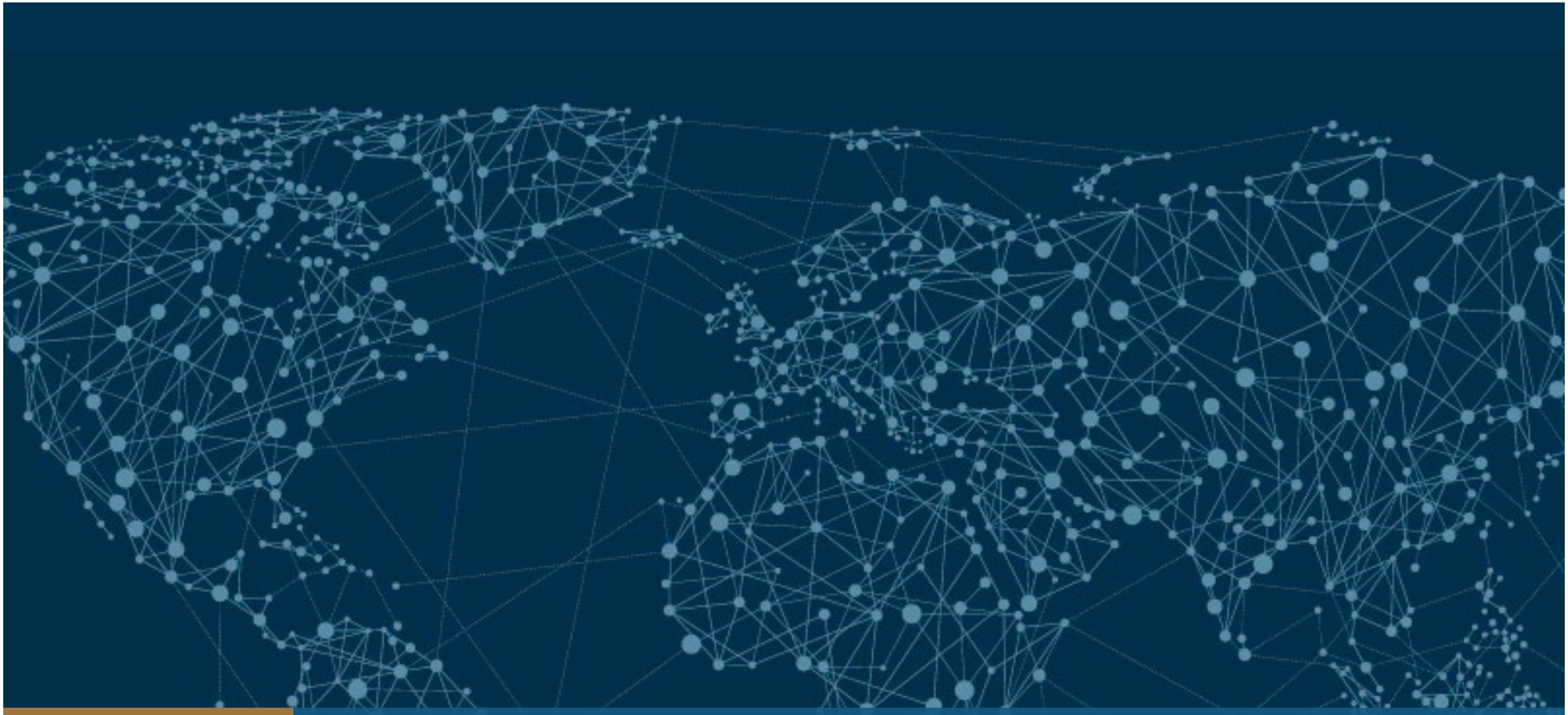


IPv4 Transfers

Analytic View

Alain Durand, February 24th 2016

Questions For This Study

A. IPv4 Transfer Market Health

1) What is the concentration of address holders?
2) Is the transfer market dominated by a few buyers?
3) Is there a regional direction of transfer?
4) What is the size distribution of transferred blocks?
5) How are things changing over time?

B. Impact on the routing table

Do transfers impact the size of the routing table?

C. Registry Accuracy

Does the WHOIS database accurately reflect who controls resources?

Herfindahl-Hirschman Index (HHI)

Source: Investopedia.com

Investopedia:

The **Herfindahl-Hirschman index** (HHI) is a commonly accepted **measure of market concentration**. It is calculated by squaring the market share of each firm competing in a market, and then summing the resulting number.

