Web standards facilitating accessibility in a digitally inclusive South Africa – Perspectives from developing the South African National Accessibility Portal

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Abstract

Many factors impact on the ability to create a digitally inclusive society in a developing world context. These include lack of access to information and communication technology (ICT), infrastructure, low literacy levels as well as low ICT related skills. The lack of standards, or poor implementation of existing standards in technology, could also have a significant impact on the pervasiveness and cost of developing applications, thus creating more barriers in society. This paper analyses the importance of Web standards (especially those associated with accessibility) in the creation of an inclusive society using experiences gathered from the development of the South African National Accessibility Portal.

1. Introduction

Free and pervasive access to information is the cornerstone of a digitally inclusive society. The Internet, through the World Wide Web (commonly referred to as the Web), is the enabler that allows for the worldwide distribution of information. The Web provides access to information through documents (which can contain text, images and other multi-media formats) as a system of navigable links. The documents are typically presented to the user through a user agent – the web browser (sometimes in combination with other applications such as screen-readers or other assistive technologies).

The impact of the lack of ICT and infrastructure is well known and documented – people will always remain marginalised from mainstream economy and society (Sinclair 2007). However, the impact of available ICT applications and infrastructure that is not geared to the specific context, is not so easy to illustrate. The context we refer to is Web accessibility which is defined as the requirement that all users, including persons with disabilities, should be able to perceive, understand, navigate, interact and contribute to the Web (Waddell 1999).

This paper presents limitations of technology, with specific reference to Web standards compliance, which impacted on meeting accessibility requirements during the development of the South African National Accessibility Portal. These limitations introduce barriers to information, thus impacting on the creation of a digitally inclusive society.

The paper's layout is as follows. In Section 2 we highlight the need for standards for the Web. Section 3 describes the most relevant and applicable standards with regard to the Web and specifically an accessible Web. Section 4 presents a variety of tools that can be used to measure the standards compliance of documents and websites. We introduce the South African National Accessibility Portal Initiative in Section 5, with a focus on the South African National Accessibility Portal component (referred to as NAP) which forms the basis of our research. We present a NAP presentation technology analysis in Section 6. Section 7 describes how non-standards compliance in technology can create barriers and thus promote exclusion. Section 8 uses the outputs from Section 7 to provide recommendations for developers, framework builders and user agent providers, which will help in creating an inclusive society. We conclude in Section 9.

2. The need for standards

The Web utilises services as provided by the Internet. Part of the Internet's success is due to the strict adherence to well published standards. Standards consist of specifications describing what a system should do, not how the system should do it. These standards allow for the interoperability between various devices, technologies and applications.

Web standards are typically associated with the presentation and publication of documents on the Web. The importance of these standards is not always clearly specified or well understood. Documents which are standards compliant promote inclusivity as they allow content to be rendered on many different user agents and devices (which in turn promotes freedom of choice with regard to the use of a specific user agent). These documents are typically easier to

maintain, since most often a standards compliant document has a smaller code base (as no exceptions have to be coded for different user agents). A smaller code base is an important aspect in a bandwidth constrained environment, as it leads to faster load time and results in a better user experience. Standards compliance allows for the separation of concerns: HTML for content, Cascading Style Sheets (CSS) for presentation and JavaScript for dynamic behaviour. Standards compliant documents are also more accessible to Web-crawlers – the mechanism used by search engines to build an index of information on the Web.

Compliance with Web accessibility standards are equally important. An accessible website allows for more people to peruse the available information. This can have economic benefits because of the larger included audience. From a legal viewpoint web accessibility is becoming more important since South Africa has ratified the United Nation's Convention on the Rights of Persons with Disabilities (Convention on the Rights of Persons with Disabilities 2006). In the next section, we provide a brief overview of the applicable markup as well as accessibility related Web standards.

3. Applicable Web standards

A number of different organisations and consortia are active in generating standards associated with the Internet and the Web. These include the World Wide Web Consortium (W3C) and the Internet Engineering Task Force (IETF)(W3C n.d., IETF n.d.). These bodies have different naming conventions for their contributions. For example, the W3C creates "recommendations", which are specifications or sets of guidelines that are similar to standards published by other bodies. These recommendations are commonly referred to as W3C standards. On the other hand, the IETF creates special Request for Comments (RFCs) that is to become a standard or part of a standard.

The W3C has published recommendations for markup languages in the form of HTML (an ISO/IEC international standard based on W3C HTML 4.01 Strict has also been published (ISO/IEC 15445:2000 n.d.)) and XHTML (XHTML n.d.) , document object model (DOM) and cascading style sheets through CSS (CSS n.d.), whilst the JavaScript specification has been standardised by Ecma International (another standards organisation for information and

communication systems), in the form of EcmaScript (Ecma-262 n.d.).

