A Unified Environment for Accessing a Suite of Accessibility Evaluation Facilities

Nikolaos Partarakis[1], Constantina Doulgeraki[1], Margherita Antona[1],
Theofanis Oikonomou[2], Nikolaos Kaklanis[2], Konstantinos Votis[2],
Grammati-Eirini Kastori[2], and Dimitrios Tzovaras[2]

[1] Foundation for Research and Technology-Hellas, Institute of Computer Science,
Heraklion, GR-70013, Greece
{partarak.cdoulger,antona}@ics.forth.gr
[2] Informatics and Telematics Institute Centre for Research and Technology Hellas,
Thessaloniki, GR-57001, Greece
{thoikon,nkak,kvotis,gkastori,Dimitrios.Tzovaras}@iti.gr

Abstract. This paper presents the design and implementation of an interactive portal and a standalone tool to act as mediators to a number of accessibility assessment facilities for Web Content Accessibility Assessment, Mobile Web Content Assessment, Web Services Assessment and Description Languages (SDL). More specifically, the design approach followed is briefly outlined in order to get an insight on the underlying rationale and the specific benefits gained in terms of the final outcome. Subsequently, the architecture adopted for achieving the goals set by this research work are presented, together with the specific technical characteristics of the approach followed for the development of the two interactive applications. Finally, the deployed versions of these applications are presented, revealing the complete set of facilities and tools and discussing their advantages and benefits from the point of view of the development of accessible applications and services.

Keywords: Accessibility, assessment, web, web services, description languages, mobile web content.

1 Introduction

Accessibility is an urgent issue nowadays. Authorities and experts are putting much effort on pushing forward accessibility of software applications but, despite this fact, ICT applications and systems are not fully accessible yet. The work presented in this paper aims at providing better accessibility for all citizens, increasing the use of standards, through the development of interactive applications for developers to assess efficiently, easily and rapidly the accessibility and viability of software applications for all user groups. Most widespread accessibility assessment tools include Sheriff Accessibility Module[1], Wave from WebAIM[2], or Lift Machine[3]

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[1] http://www.hisoftware.com/solutions/hisoftware-compliance-sheriff/accessibility-compliance.aspx
[2] http://wave.webaim.org/
[3] http://www.qbssoftware.com/product_info.aspx?current=OVERVIEW&product=LIFTMACH

allowing assessing compliance to several guideline standards, including WCAG 2.0. Although such tools exist on the market, most of them are directed towards web content and there are no integrated solutions that are specifically targeted to developers and support the assessment of content from multiple sources (web content, web services and description languages). At the same time existing tools are designed for accessibility and usability experts who have extensive knowledge of guidelines and standards and experience in their application, thus making such tools difficult to be used by developers who are non experts in the domain.

2   Assessment Environments Design

A user centered approach has been followed for the design and implementation of the proposed Assessment Environments. User-centered design is an approach to interactive system development that focuses specifically on making systems usable for their users (through their involvement during the design of the system) [1].

2.1   User Requirements Analysis

A thorough collection and elicitation of the requirements for the tools was conducted with respect to the characteristics and needs of potential end-users. Keywords and key subject titles, relative to the problem area, were identified and used to initiate and drive a search that was carried out, mostly, in on-site libraries, records and the World Wide Web (WWW). The collected requirements were categorized according to their significance and role into the following groups:

- **Generic functional Requirements** include the functionality that should be included in the system both in terms of the supported content and in terms of what assessment options and what reporting functionality should be introduced.
- **Performance requirements** imply that both systems should be able to cope with user requests without delays especially in the case of the web portal this is where a number of user request could exist concurrently on the system.
- **Operational requirements** include the support for accessibility, multimodality, support for various input and output devices and in general the existence of facilities that ensure quality of use.
- **Reliability requirements** included high tolerance to error, error recovery and reduced possibility of system error.
- **Maintainability & Interoperability requirements** imply that the system should be easy to maintain and able to interoperate with a number of assessment facilities that may reside on the local or remote computing environment.

