APNIC 42

The Status of APNIC's IPv4 Resources: Exhaustion & Transfers

Geoff Huston

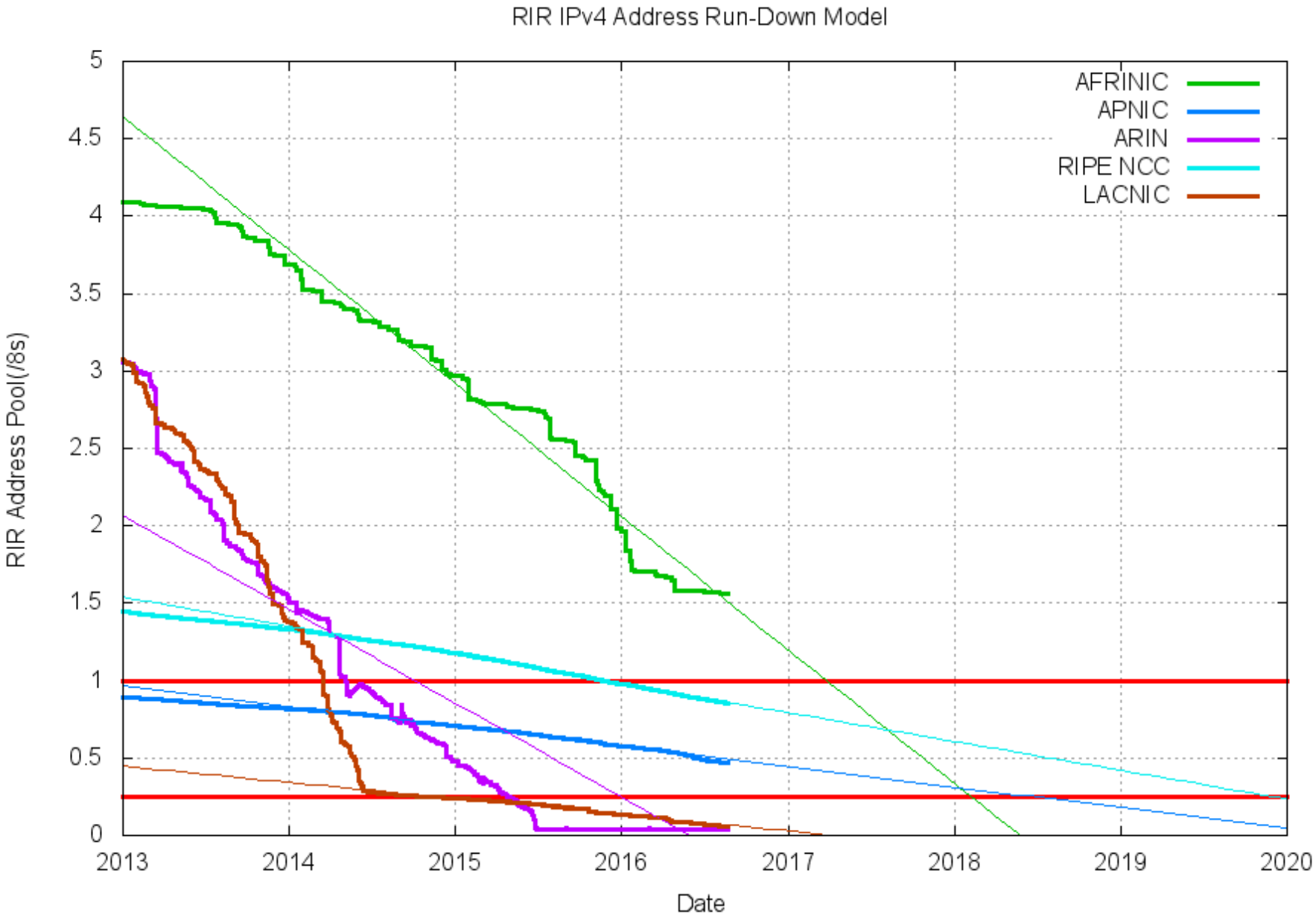
APNIC Labs

COLOMBO, SRI LANKA

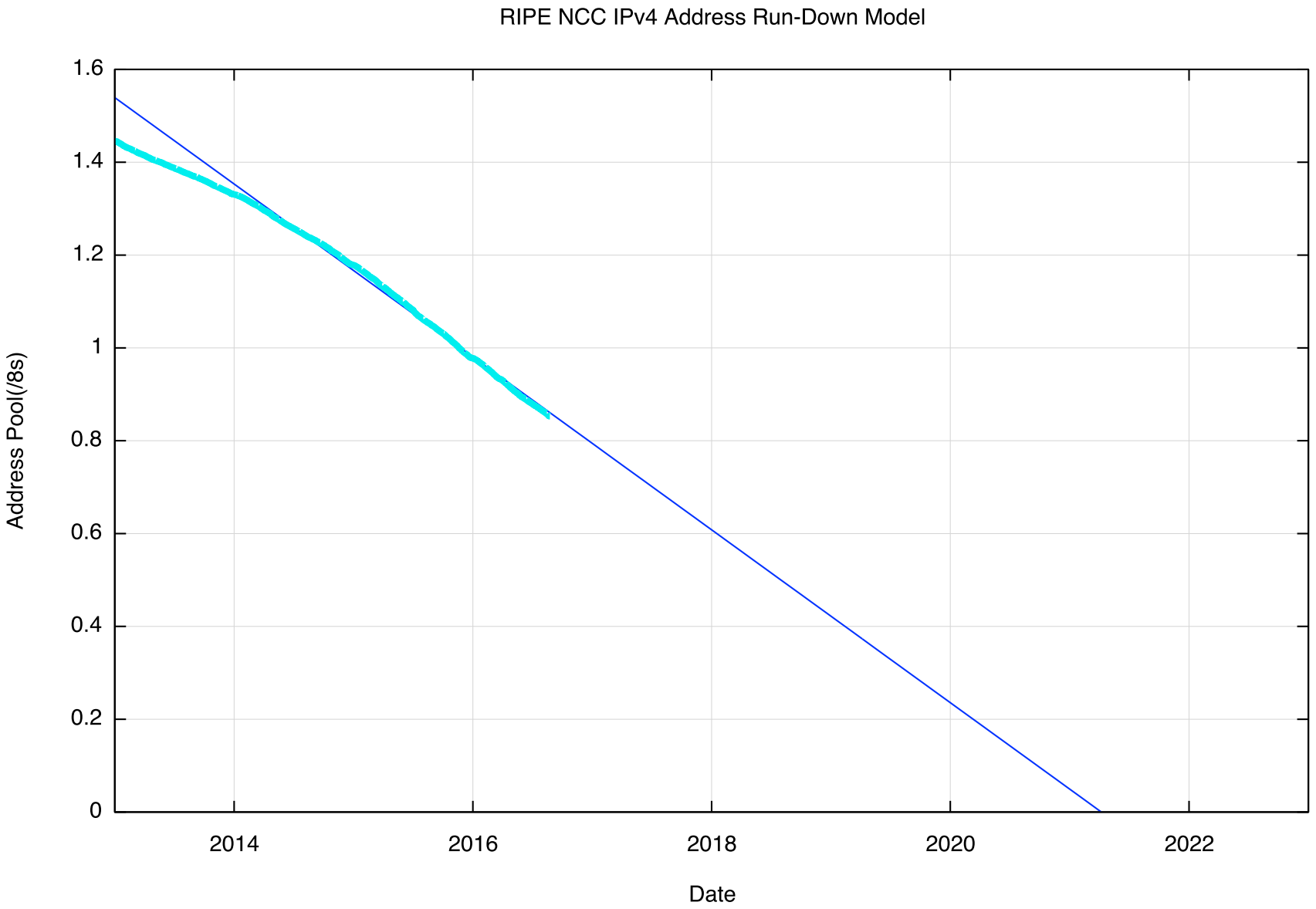
28 September – 5 October 2016

1. IPv4 Exhaustion

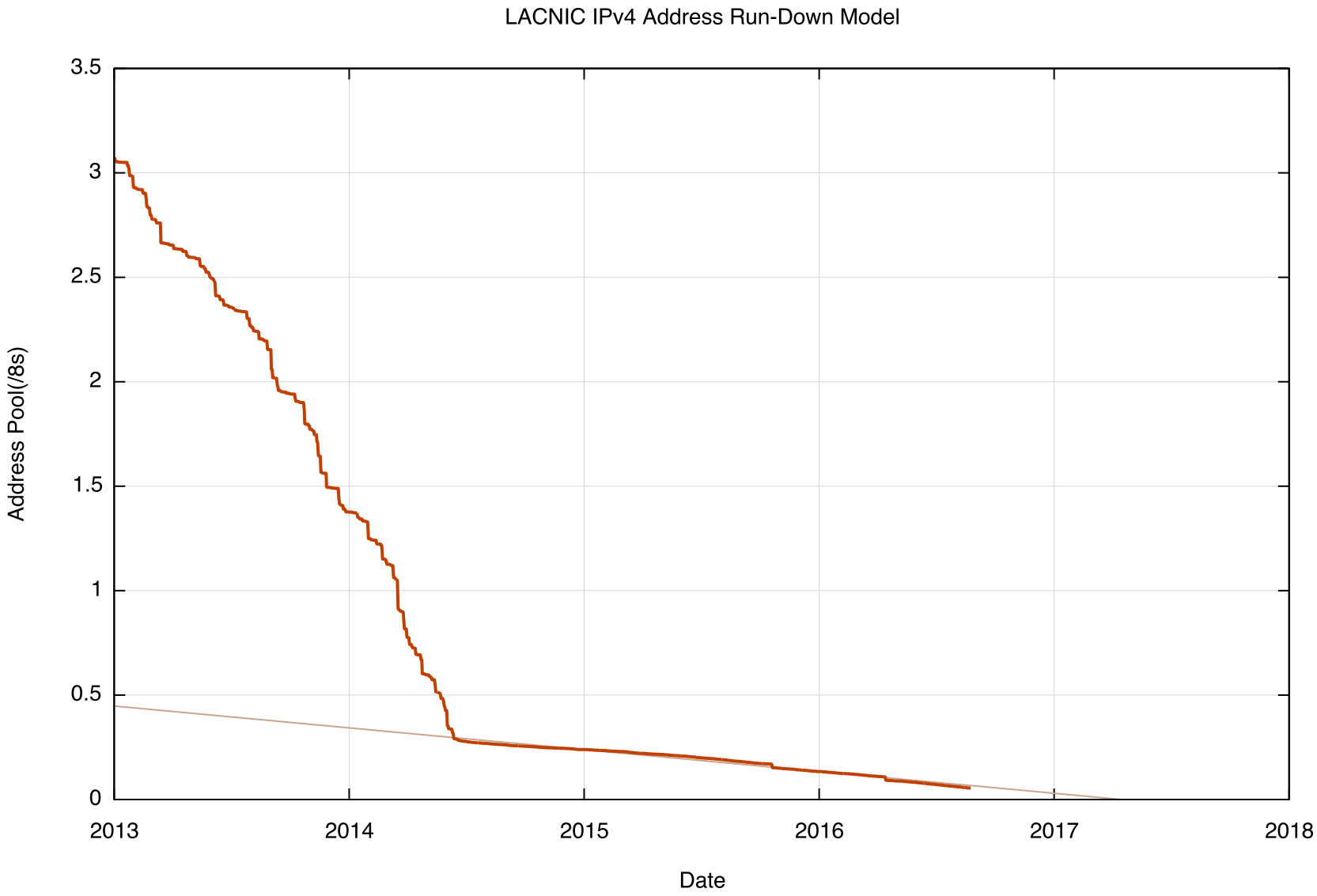
