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Web Accessibility

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Introduction

According to the traditional definition, Web accessibility means that Web can be used by people regardless of disability (see Web Accessibility Initiative [updated 2010] and Thatcher, Kirkpatrick, Urban, Lawson, Henry, Burks, Waddell, Heilmann 2006). However, since accessibility problems often appear in a context-specific form or simply due aging, Web accessibility improves the Web user experience for most users. In practice, accessibility problems might be equally due to limited end-user eyesight, or to using a small screen in a bus moving along a bumpy road.

As a simple example, an accessible Web application might allow user to replace images of a Web page with their textual descriptions, and enable filling in a form solely using a keyboard. In a more abstract sense, accessibility means organising information into manageable units, and generalising the interaction mechanism to support different input and output modalities, interfaces, and assistive technologies.

A major characteristic of Web accessibility is the relationship with Web user agent (or Web client) software and applications. Besides general-purpose applications such as desktop Web browsers, the definition of Web user agents covers many sorts of specialised applications acting on the behalf of the human user. These include, for instance, Web applications in mobile devices and in several kinds of embedded systems of consumer technology, such as televisions with Web browsers.

For practical purposes, accessibility considerations are often closely related to device independence. This is due to the fact that a person experiencing accessibility problems is likely to prefer different Web user agent settings, additional helper application(s), or a different user agent altogether, when compared to the hypothetical, "most typical" user. From a technical point of view, this emphasises the potential to interface with the application content on the application programming interface level. Consider, for instance, a person preferring text-to-speech output with speech recognition input, when accessing Web content.

Other significant, typically overlapping areas include mobile best practices, usability, and open and extensible application design. Accessibility, however, might be considered to underline the other design areas. For instance, in the context of universal design or design for all, a system can be usable only if it is accessible.

A straightforward technical baseline for Web accessibility is defined by the enabling Web technologies, such as the Hypertext Markup language (HTML), and the related software. For instance, an alternative textual description for an image can be uniformly requested only if the Web user agent supports this option, and the content representation is designed to include the alternative information. In practice, the technical baseline needs to be complemented by awareness and best practices in policy-making and in tool development. For instance, the content authors should provide text alternatives for images on a routine basis; otherwise crucial information might be missing from the applications. In turn, this also requires that the authoring tools support the feature

of adding textual descriptions, and that this activity is both encouraged and supported by the stakeholder organisations.

Standardisation at World Wide Web Consortium

The concrete definition of Web accessibility is established by the Web accessibility standards. The most significant Web accessibility standards are developed and published by the same organisation that standardises the pivotal Web technologies in the first place; the World Wide Web Consortium. In addition to the education and outreach value for the community, this ensures that accessibility features are considered in the standardisation process of the core Web technologies.

W3C and WAI

The World Wide Web Consortium (W3C) is an international community that develops standards to ensure the long-term growth of the Web (World Wide Consortium [updated 2010]). The W3C mission is to lead the Web to its full potential. Currently, the main W3C activities include Web design and applications, Web architecture, Semantic Web, Extensible Markup Language (XML) technologies, Web of services, Web of devices, and browsers and authoring tools. The W3C vision is the One Web; the Web for all and the Web on everything.

Besides technologies, W3C develops also guidelines for their usage. Following the Web development and the interests of its membership, the W3C is also continuously exploring new prominent areas for Web standardisation, e.g. in the form of joint events and W3C workshops (see Calendar of Events – W3C [updated 2010])

In 1997, W3C launched the Web Accessibility Initiative (WAI) that falls into the Web design and applications domain. In brief, WAI works with organisations around the world to develop strategies, guidelines, and resources to help make the Web accessible to people with disabilities (About WAI – Links to Documents [updated 2010]). WAI activities follow the W3C Process which explains the rigorous standardisation process in detail World Wide Web Consortium Process Document [Internet]. [updated 2005].

