

A High-Level Model for Management of the Information Resources of an Academic Organization

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Abstract. In this paper we present a high-level model for management of the information resources of an academic organization, especially a faculty of computer science that use and develop in the same time different related educational projects. The proposed model imagines that a communication animator group exists in order to facilitate the relationships and the flow of the information between the network administrator(s) group, the project manager, the professors and the different work teams inside the faculty. Also, the paper gives a set of suggestions in order to facilitate and stimulate the collaborative communication between faculty's members.

1. Introduction

The education process is a crucial factor in implementing of Information Society because the abilities acquired in the study years are essential in the outlining of the personality. If the studious young persons are integrated in an informational system, they will be able to adapt and to bring their contribution at the tomorrow information and communication technologies.

Of course, some steps were made in this way: the dispersion of Internet in the majority of education institutions, the accompaniment of some classes with presentations in Power Point or on Web, the use of some application which facilitates the distance learning and testing process.

The general trend in education is not only to put at the student disposal some applications and equipments to be used, but to involve them in the process of conceiving and building new information and communication technologies and applications. The main problem of this process has two important aspects too: the existence of well-trained teachers and the capacity of integrating all available applications in a functional system.

We shall present the current information system from the Faculty of Computer Science from Iași, with all applications developed inside of the institution – by the professors and students as well – and with a Web interface which made it very modern and accessible. Also, we propose some organizational extensions which to improve the actual system.

Because all the faculties could have some teams of computer scientists besides the specific specialized teams, our model could be applied in information organization of any faculty. Moreover, this model could be extended at an entire university, covering by this the great desideratum of an effective interdisciplinary training process.

2. Organizational structure

The Faculty of Computer Science has the particularity that the students not only use an information system, but they have an important contribution to its development. At the practical works of each discipline, a student – single or inside a team – has to finalize a project, which for sure could be useful in the educational process of the faculty: there are

strictly specialized projects, which could be use – like examples – in the teaching process of the corresponding discipline, but also there are many projects orientated to practical applications or even to the organization of the educational process. The main problem for all this projects is that to be integrated in a well-conceived system which to enable an efficient ulterior use of them. For this purpose, it is imperious necessary a centralized management of this system, which have to take into account two aspects of the organization approach: the outlook of the data formalism for the information system of the faculty and the pursuit of a set of directions for facilitating and stimulating the collaborative communication between all students and teachers involved in project teams.

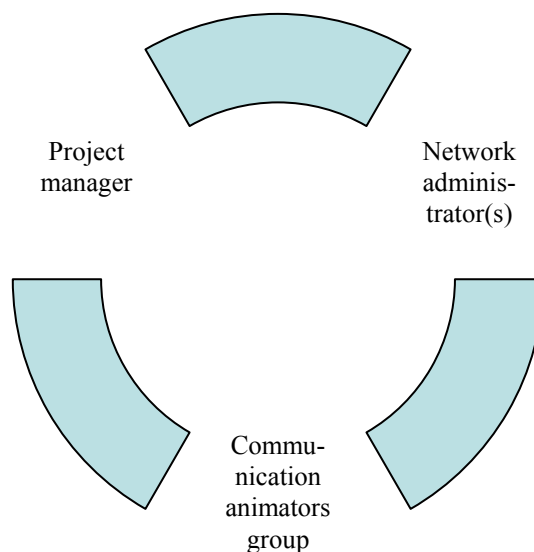
Inside a faculty, an intranet is necessary to exist, managed by *network administrator(s)*. The role of the network administrator(s) is to manage distributed information about users (accounts, rights etc.) and information resources of the faculty’s computer systems – physical resources (e.g. storage systems, printers etc.) and logical resources (i.e. databases, processes of the operating systems, applications and others). These resources need to be allocated to different users by using diverse permissions policies.

All the projects of interest for the faculty are centralized by the *project manager*, who has to know very well the requests of each project and to designate the work or research teams (by designating the teachers who’s disciplines are related with the scope of a certain project, and who will choose the students for teams; of course, during the practical works of a certain discipline there will be also developed specific projects). The project manager also functions as an interface between different teams to resolve the communication problems that may arise. This position is usually occupied by a person from the Leadership Council of the faculty.

