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Determining Ownership and Control of IPv4 Addresses

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DETERMINING OWNERSHIP AND CONTROL OF IPv4 ADDRESSES

INTRODUCTION

The creation of the Internet ushered in an era of unprecedented legal challenges as jurists and legislators struggled to keep up with rapidly evolving technology.¹ Chief among these issues is whether certain types of intangible data, specifically Internet Protocol addresses² (IP addresses), can be owned and treated as intangible property. The world has nearly exhausted its supply of unique IPv4 addresses and the property rights of individuals utilizing IPv4 addresses are poorly defined. This area of law has not been subject to robust examination by the US court system. A few recent bankruptcy cases have tangentially reached the issue of whether IP addresses may be owned by private corporations instead of the Regional Internet Registries (RIRs) that administer and maintain the vast amounts of IP numbers.³ The apparent tension is between those RIRs that wish to maintain their exclusive property rights in all IP addresses, and large companies, universities, and other institutions that were assigned IP addresses with very few, if any, contractual limitations and wish to exercise their own property rights in these IP addresses. This Note will seek to explore the modern issues associated with IP address ownership, evaluate the relative merit of all stakeholders' property claims vis-à-vis IP addresses, and recommend possible solutions from other areas of property law, while keeping one eye on future developments and market continuity.

This Note will begin by recounting a concise history of the development of IP addresses, taking time to specifically flag changes in concepts of address ownership and providing basic information on subjects such as RIRs, the Internet Corporation for Assigned Names and Numbers (ICANN). Part I will outline the differences between legacy and non-legacy IP addresses, while noting how those differences potentially affect the property rights bound up in the respective categories. Part I will also explore how different stakeholders view property rights in IP

1. See Matthew Sag, *Copyright and Copy-Reliant Technology*, 103 NW. U. L. REV. 1607, 1607 n.1 (2009) (defining the Internet Age as “the period from 1994 to the present”).

2. See Ryan et al., *Legal and Policy Aspects of Internet Number Resources*, 24 SANTA CLARA COMPUTER & HIGH TECH. L.J. 335, 370 (2008) (An IP address is “a number that identifies the location of a computer on a network. 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.”).

3. See *infra* Part II.

addresses. IPv4 address administration is currently organized as a multi-stakeholder model, and as such, this Note is organized by the views of each major stakeholder in IPv4 technology: the American Registry for Internet Numbers' (ARIN) view, the US Government's view, and the free market view. Part II will discuss the major cases that have shaped the current state of property rights in IP addresses and similar devices such as domain names. Part III will compare the views of the major stakeholders in IP addresses. Part IV will survey the major theories of property law that underlie the current views on IP address property rights. It will explore how different social values—such as transparency, openness, and fairness—impact whether property rights ought to be recognized in IPv4 addresses. Finally, part V will identify and evaluate potential solutions to this complex legal issue. The most likely of the solutions is a judicial recognition of the existing extra-judicial status quo struck between ARIN and IPv4 address traders.

I. A BRIEF HISTORY OF IP ADDRESSES

As with any property issue, a precise definition of the issue is paramount. IP addresses at their basic level are a system of standardized communication protocols that allow computers to send and receive data and route that information to its proper destination.⁴ The current version of IP addresses was developed after three prior versions failed in 1981.⁵ These addresses were known as IPv4 addresses. IPv4 addresses are binary numbers that are typically represented in dotted decimal notation (i.e. 123.45.789.101).⁶ Because of this construction there is a finite number of unique IPv4 addresses, a little over four billion, that can be assigned at a given time.⁷ It is important to note at this juncture that IP addresses do not refer to Domain Name Registrations, which are distinct from IP addresses, but will provide a useful basis for comparison later in this Note.

4. See INFO. SCI. INST., Internet Eng'g Task Force, *DARPA INTERNET PROGRAM PROTOCOL SPECIFICATION 1* (Sept. 1981), <http://www.ietf.org/rfc/rfc791.txt>.

5. See Jonathan B. Postel, Comments on Internet Protocol and TCP, INTERNET EXPERIMENT NOTES No. 2 (Aug. 15, 1977), <http://www.rfc-editor.org/rfc/ien/ien2.txt>; Vinton Cerf, A Proposed New Internet Header Format, INTERNET EXPERIMENT NOTES No. 26 (Feb. 14, 1978), <http://www.rfc-editor.org/ien/ien26.pdf>; Jonathan B. Postel, Draft Internetwork Protocol Specification Version 2, INTERNET EXPERIMENT NOTES No. 28 (Feb. 1978), <https://www.rfc-editor.org/ien/ien28.pdf>.

6. See *IPv4 Addressing*, JUNIPER NETWORKS, <http://www.juniper.net/techpubs/software/junos-es/junos-es93/junos-es-swconfig-interfaces-and-routing/ipv4-addressing.html> (last visited Nov. 17, 2015) (noting that a host may be a network or device that is used to connect to the Internet and that an IP address may vary depending on the scope of the network or type of device).

7. *IPv4 Address Report*, POTAROO.NET, <http://www.potaroo.net/tools/ipv4> (last visited Jan. 19, 2015).

These addresses have served as the primary vehicle for the expansion of the Internet.⁸ For the past two decades, many scholars and network administrators have warned that the world is rapidly approaching the exhaustion of IPv4 addresses, and as such, an alternative needs to be developed.⁹ A group of researchers at the Internet Engineering Task Force (IETF) came up with IPv6 addresses as a solution to the growing scarcity of IPv4 addresses.¹⁰ While these addresses will provide the addressing destinations necessary to facilitate further expansion of the Internet, the transition to IPv6 has been slow and uneven.¹¹ The developing world has been much slower to adopt the technological requirements necessary for the IPv6 transition, meaning that IPv4 addresses are still the primary type of Internet routing numbers.¹²

A. Two Types of IPv4 Addresses: Legacy and Non-Legacy

Long before IPv6 Addresses take the place of IPv4 Addresses, the Internet community will face very real and costly challenges regarding the fate of the IPv4 addresses that were assigned to companies, schools, private individuals, and governments. IPv4 Addresses are treated as two distinct categories of numbers based upon how they were originally distributed: legacy IP addresses and non-legacy IP addresses.

Prior to the formation of the RIRs, legacy IPv4 addresses were assigned by Internet Assigned Numbers Authority (IANA); in the early days of the Internet, these were assigned informally by a single person: John Postel.¹³ For the most part, “these numbers were assigned without contract or use limitations” because they were assigned prior to the formalization of Internet architecture.¹⁴ In many cases, the U.S. government merely processed early applications for government contractors and assigned addresses as requested.¹⁵ IANA directly distributed these early addresses to all sorts of organizations. Unlike non-

8. Ernesto M. Rubi, *The IPv4 Number Crisis: The Question of Property Rights in Legacy and Non-Legacy IPv4 Numbers*, 39 AIPLA Q.J. 477, 479 (2011).

9. See *infra* Part I.C.

10. STEPHEN E. DEERING & ROBERT M. HINDEN, INTERNET ENGINEERING TASK FORCE, *INTERNET PROTOCOL, VERSION 6 (IPv6) SPECIFICATION 3* (Dec. 1995), <http://www.ietf.org/rfc/rfc1883.txt>.

11. See IPv6 Statistics, GOOGLE, <https://www.google.com/intl/en/ipv6/statistics.html#tab=per-country-ipv6-adoption&tab=per-country-ipv6-adoption>. (last visited Jan. 19, 2016).

12. *Id.*

13. VINTON G. CERF, INTERNET ENG'G TASK FORCE, RFC 2468: I REMEMBER IANA 1 (Oct. 17, 1998), <https://tools.ietf.org/rfc/rfc2468.txt> (last visited Sept. 19, 2016).

14. See Rubi, *supra* note 8, at 486–87.

15. See Ryan et. al., *supra* note 2, at 370.

legacy addresses, legacy address-holders did not enter into any binding legal agreement delineating the address-holder's rights in those addresses.¹⁶ This is the defining characteristic of legacy addresses. Legacy addresses constitute approximately 45% of all IPv4 addresses in use.¹⁷ The sheer number of legacy addresses and the fact that the majority of them were assigned in the very early stages of the development of the modern Internet means that significant portions of legacy addresses (organized in large groups called blocks) sit unused and are easily exploited by hackers, spammers, and illegal pornographers.¹⁸ There are strong public policy implications¹⁹ weighing in favor of developing and maintaining a more secure framework for administering and tracking legacy addresses.

Non-legacy IPv4 addresses, as the name suggests, were assigned after the formation of RIRs, and are thus subject to contractual limitations on their transferability and usage.²⁰ Non-legacy IP addresses present fundamentally different legal challenges compared to their legacy counterparts.²¹ As a result of this framework and the relative youth of the Internet, RIRs had a substantial role in establishing early-Internet governance norms surrounding IPv4 addresses.²² What has emerged is a restrictive environment surrounding the third-party transferability, assignment, and usage of both legacy and non-legacy IPv4 addresses.²³

16. Legacy address holders have not agreed to any limitations on their ability to use, transfer, or otherwise maintain their addresses. See Rubi, *supra* note 8, at 486 (quoting MILTON MUELLER ET AL., INTERNET GOVERNANCE PROJECT, DIMENSIONING THE ELEPHANT: AN EMPIRICAL ANALYSIS OF THE IPV4 NUMBER MARKET 1 (Sept. 1, 2012), <http://www.internetgovernance.org/wordpress/wp-content/uploads/IPv4marketTPRC20121.pdf>).

17. See MILTON MUELLER & BRENDEN KUERBIS, INTERNET GOVERNANCE PROJECT, *REGIONAL ADDRESS REGISTRIES, GOVERNANCE AND INTERNET FREEDOM* 1, 5 (Nov. 26, 2008), <http://www.internetgovernance.org/pdf/RIRs-IGP-hyderabad>.

