

Have We Reached 1000 Prefixes Yet?

A snapshot of the global IPv6 routing table

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April 23th, 2007

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presented by CJ Aronson

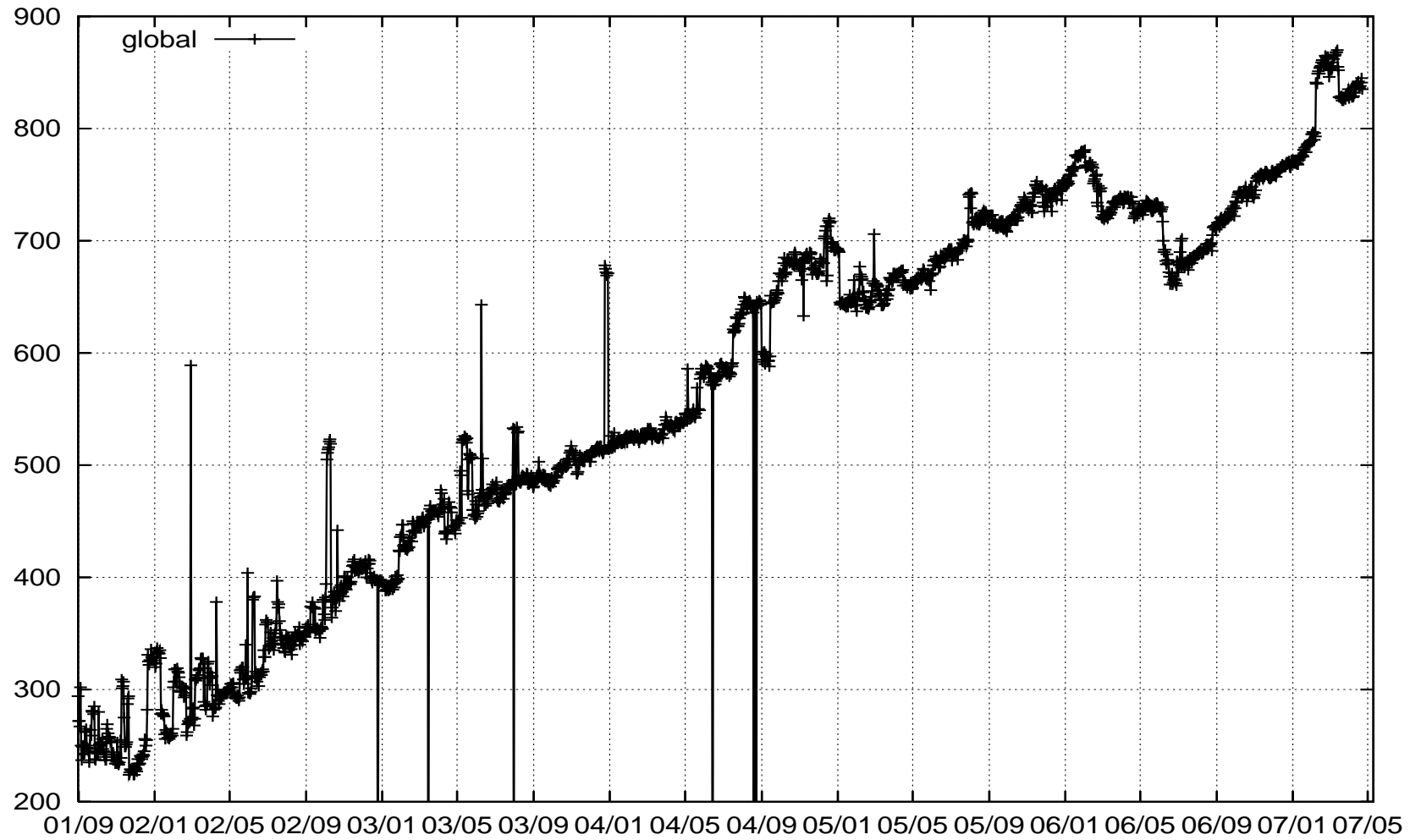
Overview

- pictures & trends
- the end of the 6bone
- numbers...
- references

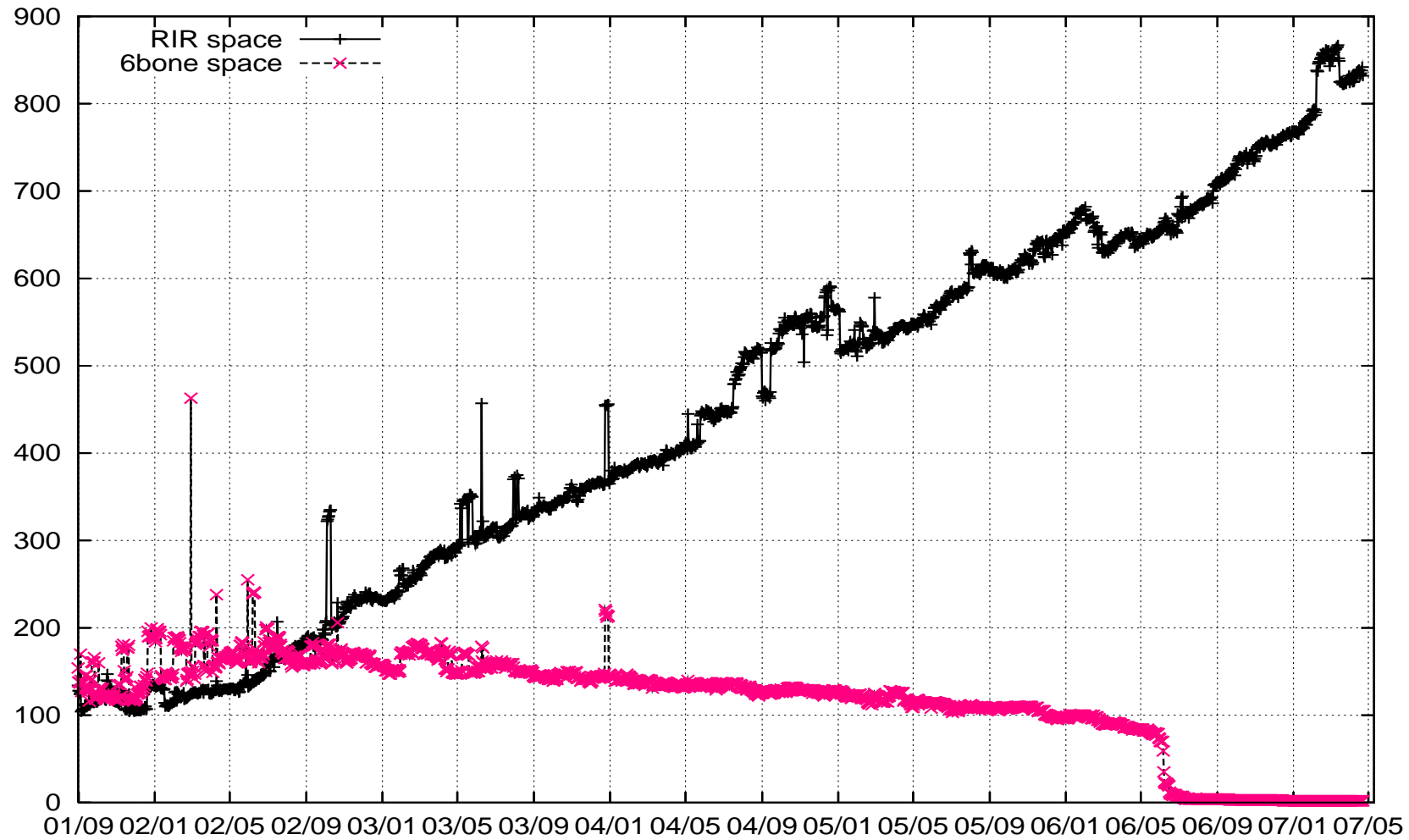
Slides online at:

