

2015

State of the IPv4 Market Report

Welcome to Avenue4's 2015 State of the IPv4 Market Report

The IPv4 market has experienced enormous growth over the last year. For many observers and participants, the market is still obscure. Obtaining actionable data about the market's norms, trends and dependencies is not easy. Publicly available information can be unreliable and out of date. Mechanisms that would help the market operate more efficiently remain elusive, due in part to the Internet governance institutions' reluctance to embrace market-efficiency as an important policy objective.

At Avenue4, we have enabled our clients to succeed in this climate, and have gained the trust and confidence of buyers by driving transparency and integrity. In 2015, the total market value of our deals reached \$88 million.

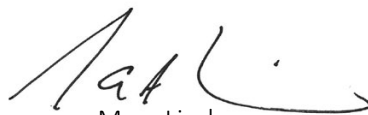
In this first annual State of the IPv4 Market Report, we provide historical and current market information from the North American region's perspective and share our insights into the interpretation of that information to help current and potential market participants make more informed decisions.

IPv4 trading has evolved over a relatively short period. In North America, the American Registry for Internet Numbers ("ARIN") routinely registered transfers between entities resulting from mergers and acquisitions (referred to in the industry as "8.2 transfers") as far back as 2002. Registration transfers for arms-length trades between unrelated entities ("8.3 transfers") did not exist until 2009. There were, however, very few actual 8.3 transfers until 2011. In February of that year, the Internet Authority for Numbers Assignments (IANA) announced that it had allocated its last /8 block to the five global Regional Internet Registries (RIRs). And then in March, Microsoft purchased 666,624 of Nortel's IP addresses for \$7.5 million in a bankruptcy proceeding. These two events received extensive media coverage, and publicly signaled the existence and potential of the IPv4 market.

From its quiet beginnings in 2009 through its splashy public reveal in 2011 until the close of 2013, the market in the ARIN region was erratic. This period was heavily influenced by two factors: a flood of numbers available for sale in the secondary market from companies enticed by the lofty \$11.25/number valuation of Nortel's IPv4 assets; and demand that was significantly constrained by the available free supply of address space from ARIN. In 2014, as ARIN rapidly approached depletion, secondary market demand—along with the volume of transactions and numbers traded—increased gradually.

At the start of 2015, there were 7.5 million IPv4 numbers in the ARIN IPv4 free pool, and the year before ARIN had approved just 35 in-region IPv4 transfers conveying just under 5 million numbers. By the end of 2015, the ARIN free pool was depleted and the volume of trades in the IPv4 market rose sharply—with 194 transactions transferring over 34 million IPv4 numbers within the ARIN region alone. The state of the market was dramatically different from all prior years.

We hope you find our 2015 State of the IPv4 Market Report both interesting and useful as you plan for 2016.



Marc Lindsey
President
Avenue4 LLC



Janine Goodman
Vice President
Avenue4 LLC



2015

Most commonly
transferred block
sizes by region

/24 ARIN / RIPE NCC

/22 APNIC

/16 Inter-RIR

IPv4 block
transfers within
ARIN



>7x
INCREASE

IPv4 number
transfers between
ARIN and APNIC /
RIPE NCC



>5x
INCREASE

34,144,000

IPv4 numbers transferred
within ARIN

Relative average price/number
by block size, Q4

\$11.75

Blocks of ≤4k numbers

\$7.00

Blocks of 65K-130K numbers

\$6.20

Blocks of ≥1m numbers



3,000+

IPv4 blocks
transferred globally

50,000,000+

IPv4 numbers
transferred globally

AVENUE4 LLC
INTERNET ASSETS

The year in IPv4

Approximately **7.5 million IPv4** addresses remain in the ARIN free pool.

January 1

RIPE NCC adopts policy allowing inter-RIR transfers between the RIPE, ARIN and APNIC regions.

April 9

The British government announces its plans to sell its unused IPv4 numbers.

February 19

The Wall Street Journal sounds the alarm on the impending run-out of free numbers in North America.

