

Bandwidth is Political
Nancy Paterson

What is the future of the Internet? Is there anything inherently democratic about the Internet, or is the opposite true? Is the World Wide Web a convenient tool for fascism, a new method for spreading violent or political propaganda or is the Internet essentially democratizing? Is online communication the most potent medium for furthering hegemony yet invented?¹ Underlying these philosophical, political and social issues is a largely unarticulated discussion regarding the design, maintenance and regulation of the Internet infrastructure. The content of the Internet – issues of ‘freedom of speech’ relating to sites on the World Wide Web, privacy regarding communications such as email, and the rights of individuals to share and exchange files and data freely without fear of litigation – these are the issues of which traditional media make headlines. Discussed less frequently are three components of the global network’s infrastructure which also have implications for the flow of information. These are: the management of the Internet’s names and numbers systems – resolving IP address to domain names; the structure of IP (Internet protocol) addresses (updating from IPv4 vs IPv6)²; and interconnection, the rules and conventions regarding the movement of data through the network also known as ‘peering’.

Bandwidth is political. There are many ways of approaching the relationship between democracy, technology and individualism. How, why, where and under whose control communications technologies³ (specifically the Internet) originate and survive, are among the most interesting and important questions that we may address. Rather than acknowledging the impact of new technologies by simply updating their tax-gathering capabilities, governments and international bodies established to regulate and administer the Internet, must recognize that business is not the sole authority and arbiter for technology and how it should be adopted or adapted to facilitate commerce, law, medicine, etc. Rather than investing in bureaucracy, governments should be empowering individuals, because it is from individuals that real creative solutions will arise.

Bandwidth, in a media saturated culture such as ours, is how we construct narratives, and how we share those narratives in order to construct identity. Bandwidth is how all of technology works (technology is always distributed). Who controls the bitstream and how much data space do we each have access to? In a digital information economy such as ours, the politics behind the movement of data and the infrastructure design has serious implications. With digital communications technologies, knowledge became information, information became data, data became commodified and arbitrage commenced.⁴ The

1 Michael D. Dorsher asserts that his PhD dissertation proves this: ‘The Quiet Convergence of Power, Culture and Computers.’ Available: www.uwec.edu/mdorsher/ica2001/hegemony_online.htm

2 IPv4 addresses are 32-bit numbers often expressed as 4 octets in “dotted decimal” notation (for example, 192.0.32.67) . The most obvious improvement in IPv6 over the IPv4 is that IP addresses are lengthened from 32 bits to 128 bits.

3 At the present time these refer to both electronic and digital communications technologies

4 Arbitrage is traditionally used to refer to a kind of hedged investment meant to capture slight differences in price; when there is a difference in the price of something on two different markets the arbitrageur simultaneously buys at the lower price and sells at the higher price

arbitrage of access and interconnection (peering), in particular, has ramifications for democratic liberalism in the 21st century.

Democracy is commonly defined as the willingness to give up economic rights in order to gain political freedom, while Liberalism is equated with the willingness to give up political freedoms in order to secure economic rights.⁵ In capitalist societies such as we have in Canada and the US, there is a constant tension between economic freedoms and political rights; however, both must co-exist in order to continue to support our most important cultural characteristics: individualism and innovation.

Online culture is suspended, at this historical moment, at a critical juncture – ideology or utopia? A tool for political activism and social transformation or a means of reinforcing the status quo? The ways each of us choose to develop and use the Internet reflects our obsessions and priorities. Personal empowerment through communication (email, chat, instant messaging) and self-publishing (weblogs) are popular, but so too are tools of self-gratification such as pornography – these are all ‘applications’ of social interaction. On a larger scale, however, at the level where decisions about Internet connectivity and governance being made, the Internet as microcosm of any one society’s political and cultural experience is almost inconsequential. More critical is how the Internet acts to facilitate individualism and knowledge across a global stage.

The past decade has seen a radical transformation in how individuals are able to access and distribute information via the communications infrastructure that we know as the Internet. This transformation was only in part inspired by technical considerations.

The Internet began when the US government, specifically the US Department of Defense, was looking for a way to share computing resources of major research centres and institutions – a system which would not depend on centralized control, and one that would allow resources to be shared regardless of the different systems, languages, hardware and network devices connected to or accessing it. ARPAnet⁶, the first wide area packet switching network, was launched in 1969, connecting four computer centres: University of California at Los Angeles, SRI International, the University of California at Santa Barbara and the University of Utah. Widespread use of the networking software by other academic and research institutions led to the merging of newly created LANS (local area networks) in the late 1980’s. In 1986, one LAN branched out to form a new competing network, called NSFnet⁷. NSFnet first linked together the five national supercomputer centers, then every major university, and it started to replace the slower ARPAnet which was finally shutdown in 1990. NSFnet formed the backbone of what we call the Internet today. Restrictions on Internet commercial traffic were gradually lessened and by 1995 the National Science Foundation (NSF) which had been subsidizing the project, completed privatization of the Internet.

The Information Processing Techniques Office (IPTO) provided leadership for the development of the Internet in the early days, utilizing the services of researchers employed by the government. For the most part, however, the Internet remained ‘under the radar’ of regulatory authorities in the US and other countries, until its commercial

5 F. Hayek and others support this view, including B. Moore-Jr., D. Apter, P. Burger etc.

6 Advanced Research Projects Agency Network

7 National Science Foundation Network

success and privatization in the mid 1990's. Changes were carried out in large part via calls for RFC⁸ an essentially democratic process, albeit one which was limited to those privileged enough to be part of the network. The Internet was able to develop as a mass communication medium without an associated commercial industry, facilitated, in large part by the fact that HDTV⁹ was being promoted as the key to the US economic strategy – the impending convergence of the television, computer and telephone industries. The commercial prospects of HDTV (home shopping, video-on-demand and other interactive services) were contrasted with the information distribution and retrieval services of the Internet. The Internet was perceived as having been designed to satisfy a very specific niche objective – research. Beyond that it was ignored by most governments, regulators and telecom Standards Development Organizations (SDOs). To some extent, the chaotic nature of communications technology and new media applications has been the strength of the Internet: it both encouraged innovation and provided a protection for innovation because its chaotic nature kept the overzealous regulators and commercial interests away for that critical period of incubation.¹⁰

Originally designed as a peer-to-peer system, the Internet as conceived in the late 1960s was intended to enable the equal sharing of resources. Every host on the Net could FTP or Telnet¹¹ to any other host. More complex systems which developed, such as Usenet¹² and DNS¹³ also included important elements of peer-to-peer communications.¹⁴ The commercialization of the network in the mid 1990s changed this model to one which emulated dominant mass medias such as television and newspaper – passive consumption. The web browser and many of the other popular applications which emerged during this phase emphasized the client/server model.

The re-emergence of peer-to-peer (P2P) applications for file sharing today demonstrates a revolt against the infrastructure which has been deployed, one in which firewalls and asymmetric network links attempt to block users from cooperating and exchanging files, data, information, knowledge. In every sense and at every level, the design and implementation of the network (including basic interconnection agreements – peering or transit) represents political and philosophical decisions and directions. And these in turn affect the attitudes and expectations of end users. Particularly as Internet services are being bundled – voice, video and data are described as the 'triple play' of telecommunications services – we must understand the motivations behind the structuring of these media, and their presentation to us.

8 Requests for comments

9 High Definition Television

10 Under ARPAnet several major innovations occurred: email (or electronic mail), the ability to send simple messages to another person across the network (1971); telnet, a remote connection service for controlling a computer (1972); and file transfer protocol (FTP), which allows information to be sent from one computer to another in bulk (1973).

11 While FTP and Telnet are client/server applications, hosts were not designated as either clients or servers, but had the ability to act as both

12 Usenet was originally based on a facility called the Unix-to-Unix copy protocol or UUCP. With no central control, one Unix machine could automatically dial another, exchange files with it, and disconnect.

13 The Domain Name System was originally established as a solution to a file-sharing problem. As the Net grew, DNS was developed as a way to distribute the data-sharing across the peer-to-peer Internet. DNS hosts act as both clients and servers in propagating data requests across the network.

14 It is important to note, however, that although Usenet was commonly perceived as providing a democratic forum, that 'democracy' was limited both by the ability to access it, and by the owners and administrators of the particular computers which were nodes on the network.

To understand why the parameters of (and limitations on) our access to these media have ramifications for democratic liberalism in the 21st century (specifically innovation and individualism) it is useful to consider Antonio Gramsci's model of hegemony vis-à-vis mass media. Gramsci's description of the character and role of the intellectual (individual) may be contrasted with the approach described by Karl Mannheim. Although Gramsci and Mannheim's views must be considered within a specific political context (Europe between the wars and the tensions between fascism and democracy), the upheaval which they describe may be applied to the current situation in North America. John Dewey points out that new technologies are inevitably disruptive of social and political systems. How they are disruptive, and our individual and cultural responses to these disruptions, are the overarching themes of this discussion.

Antonio Gramsci's hegemony describes how, through a combination of political and ideological means, one social/economic class may come to dominate others. Particularly in capitalist societies, consent (via ideology) rather than political force or coercion, is described as the most effective means of achieving and sustaining this objective. Noam Chomsky, in Manufacturing Consent also details how, through subtle means dissenting political forces are rendered irrelevant by the apathy, anxiety and uncertainty generated by mass media and the corporate interests they serve.

The control and manipulation of traditional media has become a subject of considerable interest, particularly in light of trends towards globalization. In The New Media Monopoly Ben Bagdikian details how a cartel of five conglomerates control the media upon which a majority of Americans say they rely. These five corporations: Time Warner, Disney, Murdoch's News Corporation, Bertelsmann of Germany and Viacom (formerly CBS) currently own most of the newspapers, magazines, books, radio and TV stations and movie studios of the United States. Furthermore, according to the Center for Digital Democracy (CDD), the breakdown of ownership in traditional media in the US is as follows: 5 record labels control 75% of all recordings sold; 6 cable companies control 85% of the cable TV market and the 4 major TV networks own 90% of the top 50 cable channels. According to the CDD, the new media, in contrast, offers "low barriers to market entry, modest production and distribution costs, and an open invitation to engagement and participation."¹⁵ The business model for the Internet is not 'selling shovels to goldminers' – what has to be 'sold' is the content and interactivity. Access to new media, from the advent of desktop publishing in the 1980's to today's desktop audio and video editing tools, has fostered new waves of self-expression while providing the means of distribution/publication: the World Wide Web. The line between producers and consumers has once again begun to blur; passive consumption of media can no longer be presumed, from (low engagement value) Reality Television to (highly engaging - informative) Independent Media Centers.¹⁶

Two contrasting images of the ideal intellectual are presented within the context of post-Marxist reconsideration of the concept of ideology and the sociology of knowledge. Whereas Mannheim's idealized intellectual was 'above the battle' - a 'free-floating intellectual' best-positioned to represent the situated truth of a given time and place

¹⁵ www.democraticmedia.org/ddc/nms.php

¹⁶ A list of 143 alternatives to mainstream press is available at: <http://www.indymedia.org/or/index.shtml>

precisely by virtue of being unattached to a particular ideology, for Gramsci, the opposite was true. For Gramsci it was the very connectedness to a social movement aimed at social transformation that was the ideal setting for what he would call an 'organic intellectual.'

Gramsci was also interested in future-oriented ideologies; however, for him ideology was a mode of thinking accessible to the masses, more advanced but functionally equivalent to religion as a political motivator. Hegemony, which denoted the predominance of one social class over others, represented for Gramsci not only political and economic control, but also the ability of the dominant class to project its own way of seeing the world so that those subordinated by it would accept it as 'common sense' and 'natural'. This was a dynamic process; hegemony was result of the struggle/contradiction between ideology and the social experience of the subordinate classes.

Both Gramsci and Mannheim wrote in the early twentieth century, at a time when colonialism, world war, communism, and other challenges to Western hegemony were paramount, and each intimately experienced fascism. Each attempted to come to terms with their experiences through their writing; The Prison Notebooks were written by Italian Communist Party leader Antonio Gramsci when he was imprisoned by the Fascists, while Karl Mannheim continued his work after he fled to London from Germany as the Nazis came into power.

In Ideology and Utopia, published just before he left Germany, Mannheim characterizes ideology as a conservative force supporting the status quo while utopias, which are future-oriented and potentially transformative of social structures, encourage political change by providing the vision of an alternative order.

When Mannheim moved to London, his focus changed from the sociology of knowledge and ideas (ideology vs. utopia) to the study of social structure. It was in London that he commenced his investigations of the bureaucratization of society, the structural formation of personality, the position and role of intelligentsia, and the relationship between sociology and social policy. Mannheim, who died in 1947, conceptualized sociology as a means for planning societies with the goal of avoiding both the dangers of totalitarianism and the class system. His analysis, however, while appropriate for the German society and situation, became localized and inadequate when applied to the British model. Most certainly it would not fit the North American political or social experience.