2.2   User Interface Design

Usually, user interface design initiates with the production of low-fidelity prototypes and continues with higher-fidelity prototypes. The use of prototypes in the design phase aims at allowing the designers to test some emerging ideas for the design in question. The user interface design was completed by a series of low-fidelity prototypes that were evaluated. An example of UI design for both interfaces is presented in Figure 1.
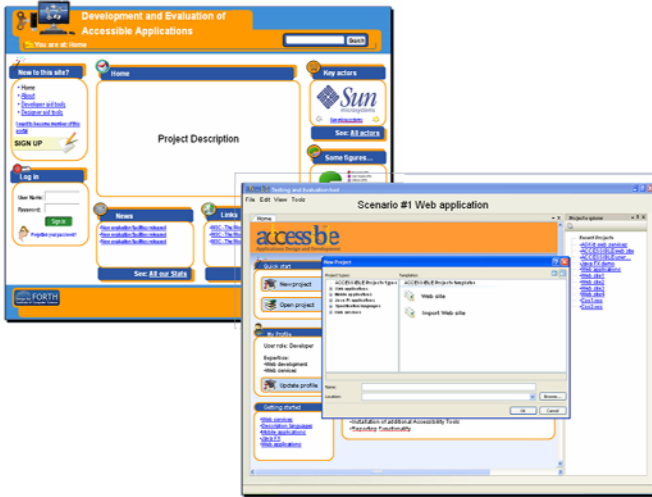
Fig. 1. UI design example

3 Architecture

This section highlights the software architecture used for the two alternative instantiations of the assessment environment. As presented in Figure 2, the user interface takes two distinct instantiations according to the means of access. When access is carried out through the web, the user interface portal is used while the standalone application makes the infrastructure available offline.

3.1 Architecture: User Interface Portal (Web Version)

In the context of the user interface portal and a multi-tier architecture is employed consisting of the (a) Data Access Layer, (b) Business logic Layer and (c) Presentation Layer. This architecture allows the core functionality of the portal to be operated in multiple setups (single machine, multiple machines organized into clusters).

3.2 Architecture: Integrated Environment (Standalone Version)

The General architecture of the stand alone tool consists of the project administration component which uses xml datasets to present projects and xml data adapters for using saved data. The presentation of the stand alone tool uses components for allowing (a) Syntax aware editing, (b) interface experience with dockable containers and (c) web browsers integration. These facilities are introduced for providing developers a familiar user interface experience resembling metaphors commonly used for the development of IDEs.
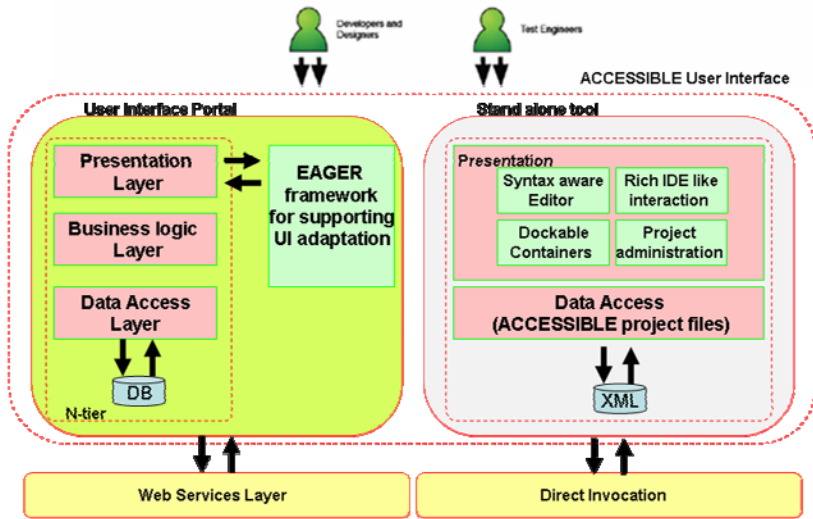
Fig. 2. A general view of the system architecture for the portal and standalone tool

