A STUDENT PERSONAL SYSTEM
FOR BOLOGNA PROCESS MOBILITY

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Abstract: The Bologna Process aimed to build a European Higher Education Area with the objective of promoting students mobility. The adoption of Bologna Declaration directives requires a decentralized approach that accelerates student's mobility, based on frequently updated legislation. This paper proposes a student personal system to manage student's academic information. This system is supported by a flexible model that integrates, for instance, knowledge about the student attended courses or about a course that the student wishes to apply. Essentially, this model holds a (i) Student's Academic Record with skills acquired in academic course units, professional experience or training and an (ii) Individual Studies Plan, which places the student in a particular (iii) Course Plan setting the curricular structure that the student wishes to apply.

1 INTRODUCTION

With Bologna Process (BP), the social and cultural developments impose a revision of the graduate and postgraduate education systems. Students can personalize their studies from a diversity of options. Furthermore, study programmes have become modular, giving students the chance of more mobility during their studies. Organisational and legal efforts have been taken to guarantee high compatibility of study programmes and modules, e.g. the so called BP in Europe (Bologna 2001). Resulting from this process students can personalized their studies and can compose different educational modules at any institutions to a highly personalised curriculum. This process will change the role of educational institutions, such as universities (Krämer 2003). They are to be considered as components of a common, integrated educational space.

The traditional tasks like offering lectures, seminars, materials, and infrastructure for education will be supplemented by new tasks, such as personalized educational programmes.

This scenario requires new information systems and data integration among the different institutions.

In order to support this new academic reality of self-management, the current work suggests a Student Personal System (SPS) to manage its academic information records. We propose a knowledge representation model to organize the student's academic information, presented at section 3.

The most important issues in this context problem are the support for the searching and studies plan evaluation. Such system should help current and prospective students to search for suitable course plans or single course units in order to compose a personal curriculum by analysing their multi-faceted skills. The student proposals for individual studies plan are submitted and approved by the desired educational institution. The proposed SPS offers a graphical user interface that is autonomous from a particular institution. The data acquisition and data submission can be implemented in multiple ways such as web services or simple by file transfer protocols.

2 BOLOGNA DECLARATION

As the Confederation of EU Rectors' and the Association of European Universities (2000) explains it (CRE et al, 2000 p.3-4):

"The Bologna declaration reflects a search for a common European answer to common European problems. The process originates from the recognition that in spite of their valuable differences, European higher education systems are facing common internal and external challenges
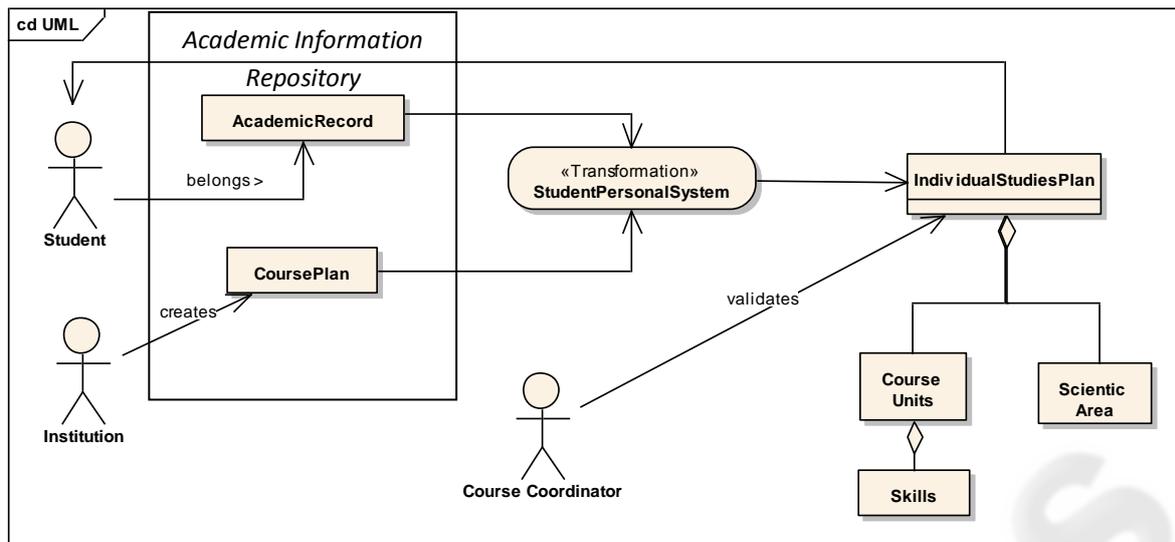
Figure 1: Student Personal System.

