

# The Solaris™ Operating Environment — Meeting the Challenge of Accessibility

A Technical White Paper



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## Chapter 1

# Introduction

In recent years, equal opportunity initiatives and even government legislation have challenged many companies to widen their talent pool to include people with disabilities, thus introducing a new perspective on how to bring network access to a new set of user needs.

**TABLE 1** Percentage of U.S. population with disabilities

Age Group	Percentage with Disabilities
0-18	6.1
18-44	13.6
25-64	29.2
65-74	44.6
75-84	63.7
85+	84.2

(Sources: 0-18: 1992 National Health Interview Survey conducted by National Center for Health Statistics. Remainder: U.S. Census Bureau, 1992. Data varies — See also Addendum 2 Additional Resources.)

More businesses must think about how to make their networks usable by people with disabilities. These initiatives, collectively known as “accessibility,” are emerging as a business imperative — to meet the needs of all users in any circumstance.

From its inception, Sun's vision has been that the "Network is the Computer."™ A key principle of technology design at Sun has been to support heterogeneous computer networks, providing simultaneous access to computing services for users in multiple locations with widely varying needs. As the Internet evolved, the sheer scale of the network's complexity required forethought of design — a vision of how to unify information and present it in a way that could accommodate the changing needs of a diverse computing audience. Sun foresaw that its operating development environments must be built to be extensible and interoperable, so application developers could easily build on a solid computing foundation. Sun championed open standards for deploying accessible solutions in the workplace, and its award-winning technology has been heralded as an example of best practices in the industry.

## Challenges Spur Innovation

Meeting the needs of people with disabilities is a step towards making technology more useful to all people, regardless of ability. Overcoming challenges often spurs innovation, forcing system designers to think in new ways about solving a given usability problem. The results can be revolutionary and may push technology in new directions. The typewriter, for instance, was initially designed for use by the blind. The curb-cut ramps common on street corners in the United States were introduced for wheelchair users, however it soon became clear that they were a practical innovation for bicycles, baby carriages, shopping carts, and many other everyday uses.

## Sun's Accessibility Strategy

Sun's accessibility strategy is based on the conviction that the entire system architecture should be built around an open, flexible set of interfaces that can facilitate the deployment of accessible applications throughout the software stack. The Solaris™ Operating Environment (OE) was rated the #1 UNIX® OS by D. H. Brown for 2001. With built-in accessibility features, the Solaris OE aims to broaden its support to even more users, including those with disabilities.

Sun's accessibility strategy includes the following tactics:

- Deliver underlying technologies within the Solaris Operating Environment so that users can more easily deploy accessible solutions in the workplace
- Enhance the Java™ development platform and the GNOME (pronounced guh-nome) desktop environment to enable easier development and deployment of accessible products
- Provide a set of fundamental Assistive Technologies to serve many users' needs
- Work closely with the open source movement in advancing technology in the area of accessibility
- Beginning with those technologies, provide built-in accessibility support throughout Sun's networked application stack

## Chapter 2

# The Business Case for Accessibility

Technology innovation in the area of accessibility could potentially create thousands of new jobs while helping people with physical challenges become even more productive members of the worldwide workforce. Companies that properly understand how to address these new users will have much to gain in increasingly competitive marketplaces.

- People with disabilities represent the largest minority group in the United States and spend \$175 billion in discretionary income.
- In the United States alone, over 30 million people have their ability to use computers compromised by inaccessible computer design.
- About 8% of Internet users have a disability.
- In the work force, there are 5.4 million working Americans with disabilities, whose employers are legally required to accommodate them.
- Roughly 7.5% (145,000) of the federal workforce are people with disabilities; by 2005 this number is predicted to reach 250,000.
- American educational institutions and government agencies annually spend \$228 million and \$26 million on electronic and information technology, respectively.
- International customers can greatly benefit from the innovation of voice technology as a means for faster data input.