3. Communication animators

Because it is hard to manage both the complex human relationships between different teams of the faculty and the matters related to the synchronizing and the compatibility of their projects, we propose the existence of a third person or group – the *communication animator* – with a role between those of the network administrator and of the projects manager: to supervise the existence of the compatible formats for the input/output data of all existing projects and to intercede the dialogue between work teams. Because the general trend is to offer a Web implementation for each application, and because the XML (Extensible Markup Language) [3, 11] is the recommended standard for all is published on Web, our approach is orientated to encourage the use of the XML documents format.

The members of the communication animators group must have different specializations such as information technology or human relations. We consider that it should be great to have a person with a double specialization – in computer science and psychology – which to be the head of the communication animators group (which could to consist in this case of some students and



teachers of the faculty). Otherwise, it is imperative necessary to exist in this group at least a computer scientist and a psychologist except the head of group, which could be very expensive for an ordinary faculty. Therefore, we consider that an eventually curricula for training the qualified Information and Communication Technologies (ICT) professionals may take into account a specialization like those required for the head of the communication animators group. Starting from he's tasks – which will be presented below –, a such curricula could establish the disciplines and the themes (from the field of computer science, psychology, and others – new conceived or existing - situated at the frontier between information technology and human relations) which to be followed at this specialization.

In this article, we shall present the actual information system of the Computer Science Faculty and the proposed improvements of it by the viewpoint of the duties of the proposed new employed person - the head of the communication animators group. By his duties we mean in fact the duties of all members of the communication animators group, distributed and managed by the head of the group. Therefore, we shall often refer the group by the common noun “communication animator”.

3.1 Formal Organization of the Project Teams

First of all, the communication animator needs to design a formal approach for I/O data that can be transmitted between the project teams, in order to exist compatibility and interoperability.

Our proposal for the formal organization of data consists of:

1. The communication animator should conceive an XML main document which contains the general structure of the input, respectively of the output data. This document type will be processed regarding formal rules defined by a Document Type Definition (DTD) or an XML schema [3].

An example for such document follows:

```
<data type="input">
  <!-- input / output -->
  <item type="text/plain">
    <name>document</name>
    <desc href="document.xml">
      ...
    </desc>
  </item>
</data>
```

We assume that input data for a given project consist of a plain text document (e.g. requirements). For this document a description is available (the long one can be specified as an external XML document).

The XML format of the documents assures the platform independence and consistence of dataflow.

For each particular project, the communication animator group should build the correspondent XML input document and should specify the structure of the desired XML output document. By this, the components of this group will be the persons which receive and gather all the observations from the work teams head, and will be able to adjust the XML documents formats so that still remains an unitary format. This activity can involve the use of different AI techniques, such as intelligent human-computer interaction multi-agent systems [2].

2. For the faculty security purposes, every resource of the faculty's information system must be accessed only by the authorized persons, and every user must be authenticated in a homogeneous (uniform) way. With a view to this purpose, the communication animator group should develop a module of unique authentication – using LDAP, PAM or other technologies – based on the user's name and password (which could be those managed by the network administrator). This module should provide, in the case of a successfully authentication, instead of a simple positive answer, an XML document specifying the type of the user (administrator, coordinator, member, etc.) and other useful information (position inside the faculty, age, studies, home address/phone etc.). Each application which wants to provide access to some specific data only to the members of the faculty should appeal to this module in the form of a get-request. The module can use SOAP (Simple Object Access Protocol) [5] or standard HTTP (HyperText Markup Language) [3] methods. The result will be an XML-based document:

```
<org name="...">
  <account>...</account>
  <password>...</password>
  <info>
    <member type="..." group="..."/>
    <!-- administrator, coordinator, member -->
    <position>...</position>
    <age>...</age>
    <address>...</address>
    <!-- other useful information -->
  </info>
</org>
```

Also, for this XML document, a DTD or XML schema is defined. For the easiest accessibility, it is strongly recommended to exist a Web implementation of this module, which we shall name **WebIdent**.

