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Mr. Allan MacGillivray
Executive Director
Telecommunications Policy Review Panel Secretariat
280 Albert Street, Room 301
Ottawa (ON)
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Email: telecomreview@ic.gc.ca

Dear Mr. MacGallivray,

These comments are being submitted on behalf of Tucows Inc.

Tucows is an internet services company that provides back office solutions and wholesale internet services to a global network of more than 6,000 web hosting companies, internet service providers (ISPs) and other service providers worldwide.

The original software download site, Tucows.com, earned its name early on for being the first to provide software on a "freeware" or "shareware" basis.

As the largest ICANN accredited wholesale domain registrar, Tucows offers a suite of complementary internet services including: domain name registration and management, digital certificates, email services and website publishing tools. Tucows back office solutions, including the Platypus Billing System and customer relationship management solutions, enable service providers to automate and enhance their service offerings.

Tucows employs around 175 people at its Toronto headquarters and more in the United States and overseas.

Our company is in the business of managing data and simplifying complex business processes for this large and expanding network of service providers, who, in turn, provide e-business products and services to their customers -- an estimated 40-million end-users worldwide. These end-users, primarily small and medium-sized enterprises (SMEs) and individuals, represent one of the fastest growing segments of the Internet economy.

More information can be obtained at http://resellers.tucows.com/about/

Tucows is vitally concerned with the health of the public Internet, its openness, and the rules by which it will operate. The success of our clients and of our business model depend on preserving access to an open and innovation-friendly public Internet, which means in turn, the preservation of transparent common carrier pipes.

Tucows seeks the opportunity of addressing the panel in person at the appropriate time. Thank you for this opportunity to respond.

Yours sincerely,

Elliot Noss

President and Chief Executive Officer

A. The Changing Telecommunications Environment

A.1	*Comment on the technological developments described above and provide your views on how telecommunications and ICT technologies will change over the next 10 years.* 1. Tucows considers that the Internet has made all the difference. Telecommunications has been revolutionized by the passage from closed, proprietary protocols to open standards. IP (internet protocol) was an idea based in the habits of mind of computer scientists, and to a great extent, the Internet constitutes a repudiation of most of the engineering ideas that inform the legacy telephone network. The ways in which the Internet diverges from telephony are many. Intelligence was placed at the edges, in the form of user-owned computers, rather than in the centre, in what was called the "intelligent network". 2. This has led to a shift in power, which is still going on. It is important for policy makers to understand that this shift could be arrested and reversed by the pursuit of wrong policies, and we will discuss those tendencies in a later section of this response. 3. The chief attribute of the Internet revolution has been *innovation without permission*. By setting networks on a common and public standard in the form of IP and its associated protocols, and by disintegrating the tight links between services and underlying carriage, the Internet allowed innovation to occur on a scale that was impossible in the old system. The Internet dissociated the economics of innovation from the economics of signal transport. 4. Before the Internet, if you wanted to compete, you had to build your own network or interconnect with the existing system. Either way potential competitors faced nearly impossible economic difficulties. It was precisely because market entry in telecommunications was so difficult, and because subscribers in the 1920s were not all connected to one another through a single system, that North America adopted economic regulation of telephony. The history of the gradual loosening of the monopolies' grip from World War II forward attests to this difficulty. Though MCI pioneered telecom competition in the United States in the 1970s, and caused massive consumer savings when long distance competition was finally allowed, the service provided was still circuit-switched telephony. Competition was envisaged in terms of more of the same, only cheaper. 5. Then along came computers and the need to link them. From this was born the Internet.

6. The two things that have made the Internet useful in most peoples' eyes are email and the World Wide Web. When Tim Berners-Lee invented the concept of the world wide web, a universal look-up system for resources held in computers, he did not have to seek the permission of carriers to load the CERN website with the web protocol. He just did it, albeit after consulting the Internet Engineering Task Force (IETF). Likewise the protocol that allows email was launched without permission. It was a matter of designing the software and selling it or giving it away for free.

7. Note also that other distinguishing mark of the computer: the relentless increase of power and performance for the same dollar. When conjoined with the Internet, computer technologies are challenging business models that rested on constriction of supply and lobbying and regulatory skills.

8. We are in a period of rapid evolution of business models, rapid innovation, and rapid shifts of power from those who held it to those who offer new services or combinations of services that people want. This is a formula for some business interests to slow the rate of change and to reduce the uncertainty engendered by the combination of open standards (the Internet), computer power, and innovation without permission. This tendency is plainly apparent in the United States at this time, where the FCC increasingly is siding with incumbents to reduce access obligations at the expense of independent ISPs.

9. The Internet was a conscious creation of engineers with particular design criteria[1], to enable computers to communicate in a robust and secure way. In designing the protocols of the Internet, these engineers overthrew nearly every assumption of voice communications. Packets replaced voice, charging for calls became irrelevant as the concept of "calls" were abolished by packets; best efforts routing replaced the "five nines" of telephone reliability, global addressing replaced area-based national addressing, the *autonomous system number* became the core designation of the network rather than the nation-state at the core of telephony and so forth.[2]

10. The boldest step of the designers of the Internet was the role that was assigned to the carrier. To the designers of the Internet the carrier did not really matter, except as a bit transporter. The carrier could be more or less reliable, more or less expensive, but it was a data transporter. The role of the carrier was limited essentially to carrying bits without further inquiry into the content and economic value of the packets.

[1] See "A Brief History of the Future, the Origins of the Internet" by John Naughton, Weidenfeld and Nicholson, 1999, ISBN 0-297-64330-4; "Nerds 2.01, A Brief History of the Internet", Stephen Segaller, TV Books, 1998, ISBN 1-57500-088-1

[2] **See "A Brief History of the Internet" by Barry M. Leiner, Vinton G. Cerf, David D. Clark, Robert E. Kahn, Leonard Kleinrock, Daniel C. Lynch;,Jon Postel, Larry G. Roberts, Stephen Wolff**

11. This is the "*dumb pipe*" idea. To condense a vast amount of policy commentary, it has led to discussion and proposals in the past several years for "net neutrality", and to the "layered model" of the Internet.

12. The core of the discussion around layered models and net neutrality has been whether the extraordinary novelty of the Internet's design should have some influence over telecommunications policy. If the openness to innovation was to be preserved, said the proponents of the layered model, then ownership of the underlying transmission facilities would not carry with it the right to foreclose that openness, or to affect the services offered over the Internet at the applications layer. This might occur by bundling of services, or any commercial scheme whereby the power of ownership of facilities was used to the advantage of the network owner.

13. The advantage of the owner of the physical layer of transmission is to be able to lever that market power into the higher layers that depend on the physical layers, which is "monopoly leveraging" in anti-trust terms.

14. The questions for telecommunications policy arising from this kind of analysis are many. To complicate matters, they engage the interests and differing mindsets of lawyers, economists and engineers, who do not always understand one another's language or concerns.

