INTRODUCTION

Lots of Dots

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Conceived as a means of sharing research, the Internet has quickly become a medium that affects the way people learn, communicate, and even conduct business. The vast computer network appeals not only to skilled computer scientists but also to those without extensive technical ability. These days, in fact, most of the world is familiar with the structure of an Internet address; we have become accustomed to what are called Internet domain names, with the three Ws and the .com (read dot-com) that often sits at the end. There is much more to an Internet domain name than the generic .com, .org, and .net, however. In fact, there are more than 250 Internet address endings.[1]

Through the use of country code Internet domain name endings, the domain name system has gained the power to effect social change and incorporate national identities and priorities. It has, in the process, evolved into more than a technological convention; it is also a means of communicating cultural values.

Understanding the structure and content of Internet addresses can help people sift through the vast amount of online information and increase their understanding of people and places that are otherwise completely foreign. While the chapters in this book discuss culture and politics as much as if not more than pure technology, an early understanding of the Internet, its structure, and its history will illuminate many of the issues with respect to domain names.

When the Internet was developed, few knew how it would evolve. Yet, even at its earliest conception, the idea of using technology to effect social change was evident. The more psychologist Joseph Lickleder learned about computer science in the early 1960s, the more he believed that computers had the potential to transform society. He envisioned the day when home computer consoles and television sets would be linked in a massive network.[2] Today, such media convergence is on the verge of becoming a reality.

In October 1962, Lickleder was the first head of the U.S. government's computer research program at the Defense Advanced Research Projects Agency (DARPA, called ARPA at the time). He and scientist Robert Taylor envisioned a globally interconnected set of computers through which everyone could quickly access data and programs from any site.[3]

The goal, therefore, was to create a computer network that they called ARPANET; achieving that goal would require the help of many scientists, each working in a specialized field. Taylor hired Lawrence Roberts to lead the team that designed and developed ARPANET. Under Roberts's leadership, the team decided to use what was then an untested technology—packet switching—to send data between computers. Under the packet switching system, instead of using a dedicated connection between two computers, electronic messages are divided up into packets and transmitted over a decentralized network. Once all the packets arrive at the destination, they are recompiled into the original message. At the time,

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the technology was untested; its success is now confirmed whenever someone uses the Internet.

Under the guidance of even more computer scientists, ARPANET grew from four host computers in 1969 into what we now know as the Internet. Though the original technologies were successful at forming a network, developers soon sought a more advanced network that would better handle the enormous amount of traffic on the system. Responding to the need for more stability, Professors Robert Kahn and Vinton Cerf developed the Transmission Control Protocol (TCP), which was soon joined by the Internet Protocol (IP) to become the global standard for networked computer-to-computer communication.[4]

To understand the roles of TCP and IP, imagine that the information you want to send over a computer network is a puzzle—not a picture of a puzzle but a puzzle itself. TCP would be the protocol used to break the puzzle into individual pieces (the packets); IP would be used to send the pieces over the network, and TCP would then be responsible for locating any missing pieces and putting the puzzle back together again at the desired destination.

Under this system, IP acts as the mailman who delivers the packets. To ensure effective delivery, computers on the network are granted a numerical IP address. IP addresses are written as four numbers, each from 0 to 255, that are separated by periods, for example, 11.11.1.111. These addresses identify specific computers that operate across multiple networks.[5]

From the network's earliest days, the computers on the network were individually named so that they could be distinguished from one another. In 1973, the list that connected computer names to their IP addresses was stored on each computer in a file called hosts.txt.[6] As an increased number of computers was added to the network, however, this cataloging process became cumbersome and tedious because of both the sheer number of additions and the need to update changes locally. In addition, as more computers were added, the possibility for repeated names was increased; a large number of users wanted to name their computers Frodo, after Frodo Baggins, one of J. R. R. Tolkien's hobbits.[7]

Recognizing that there could not be more than one Frodo on the network and in response to the need for a more centralized naming system, in 1983 computer scientists and engineers Jonathan Postel, Paul Mockapetris, and Craig Partridge developed a new addressing scheme. The Domain Name System (DNS) is novel in its organizational structure.[8] It is based on the hierarchical notion of tree branching. As Katie Hafner and Matthew Lyon wrote in *Where Wizards Stay Up Late*, "From the trunk to the branches, and outward to the leaves, every address would include levels of information representing, in progression, a smaller, more specific part of the network address."[9]

Though most Internet users read domain names from left to right, the underlying technology of the Internet reads them from right to left. As a result, the last part of the address that we read—.com, for example—is considered the top-level domain (TLD).