WAI Specifications

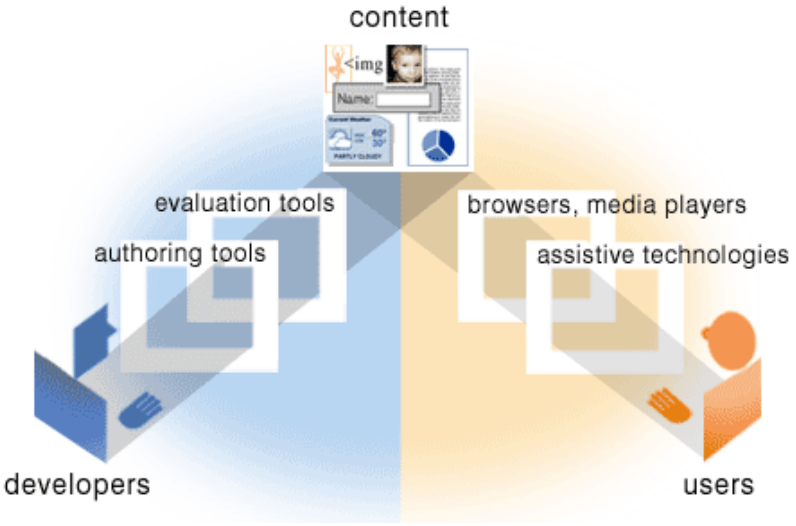
To date, the WAI has published standard guidelines and specifications related to the following aspects of Web accessibility:

- Web Content Accessibility Guidelines (WCAG)
- Authoring Tool Accessibility Guidelines (ATAG)
- User Agent Accessibility Guidelines (UAAG)
- Evaluation and Report Language (EARL)
- Accessible Rich Internet Applications (WAI-ARIA)

These consider representing Web content (e.g. HTML pages), authoring tools (e.g. functions supporting accessibility evaluation during authoring), the user agent aspect (e.g. ability to use keyboard for input and to pause dynamic content), publishing evaluation reports (e.g. reporting suggestions how to improve the accessibility of a certain application), and dynamic Web content (e.g. scripting).

Besides the standard guidelines, WAI produces also other significant accessibility resources. In particular, abstract guidelines and technique-specific or explanatory considerations are presented in separate specifications, complemented with informative resources.

Figure 1. Components of Web accessibility according to WAI (Essential Components of Web Accessibility [updated 2005])



Different guidelines address the different components of web development and interaction. Figure 1 (above) outlines the basic relationship between the components. In practice, developers need authoring and evaluation tools to create Web content. End-users need user agents and assistive technologies to get and interact with the content. Because of the natural dependences of the accessibility components, there are also dependences among accessibility standards. For instance, Authoring Tool Accessibility Guidelines refer to the Web Content Accessibility Guidelines.

The core W3C WAI standards establish the universal basement for Web accessibility. Localisation of these standards has typically been accomplished either by including (parts of the) the WAI specifications into national recommendations and laws, such as the Section 508 in the USA (Section 508: The Road to Accessibility [updated 2010]), or more recently by authorised translations, such as the Linee guida per l'accessibilità dei contenuti Web (WCAG) 2.0, the authorised translation of Web Content Accessibility Guidelines (WCAG) 2.0 in Italian (Scano 2008).

According to the W3C Process, the current standards, including the WAI guidelines, may be superseded. This means that considering the dependencies of long-term standardisation and localisation, authorised translations might be favoured. This is also advisable considering the global nature of the Web.

Web Content Accessibility

Perhaps the most significant Web Accessibility standard is established by the Web Content Accessibility Guidelines (WCAG). The current stable version, published in 2008, is the WCAG 2.0 (see Web Content Accessibility Guidelines (WCAG) Overview [updated 2009]; and Caldwell, Cooper, Reid, Vanderheiden 2008).

Principles and Guidelines

As suspected, the WCAG 2.0 standard considers the accessibility of Web content. A simple example of Web content might be the home pages of an organisation, including text, graphics, video content, and interactive forms.

The content accessibility guidelines specification is organised around four abstract principles: Accessible Web content is perceivable, operable, understandable, and robust. Each principle is explained with one or more intuitively understandable design goals, asserted as guidelines.

WCAG 2.0 asserts total 12 guidelines (Caldwell, Cooper, Reid, Vanderheiden 2008):

1. Perceivable
    1. Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language.
    2. Provide alternatives for time-based media.
    3. Create content that can be presented in different ways (for example simpler layout) without losing information or structure.
    4. Make it easier for users to see and hear content including separating foreground from background.
2. Operable
    1. Make all functionality available from a keyboard.
    2. Provide users enough time to read and use content.
    3. Do not design content in a way that is known to cause seizures.
    4. Provide ways to help users navigate, find content, and determine where they are.
3. Understandable
    1. Make text content readable and understandable.
    2. Make Web pages appear and operate in predictable ways.
    3. Help users avoid and correct mistakes.
4. Robust
    1. Maximize compatibility with current and future user agents, including assistive technologies.