What's Left in IPv4



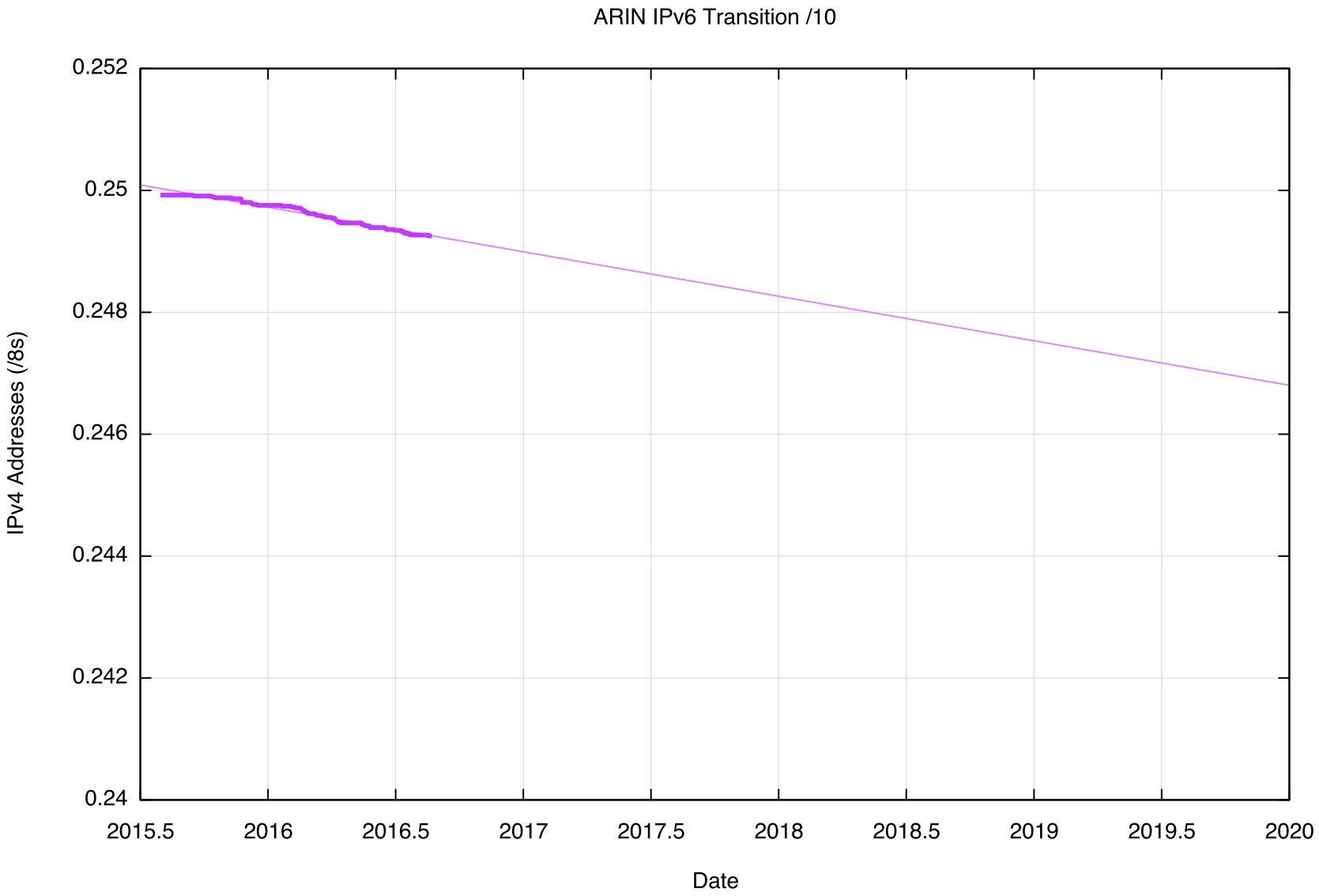
RIPE NCC's final /8



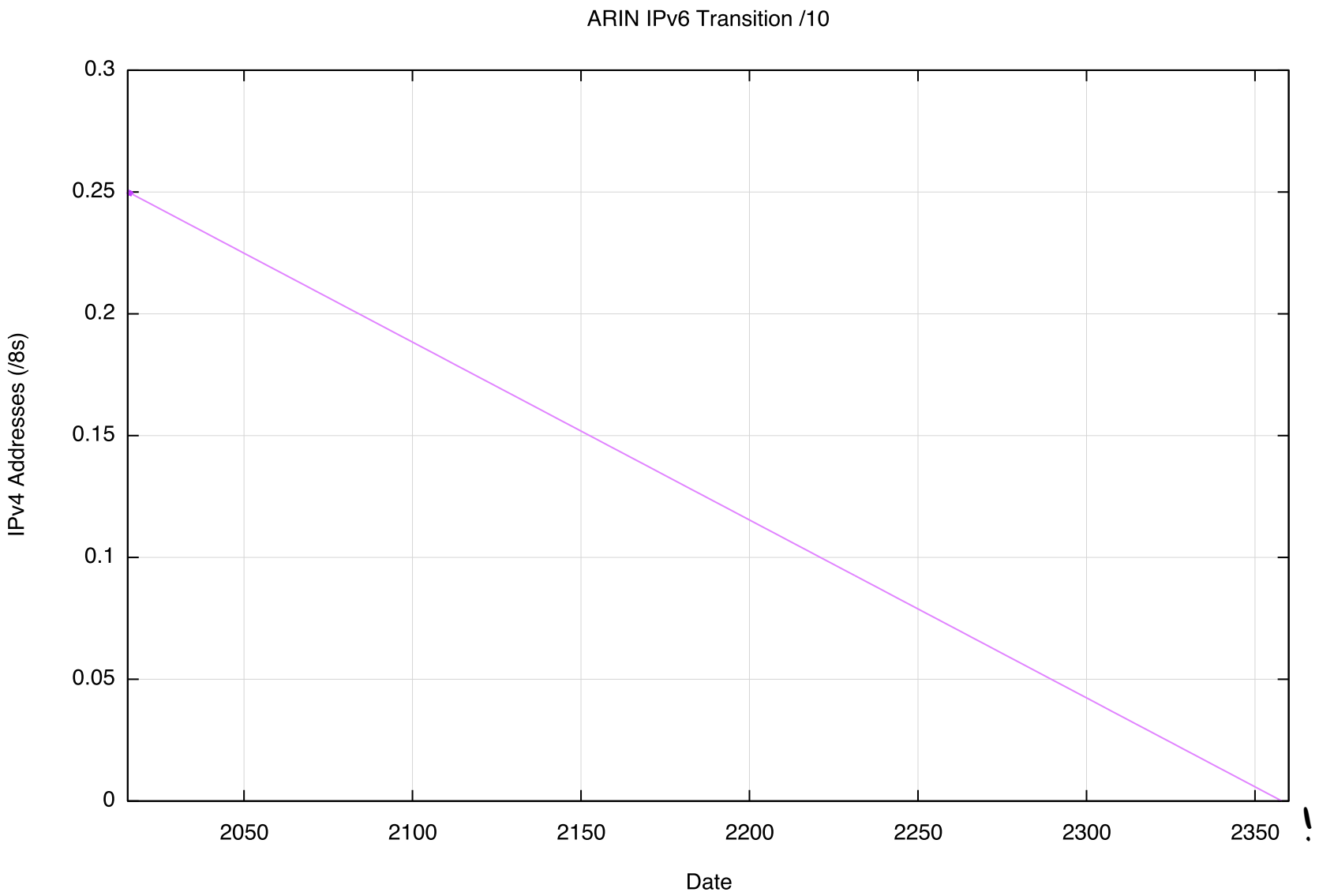
LACNIC's 2 final /11's



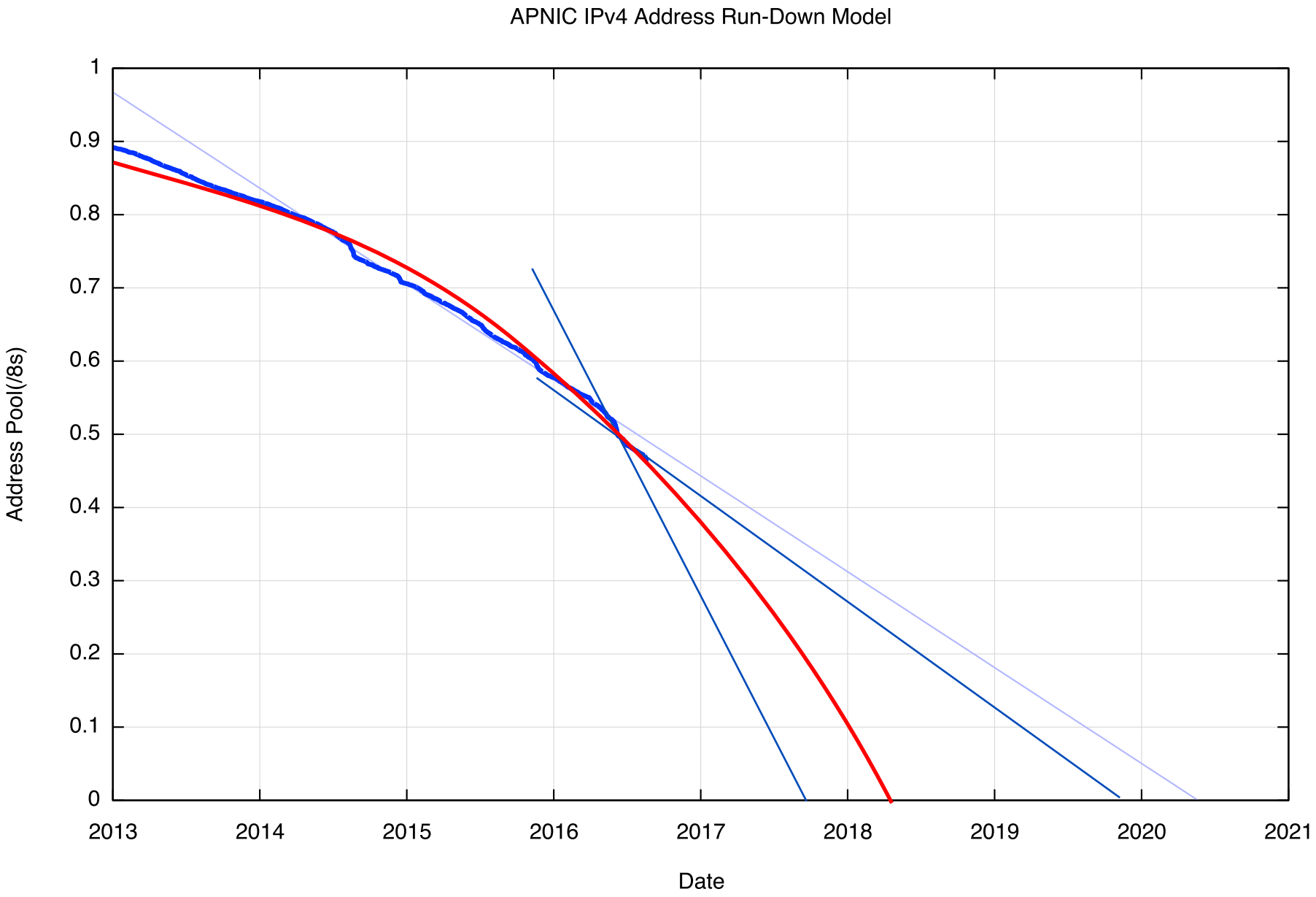
ARIN's IPv6 Transition /10



ARIN's IPv6 Transition /10



APNIC's final /8



Where Are We?

