

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, ...

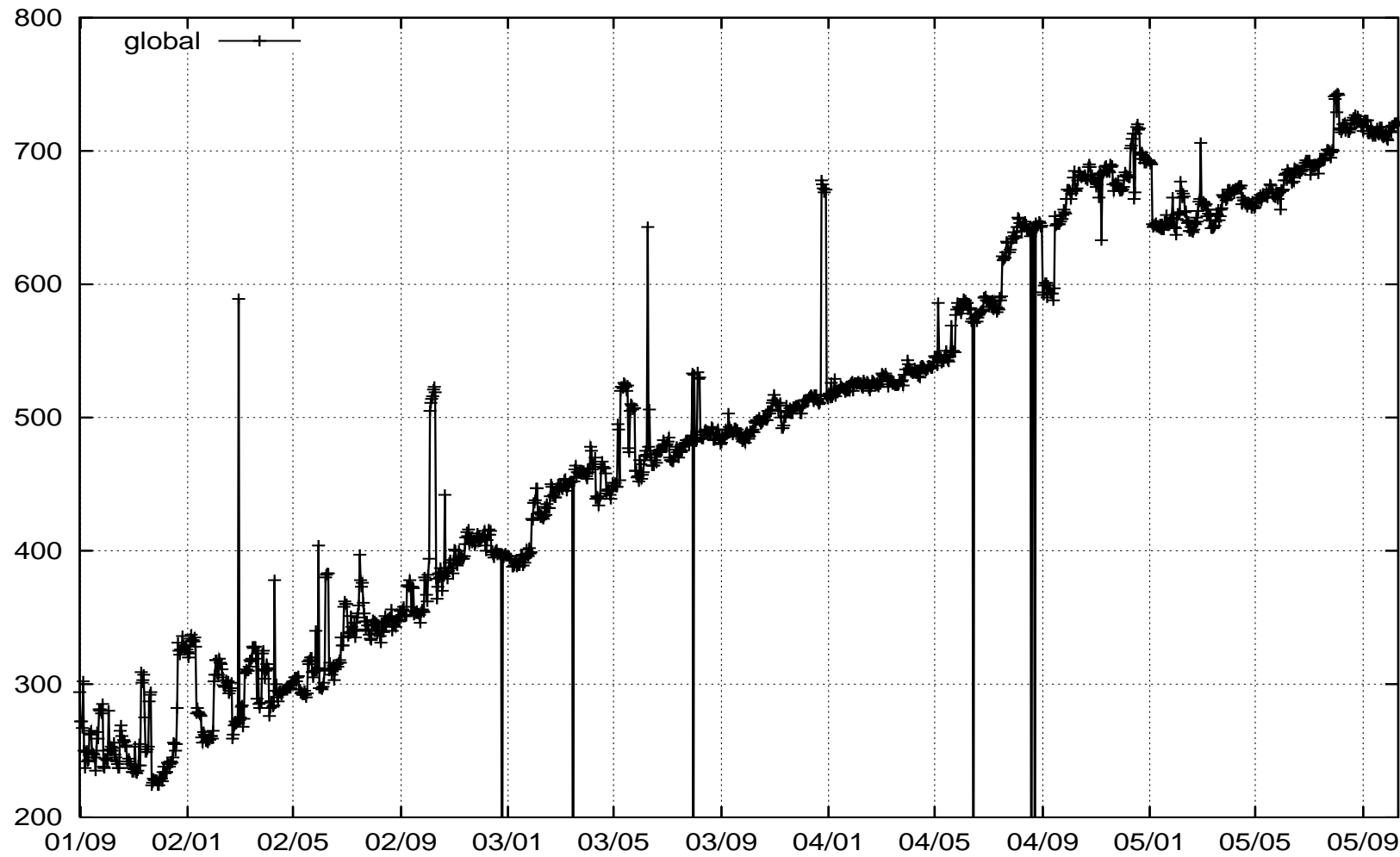
2001:360::/32	1221 i
2001:8000::/20	1221 i

