

Accessibility of Emerging Rich Web Technologies: Web 2.0 and the Semantic Web

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ABSTRACT

Web 2.0 is a new approach to Web content, making it more interactive and allowing sites to combine features in new ways. This change in paradigm brings new challenges to people with disabilities. Accessibility advocates must develop solutions rapidly. Semantic Web technologies address some of these requirements, and accessibility innovation may be part of a convergence of the Web 2.0 and Semantic Web.

Categories and Subject Descriptors

H.5.4 [Information Interfaces and Presentation]:
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General Terms

Design, Human Factors, Standardization.

Keywords

Accessibility, Accessible Rich Internet Applications, Semantic Web, Web 2.0.

1. INTRODUCTION

1.1 WEB 2.0

The term “Web 2.0” describes new characteristics of the Web. New types of services are made possible by the ability of sites to share or aggregate data, and for users to be part of the authoring process. For users, it is often characterized by much greater interactivity, with users able to influence what is presented to them. Often the content changes or updates frequently, such as in games, flight trackers, stock tickers, etc. In many ways there is a more desktop-like experience, in which Web applications converge with the features of ordinary applications. This is an emergent aspect of the combination of existing technologies supported by the open nature of the architecture of the Web. [10]

Although Web 2.0 applications behave increasingly like desktop applications, they continue to use Web technologies for content transmission, encoding, and presentation. These technologies are

used or combined in novel ways that lack the accessibility features that have been built over years into their platform-specific counterparts and are just becoming effectively mainstream in “Web 1.0” content. Web 2.0 thus presents significant risks to accessibility.

Because Web 2.0 is an emergent phenomenon rather than a specific technology or set of technologies, there is no single designer or responsible authority that ensures that the technologies and practices support accessibility. Market forces must influence this. While the work done by accessibility advocates to date has greatly increased awareness of accessibility, the voice of the community is not loud enough. Because of the fast pace of technological innovation, and because the accessibility challenges of Web 2.0 can block the very people who need most to engage in dialog to influence its form. Therefore accessibility is an important challenge.

1.2 SEMANTIC WEB

The Semantic Web was not created to solve accessibility problem, in spite of the overlap with the term “semantic” that’s an important part of accessibility techniques. But it brings great accessibility promise. The creators of Semantic Web understand accessibility and are supportive of it, seeing it as one of the dimensions of universal access that all W3C technologies are designed to support.

However, we recognize that standards are slow, and technology evolves quickly in the commercial marketplace. Innovation brings new customers and solidifies relationships with existing customers; Web 2.0 innovations also bring new types of professionals to the field, ones who care about the new dynamic medium. As technologies prove themselves, standardizing brings in the universality of the benefit, but necessarily follows this innovation. Therefore, this paper acknowledges and respects Web 2.0, discussing the issues and real world solutions.

2. IMPACT

2.1 VALUE

The compelling and responsive nature of dynamic Web sites means this technology will be used to bring a host of new services. Web 2.0 will increasingly implement everyday activities like shopping, banking, entertainment, etc. These services will make it easier for the consumer and cheaper for the business to provide. This means these technologies will become a part of the culture, impacting people with disabilities as well. In spite of some accessibility concerns, these technologies bring accessibility benefits as well.

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2.1.1 COMMUNITY SOLUTIONS

Web 2.0 techniques can be used to create accessibility on sites. One approach is the use of “mashups” to enhance accessibility. Mashups are a signature aspect of Web 2.0 in which information from several sites is combined or modified to create a new site with incrementally richer features. [7] Unlike classic aggregation that involved loading images or frames from different sites into a portal-style page, mashups involve the seamless blending of data via scripts, using APIs or other data exchange technologies. The content of the resultant page involves resources from all the involved sites with no clear demarcation between them.

An early mashup hit the news in 2003 when student provided on his own site an alternate, accessible interface to the Odeon Cinema’s Web site. [1] He was able to provide the same service of searching cinema listings, but in a lightweight, simple, and accessible interface. This was celebrated in the accessibility community and was a visionary use of the new capabilities of technology to increase access. Although this project gained a great deal of attention, and even had the potential to increase the business to the cinema, it was shut down due to legal protest.

