
Internet Update

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This article provides an update on changes in the Internet since the last Internet article was published in the March 1996 *JNMT*. Attention is focused on the World Wide Web where most of the significant changes have taken place.

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There have been dramatic changes in Internet access, software and resources since the last continuing education article on the Internet (1) was published. The Internet has continued its expansive growth which has spurred further development in many areas. This article describes the major changes that have occurred in the last year with an emphasis on nuclear medicine and imaging resources. Almost all the new developments have occurred on the World Wide Web (WWW). Other services discussed in the previous articles, such as telnet, ftp, gopher and USENET (2), are not covered here.

TELECOMMUNICATIONS

One of the major difficulties that you may encounter, when accessing the Internet with a modem, is the slow speed of downloading information. The fastest modems operate at approximately 33 kilobits/sec. Many Web pages, however, contain complex graphics and other multimedia that can require many seconds or a few minutes to download. More complex multimedia such as movie segments can take considerably longer. To overcome this problem, several technologies have been developed that increase data transmission rates (bandwidth) to homes. Telecommunications companies are making major efforts to find methods that use pre-existing communications lines into homes, cable and standard telephone lines, to provide faster data transmission.

One technology that has reached maturity and is available throughout the U.S. is the Integrated Services Digital Network (ISDN). This is a digital transmission method that can be used

with standard telephone lines and special equipment on a user's computer to provide data transmission rates of up to 128 kilobits/sec. ISDN allows you to access real-time video services that have considerably better quality than video over standard modems. All regional Bell companies provide this service, but rates vary considerably between different providers. To find out more about ISDN in a local area, contact the regional Bell company. For example, in the Pacific Northwest, ISDN is described in detail at the U.S. West Web site, http://www.uswest.com/isdn/ps_isdn_index.html.

A newer set of technologies is referred to as the Digital Subscriber Line methods. The most likely technology to become available in the near future is Asymmetric Digital Subscriber Line (ADSL). Unlike ISDN, in which data is transferred at the same rate in both directions, ADSL data can be received at up to 8 megabits/sec and sent at 640 kilobits/sec. A good source of information on ADSL and related methods that can use existing telephone lines is Orckit Communications Ltd. at <http://www.orckit.com>.

The highest bandwidth line that is available for most residences is the television cable. Digital data transmission on cable could be sent at up to 10 megabits/sec, 300 times faster than the fastest modem. There are several telecommunications companies in the U.S. which have developed systems for sending and receiving data through television cables. The main problem encountered with this method is that cable was designed for one-way, high-speed data transmission, not for two-way interactions. This is not a serious problem, since in most interactions on the Internet, you are receiving high-volume data rather than sending it. A company active in the development of cable Internet access is @ Home at <http://www.home.net>. Local areas within the U.S. may have this service available by the end of 1996.

The one feature that limits access to the Internet for most individuals is the necessity of using a computer. In order to make the Internet available to a much wider audience, several companies are working on methods to access the Internet through a television set. The exact details of this approach are still being worked out, but one arrangement consists of a special set-top box that connects the television set and standard phone lines. A user registers with an online network that provides a proprietary browser designed for a television set. A

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remote control unit allows you to switch between regular television programming and Internet services. Manufacturers emphasize that this system would be much easier to set up than Internet access with a personal computer and a modem. Other features are faster access speeds and integrated audio and video services requiring no configuration by you. Two companies developing this technology are the WebTV Networks, Inc. (<http://www.webtv.net/HTML/home.about.html>) and WorldGate Communications (TV On-Line Service, <http://www.tvol.com>). More ambitious plans have been proposed for integrating the Internet with other telecommunications systems, primarily telephone service, and other electronic systems (<http://www.navio.com>).

INTERNET ACCESS

There are now thousands of Internet service providers (ISPs) in the U.S. and several hundred in Canada. A list of these ISPs, arranged by geographical area and area codes, can be found at <http://www.boardwatch.com/isp>. ISPs range from small services confined to a single area code to international telecommunications companies. Intense competition among ISPs continues to drive down prices for Internet access. While hourly charges (usually around \$2.50 per hour) are still routine, many regional and some large ISPs offer unlimited flat-rate access for around \$20 per month. Different pricing plans are available from the various ISPs, but a common scheme is free access for the first few hours per month and then hourly charges for further access. This latter method may be cost effective for infrequent users.