3. In order to deeply refine the information security, the communication animator group should develop then use another module (called **WebRights**) by which are established the access rights to the faculty resources, including various access levels inspired by UNIX operating system [6]:
 - *individual access* – the authentication should request certain users' name and password, validated through the identification module described above (e.g. for make changes in a database);
 - *group access* – the authentication module should ask the user's name and password, but besides the appeal to the identification module, the authentication module shall verify the affiliation of the user to a certain group, consulting a centralized database. In this way no additional passwords are required for all groups in which a user is member. (e.g., each work team should constitute a group, having a personal mailing-list for debating all general problems related to the project).
 - *access for the intranet's domain* – the authentication procedure shouldn't ask the user's name or password, but should verify the IP address of the navigator (e.g. for the access from intranet to the bibliographical resources or to internal discussions lists).

4. From the software engineering point of view, for the best accuracy and clarity of the project dataflow, the communication animator group should take in account the following aspects:
 - each source code must contains explanatory comments;
 - each project must be accompanied by the user's manual, including the structure of the used databases, the hard and/or soft requirements, the general structure of the project (module organization) and other notable information.

3.2 The communication coordinating

To facilitate and stimulate the collaborative communication between faculty's members, we suggest that the communication animator to take into account the following scenario:

1. The communication animator group should have personal regular appointments with the project manager of the faculty and with the head of each particular project team in order to establish the general topics of action.
2. In order to particularize and supervise the implementation of each project, the communication animator group should organize periodical meetings with all the members of each team, asking every person to expose his/her activity from the previous discussion and his/her new observations and regards, interceding the exchange of ideas and experience. This goal can be accomplished by using face-to-face meetings – if all members are located in the same setting – or/and virtual meetings [7, 8] (mailing lists, tele-conferencing systems, virtual environments) – for remote members.
3. In the case of dilemma or mis-understantings, the communication animator group should facilitate a closer collaboration between work teams, eventually inviting an outside expert in considered problems.
4. In different stages of the on-going projects, the communication animator group should gather the (representative) members of some teams, not only to discuss common problems, but to obtain an outside view and to test each particular implemented module.
5. Before considering as finished a project, it must be sent for test and evaluation to all members of the faculty, asking them to send every kind of observation. Some employers could be asked to describe the functionality of a project without having the user's manual (in order to find out its non-inherent parts).

4. The structure of the Information System

The Web site of the faculty is the main interface for all students and professors to access, to share or to provide information related to the educational process. Beside the general information about the faculty (structure, organization, curricula, history etc.), the site includes pages of all the professors, existing in the majority of cases sub-pages of each taught course. By thus, for each discipline the students could retrieve on the faculty's site documentations, Power-Point presentations, examples and exercises, bibliography, information about the (progress of) exams, etc., or could participate at some specific mailing lists or forums.

Because the information provided through the site undergoes many changes, there will be very useful some projects to manage the principal types of data that are rolled up through the site. We enumerate below some such projects that we consider being crucial for the great functionality of the internal Information System. At the Faculty of Computer Science of Iasi, some of these projects are finalized (like **WebOpt** or **WebDoc**) and the others are now being implemented. The providing for the interoperability of all this projects also constitutes a

concern of our faculty. In their finalized form, these projects will be available to all members of the faculty either to be included in any application inside the personal Web site (like WebSearch) or to be integrated into main Faculty's Web site.

4.1 WebSearch

The huge amount of available data on the Web implies hundreds or even thousand pages to be returned by a traditional search engine (e.g. Google, AltaVista, Excite, etc.). Because someone could need to retrieve some information inside a particular site, each site should offer the possibility of internal search. In this scope, the WebSearch module shall be implemented to be used for any private Web site, offering facilities of keywords based search, extended to expressions based search by using the ordinary operators embraced as well by the search engines (AND, OR, NEAR, etc.). Thanks to this module, a student could look up information related with a particular subject inside only a namely professor's web site or the secretariat's page.

4.2 WebOpt

The optional courses constitute a quasi-presence in all university curricula. The WebOpt module is functional since last year on our faculty's site, providing to the students the opportunity of enrolling to the desired courses. The application take into account the number of places for each course, the year of study to which is addressed, the additional conditions imposed by the professor or by the faculty's rules to interested students.