Since this time, mashups have become more common and accepted, and are frequently used to provide alternate interfaces to major e-commerce sites. Such sites even specifically provide public APIs to support value-add via mashups. Often, mashups are created to integrate data from various sites to address specific interests, but users can take the lead of the Odeon cinema example and use this technique to solve accessibility problems. Amazon.com is an example site that, although it itself provides a simplified and accessible version of its user interface in addition to the primary one, alternate versions for specific usability and accessibility needs are available. [13]

2.1.2 RICH CONTENT

Many people who have difficulty with Web sites now will be able to make use of sites in these new dynamic services. Now techniques exist to provide dynamic contextual help, provide an interface suited to the user’s experience, and learn a user’s preferences in order to quickly select the most appropriate choices provide great value. This will be of particular help to users with cognitive and learning disabilities, who will benefit greatly from the more interactive nature of these sites, and from the potential to provide multimodal interaction.

2.1.3 NEW TECHNOLOGY

The new technologies also bring indirect benefits. We should also consider the direct benefits to the field of accessibility brought by these technologies. The convergence of Web 2.0 and Semantic Web is likely to be brought about by improvements in automated semantic discovery heuristics. Tools and services that can analyze a Web site and discover semantics will be able to plug in value-added services, essentially bringing the capabilities of the Semantic Web to sites that were not designed with that in mind. The same techniques to discover semantics will be invaluable to assistive technologies, which remain dependent on a semantic understanding of the site to transform the presentation and provide alternate user interfaces for interaction. As much as third party semantic discovery services will be able to add value to sites for commercial reasons, third party accessibility transcoders will be able to use this technology to provide access.

2.2 NEW CHALLENGES

2.2.1 ONGOING EVOLUTION OF TECHNOLOGY

Just as Web 2.0 is a result of a new combination of technologies and techniques, it is characterized by ongoing experimentation. One usage that is gaining traction is Microformats. [6] An author using microformats provides patterned textual information, usually as an attribute of an element in HTML. Browser extensions and special-purpose tools can be quickly written to understand the pattern’s semantics and add them to the processing model of the page.

In principle, microformats should be accessibility-neutral, or even benefit accessibility by adding new semantics. However, in practice, microformats often repurpose elements and attributes that are important to accessibility, such as the “title” attribute and <abbr> element. [9] These HTML features provide information crucial to understanding for some users, and their use to provide computer-processable, rather than human-understandable, information compromises their value.

Crucially, it is due to insufficient awareness in the public at large of the issues of accessibility that this situation arose. The HTML features repurposed for microformats were viewed as “throwaway” elements that had no use. This may be because they in fact aren’t often used in practice, because Web sites even today don’t often provide the accessibility support that would involve use of these features.

It will be difficult to support accessibility in a world where something as simple as the “title” attribute may or may not provide meaningful information to users, depending on whether it is used to provide accessibility or as a microformat. Other innovative uses of technology are likely to emerge that could present similar challenges. It is important to support the innovation, but we must be vigilant to recognize situations where innovation compromises rather than supports accessibility.

2.2.2 ACCESSIBILITY TECHNIQUES FALL BEHIND

An addition to the speed at which new approaches emerge, another difficulty with ensuring accessibility within the new paradigm is simply that we lack experience with that paradigm. By definition, a new paradigm brings new challenges. Until people with disabilities use new technologies, and there’s an opportunity to analyze what the barriers are and to gain experience with different solutions, it’s unclear what the best solutions may be.

New accessibility techniques can be developed by deploying them on a trial and error basis in the marketplace, or using laboratory research to experiment with solutions. Often techniques are developed via a combination of both these approaches, and both take time. For instance, the emergence of window-based graphical user interfaces initially stymied accessibility. It required research and creativity to develop logical models that were understandable to users who could not see the screen, and keyboard access approaches for users who could not use a mouse. Even when the approaches were designed they had to be implemented in a variety of platforms and tools. Thus it was years before the new paradigm was even potentially as accessible as the old.

Once methods of making content accessible are developed, support for the techniques needs to be deployed into standards, user agents, and authoring tools. Even in cases that we do have an understanding of the way to provide access, we still have to wait

for tools to catch up. It remains the case that the assistive technology industry serves a small market and is not able to respond as quickly as other technology companies to innovation. Furthermore, because assistive technologies frequently operate on a host / client basis, using features of mainstream browsers to mediate Web content, we are dependent on those browsers also catching up in their features.

