Open Resolver Project

Results from 2 months of active scans

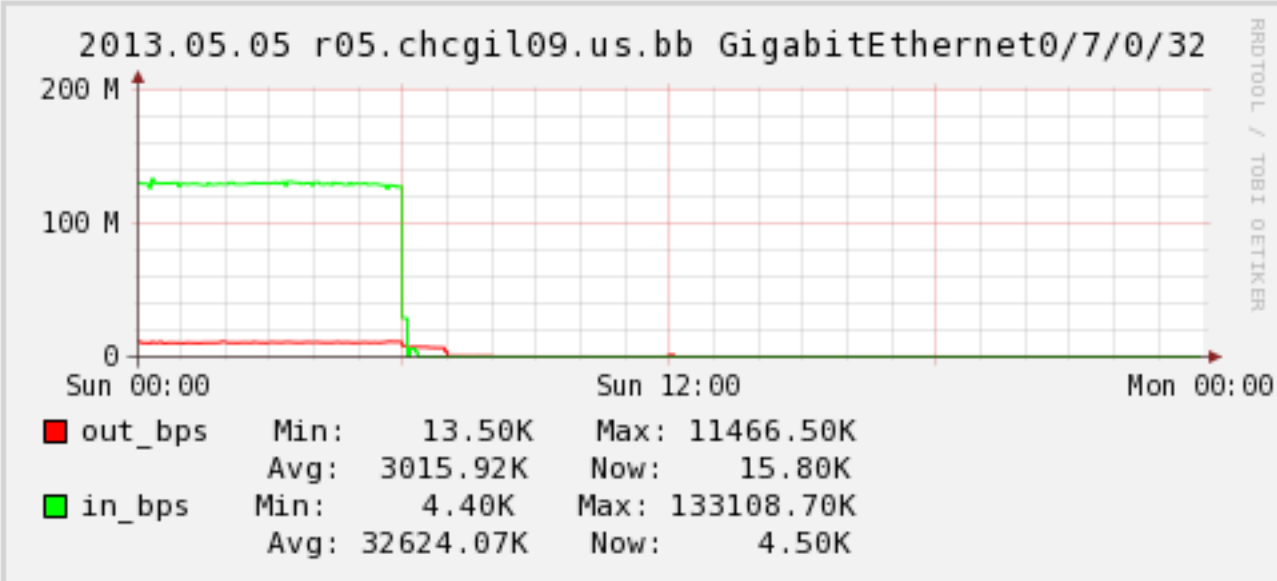
http://www.openresolverproject.org

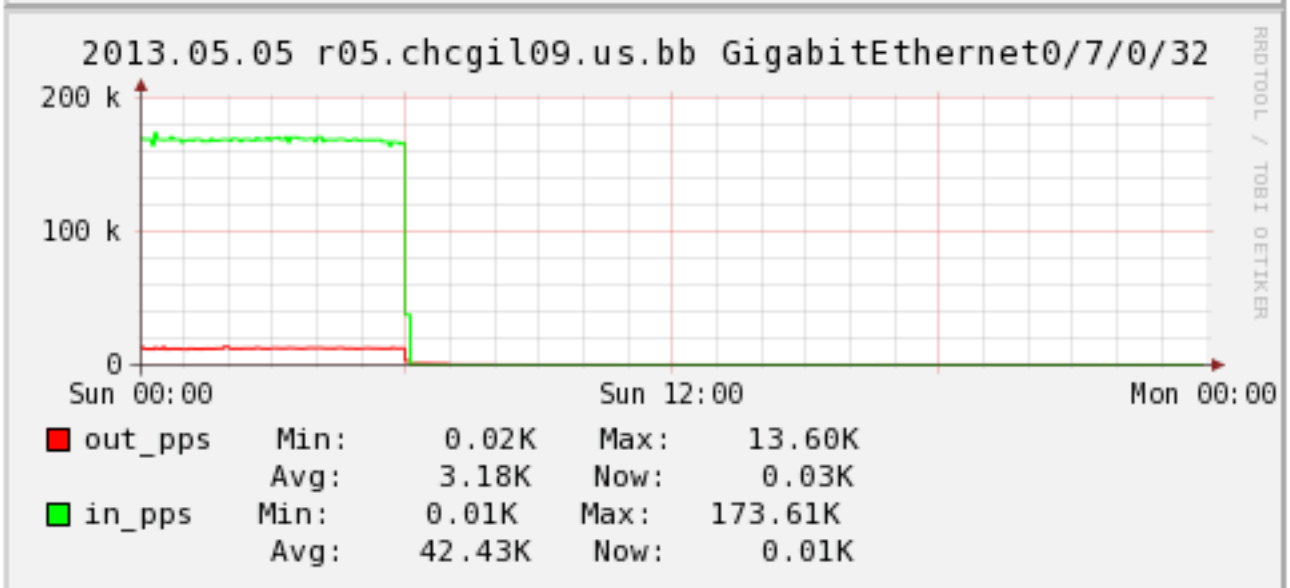
Background

- Lack of BCP-38 means open resolvers can be used in DNS amplification attacks
- Lack of RRL means authority and recursive resolvers can be abused
- Historically defaults were more permissive in software (open relays, directed-broadcast, etc)

Methodology

- IPv4-only Scan runs weekly (0 UTC Sundays)
- Takes 6.5 hours
- One packet per IP (skips 10/8 127/8 192.168/16)
- Sends about 100kpps


2013.05.05 r05.chcgil09.us.bb GigabitEthernet0/7/0/32
200 M
100 M
0
Sun 00:00
Sun 12:00
Mon 00:00
RRDTOOL / TOBI OETIKER
out_bps Min: 13.50K Max: 11466.50K
Avg: 3015.92K Now: 15.80K
in_bps Min: 4.40K Max: 133108.70K
Avg: 32624.07K Now: 4.50K


2013.05.05 r05.chcgil09.us.bb GigabitEthernet0/7/0/32
200 k
100 k
0
Sun 00:00
Sun 12:00
Mon 00:00
RRDTOOL / TOBI OETIKER
out_pps Min: 0.02K Max: 13.60K
Avg: 3.18K Now: 0.03K
in_pps Min: 0.01K Max: 173.61K
Avg: 42.43K Now: 0.01K

More Methodology

- A.B.C.D
  - Walks IP space sparsely (1.0.0.0, 2.0.0.0 … 223, 1.1.0.0.. 223.1.0.0
  - First few weeks incremented linearly through space. New method catches more resolvers
- Single host doing Scanning and Data collection
  - Process waits just 60 seconds after last packet sent to capture last data.
- DNS QNAME is unique per-IP scanned
