Recognized IPv4 Broker in:

Elvis Daniel Velea  
Chief Executive Officer

MENOG17 - April 2017
Addressing V4 Exhaustion

RIR IPv4 Address Run-Down Model

AFRINIC
APNIC
ARIN
RIPE NCC
LACNIC

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## What's Left? (20 March 2017)

<table>
<thead>
<tr>
<th>Organization</th>
<th>Available /32s</th>
<th>Reserved /32s</th>
<th>Current Run Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>APNIC</td>
<td>6,840,832</td>
<td>4,071,680</td>
<td>Last /8: early 2020</td>
</tr>
<tr>
<td>RIPE NCC</td>
<td>12,497,304</td>
<td>1,050,176</td>
<td>Last /8: early 2021</td>
</tr>
<tr>
<td>ARIN</td>
<td>0</td>
<td>6,163,968</td>
<td></td>
</tr>
<tr>
<td>LACNIC</td>
<td>16,128</td>
<td>4,930,560</td>
<td></td>
</tr>
<tr>
<td>AFRINIC</td>
<td>18,076,672</td>
<td>1,840,384</td>
<td>Pool: May2018</td>
</tr>
</tbody>
</table>

### Totals

- **Available /32s**: 37,412,936
- **Reserved /32s**: 18,056,768

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Transfer Statistics 2012 and before

Total number of IPs transferred: 10,320,128

ARIN: 6,819,584
RIPE NCC: 65,536
APNIC: 3,433,216
## Transfer Statistics 2012 and before

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RIPE</strong></td>
<td></td>
<td></td>
<td></td>
<td>65,536</td>
</tr>
<tr>
<td>IPs transfers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
<td><strong>ARIN</strong></td>
<td>17,408</td>
<td>8,192</td>
<td>1,931,776</td>
<td>4,862,208</td>
</tr>
<tr>
<td>IPs transfers</td>
<td>20</td>
<td>2</td>
<td>53</td>
<td>27</td>
</tr>
<tr>
<td><strong>APNIC</strong></td>
<td></td>
<td>2,304</td>
<td>1,611,008</td>
<td>1,821,696</td>
</tr>
<tr>
<td>IPs transfers</td>
<td></td>
<td>2</td>
<td>83</td>
<td>165 *</td>
</tr>
</tbody>
</table>

* 6 Inter-RIR transfers from ARIN to APNIC
Transfer Statistics 2012 and before

- First transfer recorded in **RIPE NCC** in October 2012
  - Intra-RIR Transfer policy since December 2010
  - Run-out on 14 September 2012

- First transfer recorded in **APNIC** in November 2010
  - Intra-RIR Transfer policy since February 2010
  - Inter-RIR transfer policy since August 2011
  - Run-out on 15 April 2011

- First transfer recorded in **ARIN** in October 2009
  - Intra-RIR policy since June 2009

- 10,3 Million IPs transferred in total before or during 2012
- Less than 2,000 IPs transferred from ARIN to APNIC
Total number of IPs transferred
9,068,032
Transfer Statistics 2013

- Number of IPs transferred in RIPE NCC almost equal to number of IPs transferred within or into APNIC
- More than half a million IPs transferred from ARIN to APNIC, 0 transferred from APNIC to ARIN
  - APNIC’s ‘free’ pool depleted while ARIN still had IPs to allocate from the ‘free’ pool

- 154 transfers within RIPE NCC
- 172 transfers within APNIC + 17 Inter-RIR from ARIN
- 30 transfers within ARIN
Transfer Statistics 2014

Total number of IPs transferred
18,245,376

ARIN
American Registry for Internet Numbers
4,745,472

RIPE NCC
RIPE NETWORK COORDINATION CENTRE
9,647,616

APNIC
2,749,440

0
1,101,824
Transfer Statistics 2014

• Number of IPs transferred in RIPE NCC increased almost 5 times compared to 2013
  - IPv4 policy clean-up in February 2014 removing needs based policy
  - IPv4 PI can be transferred since Nov 2014

• More than a million IPs transferred from ARIN to APNIC, 0 transferred from APNIC to ARIN

• 920 transfers (20 PI) within RIPE NCC
• 249 transfers within APNIC + 94 Inter-RIR from ARIN
• 59 transfers within ARIN
Transfer Statistics 2015

Total number of IPs transferred
51,283,721
Transfer Statistics 2015

- RIPE NCC Inter-RIR transfer policy compatible with ARIN and APNIC since October 2015
  - ~2,2M IPs transferred from ARIN to RIPE NCC (in less than 2 months)
  - ~3,8M IPs transferred from ARIN to APNIC in 2015
- **ARIN Run-out on 24th September 2015**
  - ~34M IPs transferred within ARIN
    - most to date, more than the number of IPs allocated by ARIN in previous 4 years
- APNIC transfers more IPs from ARIN (~3,8M) than within the registry (~2,5M)
- **2699** transfers within **RIPE NCC** + 11 Inter-RIR from ARIN
- 367 transfers within **APNIC** + 75 Inter-RIR from ARIN
  - 3 transfers from APNIC to ARIN
- 260 transfers within **ARIN**
Transfer Statistics 2016

