WORLD WIDE WEB

Introduction

The *World Wide Web*, or just "Web" for short, is a rapidly growing collection of over 800 million *pages* (in 1999) linked together in a seemingly disorganized topology which is densest over the Western Hemisphere and western Europe, but is nonetheless worldwide in scope.

A Web page resides on a *server*, a host computer (*q.v.*) which allows general access for computers connected to the host network. The largest network, the Internet, is a collection of thousands of other networks which are interconnected via common network protocols (*q.v.*) (see below). The networks which form the Internet may be either local area networks (LANs—*q.v.*) or wide area networks (WANs) and public (e.g. community Freenets) or private (e.g. Internet Service Providers— ISPs—such as America Online). While each network has different characteristics owing to its individual role and user community, all share the characteristic of supporting mainstream Internet software, including, but not limited to, that which enables the Web.

A *Website* is a coherent cluster of one or more pages (on one or more servers) whose *home page* is accessed using a *Uniform Resource Locator* (URL). Websites store information according to the tagging conventions of the HyperText Markup Language (HTML). HTML is an application of Standard Generalized Markup Language (SGML) which is a popular document definition language within the publishing community. HTML has one important extension of SGML: *hyperlinks* (*see* HYPERTEXT), usually called just *links*. They are conduits to other resources including offsets within documents, other documents, imagery, animation and motion pictures, executable programs called Server-Side Includes (SSIs), Java applets etc. Typically hyperlinks appear in Web documents either as sensitized text (in color) or as sensitized icons, where "sensitized" means that selecting a link (usually by a mouse (*q.v.*) click) produces some navigational effect. The link uses a URL to specify the location of the hyperlinked resource. The time to access a remote resource depends upon the network bandwidth (*q.v.*) available to its location.

WEB Perspectives

NETWORK PERSPECTIVE

The World Wide Web represents a major paradigm shift in networked computing both in terms of delivery of information and inter-personal, though not in-person, communication. It is the first form of digital communication that has rendering and browsing utilities adequate to allow any person or group with network access to share media-rich information with anyone else. As such, it represents an important departure from more traditional network communications protocols (*q.v.*) such as Telnet and FTP. Where prior network protocols were special purpose in terms of both function and media formats, the Web is highly versatile.

Formally, the Web is a client–server model for packet-switched (*q.v.*), networked computer systems that use a few key Internet protocols. The client handles all of the interaction with other components of the computing environment (i.e. other desktop applications and the server) and temporarily retains information for perusal. The networked servers are information repositories which host software to serve client requests. The procedural "glue" which makes the client–server interactivity possible is the concurrent support, by both client and server, of the protocol-pair HyperText Transfer Protocol (HTTP) and HyperText Markup Language (HTML). The former establishes the basic handshaking (*q.v.*) procedures between client and server, while the latter defines the organization and structure of Web documents to be exchanged. As of July 1999, the current HTTP version remained 1.0, although the draft standard for HTTP 1.1 has been approved by the Internet Engineering Task Force (IETF—http://www. ietf.org). Version 4 of HTML is the recommended standard by the World Wide Web Consortium and is in widespread use.

As a historical aside, according to NSFNET Backbone statistics, the Web moved into first place both in terms of the percentage of total packets moved (21%) and percentage of total bytes moved (26%) along the NSF backbone in the first few months of 1995. This placed the Web well ahead of the traditional Internet activity leaders, FTP (14%/21%) and Telnet (7.5%/2.5%), as the most popular Internet service. A comparison of the evolutionary patterns of the Web, Gopher and FTP is graphically depicted in Fig. 1. The trends speak for themselves. There are no corresponding statistics after 1995 since, after that, there was no single backbone from which to monitor traffic, but by 1999 it is likely that Web access accounts for more than 99% of Internet traffic and all other modes less than a collective 1%.

