

# Students Financials Management in University Information System

The Faculty of Technical Sciences, Novi Sad - A Case Study

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**Abstract-**The majority of University information system solutions are focused on administrative aspects of teaching technology support. The financial tracking services are usually part of a business information subsystem that is usually a restricted part of any Business Information System. With the proliferation of Service Oriented Architecture paradigm the students financial tracking services appears like a challenging segment of the overall services support. In this article we present the Service Infrastructure Model and the part of Data Base Schema Conceptual Model that supports service layer implementation for students and management stakeholders with Faculty of Technical Sciences, Novi Sad as the Case Study.

**Key words:** *Conceptual Modeling; Financial Management; Model Driven Software Engineering; Service Oriented Architecture; University Information System*

## I. INTRODUCTION - THE PROBLEM DOMAIN

Student Financial Services are a challenging segment of arbitrary university information system. The traditional solutions embedded in business part of an integral university information system are far for being sufficient concerning the proliferation of service oriented architecture paradigm. There are many different approaches to student financial tracking that may be referenced at university portals such as [1], [2], [3], [4], [5], and [6].

From financial aspect of faculty management there is a tremendously important role of student's financial obligations tracking in order to achieve a full control over financial transactions that are originated at the student's side. From students perspective it is essential to have a full access to Student Account, which is the central mechanism for paying tuition and course fees, reflecting financial aid awards, managing refund, and other campus services. The other cornerstone is the electronic billing services that support several different payment methods. If particular students are fully or partially sponsored by an external entity that requires an invoice for tuition and fee charges it would be advisable to support the automatic invoicing too. Besides that there are several administrative services that are charged on demand so

the automatic charging, without direct contact with the financial or admission departments would be welcomed for sure. The next challenging issue is a credit support for scholarship expenses that would benefit the financial capacities of students or their parents.

The majority of University information system solutions are focused on administrative aspects of teaching technology support. The financial tracking services are usually part of a business information subsystem that is usually a restricted part of any Business Information System. With the proliferation of Service Oriented Architecture paradigm the students financial tracking services appears like a challenging segment of the overall services support. In this article we present the Service Infrastructure Model and the part of Data Base Schema Conceptual Model that supports service layer implementation for students and management stakeholders with Faculty of Technical Sciences, Novi Sad as the Case Study.

In order to simplify the financial tracking mechanism under the service cover of The Faculty of Technical Sciences, University of Novi Sad, Serbia, (referenced in the rest of the article as Faculty), information system we have implemented integral solution that is based on the following cornerstones:

- Each student is assigned an individual code for financial transactions marking when first assigned to any particular study program that runs at Faculty. The automatic web-client registration for students web-service portal access is generated at the same time;
- Each student is assigned an individual electronic financial record that is synthetically and analytical updated in an transaction manner according to billed services on the demand basis;
- Every service is registered and billed according to the predefined price list that is directly accessible through the service portal and is updated according to the dynamic of price amount changes;
- Every financial transaction is associated with the regular set of rules that are applied when detected;
- Every exception to the regular set of rules has to be explicitly defined and assigned prior to usage;
- Every financial transaction is associated with the accounting schema that enables automatic book-keeping records generation in real-time;

- The categorization of financial transactions is performed at service consuming time not at the payment time. This means that students have a single code they are obligated to associate with every account receivable action without any classification. When they consume the service at the account payable event the service dependent classifier is automatically associated with the analytical record enabling the right financial accounting signature generation.
- There is an privileged mechanism for any accountable correction document generation;
- There is role based service rad mechanism for different role support regarding the students financial services;

## II. THE SOLUTION DOMAIN

The approach that is performed while working in the solution domain is based on Model Driven Engineering and the state of the art and perspectives of Model Driven Software Engineering approach elaborated in [9]. Regarding the usual Blackboard Architecture Pattern foundation there are two major segments of Faculty information system infrastructure that has to be sustainably designed and supported: The Repository and The Service Layer.

### A. Repository - The Relevant Part of the Conceptual Model

The Conceptual model of Students Financial Tracking support is a part of Integrated Students Admission subschema. (Figure 1).