Numbers - Prefixes

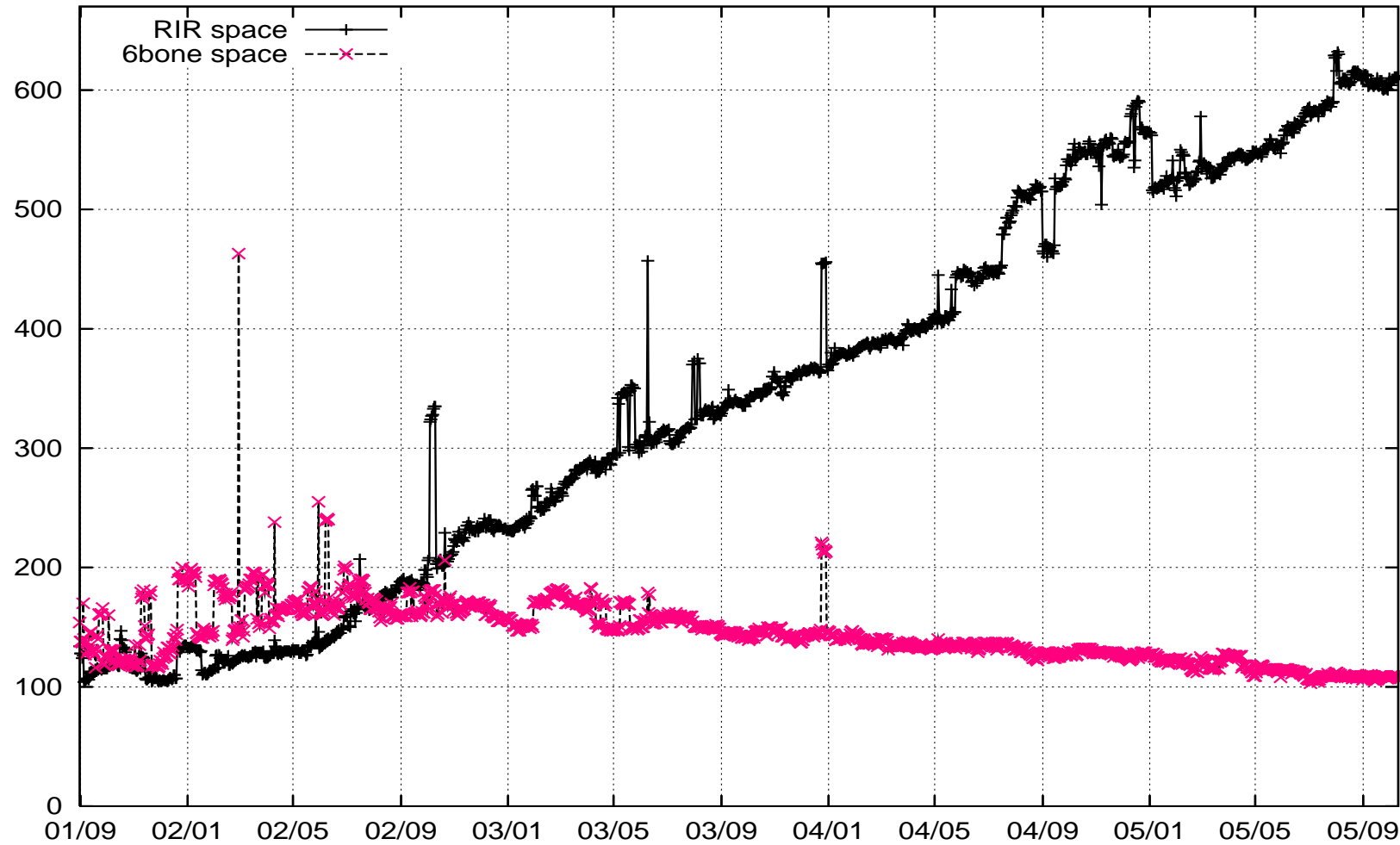
As of 2005/10/11: 720 prefixes in total (2005/05/02: 662)

/n	global	RIR space	6bone	6to4	(2004/09/20)
/16	1	0	0	1	(1 0 0 1)
/19-21	5	5	0	0	(3 3 0 0)
/24	34	0	34	0	(36 0 36 0)
/27	1	1	0	0	(1 1 0 0)
/28	33	1	32	0	(33 1 32 0)
/29-/30	2	2	0	0	(1 1 0 0)
/32	494	468	26	0	(459 431 28 0)
/33-/34	3	3	0	0	(3 3 0 0)
/35	24	24	0	0	(25 25 0 0)
/36-/39	3	2	1	0	(2 1 1 0)
/40	11	10	1	0	(9 8 1 0)
/41-/45	2	2	0	0	(3 3 0 0)
/48	101	88	13	0	(76 64 12 0)
/52-/60	0	0	0	0	(1 1 0 0)
/64	5	3	2	0	(8 6 2 0)
/65-/128	1	1	0	0	(1 1 0 0)

