Universidade de Évora's Integrated Information System: An Application

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Abstract Universidade de Évora's Information System (SIIUE) intends to represent all concepts necessary for Universidade de Évora (UE) management and day-to-day operations. SIIUE was built within a logic-based approach using the ISCO development tool. One of the mostly developed SIIUE applications resides in the Institutional Evaluation area, concerning the evaluation of lectured courses. SIIUE's support is essential to overcome this area's needs, aiming to improve the University courses quality.

Keywords: Logic Programming, Organizational Information Systems, Practical Application, ISCO.

1   Introduction

The purpose of this article is to briefly describe SIIUE and to focus in a particular and already fully functional implementation within its general deployment: the *Institutional Evaluation.*

The article is structured as follows: in the next section we briefly describe SIIUE and the principles behind its deployment namely organizational, functional and design ones. Section 3 discusses the application of SIIUE to the Institutional Evaluation area and in section 4 we present some conclusions and directions for future work.

2   SIIUE

Universidade de Évora Information System (SIIUE) [5] has been under development for about four years. It aims to represent the entire universe of concepts necessary for management and ordinary operations in an institution as Universidade de Évora (UE), such as teaching, research and others.

As a general-purpose information system, with deductive facilities and several interfaces, SIIUE has been successfully applied to issues of the institution's academic activity, namely:

– Academic Services System
– European Credit Transfer System
– Institutional Evaluation

Besides academic areas, other developments being done refer to:

– Organizational issues, in what concerns namely administrative and management information.
– Operational issues, regarding physical and technical information about the different infrastructures and its exploitation.

Finally, the development itself is being made in two directions:

- Academic, regarding all research aspects namely those concerning the development of the Logic Programming Language ISCO [6, 7].
- Operational, regarding all the aspects concerning the development, implementation and exploitation of new functionalities, see for example [8].

2.1 Organization and Design

Some of the principles behind the developments that have been made, regarding the information characteristics and usage are:

Unique canonical representation Despite the fact that the system intents to support multiple and distinct sources of information, it is a fundamental issue that in what concerns the representation in SIIUE, the information is unique. This way it is possible to guarantee its integrity and consistency.

Valid "institutional" information The information represented within SIIUE may in fact be "stored" elsewhere. Nevertheless its validity and reliability is guaranteed by SIIUE. At the end, maybe only aggregated information may exist within SIIUE.

One of the main objectives of the SIIUE is in fact to guarantee a centralized, persistent, valid and "sufficient" database that references other sources of information within the University, providing at the same time different ways of interfacing with it and mechanisms of validation and integrity.

Contextual and distributed information By aggregating or simply referencing specific information from a centralized database it is possible to consistently represent and integrate it, regarding structured, unstructured and temporal aspects of the distributed databases and specific systems existent.

OO approach Issues as inheritance, hierarchical validation and access are included in the information representation itself, in its definition and associated methods. Modularity, scalability and reutilization are also a natural consequence of this approach which has already proven to be quite adequate for solving a problem which is underspecifed and of arguably large scope, while having to endure severe restraints on the human resources involved in its design and implementation: it allowed us to go from an initially ill specified requirement to a functional, although partial, implementation in under one year with very limited human resources.

2.2 Architecture and Implementation

SIIUE's infrastructure development was made on a three layer-based architecture (figure 1):

The Web layer This level contains on or more web servers (running PHP [3] under Apache [1]) where all internet and intranet access to SIIUE is directed to and where all the HTML [4] rendering is made.

A PHP module then allows the Apache processes to connect to Prolog processes when SIIUE information is requested. These Prolog processes are part of the next architecture layer: the ISCO processing layer.

The ISCO Processing layer This layer is composed by an Logic processing server which contains a set of ISCO [6] running processes.

ISCO is a new Logic-Based development language implemented over GNU Prolog [10] based on concepts such as Constraint Logic Programming, first-order logic description of classes and inheritance, class attributes, the values used to populate the classes and algorithm. ISCO gives the developer several distinct possibilities, useful for the development of applications such as SIIUE:

- Gives a simple database structure description language that can help in database schema analysis. Tools are available to create an ISCO database description from an existing relational database schema and also the opposite action, i.e. to create a relational database schema from a ISCO class description.
- View relational databases as a part of a declarative/deductive object-oriented (with inheritance) database. Among other things, the system maps relational tables to classes which may be used as Prolog predicates.
- Gives simple access to relational data through ODBC using a GNU Prolog interface with unixODBC, which has been developed within the SIIUE project.
- Creates ISCO/Prolog executables ready for use from PHP scripts [3] in web-based interfaces. The PHP extensions have also been developed specifically for use with ISCO.

The ISCO processes receive the incoming requests, parse them and connect to the database repositories to get the necessary information. These repositories are part of the third architecture layer: the Database layer.