Nearly all major telecommunication companies, including MCI (<http://www.mci.com>) and Sprint (<http://www.sprint.com> or <http://www.igc.net>), provide Internet access. A major new international ISP is AT&T which has been aggressively promoting Internet access through its Worldnet Service. Unlimited, flat rate access for \$25 per month is available to the general public and \$20 per month for AT&T customers. In addition, AT&T supplies its own Web browser that currently is available only on disk or CD-ROM. Contact AT&T at 1-800-967-5363 or on the WWW at <http://www.att.com> for more information.

ONLINE SERVICES

Internet access is available through the four major online services. Listed according to size, these are America Online, CompuServe, the Microsoft Network and Prodigy. The largest service, America Online, has over 6 million subscribers. All of these services were not originally connected to the Internet and used proprietary software for connecting to their networks. This software is not based on the standard Internet networking software TCP/IP. To reach the Internet, special gateways are required on these networks. The display software is also proprietary which contrasts with the open standard for the WWW, the hypertext markup language (HTML). One of the main selling points for these services was a diversity of information resources that could only be accessed through their networks. Increasingly, however, much of this material is becoming avail-

TABLE 1
Web Sites for Online Services

American Online	http://www.aol.com
CompuServe	http://www.compuserve.com
Global Network Navigator*	http://www.gnn.com
Microsoft Network	http://www.msn.com
Prodigy	http://www.prodigy.com
Sprynet*	http://www.sprynet.com

*Internet service providers (ISPs).

able through the Internet. As a result, all of these services are establishing sites on the WWW that can be accessed by the general public. Basing their services on TCP/IP and HTML frees these companies from maintaining their own proprietary software allowing them to offer the same, and often many more, services through the Internet. As of this writing, all the online services can be reached through their own proprietary networks or through the Internet. Some of the online services, however, are considering moving to an Internet-only based service. CompuServe and Prodigy, in particular, have announced plans to do this. For Internet access, revenue is generated in two ways: by advertising on Web pages accessible to the general public and by charging subscription fees for access to specialized areas. This approach is similar to the way cable television works. The cable company (the counterpart of an ISP) charges for cable access. A large number of channels can be watched for free (they are supported by advertising) while channels carrying specialized content charge subscription fees. In addition, some of the online services have set up independent Internet access services. CompuServe has established Sprynet (<http://www.sprynet.com>) and America Online owns the Global Network Navigator (<http://www.gnn.com>). Table 1 lists the Web sites of the online services.

The smaller online services discussed in a previous article (3), GENie, Delphi and eWorld, have found it increasingly difficult to compete in the present environment. eWorld, the online service from Apple, was discontinued in March 1996. It is likely that the other services will be discontinued in the near future.

The Microsoft Network, the newest of the proprietary online services, enjoys a major advantage over its competitors. Windows 95, the latest operating system from Microsoft, allows you to sign-up for access to the Microsoft Network by clicking an icon on the desktop, the main viewing area for Windows 95. Once an account is established, you have one-click access to the Microsoft Network that has a gateway to the Internet.

THE INTRANETS

Hypertext and the hypertext transfer protocol (HTTP), the protocol used on WWW, were not originally developed for the Internet. Hypertext was first used on personal computers to access files on a computer's hard disk. HTTP was developed at CERN (the European laboratory of particle physics) as a means of sharing documents on the local computer network. Most corporate and other private networks are not connected

to the Internet, but these networks also have a need for sharing resources between computers. Hypertext, HTTP and Web browsers used locally on these networks form an internal Internet or intranet. Intranets are the fastest growing market for Web servers, Web browsers and the other types of Internet applications. In aggregate, intranets will probably account for more computer networking than the Internet in the future. Intranets are inherently more secure than the Internet, a marked advantage on private networks.

THE NETWORK COMPUTER

Using a personal computer to access the Internet is somewhat analogous to using a limousine to drive to a shopping mall. Personal computers are general purpose machines and most of the hardware and software, including the operating system, is not required to use the Internet. For this reason, several computer manufacturers have explored the possibility of a special purpose computer, generically referred to as a network computer (NC), that is specifically designed for accessing the Internet. The NC would not need a hard disk or much memory and only a simple operating system. The advantage of such a system is that it could be developed as a low-cost alternative to personal computers for individuals whose only need for a computer is Internet access. Projected prices for an NC are around \$500. An NC would be much more cost effective than a personal computer in libraries and other public facilities where WWW access is made available to the general public. The company furthest along in developing a commercial version of an NC is Oracle (<http://www.oracle.com/products/nc/>).