18. *Id.* at 9.

19. With improved tracking and registration services for IP addresses, RIRs would better be able to monitor and report potential dark addresses to law enforcement officials, and RIRs would be better able to understand IP address usage to help improve IP address reclamation procedures.

20. Rubi, *supra* note 8, at 487. In North America, these contracts take the form of ARIN's Registration Services Agreements. Among other things, these agreements set forth the rights (or lack thereof) in IP addresses and detail the services ARIN provides. See Registration Services Agreement, AMERICAN REGISTRY FOR INTERNET NUMBERS, LTD. (Oct. 7, 2015), <https://www.arin.net/resources/agreements/rsa.pdf>.

21. See *supra* note 17, at 11.

22. *Id.*

23. *ARIN at a Glance*, ARIN, https://www.arin.net/about_us/overview.html (last visited Nov. 19, 2016) (ARIN provides an array of services to both its membership and non-members including WHOIS lookup services for IP addresses, free registration services, and monitors IP address traffic.).

B. Regional Internet Registries

To some RIRs are restricting the flow of commerce on the Internet and generally causing problems for the free market. The reality, as is often the case, is much more complex. RIRs, such as ARIN which services North America's IP addresses, play an important role in the policing and maintenance of billions of addresses.²⁴ This Note will focus on ARIN due to its immediate applicability to the US legal system and the representative nature of ARIN's policies compared to most RIRs.²⁵

ARIN is a nonprofit, trade/membership organization based in Washington, D.C. that "provides services related to the technical coordination and management of Internet number resources."²⁶ ARIN is governed by an executive board which is elected by ARIN's membership. The services that ARIN provides fall into one of four categories: registration, organization, policy development, and technical services.²⁷ ARIN routinely holds public meetings for the purposes of engaging in policy discussions and educating about new ARIN services, among other things. Membership is not required to use ARIN's Internet number resources.²⁸

ARIN (along with the other RIRs) maintains that it alone is able to exercise assignment and control rights in IPv4 addresses (and IPv6 for that matter).²⁹ This puts ARIN directly at odds with legacy address holders who possess large blocks of unused IP addresses.³⁰ At best, these legacy addresses represent potentially valuable resources, and at worst, potential liabilities that are costly to maintain.³¹ Interestingly, ARIN has demonstrated a willingness "to modify its contractual arrangements to

24. *Id.*

25. *See generally supra* note 16 (noting how ARIN adopted an IPv4 address transfer policy a few years after other RIRs).

26. *See ARIN at a Glance, supra* note 23.

27. *Id.*

28. *Id.*

29. *See infra* Part III.A.

30. *See* Telephone Interview with Marc Lindsey (J.D., University of North Carolina Chapel Hill Law School; M.S. University of Pennsylvania) & Janine Goodman (J.D. University of Chicago Law School), President and Vice-President, Avenue4, LLC (Jan. 12, 2016) (full recording on file with author). Lindsey and Goodman began one of the first firms to advise clients on IP transfers. This interview focused on the nature of the private market for IPv4 addresses and the mechanics of IPv4 transactions. ARIN's role in policing transactions was discussed at length. Somewhat surprisingly, Mr. Lindsey noted that the private market has existed long enough to develop its own commercial norms, which can be loosely called standardized practices within IPv4 transfers. Additionally, Ms. Goodman noted how their approach to IPv4 advising is just one of many employed by attorneys engaged in IPv4 transactions, and that several approaches can produce results. *Id.*

31. *Id.*

strengthen recipients' property rights in order to keep market participants from abandoning its contractual governance regime."³² ARIN's position is essentially that it is the only organization sufficiently equipped with the expertise and resources to administer IP addresses to the Internet community.³³ ARIN's position is at odds with the views of some IP address stakeholders.³⁴ ARIN has found itself in the middle of various legal disputes recently, arguing against companies who claim to have property rights in legacy IPv4 addresses.³⁵

C. IPv4 Scarcity

Private legacy address holders wish to exercise ownership and control of IP addresses assigned decades ago, while ARIN wishes to retain exclusive ownership and control over these addresses. Recall that at the outset of IPv4 adoption, there were over four billion unique addresses. For some time, scholars have been warning that we are rapidly approaching the end of our unique IPv4 address allocation in North America.³⁶ Some RIRs have exhausted their allocations already.³⁷ Indeed, ARIN exhausted its allocation of IPv4 addresses in July of this year.³⁸ Listening to these sources, the situation seems quite dire.

It turns out that the sky is not falling after all—at least not yet. A keen observer of Internet governance issues will note that the calls to recognize the impending “crisis” have been around for over a decade, and the precise date of exhaustion is a constantly moving target.³⁹ So exactly how serious is the situation? Perhaps the best way to describe it would be a “delayed

32. See MUELLER ET AL., *supra* note 16, at 11.

33. MILTON MUELLER, *ARIN Stumbles Into The Nortel-Microsoft IP Address Deal*, INTERNET GOVERNANCE PROJECT (Apr. 15, 2011), <http://www.internetgovernance.org/2011/04/15/arinstumbles-into-the-nortel-microsoft-ip-address-deal> (last visited Sept. 16, 2015).

34. See *supra* note 8 *passim*.

35. See *infra* Part II.B.

36. See Robert McMillan, *Coming This Summer: U.S. Will Run Out of Internet Addresses*, WALL ST. J. (May 13, 2015), <http://www.wsj.com/articles/coming-this-summer-u-s-will-run-out-of-internet-addresses-1431479401>; James Sanders, *ARIN warns of IPv4 exhaustion in one week*, TECHREPUBLIC (Aug. 4, 2015), <http://www.techrepublic.com/article/ar-in-warns-of-ipv4-exhaustion-in-one-week>.

37. See *IPv4 Address Report*, *supra* note 7. To compare the relative levels of IPv4 addresses that have not yet been assigned refer to “Figure 4 - Address Pools by RIR by State.”

38. Ilijtsch van Beijnum, *It's Official: North America Out of New IPv4 Addresses*, ARS TECHNICA (July 2, 2015), <http://arstechnica.com/information-technology/2015/07/us-exhausts-new-ipv4-addresses-waitlist-begins>.

39. Lee Schlesinger, *Whatever happened to the IPv4 address crisis?*, NETWORKWORLD (Feb. 17, 2014), <http://www.networkworld.com/article/2174297/lan-wan/whatever-happened-to-the-ipv4-address-crisis.html> (discussing the creative engineering moves by ARIN and other RIRs to delay IPv4 exhaustion).

crisis.” ARIN and the other RIRs have developed ingenious ways to stretch the existing supply of IPv4 numbers.⁴⁰ The result has been a decelerated march towards the end of IPv4 address availability.⁴¹ ARIN, while it technically has several thousand in reserve, has all but exhausted its supply of addresses.⁴² However, ARIN’s remaining supply of IPv4 addresses is a tiny fraction of its original allocation.⁴³ In a perfect world, IPv6 adoption would have taken place years prior to IPv4 exhaustion; however, it is the responsibility of individual companies and institutions to make this transition, and some entities have been more proactive than others.⁴⁴ To put the current rate of IPv6 adoption in perspective: from April 5, 2016 to August 23, 2016 the percentage of the top 1,000 websites that are currently reachable over IPv6 increased from 17.9% to 19%.⁴⁵ These facts underscore the acute need for changes to existing IPv4 policies, and the need for the expedited adoption of IPv6 addresses in order to ensure seamless expansion of the Internet.

D. The Market Response

In response to the exhaustion of IPv4 addresses, private markets have popped up to facilitate the purchase, sale, and transfer of IPv4 addresses. Beginning around 2008, various RIRs began recognizing the inevitable reality that IPv4 exhaustion would occur long before IPv6 adoption.⁴⁶ Thus, most RIRs adopted market transfer policies allowing mostly legacy addresses to be sold in private markets.⁴⁷ The caveat is that these sales still have to be registered with the appropriate RIR, and the party purchasing IPv4 Addresses must “demonstrate need” under ARIN’s Section 8.3 transfer policy.⁴⁸ Further, ARIN requires all new purchasers of IPv4

40. *Id.* ARIN has undertaken significant efforts to extend the life of the current IPv4 address pool.

41. *See id.*

42. *See* van Beijnum, *supra* note 38. Interestingly, the precise number of remaining unallocated IPv4 addresses is subject to some dispute. While it is understood that ARIN has some IPv4 addresses held in reserve, most RIRs have already exhausted their allocation of IPv4 addresses. This creates regional supply shortages which complicates the transition to IPv6. *See id.*

43. *See* MUELLER, *ARIN*, *supra* note 33; *see also* *Measurements*, WORLD IPv6 LAUNCH, <http://www.worldipv6launch.org/measurements> (last visited Oct. 23, 2015) (tracking the adoption of IPv6 addresses overall and on a company-by-company basis).

44. *See* *Measurements*, *supra* note 43.

45. *Id.*

46. *About World IPv6 Day*, INTERNET SOC’Y, <http://www.internetsociety.org/ipv6/archive-2011-world-ipv6-day> (last visited Jan. 20, 2016).

47. *See* MUELLER et. al., *Dimensioning the Elephant*, *supra* note 16, at 11; *see also* *infra* note 48.