2.2.3 INTERACTIVE TECHNOLOGIES MORE DIFFICULT

Interactive technology is harder to make accessible than static content. In a fully static page, it can be sufficient to provide an effective linear presentation. However, as content updates, the user must a) be aware of the update and b) be able to access the new content, both while c) not being unduly interrupted in their current task.

Effectively conveying the relationship between elements in complex content is another growing challenge. User interface elements now exist that, for example, combine features of lists, tables, and command, or that present complexly structured tabular or graphical data. Much of the meaning or understanding of the content depends on the understanding of the relationships amongst the content elements. Assistive technologies require an understanding of the semantics sufficient to be able to represent these relationships, and standard practices for the representation of specific types of complex relationships.

We are beginning to understand what approaches work to convey this information to the user. However, since these features can be implemented in a variety of ways, there is much work to do to develop techniques to expose this information to assistive technology.

2.2.4 INCREASED NEED FOR ACCESSIBILITY EXPERTISE

Much as Web development is now rarely done by non-professionals, the field of Web accessibility requires more professionalization. [4] The challenges posed by technologies and design patterns, and the large set of techniques that can be used to form solutions, require deep understanding of the issues of accessibility. This is even more the case in the emerging Web 2.0 world, where accessibility specialists must understand the technology behind interactive or aggregate content in order to pose meaningful accessibility solutions. Thus, the availability of accessibility experts as a resource is an important part of our ability to ensure the accessibility of the developing Web. However, people become accessibility professionals at a slower rate than people join other Web fields, which means that we have a proportionally diminishing resource.

3. STRATEGIES

The challenges outlined above are described not to indicate that the new technology paradigm is problematic, but simply to outline the issues that we must be prepared to resolve to ensure that the new Web will be accessible.

3.1 INFLUENCE TECHNOLOGY DEVELOPMENT

One factor that has greatly challenged the creators of new technologies (or new technology practices as Web 2.0 largely is) has been unavailability of information about how to make these technologies accessible. Very few professionals have, or should be expected to have, the credentials to have sufficient awareness

about the accessibility implications of their designs. Most do not even have access to people with the appropriate credentials, even if they are motivated to attend to the issue.

As the pace of technological innovation continues to accelerate, meanwhile, it will become increasingly difficult for those who do have accessibility credentials to be “at the table” at all the place they need to. Therefore, it will be crucial that, as a community, we make available effective guidelines for the design of technologies themselves to incorporate accessibility support. These guidelines need to be understandable by a technology developer who is pressed for time, and comprehensive enough that, if followed, there is acceptable assurance that real accessibility will result.

3.1.1 XML ACCESSIBILITY GUIDELINES

Any early example of this type of specification is the XML Accessibility Guidelines from the World Wide Web Consortium. [5] Although only a draft, and at this time both dated and incomplete, this document provides basic principles for ensuring that accessibility principles are built into XML-based languages. As a community, we need to reinvigorate this or a similar specification and ensure it is applicable to the various kinds of technologies that we can foresee being developed.

3.1.2 ACCESSIBLE RICH INTERNET APPLICATIONS

The development of new technologies requires, however, more than simple vigilance to ensure accessibility features are included. New technologies bring new paradigms, sometimes in quite unexpected ways. While the accessibility problems and solutions of currently deployed technologies are reasonably well understood, new technologies can introduce new kinds of challenges for accessibility. The optimal solutions to these challenges might not be immediately apparent and will require experience and research to develop. The development of such solutions, in turn, is required to implement the necessary features in the technologies. Thus, it is all the more critical that accessibility advocates be involved in an active way at the earliest stages of any technology development.

As part of the solution to Web 2.0, the W3C Web Accessibility Initiative is developing a suite of specifications for Accessible Rich Internet Applications. Described in the Roadmap for Accessible Rich Internet Applications [14], it describes the technologies to map controls, AJAX live regions and events to accessibility APIs, including custom controls used for Rich Internet Applications as well as techniques to mark common Web structures as menus, primary content, secondary content, etc. The technical specifications are provided in two parts: Roles for Accessible Rich Internet Applications [15] and States and Properties Module for Accessible Rich Internet Applications [16]. WAI-ARIA Roles identifies the types of widgets that are recognized by accessibility products, and provides an ontology of roles for these that can be attached to content. WAI-ARIA States and Properties allows authors to declare important properties of an element that affect and describe interaction.