15. Should policy makers have a bias towards open systems, or should they be neutral and agnostic as regards network architecture?

16. There is little doubt that the Internet has acted as a force for *disruptive change*, in the sense employed by Clayton Christensen. [3] Voice over IP (VoIP) is an example of that disruptive change.

17. This leads us to the core of the problem for telecom policy and for innovation and productivity. The Internet model dissociates the value extracted from the meaning of the bits from the value extracted the carriage of those bits. Like all rational people, carriers want to be able to price discriminate: to charge more for some bits than for others. So the innovation offered by the Internet model is a challenge to a number of industries, which have an interest in getting this thing under control.

18. The question for policy makers is to know which way leads to higher productivity in the economy, and if that way cannot be known in advance, or on the basis of recent history, then how to place one's bets so that a variety of outcomes is possible.

19. Tucows is prepared to state its conviction that the Internet model is superior to the older model, where carriers can have a stronger say over what is carried, and can effectively charge different prices for the different values of the bits they carry.

[3] *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Boston: Harvard Business School Press, 1997

20. What we can say with assurance is that telecom policy must start addressing the historical fact that the Internet has revolutionized telecommunications. Taking notice of this fact, policy makers need to consider how the Internet differs from what came before. Then, and here is the tricky part, they need to find a balance between the rights of property in existing networks, against the interests of those who do not own networks, but who seek to reach the market through networks, and to innovate without permission.

21. A policy in favour of property rights in existing networks would allow network owners greater latitude to lever their market power over the physical layer to offer services or set prices at the applications layer. It is Tucows' view that policy should not be overly solicitous of the interests of owners of these networks: they have benefited from long periods of protection from competition via secured rates of return, and are assisted by expert legal and lobbying resources. Indeed, the real competition frequently takes place before regulatory tribunals and in the courts.

22. Communications policy should foster openness to innovation. Nevertheless, there are a couple of problems with this view for the would-be policy-maker:

    - knowing which kinds of network architecture at any given will be more likely to generate innovation and consumer benefits, and

    - even if this can be known, whether legislation should embody any biases towards one kind or another of network architecture, or whether this best kept a matter of policy, or whether it should be an idea that informs the minds of regulators.

23. To the first question, Tucows is confident that the past twenty years has demonstrated conclusively that *the main sources of technical and service innovation have come from the edges of networks, from those who do not own networks.* That is what the IP revolution has achieved, the dissociation of the costs of innovative process from the costs of networks.

24. To the second, many qualifications are possible to the view that the law should be biased towards a certain kind of network architecture. Yet we are confident in our view that this is the central issue for the Telecommunications Policy Review. How much should the design and basic ideas of the Internet inform telecommunications policy?

25. Tucows came into being on the basis of the Internet, which, as we have already implied, is a particular idea of how communications could work. Our bias therefore is Internet-centric. Our business model thrives and survives because we and our customers can launch products and services through the Internet, without anyone's permission.

26. Tucows comes to this discussion with a high degree of respect for the legitimate interests of other actors to survive the disruptive onslaught of technological and

business changes wrought by the Internet. In fact we number many of these companies among our customers. We encourage policymakers, however, to favour open networks and technical innovation to the extent they can. Investment in new kinds of networks will be favourably influenced by the possibility of offering new kinds of applications and services to customers. Thus, in our view, telecom policy should be vigilant about the market power that can be exercised on the basis of ownership of facilities, and, possibly even more important, it should welcome new forms of networks and network ownership models.

27. Historically, the first approach tried by many companies was to get access through other carriers' networks. This avenue is always subject to restriction by regulatory processes, where incumbents have strong lobbying and legal establishments. The next approach which may become necessary is the establishment of new forms of network. These could be municipal systems, for instance, or some combination of customer-owned networks and public infrastructure.

28. It is important that these kinds of network possibilities be seen as a way of allowing competitive businesses to exist. Just as roads and other public spaces allow for access to private homes and businesses, so would new network infrastructures, wired or wireless, allow new businesses to reach their customers and vice-versa. The owners of roads do not determine what kinds of businesses will travel on the road surfaces, nor what kinds of cars are driven, within very broad technical tolerances. In this view then, telecommunications policy is not restricted to constraining market power through regulation. It also encompasses encouragement to the creation of new networks.

29. The disruption of business models caused by the Internet derives from a certain network architecture, which has permitted innovation in services to be divorced from the underlying economics of network transport, a feat that was impossible before the development of the Internet Protocol. Internet Protocol is not enough to secure a future of open access networks; it can be trumped in several ways, and we would argue that regulatory decisions in the United States are moving n the direction of greater incumbent control over cable and telephone networks.

30. Our concern in the Telecom Policy Review is that a new voice should be brought to the table. The lawyers and economists who dominate this discussion have their contribution to make, as always. The new voice asks: what kind of networks do we want? And how will telecom policy help us get them? And would it not be useful to investigate why the computers and networks linked by Internet Protocol have been such great sources of innovation, lest we inadvertently harm that source?

31. And so, in addition to the voices of the lawyers and economists, we respectfully urge the addition of those who are concerned about the basic design features of networks.

A.2	*Comment on the potential for different networks (i.e. wireline telephone and cable networks, terrestrial wireless, satellite and hybrid networks) to carry existing and new ICT applications. Provide any relevant information on the infrastructure costs, bandwidth, security, reliability, and other features of such networks.* 32. The potential for different networks to carry existing and new ICT services is both a question of fact, business and law. The carrying capacity of optical fiber is such that virtually any conceivable service or combination of services could be carried on a single strand of optical fiber, and its carrying capacity could be augmented almost indefinitely with wave division multiplexing. 33. The business question, which is the key one, is whether such a network will ever be built. Indeed, if it has not been built already, policy makers should wonder why businesses have not been willing to invest in a fiber to the home (FTTH) network. What is it about these ultra-high bandwidth networks that does not attract capital? 34. These issues were explored by David Isenberg and David Weinberger in "The Paradox of the Best Network"[4] written around 2002, after the Telecom Crash of 2001. While the tone is resolutely polemical and anti-telco, the same arguments apply to all carrier business models, in our view. "The paradox arises from the meaning of "best." If "best" meant, "generate the most cash for the network owner," there would be no paradox. But if we accepted this meaning of best, we'd have to be content with the tightly-controlled, relatively thin stream of bits that the telephone companies currently grant us. Communications networks have a more important job than generating return on investment; their value comes from their connectivity and from the services they enable. Therefore, the best network delivers bits in the largest volumes at the fastest speeds. In addition, the best network is the most open to new communications services; it closes off the fewest futures and elicits the most innovation. "Designing a network that is intelligently tuned (optimized) for a particular type of data or service such as TV or financial transactions inevitably makes that network less open. As software engineers say, "Today's optimization is tomorrow's bottleneck." Thus, the best network is a "stupid" network that does nothing but move bits.[2] Only then is the network truly open to any and all services that want to use it, no matter how innovative or how unexpected. In the best network, the services live at the edges of the network and use the network to transport bits; they do not rely on any special characteristics of the network itself. "The Paradox of the Best Network comes about because as a network gets stupider, connectivity becomes a commodity. Those who own and operate

[4] http://netparadox.com/

the network have less to charge for. After all, they're just moving bits. The high-value services, the ones that command premium prices, reside at the edge of the best network. Because the best network is simple, it is low-cost to operate. In a competitive market, this means it is low priced. Low price also lowers barriers to innovation at the edges of the best network.