In 1983, .arpa was the first and only top-level domain created; all addresses on the network ended in .arpa.[10] Only a year later, Postel and his team had drawn the plan for the modern domain name system; they introduced .com, .edu, .gov,

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.mil, and .org and gave a rough layout for the addition of an additional set of two-letter codes that would identify countries.

In addition to his increasing domain name responsibilities, for many years Postel was also the editor of the Request for Comments (RFC) document series. First established in 1969, RFCs are memos written to introduce and discuss new ideas with other members of the technological community.[11] In RFC 920, Postel wrote, "While the initial domain name 'ARPA' arises from the history of the development of this system and environment, in the future most of the top level names will be very general categories like 'government,' 'education,' or 'commercial.'"[12] The motivation, he said, was to provide an organization name that was free of undesirable semantics.

By the mid-1980s, domain names were in widespread use.[13] The generic top-level domains (gTLDs), like .com, were in place, and the more than 240 two-lettered endings, like .uk and .jp, called country code top-level domains (ccTLDs), were implemented by Postel and were available for administrators to claim.[14]

When the domain names were developed, they were seen as a tool to enable the navigation of the network—to facilitate communication among the network's connected computers. They were not intended to communicate anything in themselves. In the past fifteen years, however, TLDs and ccTLDs, in particular, have, by their use and governance, constructed a space that outwardly communicates cultural identities and values.

When ccTLDs were developed, they were managed by volunteers and had no real value outside of academia. As the Internet became more commercial and governments saw a larger stake in their national codes, however, more attention was paid not only to the governance of the codes but also to what websites were allowed in their name spaces.

When Postel et al. first created the ccTLDs, they turned over management of the codes to friends and colleagues at universities and research foundations around the world. Early code delegations were made to the first person who requested one, provided that the administrative contact was located in the territory for which the code was named. As Professor Milton Mueller discusses in *Ruling the Root*, "Significantly, that delegation method tended to bypass completely the institutions in other countries that historically had possessed authority over communication, such as government ministries or posts, telephone, and telegraph monopolies."[15] While through the early 1990s few of these institutions paid close attention to the codes, as awareness of the Internet grew, so too did the codes' perceived value to many governments. In fact, arguments would soon erupt over whether national governments actually had ownership of the codes.

Mueller notes that when delegation conflicts began to occur more frequently, Postel subtly pushed the contenders to settle the disputes among themselves.[16] Once an administrator was selected, each manager was designated "the trustee of the top-level domain for both the nation, in the case of a country code, and the global Internet community."[17] Postel said that concerns about rights and ownership of domains were inappropriate, that managers and others should instead be concerned about responsibilities and service to the community. Several years later, he said, "That was written just as things were getting really

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commercial. There's been a very substantial change in the last three or four years, from a network that's primarily for academic use to a network that's overwhelmingly for commercial use. It's not appropriate for the academic world to subsidize the commercial world—maybe it should be the other way around. As the amount of commercial use has increased, it's become more appropriate to have these tasks be part of the economy. One must temper that, however, with what are practical commercial models. I still think the domain names are a kind of service."[18]

In 1989, Postel founded the Internet Assigned Numbers Authority (IANA). It was through the IANA, a U.S. government–funded body, that Postel controlled and monitored the allocation and assignment of Internet addresses. For many years, Postel not only worked at the IANA but was the IANA.[19] As the task grew in scope, however, he hired a small staff to aid in his work. From the earliest conception of allocating national domain endings, Postel and his team could foresee endless discussion about what was or was not a nation and therefore what should or should not be included on the list of codes. They did not want to be arbiters of geopolitical debate. As a result, in RFC 1591, titled "Domain Name System Structure and Delegation," Postel wrote, "The IANA is not in the business of deciding what is and what is not a country."