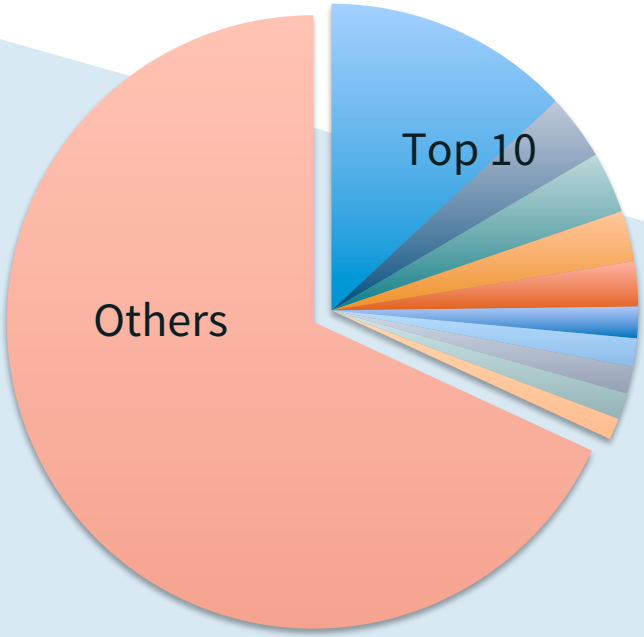
The HHI number can range from close to zero to 10,000.

The U.S. Department of Justice considers a market with
a result of **less than 1,000 to be a competitive marketplace**;
a result of **1,000-1,800 to be a moderately concentrated** marketplace;
and a result of **1,800 or greater to be a highly concentrated** marketplace.

A.1) Share of the Top 10 Address Holders per Region: 01/01/2016: ARIN, APNIC & RIPE

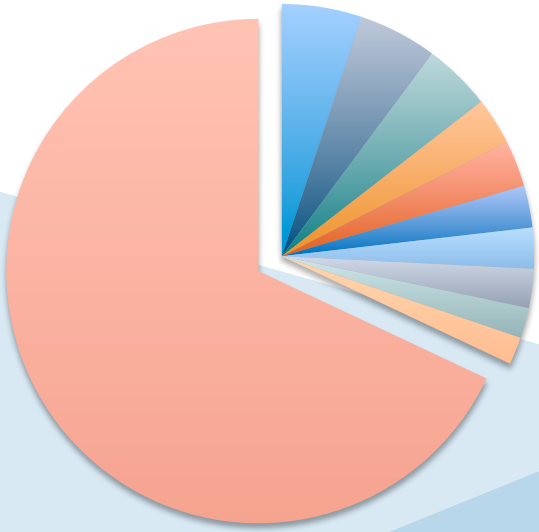
Source: delegated-extended files from ARIN, APNIC & RIPE

ARIN



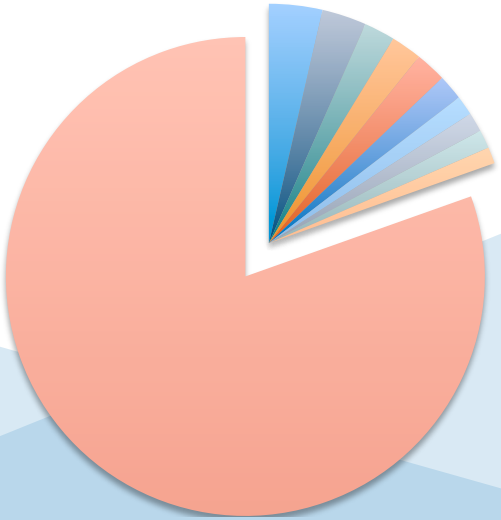
Total: 1.7 billion
Top 10: 32%
HHI = 248

APNIC



Total: 863 million
Top 10: 32%
HHI = 147

RIPE

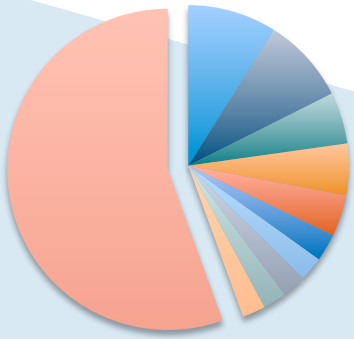


Total: 802 million
Top 10: 20%
HHI = 61

A.1) Share of the Top 10 Address Holders per Region: 01/01/2016: LACNIC & AFRINIC

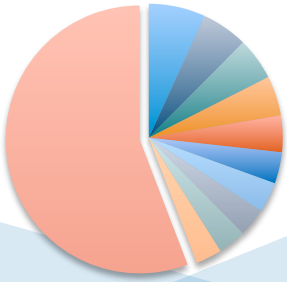
Source: delegated-extended files from LACNI & AFRINIC

