Platform for building and managing large websites with distributed information

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This paper presents UniWeb platform, a "web 2.0" distributed multi-environment platform used by the University of Granada. This platform manages the institutional websites conforming the current WAI accessibility specifications and web design guidelines. It offers a full range of uniform interactive services and makes easier future maintenance of both content and services.

Keywords web 2.0; distributed information; content management systems

Last version of this document can be found at the Inovación y Desarrollo (Innovation and Development, I+D. url: http://www.intelligenia.com/pages/imasd) section of intelligenia website (url: http://www.intelligenia.com)

1. Introduction

Since the World Wide Web beginning in the 90s [1], the programming oriented to the execution inside a web browser is one of the Computer Science areas with greater evolution and impact in the world today [2]. Currently, each organization has presence in the Internet, and must be continuously updating it to catch up new tendencies, because its image in the Internet tries to show the organization virtues to the world. Therefore, an obsolete or inaccessible web page makes a bad impression to the users.

In big organizations, such as the University of Granada, there are lots of entities coexisting and each one has its own web page [3]. After some time, each one of there entities has been adapted, in a different way, to the tendencies of web programming. Thus, after 15 years, it is common to observe fresh, standard, state-of-the-art web pages living together with others old-fashioned, using old technologies and inaccessible. Between these two extreme situations, we can find a wide range of variants that use diverse technologies, corporative images, standards, accessibility handicaps and usability concepts.

Design standards, technology and web programming have dramatically changed in the last 15 years. A lot of these technologies and incipient standards were early obsolete, being relieved by others. Nevertheless, nowadays, although the Internet technologies have reached a high level of maturity, they are still getting better. We can assert that the bases that hold the World Wide Web are much more stable than some years ago. Therefore, nowadays there are better tools and better chances to develop and deploy web applications, and this make possible create web applications that almost differ from classic desktop applications, measured in developing time, usability, features and user interfaces [4].

Moreover, current regulation, that includes European, national and regional rules and decrees, requires public organization web sites to comply with latest web standards and some accessibility rules [5,6,7]. This regulation forces the adaptation and updating of the web pages of all public universities to comply with applicable legislation.

At this point, a unification of technologies is needed. In this way, we can assure that the organization, as a whole, offers a common image and a state-of-the-art web to the world. In a big university this can not be done making a monolithic, single web page representing all entities, because in most cases, different entities are managed autonomously and have different operation plans. The solution to this problem must go through offering a different web platform to each entity, hence it can be self-managed.

To obtain unification, entities web platforms must be able to communicate with each other. This way they can maintain global data, global search capabilities and offer consistency in the information being shown to the world. In addition a unified corporative image must be given without losing each entity features. Thus, self-management should be allowed in each platform, but, at the same time, all platforms must be unified. To reach this objective, platforms must share common features in the visual aspect and in the functionality offered to the user.

Therefore, each entity can manage all the information in its web, but can not modify functionality or visual style. Each web is created by means of customizing its own image and observing certain common visual design. From this point, it is possible for the organization to progress in the same aspects at the same time, because all of entities share the same multiplatform system. This multiplatform system is the UniWeb System.

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Once UniWeb is deployed, the presence in the Internet for an organization using it grows quickly. The reason is that UniWeb makes much more affordable and faster to build up a full-featured and generic system that supports all web sites of the organization, than building up independent web sites for each entity. Moreover, these independent web sites maybe would not have as many features as UniWeb. When adopting UniWeb, all web sites are according the regulations on accessibility, standards and usability. In addition, they offer better functionality and they receive more and better information updates, creating new contents and making it a more valuable resource. In the other hand, to create an entity website is, in this sense, an easier and cheaper task. This has a profitable effect: more entities can have presence in the Internet. As seen, the growth of the presence in the Internet of the organization happens in two dimensions: quality and quantity. With this growth the influence in the Web of the organization gains strength and thus reaches the goal of the presence in the Internet.

