Community Technology

Written Component of Ph.D. General Examination

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Introduction

The "digital divide" (NTIA 1994, 1997 & 1999) ¾ the gap between the technological "haves" and "have not's" ¾ has received considerable attention in the new millennium. In November 1999, America's Black Forum aired a special, specifically focused on the divide. In December 1999, the Department of Commerce held a Digital Divide Summit in Washington, DC. In January 2000, it was the focus of a two-part PBS series. That same month, President Clinton announced his plan to narrow the gap during his State of the Union address. This placed the issue at the forefront of the nation's consciousness. Since then, a number of articles have been generated, and numerous discussions have taken place, debating its causes and implications. In February, the Clinton-Gore administration released their comprehensive proposal, ***From Digital Divide to Digital Opportunity,*** which outlined specific strategies and budget initiatives for addressing the problem. In March 2000, the digital divide was a central topic of discussion on the CBS Sunday Morning. Finally, in April 2000, President Clinton led a "new markets" tour to mobilize public and private partnerships to address this "key civil rights issue of the 21st century" (The White House, 2000).

This paper serves four purposes. First, to define the digital divide. What is it? Why is it getting so much attention? What does it mean at the community level? Second, to make the case as to why it is important that every American citizen has access (broadly defined) to computers and the Internet. This will include examples that demonstrate how the "digital haves" are using computation to better themselves and their communities. Third, given the current state of the art for community engagement with technology, to present recommendations as to where funding should be directed given the limitations of current hardware/software platforms as deployed in community settings. Fourth, to define metrics for "success." How will we know when the digital divide is "bridged"? Besides access, what are the factors that might differ between the haves and have-nots? How will we know when we have eliminated these factors?

Essentially, I seek to articulate a clear picture of where we are, a coherent vision of where we need to be, a solid argument as to why this is important, and a practical framework for how we should get there.

Defining the Digital Divide

The "digital divide" and the "great divide" are two phrases popularly used to describe the disparity in computer and Internet access and use between various social, economic, and ethnic groups within the United States. Since 1994, the National Telecommunications and Information Administration (NTIA) in the U.S. Department of Commerce has released three reports examining this problem, under the heading "Falling Through the Net" (NTIA 1994, 1997 & 1999). Each study has reached the same glaring conclusion: the great divide is getting greater. For example, in their most recent report, the NTIA (1999) writes:

> ***The data reveal that the digital divide ¾ the disparities in access to telephones, personal computers (PCs), and the Internet across certain demographic groups ¾ still exists, and in many cases, has widened significantly. The gap for computers and Internet access has generally grown larger by categories of education, income, and race.***

Excerpts from 1999 NTIA report include the following:

- ***Income*** ¾ Households with incomes of $75,000 and higher are more than ***nine times*** as likely to have a computer at home (see Figure 1), and more than ***twenty times*** more likely to have access to the Internet than those with incomes of $5,000 or less (see Figure 2). ***Between 1997 and 1998, the digital divide between those at the highest and lowest education levels increased 25%.***

- ***Education*** ¾ The percentage-point difference between those with a college education or better, when compare to those with an elementary school education, is as high as ***63%*** for computer penetration (see Figure 3), and ***45%*** for Internet penetration (see Figure 4). ***Between 1997 and 1998, the digital divide between those at the highest and lowest levels of income grew 2%.***

- ***Race*** – Black and Hispanic households are approximately one-half as likely as households of Asian/Pacific Islander descent, as well as White households, to have a home computer (see Figure 5), and approximately one-third as likely as households of Asian/Pacific Islander descent, and roughly two-fifths as likely as White households, to have home Internet access (See Figure 6). ***The gaps between White and Hispanic households, and between White and Black households, are larger than twenty-three percentage points (computers) and thirteen percentage points (Internet), which is more than six percentage points (computers) and ten percentage points (Internet) larger than they were in 1994.***

- ***Income and Race*** ¾ For households earning between $35,000 and $74,999, 40.2% of Blacks and 36.8% of Hispanics owned a computer, compared to 55.1% of Whites (see Figure 7), while for households earning between $15,000 and $34,999, 7.9% of Blacks and 7.6% of Hispanics had Internet access, compared to 17% of Whites (see Figure 8). A similar pattern emerges in each income category. ***In other words, minorities lag behind non-minorities even at the same level of income.***

Clearly, according to a variety of demographic indicators ¾ income, education, race, and more ¾ there are significant disparities in the ability of Americans to access and use modern technologies.

Related Studies

Corroborating evidence can be drawn from a number of related studies.

In 1995 Anderson et al., at RAND's Center for Information Revolution Analyses (CIRA), published the results of a two-year study in their report, ***Universal Access to E-Mail: Feasibility and Societal Implications.*** Consistent with the NTIA reports, they found "large differences in both household computer access and use of network services across income categories… large differences in household computer access by educational attainment… [and] rather large and persistent differences across race/ethnicity in both household computer access and network services usage." (Anderson et at., 1995).

In 1997, Katz and Aspden (1997) of Bellcore released the results of a national public opinion survey entitled ***Motivations for and Barriers to Internet Usage: Results of a National Public Opinion Survey.*** In similar fashion to the NTIA, they found that a disproportionately high 58% of those with a household income below $25,000 reported a lack of awareness of the Internet.

The Spring 1997 CommerceNet/Nielsen Internet Demographic Study (IDS), conducted in December 1996/January 1997, also confirms the NTIA's observations. This study was the first to collect data on patterns of use with computers and communications technologies as a function of income and race (Nielsen Media Research, 1997). Using the IDS data, Novak and Hoffman (1998) at Vanderbilt University released a report, ***The Impact of Race on Computer Access and Use,*** that examined differences in PC access and Web use between African-Americans and Whites.

