

Chapter X

The Access Rainbow: Conceptualizing Universal Access to the Information/ Communications Infrastructure

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This paper presents the Access Rainbow, a seven-layer conceptual model of access to the information/communications infrastructure intended to strengthen public interest perspectives in current 'information highway' policy discussions. In particular, it aims to provide the basis for a workable definition of 'universal access' and point to concrete steps for achieving this ideal.

Introduction

A prime impetus for the discussion of universal access is the rapid incorporation of digital networking into the information/communication infrastructure (ICI) for conducting a widening range of social, economic, educational, and political activities. While the benefits are mixed, powerful forces are propelling the shift toward network-based transactions. Acknowledging that in many cases narratives about the advent of network technologies are simplistic, deterministic and mythic in scope (Mosco, 1998), this work assumes that digital networks will continue to be increasingly central to daily life and anticipates a time when they are regarded as a mundane, but vital part of the social infrastructure. We consider how the promise of

network services may be achieved in a socially equitable and productive fashion. We seek to develop and apply a pragmatic model of access to the ICI which respects and embraces public interest perspectives. We discuss several issues central to defining access, present a seven-layered model that addresses the key requirements of an access definition, and, finally, show how the model has been applied in policy discussions in Canada.

Defining access

Defining access to the ICI is difficult for several reasons. While access is consistently identified as a key principle in policy discussions, it is not an end in itself. Access simply enables further activities that can only partially be specified beforehand. There are three main questions to address: 1) Access for what purposes?; 2.) Access for whom?; and 3) Access to what?

Access for what purposes?

In broad terms, enhancing the ICI holds the promise of enabling all citizens to participate more fully in all aspects of economic, social, cultural and democratic life (Clement, 1998, Karim, et al., 1998, Schon, et. al, 1998, Dutton, 1999). A central notion is the possibility of participative interaction with others. In contrast with existing electronic media, digital networks allow people to be creators as well as recipients. In many situations, computer based information and communications technologies (ICTs) offer significant advantages over conventional media for accessing, creating, exchanging and sharing information in the conduct of daily affairs, thus benefitting the social individual in each of his or her major roles as consumer, producer, caregiver and citizen. There are myriad possibilities: exchanging gossip, buying goods, checking the weather forecast, making a living offering information services, playing games, learning a new language, building a community resource file, assessing medical treatments for an ailing parent, contributing to civic debates, and so on. This list could be very long, and ultimately the purposes of access can never fully be defined because citizens should be free to invent their own uses and hence find new value in the infrastructure.

Access for whom?

A brief answer to this question is easy - access for all, at least for all citizens who need and wish to make use of the ICI. To the extent that network services are valuable, no one should be excluded from the opportunity of participating in their advantages. Furthermore, the benefits for everyone expand as more people become reachable through the network. As Borenstein notes, "the utility of [digital] networks appears to rise exponentially with the number of interconnected users." (1998, 6)

However, not all citizens are alike and we need to recognize the diversity of people and their particular access needs. In part this involves recognizing the obstacles to access that are characteristic of various 'populations', most notably age, gender, income, education, disability, language, ethnicity, geographic location (urban vs. rural and remote), and nationality (developed vs. developing countries)

(Castells, 1996; Golding, 1996; Ebo, 1998; Loader, 1998; Shade, 1998). Not surprisingly, there are clear indications that various aspects of the information/communications infrastructure are less accessible to individuals already disadvantaged according to these characteristics. While the development of a major new area of social infrastructure provides an opportunity to redress long-standing disparities, unless these differences are taken into account during this crucial formative period, there is a serious risk that the future society will be more widely divided along these distressingly familiar lines. As Hirschkop (1996, 93) warns, unless all people have access to a range of network services, “instead of extending access to the community the new technology will install a new form of communication apartheid.”

At the same it also true that not everyone will find network access advantageous all the time. For a variety of reasons, such as to find solitude or simply avoid being overwhelmed with email, people may not want to use network services. Promoting universal access is not equated with making it imperative that everyone be “plugged in” as much as possible. The overriding objective is to ensure that everyone enjoys a range of communicative options suited to their particular life circumstances.

Access to what?

Until recently, models of information/communications infrastructure emphasize the purely technical aspects, notably physical connectivity. In order to define more fully what access to the ICI encompasses, and to account for the intricate interplay of its social and technical aspects, a broader model highlighting multiple dimensions of access needs to be delineated. While broadening the focus on access beyond narrow digital connectivity issues makes the architecture more complicated, it also makes it easier to take fuller advantage of longstanding media practices and policy understandings for providing socially desirable and universally accessible services.