While the intuitive message is clear, the abstract guidelines are not testable as such. For purposes of conformance evaluation, each guideline is associated success criteria. Three levels of conformance are defined: A (lowest), AA, and AAA (highest or "best"). These are designed to meet the needs of different accessibility use cases.

The WCAG 2.0 is also associated with a variety of sufficient and advisory techniques. These explain how to meet the success criteria and beyond, using a specific technology, such as hypertext, scripting, or stylesheet content.

The WCAG 2.0 claims to cover a wide range of recommendations for making Web content more accessible: "Following these guidelines will make content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity and combinations of these. Following these guidelines will also often make your Web content more usable to users in general." (Caldwell, Cooper, Reid, Vanderheiden 2008).

When compared to the intuitive notion of accessibility, perhaps the main limitation of the WCAG 2.0 is the relatively modest support for evaluating cognitive accessibility. Thus, while the guidelines and the success criteria highlight good things such as the importance of intuitive structures, avoiding unusual words, and the clarity of overall presentation, there is still a need for introducing additional, domain-specific understandability criteria. This is because the WCAG 2.0 considers understandability from a global perspective, without making references to a particular application domain, assumed education, or specific user attributes.

Application

In practice, the WCAG standard provides a normative definition and an evaluation system for accessible Web content: A Web application is accessible if it meets the success criteria for the WCAG 2.0 guidelines (at least) on the level A of conformance.

The associated informative WAI resources also explain a process model for evaluating Web accessibility in terms of quick preliminary reviews and more thorough conformance evaluations (Evaluating Web Sites for Accessibility: Overview [updated 2009]). The basic tool for using WCAG 2.0, e.g., when considering the accessibility of a Web application, is the WAI resource "How to Meet WCAG 2.0: A customizable quick reference to Web Content Accessibility Guidelines 2.0 requirements (success criteria) and techniques" (How to Meet WCAG 2.0 [updated 2008]). It provides a customisable quick reference for the requirements and a consistent view of links to the more specific resources. The quick reference, however, is only a starting point. The more thorough conformance evaluation process suggests also other tools and heuristics for testing accessibility, and explains how to document the evaluation carefully.

Additional WAI information is available for educational purposes, managing accessibility, understanding how people with disabilities use the Web, selecting appropriate tools, performing conformance evaluations, reporting findings, etc. However, while the associated informative resources are very useful in practice, they are not strictly speaking considered part of the WCAG 2.0 standard. Further, the W3C does not provide certification services which leaves room for third-party business models in the area.

In the past, the WCAG guidelines have been criticised for their "technical" nature and complexity. However, much of the criticism has been directed against the first version, WCAG 1.0 published in 1999. While some criticism still applies, the design objectives of WCAG 2.0 have since addressed many of the known issues.

Nevertheless, despite the aim of reaching a relatively general audience, the essence of WCAG 2.0 remains quite technical. Considering its universal scope and practical application, however, this cannot be completely avoided. It is important to observe that the WCAG 2.0 is a global standard that aims to be concise and agnostic with respect to the content representation technology, development tools, and development process. This means that the focus lies in the amalgam of the abstract information interface and the concrete end-user interface of a content-driven application. In addition, due to its standard nature, the WCAG 2.0 conformance levels ought to be considered a common basis for designing accessible applications. As a consequence, applying additional measures, e.g., pointed out by process and usability analysis, are typically favourable in applications.

Indeed, the general scope of the WCAG (and the other accessibility guidelines) suggests that additional efforts, coordination, and case-specific tutorials are needed in hands-on projects: Developers typically benefit from clear design requirements and tool-specific accessibility instructions, with respect to a certain application domain. Indeed, the informative WAI resources recommend identifying a high-level champion or spokesperson for Web accessibility, for supporting and ensuring that Web accessibility is implemented within an organisation (Implementation Plan for Web Accessibility [updated 2008]).

Guidelines for the Other Core Components of Web Accessibility

The other main Web accessibility guidelines include Authoring Tools, User Agents, Evaluation and Report Language, and Rich Applications. In brief, these might be considered complementary to the Web Content Accessibility Guidelines (WCAG).

