The Webs and the Web-nots in the Global Economy: Electronic Commerce, the Digital Divide, and Policy Options

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ABSTRACT

With the dramatic growth of World Wide Web (WWW), graphical and multimedia protocols on the Internet gained wide-ranging acceptance. Such protocols are the bases of new networked devices as well as a rapidly exploding range of new electronic commerce services. This paper discusses the Equipment, Software, and Infrastructure factors that affect the possibility and quality of users' access to web, and of the growing Internet-based commercial offerings on the web. Based on an understanding of these factors, it is possible to develop categories of access ranging from threshold access to premium access. The paper offers a conceptual framework for understanding the technological aspects of access to the information superhighway and concludes with a discussion of the role of technological developments in affecting access.

WEBS AND WEB-NOTS

Those using cyberspace today are endowed with widely varying tools for accessing the fast-growing world of electronic information. Consider, for example, the situation of the following two people trying to access cyberspace in 1999:

> Hari Rampal lives in Bangalore, India. He is a textile technologist by day and a cyber-buff by night. From his small apartment, he boots up his Pentium-clone computer and attempts to dial the Internet access number with his 28 Kbps modem. VSNL, the state-owned long distance phone company, in collaboration with MCI International, is the main Internet access provider in India. VSNL's access phone numbers in Bangalore are usually quite busy. The modem re-dials every minute for about 15 minutes before Hari gets a connection to the Internet. He reviews the two E-mail messages he has received from Australia and Mexico, quickly replies to one of them, and then attempts to download, in a batch mode, a videoclip of the latest Star Wars movie trailer. Hari estimates that the 4 MB file will take about 25 minutes to download, and so he goes to the kitchen to heat up his dinner. When he returns to his computer 10 minutes later, he finds that his connection got terminated because of poor line quality. Frustrated, but not ready to give up, Hari fires up the modem again...
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> Jane Kelly lives in Baltimore, Maryland. A systems programmer, Jane works with powerful workstations during the day. She likes to kick around in cyberspace in her spare time. She bought a 450-MHz Pentium III machine and connected it to the Internet with a cable modem service provided by Road Runner. Jane's cable modem service allows unlimited access and, since it is based on the cable TV infrastructure, it is always on – no dial-in protocols are required. One of Jane's favorite pastimes these days is to log on to a

website called Amadeus. This site has hi-fidelity digitized symphonies and concertos, which Jane plays through her 32-bit stereo sound card and speakers. The music is coupled with lovely scanned-in natural scenes that fill up Jane's .19 dot pitch 23-inch monitor. Jane has programmed her Netscape browser to skip to the next link after one piece of music is completely downloaded. "Come to think of it, " muses Jane, "I have hardly used my TV or multi-disc CD player since I got hooked on Amadeus. And with the 16.7 million colors that my video card gives me, even *National Geographic* seems boring."

Although Hari Rampal appears to be much poorly endowed than Jane Kelly in terms of Internet access, even with his limited computing and telecommunications resources he is a part of a very privileged minority on a global scale (Sen 1995). After all, more than 80 % of the world population does not own a telephone (The World Bank 2001) and as advertisements from Lucent Technologies point out, over half the people in the world are yet to make their first telephone call.

Within the privileged world of cyberspace, however, these two cases illustrate that there are great differences in the speed, ease, and quality of access to electronic information among those connected to the "Net". When we step outside the tiny fraction of the world's population that has computing and telecommunications resources available for potentially connecting to the cyberspace, the disparities multiply manifold (see, for example, Schwankert 1996, Zgodzinski 1996). This is a larger issue that has global implications, and it is not addressed here (see Martinez 1994, Sun and Barnett 1994, for treatment of this larger issue). This paper examines the main factors affecting a user's access to and experience with the World Wide Web, assuming that the minimal basic conditions for such access exist. Based on an understanding of these factors, a framework is presented to model the type of access that users have today and may have in the near future. Such a framework can be useful in developing and assessing strategies and policies at various levels -- users, access providers, content providers, and regulators.