<http://www.space.net/~gert/RIPE/Arin19-v6-table/>

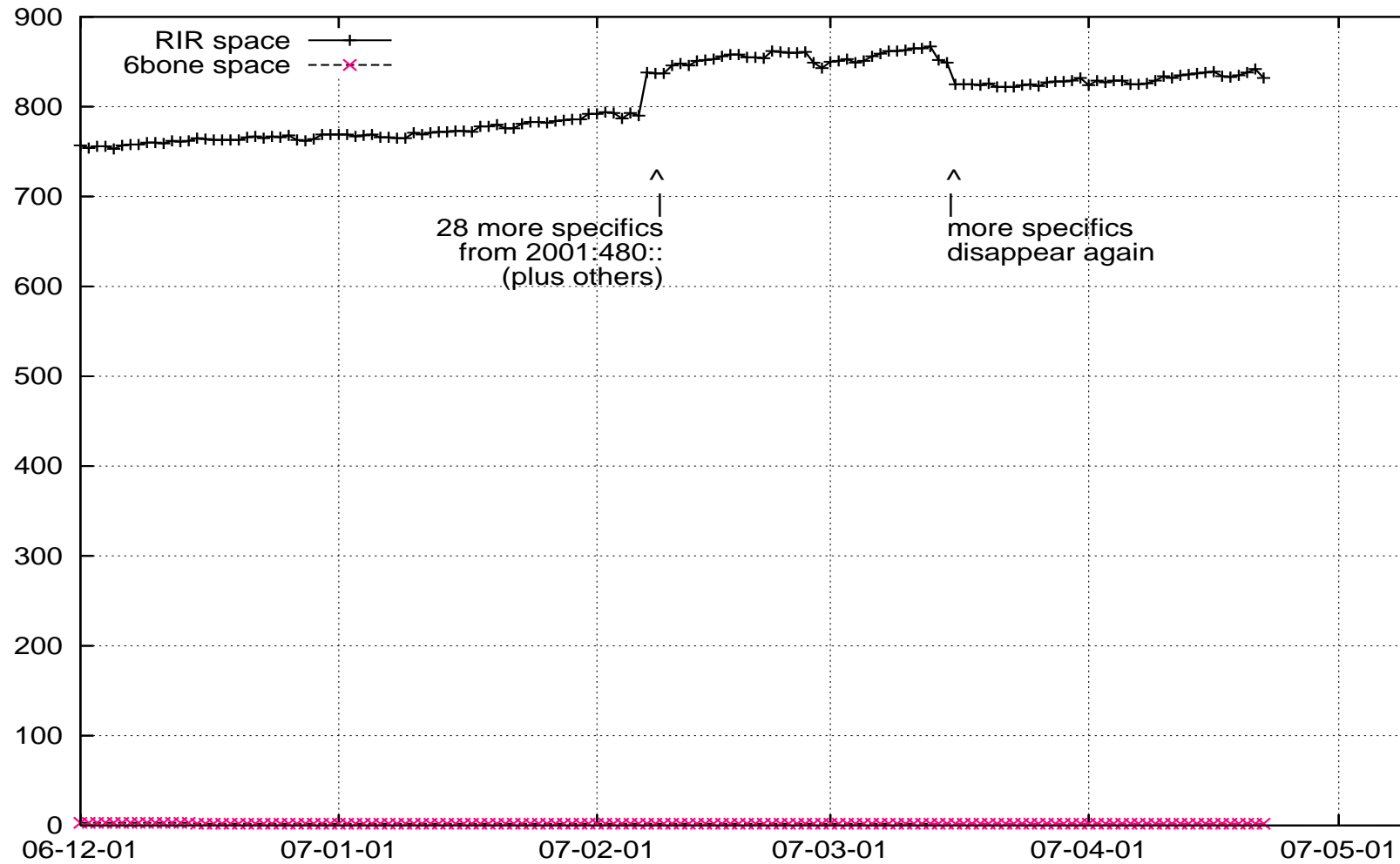
Graphics: Total Prefixes - 5.5 years



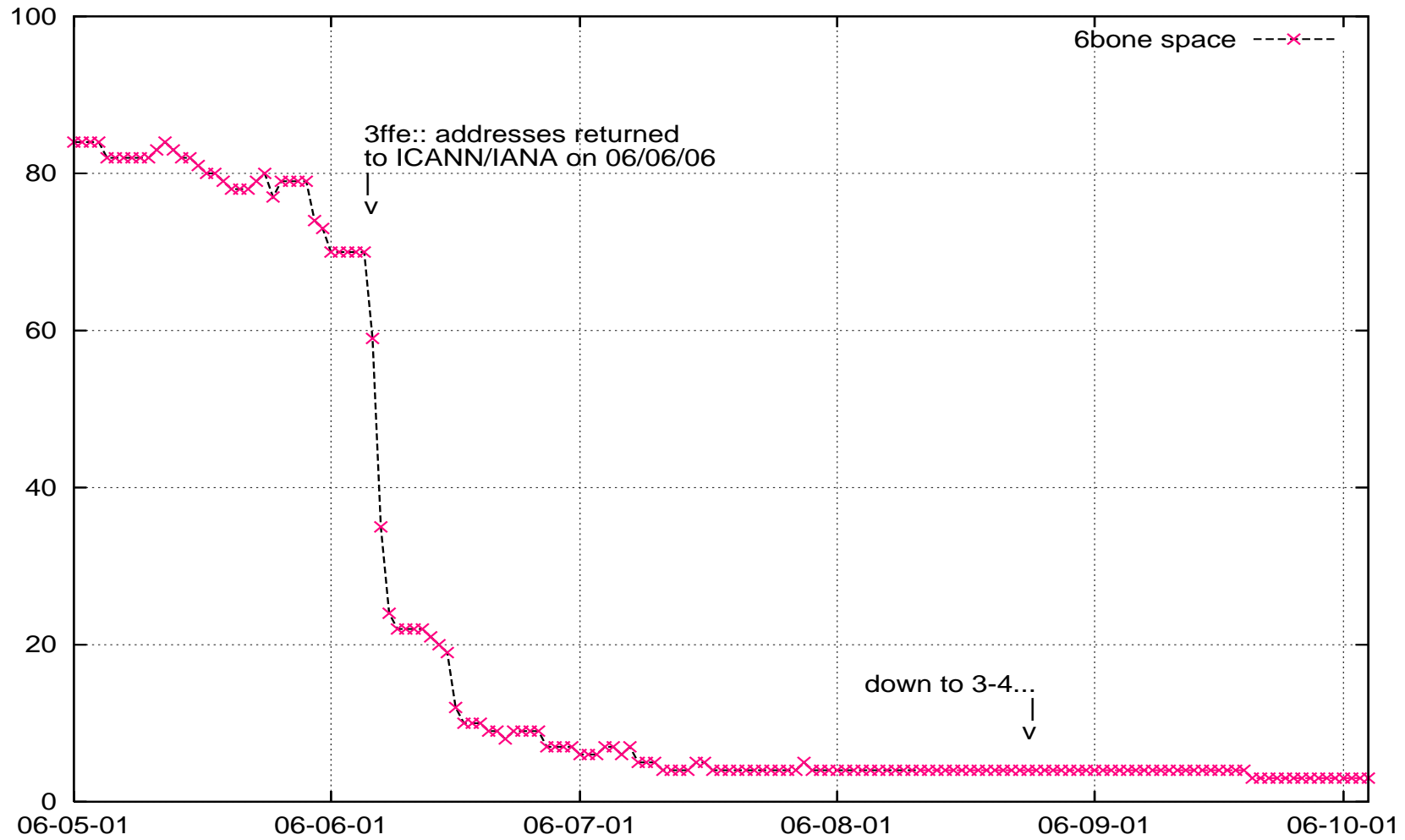
Graphics: RIR vs. 6Bone Prefixes - 5.5 years