Authoring Tool Accessibility

The Authoring Tool Accessibility Guidelines (ATAG) provides guidelines for software and services that people use to produce Web pages and other Web content (Authoring Tool Accessibility Guidelines (ATAG) Overview [updated 2008]). The currently stable version of the Authoring Tool Accessibility Guidelines is the ATAG 1.0, published in 2000 (Treviranus, McCathieNevile, Jacobs, Richards 2000). At the time of writing (February 2010), development of ATAG 2.0 is still underway (see Richards, Spellman, Treviranus 2009).

The purpose of ATAG 1.0 is twofold: to assist developers in designing authoring tools that produce accessible Web content and to assist developers in creating an accessible authoring interface. In particular, since many Web applications include authoring interfaces, the scope of ATAG is much wider than simply the commercial off-the-shelf Web authoring tools. For instance, consider a Web application that keeps a record of registered users and provides them an authoring interface for managing their contact information.

ATAG 1.0 introduces seven guidelines, associated with checkpoints of three priorities and three conformance levels: A (lowest), AA, and AAA (highest). In brief, ATAG 1.0 aims authoring Web content that is accessible with respect to the WCAG (1.0) specification. As a consequence, some ATAG checkpoints have multiple priorities, capturing the relationship with the WCAG (1.0) conformance levels.

The current ATAG 1.0 guidelines are as follows (Treviranus, McCathieNevile, Jacobs, Richards 2000):

1. Support accessible authoring practices.
2. Generate standard markup.
3. Support the creation of accessible content.
4. Provide ways of checking and correcting inaccessible content.
5. Integrate accessibility solutions into the overall "look and feel".
6. Promote accessibility in help and documentation.
7. Ensure that the authoring tool is accessible to authors with disabilities.

It is worth noticing that ATAG requires that the authoring tools and its documentation are themselves accessible. This is significant since it people experiencing accessibility problems are more likely to be interested in authoring accessible content.

The forthcoming version, ATAG 2.0 will probably change the wording and the organisation of the guidelines somewhat. In particular, ATAG 2.0 is expected to reflect the abstract principles and the structure of WCAG 2.0.

User Agent Accessibility

The User Agent Accessibility Guidelines (UAAG) considers the accessibility of the Web user agent, in particularly with respect to Web content accessibility (User Agent Accessibility

Guidelines (UAAG) Overview [updated 2009]). In this context, user agents include Web browsers, media players, and assistive technologies.

The currently stable version of the User Agent Accessibility Guidelines is the UAAG 1.0, published in 2002 (Jacobs, Gunderson, Hansen 2002). Development of UAAG 2.0 is still underway (Allan, Ford, Richards, Spellman 2009).

The purpose of the UAAG 1.0 is to provide guidelines for designing accessible Web user agents. As a consequence, the audience of UAAG is much smaller than of WCAG or ATAG. In brief, the UAAG points out the user agent implementation principles for interacting with accessible content, with a special requirement of being able to communicate with other software, especially assistive technologies.

UAAG 1.0 introduces 12 guidelines, associated with checkpoints of three priorities and three conformance levels: A (lowest), AA, and AAA (highest). Informative resources about different techniques are also available. Unlike the other guidelines, UAAG also briefly considers challenges such as accessible installation and user control over their environment when accessing the Web. In addition, the UAAG 1.0 defines a system called conformance profile labels. This supports developing and documenting (specialised) user agents that conform only to a subset of all conceivable accessibility features.

The UAAG 1.0 guidelines are as follows (Jacobs, Gunderson, Hansen 2002):

1. Support input and output device-independence.
2. Ensure user access to all content.
3. Allow configuration not to render some content that may reduce accessibility.
4. Ensure user control of rendering.
5. Ensure user control of user interface behaviour.
6. Implement interoperable application programming interfaces.
7. Observe operating environment conventions.
8. Implement specifications that benefit accessibility.
9. Provide navigation mechanisms.
10. Orient the user.
11. Allow configuration and customization.
12. Provide accessible user agent documentation and help.

The guideline 6, Implement interoperable application programming interfaces (e.g., assistive technologies, the operating environment, and plug-ins), is worth emphasising since it enables accessing and interacting Web content with the help of other applications. Considering the end user experience, this might effectively blur the borderline between the user agent and other third-party applications. It also highlights the importance of, say, accessibility of plug-in software.