Total number of IPs transferred
33,198,848

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Transfer Statistics 2016

- ARIN has had ~500 more transfers in 2016 than in 2015. RIPE NCC has had ~500 less.
- Number of total IPs transferred - 35% less in 2016
  - less large IP blocks available
- 2181 transfers within **RIPE NCC**
  - 14 Inter-RIR from APNIC,
  - 100 Inter-RIR from ARIN
- 523 transfers within **APNIC**
  - 3 Inter-RIR transfers from RIPE NCC
  - 55 Inter-RIR transfers from ARIN
- 798 transfers within **ARIN**
  - 12 Inter-RIR transfers from APNIC
  - 8 Inter-RIR transfers from RIPE NCC
Transfer Statistics 2017 Q1

Total number of IPs transferred
6,527,744

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Transfer Statistics 2017

• 429 transfers within **RIPE NCC**
  - 14 Inter-RIR from APNIC

• 80 transfers within **APNIC**
  - 3 Inter-RIR transfers from RIPE NCC
  - 7 Inter-RIR transfers from ARIN

• 261 transfers within **ARIN**
  - 4 Inter-RIR transfers from APNIC
  - 4 Inter-RIR transfers from RIPE NCC

• Expecting another decrease in total number of IPs transferred, the number of transfers is expected to increase in ARIN.

• Further de-aggregation of some of the large blocks. Some sellers prefer to split their IP block in smaller pieces and sell them to multiple Buyers at a higher price.
Fun facts about stats

- ARIN stats used to show an IP block transferred to APNIC while it was actually transferred to RIPE NCC
  - 150.112.0.0/16
- ARIN stats used to show one IP block being transferred to both RIPE and APNIC
  - 104.244.8.0/22
- ARIN stats were missing some IP blocks transferred
  - 192.28.124.0/22, 192.28.128.0/22, 66.248.204.0/22, 96.30.64.0/18
- RIPE shows a PI transferred on 01/01/2014 while the policy was implemented on the 25th of November 2014
  - 91.197.160.0/22
- All of the above issues resolved by the RIRs after discussions at the ARIN39 meeting
- APNIC and RIPE are publishing IP transfer statistics at least daily.
  - It takes ARIN at least two weeks to **manually** publish IP transfer statistics from the previous month
Transfer Statistics - RIPE NCC

- Number of transfers increased since IPv4 policy clean-up in February 2014
  - needs based criteria removed from policy
  - thus, registry accuracy increased
- Number of LIRs doubled since runout
- 5391 transfers of PA Allocations (Including 2017 Q1)
- 1000 PI transfers since November 2014 totaling 1,067,776 IPs (Including 2017 Q1)
- Import:
  - 128 Inter-RIR Transfers from ARIN totaling 4,186,368 IPs
  - 14 Inter-RIR Transfers from APNIC totaling 121,344 IPs
- Export:
  - 13 Inter-RIR Transfers to ARIN totaling 168,960 IPs
  - 6 Inter-RIR Transfers to APNIC totaling 139,264 IPs
- 2016 - the first year to see a slowdown in number of transfers in RIPE
  - 2017 will see an other slowdown in the IPv4 Marketplace
Number of IPs transferred

Number of IPs

2012 2013 2014 2015 2016 2017

RIPE  ARIN  APNIC

2017 calculated as 4xQ1

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Regional statistics - Number of transfers

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Regional statistics - Number of IPs transferred

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of IPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>IR</td>
<td>3,934,720</td>
</tr>
<tr>
<td>SA</td>
<td>2,487,296</td>
</tr>
<tr>
<td>TR</td>
<td>726,784</td>
</tr>
<tr>
<td>AE</td>
<td>723,712</td>
</tr>
<tr>
<td>SY</td>
<td>244,736</td>
</tr>
<tr>
<td>CY</td>
<td>97,536</td>
</tr>
<tr>
<td>PS</td>
<td>76,800</td>
</tr>
<tr>
<td>YE</td>
<td>65,536</td>
</tr>
<tr>
<td>IL</td>
<td>51,968</td>
</tr>
<tr>
<td>BH</td>
<td>45,056</td>
</tr>
<tr>
<td>IQ</td>
<td>18,176</td>
</tr>
<tr>
<td>QA</td>
<td>16,384</td>
</tr>
<tr>
<td>OM</td>
<td>8,192</td>
</tr>
<tr>
<td>EG</td>
<td>0</td>
</tr>
<tr>
<td>LB</td>
<td>0</td>
</tr>
<tr>
<td>JO</td>
<td>0</td>
</tr>
<tr>
<td>KW</td>
<td>0</td>
</tr>
</tbody>
</table>

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## Regional Statistics - Number of IPs