LACNIC



Total: 180 million
Top 10: 44%
HHI = 289

AFRINIC



Total: 87 million
Top 10: 44%
HHI = 262

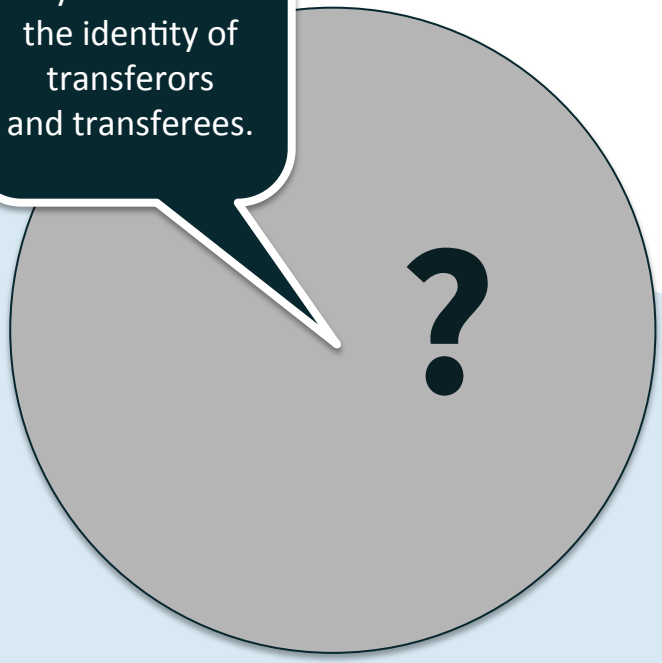
A.2) IPv4 Address Transfer Recipients: 2014/2015

Source: ARIN, APNIC, RIPE: APNIC & RIPE transfer stats files

ARIN statistics do not provide any data about the identity of transferors and transferees.

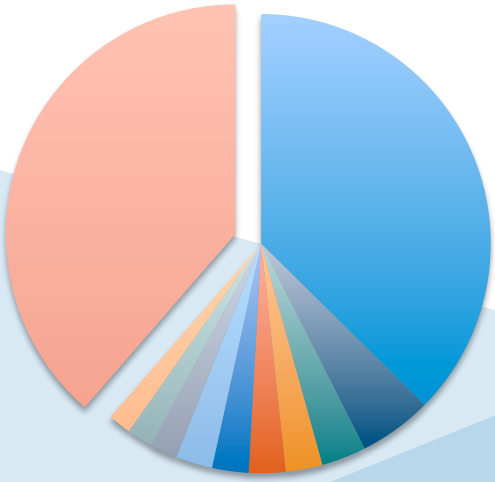
RIPE does not report on "legacy" transfers