Graphics: RIR vs. 6Bone Prefixes - 5 months



Graphics: The End Of The 6bone



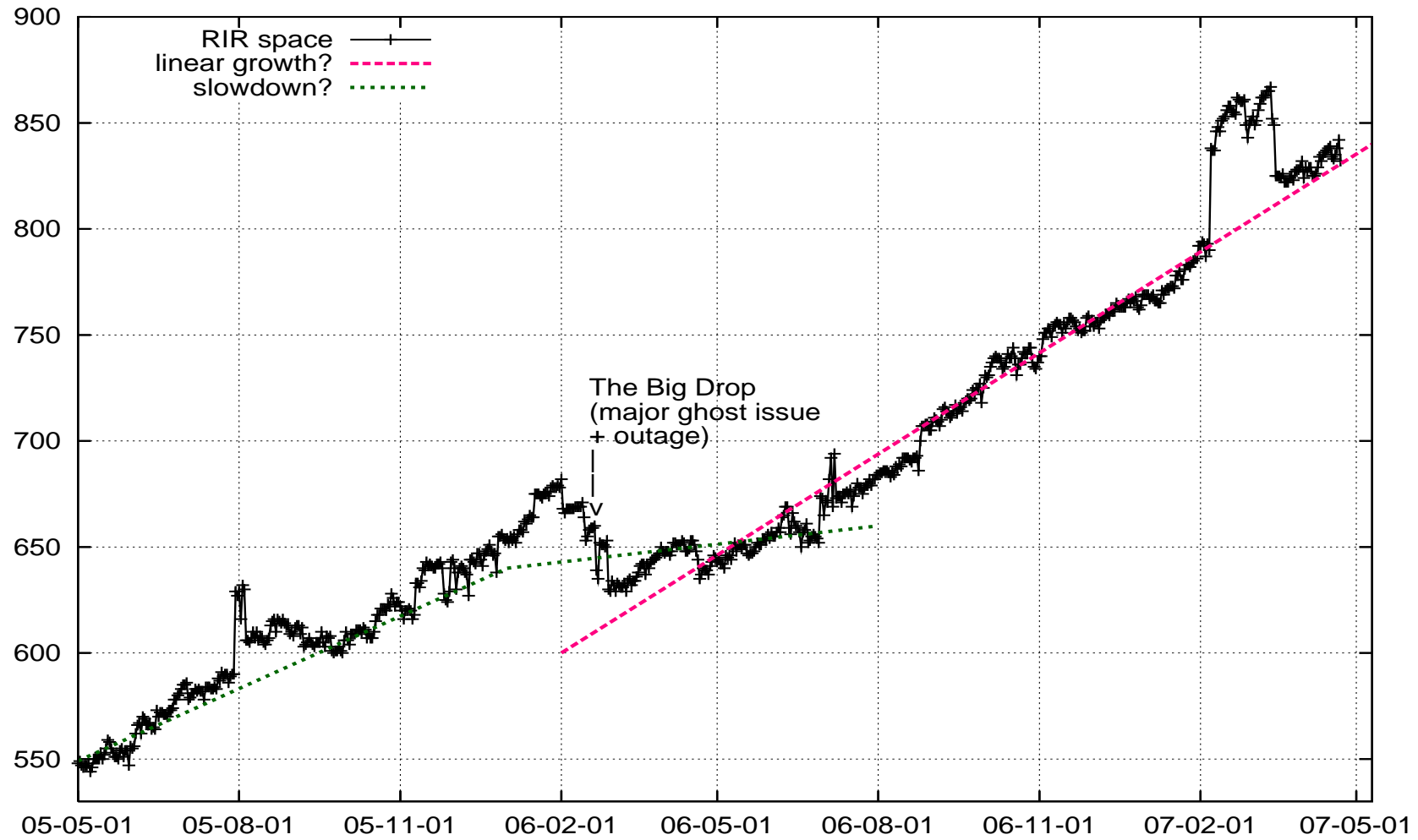
The End Of The 6bone

- on 06/06/06, the 3FFE addresses allocated to the 6Bone test network have been returned to ICANN/IANA (rfc3701)
- this means: there are no official address holders from 3FFE anymore, anybody still announcing space is an address hijacker

