedures, customer data transfer plans, termination clauses, property rights and contract period.

The content of the SLA and its design depend on the customer expectations, business and the applications involved. Internal needs, capacities and goals should be determined in advance to assure a realistic contract.

It is in the nature of contracts that all SLA elements and the defined quantities and qualities respectively are inelastic with respect to the underlying assumptions and their stated parameters. Furthermore the SLA elements are predominantly focusing on measurable criteria of the provided application. This kind of contract as a means for establishing and ASP cannot grasp the full scope of that relation. An ASP relation is a complex co-operation process.

2.2 Characteristics of an Evolutionary Model

We transfer the idea of evolutionary software development known from user-centered software development to Application Service Providing (cf. [4] [8]).

By understanding the ASP model as a complex cooperation process we can besides the application domain, distinguish three different levels in the ASP model that develop over time: the ASP-organizations, the contracts, and the services. The ASP-organizations include all organizations involved in the ASP relation. The contract level is to define the ASP relation in written language and includes the above mentioned

SLAs. The services reflect the concrete needs within the ASP relation. All aspects have to be addressed to ensure a successful ASP relation.

At the beginning, organization, contracts, and services are grounded to the needs of the application domain. As time proceeds the domain evolves and all involved organizations develop away from their initial state. Services have to be adjusted to changing use habits. The contracts in consequence need to be as flexible as to handle this change process or the relation breaks. After a certain time, contracts have to be negotiated to be updated when they have reached their limits.

Therefore we need to balance the ASP relation according to the shift that constantly happens. Figure 1 shows the loops along the discussed features run.

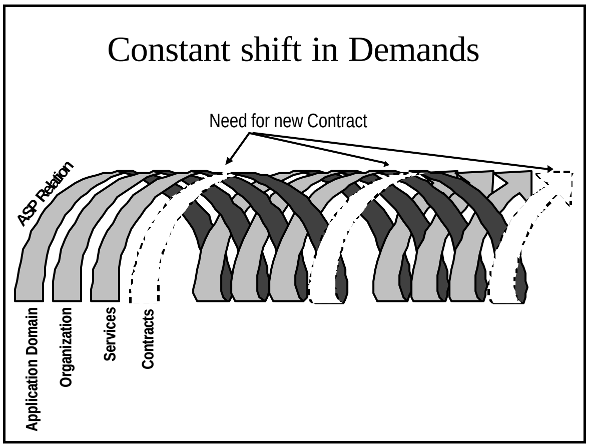

Figure 1: The development of the ASP relation

The features can be described as follows:

Application Domain: The goal of ASP is to provide software for an application domain efficiently. One characteristic of the application domain is that it progresses over time.

Organization: ASP relation is a network of organizations. All organizations need to evolve by keeping up-todate in their field and adjusting to the needs of their direct partners. So the overall organization of the ASP model will change repeatedly.

Service: As organizations evolve, so does their demand for service evolve. The services offered have to keep up-to-date with the customer needs. The implementation of services should be able to react on this in quantity as well as quality.

Contract: In spite of the constant shift, contracts are still binding to the written conditions. It is inevitable that these contracts allow for handling the situation with necessary flexibility. “Mixed contracts begin with detailed requirements and after three to five years, these requirements become ‘loose’; the idea behind this is to allow for the contract to be longer term, but also to adapt to the changing needs of the client and to exploit new efficiencies and technological capabilities“ [31]. In the educational field a period of three to five years is far too long. We suggest meetings with all included organizations twice a year to define a new start of the next cycle in the complex ASP cooperation process. These periodical meetings should be defined in the contract and SLA respectively as well (cf. [4] [6]).

With this notion of an evolutionary ASP relation we will next examine two cases in the field of university education.

3 Reviewing two ASP Approaches for Universities

Two exemplary approaches regarding ASP at universities are taken here as case studies. Firstly, the ASP model for providing the SAP R/3 system, the worldwide used business software, for educational use in universities and schools. Secondly, the ASP model for providing CommSy, a web-based e-learning software, for projectbased learning in university teaching. To start with we will briefly list the criteria for ASP in a university context.

