Linux Accessibility HOWTO

Michael De La Rue

Sharon Snider

v3.0, 2001

Revision History

Revision v3.0	2001−10−25	Revised by: sds
Updated and converted to DocBook SGML.		
Revision v2.11	1997−03−28	Revised by: mdlr
Last Linuxdoc revision.		

The Linux Accessibility HOWTO covers the use of adaptive technologies that are available for the Linux operating system, as well as the software applications and hardware devices that can be installed to make Linux accessible to users with disabilities. The information provided targets specific groups of individuals with similar disabilities.

Table of Contents

1. Introduction

The purpose of this HOWTO is to introduce the tools, applications, and configuration utilities that are available to Linux users who are disabled. The information provided targets groups of individuals with the following disabilities:

- ***Visually Impaired***
- ***Hearing Impaired***
- ***Physically Disabled***
- ***Cognitive, Language, and Other Impairments***

Please send any comments, or contributions via e−mail to Sharon Snider. This document will be updated regularly with new contributions and suggestions.

1.1. Distribution Policy

2. The Linux Operating System

The Linux operating system has many software applications and utilities that run in the non−graphical environment. The graphical user interface (GUI), which is often referred to as X Windows, is clearly separate from the underlying non−graphical, text−only environment. One major reason that a visually impaired individual can use Linux is that network connectivity is built in to the operating system and provides full access to the Internet from the non−graphical interface. All visible text on the screen can be translated using a screen reader and speech synthesizer.

Over the past few years many improvements have been made to the GUI, and many of the desktops now provide features and enhancements designed for accessibility. In the following sections you will find information on the tools, utilities, and applications that are available to assist users in configuring their desktop environment.

2.1. Assistive Technologies Available for Linux

Assistive technologies are computer hardware devices and software applications that provide individuals with impairments access to the information and applications on a computer. Although there are not many commercial applications available specifically for Linux accessibility, there are free software applications that can make the computer more accessible. Detailed information on assistive technologies that are available has been listed in this document based on the type of disability.

2.2. Usability

Linux has the advantage over Windows that a large majority of Linux software has been developed for the console. Although many programs are now being developed for the GUI, programs continue to be written for the non−graphical, text−based environment. Linux originated as a programmer's operating system and, for the physically disabled, this means that it is easy to build and customize programs to suit an individual's needs.

The windowing system used by Linux (X11) includes many programming tools that enable further modification and customization of the GUI. KDE and GNOME have included many accessibility and usability features in their latest releases and are continuing to test, upgrade, and enhance the graphical environment. The following are links to KDE and GNOME's accessibility and usability projects:

- KDE Accessibility Project − http://accessibility.kde.org/.
- GNOME Accessibility Project − http://developer.gnome.org/projects/gap/.
- KDE Usability Project − http://usability.kde.org/.
- GNOME Usability Project − http://developer.gnome.org/projects/gup/.

---

3. Visual Impairments

There are two categories of visual impairments. Individuals who are partially sighted (for example, blurred vision, near and far−sightedness, color blindness) and those who are totally blind. Assistive technologies are available for the Linux operating system for visually impaired users, and many of the software packages are free.

3.1. Technologies for the Visually Impaired

The following is a list of assistive technologies for visually impaired users:

3.1.1. Screen Readers

Screen readers are software applications that are installed on the computer to provide translation of the information on the computer screen to an audio output format. The translation is passed to the speech synthesizer and the words are spoken out loud. Currently, fully functional screen readers are only available for Linux in console mode. This section describes some of the most common screen readers.

