

2000

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Recommended Citation

Amme, Wolfram; Hotzel, Heike; Rossak, Wilhelm; and Stolle, Rene, "CAJ - Chipcard Controlled Accounting System Jena" (2000).
AMCIS 2000 Proceedings. 137.

<http://aisel.aisnet.org/amcis2000/137>

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CAJ - Chipcard Controlled Accounting System Jena

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Abstract

In this paper we present the CAJ project of the Friedrich Schiller University Jena (FSU). The project's aim is the development of an overall accounting system that can be used for the electronic payment of services delivered on any FSU campus. Currently, the focus is on the FSU library system. Component technology is utilized to achieve a flexible, generalized system architecture that provides for future extensions and ease of maintenance.

Introduction

Eleven German publishers in the field of technical sciences and seven research institutes have joined in the (German) Global Info SFM 9 project "Proving of electronic offering, accounting and payment techniques" in order to find concepts for publishing books electronically. The main task of the Global Info SFM 9 project is the development of a scientific digital library that is called eVerlage.com that can be used for electronic multimedia publications via the internet in the future (eVerlage.com, 2000).

The project "Chipcard controlled Accounting system Jena" (CAJ) at FSU is part of this Global Info SFM 9 project. The subject of the CAJ project is the development of an overall accounting system that can be used for electronic payment (O' Mahony, 1997; Assokan et al., 1997; Bellare et al., 2000) of services offered to the students and employees of the university. The pilot application of the CAJ system offers the services delivered by the eVerlage.com system, using the FSU library system as a gateway.

System Description

Each student and employee enrolled in the main library of the university receives a chipcard that identifies him/her as a person. At the time when the card is issued, an additional user-id is added to a central database. The database maintains

- name, status, password, etc. of the user,
- accounts,

- services, and
- transactions.

The account balance of a specific user is increased when the corresponding account holder performs an authorized deposit transaction. Whenever the account holder has used a service that is liable for costs, the account balance will be debited accordingly. Overdrawing an account can lead to the refusal of a desired service and, moreover, to a frozen account. Each service (transaction) that debits an account is recorded by the system and will be stored for a fixed period. Thus, each account holder always has access to an up-to-date overview of his/her disbursements.

In the current project, we are particularly interested in integrating different library services into our system, e.g. several electronic information systems or the lending library. Extensions of the system to applications that are radically different from library services are also imaginable. For instance, the services of the university cafeteria could be improved if the different processes of *identification* and *payment* would be combined to a single process *identification and payment with a chipcard*. In a similar fashion the admission control to the buildings on campus could be realized with the CAJ system. In the latter case, as a result of using a central database that holds information about all the relevant users, the CAJ system could react to undesirable occurrences at any times, e.g. with the locking of a user account after the loss of a chipcard.

The intrinsic tasks of the eVerlage.com system that are currently realized by the CAJ system are:

- registration of users,
- administration of costs, and
- notice of removal, if the student or employee will leave the university.

Parts of the costs for the services delivered by the eVerlage.com system will be paid by the university library. The concept is that the user of the CAJ system can participate in all the services of the eVerlage.com system, at no charge, for which the university has purchased the necessary licenses. After the credit made available by the university is spent, the student or employee can proceed

to access the CAJ system, but will have to pay for the costs incurred.

In principal, the relation of the CAJ system and the eVerlage.com library can be thought of as the relationship of a bank to a credit card company. A client of the bank receives a credit card from it and with it the services of the card issuing company without contacting this company. Similarly, a user of the CAJ system can use the services of the eVerlage.com system without an explicit registration at that system.

The modern organization of libraries can be compared with the structure of companies that sell information. Therefore, the activities that are performed between the eVerlage.com system and the university library can be classified as business-to-business commerce (B2B). Further, the services delivered by the university library to the students and employees of the university can be thought of as business-to-consumer commerce (B2C). As an implication, the CAJ system can be considered as an interface that hides the B2B part and presents the user a pure B2C view.

System Design

While being part of a specific project, and thus being bound to specific requirements, the CAJ system was de-

signed from the outset as a system that is able to deliver these services at high quality. However, the system is still general enough in its design to be used after its completion by a different kind of organization or in a different project with similar needs. These deliberations are underpinned by the fact that such a more or less universal product is not presently available for the domain of secure payment services.

As a consequence, the main technical property of the CAJ system is its generalized, extensible architecture and the enforced (re-)use of software components (Brown, 1997). The architecture supports access to an increasing (or varying) number of services over time by providing an evolutionary extension of the current system in a stepwise process, simply by adding additional components to a basic kernel.

Figure 1 shows an overview of the CAJ system's architecture. For the implementation of the system we will use concepts that are comparable to those of IBM's well-known San Francisco project (Bohrer, 1998; San Francisco, 2000). At first we have to identify the core provided by the CAJ system. The corresponding functions must then be implemented in the kernel of the CAJ system.