The forthcoming UAAG 2.0 will probably change the wording and the organisation of the guidelines a bit. Again, UAAG 2.0 is expected to reflect the abstract principles and structure of WCAG 2.0 and the related documents.

Evaluation and Report Language

The Evaluation and Report Language (EARL) provides a machine-readable format for expressing (accessibility) test results. The primary motivation for developing EARL is to facilitate the processing of test results, such as those generated by Web accessibility evaluation tools, using a

vendor-neutral and platform-independent format (Evaluation and Report Language (EARL) Overview [updated 2009]).

EARL is defined by several technical specifications. At the time of writing, the specifications are relatively stable but still formally at a working draft stage. Thus, there is no EARL standard available yet.

The current draft of the Evaluation and Report Language (EARL) 1.0 Guide explains the motivations for EARL and provides an introduction to its uses (Velasco, Koch 2009). The other EARL specifications define the normative standard in a more formal manner.

In practice, Web authoring tools and quality assurance software can use EARL to aggregate test results obtained from different testing tools including Web accessibility evaluation tools, validators, and other types of content checkers. EARL uses the Resource Description Framework (RDF) to define the terms for expressing test results. RDF is a general-purpose Semantic Web language for expressing statements with machine-processable semantics. Thus, EARL documents can be by default integrated with a great variety of application and process data.

The basic idea of EARL is to report test results as machine-processable statements. The main components of the statements are (Velasco, Koch 2009):

1. Who (or which tool) executed a test. This is known in the EARL terminology as the Assertor.
2. The resource tested, known as the Test Subject.
3. The tested criterion(or criteria), known as the Test Criterion.
4. The result(s) of the test, known as the Test Result.

In brief, EARL enables the creation of a standardised way to produce test reports, exchange of reports between testers (humans or tools), comparison of test results, verification of how different test subjects fared on the same test, and aggregation of test results (e.g. merging different sets of test results on the same subject).

It should be noticed that EARL indeed is a specification of an interoperable data format. Thus, developers might mainly perceive EARL as a file format when saving, importing, integrating, or analysing accessibility tests, when using a particular accessibility-related tool. EARL may also be extended or customised, to meet the needs of particular applications.

Accessible Rich Internet Applications Suite

The Accessible Rich Internet Applications Suite (WAI-ARIA) defines a way to make dynamic content and advanced user interface controls accessible to people, regardless of disability (WAI-ARIA Overview [updated 2009]). This includes content developed with Ajax, HTML, JavaScript, and related technologies.

This is significant since it has been estimated that more than half of the contemporary Web sites contain JavaScript. Unless designed with care, scripting and other rich content may easily establish accessibility barriers for end-users and assistive technology alike. For instance, no HTML mechanism currently exists to identify the role of a div (for "division" or "section") element as a pop-menu. Thus, the current assistive technology cannot by default interpret this role and support end-user actions accordingly.

At the time of writing, there is not stable WAI-ARIA standard yet available. The draft of the WAI-ARIA Roadmap explains the technical content, dependencies, and organisation of WAI-ARIA development (Schwerdtfeger 2008).

The basic idea of WAI-ARIA is that complex web applications become inaccessible when assistive technologies cannot determine the semantics behind portions of a document. Accessibility problems may also arise when the user is unable to effectively navigate to all parts of documents in a usable way (Pappas, Schwerdtfeger, Cooper 2008). The current working draft of Accessible Rich Internet Applications (WAI-ARIA) 1.0 provides an ontology of roles, states, and properties that define accessible user interface elements and can be used to improve the accessibility and interoperability of web content and applications. These semantics are designed to allow an author to properly convey user interface behaviours and structural information in document-level markup, to assistive technologies. Intuitively, the semantics may be used by assistive technology to determine the type, the focus, and the meaningful properties of a user interface object.

According to the current working draft, dynamic application authors need to associate elements in the application to a WAI-ARIA role and the appropriate states and properties (aria-* attributes) during its life-cycle, unless the elements already have the appropriate implicit ARIA semantics for states and properties (Craig, Cooper 2009). The rationale is that the accessibility of (rich) web content requires semantic information about widgets, structures, and behaviours, in order to allow assistive technologies to convey appropriate information to persons with disabilities.