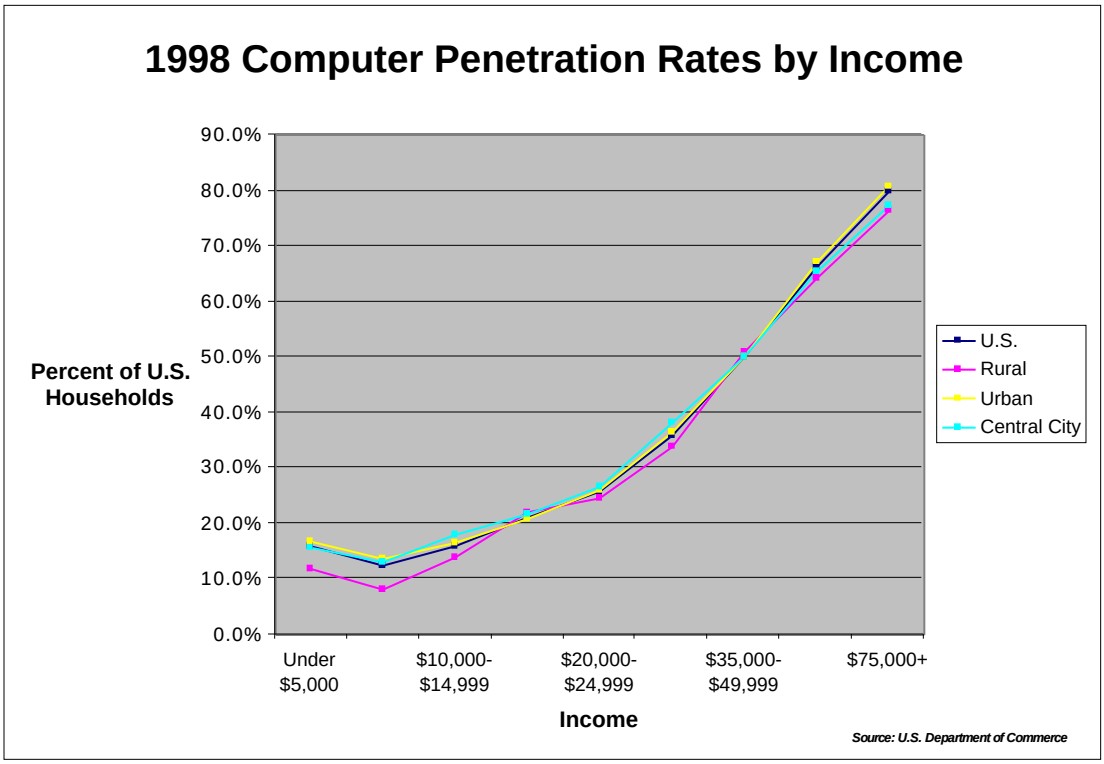

Figure 1: 1998 Computer Penetration Rates by Income

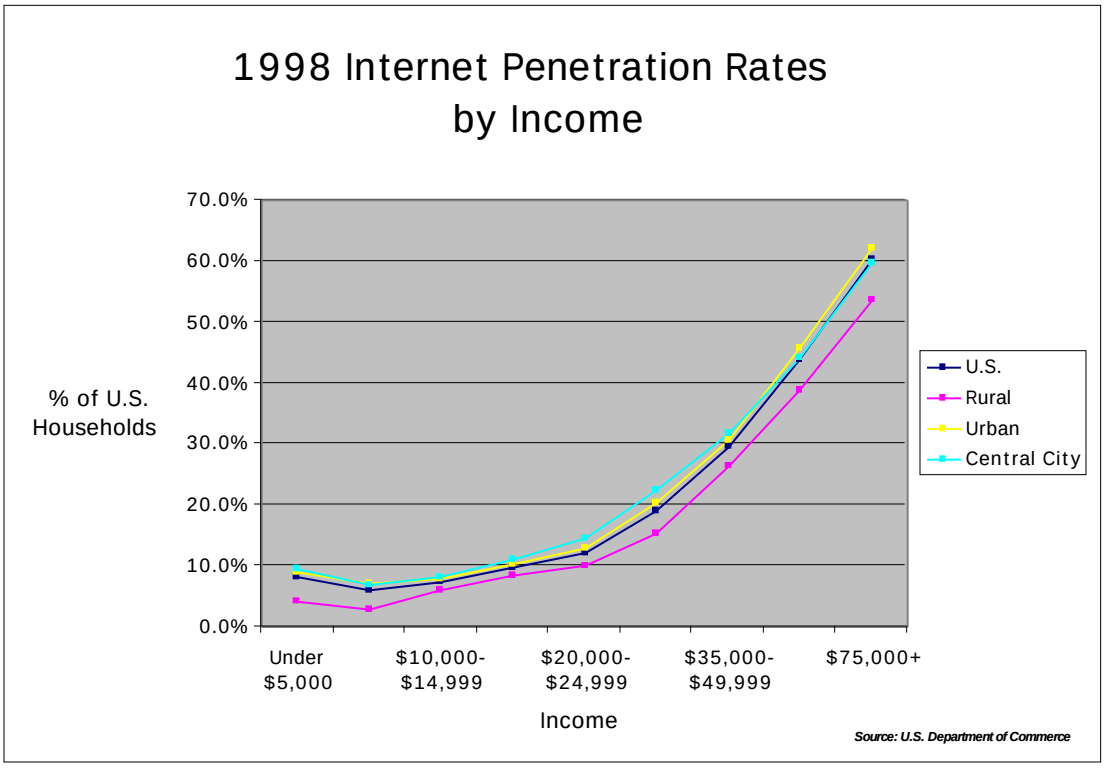

Figure 2: 1998 Internet Penetration Rates by Income

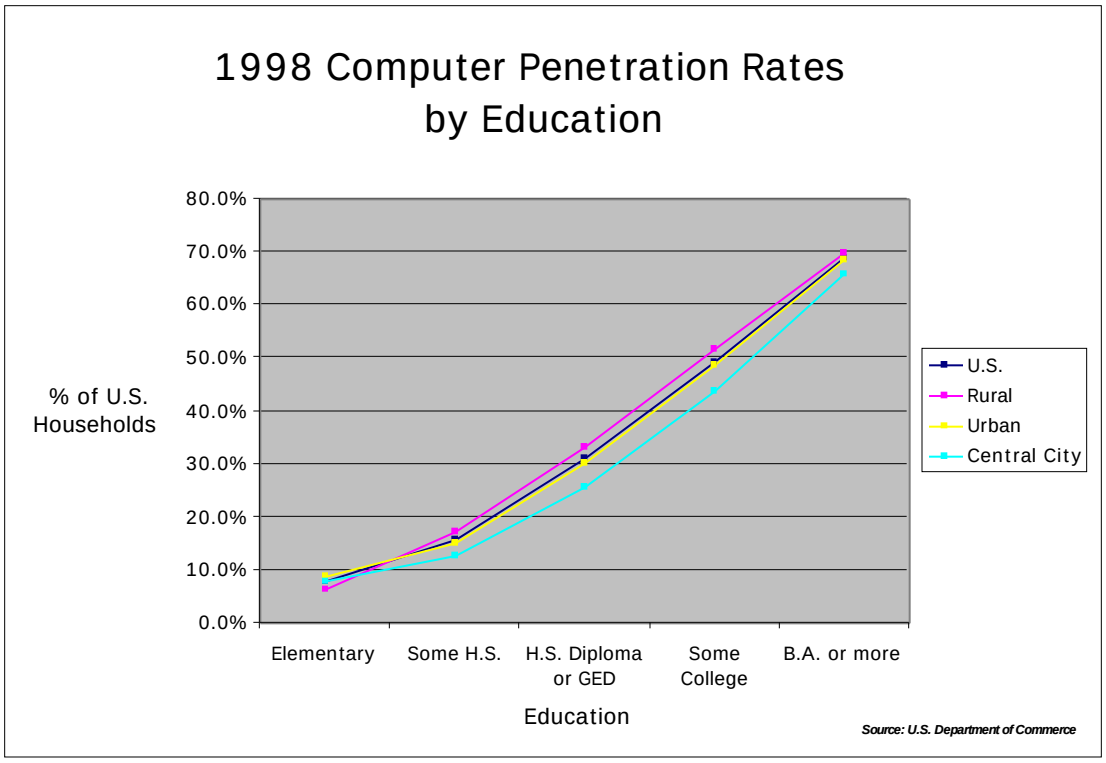

Figure 3: 1998 Computer Penetration Rates by Education

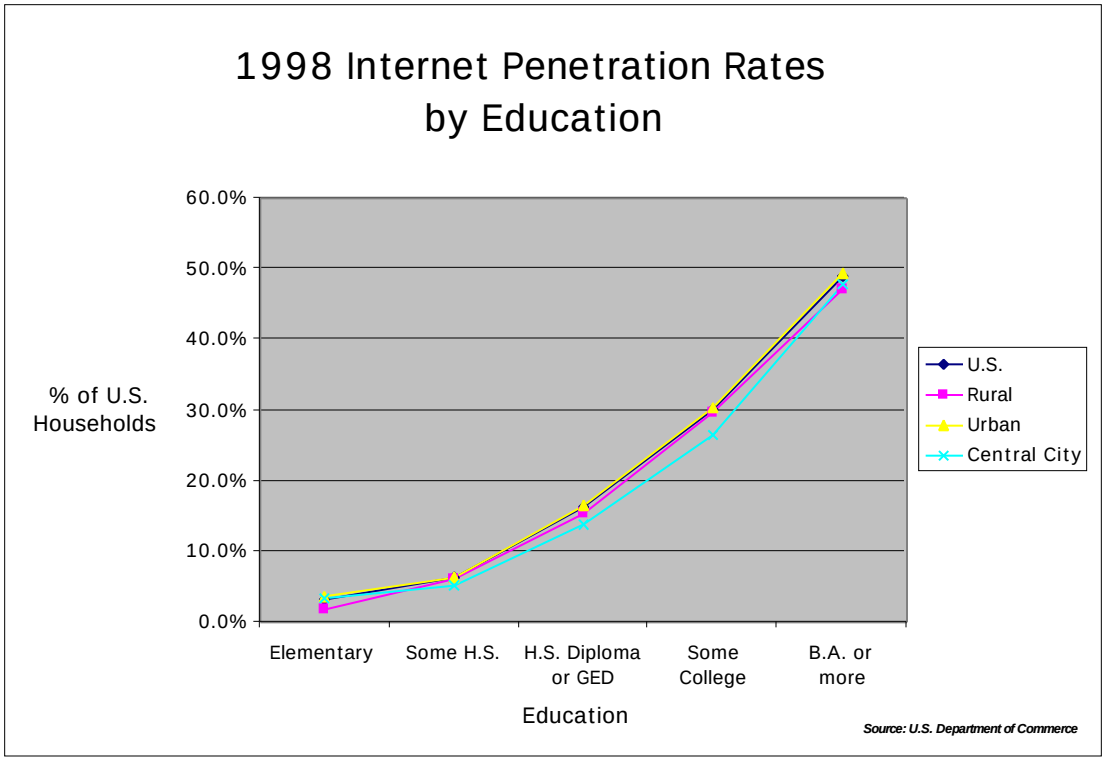

Figure 4: 1998 Internet Penetration Rates by Education

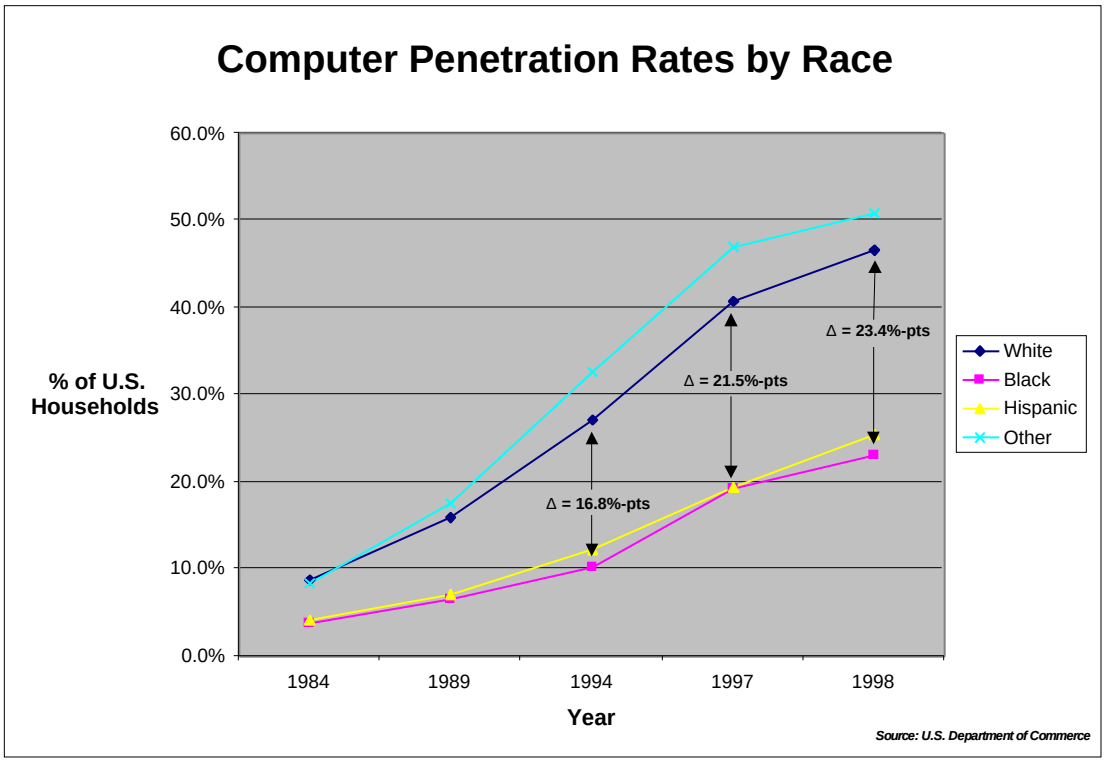

Figure 5: Computer Penetration Rates by Race

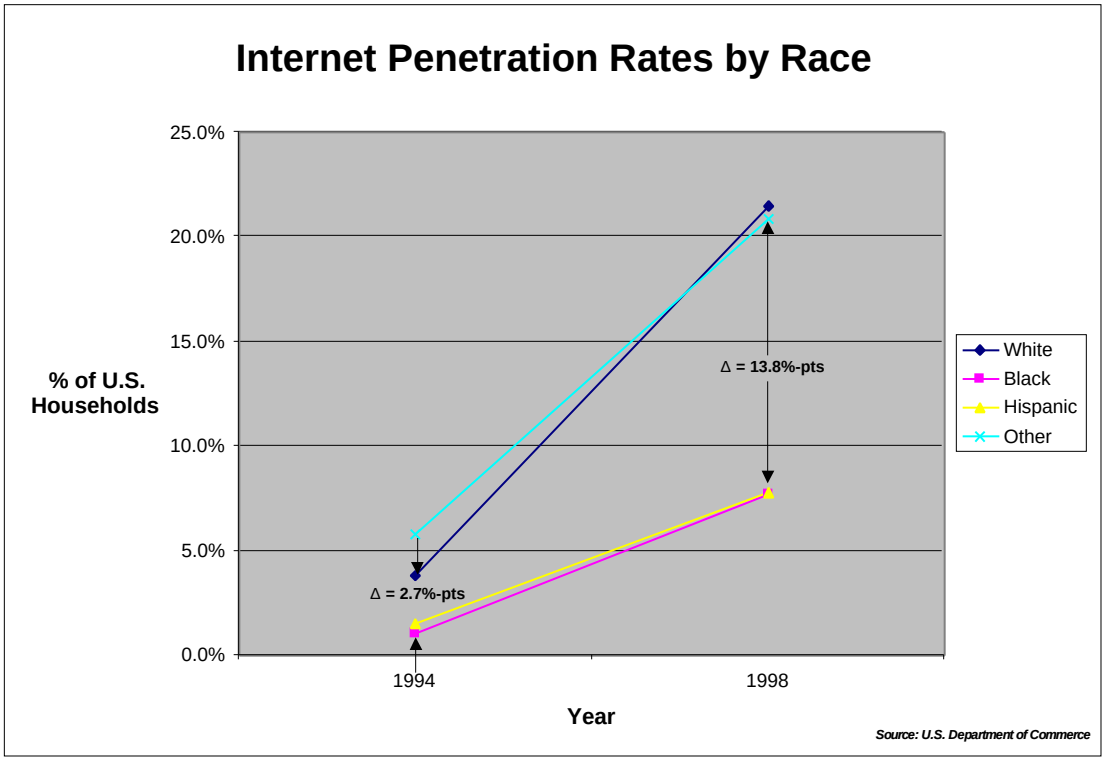

Figure 6: Internet Penetration Rates by Race

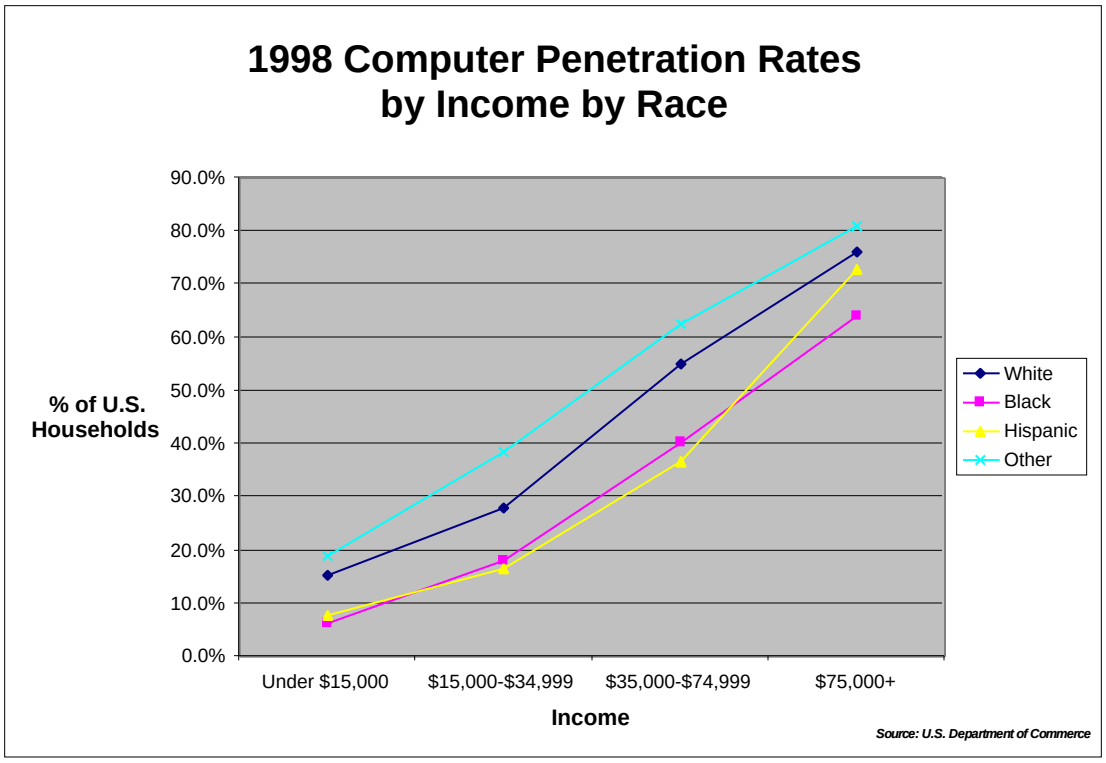

Figure 7: 1998 Computer Penetration Rates by Income by Race

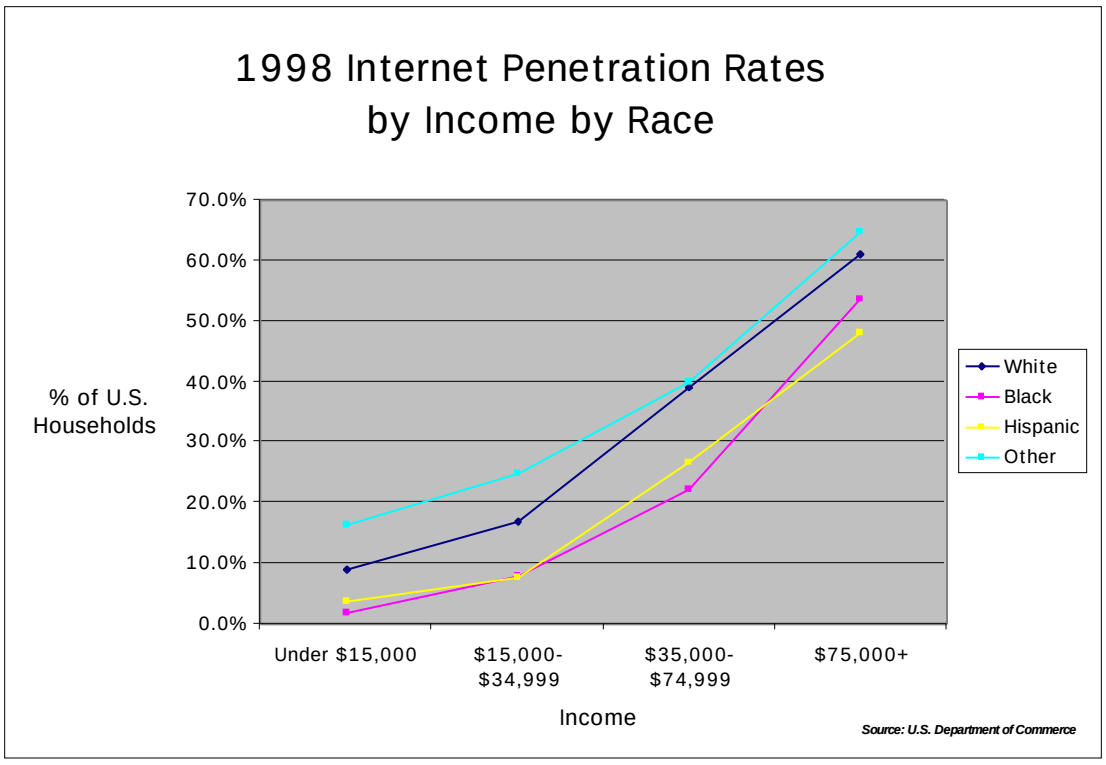

Figure 8: 1998 Internet Penetration Rates by Income by Race

The most interesting finding from their study was that income does not explain race differences in home computer ownership. While 73% of White students own a home computer, only 33% of African-American students own one, a difference that persisted when a statistical adjustment was made for the students' reported household income. They concluded that "in terms of students' use of the Web, particularly when students do not have a home computer, race matters" (Novak & Hoffman, 1998).

A 1998 Computer Intelligence Consumer Technology Survey reported that 80% of families making over $100,000 own computers, while only 25% of families making less than $30,000 own computers (Benton Foundation, 1998). Similarly, a 1998 study by Birdsell (1998) at Baruch College found that 53% of people with an undergraduate degree or higher use the Web, while only 19% of people with a high school diploma or less use the Web (Benton Foundation, 1998). Similar studies have also found that while the gender gap in computer and Internet use is closing over time (Anderson et al., 1995; CyberAtlas, 1998), the racial gap is growing (Abrams, 1997). All of these studies indicate that the digital divide is a very real phenomenon.

Most recently, Nie and Erbring (2000) at Stanford University released a preliminary report, ***Internet and Society,*** which pointed to the digital divide, but with a slightly different explanation than the NTIA for its causes. Focusing on the Internet solely (to the exclusion of computer ownership), they concluded that education and age are the most important factors facilitating or inhibiting access. According to their analysis, "a college education boosts rates of Internet access by well over 40 percentage points compared to the least educated group, while people over 65 show a more than 40 percentage point drop in their rates of Internet access compared to those under 25."