Mannheim's vision of democracy moving towards what he termed 'irrationalism' is an apt description of the impact of globalization. His assertion that irrationalism leads to a 'flattening' of democracy may further describe how diversity functions to introduce chaotic elements into relatively stable models. As has been demonstrated through physics and experiments involving chaos theory – small changes can have (eventually and/or remotely) huge effects.¹⁷ As well, it has been shown that in nature order arises from disorderly systems and actions are reflected over great distances. Chaos theory has also been incorporated into the study of economics.¹⁸ What are its applications to social and political theory? Is chaos theory and the example of 'order arising out of

¹⁷ A good reference to this is: Chaos: Making a New Science by James Gleick.

¹⁸ Used for analyzing commodity or stock prices and trends.

disorder' an argument against Mannheim's premise that democracy is doomed to fail with the emergence of 'irrationality'?

Contributing a North American perspective, John Dewey, in 1927 (The Public and its Problems) wrote that the inventions of steam, electricity and the telephone offered serious challenges to relatively static and homogeneous forms of local community life and government. The impact was not only economic and a new way of looking at space/time – but he suggested that these changes posed fundamental questions for democracy – “How can a public be organized, we may ask, when literally it does not stay in place?”¹⁹

We must credit Mannheim with naming this crisis of liberalism, even if we disagree with his view of the cause or the inevitable outcome. Mannheim felt strongly that the democratization of culture led to the abdication of individual political responsibility and initiative:

On the one hand, democracy fosters the freedom and development of the individual personality; it stimulates individual autonomy by giving each person a share in political responsibility. On the other hand, however, democracy also develops powerful social mechanisms inducing the individual to give up his autonomy. When strata not yet ripe for political responsibility are suddenly admitted to a share in power, they are more likely to make use of mechanisms of this sort than to stimulate individual freedom. Democracy officially emancipates the individual; actually, however, the latter tends to abdicate the right to follow his own conscience and to seek refuge in the anonymity of the mass.²⁰

A proponent of the competitive theory of democracy, Mannheim assumed that the majority is in fact unable to control power, willingly abdicates control and that the ruling function is most appropriately and efficiently carried out by elites. Whether this involved a 'circulation' of the elites or a healthy competition between groups of elites, it was imperative, for Mannheim, that there be no dilution of the power, influence and prestige of these ruling groups. Mannheim emphasized that the elites must remain insulated from the masses in order to cultivate necessary cultural and intellectual differences. He maintained that should this separation become less distinct, then the anti-intellectualism of the masses would become increasingly popular in elite circles. The result of this, he held, was that the quality of intellectual and artistic work would decline and the resulting weakening of the elites would push society from democracy into fascism.

In fact, there is evidence that the opposite is taking place, that the democratization of culture (particularly through communications technologies such as the Internet) is empowering individuals, facilitating the dissemination and discussion of ideas and encouraging participation in the creation of culture as well as the political process. This empowerment undeniably constitutes a threat to those groups and individuals attempting to maintain political and economic power.

At the core of the current political/social crisis of democratic liberalism is a crisis of individualism. Innovation requires individualism and the suppression of individual rights,

19 Dewey, p. 140

20 Mannheim, p. 273, 274 of 'The Democratization of Culture'

particularly individual *digital* rights is responsible for many of the negative economic effects which are beginning to emerge. Whether or not this crisis is caused by new technologies as Dewey would have argued, it is certainly brought to the forefront by this communications revolution. The intense debate surrounding various aspects of Internet governance are examples of how individual participation in culture is undermined while commercial interests are advanced through government.

The rise and fall of the Internet may be seen as a template for the failure of democratic liberalism in contemporary North American culture. Mannheim argued that industrialization leads to the creation of mass society, which he viewed, in turn, as a threat to democracy. Dewey agreed that the nature of the political experience was forever changed by new technologies.

The seriousness of the threat to the status quo (particularly the threat to an analog business model which expresses a preference for asymmetrical, asynchronous²¹ technologies) may be seen in the often elaborate measures being taken to suppress individual digital rights. At a very fundamental level, new applications of science and technology are clearly disrupting the established capitalist system of intellectual property and copyright/patent protection. The response has been to reinterpret existing legislation to favour corporate interests and to implement new legislation which works against the original spirit of the law which was intended to protect the rights of creative individuals.²²

'Digital intellectual property' or the 'content' which is distributed through these electronic and digital communications technologies has been clearly commodified, as has been the opportunity and ability to interact with that content. Microsoft (through Corbis) is cornering the market on making available and licensing digital still images²³; Apple will sell you the tools you need to either rent/purchase audio/video (ipods, imovie) or the means to manipulate these media. Macromedia dominates 2D animation and fake 3D through their Flash and Shockwave software and Cisco has become synonymous with traffic engineering (routing) within the network.

United States v. Microsoft was a widely publicized antitrust trial in which the U.S. Department of Justice (DOJ), joined by twenty U.S. states, alleged that Microsoft abused monopoly power in its handling of operating system sales and web browser sales. The DOJ and states filed this antitrust case against Microsoft in 1998, with the central issue being whether Microsoft should be allowed to bundle its flagship Internet Explorer web browser software with its Microsoft Windows operating system. It was found that Microsoft had abused its monopoly power position and the case was remanded for consideration of a proper remedy. However, the DOJ, subsequently under the administration of U.S. President George W. Bush, announced on September 6, 2001 that it was no longer seeking to break up Microsoft and would instead seek a lesser antitrust penalty. On November 2, 2001, the DOJ reached an agreement with Microsoft

21 one-sided, one-way

22 Copyright extensions over and over to protect Disney!

23 Bill Gates' private company Corbis owns a major collection of images. It has been active in licensing use of those images by businesses, other organisations and individuals. It has also become an agent for images owned by other entities, notably major art museums in North America and the EU.

to settle the case, with the proposed settlement requiring Microsoft to share its application programming interfaces with third-party companies and appoint a panel of three people who will have full access to Microsoft's systems, records, and source code for five years to ensure compliance. Microsoft was not required to change any of its code nor was it prevented from tying other software with Windows in the future. Nine States and the District of Columbia have not agreed with the settlement, arguing that it does not go far enough to curb Microsoft's anti-competitive business practices. That sentiment is shared by many people in the computer industry, especially those who advocate open source and other alternatives to Microsoft. Many believe that free market competition can only be restored by government intervention to break up the Microsoft monopoly.

Even the market on text manipulation has been taken over by search engines which constitute a powerful source of access and accessibility within the web.²⁴ In addition to individual scholarship, the National Telecommunications and Information Administration (NTIA) has released a report titled 'Falling Through the Net', which demonstrates "how access to the web is preconfigured in subtle but politically important ways, resulting in exclusion of significant voices... The politics of search engines thus represents the broader struggle to sustain the democratic potential of traditional media, the Internet, and the World Wide Web in particular."²⁵ The exclusion of certain types of websites in favor of others, as well as the priority given to some results has been troubling for some time. As well, the recent challenges to individual privacy and the infiltration of commercial interests through 'free' services offered by search engines, such as gmail, is particularly disturbing.²⁶

Mandatory registration at online newspaper sites demonstrates that media companies are attempting to peel away the Internet's cloak of anonymity in order to build closer relationships with their customers.²⁷ However, there is nothing innocent or altruistic about this sudden interest in the reading habits and income levels of the individuals accessing these sites – it is all about marketing. At least when one provides credit card information for the purpose of an e-commerce transaction, the rationale for this exchange of information is clear. Newspapers and other information provider, in exchange for 'free' access to their data are increasingly requiring personal information payment by way of payment.

The 'mainstream' appropriation of technologies which were originally developed outside of, particularly as a means of disrupting traditional distribution and delivery techniques (ICQ, P2P, VoIP)²⁸, is another strategy by which individual innovation is subsumed. Often, once such a disruptive technology is proven, mainstream media companies buy it out, then proceed to control future developments and modifications or alternately suppress it through litigation or corporate challenges.

24 www.searchenginewatch.com describes this as Google Domination Factor (GDF)

25 From 'Shaping the Web: Why the Politics of Search Engines Matter' by Lucas Introna and Helen Nissenbaum, from 'The Information Society' Vol. 16, 2000.

26 At the moment the process by which email is scanned in order to 'push' ads at users, is fully automated.

27 Available at: www.jdlasica.com/articles/OJR-registration.html 'Getting to Know You' by J.D. Lasica, originally appeared in Online Journalism Review, June 27, 2002.

28 Short for Voice over Internet Protocol, a category of hardware and software that enables people to use the Internet as the transmission medium for telephone calls by sending voice data in packets using Internet Protocol rather than by traditional circuit transmissions of the PSTN or public switched telephone network.

What is needed is a broader interpretation of 'consumption' particularly with respect to culture. Consumerism in this case has nothing to do with the exchange of cash, we are all consumers of cultural products in the sense that we all participate in culture. The mistake is in trying to put culture on the net, when the net is *in* culture. We also need to re-elevate the 'individual' over corporations as the most important constituent of democracy.

Creative individuals hack code, contribute to open-source software, and develop reverse-encryption schemes while being prosecuted for their innovative work. It is becoming clear that we need to feed and 'grow' new economic and business models, setting them in motion to evolve (along with technology) and providing opportunities for these individuals to take their place as the innovative force behind the new economy. Otherwise, propped up by the crumbling values and priorities of the 20th century, we will not be able to build enough prisons fast enough to house the Dmitry Sklyarov's²⁹ of the world.³⁰

The attack on individual freedoms and liberties represented by the recent targeting and prosecution of audio/video 'consumers' by the recording and motion picture industries, is successfully diverting attention from larger and more crucial policy issues such as universal service (designating Internet Service Providers or ISPs as 'common carriers') and regulation to promote democratic (transparent) practices in the establishment of peering or Internet interconnection agreements.

Is the Internet over? Has the World Wide Web lost all integrity and value as an alternative to traditional, mainstream media? The attempt to answer these questions must begin with an examination of Internet governance – specifically the often heavy-handed corporate attempts to prioritize their interests through manipulation of legislation. In looking at these examples, it is important to remember that most of the Internet's infrastructure is either physically concentrated in the US or controlled by US government.

Many governments have attempted to impose controls on the Internet, ranging from criminalizing the intentional or knowing transmission over the Internet to a minor of material considered "harmful to minors" (US) to the European Union's Telecommunications Council establishment of a 'Safer Internet Plus' program, a plan to develop filtering tools and codes of conduct. This 4-year program, (2005–08), will have a budget of € 45 million to combat illegal and harmful Internet content and also covers other media, such as videos, explicitly addressing the fight against racism, and also spam.

One of the most important trends in recent years is the growth of multinational corporate censors whose agendas are very different from those of governments.

29 D. Sklyarov was a Russian engineer/academic visiting the US in July 2001. He was arrested by the FBI after presenting his research on the subject of digital rights management technologies, specifically Adobe's eBook system. He was held for approximately 3 weeks without bail until his employer Elcomsoft was charged with 'trafficking in a circumvention device'. Previously, Matt Skala, a Canadian and a Swedish colleague were sued by the vendors of CyberPatrol in U.S. Federal court even though none of their actions (reverse-engineering CyberPatrol, and posting their research results online) took place on U.S. soil.

30 Nancy Paterson. Unpublished paper titled 'Right Brain Drain'

It is arguable that in the first decade of the 21st century, corporations will rival governments in threatening Internet freedoms. Some American cable companies seek to turn the Internet into a controlled distribution medium like TV and radio, and are putting in place the necessary technological changes to the Internet's infrastructure to do so. Aggressive protection of corporate intellectual property has result in substantial legal action against users, and a corresponding deterioration in trust across the Internet. A wide variety of methods are used to restrict and/or regulate Internet access. These include: applying laws and licenses, content filtering, tapping and surveillance, pricing and taxation policies, telecommunication markets manipulation, hardware and software manipulation and self censorship.³¹

Launched at the World Summit on the Information Society in Geneva, the report 'Silence: Censorship and Control of the Net' condemned not only the repressive governments of countries such as China and Burma, but also condemned governments' use of recent terrorist acts to introduce measures which would, under other circumstances, have been unacceptable. Fear mongering, as we have seen in the US 'War on Terror' is a very effective means of pushing through legislation which is very restrictive and intrusive in terms of individual rights, but is proposed as a remedy to national security risks.

Particularly since the September 11, 2001 terrorist attacks, legislation such as the USA PATRIOT ACT, which broadly expands law enforcement's surveillance and investigative powers, in the words of the Electronic Frontier Foundation "represents one of the most significant threats to civil liberties, privacy and democratic traditions in U.S. history." The USA PATRIOT Act (the Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act) was quickly developed in response to the September 11, 2001 attacks. Signed into law by President Bush on Oct. 26, 2001, this complex law received little Congressional oversight and debate. Giving sweeping anti-privacy powers to domestic law enforcement and international intelligence agencies, the Patriot Act eliminates checks and balances which previously provided courts with the opportunity to ensure that those powers were not abused. The Communications Assistance for Law Enforcement Act (CALEA) was passed by Congress in 1994 to make it easier for law enforcement to wiretap digital telephone networks. There is currently pressure by the US Department of Justice (DOJ), the Federal Bureau of Investigation (FBI), and the Drug Enforcement Administration (DEA) to extend CALEA's reach to include communications that travel over the Internet.