WEB BROWSERS

In order to access the WWW, you must run the TCP/IP software and a Web browser on your own computer.¹ The latest Macintosh and Windows operating systems have built-in TCP/IP software, simplifying access to the Internet. There are now dozens of Web browsers available from proprietary sources either as standalone products or as part of integrated Internet software. A partial list of these browsers can be found at the Yahoo! Web site, http://www.yahoo.com/Computers/World_Wide_Web/Browsers. In spite of this diversity, 70% of the browser market had been captured by Netscape (<http://home.netscape.com>) by early 1996. Microsoft, however, is making a strong challenge to Netscape. Windows 95 is equipped with Microsoft's Web browser, the Internet Explorer, that can use any access provider to connect to the Internet. In order to capture market share, Microsoft has taken the unique position of offering the browser for free to anyone who wishes to use it. Versions are available for Windows, Windows 95, Windows NT and Macintosh. See <http://www.microsoft.com/ie> for details. In addition, both America Online and CompuServe have chosen the Internet Explorer as the Web browser that

¹ You can access the Internet through a shell account (3). This does not require TCP/IP or any type of Internet software on your personal computer. Since shell accounts are text-based services, they do not permit downloading of images or other multimedia from the WWW.

their online services will use to access the WWW. Microsoft and Netscape produce new versions of their browsers every three to six months that incorporate new features.

One of the major new features that Netscape offers is the plugin.² Plugins are software modules that can be added to Netscape to allow the display of a wider range of file types than is possible with Netscape alone. Plugins are similar to external viewers (see Part 3 of the continuing education series (2)). External viewers are stand-alone programs that you can attach to a Web browser. As with a plugin, a viewer gives the browser the ability display a file type that the browser by itself cannot handle. There are two main differences between external viewers and plugins. First, plugins are specifically designed to be integrated with Web browsers. Installation is nearly automatic compared with the multistep process required to install an external viewer. Second, a plugin runs within a Web browser window allowing you to access all the Web browser controls. By contrast, an external viewer runs as an independent program that is activated by the Web browser. After using the viewer for displaying a file, you must manually exit the program to return to the Web browser. A variety of manufacturers that make software written in proprietary formats provides plugins. The Netscape home page contains a list of plugins with links to the Web sites that provide them. One example of a widely used plugin is the Adobe Acrobat reader (<http://www.adobe.com>) that is used for reading PDF (portable document format) files. PDF gives an author much greater flexibility in the layout and display of documents than can be achieved with other methods such as HTML encoding.

While the different Web browsers have more or less the same features, there are some interesting differences between them. One useful feature of some of the browsers is the ability to accept shortened forms of URLs. For example, Netscape (but not the Internet Explorer) will interpret the expressions NAME and NAME/PATH as <http://www.NAME.com> and <http://www.NAME.com/PATH>, respectively. Thus entering the string "microsoft/ie" as a location on Netscape is the same as entering "<http://www.microsoft.com/ie>."

HYPertext MARKUP LANGUAGE (HTML)

HTML is a language consisting of a set of instructions or tags and the rules for using these tags. Special text files (HTML files) contain tags that describe how a Web page is to be rendered. A Web browser reads and interprets the tags within the HTML file when displaying a Web page. New tags are constantly being created, primarily by Netscape and Microsoft. When a new set of tags produces fundamental new capabilities, a new version of the hypertext markup language is officially declared to exist. The official standard-setting body for HTML is the WWW Organization in Switzerland (<http://www.w3.org>). The current official version of HTML is designated HTML 2.0. A draft proposal for an HTML 3.0 version was widely employed but never officially adopted because neither Netscape

² Microsoft's Internet Explorer, version 3.0, also offers this feature.

or Microsoft could agree on which set of tags should be included in this version. As a result, work on HTML 3.0 was abandoned and a new, more advanced standard, HTML 3.2, has become the next proposed official version. Manufacturers which dominate the market (Netscape and Microsoft) continue to create and use new tags before they become standards and incorporate the software for reading these tags in the latest versions of their browsers. This is why some Web pages which use these unofficial tags specifically state which browser is best suited for viewing a particular site. Web browsers that do not include software for handling the new tags may be unable to properly display documents that contain them. Thus, Web pages displayed with an earlier version of a Web browser may appear appreciably different than with a more recent version of the browser. A discussion of HTML including proposed extensions of the current HTML standard can be found at http://www.netscape.com/assist/net_sites.

