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Abstract.

ICANN currently determines which top level domains are available on the A-root server and so restricts the choices facing Internet users. Thus ICANN redistributes wealth and has become the focus of rent-seeking activities. Yet, despite my belief that the Internet will become substantially more regulated in the future, I am convinced that technology will trump the best efforts of regulators to “promote the public interest.”

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Introduction.

The Internet Corporation for Assigned Names and Numbers (ICANN) was established in 1998 as a private corporation to manage the administration of the U.S. top level domains (TLDs) on the Internet. ICANN's authority covers only those TLDs recognized by the A-root server, the equivalent of the main telephone switch board. The A-root server is the only computer network that links registered TLDs to the Internet. ICANN holds a monopoly on access to the A-root server. Until it added seven new TLDs in November 2000, ICANN had permitted only four TLDs: dotcom, dotnet, dotorg, and dotedu. ICANN domination of the Internet is unlikely to continue, however, with the emergence of competition from alternative internets that are not part of ICANN-regulated cyberspace. Since ICANN is a government-established monopoly, the root servers that serve as switchboards for these alternative internets (e.g., Newnet¹, Earthlink, Excite@Home,² Netzero) cannot be accessed through the ICANN-regulated Internet.³

This paper provides key insights into the economics of regulation and rent seeking, describes how the regulation of the Internet has developed, and provides an economic analysis of some aspects of the governance of the Internet and likely developments.

Dotcom v. dotcow - what's in a name?

Sometime ago I heard a radio commercial which was both humorous and relevant to my discussion. It was announced that hackers had changed dotcom to dotcow. The hooligans, reportedly a coalition of anti-bovine interest groups, included pork, fish, and fowl. Once in dotcow, the unwary user is linked to mad cow websites, and from there to more benign options than beef. I will refer to this again at the end of the paper.

This story illustrates some of the realities of Internet governance, that is, the laws and conventions that govern the Internet. The mischievous dotcow coalition rerouted traffic to put beef in an unfavorable light by moving it to a different top level domain (TLD). Self-interest explains why it might behave in this way. Although software searches for numbers, users favor easily recognizable names. The allocation of addresses may take

¹Newnet currently sells ten domain names including dotshop, dotagent, dotinc, dotmed, dotmp3, dotclub, cotlaw, dotfamily, dotarts, dottravel, dottech, and dotschool.

²Recently Excite@Home announced that it was filing for bankruptcy.

³As I was preparing this paper for publication, I read a review of Milton L. Mueller's new book, *Ruling the Root* (Cambridge, Mass.: MIT Press, 2002), which provides a clear and extensive coverage of Internet governance issues.

place through markets with money changing hands or be determined by a government or government-sponsored organizations like ICANN. The names of websites convey information and Internet addresses are valuable assets, so it is not surprising that businesses and organizations will expend resources to acquire them. They will want to protect their property and will therefore be concerned about the property law and the regulatory agencies whose decisions affect the value of their assets.⁴ It is equally clear that some mechanism is necessary to protect people's property rights in Internet addresses. This is performed by the Internet Corporation for Assigned Names and Numbers (ICANN) which enjoys a government-granted monopoly in this regard. Let us hope that the alternative internets will arise without unnecessary restrictions and make the sluggish (and highly political) regulation by ICANN less important.

A system of well-defined and enforced property rights is a necessary precondition for reaping network externalities, a term which describes the benefits to existing users as new users join the system. ICANN's Stuart Lynn argues that "congestion, confusion, and chaos" will result if names are not carefully allocated and the system properly managed.⁵ Both individuals and society benefit when property rights are enforced. Global entrepreneurs roam the world seeking the most favorable wealth-creating regimes, that is, those with well-defined rules protecting property. There is a tension between the interests of those firms that seek to do business in unfettered markets and those firms and interest groups that seek to redistribute wealth to themselves through government power. But also relevant is the fact that the institutions and rules that govern the Internet determine the ability of politicians to serve as brokers between firms and interest groups.