ARIN



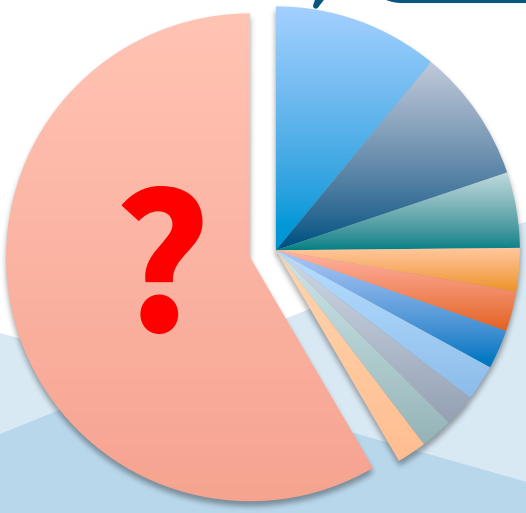
Total: 38.9 million
Top 10: ??%

APNIC



Total: 10.2 million
Top 10: 61%

RIPE

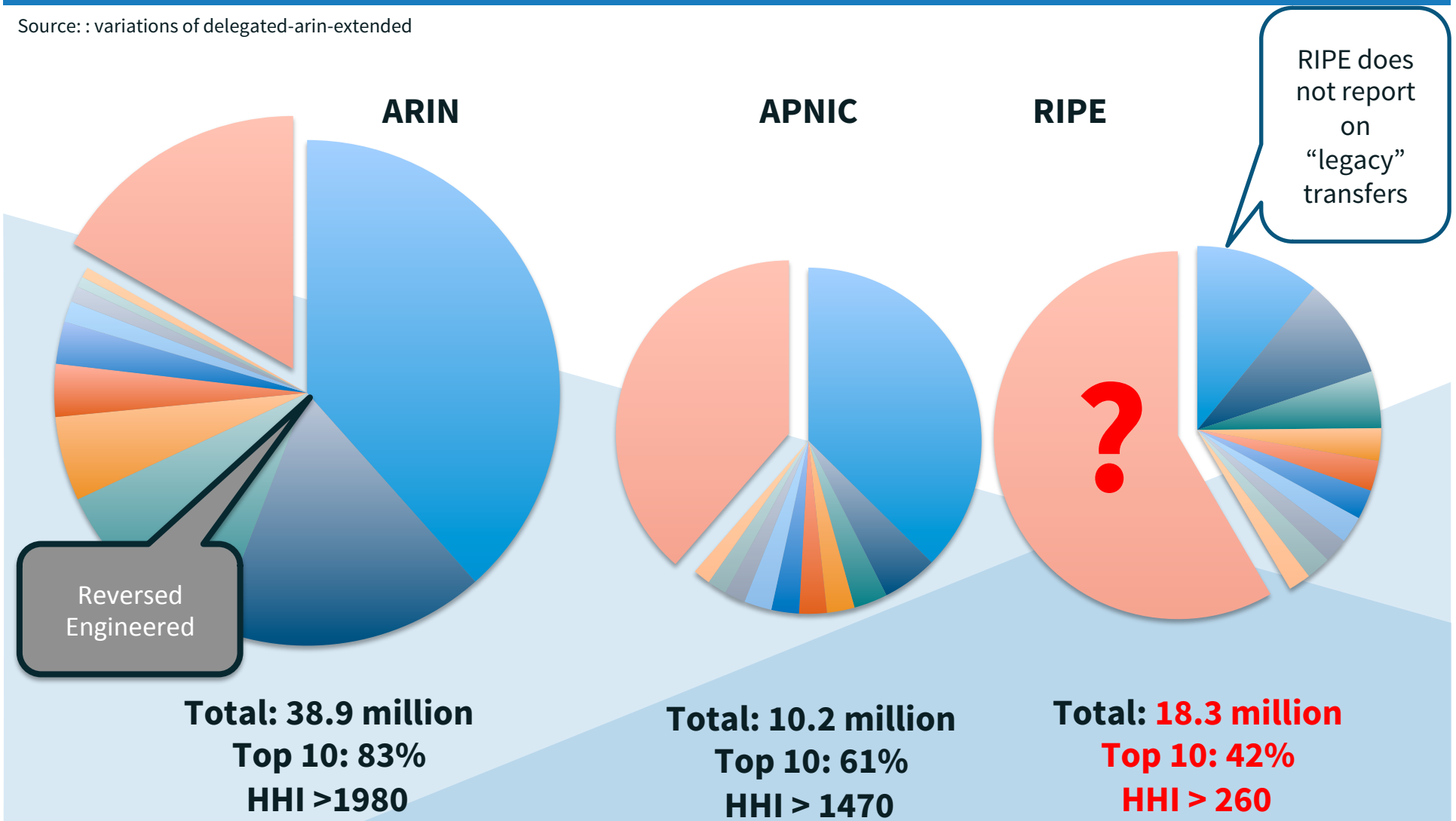


Total: 18.3 million
Top 10: 42%

A.2) IPv4 Address Transfer Recipients: 2014/2015

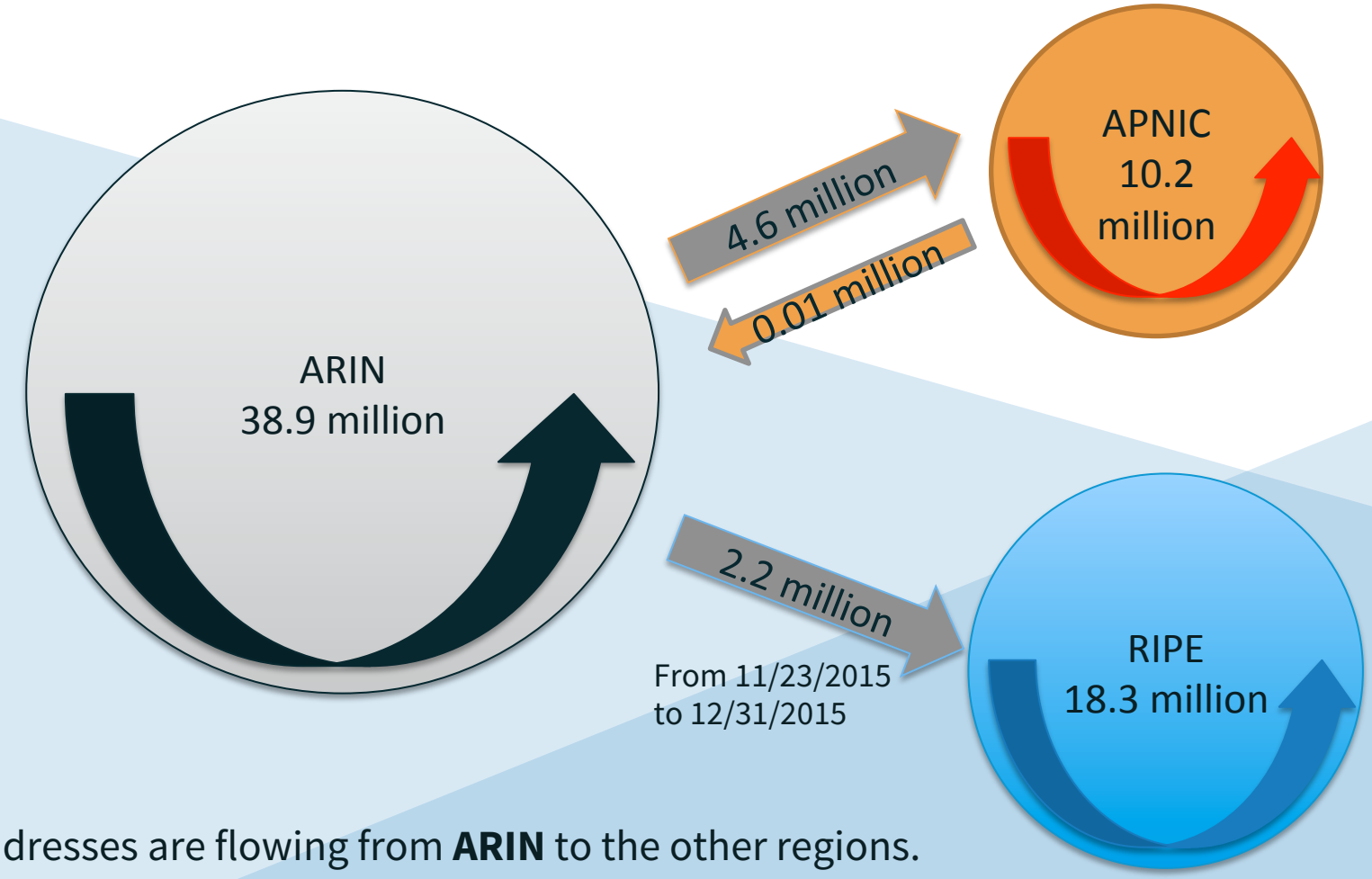
Source: ARIN, APNIC, RIPE: APNIC & RIPE transfer stats files