He did not want to become entrenched in the individual battles over which nations would receive ccTLD designations. He wanted to simplify the task of choosing which countries would get codes and what each code designation would be. To solve the problem, he turned to a preexisting list of codes that was provided and maintained by the International Organization for Standardization (ISO).[20]

In RFC 1591, Postel added, "The selection of the ISO 3166-1 list as a basis for country code top-level domain names was made with the knowledge that ISO has a procedure for determining which entities should be and should not be on that list."

Because it is the list that is the foundation for the actual two-letter codes, because it is the list that has the power to embolden a nation with a code, we must fully understand how nations are added to the list and how the interested parties have used the list to acquire national domain endings.

The ISO 3166-1 is used not only to designate ccTLDs but also to assess trade statistics in the European Union and to track FedEx shipments.[21] Many individuals, organizations, and unrecognized political entities interested in obtaining their own ccTLDs have requested to be included in the ISO 3166-1 list. "Such requests are absolutely futile," the ISO says. There are strict procedures for adding a code to the list.[22]

The only way to enter a new country name into ISO 3166-1 is to have it registered in either the United Nations Terminology Bulletin "Country Names" or the United Nations Statistics Division's "Country and Region Codes for Statistical Use." Those listed in "Country Names" are either a UN member country, a member of one of its specialized agencies, or a party to the Statute of the International Court of Justice. Once a country name or territory name appears in either of these two sources, it is added to the ISO 3166-1 automatically.

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As per RFC 1591, Postel requires a nation to be on the ISO 3166-1 list to become a ccTLD, and despite a few exceptions, which have also been called mistakes, the list of ccTLDs mirrors the ISO 3166-1. One of the most obvious exceptions is that the code for the United Kingdom on the ISO 3166-1 list is .gb, while the ccTLD for the United Kingdom is .uk.[23] There are several theories for the discrepancy.

In RFC 3071, titled "Reflections on the DNS, RFC 1591, and Categories of Domains," John C. Klensin noted that the adoption of .uk was historical in nature.[24] The notion is that .uk was chosen as a logical code for the United Kingdom before the policy of using the ISO list was settled. Others suggest it was merely a mistake.

As domain administrator Martin Maguire discusses in chapter 2, as ccTLDs have gained more economic and political value, the naming system has come under increased scrutiny. While special rules are being passed for some domains, a thorough examination of the list shows that other known political or geographic entities are not included. For example, many now argue that Scotland, Northern Ireland, England, and Wales should have their own ccTLDs as opposed to being grouped under the larger .uk.[25]

By the late 1980s, while both the gTLD and ccTLD systems were in place and there were many computers linked to the network, there was no easy way to navigate the vast information they stored. In 1990, Tim Berners-Lee, a software engineer at the European Particle Physics Laboratory CERN, developed an easier way for researchers to access the vast amount of research documents on the Internet. He named his project the "World Wide Web" because he visualized it as a web of interconnected documents that would stretch across the Internet and the world.[26]

Berners-Lee's team at CERN, in collaboration with the National Center for Supercomputing Applications (NCSA), a federally funded research facility at the University of Illinois at Urbana-Champaign, produced the first version of the Hypertext Markup Language (HTML), the coding language used to create documents for use on the World Wide Web. An entirely text-based system, the early web would probably be unrecognizable to most modern Internet users. While there was an enormous potential for reading and typing, there was no clicking, passive watching, or listening. The web's origins are reminiscent of a newspaper. Berners-Lee sought to allow access to black-and-white readable information. The web's next innovators wanted to emulate a different mass media model—television.

Marc Andreessen, an undergraduate computer science major at the University of Illinois, wanted to put a more "human face" on Berners-Lee's web.[27] Working at NCSA, he and some friends developed the first popular graphical web browser, NCSA Mosaic; he would later develop the Netscape line of web browser. By allowing the use of color, images, sounds, video, and a mouse to navigate, the web quickly moved away from its text-based roots and came to resemble television more than a newspaper.

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With the prospects of communication and commerce, the simple navigation of web links drew large numbers of people online. The shift in use of the Internet also signaled a shift in Internet governance.