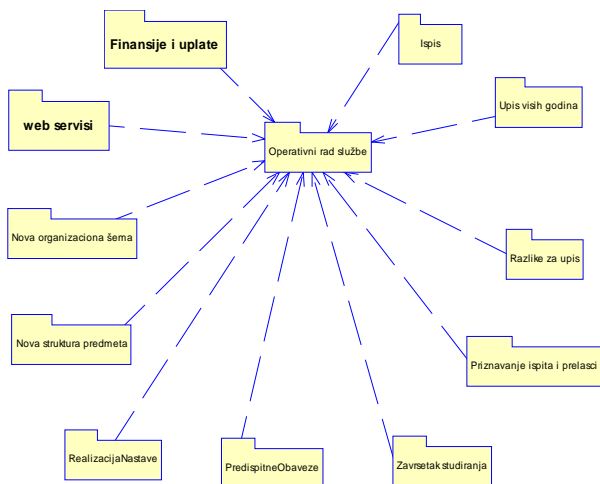


Figure 1 The Repository Schema Packages Model

The main subschema is defined in package Finance and account receivable (**Finansije i uplate**). The central segment of subschema is account receivable segment that stores all of the detected students account receivable transactions. The external electronic payment system, that is the connection point with the Faculty business information system, enables

the catching of student's payment transactions according to the individual student's payment code. In Figure 2 there is the form of payment document accessible through the student's services portal.

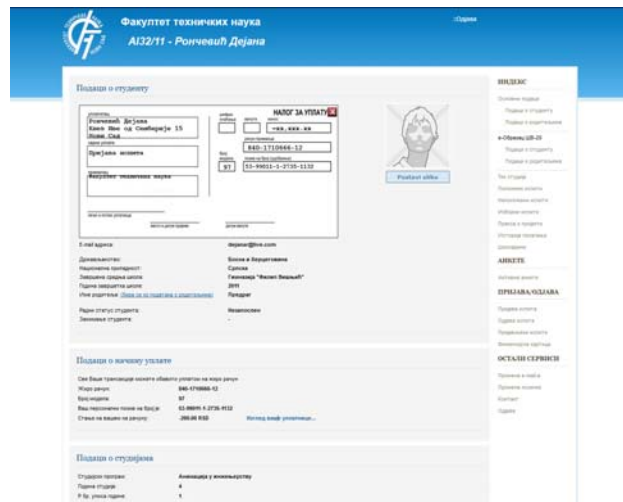


Figure 2 The Student service Portal - Individual Payment Document

All detected and verified payment documents are inserted in table Students payment (**Studentske uplate**) (Figure 3), and every record is related to the analytics (**Analitika finansija**) of Students Financial Record.