Finally, in addition of the aforementioned studies, the digital divide could be defined along a number of other dimensions, including: inequities in computer and Internet access, use, and curriculum design between urban and suburban, or predominantly minority and predominantly White schools (Benton Foundation, 1998; Taylor, 1995; Sandholtz et al., 1997), the lack of participation of underrepresented groups in computer- and information technology-related fields and businesses (Office of Science and Technology Policy, 1999; Office of Technology Policy, 1999; President's Information Technology Advisory Committee, 1999), and the dearth of online content, material, and applications, geared to the needs and interests of low-income and underserved Internet users (Lazarus & Mora, 2000).

Regardless of the social, economic, or racial characteristics one attributes to the digital divide, it is clear that there are two distinct groups that have emerged as a corollary to the technological revolution: information "haves" and information "have not's." Given this reality, I offer a simple, and overarching definition of the digital divide that will guide the remainder of this paper: ***the gap between those who benefit from computers and the Internet, and those who do not.***

By defining the digital divide in these terms, I intend to draw attention away from the mere concepts of access and use, and move towards a more holistic conceptualization that looks at how computers and the Internet can serve to empower individuals and communities.

Redefining the Digital Divide

As Resnick has often argued, "access is not enough" (Resnick & Rusk, 1998) when it comes to efforts to bridge the digital divide. Rockoff argues that universal service should include: 1) access to a computer with a World Wide Web browser, 2) a personal Internet email address, and 3) the ability to make one's own information available via the Web (Benton Foundation, 1998). Mitchel (1999) argues that universal service should include: 1) access to the "pipes" or connections, 2) access to a low-cost "appliance" such as a computer, 3) access to user-friendly software, and 4) the motivation, will, and necessary skills to use the aforementioned items.

Partially synthesizing, yet expanding on the perspectives of Resnick, Rockoff and Mitchel, I argue that the gap between the "haves" and the "have not's" will only be closed, when every American can meet the following criteria:

- ***ACCESS: The ability to readily access a computer and the Internet (including an electronic mail address)*** ¾ Computer and Internet access should be available through public access site's (PAS) as well as in the home. Furthermore, electronic mail is quickly becoming as essential to full participation in society as having a telephone (Anderson et al., 1995).