Under the leadership of Postel and IANA, through the mid-1990s, DNS functions were based in a noncompetitive, government-funded system. In 1996, Postel initiated an Internet ad hoc committee to institutionalize the IANA functions and open top-level domains to competitive registration. The U.S. Department of Commerce responded to Postel's call and published a white paper that envisioned a "global, consensus, non-profit corporation" to govern the Internet naming system.[28]

In October 1998, just before Postel died from complications following cardiac surgery at age fifty-five, he went so far as to propose bylaws for the entity that would take over the responsibility for administering policy for the Internet address system. Within weeks, the Internet Corporation for Assigned Names and Numbers (ICANN), a nonprofit California-based corporation, assumed the functions of IANA as part of the transfer of Internet administration to the private sector. ICANN has been steeped in controversy ever since.[29]

Called the Internet's own Obi-Wan Kenobi, "the sage who guided the Net from its sleepy academic genesis to its present form," by *Wired News*, Postel displayed hippie sensibility.[30] He was not interested in making money or in politics; he was a "techie."[31]

Postel saw the codes as merely an online equivalent to postal codes. Instead, just as American television's best-known ZIP code "90210" became synonymous with the rich Beverly Hills lifestyle, country code domain names began to take on more political and social meaning. As Martin Maguire discusses in chapter 2, East Timor's .tp was used as a platform from which to launch political protest and help bring freedom to a colonized people.

The local struggles are mirrored in the global system. Many controversies have erupted among ccTLD registrars and managers as well as in the larger Internet community, in part because of the sheer number of ccTLDs with diverse rules and the ever-evolving interest in the domain names. In chapter 1, law professor Peter K. Yu discusses the origins and development of ccTLD lawmaking. These controversies were hardly envisioned when the system was created.

In Chile, India, and Malaysia the local cultures have directly affected the use and development of the ccTLDs. In chapter 3, Patricio Poblete, who administers Chile's .cl, discusses why the Chilean people have rallied around the use of .cl to such a level that it has become the most popular top-level domain in Chile. The result of this high use is that the Chilean culture is not dispersed on the Internet among many TLDs but is concentrated in .cl. In contrast, despite a population of one billion, there is little use of India's .in.

In chapter 4, Tushar A. Gandhi, an Internet developer and great-grandson of Mahatma Gandhi, explains why Indians have virtually no national identity on the web and how he is working to change that.

In chapter 5, sociology and anthropology professor Toby E. Huff presents the results of his original research on domain identification among Malaysian students. Huff, a noted scholar on the Islamic world, discovers that among

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Malaysian students there is a strong desire not to be seen as provincial. That yearning, in addition to strict .my registration policies and privacy and surveillance concerns, may incline young Malaysians to opt for international identities.

The book then examines the relationship between national priorities and the ways ccTLDs are used to achieve them. As discussed earlier, each ccTLD administrator has the right to establish guidelines that correspond with the nation's cultural and political norms. This is evident in the stories of Sweden's .se and Niue's .nu. In chapter 6, Patrik Lindén, a communications officer at the organization responsible for managing Sweden's .se, discusses how Sweden established strict guidelines for those who wanted to register domains under .se. Some TLDs, like .com, can be quickly registered, with no prior assessment of whether the registrant has a legitimate use for that address; other TLDs, like .se, chose a prior assessment model, making the initial registration more difficult. As a result of the regulations, many Swedes stopped registering .se domains. In fact, sites ending in gTLD .com and ccTLD .nu accounted for almost half the nearly 126,000 Swedish websites found in 2001. Seeking to draw Swedes back to .se and reestablish a national identity online, more liberalized regulations were implemented in April 2003.

But Sweden's loss has been Niue's gain. Niue (pronounced "new-way") is the beneficiary of .nu, one of the first ccTLDs to be marketed to those outside its host nation. In chapter 7, Richard StClair, the technical manager for .nu, discusses how in many ways .nu is successful because of .se's cautious policies. As Swedish people fled .se, many registered their sites under .nu (which means "now" in Swedish). The resources generated by those sales are used to develop and maintain the Internet services on Niue; excess
funding is dispersed through a local advisory board into other fields, such as health, education, and community services. The result of the high number of registrations is the ability to provide entirely free Internet access for each of the South Pacific island's 1,500 permanent residents.