The rapid growth of the Web is the result of a unique combination of characteristics:

1. *The Web is an enabling technology.* It was the first widespread network technology to extend the notion of virtual network machine to multimedia
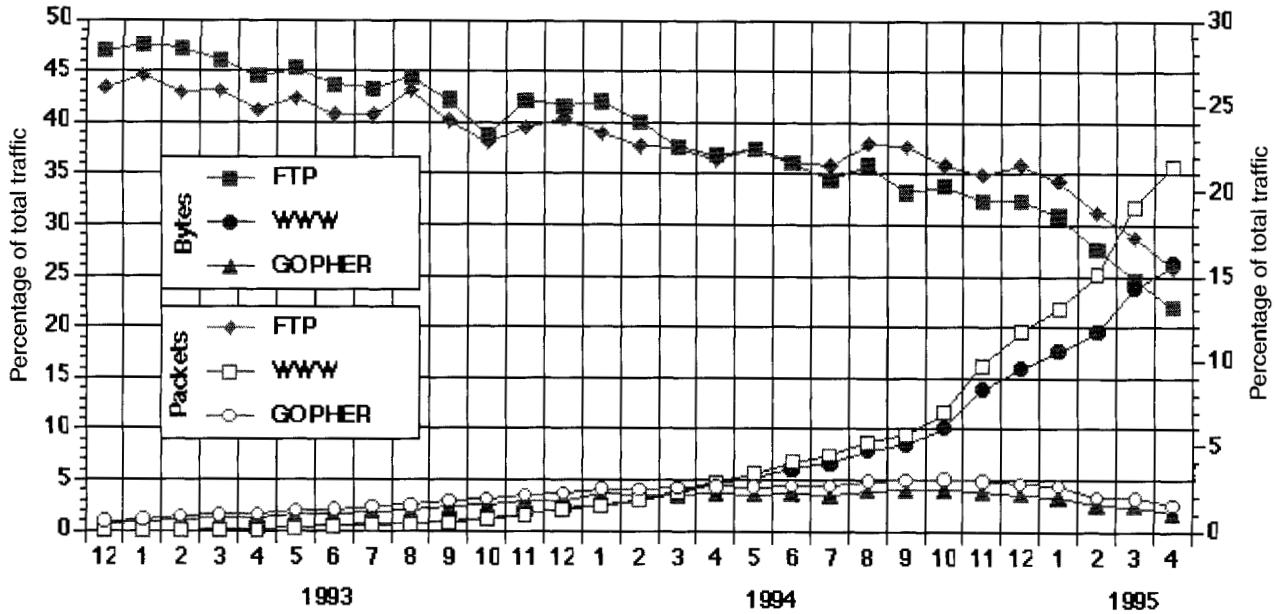
Figure 1. Merit NIC Backbone statistics for the Web, Gopher and FTP from 1993–1995 in terms of both packets and bytes (source: Merit NIC and Jim Pitkow, used with permission; see http://www.cc.gatech.edu/gvu/stats/NSF/merit.html).

(*q.v.*). While the ability to execute programs on, and retrieve content from, distributed computers was not new (e.g. Telnet and FTP were already in wide use by the time the Web was conceived), the ability to produce and distribute media-rich documents via a common platform-independent document structure was new with the Web.

2. *The Web is a unifying technology.* This occurred through the Web's accommodation of a wide range of multimedia formats. Since such audio (e.g. .WAV, .AU), graphics (e.g. .GIF, .JPG) and animation (e.g. MPEG) formats (*see* Appendix I for meaning of acronyms) are all digital, they were already unified in desktop applications prior to the Web. The Web, however, unified them for distributed network applications. Web "browsers," as they later were called, would correctly render dozens of media formats regardless of network source.