May 13

February 10

Avenue4 launches avenue4llc.com with news and information about the IPv4 market.

April 14

Avenue4's Marc Lindsey appears as a panelist at ARIN 35 in a discussion about the IPv4 transfer market.

May 27

Avenue4 publishes its "Insider's Guide to Participating in the IPv4 Market" in Network World.

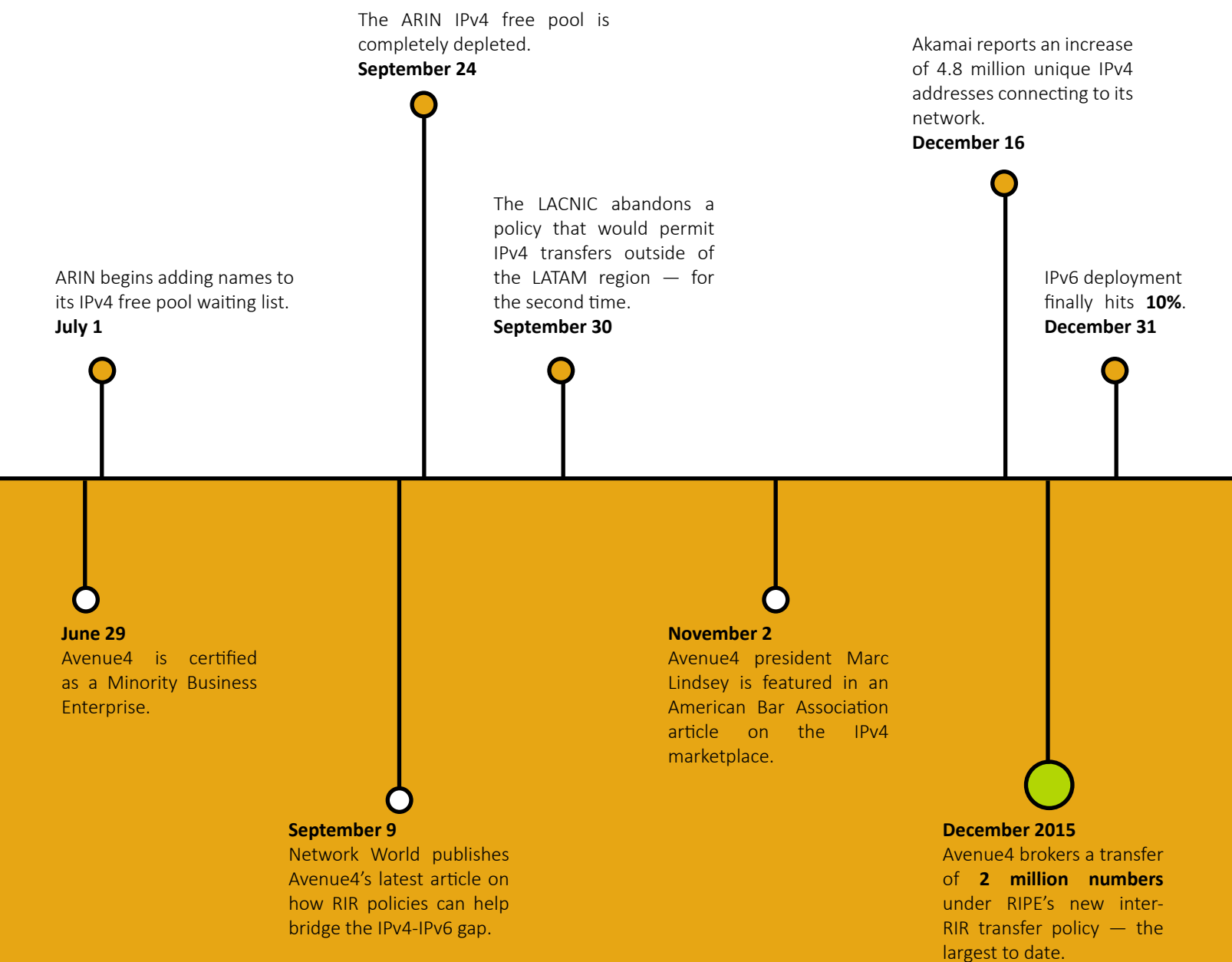
Q1 2015

Avenue4 brokers a trade for nearly **2.9 million** IPv4 numbers, then closes another for **over 4 million** numbers.