- ***TRAINING AND INDIVIDUAL/COMMUNITY SUPPORT: The ability to use a computer and the Internet to serve ones individual (technological fluency) and collective (community building) purposes*** ¾ Technological fluency "involves knowing not only basic techniques, but also how to make things of significance with them" (Resnick & Rusk, 1996; Papert & Resnick, 1995). Community building is "strengthening the capacity of residents, associations, and organizations to work, individually and collectively, to foster and sustain positive neighborhood change" (Aspen Roundtable, 1997). Technology can, and should, support these ends.

- ***CONTENT AND INFORMATION: The ability to contribute to the national information infrastructure*** ¾ "Average citizens today have tools that were never at their disposal. In effect they have their own printing presses ¾ in the form of computers connected to the Internet No longer is it their role simply to consume… the consumer is becoming a creator" (Smith et al., 1999). Citizens should be able to use technology for such a purpose.

- ***MOTIVATION: The motivation to do the aforementioned*** ¾ With respect to access, many Americans have the economic wherewithal to obtain a computer and Internet access, ***if they were motivated to do so.*** Furthermore, they have the intellectual wherewithal to master these technologies, and they would overcome the existing barriers to use, ***if they were motivated to do so.*** Motivation is a critical link to ensure fairness and equality.

This framework for the digital divide leads naturally into the next two sections of this paper where I will discuss current efforts to bridge the digital divide, and why closing the technology gap is critically important to individuals, families, communities, and the nation.

Bridging the Digital Divide

To date, three primary models have emerged for bridging the digital divide. These efforts fall under the heading of ***community computing***, or "using the technology to support and meet the goals of a community" (Beamish, 1999).

The first model is ***community networks,*** or community-based electronic network services, provided at little or no cost to users. The second model is ***community computing centers*** or community technology centers (CTCs), publicly accessible facilities that provide computer access for people who can't afford a computer, as well as technical instruction and support. The third model is ***community content,*** or the availability of material that is relevant and interesting to some target audience (e.g., low-income residents) to encourage and motivate the use of technology.

These approaches can be classified according to what they provide: hardware, software, and training, infrastructure, online access, or content. They can also be classified according to the groups they target: individuals, schools, youth, community organizations, and the general public, or specific groups such as a neighborhood, racial or ethnic minorities, the homeless, and the elderly (Beamish, 1999).

Each model is described in greater detail below.