3. *The Web is a social phenomenon.* This aspect evolved in three stages. Stage one was the phenomenon of Web "surfing" (*see* the later section *Surfing the Web*). The richness and variety of Web documents and the novelty of the experience made Web surfing the *de facto* standard for curiosity-driven networking behavior in the 1990s. The second stage involved such Web interactive communication forums as Internet Relay Chat (IRC—*see* ONLINE CONVERSATION), which provided a new outlet for interpersonal but not-in-person communication. The third stage, which is in its infancy as of this writing, involves the notion of *virtual community*. The widespread popularity and social implications of such network-based, interactive communication

is gradually moving out of the research arena and into practice. At the end of this article there is further discussion of the Web as a social phenomenon and of virtual communities.

4. *The Web can significantly reduce transaction friction and the expense of commerce.* The commercial potential of the Web is being highly touted and widely exploited worldwide. A broad base of electronic commerce vendors is already established in the areas of bookselling and music sales, software and hardware sales, electronics, travel, online brokerages and banking, and auctioning, to name but a few. The explosion of valuation of NASDAQ "Internet stocks" in early 1999 was to a great degree due to the online commerce start-ups (e.g. Amazon.com, eBay, E*trade) that continued throughout the first half of that year with exceptionally high stock price/earnings ratios without precedent. This gives some estimate of the investor's perception of the enormous potential of electronic commerce. Perhaps not surprisingly, the pornography industry was the first to pioneer the widespread use of electronic commerce. Although, of course, the nature of the content was objectionable, electronic commerce vendors profited extensively from the pornography experience for insights into electronic transactions.

END USER PERSPECTIVE

Extensive reporting on Web use and Web users may be found in a number of Web survey sites, perhaps the most thorough of which is the biannual, self-selection World Wide Web Survey which began in January 1994. Some general summary information from the tenth survey in July 1999 is reported in Table 1.

Table 1. Summary information on Web uses from the tenth (1999) WWW User Surveys at the Georgia Institute of Technology (http://www.cc.gatech.edu/user_surveys/). Since this is data from a self-selection survey in which users decide whether or not to participate, the sample is likely to be biased toward experienced users.

- Average age of Web user = 37.6 years
- Male : female ratio of users = 66 : 34
- Education: college degrees = 33.9%; Masters = 17.2%; Doctorate = 3.4%
- Users in private (public) sector = 62.4% (19.4%)
- Users for whom English is the primary language = 92.2%
- Client operating systems: Microsoft Windows = 70.7%; Apple = 23.7%; Unix = 3.1%)
- Browser preference: Netscape Communicator = 61.6%; Internet Explorer = 56%
- Source of browser: free download = 36.4%; bundled with hardware or software = 23.4%; provided by Internet Service Provider = 17.3%
- Geographical distribution of Web use: USA = 84.7%; Europe = 7.3%; Canada = 3.8%
- Connection speed: 56 Kb/sec or less = 66.3%; 1 Mb/sec or more = 23.5%
- Respondents who reported Web purchases exceeding $100 = 71%
- Average income of respondents = $57,300

HISTORICAL PERSPECTIVE

The Web was conceived by Tim Berners-Lee and his colleagues at CERN (now called the European Laboratory for Particle Physics) in 1989 as a shared information space which would support collaborative work. Berners-Lee defined HTTP and HTML at that time; see his profile in ENTREPRENEURS. As a proof of concept prototype, he developed the first Web client navigator–browser in 1990 for the NeXTStep platform.

Nicola Pellow developed the first cross-platform Web browser in 1991 while Berners-Lee and Bernd Pollerman developed the first server application—a phone book database. By 1992, the interest in the Web was sufficient to produce four additional browsers—Erwise, Midas, and Viola for the X Window system, and Cello for Windows. The following year, Marc Andreessen of the National Center for Supercomputing Applications (NCSA) wrote Mosaic for the X Window system, which soon became the browser standard against which all others would be compared. For the more recent history of browsers, see the subsection on *Commercial Products* in the *Browsers* section later in this article.