3.1 Differences and Challenges with ASP for Universities

As we pointed out [4] ASP at (German) universities in teaching contexts is quite different from ASP in business settings. We can state the following differences for ASP at universities:

- *Organization*: A university is a conglomerate of nearly autonomous organisational units. Agreements in one department or faculty are not binding for others. Sometimes cultural gaps exist between two faculties that make co-operation with both impossible.
- *Funding*: Members of universities are non-funded. There are disproportional organisational barriers for educational staff to pay small amounts. In addition to that, German universities usually do not charge tuition fees, so the central management of the university is generally non-funded, too.
- *Comprehensive* s*upport*: Generally the teaching staff at universities is not trained to integrate elearning software in their didactical concepts adequately. So besides the technical and handling support most of the teaching staff needs didactical support for integrating e-learning elements.
- *Technical equipment*: The technical equipment especially for the teaching staff is not always up-todate. There are among others two reasons for this: Firstly, universities are generally non-funded, and secondly, the staff's equipment is usually maintained by themselves.
- *Business area*: The business areas of universities are lecturing and research. Thus, the primary task is to keep up-to-date in the research field and transfer results to lecturing.
- *Availability:* In a university context 24/7 availability is not necessary all the year. During lecturing time lecturers and students might need support early in the morning or late in the evening. However, between terms the system might not be accessed at all.

These differences are on the one hand difficulties but on the other hand challenges and provide opportunities for a better fitting ASP model. The two cases now presented are both observed in this field.

3.2 The SAP University Competence Centers

The SAP R/3 system is a large business software which not only requires a huge amount of powerful hardware but also needs to be maintained on a regular basis. This alone is necessary for providing a bare system. In addition to that a customization process is obligatory to offer support for concrete business processes. Both, the use and the customization of R/3 is part of university teaching on different levels. To provide an environment that allows teaching these topics, a running R/3 system must exist and be preconfigured for the teaching situation (e.g. user accounts have to be set up). Especially in large universities and schools many classes use the R/3 system concurrently in different teaching situations, making it necessary to have multiple independent instances at hand. It is an enormous effort to maintain, to clean-up after courses have finished, and to constantly update the system to the newest version.

Some universities have installed such a system on their own and have tried to maintain it for teaching. This provision typically relied on some conditions including a free or cheap software license, a number of dedicated people investing their time, and the availability of powerful hardware.

With the R/3 software most of the conditions reach their limit as the system demands a fairly huge amount of resources and constant maintenance. Thus, most universities were not able to provide the system for teaching.

3.2.1 The SAP Model

To address this problem, the SAP company, some universities, Hewlett-Packard, and T Systems have founded so called “Hochschul Kompetenzzentren” (University Competence Centers) which offer an up-to-date running R/3 system together with related services. This system is connected to the German internet allowing cheap and fast access from nearly every university. In detail the task assignment between the partners looks like this [14]:

- *SAP*: Coordination, concept development, and provision of software as well as service and support for software installation and use, conceptual development of courses and user-group meetings for teachers, consulting and support for software introduction.
- *Hewlett-Packard*: Provision of server hardware and system software and their service and support, regular upgrades.
- *T Systems*: on-site support for set-up and extending the system as well as development of concepts for professionally hosting the system on university premises.
- *University of Magdeburg*: provision of rooms and personnel for operation of the University Competence Center.
- *University Competence Center Organization*: System operation, development of teaching material, organizing courses for teachers, user-group meetings, maintenance of a portal for teachers and students.

The concrete actors take up the ASP roles as follows:

- *Customer*: Contracting universities.
- *User*: University members (teaching staff and students).
- *Solution provider*: SAP, T Systems, University Competence Center Organization.
- *Software partner*: SAP.
- *Infrastructure partner*: University of Magdeburg.
- *Network service partner*: University of Magdeburg.
- *Support partner*: University Competence Center Organization, SAP.
- *Marketing partner*: SAP.
- *Hardware vendor*: Hewlett-Packard.
- *Software vendor*: Hewlett-Packard.

The business model for this ASP relation is dominated by the interest of the participating companies to present their capacities. Moreover, SAP’s interest to penetrate university education with its system goes well with the corresponding demand. Customer universities profit through paying only small fees for using the system.

3.2.2 Advantages and Disadvantages

This ASP model supports the interest of the software producing company to have the system easily available for teaching institutions on the one hand and that of the universities to gain cheap access to the current system on the other.