CYBERSPACE AS THE NEW MEDIUM

In his book *Being Digital*, Nicholas Negroponte reported that the population of Internet users was growing in 1994 at the rate of 10% per month, a rate that would cover the entire world population if it were to continue till 2003. Other mid-1990s estimates pegged the Internet growth rate at around 15% per month (Vlahos 1995). As a medium for information provision and commercial transactions, the multimedia World Wide Web format has been growing at a phenomenal rate. For example, use of the Mosaic browser for WWW increased at the rate of 11% *per week* from February to December, 1993 (Negroponte 1995, p.5). Depending on who was estimating, World Wide Web traffic grew at an annual rate of 1,713% (Barol 1995, p.29) to 2,300% (Taylor 1996, p.132) in 1994. The Internet doubled in size from 6.6 million hosts to 12.8 million hosts in the first half of 1996, and the number of domains (such as bigcorp.com, state.edu, airforce.mil) quadrupled from 120,000 to 488,000 during this period (Kantor and Neubarth 1996, p.46). Although both the number of hosts and domain names are still growing exponentially, the growth rate has been slowed down. For example, from January 1999 to January 2000, the number of Internet hosts increased from 44.3 million to 72 million (The World Bank 2000, 2001). Likewise, from January 2000 to January 2001, the number of domain names

grew from about 10 million to 27 million (http://www.domainstats.com/). Firms that track worldwide Internet growth – such as Nua Internet Surveys (http://www.nua.ie) – continue to report strong growth in Internet usage in all parts of the world. By November 2000, nearly 401 million people worldwide were estimated to be online. Of these, 167 million were in USA and Canada, 113 million in Europe, 105 million in the Asia Pacific region, and 16 million in Latin America.

The rapid growth of graphical and multimedia formats such as WWW set the stage for the cyberspace to become a major medium of communication and commerce. While the reach of the World Wide Web is still skewed towards high-income, young, U.S., male technophile, survey evidence indicates that the Web is widening its reach and is gradually democratizing (see Table 1). Another survey by SRI International (1996), claimed to be more representative of the web using population than other surveys, correlates web usage to SRI's well-known VALS 2 psychographic segments. Key results from this survey are shown in Table 2.

Surveys such as these indicate that we can no longer view the cyberspace as a specialized resource of the few but have to start treating it on par with other widely available media and infrastructure resources such as newspapers, telephones, television, highways, railways, and airlines. This implies further that we must understand the factors that affect the access to and use of cyberspace resources such as the World Wide Web.

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Tables 1 and 2 About Here

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TECHNOLOGY-RELATED FACTORS AFFECTING ACCESS

How well users can take advantage of emerging information, entertainment and trading opportunities on the World Wide Web and similar Internet protocols depends on a number of factors. Included in these factors are the user's resources -- whether owned by the user or available to the user as an employee. Also included are factors related to the electronic and telecommunications environment in which the user lives or works.

To illustrate the factors that affect the WWW browsing experience, we will group them into three categories: Equipment Dimensions, Software Dimensions, and Connectivity Dimensions. These dimensions are evolving rapidly. It should be noted that the profiles of typical users on the three dimensions presented below are reflective of a particular point in time – early 1999.

Equipment Dimensions

The type of computing equipment the user has determines not only the type of access to the World Wide Web, but the very possibility of WWW access. Many of the low-powered or older computer configurations just do not allow WWW browsing.

World Wide Web users are faced with some baseline processor requirements as well as memory and storage requirements in terms of RAM and Hard Drive size. It is necessary to have

a machine with a x486 or better processor, 66 MHz or more of clock speed, at least 8 MB of RAM and at least 500 MB of Hard Disk space. These are required because, to use today's popular browsers, an IBM compatible machine must be able to run Microsoft Windows (preferably 95 or NT) and the specifications outlined are the minimum necessary for running Windows 95 and NT configurations. To view movie files in formats such as MPEG or Quicktime demands even larger processor capabilities. Therefore, to take full advantage of WWW sites and their multimedia offerings, users need at least a Pentium processor operating at 75 MHz, a minimum of 16 MB of RAM and a fairly large (500 MB or bigger) hard drive.