Despite the original design goal of supporting collaborative work, Web use has become highly variegated. The Web has been extended into a wide range of products and services offered by individuals and organizations, for commerce, education, entertainment, "edutainment," and even propaganda. A partial list of popular Web applications includes:

- Individual and organizational *home pages*
- Sales prospecting via interactive forms-based surveys
- Advertising and the distribution of product promotional material
- Corporate record-keeping and databases—usually via local area networks (LANs) and Intranets
- Data warehousing (*q.v.*)
- Electronic commerce:
  —Web-centric commerce, where the entire transaction is conducted on the Web (e.g. book sales, electronic banking and brokering, online reservation systems, online publishing)
  —Web-augmented commerce, where the Web provides ancillary support for the transaction (e.g. catalogs, product support, manuals, frequently asked question (FAQ) sites)
  —Web-mediation, where the Web connects the information consumer and information provider directly (e.g. media kiosks and edutainment, electronic auctioning, information agency)
- Religious proselytizing
- Propagandizing
- Digital politics and electioneering (*see* POLITICAL APPLICATIONS)
- Creation of information portals (e.g. Web search engines)
- Low-bandwidth teleconferencing

Most Web resources remain for the most part non-interactive, multimedia downloads (e.g. non-interactive Java animation applets, movie clips, real-time audio transmissions, text with graphics) augmented with Common Gateway Interface (CGI) forms (*see* SCRIPTING LANGUAGES), and frames for added control of layout. This "rectified" information flow will change in the next decade as software developers and Web content-providers shift their attention to the quality of content as well as the interactive and participatory capabilities of the Internet, the Web, and their successor technologies. However, in 1999 the dominant Web theme still seemed to emphasize form over function and esthetics over content.

Support of CGI within HTTP in 1993 was the first major step toward adding interactive capability to the Web. Though modest by comparison with modern desktop productivity applications, CGI forms provide a simple mechanism for input from the Web user-client to be passed to the server for processing without any programming expertise. This opened the area of

interactive Web development to the majority of computer users, while the broader use of CGI programming remains within the province of computer programmers. While, in theory, CGI programs can provide server-side support for virtually any Web need, network bandwidth constraints and transmission delays make some heavily interactive and voluminous applications infeasible.

A second major advance was the advent of "plug-in" technology. This increased the media-rendering capability of browsers while avoiding the time-consuming spawning of so-called "helper apps" (applications) through the browser's launchpad. The speed advantage of the plug-ins, together with the tight coupling that exists between the plug-ins and the media formats which they render, make them a highly useful extension. As with helper apps, plug-ins also have the advantage of currency—they can be developed by third-party vendors in parallel with the development of new browsers.

Third, the advent of executable content added a high level of animated media rendering and interactive content on the client side. Such object-oriented network programming languages as Java (q.v.) produce platform-independent program modules which are executable on enabled Web browsers. Not surprisingly, this latest extension, which involves executing foreign programs which have been downloaded across the networks, is not without some security risk, although the same is true of such pedestrian applications as email, as was demonstrated by the Melissa virus that spread via email in early 1999 (see VIRUS, COMPUTER).

Fourth, we have seen advanced information-gathering strategies which go beyond the original "information-pull" concept behind the Web. Where most users, perhaps through autonomous software agents, currently seek to draw information to them, solicited *push technology* attempts to dispense information routinely and automatically to selected consumers (see Fig. 2). Several prototypes of solicited push "netcasting" have been deployed. Some, like Pointcast, consolidate and distribute information via a proprietary server called a *transmitter*. In this case, the client-side software behaves as a dedicated "peruser" for the transmissions. Other solicited push technology, such as Marimba's Castanet, contain a "tuner" which allows the client to connect to an arbitrary number of different servers. Each connection from the client to the transmitter is called a *channel*.