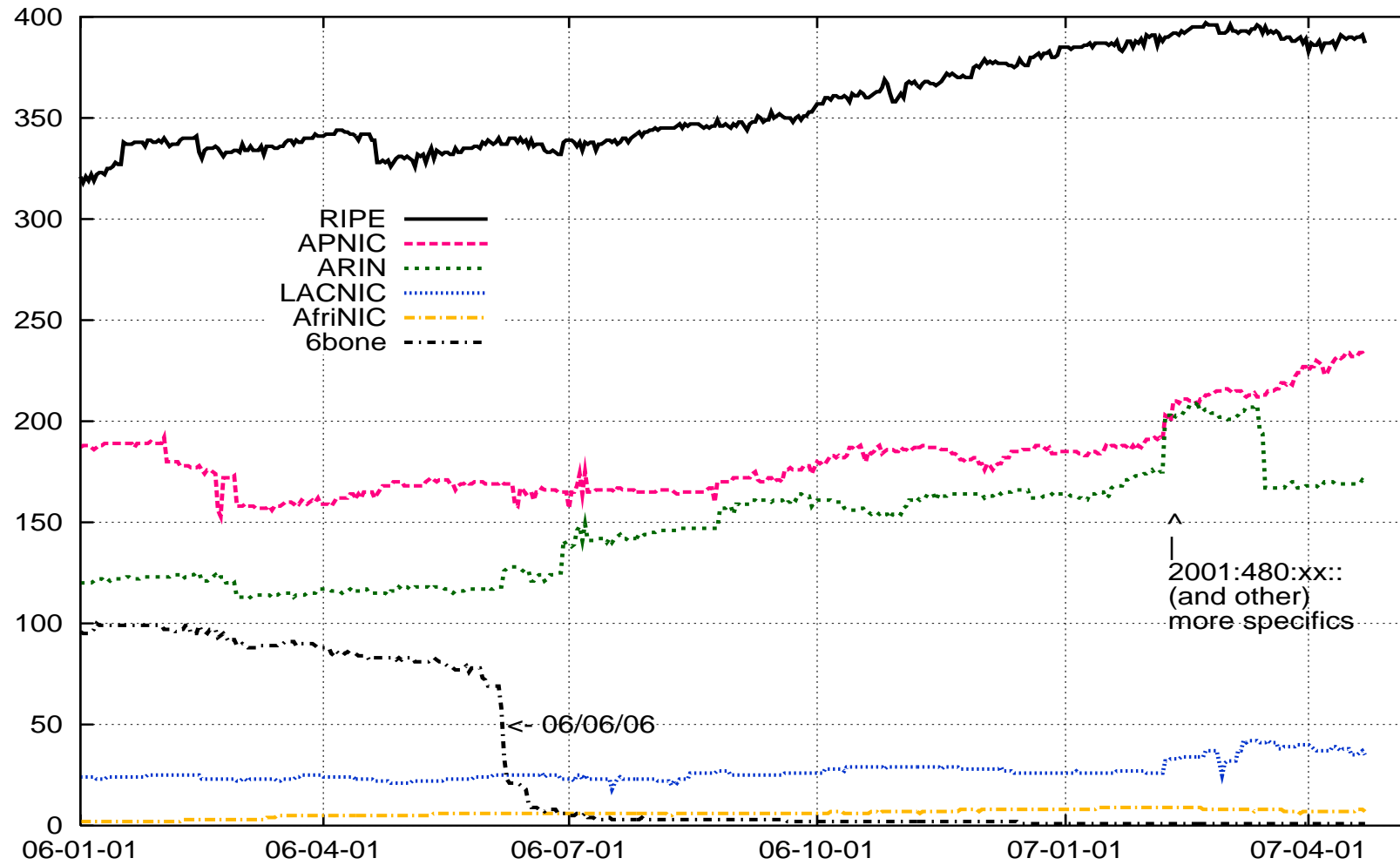
```
* 3FFE::/24          2001:470:1FFF:2::      3549 6939 4555 i
* 3FFE:800::/24     2001:470:1FFF:2::      3549 6939 4555 i
```

- this does NOT mean
 - “the end of the IPv6 Internet!”