- Query-ID is last two octets of IPv4 address

Complaints?

- Get a few complaints each week, but have tapered off
- ISP Abuse Team was pre-informed of activities
- They have a template to auto-respond to people

Reply Template

Greetings,

X.X.X.X is part of a research project to map out open resolvers on the internet. The contact for
this research project is
dns-scan@puck.nether.net. You can also read a bit more about this project at
http://openresolverproject.org

Open Resolvers pose a security threat as they are used in DNS amplification attacks.
You can read about them here:
https://www.google.com/search?q=dns+open+resolver+amplification+attack

Let us know if you have additional questions or concerns.

Regards,
NTT Communications Global IP Network Security Team

Results

- Generates about 9.5GB of raw data per week
- Captures unix time_t, IP Address, Port and data packet

- 1367734028.41022:112.207.253.255:14432:fdff8180000100020003
  0004083339383662346236136f70656e7265736f6c76657270726f6
  a656374036f72670000010001c00c0005000100000e100002c015c0
  150001000100000ca50004cc2afe05c0150002000100000ca500120
  574686f726e09626c61636b726f7365c029c0150002000100000ca5
  000f05616e796e7303706368036e657400c0150002000100000ca50
  00e047075636b066e6574686572c084c0950001000100013bf20004
  cc2afe05c095001c000100013bf20010200104 1803f4000000000000
  00000005c07a00010001000 1304c0004cc3dd804c05c00010001000
  0fbad0004cc2afe07