(Sources: See Addendum 2: Additional Resources)

Worldwide, as many as 500 million people have disabilities. In the United States, that number is about 54 million, or one in five Americans. There are users in businesses, the government, at universities, and on the Internet. Meeting the challenges of their special needs is leading technology developers to think differently about usability. Sun embraces this challenge as a way to make the next leap in technology innovation within the open computing movement.

Technology managers need to provide accessible solutions to all aspects of the computing environment. Not only must they have accessible desktop computers with a variety of applications, but they must also provide access for system administrators and application developers who may require special assistive technology. Accessibility is a category of usability: software that is not accessible to a particular user is not usable by that person. Though graphical user interfaces have made it possible for millions of nontechnical people to use complex software applications, the “see and point” model also causes a serious challenge for software accessibility, particularly for visually impaired users. Menu items, graphical icons, tables and diagrams, and other parts of the software interface must be described within the application code so that they can be accessed by assistive technology.

Assistive access means that the system infrastructure allows add-on hardware and software to provide specialized input and output capabilities. For example, screen readers enable blind users to navigate through applications, determine the state of controls, and “read” text by using text-to-speech conversion. On-screen keyboards replace physical keyboards, and head-mounted pointers replace handheld mice. These are only a few of the assistive technologies users can add to their systems.

#### *Assistive Technology*

- Screen magnifiers help people with low vision. These utilities are like a magnifying glass. People using them can select the area of the computer screen they want enlarged and can move that focus to view different areas of the screen.
- Screen readers make information available to blind or low vision users as synthesized speech or as a refreshable Braille display. These aids can only translate textual information, so graphical elements are typically accompanied by “alternative text” that describes the visual image.
- Text-to-Speech (TTS) applications convert the text content from any screen reader to give voice output to any accessible application through the computer’s speaker system.
- For people who are unable to use a standard keyboard, on-screen keyboards make it possible to select keys and other controls by using a head-mounted pointer or other alternative devices.
- Keyboard enhancement utilities assist people who have trouble typing and controlling a mouse. The utilities enable the user to perform key sequences (for example, Control-C), to control the mouse pointer and buttons from the keyboard and to set the key repeat and acceptance rates. These enhancements are built into the base platform and are known as AccessX on the Solaris OE CDE, AccessPac on Microsoft Windows, and EasyAccess on the Macintosh.
- Speech recognition programs are primarily used by people with mobility impairments to control computers with their voice instead of a mouse or keyboard.
- Alternative input devices allow individuals to control their computers through means other than a standard keyboard or pointing device. Examples include smaller or larger keyboards, eye-gaze pointing devices, and sip-and-puff systems controlled by breathing.

Too often, issues of accessibility are an afterthought in the development cycle. Support for assistive technologies is often *bolted on* and manually reengineered to accommodate inadequacies in the development platform. Application developers often need to customize components for accessible use. In the absence of a comprehensive and reliable interface to platform facilities, much guesswork and reverse engineering is needed. To follow a universal design principle, the system infrastructure must support communication between assistive technologies and applications by using a single, standard API for accessibility. This is the approach Sun has taken with its built-in methodology for software design.

## Accessibility Built In

Sun recognized that instead of bolting on accessibility to a system after it is developed, *building in* accessibility from the start can accomplish much more. By building in an expandable framework based on open standards to its core design architecture, the Solaris Operating Environment and the Java development platform give developers a set of tools that can evolve with a changing market. With accessibility support already built in, it is easy for mainstream developers with no specialized knowledge about disabilities or assistive technologies to achieve excellent results. They need only use standard components and follow good design guidelines (published by Sun and others) to build highly accessible applications. They are then freed to do what they do best — make better products that benefit all users.

Building accessibility into computer networks will help millions of people worldwide who have visual, physical, and hearing disabilities gain the same benefits from information technology that people without disabilities currently are able to access. These accessible solutions provide the software and technologies to interface, access, obtain, configure, collaborate on, and communicate information by means of a desktop computer.