Of course, Niue is not the only ccTLD to market a catchy code to the world. Tuvalu's .tv, Micronesia and Armenia's .fm and .am, and Moldova's .md are among those codes marketed to the global population. In chapter 8, attorney Dana M. Gallup shares his personal experiences with the licensing and marketing of .md.

It is not only small nations that allow outsiders to register domains within their local ccTLD name spaces. In October 2002, China eased the registration rules for its ccTLD .cn; it has relaxed its highly restrictive registration policy and now not only allows but also encourages foreign business to register .cn domain names. In chapter 9, I discuss how China has developed ccTLD policies that reflect the nation's larger attempts to open its doors and integrate its economy with Western nations.

Conversely, in chapter 10, librarian Paiki Muswazi introduces Swaziland's .sz as an example of a developing nation that markets its ccTLD not to the outside world but to its own people. The use of .sz can be divided into broad categories, namely, e-commerce, communication, cultural promotion, and social and political regulation. Both emerging technologies and the lure of tourism revenue have the

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potential to deepen the indigenous essence of .sz and to consolidate its cultural content.

Though seen as virtually dormant since its creation, a recent restructuring of the .us name space has provided a more patriotic domain opportunity for those having significant contacts with the United States. In chapter 11, I introduce .us, which for years had been underutilized both because of extreme indecision over its structure and purpose and because of the popularity and accessibility of .com. In the fall of 2001, however, the control of .us was awarded to a Washington-based firm, and the marketing of American online patriotism has been a staple ever since.

The passing of the torch from one ccTLD manager to another is called redelegation. In many ways, it represents the end of an era in ccTLD management. While Postel granted trusteeship of the ccTLDs to his colleagues, who for years volunteered their time to management of the domains, as both popular and governmental interest in ccTLDs grew, the task became too large for these individuals. Postel's designated administrators now often bow out or, as in the case of Australia's .au, feel pushed out of their longtime positions. In chapter 12, journalist Jenny Sinclair introduces us to .au and its outspoken, now former manager, Robert Elz, who devoted his time and energy to fulfilling Postel's vision and found himself in the middle of one of the most contentious redelegations to date.

Country code domains, once seen merely as street signs for computer networks, are now indicators of national cultures, identities, and priorities. Each code—and each contributor in this book—has a perspective to share and a story to tell; I hope you enjoy them all.

Notes

1. See this book's appendix.
2. Katie Hafner and Matthew Lyon, *Where Wizards Stay Up Late: The Origins of the Internet* (New York: Touchstone, 1996), 34.
3. "A Brief History of the Internet," ISOC www.isoc.org/internet/history/brief.shtml#Introduction [accessed March 13, 2003].
4. Robert X. Cringely, "NERDS 2.01: Networking the Nerds," PBS, 1998, www.pbs.org/opb/nerds2.0.1/networking_nerds/tcpip.html [accessed March 13, 2003].
5. To find out your IP address, see www.ed-phys.fr/htbin/ipaddress [accessed March 13, 2003]; to convert an IP address to a host name and vice versa, see cello.cs.uiuc.edu/cgi-bin/slamm/ip2name [accessed March 13, 2003].
6. L. Peter Deutsch, "Host Names On-line" (Network Working Group, Request for Comments No. 606), December 1973, www.rfc-editor.org/rfc/rfc606.txt [accessed March 13, 2003].
7. Haffner and Lyon, *Wizards*, 252.
8. P. Mockapetris, "Domain Names—Concepts and Facilities" (Network Working Group, Request for Comments No. 882), November 1983, www.rfc-editor.org/rfc/rfc882.txt [accessed March 13, 2003].
9. Haffner and Lyon, *Wizards*, 253.
10. J. Postel, "The Domain Names Plan and Schedule" (Network Working Group, Request for Comments No. 881), November 1983, www.rfc-editor.org/rfc/rfc881.txt [accessed March 13, 2003].
11. For more on RFCs, see "30 Years of RFCs" (Network Working Group, Request for Comments No. 2555), April 7, 1999, www.rfc-editor.org/rfc/rfc2555.txt [accessed March 13, 2003].
12. J. Postel and J. Reynolds "Domain Requirements" (Network Working Group, Request for Comments No. 920), October 1984, www.rfc-editor.org/rfc/rfc920.txt [accessed March 13, 2003].
13. Jon Postel, "Testimony to the U.S. House of Representatives Committee on Science Subcommittee on Basic Research," September 25, 1997, www.house.gov/science/postel_9-25.html [accessed September 13, 2002].