The telephone companies are impaled on the horns of this dilemma. Historically, their high-margin services have been built into the middle of their network, which has been optimized for a single application, voice. Their business is based on this special-purpose network. They know that implementing the new commodity network threatens the very basis of their business.

In contrast, the Internet is not optimized for any specific application. Its strength is its generality. It is designed simply to move bits across all kinds of wired and wireless infrastructures. As a result of this simplicity, the Internet has proven to be the most scalable, most robust communications infrastructure humans have ever built. It has proven itself effective at encouraging innovation. Of all the winning networked applications of the last decade: email, web browsing, instant messaging, chat, music sharing, streaming audio, e-commerce, etc. Every one appeared on the Internet. Not one was invented by a telephone company. And not one needed any special mechanism within the network itself.

"But, the real threat to the incumbent telephone companies isn't the Internet. It is the Paradox of the Best Network. The paradox means that

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[5] "A Layered Model for Internet Policy", Kevin Werbach Journal for Telecom and High Technology Law Vol. 1, #37, 2002, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=648581. The implications of the layered model and the protocol stack for telecom policy were first raised in "Netheads Versus Bellheads, Research into Emerging Policy Issues in the Development and Deployment of Internet Protocols", T.M.Denton, François Ménard and David Isenberg, 1999, for the Department of Communications [http://www.tmdenton.com/pub/bellheads.pdf], and especially "A Paradigm Shift for the Stupid Network", T.M.Denton and François Ménard, June 15, 2000 [http://www.tmdenton.com/pub/paradigmshift.pdf]

[6] 56 Federal Communications Law Journal FCLJ 587 and found at http://global.mci.com/about/publicpolicy/presentations/horizontallayerswhitepaper.pdf

[7] See, for instance, "Further Defining a Layered Model for Telecommunications Policy", Douglas Sicker, at http://tprc.org/papers/2002/95/LayeredTelecomPolicy.pdf

[8] Whitt, op.cit. at page 647

[9] "Free Ride: Deficiencies of the MCI 'Layers' Policy Model and the Need for principles that encourage competition in the new IP world" July 2004, New Millennium Research Council http://www.newmillenniumresearch.org/news/071304_report.pdf

[10] See "International Charging Arrangements for Internet Services" a study sponsored by APEC Tel, September 1999, at http://www.tmdenton.com/pub/reports/index.htm

[11] Code and other Laws of Cyberspace, Lawrence Lessig, Basic Books, 1999 ISBN 0-465-03913-8

[12] Stokab's Annual Report is at http://www.stokab.se/upload/Ladda%20ner/dokument/Stokab_Eng_20051.pdf

[13] Federal Communications Commission, NPRM, "In the matter of IP-Enabled Services", WC Docket No. 04-36, released March 10, 2004, at page 5 and available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-28A1.pdf

companies that run the old, closed, special-purpose telephone network have an unfit business model for running the new network. No amount of technological upgrading will fix this. To survive, the incumbents must become different businesses. But there's no guarantee that they'll be the best companies to run the best network.

"Established communications companies have tried to distract our attention with DSL and cable modems, as if these would complete the new network. But these are crippled compromises at best, touted precisely because they are not disruptive. They milk already-depreciated assets without overturning established business models. And that is precisely why the current communications companies are pushing them so hard.

There are alternatives. Incumbent communications company clout has forestalled delivery of a variety of radically simplified, extremely affordable technologies, from software-defined radios arrayed in self-organizing architectures to Ethernet-over-fiber-optics, that are storming the gates of the telephone companies' existing network. These promise every home more bandwidth than a medium sized town uses for all of its conventional telephony, for about the price of a monthly bus pass. These will be developed and deployed wherever established companies hold less sway.

"In fact, the best network embodies explicit political ideals — it would be disingenuous to pretend it didn't. The best technological network is also the most open political network. The best network is not only simple, low-cost, robust and innovation-friendly, it is also best at promoting a free, democratic, pluralistic, participatory society; a society in which people with new business ideas are free to fail and free to succeed in the marketplace".

35. Isenberg and Weinberger express here the complete Nethead point of view, linking a technological idea to a political one, and for many people engaged in network theory, these arguments have a foundational authority.

36. Legal scholars and businesses have expanded on this view to develop a model of regulation that tries to do away with vertical silos of different regulatory treatment for various technologies, which characterize the telecommunications law in the United States. However, the layered model is relevant to Canada, despite the fact that our *Telecommunications Act* avoids the regulatory silos of the American counterpart.

37. The layered model of the Internet tells us how market power will be exercised by owners of transmission layers over higher layers on the protocol stack.

38. In September 2000, Kevin Werbach published "A Layered Model for Internet Policy"[5], which has been followed by other attempts to put network architecture at the center of telecom policy discussion. This has culminated in a major paper authored by Richard Whitt, senior director of global policy and planning for MCI,

called "A Horizontal Leap Forward: Formulating a New Public Policy Framework Based in a Network Layers Model", March 2004[6]. Many other legal scholars have been engaged in the "layered model" debate.[7]

39. The essence of the concern for telecommunications policy is expressed by Richard Whitt as follows:

> "In the IP world, the preponderance of innovative applications, services and content depends on the ability of producers and end-users at the "edge" (upper layers) of the network to freely access the lower layers at the network core, including the Physical Layer. If for example, a Physical Access Provider is able to exert disproportionate market power over a last-mile conduit – based on traditional monopoly-derived advantages – that market power can be leveraged unfairly into the Applications Layer. The outcome can have a detrimental effect on the levels of competition, innovation and consumer choices otherwise prevalent at that level"[8]

40. For people concerned with the free play of markets, or with trying to make networks pay, these arguments in favour of recasting telecom policy into something more Internet-centric

    - fail to recognize the legitimate rights of business to allocate resources and undertake risks at their own discretion;
    - invite excessive or inappropriate state intervention;
    - rest on an engineering model of the network that may be surpassed faster than regulatory policy or the law can cope with;
    - place a network model at the heart of telecommunications policy rather than the market;
    - fail to provide incentives to invest in new network infrastructure if carriers are not able to engage in rational price discrimination, bundling of services across protocol layers, or exclusion of some players from their networks.

41. For these critics the layered model is an object to think with but not a model to regulate with.[9] For Tucows the layered model is the key to understanding how market power is exercised in the Internet, and is a central concern therefore of regulation or competition policy.