Section 2 of this document describes UniWeb platform, meanwhile section 3 shows a case of use for the University of Granada, which corporate web has been built over UniWeb. Conclusions and future work are pointed in the final section.

2. UniWeb platform

UniWeb is a platform that allows large website building for an organization made of multiple entities, each one managing their own content and services. Globally the application behaviour is the same in every single web in the platform and some information is shared to avoid redundancy, making an easy access to it and increasing coherence inside the large website. UniWeb allows each entity to have its own customized image web site, with its own contents and services, although the administrations tasks are done in the very same manner. Also, entities web sites can be distributed between different servers communicating among themselves with Web Services [8] to stay synchronized.

UniWeb generates XHTML and CSS2.1 output adapted to the standards, complies with the accessibility regulations and has good practices in usability. Moreover, UniWeb separate strictly the content from the presentation and, that way, prevents webmasters from the problems derived from layout, design and standards accomplishment.

2.1 Features

UniWeb offers a wide range of applications and administration tools with easy interfaces that anybody, without specific computer skills, can use. All these applications intend to classify different kind of information in order to present it in a homogeneous way into the large website, and be able to share quality information.

The most remarkable functions and features of UniWeb are:

1. *Content Management System (CMS):* This system allows the user to create web contents with no need of HTML use. UniWeb provides an interface similar to the one that you can find in any common word processor, with control buttons to apply format to text and a preview system with WYSIWYG capabilities. This web page creation system complies with browsing and accessibility standards.
2. *User Management System*: UniWeb allows managing access restrictions to each web section. Different sets of actions can be assigned individually to each user. Users can be organized in groups, making easier the creation and administration of access profiles. As an example, in a university web, profile groups could be created for teaches, students, staffs, etcetera.
3. *Download manager*: A directory and file tree can be created in a typical OS fashion from a web interface. Each file or directory can have access restrictions for any user or group, and thus the download of any file can be managed.
4. *Back-up manager*: UniWeb has its own backup tool that allows it to make and restore copies without any previous knowledge of the internal data structures used in the application. Backup copies can be downloaded and restored from the web interface.
5. *Meta-search engine*: UniWeb has a search engine that makes possible to locate any content from any application. The search results are organized by its application type. Also, this search engine is capable to locate results in other web sites of the organization, providing a global search over the large website.
6. *Contact forms*: Any number of contact forms can be created. In a contact form, different kind of subjects can be selected and, depending on the chosen subject, the message will be delivered to an associated e-mail address. Also, a variable number of custom fields can be added to the contact form to adapt it to the site needing.
7. *Auto-generated web map*: UniWeb generates a web map automatically

8. *Staff organization charts*: This application allows filling up staff information forms and showing the hierarchy between personnel. The information structure is centralized to avoid redundancy and, that way, changes on staff data are propagated all over the web.
9. *News board with RSS*: This is the news application. Categories can be created to group news on different criteria. This news board generates an RSS feed that allows content syndication.
10. *Events calendar*: UniWeb provides an event calendar connected to the news board application. News can have a calendar date associated.
11. *Image galleries*: Image galleries show thumbnails and allow downloading images in original size.
12. *Banner and advertising system*: Banners with remarkable information can be created. These banners provide its content in an accessible manner.
13. *Translator*: UniWeb provides a global translation system for any application. In that way, any UniWeb website can be translated into any language.
14. *Multimedia cards*: Images or videos can be stored on multimedia cards. Information about authoring, title, description, date and length can be attached. These cards are integrated in image galleries.