Community Networks

Prior to the advent of the computer, ***community networking*** was a sociological construct that described the pattern of communications and relationships in a community (Schuler, 1996). Mario Morino of the Morino Institute refers to contemporary community networking as "a process to serve the local geographic community - to respond to the needs of that community and build solutions to its problems. In the social

sense [it] is not a new concept, but using electronic communications to extend and amplify it certainly is" (Morino, 1994). Community networks establish a new technological infrastructure that augments and restructures the existing social infrastructure of the community.

Most community networks began as part of the Free-Net movement during the mid-1980s. Free-Nets are "loosely organized, community-based, volunteer-managed electronic network services. They provide local and global information sharing and discussion at no charge to the Free-Net user or patron" (Victoria Free-Net Association, 1994). The Cleveland Free-Net, founded in 1986 by Dr. Tom Grundner, was the first community network. It grew out of the "St. Silicon's Hospital and Information Dispensary," an electronic bulletin board system (BBS) for health care that evolved from an earlier bulletin board system, the Chicago BBS. Other notable community networks include the following: Seattle Community Network, Seattle, WA, Big Sky Telegraph, Montana, National Capital Free-Net, Ottawa, Ontario, the Buffalo Free-Net, Buffalo, New York, and PrairieNet, Urbana-Champaign, Illinois.

In 1989, Grundner founded The National Public Telecomputing Network (NPTN) which "evolved as the public lobbying group, national organizing committee, and public policy representative for U.S.-based Free-Nets and [contributed] to the planning of world-wide Free-Nets" (Victoria Free-Net Association, 1994). NPTN grew to support as many as 163 affiliates in 42 states and 10 countries. However, in the face of rapidly declining commercial prices for Internet connectivity, and a steady increase in the demands to maintain high-quality information services, NPTN (and many of its affiliates) filed for bankruptcy in 1996. Today, while a number of Free-Nets still exist, there also exist community networking initiatives that are better described as some combination of the remaining models for engagement with technology ¾ community computing centers and community content.

With the number of efforts to place computers in the homes of underserved residents expected to rise in the near future (Bishop et al., 1999, Lincoln 1998, Schön et al., 1999, Taylor, 1999, Walsh, 1999), the community network model will continue to play an important role in bridging the digital divide. However, these efforts to promote widespread involvement will be significantly enhanced by simultaneous efforts to identify innovative uses of such a technological infrastructure for the closely related purpose of community revitalization. For example, community technology initiatives should leverage existing funding and activity in the area of community building. Pinkett (2000) writes, "at the intersection between community building and community technology lies tremendous synergy… with anticipated increases in funding for large-scale community building and community technology projects, there is a great deal to be learned regarding how [they] can be mutually supportive, rather than mutually exclusive." This strategy will be revisited later in this paper as a recommended solution.

Community Computing Centers

Generally speaking, equitable computer access has been the primary focus of efforts to bridge the digital divide. Access precludes the possibility of community networking as well as the affordances of community content. As a result, the primary strategy in many low-income and rural communities has been to establish CTCs, because both the community network and the community content models are predicated on the availability of computers.

CTCs are an attractive model for a number of reasons (Bishop et al., 1999). First, they are cost-effective when compared to placing computers in the home. Second, responsibility for maintaining computer resources is assumed by an external agent. Third, knowledgeable staff members are present to offer technical support and training. Fourth and finally, peers and other community members are present, creating a pleasant social atmosphere. Consequently, CTCs are, by far, the most widely employed and effective strategy to-date for bridging the digital divide. For more than two decades, significant public and private funds have been invested in the development of CTCs nationwide (Ellis et al., 1998, Resnick et al., 1998). CTCs have been the focus of numerous studies relating to computer and Internet access and use, and the drivers to their effectiveness have been well-researched and documented (Beamish, 1995; Beamish, 1999; Ellis et al., 1998; Mark et al., 1997; Melchior et al., 1998). This argues for the need to expand the CTC model, which is one of the recommended strategies presented later in this paper.

Notable CTCs include the following: Plugged In, East Palo Alto, California, the Computer Clubhouse, Boston, Massachusetts, Austin Learning Academy, Austin, Texas, PUENTE Learning Centers, Los Angeles, CA, New Beginnings Learning Center, Pittsburgh, Pennsylvania, and West Side Community Computing Center, Cleveland, OH.

Bishop et al.'s (1999) study of a predominantly African-American, low-income community revealed some of the shortcomings of the CTC model, from the perspective of residents. Their findings included the following: the inconvenience of leaving home (especially for single parents), the inability to store files or maintain privacy, the strong desire to use the computer with family members in the comfort of home and without rules or time limitations, fear of criminal activity in the surrounding area, and the impracticality of using computers for everyday tasks such as home banking. This argues for the need to ensure universal access in the homes of America's citizens ¾ a point that will also be revisited later in this paper during the discussion of recommended strategies.

Community Content

Community content initiatives can be broadly classified along two dimensions: information vs. communications, and active vs. passive.

The information vs. communication dimension speaks to the fact that some community content initiatives focus on the Internet's ability to deliver information, some focus on the Internet's ability to facilitate communication, and some focus on both. An information focus manifests itself in the form of databases, and documents, and repositories that can be accessed online. A communication focus manifests itself in the form of chat rooms, discussion groups, listservs, and the like. Interestingly, studies have found that people use the Internet more for communication and social activities than they do for information purposes (Kraut et al, 1997).

The active vs. passive dimension speaks to the fact that some community content initiatives regard the end-user as the passive recipient of information and content, while others regard the end-user as the active producer of information and content. A passive disposition results in a static content model that is unidirectional and could be characterized as one-to-many. An active disposition results in a dynamic content model that is bi-directional and could be characterized as many-to-many.

Community content, particularly in the form of community-centered websites, was the focus of a recent report authored by Lazarus and Mora (2000) of the Children's Partnership entitled, ***Online Content for Low-Income and Underserved Americans***. In the document, community content is defined according to the following five constituent information categories (The Children's Partnership, 2000):

- Information that is more widely available
- Information that can be customized by the user
- Information that flows from many to many
- Information that allows for interaction among users
- Information that enables users to become producers of information

Based on an evaluation that included discussion with user groups, interviews with center and community network directors, interviews with other experts, and analysis of the web, they concluded the following, with respect to low-income and underserved populations and existing Internet content: 1) a lack of local information, 2) literacy barriers, 3) language barriers, and 4) a lack of cultural diversity.

Community content is an emerging strategy for bridging the digital divide, and additional work will be required to overcome these barriers. While they are limited in number, there are examples of "community networks and city-based sites [that] manage to provide relevant and up-to-date community information" (Beamish, 1999) despite the many challenges associated with maintaining quality content services. Notable community content sites include the following: Internet Resources page of the Brooklyn Public Library (http://www.brooklynpubliclibrary.org), Charlotte North Carolina's Web (http://www.charWeb.org), Neighborhood Link's All About Work (http://www.nhlink.net/employme/index.htm), East Bay Work's

employment-training site (http://www.eastbayworks.org), the Education Center on the Boulder Community Network home page (http://www.aces.uiuc.edu/~CCRScare), and the Taos Community Calendar on the La Plaza Telecommunity Site (http://www.laplaza.org/cc) (Lazarus & Mora, 2000).

A number of commercial sites have also emerged to provide community content, many of which compete directly with the aforementioned grassroots initiatives. These include geographic communities such as KOZ.com (http://www.koz.com), virtual-community sites such as Geocities (http://geocities.yahoo.com/home), demographic-community sites such as SeniorNet (http://www.seniornetorg) and iVillage.com (http//www.ivillage.com), ethnic or political communities such as a website on Kurdistan (http:///www.akakurdistan.com), and sties for storytelling such as The Fray (http://www.fray.com) (Smith et al., 1999). These commercial sites typically do not place the same emphasis on community building as the previously mentioned sites do.

Effective mechanisms for promoting community content will be revisited in the later section on recommended strategies. In the following section, I will discuss the impact of computers and the Internet, with references to each of these models.

The Impact of Computers and the Internet

Bridging the digital divide has positive implications for individuals, families, communities, and the nation as a whole. In the following subsections, I provide specific evidence to support this claim.

Individuals and Families

There are a limited number of studies that have investigated the impact of computers and the Internet on individuals and families. Here, I will discuss two particular evaluations: one that has examined computers and Internet users in the context of a community technology center, and one that has examined computer and Internet users in the context of a public school system.

Community Technology Centers' Network (CTCNet)

The Community Technology Centers' Network (CTCNet), housed at Educational Development Center, Inc. (EDC), in Newton, Massachusetts, is "a national membership organization that promotes and nurtures non-profit, community-based efforts to provide computer access and learning opportunities to the general public and to disadvantaged populations" (Chow, Ellis, Mark & Wise, 1998). CTCNet is "a network of more than 250 affiliate centers [or community computing centers] including multiservice agencies, community networks, adult literacy programs, job training and entrepreneurship programs, public housing facilities, YMCAs, public libraries, schools, cable television access centers, and after-school programs" (Chow, Ellis, Mark & Wise, 1998).