In spite of rapid convergence to binary digital representations for many overtly distinct information forms, new networked media will not soon make obsolete the existing sophisticated infrastructure based on paper and electronic media. While the Internet is currently the focus of most of the attention, it is important to see it and other data communications developments as additional components of the wider infrastructure with a long history of evolution. Undoubtedly, digital networks will displace many activities currently conducted via highly evolved conventional media such as the postal service, document publishing and distribution systems, telephone services, TV and radio broadcasting, but are unlikely to render any of them completely redundant. Rather, digital networks will be increasingly interwoven with these other networks in complex and mutually redefining ways. Thus, any access model needs to address the full range of conventional and new media.

At a time when political and economic support for many public media is diminishing (e.g. postal and public library services, and, in Canada, national public broadcasting), it is important to challenge prevailing market-oriented rhetorics which undermine the principle of universality of services benefitting everyone. Citizens should not face a degradation of existing services until they have superior alternatives to choose from. Since the new technologies offer greater capabilities at lower costs, significant benefits can be achieved without anyone being worse off.

Those who promote new services which potentially undermine existing widely used services should bear the onus for ensuring that current users will not be disadvantaged.

Canada has a unique history of ensuring national communication links (postal, telecommunications, broadcasting, and satellite) through federal government intervention (including subsidies, content quotas, and principles of universality). With the development of the ICI, however, the government has opted to let market-led forces and industry initiatives predominate. Amidst an environment characterized by competition, telecommunications deregulation, and increasing cuts to social services, issues of social cohesion, national and cultural sovereignty and notions of citizenship remain crucial. This leads to the question of what services should be considered essential to the maintenance of good societal functioning (Reddick, 1998). Ensuring these services are available may then require specific protections or promotion via collective public initiatives. An access model should assist in identifying where and how public action is required.

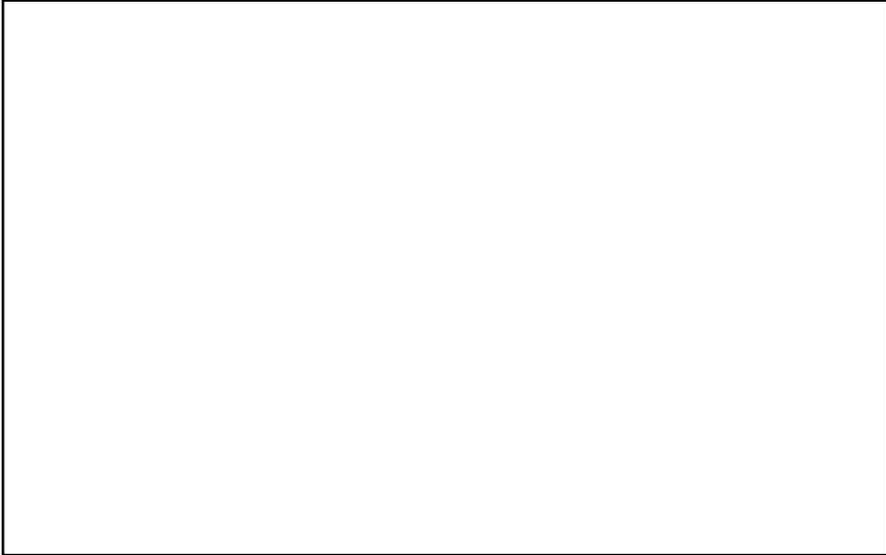
In summary, a model of access needs to:

- include support for a multiplicity of usage roles involving creation and dissemination as well as retrieval of existing information;
- address the full range of possible users and the diversity of their life situations;
- recognize the interplay of social and technical dimensions in the development of infrastructure;
- encompass both conventional and new media;
- highlight “access gaps”, areas of social need likely to be “left out” by market forces acting alone; and
- help identify what services should be considered “essential”.

The Access Rainbow: a socio-technical architecture

In light of the various considerations identified above, we developed an integrated model for analysing and discussing access to network services (Clement and Shade, 1996). A key feature of this model is that it illustrates the multifaceted nature of the concept of access. Inspired by the layered models used for network protocols, the lower layers emphasize the conventional technical aspects. These have been complemented with additional upper layers emphasizing the more explicitly social dimensions. The main constitutive element is the service/content layer in the middle, since this is where the actual utility is most direct. However, all the other layers are related to each other and are necessary in order to accomplish proper content/service access. (See Figure 1 Access Rainbow)

The layers also reflect the important regulatory separation of *carriage* and *content*. This distinction has a long history, going back to the regulation of railroads, but remains relevant as we witness the rapid growth of huge, vertically-integrated, global media conglomerates that threaten to impose monopolistic or oligopolistic control over vital societal infrastructure. Keeping the layers distinct but interoperable

Figure 1.

to allow competition within sectors is seen by some as a key step in providing consumer-oriented service (Sirois, Forget, 1995).