June 24

The value of Avenue4's brokered transactions reaches \$74 million.

The year on Avenue4



2015: Running the Numbers

“Many large buyers with available liquidity and reliable business forecasting used the surplus-influenced market conditions to their advantage in 2014 and 2015.”

This report (other than with respect to pricing) uses publicly available data provided by three regional Internet registries: ARIN, RIPE NCC, and APNIC.¹ Although many IPv4 transactions involve RIR approval, some transactions occur outside of RIR transfer policies. Buyers and sellers occasionally decide, under various transaction structures, to trade numbers without seeking RIR approval or updating the registrant of record in the RIR registry. Although not insignificant, these “dark” transactions do not materially distort the rest of the market nor do they impair an effective analysis of it. For purposes of this report, we believe Avenue4 source data and the public RIR data, taken together, provide a reasonable—though perhaps conservative—estimate of total market activity.

Overview of North American Market Activity in 2015

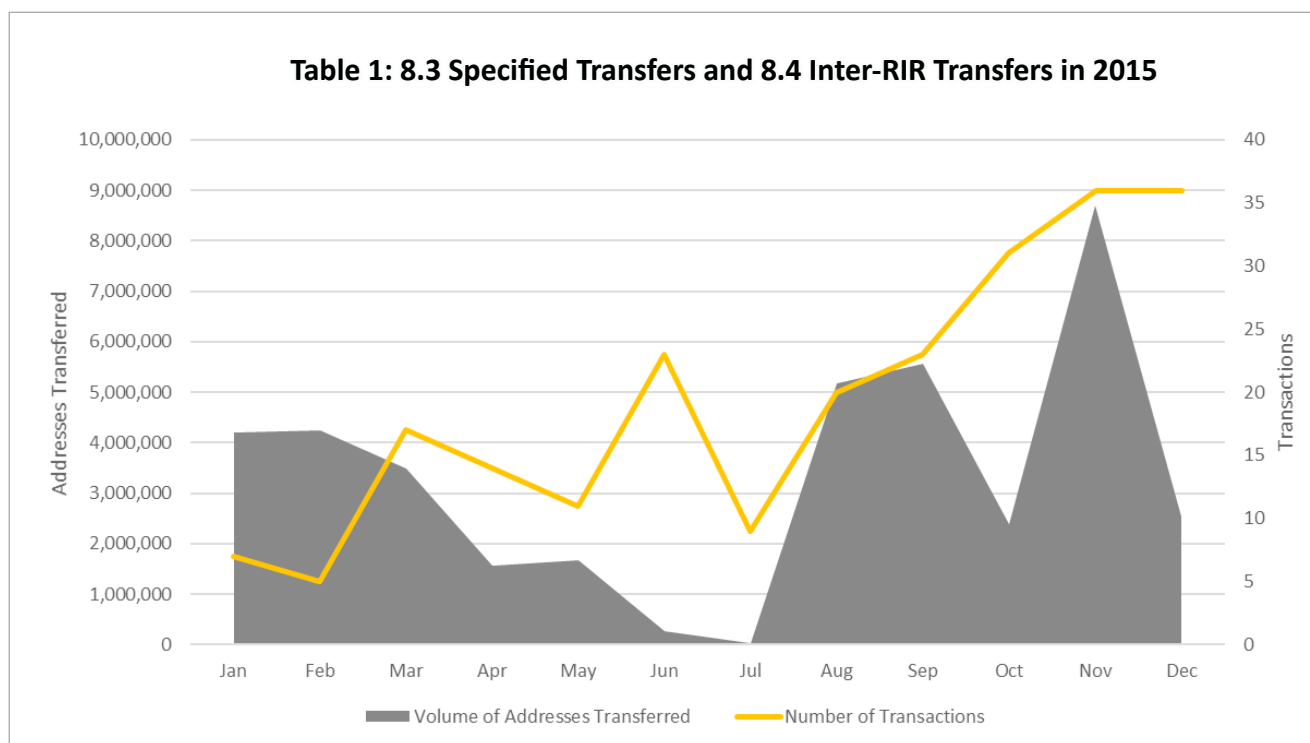
ARIN market activity (measured both by the volume of IPv4 numbers transferred, and number of separate transactions,² within the ARIN region and into or out of the APAC and European regions) has been on an upward trajectory since July 2015. See Table 1. This trend cor-

