Have We Reached 1000 Prefixes Yet?

A snapshot of the global IPv6 routing table

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Overview

- numbers
- pictures & trends
- things that should not be there...
- conclusions & recommendations
- references

Slides online at: http://www.space.net/~gert/RIPE/R51-v6-table/
**Numbers - AS numbers**

- As of 2005/10/10: 563 unique AS numbers visible (05/02: 517)
  - 375 origin-only ASes (no transit paths seen) (337)
  - 175 ASes originate & give transit (167)
  - 13 transit-only ASes (e.g. 1659, 3856, 4774, 6667, …) (13)

- Mixture of RIR (2xxx::) and 6Bone (3FFE::) space announced
  - 408 ASes originate 1 RIR prefix (366)
  - 35 ASes originate 1 6Bone prefix (34)
  - 44 ASes originate 1 6Bone + 1 RIR prefix (42)
  - 28 ASes originate 2 RIR prefixes (4 due to /32+/35)
  - 35 ASes with “more than that”, maximum is 12 prefixes

- 5 ASes still announce their prefix as /32 and /35

- Note: all paths observed from AS5539
ASes - why are people announcing 2 prefixes?

- 6bone to RIR migration: 1 6bone, 1 RIR prefix, temporary
  2001:420::/35 109 i
  3FFE:C00::/24 109 i

- /35 to /32 migration: 2 RIR prefixes, temporary
  2001:258::/32 2914 2510 i
  2001:258::/35 2914 2510 i

- new: working around too-tight filters, temporary
  2001:2000::/20 1752 1299 i w TELIANET
  2001:2040::/32 1752 1299 3301 i TELIA-SWEDEN
  2001:2060::/32 1752 1299 1759 i SONERA-TRANSIT-AS

- multi-uplink-/multi-homing-experiments? IXPs?
  2001:770:80::/48 3257 2110 2128 i
  2001:7F8:18::/48 3257 2110 2128 i

- mergers and acquisitions, business units, growth, ...
  2001:360::/32 1221 i
  2001:8000::/20 1221 i
## Numbers - Prefixes

As of 2005/10/11: 720 prefixes in total (2005/05/02: 662)

<table>
<thead>
<tr>
<th>/n</th>
<th>global</th>
<th>RIR space</th>
<th>6bone</th>
<th>6to4</th>
<th>(2004/09/20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>/16</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>(1 0 0 1)</td>
</tr>
<tr>
<td>/19-21</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>(3 3 0 0)</td>
</tr>
<tr>
<td>/24</td>
<td>34</td>
<td>0</td>
<td>34</td>
<td>0</td>
<td>(36 0 36 0)</td>
</tr>
<tr>
<td>/27</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>(1 1 0 0)</td>
</tr>
<tr>
<td>/28</td>
<td>33</td>
<td>1</td>
<td>32</td>
<td>0</td>
<td>(33 1 32 0)</td>
</tr>
<tr>
<td>/29-/30</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>(1 1 0 0)</td>
</tr>
<tr>
<td>/32</td>
<td>494</td>
<td>468</td>
<td>26</td>
<td>0</td>
<td>(459 431 28 0)</td>
</tr>
<tr>
<td>/33-/34</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>(3 3 0 0)</td>
</tr>
<tr>
<td>/35</td>
<td>24</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>(25 25 0 0)</td>
</tr>
<tr>
<td>/36-/39</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>(2 1 1 0)</td>
</tr>
<tr>
<td>/40</td>
<td>11</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>(9 8 1 0)</td>
</tr>
<tr>
<td>/41-/45</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>(3 3 0 0)</td>
</tr>
<tr>
<td>/48</td>
<td>101</td>
<td>88</td>
<td>13</td>
<td>0</td>
<td>(76 64 12 0)</td>
</tr>
<tr>
<td>/52-/60</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>(1 1 0 0)</td>
</tr>
<tr>
<td>/64</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>(8 6 2 0)</td>
</tr>
<tr>
<td>/65-/128</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>(1 1 0 0)</td>
</tr>
</tbody>
</table>
Graphics: Total Prefixes - 48 months
Graphics: RIR vs. 6Bone Prefixes - 48 months

RIR space
6bone space
Graphics: RIR vs. 6Bone Prefixes - 4 months

RIR space
6bone space
Graphics: trends? (6 months)

RIR space
linear growth?
stagnation?

apparent stagnation?
-> caused by disappearance of some APNIC prefixes
still many /35s visible
v cleanup efforts
v after RIPE 49

new policy
effective 2002/07/01
Why /35s?

- Non-upgraded /35 allocations (only /35 seen)?
  APNIC: 6, ARIN: 3, RIPE: 2 prefixes - total: 11

- Dual-announcements /32+/35 (same path) - fear of ghosts?
  APNIC: 4, ARIN: 2, RIPE: 0 prefixes - total: 6

- Traffic-Engineering with more-specific announcements??
  2001:808::/35 3320 9112 i
  2001:808:E000::/35 3320 3257 6175 8246 8364 i

- Migration things...
  2001:6C0::/35 1752 1299 i (Telia)
  2001:2000::/20 1752 1299 i (Telia)

- Multihomed enterprises sharing a /32
  2001:490::/32 3549 14277 i (Nokia)
  2001:490::/35 3549 12702 1248 i (Nokia Finnland)
  2001:490:C000::/35 3549 18084 18666 i (Nokia Dallas)
Numbers: RIRs, Allocations, . . .