However, the efficacy of governance institutions is subject to technological change, chance economic events, and the ways in which individual countries address competition, foreign investment, intellectual property, privacy, and the taxation of Internet transactions and assets. Whether the forces of wealth creation will outweigh those of redistribution is an open question, but much will depend on the system of governance and access to cyberspace through TLDs. The decisions of ICANN will continue to affect innovation, determine how

⁴See, e.g., "New domain name hell: planning for .biz, .info, and more." At the same time as an expanding list of top-level domain names will offer Web site owners more latitude in choosing a more appropriate Internet address, it will also force a lot of them into a mad scramble to defend the precious real estate they already occupy.

<http://cgi.zdnet.com/slink/?adeskb/adt0706/2782901:12160361>

⁵Stuart Lynn presentation before the New America Foundation, August 15, 2001.

interest groups interact and how disputes are resolved, and thus how the Internet will evolve. However, the enforcement of ineffective rules wastes resources and discourages innovation, thereby preventing the potential benefits of the Internet from being fully realized.

The economic theory of regulation and rent seeking.

For many years there has been a widespread recognition among economists that government may serve as a vehicle to create and maintain monopoly power and hence generate economic rents for a favored few. University of Chicago economists George Stigler and Claire Friedland (1962), Stigler (1971), and Sam Peltzman (1976) developed the economic theory of regulation. In “The Theory of Economic Regulation” (1971), Stigler argued that producers “capture” the regulatory agency to prevent competition, despite statutory obligation of the agency to represent the public interest. According to this theory, the configuration of gains and losses resulting from anti-competitive government restrictions depends on many factors and these affect the demand for, and supply of, regulation in the political market place. For example, new technology may render existing government regulations undesirable to their prior beneficiaries or make current regulations useful to new groups which hitherto did not benefit. According to this theory, if the expected political rents net of the costs of organizing and procuring favorable legislation are positive, then producers will demand and pay for regulation. Stigler concluded that regulation was generally harmful rather than beneficial for consumers. The gains from government-imposed inefficiency may be important to a few firms or interest groups, although they may not necessarily be easily identifiable. The losses, on the other hand, are borne by millions of consumers, who individually face small costs and cannot easily organize to defend their interests. As a consequence, their opposition is unlikely to be effective in combating economically wasteful regulations. Economy-wide losses (so called, social costs) are greater, and may be much greater, than the gains to the beneficiaries.

While Stigler is associated with the capture theory, it is worth noting that in his early work he emphasized that it was no more surprising that firms lobby to establish regulatory agencies which they would control than that dentists set about to work on teeth. Another important insight is that regulatory agencies may be captured not only by firms but also by environmental and consumer interest groups who participate in the political market

place.

The economic concept of rent seeking provides valuable insights in understanding the reasons for, and consequences of, the decisions of the national and international organizations that govern the Internet. The work of Gordon Tullock (1967), Anne Krueger (1974), and Richard A. Posner (1975) on rent seeking explains how interest groups seek out and take advantage of monopoly positions. Their work provides useful insights in understanding the consequences of Internet governance and of ICANN in particular. Tullock observed that monopolies rarely arise spontaneously but are usually created and defended by government. He explained how, in addition to the deadweight loss occasioned by monopoly (and measured by the reduction in consumer surplus), firms can be expected to expend resources to acquire monopoly profits (what economists call “economic rents”).

Industry-wide cartelization is not the only way these rents are created. Firms compete not only by lowering prices, but by seeking regulations that disproportionately raise the costs of rivals. For example, prohibiting access to the A-root server would increase marketing costs for their rivals who could no longer use the Internet. This type of “government predation” strategy differs from cartelization in that only some firms in the industry gain. Industry cooperation to obtain economic rents for all firms is replaced by rivalry among industry subgroups to benefit some firms at the expense of others. In the case of ICANN, this argument suggests that some firms or groups may seek to block access to the A-root server by new entrants.

Fred McChesney (1987) builds upon Stigler and Tullock in explaining how politicians may create rents by threatening regulatory changes with the idea that firms would be encouraged to contribute to their campaigns or to make concessions on regulatory matters. His insights are applicable to ICANN’s control over the A-root server and thus the distribution of rents arising from the new TLDs. It also appears that ICANN’s sponsorship by the Department of Commerce would enhance ICANN’s ability to threaten action against firms.