A large variety of contributions have been published with regard to accessibility. These take on the form of standards (e.g. W3C recommendations published as guidelines), legal acts and guides.

Foremost of these is the Web Content Accessibility Guidelines 1.0 (WCAG 1.0) created by the W3C. (WCAG 2.0, the successor to WCAG 1.0, is currently a "W3C Candidate Recommendation")(Chrisholm 1999, Caldwell 2008).

The United States conforms to the Rehabilitation Act from the United States Federal Government (specifically Section 508), which requires electronic and information technology to be accessible to individuals with disabilities (Section 508 2006).

The United Kingdom is guided by the PAS78: Guide to good practice in commissioning accessible websites, as published by the Disability Rights Commission in collaboration with the British Standards Institute (PAS78 n.d.).

Australia is guided by the World Wide Web Access: Disability Discrimination Act Advisory Notes (World Wide Web Access 2002). It is important to note that these country-specific references are all associated with developed countries, with no specific initiatives in developing countries.

Automated tools are available which can measure standards compliance. The next section introduces applicable tools and utilities with regard to the automated validation of documents.

4. Validation tools and utilities for standards compliance evaluation

Quite a few different utilities and tools are available to measure the standards compliance of a web document. XHTML/HTML validation tools are available from the W3C in the form of the W3C markup validation service, whilst CSS validation is available through the W3C CSS validation service (W3C Markup Validation Service n.d., W3C CSS Validation Service n.d.).

A few accessibility validators are also available. These automated tools can be used to assist in the process of accessibility validation but some issues still have to be reviewed and resolved through human intervention. Conformance to all guidelines and thus all validators, is a very

difficult and sometimes irrelevant exercise. The different tools measure the conformance to the guidelines differently, which can lead to conflicting results. The end goal must not be to comply to all, but to improve the accessibility while maintaining usability of the website (where usability refers to the ease of use in achieving a specific goal).

One example of such an automated accessibility validation tool is the Functional Accessibility Evaluator that evaluates accessibility based on CITES/DRES HTML Best practices (Functional Accessibility Evaluator n.d.). This is not a new standard, but provides techniques for adherence to Section 508 standards, as well as the W3C WCAG.

A second accessibility evaluation tool is WAVE (WAVE Web Accessibility Tool n.d.). This tool evaluates a site for accessibility, but does not guarantee that the use of this service will ensure that your web content will comply with all the accessibility standards.

A valuable accessibility extension that can be used by people with disabilities to view and navigate web contents, as well as by developers to check the use of structural and styling markup, is the Mozilla/Firefox Accessibility Extension (Accessibility Extension from Firefox n.d.).

The following section introduces the South African National Accessibility Portal, an initiative aimed at improving inclusivity for persons with disabilities in a developing world context.

5. Introduction to the NAP initiative

The South African National Accessibility Portal Initiative is a research, development and innovation project that uses ICT to contribute towards the empowerment and independent living of persons with disabilities, ensuring their participation and inclusion at all levels of society and the economy (South African National Accessibility Portal n.d.). The project is managed by the Meraka Institute (CSIR) in partnership with the Office on the Status of Disabled Persons in The Presidency and a representative group of Disabled Persons' Organisations, including:

- The Deaf Federation of South Africa (DeafSA).
- The South African National Council for the Blind (SANCB).

- The National Council for Persons with Physical Disabilities in South Africa (NCPPDSA).
- The QuadPara Association (QASA).
- The Independent Living Centre (ILC).
- The South African Federation for Mental Health (SAFMH).

The initiative consists of various components, ranging from research into accessible and affordable, localised ICT assistive technologies, the design and roll-out of centres in communities – which aim to reach people living in communities and to provide entry for them into the digital world. Research into sustainability models and a methodology which will allow for the replication of the initiative in other developing countries with similar needs, as well as the portal (referred to as NAP) – an accessible and usable, multi-lingual, community-based information and communication platform. The portal presents information utilising normal browser access. In addition, information is made available through different modalities, specifically a Short Message Service (SMS) query facility, as well as an Interactive Voice Response (IVR) facility utilised from a normal telephone.

NAP forms the basis of the research conducted in Web accessibility at the Meraka Institute (Coetzee 2007, Coetzee 2008). It aims to use the most recent and popular technologies to provide a platform which provides a pervasive source of relevant information regarding the disability domain, not only for persons with disabilities, but also those involved in the disability field such as caregivers, the medical profession and those offering services in the domain. In the following section, we present the technology used for the development of the portal and highlight issues with the technology which impacts on digital inclusivity through poor standards compliance.