42. For Tucows, the market is the core of our concerns. However, the infrastructure of some carriers has been paid for under regimes of guaranteed return on investment for decades. Public policy helped to build these networks into what they are now. Consequently, they are not purely the result of market skills, but were also assisted by public policy to become what they are now. It is a legitimate option for public policy to favour new kinds of networks, such as ones based on Internet principles,

if this is conducive to the public good, as we believe it to be.

43. The *paradox of the best network* does much to explain the gap between what kind of connectivity could be available, and what people are actually getting. If productivity hinges on making large amounts of bandwidth available as broadly as possible throughout the population, and if such networks do not reward their builders adequately, public policy is at an important quandary.

44. But who is determining what adequate returns are? The entire payments system for Internet traffic was worked out sometime in the mid to late 1990s. Each subscriber's payments were funneled into a set of contractual relationships among data carriers of various sizes. Those with small amounts of traffic pay "transit" fees to upstream data carriers. A few (about seven) very large data carriers "peer" with one another, that is, they take each other's traffic and pass it on. There are no "settlements" procedures between these carriers. Traffic volumes are monitored only very roughly to detect a long-term imbalance of flows.[10] The payments system for data traffic is in place. The concern may be that flows of revenue from customers for undifferentiated bandwidth are nowhere near as large as they would be if people can be sold differentiated products and services with that same bandwidth, such as VoIP or television programs. Whoever holds the last-mile connection holds the key to these profits.

45. The measures that would allow networks to be profitable (constraining bandwidth to 'good enough', charging for one's own services and keeping other competitors out) may discourage innovation from the edge of the network, which we have all experienced in the past fifteen years from the Internet model. The paradox of the best network, if its analysis is correct, argues for a type of network which may not attract capital.

46. The challenge is not technical; it lies in the design of networks. Are they open and end-to-end? How open? What does "*open*" mean in this connect? And if they are open, will they be built? Will they be profitable enough to attract capital?

47. "The potential for differing networks to carry new and existing ICT applications" then, is not so much a question of raw bandwidth as it is of architecture. On what principles will networks be built and, if necessary, be regulated? The argument being advanced here is that merely building something on a basis of IP will not necessarily suffice, if control by the carrier lies at the heart of the network's architecture. In the Internet, code is law, as Lawrence Lessig has pointed out.[11] Engineering design has as large an influence over outcomes as explicit policy objective emanating from the governmental-legal sphere of influence.

48. On the other hand, the economists have a robust and historically well-justified faith that the market will overcome all inhibitions against innovation from any source, and that in this era we need to be highly cautious about enshrining any view in legislation, Internet-centric or otherwise, that would require continuous supervision

of prices and conditions of service.

49. It is with a sense of deep appreciation for the powers of the market that Tucows offers the following view. The proper task of regulators and policy makers is to be informed by the specific technological evolution of the services at issue. Moreover, the task for regulators and policy-makers is to grasp the specific possibilities offered by some networks and not by others, to be conscious that certain network architectures will tend always produce a relative scarcity of bandwidth, while others produce an abundance. These political and business arguments have a place in the analysis of telecommunications law and policy.

50. In short, this is an argument that the legal framework needs to be sensitive to the nature of the network architecture underlying the regulatory issues before them. Constraining market power may be the chief goal of regulating existing networks. Preserving the principles of innovation and openness are appropriate goals to guide the creation of new kinds of networks. Telecommunications policy should be concerned with both.

51. This contention raises a number of issues that need to be looked at carefully and at a greater length than is appropriate for this section of the document. They include:

    - Does this cognizance of the network architecture inform the minds of regulators, without being dealt with in the governing statute, or should concepts of network architecture inform the framework of law by which they regulate?

    - Given the rapid rate of change in technologies, what essential and enduring features of desirable network architectures could be favoured by law or regulation?

    - Alternatively, does the law need to take cognizance of the properties of different network architectures?

52. Though we are a long way from the purely technical capacities of various architectures, the questions asked here go to the fundamentals of the TPR's mandate. In summary, we have maintained that

    - the carrying capacity of various networks is capable of vast expansion under the influence of Moore's Law,

    - the network's architecture (the inherent rules by which they operate) determine their carrying characteristics and their openness to innovation, and

    - these are vital matters for regulators and policy makers to be concerned with,

    - we are agnostic as to how far these principles should be taken into the construction of a new Telecommunications Act, but

- lawmakers and regulators should be cognizant of the degree to which market power can be abused to prevent, delay, or distort optimal networks, and

- the building of new kinds of networks should be encouraged by telecommunications policy.

53. We have entertained the notion that network most open to innovation, the dumb pipe, may be repellent to capital, precisely because of the disempowerment of the carrier in this hypothetical business model to engage in rational pricing decisions (such as price discrimination, integrating services with bit transport across protocol layers, and so forth). But there are and have been solidly profitable experiments in high-bandwidth bit-pipes serving municipalities on a common carrier basis, such as Stockholm's Stokab AB[12]. The challenge of building fat pipes to homes can be met in different ways, and telecommunications policy should foster these different approaches. If Canada were to follow Stockholm's example, telecommunications policy would, in addition to its other tools of analysis and regulation, start to concern itself with municipalities, school boards and other local institutions.

54. Correspondingly we have maintained that, in an era of optical fiber and intelligent edge devices, the carrying capacity of networks is not a technical question but an architectural, business and ultimately legal one. Technical constraints on usable bandwidth are not really all that important. Network architectures are a highly important consideration for telecommunications policy. The constraints that can be exercised by owners of the infrastructure over other players seeking to use that infrastructure remain the core problem, and IP will not make it go away.

55. The FCC recently asked for comment on whether "the proliferation of services and applications utilizing a common protocol may permit competitive developments in the marketplace to play the key role once played by regulation."[13]

55. The answer to this question, in our view, is a firm "no". The kind of network architecture from which maximum profit can be wrung is one that carefully controls the scarcity of bandwidth, tightly links underlying transport to services, maintains control of who gets on and who does not, and charges by the value of the packet to each consumer: something the opposite of the Internet.

56. So the relevant issue is: what kind of network do we want and what stands in the way of having it?

57. One thing standing in the way may well be the very openness and competitiveness of the very high capacity broadband network. New forms of ownership, such as municipal or customer-ownership, may be needed to solve this problem.

