

LEGAL AND POLICY ASPECTS OF INTERNET NUMBER RESOURCES

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Abstract

This paper demonstrates the heightened need for a consistent legal and public policy approach to critical management issues regarding "Internet number resources," which include Internet Protocol ("IP") addresses and Autonomous System numbers. First, we provide background information on what IP addresses are and how they are used to route Internet traffic. Second, we describe the evolution of the Regional Internet Registries ("RIRs"). The RIRs are non-profit, non-governmental organizations of continental scope that derive their authority from the consent of the Internet community, and from the U.S. Government, which has encouraged the Internet's private-sector institutions of governance. Third, we describe the open and transparent public policy process that currently creates Internet number resource allocation policies in the American Registry for Internet Numbers ("ARIN") region, which is representative of the modestly different policy processes in each of the five RIRs. We also describe the more recent creation of the Number Resource Organization ("NRO") and its modest role in global IP address policy development. Fourth, we contrast the legal nature of domain names with IP addresses, which has been the subject of recent judicial review. Fourth, we describe the serious potential problems resulting from the depletion of the supply of IPv4 addresses, the impact of "legacy" IPv4 address space, the need to adopt IPv6 applications, and other looming technical policy issues.

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I. WHAT IS AN IP ADDRESS AND WHAT IS ITS ROLE?

An Internet Protocol (IP) address is a number that identifies the location of a computer on a network.¹ IP addresses are used to identify the origin of a packet of transmitted data, the destination of that packet of data, as well as any intermediate points that may exist along the path between the origin and the destination.² Special purpose computers called “routers” guide the flow of packets of information on the Internet using the IP addresses on the packets, in the same way that the postal system uses the “to” and “from” addresses on an envelope.³

There are two addressing forms, IPv4 and IPv6.⁴ An IPv4 address, currently used by most computers, is a binary number 32 bits long.⁵ As a matter of convenience for human readers, the 32 bits are usually denoted as four byte values separated by periods, using a “dotted decimal” notation: 1.2.3.4.⁶ A typical IPv4 address as rendered in dotted decimal notation looks like this: 205.150.58.7, whereas in the raw binary form which computers use internally, the same address looks like this: 11001101100101100011101000000111.⁷

IP address space is finite.⁸ Early on, the amount of IPv4 address space available was thought to be practically inexhaustible.⁹ It was

1. See Wikipedia, IP Address, http://en.wikipedia.org/wiki/IP_address (last visited Oct. 22, 2007) [hereinafter IP Address]; see also Search VoIP.com, Internet Protocol, http://searchvoip.techtarget.com/sDefinition/0,,sid66_gci214031,00.html (last visited Sept. 22, 2007).

2. E.g., IP Address, *supra* note 1; see also Search VoIP.com, *supra* note 1.

3. E.g., IP Address, *supra* note 1; see also Curt Franklin, Howstuffworks.com, How Routers Work, <http://www.howstuffworks.com/router.htm> (last visited Sept. 22, 2007).

4. IP Address, *supra* note 1; see also American Registry for Internet Numbers (“ARIN”), ARIN IPv6 Wiki, http://www.getipv6.info/index.php/main_page (last visited Nov. 15, 2007) [hereinafter ARIN IPv6 Wiki].

5. IP Address, *supra* note 1. The term “bit” refers to a “binary digit”, either a 1 or a 0. However, this term can be used to refer to a discrete storage unit or a statistical unit of information. A byte is a collection of 8 bits.

6. “Dot-decimal notation” refers to the method of writing down octet strings using a base-10 (decimal) scheme instead of a hexadecimal number scheme (base-16). *Id.*

7. IP Address, *supra* note 1; see also Wikipedia, IPv4, <http://en.wikipedia.org/wiki/Ipv4> (last visited Sept. 22, 2007) [hereinafter IPv4].

8. IP Address, *supra* note 1.

9. See generally, 3COM, UNDERSTANDING IP ADDRESSING: EVERYTHING YOU EVER WANTED TO KNOW, http://www.3com.com/other/pdfs/infra/corpinfo/en_US/501302.pdf [hereinafter 3COM]; see also Wikipedia, IPv4 Address Exhaustion, http://en.wikipedia.org/wiki/IP_address_exhaustion (last visited Oct. 22, 2007) [hereinafter IPv4 Address Exhaustion].

difficult, if not impossible, to foresee how fast and large the Internet would grow.¹⁰ There are about four billion IPv4 addresses (more precisely, there are 2^{32} of them), of which approximately 1.5 billion remain available for future allocation to devices connected to the Internet.¹¹ It is important that the available IP address space is used prudently and efficiently without unnecessary waste.¹²

An Internet numbering system with far more addresses, IPv6, is now being issued.¹³ The primary difference from IPv4 is the length of network addresses, as it will provide 2^{128} unique addresses, representing approximately

340,000,000,000,000,000,000,000,000,000,000,000,000,000 addresses.¹⁴ While this is an astronomically large number of addresses, it is still finite, and the technical requirements for the use of IPv6 addresses require that they also be managed judiciously to preclude capricious consumption. In human-readable form, an IPv6 address can be written in hexadecimal notation and look like this: 2001:0503:0C27:0000:0000:0000:0000.¹⁵

Unlike a telephone number, for example, where the "country code" and "area code" components identify a geographic area, an IP address alone provides no clue as to:

- The exact geographic location of a network or a computer;
- Which consumer is using the IP address;
- Where the consumer obtained the IP address; or

10. World Internet Usage Statistics News and Population Stats, <http://www.internetworldstats.com/stats.htm> (last visited Sept. 22, 2007) (there are in excess of 1.133 billion internet users worldwide).

11. IPv4 uses a 32-bit (4-byte) address scheme, which has a limit of 4,294,967,296 unique addresses. However, because of addresses which are reserved for special services such as private networks (approximately 18 million addresses) or multicast addresses (approximately 1 million addresses), the number of addresses that can be allocated as public internet addresses is effectively reduced. See IPv4, *supra* note 7.

12. Network Address Translation (NAT) is one method of staving off the impending IPv4 shortage described later in this paper. NAT basically involves re-writing the source and/or destination addresses of the IP packets as they move through a router or firewall. Because NAT enables multiple hosts on a private network to access the Internet using a single public IP address, it has significantly reduced the need for reserved IP addresses, but suffers from other deficiencies.

13. IPv6 addresses are 128 bits long. Internet Engineering Task Force, Request for Comments 4291, <http://www.ietf.org/rfc/rfc4291.txt> (last visited Oct. 28, 2007) (as stated in RFC 4291). Wikipedia, IPv6, <http://en.wikipedia.org/wiki/IPv6> (last visited Oct. 22, 2007) [hereinafter IPv6].

14. IPv6, *supra* note 13.

15. *Id.* (IPv6 addresses are normally given as eight groups of four hexadecimal digits).

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- The purpose for which the consumer intends to use the IP address.¹⁶

To operate fairly and efficiently, and not confuse the rule-based systems upon which computers depend, IP address space is managed through the rigorous application of exact technical and operational policies.¹⁷ These policies are developed by the consumers of the IP address space, including computer engineering professionals and businesses who provide IP address space to homes and businesses (Internet Service Providers, or "ISPs"), operate routers, and perform technical chores to ensure that everyone adheres to the guiding principles of conservation, aggregation, and uniqueness.¹⁸ The characteristics of these guiding principles are:

- Conservation – IP addresses are allocated to ensure the efficient use of this finite resource while ensuring that consumers receive the addresses they need.
- Aggregation – IP addresses are allocated in contiguous ranges to facilitate the efficient operation of the routers that direct traffic through the Internet.
- Uniqueness – IP addresses are each allocated to one and only one recipient, so that they will, in fact, uniquely identify that recipient's computer.¹⁹

In contrast, the Domain Name System ("DNS") is an abstract system of references providing humans with a "name" to identify a computer or service. A domain name is more easily remembered than the IP address the computer will actually use to route packets to it.²⁰ In this way, it serves the same function as a telephone book, pairing easily-memorable names of people and businesses with less-easily-

16. NUMBER RESOURCE ORGANIZATION, INTERNET NUMBER RESOURCES (2007), http://www.nro.net/docs/nro-factsheet/nro_technical-sheet.pdf [hereinafter NRO: INTERNET NUMBER RESOURCES].

17. See ARIN, NUMBER RESOURCE POLICY MANUAL (2007), http://www.arin.net/policy/nrpm_20070822.pdf [hereinafter ARIN NUMBER RESOURCE POLICY MANUAL].

18. See ARIN, ARIN'S POLICY DEVELOPMENT PROCESS, http://www.arin.net/media/fact_sheets/About_ARIN_PDP.pdf; ARIN NUMBER RESOURCE POLICY MANUAL, *supra* note 17.

19. NRO: INTERNET NUMBER RESOURCES, *supra* note 16.

20. *Id.* See also Indiana University Information Technology Services Knowledge Base, What is DNS?, <http://kb.iu.edu/data/adns.html> (last visited Sept. 20, 2007) [hereinafter DNS].

remembered telephone numbers. Any number of domain names may refer to the same computer.²¹ Domain “names” are not used to move information throughout the Internet; they are merely an easily remembered moniker referring to the actual IP address.²² While every attorney knows his or her firm’s website, only one in a thousand will know, or care, about its underlying IP address. They may learn to care in the future, however, as we describe a looming policy issue relating to IP resources.

It may be useful for policy makers and judges to analogize the Internet’s “geography” to the more familiar concept of nation states. The “nations” of the Internet do not end at national borders. Networks are the new organizational tool. The “frontiers” of these networks are border routers between networks.²³ The “treaties” are voluntary peering relationships between networks.²⁴ The Internet has a dynamic geography; new networks are formed each day. New “borders” delineated by border routers are established hourly. Routing tables are changed by the minute, and happily, throughout most of the world, this activity takes place in an efficient and effective system of private-sector self-regulation.²⁵

Courts struggling to adapt to the Internet have reiterated these issues. For example, in *ACLU v. Reno*, the Court stated:

The Internet has an international, geographically-borderless nature . . . Indeed, the Internet negates geometry . . . it is fundamentally and profoundly anti-spacial. You cannot say where it is or describe its memorable shape and proportions or tell a stranger how to get there. But you can find things in it without knowing where they

21. For example, United Airlines websites www.united.com, www.unitedairlines.com, and www.ual.com all redirect to the United Airlines website: <http://www.united.com>.

22. The DNS scheme itself consists of a hierarchical set of DNS servers, with each domain or sub-domain possessing at least one “authoritative DNS server” that are aware of the name servers beneath them. DNS usually occurs transparently in web applications. When a user requests a website, a DNS table lookup occurs. Recent requests are stored in a cache which enables a ready response. Otherwise, the request is sent to a DNS server and passed up the chain to other servers for resolution if necessary. The user is then directed to the selected webpage, assuming that a successful resolution has occurred.

23. A border router directs traffic into, out of, and within a network. The term “border” refers to the fact it is the last router under the control of the local network administrator before the “untrusted” internet is reached. *See* 3COM, *supra* note 9, at 10-12.