responds to the timing of ARIN’s near depletion of numbers. Although ARIN did not deplete its stock of free pool IPv4 address space until September 2015, by the beginning of July, the largest contiguous address block available was a /23 (512 addresses).

The growth in volume of numbers transferred is primarily attributable to large block trading, almost entirely by a small number of companies. Many large buyers with available liquidity and reliable business forecasting used the surplus-influenced market conditions to their advantage in 2014 and 2015.

We expect some large-block transactions to continue in 2016, but anticipate that by the close of 2016 the number of large transactions will likely drop off and as a result large-block unit prices will rise considerably in later years due to three key factors: (i) the available inventory of large contiguous blocks for sale from large block holders has already diminished, (ii) some remaining large-block holders will increasingly decide to sell their inventory in smaller sizes to realize higher per-number valuations, and (iii) other large-block holders are waiting until the per-number prices improve.

Table 1: 8.3 Specified Transfers and 8.4 Inter-RIR Transfers in 2015



Pattern of Total IPv4 Consumption

From 2005 to 2008, the annual consumption of new IPv4 numbers—measured as the total of ARIN allocations and assignments (there were no 8.3 transfers)—generally increased each year, but then from 2008 through 2014, the total annual IPv4 consumption (including both ARIN allocations/assignments and market transfers) trended sharply downward. There was a modest increase from 2009 to 2010, but 2010 consumption remained well below 2008 levels. Largely driven by the trading market, the IPv4 consumption volume in 2015 jumped back up to levels last seen in 2010. But even with this jump, the total consumption was less than it was each year between 2005 and 2010, despite the immense growth in the Internet from 2008 to 2014. In 2012, for example, the global market connected nearly 500 million net new devices to the Internet.³ And in 2014, global mobile devices and connections grew nearly 600 million in one year.⁴

From this data, it is difficult to explain the consumption pattern. We believe several factors may have contributed. In February 2011, ARIN initiated its “IPv4 Countdown Plan” to slow depletion of ARIN’s IPv4 free pool once ARIN received its last /8 block from the IANA. Table 2 suggests these efforts were successful. The volume of allocations to ISPs and assignments to end users dropped by almost 50%—extending the life of the free pool. However,

if IPv4 demand were correlated to the growth in Internet connected devices, network operators should have made up the difference by purchasing the additional inventory in the market. We believe ARIN’s needs-based policy—which operated to reduce the quantity of free supply numbers an entity could obtain from ARIN after purchasing numbers in the market—dampened market demand considerably while ARIN had free numbers to hand out.