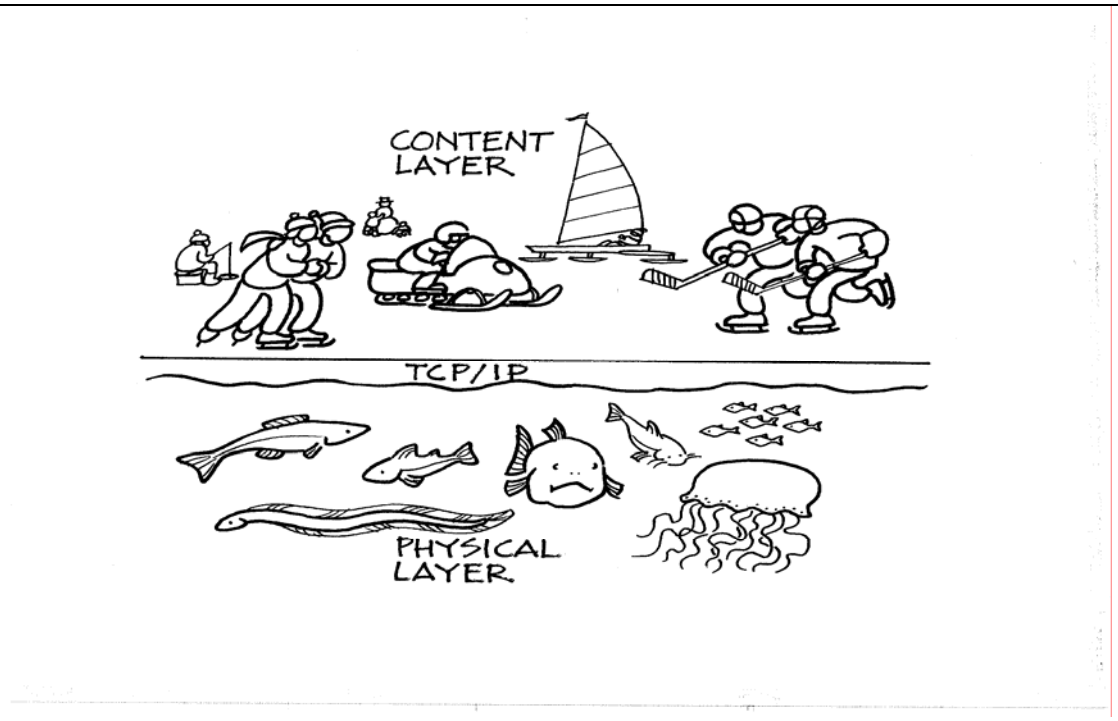

Figure 1: The Internet Model

Various sports (applications) occupy space (bandwidth) above the TCP/IP “ice”.

No overt central control is exercised by the owner of the lakebed (transport layer) over who gets on the frozen surface. The ice-surface is shared, but not allocated by authoritative arrangements. Contracts or social arrangements among classes of user determine what activities go where. These arrangements assume a large enough area of ice (bandwidth) is available.

The layers below the TCP/IP “ice” are of no interest to the applications.

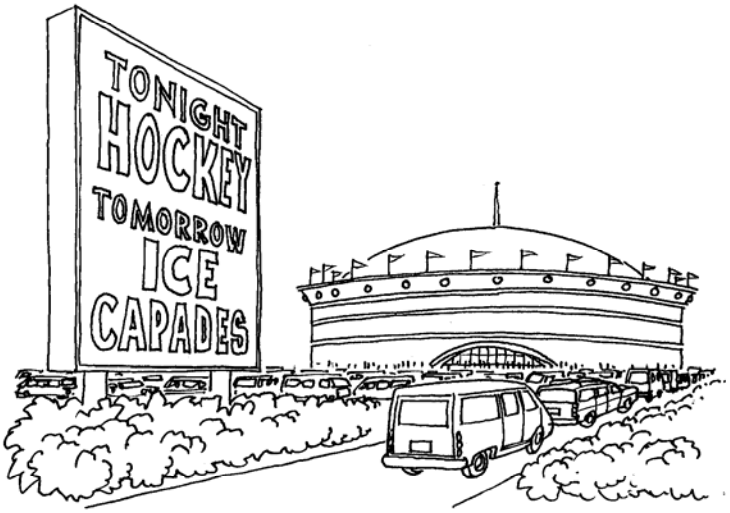

Figure 2: The Carrier Model

The “applications” are selected by contractual arrangements between the carrier (stadium owner) and the service suppliers (hockey league, ice capades, other acts, etc)

The TCP/IP “ice” is still present, but the access to it is controlled. The stadium owner wants an audience (to fill spare capacity) but he selects what is shown on the rink according to his best judgment. The range of “applications” (shows) is determined in part by what the rink-owner determines will fill seats in the arena.

Ice-time (bandwidth) is limited. Users pay to occupy seats. Vendors pay to appear on ice. Arena owner collects ticket fees and rents for ice and pays for upkeep of the arena.

Cost of building another arena limits duplication of facilities in the same market.

A.3	*Are "one pipe, multiple applications" networks likely to become the primary means for ICT applications to be provided to Canadians? If not, why not?*

58. A vast set of assumptions is conveyed by the phrase “one pipe, multiple applications”. We need to unpack the implicit content of the phrase before going further, because the use of the phrase in a policy discussion implies a profound change in assumptions about what networks are going to be like in the future, and how they might be regulated, if at all, and for what reasons.

59. For decades, the monopoly status of telephone systems was an accomplished fact and a legal idea. Regulation existed to limit its effects, and spread the benefit of a single interconnected system where every telephone could reach every other (what “universal service” originally meant)[14], and where telephone service was affordable and reached nearly everyone (what “universal service” came to mean over time). The defence of the long-distance portion of the telephone monopoly rested in the assumption that it provided the best way of distributing service from high-profit, low-cost areas to high-cost, low profit areas. Banks and other large business users eventually forced a reconsideration of this policy as microwave and other technologies lowered the production costs of long distance transmission. Consumers saw an increase in some portions of their telephone bills and decreases in others, as long distance competition got underway. This was how competition was introduced in the United States around 1985, and a similar policy was followed in Canada by 1992.

60. Competition before the 1990s was conceived in terms of telephone service: *telephony* for short. The Internet was a still a toy for university-based computer scientists.

61. The second salient feature of competition policy in this period was a reliance on a technological idea to divide the telephone industry.

62. The 1982 break-up of AT&T rested on certain technological premises of what could be competitive, and what could remain monopolistic. The local switch was assumed to be the point of control, the “bottleneck”, and above which competition could flourish in the switching hierarchy.[15] An entire industry was reorganized on this *technological and business* (not legal) principle. The AT&T break-up established a precedent for comparably sweeping organizational change along different technical lines, if this should prove necessary. It will be objected that decisions based in technological assumptions become obsolescent too fast to be relevant for inclusion in statute law. The fact that AT&T has been bought out by one of the Bell regional companies should be a cause for reflection on how rapidly technological assumptions are made obsolete by improving technology. The twenty three year lifespan of the AT&T break-up is a respectable duration of a policy in the telecom world.

[14] The exploration of the original meaning of “universal service” was conducted by Milton Mueller, 1997 in “Universal Service: Competition, Interconnection and Monopoly and the Making of the American Telephone System”, Cambridge, Mass.: MIT Press

[15] “After the Break-up: Assessing the New Post AT&T Divestiture Era”, Barry Cole, editor, Columbia University Press, 1991, ISBN 0-231-07322-4

63. Telecom policy may be on the brink of another major transformation as it grapples with the significance of the Internet. If this policy should have a twenty three-year lifespan, it will have done well.