In addition to a computer with a powerful processor and adequate memory, users also need good color and sound capabilities in their computer systems. Most creators of WWW pages assume that the viewer has computers and monitors capable of displaying more than 256 colors. For very high quality graphics, computer systems capable of 16.7 million shades are also available but are comparatively expensive. Similarly, if a WWW site has a sound file, it is necessary to have at least a 16-bit stereo sound card and high-wattage speakers. On the Macintosh side of things, most newer models come with 256 colors and 16-bit stereo sound out of the box. An owner of an older Macintosh LCIII, for example, can upgrade to 32,000 colors for about $20-$30, by ordering more video memory. Just as with Windows machines, the full use of the Web requires a high-end PowerPC-based Macintosh computer. Multimedia capabilities suitable for the average user machines have been crystallized into industry standards for multimedia PCs -- MPC and MPC-II. In a fast-changing technological environment, however, such standards become obsolete rather quickly.

Not only personal computer connected to fixed telephone network, but also handheld sets are being increasingly used to access the Internet. For instance, NTT DoCoMo of Japan is offering an enjoyable experience of mobile Internet access with color graphics. By March 2001, NTT DoCoMo had more than 19 million subscribers in Japan (Wahl 2001). NTT DoCoMo is expanding its services globally (Platt 2001). An estimate of Yankee Group suggests that the number of users in the United States wirelessly accessing the Internet will reach to 60 million by 2005, up from 200,000 at the end of 1999 (Williams et al 2000).

Users who want to store, share, or reproduce information obtained from WWW have to think about additional equipment issues such as Zip drives, printers, and video recorders. Most users may be able to get good reproductions of Web images using a 360x360 color inkjet printer or equivalent. Those requiring high-resolution images -- advertising agencies, graphic designers, and architects -- may require a much more expensive, high-end color laser printer.

Software Dimensions

Software affects the WWW experience in two ways. First is the programming language in which the web pages are authored. While basic features of the Hypertext Markup Language (HTML) have become fairly standardized, the use of fancier textual, graphical, audio, and video features may affect users in cases where they do not have compatible browsers. Second is the type and version of browser the user has. Not all browsers are capable of supporting all HTML, VRML (Virtual Reality Markup Language), or Java versions and features. As increasing amounts of multimedia content appears on (or is available through) the Web, it becomes not just

desirable but necessary to have browsers with built-in capabilities to read, run, and display multimedia files.

Browsers have evolved at a breathtaking pace. From the early Netscape and Mosaic browsers that enabled the user to view text and graphics, today's browsers either come pre-equipped with or are geared to provide downloads of special applications to view specific multimedia formats. The browser along with its recommended suite of helper applications tends to be resource intensive. In rare cases does the user pay a purchase price for the browser itself, but there is a cost in terms of the storage and memory requirements for the elaborate suite of applications. For example, the full-blown version of Netscape Communicator suite in early 1999 contained 475 files that required at least 40 MB of hard disk space and 32 MB or more of RAM for proper functioning.

While the older browsers are quickly disappearing in the advanced countries, they may continue to be employed to varying degrees in the rest of the world. Inadequate equipment configurations may hamper the deployment of newer (or any) browsers and Helper Applications in many situations in the developing world. It should be kept in mind that although computer prices do not vary greatly across the world, the ability of people to *upgrade* their computers does vary a lot. The very rapid upgrading cycles for computing equipment observable in USA and Canada are unlikely to be found in most other countries, either because of limited economic resources or because the culture is not so technology-driven and upgrade oriented.

As various methods of storing and delivering complex and executable content become widely available, users may not need the powerful hardware required today to download and display multimedia content. In fact, it is very likely that a lot of the intelligence for multimedia applications will reside in the network and be made available at the user's terminal on demand -- a situation analogous to that of the television networks in the 1980s. This was the promise of the Network Computers (NCs) launched by Sun Microsystems, Oracle, Acorn, and others in 1996, although some observers remained skeptical as to whether these stripped-down machines can offer the kind of Web access that even reasonably powerful computers cannot (Vaughn-Nichols 1996).

Connectivity Dimensions

The type of connectivity a user is able to get determines the speed and quality of data transmissions. For examples, users may access WWW sites using anything from a 1200 bps modem to a T3 line, and soon perhaps an OC-12 line which is equivalent to 12 T3 lines bundled together. Large multimedia files take a long time to download when the connection is slow. For example, a 4 MB video file containing a 30-second movie clip may take less than 10 minutes to download using a 56 Kbps modem but nearly an hour to download using a 14.4 Kbps modem. New browsers are "tuned" for a minimum transmission speed. For example, by mid-1999, Netscape and Internet Explorer browsers were tuned for a minimum transmission speed of 33 Kbps.

