

# Workflow Management Systems: A Prototype for the University of Coimbra

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## Abstract

*Consumers today are making increasing demands on the quality of products and services offered by businesses worldwide and organizations such as educational institutions are no exception to the trend. Nevertheless, many institutions, including universities, seem to be unaware of this, continuing to maintain structures and methods of working which no longer correspond to the emerging demands of the market.*

*In this project we have aimed to counter this tendency by introducing a prototype system of workflow management developed specifically for the University of Coimbra. This system aims to provide a basis both for the promotion of co-operative work patterns and also for the automation of the University's business processes.*

## 1 Introduction

In the last twenty years there has been an extremely rapid development in the equipment available in the information technology market, concentrated in two main technological areas: personal computers and information networks. These two factors make it possible to have a computer in every office, and for all computers to be linked, thereby realising the concept of the "global village".

The interconnection of computers is not the end of this evolution. At the moment, data exchange has become a common task for all network users. The next logical step - a reflection of users' expressed needs - is to connect not only programs working in separate machines and environments, but also the users themselves [Wilson, 91], through the creation of inclusive environments which promote more focused and productive interaction. One of the most notable capabilities of these environments is the support of cooperative work.

The area of CSCW has played a fundamental part in the analysis of factors which affect the construction of

computer-assisted group working environments (Ellis, 1991)(Grudin, 1994). Developments here have given rise to a new type of work, enabling people to work from home and companies to create branches or joint enterprises throughout the world, without any loss of communication, collaboration and coordination.

Associated with technical advances in CSCW is the rapidly expanding area of workflow. An important factor leading to this expansion has clearly been the growing market for this type of system, which is being adopted by an increasing number of businesses.

Workflow systems are a tool which lets organizations to respond to the ever-increasing needs and demands made by clients on services offered by them. It is necessary to analyse, restructure and automate the way they are performed, allowing an adaptation of the company to the changes of the environment.

## 2 The project

The project we have developed, called SCAPO (Computerized System for Organizational Processes), aims, after analysis and consideration of the organizational characteristics, to develop and adapt a workflow system for a university institution. The construction of a prototype was connected to the need to evaluate the degree of success and the problems in the practical use of the system, so that a system covering the whole organization could be developed in the next phase.

In this work we have sought to make a contribution to the modernisation of university administration by innovating and reorganizing, concentrating on problems at the level of independence of platforms, integration, modularity, security, and the use of distributed systems with pleasant and homogenous interfaces.

## 3 The organization

The prototype, which we shall describe, was conceived

to operate specifically in the Faculty of Science and Technology (FCTUC), one of the seven faculties of the 700-year-old University of Coimbra. Founded in March 1290, and with a student body today numbering 20,000 (8000 of these in the Science Faculty), this is one of the largest universities in Portugal.

The choice of this organization was determined by three factors which we consider highly suitable for evaluating the degree of success in the installation of our workflow system. Firstly there is the age of the organization, whereby the accumulation of changes overtime may result in redundant or ineffective processes. Secondly, the number of clients (students) is also important for our analysis, since such a large number and diversity requires a more rigorous and considered study of the organization. The third factor is that the University is one of the group of Portuguese universities, so that we have to consider questions of interaction with outside bodies, and define a set of norms for these interactions.

## 4 Modelling of processes

The business processes in an organization must be carefully identified and studied before we can construct a suitable representation to be processed by computer. Firstly, therefore, we have to model these processes to ensure that all elements and interactions have been considered.