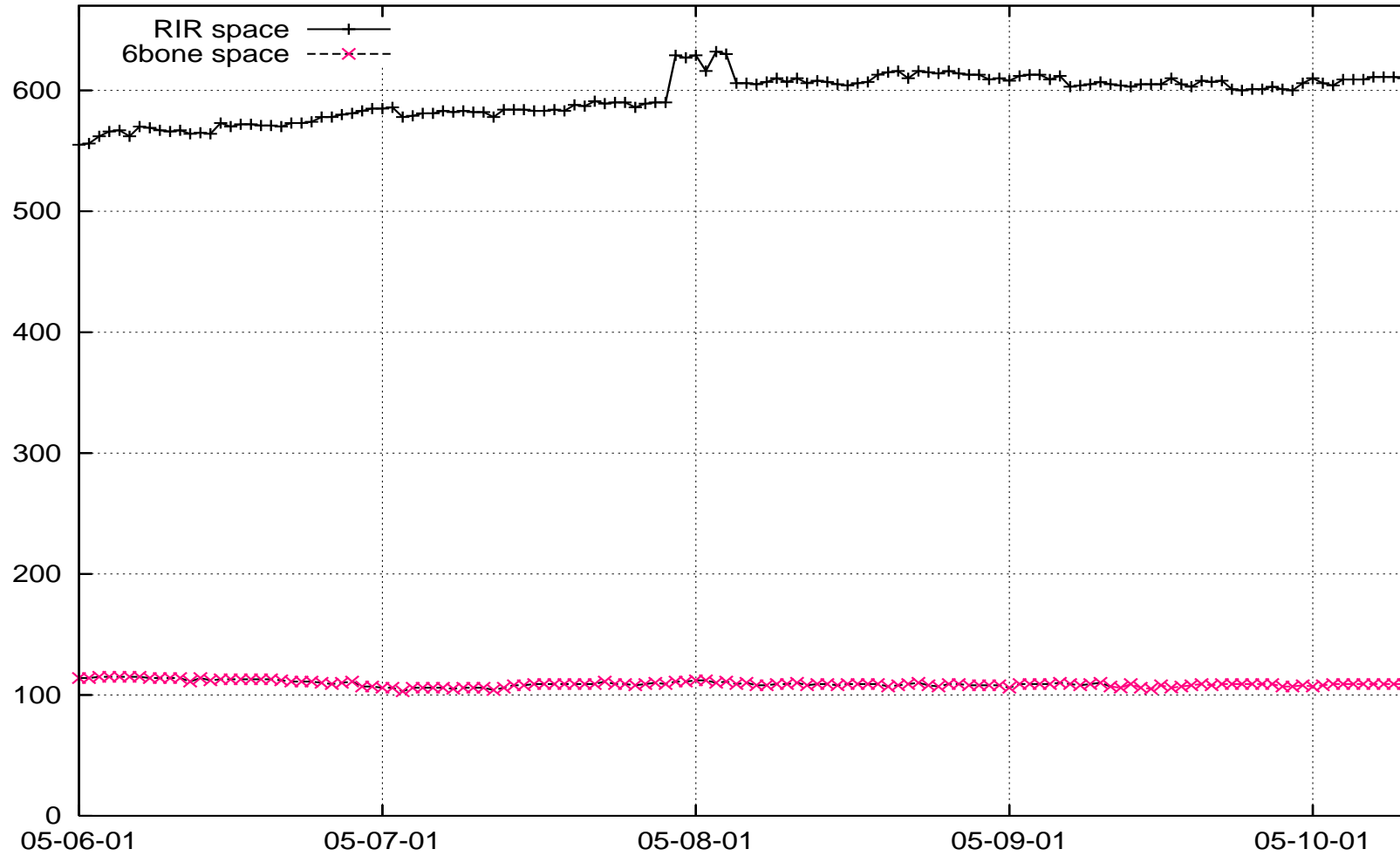
Graphics: Total Prefixes - 48 months



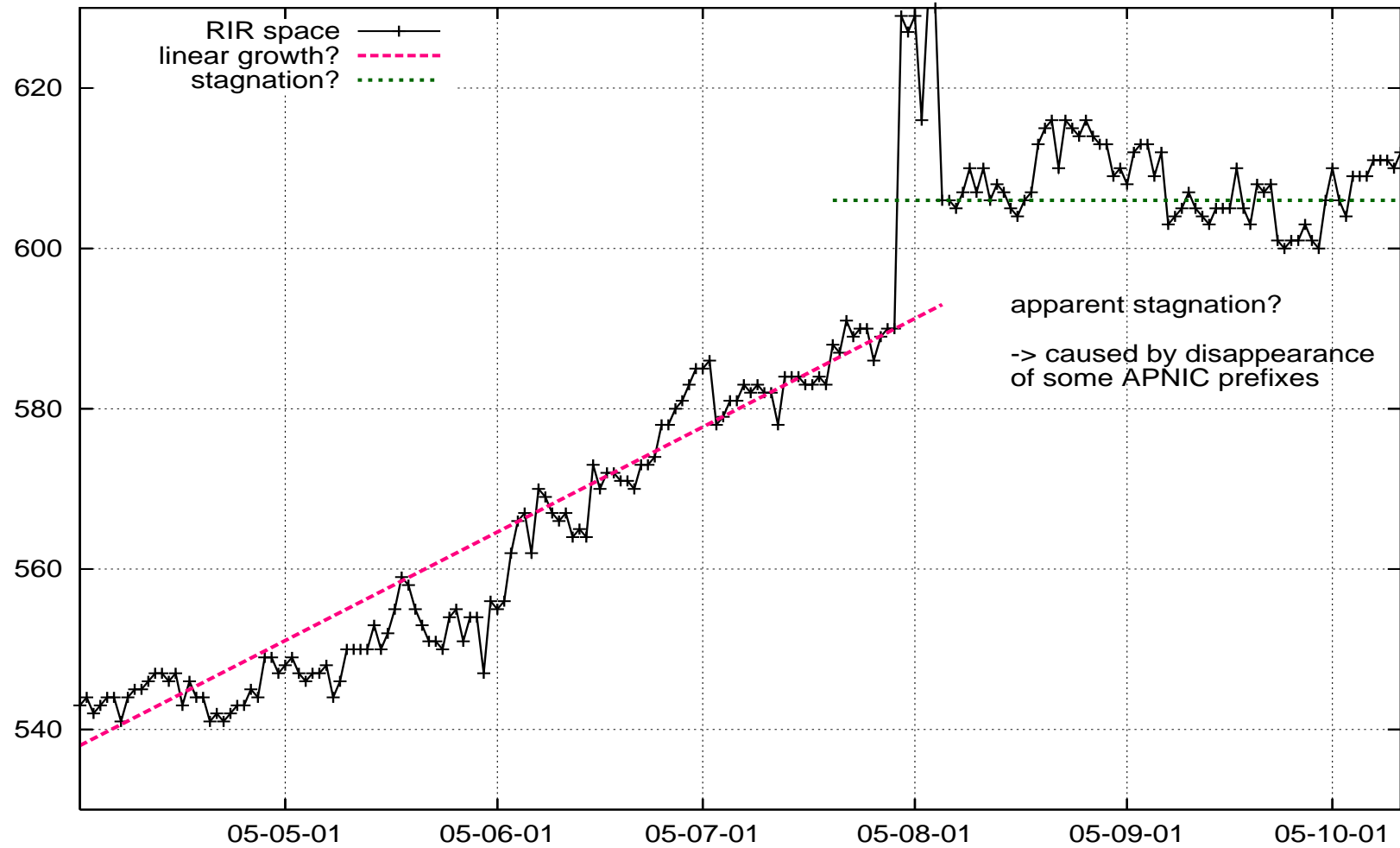
Graphics: RIR vs. 6Bone Prefixes - 48 months