24. A peering relationship describes the physical and administrative interconnection of separate internet networks so that they effectively enable the exchange of traffic from individuals end-to-end. “Public peering” occurs at Internet exchanges (IX) which enable multiple carriers to interconnect to one or more other carriers. *See id.*

25. A “routing table” refers to a table on a router which is used to store information regarding a network’s topology. This “map” enables data packets to be properly directed to the appropriate node on the network. *See id.*, at 9-12.

are. The [Internet] is ambient – nowhere in particular and elsewhere at once.²⁶

End-user customers do not care what their IP address is, nor does the IP address have a secondary meaning like 1-800-call-ATT or the domain name ATT.com.²⁷ Customers simply want their IP address to work.²⁸ In fact, ISPs from time-to-time may “re-number” customers, changing their IP address when necessary, and so long as the new number receives the same traffic that was previously going to the old number, it typically goes unnoticed.²⁹ End-user customers are typically unaware of such changes.³⁰ In effect, the IP address is more analogous to a road sign than to a piece of real estate. Just as credit card customers want to be able to use their cards to pay for their purchases, no customer can or will object if the credit card provider changes the number on the card, so long as the credit card service remains uninterrupted.³¹

The fact that IP addresses are not “owned” was decided some time ago by the Internet community. For example, in 1996 the Internet Engineering Task Force (“IETF”) published RFC 2008 entitled, “Implications of Various Address Allocation Policies for Internet Routing.”³² The IETF is a large, open international community of network designers, operators, vendors, and researchers who define the protocols that ensure the smooth operation of the Internet.³³ RFC 2008 contrasts two possible models for the dissemination of IP addresses: address ownership and address lending.³⁴ The document rejects an “ownership” model in favor of an

26. *ACLU v. Reno*, 217 F.3d 162, 169 (3rd Cir. 2000) (citations omitted).

27. See Kenneth Sutherlin Dueker, *Trademark Law Lost in Cyberspace: Trademark Protection for Internet Addresses*, 9 HARV. J.L. & TECH. 483, 492-93 (1996).

28. *Id.* at 492-93. See also Michael B. Landau, *Problems Arising Out of the Use of “WWW.TRADEMARK.COM”*: The Application of Principles of Trademark Law to Internet Domain Name Disputes, 13 GA. ST. U. L. REV. 455, 461 (1997).

29. See 3COM, *supra* note 9, at 40-44.; see also Zytrax.com, Services: Static v. Dynamic IP Addresses, <http://www.zytrax.com/isp/faqs/static.htm> (last visited Sept. 25, 2007) (An IP address that rennumbers at set intervals is known as a “dynamic” IP address. A “static” IP address is fixed and assigned to a particular user group. Because a “static” IP is fixed, there is a greater range of network services available to such users (Hosting, etc.).

30. See Dueker, *supra* note 27, at 493.

31. See generally *id.*

32. Y. Rekhter & T.Li, Implications of Various Address Allocation Policies for Internet Routing (1996), <http://www.apps.ietf.org/rfc/rfc2008.html> [hereinafter RFC 2008].

33. Internet Engineering Task Force, Overview of the IETF, <http://www.ietf.org/overview.html> (last visited Sept. 26, 2007) [hereinafter IETF].

34. Rekhter & Li, *supra* note 32, §1.

“address lending” model.³⁵ The reasoning for this policy decision had nothing to do with the economic benefit to different types of businesses.³⁶ Instead, it had everything to do with ensuring that the Internet can continue to grow and work.³⁷ The summary of RFC 2008 makes this point clear:

Any address allocation and management policy for IP addresses used for Internet connectivity must take into account its impact on the scalability of the Public Internet routing system. Among all of the possible address allocation and management policies only the ones that yield a scalable routing system are feasible. All other policies are self-destructive in nature, as they lead to a collapse of the Internet routing system, and therefore to the fragmentation (partitioning) of the Public Internet.

Within the context of the current Public Internet, address allocation and management policies that assume unrestricted address ownership have an extremely negative impact on the scalability of the Internet routing system. Such policies are almost certain to exhaust the scalability of the Internet routing system well before we approach the exhaustion of the IPv4 address space and before we can make effective use of the IPv6 address space. Given the Internet’s growth rate and current technology, the notion that everyone can own address space and receive Internet-wide routing services, despite where they connect to the Internet, is currently technically infeasible. Therefore, this document makes two recommendations. First, the “address lending” policy should be formally added to the set of address allocation policies in the Public Internet. Second, organizations that do not provide a sufficient degree of routing information aggregation to obtain access to the Internet routing services should be strongly encouraged to use this policy to gain access to the services.

Since the current IPv6 address allocation architecture is based on CIDR, recommendations presented in this document apply to IPv6 address allocation and management policies as well.³⁸

35. *Id.* at § 6.

36. *Id.* at § 7.

37. *Id.*

38. *Id.* CIDR refers to Classless Inter-Domain Routing, which was introduced in late 1992 and greatly increased the ability to divide ranges of IP addresses, thereby enabling more efficient use of the limited pool of IPv4 addresses. Essentially, it enables the grouping of blocks of addresses into single routing table entries. These “CIDR blocks” are comprised of a dotted-decimal address, followed by a “slash number” ranging from 0 to 32 (prefix length). In the case of IPv6, the prefix length can range from 0 to 128, but a similar format is used. These CIDR

In order for individual blocks of IP addresses to be useful, they must first be “routed” in the Internet.³⁹ “Routing” is the placement of entries into computer tables maintained by the top Internet Service Providers (ISP’s) around the globe.⁴⁰ For every block of IP addresses placed in service, an entry must be made in thousands of routers worldwide, and there are finite limits on the number of routing entries that may be maintained.⁴¹

One analogy that may be made is the placement of destination signs at an intersection. Every new block of IP addresses requires a sign be placed at every Internet “intersection,” pointing the way to customers using IP addresses in that block. RFC 2008 concludes that it is infeasible for every organization connecting to the Internet to “own” its own address block, as we technically cannot provide enough destination signs at every intersection.⁴² Instead, RFC 2008 clearly describes the IP address as part of a service:

The above implies that in the Public Internet it is the service environment (the Internet) and its continued operation, including its routing system, which gives an IP address its intrinsic value, rather than the inverse. Consequently, if the Public Internet routing system ceases to be operational, *the service disappears*, and the addresses cease to have any functional value in the Internet.⁴³

In the above words, RFC 2008, published in 1996, recognized that the allocation of IP addresses could only be based on a lending model going forward. Thus, RFC 2008 represents a type of “global policy” that arose in technical communities, but has profound legal consequences. Can a policy like RFC 2008, which is being followed by the Internet community, be the basis for national courts to grant or limit rights in IP addresses? As we will see, such questions are likely to be the subject of great scrutiny in the future.

In conformity with RFC 2008, the American Registry for Internet Numbers (“ARIN”) has not legally asserted in any judicial proceeding that it is the “owner” of the IP resources that have been provided to it by the Internet Assigned Numbers Authority (“IANA”),

blocks are assigned by the Internet Assigned Numbers Authority (IANA) to Regional Internet Registries (RIRs). *See id.* § 4.

39. *See* Olaf Kirch & Terry Dawson, Linux Network Administrator’s Guide Second Edition § 2.4.1, http://www.faqs.org/docs/linux_network/x-087-2-issues.routing.html (last visited Sept. 16, 2007) [hereinafter Linux Network].

40. *Id.* at §2.4.4.

41. *See id.*

42. Rekhter & Li, *supra* note 32, at § 7.

43. *Id.* at § 2 (emphasis added).

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even though such numbers are in ARIN's control, and ARIN is the sole administrative organization designated by the consensus of the Internet community to conserve, manage, and ensure the efficient utilization of these finite resources in its service area.⁴⁴ This is in consonance with the U.S. Government policy that led to the creation of both the IANA and ARIN.⁴⁵ It is identical to a worldwide system that, to date, has treated the ownership issue similarly. This policy decision was founded, as we have seen, in the necessity imposed by the technical architecture of the Internet.

RFC 2008 describes the technical requirements of IP address administration:

Hierarchical routing requires that aggregation boundaries for the addressing information be formed along some hierarchy. As a result, many exceptions will be injected into the routing system in the future, besides those exceptions that currently exist. Each exception added to the routing system deters the scalability of the routing system. The exact number of exceptions that can be tolerated is dependent on the technology used to support routing. Unbridled growth in the number of such exceptions will cause the routing system to collapse.⁴⁶

In general, blocks of IP addresses are provided to ISPs (or end users) by RIRs, who in turn bundle them in ever smaller packets to downstream service providers, and eventually to end-user consumers.⁴⁷ Blocks of IP addresses are also provided by RIRs

44. See ARIN, ARIN AT A GLANCE, http://www.arin.net/about_us/fact_sheet.pdf [hereinafter ARIN AT A GLANCE]; Internet Assigned Numbers Authority, Background: Allocation of IP Addresses, <http://www.iana.org/faqs/abuse-faq.htm> (last visited Sept. 26, 2007).

45. See Improvement of Technical Management of Internet Names and Addresses, 63 Fed. Reg. 8826 (Feb. 20, 1998) (to be codified at 15 C.F.R. pt. 23) [hereinafter Improvement of Technical Management].

46. Rekhter & Li, *supra* note 32, at §4.

47. See 3COM, *supra* note 9, at 43. The Wikipedia entry for Classless Inter-Domain Routing gives the example of the IP address 208.130.29.33 (since reassigned) which was used by the www.freessoft.org web server. The entry states:

An analysis of this address identified three CIDR prefixes. 208.128.0.0/11, a large CIDR block containing over 2 million addresses, had been assigned by ARIN (the North American RIR) to MCI. Automation Research Systems, a Virginia VAR [value-added reseller], leased an Internet connection from MCI and was assigned the 208.130.28.0/22 block, capable of addressing just over 1000 devices. ARS used a /24 block for its publicly accessible servers, of which 208.130.29.33 was one.

All of these CIDR prefixes would be used, at different points in the network. Outside of MCI's network, the 208.128.0.0/11 prefix would be used to direct to MCI traffic bound not only for 208.130.29.33, but also for any of the roughly two

directly to larger end user organizations who sufficiently justify a need for their own resources.⁴⁸ The manner in which the addresses are provided is determined by the Internet community through the development of technical and operational policies pertaining to the allocation of IP addresses.⁴⁹ When a recipient no longer requires the use of the IP address, it is returned to the ISP to be used by another customer. Any block not used by one ISP or end user can and should be returned back to the Regional Internet Registry for reallocation to an ISP with a more pressing need.⁵⁰ Since IP addresses are a requisite part of a service bundle, unlike property, they are not currently bought, sold, traded, transferred, attached, or otherwise provided to anyone other than by the methods described by the policy defined by the Internet community.⁵¹ In the United States, people or organizations wanting the use of one or hundreds of IP addresses have literally thousands of service providers to choose from.⁵² Individuals are unlikely to obtain them from ARIN because of the burden of documenting a need for the minimum volume ARIN deals in, 2048 at a time.⁵³ Individuals simply receive what they need in conjunction with services bought from an ISP. Under current policies, no one can “buy” an IP address in an “a la carte” way from an ISP or end user.

The ability to continue to grow the Internet as it currently operates is dependent upon the availability of large blocks of IP address space that can be “routed” globally as a single block of address space, but subdivided by the holding ISP to serve hundreds, if not thousands of new customers.⁵⁴ The hierarchy, inherent in the lending model of address management, ensures that the global Internet routing table will grow slowly in comparison to the number

million IP addresses with the same initial 11 bits. Within MCI’s network, 208.130.28.0/22 would become visible, directing traffic to the leased line serving ARS. Only within the ARS corporate network would the 208.130.29.0/24 prefix have been used.

Wikipedia, Classless Inter-Domain Routing, http://en.wikipedia.org/wiki/Classless_Inter-Domain_Routing (last visited Sept. 26, 2007).

48. K. Hubbard et al., Internet Registry IP Allocation Guidelines § 2.1 (1996), <http://rfc.sunsite.dk/rfc/rfc2050.html>.

49. *Id.*

50. *Id.*

51. *Id.*

52. See Richard Dennis, *Guide to Selecting an Internet Provider*, 2 ENVTL. LAW. 571, 585 (1996) (noting an extensive list of almost 1,600 internet providers).

53. See American Registry of Internet Numbers, Guidelines- Initial IPv4 Allocation, http://www.arin.net/registration/guidelines/ipv4_initial_alloc.html (last visited Oct. 13, 2007).