 - “early IPv6 networks will be disconnected!”
- but: please stop using 3FFE transfer networks
- please *STOP* giving transit to 3FFE announcements!

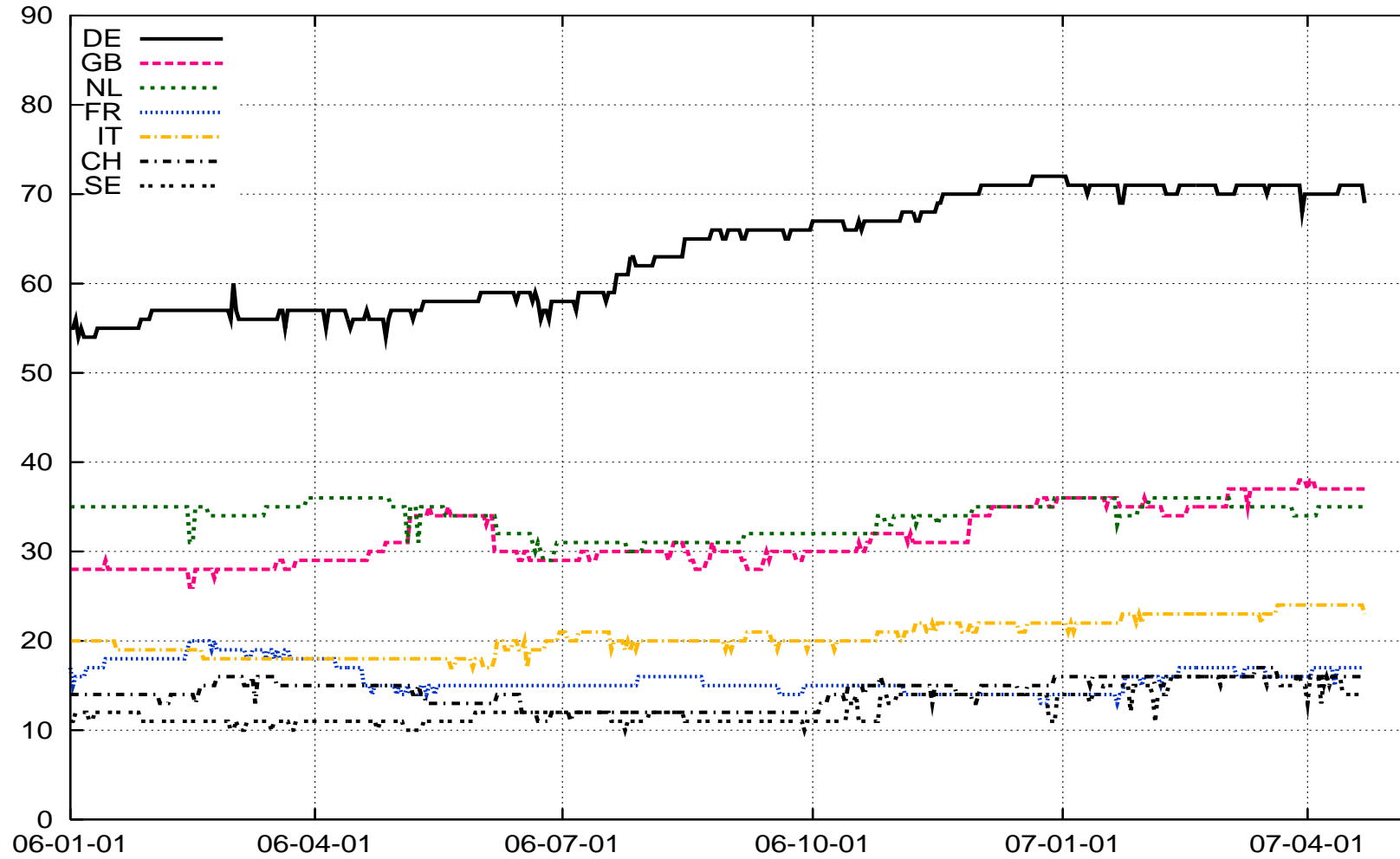
Graphics: trends? (RIR prefixes, 24 months)