related to the growth and diversification of higher education, the employability of graduates, the shortage of skills in key areas, the expansion of private and transnational education, etc. The Declaration recognises the value of coordinated reforms, compatible systems and common action.

The action program set out in the Declaration is based on a clearly defined common goal, a deadline and a set of specified objectives:

A clearly defined common goal: to create a European space for higher education in order to enhance the employability and mobility of citizens and to increase the international competitiveness of European higher education;

A deadline: the European space for higher education should be completed in 2010;

A set of specified objectives:

- The adoption of a common framework of readable and comparable degrees, "also through the implementation of the Diploma Supplement";

- The introduction of undergraduate and postgraduate levels in all countries, with first degrees no shorter than 3 years and relevant to the labour market;

- ECTS-compatible credit systems also covering lifelong learning activities;

- A European dimension in quality assurance, with comparable criteria and methods;

- The elimination of remaining obstacles to the free mobility of students (as well as trainees and graduates) and teachers (as well as researchers and higher education administrators)."

3 STUDENT PERSONAL SYSTEM

The SPS is illustrated in Figure 1. The main objective is to assist student in the management of personal academic information supported by AIR. The main objective of the SPS is to allow the simulation of a possible mobility scenario that can be submitted by the student to an institution. Essentially, the institution provides course plans that can be chosen by the student. In order to simulate the mobility, according to BP, the SPS compares the student's skills in the academic record against the skills in the course plan and produces an individual studies plan that represents de current position of the student in the context of a particular course plan. When the skills in the academic record are literally equal to the skills in the course plan or exists a historical registration about the skills similarity the individual studies plan is fulfilled. When is not possible to determine the skills similarity a human intervention is required, for instance after the submission will be the course coordinator.

3.1 Individual Studies Plan

A generic representation of the individual studies plan is illustrated in Figure 2, except the course unit element that is in the root of the individual studies plan.

The order of the terms in RDF is irrelevant; the results of the queries are independents of the position of the information. This particularity makes

the RDF flexible and permits futures actualizations with a minimum of changes.
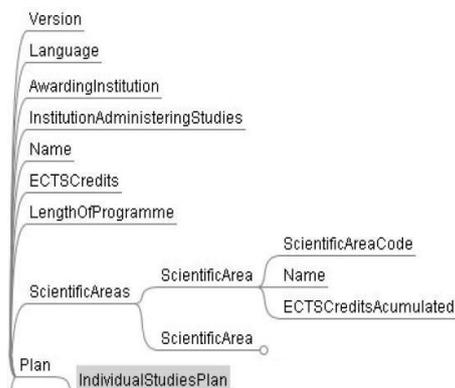

Figure 2: Part of the Individual Studies Plan.