The Accessible Rich Internet Applications suite is specifically designed as a bridge between established and emerging technologies. HTML does not provide all the semantic features needed for accessibility, and the new forms of interaction possible with Dynamic HTML and AJAX push the semantic requirements further. Therefore, WAI-ARIA catalogs the semantics currently understood by assistive technologies and provides a mechanism to attach those semantics to Web content.

The mechanism to attach WAI-ARIA to Web content uses standardized technologies of namespaces [3] and XHTML modularization [2], and the ontology of roles is implemented in Web Ontology Language [11]. Since HTML does not support these features, a technique is provided to use the “class” attribute to provide WAI-ARIA information [12]. This is similar to how microformats are used, though distinct as well because it provides multiple values and provides a mechanism to use other values of the attribute for other purposes. Use of these standard technologies, many of which are core enabling technologies for the Semantic Web, is expected to ensure forwards compatibility. However, it may prove that the ontology of roles and states will be directly adopted by future technologies and the need to provide WAI-ARIA support as a semi-separate effort will diminish.

3.1.3 RESEARCH

The WAI-ARIA suite is the result of active research by participants in the Web Accessibility Initiative working groups. To keep pace with technological change, ongoing research is very important. Research is needed to discover problems in new technologies early, and then to develop effective methods of resolving those problems for people with disabilities. This will require creativity and technical innovation. When developing solutions, approaches that yield an optimal cost/benefit balance must be high priority.

3.2 DEPLOY SOLUTIONS

3.2.1 DEVELOP ON A STANDARDS BASE

Accessibility is much more easily incorporated into an emerging platform that already accommodates accessibility in its base. For instance, once operating systems developed standard accessibility APIs, it became much easier for new applications to provide accessibility. The same is true of the new Web paradigm.

Web 2.0 owes its existence to the open nature of the Web. Many of the core standards used on the Web, from the TCP/IP and HTTP protocols for accessing content, to HTML and CSS languages for encoding and presentation of content, XML to provide a generic interoperable encoding format, SOAP for data interchange, and DOM for standardizing programmatic interaction, were all developed in such a manner as to encourage innovation (as well as, where applicable, to support accessibility). These technologies form part of the core of Web 2.0, and not by accident. At the same time, Web 2.0 itself is not a standardized technology, nor are some of the common technologies used, like AJAX, XMLHttpRequest, or Flash. So the approach of standardization that enabled its emergence, and that would support further innovation within it, is not yet a feature of it.

3.2.2 STANDARDIZATION OF NEW TECHNOLOGIES

This need not be viewed as an inherent problem, however. Innovation does not threaten standards, it is enabled by standards. One of the core reasons to standardize technologies is to provide a stable platform on which innovation can happen. Various experiments will be tried; some will attain technological or commercial success. Web 2.0 has now achieved a level of success that it makes sense to standardize its technologies, thus improving interoperability and accessibility as well as making it the basis for yet another round of innovations build on top of Web 2.0.

This standardization has, in fact, already begun with the adoption of XMLHttpRequest by the World Wide Web Consortium [18] and the creation of the Accessible Rich Internet Applications

specification that allows the mapping of Web 2.0 content to existing, standard accessibility architectures. Another potential activity that could benefit accessibility would be the creation of a declarative language to provide many of the common interactive features that now must be provided using imperative languages with greater accessibility considerations. As standardization activities like this proceed, Web 2.0 will become an intrinsically accessible platform and the basis for the next great thing.

3.2.3 SEMANTIC WEB SOLUTIONS

The Semantic Web provides a great deal of potential to address issues. Much of the challenge of Web 2.0 is one of semantics. That is, data exists, but is overly embedded in an inaccessible user interface, or is encapsulated in imperative script code that cannot be easily accessed in the absence of a standard API.