54. See 3COM, *supra* note 9, at 36-37.

of new organizations connecting to the Internet, as long as there remains sufficient address space to allocate in this manner.

II. REGIONAL INTERNET REGISTRIES ARE AUTHORIZED TO PROVIDE INTERNET NUMBER RESOURCES AS A RESULT OF DECISIONS BY BOTH THE INTERNET COMMUNITY AND GOVERNMENTS

To achieve the goals of maintaining globally unique IP addresses and conserving the finite amount of them, a system for allocating and managing these addresses was established in the early days of the Internet, and it has evolved into the global Internet registry system we see today. ARIN, one of the five current Regional Internet Registries ("RIRs"), is charged with maintaining a public trust that allocates Internet number resources in an impartial manner for its service area, which includes Canada, many of the island nations and territories of the Caribbean and North Atlantic Ocean, and the United States.⁵⁵ How did ARIN come into existence, and what is the legal chain of authority that conveyed prior government authority to ARIN?

The Internet is an outgrowth of the United States Government's financial investment in packet switching technology and communications networks carried out under agreements with the Defense Advanced Research Projects Agency ("DARPA") and the National Science Foundation ("NSF").⁵⁶ It became the policy of the U.S. Government to "hand off" certain responsibilities for Internet operations and governance, including the dissemination of IP numbers to non-governmental, non-profit community-driven organizations.⁵⁷

In 1992, within the U.S. Government, it was determined that the NSF would take responsibility for certain Internet functions, including the registration of Internet Protocol addresses and domain names.⁵⁸ The NSF based its authority on the National Science Foundation Act, 42 U.S.C. section 1861 *et seq.*, specifically, Sections 1862 (a)(4) and 1862 (g).⁵⁹ The NSF solicited bids from private companies to perform various functions for the Internet community,

55. ARIN AT A GLANCE, *supra* note 44.

56. Internet Society, Histories of the Internet, <http://www.isoc.org/internet/history/cerf.shtml> (last visited Sept. 26, 2007).

57. Improvement of Technical Management, *supra* note 45, at 8827.

58. *Id.* at 8826.

59. National Science Foundation Authorization Act, 42 U.S.C. §§ 1861-1862 (2002).

including address registration services.⁶⁰ NSF received three proposals for operating the Internet registration services and awarded the contract to Network Solutions, Incorporated ("NSI") in the form of a five-year cooperative agreement under the Federal Grants and Cooperative Act, 31 U.S.C. 6301 *et seq.*⁶¹ The solicitation specifically referenced the delegation of authority for registration services from the Internet Assigned Numbers Authority ("IANA").⁶² The solicitation also specifically provided for the possibility that service providers would charge user fees.⁶³ NSI proposed that it would charge user fees for domain name registration services.⁶⁴

NSI previously functioned as the Internet registry for domain names, from the time the Cooperative Agreement became effective on January 1, 1993.⁶⁵ Until September 1995, registration service for both names and numbers was free to registrants, with the cost of registering IP addresses being borne by the NSF.⁶⁶ The NSF reimbursed NSI for the costs of the Internet registration services at a cost-plus basis from NSF operating funds and, therefore, out of U.S. Government tax dollars.⁶⁷ The explosion in the usage of the Internet, unforeseen even by the NSF or most others, laid an unacceptable financial and administrative burden on the NSF.⁶⁸ Pursuant to its authority under Article 15 of the Cooperative Agreement, NSI developed a plan for the NSF to (1) charge user fees for domain name services that would make the Internet registry self-supporting, and (2) transfer the IP registration function to a non-profit organization.⁶⁹ The NSF agreed and later participated in the creation of ARIN, which was

60. Bruce L. Benson, *The Spontaneous Evolution of Cyberlaw: Norms, Property Rights, Contracting, Dispute Resolution and Enforcement Without The State*, 1 J.L. ECON. & POL'Y 269, 323 n.49 (2005).

61. *Id.*

62. See Cooperative Agreement Between NSI and U.S. Government, Art. 3(C) (1993), <http://www.icann.org/nsi/coopagmt-01jan93.htm> [hereinafter NSI Agreement].

63. See NSF Solicitation for Network Information Services Manager for NSFnet and the NREN (1992) <http://www.nsf.gov/pubs/stis1992/nsf9224/nsf9224.txt>.

64. See NSI Agreement, *supra* note 62, at Art. 15(A).

65. See *id.*

66. See Mark Gould, *Locating Internet Governance: Lessons from the Standards Process*, in REGULATING THE GLOBAL INFORMATION SOCIETY 193, 197 (Christopher T. Marsden ed., 2000).

67. See NSI Agreement, *supra* note 62, at Art. 8(E)(2).

68. See Internet World Stats, <http://www.internetworldstats.com/emarketing.htm> (last visited Sept. 27, 2007) (documenting statistics showing that as early as 1995, the number of internet users was at least 16 million, whereas by June 2007, the number of internet users exceeded 1.133 billion users.).

69. See NSI Agreement, *supra* note 62, Art. 15(A)(1)-(3).

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subsequently incorporated in Virginia.⁷⁰ The first phase of the plan went into effect, without prior announcement, on September 14, 1995.⁷¹ The second phase came to fruition when ARIN was incorporated in August 1997 and began operation four months later.⁷²

As part of its InterNIC Registration Services, NSI provided network number assignments and autonomous system number assignments.⁷³ Under the Cooperative Agreement, all registration services were bundled together within the "Statement of Work."⁷⁴ Article 3, Section (F) of the Cooperative Agreement provided:

The Non-military Internet registration services provided under this Agreement will initially include, but not be limited to, the following:

1. Domain name registration
2. Domain name server registration
3. Network number assignment
4. Autonomous system number assignment.⁷⁵

Beginning in 1995, the federal government and Internet community expressed an interest in unbundling Internet services and keeping Internet Protocol issues separate from domain name service issues and to place the management of the IP address space in a separate organizational entity.⁷⁶

Consistent with the expressed desires of the Internet community and the federal government's desire to unbundle IP address space allocation from the responsibilities of NSI, the NSF concurred in the NSI proposal to establish a non-profit corporation.⁷⁷ NSF Amendment No. 07 to Cooperative Agreement No. NCR-9218742, effective

70. Daniel Karrenberg et al., *Development of the Regional Internet Registry System*, 4 THE INTERNET PROTOCOL J., Dec. 2001, at 17, 23, available at http://www.cisco.com/web/about/ac123/ac147/archived_issues/ipj_4-4/ipj_4-4.pdf.

71. NSF Cooperative Agreement No. NCR-9218742, Amendment 4 (1995), <http://www.cavebear.com/archive/nsf-dns/amendment4.html>.

72. See Karrenberg et al., *supra* note 70, at 24.

73. ICANN, <http://www.icann.org/faq/#WhatIsInterNIC> (last visited Oct. 23, 2007) (explaining that the "InterNIC website is operated by ICANN to provide the public information regarding Internet domain name registration services").

74. See NSI Agreement, *supra* note 62, at Art. 3(F)(1)-(4).

75. *Id.*

76. See Karrenberg et al., *supra* note 70, at 24.

77. Amendment 7 to Cooperative Agreement Between NSI and U.S. Government (1997), <http://www.icann.org/nsi/coopagmt-amend7-03dec97.htm>.

December 1, 1997, approved the “transfer [of] responsibility for the IP Number assignment, Autonomous System Number assignment, and IN-ADDR.ARPA tasks to ARIN.”⁷⁸ Thus, the entity approved by the NSF to assume all of the responsibilities formerly performed by NSI under the NSF Cooperative Agreement was ARIN.⁷⁹ ARIN, subsequently, was incorporated as a non-profit organization in the Commonwealth of Virginia on April 23, 1997.⁸⁰ In December 1997, ARIN received its tax-exempt status under Internal Revenue Code Section 501(c)(6). ARIN was to be responsible for the management of the IP address space for all the geographic regions Network Solutions administered under its Cooperative Agreement, as amended, with the NSF.⁸¹

It took approximately thirteen months to organize ARIN.⁸² During this period the NSF directly supervised the formation process, with input from the National Telecommunications and Information Agency (“NTIA”).⁸³ The Associate Administrator (Acting) of NTIA exercised direct input into the ARIN incorporation documents and bylaws.⁸⁴ Evidence of NTIA’s direct involvement with ARIN is found in the e-mail dated June 18, 1997, from Ms. Burr to G. Strawn at the NSF and E. Maxwell at the Federal Communications Agency (“FCA”) in which Ms. Burr stated, “NSF should complete its negotiations with NSI, Inc. regarding the ARIN spin-off, providing that ARIN organization documents reflect the following points of agreement.”⁸⁵ Pursuant to this directive from NTIA, ARIN twice

78. *Id.*

79. See ARIN AT A GLANCE, *supra* note 44.

80. ARIN, LTD., ARTICLES OF INCORPORATION (1997), available at http://www.arin.net/about_us/corp_docs/artic_incorp_with_amendments.pdf [hereinafter ARIN ARTICLES OF INCORPORATION].

81. See ARIN AT A GLANCE, *supra* note 44.

82. Declaration of Raymond A. Plzak In Support of Motion to Clarify/Modify, *Kremen v. Cohen*, No. C 98 20718 JW 12 (N.D. Cal. 2006) [hereinafter Plzak Dec.].

83. National Telecommunications and Information Administration (NTIA), <http://www.ntia.doc.gov/> (last visited Sept. 28, 2007). As stated on its website, “[t]he National Telecommunications and Information Administration (NTIA) is the President’s principal adviser on telecommunications and information policy issues, and in this role frequently works with other Executive Branch agencies to develop and present the Administration’s position on these issues.” NTIA, About the NTIA, <http://www.ntia.doc.gov/ntiahome/aboutntia/aboutntia.htm> (last visited Sept. 28, 2007).

84. Plzak Dec., *supra* note 82, at 12.

85. *Id.*

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amended its Articles of Incorporation and bylaws to incorporate the points required by NTIA.⁸⁶

On June 24, 1998, the NSF issued a press release announcing the formation of ARIN, entitled "Internet Moves toward Privatization, IP Numbers Handled by Non-Profit."⁸⁷ The press release stated, in pertinent part, "The NSF has approved a plan from Network Solutions, Inc. (NSI) which establishes the American Registry for Internet Numbers ('ARIN'). Under the plan, ARIN would assume full responsibility for Internet Protocol (IP) number assignments and related administrative tasks previously handled by NSI."⁸⁸ Thus, the entire process was initiated and supervised by both the NTIA and NSF pursuant to NSF's supervisory responsibility under the Cooperative Agreement. The United States Department of Commerce granted the Internet Corporation for Assigned Names and Numbers (ICANN) responsibility for establishing, in conjunction with Internet users, policies for Internet Protocol address space, pursuant to a Memorandum of Understanding between the Department of Commerce and ICANN dated November 25, 1998, as amended May 25, 2001.⁸⁹ In 1999, ICANN also assumed responsibility for the technical functions previously performed under U.S. government contract with the Internet Assigned Numbers Authority (IANA).⁹⁰

Thus, ARIN has a clear chain of authority from the U.S. Government. The decision of the government, for example, to eventually require competition among registrars for the domain name profit-oriented business, has not been duplicated in the distribution of IP number resources.⁹¹ The reasons for this conscious choice are many, but the key is that IP number resources have been a commodity

86. ARIN ARTICLES OF INCORPORATION, *supra* note 80. ARIN, LTD., BYLAWS OF ARIN, LTD. (2007), available at http://www.arin.net/about_us/corp_docs/bylaws.pdf (last visited Sept. 28, 2007) [hereinafter ARIN BYLAWS].

87. Press Release, Nat'l Sci. Found., Internet Moves Toward Privatization, IP Numbers Handled by Non-Profit (June 24, 1997), <http://lists.arin.net/pipermail/naipr/1997-June/001505.html>.

