

TOWARDS A COMMON PUBLIC SERVICE INFRASTRUCTURE FOR SWISS UNIVERSITIES

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Abstract: Due to the Bologna Declaration and the according procedures of performance management and output funding universities are undergoing organisational changes both within and across the universities. The need for an appropriate organisational structure and for efficient and effective processes makes the support through a correspondent IT essential. The IT environment of Swiss universities is currently dominated by a high level of decentralisation and a high degree of proprietary solutions. Economies of scale through joint development or shared services remain untapped. Also the increasingly essential integration of applications to support either university-internal or cross-organizational processes is hindered. In this paper we propose an approach for a comprehensive service-oriented architecture for swiss universities to overcome the current situation and to cope with organizational and technical challenges. We further present an application scenario revealing how Swiss universities will benefit of the proposed architecture.

1 INTRODUCTION

Just like companies in the private sector universities are increasingly faced with a highly competitive market. They rival for reputation and funding on national as well as on international level. In response, “excellence” has become the slogan of various initiatives in the university environment. The requirements to achieve excellence in research and teaching are manifold. But not less important is the factor of “operational excellence”. High administrative efforts result from resource and course planning, data administration, accounting of services, and the administration of sponsorships.

The need for efficient and effective processes makes the support through IT, also for the university sector, essential. As a result university IT departments are facing a lot of challenges. The recent organisational change, caused by the Bologna declaration (van der Wende, 2000), requires European universities in addition to adhere

progressively to external (system) requirements, such as the transmission of statistical data to public authorities. In addition Bologna increases the transparency and thus the comparability of universities.

This work focuses on Swiss universities and how they could face the organizational and technical challenges. In the Swiss Campus 12 universities, 8 universities of applied sciences and 14 “universities of teacher education” such as further university institutions, supported by the Bund, exist (CRUS, 2008).

As a result of the federal organization, the IT infrastructure and systems of Swiss universities is dominated by a high level of decentralisation. Each university produces and consumes its individual IT services. Economies of scale through joint development or the use of the same standard software product remain untapped. Consequently the potential of cost reduction through the usage of the same standard applications and shared services is high.

Analogous to the experiences and empirical studies of the private sector there is a high potential for universities to decrease IT costs through the systematic use of synergies. Universities commonly agree about the weaknesses of current island solutions and about the opportunities a common service infrastructure will provide, e.g. cost reduction as aforementioned. However the required organizational and technical changes will not occur spontaneously. Universities still hold on to the federate structure, as it grants them certain autonomy. Certain barriers such as lock-in effects through existing structures are almost impossible to be overcome by an individual institution resp. university.

The way for change has to be paved and incentives for universities have to be pointed out. Joint effort is needed to overcome the described barriers. Efforts have to be based on a common architecture and understanding. Such are the declared goals of a consortium of partners from industry and academia that form the research project Swiss Campus Web Services (SCWS) funded by the CTI (Swiss Confederation's innovation promotion agency)¹. First results of this project are presented in the paper at hand.

The main goal of the project is to develop a service-oriented reference architecture for the administrative area of Swiss universities. This Swiss Campus architecture shall enable the exploitation of existing synergies, while taking into account the specifics of the federal structure of the Swiss Campus. Existing structures shall not be replaced but included into the new architecture. Hence universities will benefit from the harmonization and reuse of internal processes that run similarly in different organisations. Furthermore the complexity of multiple point-to-point connections can be reduced by creating a central infrastructure handling the communication between the universities.

The standardisation of university software and the accrual of a market for university software and IT services shall be promoted, by enabling the IT divisions of universities and IT companies to provide their applications as Web Services.

The SCWS project extends the emerging e-Government initiative in Switzerland. This initiative comprises several governmental domains e.g. the domain for resident registration SEDEX (SEDEX, 2008).

¹ See acknowledgements

On a technical layer the Swiss eGovernment initiative has jointly specified a secure communication infrastructure based on the concept of an Enterprise Service Bus (ESB), the so called *Event Bus Schweiz* (Bund, 2006). Therefore the envisaged development of a Swiss Campus architecture (see section 3) will be in line with the national initiative *Event Bus Schweiz*.

This paper evaluates how the implementation of a service-oriented concept could promote the use of synergies and support the integration of heterogeneous applications across universities. It is organised as follows. Section 1 introduces the current situation for universities and motivates our work. We give an insight into our research setting. Furthermore this section presents the embedding of our work in the emerging eGovernment landscape in Switzerland. Section 2 then discusses the current IT situation for Swiss universities and gives an overview of the envisioned architecture. The architecture is described in more detail in section 3. Finally an application scenario is introduced in section 4 that will reveal the benefit of our architectural approach.