Source: : variations of delegated-arin-extended



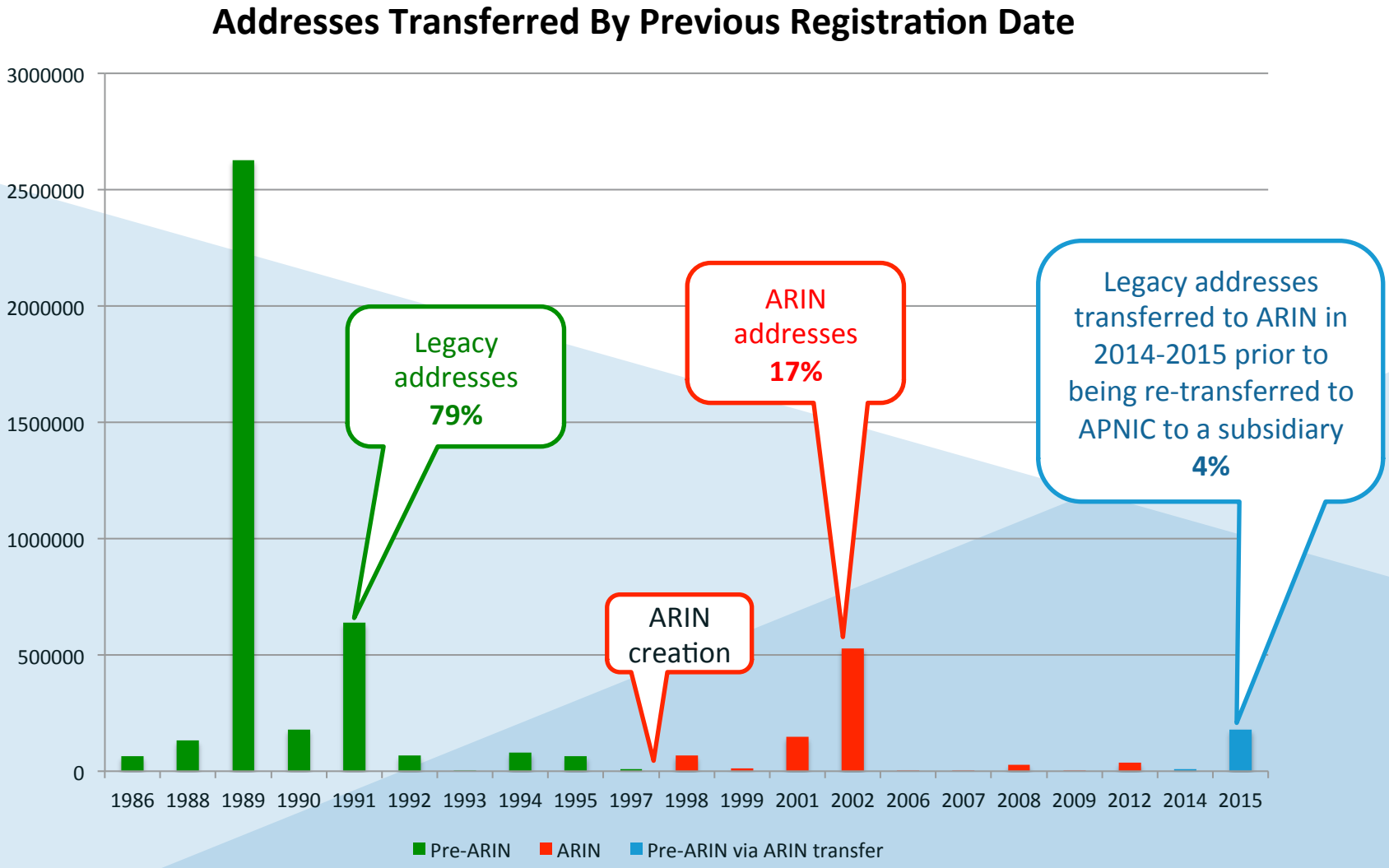
A.3) IN-Region vs OUT-of-Region 2014-01-01 to 2015-12-31