- ***Emacspeak*** is the complete Audio Desktop is an excellent non−graphical, text based interface for users who are visually impaired. This application can be used as a screen reader in conjunction with a hardware synthesizer or IBM ViaVoice® Run−time text−to−speech application. More information and software packages of are available at: http://www.cs.cornell.edu/home/raman/emacspeak/. The Emacspeak HOWTO http://www.ibiblio.org/pub/Linux/docs/HOWTO/ includes a tutorial and installation guide.
- ***Jupiter Speech System*** is a screen reader for Linux in console mode. A user guide and software packages are available at: http://www.eklhad.net/linux/jupiter/.
- ***Screader*** is a screen reader for Linux in console mode that works with the Festival software speech synthesizer and the Accent hardware synthesizer. Information and downloads are available at: http://www.euronet.nl/~acj/eng−screader.html.
- ***Speaker*** is a new plugin for the Konqueror file manager and Web browser. Speaker provides Text to Speech using the Festival speech system or IBM ViaVoice. Downloads are available at: http://dogma.freebsd−uk.eu.org/~grrussel/speaker.html.
- ***Speakup*** is a screen review package for the Linux operating system. It requires a hardware speech synthesizer, such as the DecTalk Express. An installation boot disk and packages are available at: http://www.linux−speakup.org/ that allow a visually impaired user to install the Linux operating system.
- ***ZipSpeak*** is a talking mini−distribution of Linux. More information and software packages are available at: http://www.linux−speakup.org/zipspeak.html.

3.1.2. Speech Synthesizers

Speech synthesizers can be a hardware device or a text to speech (TTS) software application that creates the sounds necessary to provide speech output. Hardware synthesizers are available for the Linux operating system; however, they can be very expensive and must be compatible with the screen reader application in order to function properly. The alternative is to download and install a software synthesizer such as IBM's

ViaVoice or Festival and configure the application to a compatible screen reader, such as Emacspeak.

3.1.2.1. Hardware Speech Synthesizers

A hardware speech synthesizer is a device that is connected to the computer's serial or parallel port and translates the text to a spoken output. Normally there are Braille labels on all controls to indicate the off and on position, and volume control. Hardware synthesizers also have the ability to speak in different tones that can be setup to indicate various parts of a document or text. Some models will provide a connection for headphones. The following is a list of speech synthesizers that are supported on the Linux operating system and can be used with Emacspeak:

- ***Accent SA and Apollo 2*** (http://polio.dyndns.org/chip/vss.html)
- ***DECTalk Express*** (http://www.4access.com/synthesizers.asp)
- ***DoubleTalk*** (http://www.rcsys.com)

3.1.2.2. Software Speech Synthesizers

A software speech synthesizer is an application that translates the text on the screen to speech output and provides speech synthesis, so that the screen reader application can read information out loud to the user.

- ***Festival*** is a general, multi−lingual speech synthesis system developed at the Center for Speech Technology Research (CSTR). It offers a full TTS system with various application program interfaces, as well as an environment for development and research of speech synthesis techniques. Mbrola or FestVox are needed to complete the Festival installation. Software packages and installation instructions are available at: http://www.cstr.ed.ac.uk/projects/festival/.
- ***IBM ViaVoice®*** is a TTS technology that provides a flexible speech synthesis engine. Currently it supports U.S. English only and is available at: http://www−4.ibm.com/software/speech/dev/ttssdk_linux.html.
- ***Mbrola*** is a speech synthesizer that can be used with a TTS application, such as, Festival to provide speech output. More information is available at: http://tcts.fpms.ac.be/synthesis/mbrola.html.

3.1.3. Screen Magnifiers

Screen magnifiers enable users that are partially sighted to view selected areas of the screen in a manner similar to using a magnifying glass.

- ***GMag*** is a screen magnifier for X Windows. It provides continuous magnification while you work, as well as the option to change the contrast of images at run−time. More information and downloads are available at: http://projects.prosa.it/gmag/.
- ***Puff*** is a screen magnifier for users who need a high magnification of text and graphics in X Windows. Puff follows the focus of the mouse or pointer and enlarges the portion of the screen under the cursor. In order for Puff to run properly on Linux the source code needs to be modified. This application is not a good option for inexperienced users. The software packages and source code modification instructions are available at: http://trace.wisc.edu/world/computer_access/unix/unixshare.html.
- ***SVGATextmode*** enlarges or reduces the font size for users who perfer to work in console mode. The normal text screen that Linux provides is 80 characters across and 25 vertically. After

SVGATextmode is installed, the text can be displayed much larger. One example would be 50 characters across and 15 vertically. The program does not offer the ablitity to zoom in and out, but the user can re−size when necessary. The most current download is available at: http://freshmeat.net/projects/svgatextmode/. Do not run try to run SVGATextmode from an X Windows terminal. You must be in console mode for the display to function properly.
- ***UnWindows*** is a collection of programs that includes Dynamag, a screen magnification program that helps the user locate the mouse pointer. The source code is available for Dynamag as a stand alone application, or the entire UnWindows package can be downloaded at: http://www.cs.rpi.edu/pub/unwindows/. The entire UnWindows package will not work with Linux without programming modifications. However, the Dynamag application can be installed successfully without any additional code changes.
- ***Xzoom*** is a screen magnifier similar to Xmag that allows the user to magnify rotate or mirror a portion of the screen. The most current download is available at: http://filewatcher.org/sec/xzoom.html.