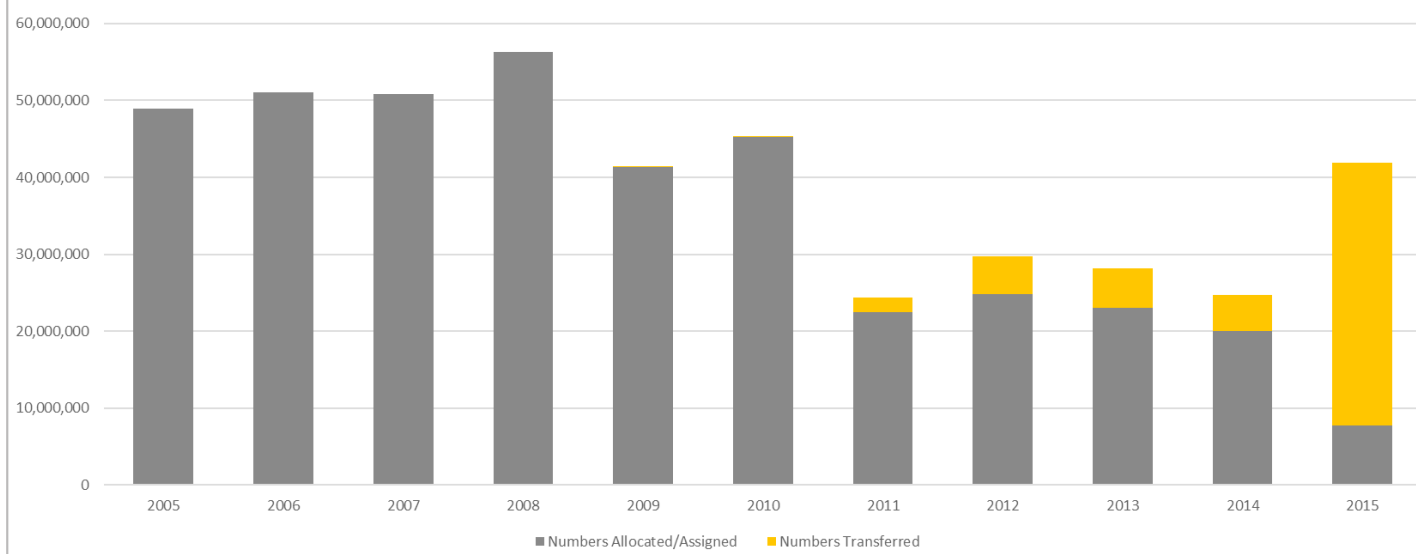
There is also evidence that ISPs and telcos increased their usage of carrier grade network address translation (CGNs).⁵ CGNs provide a means to re-use and share static IP addresses across multiple hosts, networks or endpoints.

Another possibility is that demand was not dampened as dramatically as the data in Table 2 indicates. As discussed above, there may have been many more trades conducted in the “dark”.⁶

Much of the jump in 2015 market transfers is due to purchasing by a small handful of organizations—but this is not completely unexpected. The bulk of big ARIN allocations before 2014 were spread among just a few players. Then, it was predominantly the telcos, including mobile operators. In 2014 and 2015, the cloud providers were the major IPv4 consumers. 2016 will be the first full year with no free pool, and it will be a better indicator of IPv4 demand without the distorting effect of ARIN’s free-pool policies.

“
ARIN’s needs-based policy ... dampened market demand considerably while ARIN had free numbers to hand out.
”

Table 2: ARIN Allocations/Assignments and Approved 8.3 Specified Transfers in 2015



“
We have independently developed a database of pricing information and use our pricing model for the benefit of our clients.
”

Pricing Trends

The biggest challenge for buyers and sellers generally is determining the “market price.” There is no publicly available, reliable, and comprehensive source of pricing data across a representative sample of transactions involving equally well-informed buyers and sellers. And the publicly available information is sparse and cannot be easily validated. Often, articles discussing pricing have recycled outdated data (i.e., the \$11.25/number paid by Microsoft in 2011) or restated educated guesses of authors with limited primary source data—many of them speculating on prices rather than reporting on actual prices in the market.