CTCNet has conducted two evaluations examining the impact of computers and the Internet on individuals and families. Their first evaluation, ***Community Technology Centers: Impact on Individual Participants and Their Communities,*** by Mark, Cornebise and Wahl (1997), was a qualitative study that involved semi-structured interviews with 131 participants at five intensive sites: 1) Brooklyn Public Library Program, Brooklyn, NY, 2) Somerville Community Computing Center, Somerville, MA, 3) Old North End Community Technology Center (ONE), Burlington, VT, 4) New Beginnings Learning Center, Pittsburgh, PA, and 5) Plugged In, East Palo Alto, CA.

Their results included the following (Mark, Cornebise & Wahl, 1997):

- ***Increased job skills and access to employment opportunities*** ¾ Individuals were able to access information and resources about job search and employment opportunities (14%), improve job skills including computer and literacy skills (38%), and considered new, higher-wage, career options that involved the use of technology (27%)

- ***Education and improved outlook on learning*** ¾ Individuals gained access to lifelong learning opportunities such as computer literacy and mathematics programs (15%), changed their goals for learning and educational attainment (e.g., decided to pursue a GED or more) (27%), and improved their outlook and perspective on learning (e.g., using the computer they "learned that they can learn.") (27%).

- ***Technological literacy as a means to achieve individual goals*** ¾ Individuals obtained greater computer awareness and new computer skills that increased their comfort with technology as a tool for accomplishing their goals (91%)

- ***New skills and knowledge*** ¾ Individuals improved their reading and writing (37%), mathematics skills and interest in science (8%)

- ***Personal efficacy and affective outcomes*** ¾ Individuals achieved greater personal autonomy (18%) and feelings of pride and competence as a result of success with computers (e.g., decided to stay off drugs) (23%).

- ***Use of time and resources*** ¾ Individuals found productive uses for their time (15%) which resulted in positive outcomes such as reduced reliance on public assistance (4%).

- ***Increased civic participation*** ¾ Individuals identified new avenues for voicing their opinions on a range of social and political issues (5%), gained access to community, municipal, and government services and resources, and demonstrated greater interest in and engagement with current events (5%)

CTCNet's second evaluation, ***Impact of CTCNet Affiliates: Findings from a National Survey of Users of Community Technology Centers,*** by Chow, Ellis, Mark, and Wise (1998), was quantitative study that surveyed 817 people from 44 sites. This evaluation corroborated the findings from the 1997 study, and also found the following: more than one-third of users with employment goals reported as achieving their goals, half of users with educational goals reported as achieving their goals, and more than half of users with goals of self-confidence and overcoming fear reported as achieving their goals.

The Buddy System Project

The Buddy System Project is "an effort to use technology to enhance learning in the schools and extend learning beyond the school day and into the home" (Rockman, 1995). Launched in 1988 by the non-profit Corporation for Educational Technology (CET) in Indianapolis, the Project has placed computers in the homes of fourth, fifth, and sixth grade students in school systems throughout Indiana. To date, more than 20,000 Indiana families have benefitted from the Project.

In 1995, the Buddy System Project conducted an evaluation, ***Assessing the Growth: The Buddy Project Evaluation,*** led by Saul Rockman (1995). The evaluation examined the areas of writing, mathematics, teachers and teaching, and the family. They concluded the following (Rockman, 1995):

- Participation in the Buddy Project can make a significant difference in children's writing (Buddy participants demonstrated writing gains more than three times higher than students in comparison schools).
- The Project has led to substantial teacher improvement.
- The Buddy Project has established and strengthened home-school connections.
- Parents, teachers, and administrators believe that the Buddy Project is preparing Indiana's children for the workforce of the future.
- Participation in the Buddy Project has increased the self-confidence of children, including those who are learning disabled, lack confidence, or who would not succeed easily in regular classrooms.
- As a result of their participation in all aspects of Buddy and the stake they have in the project and decisions about it, Buddy students (and their families) feel they can participate in state governance.

The Buddy System Project's second evaluation, ***Beyond Buddy: The Sustained Influence of the Buddy System Project,*** also by Rockman (1998), studied three veteran buddy sites to investigate what happened to former Buddy students and parents, along with secondary school teachers, during the middle school and high school years. This evaluation further revealed that parents believe that invaluable Buddy skills outlast middle and high school, and that secondary business and computer teachers report that Buddy students far outshine their non-Buddy peers.

Communities

There are a number of studies that have examined the impact of computers and the Internet on communities. Here, I will highlight a variety of initiatives including various community networks, community computing centers, and community content approaches.

National Capital Free-Net

The National Capital Free-Net (NCF) in Ottawa, Canada is "one of the largest and most successful" (Patrick, 1997) Free-Nets. The NCF was launched in February, 1992, with a main goal of having a "positive impact on the local community and individual members by providing access to information and an effective means of communication and sharing" (Patrick, 1997). NCF incorporates elements of the community network and community content models for engagement with technology.

In 1997, 1,073 NCF users completed a survey that measured personal and social impacts of using the system. Patrick's (1997) summary of this evaluation described various positive outcomes, including the fact that users reported an increase in social interactions (63%), contact with relatives (40%), and an overall positive impact on their lives (95%).

Making Healthy MUSIC

Shaw and Shaw's (1999) "Making Healthy MUSIC" involved the deployment of a community networking system, MUSIC (Multi-User Sessions in Community), in Dorchester, MA, and Newark, NJ. MUSIC offered a variety of community-centered features, such as the following: bulletin board postings, discussion groups, real-time and voice communications, online voting, surveying, polling, news publication, and a geocoded graphical map database/directory. In this respect, MUSIC empowered users to create their own community content. Working closely with residents, their project resulted in the formation of various formal and informal connections among residents, as well as neighborhood activism. MUSIC was found to be particularly effective in supporting social relationships, social events, and shared social goals and projects.

RAND

Anderson et al.'s (1995) aforementioned study at RAND's Center for Information Revolution Analyses (CIRA) involved the evaluation of the following five community networks and/or community computing centers: 1) Public Electronic Network, Santa Monica, CA, 2) Seattle Community Network, Seattle, WA, 3) Playing to Win Network, New York, NY (which eventually spawned CTCNet as a result of National Science Foundation (NSF) funding), 4) LatinoNet, San Francisco, CA, and 5) Blacksburg Electronic Village (BEV), Blacksburg, VA. Anderson et al. observed increased participation in discussion and decision making among those who were politically or economically disadvantaged, in addition to the following findings:

- ***Improved access to information*** ¾ Computers and the Internet allowed "individuals and groups to tap directly into vast amounts and types of information from on-line databases and from organizations that advertise or offer their products and services online" (Anderson et al., 1995).

- ***Restructuring of non-profit and community-based organizations*** ¾ Computers and the Internet assisted these organizations in operating more effectively.

- ***Delivery of government services and political participation*** ¾ Computers and the Internet promoted a more efficient dissemination of local and federal information and services, and encouraged public awareness of, and participation in government processes.

Blacksburg Electronic Village (BEV)

The Blacksburg Electronic Village (BEV) is America's first truly wired city. Beginning in 1993 as a partnership between the Town of Blacksburg, Virginia Tech, and Bell Atlantic, BEV now has more than half of its population connected to the Internet. BEV provides community networking and community content via the BEV.net homepage.

Between 1996 and 1999, Kavanaugh and Patterson conducted a series of evaluations of BEV ranging from interviews to online questionnaires to random sample surveys. Kavanaugh and Patterson's (1998) report of BEV revealed that community engagement with technology reinforced and expanded existing social networks. Kavanaugh's (1999) follow-up report further revealed that 22% of BEV users demonstrated an increase in civic participation. This increase occurred primarily among those users that were already predisposed toward community involvement. Kavanaugh also observed senior citizens meeting and working together via the Internet, as well as the establishment of network ties between home and school via electronic mailing lists.

Netville

Netville, a pseudonym, is comprised of approximately 120 detached, closely-spaced, single-family homes, in a suburb of Toronto, Canada. As part of an industrial trial with new networking technologies, Netville residents were provided with free high-speed Internet connectivity for a two-year period.

Hampton and Wellman (1999) studied Netville between 1997 and 1999 while the network was active. Their investigation included a combination of observing (Hampton moved into the development), surveying, and monitoring of online activity. They found computers and the Internet to be effective in supporting "a variety of social ties, strong and weak, instrumental, emotional, social, and affiliative" (Hampton & Wellman, 1999) including rapid political mobilization when necessary. They also observed increased local awareness and increased face-to-face interaction among residents that were connected, when compared to those that were not.