One of the new features that has been quickly adopted is the frames tag. The frames tag divides your screen into separate windows allowing you to view several Web pages simultaneously. Each window can be manipulated independently of the others. When set up properly, a Web page in a dominant window provides context for Web pages displayed in subordinate windows.

Another application still under development is the three-dimensional display of objects and scenes. The latest versions of Netscape and the Internet Explorer can display objects in various three-dimensional formats. A description of Netscape's capabilities can be found on its home page (<http://home.netscape.com>). A major new method for three-dimensional display is the virtual reality modeling (or markup) language, VRML. While VRML has been tightly integrated into the WWW, it is not actually an extension of HTML but a separate programming language. A VRML file downloaded by a Web browser displays an image along with controls for manipulating it. Depending on the image, you may, for example, change your viewpoint of a scene, enter rooms or manipulate objects. A description of VRML and a list of Web sites with VRML files (designated as world or .wrl files) can be found at <http://vrml.wired.com>. Some Web browsers have been specifically designed to display VRML files. A catalog of sites that offer VRML browsers is located at the San Diego Supercomputing Center (<http://sdsc.edu/vrml/browsers.html>).

HYPERTEXT TRANSFER PROTOCOL (HTTP)

HTTP, like HTML, continues to evolve. The present official version of HTTP is 1.0, but there is an advanced draft of a new HTTP standard, version 1.1, that will probably be adopted in the near future as the next official version (see <http://www.w3.org/pub/WWW/Protocols/> for details). HTTP has limitations on the type of objects it can transfer over the Internet, and proposals to solve these problems are addressed in the newer versions of HTTP. However, some of the problems are difficult or impossible to fix using the present structure of the HTTP protocol and its proposed modifications. As a result, a completely new protocol, called HTTP-NG (for

HTTP-Next Generation), is being developed that will allow more seamless integration of multimedia into Web pages. A discussion of this effort is available at <http://www.w3.org/pub/WWW/Protocols/HTTP-NG/Overview.html>.

DYNAMIC WEB PAGES

Web pages are primarily static entities much like pages in a book. Many of the new developments on the WWW are based on methods to animate Web pages or to continuously update information on a Web page. There are several simultaneous efforts being developed, and it is not possible to state at this time which ones will become generally adopted. The most widely employed of these methods is the JAVA programming language. A JAVA program or a link to such a program can be incorporated into a Web page. The program is run on your computer after the Web page or the JAVA program is downloaded. In order to use these programs, the Web browser has to be able to interpret the JAVA language.³ The latest Web browsers from Microsoft and Netscape have this capability. Netscape regularly uses JAVA programs to produce animation on its home page. JAVA, however, is still in development and relatively few Web pages presently use it. Because JAVA, like HTML, is an open language, its specifications are publicly available and any software manufacturer can create programs written in it. At present, only Web browsers can run JAVA programs, but the next versions of the Windows and Macintosh operating systems will have this capability. This development should accelerate the use of JAVA in many different types of applications.

Two methods of Web page updating, known as server push and client pull, are provided with Netscape browsers.⁴ Server push allows a server to continuously update a Web page that you have downloaded. Updating continues until you stop viewing the page or a certain number of updates have occurred. Normally a server terminates a connection to a browser as soon as the requested Web page is downloaded. With server push, the connection is maintained and new information, such as a series of Web pages, is sent automatically by the server. A complementary ability is client pull that functions similar to server push. When you download a Web page with client pull, the Web browser is given instructions for when it is to contact the server to download one or several other Web pages. By downloading Web pages in rapid succession, a crude form of animation can be achieved. Client pull is easier to implement than server push, and it is likely that server push will be superseded by other methods of dynamic Web page updating. A more detailed discussion of client pull and server push can be found at Netscape's Web site (http://www.netscape.com/assist/net_sites/pushpull.html). An example of a document using client pull is at the author's Web site (<http://www.teleport.com/~glowniak/home2.htm>).