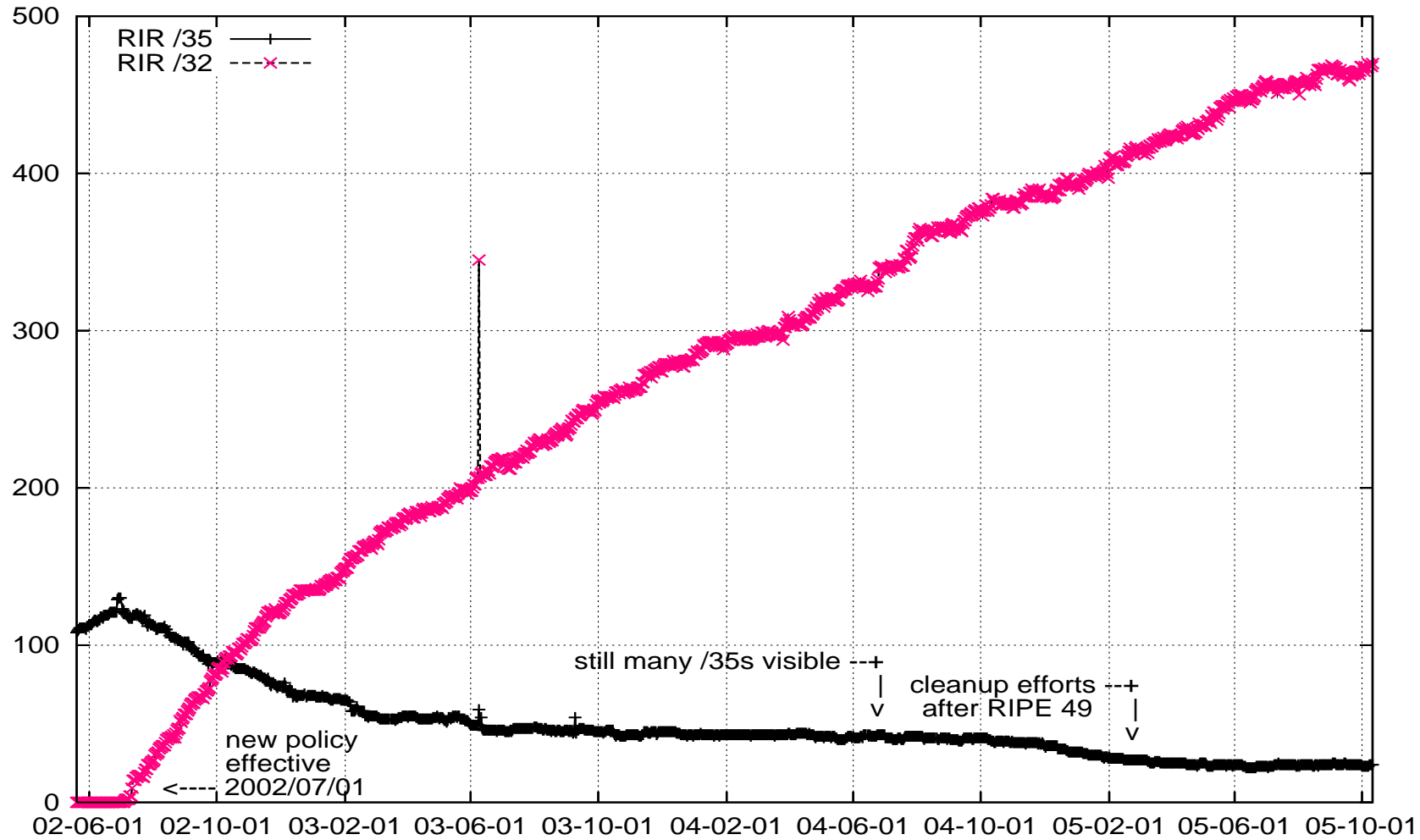
Graphics: RIR vs. 6Bone Prefixes - 4 months



Graphics: trends? (6 months)



Graphics: RIR /35s vs. /32s



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 Finland)
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:

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

- 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...!