Even with a fast modem, the reliability and speed of transmission may be affected by the physical quality of telephone lines in the user's locality. For example, a 56 Kbps modem

available on a home computer may yield a realized transmission speed not exceeding 33 Kbps because of the quality of the telecommunication line.

The hypertextual nature of WWW content means that any particular file may travel from its original source to the ultimate user through a series of linked nodes. The slowest link on such an inter-nodal path will determine the overall speed of data transfer. This is something over which the user has very little control. In some cases, deploying search engines may help in finding the fastest possible path to a desired content category. While the total number of Internet users in the "rest of the world" passed the number of users in the United States, the backbone of the Internet remains still largely in the United States. Due to the lack of intraregional infrastructure in developing nations of Asia, Africa and Latin America, even Internet communications with neighboring countries need to be routed through the United States. ISPs in these countries have to pay for the full cost of leased lines to Internet backbones in the United States which increase the costs of providing Internet services in these countries (Petrazzini and Kibati 1999). Table 3 shows that the United States backbone are in the process of being upgraded to an OC-12 speed in some cases, but even T3 backbones are few and far between in the rest of the world, including advanced regions in Europe and Asia (Gregston 1996, Mesher 1996). For example, in the Asia Pacific region, only the link between Japan and South Korea was greater than 45Mbps in 1998 (Petrazzini and Kibati 1999). This is likely to change because of massive efforts by governments and telecommunications companies to build high-speed Internet infrastructures in various parts of the world. For example, a joint venture of AT&T and Alcatel plans to ring the entire continent of Africa with a fiber optic cable capable of transmission speeds up to 2.5 gigabits per second (Zgodzinski 1996).

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Table 3 About Here

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At the content provider's end, the node capacity -- in terms of number of users that can be simultaneously supported by that node -- also affects the browsing experience of users. Users may not be able to access a certain node because of capacity constraints. This is particularly likely to happen in the case of Web sites that provide information related to popular topics or celebrities or event information about fast-breaking news stories such as sports events, mergers and acquisitions, terrorist attacks, natural disasters, or armed conflicts. In an organization with a Local Area Network, such constraints could also arise at the user's end if too many users are simultaneously trying to get on the Web.

To allow speedier access to popular web sites, commercial on-line Internet access providers such as AOL as well as major Internet Service Providers (ISPs) have built "proxying" capabilities in their servers. When such a server detects that a particular web site is popular and being accessed by multiple subscribers, it captures the information in its cache memory in its distributed network of localized servers. The Internet service provider thereby eliminates the need for subsequent users to establish a path to the source site. As the Internet content and usage continue to grow at explosive rates, fears of a breakdown of critical links in the Net are mounting (O' Flaherty 1996). This is likely to give rise to new and strategic approaches to the proxying of popular, specialized, or mission-critical sites. Such "mirroring" and "proxying" capabilities can

multiply the availability of popular content; however, as intellectual property rights are strengthened in cyberspace, it remains to be seen to what extent such strategies will be permitted.

MAPPING ACCESS POSSIBILITIES: A FRAMEWORK

At a more general level, the type of access a particular user has depends on three categories of resources: user's own resources, those made available to the user by service and content providers, and those available to the user in terms of the prevailing infrastructure. The interactions of these three categories of resources determine the quality of access.

User Resources

For any information technology, the access that users have to the technology and their experience with it depends to some extent on their resources. Four categories of resources are useful in understanding user behavior: money, time, space and skills. In general, users who are endowed generously with these resources have the best possibilities of accessing new information technologies and of creating rewarding experiences. For most people, however, there are resource constraints. Access to and experience with new technological offerings, such as the World Wide Web, are shaped by the resource constraints and the way users trade off their limited resources.

The resources of users affect all three categories of factors that influence access to the World Wide Web -- Equipment Dimensions, Software Dimensions, and Connectivity Dimensions. Of the three, however, equipment-oriented factors depend almost entirely on the user's resource situation. Software dimensions depend somewhat on the user's resources, especially in terms of the type of software that the user can install on or access from the equipment available. Connectivity dimensions depend only minimally on user's resources. Connectivity depends more on the user's situation vis-à-vis telecommunications networks.