A politician faces various opportunities to acquire votes, power, and wealth. He may offer monopolistic privileges to firms so that they may reap economic rents. Alternatively, a politician may threaten to withdraw those privileges or to impose burdensome regulations that increase a firm’s costs. What the politician has to offer is a function not only of the private benefits which he confers, but also of the private costs he

agrees not to impose. Such political blackmail is successful when the expected cost of the threat exceeds what the private parties must pay to avoid the legislative action. Assuming constant marginal utility of wealth, a firm is just as willing to pay legislators to avoid losing \$1 million, as to enjoy gaining \$1 million in economic rents.

Government regulators, who take into account the interests of the politicians who control the regulators' purse and the scope of their legal authority, may seek to create the conditions under which new sources of government largesse may be obtained. For example, the U. S. Federal Communications Commission (FCC) is empowered by the Telecommunications Act of 1996 to decide on an ongoing basis – and in light of new technologies – what services constitute the "universal service" bundle to be subsidized. This gives "public interest" groups an opportunity to lobby and litigate to broaden the set of services that telephone users are entitled to receive on a subsidized basis (Abbott and Brady 1998). Indeed, some consumer groups coordinate their activities in conjunction with the FCC.

An overview of the regulation of the Internet.

The institutions of Internet governance have evolved through a torturous process of shifting authority among government agencies. In the 1960s, the U.S. Defense Advanced Research Projects Agency (DARPA) developed a network to connect academic and government agencies in the event of a nuclear attack. By the late 1970s, the network had grown, and in response to a number of pressures, DARPA turned over the project to the National Science Foundation (NSF). NSF in turn made grants with researchers such as Jon Postel (1943-98) to assist in the development of the Internet. He negotiated with users in the U.S. and foreign countries to coordinate TLDs and policies regarding this system. The network of NSF contractors, of whom Postel was the best known, became the Internet Assigned Numbers Authority (IANA), which established protocols (procedures) linking the academic networks and also included users in Europe and Asia.

IANA also negotiated with foreign governments the terms under which they would oversee the administration of new TLDs under nation-specific country codes. By the end of the 1980s, what was to become the Internet was a nonprofit network of academics who were connected by analog telephone lines and IANA computer protocols. In the early 1990s, in response to requests for commercial access to the Internet, NSF entered an

exclusive contract with Network Solutions, Inc. (NSI) to sell and maintain a registry of domain names for private parties in the dotcom, dotnet, and dotorg domains.

In 1996, NSF transferred responsibility for Internet-related functions to the U. S. Department of Commerce. This occurred primarily due to the perception that Commerce was a more appropriate government entity than NSF to deal with the increasingly commercial nature of the Internet. Specifically, the growth of personal computing and the emergence of software to connect the various users on the WorldWideWeb had led to the rapid expansion of the Internet, which had increased the value of Internet-related assets. This introduces another level of rent-seeking opportunities and it is not surprising concerns arose regarding Commerce's exclusive contract with NSI to serve as the registrar of the names of websites of IANA-designated TLDs.

By the middle of 1996, the Department of Commerce was struggling to administer the cooperative agreements with NSF negotiated by Postel on behalf of IANA. These did not clearly stipulate which entity held the property rights to domain name registration data and whether IANA was to control access to the A-root server, and thus enjoy a valuable source of monopoly rents. Pursuant to consultations within the Clinton Administration, Commerce recognized both the need to resolve its tangled relationship with IANA and at the same time to distance itself from day-to-day involvement in Internet governance issues.

This realization arose as the Internet became increasingly important to the private sector which lobbied politicians for changes. To that end, Commerce terminated its cooperative agreement with IANA and transferred IANA's functions to a new entity called Newco – renamed ICANN in 1998. ICANN, established as a corporation chartered in California, was to be charged with managing the transition of the Internet to the private sector. In order to ensure an orderly transition, Commerce maintained cooperative agreements with ICANN and NSI. However, NSI and ICANN entered into their own agreement, specifying NSI's authority over domain name data bases and registrations. (Changes in the NSI-ICANN agreement were made subject to government approval). *In short, ICANN, the private sector entity established to manage the transition of the Internet to private sector was co-opted by NSI, the monopoly contractor.* NSI was acquired by

