

ONLINE FACULTY ENROLLMENT USING SOA

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ABSTRACT

With service-oriented architecture being widely adopted, it is easy to combine information and functionalities of distributed systems for the goal of providing new and flexible services in a seamless manner. Enabling students to enroll into faculty programs online with few simple steps from anywhere, at anytime is one such example of a flexible service. Service-oriented architecture provides basis to support this scenario. It enables students to enroll at different study programs from different faculties at one place online. This paper describes a model that can be used for online faculty enrollment using service-oriented architecture.

I. INTRODUCTION

The process of faculty enrollment [1,2] traditionally involves a lot of paperwork which makes it inflexible and cumbersome. Each year students applying for enrollment must collect different documents like: high school diplomas, nationality, registration certificate; then fill out application forms and hand over all that paperwork to student service. It then needs to be manually processed for each applicant. All the documents that the students have to provide come from high schools or government services. Students have to go to the various departments to get most of the documents they need. If the student is rejected from one faculty and wants to apply to another, he/she has to withdraw the documents first and take them to the other faculty.

The interaction between the government and the citizens is becoming easier with the government exposing their services to the public. E-government [3,4] presents a step forward in the 21st century with higher quality, cost-effective services and a better relationship between citizens and government. Following this trend, if the government offers the documents and information that are necessary for faculty enrollment, the applicant can easily get them online with no need to go to the government departments in person. A step further is a system that automatically gathers all necessary documents for the student enrolling in a program. This kind of system is the focus of this paper.

Service-Oriented Architecture (SOA) [5,6,7] is the adequate architectural basis for the E-government solution [8], including the online faculty enrollment system. Government departments can expose their functionalities as services, which then can be used, orchestrated, managed within the SOA solution. Furthermore, the online enrollment system can make use of these and other services to achieve its goal.

In this paper we will present a model for a system that is using SOA and E-government to provide country-wide online faculty enrollment service that is paperwork free, accessible

from anywhere at any time, which is completely automated without the need of human intervention in the faculty enrollment process.

The paper is organized as follows: In section 2 we will give a brief description on the benefits of E-Government and SOA. Section 3 shows the basic architecture of the model, while details of it will be introduced in section 4. In section 5 we will summarize the pros and cons of this approach and discuss future work that can be done to improve this model.

II. BACKGROUND

With the ongoing modernization of our society, the need for easier and more flexible communication between the citizens and governments is becoming a priority.

E-Government uses the Internet and the world-wide-web for delivering government information and services to the citizens. These services can be divided into: Government to Citizens (G2C), Government to Businesses (G2B), Government to Governments (G2G).

E-Government services often require communication between different government departments, which is why Service-Oriented Architecture suits best as an architectural basis for an E-Government solution.

An SOA approach to e-governance aligns IT with service delivery goals and enables various government departments to re-use developed assets. The goal is to provide a flexible SOA solution for governing, integrating, deploying, securing, and managing services, irrespective of the platforms on which they were created [8].

One of the services the E-Government offers is Enrollment in High Education [9]. This is the motif for this paper in which we will present an implementation model for this service.

III. ARCHITECTURE

A. Getting a certificate

The faculty enrollment portal will let students enroll into faculty programs after they have successfully logged in. Security has to be taken into account for the login process. Preventing malicious users logging as someone else is a crucial security step. Digital certificates [10] are introduced for this purpose. Before the high school students take the graduation examination, each of them undertakes an identity check by official authority, after which the student is granted a password and a CD (or USB) containing the digital certificate. These students will use both the password and the

certificate when logging into the faculty enrollment portal to ensure that they are who they say they are.

B. General Architecture

The online faculty enrollment system will need data from different sources and these data can be collected via web services using SOA infrastructure. The exchange of data between providers and consumers of the services is carried out using XML [11]. XML is based on open standards and is widely adopted as a data exchange format.