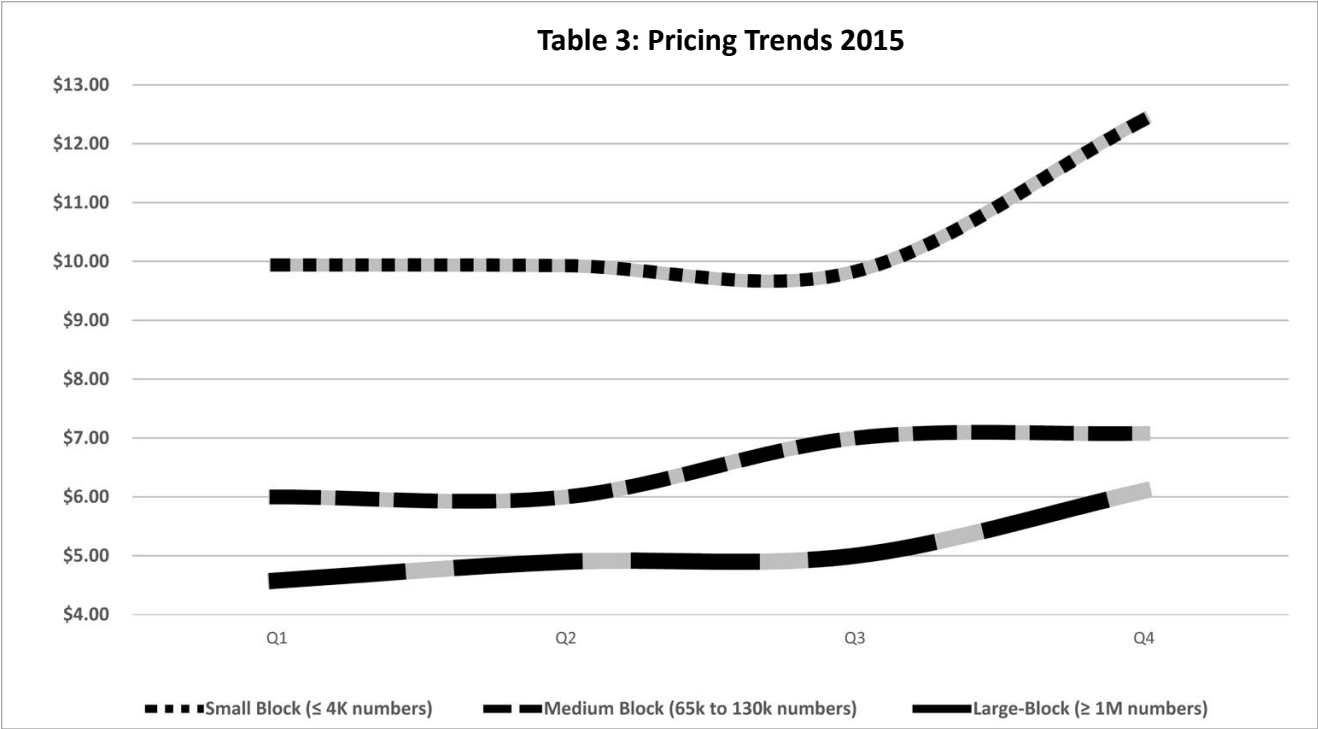
Prospective buyers and sellers must, therefore, rely on secondary sources and intermediaries for their pricing information. The continued availability of free pool numbers in North America for much of 2015, and the fact that inter-RIR trading with RIPE NCC was not even possible until September 2015, makes any historic pricing information less a predictor of where market prices are heading.

Because of the quantity of numbers Avenue4 has sold and other transactions visible to us, we have indepen-

dently developed a database of pricing information and use our pricing model for the benefit of our clients. Information pulled from Avenue4’s database shows that shortly after the public announcement of the Microsoft-Nortel deal, there was a very brief spurt of panic purchases at, or slightly above, \$11/number. Partly due to the flood of supply thereafter, prices in North America were well below \$11.25/number across all deal sizes – until the last half of 2015.

A quarterly snapshot of 2015 prices shows two pricing trends. Prices are increasing very slowly over time, and there is a strong negative correlation between block sizes and unit price. In 2015, the unit price for a /24, for example, was almost 2x the unit price for a /12 or larger block. See Table 3.