Although somewhat in disfavor as of 1999 because of the initial curiosity-driven abuse of bandwidth (q.v.) in 1997–1998, push-phase technology will continue to play an important, though different, role on the Web, especially within Intranet and Enterprise environments.
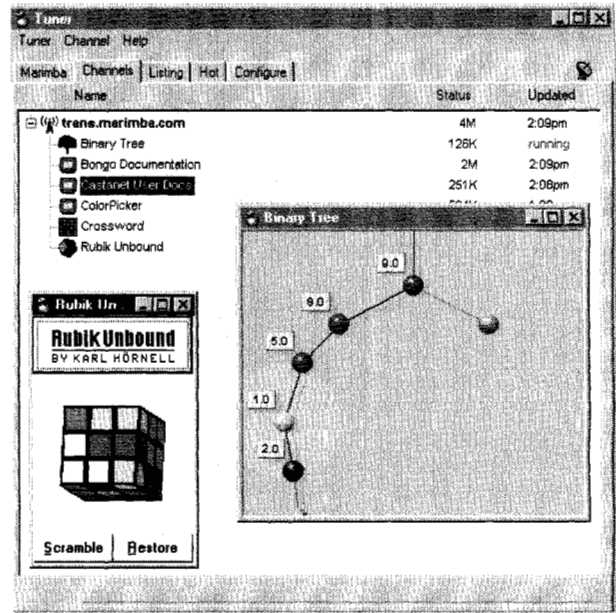

Figure 2. Marimba Corporation's Castanet tuner with two channels open, one which animates binary tree growth as random values are inserted, and the other which supports interactive Rubik cube play.

Finally, the concept of a relying on a single predefined document-structure language has been challenged. Motivated by the rapid and seemingly uncontrolled movement of HTML standards away from structure and toward format, new languages like the eXtensible Markup Language (XML) are undergoing development. XML is an application tool which seeks to render both HTML and Standard Generalized Markup Language (SGML) interoperable on the Web. In a sense, XML is an attempt to reunite HTML with its SGML roots by overcoming the former's penchant for format considerations while supporting a broader range of page design for multimedia applications. By incorporating "personal" or "group-oriented" tags, XML also overcomes a fundamental weakness in HTML, namely that HTML document structure is static between users. XML overcomes this by allowing individualized document designs. (*See* http://www.w3.org/XML/).

CGI, plug-ins, executable content, push technology, and HTML extensions represent significant departures from the original browser-centric paradigm of Web information exchange, and add considerably to Web capabilities.

Surfing the Web

The Web itself, as well as its growth and development, would have been impossible without programs called *browsers* which allow access to the pages of the Web, but in order to search for information efficiently it was

necessary to develop utilities called *search engines*. The use of browsers and search engines together is often called *surfing* the Web. Actually, since the Web is now used for many applications (e.g. financial applications, telephony) in addition to searching for information, these search engines have now become *portals* to the services available on the Web.

BROWSERS

General properties. The central software for browsing the Web is the navigator/browser, or simply, the *browser*. A browser is a client-side program which provides the interface capability to the Web. This software opens a window on the desktop which handles the information exchange with the relevant server. Specifically, this includes the formal request of information from the server (via the URL) and the rendering of that information on the desktop. In the earliest days of the Web, this rendering was restricted to text. Since the early 1990s, rendering has been extended to virtually the full range of multimedia.

A Website may contain a cluster of documents and resources. When a document or resource fits within a single browser window (which may be larger than the browser's viewing window), it is referred to as a Web page or Web document. When this Web page is the primary page of an entire Web site, it is called a home page for that site. Examples of home pages include splash pages, which are best seen as multimedia "enticements" to the site, and pass-through pages which serve as navigational or routing menus for visitors. The advantage of home pages is that they are frequently mnemonically associated with the host (e.g. http://www.ibm.com, http://www.acm.org) and thus provide a unifying effect on the entire Website.