Weekly Statistics

32959644 servers responded to udp/53 probe

31863936 unique IPs

318032 IPs responded more than once

1188210 servers responded from a different IP than probed

28016578 gave the correct answer to the A? for the DNS name queried

15299674 responded from a source port other than udp/53

28494930 responses had recursion-available bit set

29346370 returned OK (RCODE=0)

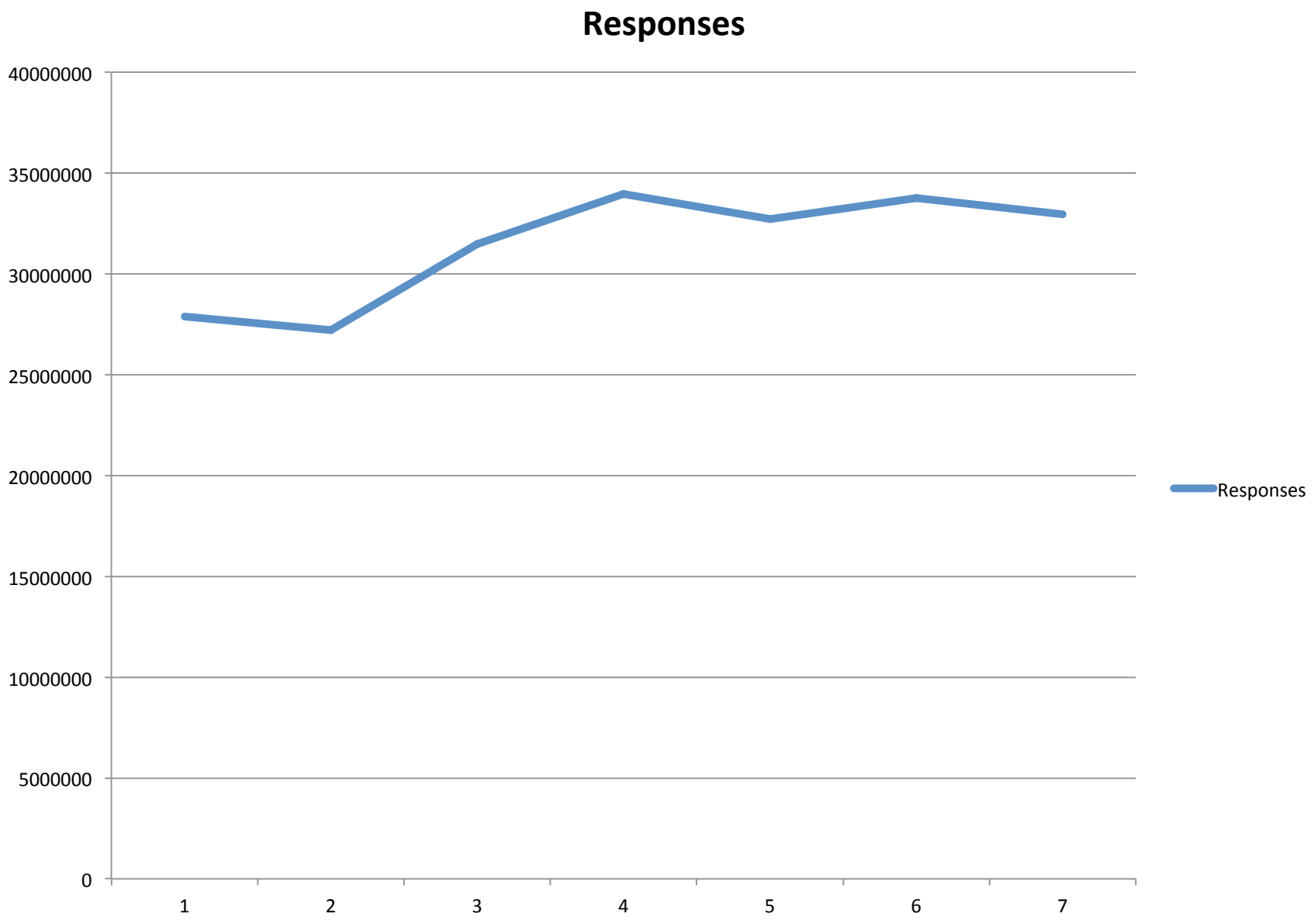
6703 returned FORMERR (RCODE=1)