We have adopted the rainbow metaphor because it embodies several concepts central to public interest ideals. It simultaneously suggests unity and diversity. Although the coloured layers can be distinguished from each other, there are no definitive boundaries between them. They are intrinsically related to one another and integral to the whole. No single strand is sufficient; all are necessary. There are, of course, limitations to such a metaphor. The broad arch of a rainbow as well as the spectrum of colours usually conveys harmony and inclusiveness, but in the case of the ICI this is a romantic ideal. The current situation is just the opposite, fraught with contradictions and enduring tensions. The rainbow thus ironically directs our attention to the many difficult challenges we face in achieving the ideal of an inclusive and supportive societal infrastructure.

We begin our exploration of the model with the overview found in Table 1 - Access Rainbow Overview Table. For each layer of the model, we provide:

- a brief working definition;
- a description of its key features, including public interest desiderata;
- illustrative examples; and
- current candidates for designation as 'essential' for achieving universality, with emphasis on those aspects most likely to require further public initiatives.

The following discussion revisits each of the seven layers in turn, expanding the description by highlighting likely gaps and obstacles to achieving universal accessibility and identifying key policy questions. While the model is generally applicable to conventional and digital media, the latter are highlighted due to space

Table 1 - Access Rainbow Overview Table

limitations. Given the broad scope of the model, the details provided are necessarily suggestive rather than comprehensive.

Carriage Facilities

The facilities that store, serve or carry information are undergoing rapid change with the expansion of digital techniques. The Internet Protocol is clearly emerging as the dominant standard. As the pace of technological development accelerates, digital networking is being extended into areas previously based on analogue transmission media, such as telephony and radio and television broadcast. Accompanying digitalization is the growth of very high bandwidth media such as fibre-optic cable and wireless transmissions in the gigahertz range. The growing importance of networked repositories means that such server-space (e.g. for WWW service, distribution lists, and e-mail store and forward) also needs to be considered as part of the carriage layer.

While these technical advances in carriage facilities promise greater capacities, wider availability and reduced unit costs, there are well founded concerns that some people, notably those with low incomes or living in rural or remote areas, will actually be worse off. The most prominent access gap results from the expense of providing terrestrial-link carriage services to those living in rural and remote areas. Currently in rural Canada there are still several hundred thousand party lines which are therefore incapable of computer or even fax usage. With the erosion of regulatory mechanisms to subsidize service to these areas from urban revenues, there is a real prospect that penetration rates may actually drop, even for conventional telephone services. Satellite-based telephony may invert the economics of distance thus making remote areas relatively cheap to serve. However, so far these satellite services are generally aimed at high-income markets. Income disparity is an issue

even in areas that are relatively cheap to serve. Some telephone and cable companies have begun withdrawing investment from inner city areas since they do not anticipate sufficient economic returns from their low-income inhabitants. Prices could also rise as these companies consolidate their hold in particular markets and return to monopolistic practices following the bout of competition and mergers triggered by the U.S. Telecommunications Act of 1996.

The growing popularity of data intensive applications (e.g. graphics and especially video) means that the current widely available analogue standard is becoming obsolete, while adopting higher speed digital services (e.g. via ADSL or cable modems) incurs a significant monthly premium beyond the reach of many subscribers. This raises the question of what constitutes the minimum “essential” bandwidth and hence what should be guaranteed in some way. Given that most useful digital services are still text-based and therefore not dependent on broadband capacity, and that upgrading local infrastructures would incur enormous costs, it appears premature to declare high-speed access (e.g. >56K baud) as “essential”. However, this will likely change over time.

Policy questions: What funding mechanisms (e.g. a universal access fund) should supplement or replace traditional internal cross subsidization to ensure universal carriage service? Should carriage providers be required to meet public accessibility criteria to operate? Are penetration rates suitable measures of universality, or should it also be based on proportion of income required to access basic services? Who will ensure the interoperability of networks? What is the minimum “essential” bandwidth?

Devices

Many access and display devices already exist, and more are being readied for market in the near future. Contrary to the trend of “convergence” seen in carriage media, we are witnessing a proliferation of devices, with a widening mix of capabilities, prices and sizes. Wireless connections are increasingly common and there is a trend to mobile, hand-held networked devices. (Chapman, 1998)

The main issues from an access point of view are the high cost of current workstations and their rapid rate of obsolescence. The annual ownership costs are thus much higher than comparable equipment costs for other major electronic media (radio, TV, telephone). The emergence of cheaper Net PCs or Web TVs together with rising economies of scale will only partially ease the situation as long as the rate of technological change remains very high. Again it is those with lower incomes who are at greatest risk.