³ A more powerful language is Javascript, a higher level programming (or scripting) language related to JAVA. For complex programs, Javascript is more commonly used than JAVA.

⁴ Internet Explorer, version 3.0, also has these capabilities.

Shockwave is another method for creating and displaying dynamic Web pages. Shockwave is a plugin that reads documents in the Shockwave file format. The plugin module can be obtained from Macromedia (<http://www.macromedia.com>). A great diversity of multimedia files can be created using the Shockwave authoring tools.

REAL-TIME APPLICATIONS

The Internet was originally developed as a highly reliable transport medium. The transmission control protocol (TCP) was designed to provide extensive cross checking of data packets and to request retransmission of data that had been lost or degraded during transmission. While this approach works well with static documents, it is counterproductive for applications such as real-time audio and video transmissions. With real-time data, timeliness of delivery is more important than accuracy. A lost video or audio packet that is retransmitted would simply garble the flow of information if played out of sequence.

For real-time applications, a simpler protocol, UDP (user datagram protocol) allows more rapid transmission of data than TCP. Combined with new compression techniques, UDP allows reasonable transmission of real-time audio and video using modems. Real-time video, while becoming more feasible, will probably require higher speed transmission methods before it is widely used. The most likely technologies that will be available for the average user in the near future are ISDN and cable as described above.

As with many commercial products, manufacturers of real-time audio software are providing evaluation copies of their programs that can be downloaded for free off the Internet. Two services, audioplayers and Internet telephones, are described here.

Audioplayers are software programs that will download and play real-time audio in the background even if you are accessing some other service over an Internet connection. The major product available as of this writing is Real Audio, available at <http://www.realaudio.com>. Using this program, you can listen to radio and audio services transmitted over the Internet. A list of sites where these services are available can be found at the above Web site.

The Internet telephone is a means of talking in real time to another individual on the Internet who is using the same software package. There are about half a dozen companies that offer these programs. Two examples of these products are the Internet Phone™ (<http://www.vocaltec.com>) and the Webphone™ (<http://www.jeval.com>). Other products can be located by using one of the search services described below. For example, using Alta Vista (<http://altavista.digital.com>) and the search term "internet phones" (including the quotes), you can find links to individual manufacturers as well as lists of manufacturers. You must have a sound card that supports these packages and a microphone that plugs into the sound card. While the quality of these phones varies considerably, all of them allow you to make long distance calls for the price of a local telephone call. The latest version of Netscape also contains software for Internet telephone service. The Intel Inter-

TABLE 2
Internet Search Services

Alta Vista	http://altavista.digital.com
DejaNews*	http://www.dejanews.com
Excite	http://www.excite.com
Health Gate†	http://www.healthgate.com
HotBot	http://www.hotbot.com
Knowledge Finder†	http://www.kfinder.com
Lycos	http://www.lycos.com
Magellan	http://www.mckinley.com
MetaCrawler	http://metacrawler.cs.washington.edu:8080
Open Text	http://www.opentext.com
WebCrawler	http://www.webcrawler.com
Yahoo!	http://www.yahoo.com

*DejaNews is a search engine for USENET newsgroups.

†These sites offer subscriptions to medical search services.

net Phone (<http://www.intel.com/iaweb/cpc>) is designed to work with either the Internet Explorer or Netscape Navigator and has companion applications that allow exchange of data and images simultaneously with the phone call.

Videoconferencing is possible using the Internet but, until recently, the specialized equipment required for this type of service was beyond what a typical personal computer could support. Advances in equipment and data compression techniques now allow anyone with a personal computer to participate in videoconferencing. While there are several commercial software packages for this service, one of the most experienced developers of this technology, Cornell University, offers free software for videoconferencing. This software, CU-SeeMe, and a description of technical requirements for setting it up can be found at <http://cu-seeme.cornell.edu>.

