IRIS: Implementing an Open Environment supporting Inclusive Design of Internet Applications

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Abstract: The paper presents the architecture and implementation of the IRIS Design Support Environment (DSE). This environment supports designers to create inclusive Internet content and applications. It is based upon the results from a wide range of work from accessibility, usability, user modelling, and content design and adaptation. It is also in itself highly accessible and usable, capable of being used by designers with special needs. The IRIS DSE is Internet-based, builds on open source frameworks and its modular components are integrated with Web services technology. The implementation has been done using emergent technologies, while adhering to relevant specifications for Web accessibility.

Keywords: Internet applications, authoring tools, design, , accessibility, usability, user profiles, design for all.

1 Introduction and Rationale

Work related to inclusive design is multifarious, and includes methodologies, techniques, principles, guidelines, and standards for accessibility and for usability, user modelling, content and application adaptivity and adaptation. Much of this work is conceived as an 'add-on' to the design process requiring 'extra' design and development effort. In terms of designing Internet content and applications, this conception may be largely attributed to the fact that the above areas of inclusive design work are not a very evident part of development/authoring environments.

The IST IRIS project has synthesised this work and developed a design support environment that takes account of the many strands of work on 'Design for all' (DfA) including accessibility guidelines, user modelling practices and user profiling recommendations, as well as practices and specifications for data models and content adaptation via a user-centred approach for requirements and evaluation. The encapsulation of several aspects of universal design work into the IRIS DSE along with its open approach for development, which is based on open source frameworks, implementation of open standards and integration with Web services technology (Tidwell, 2001) demonstrates the feasibility of transferring 'Design for All' work from

the specification and research stage to practice and can be a starting point for incorporating this work to other development/authoring environments.

2   IRIS DSE Architecture

The IRIS DSE aims at supporting all designers (including designers with disabilities) to design web applications/services for all users based on user modelling. The rational for such an environment is based on the observation that designers tasked to develop using a DfA approach, do not readily find assistance in existing Web development tools. Surveys of designers wanting to include DfA show that they want all sorts of types of aid, from static references, e.g. good book, succinct presentations, video materials, educational materials, such as courses and training materials; to interactive web based materials in form of public Q&A fora, or help desks (DASDA project, http://www.design-for-all.info). The IRIS DSE, therefore, besides being an authoring environment, also provides some of these types of including pointers to static materials; educational materials, to support for technical evaluation tools.

The IRIS DSE functional architecture (Figure 1) distinguishes modules and repositories. Modules refer to basic blocks of functionality and illustrate aspects of the IRIS DSE that are required for the Internet product design process that takes into account accessibility and emphasizes user modeling. Repositories refer to knowledge and data infrastructure that is required to support the IRIS DSE functionality, and they undertake typical management functions.
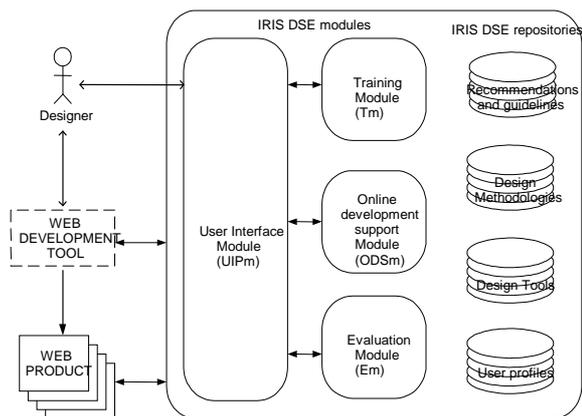

Figure 1:   IRIS DSE functional architecture

The IRIS design support environment encompasses functionalities that are not typical of classic development tools. This means that it can act synergistically with existing Web development environments and tools in order to provide 'design for all' assistance to Internet designers, and therefore does not directly compete with large IT vendors of Web development software on aspects of functionality that are already in place, for instance online development interface and automatic evaluation of aspects of accessibility of HTML pages. The IRIS DSE while it includes these functionalities, also provides others that are not currently offered by other available tools such as training and user modeling/profiling.

3   Technical Approach and Implementation

3.1   Overview

The technical approach for implementation of the IRIS DSE is based on the extension/adaptation of open source frameworks to the goals of the IRIS DSE and the integration of developed modules with Web services technology.

The main software components of the IRIS DSE modules are implemented as follows: UIPm: extends Jetspeed portal technology (http://jakarta.apache.org/jetspeed/site/index.html); Tm: extends the Cocoon publishing framework (http://xml.apache.org/cocoon/); ODSm: extends the OpenCMS open source software (http://www.opencms.com/opencms/opencms/index.html); Em: extends the JTidy open source software for HTML validation (http://tidy.sourceforge.net); Repositories: are based on native XML databases technologies, such as Xindice (http://xml.apache.org/xindice/) and eXist (http://exist.sourceforge.net) and other popular types of repositories, such as MySQL. The search engine is based on the open source engine Lucene (http://jakarta.apache.org/lucene/docs/index.htm).

However open source frameworks like those referenced above cannot be applied "as they are" to this type of development. During the implementation of the IRIS DSE particular emphasis was given towards further enhancement of open source frameworks, and especially Jetspeed and OpenCms, with regard to their accessibility and evolvement of personalization mechanisms of open source frameworks, mainly by incorporation of IRIS user/device profiles and user modeling mechanisms to Jetspeed and OpenCMS.