The kernel consists of the basic functions for the administration of user information, execution of transac-

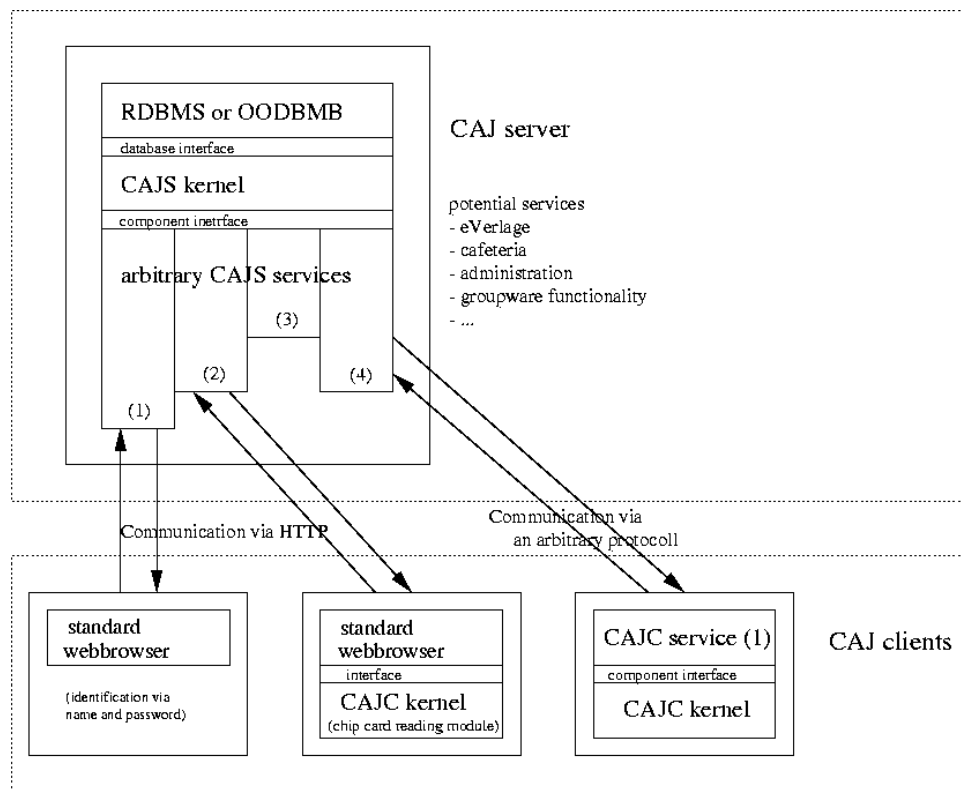


Figure 1: The basic architectural structure of the CAJ

tions, reading of the chipcards, etc. The intrinsic functionality of a real service (system) is added on to the kernel using a component interface. Therefore, the development of a specific server component is one of the main tasks.

Further, to guarantee an intelligent behavior of a client, we have to develop an appropriate client component. The simplest form of a client is a Web browser. In this case, chipcards would be used like credit cards by simply transmitting via a secure connection the card's number and a password. In this case there would be no need for reading the chipcard electronically.

Conclusions

In the paper we described first research activities of the CAJ project. We started our presentation with a short description of the eVerlage.com project. We then explained the aims of the CAJ project and gave an insight into the architectural structure of our system.

Our future work contains of three parts. First, we will analyze possible CAJ applications with the aim to identify the CAJ kernel functions, which can be used by any CAJ component to access the database, realize transactions and so on.

Second, we will also try to get information about running chipcard systems in big organizations. But this isn't easy, because the most organizations prefer to hide such critical information. Therefore, we see another challenge. The CAJ must be completely secure but nevertheless widely open.

Third, we will investigate popular component architectures (DCOM, EJB, CORBA, DCE, etc.) for their applicability in the CAJ project. We will need to discuss issues like:

- **Scalability:** The CAJ must be able to manage a large number of users.
- **Portability:** We won't accept any dependencies to special products or vendors at all layers (operating system, DBMS, programming language, etc.). We will strongly prefer open standards and interfaces.
- **Stability and run time behavior:** We want to build an efficient product, we haven't time to wait for bug fixes.
- **Lines of code** needed for special components.
- **Vocational adjustment, hardware requirements, etc.**

This examination will be finished in July 2000 when we will start with the concrete implementation. This part of our work will be supported by about 15 students working in a seminary about component based software development.

Beyond the technical questions, we are confronted with questions like:

- **Privacy aspects:** What kind of information can be logged in the system and which information must be deleted immediately.
- **Clearing:** How to realize all the things about cash transactions.

Acknowledgements

The CAJ project is financially supported by the German federal administration of education and research (BMBF).

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