3.1.4. Braille Devices

Braille terminals are normally used by individuals who are totally blind and may be hearing impaired as well. A Braille display uses a series of pins to form Braille symbols that are continuously updated as the users changes focus. A Braille embosser is a hardware device for printing a hard copy of a text document in Braille. Braille translation software is required to translate the on−screen text to a Braille format.

3.1.4.1. Braille Hardware Devices

The following Braille devices have been listed on the hardware compatibility list of one or more of the following Braille translation applications:

- ***Braillex*** http://www.redhat.com/mailing−lists/blinux−announce/msg00031.html.
- ***Alva B.V.***: ABT3xx, Delphi (serial and parallel ports), Satellite. .
- ***Baum***: Vario/RBT 40/80 (emulation 1/2) http://www.baum.de/English/homeeng1.htm.
- ***Blazie Engineering***: BrailleLite 18/40 http://www.freedomscientific.com/index.html.
- ***Handialog***: VisioBraille 2040 http://www.handialog.com/indexuk.htm.
- ***Handy Tech Elektronik GmbH***: BrailleWave, mod20, mod40, mod80 http://www.handytech.de/.
- ***MDV***: MB208/MB408L/MB408S (protocol 5) http://www.cavazza.it/cnt/schede/scheda−mb408l−eng.html.
- ***Pulse Data International***: BrailleNote 18/32 http://www.pulsedata.co.nz/graphics.htm.
- ***Telesensory Systems Inc.***: Navigator 20/40/80 (latest firmware version only), PowerBraille 40/65/80 http://www.telesensory.com/.
- ***Tieman B.V.***: CombiBraille 25/45/85, MiniBraille 20, MultiBraille MB125CR/MB145CR/MB185CR http://www.braillevoyager.nl/uk/index.html.
- ***Tiflosoft***: VideoBraille 40 http://www.tinlecco.it/tiflosoft/.

3.1.4.2. Braille Translation Software

The following Braille translation applications are available for download:

- ***Brass*** is a new program that combines speech and Braille output. The current version is still in testing and can be downloaded at: http://www.butenuth.onlinehome.de/blinux/.
- ***BrLTTY*** supports a serial port Braille terminal and provides access to the Linux console. It drives the terminal and provides complete screen review capabilities. It is available at: http://dave.mielke.cc/brltty/.
- ***NFBTrans*** is a freeware Braille translator written by the National Federation for the Blind (NFB). Software packages are available for download at: http://www.nfb.org/nfbtrans.htm.

3.1.5. Cursors for X Windows

Changing the shape and size of the mouse cursor can help users who have a problem following or seeing the cursor. The X Big Cursor mini HOWTO explains how to configure enlarged mouse cursors with the X Windows system. This HOWTO is available at: http://www.icewalk.com/doclib/howtos/mini/X−Big−Cursor.html.

There are also a large select of cursors that can be downloaded at: http://themes.tucows.com/cursors.html.

3.1.6. Audio

Audio can be very useful to users who are visually impaired. In most X Windows desktop environments audio alerts and sound events can be setup within the desktop control center by enabling sound and verifying that the option to show sound is activated. You will need to check the desktop users manual for setup and configuration of sound events.

Locktones is an excellent application for providing toggle keys that sound an audio alert to warn the user that a keystroke has created a locking state such as Cap Locks, or Num Locks. The application can be downloaded at: http://leb.net/pub/blinux/.

Linux can also be configured to beep at the login prompt so the user knows when to type in the password. A configuration utility can be downloaded and installed that can provide this function at: http://leb.net/pub/blinux/bootmeup/.