88. *Id.*

89. Memorandum of Understanding Between the U.S. Department of Commerce and Internet Corporation for Assigned Names and Numbers (Nov. 25, 1998), available at <http://www.icann.org/general/icann-mou-25nov98.htm>. Amendment 4 to ICANN/DOC Memorandum of Understanding (Sept. 24, 2001), available at <http://www.icann.org/general/amend4-jpamou-24sep01.htm>.

90. Contract Between ICANN and the U.S. Government for Performance of the IANA Function (Feb. 9, 2000), available at <http://www.icann.org/general/iana-contract-09feb00.htm>.

91. Barry Skeenes, *An Overview of ARIN's Role in the Internet Industry Today* (July 7, 2000) <http://lists.arin.net/pipermail/clew/2000-July/000023.html>.

service, bundled inside a service wrapper and not sold individually as domain names have been.⁹²

A. *The RIR Community*

Today, there are five Regional Internet Registries worldwide.⁹³ They include American Registry for Internet Numbers (“ARIN”), Réseaux IP Européens Network Coordination Centre (“RIPE NCC”) (whose service area includes Europe, the Middle East, and Central Asia), Latin American and Caribbean Internet Addresses Registry (“LACNIC”) (whose service area includes Latin America and portions of the Caribbean), Asia Pacific Network Information Centre (“APNIC”) (whose service area includes portions of Asia and Oceania), and African Network Information Centre (“AfrINIC”) (whose service area includes Africa and portions of the Indian Ocean).⁹⁴ RIPE NCC and APNIC came into existence *before* ARIN.⁹⁵ Each of these other RIRs derives its legitimacy from a similar process as that of ARIN and from the demands of their regions.⁹⁶ For example, all of Latin America, and much of sub-Saharan Africa, were originally territories ARIN serviced.⁹⁷ ARIN voluntarily helped support the growth and independence of LACNIC and AfrINIC as independent and equal sister organizations to provision Internet number resource services to the geographically large and contiguous land masses each represent.⁹⁸ Each RIR maintains continuing authority for administering and registering IP addresses under this arrangement.⁹⁹ IANA coordinates the IP address system by allocating blocks of numerical addresses to these RIRs based on the RIR showing utilization of previously issued resources, the same principle used by the RIRs with respect to their own constituencies: the five RIRs in turn allocate blocks of addresses to Internet service providers or end users.¹⁰⁰ The recipients of those address blocks then reassign

92. *Id.*

93. See Other Regional Internet Registries, <http://www.arin.net/community/rirs.html> (last visited Sept. 28, 2007).

94. *Id.*

95. See ICANN, The Regional Internet Registry System-An Overview, <http://www.aso.icann.org/meetings/other/LA2000/RIRoverview.doc> (last visited Sept. 28, 2007) [hereinafter RIRs Overview].

96. *Id.*

97. See Karrenberg et al., *supra* note 70, at 24.

98. *Id.* at 24-25.

99. See RIRs Overview, *supra* note 95.

100. See IANA: Abuse Issues and IP Addresses, <http://www.iana.org/faqs/abuse-faq.htm> (last visited September 28, 2007).

addresses to smaller providers and to end-users.¹⁰¹ The policies of the RIRs vary slightly in reflection of their regions' unique needs.¹⁰²

B. The Open, Transparent, and "Bottom-Up" Internet Number Resource Allocation Policies

Every RIR has a similar structure and provides similar, albeit slightly regionally differentiated, services.¹⁰³ All RIRs are non-profit, membership-based, community-governed organizations that distribute Internet number resources, facilitate policy development, and disseminate information to their regional communities.¹⁰⁴ This paper uses ARIN's practices to demonstrate these activities.

ARIN is a non-profit organization.¹⁰⁵ It is completely funded by its constituency through service and membership fees.¹⁰⁶ Government agencies in its service region which need resources apply and pay for them, just like private sector businesses, and each pays identical fees for similar services.¹⁰⁷ (Despite the role of the U.S. Department of Defense and National Science Foundation in creating the Internet, they pay fees for additional services ordered today.)¹⁰⁸ ARIN does not charge for Internet number resources but does charge modest transaction fees for the associated services that it provides.¹⁰⁹ These fees enable ARIN to recover the costs incurred in managing and administering Internet number resources, facilitating the policy development process, and providing for the resources and staff necessary for the equitable, efficient, and effective day-to-day operation of ARIN and to keep pace with the demands of the Internet community.¹¹⁰ ARIN's current budget is public and includes revenues and expenditures on an annual basis of approximately \$10 million,

101. *Id.*

102. *See* RIRs Overview, *supra* note 95.

103. *See id.*

104. *See* THE INTERNET SOCIETY, THE REGIONAL INTERNET REGISTRY STRUCTURE, ISOC MEMBER BRIEFING #21 (2006), available at <http://www.isoc.org/briefings/021/briefing21.pdf>.

105. ARIN, About ARIN, http://www.arin.net/about_us/index.html (last visited Sept. 15, 2007).

106. *See* ARIN, Billing, <http://www.arin.net/billing/index.html> (last visited Sept. 15, 2007).

107. *See* ARIN BYLAWS, *supra* note 86, at art. III, § 1.

108. *See* Hobbes' Internet Timeline, Hobbes' Abridged Internet Timeline, <http://www.cs.utexas.edu/~mitra/honors/timeline.html> (last visited Sept. 29, 2007).

109. *See* ARIN, Fee Schedule, http://www.arin.net/billing/fee_schedule.html (last visited Sept. 29, 2007).

110. *See* ARIN, Billing, *supra* note 106.

and a full-time staff of approximately 40 persons, most of whom have a technical degree and perform technical operations.¹¹¹

ARIN is a member-based organization.¹¹² Membership is open to any individual or entity with no accreditation required.¹¹³ "ARIN [actively] seeks a broad-based membership that represents all users and potential users of Internet number resources within its service region."¹¹⁴ This membership includes private sector, civil society, and government representatives.¹¹⁵ Many organizations that receive allocations of IP address space from ARIN are automatically accorded membership.¹¹⁶ "Any other interested parties are welcome to join for a [nominal annual] fee."¹¹⁷ Membership benefits include the ability to participate in elections, free registration for ARIN's bi-annual public policy and members meetings, and the ability to participate in member-only mailing lists.¹¹⁸

While there are many benefits to ARIN membership, it

is not required to participate in ARIN's policy development process [To ensure fairness, i]t is not necessary to become a member of ARIN prior to applying for Internet number resources, nor will doing so make it easier to obtain them. Members and nonmembers alike must justify allocation requests based on [allocation and assignment] criteria.¹¹⁹

C. Governance

ARIN has a member-elected Board of Trustees and Advisory Council.¹²⁰ Any qualified individual, regardless of ARIN membership status, may serve on the Board of Trustees, which "has ultimate responsibility for the business affairs and financial health of ARIN," or the Advisory Council, which manages day-to-day aspects of the

111. See ARIN, About ARIN, *supra* note 105; ARIN: Budget Information, ARIN 2007 Budget (2007), http://www.arin.net/about_us/corp_docs/budget.html.

112. ARIN, About ARIN, *supra* note 105.

113. ARIN, Membership, <http://arin.net/membership/index.html> (last visited Sept. 29, 2007).

114. *Id.*

115. See ARIN BYLAWS, *supra* note 86, at art. III, § 1.

116. ARIN, Membership, *supra* note 113.

117. *Id.*

118. See ARIN BYLAWS, *supra* note 86, at art. III, § 3.

119. ARIN, Membership, *supra* note 113.

120. See ARIN, About ARIN, *supra* note 105.

policy-development process.¹²¹ The Board of Trustees is comprised of seven voting members.¹²² Six members are elected by ARIN's general members and are not compensated, except for actual expenses incurred, such as airfare to travel to meetings.¹²³ The seventh member is the ARIN President and CEO, who is a salaried employee of ARIN, and is not paid for Board service.¹²⁴ Board terms are staggered so that two positions come up for re-election each year.¹²⁵ The Advisory Council is comprised of fifteen members, each elected by ARIN's general members and all are unpaid except for actual expenses incurred.¹²⁶ Council terms are staggered so that five positions are up for re-election each year.¹²⁷ Each year, ARIN members vote to fill vacant seats on the Board and Advisory Council.¹²⁸ ARIN's general members vote following the 4th quarter members meeting and the selected candidates are "announced within seven days from the close of the voting period. All terms, unless otherwise stated, are for three years beginning January 1."¹²⁹

"ARIN manages several mailing lists. All lists are open to the public except the ARIN Discussion mailing list, which is open to ARIN members only."¹³⁰ Policy discussions are prohibited on this particular list, as it is intended for discussion solely of ARIN internal governance matters.¹³¹ All policy proposals are introduced and discussed via the Public Policy mailing list.¹³² Community announcements about ARIN events and activities are posted on the website and via the ARIN Announcements mailing list.¹³³

121. See ARIN, Board of Trustees, http://www.arin.net/about_us/bot.html (last visited Oct. 25, 2006); ARIN BYLAWS, *supra* note 86, at art. 3, §§1, -4.

122. ARIN BYLAWS, *supra* note 86, at art. 6, § 2; ARIN, About ARIN, *supra* note 105.

123. See ARIN BYLAWS, *supra* note 86, at art. VI, §§ 2, -4, -7.

124. See *id.* at art. VI, §§ 2, -4, art. VII, § 5.

125. See ARIN, Election Guidelines, <http://www.arin.net/elections/electionguidelines.html> (last visited Sept. 29, 2007).

126. See ARIN BYLAWS, *supra* note 86 at art. VIII, § 2, -4, -7. For a view of the current makeup of ARIN's Advisory Council, see ARIN, Advisory Council, http://www.arin.net/about_us/ac.html (last visited Oct. 12, 2007).

127. See ARIN, Election Guidelines, *supra* note 125.

128. ARIN: Election Headquarters, <https://app.arin.net/election/> (last visited Sept. 29, 2007).

129. *Id.*

130. ARIN: Mailing Lists, http://www.arin.net/mailling_lists/index.html (last visited Sept. 29, 2007).

131. See *id.*

132. See *id.*

133. See *id.*

ARIN holds biannual public policy and members meetings, generally in the 2nd and 4th quarters of the year.¹³⁴ These meetings are open to all interested parties.¹³⁵ ARIN's members may send two representatives free of charge to each meeting; others are asked to pay a small registration fee.¹³⁶ ARIN strives to hold meetings in geographically-diverse locations throughout its region, which includes Canada, many islands in the Caribbean and North Atlantic Ocean, and the United States.¹³⁷ Meetings typically last three days and provide an opportunity for the entire Internet community to engage in policy discussions, network with colleagues, and attend workshops and tutorials.¹³⁸ For outreach, economy, and the convenience of participants, ARIN also occasionally holds its meetings in conjunction with organizations with overlapping constituency, such as the North American Network Operators Group ("NANOG").¹³⁹

In addition to holding ARIN's meetings in conjunction with other groups, ARIN staff members also participate in their meetings throughout the year.¹⁴⁰ Other complementary Internet governance organizations such as NANOG, the Internet Engineering Task Force ("IETF"),¹⁴¹ and the Internet Corporation for Assigned Names and Numbers ("ICANN"), the so-called "I-star" organizations, all host open meetings and actively solicit input from the RIRs and the Internet community.¹⁴² It is through this continuous cycle of community collaboration and cooperation that the Internet continues to be robust, secure, and stable – without overwhelming governmental bureaucracy.

ARIN is regulated by the Internet community in its region. All ARIN activities are open and transparent.¹⁴³ Policies, procedures,

134. ARIN, Meetings, <http://www.arin.net/meetings/index.html> (last visited Sept. 29, 2007).

135. *Id.*

136. ARIN, Membership, *supra* note 113.

137. *See* ARIN, Meetings, *supra* note 134; ARIN, List of Countries, <http://www.arin.net/community/ARINcountries.html> (last visited Sept. 29, 2007).