Each institution can provide different data via services: the State Examination Centre (SEC) can provide data such as scores of high school graduation; the Ministry of Internal Affairs (MIA) can provide citizenship data; the Ministry of Education and Science (MES) can provide dates for enrollment; universities and faculties can provide information for the universities, faculties and programs.

Figure 1 show how the online faculty enrollment system can use all of this data to provide the service of online faculty enrollment using the service-oriented architecture approach.

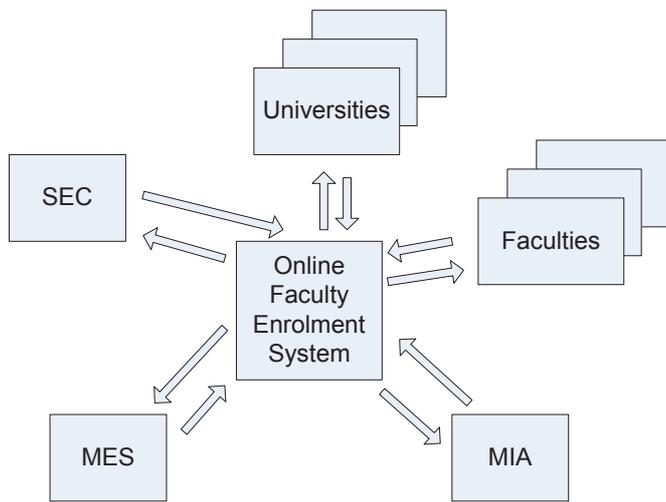


Figure 1. General architecture of the Online Enrollment System

IV. IMPLEMENTATION DETAILS

A. Required Services

Table 1 shows a list of services, the data those services provide and the providers hosting the services. Services names are kept simple for clarity and are in the format Provider:ServiceName.

The State Examination Center provides two services. *SEC:validateStudent(EMDB, certificate, password)* is used to authenticate the student when logging into the faculty enrollment portal. Students will use the password and certificate they have been granted on the day of the graduation examination to login.

Table 1: Services and Providers

Provider:Service	Data provided	Provider
SEC: validateStudent(EMDB, certificate, password) getSchoolLeavingExaminationScore(EMDB, certificate)	Credentials validity, school leaving examination score	State Examination Center
MHA: getCitizenshipStatus(EMDB, certificate)	Citizenship status	Ministry of Home Affairs
MES: getEnrollmentDates() getUniversities()	Dates for enrollment periods, list of universities	Ministry of Education and Science
UNI: getFaculties(universityID) getFacultyPrograms(facultyID)	List of faculties and their programs	Universities

SEC:getSchoolLeavingExaminationScore(EMDB, certificate) service gets the students graduation score, before previously the student credentials are authenticated with the *SEC:validateStudent(EMDB, certificate, password)* service.

The Ministry of Home Affairs can provide one service. *MHA:getCitizenshipStatus(EMDB, certificate)* is used to check weather the student has citizenship, which is a requirement for enrolling into a faculty. Provided credentials are authenticated first with the *SEC:validateStudent(EMDB, certificate, password)* service.

The Ministry of Education and Science can provide two services. *MES:getEnrollmentDates()* is used to get a list of the dates for the enrollment periods. *MES:getUniversities()* is used to get a list of all the available universities.

Universities can provide two services each. *UNI:getFaculties(universityID)* is used to get a list of faculties belonging to a specific university. *UNI:getFacultyPrograms(facultyID)* is used to get a list of faculty programs within a faculty with information for each program such as: maximum numbers of students allowed to apply and fee. An excerpt from the WSDL [12] of the last service is shown on Figure 2. It shows how the data associated with one faculty program is combined to form the FacultyProgram XML type which holds all necessary information concerning one faculty program. XML Schema Validation [13] can be used for each service requests and responses as a primary step for validation of the data being exchanged.

```

<s:complexType name="FacultyProgram">
  <s:sequence>
    <s:element minOccurs="1" maxOccurs="1"
      name="FacultyName" type="s:string" />
    <s:element minOccurs="1" maxOccurs="1"
      name="ProgramName" type="s:string" />
    <s:element minOccurs="1" maxOccurs="1"
      name="NumberOfStudents" type="s:int" />
    <s:element minOccurs="1" maxOccurs="1"
      name="RequiresExam" type="s:boolean" />
    <s:element minOccurs="1" maxOccurs="1"
      name="Fee" type="s:decimal" />
    <s:element minOccurs="0" maxOccurs="1"
      name="Url" type="s:string" />
  </s:sequence>
</s:complexType>

```

Figure 2. XML representation for the FacultyProgramType

B. Internal Logic

Figure 3 shows the workflow of the Online Faculty Enrollment System.