### 4.1 Method

We have chosen the STRIM method (Systematic

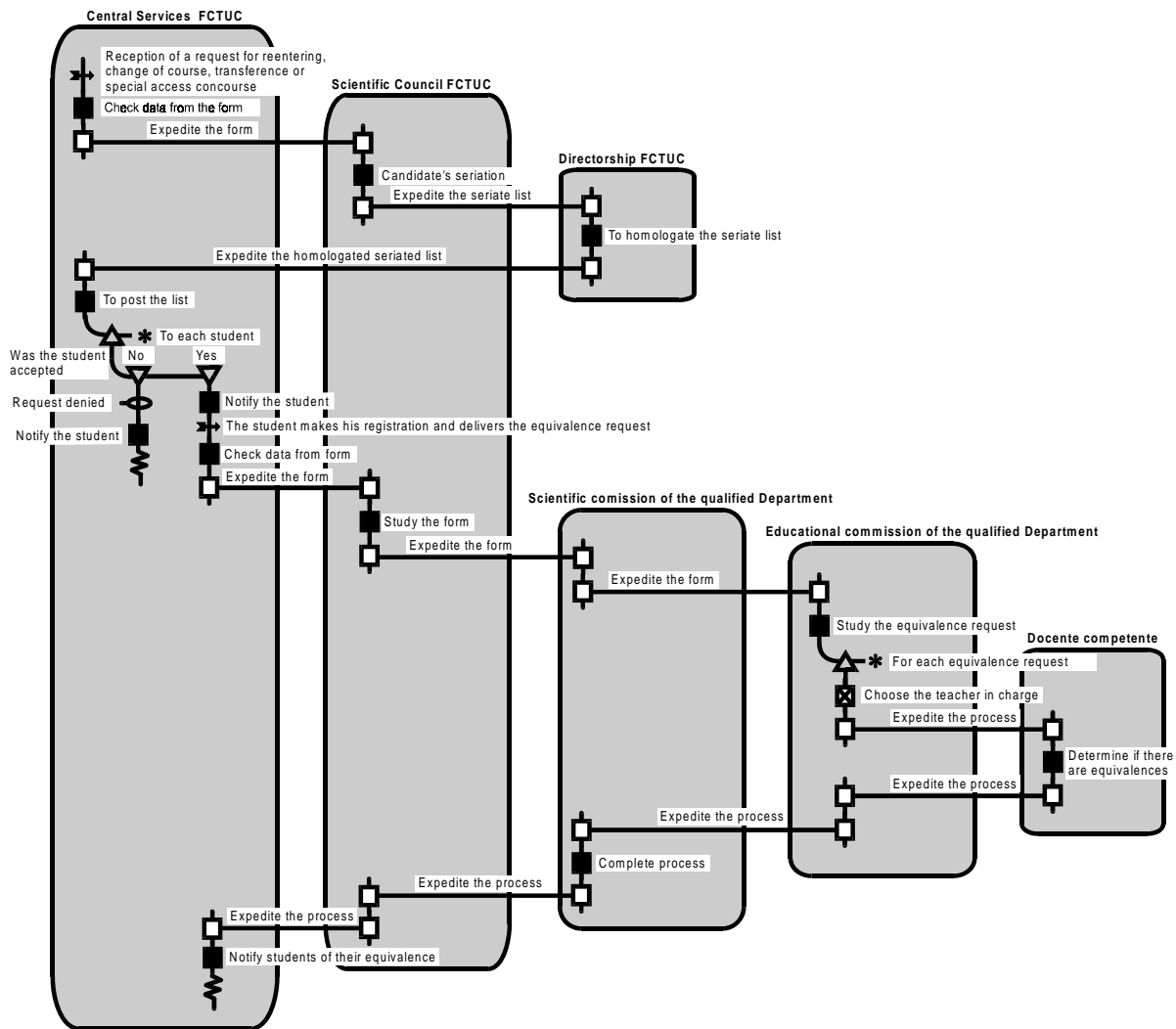
Technique for Role & Interaction Modelling) [Ould, 95] for modelling of processes. This method uses a set of techniques which enable us to model the behavior of an organization in a simple, expressive and powerful way. It is often adopted in the context of re-engineering, in which the key concerns are processes rather than functions, as it allows analysts to research the relationships between processes and organization.

In the various areas in which STRIM operates, its main notational system is RAD (Role Activity Diagram). This is made up of a set of symbols by means of which processes are modelled. RAD notation is quite intuitive, making it easily understood either by analysts or by anyone working in the organization.

### 4.2 Processes identified in FCTUC

After studying the processes in University and according to the classification suggested by McCready [McCready, 92], we identify two workflow patterns: administrative and *ad hoc*. We can find the first type in the most basic university activities, such as equivalence requests made by students. The second pattern, which is harder to identify, is made of several interactions between workers who will accomplish the request and exchange of information.

We can see in Figure 1 an example of an administrative process which was modelled by STRIM method. Its main purpose in the organization is to authorize requests like reentering, transferring, course changing and special access made by students to the University.



**Figure 1 Example of an administrative process which was modelled using STRIM method.**

## 5 The work platform

Unlike we could think, we have not chosen a workflow tool to build our prototype. We believe that University, dued to the interactions between people, basically needs a groupware environment to promote cooperative work. Such environment connects all University users through a common working platform.

This approach, although giving a solid and essential groupware platform, difficults the building of a workflow system, because the environment is not appropriated to this kind of task.

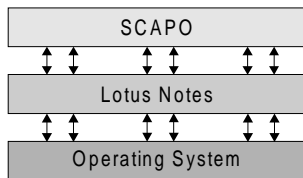
Although, after the identification of the necessary requests to make our prototype, a groupware tool was

found.