- LACNIC running a split pool of two /11 blocks
  6 – 9 months to go
- APNIC running out of their last /8
  2 – 3 years to go
- AFRINIC still have a pool of 1.5 /8s to go
  2 years to go
- RIPE NCC running out of their last /8
  4 ½ years to go
- ARIN reserved a /10 for V6 transition
  345 years to go

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  345 years to go

Let's take a more detailed look at APNIC's situation

2. APNIC’s Last /8

APNIC's IPv4 Address Pools: August 2016

	Pool	Assigned	Available	Reserved
Last /8	16,771,584	8,798,720	7,790,336	182,528
IANA Returns	4,060,160	4,020,224	0	39,936
Various	120,366,336	117,288,448	0	3,077,888
APNIC Allocations	738,150,656	737,881,088	0	269,568
RIR Transfers	383,488	383,488	0	0
Total	**879,732,224**	**868,371,968**	**7,790,336**	**3,569,920**

APNIC Allocation from the last /8

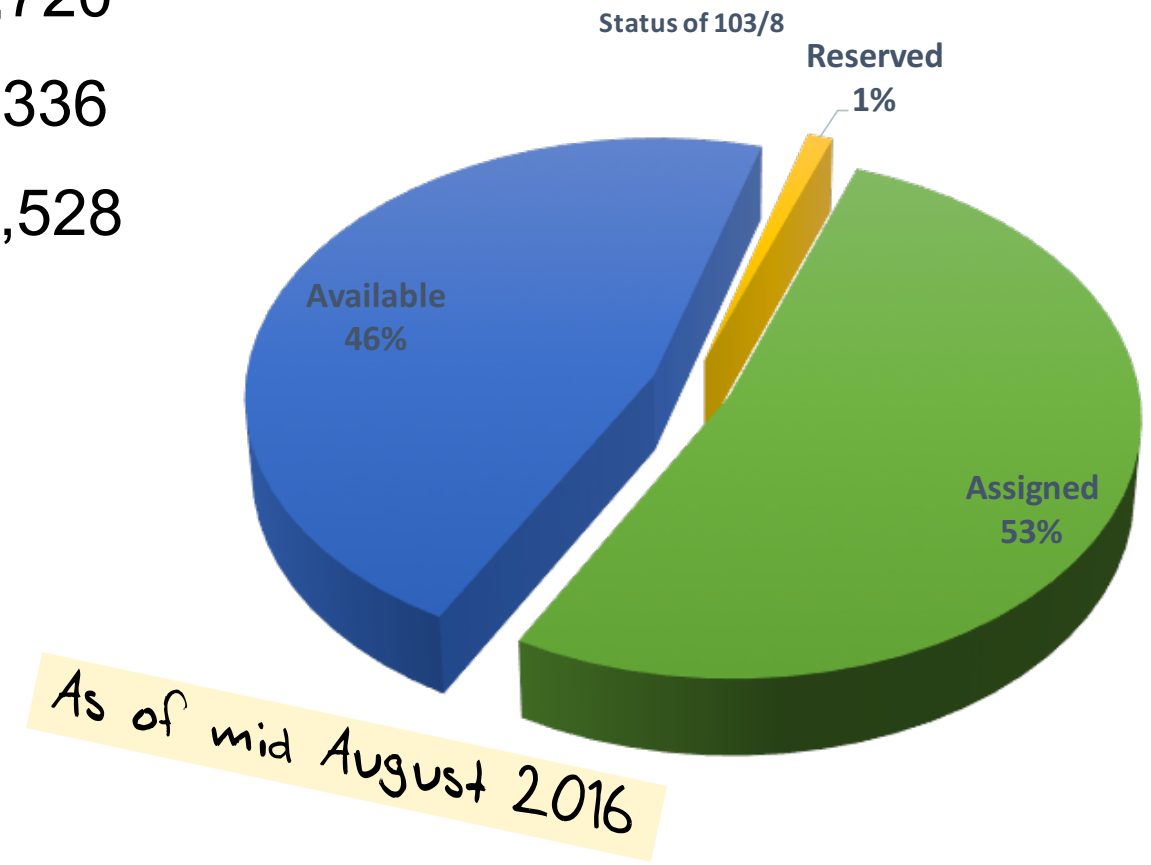
“This means that Members can still get IPv4 address space; however, each Member is entitled to a total maximum of a /22 (or 1,024 addresses) from each pool.”

Status of 103/8

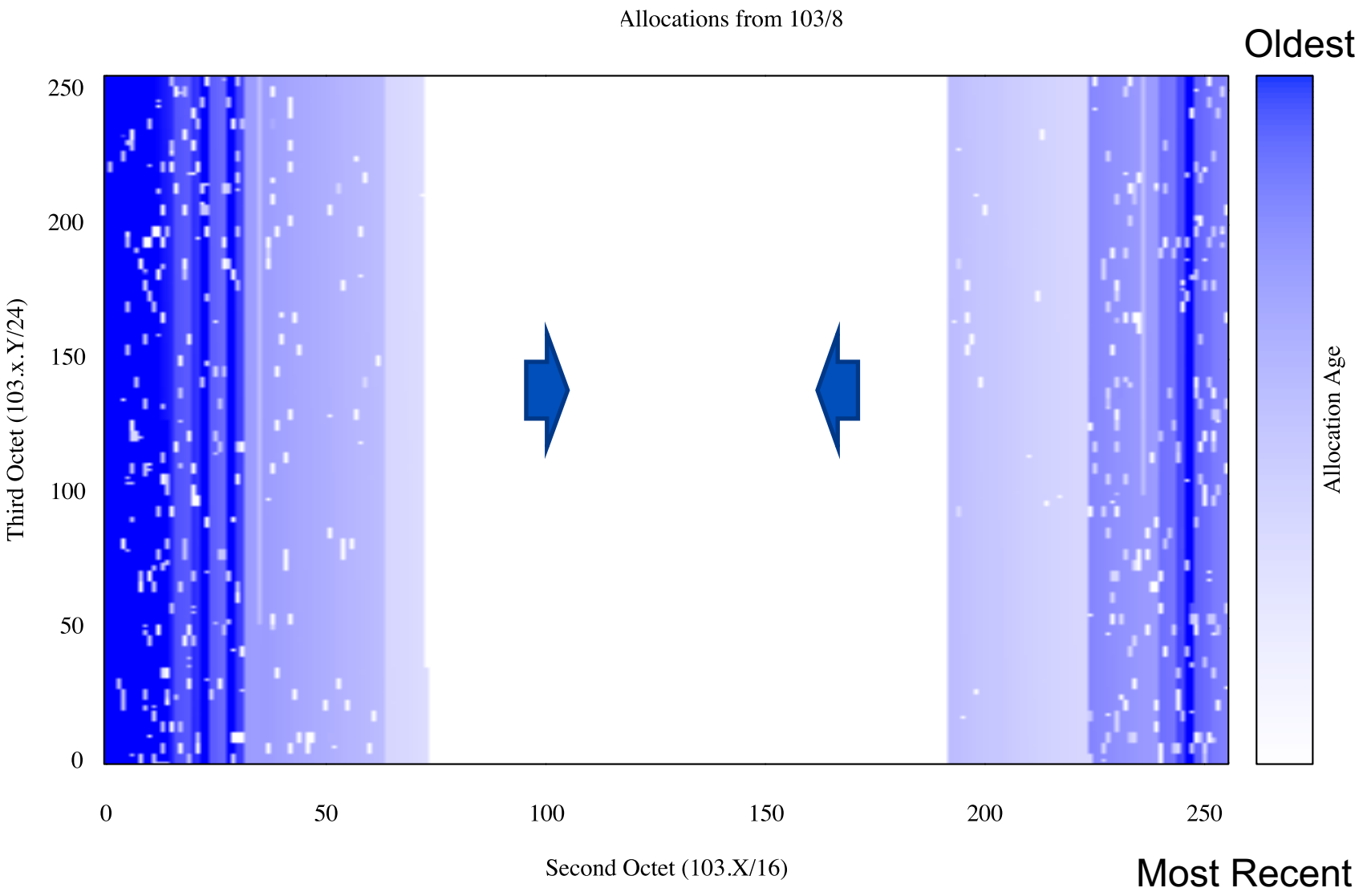
Assigned: 8,798,720

Available: 7,790,336

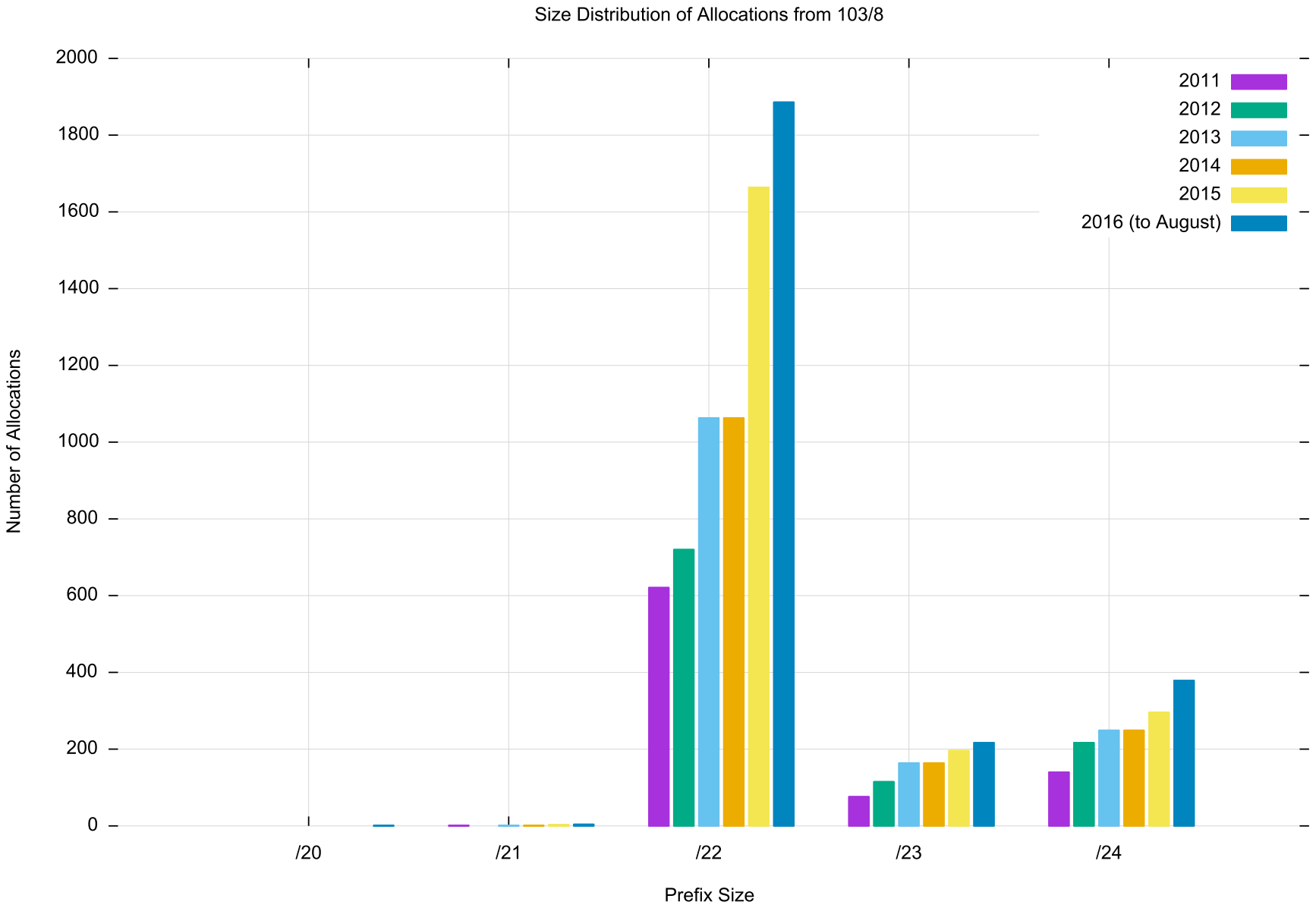
Reserved: 182,528



APNIC's Last /8



Allocation Sizes - APNIC

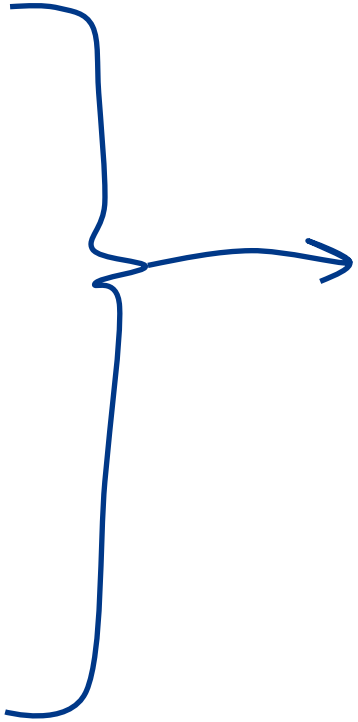


Larger Holdings in 103/8?