The costs of Internet services for a user can be broken into two components: setup costs and operating costs (Petrazzini and Kibati 1999). Setup costs relative to per capita income are much higher in developing countries than they are in industrialized ones. Whereas in the United States an average professional can afford three computers for the equivalent of a months salary, in developing countries such as Tanzania a computer costs more than three times an average professional's monthly salary (Petrazzini and Kibati 1999). In comparison to the income level, operating costs are also much higher in developing countries. For instance, regular Internet users in Beijing, China in 1998 spent an average of 35 percent of their take-home salaries on Internet access charges (Rosen 1999). Similarly, in Ghana, the cost of an account with Africa Online in 1999 was $50 a month, equivalent to twice the monthly income of an average Ghanaian (Petrazzini and Kibati 1999).

Resources Provided by Suppliers

As the trend towards the use of multimedia formats such as PDF and remote-residing applications written in languages such as Java gathers momentum, the resource threshold at which users can access the web will be lowered. The Network Computer strategy championed

by companies such as Oracle and Sun Microsystems is clearly seeking to lower the equipment threshold for access to the Web. Similarly, powerful Internet access providers can install servers, switches, and backbones that can store, process, and transmit huge amounts of information. By moving the bulk of the information processing tasks away from the users' terminals and into the network, access and content providers can make it easy for masses of users -- through the use of Network Computers, Internet appliances, Information appliances, and other devices that can hook up to a television set -- to access World Wide Web and other multimedia protocols.

Such trends towards the migration of the intelligence from the terminal to the network merit careful watching (Gilder 1995). Depending on the directions and magnitudes of such changes, the landscape of the information business could alter in dramatic ways. Today's top firms or even sunshine industries could be eclipsed by new players capable of distributing intelligence across the network and enabling masses of users to access the information they desire, on demand, through low-cost, user-friendly terminals that have a high display potency (see Schlender 1996). Acting against this NC-driven model of the Net are the ever more elaborate multimedia content creation at all types of locations and the desire of the users to store and process such content. Companies like Microsoft and Compaq are betting that these tendencies will continue to be strong and keep the demand for high-end PC-type products increasing for years to come.

Infrastructure Resources

Undergirding the whole issue of access to the Internet and the World Wide Web is the telecommunications infrastructure of a nation or region. Because it grew out of U.S. Defense Department's Arpanet, the architecture of Internet provides multiple paths to a site. These features make the Internet robust and survivable in case of natural disasters or armed conflicts. These same features, however, may make particular browsing experiences slow, unpredictable, and frustrating.

The local and regional telecommunications infrastructure of the user -- server connections, local loop telecom lines, inter-nodal connections, switching systems, etc. -- can help the user overcome some of the frustrations of using the Web. Users fortunate enough to be located in new and high-bandwidth telecommunication regions can hope to enjoy a better quality of access than regions lacking such an infrastructure (see Table 3). E-mail or Internet facilities are not available even in major universities of many developing countries. In some universities of India, for instance, only 1.2 or 2.4 kbps connections are available with which one can at best send and receive e-mails but cannot do online searches on the Internet (Arunachalam 1999). Poor telecommunication infrastructures compound the low bandwidth problem. The situation is analogous to electrical power quality and availability. Most regions of advanced countries enjoy uninterrupted power supply. This, however, is not the case in most developing regions where power outages are commonplace. Just as steady industrial progress cannot occur without reliable power supply, similarly steady information age progress cannot occur without a reliable telecommunications infrastructure. Most nations and regions are experimenting with a variety of strategies in the form of deregulation, privatization, and competition in the hope that telecom companies seeking business revenues will put a dense and reliable telecommunications infrastructure in place. Public and private policies needed to promote a high-level telecom

infrastructure are complex and need systematic analysis (see, for example, Dholakia and Dholakia 1994). As we mentioned earlier, in selected regions of the world, efforts to create high-bandwidth communication backbones are under way.