Source: ARIN, APNIC, RIPE: APNIC & RIPE transfer stats files



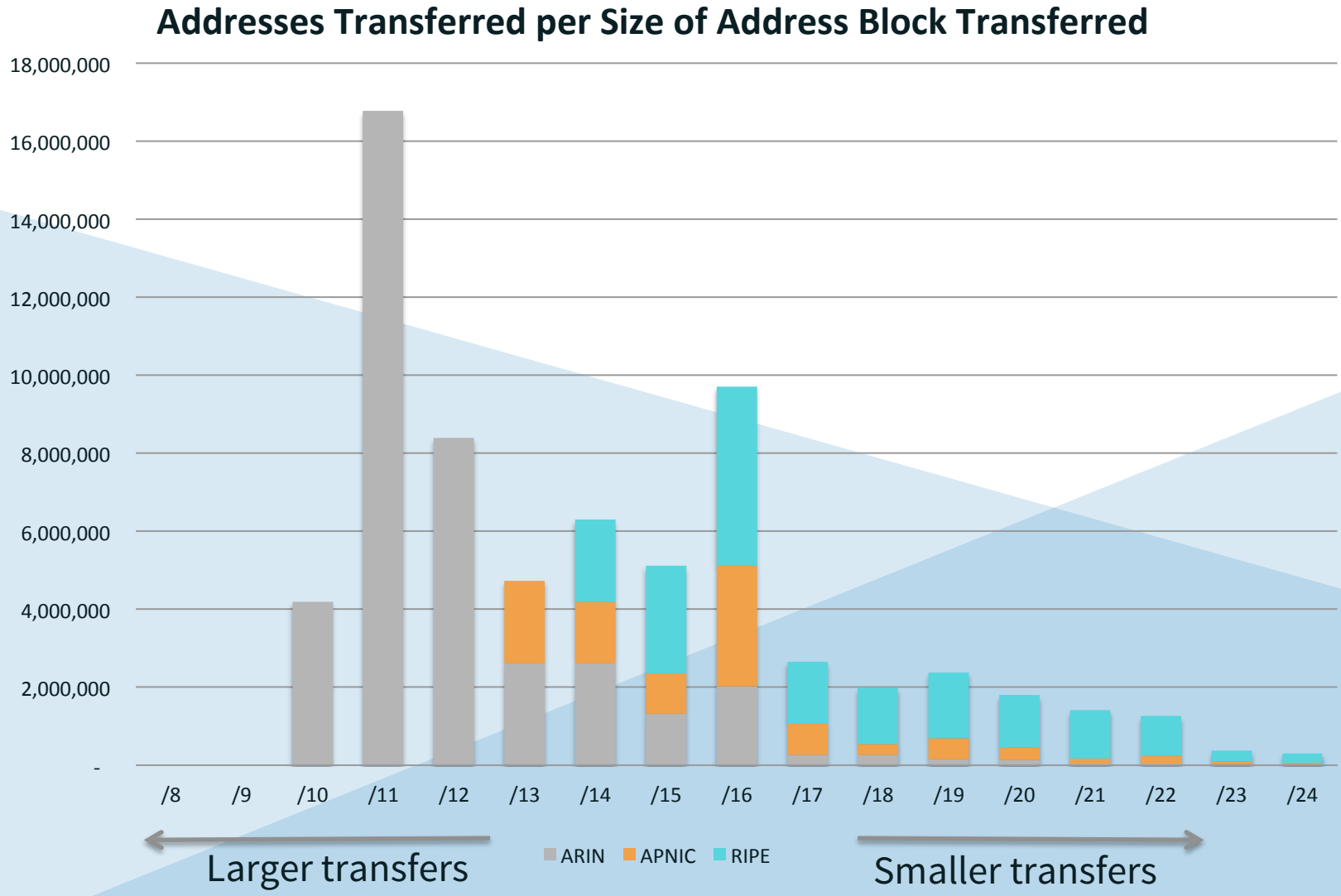
Addresses are flowing from **ARIN** to the other regions.