The Database layer This layer contains a set of information repositories which hold all SIIUE information. These repositories include not only relational databases (directly or through ODBC) but also directory services such as LDAP [2], as well as other network services such as SNMP or DNS. At the present, the following stores have been implemented: ODBC data sources, Direct PostgreSQL [9] data sources and LDAP directories.

3 Practical Application: Institutional Evaluation

One of the areas in which SIIUE became essential to satisfy existent needs and requirements is the Institutional Evaluation. This area intends to promote and coordinate the evaluation of Universidade de Évora courses. Its goal is to improve not only the courses quality but the University quality as well.

Institutional evaluation is a complex process in which there are several participants. This process is coordinated by the Central Services that gather information about courses, disciplines and faculty. This information has several sources: the faculty members, the undergraduate program coordination commissions, the departments, etc.

Until SIIUE's development on this particular area was accomplished, the information was requested by the Central Services to all the sources, which should send the information on paper. Every year the same type of information was requested:

- Course Reports - information about the course, it's program, goals, bibliography, related documents, etc.
- Lecturer Information Reports - the publications, academic qualifications, teaching career, professional career, etc.
- Summaries - a brief summary of what was actually done in a particular class.

This process meant a great waste of time and resources to the Central Services and to all the faculty members that where part of this process. Requesting the information by the Central Services and receiving it afterwards was a process that could take several days (or weeks), inevitably delaying all the evaluation process.

What SIIUE offers to this process is a global information repository where all the needed data is stored, and the means to access it. The access to the information is controlled by roles. Each role has a set of defined permissions that restrain the access to the existent information:
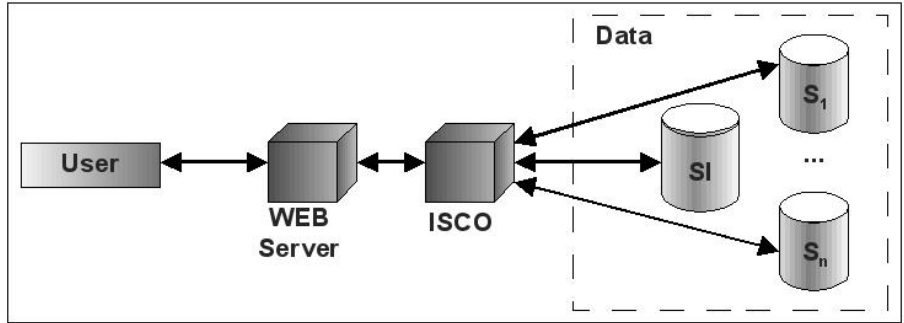
Fig. 1. SIIUE Architecture

– Faculty members - full access to the course reports, to the personal information record and to the class summaries.
While the access to the lecturers' information report is always available, the access to a course report or summaries is only available for the courses the teacher is assigned to. These assignments may change from year to year and are controlled by the departments.
– Course Coordination Commissions - read access to the courses and lecturers to check on the information introduction status.
– Departments - full access to the lecturer/course assignments. Introducing in SIIUE the information of "who teaches what course" is essential to restrain the courses that a lecturer may access and for which he can introduce information (course reports and summaries).
– Central Services - read access to all information to gather it and give it to the external evaluation commissions;

With this architecture, the departments state who teaches a course, lecturers introduce their information and their course information, course coordination commissions check for the introduced information validity and correctness and finally the Central Services gather all the information for institutional evaluation purposes.

This form of information managing process becomes gradually more efficient, requiring a small amount of effort by its participants and taking a small amount of time. These benefits along with the ability to centrally manage all information and avoid data duplication increased significantly the usage of SIIUE's evaluation application by the university community.

4 Conclusions and Future Work

SIIUE has already proven useful by permitting a number of practical applications to be developed on relatively short notice and with restricted human resources. The combination of an RDBMS with a Logic Programming core was shown to be useful in that it allows for elaborate computations to be performed on the information contained in the database.

The widening of SIIUE's scope allows for the relatively easy automation of several tasks which were manually performed.

Although some developments are being made (and will keep on being), SIIUE is now in production stage. In what concerns the evaluation process (section 3), the features described are already implemented and currently available for the University users through the SIIUE management application.

Various other on-going research and development projects at Universidade de Évora are related to this work, these include:

– Natural language interface: One of the most challenging issues when constructing database applications is the ability to automatically generate useful queries from a specification created by a non-technical user. Even for a technically savvy person, it is sometimes useful to be able to query the system in natural language. It is within our plans to provide support for queries specified in a simplified natural language (we will be targeting Portuguese, obviously), with concepts and vocabulary appropriate for the information contained within SIIUE.

– Visual Programming language to complement ISCO: With grounds similar to those that motivate a natural language interface, to which we can add the desire to ease the definition process for the concepts which underlie SIIUE (eg. the class hierarchy), SIIUE may prove a fertile ground on which to experiment with visual programming. Work is presently underway to explore this line of research.

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