138. *See* ARIN, Meetings, *supra* note 134.

139. *See* North American Network Operators' Group (NANOG), <http://www.nanog.org> (last visited Sept. 29, 2007).

140. *See* ARIN, XIX Attendees, http://www.arin.net/meetings/minutes/ARIN_XIX/attendees.html (last visited Sept. 29, 2007).

141. *See* IETF, Overview of the IETF, <http://www.ietf.org/> (last visited Sept. 29, 2007).

142. *See* ARIN, International Community, <http://www.arin.net/community/index.html> (last visited Sept. 13, 2007).

143. *See* ARIN, Internet Number Resource Policies, <http://www.arin.net/policy/index.html> (last visited Sept. 13, 2007).

meeting minutes, and meeting presentations are all accessible *via* ARIN's website.¹⁴⁴ Through the Internet Resource Policy Evaluation Process ("IRPEP"), the Internet community develops the policies that ARIN uses to distribute Internet number resources in an equitable and consistent manner.¹⁴⁵ ARIN staff merely facilitates the policy process, providing mailing lists and meeting forums to gather input from the Internet community, and implements policies once they are ratified by the Board of Trustees.¹⁴⁶

"Policy development is an open and transparent process. Anyone may participate in the process – a prior relationship as an ARIN member or customer is not a requirement, nor is it a requirement for a person to become a member."¹⁴⁷ The ARIN Board of Trustees ratifies policies only after (a) the community discusses the proposed policy on mailing lists and at ARIN meetings and (b) the ARIN Advisory Council makes a recommendation that, based on these discussions, community consensus has been reached that the proposal should be a policy.¹⁴⁸ The IRPEP has a continuous evaluation cycle.¹⁴⁹ First, an author submits a proposed policy at least 60 days prior to an ARIN public policy meeting.¹⁵⁰ The Advisory Council makes an initial review of the policy and may (a) accept the proposal as a formal policy proposal as it is presented; (b) work with the author to modify the proposal; or (c) not accept the proposal.¹⁵¹ If the Advisory Council decides not to accept the proposal, the author may submit a petition via the ARIN public policy mailing list.¹⁵²

When a formal policy proposal is accepted, it is posted to the Public Policy mailing list at least 30 days prior to the public policy meeting for online discussion.¹⁵³ The proposal is also then discussed in person at the public policy meeting.¹⁵⁴ After the meeting, the Advisory Council again evaluates the proposal for community

144. *See id.*; ARIN, Meetings, *supra* note 138; ARIN, Reference Documents, <http://www.arin.net/reference/index.html> (last visited Sept. 13, 2007).

145. *See generally* ARIN, Internet Resource Policy Evaluation Process, <http://www.arin.net/policy/irpep.html> (last visited Sept. 29, 2007).

146. *See* NANOG, ARIN Meetings, <http://www.nanog.org/arinattend.html> (last visited Sept. 29, 2007).

147. ARIN, Internet Number Resource Policies, *supra* note 143

148. *See* ARIN, Internet Resource Policy Evaluation Process, *supra* note 145.

149. *See id.*

150. *See id.*

151. *Id.*

152. *See id.*

153. ARIN: Internet Resource Policy Evaluation Process, *supra* note 145.

154. *Id.*

support.¹⁵⁵ The Advisory Council may (a) support the proposal as is; (b) work with the author to modify the proposal; or (c) find there is community support to abandon the proposal.¹⁵⁶ Again, the author may submit a petition if the Advisory Council decides not to further the proposal.¹⁵⁷

The proposal then moves on to a "Last Call" period on the Public Policy mailing list for 10 business days.¹⁵⁸ The Advisory Council reviews the comments collected during the "Last Call" period and may: (a) support the proposal as is and recommend that the Board of Trustees adopt; (b) find minor revisions are necessary, in which case the Advisory Council or author will redraft and post again to last call; (c) find major revisions are needed, in which case the Advisory Council or author will redraft and the proposal will be posted for the next public policy meeting; or (d) find community support to abandon the proposal.¹⁵⁹ Another petition process is available to the author at this point if the Advisory Council decides to abandon the proposal.¹⁶⁰

The Board of Trustees then considers the Advisory Council's recommendations and "Last Call" petitions.¹⁶¹ The Board may decide to return the proposal to the Advisory Council for clarification, or it may immediately ratify or reject the proposal.¹⁶² The Board of Trustees announces its decision through the Board of Trustees meeting minutes.¹⁶³ Finally, once the Board of Trustees has ratified a proposal, the ARIN staff implements it.¹⁶⁴ After implementation, the Internet community and ARIN staff monitor the policy to ensure there are no unforeseen consequences.¹⁶⁵

155. *Id.*

156. *Id.*

157. *Id.*

158. *Id.*

159. *Id.*

160. *See id.*

161. *Id.*

162. *See id.*

163. *Id.* See ARIN, Meeting Minutes, <http://www.arin.net/meetings/minutes/minutes/index.html> (last visited Sept. 29, 2007); ARIN, Board of Trustees Minutes, <http://www.arin.net/meetings/minutes/not/index.html> (last visited Sept. 29, 2007).

164. *See generally* ARIN, Internet Resource Policy Evaluation Process, *supra* note 145.

165. *Id.* All current ARIN policies are chronicled in the Number Resource Policy Manual, which is available on ARIN's website at <http://www.arin.net/policy/nrpm.html> and is distributed on paper at public policy meetings. Policy proposals can add to, modify, or delete any section of the existing Manual.

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In addition to the formal, community-defined policies, ARIN also publishes guidelines that provide step-by-step instructions for activities like "Obtaining an Initial Allocation of IPv4 Address Space from ARIN," and "Additional Requests for IPv6 Allocations."¹⁶⁶ The documents take visitors from the first step of reviewing policy to the actual allocation or assignment of a resource, and through the management of that resource and the ARIN database records associated with it.¹⁶⁷ These guidelines reflect the policies of the community, many of which have evolved from earlier NSF, NTIA, and Department of Commerce policies, and are based upon the fundamental proposition that issuance of IP addresses remain within the sole administrative control of ARIN's service region. Internet number resources are allocated by ARIN pursuant to the terms of a Registration Service Agreement ("RSA"), which obligates registrants to comply with ARIN's Internet Protocol resource allocation and assignment guidelines.¹⁶⁸ IP address space may be transferred from one entity to another pursuant to the terms of ARIN's Guidelines for Transferring Internet Protocol (IP) Space, and subject to ARIN's Transfer Policy.¹⁶⁹ The guidelines, among other things, provide that IP address space is non-transferable, may not be sold or assigned, and may only be transferred upon ARIN's approval of a formal transfer request.¹⁷⁰ The result is that policies are based in sound technological understanding, and have broad support in the Internet community.

D. The NRO

Since 2003, the Number Resource Organization ("NRO") has served as a single point of contact for the RIRs on joint or collective

166. See ARIN, Registration Services Guidelines, <http://www.arin.net/registration/guidelines/index.html> (last visited Sept. 29, 2007).

167. See ARIN, Guidelines-Requesting Additional IPv4 Allocations from ARIN, http://www.arin.net/registration/guidelines/ipv4_add_alloc.html (last visited Sept. 29, 2007).

168. See ARIN, Service Agreement, <http://www.arin.net/registration/agreements/rsa.pdf> (last visited Sept. 29, 2007).

169. See ARIN, Transfers of Internet Number Resources, <http://www.arin.net/registration/transfers/index.html> (last visited Sept. 29, 2007); ARIN, Guidelines-Transfers of Internet Number Resources, <http://www.arin.net/registration/guidelines/transfers.html> (last visited Sept. 29, 2007).

170. See ARIN, Number Resource Policy Manual, <http://www.arin.net/policy/nrpm.html#eight> (last visited Oct. 24, 2007). One of ARIN's required roles is to carefully examine the application for IP address resources sent to it. A very small but increasing number of these applications include intentionally falsified information intended to assist the applicant.

matters.¹⁷¹ For example, the NRO allows ICANN to interact with all five RIRs collectively on non-policy items, such as the ICANN budget and service contracts.¹⁷² The NRO provides a similar interface for other organizations, such as the IETF, addressing issues that it may be considering.¹⁷³ The NRO also provides a visible framework for existing cooperative joint activities in which the RIRs are already engaged or may become engaged.¹⁷⁴ An example of such activities is the administration of upper level reverse DNS domains or a common WHOIS.¹⁷⁵ The NRO can only act with the approval and agreement of all five RIRs, and can only work on issues delegated to the NRO by the RIRs.¹⁷⁶ Unlike the RIRs, the NRO has not been separately incorporated, and has no permanent staff or funding source of its own.¹⁷⁷

III. THE LEGAL ASPECTS OF IP ADDRESSES

As will be seen, the development of law regarding domain names is further developed than the limited legal precedents regarding Internet protocol numbers. While we take the time to describe how domain name law has been developed, domain name legal principles should not be applied to Internet protocol addresses. Those with a background in domain name legal issues can skip to *infra* Part III.B, which deals with Internet protocol resources.

A. Lessons From Domain Name Law

Internet technologies and their use create new situations to which the laws on the books may not neatly apply. Courts and resource-

171. See The Number Resource Organization, www.nro.net (last visited Sept. 30, 2007) [hereinafter NRO] ("Formed by the Regional Internet Registries to formalise [sic] their cooperative efforts, the NRO exists to protect the unallocated Number Resource pool, to promote and protect the bottom-up policy development process, and to act as a focal point for Internet community input into the RIR system.").

172. NRO, FAQs, <http://www.nro.net/about/nro-faq.html> (last visited Sept. 30, 2007) [hereinafter NRO, FAQs]. In general terms, the RIRs cooperate with ICANN and have their relationship with ICANN defined by a series of relationships, primarily the IANA function issues; second, by the voluntary monetary contribution the RIRs have made to ICANN; and third, the policy process by which global policies are adopted. This will be the subject of a separate writing.

173. *Id.*

174. *Id.*

175. *Id.*

176. See NRO, Memorandum of Understanding (Oct. 24, 2003), <http://nro.net/documents/nro1.html>.

177. See *id.*

users throughout the world are continually struggling to apply old laws to new technologies, and the Internet is no exception. For example, courts have had to determine issues such as whether sending digital signals over a telephone line to a computer would constitute an unlawful interference with possession of personal property, *i.e.*, a trespass to a chattel.¹⁷⁸

Courts and participants have had to tackle how to classify a domain name and what rights attach thereto.¹⁷⁹ Through a process of developing domain name case law and related new legislation, courts and the U.S. Congress have appropriately recognized a property right in domain names, and equally appropriately never extended the same to IP addresses.¹⁸⁰

When courts first analyzed the domain name issue, they did not instantly come to the same conclusion. For example, in one case a federal court in Colorado had a statutory interpleader matter before it.¹⁸¹ Interpleader actions generally require that a plaintiff is in possession of money or property to which two or more adverse claimants claim rights and that it can deposit that money or property with the court for the duration of the dispute.¹⁸² The plaintiff, Network Solutions, had registered a domain name to one of the defendants, Clue Computing.¹⁸³ The second defendant, Hasbro, Inc., claimed that Clue Computing's use of the domain name infringed its trademark rights.¹⁸⁴ Network Solutions filed an interpleader action naming Hasbro and Clue Computing as defendants, hoping to have the court decide the ownership issue.¹⁸⁵ The court held, however, that Network Solutions was subject to an order from a state court forbidding suspension of the domain name at issue.¹⁸⁶ As such, Network Solutions could not establish interpleader jurisdiction, and the case was dismissed.¹⁸⁷ The court did note that the domain name could be treated as an intangible property right, and could be the subject of an interpleader action in appropriate circumstances.¹⁸⁸

178. *See Thrifty-Tel, Inc. v. Bezenek*, 55 Cal. Rptr. 2d 468, 473 (Cal. Ct. App. 1996).