There are 100 instances where the same end entity is listed as holding more than 1,024 addresses assigned from 103/8

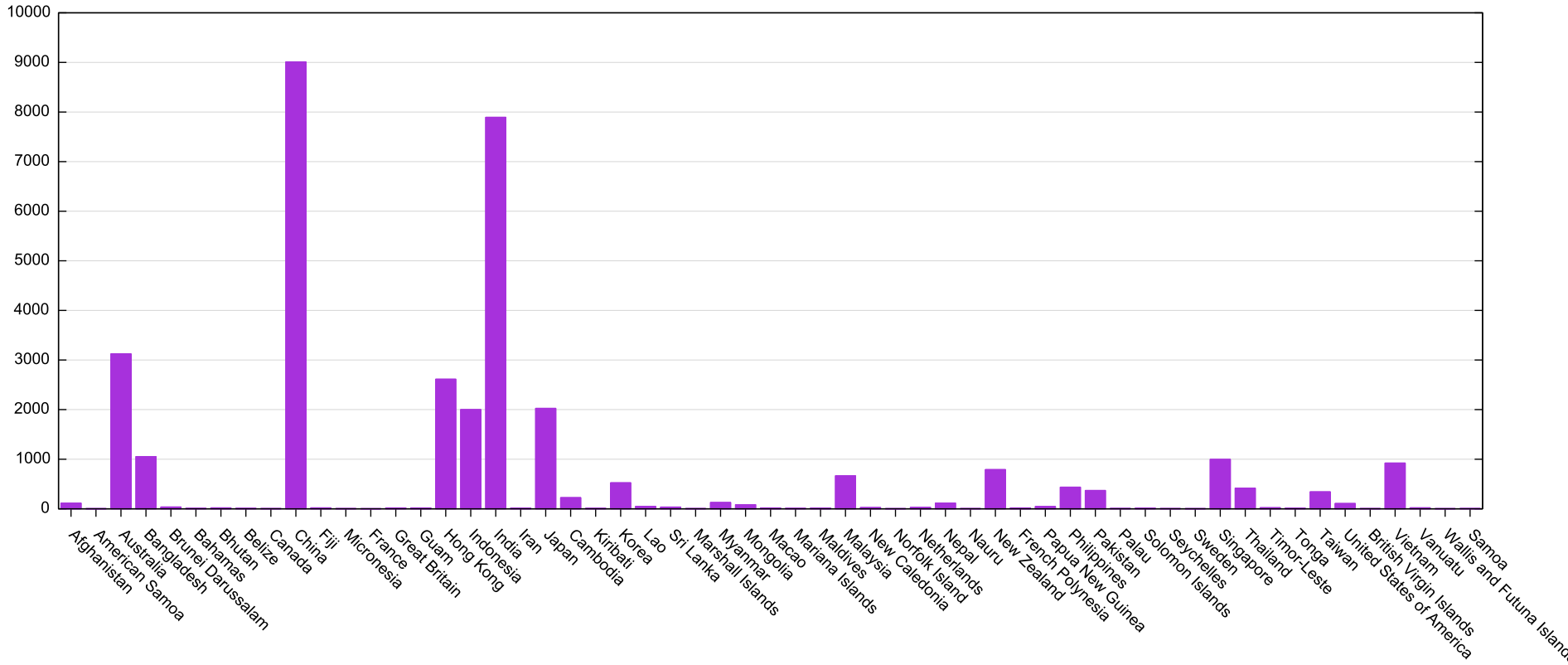
These are probably the result of post-allocation mergers, acquisitions and transfers

1	x	1,280
17	x	1,536
1	x	1,792
185	x	2,048
1	x	2,304
1	x	2,560
26	x	3,072
8	x	4,096
1	x	4,352
3	x	5,120
1	x	7,168
1	x	8,192
1	x	10,240
1	x	13,312
1	x	14,336
1	x	67,840

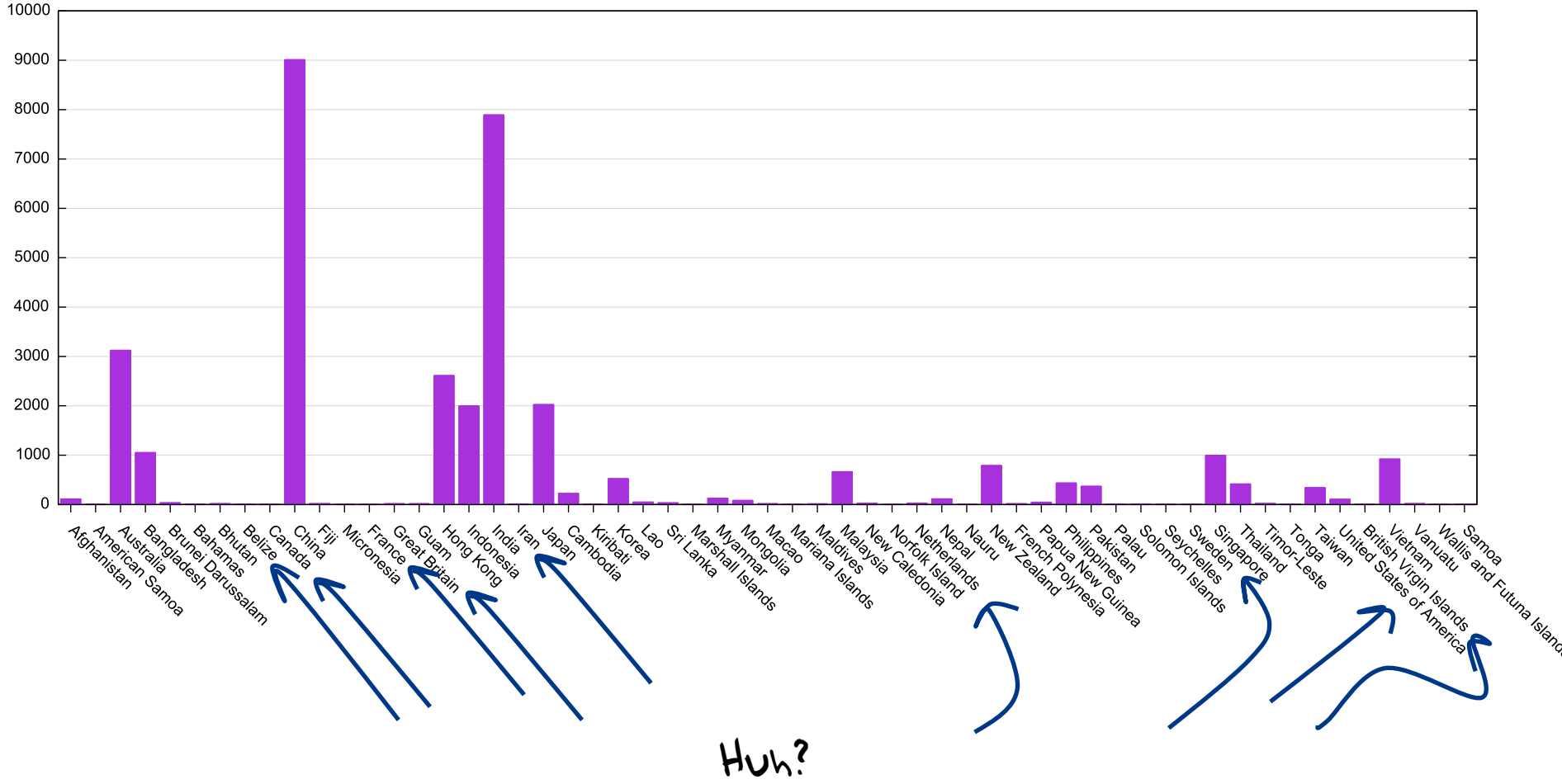


Cumulatively, this accounts for 66,368 addresses, or 8.5% of all addresses that have been assigned from 103/8

Country Allocations from 103/8



Country Allocations from 103/8



Transfer Activity in the Last /8

6 Inter-RIR transfers:

- 2,048 addresses transferred to RIPE NCC, Netherlands (2015)
- 1,024 addresses transferred to RIPE NCC, Iran (2016)
- 3,072 addresses transferred to ARIN, United States (2016)

195 APNIC transfers:

- 172,032 addresses transferred

Advertised vs Assigned in 103/8

Assigned Addresses:

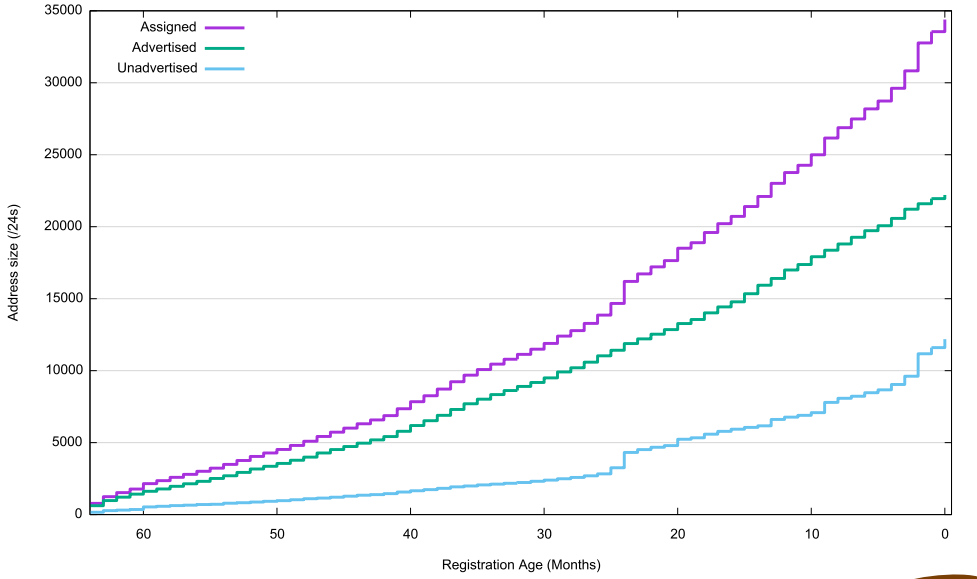
8,804,352

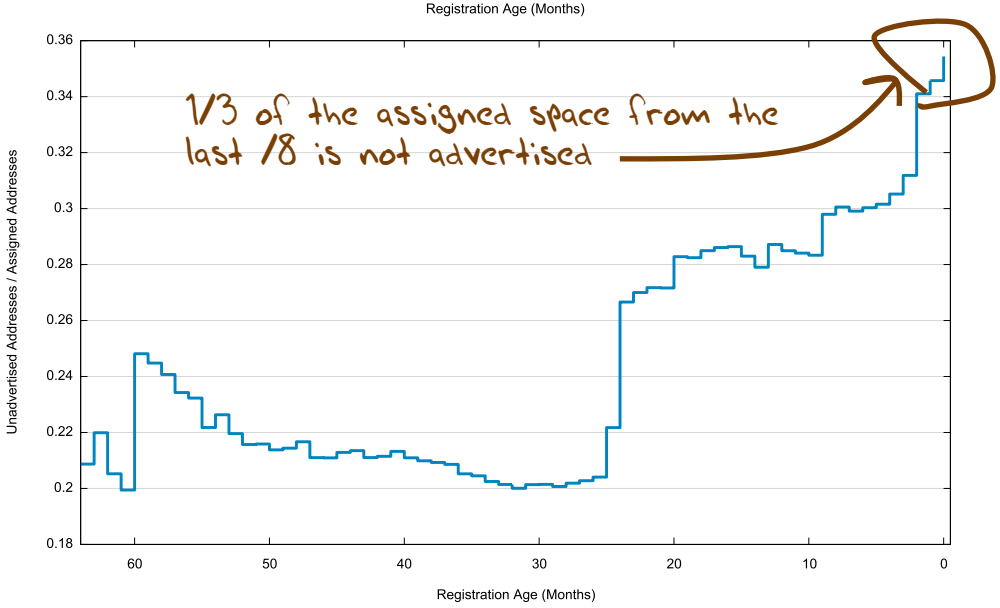
Advertised Addresses:

5,865,984

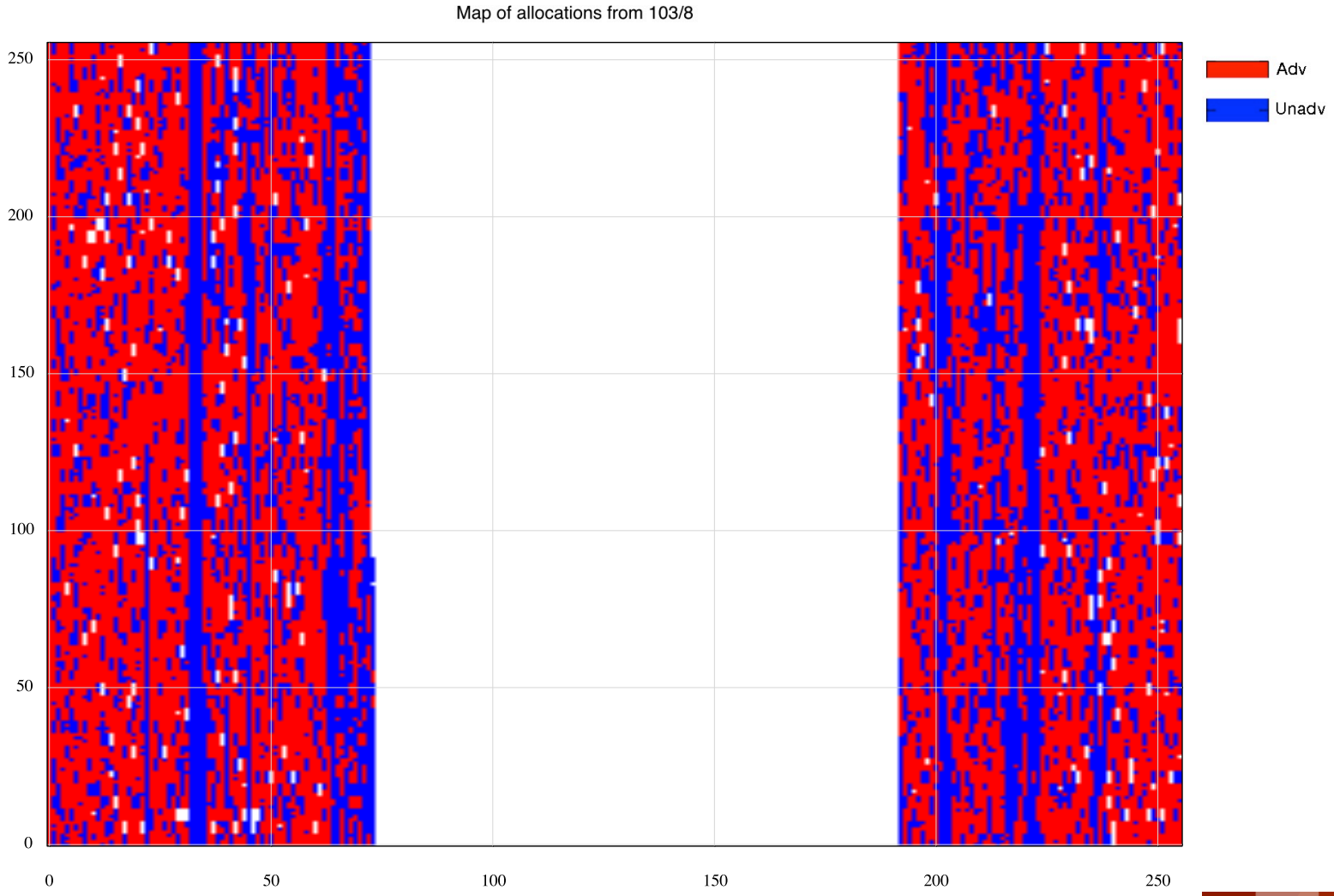
Unadvertised Addresses:

2,938,368

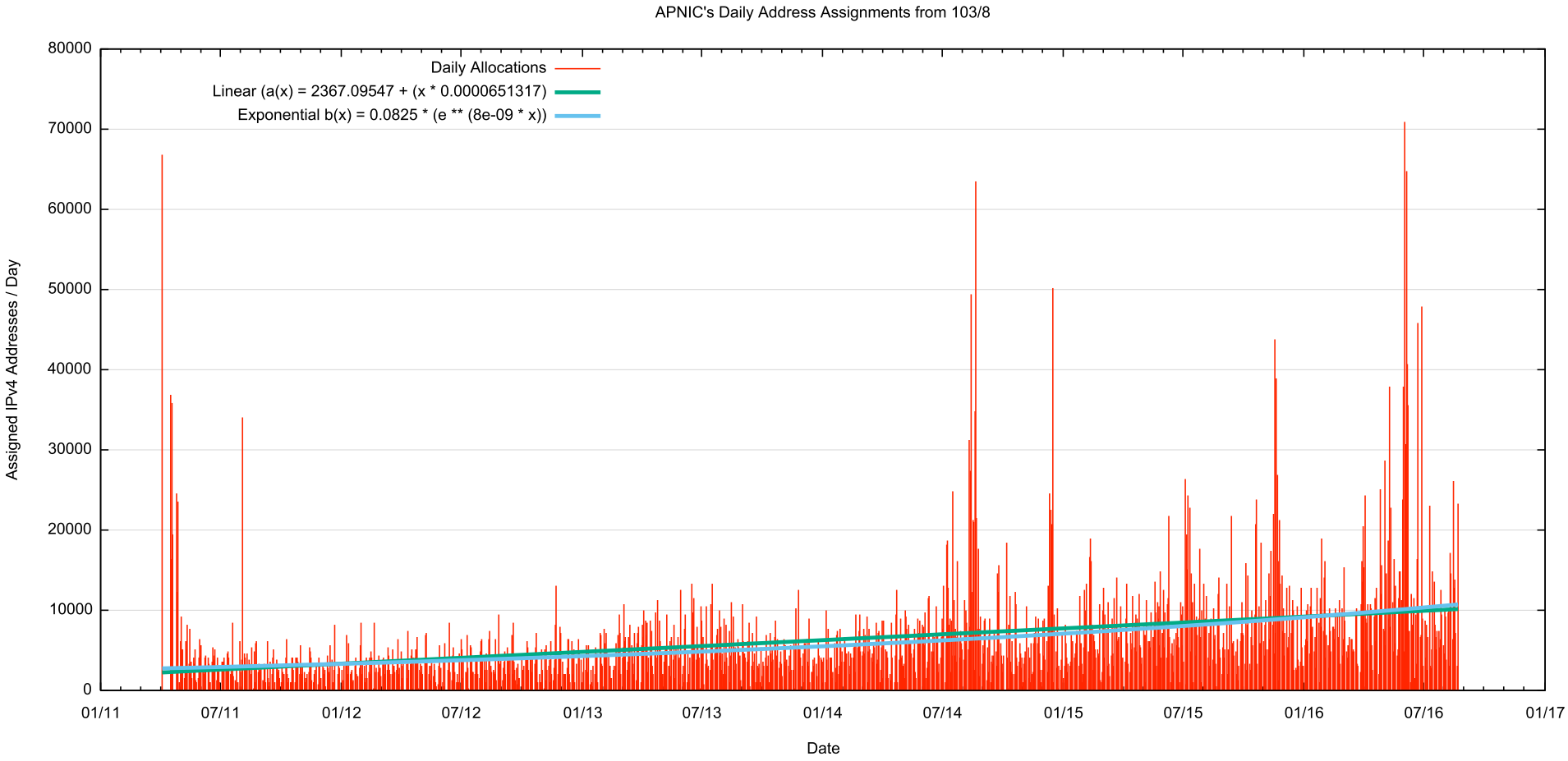




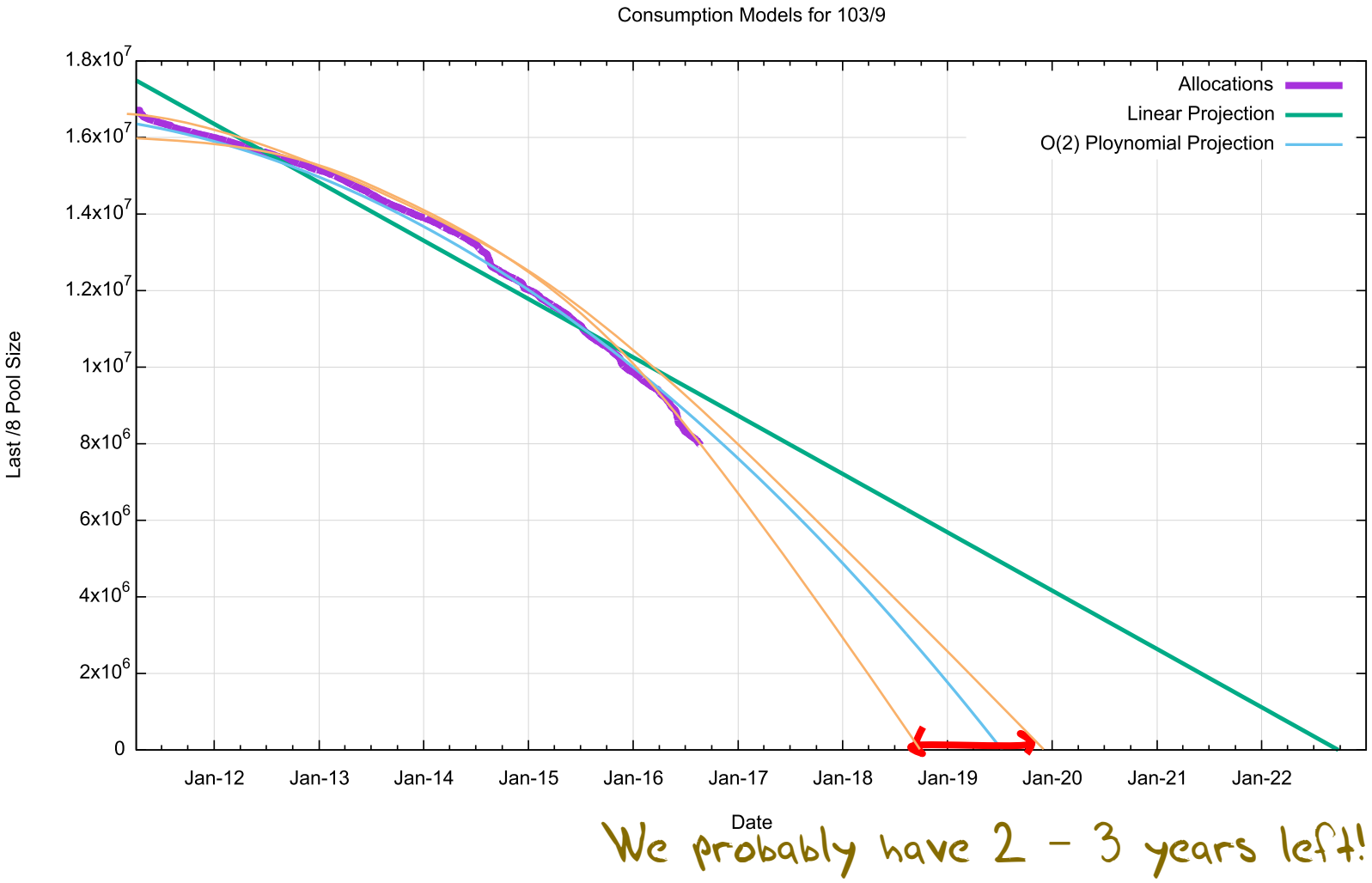
Advertised/Unadvertised Map of 103/8



103/8 Consumption Modelling



Projection for the last /8



3. IANA Recovered Space:
Returns to APNIC

APNIC's IPv4 Address Pools: August 2016

	Pool	Assigned	Available	Reserved
Last /8	16,771,584	8,798,720	7,790,336	182,528
IANA Returns	4,060,160	4,020,224	0	39,936
Various	120,366,336	117,288,448	0	3,077,888
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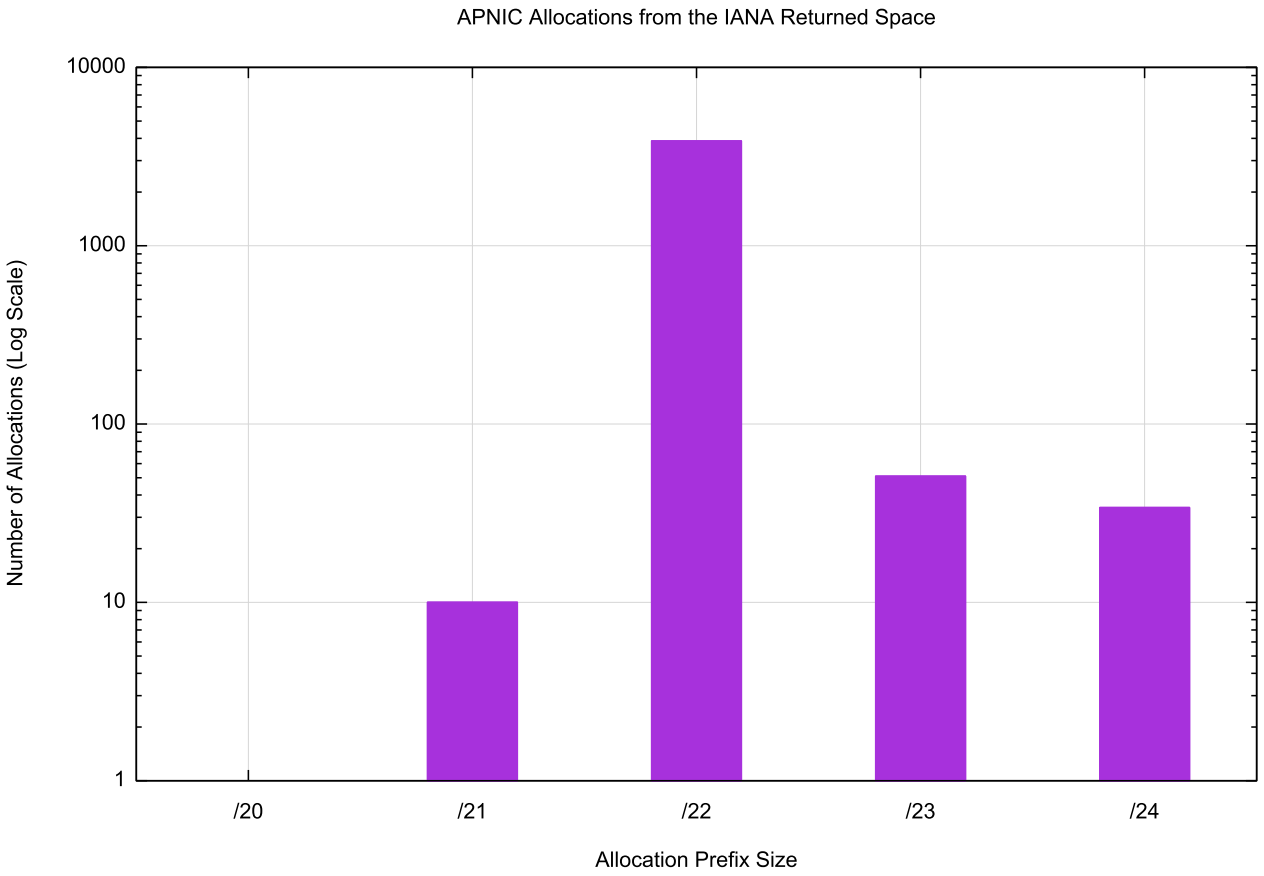
RIR Transfers	383,488	383,488	0	0
Total	**879,732,224**	**868,371,968**	**7,790,336**	**3,569,920**

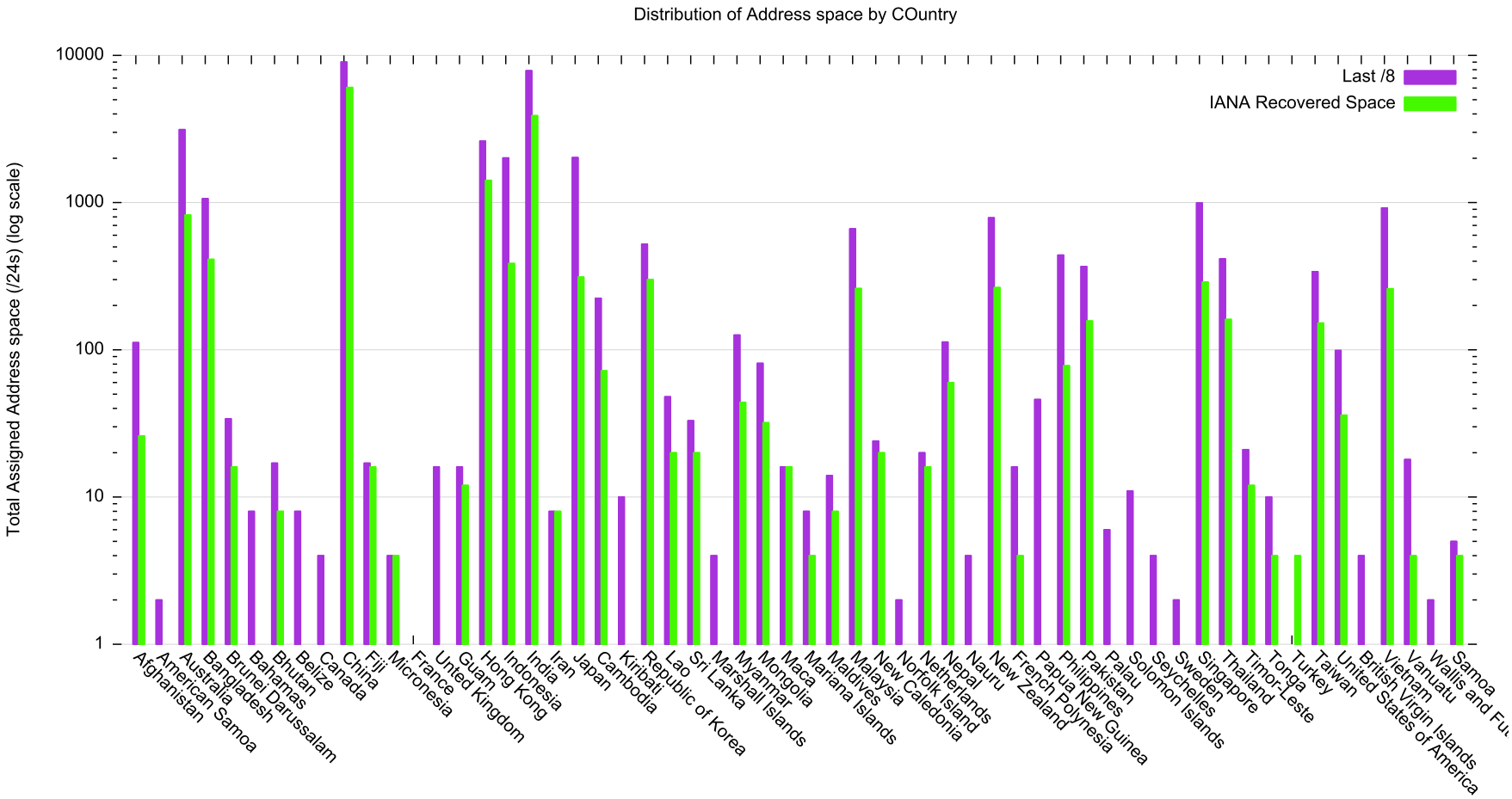
Recovered Pool Status

		Advertised	Unadvertised	
Total_Pool	4,063,232	2,241,536	1,821,696	45%
Transferred	3,072	2,048	1,024	33%
APNIC Pool	4,060,160	2,239,488	1,820,672	45%
Available	0	0	0	
Reserved	40,960	4,096	36,864	90%
Assigned	4,019,200	2,235,392	1,783,808	44%

Allocation Size Distribution



Economy Distribution



Advertised vs UnAdvertised

	Last /8	IANA Returned
Advertised	5,865,984	2,239,488
UnAdvertised	2,938,368	1,820,672
Total	8,804,352	4,060,140
	66÷ advertised	55÷ advertised

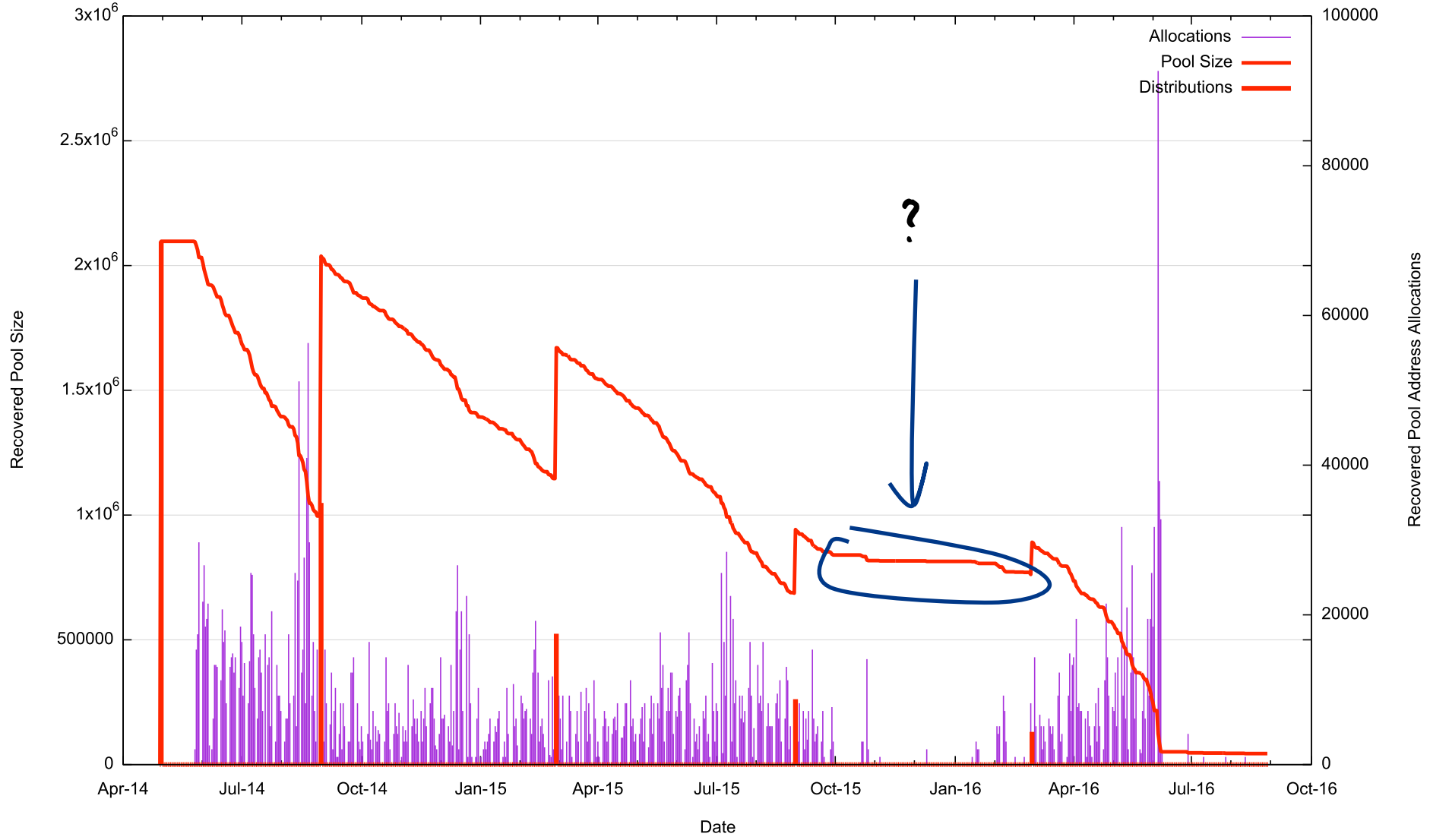
Who Has What

Of the 6,803 distinct holders of pre-exhaustion address space, only 2,159 entities also hold last /8 and/or IANA recovered space.