Furthermore, the wrapping of the IRIS DSE modules as Web services provides an open-standard interface for IRIS DSE (and other) modules, as well as for other IRIS components such as the help system, logging, and others. Web services are self-contained, self-describing, modular applications that can be published, located, and invoked across the Web and can perform functions, which may range from simple requests to complicated business processes (Tidwell, 2001). The approach used within the development included the definition of IRIS DSE functionalities as Web Services with the Web Services Description Language (WSDL, Christensen et al., 2001),

3.2 User Interface/Profiles module (UIPm)

The UIPm implementation is based on two open source software platforms; one which is responsible for information concentration and personalisation and the other which offers device profile transportation.

Information Concentration and Personalisation

The platform that was chosen as the basis of the IRIS user interface was Jetspeed. This is an open source pure Java portal that offers a coherent front end application for end-users. A portal can be defined as a hub from which users can locate all their commonly used web content.

In terms of IRIS implementation the customization, personalization and adaptation mechanisms of Jetspeed were enhanced with the overall IRIS approach to user modelling, including the use of IRIS user and access device profiles with respect to specifications such as P3P (Cranor et al, 2002) and CC/PP (http://www.w3.org/TR/CCPP-struct-vocab/) and the deployment of user profile agents.

Device Profile Transportation

DELI (Butler, 2002) was chosen to provide server side CC/PP support for the implementation of the IRIS device profiling mechanisms. It is an open-source library developed at HP Labs that allows Java Servlets to resolve HTTP requests containing CC/PP information.

An important issue regarding the device profiling mechanism is that there are no browsers available that are capable of collecting and transmitting device profiles to servers. In order to make this possible a completely new agent had to be designed and implemented, which would act as the CC/PP intermediary between server and client. The issue was addressed by designing and implementing a java application that runs on the client side, called the Profile Handler, and is responsible for the device profile manipulation and transmission through the use of an integrated HTTP proxy server.

The Profile Handler automatically retrieves the IRIS device profile from the client, and sends it to each web server by incorporating it into the browsers HTTP request headers according to CC/PP specifications.

3.3 Online Development Support module (ODSm)

The ODSm core is based on the open source OpenCms project. This is a Java based website content management system developed by the OpenCms group. It allows a company to maintain a website with little or no help by an external agency or internet professional. To achieve this, OpenCms hides the complexity that is still involved when publishing in the Internet and thus, corporate and individual users can concentrate on creating the content for the website, and publish it in an easy and intuitive way.

OpenCMS constitutes with Jetspeed the basis of the IRIS DSE platform. It provides the backbone for the IRIS DSE Web authoring environment, remote resource management and collaborative support for working groups. In order to ensure smooth integration with Jetspeed, collaboration with the Evaluation module and accessibility, all the appropriate changes/additions were made to OpenCMS These changes included the implementation of support for native XML databases and the replacement of *ActiveX* components, such as HTML editors, with other accessible java-based components.

3.4 Training module (Tm)

Personalisation and Device independent publishing form a core part of the IRIS DSE. In particular, the following needed to be implemented:

- An integration platform for publishing XML/XSL content to different devices
- Personal profile and authentication
- Integration with Jetspeed Portal

The open source Cocoon framework is being used to deal with these issues. It is an XML framework that advances XML and XSLT technologies for server applications offering centralized configuration system and sophisticated caching that enable developers to create, deploy, and maintain solid XML server applications. It was designed as an abstract engine that could be connected to almost anything, it contains already servlet and command line connectors.

Searching for documents and information is a key issue within the IRIS DSE. For this task, Lucene is used. This is part of the Jakarta Apache project and offers high-performance, full-featured text search engine written entirely in Java. It is a technology suitable for nearly any application that requires full-text search, especially cross-platform.

3.5   Evaluation module (Em)

This module, implemented as a web service, is used by other DSE modules to obtain code verification and repair. The results and the validation guidelines are provided in an Extensible Markup Language (XML) structure.

XML is becoming the de facto standard for exchanging data via structured documents. However, the fact that currently data are usually stored in relational databases requires translation of XML documents to relational databases and vice-versa. However, a new approach termed Native XML databases (NXDs) go some way to overcoming the translation overhead. NXDs can be considered as a new tool aiming to assist the developer by providing him robust storage and manipulation of XML documents.

The use of NXDs is highly appropriate when Web Services technology is involved, for which XML is a key part.

The choice of native XML databases required some technology choices in implementation, between eXist and Xindice. Both are open source NXDs, Xindice was chosen because it had more features and much better documentation, as Apache software it offers the flexibility to be easily integrated with other Apache software such as Cocoon and Jetspeed.

For checking HTML syntax, the open source tool JTidy was used, to help in identifying where attention is needed on making pages more accessible. Used this way JTidy is able to fix up a wide range of problems and to draw attention to things that the designer needs to work on by himself. Each found item is listed with the line number and column so that the designer can see where the problem lies in the mark-up.

For validating CSS, a Java based CSS Validator (http://jigsaw.w3.org/css-validator/validator.html.en) was used.

4   Conclusions and further work

This paper has described briefly the architecture and implementation of an authoring tool for designing accessible content. The IRIS Design Support Environment represents considerable advances over existing tools in that firstly, it gathers together a wide range of accessibility and usability knowledge, and draws upon it to create an environment where designers can be helped while they are creating content, both with automatic correctors, as well as with more in depth training with reference and educational material. In order to minimise learning curves, the IRIS DSE can be used in conjunction with their favourite authoring tools. Secondly, the DSE practises what it preaches, and is in itself, an accessible environment. Thirdly, the environment is built on open source software, thus relieving any lock-in effect of proprietary software, while at the same time accruing all the benefits of open source software, such as the pooling of resources of world experts, and wide conformance. Finally, the IRIS developers whilst working with these open source tools are able to voice accessibility concerns in a proactive way. An example in point is the recent upsurge in the use of portals. While this technology is very exciting, the technologies for implementing them, for instance Jetspeed portlets, have many problems related to accessibility.

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