For example in RDF and for a specific case, the individual studies plan can be modelled by the code presented in Example 1.

```
<Plan rdf:ID="PT-IPL-ISEL-LEIC-ALUXOX">
 <Version>1.0</Version>
 <dc:language>por</dc:language>
  <AwardingInstitution>Instituto
  Politécnico de Lisboa
  </AwardingInstitution>
  <InstitutionAdministeringStudies>
  Instituto Superior de Engenharia de
  Lisboa
  </InstitutionAdministeringStudies>
 <Name>Engenharia Informática e de
 Computadores</Name>
 <LengthOfProgramme>6S
 </LengthOfProgramme>
<ScientificAreas>
 (…)
<ScientificArea rdf:ID="MAT">
 <ScientificAreaCode>MAT
 </ScientificAreaCode>
  <Name>Matemática</Name>
  <ECTSCreditsAcumulated>6
  </ECTSCreditsAcumulated>
 </ScientificArea>
  (…)
</ScientificAreas>
<CourseUnits>
  (…)
  <CourseUnit rdf:ID="MATII">
   <Code>MATI</Code>
   <Name>Matemática II</Name>
   <ScientificAreaCode>MAT
   </ScientificAreaCode>
   <Lenght>1S</Lenght>
   <AcademicYear>1</AcademicYear>
   <AcademicSemester>2
   </AcademicSemester>
   <TotalLectures>160</TotalLectures>
```

```
   <TotalLecturesTP>90
   </TotalLecturesTP>
   <ECTSCredits>6,5</ECTSCredits>
   <Mandatory>Sim</Mandatory>
  </CourseUnit>
 (…)
 </CourseUnits>
</Plan>
```

Example 1: Part of the Individual Studies Plan.

3.2 Skills and Course Units

The concept of skills is used to establish a link between the ones acquired by the student by various means and those necessaries to complete a determined course plan.

The definition of the skills must be clear. For this we propose the European Dictionary of Skills and Competencies to provide a common terminology, easy comprehension and high scientific accuracy.

A model for skills representation is showed in Figure 3. A skill is composed by a code (ID) and by a description.

Figure 3: Skills.

```
<Skills>
 <rdf:Bag>
  <rdf:li>
   <Skill rdf:ID="S17454">
    <Code>17451</Code>
    <Description>HTTPS</Description>
   </Skill>
  </rdf:li>
  <rdf:li>
   <Skill rdf:ID="S17454">
    <Code>17931</Code>
    <Description>Negociation
    </Description>
   </Skill>
  </rdf:li>
 </rdf:Bag>
</Skills>
```

Example 2: A Skill in RDF.

The course unit is a central element for the mobility process. The code, name, skills, total of lectures and ECTS credits of a course unit are presented in the modulation of the course unit in Figure 4.

An example of the implementation of the course unit "computer networks" including a skill, and part of the RDF code is presented:

```
<CourseUnit rdf:ID="ES-UPM-RC">
 <Code>ES-UPM-RC</Code>
 <Name>Computer Networks</Name>
 <Skills>
   (…)
   <Skill rdf:ID="S17454">
    <Code>17451</Code>
    <Description>HTTPS</Description>
   </Skill>
   (…)
 </Skills>
<ECTSCredits>9</ECTSCredits>
</CourseUnit>
```
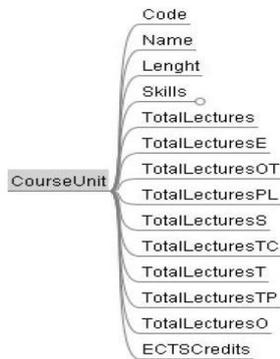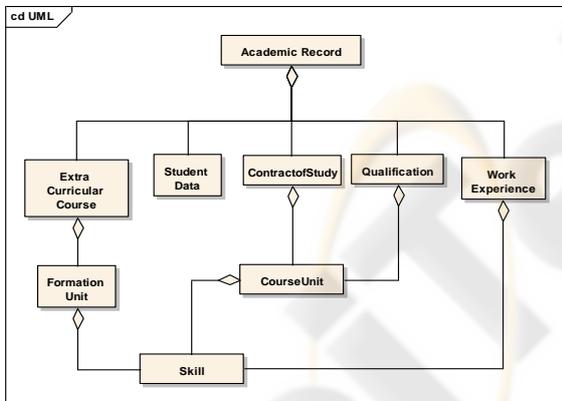
Example 3: A Course Unit in RDF.

Figure 4: Course Unit.

Figure 5: Academic Record model.