Another key issue is usability. Many devices are difficult to use and not readily adaptable to individual differences, especially for people with disabilities. Principles of “Universal Design”, which aims for accessibility by everyone, including those who are disabled in various ways, are only just beginning to be followed and need to be adopted more widely (Shneiderman, 1999). As Perry, et al., (1997) note, “designed access is preferable to retrofitted access.”

Where people cannot afford their own equipment there should be public access facilities close at hand that are suited to a wide range of users. This will be especially challenging away from urban centres.

Policy questions: Are the ICT devices located close to where people need them? Are they affordable? Are they easy to use, especially for people with disabilities? Are they adaptable to human variations? Are they interoperable? Are the devices designed to be augmented with technical refinements, or do new designs render old designs obsolete?

Software Tools

Software is the critical new technical ingredient which expands the capabilities of the ICI. Until recently, software tools have only been related to computers, but they are now becoming incorporated into many common appliances. While there are attempts to make software easier to use, the widening range of products and features adds to their complexity and usability difficulties. Even GUI (graphical user interface) interfaces using icons, pull-down windows, and other non-textual elements can present additional problems for the visually-impaired. Monopolistic practices in the software industry, as revealed in the Microsoft antitrust trial, contribute obstacles to the smooth interoperability of software packages from competing vendors. All these factors make software more expensive to buy and learning to use it effectively a major challenge. Even more than with devices, there needs to be greater adoption of “universal design” principles and the participatory design practices involving diverse user communities (Greenbaum and Kyng, 1991). Furthermore, software is largely written with English speakers in mind, thus disadvantaging other language groups. The general lack of encryption and other privacy protection features (e.g. in web browsers) represents another inhibition to the widespread usefulness of software.

Policy questions: Are major software tools easy for everyone to learn and use? Are they affordable, interoperable, privacy protective and platform independent? How can a wider range of user constituencies participate in software design? How can software tools be developed in an open, non-proprietary fashion? Are they available in languages other than English?

Content/Services

Improving access to the information and communications services people find valuable in their daily lives provides the central rationale for ICI development. Such services must include the ability for users to interact in a creative and participative fashion as well as simply to receive stimuli. People should find them as readily available resources that contribute to fulfilling their roles as citizens, producers, consumers and caregivers. To achieve this goal, content and services should be affordable, timely, reliable, and easy to use. They should cover a wide range of offerings that reflect social diversity in terms of cultural identity, linguistic preferences and political views. People should be freely able to express their observations and opinions without fear of censorship or sanction. While enjoying unrestricted access to what others have contributed, they should be able to avoid full exposure to materials they find offensive or disturbing. Interaction between individuals and organizations should be based on the assurance of privacy, security and authentication.

Essential on-line data bases potentially include those providing access to information about environmental conditions (e.g. weather, pollution), employment

opportunities (e.g. job banks), health matters, emergency services, library holdings (e.g. via OPACs), political processes, civic/local events. Many of these are currently available via the Web without charge to the user. However, commercial influences could undermine some of the diversity and quality of the information. For example, some health-oriented sites are supported through advertising, including from pharmaceutical firms, raising questions of potential bias. A significant and growing proportion of web activity goes through large commercial portal sites (e.g. AOL, MSNBC, Yahoo, Sympatico, Disney). While in important ways these make finding materials easier for many people, they also channel attention to those that are most lucrative to the portal host. This tends to marginalize content providers that cannot afford to pay for visibility on the portal site or that appeal to relatively small market segments. This has national and cultural sovereignty implications, leading in Canada to calls for policies that ensure prominent “shelf space” for Canadian content in on-line cultural emporia.

Government held information is another area requiring special attention. Large amounts of information collected in the name of the public interest with public funds are stored in computerized databases. Over time, it should be relatively inexpensive to make much of this information available via the WWW with no personal privacy violation. While some useful steps are being taken in this direction, they are so far haphazard. Much more needs to be done to fulfill the public’s right to know. A similar principle applies to information of public concern held by private organizations, such as health and safety records, public legal filings, licensing violations, environmental activities, and privacy practices. As with government information, this would be relatively cheap and technically easy to accomplish with network facilities. However, the institutional obstacles are formidable and this form of public accountability may require legal mandating.

Electronic mail is the main candidate for an essential universal digital network service (Anderson, et.al., 1995; Markle Foundation, 1998). It demonstrably fills an important communications niche as witnessed by the rapid growth in the volume of transactions and number of subscribers. Partly this has been enabled by several companies, such as Hotmail/Microsoft, and Juno, offering it free of charge to anyone in exchange for carrying advertising on each message. Whether or not this practice is a short term phenomenon that will end once the market has stabilized, it does at least indicate that the costs of email are sufficiently low that ensuring it is available to everyone would not be prohibitively expensive.