The WAI-ARIA suite is quite technical and mainly aimed for dynamic application designers. Also, support for WAI-ARIA needs to be included to user agents, script libraries, or assistive technologies, in order to be of practical use. From the perspective of non-technical Web authors, WAI-ARIA might be perceived as quality criteria for choosing third-party widgets and other components in a development project. WAI-ARIA effectively complements the Web content accessibility guidelines (WCAG) by considering the dynamic aspect of Web applications. As a consequence, it will most likely also have influence on the other guidelines, and the process of evaluating the accessibility of Web content with characteristics of rich Internet applications.

Discussion

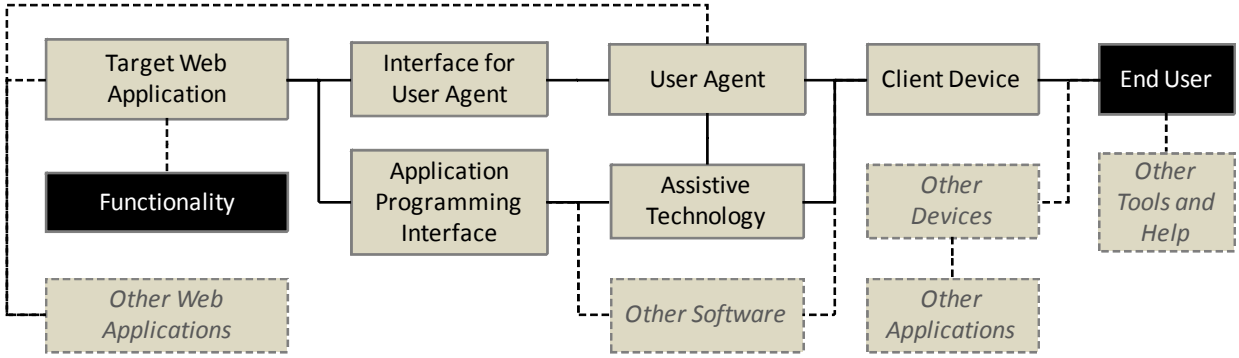
The Web accessibility standards provide the concrete basement of Web accessibility, focusing onto the various interfaces related to Web user agents. When developing accessible applications, however, a broader perspective to Web accessibility is typically helpful. Also, understanding the concept and scope of Web accessibility in itself benefits from pointing out some of the main relationships and the basic assumptions of the contemporary Web technologies and applications.

Systemic Perspective to Web Accessibility

In practice, the accessibility requirements and issues appear distributed over several systemic components in Web application user experience. This is partly due to the network characteristics of the Web, partly due to the use of devices and software in accessing content.

Figure 2 (below) outlines the systemic components of accessing a target application. In brief, an end user would like to access the functionality of a (target) Web application. This requires an appropriate client device running user agent software. The user agent can access the functionality of the target application via the provided user agent interface. If the target application is accessible, the functional end user objectives can be met.

Figure 2. Systemic perspective of users accessing the functionality of target Web applications



A typical usage scenario might be a person reserving tickets to a music concert using a Web browser. The primary objective is making a reservation, through the provided functionality of the ticket reservation system. From the perspective of the functional end user requirements, however, using the Web interface of the ticket reservation system is only a secondary objective.

Considering practical use cases, the systemic perspective needs to be complemented with several other components. In particular, the user agent might be associated with assistive technology. Assistive technology might be used for navigating and interacting with the application content using interface techniques not supported by the default user agent. Typical extensions might include haptic or speech interactions. In most cases, assistive technology relies on the data provided by the user agent. However, assistive applications might significantly benefit from an additional application programming interface, providing access to the functionality of the target application.

Further, users have often access to other software running in the client device, perhaps also accessing the target application. The (operating system of the) client device might also itself be able to provide some accessibility features such as zooming, controlling the colouring of the visual interface, or switching to voice interaction. The client device might accept different kinds of control apparatus, such as joysticks or eye tracking systems. From end user point of view, this might effectively blur the borderline between assistive technology, (Web) user agent, and the client device.

The user might be also operating other devices with other applications, and have other kinds of tools and help available. Further, using the target Web application might require using some other Web applications as well. Notice that since the other Web applications are typically implemented by others, accessibility of these cannot be directly controlled by the developers of the target application.

Continuing the above example of reserving concert tickets, the end user might well have access to an email client. In fact, some ticket reservation systems might even require this, for processing confirmations about the ticket reservation transaction. Additional requirements might originate from authentication and money transactions, perhaps requiring access to some electronic banking service. Also, the information about an interesting concert might originate from a different device, such portable media device or television. This means that before accessing the ticket reservation system, the user might have to transfer information between systems and look for the concert using a search service.

