



The Next Refinement to Software

Keith Thurston

Office of Government-Wide Policy

Access for persons with disabilities has been an issue in software development for a number of years. However, the importance and impact has reached new levels with a change in the law regarding access to federal information.

To ensure that technology would be accessible to individuals with disabilities, Congress added Section 508 to Title V of the Rehabilitation Act in 1986. Under Section 508 (29 U.S.C. 794d) agencies must give disabled employees and members of the public access to information that is comparable to the access available to others. The law specifically exempted intelligence systems and military command and control systems, but applies to all other systems such as logistics and administrative systems. However, little progress toward fulfilling Section 508's objectives prompted the introduction of new legislation in 1998. It establishes an enforcement procedure to strengthen Section 508.

There are 54 million Americans with some level of disability. In the federal workforce there are 167,902 employees with reportable disabilities and 28,672 employees with targeted (significant) disabilities. The real number of Americans with disabilities is actually larger because the 97 percent of the population born without disabilities fail to report them to human resources departments when they are acquired later in life. They simply adopt methods and processes that accommodate their disability to permit them to remain productive.

Who Will Be Impacted?

The 1998 law has government-wide impact, including contractors and will essentially be society-wide as the electronics and information technology industry continues to make all products and services more accessible. Citizens with disabilities and employees will have the right to sue federal agencies for non-compliance and inaccessible information in any program area where information technology procurements have been made after June 21, 2001.

Information technology accessibility for persons with disabilities is a fascinating area that encompasses multi-modality –

individuals' ability to request and retrieve information in the mode that is best suited and most convenient at the time. It is really just the leading edge of features that we all like to have as we become a more mobile workforce. There are times when I really need to access my e-mail by telephone and have the messages read to me. Cell phones that respond to voice commands while driving are the type of capability that voice recognition systems for the blind provide for the mass market.

Section 508 applies to all electronic and information technology: the Web, software and hardware, photocopy machines, audio-video, telecommunications, and kiosks. In fiscal year 1999, the federal government purchased \$37.6 billion in information technology. It is estimated that \$12.4 billion of that would be subject to Section 508. The regulatory analysis conducted in conjunction with the 508 final regulation estimated the added government cost of Section 508 between \$85 million and \$691 million annually. The legal requirements are clear: "When developing, procuring, maintaining, or using electronic and information technology, each federal department or agency, ... shall ensure, unless an undue burden would be imposed on the department or agency, that the electronic and information technology allows, regardless of the type of medium of the technology:

i) individuals with disabilities who are federal employees to have access to and use of information and data that is comparable to the access to and use of the information and data by federal employees who are not individuals with disabilities; and

(ii) individuals with disabilities who are members of the public seeking information or services from a federal department or agency to have access to and use of information and data that is comparable to the access to and use of the information and data by such members of the public who are not individuals

with disabilities." The regulations for Section 508 primarily targets software development issues that preclude access to information for persons with blindness or low vision, deafness or difficulty hearing, or persons with mobility or dexterity limitations.

Keyboard Equivalents

Making information totally accessible using keyboard commands provides the interface for most of the special accommodation devices that are used by persons with blindness and dexterity limitations. While this approach works well within an application, there are development considerations. Developers must consider the entire software stack and operating environment to ensure that keyboard commands in the application software do not conflict with commands operating through other software layers. Accessibility requires clear standards and consistency for reserved keyboard commands and function keys. The regulation requires that applications do not disrupt or disable features of other products that are identified as accessibility features.

Many commercial products with graphical user interfaces have very well developed keyboard equivalencies to perform functions. However, one problem is consistent keyboard commands, which really is the motif or metaphor for the person with blindness. If each application randomly chooses a different set of keyboard commands for the close and exit commands, it then places a real limit on the number of applications a person can learn and memorize. A good solution for this while organizations are thinking about standardized metaphors and motifs is to adopt a popular set of keyboard equivalents.

A second problem with keyboard commands is that some applications have commands that require three or four keys to activate. While this may work fine for a person with blindness, it will cause havoc

for people with dexterity limitations. To accommodate the four-key command, they may have to slow the activation speed of their accessibility so much that typing text would be torturous or impossible.

Lastly, keyboard command applications cannot disrupt or disable other products' activated features that are identified as accessibility features, where those features are developed and documented according to industry standards. Also, activated accessibility features cannot be disrupted or disabled when their application-programming interface has been documented by the manufacturer and is available to the product developer. This becomes an issue for applications development in selecting keyboard equivalents and for configuration management.

User Focus

In navigating for accessibility, it is important that a well defined on-screen icon be provided that moves among interactive interface elements as the input focus changes. The icon must be programmatically exposed so that assistive technology can track focus and focus changes. Indeed, standard screen metaphors that are normalized across operations provide easy navigation for the disabled and are helpful to everyone learning to navigate new software.

Be sure to make sufficient information about a user interface element, including the identity, operation, and state of the element, available to assistive technology. When images, icons, or bitmaps are used to identify controls, status indicators, or other software programmatic elements, the information conveyed by the image must also be available in text. Furthermore, the meaning assigned to those images needs to be consistent throughout an application's performance.