VeriSign in 1999.⁶

In 2000, pursuant to an agreement, “retail” competition began for registration of names in the dotcom database. Today over 150 registrars pay VeriSign \$10,000 to compete with VeriSign for this business. VeriSign, however, retains control over the lucrative dotcom database, a continually updated master list of all addresses registered in dotcom. VeriSign operates the registry and collects a \$6.00 “wholesale” fee for every dotcom name registered. In this way VeriSign acts as a monopoly seller to the new registrars that compete with it for retail sales. In March, VeriSign agreed to sell its registrar operation by May 2001. This was later rescinded and ICANN allowed VeriSign to keep its wholesale and retail business under the same corporate roof. ICANN defended this action on the basis that VeriSign had agreed in May at ICANN’s meeting in Geneva to relinquish control over the far less lucrative dotnet and dotorg databases over the next few years.⁷

Currently, ICANN manages the government-designated top level domains and oversees the Internet domain name system, including recommending to the U.S. Department of Commerce which TLD names (like dotcom or dotorg) have access to the A-root server. However, this root server is but one of a number, each of which is a computer network that provides an independent conduit to cyberspace. The source of this authority was never clear and remains a subject for discussion.

ICANN has an unwieldy governance structure. The ICANN board is a self-perpetuating club which appoints new members on the advice from the U.S. government and interest groups. Its Board of Directors consists of 19 representatives of business, technical, academic, and user communities and the president. There is also a process for selecting “at-large” members although the number has not been determined and remains a public relations problem for ICANN. An individual who wants to become a board member nominates himself and runs an electronic campaign.

⁶VeriSign describes itself as “the leading provider of trusted infrastructure services to Web sites, enterprises, electronic commerce service providers and individuals.” It provides a domain name, digital identity authentication, and transaction infrastructure for e-commerce and communications to any firm wishing to establish its presence on the Internet. VeriSign's services are available through its Web sites (www.verisign.com and www.networksolutions.com) or through its direct sales force and worldwide agents. VeriSign offers SnapNames.com's SnapBack service which monitors any of the 10 million existing domain names estimated to become available in the next year. Nearly one million domain names become available for registration each month.

⁷It was announced (August 22, 2002) that ICANN would transfer the right to sell dotorg domain names from VeriSign to the Internet Society effective January 1, 2003. The Society is essentially a trade body comprised of some 6,000 individual and 150 organizational members.

ICANN faces competition from industry groups seeking self-regulation and from such bodies as the European Union and the Commission for International Telecommunications, which have also sought to redistribute wealth to European interests. Many Internet pioneers, including Vinton Cerf, argue it is no longer necessary for governments to designate TLDs. While ICANN is not empowered to prevent any government from running its own internet and designating its own TLDs, in practice this would be too costly given U.S. domination over the Internet.

ICANN's seven new TLDs.

ICANN's charter allows it to charge a non-refundable fee of \$50,000 to applicants for TLDs on the A-root server system. In November 2000, ICANN selected seven new TLDs from forty-four applications. See Table 1 below. ICANN rejected "dottravel," proposed by the International Association of Travel Agents (IATA), which represents over 70% of all travel agents on the grounds that IATA was not representative of the industry. ICANN also decided to add "dotbiz" as a TLD while refusing to recognize that the owners of the preexisting "dotbiz" registration on a competing root server system might have a prior claim to that name on the A-root server. This suggests that ICANN may block efforts to broaden competition within cyberspace. Legal actions have been brought by IATA and by the owners of the existing "dotbiz" TLD, and there is a lobbying campaign to make ICANN more accountable and its decision making more transparent. The outcome of these efforts will determine whether ICANN is a private sector corporation or an agency of the U.S. government and therefore subject to the Administrative Procedures Act (APA). Rent seeking will assume new dimensions if ICANN is subject to the APA requirements for transparent decision making and at the same time made more accessible to interest groups. The APA includes such provisions as notices of proposed rule making, public comment periods, and public hearings with paid public interest interveners.

*Table 1**ICANN's new top level domains (TLDs)*

<u>TLD</u>	<u>Managing organization</u>
dotaero	Societe Internationale de Telecommunications Aeronautiques SC (SITA)
dotbiz	JVTeam, LLC
dotcoop	National Cooperative Business Association (NCBA)
dotinfo	Afilias, LLC
dotmuseum	Museum Domain Management Association (MDMA)
dotname	Global Name Registry, Ltd.
dotpro	RegistryPro, Ltd.