## Mandate for Accessibility

To the United States Federal Government, accessibility in the workplace is serious business, and is now mandated by law. Section 508 of the 1998 amendments to the Federal Rehabilitation Act covers the procurement of information technology (IT). Effective June 2001, Section 508 obligates federal government agencies to make accessibility an explicit requirement in the procurement of all information technology. The impact of this legislation could potentially be quite far-reaching. Many kinds of businesses sell to and interact with the federal government. As more users with disabilities enter the federal workforce, expertise in the use of accessible products and assistive technologies could easily spread to other industries.

### *What Section 508 Means for Accessibility*

- Full navigation and control must be possible from the keyboard. It must be possible to operate the product without using a pointing device (for example, a mouse).
- User interface components must be able to communicate information about themselves (for example, name, role, and state) to assistive technologies.
- All nontextual elements, such as images in Web pages or symbols in software applications, must be described by text that can be presented to the user by assistive technologies.
- All product documentation must be available in an accessible form.
- Online information (such as online documentation and help) must be accessible.

## Chapter 3

# Built-In Accessibility Support Today

Usability has always been an important consideration in the design of Sun's products. The company's hallmarks — open standards, reliability, performance, and a consistent, easy-to-use architecture — encouraged the development of several accessible features that are already incorporated into the Solaris platform.

## System Accessibility in the Solaris OE

Following the Americans with Disabilities Act in 1992, Sun began to investigate open standards efforts to bring accessibility features into the core Solaris software libraries and desktop. Sun employees participated in an industry group to solve this challenging issue. The result was a feature called AccessX.

### *AccessX Features*

- **Sticky Keys:** Enables single-finger operation of multiple key combinations.
- **Mouse Keys:** Provides keyboard-based explicit control of cursor movement and all mouse button press/release events.
- **Repeat Keys:** Enables users with limited coordination time to release keys before multiple characters are sent.
- **Slow Keys:** Permits users with limited coordination to accidentally press keys without sending keypress events.

- **Toggle Keys:** Indicates locking key state with a tone when pressed (for example, Caps Lock) in order to assist visually impaired users.
- **Bounce Keys:** Enables users with tremors to prevent the system from accepting inadvertent key presses.

With AccessX, users can change the appearance and behavior of the Solaris OE by changing settings of the keyboard and mouse functions. Users with mobility impairments may have the use of only one or two fingers, or even may need to use a head-mounted pointer to depress the keys on the keyboard. AccessX can help these users avoid making key entry mistakes. With AccessX features, users can press one key at a time, instead of using multiple simultaneous key presses.

Users with visual and hearing impairments also have basic control of system functions. Users with low vision can use the `dtstyle` application to increase font size or change colors on the CDE desktop to make text easier to read. For the hearing impaired, platform support has been added in the Solaris 9 OE for users to configure system tones with variable pitch duration and loudness.

## Accessibility in the Solaris Desktop Today

Sun's current desktop (CDE) provides basic support for people with visual and mobility limitations. In addition to AccessX features on the desktop, many text-based interfaces can be made accessible to assistive technology.

- To the extent that a CDE/Motif application has a corresponding command-line interface (CLI), assistive technologies (such as screen readers for blind users) can provide voice output for the visually impaired. A screen reader (such as Emacspeak) can access all textual-based content of the command-line interface through a common terminal window (such as that provided by the Emacs editor). The screen reader then sends this content to a text-to-speech (TTS) application, which converts the text content to voice output via the computer's speaker system. Solaris provides the `FreeTTS` application for this purpose.
- Many of Sun's older products provide a complete textual command-line interface, and are therefore partially accessible. For example, users can access voice output to their e-mail through the CLI of the `dtmail` application on CDE.
- Virtually all Solaris software documentation is available online, and can be obtained from an accessible Web browser.