Textual information must be provided through operating system functions for displaying text. There is minimum information that must be made available: text content, text input caret location, and text attributes.

Color Usage

Colors selected for user interfaces can be an issue for people with limited sight (contrast) and color-blindness. Therefore

color-coding should not be used as the only means of conveying information: indicating an action, prompting a response, or distinguishing a visual element. If color is used, then another color-neutral textual method should accompany it. For instance, instead of directing the user to click on the green button to complete the transaction, direct the user to click on the green "Done" button to complete the transaction.

Applications should not override user-selected contrast and color selections and other individual display attributes. This is important since adaptability tools for people with poor vision allow the user to select the high-contrast color that works best. When a product permits a user to adjust color and contrast settings, it provides a variety of color selections capable of producing a range of contrast levels.

Screen Motion

When animation is displayed, the same information should be displayable in at least one non-animated presentation mode for the user's option. To prevent a type of neurological seizure that can be initiated by the blinking on televisions and computer monitors, software should not use flashing or blinking text, objects, or other elements with a blink frequency greater than 2 Hz and lower than 55 Hz.

Filling Forms

All electronic forms must allow people using assistive technology to access the information, field elements, and functionality required to complete and submit the form, including all directions and cues. This means that screen readers and other devices should be able to read through the form and the text input, and that software and input screens can be navigated solely by keyboard commands. Visually impaired persons with blindness and low vision use screen readers. Purchasing a screen reader and testing software assures that it is accessible for the blind under Section 508 requirements. Of the screen readers available, two have emerged as clear market leaders, and both are used by federal employees: JAWS for Windows by Henter-Joyce, a division of Freedom Scientific, and Window-Eyes by GW Micro Inc.

Functional Performance Requirements

The regulatory standard also includes some functional performance requirements that software and system must address. At least one mode of operation and information retrieval that does not require user vision must be provided, or blind or visually impaired people must be given assistive technology. Providing keyboard equivalents and being screen-reader compatible for the text-oriented software meets this requirement. Remember that if diagrams, graphics or video clips are used text and/or audio equivalents must be available, too.

At least one mode of operation and information retrieval that does not require visual acuity greater than 20/70 shall be provided in audio and enlarged print output working together or independently, or support for assistive technology used by people who are visually impaired must be available.

For those that are deaf or hard of hearing, at least one mode of operation and information retrieval that does not require user hearing is to be provided, or support for assistive technology must be provided. It is important to remember this when including gongs or other sounds to alert for input errors or process errors. A visual equivalent should also be displayed. One similar frequent problem area in commercial software is that the blind user may know that a pop-up error messages has occurred, but the screen reader can not read the error message because the pop-up is an image and not text.

For the hard of hearing, where audio information is important for the use of a product, at least one mode of operation and information retrieval shall be provided in an enhanced auditory fashion, or support for assistive hearing devices shall be provided. And likewise, for those with problems speaking, at least one mode of operation and information retrieval that does not require user speech must be provided

Lastly for those dexterity problems, at least one mode of operation and information retrieval that does not require fine motor control or simultaneous actions and that is operable with limited reach and strength must be provided. People that

have special adaptive appliances usually can plug those into a keyboard interface so the keyboard equivalents go a long way towards meeting this requirement on standard desktop PCs and terminals.

Other Parts of the Requirements

This article discusses the software development requirements of the Section 508 regulations. The regulations also has specific sections:

- Web-based information and operations.
- Telecommunications products.
- Video and multimedia products.
- Self-contained, closed products.
- Desk-top and portable computers.
- Information documentation and support.

The entire regulation and further information are available at www.section508.gov

The requirements of Section 508 are to be met in all systems (unless otherwise exempted), and to be available to all users, not as customizations for just those specif-

ic users with disabilities. The idea is that the information should become universally accessible. While this may appear to be add-on requirements now, I believe that it will become normal for all software to offer multi-modal access so that it can be used under many different conditions by anyone. Our challenge is to build these requirements into our software and systems development procedures and methods to begin getting the benefits or universal access.

Status of Implementation

The regulatory standards were issued in December 2000, so the 508 regulation takes effect by June 21, 2001. For purchased items, the Federal Acquisition Regulations are being modified. The industry and government agency officials in information technology, procurement, human resources, and technology are being briefed. Additional information on policies is also available at www.section508.gov ♦

About the Author



Keith Thurston is assistant to the deputy associate administrator in the Office of Information Technology, part of the Office of Government-Wide Policy at the U.S. General Service Administration. He works with a number of government-wide initiatives and groups to help formulate technology guidance, direction, and policy. He has worked with the Federal CIO Council since its inception in 1996 and focuses on the new policy issues as the technology evolves. Federal IT Accessibility Initiative implementing Section 508 Government-wide is the latest focus area for his office. Formerly Thurston was with U.S. Treasury and IRS working in technology and network communications for 14 years. He has a bachelor's in business and a master's of business administration in telecommunications.

1800 F Street NW, Room 2239
 Washington, DC
 Voice: 202-501-3175
 Fax: 202-501-2482
 E-mail: keith.thurston@gsa.gov

"I didn't want to pay to use somebody else's computer, so I decided to design my own."

Stephen Wozniak

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"People in charge are the last to know when things go wrong."

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