179. *See Network Solutions, Inc. v. Umbro Int'l*, 529 S.E.2d 80, 86 (Va. 2000).

180. *See MTV Networks, Inc. v. Curry*, 867 F. Supp. 202, 203 n.2 (S.D. N.Y. 1994).

181. *Network Solutions, Inc. v. Clue Computing, Inc.*, 946 F. Supp 858 (D. Colo. 1996).

182. *See* 28 U.S.C. § 1335 (2000).

183. *Clue Computing*, 946 F. Supp. at 859.

184. *Id.*

185. *See id.* at 858.

186. *See id.* at 860.

187. *See id.*

188. *See id.*

The Virginia Supreme Court also recognized the intangible rights associated with a domain name in *Network Solutions, Inc. v. Umbro Int'l, Inc.*¹⁸⁹ In that case, Umbro International, Inc. ("Umbro") obtained a default judgment (that included attorneys' fees) against a Canadian company and a Canadian individual in a federal court action ("the Judgment Debtors").¹⁹⁰ Umbro, however, faced the difficult prospect of trying to enforce the judgment against the Canadian parties, who did not have any property in that jurisdiction.¹⁹¹ As such, it instituted a garnishment proceeding against thirty-eight domain names owned by the Judgment Debtors and named Network Solutions, Inc., the company who registered the domain names to the Judgment Debtors, as the garnishee.¹⁹² The Virginia Supreme Court agreed with the plaintiff that an intangible property right existed in the domain names, but determined they were not subject to garnishment proceedings.¹⁹³ The court's decision was based on its view that the right to the domain name was inexorably intertwined with the domain name services provided by Network Solutions to ensure the proper functioning of the domain name and its associated IP address.¹⁹⁴ The court was reluctant to allow service rights to be garnished because it was concerned about the other types of service rights that could be subject to garnishment if it allowed the rights attached to a domain name to be garnished.¹⁹⁵

Trademark owners also had to step forward to protect their intellectual property rights in domain names. In one of the earliest cases to deal with cybersquatting with respect to domain names, *Panavision Int'l., L.P. v. Toebben*, Panavision International had to decide how to get the domain name "panavision.com" back from an individual who had speculatively registered it.¹⁹⁶ Panavision had to rely on the Federal Trademark Dilution Act and the California anti-dilution statute to get the domain name back from the defendant.¹⁹⁷ The defendant recognized the value of Panavision's intangible

189. *Network Solutions, Inc. v. Umbro Int'l, Inc.*, 529 S.E.2d 80 (Va. 2000).

190. *Id.* at 81.

191. *See id.*

192. *Id.*

193. *See id.* at 88.

194. *See id.* at 86.

195. *See id.* at 86-87.

196. *See Panavision Int'l, L.P. v. Toebben*, 141 F.3d 1316, 1319 (9th Cir. 1998).

197. *Id.* The Federal Trademark Dilution Act of 1995 was enacted as Public Law No.104-98 and eventually amended in 15 U.S.C. § 1125 to provide remedies for dilution of famous marks.

property – the domain name – and offered to sell the domain name to Panavision for \$13,000 when it contacted him and requested that he cease its use.¹⁹⁸ While Panavision was able to recoup its domain names, not all plaintiffs would have been able to use the two dilution statutes to get a domain name back from a cyberspeculator due to some of the statutory requirements. For example, both the Federal Trademark Dilution Act and the California Anti-Dilution Statute require the plaintiff to be the owner of a famous mark.¹⁹⁹

Shortly after the *Toeppen* decision, however, Congress enacted the Anti-Cybersquatting Consumer Protection Act (“ACPA”) in 1999.²⁰⁰ The ACPA codified the courts’ recognition of property rights in a domain name, specifically, trademark rights. Domain names may operate as trademarks when used in commerce to identify the particular source of goods or services.²⁰¹ Unlike the dilution statutes, the ACPA does not require the trademark holder to prove that its mark is famous.²⁰² As such, the protections afforded by the ACPA could be offered to a wider range of trademark holders.

The ACPA also recognizes the difficulty a putative plaintiff may have in locating the registrant of a domain name.²⁰³ When registrars take and process applications for domain names, they are not required to verify the applicant’s contact information.²⁰⁴ To do so would result in a significant burden on the registrars’ ability to provide the services of registering domain names and associating those domain names with the proper IP addresses. To avoid the problem of locating an unlawful domain name registrant, the ACPA allows the property of the domain name to serve as the basis for an *in rem* lawsuit.²⁰⁵ *In rem* lawsuits are typically used when a plaintiff wants to sue a defendant,

198. See *Toeppen*, 141 F.3d at 1319.

199. 15 U.S.C. § 1125(c) (2000); Cal. Bus. & Prof. Code § 14330 (West 1987 & Supp. 2007).

200. Anti-Cybersquatting Consumer Protection Act, Pub. L. No. 106-113, Tit. III, 113 Stat. 1501A-545 (codified at 15 U.S.C. 1125(d)(2000)). The ACPA was part of a bill to amend the provisions of 17 U.S.C. and the Communications Act of 1934, dealing with copyright licensing and the carriage of broadcast signals by satellite.

201. See generally *Toeppen*, 141 F.3d at 1324-25.

202. See generally Trademark Cyberpiracy Prevention, *supra* note 200, at § 3002(a)(ii).

203. See S. Rep. No. 106-140, at 10 (1999)..

204. See generally U.S. GOVERNMENT ACCOUNTABILITY OFFICE, INTERNET MANAGEMENT: PREVALENCE OF FALSE CONTACT INFORMATION FOR REGISTERED DOMAIN NAMES, 1 (Aug. 30, 2005) [hereinafter GAO REPORT], available at <http://www.gao.gov/new.items/d06165.pdf>; ICANN, Whois Recommendation of the Security and Stability Advisory Committee 2 (Dec. 2002), <http://www.icann.org/committees/security/whois-recommendation-01dec02.pdf>.

205. See 15 U.S.C. § 1125(d)(2)(A) (2000).

but the defendant does not have enough contacts with the forum to exercise personal jurisdiction over the party.²⁰⁶ However, if the defendant owns property in the forum in question, the principle of *in rem* jurisdiction allows the plaintiff to file suit against the defendant in the jurisdiction where the property sits.²⁰⁷ The plaintiff must then make an effort to notify the defendant of the lawsuit, either through constructive or actual notice in order to comply with due process requirements of the Fourteenth Amendment.²⁰⁸ The suit can be brought in the jurisdiction where the registrar or registry of the domain name is located.²⁰⁹

In short, the ACPA recognizes a domain name as a piece of property within the subject jurisdiction. Even the name of the act implies that the person holding the domain name at the time of the lawsuit is "squatting," the way one squats on real property when one occupies it but is not the rightful owner. By registering a domain name to which one may not have rights, the registrant is essentially "squatting" on that property in cyberspace.²¹⁰ The need to treat domain names as property may have arisen out of difficulties in determining who the owner of a domain name is in order to name as a defendant in a lawsuit. Generally, the information supplied by an applicant, such as his or her name and contact information, is not subject to verification procedures.²¹¹ Thus, some applicants with nefarious intentions will list falsified information, making it very difficult to seek them out to sue.²¹²

While the ACPA treats a domain name as property that can serve as the basis of an *in rem* proceeding, the Ninth Circuit has gone a step further and acknowledged that domain names themselves are property.²¹³ The issue arose, according to the court's decision, when an individual, Stephen Cohen, allegedly fraudulently obtained a transfer of title to the domain name *sex.com* from Gary Kremen, the original registrant.²¹⁴ When Kremen discovered this, he filed suit

206. See BLACK'S LAW DICTIONARY 869 (8th ed. 2004).

207. See *Shaffer v. Heitner*, 433 U.S. 186, 199 (1977).

208. See *id.* at 206; *Mullane v. Cent. Hanover Bank & Trust Co.*, 339 U.S. 306, 314 (1950).

209. See 15 U.S.C. § 1125(d)(2)(A).

210. See Wikipedia, *Cybersquatting*, <http://en.wikipedia.org/wiki/Cybersquatting> (last visited Sept. 30, 2007).

211. See GAO REPORT, *supra* note 204, at 1.

212. See generally *id.*

213. See *Kremen v. Cohen*, 337 F.3d 1024, 1024 (9th Cir. 2003).

214. See *id.* at 1026-27.

against Cohen alleging, *inter alia*, conversion of his property rights in the domain name. In analyzing Kremen's conversion claim, the Ninth Circuit reviewed the issue of whether domain names as a class are a species of property.²¹⁵ The court concluded that domain names are a species of intangible property.²¹⁶ In reaching that conclusion, the court utilized a three part test to determine whether a property right exists in a domain name.²¹⁷ The court first found that there is an interest capable of precise definition – the domain name itself is the well-defined interest, much like a stock certificate or a plot of land.²¹⁸ Second, the court found that a domain name is capable of exclusive possession or control because the registrant can decide whether he or she has exclusive possession of the domain name at the time of registration.²¹⁹ Finally, the registrant establishes its claim to exclusivity by registering the domain name and developing a website under that domain name.²²⁰ Since domain names meet the criteria for property, the court found that Cohen converted Kremen's property rights in the domain name.²²¹

The treatment of domain names as property has evolved with courts initially determining whether domain names were property subject to garnishment proceedings and using anti-dilution statutes to allow trademark holders to challenge another's registration of a domain name. Then, with the development of the ACPA, Congress realized the nature of domain names was very similar to that of a real property, and allowed the domain name to serve as the basis of an *in rem* lawsuit.

B. A Recent Case on Internet Protocol Law

Now let us contrast the development of technical and legal doctrine related to IP addresses. We are unaware of any decisions in which a plaintiff has successfully argued that they "own" an IP address, in the manner that famous trademark domain names can be "owned." As we have seen, this is not in any way surprising.

Mr. Kremen also provided the leading case on the development of IP resource law, but instead of winning his case, as he did in

215. See *id.* at 1030, n.5.

216. See *id.* at 1030.

217. See *id.*

218. See *id.*

219. See *id.*

220. See *id.*

221. See *id.* at 1036.

domain name law, he lost in IP resource law. It began with action not involving ARIN. In September 2001, Kremen obtained an order from the U.S. District Court in San Jose, California as an adjunct to his dispute over sex.com, claiming that financial assets stemming from his loss of sex.com had been used by Cohen to obtain an ISP, and the ISP had obtained number resources from ARIN, and that these resources therefore “belonged” to Cohen as fruits of his theft from Kremen.²²² In one of many *ex parte* orders, the court granted Kremen’s request for an order transferring the ownership of the resources to him.²²³

Kremen, however, then engaged in a long-running dispute with ARIN. Kremen refused to sign a standard ARIN registration service agreement. Instead, Kremen demanded ARIN provide him with resources and initially claimed he had no responsibility to fill out an application, or implicitly, pay for the future use of IP services.²²⁴ ARIN refused to transfer the resources absent Kremen filling out the usual ARIN paperwork.²²⁵ ARIN claimed that if corporate representatives like Microsoft, and government representatives such as the Department of Defense, sign ARIN service agreements, Kremen should as well.²²⁶

In April 2006, Kremen dramatically upped the ante in the dispute by filing a thirty-five page complaint in the U.S. District Court in San Jose as a freestanding case alleging violations of antitrust law, conversion of Kremen’s assets, unfair business competition under California’s broad § 17200, and breach of fiduciary duties.²²⁷ The prayer for relief demanded no less than \$45 million from ARIN.²²⁸ In response, ARIN filed motions to dismiss under FRCP Rule 12, and in December 2006, the Court dismissed the entire suit.²²⁹ Kremen

222. See Order Granting Motion for Clarification by Non-Party American Registry for Internet Numbers, Ltd. at 4, *Kremen v. Cohen*, No. C 98-20718 (N.D. Cal. Dec. 12, 2006), available at <http://www.arin.net/media/litigation/clarification-granted.pdf> [hereinafter *Kremen Order for Clarification*].