## Assistive Technology for the Visually Impaired

Solaris is interoperable with many popular open source assistive technologies that are available for free on the Internet. For user convenience, several of these technologies are provided on the companion CD with the Solaris Operating Environment. Users with visual impairments can benefit from the audio output or screen magnification provided by these facilities. Some of these applications include:

- Emacspeak, a popular, open source screen reader that allows visually impaired users to independently and efficiently interact with the computer. Since the application itself was designed by a blind engineer, its interface was designed with special insight into the requirements of the visually impaired. Emacspeak gives blind and low-vision users a way to get voice output from some of the desktop and development applications on top of the Solaris OE. Working in conjunction with the Emacs display editor, Emacspeak provides spoken access to more than 100 applications, including a text editor, mail client, news reader, word processor,

and integrated development environment. Emacs version 20.7 is also shipped with the Solaris Operating Environment.

- Emacs/W3 Browser is an Internet browser which, when used in conjunction with Emacspeak, gives users access to the Internet through audio output. Users can browse the Web from within Emacs by using Emacs/W3.
- The UnWindows toolset allows low-vision users to selectively magnify areas of the screen so that the contents can be seen comfortably. It also provides aural and visual cues allowing the position of the cursor to be more easily tracked.
- FreeTTS is an open source speech synthesizer application written entirely in the Java programming language. This high-performance software, written by the development engineers in Sun Labs, converts text from any source (including a screen reader such as Emacspeak) into spoken text, giving voice output to any accessible application through the computer's speaker system. FreeTTS includes a server for Emacspeak to make interaction easier with the Emacs editor.

## Proven Success in the Market

Sun's technology already enables the use of important applications within the public and private sectors today. For example:

- Oracle is shipping more than 250 accessible applications written entirely in the Java programming language.
- American Management Systems moved to Java technology, largely to meet an accessibility requirement by the U.S. Department of Education.
- Blind audio engineers at the National Security Agency are using in-house applications built on Java technology with speech and Braille.
- Blind account managers at Discover Financial take phone calls by using an in-house Java Swing application combined with assistive technology for speech and Braille.

## Award-Winning Technology

The Solaris Operating Environment has been recognized as the "Best Network Server Operating System 2001" by Network Computing magazine. Java technology has been recognized with the 2001 Access Award from the American Foundation for the Blind for Best Practices in designing accessible technology. Together, the Solaris OR and Java technology provide a powerful solution for the networked enterprise.

## Chapter 4

# Designing for an Accessible Workplace

IT managers should not have to go through extra work to accommodate their employees with disabilities. Ideally, the entire data center should be built around a sophisticated set of interoperable technologies that can just as easily provide a comparable user experience to those with physical challenges as they can for any other user. If the system architectures are properly designed for accessibility across the network, system administrators can quickly set up an accessible environment for the users who need standard applications in their data centers. Sun's intention is to incorporate accessibility into all levels of the Solaris Operating Environment, including:

- Incorporating GNOME 2.0 as the next desktop for the Solaris Operating Environment, thus delivering built-in accessibility solutions. GNOME 2.0 for the Solaris OE will include accessible desktop applications and assistive technologies that meet the needs of users with disabilities
- Providing an accessible Web browser and office productivity suite
- Enabling the system management software stack (Sun™ Cluster, Solaris™ Resource Manager and Sun™ Management Center software) for accessibility

By building on its successes in designing the accessible Java platform, Sun has been actively involved in spurring innovation in open source accessible technologies. Sun participated in the establishment of the GNOME Foundation, an industry-wide collaboration for the next integrated desktop environment for UNIX and Linux-based systems. Sun's accessibility engineers became active proponents within this open source project for building in an accessibility framework to the underlying desktop toolkit from the beginning. This powerful framework will support not only a

complete set of desktop applications, but also an accessible network environment built on the Solaris OE, which can tie together assistive technologies and accessible system applications.

GNOME is rapidly gaining user and industry acceptance as it evolves into a standard across multiple UNIX and Linux platforms. The GNOME Foundation already includes Sun and other industry leaders such as IBM, Compaq, HP, Red Hat, Ximian, and more.