48. *Transfer Resources*, AMERICAN REGISTRY FOR INTERNET NUMBERS, LTD, <https://www.arin.net/resources/transfers> (last visited Jan. 19, 2016).

addresses to agree to abide by ARIN's terms and conditions, known as the Registration Services Agreement (RSA).⁴⁹ Interestingly, these private markets developed several years before IPv4 exhaustion occurred in North America.⁵⁰ North America has one of the most robust private IPv4 markets in the world.⁵¹ Marc Lindsey and Janine Goodman, two prominent IPv4 attorneys in Washington, D.C., have carved out a niche legal practice advising clients and facilitating the transfer of IPv4 addresses between private parties.⁵²

Legacy addresses constitute the overwhelming majority of private IP address transfers.⁵³ About 6.03 million IP addresses have been transferred in private markets.⁵⁴ 89% (5.36 million) of those transfers involved addresses that are classified as legacy allocations by IANA or their respective RIR.⁵⁵ This is indicative of two things: (1) ARIN's amended RSA still disfavors private transfers of non-legacy IPv4 addresses, and (2) companies and institutions are willing to pay a premium for legacy addresses even though some purchasers could have applied for free non-legacy addresses through ARIN.

II. THE LEGAL CLASSIFICATION OF LEGACY IPV4 ADDRESSES

While the private market responded with speed and vigor to the changing landscape of IPv4 address ownership, the legal status of these property interests has yet to be decisively determined. Even with ARIN's relaxed standards regarding the transfer and sale of legacy addresses, the question remains whether ARIN's imposition of mild restrictions over legacy transfers is lawful. Before attempting to answer that question, it is necessary to review the pertinent case law. The following cases represent the most recent and relevant cases on the issue of whether property rights exist in certain Internet resources; while they seem disparate and disconnected, they are the only U.S. case law on the subject.⁵⁶

49. See Registration Services Agreement, *supra* note 20.

50. Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30 (“[Practitioners viewed IPv4 [addresses] as an asset long before [the] Microsoft [transaction]”).

51. Marc Lindsey & Janine Goodman, *An Insider's guide to the private IPv4 market*, NETWORKWORLD (May 27, 2015), <http://www.networkworld.com/article/2927216/lan-wan/an-insider-s-guide-to-the-private-ipv4-market.html>.

52. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30.

53. MUELLER ET AL., *supra* note 17, at 8.

54. *Id.*

55. *Id.*

56. See Rubi, *supra* note 8 *passim*.

A. *Kremen v. Cohen*

*Kremen*⁵⁷ was the first case of its kind in the United States that delineated property rights in Internet numbers. However, this case did not specifically deal with IPv4 addresses; instead it dealt with domain names.⁵⁸ The court in *Kremen* held that, in the absence of an express contract, a registrar of domain names could not preclude a registrant from assigning a domain name to another party.⁵⁹ Due to the similarities between domain names and IP addresses, this case opened the door for the more recent battle over ownership rights in IPv4 addresses. The district court in *Kremen* did touch on IPv4 address ownership, albeit indirectly, by saying that ARIN can allocate non-legacy numbers and subject the registrant to ARIN's RSA.⁶⁰ However, this did not have any bearing on the state of legacy IPv4 addresses.⁶¹ The implication of the discussion of IPv4 addresses in the district court seems to be that ARIN may only place restrictions on the usage of IPv4 addresses if the end user has agreed to ARIN's RSA.⁶² In turn, this suggests that ARIN cannot exercise control over legacy addresses.⁶³ Other courts have similarly implied that legacy-address holders in fact "own" those numbers.⁶⁴ These decisions are not binding, and thus more clarification is needed.

B. *In Re Nortel Networks*⁶⁵

*Nortel*⁶⁶ involved a successful attempt by Nortel Networks Incorporated (NNI) to sell several blocks of IPv4 numbers to Microsoft

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

58. *Id.* at 1029.

59. *Id.*

60. See Rubi, *supra* note 8, at 490 (Rubi points out that this is dicta from the district court, legacy addresses were not discussed in the 9th Circuit opinion).

61. See Declaration of Raymond A. Plzak in Support of Motion to Clarify/Modify at 5, *Kremen v. Cohen*, 337 F.3d 1024 (9th Cir. 2003) (stating that as to "'legacy' [addresses] issued . . . before ARIN began, ARIN has never had an agreement . . . that would give it authority over those specific resources").

62. See *Kremen*, 337 F.3d at 1029 (assertion generally follows from *Kremen*'s discussion of contract limitations in domain name space).

63. This assertion is based on an expansive reading of *Kremen* and is not recognized by any U.S. court.

64. *Chism v. Washington*, 683 F. Supp. 2d 1145, 1148 (E.D. Wash. 2010), *rev'd sub nom.* *Chism v. Washington State*, 655 F.3d 1106 (9th Cir. 2011), *withdrawn from bound volume* and *rev'd and remanded*, 661 F.3d 380 (9th Cir. 2011) ("The IP address (68.113.11.49) was owned by Charter Communications.").

65. *In re Nortel Networks Inc.*, No. 09BK10138, 2011 WL 1560720 (Bankr. D. Del. Mar. 21, 2011).

66. For a thorough description of *In re Nortel Networks* and its impact, see Rubi at 501–505.

Corporation (Microsoft) as part of its bankruptcy estate.⁶⁷ Nortel attempted to sell these IPv4 assets by retaining a broker to help identify potential purchasers, Microsoft submitted the highest bid.⁶⁸ This case attracted the attention of many interested third parties, including the Canadian government *and* ARIN.⁶⁹ Ultimately, the court approved the sale, in large part because Nortel's IP addresses were legacy addresses, and because ARIN intervened and negotiated a Legacy Registration Services Agreement (LRSA) with Microsoft prior to the entry of the order approving the sale.⁷⁰ *Nortel* is especially important considering it opened the floodgates to large corporate transfers of legacy IPv4 addresses.⁷¹ This paradigm of Internet number property rights is echoed in subsequent large company bankruptcy proceedings.⁷²

The key question *Nortel* presents is whether ARIN's intervention in the bankruptcy proceedings were necessary for the court's eventual approval of the sale of IPv4 numbers.⁷³ In one of the earliest comments on the subject, Ernesto Rubi argues that ARIN's involvement in the transaction and the subsequent Microsoft-ARIN LRSA were merely incidental to the court's approval of the sale.⁷⁴ However, three facts weigh heavily against such a reading. First, NNI submitted an additional brief in support of the proposed sale in order to inform the court that Microsoft had agreed to enter into an LRSA with ARIN prior to the approval of the sale, and to state that "neither ARIN nor the Internet Corporation for Assigned

67. *See generally In re Nortel Networks Inc.*

68. *See* Rubi at 502.

69. *See* Brief in Support of Motion to Approve Sale of Internet Numbers, *In re Nortel Networks Inc.* (Bankr. D. Del.) (No. 09-10138), 2011 WL 7403924 (Assistant Deputy Minister, Strategic Policy Sector of the Department of Industry, a department of the Government of Canada's brief in support); *see* Order (I) Authorizing and Approving the Sale of Internet Numbers Free and Clear of All Liens, Claims, Encumbrances and Interests; (II) Authorizing and Approving Entry Into A Purchase and Sale Agreement; (III) Authorizing the Filing of Certain Documents Under Seal; and (IV) Granting Related Relief, *In re Nortel Networks Corp.* at 4, 426 B.R. 84 (Bankr. D. Del. 2010) (No. 09-10138) (hereinafter "Order Authorizing and Approving Sale").

70. Order Authorizing and Approving the Sale, at 8 ("For the avoidance of doubt, the Order shall not affect the LRSA and the purchaser's rights in the Internet Numbers transferred pursuant to this Order shall be subject to the terms of the LRSA.").

71. *Cf. ARIN at a Glance*, *supra* note 23. Goodman and Lindsey contend that *Nortel* was merely recognition of existing beliefs within Internet technology firms. While they agree that *Nortel* is the first instance of any U.S. court recognizing a private right to transfer IPv4 addresses, they assert that private market transfers of IPv4 addresses took place before *Nortel* was decided. *See* Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 31.

72. *See infra* Part II.C.

73. *See* Rubi at 504-05.

74. *Id.*

Names and Numbers oppose[d] the transaction....”⁷⁵ Second, the Amended Purchase and Sale Agreement includes explicit language in the definition of the term “Sale Order” stating that “ARIN and Purchaser have entered into the LRSA and that no other Consents are required”, which suggests the parties viewed ARIN’s LRSA as a consent necessary to the transaction.⁷⁶ And third, the final order approving the sale contains explicit language that the Order shall be subject to the terms of the LRSA.⁷⁷ These facts demonstrate an intent by both NNI and Microsoft to comply with ARIN’s LRSA and thus to acknowledge the centrality of ARIN to the ongoing administration of IPv4 Numbers.⁷⁸

C. *In Re Borders and In Re Teknowledge*

Two additional bankruptcy cases have helped solidify the contention that legacy IPv4 addresses are transferable between private parties. Both *In Re Borders*⁷⁹ and *In Re Teknowledge*⁸⁰ involved courts approving the sale of legacy IPv4 addresses as part of larger bankruptcy proceedings. These cases represent an important shift because not only are they geographically diverse, but they also involve diverse types of businesses.⁸¹ This suggests that there is no technical knowledge barrier to the proper sale and transfer of IPv4 assets.⁸² Additionally, some of these cases help determine the value of legacy addresses at somewhere between \$9.00 and

75. Debtors’ Reply in Further Support of Their Motion for Authorization and Approval of the Sale of Internet Numbers Free and Clear of All Liens, Claims, Encumbrances and Interests, *In re Nortel Networks Inc.* (Bankr. D. Del.) (No. 09-10138), 2011 WL 7403924.

76. Amended and Restated Asset Sale Agreement by Nortel Networks Inc. and Microsoft Corporation, April 13, 2011 at 5, <http://www.internetgovernance.org/wordpress/wp-content/uploads/NNI-MSFT-ipsale.pdf>.

77. *See supra* note 70.

78. *Cf. Rubi* at 504–05.