4   Access to Evaluation Facilities through a Number of Web Services

Based on the presented architecture the proposed instantiations of the assessment environments are accessing web-services in order to perform the supported evaluation activities. More specifically both the user interface portal and the stand alone tool access the following services:

- **The inference engine:** Web services that offer ontology based filtering of guidelines to be used for assessment and inference of the specific tests to be run [6] [7]. The output produced by the inference engine is in turn redirected to the appropriate assessment service.
- **Web Assessment (WCAG2):** Web services for performing web content accessibility assessment based on WCAG2.0. These web services already support a large number of tests and are frequently updated to support the majority of tests needed for fully implementing WCAG2.0 assessment.
- **Mobile Web Assessment:** Web services for performing mobile web content accessibility assessment based on WCAG2.0 and Mobile Web Best Practices [2][3][4]. In the case of mobile web content WVAG2.0 are used to ensure accessibility while Mobile Web Best Practices are used for usability.
- **Web Services Assessment:** Facilities for performing accessibility evaluation of Web-services [5]. The assessment process is initiated by performing syntactic check of the WSDL description and is followed by an alignment process where the web-services to be evaluated are aligned with some identified ideal operations. These operations describe what web-services should provide as output in

accordance to their functionality (for example a web service returning an image should also provide an alternative text for that image)

- **Description Languages Assessment (SDL):** Web services for assessing description languages. These web services take as input the SDL script responsible for rendering the user interface (to be run in the context of embedded systems) and a number of assessment criteria as returned by the inference engine. This SDL script is in turn evaluated based on the assessment criteria and on the Guidelines defined for the specific application domain.

5   An Overview of the User Interface Portal and Standalone Tool

This section presents the two interface variations developed in the context of this research work. More specifically, the user interface portal aims at providing access to the developed evaluation facilities through the internet, while the stand alone interface can be downloaded and installed in the local user's file system.

5.1   Access to Assessment Facilities through the Portal

The currently deployed version of the user interface portal offers a number of public information facilities for non subscribed users. The central entry point for all the evaluation facilities offered by the portal is the "Online Evaluation Projects" widget. Through this widget, the users of the portal can access their (a) Website Accessibility Inspection Projects, (b) Mobile Web Applications Assessment Projects, (c) Description Languages Assessment Projects and (d) Web Services Assessment Projects. For each project, a number of assessment criteria are available:

- **Evaluate against Personas:** Select among a number of predefined personas the ones that match the target user population of the application under development and let the system decide which specific guidelines and test should be used. These personas represent instances of virtual users connected to specific settings from the ontology (such as disabilities, functional limitations, etc).
- **Evaluate against Ontology:** Select among a number of settings from the ontology that correspond to the target user population of the application under development (disabilities, functional limitations, device and software usage etc.).
- **Evaluate against specific Guidelines:** Manually select the guidelines to assess from the collection of the available accessibility guidelines (this option is useful when for example someone needs to make sure that all images in a web site have alternative text in the case where step by step assessment is performed).
- **Quick Evaluation against Ontology:** Select not individual settings but complete categories (for example all disabilities, all functional limitations, all personas etc.). Using this option does not mean that all the guidelines will be used because for example the selection of all functional limitations is not necessarily connected to all guidelines.
- **Quick Evaluation against specific Standards:** Select to assess all the guidelines contained in a standard (all WCAG2 guidelines, all MWBP etc.). This option is similar to the one supported by most commercial products where all the guidelines are used simultaneously.

Upon selection of the desired assessment criteria, the portal presents the outcomes of the inference (what exactly will be assessed based on user selections). Through this page the user has the option to alter these automatic selections before continuing with the assessment. The results of the assessment are presented together with a number of alternative presentation options:

- Access a page that presents only Errors. This is useful especially for developers who are not aware of guidelines. The system just reports the error and the location of the error.
- Access an EARL based report in xml format of the assessment outcomes. This report is useful when a developer needs a machine readable representation of the results to be possibly used for creating custom reports (generated by other tools based on these data).
- Access an EARL based report in PDF format of the assessment outcomes. This report is generating by compiling the EARL data to pdf format.
- Access a PDF report that summarizes the assessment. This report is similar to the reports produced by most assessment products and contains the overall accessibility score of the assessment content based on the specific user selections.