Bellcore

Katz and Aspen's (1995) aforementioned research study at Bellcore, based on a national random telephone survey and systematic in-depth interviews of Internet users and non-users found that, by some measures, cybercitizens are more involved in social activities than their non-Internet counterparts, and that Internet use has a positive affect on community involvement.

Community Technology Centers' Network (CTCNet)

Finally, CTCNet's (Mark, Cornebise & Wahl, 1997) aforementioned study of five affiliate centers reported an increase in community collaborations, a strengthened sense of community, and improved social relations among community residents.

The Nation

Two government agencies have looked closely at the benefits that are derived nationwide from computer use and the Internet access: the National Research Council (NRC) and the Office of Technology Policy (OTP) in the U.S. Department of Commerce.

National Research Council (NRC)

In 1997, the Computer Science and Telecommunications Board (CTSB) of the National Research Council (NRC) initiated a study in response to a request from the National Science Foundation (NSF) to address the subject of information technology literacy. In their report, ***Being Fluent with Information Technology,*** they argue that fluency with information technology requires three kinds of knowledge, and in doing so, highlight its importance to the development of American human capital (NRC, 1999):

> ***Contemporary skills, the ability to use today's computer applications, enable people to apply information technology immediately. In the present labor market, skills provide a store of practical experience on which to build new competence. Foundational concepts, the basic principles and ideas of computers, networks, and information underpin the technology. Concepts explain the how and why of information technology, and they give insight into its opportunities and limitations. Concepts are the raw material of understanding new information technology as it evolves. Intellectual capabilities, the ability to apply information technology in complex and sustained situations, encapsulate higher-level thinking in the context of information technology. Capabilities empower people to manipulate the medium to their advantage and to handle unintended and unexpected problems when they arise. The intellectual capabilities foster more abstract thinking about information and its manipulation.***

NRC (1999) identifies four broad areas of national benefit as a result of fostering technological fluency via computers and the Internet:

- ***Personal*** ¾ Technological fluency can make citizen's lives more efficient, can provide access to information and the means to process it, can provide a mechanism for communicating with family and friends, manage finances, perform banking, track investments, pursue hobbies, help children with homework, access health care, become political informed, track public policy issues, and much more,

- ***Workforce*** ¾ "If the nation is to obtain the maximum benefit from its investments in information technology, a labor pool capable of using it appropriately is necessary" (NRC, 1999). Technological fluency benefits employers in the form of sophisticated "knowledge workers", but it also benefits employees in the form of enhanced marketability and mobility.

- Educational ¾ Papert has long argued that computers can be the means for educators "to support the development of new ways of thinking and learning" and can "help people form new relationships with knowledge that cuts across the traditional lines separating humanities from sciences and knowledge of the self" (Papert, 1980). Technology also provides access to new resources (i.e. online) and develops critical thinking skills.

- ***Societal*** ¾ "A basic understanding of information technology… is needed to make informed judgements about… public policy issues, many of which have a direct impact on citizens whether or not they use information technology in their daily lives" (NRC, 1999).

Clearly, these benefits go hand-in-hand with efforts to bridge the digital divide. Greater participation of U.S. citizens with computers and the Internet translates directly into greater national benefits in each of these areas.

Office of Technology Policy (OTP)

In January 1998, the U.S. Department of Commerce sponsored the Information Technology Work Force Convocation in Berkeley, California. This event, which included representatives from government, academia, and industry, spawned similar regional meetings around the country in cities such as Austin, Texas, Brooklyn, New York, Chicago, Illinois, Boston, Massachusetts, and Phoenix, Arizona. The focus of these meetings was to begin a dialogue about the current and future challenges of developing America's human capital for the information age. In June 1999, the Office of Technology Policy (OTP)

published a report, ***The Digital Work Force: Building Infotech Skills at the Speed of Innovation,*** which summarized the results of these and other related gatherings.

One of the main conclusions was that the extraordinary growth of the information technology (IT) sector would continue as a result of numerous contributing factors (OTP, 1999):

> ***Technology has contributed almost half of the Nation's long-term economic growth since World War II. And IT is the most important enabling technology in the world today. It is responsible for new products and services; new companies and industries; revitalizing existing products, services, and industries; providing new avenues for commerce; enhancing our ability to manage information and to innovate; and improving our productivity, quality of life, and national standard of living. IT is changing the way we live and work and transforming the economy at a fundamental level.***

The report notes that "for more than fifteen years, employment in the core IT occupations… has grown at an astounding pace" and that between 1996 and 2006, "the United States will require more than 1.3 million new highly skilled worked in these occupations ¾ an average of about 137,800 per year ¾ to fill newly created jobs (1,134,000) and to replace workers who are leaving these fields (244,000)" (OTP, 1999). Consequently, because the projected demand for IT workers far exceeds the projected supply, OTP predicts that there will be a tremendous shortage of domestic workers qualified to fill these positions. Their recommendations include the following (OTP, 1999):

- Encourage and prepare young people to enter technical education and careers
- Prepare students for technical education and careers through math and science education, and technical skills training
- Prepare post-secondary students for the information technology workforce
- Retrain the incumbent work force
- Tap into non-traditional pools of labor to expand the size of the IT labor pool
- Increase the participation of groups underrepresented in the technical professions

Not surprisingly, all of the recommendations outlined in the report are inextricably linked, and significantly bolstered by efforts to bridge the digital divide. Widespread access and use of computers and the Internet are central to any effort aimed at filling the pipeline of domestic IT talent.

As is evident from these and other studies, computers and the Internet have a profound, and far-reaching impact on individuals, families, communities, and the nation. Recommendations are presented in the next section.

Recommendations

The following are recommendations for bridging the digital divide. These recommendations fall into each of the four categories identified earlier as being central to bridging the digital divide: 1) access, 2) training and individual/community support, 3) information and content, and 4) motivation. Where appropriate, I have noted similar or related recommendations from the Clinton-Gore digital divide proposal.

Access

- ***Increase funding for the Department of Education's Community Technology Center Program*** ¾ all of the CTCNet studies demonstrate that CTCs are an effective strategy for engaging underserved groups with technology including minorities, low-income residents, women, and the unemployed. The drivers to their success are well-documented and are easily replicated. Note that CTCNet has also pointed to the need for CTCs, in concert with efforts to bring computers into people's homes. 45% of CTCNet users own a home computer, yet continue to visit the facility for technical support, training, and social interaction (Mark, Ellis, Wise, & Chow, 1998). ***Note that the Clinton-Gore digital divide proposal calls for $100 million for the Department of Education to create 1,000 CTCs in low-income and rural neighborhoods.***

- ***Increase funding for the Department of Housing and Urban Development's Neighborhood Networks Program*** ¾ With 340 neighborhood networks centers already established, and another 1,060 in the planning stages, this program promotes HUD properties, such as low-income housing developments, as sites for CTCs. These sites are naturally convenient to the residents they serve, and are worthwhile investments for the reasons stated in the previous recommendation. ***Note that the Clinton-Gore digital divide proposal calls for $25 million to accelerate private sector deployment of broadband networks in under-served urban and rural communities.***

- ***Increase funding for the Department of Commerce's Technology Opportunities Program (TOP)*** ¾ TOP monies, which typically fund infrastructure improvements, should be targeted at organizations that represent a strong affiliation for minorities, low-income and rural residents, and should encourage community-wide partnerships that seek to use technology to address community-wide, and community-defined problems. Community residents and community members should be enlisted in the co-creation of tools and content, as well as the identification of their interests and needs. ***Note that the Clinton-Gore digital divide proposal calls for $2 billion in tax incentives over 10 years to encourage private sector donations of computers, sponsorship of community technology centers, and technology training for workers, including special incentives for Empowerment Zones/Enterprise Communities (EZ/ECs), and high-poverty areas.***

- ***Expand the E-Rate program to include community-based organizations (CBOs) and non-profit organizations, in addition to libraries and schools*** ¾ The E-Rate program, "established in 1997, has been successful in connecting over one million K-12 classroom, and 10,000 libraries to the Internet" (Benton Foundation, 2000). The program provides 20% to 90% discounts on telecommunications equipment and services based on the percentage of students participating in the federal school lunch program. However, the program excludes CBOs and non-profits from obtaining these discounts. Since schools and libraries have not emerged as likely candidates for public access sites (Bishop et al., 1998), the program should be expanded to include these constituencies.