A.3) How "Old" Were ARIN Addresses Transferred to APNIC? 2014-01-01 to 2015-12-31 2014-2015



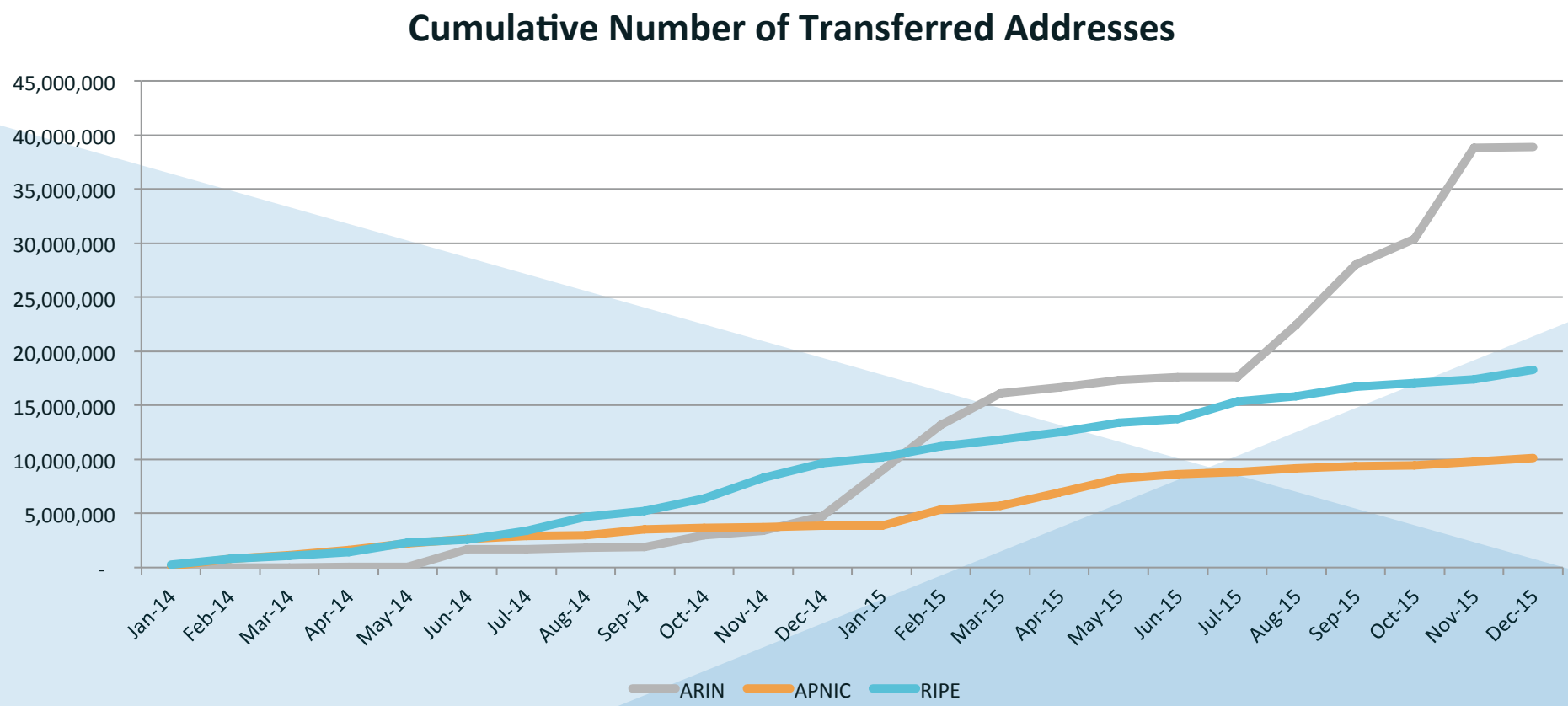
A.4) Distribution of Address Block Size in Transfers 2014-01-01 to 2015-12-31

Source: ARIN, APNIC, RIPE: APNIC & RIPE transfer stats files



A.5) Evolution Over Time
2014-01-01 to 2015-12-31

Source: ARIN, APNIC, RIPE: APNIC & RIPE transfer stats files



B) Growth of RIRs IPv4-Delegated Table

Source: delegated files

Counting increases of IPv4 assigned or allocated entries over the last 4 years

	ARIN..	APNIC..	RIPE..	LACNIC..	AFRINIC..	Total..
1/2012	43,739	19,806	44,130	3,714	1,926	113,315
1/2013	45,410	21,144	48,643	4,001	2,145	121,343
1/2014	52,047	22,742	50,004	7,800	2,382	134,975
1/2015	54,438	26,773	51,319	9,373	2,582	144,485
1/2016	56,852	31,616	56,105	10,798	2,857	158,228
4 Years later:	+30%	+60%	+27%	+191%	+48%	+40%