As with software tools, content/service design must accommodate a broad range of users (including people with disabilities), cultures, and languages. Services should be available in text-only form so they are accessible by older, low-end devices and software. Mechanisms should allow users to filter out offensive materials, individually and for their children. Privacy-Enhancing Technologies (e.g. encryption) should be available for individuals to maintain control over their personal information. In terms of content, not all service needs of various groups are represented. The overwhelming dominance of the English language is also a major impediment for global access. (Fishman, 1998) In order to meet the needs of diverse cultural groups, a range of material must be created by these peoples with respect to their particular cultural priorities and heritage.

Policy questions: Which of these services are actually basic/essential? Are they free or very affordable, authentic, and reflective of the diversity of the community? How can one ensure participative decision-making and design regarding essential content for various diverse communities? Which essential content/services are unlikely to be offered universally by market forces, and are hence worthy of public support?

Service/Access Providers

The organizations that provide network access to users are a vital but relatively neglected aspect of the overall ICI. Recent statistics indicate that users access the Internet mostly from their places of employment. But workplaces offer much more than just free access to equipment and connection - they provide a range of services that in combination (ideally at least) provide a supportive use environment. These services include purchasing, configuring, upgrading, maintaining, troubleshooting, repairing, and documenting systems as well as staffing help desks and training sessions. All of these are skill demanding and expensive but vital to routine, unproblematic network use. As network access becomes commodified and sold to individual subscribers some of these support functions become easier, but they don't disappear completely. Individuals have come to rely on an expensive and sometimes unresponsive collection of internet service providers(ISP), telephone or cable companies, hardware and software vendors to maintain minimal network access. While the number of people who have Internet access as individuals is growing rapidly, it is a long way from being the norm. In Canada, domestic access to the Internet was recently just 28% (Ekos, 1998).

We can therefore expect that for years to come, the many people who do not have access through their workplaces nor can afford domestic purchase of networking services will have to depend on public access facilities. Consideration should be given to implementing public access points in public, non-profit, volunteer, community organizations. These should provide access to computer terminals, software, applications, and broadband access to the Internet should be provided (OECD, 1997, 58). With schools and universities increasingly supplying students with public access workstations and network accounts, educational institutions are becoming prime providers of such public network access. However, although both the Clinton and Chretien governments have advocated K-12 access to the Internet in public schools, this does necessarily mean that every child will have ready and useful access to the Internet. In many cases the emphasis is on getting the wires to the school, with little support for other aspects of the learning and use environment. Teachers in particular are often not consulted, nor provided with the time to modify curriculum and offer their students the assistance they need (Shade, 1999). Similarly, although public libraries and other community organizations, such as hospital clinics, daycare centres, post offices, and community centres, are well positioned to provide access to digital network technology, an overall climate of fiscal restraint threatens to diminish the viability and availability of such services. Taking on the role of public access provider can become a major burden that draws resources away from other service priorities, thus weakening the institution.

Non-profit, volunteer-run community networking organizations have grown up in many towns and cities specifically to provide various forms of public access. Although in many cases they began simply as internet service providers, they are becoming increasingly important as sources for both community-based content and training. While their primary focus on digital networking gives them some advantages over more conventional public sector organizations, they so far generally lack reliable access to funding sources. In Canada, the federal government's Community Assistance Program (CAP) is helping thousands of local organizations establish their own networking facilities, but the long term sustainability of these promising initiatives is a thorny and so far unresolved issue. Incorporating local, non-profit and civically responsive organizations into the ICI is a central policy challenge for infrastructure development.

Policy questions: How accessible and sustainable are public access sites and projects? How can existing public institutions, such as public libraries and community centres, be supported in taking on responsibilities for public network access? How can sustainable models of community networks be built? Given a widening gap between education, income, and employment levels, how can community organizations and sites effectively support citizens in the use and development of the ICI? How can commercial Internet service providers participate in public policy discussions accompanying technological design and implementation?

Literacy/Social Facilitation

New digital media place significant learning burdens on users. Even when the design improvements identified in the discussion of the Devices and Software and Content/Services layers become commonly adopted, people will find mastering the inherent complexities of the infrastructure a continuing challenge. Achieving widespread effective use of network technologies must therefore be supported by a variety of formal and informal learning facilities. According to Neice (1996),

A person's relative degree of digital literacy will enormously influence their participation in and access to the information techno-structure. A complete understanding of the socially-included and the excluded, in the information techno-structure, will depend on a much richer and more detailed understanding of the nature and form of digital literacy skills than is available today.