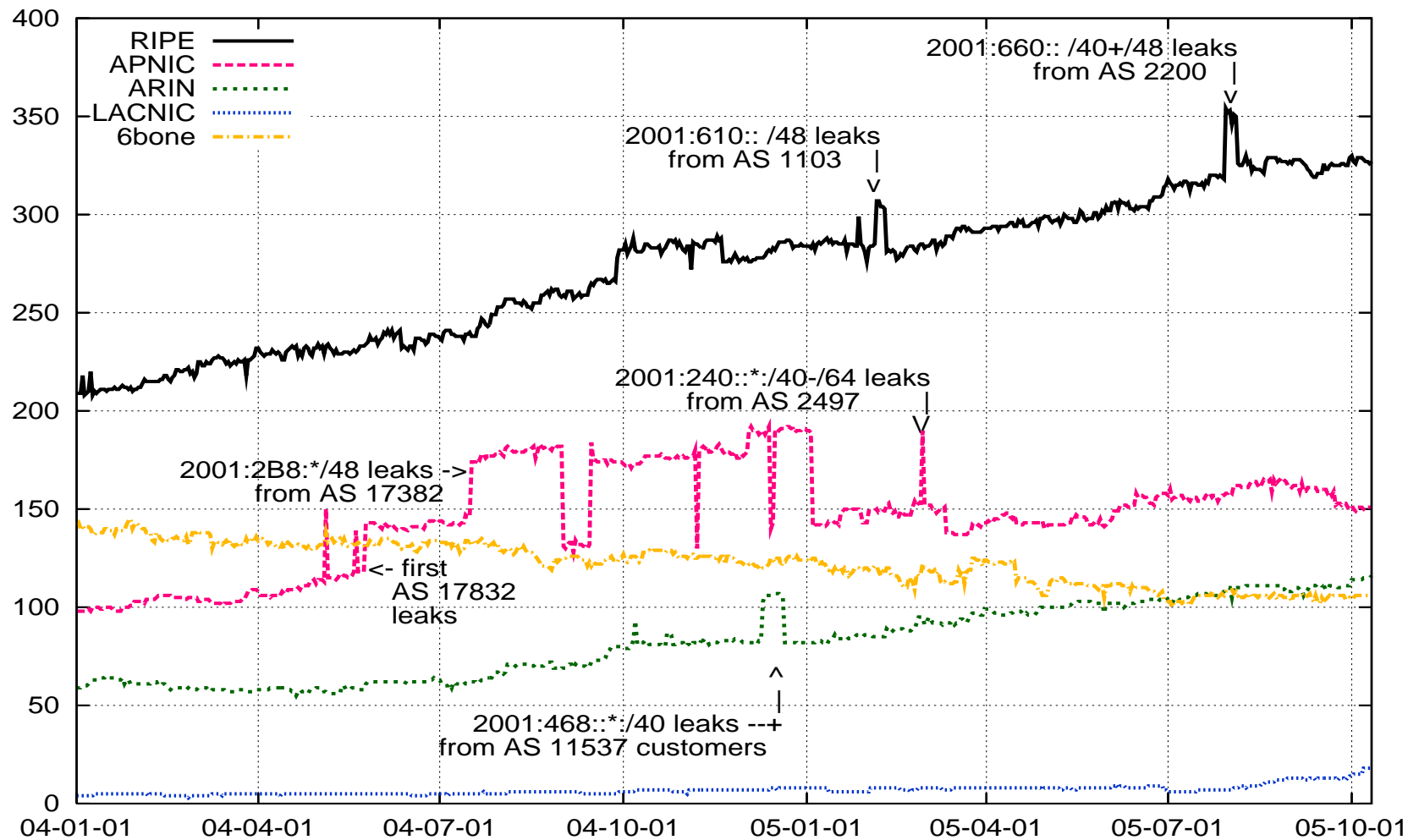
Numbers: RIRs: notable allocations (2)