6. NAP technology analysis

6.1 Technology stack

NAP utilises a technology stack consisting of an Enterprise Application Server (JBoss 4), which is compliant with the Java Enterprise Edition (JEE) specification, including support for the EJB3 specification (using stateful and stateless session beans as server side components) (Java Platform Enterprise Edition 5 n.d., JSR-000220 n.d.). Presentation is facilitated through the use of JavaServer Faces (JSF) and Facelets in

combination with cascading style sheets (JavaServer Faces Technology n.d., Facelets n.d.). The application (consisting of server side business and logic components, as well as client side presentation components) is glued together using JBoss Seam (JBoss Seam n.d.). JSF forms part of the Java Enterprise standard (which drives a large part of Web publication environments). The following subsections analyse the presentation technologies responsible for creating the Web documents (the other elements used in the development do not impact directly on accessibility and are not included in the analysis).

6.2 Presentation technologies

JSF is component based with good tooling support, e.g. a specific JSF component can be placed on an HTML page in an integrated development environment (IDE). JSF is responsible for the runtime generation of the HTML or XHTML, which constitutes the presented documents. This approach implies that the developer has no direct knowledge of, access to or control over the generated HTML. JSF is used in conjunction with Facelets (a templating framework). Through this combination, JSF components are glued together to form a meta-component with enhanced functionality. This meta-component can then be included on any HTML page, thus improving the re-use of code.

Due to the pervasiveness and application of the JEE standard, JSF (in conjunction with Facelets) is utilised for the creation of many websites on the Internet. Thus, if the code generated by these frameworks is not standards compliant or requires workarounds to ensure correct rendering and accessibility, it will have a negative downstream impact. The following highlights issues with regard to the presentation technologies as experienced during the development of NAP.

6.2.1 Technology issues: JSF

Through our experiences in developing NAP we have identified certain issues with regards to the applicability and usefulness of JSF when developing a standards compliant (and accessible) website. JSF version 1.2_08 (which is used in NAP) has specific limitations:

- It can only create XHTML "transitional" (JSF Issue Reporting, Issue 465 2006). Deprecated elements and attributes are not allowed in XHTML "strict", thus XHTML "strict" achieves accessible, structurally rich documents that can easily adapt to style sheets and different browser situations. XHTML "transitional" allows deprecated elements which can impact on accessibility.

- It does not create valid HTML (based on the W3C validation service) as the encoding of ampersands in URLs are invalid (JSF Issue Reporting, Issue 404 2006). Some browsers will incorrectly convert an ampersand, which is assumed to be an entity reference. This may cause links to fail.

- JSF provides components, which are solely dependent on JavaScript that renders the site inaccessible to users utilising different user agents without the required JavaScript engines (specifically the *commandLink* component).

- The developer still has to manually associate labels with every form element. Label information is used by assistive technologies to communicate to the user the purpose of this form control.

- JSF tags, such as *dataTable,* use an underlying data model to provide rows for rendering purposes. The tag *panelGrid* can be used to control a grid-based layout. The combination of these tags can result in inaccessible layout. The HTML generated from these components use the *<table>* environment for the layout. Therefore, very often nested tables are created, which are inaccessible. Ideally, CSS should be used to manage the layout of documents.

- The developer has to manually add the DOCTYPE to all XHTML pages. XHTML/HTML standards require a document type declaration. This information is used to reliably validate a document. The developer is also responsible to ensure that HTML head and body elements are present, with a title element embedded in the head.

The above indicates that the developer is forced to take additional care to ensure pages that validate and which can be regarded as accessible.

6.2.2 Technology issues: Facelets

Facelets as a templating technology is very powerful as it facilitates code re-use. However, it is quite easy to generate invalid HTML through incorrect use of the "rendered" attribute, which can lead to generated code that does not pass the W3C validation (for example, it is easy to render an unsigned list without any items).

6.2.3 Technology issues: CSS

CSS as a presentation technology removes styling and layout from the HTML pages and thus improves maintainability and allows implementations for different skins ("look and feel") for presentation. Due to the different compliance levels to CSS standards or the ignorance thereof in web browsers, the developer often has to implement workarounds to allow browsers and assistive technologies to make use of, or acknowledge, implementations in presentation code that enhance accessibility.

- One such technique is the use of hidden messages that are voiced by a screen reader, giving the user valuable feedback regarding navigation, the structure of an HTML document and the position within an HTML document. However, inadequate support for styling options such as *visibility:hidden* and *display:none* that are available to prevent these messages from being rendered in a visible way, also have the consequence that some screen readers will fail to voice output formatted with this styling option. Therefore, developers have to use CSS positioning to keep these messages from displaying.