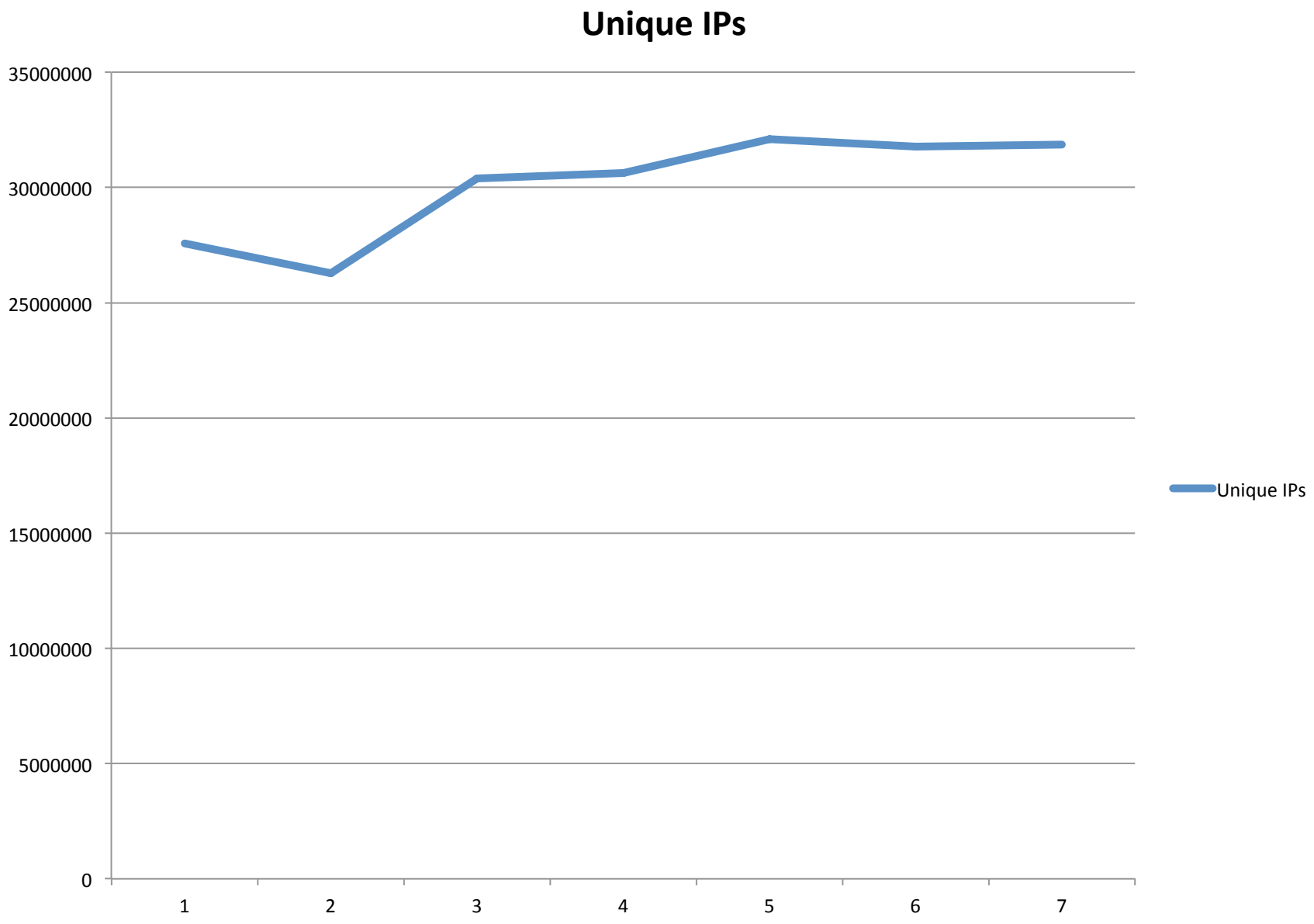
488903 returned SERVFAIL (RCODE=2)