Digital, or network literacy, is too often treated in practice as being mainly about keyboard and menu navigation skills. It is more usefully viewed as encompassing a broad range of knowledge and skills. Knowledge includes an understanding of the various types, sources and uses of global networked information; the role of networked information in research and problem solving; and systems whereby information is stored, managed, and transmitted. Skills include the ability to retrieve specific sorts of information using a range of tools such as search browsers and online databases; the ability to manipulate, enhance, or increase the value of information; the ability to purchase and configure local systems and then troubleshoot them when they (inevitably) don't work as expected; the ability to analyze and resolve both professional and personal services that increase the quality of one's life through actively creating as well as passively consuming information.

While good materials (of the right level and language) in combination with self-study are important in acquiring the necessary skills and knowledge, the social aspects of learning are often over-looked. Much learning relevant to accomplishing practical tasks occurs informally “on the job” with the assistance of “local experts.” These are friends or colleagues close at hand who are approachable and knowledgeable about both the technological capabilities and the task requirements. The access/service providing organizations mentioned above are clearly a principal source for such learning support. However, those who will be most in need of learning assistance will be those who can’t attend educational institutions or have jobs in workplaces where network services are readily available. Local, community-based support for learning therefore become essential.

Policy questions: How can and should digital literacy be defined? What are the basic levels of digital literacy required to obtain good employment, become informed civically or otherwise play an active role in society? How can one foster public support of education/training and a climate of experimentation and diffusion of innovation?

Governance

Governance is about the ways in which decisions are made concerning the development and operation of the information/communication infrastructure. Current governance and policymaking is centred in the major developed (OECD) countries, with corporate and industry stakeholders playing leading roles. Privatization and the deregulation of global telecommunications markets are seen as the way to foster competition and technological innovation. The principal role for individuals in this approach is as consumers, choosing from among the growing array of digital goods and services. This represents an overly narrow range of actors and interests. Important issues, such as public accountability, cultural identity, social inclusiveness and cohesion, and national sovereignty, are being threatened by giving such a priority to market forces. A major challenge during this crucial formative period is to broaden the range of participants and ensure that decision-making is democratic at the local, national and global levels. (Herman, McChesney, 1997).

The general citizenry has much at stake in the current phase of ICI expansion, but faces formidable difficulties in effectively shaping the development process. Social priorities need to be established, technological and economic alternatives examined, issues clarified, potential “impacts” assessed and policy options debated. This requires a combination of research projects, experimental trials, education campaigns, expert testimonies and public hearings that engage the interest of a wide range of citizens and their organizations. All of this is feasible and there is considerable experience to draw upon. However, what appears to be the main obstacle to greater public involvement is the unwillingness of the leading actors to broaden the discussion.

Canada has had a long history and some notable achievements with active public involvement in decision making over complex infrastructure initiatives (e.g. Aird Commission, 1926, and the MacKenzie Valley Pipeline Enquiry (“Berger Commission”), 1974). In the case of the ICI, the most publically visible policy discussion involved the Information Highway Advisory Council (IHAC). In a break

with tradition, it did not conduct significant research nor hold public hearings. Its final reports provide a useful overview of the many issues involved in the information highway discussion, but the recommendations largely reflect the dominance of the telecommunications and media industry representation on the Council (IHAC, 1995, 1997). The Council did recognize the need for a comprehensive strategy for achieving universal access, and in response the Canadian Government committed itself to:

“By 1997, ... develop a national access strategy ... to ensure affordable access by all Canadians to essential communications services. ... Developing this strategy will involve widespread consultations with all interested parties” (Government of Canada, 1996, p. 24)

Unfortunately, public consultations did not occur and the goal of universality has been replaced by a much narrower and vaguer ambition to make “Canada the most connected nation in the world.” However, several public interest organizations are continuing to pursue the access issue (Buchwald and McDowell, 1997, Clement and Shade, 1998). Through a series of workshops, funded in part by the federal government, they have begun formulating their own national access strategy (Clement, 1998). Central to the strategy is declaring cyberspace as an ‘electronic commons’ embracing a variety of public and private spaces for a range of profit and non-commercial exchanges. The electronic commons is a shared resource vital for supporting the varied activities of daily life. One that needs to be equitably apportioned and managed in the public interest by carefully balancing the contending legitimate demands for its use. In keeping with the rainbow model, access to electronic network services is treated as a complex social/technical phenomenon, and not mainly about connection to high-speed transmission facilities.

Some of the key governance principles include:

- Giving priority to community-based initiatives;
- Re-dressing existing inequities which inhibit access;
- Ensuring there will be no decline or degradation of existing information/communication services;
- Using commercial expansion to fund broadening of access; and
- Affirming the public’s right to full participation in decision-making concerning development of the communications/information infrastructure.