Finally, assuming the end user faces accessibility issues, she might be already using special apparatus or assistance. For instance, an end user with limited eyesight might be using eyeglasses or a magnifying class, which can be used for enlarging not only paper documents, but also the screen and the controls of the device.

This discussion points out the holistic challenge of accessibility, and the importance of understanding end user needs and the implicit dependencies between different components of the system. It also points out the scope of the current Web accessibility guidelines that rationally emphasise the information interface of the user agent and the related software from standardisation point of view.

As a consequence, a Web application might be intuitively considered accessible only when it not only meets the standard accessibility guidelines, but also depends only to other systems that are accessible. As a consequence, the importance of the accessibility of the critical or otherwise commonly needed Web applications, such as government and banking applications, gets highlighted.

The systemic perspective to (Web) accessibility is recognised in various forms in certain best practices, often dealing with specific kinds of business or eGovernment services or service chains (see, e.g., eGovernment at W3C [updated 2010]). In Finland, for instance, government-level recommendations exist for developing accessible Web services to citizens (see, e.g., Laatua verkkoon [updated 2010].). On international level, this relates, for instance, to the European eInclusion etc. activities. (see, e.g., eInclusion | Europa – Information Society [updated 2008]).

The systemic perspective also points out several bottlenecks in accessibility. In particular, the target application interfaces, user agents, and client devices play critical role in implementing Web accessibility. This also implies a certain technical flavour of the topic.

Beyond Web Accessibility Guidelines

Web is increasingly accessed by laptops, mobile phones, and other consumer devices that do not match the characteristics of workstations in terms of device capabilities or stereotypical office use cases. This implies that the scope of accessibility considerations is broadening. Further, the repertoire of Web user agents and interaction paradigms is becoming more widespread, including multimodal interfaces and mainstream speech interaction systems.

As a consequence, the scope of the guidelines that have originally been developed to help people with disabilities is also broadening. While this development might well fit into the general scope of Design for All, other complementary trends improving user access are emerging.

Perhaps the most significant example of this trend is mobile Web access. In 2005, the W3C launched the Mobile Web Initiative (MWI) with the objective to make Web access from a mobile device as simple, easy, and convenient as Web access from a desktop device (W3C Mobile Web Initiative [updated 2010]). The Mobile Web Initiative shares many of the concerns of Web accessibility, in the context of mobile devices. Because of the overlapping needs of the applications, the Mobile Web Best Practices (MWBP) 1.0 directly includes and adapts material from the Web Content Accessibility Guidelines (WCAG) (Rabin, McCathieNevile 2008). However, while MWBP and WCAG show significant overlap in many areas, there is not always a one-to-one mapping between them (Chuter, Yesilada 2009). In practice this means that application-specific heuristics are needed.

Other closely related Web technology standardisation domains include Internationalisation, Device Independence and Content Adaptation, Audio and Video, Voice Browsing, Multimodal Access, Semantic Web, and Web of Services, to name a few (see World Wide Consortium [updated 2010]). These consider localisation, content adaptation, capturing multimedia, interacting using voice and other modalities, and opening and accessing data in distributed applications.

Quite curiously, the emerging novel interaction technologies, for instance Voice Browser and WAI-ARIA, point out that much of the mainstream Web accessibility work is based on applications due significant legacy assumptions. In particular, Web applications are often designed from the perspective of visual appearance, even when the technology would not dictate this. However, application functionality might also by default be accessed based on a (speech) dialogue, or some other form of interaction. The systemic perspective to Web accessibility (see Figure 2) reveals that many of the current visually-oriented Web applications short-sightedly merge the functionality and the user interface of applications. A much more general approach would be providing the functions (and the program logic) of Web applications in terms of a well-documented application programming interface. Effectively, this should provide a clear contract for developing various kinds of accessible user agents based on a variety of interaction paradigms. As a consequence, one might anticipate a new generation of Web applications and user agents which are by default capable of distinguishing the abstract functionality of applications from a particular end user interface implementation.

Finally, it is important to acknowledge that Web includes other content than, say, scripted HTML. Thus, the accessibility of several other document formats and interface technologies, such as Portable Document Format (PDF) and Flash, needs attention.

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