

Impressions

An overview of the global IPv6 routing table

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Overview

- what's “the global IPv6 routing table”
- numbers & pictures
- observations
- conclusions
- references

What's "the global IPv6 routing table"?

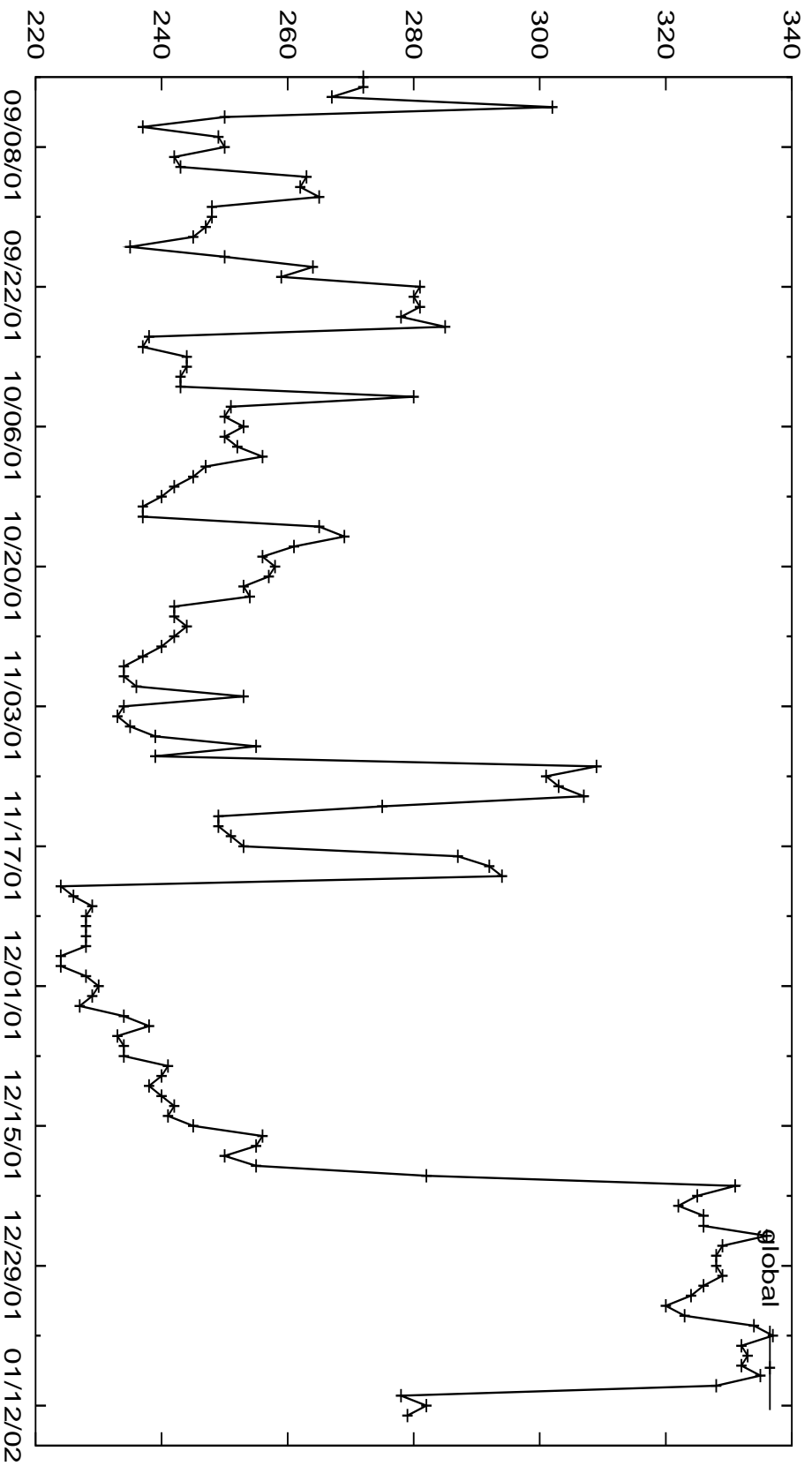
- it's what you get when you hook up to "the IPv6 routing world" using BGP4++
- a mixture of 6bone and RIR IPv6 addresses and networks
- some ASes announce 6bone only, some RIR space only, a few both
- unlike IPv4: most ASes give transit to each other (will change)
- unlike IPv4: most ASes do not filter anything (is changing)
- unlike IPv4: still mainly tunnel based - BGP topology does not reflect physical topology