Other pages on the site and which are linked (perhaps indirectly) to the home page are said to be *derivative* of the home page. As an example, the homepage for the XYZ Corporation might be http://www.XYZ.com/homepage.html. If no HTML page is specified, the default page or file is assumed to be index.html. Thus, the links http://www.XYZ.com/index.html and http://www.XYZ.com will have the same effect on the browser. It is common to structure Web sites hierarchically, either in terms of the contained links, or in terms of the underlying file structure on the server, or both. In this manner, the URL http://www.XYZ.com/corporate_officers/ would refer to the subdirectory "corporate_officers" beneath the root directory of the Website (named public_html on the server machine). A browser would look for a file called "index.html" in that subdirectory for information on what to display. However, more complex Websites may eschew the simplicity of hierarchical organization for more complex network models.

Commercial products. In its earliest days, the popularity of the World Wide Web was inextricably linked to one browser, Mosaic, developed at the National Center for Supercomputing Applications. While Mosaic was but one of several competing Web-based browsers available at that time, it quickly displaced the others as the dominant environment for taking in the Web experience. By 1993 Mosaic had more than 90% of the browser market and became the design standard against which all other browsers would be compared for years to come. In 1994, the primary designer and developer of Mosaic, Marc Andreessen, went on to co-found Netscape Communications, whose Netscape Communicator became the *de facto* standard for second-generation Web browsers (*see* Fig. 3). In 1999, the browser market was about evenly split between Netscape and the latest entry into the so-called browser war, Microsoft's Internet Explorer. Both products are currently available as standalone products or bundled with other programs like text editors, email facilities, graphics packages, and office productivity applications. (For information on the history of browser features, see the World Wide Web Test Pattern at http://www.uark.edu/~wrg/). The "findings of fact" in November 1999 by Judge Thomas Penfield Jackson in the US Department of Justice prosecution of Microsoft may result in a lessening of Microsoft's advantages in its "browser war" with Netscape (*see also* MICROSOFT).
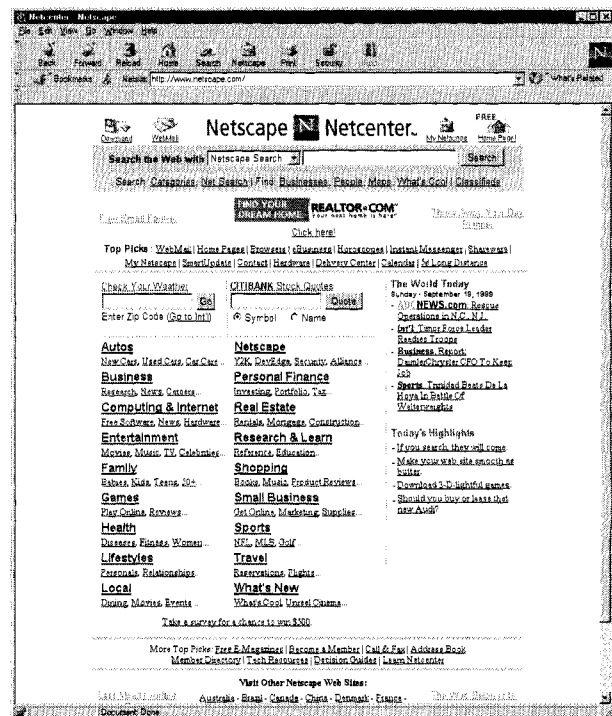

Figure 3. Netscape Navigator 4.5 is a recent generic "navigator/browser" from Netscape Corporation. Displayed is Netscape's Netcenter portal page, which acts as a gateway to Web content.

SEARCH ENGINES

With millions of Websites and Web pages and an astonishing growth rate, a major issue for users is finding relevant information. To meet the need, several search engines have evolved, such as Yahoo!, Excite, AltaVista, Lycos, Webcrawler, Northern Light, Infoseek, Hotbot, Snap, Google, and many others. (Some search engines, such as Yahoo!, whose information is compiled by human editors who search the Web, are perhaps better called *directories* to distinguish them from others whose information is compiled from automated searches of the Web.) Each browser contains a "search" link that leads to a particular search engine, or list of engines. Alternatively, the user who wants to call a particular engine can either recall a link to it from a list of *bookmarked* sites or, if known not to be there, enter its URL from the keyboard.