The strategy proposes establishing “Access Councils”, broadly representative and publically accountable bodies at the local and national levels mandated to pursue the goal of universal accessibility. Among its functions would be to define an evolving set of ‘essential network services’ and establish priorities for a Universal Access Fund.

Policy questions: How can one establish a participative public policymaking process? What new governance institutions are needed? What are the prospects for “digital democracy” - i.e. what role can the Internet itself play in involving citizens in ICI development and other policy areas? (Alexander and Pal, 1998). How can community-based and public interest organizations be supported in taking and active part in ICI governance? How can one govern locally or nationally within an

increasingly global arena? How do various trade regimes (e.g., WTO, NAFTA, GATT, OECD policies, and the proposed Multilateral Agreement on Investment - MAI) affect governance? (Clarke, Barlow, 1997).

Applying the model

This section shows how the Rainbow model has been used in two different scenarios: in examining how new technologies might be implemented and accessed in a non-profit organizational setting; and as part of a recent policy discussion surrounding the development of a Canadian health information infrastructure. The Rainbow model has also been applied in policy discussions concerning a gender-based analysis to the needs of women and women's groups within Canada with respect to access to information and communication technologies (Balka, 1997).

Non-Profit Organizational Setting: The Social Development Network

The Social Development Network (SDN) (<http://www.web.net/sdn>) comprises a broad cross section of 8,000 non-profit organizations in Ontario. SDN members believe that accessible and affordable information and communications technology should be used to achieve their individual and shared goals; therefore, SDN encourages broad-based participation which flows from shared commitment to this mission. SDN's goals are to provide an electronic forum for not-for-profit organizations to work together in support of social development; promote inter-organizational capacity-building; make technology easier to use for organizations and people in the non-profit sector; add value with information and communication technology; and promote cooperation among organizations and people involved in social change.

Mielniczuk (1996) has adapted the Rainbow model for the development of SDN, which is described as "a human network supported by a technical one." While the uppermost layers represent the organizational and social considerations for a working system, the middle layers consider process and service content and the lower layers address the technical components. Each of these layers interact; and "in order for a system to be responsive, participants, stakeholders and users must have explicit opportunity to shape all levels." The Rainbow model was particularly helpful in providing a comprehensive and coherent framework around which a disparate and far flung collection of small organizations could coalesce.

Of special importance is SDN's emphasis on facilitation and training to develop lead users at each location of member organizations. These lead users are supported by readily available shared resources and skilled support staff. Organizational members and sectors commit to ensuring that local innovations and challenges are broadly shared with others through designated facilitators, and they will identify specific equity problems between information have's and have-nots.

(See Figure 2 "Social Development Network : Information Infrastructure" found at <http://www.web.net/sdn/sociotec.gif>. Also see <http://www.web.net/sdn/govserv.gif>)

Developing Canada's "Health Info-Structure"

New information and communications technologies hold considerable promise for the general public to play a larger role in making informed decisions about their health and that of those they care for. However, there has so far been relatively little attention given in Canada to the complex issues of accessibility - how members of the public may readily obtain relevant, reliable and timely health information and communicate with others about health matters. There are significant economic, technical, and social barriers to access that can prevent many citizens from benefiting fully from the health info-structure, and which may further increase the disparities in health status among citizens.

Federal government planning for incorporating digital networking into Canada's health system has been centred in the Advisory Council on Health Info-Structure which reports to the Minister of Health (Health Canada, 1998). A recent study commissioned by the Advisory Council examined accessibility issues with a view to recommending steps towards the elimination of access barriers for Canadian citizens and suggesting a design framework for the development of a Canadian health infrastructure (Clement et al., 1998).

The study identified a major gap in the networked info-structure as the lack of a definitive electronic repository of basic health information resources and linkages to the wide and growing range of Internet based information/communications services. This gap could be overcome by developing the Canada Health Space (CHS) "a universally accessible health information/communications 'commons'". In keeping with the foundational principles of Canada's public health system, it would be owned and governed by Canadians and operated in the public interest. It would make available to all Canadians an integrated set of electronic resources with multiple providers and entry points. As a complement to independently maintained resources and by providing an effective means for enabling Canadians to obtain health relevant information and to communicate with each other about health related matters, it should develop a popular reputation as the principal place for Canadians to begin looking for health related information and communications services. At the same time it should become the preferred means of publicity for those offering health services, information, or opinion. In time, it should also become a mandatory reporting vehicle for every individual or organization whose products or activities are intended or likely to affect significantly the health of Canadians.