## The New GNOME 2.0 Accessible Desktop

Sun's desktop accessibility strategy is built on GNOME 2.0 for the Solaris Operating Environment. GNOME stands for GNU Network Object Model Environment. Its built-in accessibility architecture, combined with powerful assistive technology solutions, will provide the infrastructure needed for people with disabilities to quickly gain the benefits of using desktop computer technology.

GNOME 2.0 for the Solaris Operating Environment delivers a compelling network-based desktop user environment that is easy to use and is interoperable across multiple UNIX and Linux platforms. It enables users to run full-featured office productivity software; surf the Web; easily and freely exchange files; and personalize their work environments. With GNOME's built-in accessibility support and component-based architecture, accessible and network-centric applications can easily be deployed along with popular assistive technology. In addition, Java technology-based accessible applications can interact with the assistive technologies that are part of the GNOME 2.0 desktop. Because it is cross-platform, GNOME 2.0 provides a common unified desktop for application interoperability. Accessibility support is built into the GNOME desktop.

The GNOME 2.0 desktop includes:

- Standard desktop: A Control Center helps users configure and personalize aspects of the desktop environment, including themes, screen savers, and other preferences.
- Office productivity features:
  - An advanced, integrated software suite that includes word processing, presentation tools, spreadsheet, database, mail client, appointment calendar, contact manager, Web publisher, and image editing tool
  - Accessories and utilities, including a calculator, media player, image viewer, and text editor
- Window and workspace management tools:
  - Panel - Includes application launchers and running applets, enabling users to easily locate and select applications and to view system status
  - Nautilus - User interface to the Solaris and Web file systems, providing a unified view of local and remote files
- DeskGuide - Workspace manager for creating and organizing multiple desktop environments containing favorite sets of applications and information
- System resource management: Powerful graphical tools enable users to easily monitor system resources, manage printers, and access system information
- Developer resources: These include libraries, APIs, components, and visual design tools

## Deploying Accessible Java Applications on the GNOME 2.0 Desktop

GNOME fully supports the Java Runtime Environment, which is a standard service provided by the underlying Solaris Operating Environment, so all Java technology-based applications run just as they do on any other desktop user environment (such as CDE). This means that GNOME supports the creation of Java technology-based software. A developer can continue taking full advantage of the benefits of Java development, such as binary portability, productive development, and well-structured code.

## Accessible Browser and the StarOffice™ Suite

Sun plans to include an accessible version of Netscape™ software and StarOffice™ software with the GNOME environment in the future.

## Assistive Technology Included with GNOME 2.0 Desktop

The GNOME 2.0 platform, in addition to supporting third-party assistive technologies, includes solutions designed to assist users with disabilities. These include an on-screen keyboard to aid people who have difficulty with the keyboard or mouse, and a screen-reading package to assist users who are blind or visually impaired.

- The GNOME On-Screen Keyboard (GOK) provides users with physical impairments a wide variety of ways to enter text and manipulate the GUI of applications and the GNOME desktop. This goes beyond the standard physical keyboard — it supports word prediction, scanning and coded access, and customizable keyboard layouts. Dynamic keyboard functionality conveniently places menu bar options and other application elements onto the keyboard display for direct manipulation.
- The Gnopernicus Screen Reader is a screen-access package to assist persons who are blind or have low vision. Gnopernicus combines the functions of a screen reader and a screen magnifier in one solution. The reader is compatible with the GNOME 2.0 desktop and any application that uses a toolkit implementing the GNOME accessibility framework, including any application written with GTK+ 2.0 or the Java™ Foundation Classes. The package provides synthesized speech output, using a sound card or external synthesizer. The package can provide Braille output, if a refreshable Braille display is interfaced to the platform. The screen magnifier tracks focus and enables screen enlargement as well.