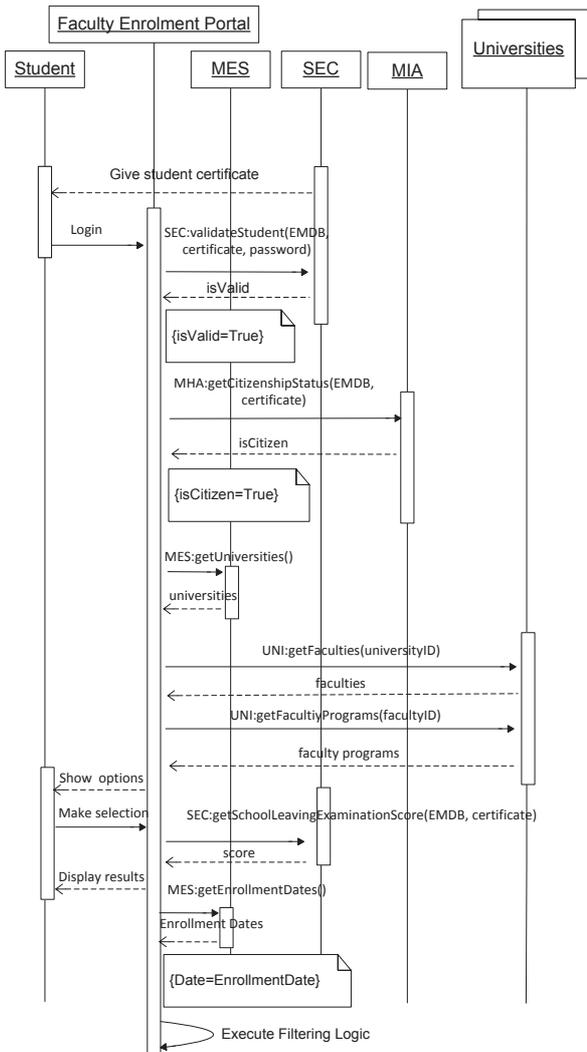


Figure 3. Workflow of the Online Enrollment System

After the high school graduation examination, the results of the exam for each participant are saved in electronic form and are stored in the State Examination Center database. We already mentioned that right before the examination students are given password and a digital certificate.

Students can now log into the online faculty enrollment portal where the logging process will undertake authentication based on the password and the digital certificate the user will provide. The portal will then make a call to the *SEC:validateStudent(EMDB, certificate, password)* service which will return true or false based on the validity of the student credentials. Next thing the portal needs to check is whether the student is a registered citizen of the country. The Ministry of Internal Affairs has already exposed a service for this purpose. *MHA:getCitizenshipStatus(EMDB, certificate)* service can first make a call to the *SEC:validateStudent(EMDB, certificate, password)* service and after a positive response it can check for the citizenship status of the student and return a value. Students can only use the enrollment portal if they have valid credentials and citizenship.

Once logged in students can have access to all available faculty programs for enrollment. Information for these programs is available from the services that the Ministry for Education and Science, universities and faculties will provide and it will consist of data such as list of universities, faculties, faculty programs, the number of allowed applicants per program and the fee that needs to be paid. One other important information related to the faculty programs is whether enrolling into a program requires taking additional tests (for example the faculty of art) or not. If it does, initial ranking of the applicants can be performed based on their leaving examination results and the final scores and rankings will be available after the additional tests take place.