- Allocations ICANN \Rightarrow RIRs since RIPE 50

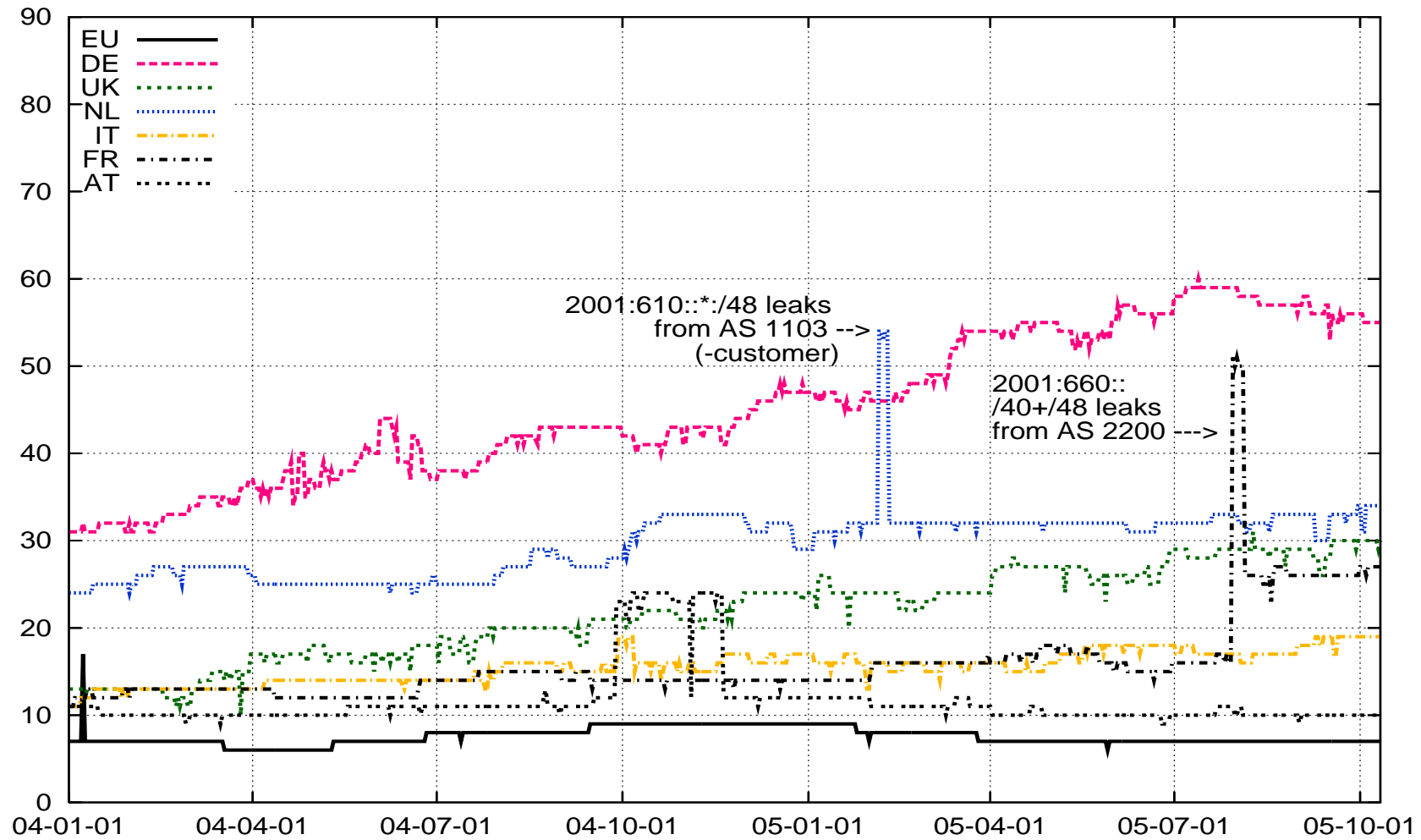
Prefix	RIR	Date	Comment
2400:0000::/19	APNIC	20 May 05	KR/Telecom
2400:2000::/19	APNIC	08 Jul 05	JP/Softbank
2400:4000::/21	APNIC	08 Aug 05	JP/OCN
2A00:0000::/21	RIPE NCC	19 Apr 05	DE/Arcor /22
2A01:0000::/23	RIPE NCC	14 Jul 05	??