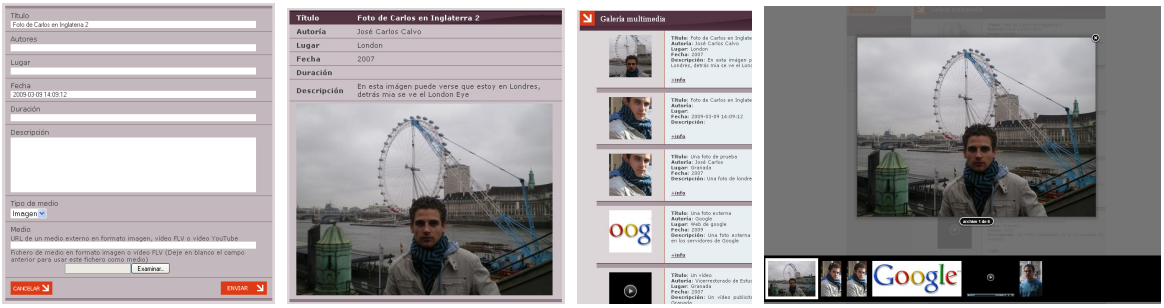

Fig. 1: Example of Multimedia Gallery, from creation to visualization (displaying a part of the screen)

2.2 Software Architecture

UniWeb has been built using Object Oriented Programming model plus state-of-the-art development techniques. Into UniWeb we can find several techniques, such as, inheritance, polymorphism, dynamic reflection, programming interfaces and automatic documentation generation.

Using programming interfaces makes UniWeb 100% scalable on new features and these new features remain totally integrated inside UniWeb. For instance, using interfaces, an application can be incorporated to the translation system, to the CMS, administration interface, and search engine with no need to make external configurations. This allows enabling and disabling system applications without reconfiguration, easing the customization or extending UniWeb.

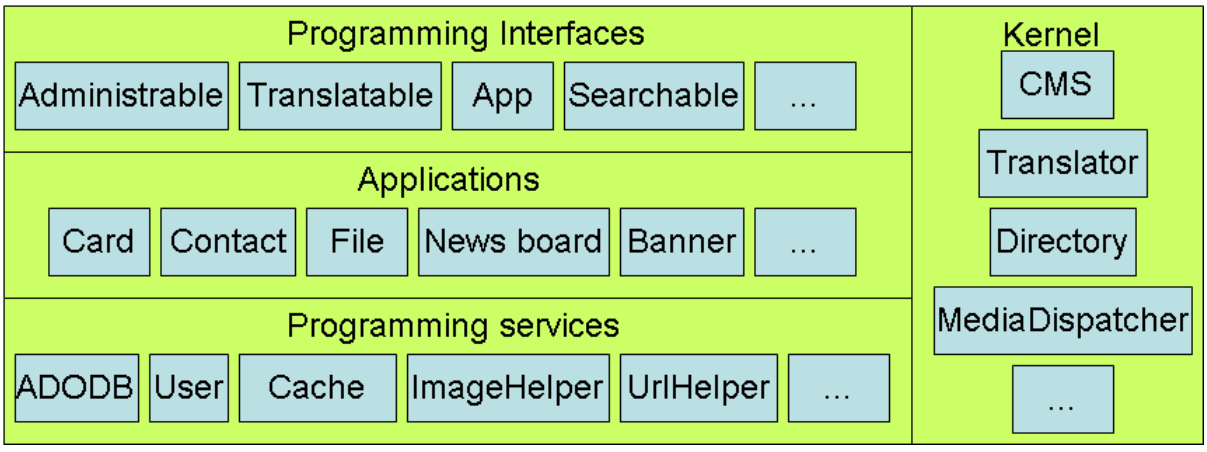

Fig. 2: Software architecture of UniWeb

2.3 Information flow

Websites in UniWeb can be hosted in a single system or in servers distributed in any part of the Internet. Among these servers, secure communication links are established using signing and encryption schemes. These communications links provide the mechanism to share data and keep consistency between global information.

Therefore, data is distributed because each entity generates its own information and it can be used by any other entity.

With this approach, a Web 2.0 large website can be deployed, where users and administrators of each platform add information to a common network where data flows from the sources to the visitors looking for this information.