- On 2005/10/09, 928 LIR blocks (2000::/4) allocated by RIRs:

<table>
<thead>
<tr>
<th>RIR</th>
<th>alloc.</th>
<th>members</th>
<th>perc.</th>
<th>on 2005/05/02</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARIN</td>
<td>169</td>
<td>~ 2276</td>
<td>7.5%</td>
<td>148 (+14%)</td>
</tr>
<tr>
<td>APNIC</td>
<td>219</td>
<td>~ 1890</td>
<td>11.6%</td>
<td>197 (+11%)</td>
</tr>
<tr>
<td>RIPE</td>
<td>497</td>
<td>~ 4123</td>
<td>12.1%</td>
<td>465 (+7%)</td>
</tr>
<tr>
<td>LACNIC</td>
<td>39</td>
<td>~ 463</td>
<td>8.4%</td>
<td>17 (+129%)</td>
</tr>
<tr>
<td>AfriNIC</td>
<td>4*</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

- note: not counting /48 microallocs and /35⇒/32 extentions
- actual *percentage* with IPv6 similar for RIPE and APNIC
- 483 (R50: 442) allocations visible in routing table (*only 52%!*)
Numbers: RIRs: notable allocations (1)

- more “very large” allocations seen:
  - 2400::/20 to Korea Telecom (2005/06/01)
  - 2400:2000::/20 to SoftbankBB, Japan (2005/07/12)
  - 2400:4000::/22 to OCN IPv6 Network, Japan (2005/08/15)
  - 2001:13b0::/29 to Impsat Fiber Net., Argent. (2005/08/04)
  - 2001:4400::/30 to TelstraClear Ltd, NZ (2005/05/09)
  - 2001:4490::/30 to Bharat Sanchar Nigam, IN (2005/09/22)

- some networks still mistakenly filtered (e.g. Telia’s /20)

⇒ check your BGP filters!!

⇒ what sort of filters are useful? Some are more harmful...!
## Numbers: RIRs: notable allocations (2)

- Allocations ICANN ⇒ RIRs since RIPE 50

<table>
<thead>
<tr>
<th>Prefix</th>
<th>RIR</th>
<th>Date</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2400:0000::/19</td>
<td>APNIC</td>
<td>20 May 05</td>
<td>KR/Telecom</td>
</tr>
<tr>
<td>2400:2000::/19</td>
<td>APNIC</td>
<td>08 Jul 05</td>
<td>JP/Softbank</td>
</tr>
<tr>
<td>2400:4000::/21</td>
<td>APNIC</td>
<td>08 Aug 05</td>
<td>JP/OCN</td>
</tr>
<tr>
<td>2A00:0000::/21</td>
<td>RIPE NCC</td>
<td>19 Apr 05</td>
<td>DE/Arcor /22</td>
</tr>
<tr>
<td>2A01:0000::/23</td>
<td>RIPE NCC</td>
<td>14 Jul 05</td>
<td>??</td>
</tr>
</tbody>
</table>

- [http://www.iana.org/assignments/ipv6-unicast-address-assignments](http://www.iana.org/assignments/ipv6-unicast-address-assignments)
Graphics: prefixes by RIR region

- **RIPE**
- **APNIC**
- **ARIN**
- **LACNIC**
- **6bone**

<table>
<thead>
<tr>
<th>Date</th>
<th>Prefix</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>04-01-01</td>
<td>2001:610::/48 leaks</td>
<td>from AS 17832</td>
</tr>
<tr>
<td>05-01-01</td>
<td>2001:610::/48 leaks</td>
<td>from AS 17832</td>
</tr>
<tr>
<td>04-07-01</td>
<td>2001:660::/40+/48 leaks</td>
<td>from AS 2200</td>
</tr>
<tr>
<td>04-10-01</td>
<td>2001:240::*/40-/64 leaks</td>
<td>from AS 2497</td>
</tr>
<tr>
<td>04-01-01</td>
<td>2001:468::*/40 leaks</td>
<td>from AS 11537 customers</td>
</tr>
</tbody>
</table>

IPv6 routing table Numbers
Graphics: prefixes by country (RIPE)

2001:610::*/48 leaks from AS 1103 -->(-customer)
2001:660::/40+/48 leaks from AS 2200 -->
The Cabinet Of Horrors...

... is fairly empty this time

- no 100-prefix-leaks
- no /128s in the global table (a single /127, though)
- no AS hijacks
- hardly any Ghost Routes seen

... thanks!
route6 object example

- it’s as easy as this...
  
  route6: 2001:608::/32
  descr: DE-SPACE-2001-0608
  descr: SpaceNET AG, Munich
  origin: AS5539
  notify: noc@space.net
  mnt-by: SPACENET-N
  changed: gert@space.net 20041230
  source: RIPE

- strongly recommended, helps upstream/peer ASes build decent BGP filters, based on IRR data
IPv6 routing table

route6 is good for you

Graphics: route6 objects vs. routes seen

RIPE routes
RIPE route6 obj

2004/12/29: RPSLng support in RIPE DB
References

- Ghost Route Hunter: http://www.sixxs.net/tools/grh/
- List of IPv6 blocks allocated by the RIRs:
  http://www.ripe.net/rs/ipv6/stats/index.html
- MIPP (minimum peering policy) project:
  http://ip6.de.easynet.net/ipv6-minimum-peering.txt
- IPv6 sample prefix filter page
  http://www.space.net/~gert/RIPE/ipv6-filters.html
- Slides are available at:
  http://www.space.net/~gert/RIPE/R51-v6-table/
Questions?

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