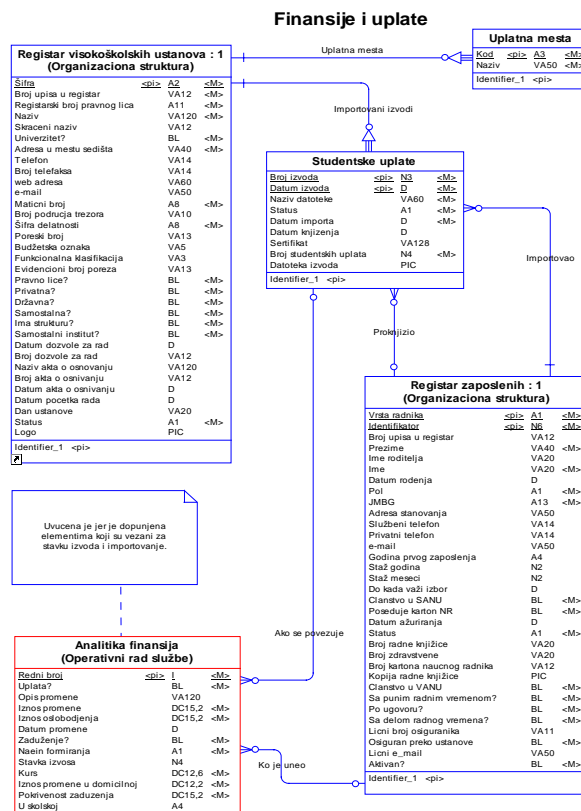


Figure 3 The Students Payment Repository Model - A Part of

The other side of the coin deals with the students obligations that have a financial impact. In Figure 4 there is a part of repository conceptual model addressing students obligations presented. Multi currency support is obtained through Currency (**Valute**) entity. Faculty services (**Usluge ustanove**) contains all the services that are offered to students and that, according to modalities, may cause financial receives. Students Obligations (**Zaduzenja Studenta**) structures the obligations that are potentially structured through Analytic of Obligations (**Analitika zaduzenja**) and may be differentiated according to Discount Policy (**Razlog umanjenja**). If the obligation is credited, entity (**Plan dospeca zaduzenja**) enables the definition of payment plan that will be automatically triggered on the time basis.

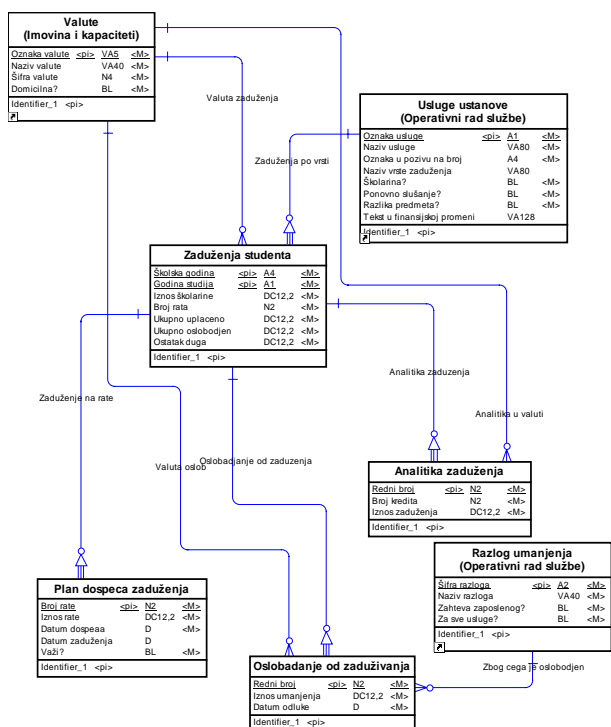


Figure 4 Students Obligations - A Part of the Conceptual Model

System supports the corrections that have to be performed according to the different circumstances that may deserve controlled correction of student's financial status. In Figure 5 there is a part of data base schema conceptual model that enables the tracking of corrections, presented. The Correction Type (**Vrsta korekcije**) entity enables registering of different correction classifiers that enable different accounting handling of performed correction. The entity Correction document (**Dokument korekcije**) with its analytical structure (**Stavke korekcije**) caches the accounting valid collection of changes that may be performed in order to apply desired correction. All of the correction document records are strongly related to the Students' Financial Card (**Finansijska kartica**) enabling financial corrections tracking.