79. *In re Borders Grp., Inc.*, No. 11–10614 MG, 2011 WL 5520261, at *1 (Bankr. S.D.N.Y. Sept. 27, 2011), http://www.internetgovernance.org/wordpress/wp-content/uploads/Bankr.S.D.N.Y._-2233_merged.pdf (authorized the bankruptcy trustee to sell IPv4 resources on behalf of the debtor).

80. *In re Teknowledge Corp.*, No.10-60457, at *1 (not reported) (Bankr. N.D. Cal. 2012), http://www.internetgovernance.org/wordpress/wp-content/uploads/Bankr.N.D.Cal._-034022138232.pdf (authorized sale of IPv4 addresses for \$590,000).

81. *See, e.g., Kremen*, 337 F.3d at 1029; *see also supra* notes 79 and 80.

82. Essentially the fact that IP address ownership cases have come from companies of all types and sizes indicates that there is not a substantial amount of technical knowledge required to vindicate property rights in IP addresses.

\$12.00 per address.⁸³ The private market for these addresses places significant, yet highly variable, monetary value on these addresses.⁸⁴

Perhaps most impactful, however, was the private sale of legacy addresses from Merck Pharmaceutical to Amazon, Inc. in 2012.⁸⁵ Completed outside of bankruptcy proceedings, this transaction suggests increasing confidence in the private legacy IPv4 market.⁸⁶ That two major companies were willing to pursue a deal of this size was a watershed moment for the private IPv4 market.⁸⁷ Taken together, these independent sales underscore the value of legacy addresses in private markets, the willingness of legacy address holders to circumvent ARIN, and the limited acceptance of some courts as to the merit of the idea that legacy addresses contain *de facto* property rights.

III. PROPERTY RIGHTS IN INTERNET NUMBERS

Recent court rulings have moved the law of private ownership of legacy IPv4 addresses into relative uncertainty.⁸⁸ To get a glimpse of the multi-layered interests at stake in this issue, there were dozens of third-party briefs filed in the Microsoft-Nortel dispute both in support and in opposition.⁸⁹ Those entities that have signed ARIN's LRSA are contractually bound to follow ARIN policies, but what about those legacy address holders with no such contract? Viewed one way, ARIN is providing invaluable, free resources to all members of its geographic community that are inherently necessary to the continued operation and expansion of the Internet.⁹⁰ The provision of these services may create an implied contract that may bind legacy holders without a formal contract to

83. See *In re Nortel Networks Inc.*, No. 09BK10138, 2011 WL 1560720, at *1, *5–6 (Bankr. D. Del. Mar. 21, 2011) (purchase price of \$7.5 million for 666,624 addresses); see also *In re Borders Grp.*, 2011 WL 5520261, at *6; *In re Teknowledge Corp.*, No.10-60457, at *2 (purchase price of \$590,000 for 65,636 addresses).

84. MILTON MUELLER, INTERNET GOVERNANCE PROJECT, SCARCITY IN IP ADDRESSES: IPV4 ADDRESS TRANSFER MARKETS AND THE REGIONAL INTERNET ADDRESS REGISTRIES 1, 8–9 (July 20, 2008), http://www.internetgovernance.org/wordpress/wp-content/uploads/IPAddress_TransferMarkets.pdf.

85. *Id.* at 8. (“In 1992 [Merck] was given a /8 (16.78 million numbers). From that original allocation, it sold to Amazon two /12s (roughly 2.1 million numbers) early in 2012.”). In this context, “/8” refers to one eighth of a block of IP addresses.

86. See also Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30 (“In terms of viewing IPv4 as an asset, Microsoft-Nortel was one manifestation of that.”).

87. Unfortunately, due to the private nature of the sale, the exact price of the IPv4 addresses is unknown to the public. MUELLER ET AL., *supra* note 16, at 9.

88. See *supra* Part II.A–C.

89. See, e.g., *supra* note 69 and accompanying text.

90. See *ARIN at a Glance*, *supra* note 23.

follow ARIN's policies.⁹¹ Viewed another way, legacy address holders are the owners of valuable property; while ARIN, a non-governmental body, is attempting to impose transfer and usage restrictions on these addresses without consent.⁹² Alternatively, IPv4 addresses could be viewed as containing sensitive personal information that must be protected in some fashion from surveillance or theft. These stakeholders hold separate views on the best way to administer IPv4 address space, and each view requires further scrutiny.

A. Stakeholder One: ARIN

ARIN's position is relatively straightforward: ARIN provides a number of free services to those who use IPv4 addresses in its geographic service region, and all it asks in return is that users abide by the RSA.⁹³ Since the private market for IPv4 addresses has sprung up, ARIN has been surprisingly responsive, despite the fact that the existence of any private transfer market decreases the influence ARIN is able to exert over the entire pool of IPv4 addresses.⁹⁴ ARIN remains the largest stakeholder in any debate over ownership of IPv4 addresses, and as such will be necessarily involved in any major change to the legal footing of IPv4 ownership.⁹⁵

From a practical perspective, ARIN and the other RIRs still are able to exercise considerable influence on the private market for IPv4 addresses.⁹⁶ While some of the notable IPv4 transfers took place without the acquiescence of an RIR, some RIRs have shown a willingness to amend their IPv4 transfer policies in light of the growing need to liberalize the market for IP addresses.⁹⁷ The majority of RIRs around the world have

91. Cf. Rubi, *supra* note 8 at 494 (Some courts have called contracts such as ARIN's LRSA and RSA "illusory contract[s]" because they can be modified or revoked without notice or consent.).

92. See *id.* at 502 (summarizing the order issued in *Nortel* which recognized property interests in legacy IP numbers).

93. *ARIN at a Glance supra* note 23. It should be noted that because this is ARIN's corporate website, it is likely to cast information in a light favorable to ARIN and its policies.

94. See Understanding Legacy Registration Services Agreement (LRSA) Ver 3.0, https://www.arin.net/resources/legacy/understanding_lr3.html (last visited Jan. 19, 2016) (ARIN describes this document as "the first truly fundamental rewrite to the LRSA..." It was passed after considerable debate within ARIN's membership regarding what to do about legacy addresses.).

95. ARIN is necessarily the largest stakeholder due to the sheer number of IPv4 addresses in ARIN's registry that are subject to their RSA. This gives them an enormous amount of influence over topics beyond IP resource management, including broader topics of Internet governance. ARIN's influence cannot be overstated.

96. See, e.g., Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30 ("For large buyers and sellers, registering transfers typically has more positives than negatives.").

97. *Id.*

adopted less restrictive transfer policies.⁹⁸ In the case of LACNIC and AFRINIC, the lack of transfer policy is not necessarily a bar to private market transfers.⁹⁹

Though it is an encouraging step that some RIRs demonstrated flexibility and a willingness to embrace a position they had once vehemently opposed, this further underscores the custom-based nature of the current IPv4 system.¹⁰⁰ It is unclear whether this type of ad-hoc decision-making will be a net benefit to the operation of the current system of Internet governance.¹⁰¹

In fairness, ARIN maintains robust public reporting and transparency procedures in connection with their administration of the pool of IPv4 addresses.¹⁰² ARIN has advocated good faith positions that promote an equitable system of Internet number assignment.¹⁰³ The fact that ARIN explicitly states that it will not inquire into the terms of private market transfers¹⁰⁴ seems to support the image of ARIN as a responsible Internet watchman attempting to regulate aspects of the Internet without regard for its own bottom line. ARIN may be the only entity with the resources to do so effectively, which raises some eyebrows.

B. Stakeholder Two: Government Agencies

The precise view of various governments operating within the purview of ARIN is difficult to define. Governments often have competing interests in these areas that are borne out across complex relationships between regulators and politicians. However, there is some limited information regarding the position of the United States Department of Commerce¹⁰⁵ and the position of the Canadian government under previous Prime Minister Stephen Harper.¹⁰⁶

98. See MUELLER ET AL., *supra* note 16, at 3; see also *New Policy Implemented (Transfers)*, ARIN, https://www.arin.net/vault/announcements/2009/20090601_nrpm.html (last visited Jan 19, 2016).

99. For a detailed explanation of RIR transfer policy adoption, see MUELLER ET AL., *supra* note 84, at 3.

100. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30 (“ARIN was asking companies to voluntarily return [IPv4] addresses.”).

101. This statement necessarily requires a broad-based discussion of exactly what are the chief goals of Internet governance (e.g., security, open source development, equality of access).

102. MUELLER ET AL., *supra* note 17, at 6.

103. See generally Rubi, *supra* note 8.

104. See *New Policy Implemented (Transfer)*, *supra* note 98.

105. Lawrence E. Strickling, *United States Government’s Internet Protocol Numbering Principles*, NTIA BLOG (Dec. 3, 2012), <https://www.ntia.doc.gov/blogs>.

106. See Brief in Support of Motion to Approve Sale of Internet Numbers, *supra* note 69, at 1.

The United States Department of Commerce (DOC) has consistently advocated for a multi-stakeholder approach in dealing with issues related to IP resources.¹⁰⁷ More pertinently, the DOC strongly advocates for the supremacy of the RIRs, specifically ARIN's continued importance to the overall structure of modern Internet governance.¹⁰⁸

In connection with the Nortel Networks bankruptcy with Microsoft, the Strategic Policy Sector of the Department of Industry of Canada filed a brief in opposition to the sale of Internet numbers by Nortel Networks.¹⁰⁹ In that motion, the Canadian government argued that legacy IPv4 addresses were not protectable property, stating that “[i]t is our view that Internet Numbers never became the property of the persons who were authorised [sic] to use them, nor were they ever free of the conditions governing their use.”¹¹⁰ This is a fascinating position to come from a governmental source. It suggests that the Canadian government is content with a foreign corporation being the sole clearinghouse for Internet numbers.¹¹¹ Ultimately the position of the Canadian government had little effect on the eventual sale of addresses to Microsoft, however their disclaiming of any property rights in IPv4 addresses hints at a possible solution.