Both assessment options and results vary according to the specific assessment project. Figure 3 presents an example of such a workflow as applied to a web assessment project.

5.2   Access to Assessment Facilities through the Standalone Tool

The currently version of the stand alone tool offers a number of facilities that are familiar to developers as it resembles the functionality offered by modern IDEs. All assessments are carried out using the project metaphor where developers create new projects, add content to their projects and compile them to receive a report of the warnings and errors that occurred. More specifically, the home page of the standalone tool offers:

- File Menu, Toolbar and Quick start widget. This is the standard entry point for creating new projects adding new files to projects etc.
- Open existing project. Developers can search for their projects in the local file system and locate the one to be loaded in the assessment environment.
- Recent Projects widget: Open one of the recently created or opened projects. This is used by modern IDEs and is based on the fact that users may wish to open projects that have recently worked in.
- etc.

Each assessment session is initiated either through the creation of a new project or the selection of one of the recent projects or with browsing to locate a project from the file system. Files can be added to the project either by selecting a saved file in the local file system, or by entering the url of files residing on the web. The added files appear on the project explorer widget, offering the option to view their source code or browse their files when applicable using embedded browsers (Internet Explorer and

Firefox). The selection of the project options menu item from the solution explorer provides access to the assessment criteria of the specific project. These criteria represent the options offered by the ontology and are used for filtering the evaluation approaches to be used when performing the assessment. Some indicative options offered by the ontology include Disabilities, Functional Limitations, Impairments, Standards, Devices, Software, Guidelines, and Personas. After performing the evaluation, the assessment results are presented in a number of different ways.
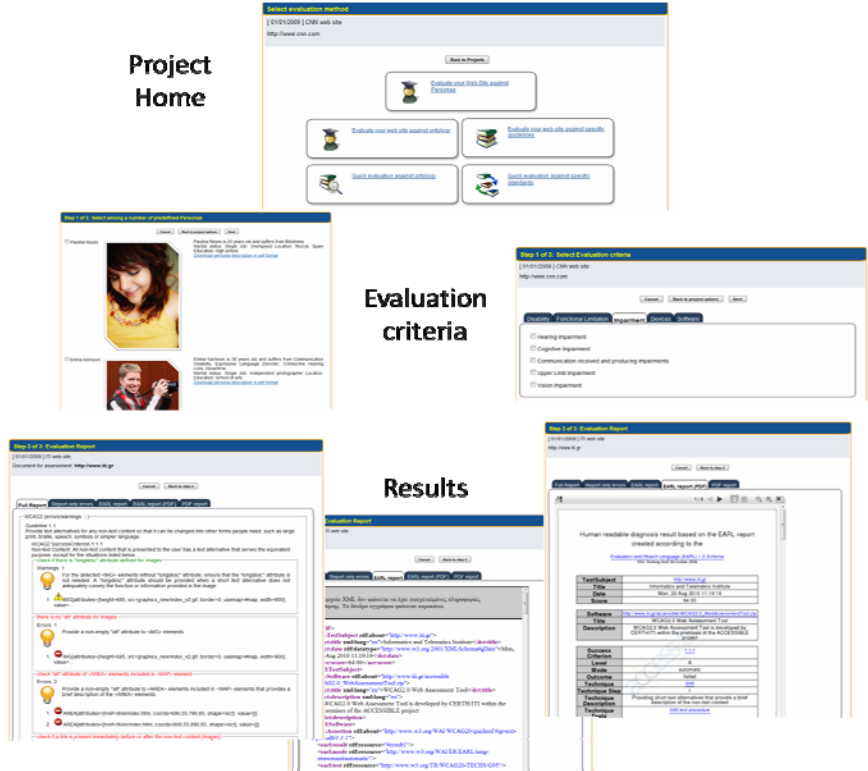