Podrska korekcijama stanja finansijske kartice

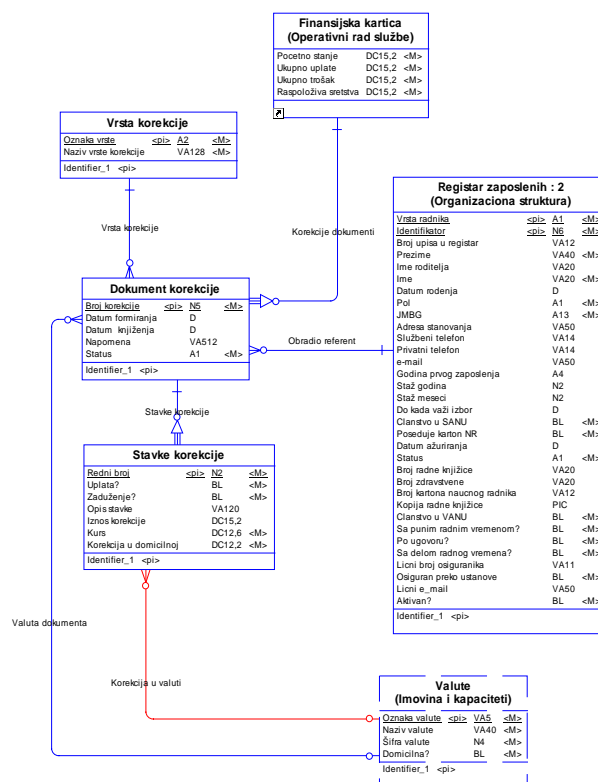


Figure 5 Corrections Tracking Subschema

## B. The Role of Service Layer - Service Oriented Architecture (SOA)

The term Service Oriented Architecture (SOA) appeared first in the Gartner's market research published in 1996 [7]. According to [8], Service Oriented Architecture (SOA) is an information technology architectural pattern addressing the distributed approach to information technology systems architecture design. It is based on the decomposition of externally visible functionality of a complex system into a set of self-contained, modular units that can be combined by a simple application to accomplish arbitrary complex tasks.

There are several roles that are supported through Faculty service portal. They are roughly divided into Students', Managerial and Teacher services.

In Figure 5 there is a students' view of his personal financial record (synthetic end analytic) presented. Through students' service portal students have real-time approach to all of financial obligations and the balance of their account (**Finansijska Kartica**).

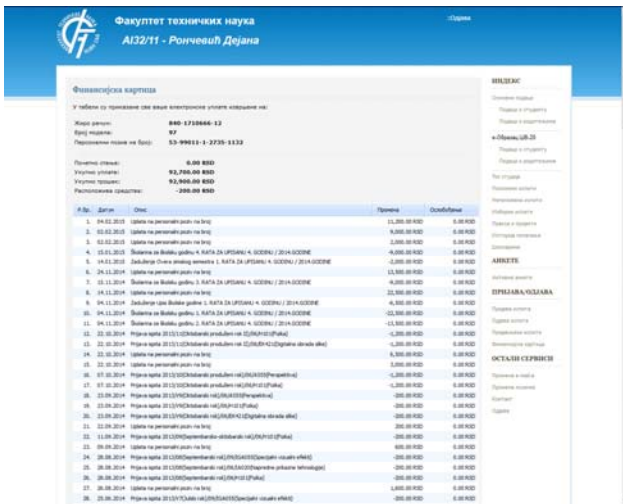


Figure 5. The infrastructure model of SOA based systems

In Figure 6 there is a financial structure of students' scholarships for selected Department presented. This is a part of Department Management Service Role and enables the head of particular Faculty Department to view all scholarship finances that are department relative and depends solely on student that are assigned to departmental study programs.

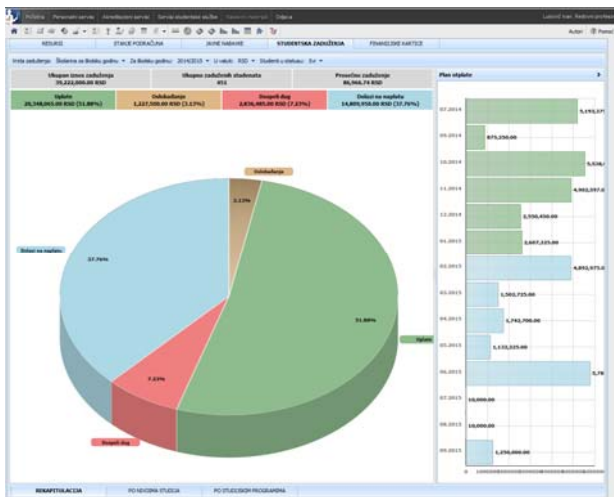


Figure 6 Department Manager View of Scholarship Financial Data

In Figure 7 the classified view of account receivable side of Department Management Service, concerning all of the typed obligations (scholarship, administrative taxes, differential exams, repeated courses, additional courses etc.) is presented. The service enables financial analysis according to the type of classified obligations.

In Figure 8 there is a detailed view of selected administrative financial obligation, namely semester admission fee, presented, while Figure 9 enables the estimation of account receivables from the department aspect regarding the selected type of obligation.