3.1.7. Additional Resources

- ***Access Mozilla*** has a goal to build an accessible Web suite: browser, e−mail, news, composer and chat that conform to the W3C accessibility standards. More information is available at: http://access−mozilla.sourceforge.net/.
- ***Blind + Linux = BLINUX*** provides documentation, downloads and a mailing list that focus on users who are blind. Information and software packages are available at: http://leb.net/blinux.
- ***LaTex/Tex*** is an extremely powerful document preparation system and it can be used to produce large print documents. More information is available at: http://www.emerson.emory.edu/services/latex/latex_toc.html.
- ***National Federation for the Blind's (NFB) purpose is to help blind persons achieve self−confidence and self−respect and to act as a vehicle for collective self expression by the blind. Information for blind users, as well as software are available at:*** http://www.nfb.org/.
- ***Project Ocularis*** is run by volunteers, and the project's aim is to improve Linux accessibility through

the creation of new free software and the modification of pre−existing free software. More information is available at: http://ocularis.sourceforge.net.

- ***Screen*** is a standard piece of software that allows many different applications to run at the same time on a single terminal in console mode. Screen has been enhanced to support some Braille terminals directly. It is available for download at: http://www.icewalk.com/softlib/app/app_01508.html.
- ***SuSE Linux*** is the first Linux distribution to support installation of the Linux operating system and applications that run on Linux in Braille. The Blinux screen reader runs in the background to enable visually impaired users to work in a Linux console environment. More information is available at: http://www.suse.de/us/products/susesoft/70news/new_in_70.html.
- ***xocr*** is an optical character recognition program that scans written text, such as a book and translates it to audio output, so the information is available to visually impaired users. More information is available at: http://sal.unimedya.net.tr/Z/3/XOCR.html.

4. Hearing Impaired

For users who have hearing impairments the audio output must be conveyed visually on the screen. Most desktops provide visual audio alerts and warnings. In console mode the system can also be configured to provide visual bells. There is a "Visual Bells mini−HOWTO" written by Alessandro Rubini that provides the configuration details available at: http://www.ibiblio.org/pub/Linux/docs/HOWTO/mini/.

4.1. Assistive Technologies for the Hearing Impaired

The following is a list of assistive technologies for the hearing impaired:

4.1.1. Telecommunications Devices for the Deaf (TDD)

TDD allows for the user you to communicate over the telephone using the computer as a text terminal.

- ***Zapata*** is a computer−based, high−density telephony project. The current version is available for download as source code on at: http://www.zapatatelephony.org/project.html.

4.1.2. Closed Captioning

Closed captioning provides text translation of spoken words to video display. Closed captioning can be used for distance learning, video−teleconferencing, audio from a CD−ROM, and other types of interactive technology.

- ***Ccdecoder*** is a closed captioned, extended data services decoder for the bttv and video4linux based tv video cards: http://sourceforge.net/projects/ccdecoder/.

5. Physically Disabled

There are a wide range of physical disabilities that can impair a user's mobility, and many of these impairments need to be addressed on an individual basis. This section addresses impairments that apply to users who have difficulty using a mouse, pointing device, or keyboard.

5.1. Keyboard Navigation

There are features that are built into the Linux operating system that allow for additional keyboard configuration. In some of the X Windows desktops these settings can be changed from the control center. An application has also been developed for X Windows called AccessX and it provides a graphical user interface for configuring all the AccessX keyboard settings. These settings are:

- ***StickyKeys*** enable the user to lock modifier keys (for example, control and shift) allowing single finger operations in place of multiple key combinations.
- ***MouseKeys*** provide alternative keyboard sequences for cursor movement and mouse button operations.
- ***SlowKeys*** requires the user to hold the key down for a specified period of time before the keystroke is accepted. This prevents keystrokes that are pressed by accident from being sent.
- ***ToggleKeys*** sound an audio alert that warns the user that a keystroke created a locking state for keys, such as Caps Lock, and Num Lock.
- ***RepeatKeys*** allow a user with limited coordination additional time to release keys before multiple key sequences are sent to the application.
- ***BounceKeys*** or ***Delay Keys*** have a delay between keystrokes. This function can help prevent the system from accepting unintentional keystrokes.