- Relative units can be used to easily adjust font sizes on the presentation layer. This feature is especially important for persons with visual disabilities. However, some versions of Microsoft's Internet Explorer (IE) do not interpret these units correctly and additional styling has to be added to the style sheet to enable correct interpretation of these units.

- Definition of the style sheet also needs careful consideration. If an id selector is used in the CSS (through the "#"

operator), cognisance has to be taken of the XHTML requirement of having unique id's in the document. The class selector (defined with the "." operator in the CSS) is more appropriate as there is no constraint on the number of appearances in the document.

- CSS pseudo classes can be applied to links to change the presentation. Poor support in some browsers requires the developer to specify values for more than one pseudo class to have cross-browser support. For example, *a:active*, *a:focus* and *a:hover* have all to be specified to have the same effect for keyboard and mouse events.

- Users that make use of font enlargements have difficulty completing forms when the form label is displayed adjacent to the input field. Positioning of the form label just above the input field limits horizontal scrolling. However, special styling options have to be defined in CSS for versions of IE to force the preferred layout order. In this case, to ensure accessibility, CSS must be used for layout and not tables.

This section has highlighted some of the technology issues and required workarounds to ensure conformance to accessibility guidelines. In the next section, we show how these issues can detract from attempts at creating an inclusive society.

7. Non-standards compliant technology promoting digital exclusion

The issues highlighted in Section 6.2 have the undesirable effect of enhancing digital exclusion instead of promoting the creation of a digitally inclusive society.

To overcome the mentioned issues, the application had to be reworked significantly (and repeatedly). Cognisance of these limitations need to be taken into account for every additional feature that is added or for every refactoring of a page. This has a cost implication, as well as resulting in an extended development time. Most often, regular websites do not have the luxury to allow for the above factors. Developers have to be aware of the limitations and be skilled in resolving them. Often developers migrate between projects or companies, taking valuable skills with them. A website might start off

compliant, but there is no guarantee that the website will stay compliant under a new team of developers. The result is non-compliant websites, with a resultant exclusion of people (specifically persons with disabilities).

The other side of the coin is just as disturbing. Microsoft's generation of web browsers (Internet Explorer) is known for its non-compliance to W3C published standards. IE6, which has the largest footprint on desktops worldwide, requires many additional CSS hacks to render properly. IE7 has improved slightly, but often falls back into quirks mode (also known as the backwards compatible mode, as it shares the same problems and behaviour as older versions). IE8 (not publicly available at the time of writing) promises to be more standards compliant. To develop documents that render correctly in spite of the improper standards support in the web browsers, again has cost implications. It requires browser-specific hacks for pages to render correctly. This results in more code which is also more difficult to maintain. Often a choice is made to only support the Microsoft based browsers, at the cost of users using other user agents, thus excluding more people from access to relevant information.

Assistive technologies depend on the compliance to standards and are developed against these standards. But even if assistive technologies and browsers implement all criteria (standards) for accessibility, an inaccessible HTML document design will still make browsing difficult or even impossible. Thus, the appropriate selection of software technologies that automates the process of accessible HTML document design, is an important factor to overcome the digital divide.

If the mentioned presentation technology generates standards-compliant code, a larger user base can be included without additional cost implications. The following section contains recommendations that, when followed, can aid in the creation of an inclusive society.

8. Recommendations

Commercial vendors and Open Source initiatives developing standards and frameworks based on other standards have to take cognisance of the problems introduced when these frameworks do not comply with published and accepted Web standards. It would greatly promote the inclusion of all, if the vendors create frameworks that create code that automatically pass all validation and accessibility requirements.

Similarly, better code without needing special workarounds to cater for poor browser implementations would allow for faster turnaround time and addition of applicable features, instead of resources spending undue amounts of time in developing workarounds.

Finally, end-users can choose devices and applications that are standards compliant, thus over time moving away from poor user agent implementations, and making better use of the benefits of being standards compliant.

9. Conclusion

Access to ICT is viewed by some as the only element needed to create a digitally inclusive society. Unfortunately this is not the case. Many other elements need to be addressed to allow for the creation of a digital society. These elements include addressing ICT literacy, ICT affordability and access to a variety of ICT devices using different modalities (for example, telephones or the personal digital assistant (PDA)). These elements are glued together through standards compliance, ensuring interoperability.

The paper argues for the importance of compliance to a variety of Web standards (normal and accessibility) in facilitating a digitally inclusive society. It shows the barriers introduced through non-standards compliant technologies, through experience gathered from analysing the NAP presentation technology. Issues such as increased development cost due to required workarounds as well as the continuous retesting and revalidation of code are highlighted. The paper presents recommendations applicable to developers, standards bodies and framework providers, as well as user agent providers which, when implemented, can contribute to the creation of a digitally inclusive society.

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11.Endnote

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