The environment (Lotus Notes) gives a set of functions and functionalities which we describe next, and can be used to build a workflow system.

1. It has an integrated development environment, which facilitates the development of client/assistant applications.
2. It is compatible with various platforms
3. It provides various security mechanisms: encoding of data, passwords and certificates.
4. It allows remote access to data via networks or dial-in.
5. It has a directory, which allows the organization to be represented.
6. It includes an e-mail client which is easy to use and transfers messages to various postal systems.
7. It provides an intuitive and consistent interface for all users, regardless of the platform used.

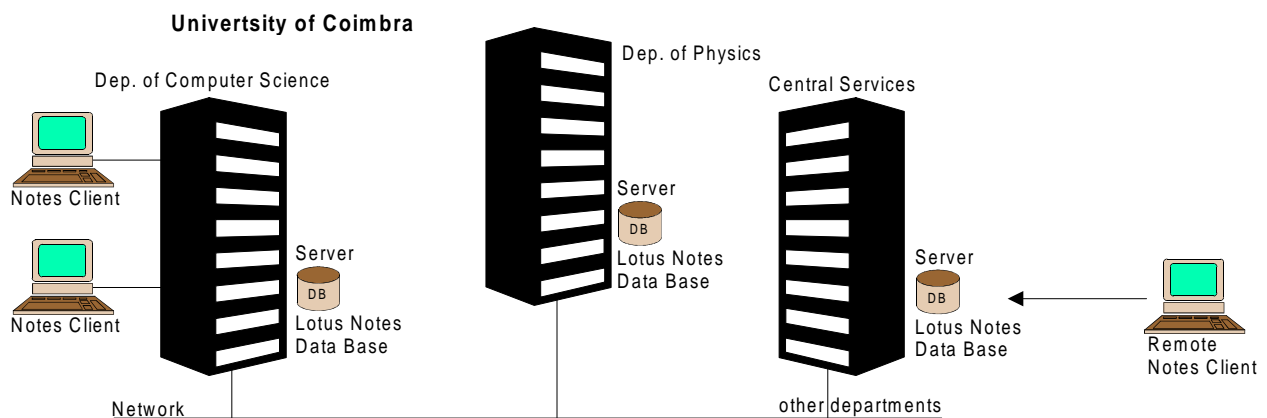
The selected system puts our prototype working on the top of Lotus Notes environment, according to the structure described in Figure 2.



**Figure 2 Structure of the adopted environment and the developed system.**

## 6 Global design

A main platform will be installed in all the elements of the organization. All faculties and departments, will have a server which will store the human resources available. Servers will be interconnected, creating a global network of Universities. Each server will have a group of clients who represent the authorized workers to have access and to work on them. According to internal administrative policies of each entities, the system can support and authorize remote work, as we can see in Figure 3.



**Figure 3 Global design of the system.**

## 7 The prototype

The developed prototype (whose main purpose is to support the automatization of the administrative processes in the University), was totally build using LotusScript language. The use of a programming language permitted the construction of an application which included all the wanted requests.

The SCAPO system implemented is basically made up of four modules: definition of workflow; engine; processes, plus management and monitoring of processes carried out.

### 7.1 Definition of the workflow

The specification of workflow, which aims to describe the route taken in a process, is independent of the engine. This permits greater flexibility of the system, makes the engine a generic element, and allows the same pathway to be used by multiple engines.

The data introduced includes the definition of the chain through which the process will circulate, and its associated characteristics, as well as information on the priority.

### 7.2 The engine

This is a fundamental part of the system, responsible for carrying the process through the organization. As a module which is independent of the processes, its structure allows it to be attached to any process, thus making it very easy to use.

The engine is also responsible for notifying participants, by e-mail, about processes requiring their attention, so that certain duties may be carried out to enable the process to continue.

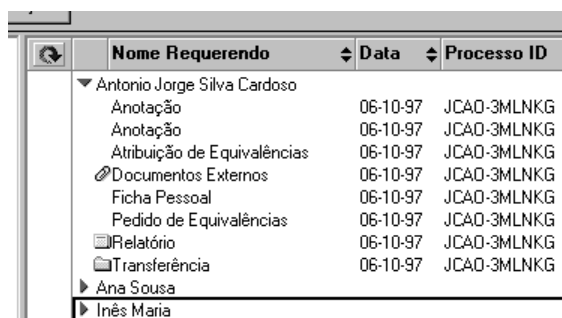
### 7.3 The processes

These are the entry point for the user, bringing together all the documents annexed by workflow participants. When a participant receives a process, he/she can consult the collected documents, if given permission to do so, and create and annex the documents required. When the task is finished, the process is sent specifically to the next participant.