As a private entity with a governmentally granted monopoly to control access to the A-root server, it is not surprising that ICANN serves as a cartel manager. Furthermore, ICANN's lack of explicit criteria for choosing among applicants for TLDs has been criticized as giving ICANN unconstrained ability selectively to limit competition and to bestow rents by restricting the number of TLDs, thus increasing the returns to owners of existing names. Through political channels, ICANN is likely to increase its power as a cartel manager irrespective of whether it is either a government agency subject to the Administrative Procedures Act or a private organization making recommendations to the U.S. Department of Commerce.

At this time, the availability of technology which would allow TLDs on other internets to be accessed through the A-root server is a major unanswered question. As noted at the beginning of this paper, the existence of competition leads one to expect that ICANN's monopoly powers will be challenged. And, it is also worth noting that country-level TLDs, which are quite numerous and well-used, are an important source of competition (e.g., dot.tv for Tuvalu). The top three such country-level TLDs (.tv, .cc and .ws) have 600,000 registered names.

While ICANN seeks to control the Internet by limiting the number of TLDs, there are pressures for self-regulation of cyberspace by such groups as the Internet Engineering Task Force (IETF, a voluntary standards-setting group), the Global Business Dialogue

(GBDe), and the Global Internet Project (GIP). In order to address the concerns of those seeking government intervention, the GBDe, comprising government officials and executives of some of the world's largest multinational firms, has urged self-regulation. In answer to the criticism that GBDe lacked public interest representatives to provide other viewpoints, the GBDe's board was expanded (like ICANN) to include consumer interest groups.

A newcomer to the policy debate is the GIP, whose members include executives from firms providing telecommunications, software, financial services, and Internet content.⁸ The objective of the GIP is to “connect the unconnected” in developing countries by encouraging governments to adopt policies that foster innovation, investment, and market competition in the Internet. The GIP believes that to ensure growth and innovation, the Internet must be kept free of unnecessary regulation, and what regulations there are, should be flexible enough to keep pace with the rapid evolution of e-commerce. Like the GBDe, this organization calls for self-regulation, rather than government regulation.

What we may expect.

The Bush Administration has not announced its policy for Internet governance. Intense lobbying is taking place by ICANN and NSI to get legislation favorable to the dotcoms. Perhaps the current situation is similar to the efforts a century ago by the Bell telephone system to deny interconnections with rival telephone networks. Ultimately the government forced AT&T to merge the new networks into the AT&T system but allowed this to take place at a slower rate than rival firms would have liked. The rents arising from being on the A-root server encourage firms on parallel “internets” to seek access to that server, which will therefore make them a *de facto* part of the ICANN-governed system. How these questions are resolved will depend on the outcome of legal action against ICANN regarding ICANN's authority to control interconnections and access to the A-root server, including the question of whom ICANN must answer to.

The assignment of domain names permits authorities to discriminate among interest groups and thus creates the incentive for rent seeking in a way that is similar to the zoning of commercial and residential activities. In selecting among applicants for TLDs, ICANN either creates an economic rent or protects one already in existence. Consider the

⁸<http://www.gip.org/about>.

distinction between established “dotcoms” and firms that would apply for the proposed TLD “dottravel.”

Stigler’s model of economic regulation implies that those firms with brand-name capital, such as *travelocity.com* or *lowestfare.com*, would oppose the *dottravel* TLD because it would reduce the present value of their capital which they have built up through their listing on the dotcom TLD. Refusing to create new TLDs helps preserve the value of the pre-existing TLDs (dotcom, dotnet, and dotorg), at least in the short term. The “dotbiz” TLD, which was established in 1996 by MCSNet, began registering servers that year. The Atlantic Root Network, Inc. (ARNI), a Georgia corporation, operates the “dotbiz” TLD in the Open Root Server Confederation (ORSC), the PacificRoot, SuperRoot, and the North American Root Server Confederation (NARSC). Access to these internets is obtained by “pointing” one’s computer to the root server or by requesting your Internet Service Provider to designate a specific alternative root server. That said, having only one address option may be attractive to some firms but not to others, which may want multiple addresses on numerous internets. As discussed later in this paper it appears that technology will provide the critical link from the alternative internets to the A-root server.