## Chapter 5

# Developing for an Accessible World

Software development and deployment is a layered process to which many people contribute. The platform is not only the operating system and the software development environment, but also the windowing system — driven by a user interface toolkit — and the many applications that plug into it. Assistive technologies need to interact with every aspect of the platform and with the applications, as well. The assistive technology required to meet users' needs must be able to access every element of the user interface in order to provide alternative presentation and control. This is enabled by standard accessibility interfaces integrated with the platform.

Making it easy for assistive technology to obtain information is one thing; but why not make it easy for an application to provide information? Ideally, it should be so easy to give information that the application developer doesn't even think about it. The Java Accessibility API (JAAPI) and the GNOME accessibility framework were designed to this ideal. Practically, it is not necessary to give up any functionality, performance, flexibility, or usability when building in accessibility.

## Using the Java Platform for Accessible Application Development

The focus with Java technology (and also with GNOME) is down at the platform and UI toolkit level. The Java language addresses difficult challenges — such as how to make the platform accessible, make it easy for developers to create accessible applications, and make it easy for assistive technology developers to plug their technology into the Java platform and get the information they need.

Sun designed and implemented three solutions into the Java development platform:

- The Java Accessibility API architecture
- The JAAPI contract
- Tools to help developers live up to the contract

### **Java Accessibility API Architecture**

The Java Accessibility API (JAAPI) is a powerful and mature set of interfaces that provide information about the user interface of Java applications to assistive technologies (AT), enabling AT to present application interface information in alternative ways.

Because of the API support already built in to the Java and GNOME architectures, less engineering effort is required with Java technology and GNOME than with other approaches. A developer might take as much as a week to add the nuts and bolts to make a custom component accessible in more traditional systems; the same result can be achieved in one day with the use of built-in, standard Java technology-based components as a model.

#### *How the JAAPI Works*

1. All standard JFC components implement the Java Accessibility API. If custom components are included in the application, the developer must provide JAAPI support specifically for those components to make them accessible.
2. The assistive technology (AT) queries all JFC components in the application and obtains information about them through the JAAPI. This information includes the name, role, and state of each component, along with other attributes.
3. The AT uses the underlying platform to obtain and generate lower-level system events (a key press or mouse button click).
4. This support also allows the user to browse other areas of the application's UI without changing the component that has the keyboard input focus.
5. The AT presents the content of the application as the user navigates the UI.

### **The Java Accessibility API Contract**

The Java Accessibility API defines a contract between the individual user interface components that make up a Java application and an assistive technology that provides access to that Java application. If a Java technology-based application fully supports the Java Accessibility API, then it will be compatible with, and friendly to, assistive technologies such as screen readers and screen magnifiers.

## **Tools for Building Accessible Applications**

Accessible application development can be made easier with a set of helpful tools. In addition to the Java Accessibility API itself, developers can employ additional tools to assist them in accessible design.

The Java Accessibility Helper is one such tool, specifically designed for ensuring accessibility support within an application. With a powerful set of programmer's guidelines, this tool quickly identifies design hurdles for enabling accessibility. It reports on accessibility problems (such as keyboard operability) and gaps in the developers' use of the JAAPI (such as a failure to ensure that all user interface components, including graphical elements, have accessible descriptions). The Java Accessibility Helper makes it easy for mainstream developers with no particular knowledge of assistive technologies to build highly accessible applications. Developers can access this tool from [www.sun.com/access/downloads](http://www.sun.com/access/downloads).

## Chapter 6

# Summary

Sun's vision of a built-in approach to the networked accessible data center is to tie together a powerful system infrastructure built on the Solaris Operating Environment, an accessible desktop environment with a suite of accessible system applications, and an extensible development environment whereby people can expand the choice of applications for users with special needs.

The Java accessibility architecture is mature, built into the core of the Java platform, and growing in popularity among developers and assistive technology vendors. Sun's contribution of an accessibility framework to GNOME is leading the open source effort. On the Java platform and especially on GNOME, Sun is collaborating with other companies to bring accessibility into the mainstream.