Taken together, these position statements illustrate the entrenched nature of RIRs to the administration of the Internet. The effect of these policies being in lockstep with one another is that any sort of institutional reform originating in the government will be very difficult to achieve without significant paradigm shifts from American and Canadian policy-makers.

If the erosion of ARIN's capacity to effectively regulate and control Internet numbers is the greatest concern going forward,¹¹² then it is easy to see why the Canadian government takes the position that no property rights can exist in IPv4 addresses. In their view, ensuring that ARIN can control as many aspects of the IP address pool as possible, ARIN is making the continued expansion of the Internet simultaneously more

107. See Strickling, *supra* note 105.

108. *Id.*

109. See Brief in Support of Motion to Approve Sale of Internet Numbers, *supra* note 69, at 1.

110. *Id.*

111. For the U.S. government, this is less troubling because ARIN operates on an explicit grant of authority from the Dept. of Commerce. Management of Internet Names and Addresses, 63 Fed. Reg. 31, 741–43 (June 10, 1998).

112. There is a value judgment implicit in this statement. If Internet security is less important than, say, transparency on the Internet, then there is a strong argument to be made that other issues are paramount.

secure and more equitable. The view is straightforward: The Internet has been a cooperative endeavor since the beginning, and the idea that the pathways upon which our Internet relies can be bought and sold is antithetical to a free, open, and equal Internet.

Further, there are major implications for law enforcement. If unrestricted private sales are authorized, it could lead to an increase in the amount of unregistered IPv4 addresses.¹¹³ These unregistered IPv4 addresses would not be able to be paired with their corresponding owner, which would hamper law enforcement officials attempting to shut down pornographers, scammers, identity thieves, etc.¹¹⁴ These unregistered IP addresses, or “black numbers,” would effectively “mask the activities and identities of the perpetrators of such activities.”¹¹⁵ The potential for abuse is great here. Due to the recent formalization of private market transfers under ARIN’s 2009 policy, which requires private market transfers to meet certain criteria, the magnitude of such activities is difficult to determine.¹¹⁶

Of course, the preceding paragraphs are merely one of many ways to view the positions of the United States and Canadian governments. Viewed more skeptically, one begins to get a sense that the underlying motivations for governments in advocating centralized control of Internet architecture is to make digital surveillance easier and more cost effective.¹¹⁷ Individual privacy has been conspicuously absent from our discussion until now. However, when talking about IP addresses, individual privacy is a very real concern.¹¹⁸ Not all IP addresses implicate personal privacy concerns, though. Only a portion of IP addresses are linked to personally identifiable information, which minimizes the problem.¹¹⁹ Some scholars have suggested that IP addresses should be

113. Cf. Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30. Under these views both unrestricted private market transfers and unduly restricted private market transfers can cause legacy address holders to forego registration with ARIN and other RIRs, suggesting a balance must be reached between the two extreme positions.

114. *Id.*

115. See Brief in Support of Motion to Approve Sale of Internet Numbers, *supra* note 69, at 2.

116. See chart *infra* note 126.

117. Symposium, Balancing Expectations of Online Privacy: Why Internet Protocol (IP) Addresses Should Be Protected as Personally Identifiable Information. 60 DEPAUL L. REV. 895, 895–96 (2011).

118. See James X. Dempsey, *Digital Search & Seizure: Standards for Government Access to Communications and Associated Data*, in 2 TENTH ANNUAL INSTITUTE ON PRIVACY DATA SECURITY LAW. 687, 702–03 (2009) (stating that privacy in IP addresses is a real concern because law enforcement routinely serve subpoenas to Internet Service Providers to unmask online speakers and ISPs will rarely fight these subpoenas).

119. See Symposium, *supra* note 117, at 900.

protected as personally identifiable information.¹²⁰ This is to say that we should be rightly skeptical of any government arguments for centralized control of the Internet architecture, especially in the age of Edward Snowden and rampant NSA surveillance.¹²¹ Whether those privacy concerns are persuasive enough to upend the current model of Internet governance is unclear.

C. Stakeholder Three: Private Market Actors in IPv4 Space

“[IPv4] transactions need to be more efficient.” That statement encapsulates the view of Lindsey and Goodman.¹²² Those entities that wish to have greater freedom and control over their IP address resources certainly advocate for fewer restrictions on how they can transfer or sell their addresses.¹²³ However, varying levels of sophistication and motivation have kept some companies from aggressively pursuing private market transfers, even in light of ARIN’s amended policy.¹²⁴ Certain legal practitioners have already created robust practices centered on Internet number transactions.¹²⁵ While only a few attorneys have jumped into the fray to participate in this exciting new type of transactional law, the number of transactions has been increasing rapidly.¹²⁶ Without precise numbers, it is difficult to estimate the relative size of private-market transfers today; however, since ARIN almost exhausted its unallocated IPv4 numbers in the summer of 2015, it is likely that private-market

120. *Id.* at 899.

121. See generally *ACLU v. Clapper*, 785 F.3d 787 (2d Cir. 2015) (holding that the bulk of the NSA’s data collection program is unconstitutional).

122. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30 (“There is actually a model for a market with more efficient transactions, RIPE. Around the time that IPv4 were exhausted, RIPE determined that accuracy of the registry was the most important goal and so they relaxed their transfer policies...APNIC and RIPE have systems designed to encourage transfer and registration with the RIRs.”).

123. *Id.*

124. *Id.*

125. See Lindsey & Goodman, *supra* note 30.

126. See MUELLER ET AL., *supra* note 16, at 7 tbl.3.

	2009	2010	2011	1st half 2012
IP numbers allocation by ARIN	41,317,376	45,266,688	22,471,424	16,077,056
IP numbers transferred via market in ARIN region	11,264	8,192	823,296	4,221,184
Percent allocated via market	0.03%	0.02%	3.66%	26.26%

transfers now account for close to one hundred percent of all new owners of IPv4 addresses.¹²⁷

This has potentially harmful implications. What now exists is essentially a temporal doughnut hole for access to free IP addresses.¹²⁸ If the only available IP addresses must be purchased, a new barrier to entry on the Internet has thus been created. A new business that needs several hundred IP addresses before they can begin operations has two choices: 1) spend considerable time and effort to migrate to IPv6 and hope that IPv6 addresses are available and are supported by your ISP, or 2) enter the private market for IPv4 addresses to purchase addresses according to the business's needs.¹²⁹ Neither option is an attractive one when considering that a few years prior, those addresses could have been procured free of charge from ARIN in exchange for signing the RSA.¹³⁰ Somewhat counter-intuitively, in the rush to legitimize a private market for IPv4 resources, access may have actually become more restricted.

Consider the hypothetical situation where bankruptcy courts refused to approve the sale of IPv4 numbers in any case. In that instance, ARIN would be forced to attempt to reclaim unused IPv4 addresses from mostly non-legacy holders, as their rights are less robust than legacy holders, and attempt to redistribute them based on the "demonstrated need" of new applicants.¹³¹ At least in this hypothetical, everyone is equally restricted from obtaining new IPv4 resources at will, whereas in the current situation those with the most resources are in the best position to obtain new addresses and use them.¹³² Further, it is possible that disallowing private-market transfers of IPv4 addresses would actually hasten the transition to IPv6.

Regarding whether property rights exist within legacy IPv4 addresses, the private market has resoundingly answered: it doesn't matter.¹³³ What has occurred is a broad recognition of a thing of value: unique Internet

127. *IPv4 Address Report*, *supra* note 7.

128. See van Beijnum, *supra* note 38; see also *IPv6 Statistics*, *supra* note 11.

129. See Rubi, *supra* note 8, at 485.

130. See Registration Services Agreement, *supra* note 20.

131. *Draft Policy ARIN-2015-7: Simplified requirements for demonstrated need for IPv4 transfers*, AM. REGISTRY FOR INTERNET NOS., <http://lists.arin.net/pipermail/arin-ppml/2015-June/030130.html> (last visited Jan. 19, 2016) (showing that ARIN in mid-2015 relaxed their 24 month "demonstrated need" showing in light of the increased volume of private transfers).

132. IPv4 scarcity together with the existence of the private market means that potential market entrants are forced to buy from private address holders rather than receive free addresses from ARIN.

133. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30 ("Microsoft-Nortel was a recognition that this had value, not the beginning of the idea, this was merely the formalization of the mechanism to buy/sell IPv4 addresses.").

addresses. This recognition was followed by the creation of standardized practices for buying and selling IPv4 legacy addresses via asset purchase agreements.¹³⁴ These developments point out the robust nature of private transactions and many firms' frustration with dealing with ARIN

There are limitations to this analysis, of course. Not all free market practitioners will have identical views on the development of IPv4 markets.¹³⁵ There are some practitioners who may look at it as a necessary evil that must be tolerated until IPv6 is fully supported. It is important to note that this is likely a temporary problem.¹³⁶ The eventual transition to IPv6 architecture should mitigate some of inequalities that will develop through the operation of a private market, although a gap between developed countries and developing countries will likely persist.¹³⁷

IV. SCOPE OF PROPERTY RIGHTS IN IPv4 LEGACY ADDRESSES

John Locke's labor theory of property states that an individual has "a property [right] in [her] own person" and in "[t]he labor of [her] body."¹³⁸

Whatsoever then he removes out of the State that Nature hath provided, and left it in, he hath mixed his Labour with, and joyned to it something that is his own, and thereby makes it his Property. It being removed from the common state Nature placed it in, it hath by this labour something annexed to it, that excludes the common right of other Men.¹³⁹

In applying Locke's view of labor theory to IPv4 addresses, there is a clear implication that natural law supports the recognition of some rights in the property.¹⁴⁰ IPv4 address holders expend resources ensuring that their

134. *Id.* More importantly, the IPv4 legacy transaction norms and customs typically include registration with ARIN or an RIR that allows for retention of legacy status for subsequent purchasers. This supports the idea that barriers to registration emanate from RIRs, not the free market. *See id.*

135. *Id.*

136. *See IPv4 Address Report, supra* note 7. Not to mention the fact that this will cause very immediate problems for developing countries and new businesses without the capital to buy existing IPv4 addresses.