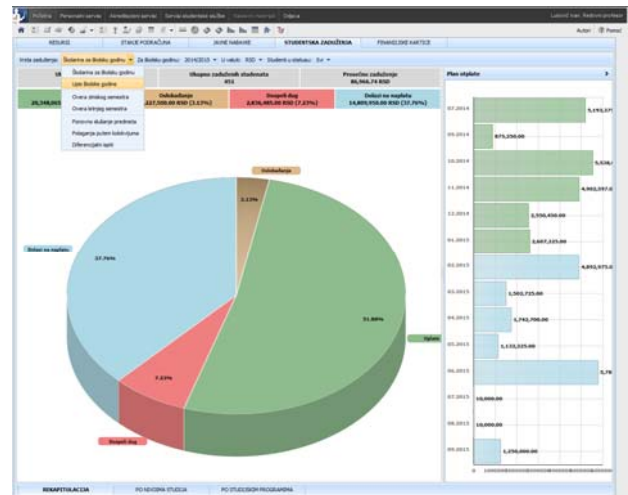


Figure 7 The Classified Financial Data View

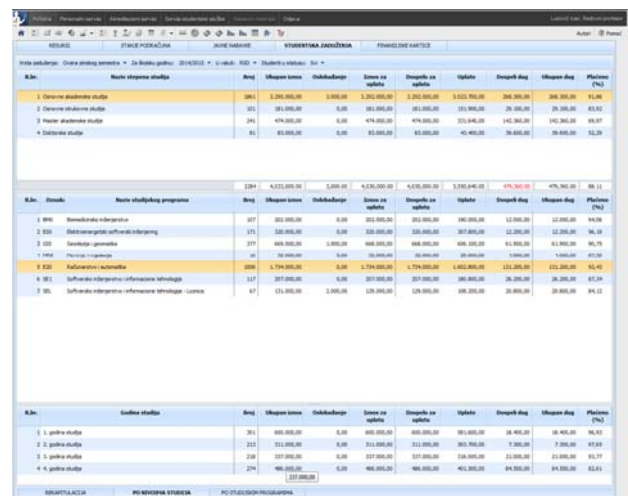


Figure 8 The Detailed View of Selected Financial Obligation

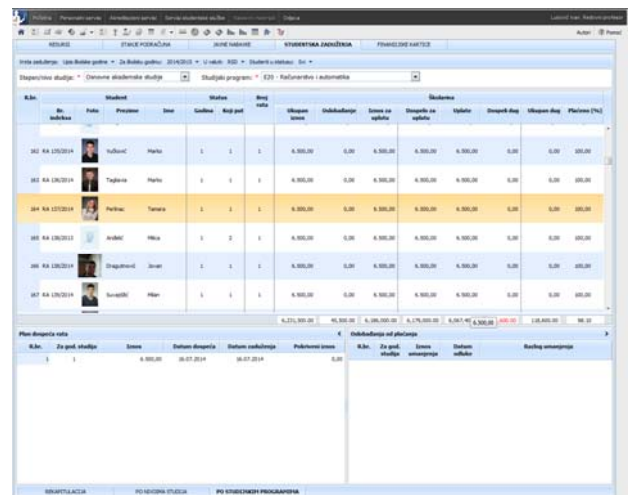


Figure 9 The Prediction of Account Receivables - The Departmental View

### C. The Implementational Framework

The implementation framework for discussed SOA includes: development module, server side and client side segments. The development segment is based on Model Driven approach to software development and JGen tool, developed at Faculty of technical sciences, for automatic code generation for JAVA programming platform. Sybase Power Designer Data Architect Ver. 15.5 is used for the modeling purposes. Server side is composed of three servers: Database server implemented on Microsoft 2008 Server operating system and Microsoft SQL Server 2005 Express; and two web-servers (Apache 2.2 for PHP and Apache Tomcat - for JAVA reporting purposes). Client side uses jQuery and Dhtmlx component library. Clients access services through Apache 2.2 for PHP which is the only server taht is publicly available and encapsulates all other servers. The reports are supported by Apache Tomcat while the reports implementation is performed with iReport-JasperReport engine for JAVA programming platform.

### III. CONCLUSION

The majority of University information system solutions are focused on administrative aspects of teaching technology support. The financial tracking services are usually part of a business information subsystem that is usually a restricted part of any Business Information System. With the proliferation of Service Oriented Architecture paradigm the students financial tracking services appears like a challenging segment of the overall services support.

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The next efforts would be directed to more refined financial services design and deployment.

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