OpenNet Initiative, a partnership between the Citizen Lab at the Munk Centre for International Studies, University of Toronto, the Berkman Center for Internet & Society at Harvard Law School, and the Advanced Network Research Group at the Centre for Security in International Society at Cambridge University looks at how new media technologies, including the Internet and World Wide Web are controlled and manipulated in both democratic and non-democratic societies. OpenNet describes its mission as the investigation and challenge of state filtration and surveillance practices.³² A tool called the 'Internet Censorship Explorer' developed at the OpenNet Initiative allowed anyone

31 'Silence: Censorship and Control of the Net' produced by Privacy International and the GreenNet Educational Trust. Available: <http://www.privacyinternational.org/article.shtml?cmd%5B347%5D=x-347-61390&als%5Btheme%5D=Silenced%20Report>

32 www.opennetinitiative.net

with a Web browser to test the limits of certain national and organizational Internet-blocking schemes. The Electronic Frontier Foundation and similar groups are carefully monitoring what is happening in North America and Western Europe and advocating from the perspective of guaranteeing and protecting individual liberties.

Mannheim warned against the 'flattening' of democracy which he asserted was related to the growing 'irrationalism' of the masses he had experienced in Europe immediately prior to WWII. Just as the social transformation which Mannheim observed could be attributed in large part to the industrial revolution, what we are witnessing at the turn of the millennium in North America may be related to the impact of the information revolution. The conversion of knowledge – to information – to data, which can then be manipulated and disseminated by communications technologies, is a paradigm shift, a reconfiguration of how we perceive space and time. It also represents a new way of looking at the sociology of knowledge and related fields such as economics; the economy no longer drives technology, today technology drives the economy. Interactivity is replacing the passive media of cinema as the preferred means of entertainment.³³ not simply because we now have the means to produce such applications. The tools (innovation) are rising to meet a need, a natural evolution in the development of individualism and democratic liberalism.

When the Internet was a tool of researchers and academics, the peer-to-peer³⁴ model of interactivity and equal exchange did not attract a lot of attention. Once the Internet passed out of their hands and the commercial model took over, a calculated and deliberate effort was made to ensure that this 'communications' media became a means of 'distribution.' Today's 'irrationalism' of the masses and the subsequent 'flattening' of democracy must be seen in this context. Both the desire and the means to achieve the goal of full interactivity now exist. What has not evolved is the business model which will support this new means of obtaining and exchanging knowledge.

There are two types of policy issues with respect to new communications technologies. Issues such as intellectual property, digital rights management, privacy, surveillance and P2P filesharing are being addressed through national legislation; although this may not be the most effective approach it does give us the opportunity to compare the differences in political philosophies between Canada and the US. The second type of issue are those broader questions such as 'who controls network access and connectivity' and 'what (traffic engineering) structures are in place to move data through the Internet?' These are global issues which cannot and should not be addressed at any other level. These are the real issues of Internet governance.

The priorities of commercial interests with respect to Internet governance is obvious in the list of Policy Papers produced by the Global Information Infrastructure Commission (GIIC), "a confederation of chief executive officers of firms that develop, operate, rely upon, and finance information and communications technology infrastructure facilities."³⁵ Established in 1995, the political heads of the world's leading national economies

33 Even Lev Manovich's 'digital cinema' perpetuates a passive model

34 Peer-to-peer or P2P describes a type of network in which each workstation has equivalent capabilities and responsibilities. This differs from client/server architectures, in which some computers are dedicated to serving the others.

35 From www.giic.org

“challenged business leaders to unite in the promotion of public policies and information technology applications likely to spur needed investment in communications infrastructure facilities” – the key word being ‘investment’. In the first few years of operation, the GIIC produced Policy Papers on topics ranging from ‘Healthcare and Telemedicine’ (1996) to ‘Education for the Global Information Society (1997). However, since March 1998 when they released ‘A Comparison of U.S., EU, MITI and GIIC Reports on Electronic Commerce’ of the ten Policy Papers published and available online, eight are directly concerned with electronic commerce, with the remaining two being Global Business Statements.

One of their early publications, released by the GIIC in 1996, titled ‘Standards, Interoperability and Interconnection’ acknowledged that policy developments in this area “do not simply refer to networks and applications, but rather to information and communications infrastructures developed with social values and public order in mind”.³⁶ However, in the same document the language utilized demonstrates the transition from considering the end-user as a ‘consumer’ rather than a ‘subscriber’; the emphasis is theirs. “In the past, information communications standards were developed from the standpoint of carriers and manufacturers. Those standards focused on the lower layers to provide satisfactory connection service to “subscribers”...the convergence of computers, broadcasting, and communications will lead to the development of advanced applications. Therefore, official standardization organizations should listen to the views of users as “consumers””.³⁷

This emphasis on e-commerce is neither surprising nor unexpected. The GIIC is comprised of CEO’s from companies including: Fujitsu, NEC, Hitachi, Toyota, Ford, Cisco Systems, etc. Telecoms are represented by the President, Global Markets Group, Sprint Corporation; the Regional Head of the Americas, Duetsche Telekom AG; the CEO of Telekom Malaysia; Telecom Portugal; CEO, Global Services, Cable & Wireless. Only one government official thrown in: Under Secretary-General, UN and Executive Secretary, Economic Commission for Africa; few academics (Professor Branscomb, Harvard University’s Kennedy School of Government).

Originally established to deal with the reparation payments imposed on Germany following WWI, the Bank for International Settlements (BIS) was established in 1930. Its role, however, quickly moved to focus the Bank’s activities entirely on cooperation among central banks and, increasingly, other agencies in pursuit of international monetary and financial stability. Until the early 1970s the policy focus of the BIS was on implementing and defending the Bretton Woods system. More recently, it has addressed the issue of financial stability in the wake of economic integration and globalization and is now closely monitoring the financial implications of e-commerce and telecom debt.³⁸

Acknowledging that international coordination is necessary, another organization which prioritizes Internet security, but primarily in the application of e-commerce, is the ICC (Internet Chamber of Commerce). In a January 2004 report the ICC stated:

³⁶ www.giic.org/papers/policy/pstandards.asp

³⁷ www.giic.org/papers/policy/pstandards.asp

³⁸ IT Innovations and Financing Patterns: Implications for the Financial system. Report prepared by a Working Group on the Global Financial system, Feb. 2002, BIS.

ICC recognizes that the Internet and the information society raise many important public policy considerations that may require governmental facilitation. Government intervention may be required to develop the legal structures to ensure enforcement and for removing existing legal barriers confronting electronic commerce and the integration of information and communication technologies. Such matters include intellectual property protection, taxation and the removal of barriers to competition.³⁹

The definition and scope of Internet governance is still being debated. As recently as April 2004, the International Telecommunications Union (ITU) wrote:

Faced with convergence between telecommunications, broadcasting, multimedia and information and communication technologies, government policy makers and regulators are faced with new and evolving challenges at both national and international levels. A number of important ICT (Information and Communications Technology) policy issues highlighted in the WSIS (World Summit on Information Society) process, including regulatory reform, privacy, security, SPAC (Spectrum Planning and Policy Advisory Committee), government role in the promotion of free & open source software, management of Internet resources, intellectual property and interconnection, suggest that the strengthening of national ICT policy making processes as well as finding new methods for international cooperation and harmonization are sought.⁴⁰

The need to articulate public policy and the consideration of the role of regulation within Internet governance, has three distinct aspects for the ICC:

- 1/ the technical engineering function that allows different components of the Internet to interact;
- 2/ the technical coordination of the key protocols and addresses and names that underpin the technical functioning of the Internet (essentially a sophisticated directory system that allows people to accurately contact a website or other people on the Internet);
- 3/ the handling of public policy matters – which should be discussed openly among governments, business and civil society.

While according to this delineation of Internet governance issues, the technical engineering function and the handling of public policy matters are positioned at opposite ends of the debate, they are, in fact, closely linked. As defined by ICC, regulation of the Internet includes the technical engineering and technical coordination activities engaged in by all of these organizations as well as any and all public policy decisions made (both domestic and international) related to the Internet. The overlap between policy and technical administration of the Internet is one which has caused confusion and difficulties for many other organizations as well.

In the early days of the Internet, standards were set by small groups of people or often by single individuals. At this time, neither commerce nor governments paid too much

³⁹ 'Issue Paper on Internet Governance', p. 10

⁴⁰ Chairman's Report, Report on Internet Governance. Available: <http://www.itu.int/osg/spu/intgov/index.phtml>

attention to the Internet. The standards at this time reflected a prevailing Internet culture favouring openness and the consensus of all stakeholders. The rapid expansion of the Internet have seen both government and commercial groups vying to take over the determination of standards.

The Association for Progressive Communication (APC), an association of Internet and ICTs for Social Justice and Development, outlines the mandates of three major Internet standards bodies on their website:⁴¹

1/ Internet Engineering Task Force (IETF) This group sets the underlying technical standards for the Internet. It describes itself as "a loosely self-organised group of people who make technical and other contributions to the engineering and evolution of the Internet and its technologies." Membership of IETF working groups is open to anyone who chooses to participate via email. These working groups develop technical specifications based on "rough consensus and working code". The Internet Society (ISOC) plays a prominent role in overseeing IETF activities.

The open and democratic nature of the IETF processes has played an important role in creating and preserving an open and democratic Internet, but, in practice, effective participation has been limited to those who have both the time and technical knowledge to contribute. In recent times the IETF has been coming under increasing pressures from commercial organisations complaining that its policy of reaching wide consensus makes it too slow, and from governments and law enforcement agencies wanting to impose legal obligations on it to incorporate such things as wiretapping facilities and traceability of users into its standards.

2/ WorldWide Web Consortium (W3C) This sets standards for the World Wide Web (accessibility, user interface, architecture, etc) through defining such things as HTML specifications. Its structure differs fundamentally from the IETF in that participation is restricted to member organisations willing to pay annual membership fees (minimum \$5,000 for non-profit) or to "invited experts". The W3C has maintained relatively open standards, but this has mainly taken place through its domination by one person, Tim Berners-Lee, the inventor of the html code behind the two dimensional World Wide Web. He has largely succeeded in maintaining his own personal vision of the web as a place for open and free information exchange. It is questionable, however, whether this 'benevolent dictatorship' can be relied upon forever. There are great pressures on W3C to introduce ways of filtering out "harmful" content, which as far as some governments are concerned, certainly includes civil liberties and social justice campaigning material. At the same time, commercial interests and law enforcement bodies are pressing for traceability and the ability to collect private data on users.

3/ Internet Corporation for Assigned Names and Numbers (ICANN)

This was set up to administer the Internet Protocol address space and Domain Name System in 1998. It arose out of a directive from the Clinton government that the responsibility for registering names and numbers should include international participation and be based on consensus. ICANN soon became the target of lobbying from US based civil liberties and consumer interest groups. Under pressure from this lobbying and in line with its original mandate to give representation to all stakeholders, the ICANN Board agreed to the principle of online elections for nine out of the eighteen

41 <http://www.apc.org/english/rights/governance/>

ICANN Board seats. Anyone could register online as an "at-large member" of ICANN and could then vote in the election. Five Board members were elected in this way. However, these elections were very controversial within the ICANN Board. A far more restrictive form of at large membership, based on domain name holders, is now being proposed. A section of the ICANN Board wants to go further still and remove at-large representation entirely, substituting representation of governments instead.

Government and commercial pressures on these organizations, is well documented by APC, and a closer look at the evolution of ICANN, and the direction(s) which this group is taking, reveals the impact of these pressures.

The mandate of the Internet Corporation for Assigned Names and Numbers (ICANN) is to oversee the Internet's Top Level Domains (TLDs). ICANN is a not for profit organization, and its main responsibilities concern IP address space allocation, domain name system management, root server system management functions and other related administrative functions that were originally performed by the US government (and other organizations via contract). ICANN was formed in 1998 after a call from the US government to establish a not for profit organization to oversee the Internet's functionality. Operating for many years on a budget of approximately six to eight million dollars (USD) per year with fees from domain name registrars representing the bulk of their income, the announcement of their 2004/2005 budget revitalized serious debates about their role (this budget finally reached the 2/3 level of registrars required for approval in October 2004). The doubling of their budget to \$15.8 million was described as necessary because of international travel and political, governmental and environmental factors such as litigation.