However, software development and design are totally separated from this service providing process. Students and teachers are not the same group of persons who have influence on system design.

Hence, it is necessary to subsidize the provision through companies. Each member company of the center is interested in showing its competences and quality to influence future decisions taken in companies by the students. Financial support for the continuous provision is given by the software company which can only be secured due to the existing core market in which the software can be sold. The teaching environment is not the primary business and so cross financing is not only necessary but possible.

3.3 The WissPro Research Project for CommSy

CommSy is a platform designed for asynchronous learning networks which has been developed at the University of Hamburg [22]. Starting in 1999 the CommSy system has been developed in unpaid and paid student projects and by researchers. In the period from 2000 to 2003 the CommSy system was available through an international student portal [4]. Since 2001 a publicly funded research project residing at three universities has been developing a holistic and lasting concept for its development and provision.

CommSy is a web-based e-learning environment which on the server side requires a standard Unix server offering file space, a web-server with a scripting language, and a database server. Although, the hardware requirements are minimal, the qualification requirements concerning the software range from operating system and database maintenance to network and web-server security.

CommSy is used in university teaching as a learning vehicle. It supports communication (with e.g. news and discussion forums) and the exchange of working materials (with e.g. file uploads and online documents) as well as organizing the project (with e.g. dates and groups). CommSy has been used in a variety of teaching fields including history, languages, education, economics, and informatics.

Teachers of the Department for Informatics at the University of Hamburg first installed and used the webbased e-learning platform with voluntary support by research assistants and students. Each teaching project acquired its own resources for providing the environment. When the support of dedicated people reached its limit, the available hardware no longer sufficed and the necessary knowledge on security issues was not at hand, outsourcing became a viable solution.

3.3.1 The WissPro Model

Some approaches have been taken to provide the elearning platform CommSy permanently. Besides local activities performed by dedicated researchers and students an international Internet company has included the system in its public student portal [28] and a national research project has been acquired to establish a model for permanently providing the e-learning platform (WissPro [30]). We will here focus on the activities and concepts established in the research project. They summarize the experiences gained with the own provision activities as well as the co-operation with the Internet company. The results of the research project lead to design decisions useful for e.g. the ELCH association (E-Learning Consortium Hamburg) a city-wide activity to permanently provide electronic media within all local universities.

The WissPro research project is funded by the German Federal Government (BMBF) and runs for three years (2001-2003). Its goal is to develop an e-learning platform that will be available at least for the participating universities even after the project has finished. Furthermore it develops a holistic concept on how to ensure permanent provision of an e-learning platform. Currently, one of the project’s tasks is to act as an Application Service Provider including running a server offering the web-based e-learning platform, conducting training and application of the system, and performing evaluation of its use. The task assignment for this project looks like this:

- *WissPro*: System Provision, Software Development, Technical Services, User and Teaching Support, Evaluation and User Feedback, scientific marketing, …
- *University of Hamburg*: Connection to global Internet infrastructure
- *Department for Informatics*: Provision of rooms and local infrastructure

- *Open Source Community*: The open source community develops additional software for the provision of CommSy like: Apache web server, PHP scripting language, MySQL Database, …

The concrete actors take up the ASP roles as follows:

- *Customer*: Universities, BMBF.
- *User*: University members (teaching staff and students).
- *Solution provider*: WissPro.
- *Software partner*: WissPro.
- *Infrastructure partner*: WissPro, Department for Informatics.
- *Network service partner*: University of Hamburg.
- *Support partner*: WissPro.
- *Marketing partner*: WissPro.
- *Hardware vendor*: not important.
- *Software vendor*: Open Source Community.

The business model of this ASP relation is in many ways special. First of all, the project is currently publicly funded. Secondly, most of the tasks are performed by the same group of people taking over the roles as needed. However, the existence of this externally funded ASP makes obvious what tasks there are to be performed and how many people are necessary to ensure that work is done. Current business is done on the basis of participation in the research activity: people demanding service need to allow for evaluation and consultation.

3.3.2 Advantages and Disadvantages

The ASP model for this e-learning platform mainly focuses on the interest of the teaching situation to have the system easily available for project based teaching at universities.