On the other hand, ICANN’s decision to authorize a new “dotbiz” TLD designation for new applicants reflects the future rents from names sold through the ICANN-regulated Internet. ICANN’s refusal to register all “dotbiz” addresses from another root server prevented the owners of those addresses from participating on the A-root server. This deprived them of valuable business opportunities which at least for now are most cost-effectively provided through the A-root server.

Several legal challenges are being brought by those who lost out through ICANN’s decision in November. As I have just mentioned, one of the seven new TLDs is “dotbiz,” which is already used by a server on the non-government internet. These challenges are likely to prevail or, if they do not, technology will make the challenge obsolete. In effect, limiting access to the A-root server prevents the benefits of network externalities accruing to consumers while maintaining rents to existing firms on the ICANN-designated TLDs.

We may expect that governments throughout the world will closely scrutinize the actions of U.S. government agencies because the U.S. currently dominates the Internet. The U.S. government’s oversight of ICANN (the U.S. Department of Commerce must approve ICANN decisions regarding TLDs) warrants careful study. The composition of

the ICANN board is very important for a number of reasons. Interest groups, whose members are involved in Internet-related activities, lobby and make presentations to ICANN's Board.⁹ In addition to industry, a number of non-governmental organizations (NGOs) also participate. They seek formal representation on the Board or, at least, seek to ensure that there will be Board members who are sympathetic to their views. Conceivably, ICANN's board members might seek to shift pressures away from them by enlisting the U.S. government to provide criteria for authorizing new TLDs that would set a cap on their number. This approach would enable ICANN to collect the rents generated by its monopoly status while avoiding the charge that its actions were somehow self-serving. Unfortunately, this would constrain the growth of competition that would otherwise be spawned by new TLDs. By centralizing the authority for TLDs in ICANN, the U.S. Government has created the circumstances under which rent-seeking may flourish. ICANN and NSI are thus the most important institutions to monitor.

Some information on ICANN is readily available over the Internet. In response to widespread concerns, ICANN now includes representatives from Europe and Asia on its board and holds meetings open to the public to stress transparency in decision making. Several websites provide current information on those actions of ICANN which are publicly available. However, it is difficult to monitor what goes on behind the scenes and prior to the public meetings where the major decisions are actually made. It could be argued that ICANN meetings, like the meetings of many international organizations, are public relations exercises rather than genuine efforts to be transparent. Some ICANN policy is made outside ICANN itself. For example, the World Intellectual Property Organization (WIPO) provides advice to ICANN and in return ICANN requires the use of WIPO's arbitration procedures in disputes over domain names. In particular, ICANN, with WIPO input, has sponsored a system for resolving disputes that enables trademark holders to strip domain name holders of web addresses that infringe existing trademarks.

⁹For related coverage, see <http://www.icannwatch.org/join/thanks.html> (Oct 27, 2000).

Stuart Lynn's perspective.

On August 15, 2001, I attended a presentation by Stuart Lynn, the new president of ICANN, a mathematician (B.A., M.A., Oxford; Ph.D., UCLA) with experience in university administration, specifically government grants for Internet-related research. He was a member of, and had the support of, the Domain Name Supporting Organization, one of the three major organizations that are represented on the 20-member ICANN board of directors.

Lynn gave short responses to my two questions regarding ICANN's monopoly. My first question concerned ICANN's monopoly status with regard to recommending which TLDs have access to the A-root server. He refused to acknowledge my premise that ICANN holds a monopoly. My second question involved ICANN's November decision to approve only seven new TLDs out of some forty applicants. To this he responded that no applications had been rejected and the approval process was continuing. (That certainly was not what the losing coalitions thought as they filed legal action against ICANN.) I was not allowed to ask my third question regarding competition to ICANN's monopoly from the losing coalitions of alternative root servers. He also failed to answer another person's question about how technology might erode ICANN's authority.