In January 2004, for the first time in Internet history, the number of instanced DNS root servers outside of the United States exceeded the number within. There are 13 DNS root servers in the world; these can be mirrored or 'instanced' employing mirroring products such as 'Anycast', and in January 2004 an additional mirror site was essentially launched in Frankfurt for the K-root server which is located at the London Internet Exchange (LINX) in London, managed and operated by RIPE NCC⁴². In fact, RIPE NCC Centre technicians were among the pioneers of the Anycast concept and deployed instances of the K-root server first in Amsterdam and subsequently in Frankfurt with a goal to have up to 10 instances of the K-root server deployed by the end of 2004.

The role of a DNS root servers is to resolve lookups for domain names globally. As such, DNS root servers form a critical part of the global Internet infrastructure. Anycast allows exact copies of the server, including the name and IP address, to be deployed in different locations.

The Domain Name System (DNS) enables users to find their way around the Internet. Every computer on the Internet has a unique address (similar to a telephone number), a series of numbers called its IP (Internet Protocol) address. However, rather than requiring users to remember the IP address for any and all websites which they want to visit, a 'domain name' is assigned to each IP address (a mnemonic device that makes addresses easier to remember). The process of translating the name into the IP address

42 Réseaux IP Européens Network Coordination

is called "resolving the domain name." The goal of the DNS is to enable any Internet user anywhere to reach a specific website IP address by entering its domain name. The telephone system is a useful analogy. Dialing a number routes a call to a particular location because there is a central numbering plan that ensures that each telephone number is unique. The DNS works in a similar way. If telephone numbers or domain names were not globally unique, phone calls or e-mail intended for one person might go to someone else with the same number or domain name. Ensuring predictable results from any place on the Internet is called 'universal resolvability' and this is a critical design feature of the DNS. The management and coordination of DNS to ensure universal resolvability is the primary function of ICANN⁴³. ICANN ensures that the DNS continues to function effectively by overseeing the distribution of unique numeric IP addresses and domain names. Among its other responsibilities, ICANN oversees the processes and systems that ensures that each domain name maps to the correct IP address.

The suffix of any Internet address (the .com or the .org) is known as a Top Level Domain, or TLD. So-called 'TLD registry' organizations house online databases containing information about the domain names in that TLD. The .org registry database, for example, contains the Internet whereabouts – or IP address – of icann.org. So in trying to find the Internet address which corresponds to the domain name: icann.org, an end-user's computer must first locate the .org registry database.

At the heart of the DNS are 13 special computers known as root servers. These root servers are coordinated by ICANN and are distributed around the world. Each contains the same information – this is to spread the workload and provide back-up. The root servers contain the IP addresses of all the TLD registries – both the global registries such as .com, .org, etc. and the country-specific registries such as .fr (France), .cn (China), etc.

Scattered across the Internet are thousands of computers known as 'Domain Name Resolvers' (or just plain 'resolvers'). These computers are used to respond to a user's request to resolve a domain name – that is, to find the corresponding IP address. This is accomplished by caching the information which they receive from queries to the root servers. These resolvers are located strategically with Internet Service Providers (ISPs) or institutional networks.

When an end-user types in a domain name, the ISP sends the request to a local resolver. The resolver splits the request into its component parts. Either working from data within its cache, or locating the .org registry for the user, the request is subsequently forwarded to the .org registry to find the IP address for the requested domain name. Once the end-user has this information, the final connection can be made – having been 'resolved', the requested website can be displayed. In summary, it works as follows: first, the 'resolver' finds the IP address for the .org registry, queries that registry to find the IP address for icann.org, then queries a local computer at that address to find the final IP address for www.icann.org. For reasons of performance, 'resolvers' handle requests rather than allowing end-users to query root servers directly. New (official) TLDs are created through ICANN (through a consensus-driven process). Unofficial, alternate root systems do exist. When they are set up within private

⁴³ Internet Corporation for Assigned Names and Numbers

corporations they have no effect on the DNS; however, when these overlap the authoritative global DNS by using the unique root information (while adding new pseudo-TLDs) there is potential for confusion. As these pseudo-TLDs are not included in the authoritative root managed by ICANN, they will not be resolvable by the vast majority of Internet users.

Theoretically, since root servers are located around the world, a sequential server might actually be on the other side of the world – at which point latency and packet loss (associated with crossing an ocean) might come into play. So while the instancing of root servers (such as the K-root server), is in itself good news, the management/distribution of the primary 13 DNS root servers, their location around the world as well as their status is worth examining – as part of the 'larger picture' of Internet topography and infrastructure.

The makeup/distribution of the 13 DNS root servers is as follows: A total of ten out of the 13 DNS root servers are located in the United States. Three are run by private companies, and are located in the United States, operated by: Network Solutions Inc. (A), Performance Systems International Inc. (C-NYSER) and Network Solutions, Inc. (J). Three are run by the United States Military: Army Research Laboratory (B), US Army (H) and GSI (DIIS-NS). Two are run by Universities in the United States: University of Maryland Computer Science Center (UMD-TERP) and University of Southern California Information Sciences Institute (ISI2). One is run by the US Government: NASA Ames Research Center (E). And one is run by a non-profit organization, located in the United States: Internet Software Consortium (F). Only three DNS root servers are located outside of the United States: two in Europe and one in Japan. It has been suggested that under the current addressing system (IPv4), 13 global root servers is the optimal number.

One of the main benefits of deploying servers at multiple locations is that operational responsibility for the servers themselves is distributed, contributing to a stronger infrastructure which is resilient to attack. Daniel Karrenberg, Chief Scientist of the RIPE NCC, and an important figure in the implementation of K.root-server instancing, has noted that "The strength of the Internet does not come from centralistic or hierarchical designs but from de-centralized and distributed design and engineering. Operationally, the root servers are equal peers and client software can choose any one of them based on an estimate of which provides the best service to the client's location at the time."⁴⁴

Discussion of location and management of global root level server takes place within the Internet Engineering and Planning Group (IEPG), an Internet operational group intended to assist Internet Service Providers to interoperate within global infrastructure of the Internet. In June 1996 the IEPG discussed the deployment structure of root name servers in respect to provider and exchange topology: "It was noted that while the placing of a root server on an exchange was a topological neutral location both in terms of traffic flow and in terms of relation to potential inter-provider settlement structures, the location did hamper effective management of the root name service. Placing a root server within a provider network offers improved management capability and places the

44 <http://www.circleid.com/article/464/0/1/0/>

onus on the provider to provide high quality connectivity to the server, and was generally considered to be a more stable deployment structure.”⁴⁵

The IEPG is also exploring the funding of root servers. A large percentage of root level servers are government-funded (specifically, they are funded by US taxpayers); furthermore, they rely on volunteer hosting. Both of these issues raise concerns as the Internet continues to evolve, particularly moving towards a fully commercially driven network. Root servers are essentially the equipment for the ‘air traffic controllers’ for the Internet. Full-time professional maintenance of the DNS root servers has been recommended by IEPG; as well the uneven distribution of the DNS root servers around the globe should also be addressed.

Almost every country in the world has its very own Top Level Domain all of which are managed by an appointed registrar. Generic domains were created for use by the Internet public, while country code domains were created to be used by individual countries as they deemed necessary. The ICANN functions of IP address management and root server maintenance are the subjects of political and economic pressures; however, ICANNs function of naming (Top Level Domains) has become particularly contentious. DNS has become the most significant naming system in the world. However, there is an inherent flaw with the way the system has been designed. Control of top level domains has essentially become a monopoly on certain types of names on the Internet. When a top level domain (TLD) has a meaning as in .com = all commercial domains, this implies that the entity which controls the .com domain, has a monopoly on the most desired names for commercial efforts

This can be compared to the system of trademarks, where limited monopolies are given on names as well. Ownership of a trademark like ‘Apple Computer’ restricts everyone else from using the word Apple in naming a product in the computer industry. However, no one may obtain trademark ownership of a generic term. It does not restrict a car company from calling a new model the ‘Apple’ because there will obviously be no confusion between the computer and the car. If a term has a real-life inherent meaning in the commercial area you’re applying it, you can’t use it as a trademark and get a monopoly on its use. For example, a car company cannot apply for trademark for the word ‘sedan’. This is essentially what has happened with DNS. People/companies have acquired ownership of ordinary words or special words with established meanings. Apple Computer’s ownership of apple.com means that Apple Records are restricted from using that domain name. And because .com has come to be equated with all commercial domains, every domain within .com has essentially been given a monopoly over that name in the commercial space.

Restructuring the naming assignment should prioritize ensuring that no one TLD is given an inherent advantage over any other TLD. TLDs are essentially lookup tables or directories, like telephone white pages. The idea that there can be one authoritative directory for commercial sites (.com) illustrates the problem with the current system. It has been suggested that TLDs should represent what they in fact represent: directories. Examples would include: .yahoo, .yellowpages, etc.

⁴⁵ http://www.isoc-id.org/iidp/global_root_level_server.php

The phrase 'Internet governance' is commonly used, inappropriately, to refer exclusively or primarily to the management of the Internet's names and numbers system by ICANN. In fact, it is not clear whether this particular system is one of governance or rather coordination, administration and allocation. Some contend that responsibilities in this area are properly limited to: the administration, coordination and allocation of IP addresses and domain names; the administration and coordination of the root server system; the coordination of relationships with other entities such as the regional addressing registries; promoting competition within generic top-level domain name space (.com, .org, etc.) and matters related to these functions such as a system for domain name dispute resolution. Clearly, although many of the functions of the Internet's names and numbers systems are strictly technical, there are policy issues which cannot be handled separately. For this reason, and as 'Internet governance' is most frequently applied to ICANN's role, it is important to understand how they function.

Selection of an organization to oversee a large part of this function demonstrates some of the inherent difficulties in international management of this global network. In 2003 the US Department of Commerce renewed ICANN's 3-year contract to run the functions of the Internet Assigned Numbers Authority (IANA). This decision took place amid a great deal of controversy with organizations such as the Internet Multicasting Service and Nominet⁴⁶ contending that this contract was awarded without a proper tender process. In particular, they challenge the heavy-handed approach of ICANN, particularly in Europe where their policy decisions emphasized binding rather than persuasive agreements. Dr. Black, chairman of Nominet made the point that management of the IANA database "must not seek to override the wishes and policies developed in countries outside of the US."⁴⁷

A great deal of controversy surrounds ICANN (both the non-IANA and IANA-based functions of this organization) and a lot of this is concentrated on the perception of US control. What is also emerging is a division between those who feel that ICANN's role should include policy-making vs. those who feel that ICANN's role should be strictly technical coordination. The need to balance technical and administrative functions within individual organizations participating in managing the Internet as well as the perception of US control are common to many aspects of Internet governance.

The International Chamber of Commerce's recent foray into forums concerning Internet regulation and management has not been unchallenged. In late 2003, at a preparatory meeting for the United Nations' conference on Internet Issues (the World Summit on the Information Society), the ICC proposed the UN take over responsibility for ICANN. Unfortunately, their approach to tabling this proposal deliberately excluded ICANN and US government representatives from this meeting. Although this highlighted the resentment which many members of the international community feel over the way the Internet is run as well as the US ownership of many important Internet resources, many feel that a proposal for overhauling ICANN's governance must include key stakeholders. By blocking ICANN participation in their recent meeting, there is some question as to whether ICC is the appropriate organization to undertake this task.

⁴⁶ Nominet UK is the Registry for all domain names ending .uk

⁴⁷ <http://news.zdnet.co.uk/business/0,39020645,2130201,00.htm>

Following the World Summit on the Information Society meeting⁴⁸, another organization entered the fray, again focusing on ICANN's role. Formed in the mid 19th century, the ITU is headquartered in Geneva Switzerland. It has regulated telecommunications for over a century and recently came under the umbrella of the United Nations. This organization is intended to assist governments and private corporations to coordinate global telecom networks and services. They have largely represented government regulatory agencies and monopoly telephone companies, but has also been involved in developing standards for telegraphs, telephone and radio communications. Realizing the convergence of conventional communications traffic and Internet services, the ITU has expressed an interest in becoming more involved in the management of the Internet. To allow the ITU to move beyond their traditional role of allocating spectrum, however, raises a number of questions. The Internet Engineering Task Force (IETF) has done an adequate job to date in managing Internet standards to date and the ITU threatens to impose a bureaucratic or centralized (broadcast) model on the Internet particularly in respect to content. Control over content transmitted via the Internet also falls within the interests of the ITU, but this is not necessarily in the best interests of the rest of consumers or producers of content.

The Internet Society (ISOC) is the organization home for the groups responsible for Internet infrastructure standards, including the Internet Engineering Task Force (IETF) and the Internet Architecture Board (IAB). On their website they describe their role as follows: since 1992, the Internet Society has served as the international organization for global coordination and cooperation on the Internet, promoting and maintaining a broad spectrum of activities focused on the Internet's development, availability, and associated technologies. Together with the ISOC, the ITU coordinated one of the earliest attempts to 'fix' the domain name system. Their efforts, however, were ignored by the US government, which put together its own proposal which was subsequently accepted by government and industry bodies around the world. This was the beginning of the IANA or Internet Assigned Numbers Authority. Prior to 2003, this had been the extent of the ITU's involvement with Internet governance.