2 HOW THE SWISS CAMPUS ARCHITECTURE WILL COPE WITH THE CURRENT SITUATION

To underline and clarify the present situation in the Swiss Campus we conducted numerous workshops during the SCWS project involving Swiss universities. The goal of these workshops was to gather information and to derive concrete figures about their current IT infrastructure and systems. Analysing the results of these workshops we figured out both technical and organizational challenges of the existing information technology the SCWS project has to cope with. The following main findings have been derived:

There is a lack of organisational support for tasks and processes spanning different organizational units both within and across universities and their related organizations. From a technical point of view the electronic integration of the correspondent applications to support such processes is still rudimentary.

The current IT infrastructure and IT systems of Swiss universities do not provide the flexibility to accommodate to changing organisational conditions. The objective of SCWS is to provide an IT

architecture that is flexible and agile enough allowing for an easy adaptation to changing organisational and legal requirements.

While most of the applications in use are still traditional client/server systems, there is a trend towards the establishment of web-based applications. These web-based applications either replace existing applications or cover functionalities that haven't been implemented yet.

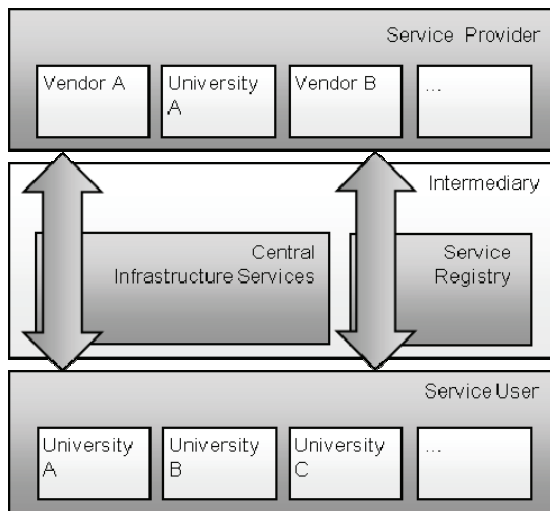


Figure 1: Swiss Campus architecture.

There are only a few commercial software-vendors that dominate the Swiss standard software market for universities. A potential for the Swiss Campus architecture is to define an open infrastructure allowing other software vendors to gain market share, to allow for the modularisation of comprehensive software solutions, and to provide these solutions as a service.

At the moment software is mainly hosted in data centres operated by universities themselves. By leveraging a software market and enabling the easy composition of independent software modules universities will be able to consume these modules as a service. Hence the need to operate an own data centre will become obsolete.

Since SOA and business process management initiatives should be combined (Schulte, 2008b) the Swiss Campus architecture has to consider the modelling of processes and tasks as well as to elaborate a concept for the transformation of these models into IT services.

The SCWS project therefore proposes an architectural approach enabling both the SCWS application partners and external organisations to

establish a platform where they can bring in and share services.

Figure 1 gives an overview of the envisaged architecture. The architecture includes three main roles of agents; Service users are universities or university institutions. The functionality of a service provider can be taken over by a software provider but as well by a university offering internally developed services to other universities. Service provider and user communicate via a central platform, the intermediary, that provides a service registry and further central infrastructure services (security, authentication, monitoring, etc.).

The Swiss Campus architecture will have to cope with existing, heterogeneous solutions of the universities' IT-departments. These legacy systems will be integrated into the service-oriented architecture as web services. Another architectural challenge is the implementation of the central infrastructure functionality. Furthermore a goal of the envisioned architecture is to create an environment where software vendors and IT-service providers are leveraged to create services that decrease the universities' IT and process costs.

3 AN ARCHITECTURE FOR THE SWISS CAMPUS

3.1 Meeting Organisational Challenges

In order to meet the organisational requirements, discussed in the previous section, we propose an architectural approach for the Campus Switzerland that extends the proposed architecture of the Swiss e-Government initiative. This enhanced architecture has to consider the integration of different stakeholders like the universities' IT departments, markets for commercial software vendors and IT service providers, and peer universities as well as Swiss governmental organisations and initiatives like SEDEX.

The planned architecture is based on the coupling of multi-agent systems that will seamlessly interact with each other. The multi-agent systems represent domains containing central communication and mediation services and standard objects that are exchanged between the so called agents that represent the stakeholders of one domain. Through the loose coupling of these heterogeneous multi-agent systems we will allow each university, institute, and external partner to keep their proprietary applications and infrastructure. Our approach