Depending on information type, it might be in a centralized website or in a distributed one. UniWeb supports any configuration and point-to-point communication pattern.

In order to maintain a communication security scheme, a website is configured as a central key repository. This mentioned node holds validations for any other network node. To establish a connection between two nodes, a public-key/private-key pair is used. If some node doesn't have the public key of its peer, it must request the public key to the central repository, and thus every node should have the central repository key. With this technique, a secure communication inside the network can be guaranteed.

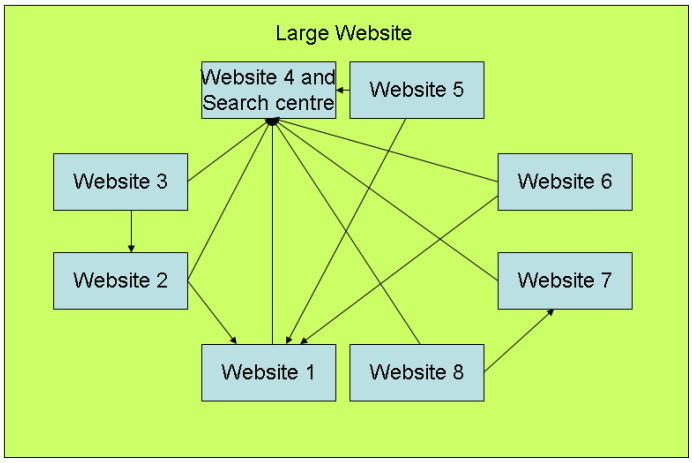

Fig. 3: Communication between websites using RPC

2.4 High availability system

The UniWeb platform is prepared to work in a load balancing high availability cluster environment. Thus, it is possible to offer a robust and scalable service, allowing additional entities to incorporate to the UniWeb system. The complexity involved in the communication process among the distributed modules is transparent to the users.

UniWeb can also work in a mono-processor system, offering the same functionality. This confers a huge flexibility in the choice of the installation environment.

3. Example of use: University of Granada

The following entities are part of the University of Granada:

- 1 main site
- 15 vice-chancellors
- 15 institutes
- 30 faculties and schools
- 50 institutional services
- 75 degrees
- 116 departments
- 400 research groups

Creating a web site for each entity in a short period of time maintaining each one personality is a complex task, but progress is being made in that way. UniWeb has been implanted in the University of Granada and step by step it is hosting more entities. Currently, all vice-chancellors and government boards, some institutes, schools and services have been integrated in UniWeb. In a 6-month period 25 entities have been incorporated into the platform, gaining presence in the Internet. The number of entities in UniWeb rises every week.

Nowadays, all entities integrated in UniWeb are being maintained by their own staff, with no need of previous specific knowledge of web design or advanced skills with computers. All they need to use UniWeb and get all its power is a short seminary. After this seminary, administrators can create new web pages, news, menus,

banners, staff cards, downloadable files, image galleries, contact forms and the rest of information for the applications already present in UniWeb.

The easy administration, after its internal architecture, is the main feature of UniWeb. All user interfaces have been designed with usability in mind and are constantly updated with user feedbacks.

Fig. 4: Website examples in the University of Granada

4. Conclusions and Future Work

A big organization such as a university is composed by plenty of entities. Each one of them has its own web site and must share information, functionality and visual style. UniWeb platform reaches these goals and provides to each entity its own customized web site with lots of applications that can be autonomously administrated. UniWeb manages and organizes information in a distributed manner. In addition, it complies with current regulations about standards, accessibility and usability.

With this platform, a university can experiment a significant increasing presence in the Internet, because the information provided to the web grows in quality and quantity, given the fact that it supplies low cost, communication tools that generate more and better information from many other entities.

Future work will be the incorporation of more applications, the integration of more entities in UniWeb, the creation of Web Services in order to export information to different channels and the continuous improvements of current applications.

Acknowledgements The University of Granada and the Ministry of Education and Science under project TIN2007-60587

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