Numbers - Prefixes

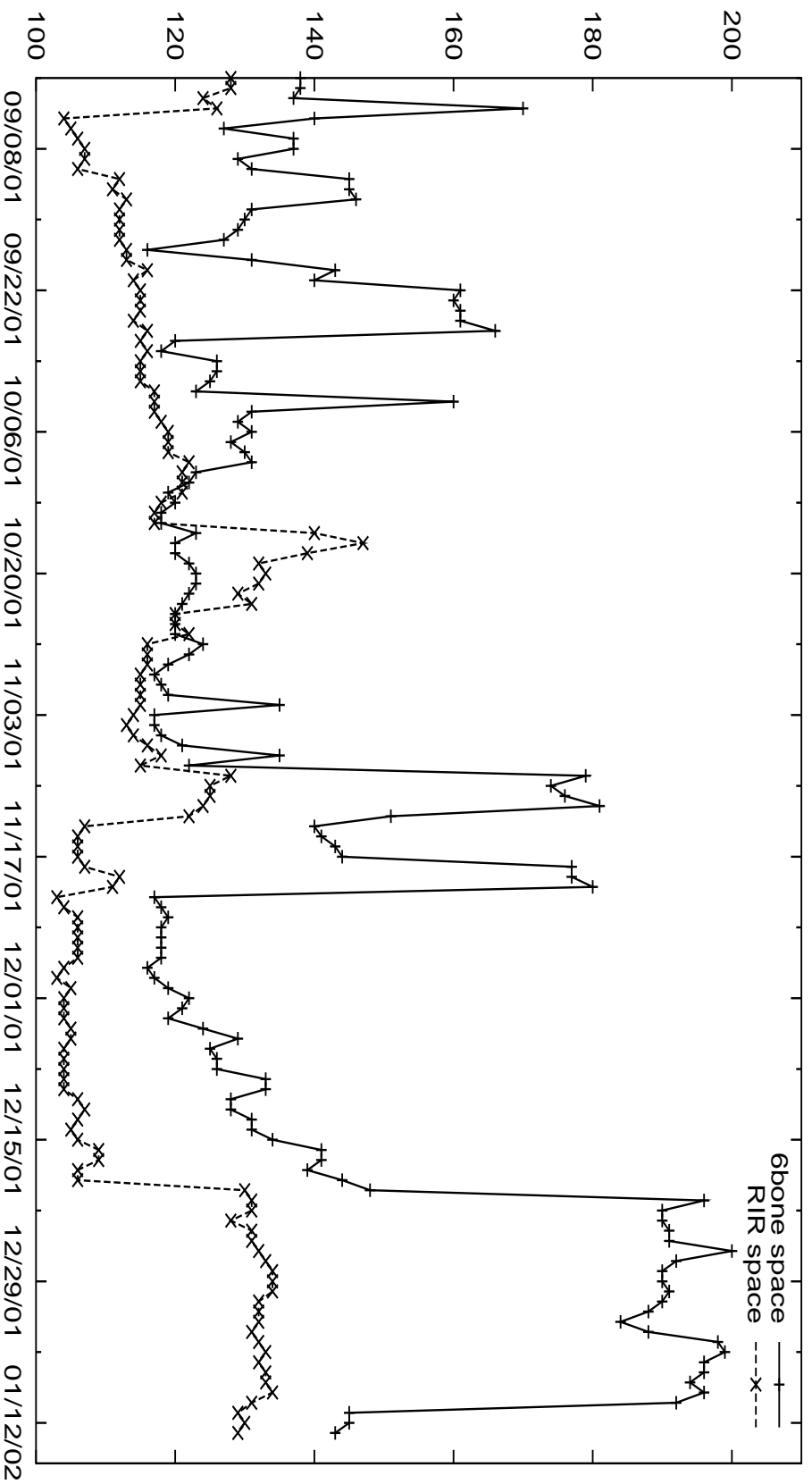
As of 2001/01/13: 279 prefixes in total (2001/09/29: 244)

/n	global	RIR space	6bone space	(2001/09/29)
/16	3	1	0	(1/0/0)
/24	50	0	50	
/28	47	0	47	(40/0/40)
/32	15	0	14	
/34	1	0	1	
/35	96	95	0	(82/82/0)
/40	8	7	1	
/42	1	1	0	
/44	1	1	0	
/48	42	20	20	(45/19/24) ¹
/60	2	1	1	
/64	13	4	9	(5/2/3)