Presented with list of faculties and programs, users of the enrollment portal can browse and make their own selections for enrollment. Links to the web pages of the universities and faculties are available where students can get extra information for the faculties and programs. Each student can apply to maximum of 3 faculties thereby specifying the priority order of the faculties. The portal can provide summary for the number of students that applied to each faculty and program. Users can see their ranking among the other applicants so they can change their selection if necessary.

At the end of the day of each enrollment period the option to enroll is put to a stop and the internal filtering logic of the online faculty enrollment system is started. For each faculty program applicants are ranked based on their score and faculty priority they have selected previously. Once enrolled in a program, the system removes the entries for the student from the other faculties (if any) and accommodates qualified students on those positions subsequently. At the end of the

filtering process the students can see the official rankings made by the system.

Applicants rejected for the current enrollment period can try applying on the next available period and on other faculties without the need to withdraw their documents first from one faculty and take them to the other. On the other hand for the accepted students the online faculty enrollment system calculates the fee that students have to pay. The fee is calculated using information provided by the services of the faculty the student has applied to. An official receipt is then mailed to the address of the student. Once enrolled in the online faculty enrollment system, student will need to hand all the necessary documents in hard copy format to the faculty they enrolled in because the current laws state that.

C. Proof of Concept

An example implementation of the faculty enrollment portal is shown on Figures 4 and 5. Figure 4 shows the section where the management of the faculty priorities takes place. Users of the portal can browse through the universities and faculties to select preferred faculty programs and add them to their priority list.

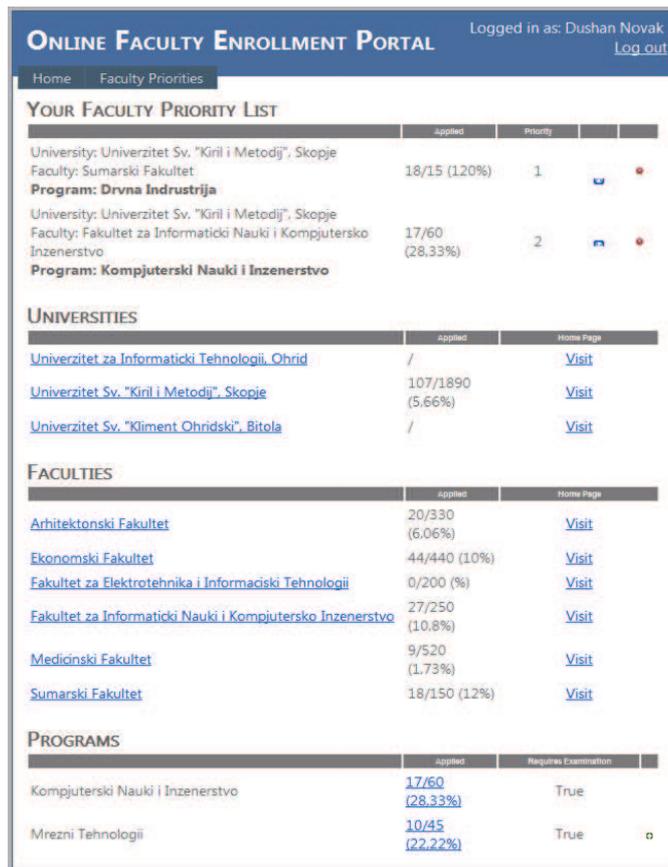


Figure 4. Managing faculty priorities

Adding and removing programs from the priority list is very simple as well as modifying the order of the priorities. Information for the faculties and programs, such as number of applied students, maximum allowed students or whether the

program requires examination are presented to the user. Links to the universities, faculties and programs are shown, where the users can find more information for the educational institutions and programs.

Figure 5 shows details of the user's priority list and chances for enrolling into the selected faculties.