64. This returns us to the "one-pipe, multiple applications" idea. As long as competition was conceived as a form of telephony, then competition in facilities was of supreme importance. Indeed, it was thought the only way of achieving competition, with leasing of the incumbents' facilities a distinctly second best option. Regulators in Canada and the United States struggled with whether to encourage the leasing of network elements by telephone rivals, or to encourage them to build new facilities. One involved endless regulatory intervention, the other heavy investments in rival networks.

65. Given the very slow progress in wire-based local competition in Canada since it was first mandated in 1997[16], it has become obvious that building rival networks to engage in *telephony* alone is irrelevant to the needs of the age.

66. The relevant competition has moved on. Competitors want to be able to offer all the services that the Internet makes possible.

67. This brings us to the "one-pipe, multiple applications" idea. First, one-pipe multiple applications is compatible with both open and closed networks, vertical integration of transport and applications layers, innovation without permission, or any level of market power being exercised by the pipe-owner.

Number of Pipes	Closed Architecture	Open Architecture
1	telco	?
2	Cable, telco	?
3 or more	Cable, telco, municipal, satellite	?

- One pipe, but a choice among more than two pipes (cable and its cellphone carriers, telephone company and its cellphone carriers, some form of customer-owned radio-based access in any combination with the large carriers)
- One pipe, and only two pipes to choose from.
- Open or closed pipes, or any combination in between. This is the really important question, though multiple pipes will help provide customers with a

[16] http://www.crtc.gc.ca/archive/eng/Decisions/1997/DT97-8.htm

	choice of business models. • As soon as one pipe to the home is made of optical fiber, supply of bandwidth is practically infinite. It could therefore foreclose all other competitors. So the architecture of the network becomes even more of a concern when the "pipe" is of optical fiber. 68. The questions we think need asking are: • How much power will the owner of the transmission facilities exercise over the consumer's choice of applications? • Will this power be effectively limited by intermodal competition? • Will this power be limited by economic regulation of the kind we now have under the Telecommunications Act? • Will the Telecommunications Act undergo a fundamental revision?
A.4	*Are there likely to be multiple IP network providers offering service to the home, business and public sector? If so, how many and which types of network providers are likely to be providing service to each market? If not, which types of network providers are likely to serve each market and with which technologies?* 69. The question of how many network providers there will be turns on previously raised issues. 70. One model envisions investments on the scale of the cable and telephone industries, or the cellphone industries, building out in the order of hundreds of millions of dollars. 71. How much incentive will there be for these investments? In order to make them pay, will it be necessary for them to be able to exclude some applications? Bundle others? How much power will need to be exercised over the applications to make the large investments in the transport level profitable? 72. Another possibility is that radio-based technologies might be employed in unlicensed spectrum bands to cause networks to be created. These networks would be paid for by users, in the same way the computers are paid for – by the end-user. Just as people own and operate their computers and assume the costs of their obsolescence, so would people own and operate mesh networks of radio devices, whose carrying capacity would expand rather than diminish with density of users. 73. To answer the question directly, there is every indication that there will be only two sets of networks available in ten years, one owned by the former cable television industry, and the other by the former telephone industry. These would each

	comprise wired and wireless offerings. 74. Unless something changes, we do not see much competition coming from other public utilities with rights of way, such as hydro-electric distribution systems, nor do we see significant customer-owned radio-based mesh networks, *unless* policy is developed to favour their deployment. Rights of way and high points are crucial issues for any entrepreneurs seeking build new networks. Federal and provincial laws may need to be amended to assist this to happen. 75. The creation of these alternative networks, be they customer-owned or utility-provided, or some combination of both, rests on a business model that makes money for someone. People are going to need bandwidth in amounts that the existing players are not providing at the time. That implies that people are going to have to want much more bandwidth in order to make it worth their while to buy the antenna or the fiber extension that makes the new service possible.
A.5	*Is the Canadian competitive environment in telecommunications likely to evolve into a form of duopoly (i.e. incumbent local exchange carriers (ILECs) versus cable companies)? If so, what would be the implications for the telecommunications and ICT markets? What would be the implications for the regulatory framework?* 76. Yes. It is doing so already. In the vast majority of markets, the incumbent telephone company and the incumbent cable company are the only providers of high-speed Internet access. Alternative providers of bandwidth, such as satellite, terrestrial radio, other utility companies, should be encouraged.
	.
A.7	*Assuming a "one pipe, multiple applications" environment does evolve, describe the effect of this environment on the market position of existing service providers (e.g. ILECs, cable companies, wireless service providers, Internet Service Providers) and any new entrants. Provide market share projections, if possible.* 77. Internet service providers are already being squeezed out of the market by regulatory action in the United States. This result is being achieved by the FCC's decision to deregulate the telephone companies as regards access requirements to independent ISPs. This is being done on the ground that there needs to be competitive equality between cable and the telcos in the United States.[17] 78. The FCC stated that "Consistent regulatory treatment of broadband platforms will enable potential investors in broadband network platforms to make market based,

[17] http://www.fcc.gov/meetings/080505/sharing.pdf; http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-260433A1.pdf

	rather than regulation-driven, investment and deployment decisions." 79. While the legal basis of this FCC decision is rooted in the particular legal and constitutional structure of US telecommunications law, its direction is consistent with a general FCC policy towards full and less fettered competition between cable and telco platforms. 80. As regards obligations to interconnect, telephone companies and cable television operations in Canada have in fact been under different obligations to allow interconnection, though the regulator may have attempted to put them on the same basis. The cable industry has argued strenuously that it should not be subjected to common carrier obligations. If the carrier industry is to be made subject to common carrier obligations, then the cable industry's DOCSIS standard should come under scrutiny. There is reason to consider that this standard is designed to prevent third party access and competition across cable infrastructure.
A.8	*Comment on the need for ongoing financing of advanced and legacy network infrastructure in Canada and on how such funding should be obtained by network providers in a "one pipe, multiple applications" environment. Since VoIP and other advanced ICT services may be provided separately from access networks, how should network infrastructure be financed in the future?* 81. New network infrastructure may well be paid for by different approaches to owning and operating networks, such as municipal or customer-owned wireless and wired systems, as discussed above. 82. Second, the history of the Internet has shown that Internet infrastructure has been built and paid for on the basis of private contractual agreements, called peering and transit arrangements. These involve payments up and down the ladder of ISPs from smaller to larger, roughly based on traffic volumes, on the basis payments made by the end subscribers. In other words, the funding has already been obtained some years ago and the commercial solutions are in place among large data carriers. 83. The question implicitly is remised on the view that there is some sort of funding crisis if all networks go IP, but this is only the artifact of the high cost structure of the existing PSTN. When long distance competition was introduced, employment fell by 90% inside the long distance portion of some carriers. Likewise employment may fall considerably inside PSTN carriers. Yet the commercial arrangements to pay for the world's IP traffic were instituted by the large scale private Internet carriers in the mid-to-late 1990s, and would need no special adjustment if the PSTN disappeared tomorrow.
A.9	*Provide any other comments on the implications of IP and other new technologies for the Canadian telecommunications and ICT sector that the Panel should take into account in*