Graphics: prefixes by RIR region



Graphics: prefixes by country (RIPE)



Numbers - AS numbers

- as of 2007/04/22: 708 unique AS numbers visible (10/02: 629)
 - 487 origin-only ASes (no transit paths seen) (426)
 - 193 ASes originate & give transit (179)
 - 28 transit-only ASes (e.g. 57, 2153, 5549, 6667, ...) (24)
- mixture of RIR (2xxx::) and 6Bone (3ffe::*) space announced
 - 590 ASes originate 1 RIR prefix (536)
 - 0 ASes originate only 6Bone prefixes (0)
 - 1 AS originates 2 6Bone + 2 RIR prefixes (1)
 - 53 ASes originate 2 RIR prefixes (4 due to /32+/35)
 - 27 ASes with “more than that”, maximum is 14 prefixes
- 4 ASes still announce their prefix as /32 and /35
- note: all paths observed from AS5539

ASes - why are people announcing 2+ prefixes

- /35 to /32 migration: 2 RIR prefixes, *temporary*

2001:420::/35	109 i
2001:420::/32	109 i

- Traffic Engineering? Internal aggregation leaking out?

2001:12F0::/32	3549 1916 i
2001:12F0:500::/42	109 5511 10764 11537 27750 1916 i

- ISP/LIR address space plus IXP prefixes

2001:5000::/21	1273 i	(C&W LIR space)
2001:7F8:2B::/48	1273 i	(IXP: INXS HAM)
2001:7F8:2C::/48	1273 i	(IXP: INXS MUC)

- mergers and acquisitions, business units, customer pfxs, ...

2001:218::/32	2914 i	NTT JP
2001:418::/32	2914 i	NTT America
2001:49F0::/32	2914 i	FDCServers
2001:728::/32	2914 i	Verio Europe
2610:150::/32	2914 i	Sharktech Internet
2610:F8::/32	2914 i	Command Information Inc.

Numbers - Prefixes

As of 2007/04/20: 841 prefixes in total (2006/10/02: 734)

/n	global	RIR space	6bone	6to4	(2006/10/02)
/16	1	0	0	1	(1 0 0 1)
/19-21	6	6	0	0	(6 6 0 0)
/24	3	1	2	0	(3 1 2 0)
/25-/27	4	4	0	0	(3 3 0 0)
/28	3	3	0	0	(2 1 1 0)
/29-/30	3	3	0	0	(3 3 0 0)
/32	618	618	0	0	(567 567 0 0)
/33-/34	9	9	0	0	(10 10 0 0)
/35	29	29	0	0	(30 30 0 0)
/36-/39	4	4	0	0	(3 3 0 0)
/40	10	10	0	0	(9 9 0 0)
/41-/47	9	9	0	0	(5 5 0 0)
/48	134	134	0	0	(86 86 0 0)
/52-/60	2	2	0	0	(1 1 0 0)
/64	3	3	0	0	(5 5 0 0)
/65-/128	0	0	0	0	(0 0 0 0)