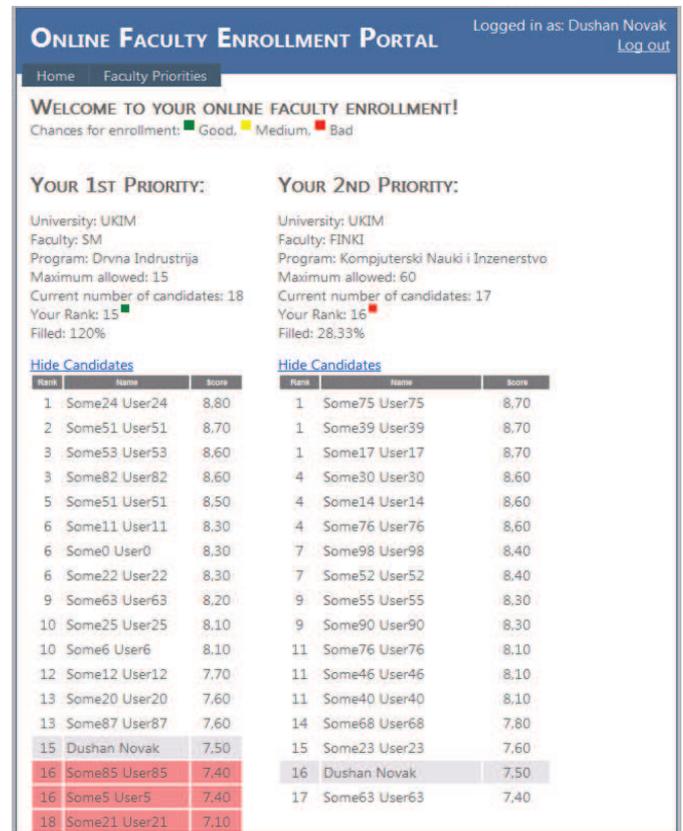


Figure 5. Preliminary Rankings

The chances are displayed using the colors green (good chance), yellow (average chance) and red (bad chance). Chances are calculated based on the number of maximum allowed students to a particular program, the number of applied students at the moment for that program and the rank of the user among the other students that applied for the same program. List of all candidates and their scores are available for the user for each program in the priority list. Candidates marked in red are below the threshold of maximum allowed students for the program. User can change their priorities based on all of this information for making a better chance to enroll. Once the internal filtering logic of the system is executed on the day of the enrollment period, the user is presented with the official ranking list and results.

V. CONCLUSION AND FUTURE WORK

In this paper we presented a model for online faculty enrollment system which can improve the way students enroll into faculty programs today. Traditionally, applicants need to provide various documents when applying for an enrollment to a faculty program. Documents like birth certificate and

citizenship certificate have to be collected in person from state authorities and along with other documents like high school diplomas and application papers then need to be taken to the preferred faculty. If a student is rejected from one faculty and wants to apply to another one, the student has to pick up the documents from the first faculty and take them to the second one.

Much more elegant solution is letting students to enroll into faculty programs online. E-government and underlying SOA infrastructure will enable the system to make use of distributed government services and use the data obtained to expose such functionality for online faculty enrollment. Security measures needs to be satisfied with this approach. Each student receives a password and a digital certificate which they will use to log into the online faculty enrollment portal whereby those credentials will undertake authentication to verify student's identity. Once logged in students simply make a priority list of faculties and programs they wish to enroll into and in the end of each enrollment period they are presented with the rankings and the status weather they are accepted or rejected. Applying to another faculty is again done online, with the same few simple steps.

There are many advantages for this kind of approach for faculty enrollment. Precious time is saved with avoiding going to the state officials for the documents required for enrollment. Financial factors are also obvious for students leaving in remote place which will save on transport. The automated system will generate the rankings and the results of the enrollment very fast because there will be no need for human intervention in the process. Crowds caused by the enrollment periods will be avoided and this process will make things easier for the administration employees in the faculties.

In future work this model can be expanded to support online faculty enrollment between countries, like the European Union for example, also the system can be easily modified to accomplish similar tasks like examination for civil service. Furthermore, the model can be improved so that no paperwork is required at the end of the enrollment process that is currently required by law. An option for online payment of the faculty fee can be also available.

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