His presentation and most of his responses lacked substance. He sought to emphasize how worldwide interests ("stakeholders") actively participate in consultative meetings. (These, I might add, usually take place in exotic resorts around the globe.) He maintained that decision making was open to all participants. Participants, I might add, chosen by ICANN. He welcomed new technology and policy generated locally throughout the world (he called it a "global laboratory"). But, how many resources and how much freedom to innovate do these local interests have in the highly centralized system managed by ICANN and dominated by major U.S. technology providers? In short, Lynn saw ICANN creating a consensus-building forum that would bring people together to learn how to work collaboratively. But is this a reasonable goal under the circumstances which I have described?

Technology and the ICANN monopoly.

We have seen how economic rents are generated by the ICANN monopoly of the registration and thus allocation on the TLDs on the A-root server. However, technology exists that can bypass ICANN and thus restore a competitive market in domain names. There is potentially a large number of root servers (TCP/IP networks) each of which can accommodate an infinite number of TLDs. (TCP/IP refers to Transmission Control Protocol/Internet Protocol.) The other networks such as Pacific Root Network, Atlantic Root Network, and AlterNIC may replace the existing monopoly system with networks which have differing rules for content, privacy, and rules regarding names.

There are potentially 4.3 billion addresses in the IP address space although methods exist to increase substantially the number of possible addresses. The domain name system and the internet protocols which convert domain names to Internet addresses enable the non-computer literate to easily access the internet. However, under certain circumstances domain name servers may be used to access other TCP/IP networks. The process to convert a domain name to an Internet address is called resolution. It begins when you attempt to access a domain name like `cato.org` (206.20.132.242) by connecting your computer to a browser which then seeks the appropriate domain name server. The domain name request is "handed" to a specified server which either hands back an Internet Protocol address if the domain is known to the domain name server, or it forwards the request to a higher-level domain name server which ultimately passes back the answer or indicates there is no address available.

Most domain name servers use a standard table which specifies a hierarchy of domain names (the A-root server is at the top). This table which is available from a number of sources normally contains only domain names within the ICANN-regulated A-root server. As a result of ICANN's right to allocate TLDs, the other TCP/IPs are not available. There are three copies of the A-root server outside the U.S. that may be modified for local users.

Root servers may be added by the user or provided by their ISP (Internet service provider). Recently (the last five years or so), most computers connected to the Internet receive a temporary Internet address when they connect to the internet (dial-up, DSL, cable) through a process called Dynamic Host Configuration Protocol (DHCP) which assigns an IP address to a customer of an ISP. This "handshake," which occurs at the time

of connection, also provides other necessary information for the user's machine to connect to the Internet, including the addresses of two domain name system servers (the second providing redundancy in case of failure) and other configuration information not germane to this discussion. Rather than assigning a unique address to each computer, the ISP maintains a pool of addresses that it can assign to a user when he dials in. When the customer makes a connection, the ISP assigns a temporary Internet protocol address to the user, once he is validated through the username/password combination.

The simplest way for a user to access a domain name system where one could resolve addresses with a TLD outside the ICANN system is to manually configure the domain name server reference addresses on his computer. Most Windows operating systems will accept up to four domain name server Internet protocol addresses to use in searching for a domain name, instead of the two that come from an ISP. The TCP/IP module within Windows will pursue a resolution using each referenced domain name server until a positive response is received, or all four fail.

The complication for a new TLD name like dottravel is that a false positive may result from a conversion in the main network, where the user may have desired a different Internet protocol address on another network. However, switching the sequence of Internet protocol addresses of the domain name server, so that the other networks are queried first would resolve this problem, but would slow down response times for most addresses on the main network. For example, if one asks the secondary network for dottravel, and it does not exist there, the response may take 15 to 30 seconds, by which time the user's computer would default to the main network. (By now the user would probably have clicked the STOP button on his browser.)

With a Windows operating system, it is possible to configure manually the Internet protocol address of the domain name server sequence, and then reboot. But many users will find this time-consuming and frustrating. This may present less of a problem for Unix/Linux users for several reasons. First, they are typically more technically astute. Second, the Unix/Linux system allows changes in the domain name server table (it is a text file-resolv.conf), which can then reissue the request (typically in a matter of seconds), without rebooting, and in most cases, not even a restart of the conversion service.

