WCAG Formalization with W3C Techniques

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Abstract. Web accessibility consists of a set of restrictions that Web pages should follow in order to be functional for different devices and users. These restrictions, which are quite heterogeneous and rather expensive to evaluate, unless relayed to human judgement, are usually expressed within a program's code. Different solutions have recently emerged to express these restrictions in a more declarative way. We present a comparison of some of them and propose some W3C techniques for expressing these constraints. Using W3C technologies, the evaluation cost can be clearly minimized.

1 Accessibility

WAI (Web Accessibility Initiative)'s WCAG (Web Content Accessibility Guidelines) 1.0 [1,2] is an important contribution to Web accessibility, focusing not only on eliminating barriers for disabled people, but also a major step towards device independence, allowing Web interoperability to be independent from devices, browsers or operating systems. WCAG 1.0 have become an important reference for Web accessibility in the Web community. However the set of the 65 WCAG's checkpoints that accessible documents have to pass is a very heterogeneous set of conditions whose evaluation and repair is difficult to evaluate. WCAG 1.0 specification is written in a high abstraction level which is frequently quite far away from the low level technical detail of the HTML format. Many of those checkpoints are also open to subjective interpretation, including implicit conditions or, simply, containing conditions whose detection can not be automated.

2 WCAG Evaluability

Several rules can not be evaluated automatically by a program with an acceptable degree of trust because they require human judgement. However, there are some automatable rules that can be automatically evaluated with a computer's program. Typical evaluation tools [8,9,10] automate the evaluation of these restrictions **with their own program's code**. XML-based APIs like DOM [5],

SAX [6] or JDOM [7] can be used in programming languages like Java or Haskell as long as Web pages get a similar aspect as a XML file. However, this involves several difficulties and differences on how their programmers interpret this set of rules. As a result, tools really implement their own set of constraints which are based on the original from W3C, but having important differences from each other that result on different evaluation results, even for the same document, depending on which tool is being used.

The need for a declarative set of restrictions for expressing constraints within Web documents has been recently addressed by some previous work. Taw [8] has had an attempt to express this rule in an internal XML file based on regular expressions that should match document’s markup, but the expresivity power was really poor and regular expressions maintainability was not very cost effective. Kwaresmi [11] recently used a self-developed XML-based language for expressing accessibility constraints. It was based on the document’s structure (not the document’s markup itself), so things like the order of the attributes within a tag, uppercase or lowercase sensitivity or white-spaces became properly treated, among others. However, this XML-based language results rather verbose and is no more than a *ad-hoc* developed format specifically devoted to express accessibility constraints. More generic approaches can be achieved with generic XML-based restriction languages like Xlinkit [12] which is a first-order logic XML-based language for generic restrictions on XML documents. This language could effectively be used to express declarative rules that are automatically checked by a generic validation tool that spots all XML nodes that do not follow the declared restrictions. Each failing node is spotted with a unique XPath locator that facilitates where accessibility barriers may be found. Xlinkit provides evaluating constructors for first-order logic operators including conditional, comparison and quantified expressions. Though this solution is generic and powerful, tools incorporating Xlinkit should use their implementor’s platform.

In front of these related works, we have found that XPath 1.0 [3] and XQuery 1.0 [4] may be used to express accessibility restrictions. Table 1 shows several XPath locators for nodes breaking some WCAG checkpoints. Other XQuery 1.0 based expressions can be found at [13].

Table 1. XPath 1.0 locators for nodes breaking accessibility constrains

WCAG #	XPath 1.0 rule
1.1b	<code>//input[@type="image"][not(@alt)]</code>
1.1e	<code>//frameset[not(noframes)]</code>
3.5a	<code>//h2[not(preceding::h1)]</code>
4.3	<code>//html[not(@xml:lang)]</code>
6.4a	<code>//*[@onmouseover != @onfocus]</code>
7.4, 7.5	<code>//meta[@http-equiv="refresh"]</code>
9.2a	<code>//*[@onmousedown != @onkeydown]</code>
9.2c	<code>//*[@onclick != @onkeypress]</code>
10.4b	<code>//textarea[normalize-space(text())=""]</code>
12.1	<code>//frame[not(@title)]</code>

Acknowledgements

The work reported in this paper has been partially funded by the projects IN-FOFLEX *TIC2003-07208* and SIEMPRE *TIC2002-03635* of the Spanish Ministry of Science and Research.

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WWW2005 conference, May 2005, Chiba, Japan, accepted poster