	developing its recommendations. 84. The claims of the security services on network and telecommunications policy will make themselves felt, in response to the terrorist threat. It is important that they have a voice, and it is equally important that they do not have the controlling voice in network policy.
A.10	*Comment on the development of wireless services in Canada over the next 10 years and the implications for Canadian productivity, competitiveness and social benefits.* 85. Tucows has commented below (B19-21) on the need to reformulate spectrum policy to accommodate the advent of machine intelligence in devices, which argues for allocating large bands of unlicensed spectrum for experimental use. This spectrum might be obtained from analogue spectrum being returned to the government as its users switch to digital broadcasting,
A.11	*Please add any comments on the evolution of telecommunications networks or the telecommunications industry structure over the next 10 years that the Panel should take into account in developing its recommendations.*

B. Regulatory Institutions

B.1 *Should the existing policy objectives set out in section 7 of the* Telecommunications Act *be changed? If so, what should they be?*

86. Yes. The policy objectives need fundamental rethinking. The tools in the Act flow from the objectives, and if we are to modify the Act we need to consider the continuing relevance of the objectives.
87. The seven objectives of the Telecommunications Act are so diverse that they allow for virtually any policy direction that the CRTC and the government may choose to implement. As the CRTC generally is the decisive power in day-to-day decision making, the Commissioners and staff may take almost any position they see fit and justify it in terms of the objectives of the Act.
88. The Telecommunications Act of 1991 is solidly rooted in the nation-building idea of its sister, the Broadcasting Act, and the statist and

interventionist ideas of the New Deal. “Orderly development” implies the far-seeing eye of the wise and omni-competent government permitting things to happen at some rate determined by policy considerations, whereas it could be argued that the chaotic development of telecommunications by sometimes unwise investors ready to stake their fortunes in the market might be a closer depiction of how things actually work. The Internet occurred by a combination of government grants supporting far-sighted computer-communications research. Promoting the ownership and control of Canadian carriers by Canadians locks the government into a supervisory relationship to movements of capital which is absent in most other sectors of the economy. Promoting the use of Canadian transmission facilities for communications within Canada and between Canada and points outside of Canada, besides being a dead letter, hearkens back to 17th century Navigation Acts.

89. Few of the objectives are unambiguously pro-market, and most imply the guiding hand of the state.

a) to facilitate the orderly development throughout Canada of a telecommunications system that serves to safeguard, enrich and strengthen the social and economic fabric of Canada and its regions;

(b) to render reliable and affordable telecommunications services of high quality accessible to Canadians in both urban and rural areas in all regions of Canada;

(c) to enhance the efficiency and competitiveness, at the national and international levels, of Canadian telecommunications;

(d) to promote the ownership and control of Canadian carriers by Canadians;

(e) to promote the use of Canadian transmission facilities for telecommunications within Canada and between Canada and points outside Canada;

(f) to foster increased reliance on market forces for the provision of telecommunications services and to ensure that regulation, where required, is efficient and effective;

(g) to stimulate research and development in Canada in the field of telecommunications and to encourage innovation in the provision of telecommunications services;

(h) to respond to the economic and social requirements of users of telecommunications services; and

(i) to contribute to the protection of the privacy of persons.

B.2 How detailed should the telecommunications policies set out in the Telecommunications Act *be and, conversely, how much discretion should be left to regulators such as the CRTC and Industry Canada*

90. The first question that a policy review should be asking about the statute is whether the Telecommunications Act should be abandoned and a clean start made. This idea has two advantages.

91. First, it would create a degree of institutional uncertainty. While institutional uncertainty is uncomfortable for those who live through it, a policy process leading to a new Act allows for the possibility that an institution such as the CRTC might come to and end. Even if its successor were created the day after to replace it, (and we would argue something must be able to deal with market power issues in telecommunications), the new institution can start out with new personnel, new rules, and new objectives.

92. One could easily imagine, for instance:

a) separating the institution that regulates telecommunications from the one that regulates broadcasting;
b) reducing the number of Commissioners empowered to deal with telecommunications, and requiring them to write the decisions, as is the case with the Copyright Board;
c) starting from the assumption that the limitation upon market power is the core consideration of telecommunications policy;
d) reversing the assumption that every service is regulated unless the industry is exempted or the service is foreborne;
e) recognizing that the major technical innovations in ICT have derived from the open nature of the Internet, and further defining the nature of the openness and striving to protect it; and
f) getting away from quasi-judicial procedures as the default method of dispute resolution.

93. Tucows is not saying that every one of these suggestions is the right course of action; it is declaring that a thorough review of telecom policy would start with a broader view even than that of amending the seven telecom policy objectives.

94. The second advantage would be to open up the process of discussion in a fundamental way. The TPR is to be congratulated for the breadth and depth of the questions it is asking about Canadian communications policy. Yet the very specificity of the questions might lead one to believe that the panel inclines to the view that the Telecommunications Act should be further perfected, rather than set aside and a radical rethink begun.

B.3 *What should be the overall objectives of economic regulation?*

95. The constraint of market power in the interests of technological, market and service innovation, to the end that the wealth of the Canadian people be maintained and increased.

B.4 *Are the two main principles of economic regulation set out in the* Telecommunications Act*, namely "just and reasonable rates" and "no unjust discrimination", still appropriate? If yes, should they be further clarified in legislation or in other statements of regulatory policy? If not, how should they be modified or replaced?*

96. If the fundamental question is the constraint of market power, is it appropriate to start with the assumptions about service pricing principles? Are there other ways to constrain market power as effectively?

97. Tucows inclines to the view that intermodal competition should be the first line of defence against the potential abuses of market power. Such a policy would encourage the creation of new kinds of carrier networks.

98. We have no objection to the concepts of “just and reasonable rates” and “no unjust discrimination”. One reaches these points after a determination that some service needs to be regulated for certain purposes because its provider exhibits particular characteristics.

99. Should the law assume that all of a carrier’s offerings need to be regulated? If not, under what conditions should a carrier’s offering be regulated? How frequently should that determination need to be made? On what criteria?

B.12 *Should the ILECs continue to be required to provide their regulated services to any potential customer on demand? If so, is a new regulatory framework required to finance this obligation to serve?*

100. If carriers are to continue to have the status of common carriers, as opposed to private contract carriers, the obligation to serve all customers under similar circumstances is the essence of that status. They should be allowed to charge rates that reflect their costs. They do not need a new regulatory framework in order to obtain sufficiently high prices to recover their costs and make a profit.

