ADDRESSING ACADEMIC NEEDS IN MANAGED LEARNING ENVIRONMENTS†

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ABSTRACT
Universities are naturally distributed organisations. One consequence of this distributed functionality is that against the background of increasing adoption of information technologies in the workplace, the gradual transition from paper-filled filing cabinets to online repositories has proceeded in an ad hoc fashion, resulting in incompatibilities, duplication of effort, redundant copies of information, and the provision of online information services that are often obscure and unhelpful from the point of view of academic staff and their students. The INSIDE project, supported by the JISC Committee on Integrated Learning Environments, had a key goal of producing a user-centric portal for academic staff and their students that would integrate useful and usable information services. This paper reports on the issues which motivated the goal, and describes a module management system which has been built to address them. The system, MMS, is used extensively by staff and students in the School of Computer Science at the University of St Andrews.

Keywords
Managed Learning Environments, Role-based Access Control, e-Learning, Portals

1. MOTIVATION: THE NEED FOR APPROPRIATE INFORMATION SERVICES
As the use of ICT in the everyday workplace becomes the norm there are expectations that existing organisational processes will migrate to online systems which facilitate data sharing, co-operative working, and eliminate paper trails. In the context of education the notion of a Managed Learning Environment (MLE) has emerged. This is an attempt to combine Virtual Learning Environments (VLEs), where they exist, with Management Information Systems (MIS) to meet the needs of staff and students for relevant and helpful information services. When the JISC Committee for Integrated Learning Environments (JCIEL) launched its 7/99 program in July 1999 few institutions had fully grasped the concept of an MLE, and there was a significant divide between what traditional MIS provided, and what was wanted, especially with the increasing demands for accountability of administrative procedures being placed on academic staff. So, although a member of staff is an individual who plays particular roles and holds specific responsibilities within their institution, they can be faced with ploughing through multiple unconnected data repositories in order to satisfy simple queries and accomplish routine tasks. Even then there was no guarantee of a successful outcome. Inappropriate access control mechanisms and the lack of client software can deter even the most persevering online user. The numerous ad hoc record systems which blossomed at Departmental level replicated work that was also being done Centrally, but these systems were not co-ordinated with each other or Central Services. The JCIEL 7/99 program was renamed “Building MLE’s in Higher Education” in 2000, as the MLE concept started to crystallise and attract more attention. INSIDE (An Institutionally Secure Integrated Data Environment) [1] was one of the projects supported by the programme, its distinguishing feature being its recognition that the information maintained by Academic Departments, and the work involved in doing so, is an important, but under represented, component in the overall institutional information base. In other words, although the project it had the backing of central services and senior management at St Andrews, INSIDE was the only project in the programme driven directly by academics.

INSIDE had two key goals (i) the piloting of value-added services based on formal analyses of existing processes, and (ii) the generation of user-centric portals for academic staff based on their institutional roles and responsibilities. The latter goal was intended to be a delivery vehicle for the value added services. The INSIDE approach to value-added services, has been to...
Model, Analyse, Improve and Pilot [2]. This methodology resulted in the decision to build a user-centric module management system (MMS) for managed learning. The remainder of this paper explains key concepts and design considerations behind MMS.

2. **The User-Centric Portal Concept**

The purpose of a web portal in general is to provide a single, initial point of contact for a range of services. It is a technique widely used by commercial web-based service providers. It is intended to reduce the time that individuals spend searching, although it only promotes options that are commercially sponsored. Portals sometimes offer facilities for personal customisation. For example, an interest in specific sporting events or the local weather forecast. However, these options are very limited. By and large, web portals are public and cater for anonymous users.

User-centric portals differ from public portals in that they are built entirely around the identity of the user. Their utility in an institutional setting is that they can be generated for individuals and dynamically maintained using information that is already known about an individual’s official roles and responsibilities. Such information is often already online, albeit spread across many diverse data repositories. For example, if a lecturer is (i) a 1st Year Advisor of Studies for the Science Faculty, (ii) lecturing on modules CS3013 and CS2001, (iii) responsible for tutorial group five in module CS1001, (iv) a grant holder for EPSRC/ELC23, and (v) an Exams Officer, all the links to the relevant information could be aggregated onto a single page. From that page, it is important that the exact information services needed by an individual can be reached as directly as possible without wading through multiple interfaces. Note that some of this information may only be held locally – who is teaching which module, who is in charge of which tutorial group; some may only be held centrally – who is an adviser of studies; and some will be held at both levels – who is an Exams Officer, who is a grant holder.

3. **Building on the TAGS Framework**

TAGS [3-6] is a framework for the research, development, deployment and management of distributed learning environments (DLE). The principle of delivering online learning resources to each user based on their roles has been piloted in TAGS. Indeed, TAGS has piloted both MLE and VLE functionalities, its use for managing widely distributed student work placement projects was described in an earlier LTSN-ICS article[7]. The TAGS technique for dynamic user portal generation is based around the three simple components of users, groups and resources. Users and groups are unique by name; resources are unique by name and type. Groups form the basis of privileges and access, they provide the building blocks for the user’s portal page, and they can also act as dissemination channels when a communication resource is involved. There is no restriction on the nature of a resource. It can be a simple timetable, an interactive multi-user spreadsheet or a live data feed. All a users allocated resources appear on their home page, which is generated from their group memberships. Access rights can be specified when a resource is allocated to a group. A resource may simply be distinguished as Read-only or Read-Write, or it may export a more subtle set of access methods.

When a resource is edited the changes are reflected to all members of all groups it has been allocated to. If it is deleted it is removed from all the groups it was associated with. When a group is deleted the mappings it has formed between individuals and resources are removed. If a group’s membership is changed then only the new membership will have access to resources allocated to that group. When a user is removed from a group they lose access to that group's resources and if a user is deleted they are removed from all groups in the system. Various commonsense rules apply as to who can manipulate which users, groups and resources. When a user is a member of multiple groups who have different access privileges to the same resource then they are credited with the highest level from their set of privileges.