<table>
<thead>
<tr>
<th>Country</th>
<th>IPs Transferred until Apr 2017</th>
<th>Total IPs as of Apr 2017</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>YE</td>
<td>65536</td>
<td>134144</td>
<td>96%</td>
</tr>
<tr>
<td>IR</td>
<td>3934720</td>
<td>12508672</td>
<td>46%</td>
</tr>
<tr>
<td>SA</td>
<td>2487296</td>
<td>8905728</td>
<td>39%</td>
</tr>
<tr>
<td>SY</td>
<td>244736</td>
<td>1126400</td>
<td>36%</td>
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<tr>
<td>AE</td>
<td>723712</td>
<td>3926656</td>
<td>23%</td>
</tr>
<tr>
<td>PS</td>
<td>76800</td>
<td>648448</td>
<td>14%</td>
</tr>
<tr>
<td>TR</td>
<td>726784</td>
<td>1646899</td>
<td>11%</td>
</tr>
<tr>
<td>CY</td>
<td>97536</td>
<td>1059136</td>
<td>10%</td>
</tr>
<tr>
<td>BH</td>
<td>45056</td>
<td>460800</td>
<td>11%</td>
</tr>
<tr>
<td>IL</td>
<td>51968</td>
<td>7645440</td>
<td>7%</td>
</tr>
<tr>
<td>IQ</td>
<td>18176</td>
<td>658688</td>
<td>3%</td>
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<tr>
<td>QA</td>
<td>16384</td>
<td>833792</td>
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<tr>
<td>OM</td>
<td>8192</td>
<td>912384</td>
<td>1%</td>
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<td>1950208</td>
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<td>JO</td>
<td>0</td>
<td>672640</td>
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<tr>
<td>LB</td>
<td>0</td>
<td>571904</td>
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</tr>
<tr>
<td>EG</td>
<td>0</td>
<td>59392</td>
<td>0%</td>
</tr>
</tbody>
</table>
Regional Statistics - Oman

- 96.9.128.0/19 transferred from APNIC to Awaser Oman
  - on the 29th of February 2016
- only 7 /22s from the last /8 received
  - 2 in 2017
- 11 LIRs in Oman, 7 have their last /22
- Largest IP blocks received from the RIPE NCC: 2x/15
  - both received in 2012, before runout, by OmanMobile Telecommunication company LLC
Predictions

- V4Escrow was asked during Menog14 in 2014 to make a prediction on the number of IPs transferred in 2014. We estimated that 1x/8 will have been transferred and were 98% right.

- During Menog15 in 2015 we also predicted that 4x/8s will be transferred globally in 2015. The 4 /8s prediction was also over 90% accurate.

- During Menog16 we predicted that the total number of IPs transferred in 2016 will decrease to 2.5x/8s.
  - 1st observed slowdown of the IPv4 market
  - total number of IPs transferred (not including legacy space transfers) was just shy of 2x/8s.
  - if we are to include the RIPE Legacy transfers which are not public, we can say that we have a great understanding of the IPv4 market and thus can make accurate predictions.

- We predict now, at Menog 17, that the total number of IPs that will be transferred in 2017 will decrease to less than 2x/8s.
Lessons learned

- **Contact Geo-IP providers** once you receive an IP block through a transfer
  - your customers will be seen in the country of the transferor for the first 1-2 months.
  - if you are not in a hurry to add the IP block to production, use it in a test environment first.
- Ask for a blacklist report on the IP block or check major blacklisting providers.
- If you are the Buyer - request the seller to forward you the abuse reports for the IP addresses transferred to you
  - the Seller will continue to receive abuse reports for at least 6-12 months for the IP addresses transferred because abuse reporters do not update their databases and continue to send the reports to the ‘old’ abuse contact
- Start routing immediately, hijacks do happen very often
- Make sure the person you talk to has corporate authorization to transfer to you.
  - **Ask for PoA** (Power of Attorney).
Pricing - observed vs estimated

- Runout in ARIN in 2015 affected pricing - prices started to go up in ARIN
- RIPE Inter-RIR transfer policy caused prices to harmonize between ARIN and RIPE
- Prices keep going up while supply is decreasing
  - minimum price observed was around 2013 - $5/IP (ARIN) and $7/IP (RIPE)
    - a lot of IPv4 available on the market
  - prices have harmonized at $10-$12/IP in 2015-2016 within all the regions
    - only a few large blocks (/16 or larger) available on the market
    - many transactions (/17 and smaller) observed at $12-$14/IP
    - several small transactions at even $15-$20/IP
- **very little supply still available**

- Probable price per IP at the end of 2017 will be between $15 and $20 per IP even for large blocks
- Maximum price still to be observed but we estimate it to grow above $25/IP in 2018
- IPv4 Marketplace estimated to last at least until 2025
IPv6

- as per Google site
  - measured since 2008
  - 0.5% before 2012
  - 100% growth in 2012 up to 1.1%
  - 150% growth in 2013 up to 2.8%
  - 100% growth in 2014 up to 5.6%
  - 95% growth in 2015 up to 10.4%
  - 50% growth in 2016 up to 16%
  - now at 17% worldwide - slowdown of growth in 2016 and 2017
IPv6 in Oman

- IPv6 adoption in Oman
  - 0% according to Google
  - 0% with 4 * RIPEness
  - compared to 20% in RIPE

- low IPv6 adoption = higher IPv4 prices in the next years
Questions?

www.v4escrow.net
elvis@v4escrow.net