137. *See Rubi, supra* note 8, at 487.

138. Sudakshina Sen, *Fluency of the Flesh: Perils of an Expanding Right of Publicity*, 59 ALB. L. REV. 739, 739-40 (1995) (quoting JOHN LOCKE, *THE SECOND TREATISE OF GOVERNMENT* 16-30 (Thomas P. Peardon ed., 1952)).

139. JOHN LOCKE, *TWO TREATISES OF GOVERNMENT* 306 (Peter Laslett ed., Cambridge Univ. Press 1967) (1698).

140. *See id.*

Internet numbers are not being used for nefarious purposes.¹⁴¹ However, ARIN too expends considerable resources maintaining the pool of IPv4 addresses, providing free WHOIS services, as well as reverse address lookup to determine the identity of the actual users and licensees of IPv4 addresses.¹⁴² Ultimately, natural law reflects an idea that those who expend effort and labor should have a recognized property right as a result of the value of that labor.¹⁴³ In this instance, the efforts of ARIN to maintain its database are directly linked to the value of unique blocks of IPv4 addresses.¹⁴⁴ Under Locke's theory of property rights, the end user and registrant of IPv4 addresses should jointly hold some property rights in IPv4 addresses.¹⁴⁵

To address whether holders of IPv4 legacy addresses have protectable property rights, several comparisons need to be made, the first of which is between non-vanity and vanity telephone numbers.¹⁴⁶ The FCC rules do not recognize property rights in a subscriber's underlying phone number.¹⁴⁷ Courts have used two approaches to determine the extent of subscriber rights in phone numbers:

Under the first approach, courts use the law of contracts to determine a subscriber's rights . . . [u]nder the second approach, courts view vanity telephone numbers as a form of intellectual property that is protected from trademark infringement and unfair competition under both state common law and the federal Lanham Trademark Act.¹⁴⁸

This approach is instructive in terms of the factual comparison to IPv4 legacy addresses, and also cognizant of the personally identifiable information critique.¹⁴⁹ Courts have looked to the FCC regulations disclaiming any property rights in phone numbers as dispositive of the issue.¹⁵⁰ There exist no such regulations in IPv4 addresses.¹⁵¹ It is

141. This will be even more accurate due to the capital and technical requirements of IPv6 architecture. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30.

142. See *ARIN at a Glance*, *supra* note 23.

143. See *supra* note 139 and accompanying text.

144. See Ryan et. al., *supra* note 2, at 344.

145. See *supra* notes 138–41 and accompanying text.

146. Vanity phone numbers are numbers such as 1-800-FLOWERS, whereas non-vanity numbers are residential telephone numbers.

147. *In re Toll Free Service Access Codes*, Notice of Proposed Rulemaking, FCC (Oct. 5, 1995), http://www.fcc.gov/Bureaus/Common_Carrier/Notices/1995/fcc95419.html [hereinafter Notice of Proposed Rulemaking].

148. Susan Eisenberg, Note, *Intangible Takings*, 60 VAND. L. REV. 667, 676 (2007).

149. See Symposium, *supra* note 117.

150. See Eisenberg, *supra* note 148, at 676.

important to note though that in addition to not recognizing any property interests for subscribers' phone numbers, the FCC prohibits the transfer of phone numbers between subscribers.¹⁵² Arguing by analogy, it would be difficult to see how one could argue for robust property rights in non-legacy IPv4 addresses within the paradigm of phone numbers.

This analysis, while helpful, is not directly applicable to our question. There are many differences between how IP addresses and telephone numbers are governed. Most notably, there is not an agency comparable to the FCC that places restrictions on ownership and transfer of IP addresses. Perhaps the most interesting comparison is whether vanity phone numbers are comparable to legacy IPv4 addresses. For vanity numbers, "[t]rademark law ignores the underlying number and instead protects the mnemonic spelled out in the vanity number."¹⁵³ This captures the fundamental similarity between legacy IPv4 addresses and vanity numbers. There is an underlying distinguishing feature about legacy addresses, since many contain personally identifiable information, and all are subject to less restrictive regulations by ARIN due to the lack of RSA.¹⁵⁴ Trademark infringement cannot be invoked unless actual consumer confusion is shown.¹⁵⁵ These expanded rights due to lack of a contract with ARIN do not implicate any consumer confusion. Some have noted that this produces incongruous law and fails to adequately protect the holders of entity locator rights (e.g., IP addresses, phone numbers, etc.).¹⁵⁶

In the late 1990s, the National Science Foundation (NSF), in concert with the Department of Commerce, issued a series of decisions, which divided the regulatory roles of Internet governance between non-profit entities and government agencies.¹⁵⁷ In doing so, the NSF took care to separate domain names administration from IP address resource administration.¹⁵⁸ NSF General Counsel Lawrence Rudolph, who has been

151. See Rubi, *supra* note 8 *passim*.

152. Eisenberg, *supra* note 148, at 677.

153. *Id.* at 679.

154. This final characteristic is what imbues legacy IPv4 addresses with their value. The activity of the private market has demonstrated that these addresses are more valuable than non-legacy addresses available from ARIN. Based on this, it can be said with certainty that legacy IPv4 addresses are sufficiently similar to vanity phone numbers to argue by analogy.

155. Eisenberg, *supra* note 148, at 680.

156. *Id.* at 681.

157. *Brief History of the Domain Name System*, HARVARD UNIV. (Sept. 21, 2016), <http://cyber.law.harvard.edu/icann/pressingissues2000/briefingbook/dnshistory.html> (last visited Jan 18, 2016).

158. See *supra* note 105.

in that position since 1995, reviewed the applicable law and gave the following statement on whether IPv4 addresses can be owned:

NSF transferred a ‘thing of value’ to the awardee under the NSF-NSI Cooperative Agreement, and that awardee in turn gave it to you. ...we [NSF] know of no provision under the Cooperative Agreement which would have authorized the awardee (NSI) to unilaterally reclaim IPv4 number blocks, once distributed. The NSF has never had a cooperative agreement, or any other agreement, with ARIN or any other similarly situated entity. In short, NSF does not believe that ARIN, or for that matter any other organization, could retroactively affect property and rights distributed to you (or any other recipient) by awardee NSI under its Cooperative Agreement with the National Science Foundation.¹⁵⁹

This assertion by Rudolph is interesting on several fronts. The opinion is unique in that it is given by one of the earliest actors in Internet governance who was present during the creation of the modern Domain Name System.¹⁶⁰ The origins of the statement and the qualifications of Rudolph together suggest that the “original intent” of the architects of the current Internet Governance regime was to allow IPv4 address ownership rights to be held by end users, not RIRs.¹⁶¹ If this view is persuasive to future policy makers and jurists, ARIN could face far greater challenges in connection with its policies towards legacy address holders.

As explained above, there are at least three different ways to recognize property rights for end users of legacy IPv4 addresses. The first is Locke’s theory of natural property rights.¹⁶² The second is treating legacy IPv4 addresses as analogous to vanity phone numbers.¹⁶³ The final method is to look to the “original intent” of the architects of early Internet governance

159. MILTON MUELLER, *It’s Official: Legacy IPv4 Address Block Holders Own Their NumberBlocks*, INTERNET GOVERNANCE PROJECT (Sept. 22, 2012), <http://www.internetgovernance.org/2012/09/22/its-official-legacy-ipv4-address-block-holders-own-their-number-blocks> (quoting Rudolph’s statement). While the tongue-in-cheek title of this Mueller article suggests a definitive resolution of the question over legacy block ownership, it only refers to the statement by Rudolph.

160. *Id.*

161. This point should not be overstated. The information presented here merely indicates that at least some high-level NSF executives believed, contrary to ARIN’s assertions, that RIRs were not receiving exclusive property rights in IPv4 addresses during the reorganization of the late 1990s. It is important to keep in mind that this view has persisted in other forms, and Rudolph is cited to establish the longevity of this view. *Id.*

162. See LOCKE, *supra* note 139.

163. See *supra* notes 146–52.

such as Rudolph, who unequivocally supports the recognition of property rights in legacy IPv4 addresses.¹⁶⁴

From a 50,000-foot-view, it might seem like these Internet infrastructure companies such as ARIN and ICANN are operating anti-competitively. After all, each entity has de facto control over all aspects of its resources by virtue of grants of authority from the US government.¹⁶⁵ ICANN, and to a lesser extent ARIN, has been the subject of several unsuccessful anti-trust suits over the years.¹⁶⁶ Those who argue that ARIN operates anti-competitively miss the mark, however.¹⁶⁷ It is important to keep in mind both that ARIN is a “bottom-up,” open, and transparent non-profit organization that takes great care to make sure that its regulations are in line with the will of the Internet community it serves.¹⁶⁸ Perhaps more crucially, the very nature of ARIN’s business suggests that the principles underlying our anti-trust laws are not applicable to the administration of Internet numbers.¹⁶⁹ It is fairly clear that ARIN’s operation is not at loggerheads with the policy rationales that underlie U.S. anti-trust laws.¹⁷⁰

164. See MUELLER, *supra* note 159. Mueller points out that at the very least, Rudolph disclaims that ARIN has any property rights in the legacy IPv4 addresses. *Id.*

165. See ICANN, NATIONAL TELECOMMUNICATIONS & INFORMATION ADMINISTRATION (last visited Oct. 2, 2016), <https://www.ntia.doc.gov/category/icann>; see *infra* note 167.