While there is certainly no shortage of dissatisfaction with ICANN's role, the prospect of ITU or ICC becoming involved with either technical or policy matters relating to the Internet, raises many concerns from critics such as Andy Oram:

...the Internet is a subtle ecology that has always rested on the cooperation of multiple parties. This cooperation spans a spectrum from the individual home user on his PC to the peering agreements between major backbone owners. As these peering arrangements and the history of ICANN show, systems have evolved historically in a rough, unsystematized way, and some participants do not like the terms of cooperation. For instance, underdeveloped countries complain about the interconnection fees they have to pay to more powerful backbone operators in developed countries. Expanding interconnection points is a way to bring down costs without trying to change the politics of peering, but a review of the politics would also be pertinent.

⁴⁸ The UN General Assembly Resolution 56/183 (21 December 2001) endorsed the holding of the World Summit on the Information Society (WSIS) in two phases. The first phase took place in Geneva hosted by the Government of Switzerland from 10 to 12 December 2003 and the second phase will take place in Tunis hosted by the Government of Tunisia, from 16 to 18 November 2005.

While ICANN has bumbled many tasks and exceeded its authority on others, its leaders have a sense of the fragility of the Internet ecology. The ITU, in contrast, is tromping all over the grounds, just in the process of mapping it.⁴⁹

The issues under discussion are not solely technical, nor are they strictly policy concerns. The administration of Internet addresses and domain names, for example, creates a political economy which is vulnerable to serious abuse. Attention must be paid, not just to policy, but to administration and operation of these global, mission-critical services. In and of themselves, such tasks are difficult to perform well, as the dominant DNS registry Network Solutions (NSI)⁵⁰ have repeatedly demonstrated over the years – by losing registrations and corrupting critical data files. The implications of mismanagement and the dangers of political influence are huge. For example, NSI benefited spectacularly from the National Science Foundation's decision to permit charging for domain names, from the policies and delays in the formation of ICANN, and continues to benefit from ICANN's distraction away from its intended registry oversight function toward abstract debates about Internet governance.

In addition to the mechanics of resolving IP addresses to domain names, the nature of the IP addresses themselves, is currently being debated. In 1969, ARPAnet had initiated an early version of NCP (Network Control Protocol). As the usability and demand for network increased between universities, it was clear that NCP was unable to handle the volume of traffic passing through its network. Vinton Cerf and Bob Kahn had co-authored the protocol that allowed ARPA to connect various independent networks together to form one large network of networks – what was increasingly being described as the Internet. The criteria which the new protocol included: independence of the underlying network and computer hardware and the ability to support universal connectivity throughout the network.

The protocol which they devised, TCP/IP, is today the basic communication language or protocol of the Internet, a suite of protocols also known as the 'Internet Protocol Suite'. TCP is comprised of both the transmission control protocol (which manages the assembling of messages or files into smaller packets that are transmitted over the Internet and received by a TCP layer that reassembles the packets into the original message) and the Internet protocol (which handles the address part of each packet so that it gets to the right destination). Each computer which directly accesses the Internet uses the TCP/IP combination.

The Internet protocol suite is comprised of 4 layers: the application layer (eg. HTTP, FTP), the transport layer (eg. TCP, UCP), the network layer (eg. IPv4) and the data link layer (eg. Ethernet). TCP/IP is not to be confused with the OSI reference model, although elements of TCP/IP do exist in OSI. The Open Systems Interconnection Reference Model (OSI Reference Model or OSI model for short) was the most important advance in the teaching of network concepts. It promoted the idea of a common model of protocol layers, defining interoperability between network devices and software. However, the OSI protocol stack was considered by many to be too complicated and to a large extent unimplementable. The OSI approach with its seven layer model (layer 1 –

49 www.circleid.com/print/396_0_1_0/

50 now known as VeriSign

physical; layer 2 – data link; layer 3 – network; layer 4 – transport; layer 5 – session; layer 6 – presentation; layer 7 – application) was eventually eclipsed by TCP/IP.

In addition to the adoption of TCP/IP by ARPA in 1983, a protocol which ensured that any kind of platform was able to participate in the network, two major Internet scaling issues had been identified by the Internet Activities Board in 1991: a sharply increasing rate of consumption of address space and a similar unconstrained growth of the interdomain routing table. These issues were subsequently addressed by the Internet Engineering Task Force, and led to the establishment of the ROAD (Routing and Addressing) effort. The IETF's short-term solution was CIDR (classless interdomain routing). Another possible solution to the limitations of IP addressing is IPv6 also named IP Next Generation (IPng). Designed to take an evolutionary step forward from IPv4 (IPv5 was a short-lived experiment), the goal of IPv6 was to modify and improve IPv4, keeping the working functions and discarding what was or had become unworkable. Currently, both types of Internet Protocol (IP) addresses are in active use. IPv4 was initially deployed on 1 January 1983 and is still the most commonly used.

However, there is an impending shortage of IPv4 addresses (the addresses will run out approximately by 2008, according to calculations made by IETF in 1994) and IPv6 is the proposed solution. The challenge is for the transition to IPv6 to be complete before IPv4 routing and addressing becomes completely inadequate. The two transition requirements are: flexibility of deployment and the ability for IPv4 hosts to communicate with IPv6 hosts (IPv6 hosts should also be able to communicate with IPv4-only hosts globally). Interoperability between the two protocols must be maintained. Features designed into an IPv6 have to be backwards compatible with IPv4. As well, IPv6 should be deployed in a highly diffuse and incremental fashion, with few interdependencies. And finally, the transition should be transparent: easy for users, system administrators, network operators to understand and carry out. Deployment of the IPv6 protocol began in 1999.

The administration of Internet addresses and domain names, the adoption of TCP/IP over the OSI model and the promotion of IPv6 as a means to address the impending shortage of IP addresses – seem to be largely technical issues. They must be understood, however, within the context of the global network which they are intended to facilitate. The Internet does not exist for its own sake; it is impossible to isolate technical issues from the content/data/information and the criteria and rules which govern its distribution – particularly when government and corporate interests are involved alongside the interests of individuals.

The convergence of these interests can also be seen within the context of traffic engineering and Internet interconnection. Interconnection, often termed 'access', is the process of transferring traffic within a network: voice traffic, IP traffic, data traffic, video content, etc. The issue of interconnection within an IP framework is described by the terms 'peering' and 'transit'. Peering is usually a bilateral business and technical arrangement, where two providers agree to accept traffic from each other's customers. It does not include the obligation to carry traffic to third parties. Transit is also a bilateral business and technical arrangement; however in this case one provider agrees to carry traffic to third parties on behalf of another provider. Whereas peering offers a provider access only to a single provider's customers, transit usually provides access at a defined cost to the entire Internet.

Peering is not totally defined⁵¹, Peering is a term used to describe an economic and political arrangement regarding the exchange of data. These two scenarios (the 'peering' of ISPs and individuals engaged in P2P) – have the opposite political effect – for individuals it reinforces their independence and autonomy, for ISPs it reinforces their control, and ultimately the monopolies which they attempt to establish.

'Peering' between telecoms/ISPs, whether through public access points or via private negotiated arrangements, is presented by the media (with their questionable alliances as a result of ownership) as being 'business as usual' and a purely technical decision which has no impact or implications for individual users. Issues of interconnection are represented as being far less interesting and certainly less controversial than P2P (peer-to-peer) activities of College students, young children and even grandparents. While a few groups such as the Electronic Frontier Foundation point out the futility and absurdity of tying up the courts with petty lawsuits which are intended to 'make examples' of select offenders, the majority of people who are willing to take a stand on 'peering' limit their critique to P2P and are consequently engaged in a relatively minor battle when considered in the larger context of the policy wars over peering and Internet infrastructure.

Disentangling the interests of distributors from the interests of producers (re-defining copyright and intellectual property in the process), articulating the legal rights and obligations of cultural consumers (reaching a consensus regarding cultural products in the process), and defining the role and liability of third parties (the manufacturers of MP3 player, DVD recorders and, indeed, the ISPs providing the networks over which the sharing/stealing of content takes place) – these are all necessary efforts. However, culture is not static; it is dynamic and constantly evolving. In fact, it may be the case that the current tug-of-war over these cultural artifacts (audio and video files) is not resolved before their significance fades in the bright light of culture's next big idea: interactivity. As content producers/distributors fuel the debate regarding downloading and peer-to-peer file-sharing of what they consider to be their cultural 'assets' or 'property,' deals are being struck regarding access and interconnection which, if unchallenged, will mean the end of the Internet as we have come to know it.

If the 'medium is the message'⁵² then our participation in shaping the infrastructure of delivery and access to communications networks is essential. Interconnection is not merely a technical issue, but is a philosophical and a political issue as well. At stake is the possibility of universal access and the types of activities which the infrastructure will allow. Either the Internet becomes a commercial marketplace or what some have envisioned as a community forum and cultural/creative commons⁵³. Either we ensure that the infrastructure is in place to permit open and democratic participation, or we pay later – with the price being a space highly regulated by the distributor/provider, with controls focused on the user.

When discussing bandwidth, peering arrangements, regulation and the prospect of facilitating universal service or universal access, those involved in Internet governance

51 Strictly speaking every computer hooked up to the internet is a 'host' and is capable of running any software, including server software.

52 [Understanding Media](#), Marshall McLuhan

53 The idea of the Creative Commons is discussed by authors including Lessig and Vaidhyanathan and I reports such as 'Saving the Information Commons' by the New American Foundation.

must take into account the logic and rationale behind the evolution of interconnection. In a global context in which democracy and liberal values are considered to be politically and culturally important, the factors which influence the choices, decisions and policy direction of ISPs cannot be ignored – whether these relate to the evaluation of technical issues (how the allocation/sharing of bandwidth works and doesn't work) or the philosophical issues around peering policies.

How and why did the two types of interconnection ('peering' and transit) emerge and diverge? Since the Internet was originally designed to operate over an existing infrastructure – the infrastructure already in place for the US telephone service – the role of government regulation cannot be underestimated.

In 1984 AT&T had been forcibly disbanded, breaking the monopoly on telephone service in the US. Over the next ten years Congress and the Federal Communications Commission (FCC) struggled to find a model for regulating the Regional Bell Operating Companies (RBOCs) which had been created by this breakup.

In 1996 the FCC imposed a requirement that the RBOCs be neutral about how their lines would be used – this deregulation, intended to create competition in the telephone service, meant that the RBOCs had to stand by as their infrastructure was utilized, the initial means of providing Internet access.

Two aspects of the 1996 Telecommunications Act led to the explosion of Competitive local Exchange Carriers (CLECs) to compete with Incumbent Local Exchange Carriers (ILECs) such as RBOCs. The Act stated that any telecommunications services which ILECs offer at retail, must be offered to CLECs at a wholesale discount and, as another means of allowing other companies to compete with them directly, they were required to unbundle the services they offered. RBOCs and Local Exchange Carriers (LECs) were allowed to compete for long-distance telephone traffic under certain circumstances. The way this has manifested is that RBOCs are generally in competition for digital data and Internet traffic with wireless service providers and cable TV companies, with RBOCs gradually making available new telephone carrier technologies such as Integrated Service Digital Network (ISDN) and Digital Subscriber line (DSL).

The development of cable is also important in understanding the availability and delivery of Internet services. In 1970s cable companies were given certain incentives to build networks with the primary incentive being monopoly control. Interestingly enough, just as the US government was resolving to limit the control that the network owner had over one set of wires (telephone), it was increasing the control the network owner would have over a different set of wires (cable).

Originally envisioned as a way of bringing television to remote and combined communities, Ted Turner had a different vision for cable. Buying access to a satellite he turned cable into a competing broadcast network; Turner transformed cable into a provider of content provider rather than just a means of delivery. In addition, the provision of consumer satellite TV, by comparison, did not require an expensive infrastructure and this prompted cable providers to upgrade their systems in order to provide two-way communication (specifically, pay-per-view services). While this upgrade was underway, cable providers realized that they could also enter the business of providing Internet service as well as telephony. Unfortunately, the unregulated cable TV monopoly has led the way in consumer abuse by 1) pushing cable TV rates up at almost

three times the rate of inflation; and 2) closing down the broadband Internet by refusing to provide nondiscriminatory access for independent Internet service providers to its high-speed, two way telecommunications networks and 3/ denying end user hosts dedicated IP addresses.

At the turn of the millennium the world of communications was still largely compartmentalized – cell phone service came from a wireless phone carrier, pay TV from a cable or satellite company. Local phone service was provided by a local telephone company and Internet access came from an ISP. Over the past four years, the transformation into a sector-less society has begun – “the most fundamental evolution of the telecommunications business since the breakup of Ma Bell two decades ago”.⁵⁴ The prize? In the US, telcos, cable and satellite are vying for a \$200 billion phone business, and the \$55 billion cable-TV business – in addition to Internet service revenues. This is known as the ‘triple play’: voice, video and data.