In the euphoric discussion about low-cost Web access devices and an expanding infrastructure to deliver Internet service, one issue is largely side-stepped: What will happen to the basic access charge for Internet service? Since dramatic growth in access will require huge investments in telecommunications and computing infrastructure, there is a distinct possibility that access charges could go up in the short to medium run before coming back to current levels in the longer run. This means that users could face a trade-off characterized by declining equipment and software costs but high monthly service charges.

A Framework for Categorizing Access

Based on the three categories of access dimensions, it is possible to divide the population of current and potential users into three categories -- those having threshold access, those who fall in the "modal" access category, and those having premium access (see figure 1). Threshold access contains those users who have the bare minimum equipment, software, and connectivity configurations for WWW access. These users can access the web but may not be able to use its advanced features and usually have slow or no access to high-resolution images, fancy formatting, and movie clips. The modal access category contains the maximum number of current users. These users have adequate access to the web under the prevailing state of technology. Most of the standard equipment and software, as well as most of the content on the web, has been developed to be accessible and appealing to these users. The premium access category contains users who have access capabilities superior to the modal group. In terms of access quality, this group has the maximum variability -- ranging from users with slightly premium access to "power users" who may have an access quality that is an order of magnitude beyond what is available to the modal user.

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Figure 1 About Here

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Frontier, Upgrading, and Enabling Technologies

It is interesting to examine the impact of technological change on the categories of access. Many technologies are geared towards improving the quality of access at the premium end of the user spectrum. We can call these "frontier" technologies. Examples are ISDN, cable modems, high-end processors and monitors, audio and video cards, and specialized browsers and multimedia software. Such technologies attempt to stretch the premium band and offer levels of super-premium access higher than what was possible before.

Other technologies are geared towards improving the quality of access of the average or the modal user. These can be termed "upgrading" technologies. Examples are upgraded versions of popular browsers and mass-market Helper Applications. Upgrading technologies improve the web usage experience of the modal group, but do not significantly enlarge this group. Finally, there is the category of technologies that help to expand the universe of WWW users by enabling

the non-users to become users. We can call these "enabling" or "empowering" technologies. Such technologies tend to lower the threshold of access. For example, compression technologies such as HARK are attempting to retain very high fidelity in still images, movies, and sound, even at very high compression ratios. Similarly, PDF and Java formats enable the transmission of complex content to simple NC-type machines. A variety of products and services that bring at least some of the popular web content to the TV set are either in the market or in trial stages. Such technologies may make it possible for people with low-end computers and modems, or even a TV set with a cable connection, to access web features that are so far only available to high-end users.

The Politics of Access

In general, users would tend to favor public policies and respond positively to corporate strategies that enhance the interests of the user category to which they belong. Thus, premium users would favor frontier technologies and do all they can to promote and lay their hands on such technologies. Modal users would be especially interested in upgrading technologies, especially those upgrades and enhancements that can be acquired and deployed at little or no cost to the user. Threshold users and non-users would be interested in enabling technologies. Advocacy groups that promote the interests of this last category of people would lobby for public and corporate policies that lower the threshold of access. Internet and Web access clearly emerged as major political issues in the 1996 United States presidential election and will continue to play a role for some years. By 2000, the politics of Internet access was not just an issue in the advanced Western nations but also in poorer countries such as Bangladesh and Uganda.

In a plural and diverse society such as the United States, we find all these three groups, with varying degrees of political activity. Those developing and commercializing new Internet and WWW technologies are also likely to take any or all of these three political positions because each political position corresponds to a particular business strategy. Thus, catering to the premium users with frontier technologies could lead to new business opportunities, perhaps spawn entirely new industries. Upgrading strategies help to maintain the loyalty of the modal group -- the bulk of current users, the upper middle class in the advanced countries. Such technologies help to maintain and enhance the market positions of the key technology giants of today. Enabling technologies could lead to rapid market expansion by reaching out to masses of non-users. Such strategies may prove to be wildly rewarding to those seen as the main providers of products and services that open up the mass market.

The politics of access is not restricted in national level only. In 1999, a number of operators from Asia Pacific region issued a joint statement in which they claimed that it is inappropriate for them to cover the entire cost of the international Internet backbone between the Asia Pacific region and the U.S. (Petrazzini and Kibati 1999).