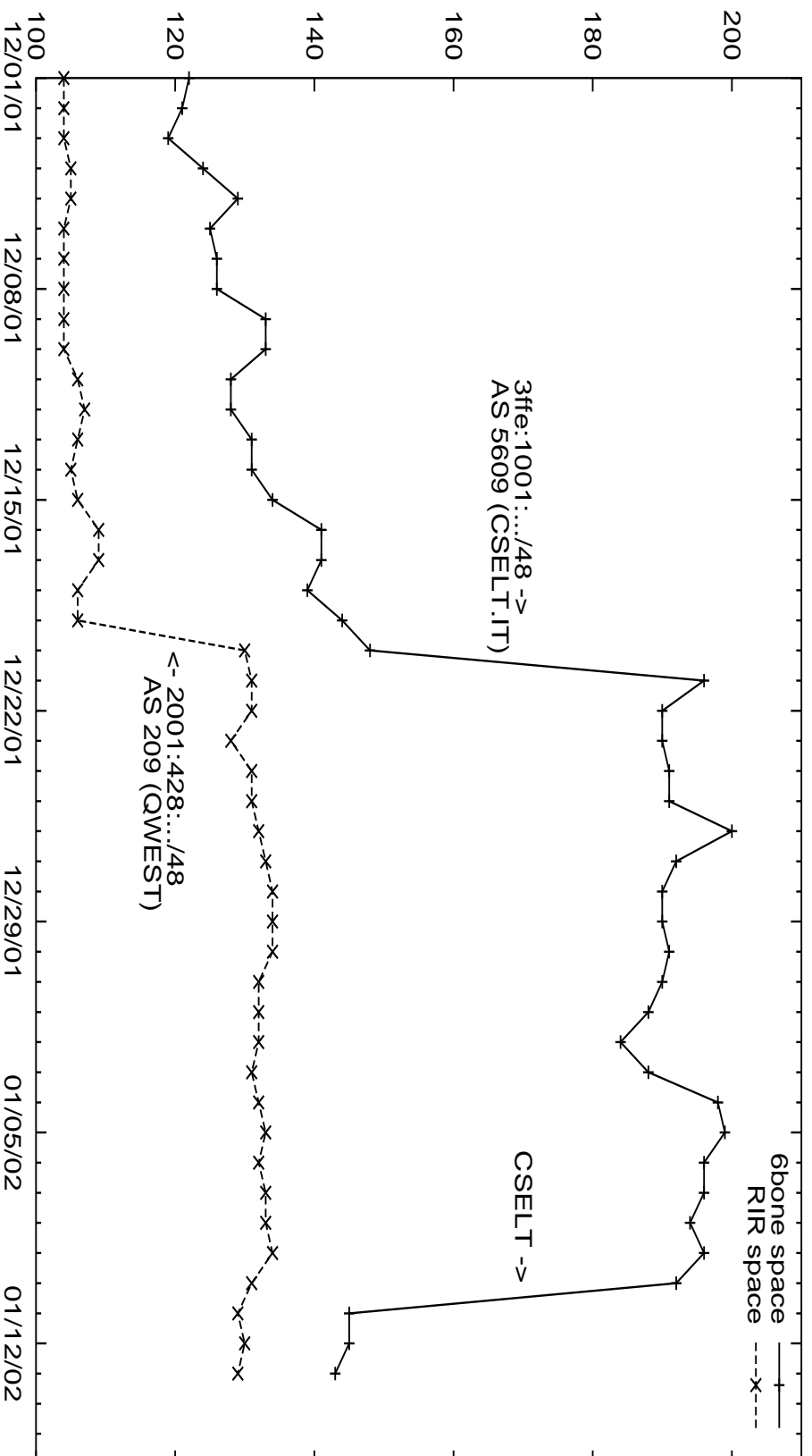
Graphics: Total Prefixes - 5 months



Graphics: RIR vs. 6Bone Prefixes - 5 months



Graphics: RIR vs. 6Bone Prefixes - 6 weeks



Numbers: RIRs, ASes and AS paths

- 96 /35's out of 2001::/16 announced - 124 allocated by RIRs
ARIN: 24(20), APNIC: 49(39), RIPE: 51(44), as of 2002/01/16
- total unique ASes in the 6bone table (2002/01/14): 186 (171)
- new /35s in the table since 2001/09/30:

2001:208::/35	2001:478::/35	2001:690::/35
2001:290::/35	2001:4A0::/35	2001:6D8::/35
2001:310::/35	2001:4B00::/35	2001:720::/35
2001:318::/35		2001:738::/35
2001:340::/35		2001:768::/35
2001:350::/35		2001:770::/35
2001:368::/35		2001:778::/35

Interesting Observations (1) - Martians / Zombies

Network	Next Hop	Path
*> 2001::/35	2001:478:FFFF::1	4554 278 237 10566 20834
	3292 109 15589 1275 680 4589 8733 5511 2500 4691 2042	
	4774 2497 4697 3425 293 6175 6435 6939 9044 1654 1849	
	3561 3748 ?	
* 2001:A00::/35	2001:618:1::A3	1752 4725 4697 6726 2603
	1275 8002 2607 2852 3263 1654 8664 15694 8627 4589 8733	
	6830 559 1122 786 11537 18592 278 6435 6175 4554 ?	