Looking at the impact of regulation on the evolution of communications technologies (including data over POTS or ‘plain old telephone service’), as well as the government’s position on regulation of cable service, a new light is shed on the relationship between telecommunications policies in the US (specifically, the Telecommunications Act of 1996) and the growth of the Internet in the years prior to 2001. These decisions clearly had an impact on the structure of the global network (Internet) as we now know it. Policies set today in the US (or in any country connected to this network) ripple like waves across the surface of a pond. This effect is particularly pronounced when the issues being addressed are concerned with interconnection.

In the early days of the Internet, a single backbone network had existed in the form of ARPAnet⁵⁵ and later NSFnet⁵⁶ – all other networks connected with one another via that one Internet backbone, and routing information was conveyed between the backbone and the other networks via the Exterior Gateway Protocol (EGP).

Today the Internet does not have a single backbone in the traditional sense. Rather, it has many, comprised of the individual backbones of various commercial ISP’s and private networks. They are all connected at many different points – called peering points. Today their operations rely upon the Border Gateway Protocol (BGP), which allows them to coordinate the operation of the Internet without the need for any central authority. Between the time the backbone was privatized (1995) and the year 2000, the single backbone of the NSFnet was replaced by 42 linked backbones.

For ISPs to offer the service of connecting end-users to the public Internet, it is necessary for them to connect their network to the global network. There are a number of different ways of accomplishing this. When an ISP buys a direct connection to another ISP’s network, this is called wholesale service. Wholesale service does not include access to the rest of the Internet, only the wholesale ISP’s network. The purpose of wholesale service is to provide better performance for customers by offering direct

54 ‘Tearing Down the Walls in Telecom’ Business Week Online, March 2, 2004

55 The first wide area packet switching network

56 The National Science Foundation subsequently took over responsibility for ARPAnet

access and eliminating 'hops'⁵⁷. In order for a service provider to provide its customers with access to the rest of the Internet as well as another ISP's network, it must purchase transit services.⁵⁸ Paying for transit from an upstream provider gives the customer (the ISP) access to all network routes in the upstream ISP's routing table. In return the upstream ISP receives and announces the customer's routes on all of its peering and transit interconnections. However, the transit provider charges on a volume basis (measured on a per-Megabit-per-second basis). As traffic volume rises, this type of arrangement can become costly (although some service providers prefer a transit relationship with their upstream ISPs, citing the logic that the threat of lost revenue is greater than the threat of terminating a peering arrangement).

Kenneth Cukier defines peering as an interconnection of two public networks that provide connectivity to hosts whose routes are advertised on the global Internet, on a settlement-free basis that allows customers of one network to exchange traffic to customers directly on the second ISP's network. Technically speaking, peering is simply the agreement to interconnect and exchange routing information. Originally peering was both free and reciprocal (ie. symmetrical).

In discussing the relationship of Internet governance to interconnection services today, it is important to distinguish between public and private peering. Most ISPs have dedicated connections at either metropolitan-area exchanges (MAEs) or network access points (NAPs) which are utilized in order to exchange traffic with other ISPs – both NAPs and MAEs constitute the system of public peering points. Through the MAE or NAP exchange points, ISPs of any size can exchange traffic. The drawback is that all ISPs offering Internet access service in a specific area may be doing this through the same MAE, and the volume of traffic affects the level of service.

Peering may involve more than two ISPs in which case all traffic destined for any of the ISPs is first routed to a central exchange called a peering point, and then forwarded to the final destination (similar to the Network Access Points or NAPs, but on a smaller scale). Bilateral peering exists between two parties, multilateral peering describes an agreement between more than two parties. In any case, when peering takes place via an Internet Exchange Point (ones that are independent of any single provider), that is called public peering.

How did peering evolve? In 1990 MCI, Merit (Sprint) and IBM - three major commercial long distance networks - formed a non-profit corporation called American Network Services and the Internet's growth and expansion was taken over by ANS in 1991. When the NSF discontinued funding the Internet's precursor NSFnet and transferred 'ownership' to ANS (Advanced Network & Services Inc) it was perceived that ANS would require settlement-based interconnections to its Internet backbone. This was the first impetus for public peering points which were created in order for ISPs to swap traffic

⁵⁷ A hop is an intermediate connection in a string of connections linking two network devices. On the Internet, for example, most data packets need to go through several routers before they reach their final destination. Each time the packet is forwarded to the next router, a hop occurs. The more hops, the longer it takes for data to go from source to destination.

⁵⁸ Transit is the term used for interconnection services which are for fee.

The Herndon, Virginia-based Commercial Internet Exchange (CIX) was the first public, commercial interconnect point on the Internet – the first alternative for networks to exchange traffic other than transiting the NSFnet backbone. Established specifically to address the issue of peering, CIX, which remains in operation today, is a membership organization that promotes the development of a level playing field for ISPs. Founded in 1991 by Rick Adams, Marty Schoffstall and Susan Estrada, instead of bilateral peering agreements between two parties as is common on other NAPs, CIX provided for multilateral peering, whereby all members must exchange traffic with each other.

To prevent the Internet from fragmenting, the NSF had originally paid four private enterprises in 1994 to build public Internet access points: in Washington (DC), San Francisco (CA), Pennsauken (NJ) and Chicago (IL). A fifth was subsequently added in Palo Alto (CA). Participation in these NAPs was made mandatory for all ISPs which were also signing government contracts. Two Metropolitan Area Exchanges or MAEs (MAE East in Fairfax, VA and MAE West in San Jose, CA) were subsequently opened up by MFS Communications, MCI/WorldCom's predecessor. These MAEs provided public peering anchors on both coasts.

In 1996 the NSF pulled its financial support from NAPs, declaring that the original intent of public peering had been achieved. Subsequently, at one point 95% of peering was being routed through the two MAEs (East and West). Congestion, resulting in latency⁵⁹ and packet loss,⁶⁰ resulted and ISPs began to look for alternatives: private peering.

Public peering keeps accessibility to the Internet in the public domain by allowing ISPs to interconnect at (neutral) network access points (NAPs or MAEs). ISPs, regardless of size, are treated equally. Large ISPs, with many customers, however, began to express a preference for exchanging traffic through private peering agreements with ISPs of a comparable size, rather than working through this system where their customers were being given no more priority than those of a small ISP.

The two most important considerations, from the perspectives of both the provider and the end-user, of how interconnection is negotiated are: quantitative, that is – the cost of interconnection in terms of network resources (the bandwidth expended to carry traffic from another network onto one's own network for one's own customer); and qualitative, where the value is the connectivity, the interoperability of customers, latency. For most ISP's, the motivations for pursuing peering in addition to transit arrangements can be described in two words: technical and financial.

The financial benefits of peering are obvious. Peering decreases reliance on and therefore cost of purchased Internet transit (as these are otherwise the single greatest operating expense, ISPs seek to minimize telecommunications costs). Internet transit prices are expensive so ISPs seek peering (zero or reduced cost) relationships with other ISPs that provide more direct traffic exchange and reduce the load on expensive upstream transit services – packet loss and latency slows traffic consumption, so a service such as peering which improves either of these issues, will increase traffic efficiency and consumption. Engineering or technical considerations also promote

59 Latency is the measure of how long, on the average, it takes to get a response from something. This term usually refers to network response speed, but can also refer to storage devices (hard drives, CD-ROM drives, etc.)

60 Packet loss refers to the percentage of packets sent that will be lost (out of 100%) in a data transmission.

peering; peering lowers inter-Autonomous System (AS) traffic latency, because traffic exchanged between two peering ISPs is necessarily taking the lowest latency path.

Why might an ISP decline to participate in peering? First, traffic asymmetry and investment (asymmetry means that one party bears more of the cost as a result of peering). Some ISPs do not have the resources to offer, particularly when peering consumes resources (router interface slots, circuits, staff time) which could otherwise be applied to revenue generation. A strong disincentive for Tier-1 ISPs to peer is the fact that Tier-1 ISPs compete on the basis of better performance. Peering with other ISPs improves the performance of the peer, making them a more powerful competitor) and this may work to their disadvantage by increasing the number of top tier competitors. Finally, regardless of the size of the ISP, in a peering relationship there are no Service Level Agreements (SLAs) to guarantee rapid repair of problems; a (transit) customer relationship generally has more contractual teeth, since money is changing hands.

Following the release of the 1996 Telecom Act, however, large backbone ISPs had begun to radically alter their interconnection terms. Critics identified a movement towards commercialism as large networks seemed to have as their goal changing peer relationships into supplier-customer relationships.⁶¹ At this point 'peering' agreements which were reciprocal and free became 'transit' requiring legal contracts.

Private peering agreements began to be set up by ISPs in 1996, shortly after control of the public peering sites (MAEs and NAPs) were divested by the US government. Private peering is usually comprised of two dedicated connections between two ISPs, with each ISP managing one of the connections. Each ISP only exchanges traffic destined for the other ISP's network. Improved service results as the reduced number of router hops means that packets aren't dropped. ISPs generally don't charge each other fees when these connections are set up, because they are mutually beneficial. The difficulty arises when a small ISP wants to connect to a larger ISP. Providers with large traffic volumes (often known as Tier-1 carriers) tend to peer without charge with other large providers, while charging for peering with smaller ISPs. As large ISPs began to realize their value as peering partners for smaller ISPs, they began to charge for transit, the right to move traffic across their networks. In 1999, Telephony Online reported that "Some charge that the dominant backbone providers – UUNet, Sprint and Cable & Wireless – have used peering to retain what amounts to an oligopoly. Combined, those three providers control approximately 75% of backbone traffic."⁶²

In Spring 1997, UUNET had advised approximately fifteen ISPs that they had previously provided peering services to, that their peering arrangements would be terminated and that new, bilateral transit agreements would have to be negotiated; this effectively transformed peers into customers. "UUNet said it would stop peering with small carriers; they would have to pay. Sprint and AT&T followed suit within months. The modern Net began to emerge. Titans swap traffic free and charge others; those who can't pay take the back roads of unreliable public exchanges."⁶³

61 paper titled 'Peering and Fearing: ISP Interconnection and Regulatory Issues' written in 1998

62 <http://telephonyonline.com/microsites/> - Aug. 23, 1999 article by Pat Blake titled 'Can Public Peering Survive'

63 'Backbone Bullies', Forbes, June 12, 2000

Overall, Tier-1 ISPs increasingly chose to peer with fewer ISPs. Meanwhile, peering grew more prevalent among smaller networks and was boosted by the creation of more local networks access points. At the same time, numerous Internet backbone providers were bought out by larger ISPs. This consolidation decreased the number of ISP backbones and widened the margin between Tier-1 providers and other ISPs. Parallel to the ISP consolidation was the trend for backbone ISPs to be aligned with facilities based telecommunications carriers.

By 1998 the impact of the consolidation was clear. Fewer players control more of the traffic on the Internet backbone. Measuring ISP backbone traffic is difficult; to a large degree it depends on defining the parameters you wish to measure. However, analysts and researchers say that by November 1997 the US's four largest networks (UUNet, MCI, BBN and Sprint) controlled between eighty-five percent and ninety-five percent of the total backbone traffic.⁶⁴ Increasingly, government regulation regarding interconnection agreements was being demanded, particularly by small and medium size ISPs who were being cut off from private peering.

In 1999, in order to encourage ISPs to utilize public exchange points, companies such as Ameritech began to convert from fiber distributed data interface within the exchange, to ATM or other high-speed protocols with extremely large buffers to prevent traffic loss. Their goal was to provide the increased bandwidth and reliability being demanded by large ISPs.

In September 2000, the FCC's Office of Plans and Policy (OPP) working paper series released 'The Digital Handshake: Connecting Internet Backbones' – a report announcing that the FCC would continue to allow market forces to dictate interconnection agreements. The FCC also argued that in light of the intermixing of telecommunications companies from different countries, it would be unhealthy to impose regulations on international backbone interactions.

Two weeks after the FCC report was released, the International Telecommunications Union (ITU) issued their own recommendations at the World Telecom Standardization Assembly in Montreal. However, they approved a recommendation on Internet cost-sharing which appeared to open the door to Internet interconnection governance. In general, third world countries demanded regulations, whereas Canada, Europe and the United States preferred a pro-market approach. "In Montreal, ITU delegates from developing countries raised concerns over an international Internet divide and the heavy concentration of Internet backbones and content in the United States"⁶⁵

Since then, the FCC has continued to argue that regulations imposed on competing backbones would be counterproductive, that there are market stimulants that motivate them to work together. In the 'Digital Handshake' the report's author Kende argued there is no dominant backbone now and that existing anti-trust regulations should prevent one emerging through acquisition.