166. See Robert Lemos, *VeriSign’s antitrust suit against ICANN dismissed*, CNET (Aug. 27, 2004), <https://www.cnet.com/news/verisigns-antitrust-suit-against-icann-dismissed/>; *US Circuit Court Upholds ICANN’s Defense of the New gTLD Program*, ICANN (July 31, 2015), <https://www.icann.org/news/announcement-2-2015-07-31-en>; Order Granting Defendant’s Motion to Dismiss with Prejudice, *Kremen v. ARIN, Ltd.*, No. C 06-02554 JW (N.D. Cal. Dec. 20, 2006), <https://www.scribd.com/document/2615012/Kremen-v-American-Registry-For-Internet-Numbers-Ltd-Document-No-41> (granting defendant’s motion to dismiss the antitrust action that had been filed against it).

167. ARIN easily defended the anti-trust suit brought by Mr. Kremen. See Ryan et. al., *supra* note 2, at 364–65.

168. Ryan et al., *supra* note 2, at 355 (“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.”) (quoting *Internet Number Resource Policies*, ARIN, <http://www.arin.net/policy/index.html>).

169. Ryan et al. argue that oversight of transfer of IP resources has special benefits:

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 the RIR to the ISP, and obtaining the identification of the person with the unique IP address from the ISP, using appropriate legal demands.”

Ryan et. al., *supra* note 2, at 366–67.

170. See A. Michael Froomkin & Mark A. Lemley, *ICANN and Antitrust*, 2003 U. ILL. L. REV. 1, 2 (2003) (concluding “that the U.S. government should either assume a more active role in setting

V. POTENTIAL SOLUTIONS TO RESOLVE THE LEGAL AMBIGUITIES SURROUNDING OWNERSHIP OF IPV4 ADDRESSES

While the courts could take any number of routes in deciding how property rights are to be delineated in IPv4 addresses, the apparent resolutions fall into three categories: (1) continue to treat legacy addresses like vanity phone numbers and non-legacy like ordinary phone numbers,¹⁷¹ (2) unwind ARIN's policy change to disallow private-market transfers and affirm ARIN's exclusive control over the addresses, or (3) affirm the current state of IPv4 administration while examining the legal framework before the IPv6 transition.

A. Vanity Phone Number Solution

One potential parallel legal comparison suggested by Rubi is to treat IPv4 addresses like phone numbers.¹⁷² If this framework was broadened to cover non-bankruptcy IPv4 addresses, it would have a significant effect on the administration of IPv4 addresses. This would mean that IPv4 address holders, like vanity phone number holders, would have "a possessory interest...but no ownership interest" in those numbers.¹⁷³

This solution has several advantages. Some courts already acknowledge this paradigm, albeit on a limited basis.¹⁷⁴ It is also a common-sense solution based on a fundamental recognition that if a business was not forced to sign an RSA, that business's rights should be greater than those of a business that did sign an RSA. Further, it draws upon existing legal frameworks, which should cut down on future litigation.¹⁷⁵ It is also a clear signal that while the courts respect ARIN's central role in the IPv4 address space, the judiciary has the ultimate authority to determine property interests. This solution should not disrupt

domain name policy or, in the alternative, let the market operate unfettered," which suggests that ARIN, in absence of more active supervision, should be left to its own administration).

171. This characterization of the status quo in the private market for IPv4 transfers is a little oversimplified. In the current market, non-legacy address holders must comply with ARIN's RSA if they wish to transfer, buy, or sell addresses. Legacy holders do not have to follow the RSA unless the buyer and seller agree that they will update ARIN's registry information upon execution of the sale. There are advantages and disadvantages to registration, the most meaningful of which is loss of legacy status. If ARIN is notified of a transfer, it mandates the new address user sign an RSA. Ryan et al., *supra* note 2, at 357, 371–72.

172. Rubi, *supra* note 8, at 499–501.

173. *Id.* at 501.

174. See, e.g., *supra* note 65. *Nortel* recognized this view in a bankruptcy sale of assets where ARIN secured an LRSA with the eventual buyer.

175. See Eisenberg, *supra* note 148, at 678.

the private market for IPv4 transfers. Additionally, this solution would not necessarily be inconsistent with ARIN's position as gatekeeper to IPv4 addresses. While ARIN's role may change with respect to legacy address holders who would have expanded property rights in IPv4 addresses, ARIN would still serve as gatekeeper and registrar of IPv4 assets.¹⁷⁶

Treating IPv4 addresses like vanity phone numbers would represent a small modification to the current IPv4 address transfer regime in North America, the change being that even if a legacy address is bought and sold via the private market, and ARIN is notified of the transaction, the address would retain its legacy status.¹⁷⁷ This would be a distinct change from ARIN's current policy, which forces the purchasers of legacy addresses who wish to register them with ARIN to agree to their LRSA or RSA.¹⁷⁸ One of the earliest advisors for private-market IPv4 transfers, Marc Lindsey, believes that "the biggest problem is that ARIN wishes to tightly constrain transactions."¹⁷⁹ These constraints lead to higher transactional costs for private IPv4 transactions.¹⁸⁰

Allowing legacy addresses to retain property rights through subsequent private market transfers would bring ARIN's transfer policies in line with Réseaux IP Européens (RIPE) and Asia Pacific Network Information's (APNIC) transfer policies, which allow for the retention of legacy status for subsequent purchasers.¹⁸¹ The primary benefit of RIPE and APNIC's policy is increased accuracy of RIR registration records, because new purchasers of IPv4 legacy addresses have little incentive to forego registration.¹⁸² Accuracy of RIR records is paramount with increasing digital privacy and security concerns.¹⁸³ Inaccurate recordkeeping of IPv4 ownership makes cybercrime investigations more difficult, hinders commercial activity through costly investigations in order to validate the chain of title for IPv4 assets, and runs contrary to the stated missions of RIRs to create robust registries for Internet numbers.¹⁸⁴ The end result of

176. In this hypothetical, ARIN could still be the clearinghouse for legacy IPv4 addresses and have an ownership interest in those numbers.

177. Businesses and individuals are likely to do this. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30.

178. Rubi, *supra* note 8, at 493.

179. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30.

180. *Id.*

181. *Id.*

182. *Id.*

183. See MUELLER ET AL., *supra* note 84, at 5 (Mueller persuasively argues that accuracy is crucial for keeping the IP address space efficient and secure).

184. The biggest concern for most companies that buy and sell IPv4 addresses is validating the chain of title to ensure the addresses are not being used for criminal purposes. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30.

these uneven restrictions across RIRs could be a “net flow of IP addresses out of ARIN,” which would deplete the North American supply of IP addresses.¹⁸⁵ Viewed from the private market perspective, ARIN’s restrictions on IPv4 addresses create additional transactional friction that increases the cost of doing business with ARIN and leads to inaccurate registries.

B. Pre-2009 ARIN Solution

A second possible solution is essentially a denial of all possessory and ownership rights in IPv4 addresses. Under this solution, ARIN’s RSAs would still be valid and enforceable. The only difference would be that ARIN would cease facilitating private market transfers of IP addresses. While it is a radical step that would certainly cause a flood of litigation, it may be the most logical solution if the main goal is maintaining an open, honest, and transparent Internet.¹⁸⁶ The courts could determine that ARIN is acting within a grant of authority from the U.S. government and that long-held tenants of contract law govern what private parties may do with these addresses. This would strengthen ARIN’s ability to reclaim IPv4 addresses that were not in use and redistribute them to the broader community based upon demonstrated need.¹⁸⁷

Denying all individual property rights in IP addresses would aid ARIN in managing and tracking current IPv4 allocations, in addition to better facilitating the transition to IPv6. There is precedent for such a move.¹⁸⁸ The Department of Defense was an early collaborator that spent considerable resources developing the first Internet capable machines.¹⁸⁹ As such, they have large blocks of IPv4 addresses at their disposal. “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

185. *Id.* (based on the careful observation of Mr. Lindsey over the past eight years of advising clients on IP address matters).

186. Once again, this is a question of values and priorities. For those scholars primarily concerned about the barriers to entry to doing business on the Internet, this is the optimal solution. *See supra* Part III.C.

187. This is not a large benefit to the plan because most non-legacy addresses are in use due to the “demonstrated need” requirement imposed by ARIN on all IPv4 allocations and transactions. A more impactful action would be to free up some of the out-of-use legacy addresses, of which there are many. However, the mechanism to do that would be far more radical than what this Note suggests. *See* K. HUBBARD ET. AL., INTERNET ENG’G TASK FORCE, RFC 2050: INTERNET REGISTRY IP ALLOCATION GUIDELINES 7–8 (Nov. 1996), <https://tools.ietf.org/html/rfc2050>.

188. Ryan et al., *supra* note 2, at 369.

189. *Id.* at 370–71.

resources to the community as the DOD decides it no longer needs these resources.”¹⁹⁰ Based on this example, a voluntary return program could be implemented to free up unused blocks for repurposed use. The issue remains, however, that companies would still need to be convinced of the value of voluntarily returning unused addresses.¹⁹¹ That worry is alleviated by a strong judicial signal disclaiming property rights in non-legacy IPv4 addresses. IPv4 scarcity will affect everyone in North America equally under this plan because companies would need demonstrate need for the addresses rather than buying blocks from private address holders. Thus, the large ISPs who are necessarily the key players in the United States’ ongoing transition to IPv6 addresses would not be able to buy time via private purchases of IPv4 addresses.¹⁹²

C. *Affirm the Status Quo Solution*

The final, and most likely, solution is for the courts to give judicial approval to ARIN’s current administration of IPv4 addresses. This solution is valuable because it is the least disruptive to ARIN and to the private market as it would involve essentially a judicial rubber stamp.¹⁹³ This solution recognizes the immediate necessity of the private market for IPv4 addresses, at least in bankruptcy proceedings, while keeping an eye towards the vital role that ARIN plays in keeping the Internet secure, open, and free. Like the Pre-2009 Solution,¹⁹⁴ this solution recognizes ARIN’s legitimacy as the *de facto* administrative body of all IP address resources.¹⁹⁵

This solution would not prevent the free market from appropriately addressing the very real scarcity that currently infests the IPv4 allocation pool. It allows private companies to buy and sell legacy IPv4 addresses, and allows each buyer to choose whether to register the addresses with ARIN and make the required showing that it has a demonstrated need for

190. *Id.*

191. *See* Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30 (noting that the early existence of a private market for IPv4 addresses suggests that companies will hoard addresses rather than return them). This is a significant concern.