223. See *id.* at 2.

224. See Plzak Dec., *supra* note 82, at 3.

225. See *id.*

226. See *id.* at 3-4.

227. Complaint for Violation of Antitrust Laws; Conversion; Unfair Business Competition; Breach of Fiduciary Duty at 2, *Kremen v. ARIN, Ltd.*, No. C 06 2554 (N.D. Cal. Apr. 12, 2006) available at <http://eplaw.us/kremen/complaint.pdf> [hereinafter *Kremen Complaint*].

228. See *id.* at 37.

229. Order Granting Defendant’s Motion to Dismiss with Prejudice at 1, 7, *Kremen v. ARIN, Ltd.*, No. C 06-02554 JW (N.D. Cal. Dec. 20, 2006), available at <http://www.arin.net/media/dismissal-granted.pdf>.

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appealed, but the appeal was ultimately withdrawn by agreement of the parties.²³⁰ More important to precedent than this dismissal was the District Court's simultaneous order, which it issued at ARIN's request and motion, reconsidering its prior *ex parte* order issued in 2001.²³¹ This 2006 order broadly adopted ARIN's request for relief and directed Kremen that he could only receive the number resources if he followed ARIN's procedures, applied for the transfer of the resources, and signed ARIN's standard Registration Services Agreement (RSA) in effect when the resources were issued; or as ARIN had offered, the RSA in effect when the 2001 Order was signed, or the current RSA.²³²

Kremen's theory of the case was that the mere existence of the Court's 2001 *ex parte* order made Kremen the "owner" of the IP resources.²³³ He later amended to say that he, Kremen, stood in the "shoes" of those who held the resources.²³⁴ But the decision contains the Court's explicit finding as to the validity of ARIN's processes.²³⁵ Given the Court's prior sympathy for Kremen, who was a victim of Cohen, but not of ARIN, it was an important decision creating a precedent of recognizing ARIN's procedures. The Court cited as fact in its Order ARIN's representations:

All U.S., Canadian and other IP resources (a portion of ARIN's geographical service area) are administered in a public trust by ARIN pursuant to a Cooperative Agreement with the U.S. government. Because IP address space is finite and a public trust, IP resources are allocated to registrants subject to contractual terms and ARIN's policies. IP resources are allocated by ARIN pursuant to the terms of a services agreement, which obligates registrants to comply with ARIN's Internet Protocol address space allocation and assignment guidelines . . . IP resources may be only transferred from one entity to another pursuant to the terms of ARIN's Guidelines for Transferring Internet Protocol (IP) Space. . . and subject to ARIN's Transfer Policy . . . Among other things, the Guidelines provide that IP resources are non-transferable, may not

230. See Amendment to Order Re. Clarification of Order Granting Defendant American Registry of Internet Numbers, Ltd.'s Motion to Dismiss Plaintiff's Complaint Pursuant to Rule 12 (B)(6) and/or [Alternative] Stay Order at 2, *Kremen v. ARIN, Ltd.*, No. C 06-2554 JW (N.D. Cal. Aug. 17, 2007, available at <http://news.justia.com/cases/226436/> (follow "54" hyperlink).

231. See *Kremen Order for Clarification*, *supra* note 222.

232. *Id.* at 4. ARIN's Registration Service Agreement, which can be found in its Number Resource Policy Manual at <http://www.arin.net/policy/nrpm.html> (last visited Sept. 30, 2007), has changed over time and become more complex as legal requirements and experience dictate.

233. See *Kremen Complaint*, *supra* note 227, at 16.

234. See *Kremen order for Clarification*, *supra* note 222, at 4.

235. See *id.*

be sold or assigned and may only be transferred upon ARIN's approval of a formal transfer request.²³⁶

The *Kremen* decision represents an important milestone in the development of legal thinking related to ARIN and the other RIRs. It stands for the proposition that a technologically sophisticated U.S. District Court, located in the heart of Silicon Valley, has upheld in every regard ARIN's current practices and authority. The Court unequivocally required *Kremen* to abide by the normal Internet community processes.

Under these factual circumstances, a further definitive judicial case that will inevitably address these issues is likely to arise in one of two ways. First, it may occur as a result of ARIN (or another RIR) taking definitive action to strip an IP address holder of a block of resources issued to them for violation of its contractual agreement, or having obtained the resources through fraud. For example, ARIN may choose to take an affirmative action to strip resources from an entity that intentionally provided false and misleading information to ARIN in order to obtain the resources in the first instance. The next person whose actions create such a test case will inevitably argue their rights are somehow impinged by ARIN's practices, and that their representations are satisfactory.

Another likely source of such a test case is a bankruptcy proceeding. A gross assumption may be made by a bankruptcy court that "ownership" of a block of IP addresses issued to ISP "ABC," now bankrupt, whose assets are transferred by the bankruptcy trustee to ISP "XYZ," is like a car or desk. Bankruptcy court lawyers (and judges) with no expertise in Internet services may equate a block of IP address to an automobile – and see both as property of the bankrupt estate. But a transfer, even one ordered by the bankruptcy court, can only become effective when "transfer" paperwork is completed with a registry like ARIN.²³⁷

There is an important policy side benefit to requiring that every transfer of IP resources proceed through the RIR, whose records are well maintained. For example, other government actors, such as the U.S. Department of Homeland Security, will be able to use RIR records to ascertain if the person they believe is a terrorist, or other law enforcement agency believes is a child pornographer, has been issued a particular IP address by tracking the specific IP address from

236. *Id.* at 3.

237. See ARIN, Number Resource Policy Manual, *supra* note 232.

the RIR to the ISP, and obtaining the identification of the person with the unique IP address from the ISP, using appropriate legal demands. Government policy considerations may need to play a greater role in such decision making based on such policy issues.

IV. CURRENT TECHNOLOGY AND POLICY CHALLENGES: DEPLETION OF IPV4 UNISSUED BLOCKS AND LEGACY SPACE

A. Depletion of Unallocated New IPv4 Address Blocks

“On May 7, 2007, the ARIN Board of Trustees passed a resolution advising the Internet technical community that migration to an [updated] version of the Internet Protocol, IPv6, will be necessary to allow continued growth of the Internet.”²³⁸ Furthermore, ARIN’s Board stated that “with only 19% of IPv4 address space remaining . . . ARIN is now compelled to advise the Internet community that migration to IPv6 is necessary for any applications that require ongoing availability of contiguous IP number resources.”²³⁹ However, this is not a new phenomenon as the central pool of unissued IPv4 addresses has been shrinking at a clear and increasingly rapid rate for some time.²⁴⁰ In December 2004, there remained 78 “/8 blocks” of sixteen million addresses each.²⁴¹ By December of 2007, this had declined to 42.²⁴² See Figure 1 for an illustration of the central pool devolution. At the time of this writing, it is expected that at the current rate, perhaps by the beginning of 2010, the IANA’s central pool will be exhausted, and sometime in 2011 (or earlier) the RIRs will issue the last of the remaining IPv4 address blocks.²⁴³

238. Press Release, ARIN, ARIN Bd. Advises Internet Cmty. on Migration to IPv6 (May 21, 2007), available at <http://www.arin.net/media/releases/070521-v6-resolution.pdf>.

239. *Id.*

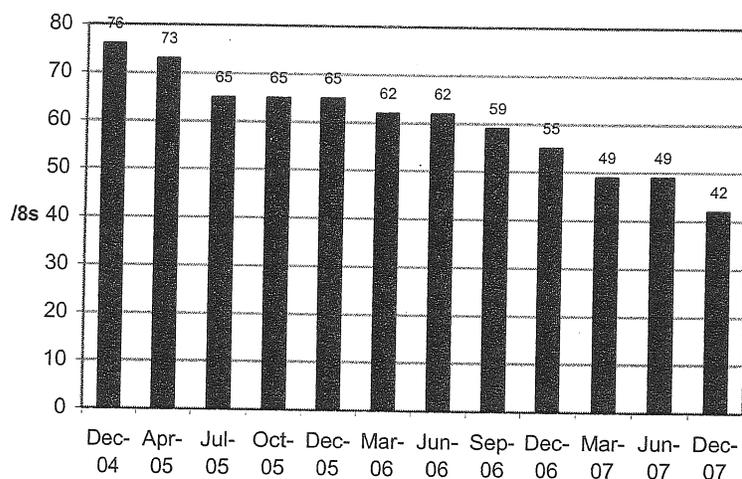
240. See Global IP Addressing Statistics, <http://www.arin.net/statistics/statistics.pdf> (last visited Sept. 30, 2007).

241. *Id.* According to Wikipedia’s definition of Classless Inter-Domain Routing, found at http://en.wikipedia.org/wiki/Classless_Inter-Domain_Routing (last visited Sept. 26, 2007), the “/8” is a CIDR prefix. A very easy way to determine the number of IPv4 addresses in a given CIDR prefix is the following: Given that a single IP address is represented by “/32”, count the difference between a given prefix and “/32” (value is X). Then, do the following mathematical operation: 2^X . The answer represents the number of IPv4 addresses in a given CIDR prefix. A CIDR prefix of /8 represents 16,777,216 IP addresses; /16 represents 65,536 IP addresses; /19 represents 8,192 IP addresses; /20 represents 4,096 IP addresses; /24 represents 256 IP addresses; /32 represents 1 IP address.

242. Global IP Addressing Statistics, *supra* note 240.

243. IPv4 Address Report (Sept. 16, 2007), <http://www.potaroo.net/tools/ipv4/index.html>.

Figure 1. Central Pool Devolution



A possible “run on the bank” effect is likely to further accelerate the rate of IPv4 address depletion. There is nothing like Moore’s Law to provide a technological *deus ex machina* in this case.²⁴⁴ Hypothetically, the development of new technology might delay by months, but is unlikely to again substantially push back for a period of years, the day when there are no more new “virgin” blocks of IPv4 to distribute.

This will lead to a series of difficult issues. It is clear that IPv6 can supplement, and in the long run eventually replace, IPv4, but there are very substantial costs associated with switching from the old system to the new.²⁴⁵ IPv6 adoption is simply not proceeding fast

244. Wikipedia, Moore’s Law, http://en.wikipedia.org/wiki/Moore%27s_law (last visited Oct. 12, 2007). Moore’s Law is named for Gordon E. Moore, a co-founder of Intel, who made the empirical observation in 1965 that the number of transistors on an integrated circuit for minimum component cost doubles every 24 months.