*To summarize:*

- There is a difference between accessibility and usability. The former is easily achieved with Sun's object-oriented, API-based technology. Vendors with expertise in specific accommodations can gain huge efficiencies from built-in accessibility and applying their expertise in improving usability.
- Newer technologies will take advantage of today's desktop accessibility architectures and bring the value of alternative user interfaces to people in many situations, regardless of ability. This only happens when the operating environment can provide extensible facilities that are built in, not bolted on.
- Building accessibility into end-user platforms is a good idea; it works for mainstream developers and it works for assistive technology vendors, which means it also works for users.

## Chapter 7

# Addendum 1: Understanding Disabilities

It is good business to understand the impact of accessibility and the requirements that companies must meet to accommodate this new set of users. Different types of assistive technology must be employed to varying degrees, depending on the extent of physical impairment. Some of these impairments and the attendant problems that can be alleviated with assistive technology are:

- *Visual impairments.* From low vision to blindness, the range of visual limitations is broad. Symptoms of low vision include dimness, haziness, extreme far- or near-sightedness, color blindness, and tunnel vision, among others.

People with these disabilities are concerned with being able to see text or images on a computer screen and performing tasks that require eye-hand coordination, such as moving a computer mouse. Text size and color can make a big difference in legibility for people with low vision.

- *Mobility impairments.* These may be caused by arthritis, stroke, cerebral palsy, Parkinson's disease, multiple sclerosis, and loss of limbs or digits.

Poor muscle control or weaknesses can make it difficult to use standard keyboards and mouse devices. For instance, some people are unable to hold down two keys simultaneously, while others tend to hit multiple keys or bounce keys when pressing or releasing them. People who have the use of only one hand likewise have difficulties with some keyboard and mouse-related tasks.

- *Hearing impairments.* People with hearing impairments may be able to hear some sounds, but may not be able to distinguish words. Other people may not be able to hear at all. The inability to hear computer prompts, such as beeps and spoken messages, can be problematic for these individuals.
- *Cognitive and language impairments.* These include dyslexia and difficulties with memory, problem-solving, and perceiving sensory information as well as language comprehension and usage. For people with these impairments, things such as complex or inconsistent displays or word choices may make it more difficult to use computers.
- *Seizure disorders.* Specific patterns of light or sound can trigger epileptic seizures in some susceptible individuals.

## Chapter 8

# Addendum 2: Additional Resources

### *ACCESSIBILITY AT SUN:*

- [www.sun.com/access](http://www.sun.com/access)

### *SECTION 508:*

- [www.access-board.gov/news/508-final.htm](http://www.access-board.gov/news/508-final.htm)

### *STATISTICS ON PEOPLE WITH DISABILITIES:*

- Overall population statistics
  - [www.census.gov/prod/3/97pubs/cenbr975.pdf](http://www.census.gov/prod/3/97pubs/cenbr975.pdf) (Census Brief)
  - [www.dsc.ucsf.edu/UCSF](http://www.dsc.ucsf.edu/UCSF) (Click on “Publications”)
- Age breakdown
  - [www.census.gov/population/www/pop-profile/disabil.html](http://www.census.gov/population/www/pop-profile/disabil.html)
  - [www.dsc.ucsf.edu/UCSF](http://www.dsc.ucsf.edu/UCSF) - (Click on “Publications”)

- Internet use
  - [www.ntia.doc.gov/ntiahome/fttn00/Falling.htm#XV](http://www.ntia.doc.gov/ntiahome/fttn00/Falling.htm#XV)
- Miscellaneous statistics
  - [www.census.gov/population/www/pop-profile/disabil.html](http://www.census.gov/population/www/pop-profile/disabil.html)
  - [java.sun.com/features/2000/03/accessibility.stats\\_ns.html](http://java.sun.com/features/2000/03/accessibility.stats_ns.html)
  - [java.sun.com/features/2000/03/accessibility.html](http://java.sun.com/features/2000/03/accessibility.html)