5.2. Assistive Technologies for the Physically Disabled

The following is a list of assistive technologies for the physically disabled:

5.2.1. On−Screen Keyboard

On−screen keyboards enable a user to select keys using a pointing device, such as a mouse, trackball, or touch pad. This application can be used in place of a standard keyboard.

- ***GTkeyboard*** is a on−screen, graphical keyboard and can be downloaded at: http://opop.nols.com/gtkeyboard.html.

5.2.2. Speech Recognition

Speech recognition utilities are used by people with mobility impairments, so they can operate the computer using voice control.

- ***Open Mind Speech*** is a development project for speech recognition tools and applications. Information for the project and a mailing list are available at: http://freespeech.sourceforge.net/.
- ***ViaVoice Dictation for Linux*** allows you to write documents using your voice rather than a keyboard. Information and downloads are available at: http://www−4.ibm.com/software/speech/dev/.
- This site has information and links related to several different speech recognition utilities. http://www.trace.wisc.edu/world/computer_access/unix/unixshar.html.

5.3. Additional Resources

The following is a list of additional Web sites that may be of interest to users with mobility impairments:

- This site provides a kernel patch that can be downloaded to enable a one−handed keyboard. The download is available at: http://www.fourtytwo.de.
- Configuration and information on Adapting the Linux Keyboard for a one handed user is available at: http://www.eklhad.net/linux/app/onehand.html.
- ***Morseall*** allows the user to control a Linux shell by tapping Morse code on the left mouse button: http://sourceforge.net/projects/morseall.
- The keyboard and console HOWTO provides additional keyboard configuration information. http://www.ibiblio.org/pub/Linux/docs/HOWTO/Keyboard−and−Console−HOWTO.
- There is a ***Speech Recognition HOWTO***, written by Stephen Cook that provides complete details for anyone interested in learning more about speech recognition applications. http://www.linuxdoc.org/HOWTO/.

6. Cognitive, Language, and Other Impairments

Cognitive and language impairments include dyslexia and problems with; memory, comprehension, problem solving, and written language. For many individuals with cognitive and language disabilities, complex graphical displays and inconsistent use of words can make using the computer more difficult. A user with epilepsy can have a seizure from an application with blinking lights and animation. Most desktops now allow users to disable animation. Web browsers such as Mozilla and Netscape allow users to disable graphics. It is important to check the documentation for preferences that are available in the desktop environment you are using, as well as any applications that are used. This section discusses the tools that are available to aid users with these impairments:

6.1. Assistive Technologies for Cognitive, Language and Other Impairments

The following is a list of assistive technologies that can be helpful to users with cognitive, language, and other impairments:

6.1.1. Screen Readers and Speech Synthesis

Screen readers with speech synthesis enable the system to read on−screen information and text out loud to the user. This type of assistive technology can be particularly helpful to individuals who have dyslexia and other learning disabilities. Although there are no screen readers available for the GNOME desktop, screen reader applications are available for Linux in console mode that provide this functionality.

- ***Emacspeak*** is a speech interface that will provide audio output for all text. The program works in terminal and console mode and requires a software or hardware speech synthesizer. The downloads and users manuals are available at: http://www.cs.cornell.edu/home/raman/emacspeak/.
- The Trace Center provides information and downloads for various screen readers and speech synthesizers. More information is available at: http://www.trace.wisc.edu/world/computer_access/unix/unixshar.html.

6.1.2. Keyboard filters and Word Processing

Keyboard filters and word processing applications that have word prediction and spell checking utilities can be an excellent aid for users with learning and language impairments.

6.1.3. Speech Recognition

Speech recognition applications enables you to control the computer with your voice rather than having to type or write out the information.

- ***CVoice Control*** is a speech recognition system that enables a user to connect spoken commands to UNIX commands. More information is available at: http://www.kiecza.de/daniel/linux/.

- ***IBM ViaVoice Dictation for Linux*** allows the user to write documents using their voice rather then a keyboard and can read the information back to the user. More information is available at: http://www−4.ibm.com/software/speech/dev/.
- ***Open Mind Speech*** is a development project for speech recognition tools and applications. The developers have established a mailing list for asking questions and obtaining information at: http://freespeech.sourceforge.net/.
- ***XVoice*** enables continuous speech to text dictation for many applications. More information is available at: http://www.compapp.dcu.ie/~tdoris/Xvoice/.