## 7.5 Management and monitoring of processes

An organization must have at its disposal mechanisms for the management and monitoring of the state of processes currently being carried out. In our system the engine which directs the processes maintains an updated report of the state of the processes, in which records are made of all operations by participants, with dates, as well as other general information. This report is always available, thus acting as an essential source of information for the client who has initiated a process.

As well as the production of reports, it is also possible to inspect all processes being carried out, and the documents they consist of.



Nome Requerendo	Data	Processo ID
▼ Antonio Jorge Silva Cardoso		
Anotação	06-10-97	JCAO-3MLNKG
Anotação	06-10-97	JCAO-3MLNKG
Atribuição de Equivalências	06-10-97	JCAO-3MLNKG
Documentos Externos	06-10-97	JCAO-3MLNKG
Ficha Pessoal	06-10-97	JCAO-3MLNKG
Pedido de Equivalências	06-10-97	JCAO-3MLNKG
Relatório	06-10-97	JCAO-3MLNKG
Transferência	06-10-97	JCAO-3MLNKG
▶ Ana Sousa		
▶ Inês Maria		

Figure 4 Monitoring of current processes

## 8 Conclusions

The extent of clients' demands, allied to the globalization of economic activity and the growth of competition, have resulted in greatly increased pressure on businesses, obliging them to supply better products and services. Workflow systems are certainly a positive way to restructure traditional forms of work, as we have seen in the system developed and installed in the University of Coimbra.

### 8.2 Achievements

The workflow management system development in Coimbra's University, has become an important step in conforming the success of such systems in educational organizations. In our research and implementation, various aims were achieved, such as: the amount of paper used was drastically reduced, when replaced by electronic forms. The time spent to conclude a process was improved, due to the reduction of the transport time between two entities, and the facilities in treating documents. The management and monitoring of processes, gave us an updated status of the processes, and

a list of actions made on them. The ability to connect remotely to the main office, allows workers to perform teleworking at home.

### 8.1 Difficulties encountered

Despite the benefits introduced by the use of this system, we have encountered several difficulties, some of them difficult to resolve.

The change of information context, which happens when elements belonging to processes from outside the University are brought in, causes problems with some processes, necessitating recourse to OCR (Optical Character Recognition) techniques to convert paper documents to binary ones.

The lack of staff training in the area seems to be a frequent problem [Orlikowski, 92], and since it often involves cultural issues, this can be a difficult barrier to surmount.

The presence of ancient processes, the result of many consecutive changes, introduces redundant elements and useless steps which have to be eliminated by the use of advanced and efficient techniques such as BPR (Business Process Re-engineering).

The integration of the new system with pre-existing ones (legacy systems) has to be considered with care, since database and electronic mail systems already exist in the organization.

### 8.2 Future work

As mentioned above, this first approach resulted in the construction of a prototype, and its predefined objectives have been successfully achieved.

The work we intend to carry out after SCAPO consists of the total integration of a similar system in the University of Coimbra. We aim to carry out an in-depth analysis of the organization as a whole, from its roots upwards, so as to apply BPR techniques, encompassing all existing University processes, and interacting with existing systems to create a reference model facilitating the interconnection of various Portuguese universities.

## References

- I. M. Author, "Some Related Article I Wrote," Some Fine Journal, Vol. 17, pp. 1-100, 1987.
- [1] U. Busbach, "Activity Coordination in Decentralized Working Environments", CSCW issues for Mobile and Tele-workers, Springer, 1996.
  - [2] C. Ellis, S. Gibbs, G. Rein, "Groupware Some Issues and Experiences", Communications of the ACM, 34 (1), pp.

38-58, 1991.

- [3] J. Grundin, "*CSCW: The Convergence of Two Development Contexts*", Proceedings of CHI'91. ACM, pp. 91-97, 1991.
- [4] J. Grundin, "*CSCW: History and Focus*", IEEE Computer, 1994.
- [5] S. McCready, "*There is more Than One Kind of Workflow Software*", ComputerWorld, 1992.
- [6] W. Orlikowski, "*Learning From Notes: Organizational Issues in Groupware Implementation*", Technical Report n. 134, Sloan School of Management, Massachusetts Institute of Technology, 1992.
- [7] M. Ould, "*Business Processes - Modelling and Analysis for Re-Engineering and Improvement*", John Wiley & Sons, 1995.
- [8] P. Wilson, "*Computer Supported Cooperative Work: An Introduction*", Intellect Books, Oxford, 1991.