Should peering be left for market forces to resolve? The argument that settlement-based interconnections are efficient (technically workable, fairly compensates all providers and

64 Cukier, p. 5

65 from Communications Technology article 'FCC and ITU Diverge on Internet Backbones' (Nov 2000)

promotes interconnection) does not address the fact that this practice may lead to and in fact encourage monopolies.

The Network Reliability Council was established by the FCC in 1992 following a series of major service outages in various local exchange and interexchange wireline telephone networks. The purpose of the NRIC was to study the causes of service outages and to develop recommendations to reduce their number and their effects on consumers. The Council's Charter was revised, and its title changed to the present Network Reliability and Interoperability Council by the FCC in April of 1996 and they were charged with advising the FCC on how Section 256 of the Telecommunications Act – 'Coordination for Interconnectivity' -- should be implemented. Stopping short of recommending regulation, the Final Report of NRIC Focus Group 4 produced two outputs: a short statement recommending that Internet providers, and especially the largest Internet providers, consider (consistent with their business practices) publication of their criteria for peering (the terms and conditions under which it will peer with other networks for various types of traffic); and an informational paper discussing IP service provider interconnection, peering, and transit service.⁶⁶

ISPs are intense competitors but are at the same time driven to cooperate and collaborate in order to provide the universal connectivity needed and demanded by their customers. Differences among networks in location, coverage, customer mix, customer size, loyalty of installed base, service offerings, network quality, cost and market structure complicate the mutual assessment of peering versus transit. Typically, ISPs develop interconnection strategies to address two main points: cost and performance.⁶⁷

While recognizing the complex demands and motivations which have an impact on how ISPs cooperate, it is also obvious that there are many problems with how peering agreements are currently implemented. Terms of peering are not made public by Tier-1 ISPs; ISPs who peer (or interconnect in any way) with a Tier-1 ISP must first sign a non-disclosure agreement, interconnection and peering arrangements can be cancelled with little notice on the part of the larger network. Tier-1 providers and other large networks meet regularly and privately to discuss engineering issues. Lack of public disclosure leads to arbitrage (backbone ISPs that provide connectivity to smaller ISPs yet must also interconnect with larger ISPs act like foreign exchange arbiters: they seek to extract revenue in both directions). As well, large network service providers tend to emphasize the benefits of buying rather than bartering access.

'Peer-to-peer' or P2P refers to network communications that bypass servers and allow hosts to directly communicate. A host is any computer which is connected to the Internet. A P2P computer network refers to any network that does not have fixed clients and servers, but a number of peer nodes that function as both clients and servers to the other nodes on the network. This model of network arrangement is contrasted with the 'client-server' model. Any node can initiate or complete any supported transaction. Technically, the term may be applied to any networking technology, however it is most frequently used to refer to file sharing networks such as Gnutella, FastTrack and the now-defunct Napster which provides facilities for free (and somewhat anonymous) enables file transfer between personal computers connected to the Internet.

⁶⁶ Available: <http://www.nric.org/pubs/>

⁶⁷ Appendix B, Focus Group 4 Final Report, pg. 8

P2P works by harnessing the unused bandwidth of client nodes without the need for centralized servers. “Every consumer of resources can now be a contributor of resources in optimizing the efficiency and quality of the network. P2P technology solves distribution problems by directing viewers to each other, minimizing the load on origin servers and existing infrastructure.”⁶⁸

Because of the importance of the free flow of information to democracy, it can be argued that communications networks should not be allowed to function on a discriminatory basis under any circumstances. High speed ‘Internet access services’, which are clearly telecommunications services delivered in markets that are far from effectively competitive, should be subject to obligations of nondiscrimination and interconnection. Individuals have recognized this, and this understanding is embodied in the use of P2P technologies.

It is a myth to say that global connectivity was an initial Internet principle; the Internet was originally designed as a US-centric research network, the idea of global connectivity was conceived only as ever-increasing numbers of individual networks connected. Even today ISPs, strictly speaking, do not provide universal connectivity (corporate networks use IP numbers for internal networking and these routes are not advertised to the global Internet).

The telecommunications network is based on the principle of universal connectivity – does the telephony model of universal access apply to the Internet? Currently, the Internet is considered an ‘enhanced service’ by the FCC. The Internet has traditionally been exempted from regulation; this hands-off approach was clearly articulated in the 1996 Telecom Act). Today, the FCC continues to hold the line that the Internet should not be regulated, since it represents a new medium characterized by enormous growth and rapidly changing technological innovations. Former Chairman Reed Hundt indicated that regulations might address the wrong problems, not be effective and possibly harm Internet development.

“Unfortunately for the FCC such a clean semantic dichotomy cannot operate in a time of rapid technological evolution and convergence. Enhanced service providers are not simply ‘access charge exempt users’ of telecommunications, because to some extent they provide services to third parties and these services increasingly provide substitutes for services telecommunications carriers provide.”⁶⁹ In the FCC working paper 21 (March 1997) the Commission noted that the Internet does fall under its jurisdiction, regardless of whether it decides to impose regulations or not.

Universal service has long been a cornerstone of broadcasting and telecommunications provision, yet there have been distinct differences of emphasis in the rationale for, and form of, its provision. This debate has latterly been accentuated because of the profound

68 from Synccast website: www.synccast.com

69 Frieden, p. 11

changes affecting the communications sector, in particular, its two main constituents: telecommunications and broadcasting (and the convergence thereof).⁷⁰

The convergence described is, of course, the triple play. The European Commission refers to the combined sectors of telecommunications, information technology and broadcasting as: the 'electronics communications sector'. Is this new space/tool/content/media more appropriately described as broadcasting or telecommunications? Or is it something altogether different? The answer to all three questions? Yes.

As the Internet market continues to mature, Tier-1 ISPs, which are increasingly facilities-based full-service Internet Communications Providers, are adopting the economic models of more traditional telecommunications network providers. This means that eventually major Tier-1 ISPs (which are primarily owned and operated incumbent carriers) gain economies of scale and scope through increasing customer base, available bandwidth, number of interconnection sites and content. The result? The Internet is becoming more hierarchical and there is evidence of the existence of market dominance by major ISPs which makes it possible for them to set access and interconnection terms and conditions. This will lead to limitation of competition and innovation. Also obvious from this examination of peering is the fact that there are many corporate influences on the infrastructure of the Internet and how connectivity is established and maintained. Yet how the Internet is defined will have important implications regarding when and whether regulation through public policy should play a role.

Is regulation desirable? Necessary? What approach will ensure fair competition, encourage innovation and protect public interest? What is the public interest (access? employment?) and who sets the agenda and timetable for articulating and implementing policy?

What is the fundamental difference between the Internet and radio/television or telephony? Spectrum management – legislation which takes into account the amorphous nature of technologies which cross technical boundaries – these are not new issues. But with broadcasting and telecommunications, the providers/distributors have followed a traditional commercial model with well defined roles – these technologies are much easier to control. The Internet is 'all over the place', philosophically as well as physically.

A critical factor in moving towards regulation seems to be the decision as to whether the notion of 'common carriage' should be applied to private Internet backbones. Operating as a common carrier is essential to this definition – common carriers have a legal duty to interconnect their facilities with other carriers on fair terms and conditions – if the traffic flow is asymmetrical, there is a transfer payment involved – that is the single important consideration. If defined as a common carrier, then government regulation of ISP interconnection would be justified because the notion of common carriage would demand that networks provide service to all operators on an equal basis, not be permitted to refuse to sell to competitors, and be required to publish all prices.

⁷⁰ Universal service and the future of regulation' Editorial by Douglas Pitt and Niall Levine, from Telecommunications Policy, Vol. 28, Issue 3-4, April-May, 2004

If regulation regarding interconnection is not forthcoming is it a viable alternative to allow ISPs to govern themselves (e.g. through an industry-led consortium)? The disadvantage to such an arrangement is that it leads to cartel-like behavior. Some have suggested a government-backed approach taking the form of Federal Advisory Committee (comprised of industry executives). Unfortunately, such groups often seek solutions best for themselves rather than the public good.

In the early 1980s, governments, led by the United States and United Kingdom, undertook telecommunications regulatory reforms by adopting pro-competitive telecommunications policies such as privatization, liberalization, and deregulation. This was followed immediately by asymmetric regulation, wherein the incumbent carriers are mandated to interconnect and open their facilities to new entrants and make available their services on an unbundled cost-based pricing basis. In direct contrast to this, governments adopted a hands-off policy for information processing market players such as Internet Service Providers.

Pro-competitive regulatory reform coupled with the technical and market convergence and the increasing demand for data communications bandwidth contributed to the Internet's ascendancy. Optimism, and a desire to see where technology might take us, compelled investors to inflate the value of Internet-based business. It was the greed of corporate managers and a lack of securities regulation which turned that optimism into one of the most distressing financial debacles of the past hundred years: the technology boom and bust.

Three of the six largest bankruptcies in American history -- WorldCom, Enron, and Global Crossing -- occurred between December 2001 and July 2002, shattering investor confidence in the world's premier financial market. Three common themes unite many of these market failures: the use of sophisticated financial instruments; the lack of securities regulation; and the role of arbitrage.

WorldCom began operations in 1984, the year that AT&T was divested by the US authorities -- as a reseller of long-distance services. Only after several years did they begin to construct their own network. In 1997 WorldCom took over MCI Communications for \$37 billion -- at the time the largest takeover in American corporate history. In 1998 the European Commission forced the pair to spin off MCI's Internet backbone. Cable&Wireless paid \$1.75 billion for the backbone -- then later sued MCI WorldCom for trying to hamstring the business by withholding contracts, blocking database access and failing to transfer key people. In 2000 US communications regulators vetoed WorldCom's \$129-billion offer for Sprint Corp., which WorldCom had hoped would add wireless and local phone assets to the mix. In 2002 WorldCom was hit with fallout from the bankruptcy filing of Global Crossing (telecom). In Spring 2002, shares of WorldCom hit all-time low of \$2.35, down more than 95 percent from their peak of \$64.50 on June 21, 1999. In mid 2002 WorldCom was forced to disclose that it had inflated profits for over a year by improperly accounting for more than \$3.9 billion.

Enron was also involved in the manipulation of markets and arbitrage -- what became known as 'megawatt laundering' of the energy supply. Enron, it has been said "widened

the definition of commodity to include electric power, bandwidth, credit risk, advertising space, and weather derivatives — among others.”⁷¹

The privatization of the Internet was followed by the Democrat’s 1996 Telecom Act. Privatization followed by deregulation. When a monopoly is privatized, you still have a monopoly, and unregulated monopolies abuse consumers. According to proponents of democratic regulation (particularly those who support the regulation of utilities) a privatized monopoly is a monopoly that requires regulation. Two important principles of democratic regulation which they advocate are transparency and participation⁷²

The Internet (dotcom) crash had several interesting results. Resulting Tier-1 ISP bankruptcies along with bankruptcies of many Tier-2 and content companies, caused many Internet players to re-evaluate their business models and ensure their practices were financially sound. These bankruptcies also had a positive impact on the cost of peering, as the market was flooded with used equipment from the bankrupt companies, allowing surviving ISPs to reduce the capital cost of this expense. When @home, the upstream provider for the cable companies, went bankrupt, this forced North American cable companies to negotiate emergency multi-Gigabit per second transit connections with several of the Tier-1 ISPs. Peer-to-peer file sharing systems increased traffic between access providers.⁷³ Transit prices dropped.

These forces (combined) have produced the following major shifts⁷⁴ in terms of peering :

- 1/ Cable companies are now participating in peering. There is no economic disincentive for them to peer with each other, the Tier-2 ISPs or the content providers, since they aren’t in the business of selling transit to ISPs or content providers and they generally work in non-overlapping regions so they don’t compete against each other. Peering allows the cable companies to offload their P2P traffic from transit connections (which they pay for) onto free peering interconnections
- 2/ Network savvy large scale content companies are peering in order to reduce transit costs, and to improve end-user experience (e.g. Yahoo, Google, Microsoft, Apple). Due to this, the volume of traffic now being peered has increased substantially (Google’s peering policy is one word: ‘Yes’)
- 3/ Cable companies are now peering directly with content companies. This “puts the most popular content on the Internet on the same network as the largest set of subscribed broadband eyeballs. The end result is a major disruption in the Internet Ecosystem, motivated by network performance between the customers of both and significant cost savings from peering.” The result is that Tier-1 ISPs are being cut out of a high volume traffic exchange loop. Tier-1 transit providers are now used for the route of last resort and have lost their grip on the US Internet Peering Ecosystem.

The FCC ruled in March 2002 that cable modem broadband service is an unregulated information service. As a result, without FCC regulation cable companies are not

71 ‘How Enron Failed’ by Victor Canto.