The Academic Information Repository (AIR) proposed Model for Mobility (MM) is composed by two sub-models:

- Academic Record, illustrated on Figure 5;
- Course Plan, illustrated on Figure 6;

A studies contract is celebrated between the student and the institutions to formalize the terms of the
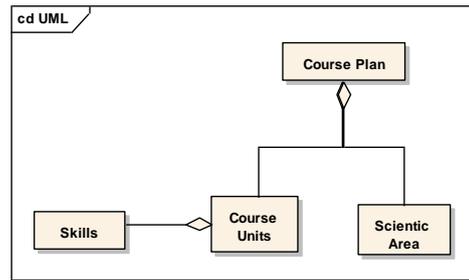

Figure 6: Course Plan model.

mobility process.

The language used to write the documents is RDF (Resource Description Framework) and respective schema the RDFS. An excerpt of the Model for Mobility is represented in Example 4.

```
<?xml version="1.0"?><rdf:RDF
  xmlns:rdf=
   "http://www.w3.org/
   1999/02/22-rdf-syntax-ns#"
  xmlns:rdfs=
   "http://www.w3.org/
   2000/01/rdf-schema#">
 <rdfs:Class rdf:ID="AcademicRecord">
Resource"/>
  <rdf:Property rdf:ID="StudentsData">
  (...)
  <rdf:Property rdf:ID="Code">
  <rdfs:domain rdf:resource=
   "#Nationality"/>
  <rdfs:domain rdf:resource=
   "#CourseUnit"/>
  <rdfs:domain rdf:resource="#Skill"/>
  <rdfs:domain rdf:resource=
   "#FormationUnit"/>
<rdfs:range
```

Example 4: Part of the Model for Mobility.

3.3 Academic Record and Versions

The academic record, presented in Figure 5, can aggregate translations in various languages. The academic record is composed by records. Each elementary record has its own language.

The model is flexible and expansible and can be improved incrementally. A simple control of versions mechanism is implemented, see the representation in Figure 7. The record has the corresponding version.
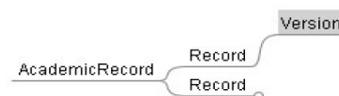

Figure 7: Control of versions.

3.3.1 Student Data

The student data is the same, do not changes, whatever the language is used. The element in the root of each academic record is showed in Figure 8.
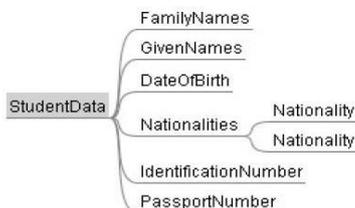

Figure 8: Student Data.

3.3.2 Qualifications

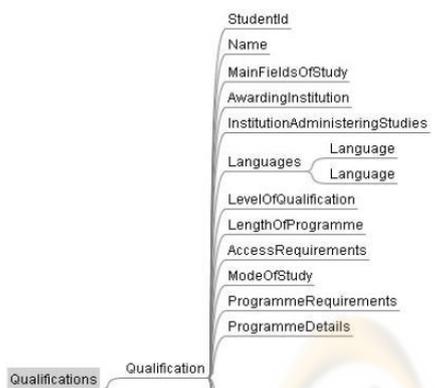Part of the model for the qualifications of a student is represented in Figure 9.

Figure 9: Qualifications.

3.3.3 The Work Experience

The modulation for the work experience is described in Figure 10.

To illustrate the work experiences of the model, for a Java programmer see Example 5.

```
<WorkExperiences>
 (…) <WorkExperience rdf:ID="WE01">
  <StartDate>2009-01-01</StartDate>
  <EndDate>2009-12-31</EndDate>
  <Occupation>Java Programmer
  </Occupation>
  <MainActivities>
  Development of Java Applications
  </MainActivities>
  <EmployerName>JavaSofts
  </EmployerName>
  <EmployerAddress>Liberty Street -
  Lisbon</EmployerAddress>
```

```
  <TypeBusinessSector>Informatics
  </TypeBusinessSector>
 <Skills>    (…)
    <Skill rdf:ID="WOEXS-WE01-S01">
     <Code>17344</Code>
     <Description>Java</Description>
    </Skill>        (…)
  </Skills>
  </WorkExperience>
</WorkExperiences>
```
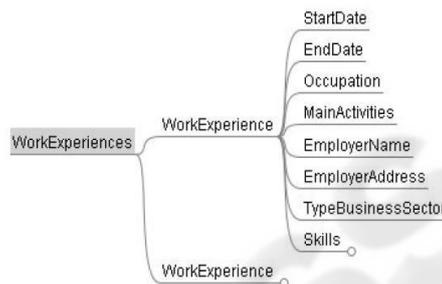
Example 5: The Work Experience of the student.