The Accessibility study drew upon the Rainbow model in several ways. Foremost, it highlighted the notion of accessibility as a complex multimodal and multilayered notion in which the social aspects of the health information/communication infrastructure play a prominent role. This is in contrast to treating access mainly as connection to high-speed networks linking data bases of health information with individual health consumers. A view which dominates the current policy discussion. A consequence of this shift in attention is the need to keep the development of the social infrastructure in balance with technological investments. In particular, policy must recognize and support the ongoing role of health information intermediaries in providing, interpreting, and disseminating information.

The access rainbow was also useful in articulating specific aspects of the Canada Health Space and its overall architecture.

Carriage

Given the variety of health information users and use circumstances, the health info-structure must offer multiple carriage modes. Integrated with the direct, in-person communication between an individual and front line health (information) provider, there needs to be a coordinated array of transmission options, including via:

- telephone (e.g. 1-800 numbers, involving a flexible combination of skilled human agents, and Interactive Voice Response technologies)
- Internet(e.g. WWW, email, chat, etc.)
- fax (e.g. fax form entry and fax back services)
- standard mail (e.g. brochures and other bulky or glossy-printed materials)

In so far as digital modes are used to carry health information for the general public, the initial priority should be on taking full advantage of the currently available voice grade network to extend the reach of the CHS rather than promoting applications requiring broad band facilities available to the fewer already relatively advantaged users.

Devices

Health information services should be designed to work well with widely available “off the shelf” hardware components. Given that the users of health information services are more likely than the public generally to be physically disadvantaged in some way, it is especially important that public access devices meet the highest standards of usability. The priority locations for such devices should include health information centres, clinics and hospital waiting rooms.

Software Tools

Again, as with devices, the emphasis should be on taking advantage of the software tools that are already widely used. Software for public access points should be carefully chosen for wide usability. Given the often sensitive nature of health matters, privacy and even anonymity protection features are especially important

Content/Services

Health information and communication services that many people will find useful include: preventative health information, medical treatment options, health system performance statistics, health promotion/advocacy organizing information, community health indicators, environmental hazards, health and safety records of employers and product manufacturers, disease/disorder-related discussion groups. The information needs to be timely and reliable. The source of information should be clearly identified, especially if it is commercially sponsored, so its credibility can be assessed. Information should be available from alternative sources, including from non-profit, public or community-based organizations. Making queries and obtaining information should not compromise privacy rights.

Since users of a health info-structure (e.g., the lay public, experienced health intermediaries, front line health providers) will reflect differing degrees of health expertise, the information will need to be presented at several levels of sophistica-

tion. In particular, information geared to the non-medical specialist should be available.

People should be readily able to find others sharing similar health concerns and freely discuss these matters. They should have an opportunity to learn of other peoples experiences, opinions and ratings of particular health services as well as contribute their own publically accessible reviews.

Service/Access provision

Health information/communication intermediaries (e.g. librarians, front-line health providers, medical clinics, voluntary & community health promotion organizations) are an established part of the existing health info-structure. Far from digital networks rendering them increasingly obsolete, they have vital and ongoing access role to play. Since they are already experienced in providing information services, they are well positioned to host public access sites, evaluate software tools, develop digital materials, assist users in learning to interpret health information, and contribute to decision making around health info-structure development. They thus need to be better supported in these roles and the networks that link them strengthened. Digital networking can help in this regard.

Literacy/Social facilitation

Beyond conventional and computer literacy, users of the CHS will need to develop skills in making sense of information involving unfamiliar medical terminology and reflecting widely differing perspectives. People need to be able to judge the relevance, reliability and sources of information. The network of health information/communication intermediaries mentioned above will be especially valuable in helping people learn to navigate health databases and interpret the information they find.

Governance

The good functioning of the health info-structure is a matter that concerns everyone, in a variety of ways. Decision making around development of the health info-structure should therefore reflect this range and diversity of stakeholders. This will require ongoing public participation in all phases of design, implementation, and operation. Large medical institutions and suppliers are already well positioned to play an active part in this process. It is the participation of smaller, resource-weak health organizations which will need facilitation. In particular, health information intermediaries and community-based health promotion/advocacy organizations will need support in this.

Conclusion

This paper has sketched a holistic model for defining access to the information/communications infrastructure that addresses universality and other key public interest concerns. While much work needs to be done in testing, refining and elaborating the model, probably the most important task is to apply it to current

policy debates. One possible such application of this model is to provide the basis for defining essential aspects of access at every infrastructure level which in turn could guide the expenditures from a possible Universal Access Fund.

A major design challenge now facing policy makers is to specify a multifaceted architecture for developing network technologies that takes all seven elements of the Rainbow model into account and affords access to everyone by virtue of their membership in society. The design process must be broadly participative and dynamic. It must be carried out in the face of strong pressures from rapid technological change, ideological opposition, ignorance of technical possibilities and social implications, strained public resources and societal instability.

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