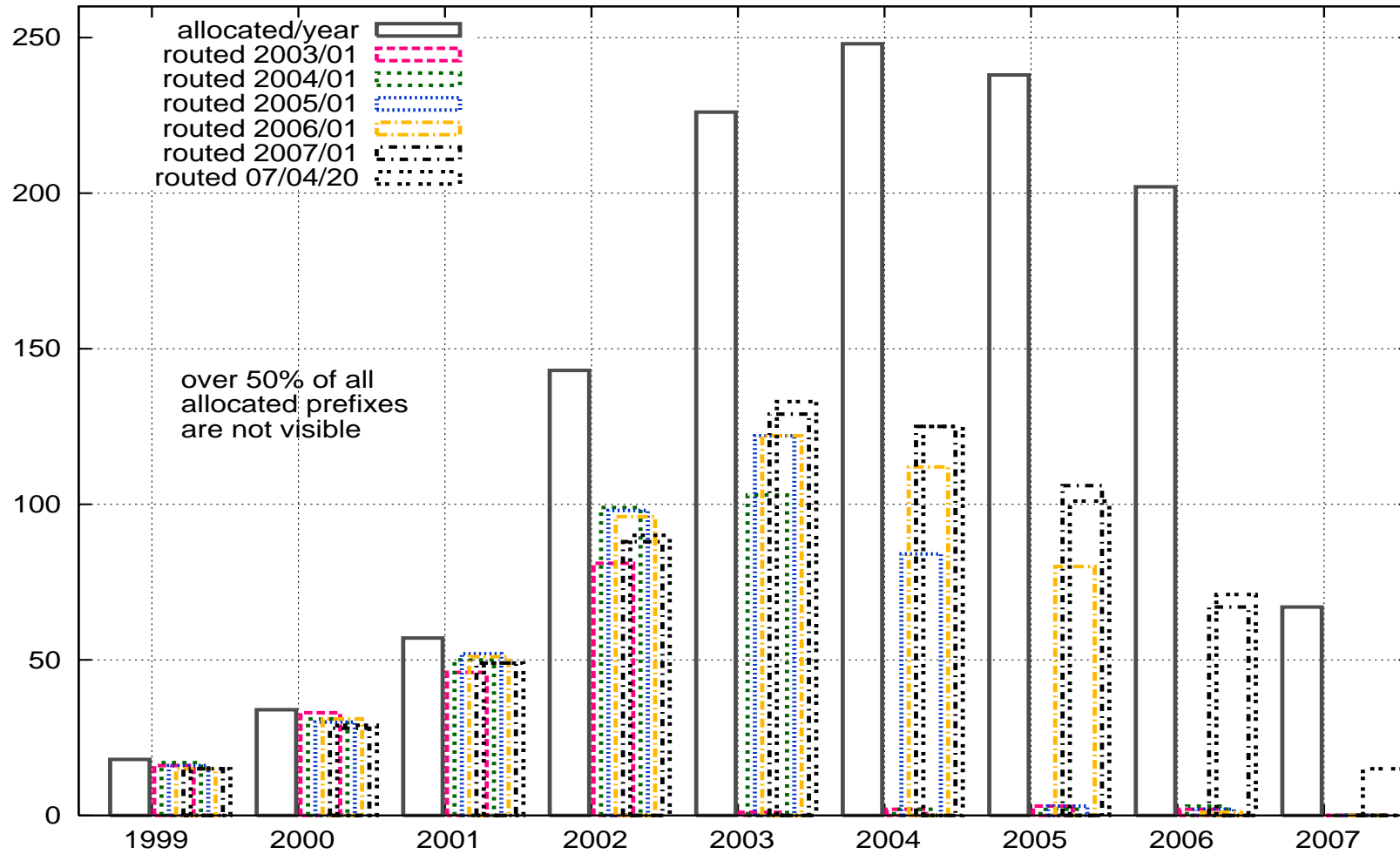
Numbers: RIRs, Allocations, ...

- On 2006/10/03, 1144 LIR blocks (2000::/4) allocated by RIRs:

RIR	alloc.	members	perc.	on 2006/04/24
ARIN	212	~ 2565	8.3%	198 (+7%)
APNIC	263	~ 2143	12.3%	249 (+6%)
RIPE	583	~ 4471	13.0%	547 (+7%)
LACNIC	63	~ 564	11.2%	51 (+24%)
AfriNIC	23	~ 350	6.6%	11 (+109%)

- note: not counting /48 microallocs and /35 \Rightarrow /32 extentions
- actual *percentage* with IPv6 similar among regions
- 489 (R52: 437) allocations visible in routing table (*only 42%!*)

Graphics: Allocated vs. Routed



Numbers: RIRs: notable allocations (1)

- more “very large” allocations seen:
 - 2404:0e0::/28 MCI Asia Ptr, AP (2006/05/10)
 - 2404:180::/28 Samsung Networks, KR (2006/08/28)
 - 2610:080::/29 RCN Corporation, US (2006/06/02)
 - 2a01:110::/31 Microsoft, GB* (2006/06/01)
 - 2a01:2000::/20 Telecom Italia, IT (2006/05/16)
 - 2402::/22 Korean Education Network, KR (2006/10/20)
 - 2401:8000::/26 NCICNET, TW (2007/01/23)
 - 2001:500:6::/47 + 2001:500:8::/45 Afilias, CA (2006/10/19) **
 - 2600::/29 Sprint, US (2006/12/21)
 - 2600:800::/27 MCI / Verizon Business, US (2007/01/08)
 - 2a01:2e0::/28 Polkomtel S.A., PL (2007/03/19)
 - 2800:a0::/28 Administration Nacional d. Tel., UY (2007/01/15)

Numbers: RIRs: notable allocations (2)

- first IPv6 PI networks assigned by ARIN:
 - 2620::/48 U.S. Securities & Exchange C. (2006/09/13)
 - 2620:0:10::/48 S. D. Warren Services (2006/09/13)
 - 2620:0:20::/48 CollabNet (2006/09/13)
 - 2620:0:30::/48 Tellme Networks (2006/09/14)
 - 2620:0:40::/48 YouTube, Inc. (2006/09/19)
 - 2620:0:50::/48 Univ. of Texas at Austin (2006/09/21)
 - (43 “direct” assignments from ARIN so far, 4 in BGP)
- DNS anycast assignments from RIPE (2001:678::/29)
 - 2001:0678:0::/48 .FK – Falkland Islands (2006/10/09)
 - 2001:0678:1::/48 .CZ – CZ.NIC (2006/10/11) (in BGP)
 - 2001:0678:2::/48 .DE – DENIC eG (2006/10/13)
 - 2001:0678:3::/48 .CH – Switch (2006/12/12) (in BGP)
 - 2001:0678:4::/48 .CO.UK – Internet Comp. Bur. (2007/03/22)
- ⇒ **check your BGP filters!!**