Software development and design are incorporated in an evolutionary process consisting of loops of development, application, feedback collection, and evaluation. Students and teachers have direct influence on the system design.

Limitations of this outlined business model are the part-time availability of services and the weaker contracts compared to real ASP contracts. This may be a general problem when having services provided by inhouse units.

This ASP model leaves open the question of who is to finance the system with all related service. As shortly mentioned above, it can be managed by dedicated people spending their time or by institutionalizing the provision. The latter requires the department to direct resources towards that effort. Alternatively, resources on the university level could be spent to offer the service to the organization as a whole.

3.4 Comparison

The R/3 system is by far larger and more mature than the CommSy e-learning platform. However, new software can learn from such well established systems as can the other from a more agile project. It is helpful to compare these two different approaches in relation to their motivation, location concept, underlying business model, realizability and the flexibility they offer to find out their applicability for different software categories.

The motivations for the two ASP models differ clearly. The SAP model for ASP clearly addresses the need for having a current R/3 system available providing service on all levels. However, the R/3 system is not the medium the students learn with but the object they learn to work with. Therefore the ASP model does not address all topics related to the adaptation of the teaching process and the software.

Due to the demand in hardware the location concept of the SAP model is centralized through an external service provider. The WissPro model focuses on an inhouse service provider because of the need for quick communication and adaptation to local demands. SAP's business model is to cross finance the provision of R/3 asking participating universities for small fees to cover only parts of the efforts. In contrast to that the WissPro model relies on explicitly pointing out the financial needs while at the same time trying to cover all costs from the provision by the customer.

The size and scope of the SAP model is only feasible with support of external companies that do professional business in that area. This ensures a high quality of services but at the same time enlarges the organisational distance. Communication is focused though user-group meetings to improve the ASP process and teaching of the system's use. The WissPro model focuses on inhouse availability to have tighter communicational links to users. Communication between users is fostered to exchange different ways of application. Feedback is gathered for improving the software and the ASP.

The R/3 system is constantly developed. However the characteristics of the system only change slightly due to its maturity and large installed base. Therefore the ASP of this system can rely on a stable system that basically needs to be updated. An integration into local software arrangements (which is part of a customization process) is not intended. The WissPro model stresses the aspect of integrating the software in the organisational frame. Due to the fact that the subjects and the methods for teaching change in university education the software has to change, too. This requires the ASP model to be flexible and adjustable to this constant change process.

The evolutionary approach presented in the next section stresses the importance of a flexible ASP relation in a university context when it comes to the provision of software that is used as medium for teaching.

4 An Evolutionary Approach for ELearning Platforms in a University Context

The evolutionary approach for the e-learning platform CommSy allows for constantly adapting the ASP relation to the changing needs of all included actors. Our research work has shown that in teaching situations where the software is used as a medium for the communicational process a change in the subject taught or the way the subject is taught requires adjusting the medium as well. Firstly, we will point out the need for adaptation on different levels. Then, we will sketch the evolutionary loop for service providing and how each level is addressed. To illustrate the evolutionary approach, an exemplary implementation for the concrete project is suggested. In conclusion, we point to some limitations and stress the advantages of this approach.

4.1 Adaptation on Different Levels

We have learned from our experience in four years of providing an e-learning platform that not only organizations, contracts and services develop over time. In this context the field of application – the teaching subject – and the way it is acquired develop independently of the ASP relation. Teaching organizations need to evolve constantly to keep up-to-date with the latest results in their field. That means that the "content" of the teaching as well as the presentation or adoption of that content are part of a continuous change process. E.g. teaching moves from lectures and seminars to projects and practice oriented internships. This may necessitate having other points of access to the system as well as other access media. The ASP relation should be capable of moving in that direction in terms of all actors concerned.

4.2 The Evolutionary Loop

The proposed evolutionary loop for Application Service Providing emanates from an interlocked development of the application domain, the respective organization and the ASP-related services. As the content of research and teaching changes, the organization will adjust to the situation. This may result in a need for new or changed services in the ASP-relation. Some services may no longer be necessary; some need to be available in a new quality or quantity. The contract must be negotiated under these new conditions: SLAs on the one hand should allow for flexibility before contracts can be changed. One loop can be seen as the balancing process to find equilibrium until the next change starts a new loop. Evolution is triggered not only by changes in the application domain but also through organisational alterations, changes in available services or demands initiated by the application service provider. Figure 2 depicts the evolution of each ASP element with repeated grounding periods where a new basis is established.