Fig. 3. Web content assessment workflow (portal)

− **For Development purposes**

     o   Full evaluation output. This is similar to compiling a project where all compilation process is presented together with errors and warnings.

     o   Errors List: Only a list of errors is presented together with the line number where the error occurred (users can navigate to this line number by double clicking the error)

     o   Warnings List : Only a list of warnings is presented together with the line number where the warning occurred together with source code navigation functionality

− **For Reporting:** XML EARL reports, EARL reports in PDF format, Compiled
PDF Reports. These reports are similar to the ones returned by the portal.

Both assessment options and results vary according to the specific assessment project.
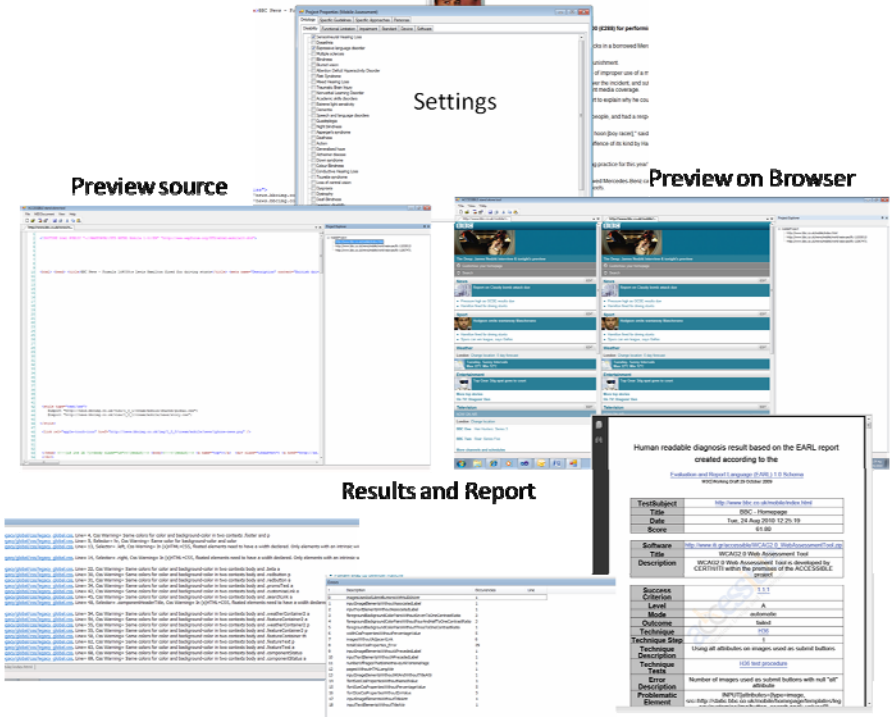Figure 4 presents an example of such a workflow as applied to a Mobile Web
Assessmentproject.

Fig. 4. Mobile web content assessment workflow (using standalone tool)

6   Conclusions and Future Work

This paper has presented two alternative instantiations of an integrated assessment
environment developed in the context of FP7 Project ACCESSIBLE. In conclusion,
the   innovations introduced by these new assessment environments include: (a)
specifically targeted to developers, (b) functionality that resembles modern IDEs such
as preview, source code and navigate to error, (c) save and recover project settings, (d)
multiple alternative evaluation options (personas, guidelines, standards, disabilities
etc), (e) accessible both through the web and as standalone application, (f) support for
state of the art assessment such as WCAG2.0 and Web services assessment and (g)
support of a wide range of reporting options (EARL, pdf, etc).Regarding future
improvements, the aforementioned assessment environments will be put into use by
real users (by deploying the portal and making the stand alone tool available for

download) in order to get valuable feedback for improving these products both in terms of usability and functionality. At the same time the Web-assessment functionality is currently been updated to support the syntactical assessment of ARIA allowing both tools to integrate such facilities in their assessment front end in the context of their future releases.

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