In 2016, we expect this trend to continue; however, we anticipate that the spread between the unit prices for small trades and large trades will reduce as the number of large sellers in the market dwindles and the remaining large sellers set higher minimum prices (and break up their address space) in an effort to keep pace with the valuations of small to medium block sellers.



Influence of IPv6 on the Global Market

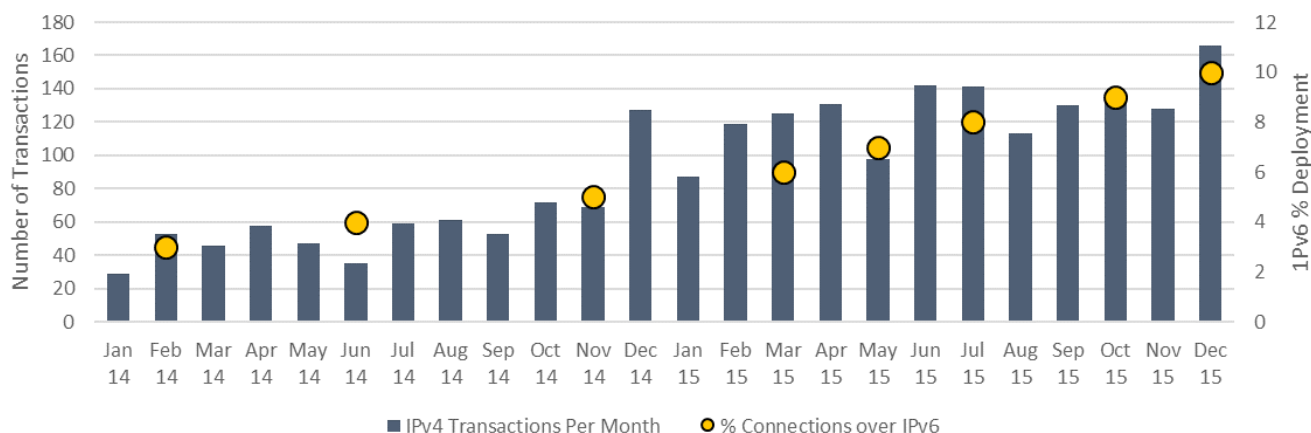
In North America, IPv4 demand remains strong, notwithstanding the progression of IPv6 deployments. See Table 4.

When comparing the number of IPv4 transactions recorded in the ARIN, APNIC and RIPE NCC registries (including both internal transactions and inter-RIR transactions) since 2014 with Google's global native IPv6 connectivity measurements⁷ over that same time period, we find that IPv6 deployment and IPv4 marketplace activity are running on parallel tracks. Because the shift to IPv6 requires organizations to run dual stack environments (i.e., operating IPv6 and IPv4 networks concurrently) as an interim step toward full IPv6 deployment, the correlation between IPv6 deployments and IPv4 is in line with expectations.

Key Takeaways

- The IPv4 market has finally gained acceptance as the only source for obtaining IPv4 numbers during the slow migration to IPv6.
- The impressive growth in volume of numbers traded—driven in part by large purchases of a few heavyweight tech-sector buyers—suggests key players in the tech industry expect to grow their IPv4 infrastructure over the next 3 to 5 years.
- Current IPv6 deployment trends have not materially slowed the growth of the IPv4 market.
- Transfers out of the ARIN region to APNIC and RIPE are growing but still modest when compared to intra-ARIN region transfer activity. We expect this to change as buyers in Europe and the Middle East avail themselves of RIPE NCC's new transfer policy to access the large quantity of unused numbers in North America.

Table 4: Comparison of Global IPv4 Transactions and Native IPv6 Deployment



¹ ARIN: <https://www.arin.net/knowledge/statistics/index.html>; APNIC: <http://ftp.apnic.net/transfers/apnic/transfer-apnic-latest>; RIPE NCC: <https://www.ripe.net/manage-ips-and-asns/resource-transfers-and-mergers/transfers/>.