Agility in this process is achieved by short term fixations. Contracts include only short durations and have a set of flexible SLAs.

4.3 Exemplary Implementation

Our exemplary organization for the CommSy ASP models will then be:

- *Customer*: Universities, ELCH.
- *User*: University members (teaching staff and students).
- *Solution provider*: HITeC.
- *Software partner*: HITeC, Open Source Community.
- *Infrastructure partner*: A professional computer center (see below).
- *Network service partner*: (see below).
- *Support partner*: Local staff of customer organization (first-level), HITeC (second level).
- *Marketing partner*: HITeC.
- *Hardware vendor*: (see below).
- *Software vendor*: Open Source Community.

The solution provider, HITeC, is a loose department of the university. It is not bound to organisational restrictions and can act freely. ELCH (E-Learning Consortium Hamburg) is a public organization for providing different e-learning platforms for all local universities. The open source community is responsible for the software development to ensure innovation and openness.

Depending on the required agility the network service partner, the hardware vendor, and the infrastructure partner can be organized in different ways. It could very well be the university's computing center which is an established organization within the university. However, its structure is typically not as flexible as a new organization can be. Alternatively, the loose department or a local start-up company could take this place to ensure innovation and flexibility.

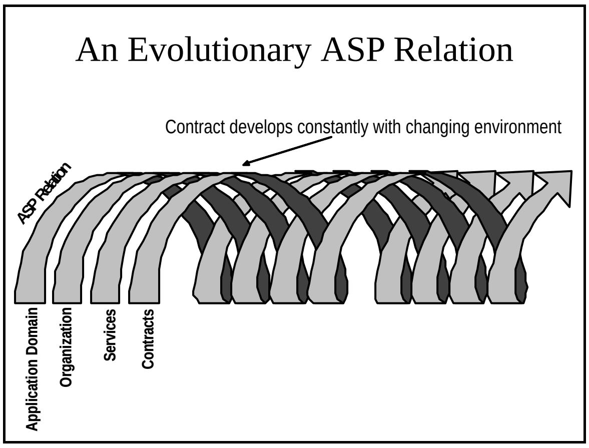
An Evolutionary ASP Relation
Contract develops constantly with changing environment
ASP Relation
Application Domain
Organization
Services
Contracts

Figure 2: All levels of the ASP relation develop over time

The solution provider (HITeC) is located in the center of the network of the ASP partners. We understand the solution provider as a moderator of the evolution process. This is initiated by bi-directional communication between the solution provider and the partners, workshops with user and other ASP partners. Communication is essential to step forward in the evolution loop and as a basis for the next negotiation cycle. Collected communication can help better understand the different levels of the ASP relation. Workshops are suitable means to work on conflicts triggered by shifts on each of the four levels. Both, the communication and the workshops are used for collecting requirements as a basis for the next cycle. The starting point for next cycle is given in the contract and SLA's respectively.

5 Conclusion and Future work

It is an advantage to accept changes within the ASP relation. As shown above, changing requirements happen on different levels. Additional communication and more flexible contracts help to balance the ASP relation. By discussing two cases we have not only pointed out the different requirements the provision of software in a university context has but also shown possibilities for a reasonable ASP model.

Limitations of this evolutionary approach for ASP are in the business part of the contract. Due to its flexible character most of the fees are not well calculable in advance. Contractors may experience irregularities in the billing process due to shifting needs. This may then also be an indicator of an unbalanced relationship. Another limitation in this ASP model lies in the loss of control which all partners face. This may lead to increased costs when it comes to flexibility. Providing the same application to different contractors may result in different evolution processes developing in different directions. The Application Service Provider may loose benefits gained from synergy when differences become significant and the effect is providing independent applications.

An insight gained from this research is the different characteristics software can have. Used as a tool a classic ASP approach might be sufficient, but when used as a medium the evolutionary approach is far more appropriate. This kind of approach fits best in the field of education as it addresses the need for flexibility.

Future work in this area will be a long-term evaluation of this ASP model and the test of applicability for other potential software in the e-learning field.

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