245. See generally 3COM, *supra* note 9. See also U.S. DEPARTMENT OF COMMERCE, TECHNICAL AND ECONOMIC ASSESSMENT OF INTERNET PROTOCOL VERSION 6 (IPV6) 10 (2006), available at <http://www.ntia.doc.gov/ntiahome/ntiageneral/ipv6/final/ipv6final.pdf> [hereinafter Assessment of IPV6]. Those with established IPv4 based networks and services will be required for some period of time to operate in both an IPv4 and IPv6 environment. Any long-term conversion plan from IPv4 to IPv6 will likely be accomplished in stages. For example, initially the enterprise can operate in its IPv4 environment with the addition of IPv6 services such as email and web on its outward facing servers. This may also require the use of a “dual stack” IPv4-IPv6 router and applications. The mid-term stage may require the upgrade of all of the computers, routers, and other devices in the internal infrastructure to operate in an IPv6 environment. The last stage will be phasing out use of IPv4 for public-facing servers. The

enough, and the Internet is already well past the point at which large users should have begun the process of switching without encountering a painful transition.²⁴⁶ Unless action is taken now, a quiet technical crisis will occur, not unlike its more celebrated counterpart, Y2K, but without a fixed date or high level public attention, and possibly without the happy ending.²⁴⁷

An economist would suggest that if you are very cheaply giving away a valuable commodity or service that will run out, a market-type solution would be to immediately increase the price for the service and/or reduce the volume of the number resources provided.²⁴⁸ To date, policy steps to avert the problems are being considered.²⁴⁹ But while prices can be raised rapidly within the existing RIR framework,

conversion activity will require software upgrades of computer systems, firmware upgrades of devices with embedded code, and where necessary the replacement of systems and devices. These devices are surprisingly widespread – home gateways (e.g. wireless routers), XBoxes and similar video game consoles, and Ethernet-connected laser printers (prevalent in many offices). Even many cable modems and DSL modems are likely to need at least upgrades, and in some instances replacement. The resulting equipment costs of conversation will be substantial – possibly including accelerated retirement of existing equipment that is otherwise working. At least as large a challenge is the support costs in making the swaps and upgrades. Overall, the transition to IPv6 is generally more invasive than other prior infrastructure transitions faced by other technologies. For example, expanding a metropolitan area to have another area code does not require upgrading telephone handsets, and adding a new lane to a highway doesn't require upgrading cars. A carefully phased approach to IPv6 transition can ease the challenge of these updates, as a longer update timetable means more devices will be replaced naturally, due to ordinary end-of-useful-life phase-outs. All of these costs and challenges make efficient use of the remaining IPv4 address space all the more important.

246. See 3COM, *supra* note 9; ASSESSMENT OF IPV6, *supra* note 245. IPv6 offers minimal benefits when others aren't using it. So long as others aren't using it, network operators face little incentive to implement it. (To the extent that IPv6 offers benefits even in isolation, these benefits are not widely understood.) In short: There is a chicken-and-egg problem; no network has a strong incentive to move first to implement IPv6 for lack of others to communicate with. (Compare: Who bought the first fax machine?) The natural response here is a strong mandate from a central authority – be it large organizations' rules for suppliers (e.g. DoD contractors), or ARIN rules for IPv4 issuance or renewal.

247. The Y2K problem, as discussed in a CNN article, Carol Clark, *Experts: Sky May Not be Falling, but Prepare for a Storm*, CNN.COM, <http://www.cnn.com/TECH/specials/y2k/stories/overview/> (last visited Oct. 26, 2007), refers to the millennial computer glitch, as a result of computer programs which stored dates using two digits. Thus, the year 2000 would be represented by 00, but would possibly be interpreted by programs as the year 1900. The concern was that essential systems would fail as a result of the changeover. No significant computer failures occurred, but it's not clear whether this was due to the extensive industry preparation made or an overstatement of the problem.

248. See generally Sam Vaknin, *The Misconception of Scarcity*, GLOBAL POLITICIAN, Apr. 10, 2005, <http://www.globalpolitician.com> (follow "United States" hyperlink; then follow "Economics & Trade" hyperlink; then follow "The Misconception of Scarcity" hyperlink); International Society for Complexity, Information, and Design, *Economic Complexity*, http://www.iscid.org/encyclopedia/Economic_Scarcity (last visited Sept. 30, 2007)

249. See generally ASSESSMENT OF IPV6, *supra* note 245

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reducing the volume of numbers issued by reducing the size of the blocks issued, complicates the Internet's routing table and could require more powerful routers or slow the Internet even if more powerful routers are used. This effect is not intuitive for political policymakers.

B. Treatment of Legacy Space

The most important key factual issue that will create legal issues of importance is the expected depletion of new blocks of IPv4 addresses, and the possibility that persons holding large unused or under-utilized blocks of "legacy address" resources will openly seek to sell or transfer them in contravention of Internet community policy. These "legacy address" resources are number resources that were granted to individuals and corporations during the early adopter period of the Internet.²⁵⁰ For example, many recipients may have merely filled out an application as a government contractor and sent it to Professor Jon Postel and obtained resources.²⁵¹ So the question is, who holds these blocks of IPv4 address space issued before ARIN began in December, 1997, and what rights to they have?

Normally, anything provided by a government contractor to a third party like this for use in government role would be considered government-furnished material (GFM) or government-furnished equipment (GFE).²⁵² Stepping aside from equating IP number resources with brooms, mops and tool and die equipment, GFM or GFE must be "returned" when the government contract is concluded.²⁵³ Therefore, any legacy resources provided to government contractors during this period have undoubtedly now been concluded and the resources should be returned to the U.S. Government by normal contractual processes.

Importantly, the United States Department of Defense (DOD) has also agreed to create a process for the return and repatriation of IPv4 resources it no longer needs, and for their return to ARIN for redistribution of these resources to the community as the DOD decides it no longer needs these resources.²⁵⁴ This return process is

250. See generally IANA, Internet Protocol v4 Address Space, <http://www.iana.org/assignments/ipv4-address-space> (last visited Sept. 30, 2007) (listing IPV4 address space to various registries).

251. See Karrenberg et al., *supra* note 70, at 18-19.

252. See Federal Acquisition Regulations System, 48 C.F.R. § 45.101 (2005).

253. See generally *id.*

254. See ARIN, ARIN XIX Members Meeting Notes (Apr. 25, 2007), http://www.arin.net/meetings/minutes/ARIN_XIX/mem_notes.html.

important as a political and legal symbol. The DOD has quite a legitimate claim that it funded much of the development of the Internet and IPv4.²⁵⁵ If any government organization in the U.S. or the world community had a political “right” to assert in keeping such legacy address space to itself, it is the DOD. The DOD has continued the generally wise U.S. Government policy of recognizing the critical role of stewardship of such IP resources, and the important role of non-governmental, non-profit entities such as ARIN.²⁵⁶

But clearly some legacy address recipients were not government contractors, and the GFE/GFM theories arguably don’t apply to them. Individuals, universities and private corporate enterprises who were early adopters of the Internet and who were given such blocks of IP address space are now holding a valuable resource, with different legal constraints on the use of the resource than the rest of the community, which likely has a written agreement with its RIR on the issue. There is no definitive legal decision on the issue.

ARIN is in the unique position to provide guidance to the Internet community regarding any theoretical offer to sell IP resources by an existing ARIN member or a “legacy address” IP holder in the ARIN region. While the *transfer* (not sale) of such resources pursuant to the sale of an operating network is permitted under ARIN’s policies, an offer to “sell,” or attempt to “buy” IP resources, apart from an operating network using such IP resources, is facially inconsistent with all current global and ARIN policies as well as community standards such as RFC 2050.²⁵⁷ RFC 2050 documented the long established and recognized guiding principle, later adopted in ARIN’s Registration Service Agreement, that the right to use IP addresses is not a property right, and thus not subject to transfer.²⁵⁸ A person who contributed to community agreement to RFC 2050 was

255. See generally U.S. DEPARTMENT OF COMMERCE: MANAGEMENT OF INTERNET NAMES AND ADDRESSES, available at http://www.ntia.doc.gov/ntiahomes/domainname/6_5_98dns.htm (last visited Sept. 30, 2007) [hereinafter MANAGEMENT OF THE INTERNET]. ARPANET was developed by the Defense Advanced Research Projects Agency (DARPA). It represented the world’s first operational packet-switched network and is the predecessor of the current Internet.

256. See generally MANAGEMENT OF THE INTERNET, *supra* note 255; Karrenberg et al., *supra* note 70, at 17, 22.

257. See generally Hubbard et al., *supra* note 48.

258. ARIN, Service Agreement, *supra* note 168. ARIN’s current Registration Service Agreement specifically states in Section 9: “9. NO PROPERTY RIGHTS. Applicant acknowledges and agrees that the number resources are not property (real, personal, or intellectual) and that Applicant shall not acquire any property rights in or to any number resources by virtue of this Agreement or otherwise.”

Professor Postel, the same person responsible for provision of legacy resources to the early adopter Internet community.²⁵⁹ Because IP resources have historically been issued based only on demonstrated need and utilization of past issued resources, in conformance with RFC 2050, the offer of such resources for sale essentially demonstrates that the seller has no such operational need for them. Such action will be carefully reviewed in the unlikely event that such entities or persons attempt to gain future resources from ARIN, and it may create a presumption that no need exists. Similarly, any purchaser of such resources held out for sale separate and apart from the sale of an operating network, might also be presumed to be satisfying their IP resource needs through such unauthorized methods. Currently under discussion is how ARIN, or other RIRs, will choose to handle IN-ADDR or WHOIS data related to such transferred assets since they were transferred outside of the community's policies. Proposals discussed have included not continuing to update this associated data, which may have an impact on the usability of those number resources.²⁶⁰

C. Market Considerations?

It is also possible that a black, gray or potentially a lawful market will be created "selling" IP resources in violation of current Internet community policies, or these policies could be theoretically amended to permit such a transfer. The characteristics of such a market have yet to be seriously discussed, are not trivial in their implications, and require serious peer review by trained economists as well as legal and Internet experts. Such a market could, for example, result in delivering "windfall" profits to those who obtained legacy address blocks prior to the formation of the RIRs. The authors do not support such a windfall. In such a market, corporate assets will instantly be more valuable if they have such IP blocks associated with them. The intergovernmental policy implications of the unrestricted commercial transfer of scarce IP resources need to be carefully considered as well. The authors and ARIN are working on evaluating the many problems that could ensue, but are initially skeptical of a financial market alone being the core solution to IPv4 scarcity problems, and totally skeptical of the utility of a market being created

259. See ARIN, Jon Postel Resolution (Oct. 1998) http://www.arin.net/about_us/jon.htm.

260. See ARIN, Policy Proposal 2007-15: Authentication of Legacy Resources, http://www.arin.net/policy/proposals/2007_15.html (last visited Sept. 30, 2007).

outside of the community policy creation mechanisms described in this paper.

Being in favor of or against the emergence of a market for IP addresses is fairly meaningless without additional considerations. Depending on the particular rules for the proposed market, one can get very different outcomes in utilization and routing impact. These relevant considerations include:

- Should a “holder” still have to prove an actual need for the resources to the RIR, or should speculators be permitted to buy and hold resources without need?
- Should the proposed market be intra-RIR-region or inter-region?
- Should the proposed market be intra-country or inter-country?
- Should the IANA/RIR be a party to the market or simply a registrar?
- Should the proposed market be a “multiple use” market or provide for a single allowed sale per block?
- Should the proposed market provide for coordination of complimentary markets (e.g. route entries) or not?
- Should the market comprise a “single seller”, “single buyer”, or multiple buyer (auction)-type market?
- Should legacy space holders be allowed to participate in the proposed market or not?
- Should recent/new space holders (i.e. “yesterday’s assignee”) be allowed to participate or not?

Depending on how the above considerations are dealt with, one could have very different opinions about the desirability or inevitability of a market developing. This is particularly true since almost any market-based proposal would depart from the proven and approved framework of need-based, hierarchical assignment per RFC 2008 and RFC 2050. Thus, determining if a given market model offers a responsible option for administering the IPv4 address space is extremely challenging.

V. CONCLUSION

The authors look forward to a robust policy process review of the policies that would extend the usefulness of the IPv4 address space. However, we believe that any policy proposal that affirmatively departs from the established policy framework of RFC

2008 and RFC 2050, which confirm democratically operated RIR and global policy processes, must be sufficiently detailed in scope to allow a thorough assessment of its merit. Navigating the transition of technology is tough, but creating a totally new legal regime in the middle of this period of shortage is also a daunting challenge. Certain sovereign nations outside the ARIN service region, who have always been more comfortable with a model of government controls of Internet resources, may use the current issues to suggest the abandonment of the technology and need driven policies which currently govern IP resources for a more active set of static controls. We do not support such proposals. It is our hope that this paper will provide resource information for policymakers and lawyers addressing IP number resource issues throughout the world.