have hardware for such connections and execute server software such as Web daemons **118**. When servers **104** execute Web Daemons **118**, such servers **104** are known as Web servers. Client computers **102** connected to Web servers **104** normally retrieve human readable data as web pages written in a mark-up language such as HTML.

[**0030**] At times, rather than connecting directly to servers **104** and retrieving the data, client computers **102** connect first to a so-called proxy server **106**. In this case, client computer **102** indicates to proxy server **106** the data to be retrieved from server **104**. Proxy server **106** then retrieves this data from server **104** on behalf of client computer **102** and forwards the retrieved data to client computer **102**.

[**0031**] In addition to hardware and software for connections to servers **104**, client computers **102** have hardware in the form of input/output peripheral devices for interfacing with human users. For use in conjunction with the present invention, client computers **102** preferably have one type of user interface device known as a touch pad **108**. Examples of touch pads are the "Glidepoint" touch pads available from Cirque Corp., 2463 South 3850 West Suite A, Salt Lake City, Utah 84120 USA. Touch pad **108** utilizes resistive, capacitive or electromagnetic inductive effects to determine the input position coordinates of a user's finger on a touch surface of touch pad **108** and the type of actions a user's finger performs on the touch surface, such as tapping or sliding, in order to provide user input to client computer **102**. The input position coordinates are mapped to the display coordinates for interacting with displayed data.

[**0032**] When utilized with the present invention, touch pad **108** also provides tactile output. Preferably, the tactile output is in the form of vibrations. This may be accomplished by attaching a vibrator to touch pad **108** in a manner similar to that described in U.S. Pat. No. No. 5,977,867; by mounting touch pad **108** on a voice coil motor or loudspeaker; or by any other equivalent method of producing vibratory feedback.

[**0033**] Client computer **102** also includes an auditory output device (not shown), such as a speaker, for providing auditory output. In the case that touch pad **108** is mounted upon a loudspeaker, the loudspeaker can be utilized to provide the auditory output. Additionally, when the present invention is utilized in its preferred environment, client computer **102** also includes a traditional visual display screen for providing visual output to facilitate collaboration between a sighted and visually impaired user.

[**0034**] Referring to **FIGS. 1***a* and **1***b*, the preferred embodiment of the present invention comprises an intermediary **112** and an interface component **116**. When the present invention is used with web pages, intermediary **112** receives a requested web page from Web server **104**, analyzes the page and generates an abstract representation of the page layout. This abstract representation describes the locations of boundaries between areas of content in the layout and includes meta-information on the content in the areas of the layout. This abstract representation of the layout is sent to and maintained by interface component **116**. Preferably, a browser **114** is included at client computer **102** to facilitate collaboration between a sighted and visually impaired user; and intermediary **112** passes the received web page to browser **114** for interaction with and display to a sighted user. Via touch pad **108**, a user interacts with interface component **116**, which processes inputs and provides vibratory and auditory feedback to the user by generating output commands. These output commands cause touch pad **108** and auditory output device to create the respective feedback. The vibratory feedback is provided for the boundaries in order to supply a non-visual representation of the spatial layout of areas of the page, while the auditory feedback supplies the meta-information of the content of the areas. Therefore, a physical, tactile display of the overall layout of the web page is created via touch pad **108**, while additionally providing an auditory, abstracted view of content in an area, all of which provides for an easily scanned non-visual display of the web page. When interaction with interface component **116** or browser **114** results in a request for a new page, this request is passed to intermediary **112**, which communicates with the appropriate Web server to receive the requested page.

[**0035**] In general, interface component **116** comprises computer readable data and instructions which, when read, interpreted, and executed by client computer **110**, causes client computer **102** to perform the steps of the present invention. Likewise, intermediary **112** comprises computer readable data and instructions which, when read, interpreted, and executed by client computer **102**, Web server **104**, proxy server **106** or any other appropriate processor capable of communication with interface component **116** and Web server **104**, causes the executing processor to perform the steps of a further aspect of the present invention. Generally, the data and instructions of interface component **116** and intermediary **112** are embodied in and readable from computer usable storage media, such as magnetic tape, optical disc, compact disc, hard disk, floppy disk, ferroelectric memory, EEPROM, flash memory, EPROM, ROM, DRAM, SRAM, SDRAM, ferromagnetic memory, optical storage, charge coupled devices, smart cards or any other appropriate static or dynamic memory, data storage devices, or remote devices coupled to the respective processor via a data communications device (not shown).

[**0036**] Those skilled in the art will recognize that the exemplary environment and components illustrated in **FIG. 1***a* are not intended to limit the present invention. As such, alternative hardware environments will be appreciated by those skilled in the art and may be used without departing from the scope of the present invention. Also, as will be appreciated, the present invention may be implemented as a method, apparatus, or article of manufacture using standard programming and engineering techniques to produce software, hardware, firmware, or any combination thereof. The term "article of manufacture" as used herein is intended to encompass logic and data embodied in or accessible from any computer usable storage media.

Operation Of The Preferred Embodiment

[**0037**] To aid in the understanding of the present invention, **FIGS. 2***a* and **2***b* illustrate an exemplary web page utilizing frames in which one of the content areas is changed. As shown in **FIG. 2***a*, the exemplary web page is divided into three areas: a top area **200**, a lower left area **202** and a lower right area **204**. Lower left area **202** contains content of a type known as a form. Lower right area **204** contains textual content. Top area **206** contains content in the form of navigation buttons **206**, which, when activated, retrieve additional content for display in lower right area