² For purposes of the analysis in this report, a single transaction represents a transfer of numbers (which may include multiple blocks) between the same parties.

³ Geoff Huston, Addressing 2012 – Another One Bites the Dust!, THE ISP COLUMN (Jan. 2013), <http://www.potaroo.net/ispcol/2013-01/2012.pdf>.

⁴ <http://www.networkworld.com/article/2942596/microsoft-subnet/127-devices-added-to-the-internet-each-second-but-congress-is-clueless-about-iot.html> (July 1, 2015); <http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html> (Feb 3, 2016).

⁵ <http://www.potaroo.net/ispcol/2016-01/addressing2015.html>.

⁶ In his “Addressing 2015” blog, APNIC Chief Scientist Geoff Huston raises the specter that not all address transfers are being accurately reflected by the registries due to address leasing or off registry transfers. <http://www.potaroo.net/ispcol/2016-01/addressing2015.html>.

⁷ <https://www.google.com/intl/en/ipv6/statistics.html>.





ARTICLES BY AND ABOUT AVENUE4

The Real Deal on IPv6 Migration

[TMC Internet Telephony](#)

December 9, 2015

Trading in IP addresses becomes a lucrative market

[ABA Journal](#)

November 1, 2015

ARIN's registry and transfer policies can help bridge the gap from IPv4 to IPv6

[Network World](#)

September 9, 2015

The Sky is Not Falling: Choice Remains in the IPv4 Market

[Data Center Post](#)

September 8, 2015

Don't Blame the Market for Breaking the IPv4 Routing Table

[avenue4llc.com](#)

August 20, 2015

It's official: North America out of new IPv4 addresses

[Ars Technica](#)

July 2, 2015

IPv4 Numbers as Property

[avenue4llc.com](#)

June 12, 2015

An insider's guide to the private IPv4 market

[Network World](#)

May 27, 2015

Avoid IPv6, Buy an IPv4 Address

[No Jitter](#)

May 8, 2015

Enterprising Lawyers: Avenue4's Janine Goodman and Marc Lindsey

[Attorney at Work](#)

April 8, 2015

Global Consequences of Rushing IPv6 Deployment

[avenue4llc.com](#)

January 19, 2015

The False Scarcity of RIR IPv4 Exhaustion

[avenue4llc.com](#)

January 10, 2015

Predictions for 2016

- IPv6 connectivity hits 17%
- Market price for small blocks (/20 or less) hits \$14 with a sliding scale for bigger blocks
- RIPE NCC's inter-RIR transfers explode
- The number of IPv4 transactions continues to increase but volume of transferred numbers declines
- ARIN adopts a policy that relaxes needs justification for small to medium 8.3 transfers on a "trial basis"



Avenue4 was founded in September 2014 by Marc Lindsey and Janine Goodman.

As early as 2008, Marc advised several legacy "Class A" block holders on the nature of their rights and interests in their IPv4 asset, and Nortel was one of his early clients. Marc's niche expertise soon became widely recognized.

Janine joined Marc's IPv4 practice in 2012, bringing nearly 20 years of experience serving as a telecommunications and IT lawyer to Fortune 500 companies and lead negotiator in numerous strategic enterprise procurements.

Together Janine and Marc have consulted some of the most demanding market participants and closed many of the largest deals in the market to date.

Avenue4 helps its clients strategize and execute IPv4 transactions in an opaque and rapidly evolving market. We provide advice on managing, preserving and monetizing IPv4 numbers as an asset.

Our services include:

- Conducting due diligence
- Developing go-to-market strategies
- Matching buyers with sellers
- Identifying value enhancing opportunities
- Structuring, negotiating and closing transactions
- Facilitating registration transfers
- Maintaining IPv4 registry records and preserving entitlements

We dedicate our reputation, knowledge, experience and resources to minimize risk and deliver value for our clients.

Avenue4 LLC
2001 L Street NW Suite 900
Washington, DC 20036

202.741.9525

info@avenue4llc.com

avenue4llc.com