There are more entities holding only last /8 and/or IANA recovered space (7,090) than holders of the pre-exhaustion address space

APNIC Allocated	ERX/Legacy	Last /8	Recovered	XFR IN	Count
✓					3,836
	✓				680
✓	✓				126
		✓			3,836
✓		✓			1,476
	✓	✓			17
✓	✓	✓			47
			✓		20
✓			✓		6
✓	✓		✓		1
		✓	✓		3,228
✓		✓	✓		554
	✓	✓	✓		14
✓	✓	✓	✓		25
				✓	3
✓				✓	1
✓	✓			✓	1
		✓		✓	2
✓		✓		✓	7
✓	✓	✓		✓	1
		✓	✓	✓	4
✓		✓	✓	✓	4
	✓	✓	✓	✓	3
✓	✓	✓	✓	✓	4
6,089	919	9,222	3,863	30	13,896

Returned Pool Consumption

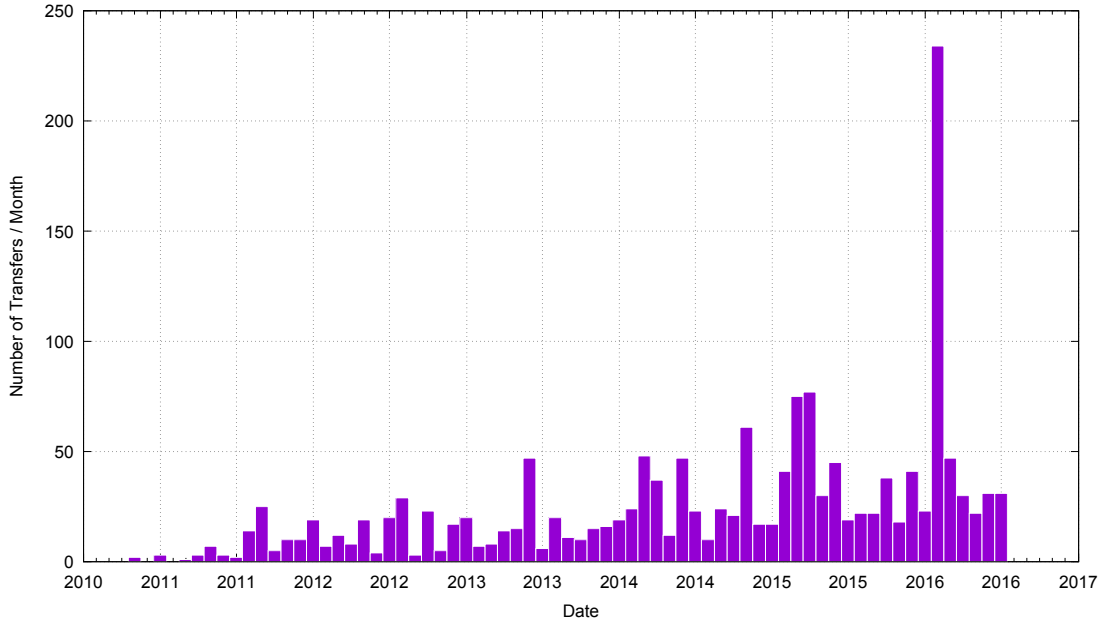


4. Transfers

IPv4 Address Transfers

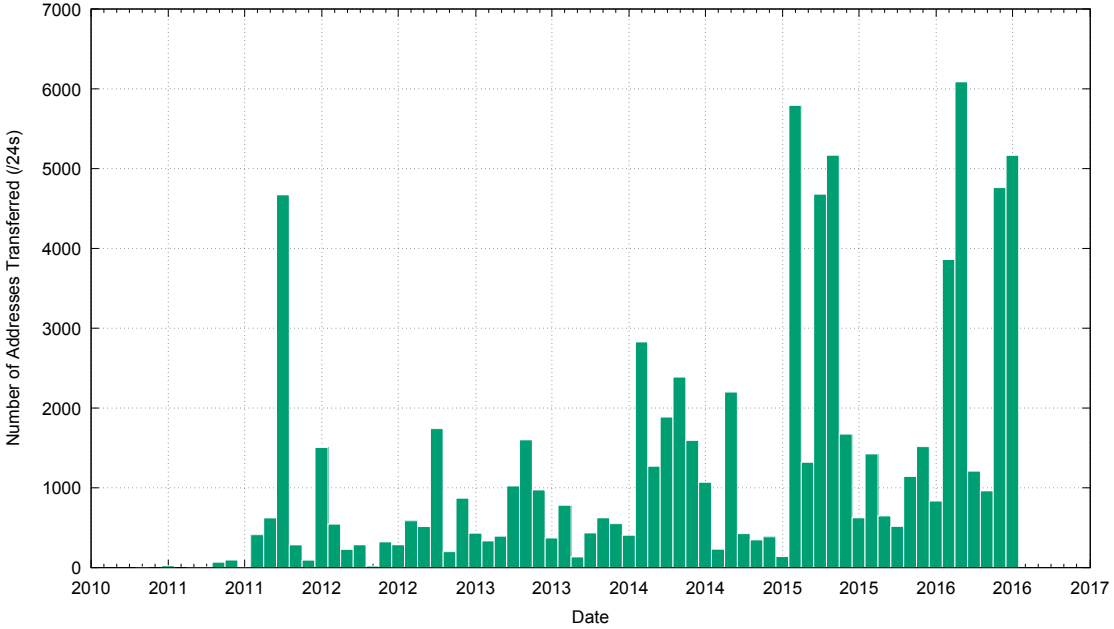
Total Transfers Registered with APNIC:	1,672
Internal (APNIC -> APNIC):	1,425
Inter-RIR: ARIN->APNIC	229
APNIC ->ARIN	9
APNIC->RIPE NCC	9

Total Address Volume Transferred:	21,702,400
Internal (APNIC -> APNIC):	12,554,944
Inter-RIR: ARIN->APNIC	8,012,288
APNIC->ARIN	19,456
APNIC->RIPENCC	115,712

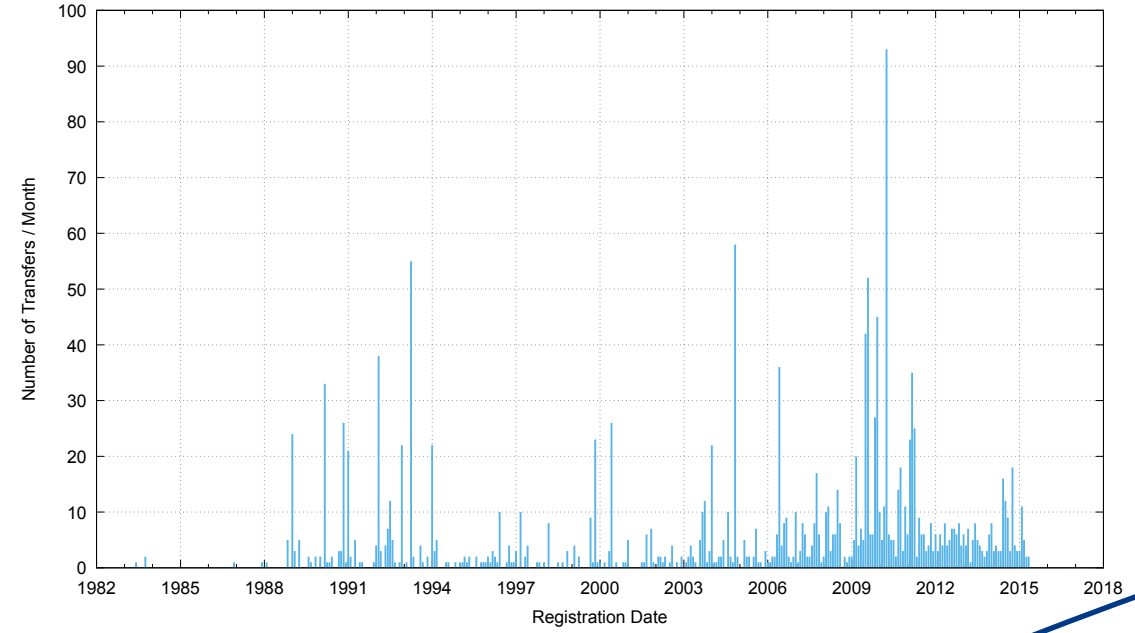


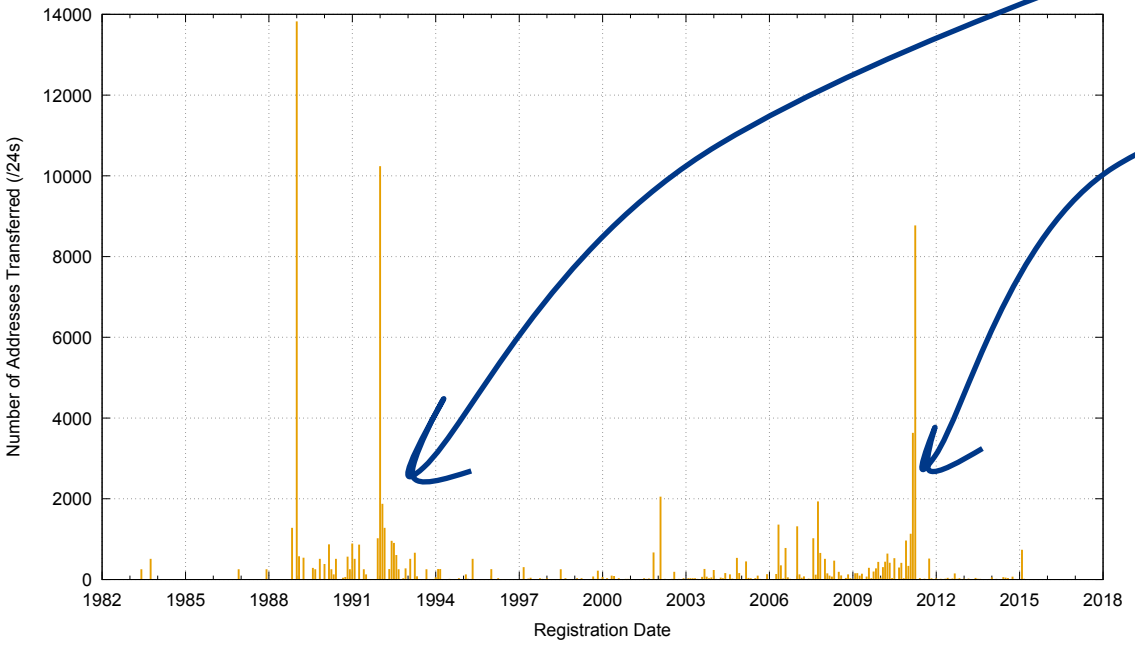
Transfers started in APNIC in late 2010

The average number of transfers per month has risen from 2 – 3 per month to 30 – 80 per month in 2016



The volume of addresses transferred has risen from some 10 x /24s per to a total monthly volume of of 1,000 – 6,000 /24s in 2015 - 2016.