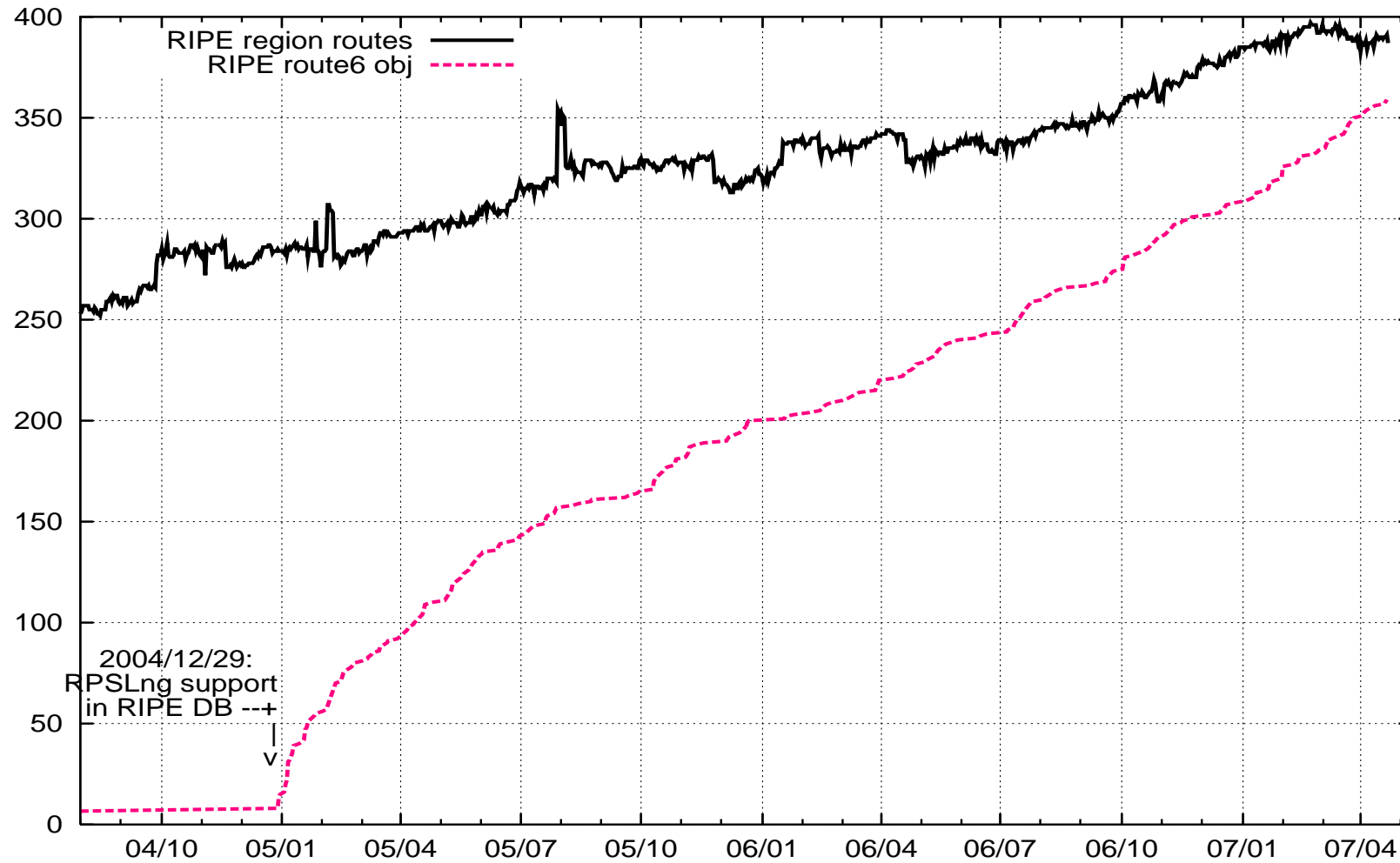
Numbers: RIRs: notable allocations (3)

- Allocations ICANN \Rightarrow RIRs since RIPE 52

Prefix	RIR	Date	Comment
2620:0000::/23	ARIN	12 Sep 06	last /23
2400:0000::/12	APNIC	03 Oct 06	
2600:0000::/12	ARIN	03 Oct 06	
2800:0000::/12	LACNIC	03 Oct 06	
2A00:0000::/12	RIPE NCC	03 Oct 06	
2C00:0000::/12	AfriNIC	03 Oct 06	

- <http://www.iana.org/assignments/ipv6-unicast-address-assignments>
- new global IPv6 distribution policy has been ratified by ICANN \Rightarrow /12 allocations to RIRs on Oct 03
- hopefully these will last for a while

Graphics: route6 objects vs. routes seen



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

new tool: GRH Longest Distance Routing

- <http://www.sixxs.net/archive/sixxs/2007-04-01-GRH-LongestDistanceRouting.html>
- approximate the *geographical* AS path length for a given prefix
- originally meant as a April Fool's joke, but actually it's quite useful to quickly find *really* bad paths
- and the winner is...
2001:200:a000::/35 25441 3257 3549 6939 2516 7660 22388 11537 2500
at 40760 km (Ireland, Germany, NL, US, JP, US and Japan),
and
2001:200:a000::/35 1836 3549 6939 2516 7660 22388 11537 2500
at 39500 km (Switzerland, NL, US, JP, US, and Japan)
- kudos goes to Jeroen Massar

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/Arin19-v6-table/>

Questions?

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