*ASSISTIVE TECHNOLOGY FOR THE VISUALLY IMPAIRED:*

- Emacs: [emacspeak.sourceforge.net/](http://emacspeak.sourceforge.net/)
- Emacs W3 browser:
  - [www.cs.cornell.edu/Info/People/raman/emacspeak/info/emacspeak.html#SEC112](http://www.cs.cornell.edu/Info/People/raman/emacspeak/info/emacspeak.html#SEC112)
- UnWindows toolset: [trace.wisc.edu/linux/indepth/unwindows.htm](http://trace.wisc.edu/linux/indepth/unwindows.htm)
- FreeTTS: [java.sun.com/features/2001/12/flite.html](http://java.sun.com/features/2001/12/flite.html)

*GNOME DESKTOP: [developer.gnome.org/projects/gap](http://developer.gnome.org/projects/gap)*

*JAVA TECHNOLOGY ACCESSIBILITY:*

- Overview: [www.java.sun.com/products/jfc](http://www.java.sun.com/products/jfc)
- Accessibility Helper: [www.sun.com/access/downloads](http://www.sun.com/access/downloads)

## Chapter 9

# Addendum 3: Glossary

### *accessibility*

The degree to which software can be used comfortably by a wide variety of people, including those who require assistive technologies such as screen magnifiers or voice recognition. Accessibility is about enabling people with disabilities to participate in life activities that include work and the use of services, products, and information.

### *AccessX*

A set of features within the XKEYBOARD extension of the X Window System designed to make all UNIX technology-based systems more accessible to users with disabilities. XKEYBOARD is present in X11R6.1 and later.

### *ADA*

American with Disabilities Act. Legislation that prohibits discrimination on the basis of disabilities in employment, programs, and services provided by state and local governments, goods and services provided by private companies, and commercial facilities. The Act requires that companies in the United States with 15 or more employees must provide any “reasonable accommodations” needed by people with disabilities to accomplish their jobs.

*assistive technology*

The hardware and software that helps people with disabilities use a computer (or provides alternative means of use to all users). Examples include pointing devices other than the mouse, audio or text-only browsers, and screen readers that translate the contents of the screen into Braille, voice output, or audible cues.

*CDE*

Common Desktop Environment. An integrated GUI for open systems desktop computing. It delivers a single, standard graphical interface for the management of data and files (the graphical desktop) and applications.

*dtmail application*

The mail user agent (MUA) for CDE. It provides an intuitive, easy-to-use GUI for reading, sending, and managing electronic mail.

*dtstyle application*

A program that provides interactive customization of visual elements and system behavior for the desktop through the style manager. This component consists of the UI and supporting code that allows the end user to interactively customize most of the visual elements and system behavior for the CDE desktop.

*Emacs*

An extensible, customizable, self-documenting, real-time display editor.

*JAAPI*

Java Accessibility Application Programming Interface. This interface (part of the Java Foundation Classes) enables assistive technologies to interact with user-interface components. A Java technology-based application that fully supports the Java Accessibility API is compatible with such technologies as screen readers and screen magnifiers.

*JFC*

Java Foundation Classes. A collection of APIs for developing graphical user interfaces. The JFC includes the Abstract Window Toolkit, the 2D API, Swing components, and the Accessibility API. See also JAAPI and Swing.

*Motif*

A graphical user interface for open systems desktop computing. Motif is the base graphical user interface toolkit for the Common Desktop Environment (CDE). See also CDE.

*screen magnifier*

Utility that enlarges selected areas of a viewing screen.

*screen reader*

An assistive technology designed to convert information on the computer screen into synthesized speech or Braille output.

### *Swing*

A set of GUI components, featuring a pluggable look and feel, that are included in the Java Foundation Classes (JFC). The Swing classes implement the Java Accessibility API and supply code for interface elements such as windows, dialog boxes and choosers, panels and panes, menus, controls, text components, tables, lists, and tree views.

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