SEARCH SERVICES

There are now tens of millions of Web pages available to the general public on the Internet and every day thousands of new pages are added. The need to have some sort of indexing method to coordinate this information has spawned a number of services that have searchable databases of Internet resources, primarily the WWW. Each of these search services uses its own method of indexing information and you should try several of them to determine which one best suits your needs. Some sites offer tutorials on how to perform searches, but all of them accept simple keyword searches. Table 2 gives a list of the better known programs for searching the WWW and other types of sites on the Internet. It is difficult to give a comprehensive review of these services since they are continually upgrading and revising their search algorithms and databases. The most comprehensive search engine on the Internet as of this writing is a redesigned version of Inktomi™ at <http://www.hotbot.com>. The home page claims to have a complete index of the entire contents of over 50 million Web pages in its database.

A few simple suggestions can facilitate finding information. Using the search term *nuclear medicine*, for example, at the Alta Vista site (<http://altavista.digital.com>) returns more than

200,000 references. Using the same term including quotes, "nuclear medicine", narrows the search to around 10,000 documents because the first term returns any document that contains the words *nuclear* and *medicine* while the second term requires an exact match of the phrase *nuclear medicine*. Since some of the search services index every word on every Web page in their databases, they can be used for searching for individuals and e-mail addresses. The search term CNMT, for example, locates many nuclear medicine technologists.

PERSONAL WEB PAGES

One of the major difficulties in using the Internet is the rapidly expanding number of Web pages. Finding information is relatively easy using the search services described above, but finding relevant information is becoming more difficult. Several sites create custom Web pages to help alleviate this problem for users.

The simplest of these approaches allows you to construct Web pages from templates and to store this information in a file on your hard disk. Netscape (<http://home.netscape.com>) and Microsoft (<http://www.msn.com>) provide a link on their home pages to such templates. The file containing the information entered on the template is called a cookie. After you provide your preferences (URLs to places of interest and choices in areas such as search services, sports, business, etc.), the Web server creates a cookie file on your hard disk. When the home page of Netscape or Microsoft is accessed, the server retrieves the file and the information in the cookie is used to create a Web page. This customized page can be displayed only by the computer on which the cookie file is located. Other Web servers automatically create cookies when you connect to a site, storing information on user choices to help create individualized Web pages when you again visit the site.

Some Web sites provide software programs that create a more sophisticated display of user-defined areas of interest and update all areas simultaneously when requested by you. The updates are stored on your hard disk so that information can be viewed off-line, in other words, once the information is downloaded you can disconnect from the Internet. This saves access charges and makes information retrieval much more rapid once it has been downloaded. There are several Web sites that offer programs for creating personal information resources. A good example is the PointCast Network at <http://www.pointcast.com>.

A more advanced service that will be available in the near future is the personal user agent. Several companies are developing servers that will store information in a user profile and search for Web pages that match criteria in the profile. When you download your personal Web page from the server, a new dynamically created Web page is returned with links to Web pages that meet criteria in the profile.

WEB AUTHORING

Web authoring tools are becoming more common and there are now many software packages similar to word processors that can be used to create Web pages. As discussed in Part 3 of

the continuing education series (2), however, it is relatively easy to create interesting Web pages using just a few HTML tags and any editor that produces simple (nonformatted) text files. You can create the HTML files on your PC and transfer them (for example, by ftp) to the computer on which the Web server is located. By placing the files in a directory accessible to the Web server, these files become available on the WWW.

I will demonstrate how you can make files available on the WWW. I have a Unix account with a local Internet service provider, Teleport, Inc., in Portland, Oregon. Using an ftp program on my PC, I have transferred several HTML, text and image files to my account at Teleport. Teleport allows subscribers to use its Web server, <http://www.teleport.com>, to publish Web pages on the WWW. Teleport uses a standard Unix convention for doing this. Files accessed through an individual's account are placed in a special subdirectory called `public_html`. Each user has this subdirectory in his home directory. The URL of this subdirectory is given the name <http://website/~username> where `website` is the domain name of the computer and `username` is the way an individual is identified by the computer. The symbol `~` tells the Web server to look in the `public_html` subdirectory of user's home directory for files. Thus, to access files from my account at Teleport, the URL <http://www.teleport.com/~glowniak/filename> is used where `glowniak` is my username and `filename` is the name of any file in my `public_html` subdirectory. To see the structure of my HTML files, click on a filename to download and display a Web page. Then select View from the main menu bar of the Web browser. A pull-down menu appears. Choose Document Source. The HTML file that created the current Web page will be displayed.