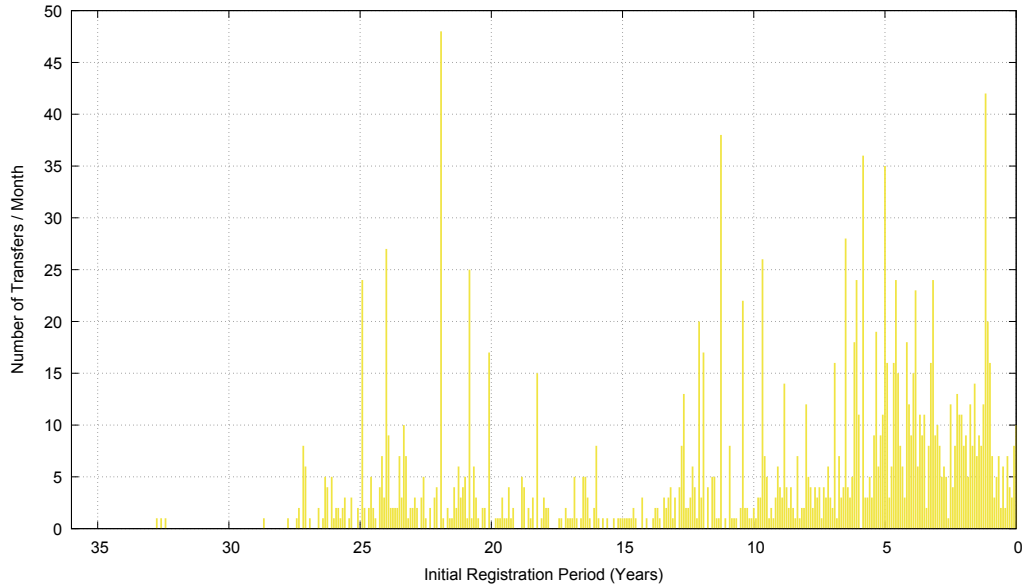


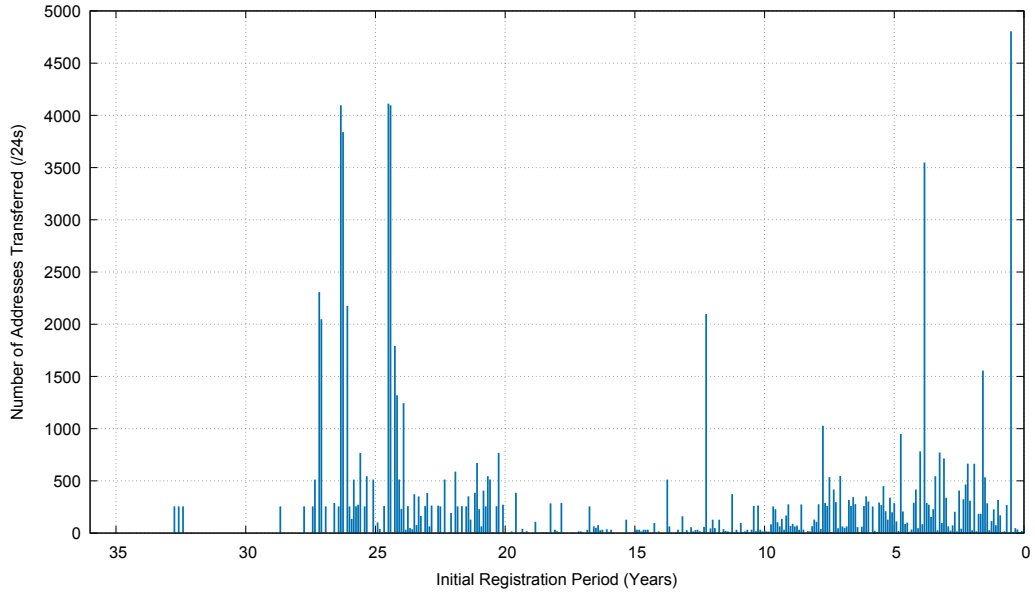


Original Allocation (Registration) date of the Transferred Addresses

There are two visible peaks here: one is the so-called “legacy” space which was originally allocated pre 1994
The other is the address blocks allocated in 2009 – 2011, immediately prior to APNIC address exhaustion.

These relative peaks are visible when looking at the volumes of transferred addresses,





Age (since initial allocation) of the Transferred Addresses

There are again two visible clusters here: one is the so-called “legacy” space which is transferred some 20 - 25 years after the initial allocation and the second is a peak of transferred addresses that were transferred within 2 - 8 years following the initial allocation.

An Economy View of Transfers

- The next few slides look at transfers from a national perspective.
- An “**Import**” is where the receiver of the transferred address is registered within the country
- An “**Export**” is where the disposer of the transferred address is registered within the country
- A “**Domestic**” transfer is where the disposer and receiver are both in the same country

Imports and Exports

CC Code	Imports		Exports		Internal		Total		Name
	Number	Addresses	Number	Addresses	Number	Addresses	Number	Addresses	
AF	2	33,792	1	1,024	0	0	3	34,816	Afghanistan
APNIC	21	310,784	11	150,784	7	76,800	39	538,368	APNIC - AP Code
ARIN	9	19,456	229	8,012,288	0	0	238	8,031,744	ARIN
AU	24	545,024	28	467,968	175	597,760	227	1,610,752	Australia
BD	4	2,560	2	9,216	22	49,152	28	60,928	Bangladesh
CN	32	3,916,544	13	1,447,936	54	1,801,984	99	7,166,464	China
FJ	0	0	1	256	0	0	1	256	Fiji
HK	43	2,002,176	40	1,786,368	93	328,192	176	4,116,736	Hong Kong
ID	1	8,192	7	43,008	44	53,248	52	104,448	Indonesia
IN	107	2,643,200	2	8,192	128	337,152	237	2,988,544	India
JP	33	1,225,984	7	98,816	603	3,012,096	643	4,336,896	Japan
KH	3	18,432	0	0	6	13,312	9	31,744	Cambodia
KR	2	2,048	0	0	0	0	2	2,048	Republic of Korea
MM	2	3,072	0	0	0	0	2	3,072	Myanmar
MN	2	8,448	1	256	3	17,408	6	26,112	Mongolia
MY	20	187,136	3	1,536	9	8,704	32	197,376	Malaysia
NP	0	0	1	2,048	3	18,432	4	20,480	Nepal
NZ	11	33,024	11	101,632	17	72,192	39	206,848	New Zealand
PF	1	16,384	0	0	0	0	1	16,384	French Polynesia
PG	0	0	0	0	2	2,048	2	2,048	Papua New Guinea
PH	7	77,568	12	48,128	9	61,440	28	187,136	Philippines
PK	1	4,096	0	0	27	24,576	28	28,672	Pakistan
RIPE	9	115,712	0	0	0	0	9	115,712	RIPE NCC
SG	55	3,112,448	36	2,546,944	10	40,704	101	5,700,096	Singapore
TH	9	434,176	0	0	42	391,168	51	825,344	Thailand
TL	3	2,304	0	0	0	0	3	2,304	Timor-Leste
TO	0	0	0	0	1	512	1	512	Tonga
TW	4	4,096	2	1,536	8	65,536	14	71,168	Taiwan
VN	4	3,328	0	0	0	0	4	3,328	Vietnam
WS	0	0	2	2,048	0	0	2	2,048	Samoa
	409	**14,729,984**	**409**	**14,729,984**	**1,263**	**6,972,416**	**2,081**	**36,432,384**	

Imports and Exports

- The Asia Pacific region is a net importer of IPv4 addresses (8.0M addresses have been imported from ARIN via transfers)
- Japan is the largest domestic market for IPv4 addresses
- Singapore is the largest regional exporter of addresses, and China is the largest regional importer

How Many are Buying and Selling?

502 different sellers

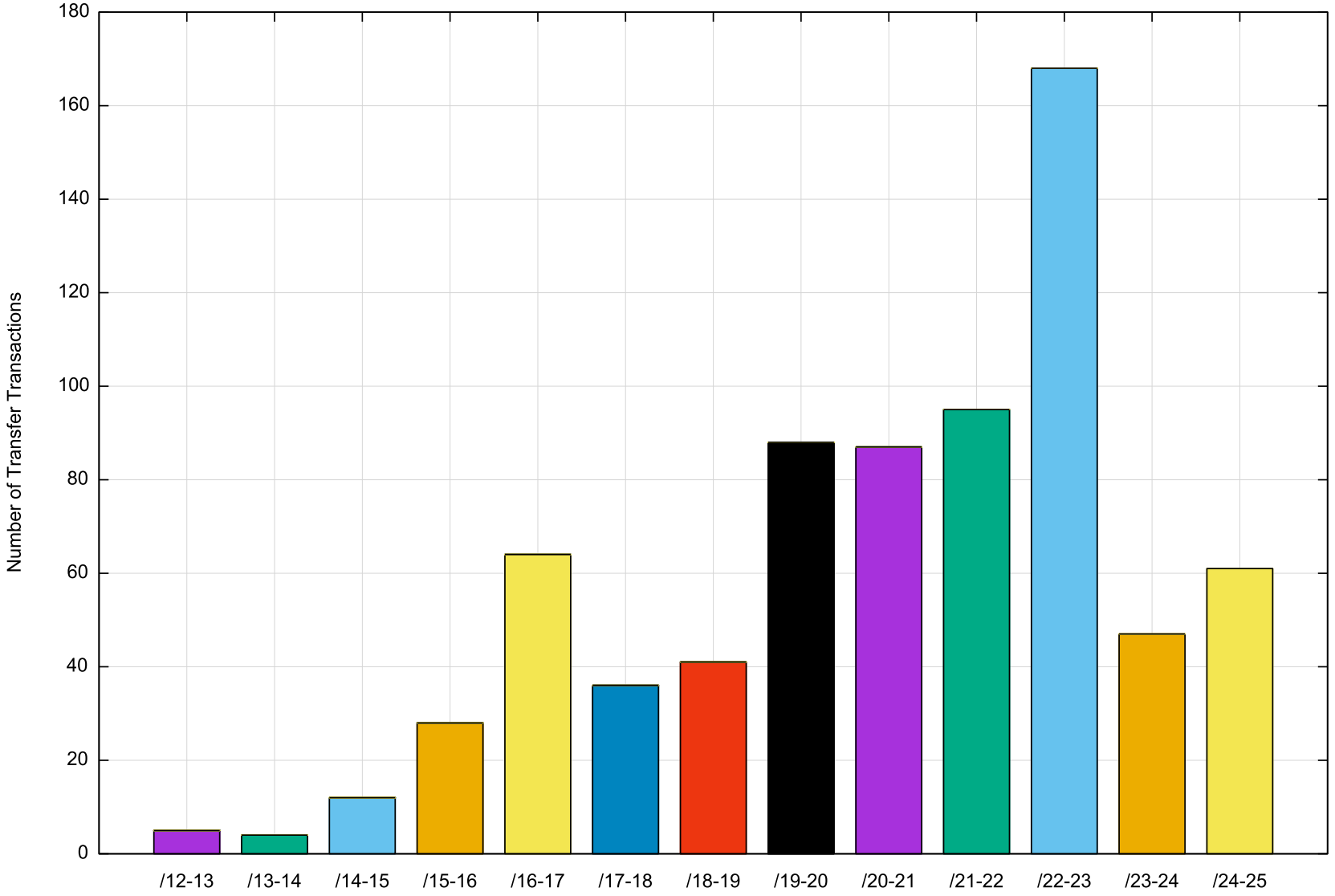
478 different buyers

913 participants

Transfer Size

- The transfer log records a transfer in terms of individual CIDR blocks
- We can group these together by using a common key of source entity, destination entity and date.
- Using this we see that the transfer log contains distinct 740 transactions

Transfer Size Distribution



Transfers in APNIC

This is still a relatively small scale activity in this region.

Out of the 879,732,224 addresses in the APNIC registry, transfers account for the movement of 21,702,400 addresses (2.5%)

Transfers involved 913 entities out of a total of 13,897 unique holders of IP addresses (6.6%)

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Questions?

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