- <http://www.iana.org/assignments/ipv6-unicast-address-assignments>

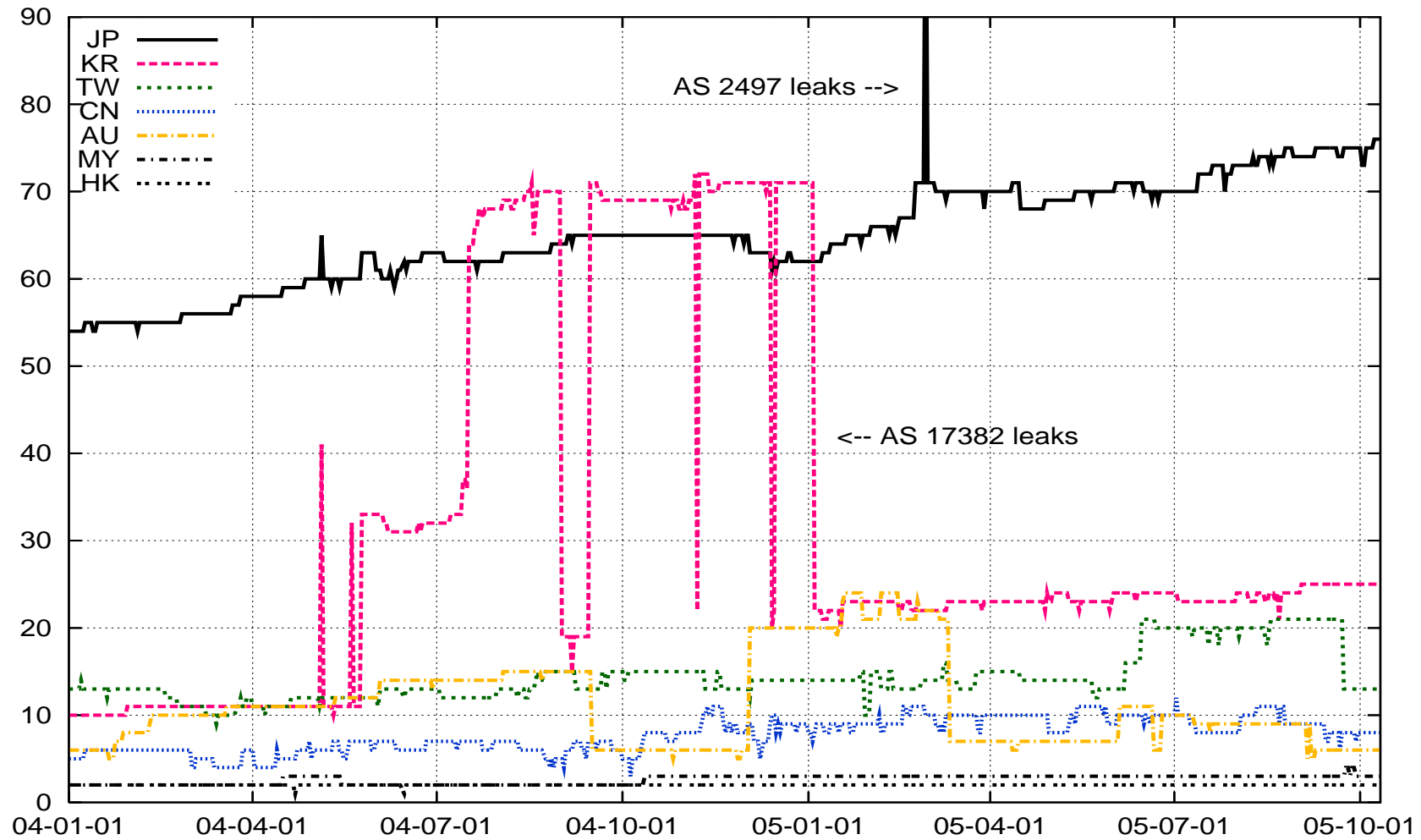
Graphics: prefixes by RIR region



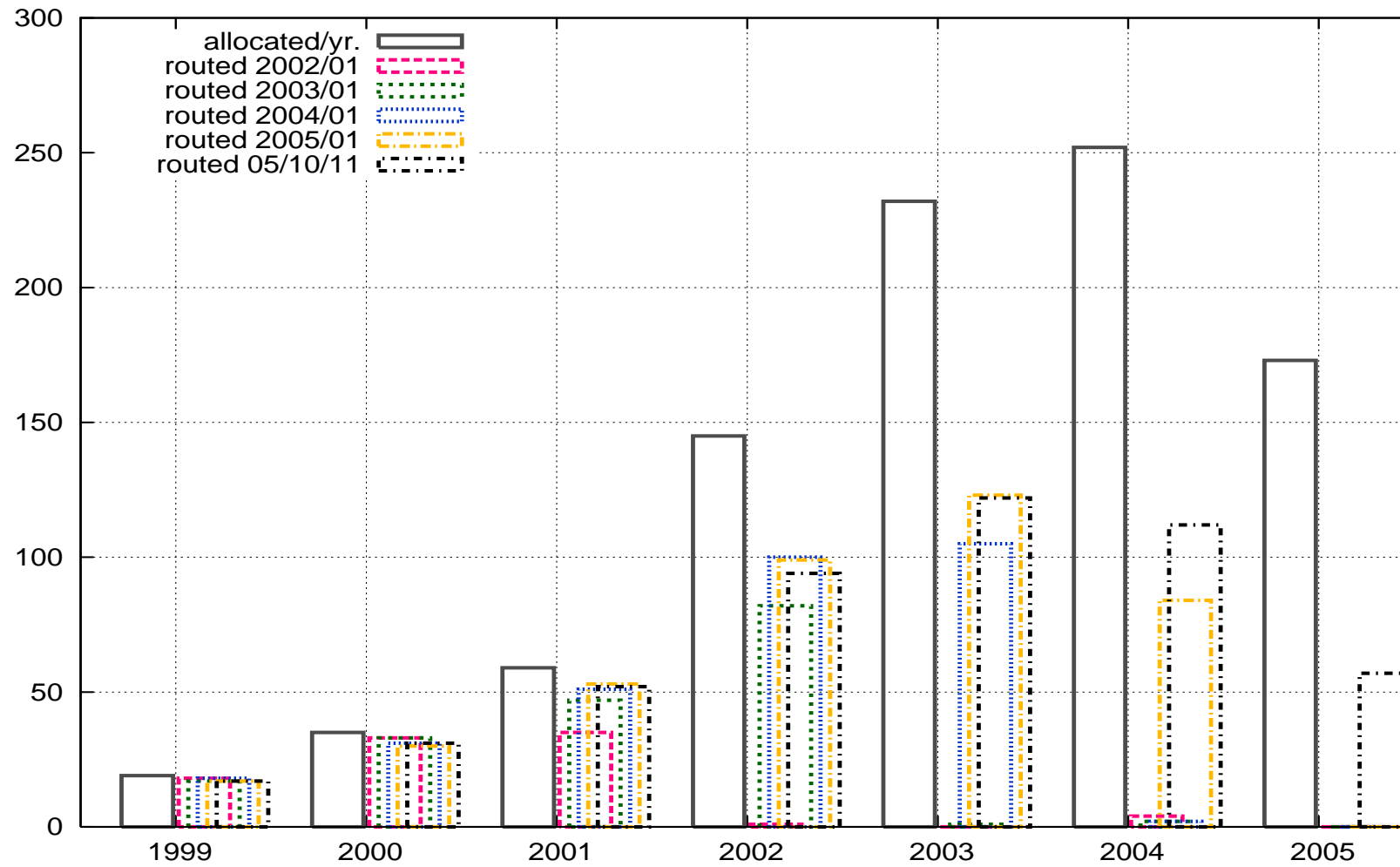
Graphics: prefixes by country (RIPE)



Graphics: prefixes by country (APNIC)



Graphics: Allocated vs. Routed



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!