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Table 1: Profile of World Wide Web Users - 1995 and 1998

Demographic Variable	Profile of World Wide Web Users		Comments
	late-1995	late-1998	
Location	80.6% United States 9.8% Europe 5.8% Canada, Mexico	84.4% United States 5.8% Europe	User percentages located in Asia, South America, Oceania, and Africa are small but growing rapidly. There is clearly a greater tendency for US users to respond to GVU surveys in 1998
Gender	70.7% Male 29.3% Female	61.3% Male 38.7% Female	Europe continued to be more heavily male in terms of web usage. By late 1998, just over 16% users were female
Average Age	N/A	35.1 yrs. overall 35.5 yrs. Men 34.4 yrs. Women	European age profiles are younger than the U.S. profiles. In the first-time user group, women outnumber men
Average Income	$69,000	$52,500	Significant non-response in income reporting
Occupation	23.7% Education 31.4% Computer-related	26.2% Education 22.3% Computer-related	In Europe, users were more likely to be in computer-related fields

Source: Adapted from data from GVU 3rd and 9th WWW User Surveys, as reported in Kantor and Neubarth (1996) and on the GVU website. Also based on NUA Internet Surveys, 1999 and RITIM Research, 1999. It should be noted that GVU survey respondents self select themselves.

Table 2: Web Usage by Psychographic Segments

VALS 2 Psycho-graphic Category	Profile of the Psychographic Category	Percentage of U.S. Population	Percentage of Web User Population	Comments
Actualizers	Active, discriminating, adventurous, In the prime of life, Nearing the peak of occupational income. Read magazines like *Scientific American* and drive cars like Acura, Travel a lot	10%	50%	Heavily male dominated (77% of users), 70% believe Web makes them more productive, 70% also surf for fun, 44% report conflict between work and fun surfing
Strivers	Followers rather than leaders	14%	13%	Spend more time than any other segment of the Web, 70% report conflict between recreational web-surfing and work, probably use in college or right after it
Experiencers	Young, innovative, stimulation seeking, fashionable	12%	18%	Use web are cool toward it, Easily bored by text-heavy and slow Web content
Fulfilleds	Older, Practical, Desiring order, Read magazines like *Consumer Reports*	11%	11%	Find the Web difficult to use in form and content, Waiting for better navigation tools, contextual authority, and trusted brands on the Web
Achievers	Stable, upscale, family-oriented segment; Occupations like management and sales	15%	6%	Heavy representation of women in this segment; Time-pressured; Not thrilled by male-oriented, disorganized Web; Value personal relationships and find Web lacking
Believers, Makers, and Strugglers	Various profiles, usually associated with lower socio-economic status	38%	2%	Lack of education, finances, occupational subsidies, as well as techno-phobia inhibit computer and Web use

Source: Adapted from "Exploring the World Wide Web Population's Other Half", http://future.sri.com/vals/vals-survey.results.html, Accessed November 4, 1996; and RITIM Research 1998-1999.

Table 3: Transmission Speeds over the Internet - circa 1999

Type of Connection or Link	Speed	Approximate time to transfer the contents of a 680 MB hard disk	Availability of such Connections or Link-type circa 1999
Standard Modem	56 Kbps	28 hours	Late model (typically post-1997) home and small business computers
1-channel ISDN	64 Kbps	24 hours	Selected cities in the U.S. and other advanced nations
2-channel ISDN	128 Kbps	12 hours	Selected cities in the U.S. and other advanced nations
T1 or DS-1	1.544 Mbps	1 hour	Typical connection for mid- to large-sized organizations in advanced countries
T3 or DS-3	44.736 Mbps	2 minutes	Backbone between major U.S. cities; from U.S. hubs to Toronto, Ottawa, Mexico City, and to South America; from U.S. East and West coast hubs to Europe and Asia
OC-3	155.52 Mbps	35 seconds	Between major connection points in the U.S. such as New York, Baltimore, Chicago, and San Francisco, and a few other U.S. cities
OC-12	622.08 Mbps	9 seconds	Major backbones such as those of MCI WorldCom. Availability mainly in North America but global expansion occurring through undersea fiber optic cables such as FLAG.

Source: Adapted from Susie Davis, Jim Ivers, and Scott Frommer, *U.S. Map of the Internet*, Westport, CT: Mecklermedia, 1996. Also, RITIM Research, 1999.