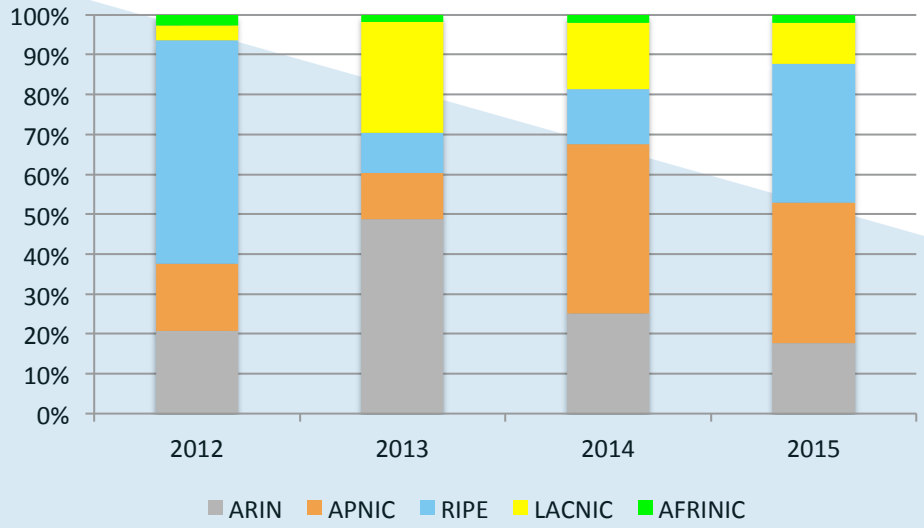
Why is this important to track over time?

The global BGP table derives from the RIR table and contains about 600,000 entries on Jan 1st 2016, roughly 4 times the number of entries in the RIR table (due to factors including internal de-aggregation and traffic engineering). Any increase in the RIR table could then create a significant surge in the BGP table.

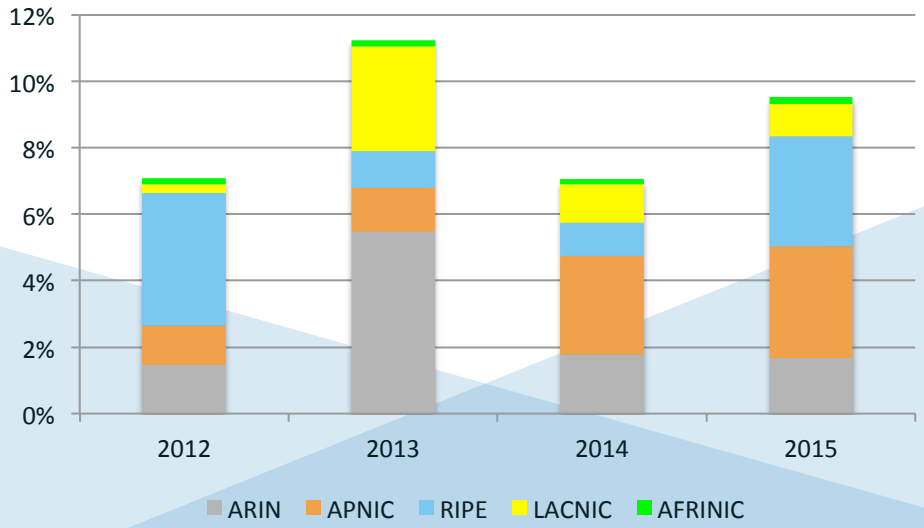
RIR Contributions to IPv4-Delegated Table Growth Year over Year

Source: delegated files

Relative Contribution



Absolute Contribution



C) Need-Based Policies and Private Contracts

The effect of need-based policies is to limit the size of the address block being transferred to the actual assessed need of the recipient.

They do not prevent **private contracts** between parties such as **Letter of Authorizations** and **Options**.

Such contracts and are **not recorded publicly**, thus it is **impossible to measure** the number of IPv4 addresses under those contracts and **evaluate the concentration of this derivative market.**

Note about Statistics Collection

ARIN, APNIC & RIPE report different data about transfers.

	Origin Org Id	Dest. Org Id	Original Block	Transferred Block	Previous Registration Date	New Registration Date	Country of Origin	Country of Destination	Format
ARIN				✔		✔			WEB
APNIC	✔	✔		✔	✔	✔	✔	✔	TXT
RIPE	✔	✔	✔	O		✔			JSON

Note: O RIPE does not report transfers of legacy blocks

This makes data analysis across regions difficult.