Figure 10: Work Experiences.

3.3.4 Extracurricular Unit

The formation unit of the extracurricular unit is composed by the following terms presented in Figure 11. The element Formation aggregates the professional experiences of the extracurricular courses.
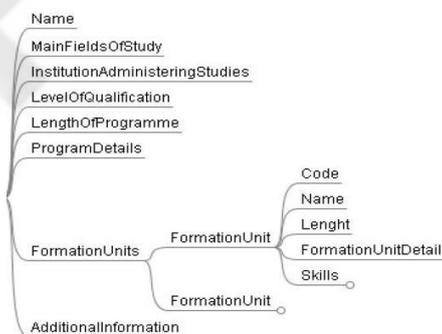

Figure 11: Formation Unit of the Extra Curricular Unit.

3.3.5 Contract of Studies

A contract of studies is celebrated between the student and the institutions to formalize the terms of the mobility process. The contract is formed by transcript of records represented in Figure 12. An example of a study contract includes the student id, the institution administering the study, the course unit etc.
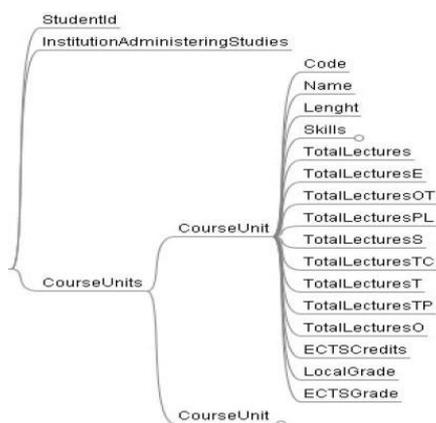
Figure 12: Transcript of Records of the CS.

3.4 The Course Plan

The course plan characterizes a specific course by the means of descriptive elements of the curricular structure and the studies plan. The complete element qualification is also composed by course units, already presented in Figure 4. The individual studies plan places the student in the context of a determined course. The student must conclude the total of ECTS in determined scientific areas.

3.5 The Academic Training

An academic training includes the qualification is characterized by the main field of study, the course unit, the total lectures etc.

4 FUTURE WORK

The proposed model for BP student mobility is an open model that needs to be continuously improved and consolidated. In that sense the following themes are suggested: (i) To propose a model for elements of the Bologna process not addressed in this paper; (ii) To explore the possibility to develop or adopt an existing ontology; (iii) To define a complete and dynamic flow of work processes to support the mobility of the student between institutions of higher education. (iv) To create a model of learning with the proposed model using: Case-based learning or Case-based reasoning.

5 CONCLUSIONS

This paper proposes a personal acadeemic system supported by a BP mobility knowledge model for students in the European area (Covelinhas E., 2008). Bologna Declaration demands for a common background based on student skills management. The proposed system addresses this key issue in order to widely support BP that needs to be implemented until 2010.

The inclusion of emergent ideas and orientations, like the semantic web, allows and suggest the use of RDF language which is flexible and where the data can be updated in any order.

The discussion of ideas about the option between other models of knowledge representation and this model is still valid.

The main contributions of this paper are: (1) a characterization of the components of the mobility of a student in the European space; (2) a model that is a complete and compliant solution for the existing legislation, namely Portuguese legislation; (3) the implementation in RDF/RDFS allows the use of the emergent query language SPARQL (Query Language for RDF); (4) a functional prototype developed in our laboratory.

ACKNOWLEDGEMENTS

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