4.3 WebExam

For each discipline there exist two possibilities during the session for each student to pass the exam. Implicitly, one of this dates represent the day allocated especially for his group. The WebExam module should offer to the students the possibility of enrolling to a particular exam at a preferred date, different by the implicit one. Besides the authentication realized by appealing to the WebIdent module, the constraints could refer to a maximum number of students accepted to an exam, a period of subscription to a particular exam, etc. Moreover, the application could provide at any moment centralized information about an exam both to the students, professors or secretariat.

4.4 WebDoc

The documentation in all disciplines available for students could be centralized inside a specialized sub-site, organized around some specific interest themes and sub-themes. The access to each material shall be controlled by using WebIdent and WebRights. The structure of the site shall take into account that the documentations could be accessible in different languages (e.g. English and/or Romanian), and could be by a specific type (book, reference manual, specification, tutorial, etc.), in a particular stage (draft, proposal for standardization, final, etc.). For each document, there shall be specified at least the following information: author, title, type (book, article, technical report, essay etc.), editor, year and place of appearance, abstract, keywords, and a link to the complete document. The WebDoc application should provide, too, statistics regarding the most accessed documents, and possibilities of internal search.

4.5 WebTest

The WebTest is conceived like an application for the storage in a distributed manner of the different types of tests which could be used in the examination of students or for auto-evaluation. After the authentication as professors, the courses leaders could manage the tests collection from a particular discipline (access to the questions and answers, build of new tests by selecting the questions from database after different criteria or random, etc.). The students should access some auto-evaluation modules on diverse domains, counter-chronometer or not (demos of the exams tests). There should exist single/multiple choice of tests, with different ways of granting the points, with questions dependent one by another. The professors could obtain reports concerning the stateliness of a student to a particular discipline, eventually accompanied by various relevant statistics for the degree of knowledge (the number of erroneous answers, the realized time, the questions with no correct answer, etc.).

4.6 XML-based Inter-Communication

The relationships between resources (users, shared data, virtual rooms) of the inter-communication system used by communication animator group can be modeled by XML-based documents, too. In [9] we give a higher-level model to accomplish this goal. This model is based on RDF (Resource Description Framework) [3, 10] constructs and provides interoperability between applications that exchange machine-understandable information on the World-Wide Web.

An example of such document follows:

```
<rdf:Bag id="UsersOfSuperiorLevel">
  <rdf:li resource="Sabin.xml">
  <rdf:li resource="Victor.xml">
  <rdf:li resource="Stefan.xml">
</rdf:Bag>
<rdf:Description
  aboutEach="#UsersOfSuperiorLevel">
  <system>
  <user>
  <info>
  <level>Maximum</level>
  <desc>All users which administrate the inter-communication system</desc>
  </info>
  </user>
  </system>
</rdf:Description>
```

5. Benefits and implementation proposal

The main benefit of our proposed model consists of platform independence of any possible components, at the hardware, network and software levels. Because whole information is stored into XML-based documents, all modules of the system can be implemented using open-source XML processing libraries (e.g. Expat or JAXP) in a variety of Web-related programming languages such as Perl, PHP, Java, JavaScript or C#.

The heterogeneous applications of the system can be able to interchange information in a reliable and flexible way using XML-based communication protocols such as SOAP or XML-RPC over HTTP.

6. Conclusion

In this paper we presented a high-level model for management of the information resources of an academic organization, especially a faculty of computer science that use and develop in the same time different related educational projects. The proposed model imagines that a communication animator group exists in order to facilitate the relationships and the flow of the information between the network administrator(s) group, the project manager, the professors and the different work teams inside the faculty.

Because the general tendency is to offer a Web implementation for each application, our approach is orientated to encourage the use of the XML documents format. The input/output data that can be transmitted between the project teams will be stored in XML-based documents in order to assure the platform independence and consistence.

Also, the paper gave a set of suggestions in order to facilitate and stimulate the collaborative communication between faculty's members.

All implementation issues can be addressed by open-source XML processing libraries, in different popular Web-related languages such as Perl, PHP, Java, C# or even JavaScript.

The proposed global model was inspired by the actual information system of the Faculty of Computer Science from the "Al. I. Cuza" University from Iasi, which provide to the students various opportunities of improving their knowledge, of obtaining useful information, and of communicating with the professors through the faculty's Web site. Moreover, this kind of system co-opt the students in the process of developing new applications which are supposed to be integrated in the faculty's information system and to be use in the education activities.

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