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14. In 1985, three ccTLDs were delegated; see "History of the Internet: ccTLDs in Chronological Order of Top Level Domain Creation at the Internic," www.wwtld.org/aboutcctld/history/wwtld1999/ccTLDs-by-date.html [accessed March 13, 2003].
15. Milton L. Mueller, *Ruling the Root: Internet Governance and the Taming of Cyberspace* (Cambridge, Mass.: MIT Press, 2002), 88.
16. Mueller, *Ruling the Root*, 89.
17. Jon Postel, "Domain Name System Structure and Delegation" (Network Working Group, Request for Comments No. 1591), March 1994, www.rfc-editor.org/rfc/rfc1591.txt [accessed March 13, 2003].
18. Diane Krieger, "An Interview with Jon Postel," *NetWorker* 7, no. 5 (Summer 1997): 2, www.usc.edu/isd/publications/networker/96-97/Summer_97/innerviewpostel2.html [accessed March 13, 2003].
19. See, for example, Vint Cerf, "I Remember IANA" (Network Working Group, Request for Comments No. 2468), October 1998, www.rfc-editor.org/rfc/rfc2468.txt [accessed March 13, 2003].
20. "ISO" is not an acronym; the name "ISO" is a word, derived from the Greek "isos," meaning "equal"; see "What Is ISO?" International Organization for Standardization, www.iso.ch/iso/en/aboutiso/introduction/whatisISO.html [accessed March 13, 2003].
21. See "The Implementation of ISO 3166-1," International Organization for Standardization, www.iso.ch/iso/en/prods-services/iso3166ma/04background-on-iso-3166/implementations-of-iso3166-1.html [accessed September 13, 2002]. Of note, the ISO is located in Switzerland; its ccTLD is .ch, the code for Switzerland. (Because Switzerland has four national languages, each of which spells the nation differently, Swiss coins, license
plates, and domain names refer to the Latin name "Confoederatio Helvetica" [Swiss Confederation], hence .ch.)
22. "ISO 3166-1 and Country Coded Top-Level Domains (ccTLDs)," International Organization for Standardization, www.iso.ch/iso/en/prods-services/iso3166ma/04background-on-iso-3166/iso3166-1-and-ccTLDs.html [accessed September 13, 2002].
23. For a discussion of the history and development of .uk, see Daniel J. Paré, *Internet Governance in Transition: Who Is the Master of This Domain?* (New York: Rowman & Littlefield, 2003).
24. John C. Klensin, "RFC 3071: Reflections on the DNS, RFC 1591, and Categories of Domains" (Network Working Group, Request for Comments No. 3071), February 2001, www.rfc-editor.org/rfc/rfc3071.txt [accessed March 13, 2003].
25. "Scotland Entering New Domain," BBC News, May 1, 2000, news.bbc.co.uk/1/hi/scotland/732199.stm [accessed March 13, 2003].
26. See Tim Berners-Lee, *Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web* (New York: HarperBusiness, 2000).
27. Robert X. Cringely, "NERDS 2.01: A Human Face," PBS, 1998, www.pbs.org/opb/nerds2.0.1/wiring_world/mosaic.html [accessed March 13, 2003].
28. U.S. Department of Commerce, "Statement of Policy," June 5, 1998, www.icann.org/general/white-paper-05jun98.htm [accessed March 13, 2003].
29. See, for example, discussions at ICANNWatch at www.icannwatch.org [accessed March 13, 2003].
30. "New Internet Government Forged," *WiredNews*, September 17, 1998, www.wired.com/news/politics/0,1283,14795,00.html [accessed March 13, 2003].
31. "Esther Dyson on the Internet, ICANN and Doing Business Abroad," Knowledge@Wharton, April 10, 2002, knowledge.wharton.upenn.edu/articles.cfm?catid=9&articleid=542 [accessed March 13, 2003].

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