TAGS provided a solid basis for the further development of institutional user-centric MLE portals in INSIDE.

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1. Although earlier TAGS-based learning environments provided tools for managed learning, TAGS itself did not interface directly with central MIS. So, module lists had to be transferred via downloads and uploads of spreadsheets, and tutorial group memberships and class lists maintained manually in parallel with maintenance work at other Central and Departmental data repositories.
4. **CASE STUDY: A MODULE MANAGEMENT SYSTEM**

4.1 The Scope of a Portal

For a portal to be useful and usable it is necessary to define its scope. To start building a portal without a clear focus will result in yet another web page with lists of links that vary enormously in their relevance, currency, importance and quality. In practice this means limiting the scope of a portal, rather than trying to be an all-singing-dancing solution to everyone’s needs. So, the question arises: User-centric with regard to what? (Where “what” defines the scope). As the INSIDE project progressed, analysing and modeling Departmental and Central information systems, it became clear that the “Module” was a common organisational focus for administration.

4.2 Modeling the Distributed Information Base

There are two distinct sources of information: those maintained at the Departmental level and those maintained centrally. Although UML has been used extensively in the INSIDE project (Use Case, Sequence and Interaction diagrams), we will use less formal diagrams here, for the sake of brevity.

4.2.1 Departmental Systems

Figure 1 gives an overview of the information repositories maintained at Departmental level.

Historically the School web site and TAGS-based MLE tools grew up independently of each other. The more recent additions of a Staff Resources server and a Student resources server are slightly better integrated with each other, but only marginally with the other two servers. In particular, from a student’s point of view, module-related information is spread out across three servers and from a staff users point of view across four servers.

4.2.2 Central Systems

The main systems holding module-related information are Student Records (Registry), the Advisors Database, and the Data Warehouse. The Student Records database is a proprietary package which is used by several Universities in the UK. The Data Warehouse is the Center’s preferred solution for letting academic staff have access to the module and student information maintained authoritatively by Student Records. It is a read-only database accessed via a web front end. It is updated once every 24 hours from Student Records. More recently an “Advisors” database has been created which allows Advisors of Studies to enter student module choices online, instead of carrying bits of paper to Registry. The Student Records system is updated once every 24 hours from the Advisors Database. Note that at busy times of the year, when students are enrolling for modules, that the Data Warehouse information is at best 48 hours

![Figure 1: Departmental-level Information Sites](image_url)
out-of-date. This is not good enough for Departments, especially when trying to organise large first year classes. So, many Departments still maintain their own module lists. Student Records attempts to do a reconciliation between Departmental and Central lists in week 3 of a semester, by which time students are not allowed to change modules. An early INSIDE value-added service was to generate the differences online, on demand via the web.

4.3 Design of the Module Management System (MMS)

Figure 2 gives an overview of the MMS structure. Its goals are to provide user-centric information services for academic staff and students. Each instance of MMS is primed with two main sources of information, the module codes to be managed, and the roles of staff with respect to these modules. The list of modules is taken from the University Course Catalogue. The list of staff roles are maintained by each Department, often as one or more “Who Does What” spreadsheets. MMS imports this information and facilitates the association of individuals with roles with respect to each module.

As well as Departmental level information MMS also imports centrally produced information. This is done through a data control import hub, as critical information such as class lists are not useful if their quality is not maintained. Hence the need to compare and select from the different sources. We can characterise data quality by the following properties: Accessibility, Accuracy, Timeliness, Currency, Integrity and Relevance. Accessibility is met by providing this information via a web service. Accuracy and Timeliness are maintained by the moderating influence of the data import control unit that allows moderated import from various information sources in various ways. For example the Advisors Database (see Fig.2) is the most up-to-date with regard to approved student module choices, so the Currency of the class lists is best met using that as the source of data. Other types of data such as student details and module information are maintained elsewhere. The Data Warehouse is useful for providing matriculation photographs and “pretty printed” representations of individual student records. The Relevance of the information is maintained for each individual through the association of their roles with respect to each module. Similarly, on logging in to MMS a student will only find information services relevant to the modules they are enrolled on. An accessibility feature is that students can log in to MMS using their institutional name and password.
MMS currently supports the following MLE resources which can be allocated for each module: an Online Assignment Tracking System (OATS), a Tutorial Attendance System (TAS), a FileShare (document-centric groupware), a simple URL and an Enrollment Service. Each resource presents different operations and views to each user dependent on their role and identity. While this is sufficient to create a useful and useable integrated user-centric environment for staff and students it is also extensible through the potential for adding new resource types.

5. CONCLUSIONS

The MMS represents an advanced user-centric MLE which has now been used intensively for a full semester by over twenty academic staff and four hundred first and second year students. It has used role-based modeling with respect to teaching modules to maintain relevant, noise free services for staff and students. The accuracy of the module lists is maintained by selectively importing data from various sources, and the timeliness of module data is maintained through co-operation with central services in providing direct connections to their databases. The design of MMS has been informed by systems analysis of both central and departmental level data repositories and processes. An important side effect of this effort has been to reflect on the way things are currently done – for example the public School web site and the Student Resources server could usefully be merged with respect to module specific information and resources. Finally, our experience with University information systems suggests that although there is considerable scope for better sharing of data and services, it would be counter productive to try to impose, and virtually impossible to specify, a uniform approach to information management throughout an institution. Accordingly, we argue that the best way forward is to recognise the naturally distributed functionality of Universities, and accommodate their diversity through integrating various data sources and information services.

6. REFERENCES