- ***Ensure universal computer and Internet access in the home*** ¾ There is no substitute for home access. Both the computer and the Internet are tools. Like a pencil, their ability to serve as tools for empowerment is limited by the accessibility. Funding should be directed at economical solutions to providing home computing and Internet connectivity. One example is the Computers for Youth (CFY) program in New York, NY (Stock, 1999). ***Note that the Clinton-Gore digital divide proposal calls for $50 million for a public/private partnership to expand home access to computers and the Internet for low-income families.***

Training and Individual/Community Support

- ***Create national and regional intermediaries to provide training and support to community computing centers and community networks*** ¾ There is an economy of scale associated with the delivery of technology-based training and support. Most community computing centers and community networks aren't large enough to support ongoing staff development and full-time technical support. In fact, it isn't economical for most of these organizations to do so, since the demand for such items is intermittent. National and regional intermediaries can spread these costs across multiple sites by providing workshops and training, technical support, evaluation instruments, and brokering relationships with educational technology centers to develop curricula (see below).

- ***Increase the capacity of existing national and regional intermediary organizations to service their local affiliates as resources for training and support*** ¾ A scan of technology in youth-serving organizations, sponsored by the Dewitt Wallace-Reader's Digest Fund, and conducted by Brandeis University, found that "local organizations are operating in isolation: short on information and trained staff, short on technical expertise, and operating alone in their efforts to finance and acquire equipment, training, and other needed resources" (Melchior, Thorstensen & Shurkin, 1998). Furthermore, existing national and regional intermediary organizations such as the Urban League, Boys and Girls Club, and

CTCNet, were found to lack the capacity to support their own affiliates for training and support. Funding should be directed at these national and regional organizations that are central to the digital divide, to increase their capacity to service their local constituencies.

- ***Develop contextualized curricula*** ¾ Training that is targeted at populations that have not traditionally enjoyed the benefits of technology should be designed around specific, practical themes such as improving access to health care, identifying social services, or conducting an employment search (Bishop et al., 1999). To implement this strategy, the aforementioned national and regional intermediaries should be structured to develop contextualized curricula that can be distributed to local organizations, in addition to their responsibilities for training staff to use technology. Funding should also be directed toward technological fluency and job training/placement programs..

- ***Improve technology infrastructure and teacher development in schools*** ¾ Schools, particularly those located in distressed neighborhoods, require additional infrastructure and training for teachers to effectively incorporate technology into their curriculum. ***Note that the Clinton-Gore digital divide proposal calls for $150 million to train teachers entering the workforce to use technology effectively.***

- ***Leverage existing initiatives and funding in community revitalization with technology*** ¾ Federal programs such as Empowerment Zones/Enterprises Communities (EZ/ECs), community-based institutions such as Community Development Corporations (CDCs), the National Community Building Network (NCBN), and the National Congress for Community Economic Development (NCCED), and community-focused foundations such as Annie E. Casey, Ford, Kauffman, Kellogg, Rockefeller and Surdna, need to partner with leading national, regional, and local organizations in the digital divide arena such as the National Urban League, Boys and Girls Club, and CTCNet, to integrate community building efforts with community technology efforts. Grant monies, both public and private, should be targeted specifically at initiatives that foster such collaborations.

Information and Content

- ***Foster private/non-profit partnerships that can provide appropriate content for underserved groups*** ¾ Beamish (1999) writes, "although content projects have the greatest potential, they often suffer from a fatal flaw ¾ a lack of content. Projects that start off with a vision of providing a deep and current source of information find that creating and maintaining a Web site takes a tremendous amount of work and energy that they cannot always sustain." Consequently, there is a need to forge partnerships between private firms, that have the expertise and resources to maintain up-to-date sites, with non-profit entities, that are in touch with the interests and needs of low-income and rural end-users. The recently announced partnership between DME Interactive and American Online (AOL) to create the African-American-centered "Places of Color" provides some direction for similar initiatives. Any of the aforementioned grant programs could targets funds towards such efforts.

- ***Build and distribute community-based technologies that enable residents as active information producers*** ¾ In their 1998 study of PrairieNet in Urbana-Champaign, Bishop et al. (1999) found that low-income residents have a strong desire to contribute to the Internet. Consequently, there is an ongoing need for tools to be developed that can lower the threshold and enable this activity. This is further corroborated by Lazrus and Mora (2000) who write, "industry leaders should come together to make tools available that enable communities to add new functions to existing websites or create brand new ones that can gather and organize information of value to residents." The aforementioned Multi-User Sessions in Community (MUSIC) system is one strong example. ***Note that the Clinton-Gore digital divide proposal calls for $45 million to promote innovative applications of information and communications technology for underserved communities.***

Motivation

- ***Expand existing programs that serve to increase participation of underrepresented groups in technology-related fields*** ¾ This includes many of the strategies outlined in the Office of Technology Policy (1999) report such as: 1) improve the image of the technical professional and technical professions through marketing and public relations campaigns, 2) develop young people's interest in technical careers through after school programs and other initiatives, and 3) increase student opportunities, for example, through scholarships. ***Note that the Clinton-Gore digital divide proposal calls for $10 million to prepare Native Americans for careers in information technology and other technical fields.***

In the next and final section, I define metrics for success against which these strategies can be measured.

Evaluation

As mentioned earlier, the digital divide is the gap between those who benefit from computers and the Internet and those who do not. Based on this definition, any metric that seeks to gauge the effectiveness of a technology-based initiative must demonstrate that those who have traditionally been denied these benefits are truly being empowered. Therefore, the following metrics should be used in measuring progress toward bridging the digital divide:

- ***Computer and Internet penetration rates*** ¾ statistics, such as those gathered by NTIA, should continue to be obtained and monitored. They should also be gathered for schools. These metrics are useful to the extent that they measure the first tier of the digital divide, ***access to technology.***

- ***Computer and Internet patterns of use*** ¾ data regarding patterns of use, such as those gathered by the Internet Demographic Study (IDS), should continue to be obtained and monitored. They should also be gathered for schools. Particular attention should be paid to whether these patterns are characterized by fairly rudimentary uses, of technology such as surfing and playing games, or more meaningful uses of technology, such as electronic commerce and community building. These metrics are useful to the extent that they measure the second tier of the digital divide, ***use of technology***.

- ***Quality of instruction in traditionally underserved schools*** ¾ data should be gathered that investigates the quality of instruction in schools, to determine if technology is being integrated in a meaningful and constructive way. Anything short of pedagogy that involves higher-order thinking, as opposed to rote drill-and-practice, is also tantamount to the second tier of the digital divide, ***use of technology.***

- ***Representation of traditionally underrepresented groups in technology-related fields, businesses, and the production of online content*** ¾ until traditionally underserved groups such as minorities, women, and low socioeconomic status residents achieve proportional representation in technology-related fields, businesses, and the production of online content, a third tier of the digital divide will still exist, with respect to ***empowerment with technology.***

Conclusion

This paper has discussed the digital divide from a number of perspectives.

First, the digital divide was defined. It was defined as the gap between those who benefit from computers and the Internet, and those who do not. Furthermore, it was argued this gap will only be closed when every American has: 1) the ability to readily access computers and the Internet (including an electronic mail address), 2) the ability to use a computer and the Internet to serve ones individual (technological fluency) and collective (community building) purposes, 3) the ability to contribute to the national information infrastructure, and 4) the motivation to do the aforementioned.

Second, an analysis was performed of the three models for bridging the digital divide: community networks, community computing centers, and community content. Each model was described in the context of their respective strengths and weaknesses. Given these approaches to engagement with technology, the impact of computers and the Internet was presented next. This included evidence from qualitative and quantitative studies, both public and private, that have examined how individuals, families, communities, and the nation have, and will continue to benefit from closing the technology gap.

Third, recommendations were presented for bridging the divide in the areas of access, training and individual/community support, information and content, and motivation. These recommendations included items such as increased funding for federal programs to expand CTCs, expand E-Rate, expand programs that increase the participation of underserved groups with technology, and support the development of empowering technologies for communities. Strategies were also suggested to leverage existing funds for community revitalization, create national and regional intermediaries to develop curricula and provide training and support, and improve technology access and use in schools.

Fourth, and finally, key metrics were suggested as indicators of progress against these strategies. These metrics addressed the three tiers of the digital divide: access to technology, use of technology, and empowerment with technology.

As mentioned in the introduction, the digital divide is indeed the " key civil rights issue of the 21st century." Failure to address this important problem will result in the exacerbation of two separate and unequal distinctions that currently exist ¾ the technological "haves" and the technological "have not's" ¾ the information "rich" and the information "poor". Such a reality would have social and economic implications deep enough to undermine the strength of this nation. Let us hope that through our dedicated and combined efforts, the "great divide" will be eradicated, thus becoming a contradiction in terms.