B.13 *Are changes required to the contribution regime or other aspects of the regulatory framework that subsidize delivery of telecommunications services in high cost areas?*

101. In conditions of rapid change and great uncertainty, such as telecommunications is passing through, it would seem advisable to rethink how communities could be served by municipal or other public or private institutions offering bandwidth in some appropriate combination of optical fiber and wireless transmission paths. Especially if the alternative is a single pipe over which the carrier can exercise considerable control of who interconnects and what gets on its network, the idea of the customer-owned or community-owned network needs to be encouraged. Tucows recommends we stop thinking of subsidies for what is becoming progressively cheaper to supply, and start thinking about what and who is being subsidized, and do they need subsidy to supply what people could supply for themselves by cooperative arrangements?

B.19 What steps, if any, should be taken to enhance the effectiveness of Canada's participation in international spectrum and standards organizations?

B.20 Given the inevitable implications for Canada, should the federal government and industry groups participate more in United States' spectrum and standards policy and regulatory processes?

B.21 Should regulation of spectrum, technical standards, interconnection, numbering and other technical matters be unified under a single regulatory authority? If so, which authority, and under what conditions?

102. Spectrum policy is in need of a complete rethink. Computers have been invented. Intelligent devices abound. Therefore it is time to stop predicating spectrum policy on dumb devices at the edge and whatever intelligence may be in the system in the centre. As David Reed, one of the authors of the Internet Protocol, once caustically remarked:

> "The last time spectrum policy coincided with science was 1912." (referring to the Titanic disaster)

103. Intelligent devices overturn all ideas of "interference" on which conventional spectrum policy is predicated. Therefore, the way is open for significant use of unlicensed spectrum. Let the edge devices figure of what signal is intended for them, rather than assume they have to be told by spectrum assignments.

104. In a like manner, if Canada is to have some opportunity for unlicensed spectrum, there exist vast portions of the spectrum now allocated to analogue uses that could be returned for re-use by unlicensed applications, once the current holders have been given their new digital spectrum bands.

105. The United States has begun to think favourably about issuing more unlicensed spectrum. If Canada is to develop alternative radio-based networks for customer-owned devices that will access the Internet, there needs to be spectrum available for the purpose.

B.25 *Should the regulatory framework for numbering be changed? If so, how and by whom should telephone numbers be administered?*

B.26 *Over the next 10 years, is there likely to be a new method of assigning addresses to telecommunications devices which would replace traditional numbering? If so, what might that method be, who should administer it, and how?*

106. Telephone numbers and domain names serve as forms of personal identifier, and they have value for that reason. At the moment, the default look-up for VoIP still rests in telephone numbering look-ups conducted in the old Signalling System 7 (SS7). In order to move away from legacy infrastructure and its associated costs, telephone addressing will soon move to a system more compatible with the addressing system of the Internet. This is the DNS, the domain name system. ENUM is the protocol[18] that achieves this translation from telephone number into an DNS type of look-up. ENUM comes in two fundamental flavours, carrier or infrastructure ENUM, in which the public is not directly involved, and public ENUM, where people would subscribe to ENUM-enabled services as they currently subscribe for domain names.

107. The management of domain names in Canada is dealt with by the Canadian Internet Registration Authority, or CIRA, which manages and supervises the .ca domain[19]. Telephone numbers, by contrast, are legally under the authority of the CRTC but are in fact managed by a telephone industry committee, which contracts out the management of the work to the Canadian Numbering Administration, under the authority of CISC, and ultimately of the CRTC. An issue to be resolved in the current work on ENUM in Canada is the form of management organization for ENUM in Canada. Is it to be an industry association, such as the current telephone numbering arrangements? Or will it have some elements of user input, such as domain name management in this country in the not-for-profit CIRA? Some of this may turn on the form which ENUM ultimately takes, whether public subscription-based ENUM, or a private inter-carrier exchange of information.

108. It is timely to review the structures for managing telephone numbers because, with the advent of IP telephony, they will shortly be detached from their ancient linkages to geography, they will be assimilated to domain names, and they

[18] RFC 3716 at http://www.faqs.org/rfcs/rfc3761.html
[19] www.cira.ca

could well become a bottleneck in competition policy terms. Telephone numbers have long since moved away from being routing instructions to the PSTN and have become valuable identifiers. As their uses change, and as the underlying technology for which they are used undergoes a transformation (PSTN to VoIP), it is time to consider whether they should be managed by a more broadly-based set of interests.

C. Regulatory Institutions

C.22 Please provide comments on the nature and extent of convergence as a technological and industry trend and propose any changes to Canadian telecommunications regulatory framework that should be made to ensure this framework can cope adequately with technological changes.

C.23 Please comment on any specific legislative or regulatory measures that would enhance the ability of the federal government policy-makers and regulators to address the issues arising from convergence.

109. "Convergence" is a term we apply to the current industry transformations because in former times analogue devices were single-purpose and served to keep industries separate. Looking back from the future we will wonder how they were ever separate. Laws based on the former separations engendered by those devices need to be reviewed for their relevance.
110. Intelligent devices are subject to all the amazing returns on compactness and price/productivity with which we have become familiar. Coupled to radio or wired linkages, these devices have increased the power, reach, and productivity of individuals and reshaped how work is done and what work consists of. We are all aware of these phenomena but we need to remind ourselves that telecommunications policy is about these linkages.
111. The argument that Tucows has been advancing throughout this presentation bears on the question whether this innovation will be allowed to continue, and who shall reap its rewards. It is our observation that open standards, such as TCP/IP, which linked machine intelligence wherever it was found to the service of people, succeeded in enhancing the possibilities of human existence in ways that could not have been thought of by centralized institutions, and which were not realizable in the specialized networks optimized for voice or any other particular purpose.
112. Consequently, if we are going to keep reaping the benefits of the Internet, we must understand its fundamental role in shifting power away from network owners to the users at the edge of network. It is they who must continue to be empowered to create, to connect, and to own the rewards of their creative work: in services, ideas, devices, financial arrangements, or anything else. If existing networks are not ultimately friendly to this new conception of how networks can

be used to create and distribute wealth, then policy should be conducive to the creation of new ones.

113. Finally, a word about the public realm. Private property in the physical world is reached, in the main, through public roads. The value of private property very much depends on our ability to reach it, and for people not to be blocked by those who own rights of way. In the same manner, then, Tucows is stating that the value of holdings is cyberspace depends on the ease, speed and cost of reaching them from any point on the globe. In our view, then, there is necessarily a public interest in these access arrangements. Whether access is assured through price regulation, intermodal competition, or competition policy, is a matter of pragmatic wisdom. It should be a central concern of telecommunications policy that the transmission system and its ownership arrangements should not stand in the way of the wealth creation, and communications, engaged in by the users of these networks. The Internet model offers decisive advantages over the models of communication that came before it, precisely because of its power to allow for the creation of wealth in ways that were not possible in older, more specified networks. Protecting that feature should be a central concern of telecommunications policy.