Users may query search engines using keywords or key phrases. Most engines support complex Boolean operations. For example, one can ask to find all Websites that refer to "strike AND delivery BUT NOT (baseball OR bowling)." Some engines also have proximity operators that allow one to search for occurrences of "encyclopedia NEAR computer." The exact syntax of the request depends on the search engine; there is as yet no standard query format. In addition to the general search engines, there are also search engine sites that specialize in searches for a host of applications in such areas as law, medicine, and health.

To maximize effective service to their users, search engines cruise or "crawl through" the Internet, more or less continuously, searching for information in Websites. Information may be sought in the complete text of the site or just on its page headers; thus Website developers can attract the attention of more search engines by placing certain keywords or phrases at or near the top of their Web pages in attempts to attract more "hits," that is, accesses of their Website. Some search engine companies, most notably Yahoo!, enhance their database of Websites through use of human editors who also create taxonomies and directories in which Websites are catalogued. To gain the attention of these human catalogers, Website creators may also formally register their site with particular search engines, either one by one or by using the services of a third party Internet company which, for a fee, will register a Website with many search engines. Through a combination of registration and their own exploration, search engines develop many pages of information about millions of Websites.

There is an indication, however, that search engine data collection cannot keep pace with the rapid growth of the Internet. The research of Lawrence and Giles (1999) indicates that there are now at least 800 million Web pages, and that the leading search engine (Northern Light at the time of their survey) had indexed only 16% of them. Only two years before, Hotbot, the leading engine of 1997, had indexed 34% (of a far smaller number of pages). In desperation, many users turn to "meta engines" which delegate queries to a number of engines and collect and merge their results, raising coverage to about 42% of the Web. Among these are http://www.metacrawler.com, http://www.metasearch.com, and http://www.dogpile.com.

Another way to manage the growth of information on the Web is to classify its importance to enable users to find the most useful sites. Yahoo's human-constructed directories are one attempt to do this. The experimental CLEVER project explores the graph-like structure of the Web to find sites that are frequently linked-to ("authorities") and those that contain numerous links to such sites ("hubs"). CLEVER can then respond to a query by giving a list of hubs and authorities for the topic, and thus help to guide a search. See http://www.almaden.ibm.com/cs/k53/clever.html and (Clever Project, 1999).

The Lawrence-Giles data also shows the diversification of categories of Web sites. The leading category was "Scientific/Educational," at 6%. "Health" was next at 3%, with categories called "Personal" and "Societies" at about 2% each. What will be surprising to many readers and users (because of the disproportionate amount of email spamming (junk mail) that they generate) is that "pornography" servers account for less than 2% of all Websites.

Most search engine companies base their revenue on the sale of advertising which, in turn, is based upon the number of downloads or page hits that they can offer to an advertiser. The more popular the engine, the higher the price charged.

The Web as a Social Phenomenon

The social effect of the Web remains poorly understood. Not surprisingly, the zeal to harness and exploit the richness of Web resources and technology, combined with the desire to capitalize on commercial Web services, have taken precedence over efforts to understand the social dimensions of Web use.

Much of what little we know of Web behavior seems to be derived from two disparate sources. Descriptive statistics produced by the Web surveys are most useful to measure isolated events and independent activities such as, for example, the number of Windows users who use Netscape, Explorer, or some other browser.

The second source is the study of the use of email. Email's status as a *de facto* paradigm of "interpersonal

though not-in-person communication" makes it a useful testbench for testing hypotheses about network behavior, generally. Since email and the Web share several characteristics (e.g. they both minimize the effects of geographical distance between users; they are both based on user-centric models of communication; both rely on self-imposed interrupts, both are paperless and archivable by default, both create potential security and privacy problems, and neither requires continuous endpoint-to-endpoint network connectivity), email can teach us something about Web behavior.