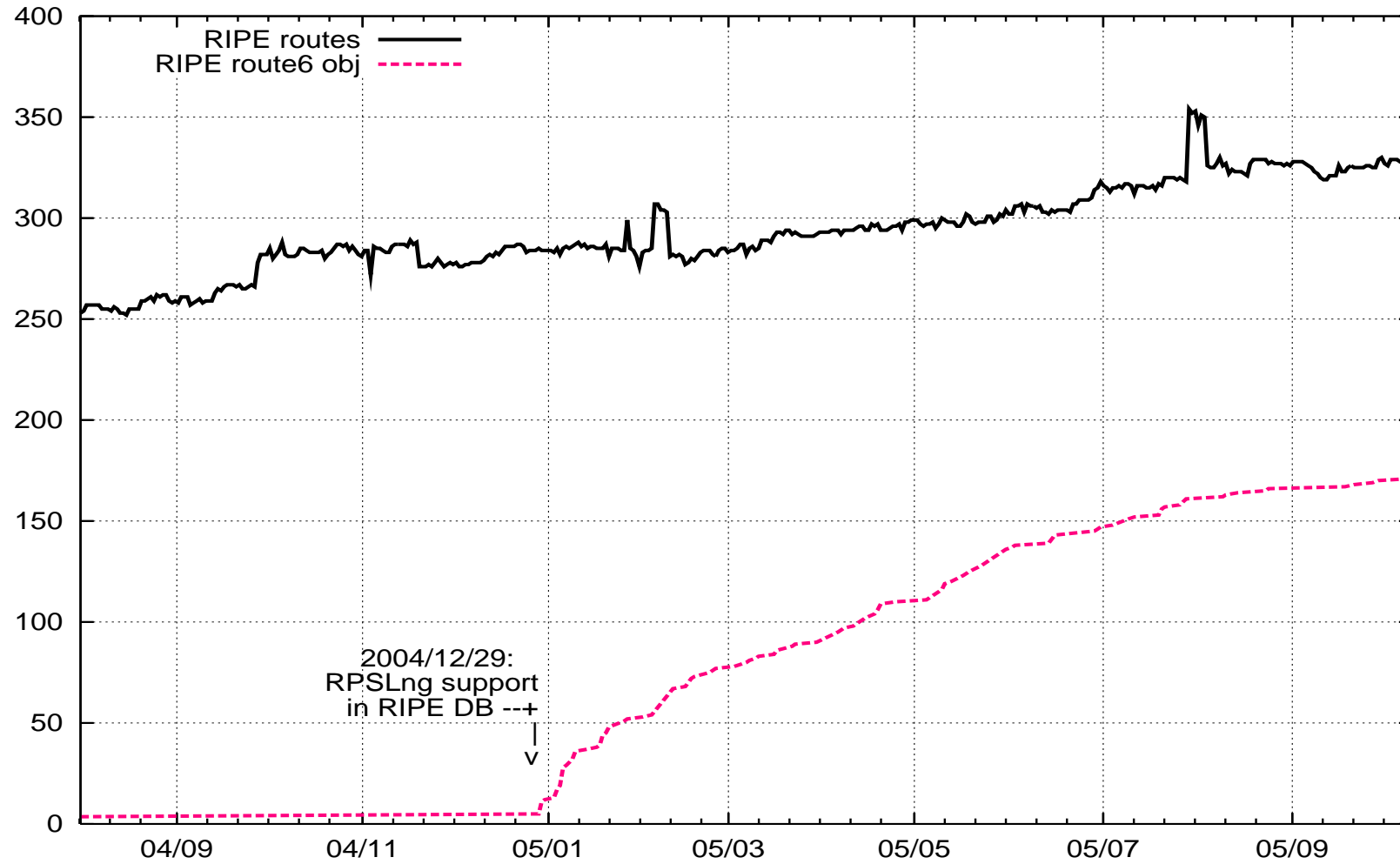
route6 object example

- 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

Graphics: route6 objects vs. routes seen



route6 funnies

- people are really busy registering route6 objects...

```
route6:      2001:648:2F00::/48
descr:      Greek High-School-Siros
origin:     AS8248

route6:      2001:648:2E80::/48
descr:      Greek High-School-Xanthi
origin:     AS8248

route6:      2001:648:2E10::/48
descr:      Greek High-School-Ioannina
origin:     AS8248

route6:      2001:648:2D80::/48
descr:      Greek High-School-Larissa
origin:     AS8248

route6:      2001:648:2D00::/48
route6:      2001:648:2C20::/48
route6:      2001:648:2900::/48
...
```

- these /48s are not announced - why these route6 objects??

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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