192. Due to the increased scarcity of IPv4 addresses under this solution, it follows that investment in and adoption of IPv6 architecture would accelerate.

193. The private market, while difficult to measure, appears to have reached a state of equilibrium according to Lindsey and Goodman. Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30.

194. *See infra* Part V.B.

195. An additional benefit of this solution is that it ignores the antitrust issue regarding ARIN’s role in the market.

the IPv4 address resources over the next twenty four months.¹⁹⁶ It also shores up ARIN's position on non-legacy addresses by treating the RSAs as granting a mere "right of use."¹⁹⁷ In this solution ARIN is still treated as indispensable to the ongoing administration of the Internet, which has the dual advantage of preserving an important source of institutional knowledge while maintaining continuity in the overall structure of Internet governance.

CALL FOR FURTHER CLARITY

It is relatively clear from recent events and scholarship that legacy IPv4 addresses do contain at least some limited property rights.¹⁹⁸ Non-legacy addresses, however, may be far more restricted. In either case, there is a clear need for judicial review of property rights in IPv4 addresses. The issue, of course, is the pathway that potential litigation might take to reach the appellate courts. Legacy addresses have some judicial clarity, while the same cannot be said for non-legacy addresses. Unfortunately, until more non-legacy IPv4 address holders attempt to break ARIN's RSA, there is not likely to be much litigation on the issue.¹⁹⁹ Timing is a double-edged sword due to the eventual transition to IPv6 addresses will render the issue effectively moot.²⁰⁰ However, the *Nortel Networks*²⁰¹ case did demonstrate on a limited basis that businesses value unencumbered IPv4 resources more than they value more legally secure addresses governed by ARIN's RSA.²⁰²

The value placed on legacy IPv4 over the value placed on non-legacy IPv4 addresses by the private market is crucial to figuring out how this issue is going to be resolved. As long as the private market will pay for unencumbered legacy addresses, then there will be pressure on ARIN to

196. Marc Lindsey noted that current legacy address holders can choose whether they are going to notify RIRs of ownership changes. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30.

197. See Strickling, *supra* note 105.

198. See MUELLER, *supra* note 17; MUELLER ET AL., *supra* note 16; Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30; Rubi, *supra* note 8. See also LOCKE, *supra* note 139, at 306.

199. This is the paradox of the private market for IP addresses: the only entities with the resources and financial stake in challenging ARIN's status as IP regulator have little incentive to file suit for fear of a costly outcome.

200. See DEERING & HINDEN, *supra* note 10.

201. See *In re Nortel Networks Inc.*, No. 09BK10138, 2011 WL 1560720, at *2 (Bankr. D. Del. Mar. 21, 2011).

202. *Id.* It bears repeating that the judge in *Nortel* approved the transfer of IPv4 addresses only after ARIN filed a brief with the court stating that it had approved the transfer.

ease the friction of those transactions. Further, it is difficult to predict what will happen due to the presence of disparate policies among the global community of RIRs.²⁰³ The fact that Asia and Europe’s respective RIRs allow legacy holders to transfer control of legacy addresses to new entities that can register them with APNIC and RIPE without losing the legacy status of the addresses will have serious implications for the ability of ARIN and other RIRs to protect their supplies of IPv4 addresses.

Interestingly, APNIC and RIPE may have provided the exact blueprint for how to solve the legacy-address riddle. Both scholarly sources and free-market practitioners agree that accurate IP registries are paramount for secure and continued growth of the Internet as a means of commerce and as a means of communication.²⁰⁴ If ARIN were to change its policies to allow for subsequent purchasers of legacy addresses to register those numbers without signing an RSA, then the free market will be able to better provision the world with affordable IPv4 resources until such time that the IPv6 transition is accomplished.²⁰⁵ However, if nothing changes, ARIN’s policy deficit vis-à-vis APNIC and RIPE will continue to lead to “venue shopping” for companies looking to control IPv4 resources.²⁰⁶

However, it is difficult to make a recommendation as to which paradigm of Internet governance will be most useful in the future. Like most issues, the answer depends on what values are most important to preserve. If freedom to contract is paramount, then recognizing ARIN’s centrality to IPv4 address administration is proper and likely the least disruptive. If equality of access to Internet resources is the chief goal, then ARIN should be granted expanded rights to reclaim and distribute IPv4 addresses based upon demonstrated need no matter the potential societal disruption.

To further complicate matters, the U.S. Commerce Department’s National Telecommunications and Information Administration (NTIA) transferred IANA authority to a “broad base of Internet stakeholders”.²⁰⁷

203. See MUELLER ET AL., *supra* note 16.

204. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30. See generally Rubi *supra* note 8; Ryan et. al., *supra* note 2.

205. *Nortel* suggests that ARIN already allows for subsequent legacy transfers in a bankruptcy context.

206. See Telephone Interview with Marc Lindsey & Janine Goodman, *supra* note 30 (“There is a notion of some RIR shopping.”).

207. Ellen Powell, *Has the United States ‘lost control’ of the Internet?*, CHRISTIAN SCIENCE MONITOR (Sept. 28, 2016), <http://www.csmonitor.com/USA/2016/0928/Has-the-United-States-lost-control-of-the-internet>.

In order to accomplish this, NTIA is ending its contract with ICANN.²⁰⁸ While this will change absolutely nothing in terms of the day to day functioning of the Internet, it has caused a stir among some critics.²⁰⁹ It bears mentioning at least that the next few years will be crucial from the perspective of setting Internet governance norms.

If equality of access and fostering a pro-growth Internet governance scheme are paramount, then the last thing U.S. observers wish to see would be a compromise between ARIN and the free-market IPv4 traders. The Internet is unique in that it brings together people from opposite sides of the ideological spectrum into one expansive idea space. ARIN itself is an embodiment of the principles that have made the Internet such a disruptive and wonderful technology.²¹⁰ Before ARIN or other stakeholders in the IPv4 market take any action, it is first necessary to clarify the goals inherent in the structure of the Internet and discuss the best way to bring about those goals.

All these values have a place and role in determining the proper allocation of authority in the Internet governance regime. For legacy address holders who have never signed a contract limiting their rights in their IPv4 addresses, they should have complete ownership rights in those addresses to buy, sell, trade, or give away as they see fit without being subject to a new RSA by ARIN. However, they cannot expect continued free WHOIS and tracking services from ARIN. ARIN would be well within its rights to charge these types of legacy address holders if they request services from ARIN. This is crucial here because it is fundamentally unfair to bind parties to terms they never agreed to or anticipated.²¹¹

For legacy address holders who signed LRSAs or RSAs at some point since being allocated addresses, those agreements must govern. These entities, presumably, knew full well what they were signing and had adequate notice of the rights they were foregoing in signing. They will still be able to participate in the private market under ARIN's 2009 Amended

208. David G. Post & Danielle Kehl, Controlling Internet Infrastructure Part I: The "IANA Transition" and Why It Matters for the Future of the Internet 1 (July 27, 2015), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2636417.

209. See Powell, *supra* note 207.

210. The Request for Comment (RFC) system was designed by ARIN to facilitate discussion and debate among its members to build consensus, increase transparency, and foster accountability.

211. At this point, the discussion of antitrust is pertinent to but separate from the main conclusion. Under this structure, ARIN would most certainly be subject to antitrust litigation if it began to charge for its WHOIS lookup service because it is the only market player capable of offering such a service and any change to it would be looked at as potentially anti-competitive.

RSA Policy²¹², but they will have more restricted rights and any potential transferee would have to demonstrate need per ARIN policy.

For non-legacy address holders, the situation is straightforward. These entities do not have property rights in their addresses beyond those usage rights granted by ARIN's RSA.²¹³ They are bound by ARIN's policies and are subject to the remedies contemplated in the RSA.²¹⁴ Without a ruling that ARIN exerts anti-competitive pressure on the market for IP addresses,²¹⁵ it is unlikely that non-legacy address holders will see any expanded recognition of property rights in their addresses.²¹⁶

Despite the many solutions surveyed in this Note, the best solution is likely the simplest one: do nothing. Since its founding, ARIN has demonstrated itself to be a benevolent steward acting in furtherance of the pursuit of an open, free, and equally-accessible Internet. The impending transition to IPv6 architecture will mean that an ever-decreasing amount of global Internet traffic will depend on IPv4 architecture. Despite the arguments in favor of recognition of formal property rights in IPv4 legacy addresses, the benefits of a robust and accurate registry are more compelling. Until the U.S. courts or Congress address these legal issues, the free market will continue to do what it does best: place value on obscure goods, allocate resources efficiently, and continue to provision individuals and companies with the only available sources of IPv4 addresses.

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212. See MUELLER ET AL., *supra* note 84, at 3.

213. See *Registration Services Agreement*, *supra* note 20.

214. *Id.*

215. Such a ruling is exceedingly unlikely. See Ryan et. al., *supra* note 2.

216. This situation could change if the scarcity of IPv4 addresses becomes so great that the price of IPv4 addresses rises to the point that non-legacy holders begin contemplating breaking their RSAs with ARIN.

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