However, both sources provide incomplete views of Web behavior. Descriptive statistics tell us little about either the causes of emerging trends or the connections and associations between various aspects of Web use (e.g. to what extent, if any, do anonymous Web engagements promote discussion of controversial topics?).

There are differences between email and the Web as well. Email deals with network, peer-to-peer communication partnerships, whereas the present Web remains primarily an information-delivery system. Email, in its most basic form at least, exemplifies *push technology*, while the current Web is mostly *pull* oriented. Of course, the onset of new technologies such as Web teleconferencing and virtual communities will change the nature of such comparisons.

While definitive conclusions about the social aspects of Web use remain elusive, at least some central issues have been identified for future study (*see* Table 2).

We are slowly coming to understand the capabilities of the Web for selected applications and venues. To illustrate, early use convincingly demonstrated that the Web was a popular and worthwhile medium for presenting distributed multimedia, even though we cannot yet quantify the social benefits and institutional costs which result from this use. As CGI was added to the Web, it became clear that the Web would provide important location-independent, multi-modal interactivity, although we know little about the motivations behind such interactivity, and even less about how one would measure the long-term utility for the participants and their institutions.

Virtual Communities

The Web's primary utility at the moment is as an information delivery device, what some authors have called the "document phase" of the Web. However, more powerful and robust Web applications are beginning to take hold. Perhaps the most significant future application will involve the construction of *virtual communities*. Virtual, or electronic, communities, are examples of interactive and participatory forums conducted over digital networks for the mutual benefit of participants and sponsors. They may take on any number of forms. The first attempts to establish virtual communities dates back to the mid-1980s with the community, "freenet" movement. While early freenets offered few services beyond email and Telnet, many quickly expanded to offer access to documents in local libraries and government offices, Internet relay chats, community bulletin boards (*q.v.*), and so forth, thereby giving participants an enhanced sense of community through another form of connectivity. Virtual communities of the future are likely to have both advantages and disadvantages when compared to their conventional counterparts (Table 3).

Table 3. Potential advantages and disadvantages of electronic communities.

Advantages
- Potential for dynamic involvement where membership may be transitory and the infrastructure of the community informally defined.
- Location transparency for members, as all electronic communities are potentially global.
- Capability of self-administration and self-organization by a membership in continuous flux.
- Creation of "thought swarms" through the continuous, interactive stimulation of participants.
- Increased attention on content.

Disadvantages
- Quality of experience may not justify the participation, or may degrade over time.
- Potential loss of privacy by invasive Web technologies such as cookies, CGI environment variable recording, and the like.
- Some forms of electronic communication lack intensity, and some may lack content (e.g. more information exchange does not imply better information exchange).
- Not all experiences translate well into the electronic realm, as documented by the easy misinterpretation of email and the "flaming" that can ensue.

Table 2. Social issues and Web behavior.

- To what extent can the effects of information overload be avoided by advanced information retrieval methods?
- To what extent will future interactive and participatory Web engagements become enticing and immersive?
- What are the advantages and disadvantages of anonymous engagement?
- What virtues are there in quasi-independent and relative-identity environments ?
- To what extent will Web use enhance or supplement alternative modes of information exchange?
- To what extent will the Web increase intellectual quality and economy?
- To what degree will complete geographical transparency be realized? How long will it take before Web access moves beyond technologically advanced nations and regions?
- What rules will govern self-organizing and self-administering virtual communities of the future? How will that affect socialization?
- How will electronic communities of the future enhance and complement their physical counterparts?

Conclusion

The World Wide Web represents the closest technology to the ideal of a completely distributed network environment for multiform communication. As such, it may be thought of as a paradigm shift away from earlier network protocols. Many feel that the most significant impact of the Web will not be felt until later in the 21st century, when technologies are added to make the Web fully interactive, participatory, and immersive by default.

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