For the non-duplicated domains (e.g., dottravel, which is not a recognized TLD name on the A-root server), this is not a problem. A secondary domain name server ISP is

fast (milliseconds) when the primary system says that the TLD is not valid. However, this requires detailed knowledge of domain name server specifics which most Windows users don't have, and have little incentive to learn, unless they are aware of the existence of other networks.

A simple technology fix would be for Internet browsers to have their own domain name server tables in their preference setup boxes. These can be used for searches, instead of the machine-configured ISPs. It would be easier for the browser to use the tables than to adapt to the use of other domain name server ISPs, which would be an unlikely revision to an operating system. It would also be possible to provide a "tweak" feature in a program that could modify the Windows domain name server table. There are two additional options. One is for the other servers to make available a program that will change the main DNS from your ISP's default to theirs. A second is for other systems to copy the root server and add their content and services with the objective to become the best DNS. One would expect that people would learn about the faster, more reliable conversion – and the existence of other web sites – and so go to this DNS. ICANN would not be able to prevent this from happening.

This discussion has assumed that users are interested in gaining access to the non-ICANN cyberspace. However, the adoption of new technology does not require consumers to understand or even to be aware of it. Historically, technological innovation has been introduced by entrepreneurs in anticipation of consumer demand. So why have entrepreneurs failed to provide services to access other, non-ICANN root servers? Have they failed to perceive this entrepreneurial opportunity which could be addressed through advertising? Or have they concluded there really is little or no market for this service. Or perhaps there exist legal or institutional barriers or obstacles that deter or prevent entrepreneurs from marketing this technology?

The owner of a web site on other networks would surely know that his domain name would not be directly accessible using standard methods. Under such conditions, it is likely that the owner would provide an IP address or reference another web site on the A-root server that would have his pointer setup as a hotlink. However, it is also possible for the Dynamic Host Configuration Protocol (DHCP) server software to offer the domain name server addresses of secondary networks at the behest to users.

While there do not appear to be barriers or obstacles which prevent software from

working, many people, and even a few economists, would argue that Microsoft has monopoly power that enables it to promote its own software to the disadvantage of competing products (Leibowitz and Margolis 2001). According to this argument, we should not expect Microsoft to include such a feature if its own product was inferior to its competition. However, with the rise of Linux and its tradition of open access to software, there are other paths to this end.

Conclusion.

We have examined the evolution of government regulation of the Internet and used economic analysis to understand its implications. Despite my belief that the Internet is likely to become substantially more regulated in the future, I am convinced that technology will trump the best efforts of regulators to promote their view of what constitutes “the public interest.” An example of new technology is Microsoft’s software called Universal Description, Discovery, and Integration (UDDI), which provides the ability to sort through vastly greater amounts of information and thereby makes it practical for ordinary people to access a multiplicity of internets. It is true that various interest groups will continue to seek to mold the Internet in ways that benefit them, and that regulation will continue to be used to resolve the ensuing conflicts. However, if the past is any indication, we might expect that such short term fixes will be eroded by technology.

One might envision several internets, each offering different ground rules for privacy, content, and access. For example, there may be a children’s internet provided by Disney or LEGO. On the other hand, there may also be an internet aimed at a purely adult audience and restricted to adult users. As broadband infrastructure grows and servers become more numerous, we could surf other networks. At some point, the net benefits of privately-owned networks having different approaches rather than uniform rules on privacy, content, and access may be seen to outweigh the net benefits of the uniform system regulated by ICANN. Certain overarching issues such as Internet tax policy, which I have not discussed, will apply to all networks but it may be preferable for consumers and businesses to choose among a variety of networks rather than to accept ICANN’s increasingly uniform cyberspace.

To summarize, I believe that the future will be driven by entrepreneurs who will exploit the continuous technological innovation that characterizes this industry, despite the

substantial role government played in its initiation. It is my expectation that entrepreneurs are translating improvements in hardware and software into opportunities for consumers to choose among alternative internets. Thus the competitive market process may simply render irrelevant the ICANN stranglehold.

In closing, I will return to my story about the hackers who changed dotcom to dotcow. Someday there may be a dotfish and dotfowl as well as a dotcow. I should add that it will come about despite the best efforts of ICANN.

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