When you create a Web site from your account, you have the option of specifying a home page. On Unix systems, the home page is named `index.html`. If <http://website/~username> is accessed without specifying a filename in the URL, the home page is displayed. If you do not name a file `index.html`, in other words, you do not designate a home page, <http://website/~username> will produce a hypertext-linked menu of all the files and subdirectories in the `public_html` subdirectory. Note that the subdirectory `public_html` where the files are located is never named in a URL; the Web server automatically reads from this directory when the URL <http://website/~username> is encountered. I have not designated a home page for my account so that you can see all the files I have used for my Web site. Entering <http://teleport.com/~glowniak> displays the directory listing shown in Figure 1. I created the HTML files on my PC which is a DOS-based system. DOS only allows three character extensions to file names, so I labeled the HTML files with the `htm` extension (I could have changed the extension to `html` once the files were on the Unix system, but there is no need to do this). A Web browser that encounters either an `html` or `htm` extension on a file will interpret the file as an HTML file. I have included several image (GIF) files in a subdirectory called `GIF`. Some of these GIF files are used in the accompanying HTML files. To view the images without the Web pages, go to the `GIF` subdirectory and click on a file

Index of /~glowniak			
Name	Last modified	Size	Description
 Parent Directory	27-Jul-96 17:39	-	
 GIF/	27-Jul-96 17:33	-	
 Medical	18-Jun-96 15:25	1k	
 babel195c.txt	19-Jun-96 11:33	120k	
 home-ear.htm	27-Jul-96 17:34	1k	
 home.htm	27-Jul-96 17:36	1k	
 home2.htm	27-Jul-96 17:37	1k	
 update.htm	28-Jul-96 12:32	5k	

FIGURE 1. Index of <http://www.teleport.com/~glowniak>. Contents of the author's Web site as displayed by Netscape.

name. I obtained these GIF files from image archive sites around the Internet.

It should be noted that it is not necessary to write documents in HTML to make them available on the WWW. I have included two text files in my home directory: Medical and babel19c.txt. A Web browser will interpret a file as plain text if its extension is txt or if there is no extension, as is the case with the file Medical. You can access a file by clicking on it or by specifying its URL, such as, <http://www.teleport.com/~glowniak/Medical>.

I have created an HTML file called update.htm that contains all the links in this article. I update this file periodically so that links that change can still be found. The HTML file home.htm was described in a previous article (2). The other home HTML files are variations on home.htm that demonstrate different ways of creating Web pages. To view an HTML file directly, use the View option.

For individuals who do not wish to create Web pages themselves, there are a large number of commercial organizations that offer this service. Many ISPs will construct Web pages for their subscribers at a discounted rate and make the pages available on the Internet through the ISP's Web server.

FINDING PEOPLE

One of the most frequently asked questions is how to find people on the Internet. Over the last several years, indexing methods and protocols have been developed to provide the equivalent of Internet telephone books. Protocols such as whois, finger and cwis (2) are in use, but they have fallen far short of the goal of creating truly comprehensive directories. Within the last year, several Web sites have developed extensive directory services. The Four11 service (<http://www.four11.com>), Switchboard (<http://www.switchboard.com>) and Search America (<http://www.searchamerica.com>) use the telephone directories of all the Bell telephone companies in the U.S. as their databases. Using these services, it is possible to search for anyone by name in a given city, state or the entire U.S. International directories are under development. These sites also have separate directories for e-mail addresses.

As might be expected, the telephone directories are much more comprehensive than the e-mail directories. Search America, for example, claims to index 95% of telephone numbers for households and businesses in the U.S. A yellow page directory is available at <http://www.bigyellow.com>. One complementary service that helps to locate individuals geographically is GeoCities at <http://www.geocities.com/BHI/geoviewer.html>. This service produces maps of locations based on addresses, cities or states. A similar service is Mapquest (<http://www.mapquest.com>).

MEDICAL RESOURCES

A large increase in medical resources has paralleled the growth of the WWW. There are several ways to find relevant medical and nuclear medicine resources. One straightforward approach is to use the search services listed above. In addition, several medical Web sites have links to general medical resources or resources in a particular area. One example is Hospital Net at <http://neuro-www.mgh.harvard.edu/hospitalweb.nclnk> that provides an index of hospitals with Web pages arranged by country and state. Many of the medical and nuclear medicine sites in Part 4 of the continuing education series on the Internet (1) contain similar indices. Word of mouth from colleagues, USENET newsgroups and mailing lists are other sources.