7. Developing Accessible Applications

It is important to consider accessibility when developing new applications for the Linux operating system. The American Foundation for the Blind, the GNOME Accessibility Project, IBM, and Sun have written guidelines that are excellent road maps for developing and testing new Linux software. The following Web sites provide the tools, checklists and testing information to help developers write accessible programs for impaired users.

- ***American Foundation for the Blind*** provides information on creating accessible computer applications at: http://www.afb.org/info_document_view.asp?documentid=198.
- ***GNOME Accessibility Project*** has written a guide specifically for application development for the GNOME 2.0 desktop. More information is available at: http://developer.gnome.org/projects/gap/guide/gad/index.html.
- ***IBM Accessibility Center*** provides links to a software accessibility checklist, testing information, and the Section 508 Rehabilitation Act. This site is located at: http://www−3.ibm.com/able/guidelines.html.
- ***Sun Accessibility*** provides information on designing applications for accessibility at: http://www.sun.com/access/developers/software.guides.html and an Accessibility Quick Reference Guide is available at: http://www.sun.com/access/developers/access.quick.ref.html.

8. Other Helpful Information

The following is a list of additional information that may be helpful, but is not necessarily targeting a specific disability:

- ***The CMU Sphinx Group Source*** has released a set of reasonably mature, speech components that provide a basic level of technology to anyone interested in creating speech enabled applications. More information is available at: http://fife.speech.cs.cmu.edu/sphinx/.
- Access to Linux documentation is critical to learning and using Linux. The ***Linux Documentation Project*** has links to many Linux HOWTOs, mini HOWTOs, and guides, as well as information on becoming involved in authoring new HOWTOs. More information and downloads are available at: http://www.linuxdoc.org.
- ***RPMFind.net*** provides rpm downloads for Linux applications on most Linux operating systems. The site is located at:http://www.rpmfind.net.
- ***Sourceforge*** provides updated information, documentation, and software for Linux. Some of the applications available are under development. More information and downloads are available at: http://www.sourceforge.net.
- ***The Trace Center*** provides accessibility information and software for the Linux operating system. More information is available at: http://trace.wisc.edu/worl/computer_access/.

9. Acknowledgments

These are the orignal acknowledgments documented by Michael De La Rue. They have been included in their entirety to ensure that each persons efforts to make Linux more accessibile are acknowledged.

Much of this document was created from various information sources on the Internet, many found from Yahoo and DEC's Alta Vista Search engine. Included in this was the documentation of most of the software packages mentioned in the text. Some information was also gleaned from the Royal National Institute for the Blind's help sheets.

T.V. Raman, the author of Emacspeak has reliably contributed comments, information and text as well as putting me in touch with other people who he knew on the Internet.

Kenneth Albanowski kjahds@kjahds.com provided the patch needed for the Brailloterm and information about it.

Roland Dyroff of S.u.S.E. GmbH (Linux distributors and makers of S.u.S.E. Linux (English/German)) looked up KTS Stolper GmbH at my request and got some hardware details and information on the Brailloterm.

The most major and careful checks over of this document were done by James Bowden, jrbowden@bcs.org and Nikhil Nair nn201@cus.cam.ac.uk, the BRLTTY authors who suggested a large number of corrections as well as extra information for some topics.

The contributors to the blinux and linux−access mailing lists have contributed to this document by providng information for me to read.

Mark E. Novak of the Trace R and D centre http://trace.wisc.edu/ pointed me in the direction of several packages of software and information which I had not seen before. He also made some comments on the structure of the document which I have partially taken into account and should probably do more about.

Other contributors include Nicolas Pitrie and Stephane Doyon.

A number of other people have contributed comments and information. Specific contributions are acknowledged within the document.

This version was specifically produced for RedHat's Dr. Linux book. This is because they provided warning of it's impending release to myself and other LDP authors. Their doing this is strongly appreciated since wrong or old information sits around much longer in a book than on the Internet.

No doubt you made a contribution and I haven't mentioned it. Don't worry, it was an accident. I'm sorry. Just tell me and I will add you to the next version.