These hint at a BGP withdrawal bug (there are a few more)

For amusement value, try a traceroute at 2001:a00:10::1 (loops after 14 hops).

Interesting Observations (2) - Lazy Aggregation

Network	Next Hop	Path
* 2001:428:8:100::/64	2001:608:0:3::3	1122 786 5623 6939 14277 209 i
*	2001:650:0:2::26	3561 1849 5623 6939 14277 209 i
* 2001:428:9::/48	2001:608:0:3::3	1122 786 5623 6939 14277 209 i
*>	3FFE:C00:8023:19::1	109 6939 14277 209 i
* 2001:428:10::/48	2001:608:0:3::3	1122 786 5623 6939 14277 209 i
*>	3FFE:C00:8023:19::1	109 6939 14277 209 i
* 2001:428:28::/48	2001:608:0:3::3	1122 786 5623 6939 14277 209 i
*>	3FFE:C00:8023:19::1	109 6939 14277 209 i
* 2001:428:40::/48	2001:608:0:3::3	1122 786 5623 6939 14277 209 i
*>	3FFE:C00:8023:19::1	109 6939 14277 209 i
* 2001:428:50::/48	2001:608:0:3::3	1122 786 5623 6939 14277 209 i
*>	3FFE:C00:8023:19::1	109 6939 14277 209 i

(this is in the table since four full weeks - and there are others!)

Interesting Observations (3) - Invalid AS numbers

```

Network      Next Hop      Path
* 3FFE:8260::/28
    2001:618:1::A3
        1752 8954 8277 45328 i
*>    2001:608:0:3::5
        8379 8277 45328 i
* 3FFE:80E1:8000:E::1
        6726 8277 45328 i
*    2001:600:4:1D1::1
        1849 5609 6939 45328 i
* 3FFE:1900::/24
    2001:618:1::A3
        1752 3265 6175 10318 33 6939 2549 3274 1103
        766 278 8002 6726 20834 8664 59650 59650 ?
    3FFE:2A00:100:7FF3::1
        2603 1275 762 6175 10318 33 6939 2549 3274
        1103 766 278 8002 6726 20834 8664 59906 59906 ?

```

AS 45328, 45589, 59650 and 59906 are **not** assigned by IANA!

Interesting Observations (4) - Typos Do Happen

Network	Next Hop	Path
* 2001:4B00::/35	3FFE:80E1:8000:E::1	6726 10566 11630 i
* 2001:618:1::A3		1752 3265 15589 11630 i
* 3FFE:2A00:100:7FF3::1		2603 1275 4538 11630 i
* 2001:478:FFFF::1		4554 11630 i
* 2001:680:0:1::4		517 8954 15589 11630 i
* 2001:650:0:2::26		3561 145 11630 i
*> 3FFE:C00:8023:19::1		109 11630 i

AS 11630 is AOL USA, so I assume that this was meant to be 2001:04B0::/35 (AOLTIMEWARNER) and not :4B00..

News

- People start filtering IPv6 prefixes
- Filters mainly used *outgoing* (“we accept all the crap to make sure we can reach the target, but we will not redistribute it”)
- sample filter (from UUnet UK):

```
ipv6 prefix-list ipv6out seq 5 permit 2001:600::/35
ipv6 prefix-list ipv6out seq 10 permit 3FFE:1100::/24
ipv6 prefix-list ipv6out seq 15 permit 2001::/16 le 35
ipv6 prefix-list ipv6out seq 20 permit 3FFE::/16 le 28
ipv6 prefix-list ipv6out seq 25 permit 2002::/16 le 48
ipv6 prefix-list ipv6out seq 30 deny ::/0 le 128
```

Conclusions

- it works!
- interest in IPv6 is growing
- people are very cooperative
- still fairly experimental
- overall stability and professionalism has to be improved

References

- Merit 6bone routing report:
<http://http://www.merit.edu/mail.archives/html/6bone-routing-report/>
- List of IPv6 blocks allocated by the RIRs:
<http://www.ripe.net/rs/ipv6/ipv6allocs.html>
- Slides are available at:
<http://www.space.net/~gert/RIPPE/r41-6table.ps>

Questions?

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