Anyone who has explored Web pages on the WWW soon realizes that much of the information is redundant, of poor quality or not relevant to their needs. Recognizing the need for critical evaluation of information on the Internet, some organizations have begun offering reviews of Web sites. Web Watch is a service provided by the American College of Physicians (<http://www.acponline.org>) that evaluates medical sites on the WWW. The concept of peer review, however, is much more difficult to apply on the Internet than with printed journals because of the extreme ease of publishing material on the WWW, the large number of Web sites and the fact that content is not static. Furthermore, most Web sites do not archive their material, so even relevant information can disappear. In addition, a well-run Web site that offers extensive information requires a Webmaster who functions in many ways that are similar to the editor of a print journal. For any Web site that seeks to maintain up-to-date, relevant information, a Webmaster is a full-time job. Sites that employ individuals who are not skilled in both the technical administration of the site and the content of the material being offered may produce low-quality information.

There are Web sites that function as search services for medical resources. Two of these are Health Gate (<http://www.healthgate.com>) and the Knowledge Finder (<http://www.kfinder.com>). Both sell subscription services to several major medical databases including Medline. In order to attract interest, they offer free, though limited, Medline searches from their home pages.

NUCLEAR MEDICINE RESOURCES

The number of nuclear medicine sites on the Internet continues to increase. One way of locating resources is to employ the search services. Using Alta Vista and the search string hospital + "nuclear medicine", you can locate a large number of nuclear medicine departments. Similarly, since many medical organizations and medical journals have Web pages, you can also locate them through the search services. The search string "nuclear medicine communications" locates this journal at <http://www.thomson.com:8866/journals/nmc.html>.

Some of the best nuclear medicine resources on the Internet are the Joint Program in Nuclear Medicine at Harvard (<http://www.med.harvard.edu/JPNM/JPNM.html>), the Mallinckrodt Institute of Radiology (<http://gamma.wustl.edu>) and LUNIS, the Loyola University Nuclear Information System (<http://www.lunis.luc.edu>). These sites were discussed in Parts 3 and 4 of the continuing education series (2,1). All of them have expanded and updated material at their sites.

The Web sites at Harvard and the Mallinckrodt Institute of Radiology have large teaching files. A recent article in the *Journal of Nuclear Medicine* described how these and other sites could be integrated into an Internet-based nuclear medicine teaching resource (4). These sites have added many new links to other resources including nuclear medicine and radiology departments, PET facilities, vendors of nuclear medicine related products and services, and nuclear medicine and radiology organizations.

LUNIS functions as a nuclear medicine bulletin board allowing active exchange of information between registered users. One of the new sites that has a hyperlink at LUNIS is UNM, Ltd. (<http://www.unm.inter.net>), a source for medical educational and practice management materials.

An interesting service is the Nuclear Medicine Review Manual (5) at the University of Texas Health Science Center at San Antonio (<http://nuc-med-read.uthscsa.edu>). This manual, created by Scott Williams and Christopher May, is a textbook-like reference source for selected topics in nuclear medicine that is updated on a regular basis. A useful feature is that you can download the entire manual to your hard disk where you can access it locally (off-line) rather than across the Internet, mark-

edly speeding up information retrieval. Of course, the downloaded version becomes a static document and can be updated only by downloading a new version of the manual.

More vendors have developed Web pages within the last year. Two noteworthy additions are Siemens (<http://www.sms.siemens.com/nmg>) and ADAC Laboratories (<http://www.adaclabs.com>). Other vendors can be found through the search services or hyperlinks at the nuclear medicine Web sites described above.

CONCLUSION

The topics covered in this article are just some of the changes that are occurring on the Internet. Development of more advanced capabilities, such as telemedicine and video services, will become more commonplace when high-speed data transmission is more readily available. One of the best ways of keeping informed of the latest developments on the Internet is through the Internet itself. As one example, Netscape has a great deal of reference material on its home page. Many of the resources discussed in this article can be found there. There are also many computer magazines that deal with the latest developments on the Internet from general purpose publications such as *Byte* to Internet magazines such as *Internet World*, *Net Guide* and *The Net*. Yahoo! has an index of computer and Internet publications with links to their Web sites. Many of these magazines can be found at computer stores and bookstores.

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