The Semantic Web standardizes formats for the interchange of data. When data in such standard formats is available, third party tools such as assistive technologies can repurpose the presentation much more easily. Another crucial aspect of the Semantic Web is that the semantics of data are designed to be inherently discoverable or learnable by tools. When assistive technology encounters data that it does not know how to handle, information is available that can be used to relate the semantics of that data to semantics that are understood by the tool. An effective presentation of new types of content can thus be made with recourse to design cycles, mashups, or custom application turning.

3.2.4 INNOVATIVE ACCESSIBILITY SOLUTIONS

As with many other accessibility-oriented technologies, Assistive Technology is likely to be an early adopter of this feature that ultimately will be shown to benefit everyone. For instance text-to-speech and speech-to-text programs were originally designed as Assistive Technology but are now becoming widely available and ubiquitous on kiosks etc. Accessibility APIs were created to support assistive technologies, but brought a layer of reflection and automation to applications that benefit many other types of tools as well such as evaluation tools and feature extension tools.

The Accessible Rich Internet Applications suite, for example, brings potential benefits beyond accessibility. Authors implementing WAI-ARIA have easy hooks on which to apply style and script events. The enhanced semantics allow authoring tools to understand author intent and therefore allow editing of content that was created in a different tool, a situation that might be ambiguous today. It is to be hoped that these benefits will encourage uptake of these solutions, benefiting accessibility overall.

3.2.5 TOOL IMPLEMENTATION

A key prerequisite to Web accessibility is support by Web browsers and assistive technologies. The rapid change in authoring practices into Web 2.0 has left the accessibility features of user agents behind. Even when standards such as WAI-ARIA exist, they provide no benefit to users, until they are supported. The development of WAI-ARIA has focused as much on working with tool vendors as on standards development itself. There is much promising early work in this area, thanks to vigilance from accessibility advocates and participation of a diverse array of tool vendors. Further technical innovations will require equal rapid response. User agents should follow the User Agent Accessibility Guidelines [8], and we must encourage them to update support rapidly as technology changes.

In addition to user agents, Web content will not be easily made accessible until the required features are directly supported by the

tools developers use to create content. Authors do not understand the details required to make content accessible, and we cannot expect the millions of content authors today to attain that level of knowledge. Tools must support accessibility by prompting authors for accessibility-specific features where needed, and by following accessibility standards in the coding of content—a process that is invisible to authors but quite visible to the users of the content. Principles for accessible authoring are described by the Authoring Tool Accessibility Guidelines [17]

3.3 WORK WITH COMMUNITY

One trend that has provided important new opportunities for accessibility has been the rise of community-developed tools, particularly user agents. Accessibility advocates unable to obtain rapid results in the implementation of accessibility features in mainstream products have been able to contribute accessibility features to community developed products such as Firefox. This has had the direct benefit of making needed accessibility features available sooner. It has also provided a forum for accessibility advocates to have a voice in the future of Web technology. This in turn has created real market pressure that has led to an acceleration in the implementation of accessibility features in mainstream products. Note that mainstream technologies are not likely to lose their market dominance by this trend, but the ability for people with specialized needs, including people with disabilities, to develop their own solutions has led to noticeable increases in attention from all technology developers.

In support of all this growth of the field, there will be a need for increased professionalization of Web accessibility. In particular, accessibility-oriented design expertise will be in demand, as well as accessibility evaluation expertise. Designers must be able to create template designs, reusable widgets, etc., and most large organizations will engage staff or consultants as part of the normal process of creating Web sites. Evaluators will verify to third parties that sites created by these designers do in fact meet the needs of people with disabilities.

Finally, advocacy will continue to play a vital role in maintaining this trajectory of the field of accessibility. Without the work of advocates, the awareness that currently exists will fade again. Advocacy has brought about the research into solutions for accessibility problems, and created a social and legal environment in which organizations developing Web technologies and Web sites pay attention to the issues. This is a trend which we must work actively to maintain.

4. CONCLUSION

While the new techniques and paradigm of Web 2.0 present challenges to Web accessibility, there is much opportunity as well. New technologies bring new abilities, on which we should capitalize while being responsive to potential new problems. Web 2.0 and Semantic Web, often viewed as alternatives to each other, actually help to solve each other's problems. Web 2.0 brings interactivity and information sharing, while Semantic Web brings semantics to the process, beneficial to accessibility as well as to the robustness of the combined platform. This is a rich field in which accessibility advocates can work.

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