72 From ‘The Failure of Deregulation in the United States’ by Jerrold Oppenheim and Theo MacGregory. Available: democracyandregulation.com

73 1.5mb MP3 files became 700mb AVI files

74 From the white paper ‘The Evolution of the U.S. Internet Peering Ecosystem’ by William B. Norton. This is described as a Network Operations Document (NOD) which ‘identifies a critical but undocumented area of Internet operations’. The papers “are never “done” but rather are considered living documents, evolving with input from the community” (p. 14)

required to share their broadband networks with other ISPs. In October 2003 the US Court of Appeals for the Ninth District ruled against the FCC, opening up cable modem networks to competing ISPs. In March 2004 the court denied an FCC request for a rehearing of the case but the FCC (and the National Cable and Telecommunications Association NCTA) were granted a stay of the court's decision pending a request for the Supreme Court to take the case. Policymakers must define high-speed Internet access, whether provided by cable TV or telephone companies, as a telecommunications service and implement an obligation to provide nondiscriminatory access to these networks.

In April 2004 a group of independent ISPs formed a grassroots group – National Internet Alliance – to lobby the US Congress, out of concerns that they would be denied access to the broadband pipes owned by major cable and telecommunications companies. This group also intends to lobby as needed to protect their current right to use DSL lines owned by major telecommunications carriers

Segmenting the Internet into various levels of performance reliability with possible partitioning of bandwidth and the creation of temporary dedicated links makes the Internet appear and operate more like a conventional circuit-switched, telecommunication network. "Instead of a 'best efforts', 'one size fits all' network topology, the Internet will become an amalgam of networks with different degrees of reliability, service quality, accessibility and cost."⁷⁵ The push to privilege certain types of traffic over others (the QOS Quality of Service initiative) demonstrates that this is one possible vision for the Internet.

Many describe this shift as having already commenced. A move towards a balkanization of the Internet; disaggregation into an amalgam of networks with varying degrees of accessibility to other networks – based on available bandwidth, financial resources, number of Points of Presence and subscribership. "It may trigger the same sort of parity and cost of access concerns raised by consumer groups, competitive local exchange carriers and other telecommunications market entrants."⁷⁶

The big telecom trend for this decade is clear: Internet Protocol networks are subsuming older forms of communications networks – data, voice, video. In 2005 the IP threat will hit the phone companies especially hard. Over the next 18 months telcos and cable companies will continue their battle for dominance in the consumer market with the introduction of 'grand slam' offerings that incorporate wireless voice in with their 'triple play' bundles of fixed voice, broadband Internet, and cable TV. Wireless Internet service providers (WISPs) are entering the broadband race as well, and will challenge the dominance of cable companies (cable modems) and phone companies (digital subscriber lines).

The issues, however, remain the same – regardless of whether the upper Tier ISPs utilize cable, telco, satellite or wireless. Should interconnection policies be left to market forces or should they be regulated? This issue will become particularly critical as mergers and acquisitions make it increasingly difficult to distinguish between content

75 P. 2 'Without Public Peer: The Potential Regulatory and Universal Service Consequences of Internet Balkanization' by Rob Frieden, Virginia Journal of Law and Technology, Fall 1998. Available online: http://vjolt.student.virginia.edu/graphics/vol3/vol3_art8.html

76 p. 3 of 'Public Peer' by Robert Frieden

providers and distributors, and to disentangle the various services which are now being combined.

We need to find the right balance between the heavy handed regulation of incumbent telecommunications carriers and the hands-off policy adopted for the ISPs and other information processing market players. Regulators should be required to focus on being pro-competition rather than pro-business. The incumbent monopolists should be forced to open their markets in order for consumers to receive the benefits of competition.

At minimum, one approach to preventing the negative effects of market dominance would be encouraging ISPs to make public certain types of information about peering. Peering policies are a politically sensitive subject and are often not explicitly articulated. Peering Coordinators are charged with establishing and managing the interconnections between their network and others and their jobs are a combination of: network architecture, technical (routing), business (profits), legal (contracts). ISPs often have a 'Peering Steering Committee' to evaluate peering request. An increasing number of peering policies are being made available online, perhaps in recognition of the benefits of transparency; this should be mandatory.

Also desirable but less likely would be the establishment of a framework to ensure that networks meeting certain minimum criteria cannot be refused a peering arrangement by an upper tier ISP without proof that anti-competition does not play a role. Such a structure would be useful to ensure that commercial discrimination does not take place.

On November 11, 2004 the United Nations announced the establishment of a Working Group on Internet Governance. The Secretary-General had been requested to establish such a group by the first phase of the World Summit on the Information Society, which was held in Geneva in December 2003. The task of this Working Group is to organize an open dialogue on Internet Governance, among all stakeholders, and to bring recommendations on this subject to the second phase of the Summit to be held in Tunis in November 2005.

In a paper submitted to UNESCO, Christine Maxwell, on behalf of the Internet Society,⁷⁷ raises the issue of universal internet access – access which is global not only in theory, but in practice, addressing issues of inaccessible design (for people with disabilities), and issues of economic situation and geographic location as well.

The infrastructure of the Internet, of course, is a prerequisite for all other aspects of access, for anyone, anywhere. It is to be hoped that the new UN Working Group will recognize the need for more transparency in peering, stronger public peering points, an international (representative) body overseeing peering and making sure that this global access becomes a reality.

The underlying philosophy of peering is not theft – it is cooperation and interactivity. Individual digital rights – the right to symmetrical bandwidth and the right to a personal dedicated IP address – are mirrored at a macro level as issues of Internet infrastructure are addressed and resolved. In the end it's all about personal empowerment, and it's all about peering.

⁷⁷ <http://www.isoc.org/isoc/unesco-paper.shtml>

Bibliography

Adamson, Greg. 'Early Internet Regulation and Current Implications' Available online: <http://www.crf.dcita.gov.au/paper03/adamsonpaper6final.pdf>

Bagdikian, Ben. The New Media Monopoly. Beacon Press, Boston. 2004.

Black, Ulyess. IP Routing Protocols. Prentice Hall, New Jersey. 2000.

Bollier, David and Watts, Tim. 'Saving the Information Commons: A New Public Interest Agenda in Digital Media' New America Foundation, Washington, DC. 2002.

Canto, Victor. 'How Enron Failed' January 14, 2002. From 'National Review Online'. Available online: http://www.natinalreview.com/nrof_canto-canto011402.shtml

Center for Digital Democracy. 'Cable Broadband and Beyond: Open Access Principles for Public Interest Programming'. Available online: <http://www.democraticmedia.org/issues/openaccess/principles.html>

Center for Digital Democracy. 'New Media Solutions to Old Media Bottlenecks'. Available online: <http://www.democraticmedia.org/ddc/nms.php>

Chomsky, Noam and Herman, Edward. Manufacturing Consent: The Political Economy of the Mass Media. Pantheon Books, New York. 2002.

Clements, Alan. The Principles of Computer Hardware. Oxford University Press, UK. 2000

Consumer Federation of America. 'Lessons from 1996 Telecommunications Act: Deregulation Before Meaningful competition Spells Consumer Disaster'. February 2001. Available online: <http://www.consumersunion.org/telecom/lessondc201.htm>

Cukier, Kenneth. 'Peering and Fearing: ISP Interconnection and Regulatory Issues'. Available online: <http://www.ksg.harvard.edu/iip/iicompol/Papers/Cukier.html>

Dewey, John. The Public and Its Problems. New York, Holt, 1927.

Drew, Jesse. 'Who Owns the Internet: An Investigation into the Privatization and Corporate Control of the National Information Infrastructure'. Available online: http://www.nlgcdc.org/articles/internet_drew.html

Ferreira, P. 'The Evolving Architecture of the Internet: Policy Issues Associated with Transitioning to a Competitive Environment'. Available online: <http://www.andrew.cmu.edu/user/pferreir/6IC-Japan.pdf>

Festa, Paul. 'ICANN Breaks Budget Impasse' from CNET News.com. October 13, 2004. Available online: http://news.com.com/ICANN+breaks+budget+impasse/2100-1028_3-5408626.html

Frieden, Rob. 'Without Public Peer: The Potential Regulatory and Universal Service Consequences of Internet Balkanization' from Virginia Journal of Law and Technology. Fall 1998. Available online: http://vjolt.student.virginia.edu/graphics/vol13/vol3_art8.html

Gleick, James. Chaos: Making a New Science. Penguin Books, 1987. New York.

Gramsci, Antonio. Selections from the Prison Notebooks. International Publishers, New York. 1971.

Gross, Grant. ISPs to Form National Lobbying Group' from InfoWorld. April 15, 2004. Available online: http://www.infoworld.com/article/04/04/15/HNisps_1.html

Hauben, Ronda. 'Internet Governance: The Proof is in the Pudding.' From CircleID. Available online: http://www.circleid.com/article/91_9_1_0/

Introna, Lucas, and Nissenbaum, Helen. In 'The Information Society' Vol. 16, No. 3, Available online: www.nyu.edu/projects/nissenbaum/papers/searchengines.pdf

Kehoe, Brendan. Zen and the Art of the Internet. Brendan P. Kehoe. 1992. Available online: <ftp://ftp.banffcentre.ab.ca/ab/docs/zen.txt>

Kende, Michael. The Digital Handshake: Connecting Internet Backbones. Office of Plans and Policy, Federal Communications Commission. Washington, DC, September 2000. Available online: http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp32.pdf

Kettler, David & Meja, Volker. Karl Mannheim and the Crisis of Liberalism: The Secret of These New Times. Transaction Publishers. New Jersey. 1995.

Kharif, Olga. 'Tearing Down the Walls in Telecom' from BusinessWeek Online. March 2, 2004. Available online: <http://www.businessweek.com>

King-Guillaume, Lisa. 'Advanced Peering: A Better Alternative to the Traditional Internet Peering Model'. From Telephony Online, Jan. 15, 2003. Available online: http://telephonyonline.com/art/telecom_advanced_peering_better

Ladley, Eric and Tombes, Jonathan. 'FCC & ITU Diverge on Internet Backbones' From Communications Technology, November 2000. Available online: http://www.broadband-pbimedia.com/ct/archives/1100/148_backbone.htm

Lasica, J.D. 'Getting to Know you: Online Newspapers are Requiring Users to Register – but at what Cost?' Online Journalism Review. June 27, 2002. Available online: <http://www.jdlasica.com/articles/OJR-registration.html>

Mannheim, Karl. Ideology and Utopia. Harcourt, Brace & World, Inc. New York, 1968

Maxwell, Christine (on behalf of the Internet Society). 'Global Trends that will Impact Universal Access to Information Resources' Submitted to UNESCO, July 15, 2000. Available online: <http://www.isoc.org/isoc/unesco-paper.shtml>

McLuhan, Marshall. Understanding Media: The Extensions of Man. MIT Press, Cambridge. 1994.

Milton, M.L., Mueller, L., Lee, L.W., McKnight, W. 'The Post-.COM Internet: Toward Regular and Objective Procedures for Internet Governance' in Telecommunications Policy, Vol. 28, Issue 7-8, August-September 2004, p. 487-502.

Network Reliability and Interoperability Council V; Focus Group 4: Interoperability. Final Report. Available online: www.nric.org/pubs/nric5/284finalreport.doc; www.nric.org/pubs/nric5/284appendixa.doc; www.nric.org/pubs/nric5/284appendixb.doc

Next Generation Networks, 2004. Boston, MA. Conference Proceedings. October, 2004.

Norton, William. 'Internet Service Providers and Peering' Draft 2.5. Last modified: 05/30/2001. Available online: <http://www.equinix.com/pdf/whitepapers/PeeringWP.2.pdf>

Oram, Andy. Peer-To-Peer: Harnessing the Benefits of a Disruptive Technology. O'Reilly Sebastopol, CA, 2001.

Pitt, Douglas & Levine, Niall. 'Universal Service and the Future or Regulation' From Telecommunications Policy. Vol. 28, Issue: 3-4. April-May 2004. p. 227-232

Privacy International and the GreenNet Educational Trust. 'Silence: Censorship and Control of the Net'. Available online: <http://www.privacyinternational.org/article.shtml?cmd%5B347%5D=x-347-61390&als%5Btheme%5D=Silenced%20Report>

US Internet Industry Association. 'Internet Public Policy in 2004'. January 8, 2004. Available online: <http://www.usiia.org/>

Vaidhyanathan, Siva. The Anarchist in the Library: How the Clash Between Freedom and Control is Hacking the Real World and Crashing the System. Basic Books, New York. 2004.

Vanberg, Margit. 'Internet Regulation: Monopolistic Bottlenecks in Internet Service Markets?' August 2003. Available online: intel.si.umich.edu/tprc/papers/2003/259/TPR2003_vanberg2.pdf

Weinberg, Neil. 'Backbone Bullies' from Forbes.com. June 12, 2000. Available online: <http://www.forbes.com/forbes/2000/0612/651423a.html>

Wolf, Christopher. 'Internet Infrastructure Issues: Regulation and Un-Regulation of the 'Pipes' that Provide the Internet. From FindLaw. Available online: <http://library.lp.findlaw.com/articles/file/00086/002196>

Wolff, Kurt H. From Karl Mannheim. Oxford University Press, New York. 1971.