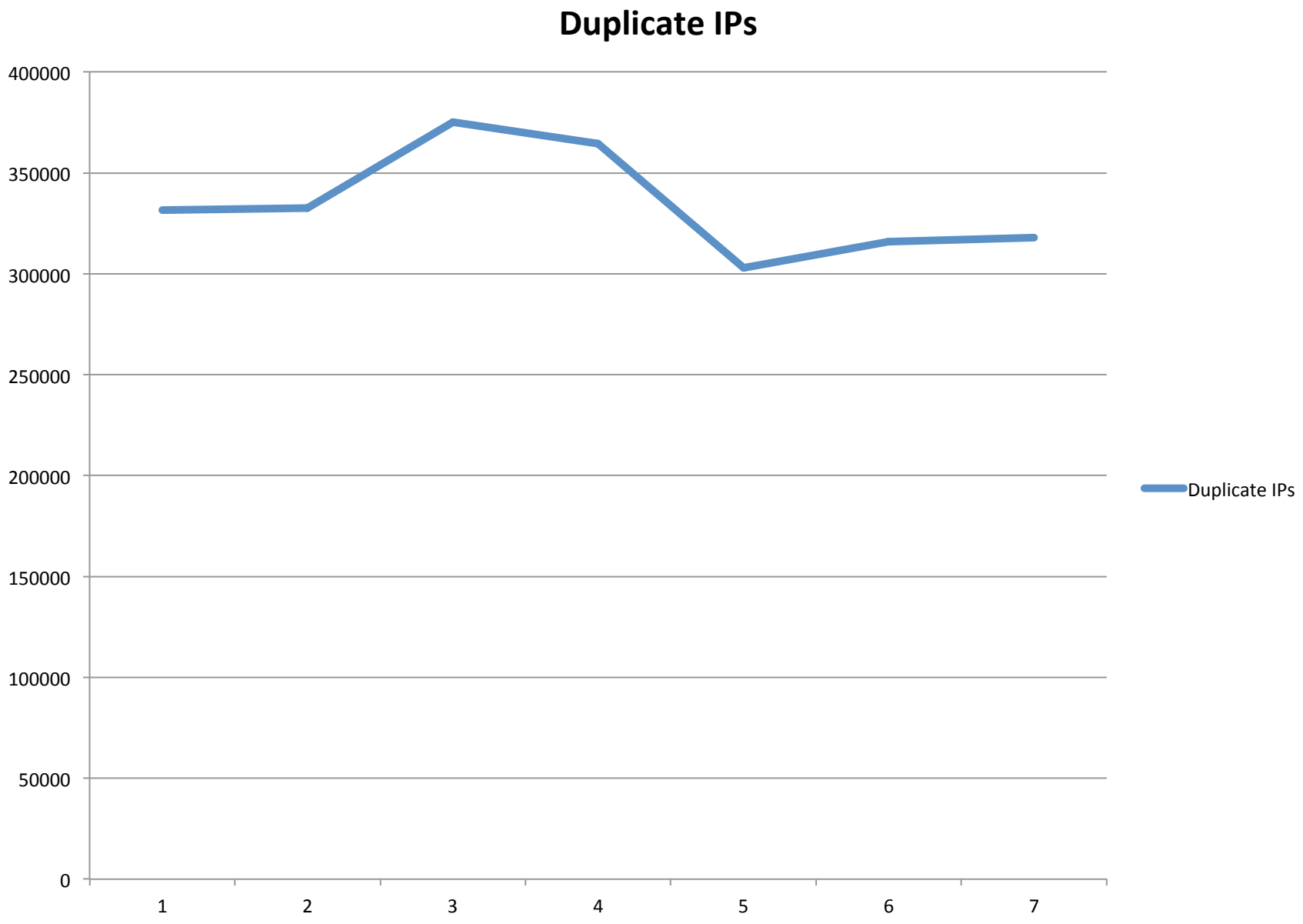
168368 returned NAMEFAIL (RCODE=3)

134 returned NOTIMP (RCODE=4)

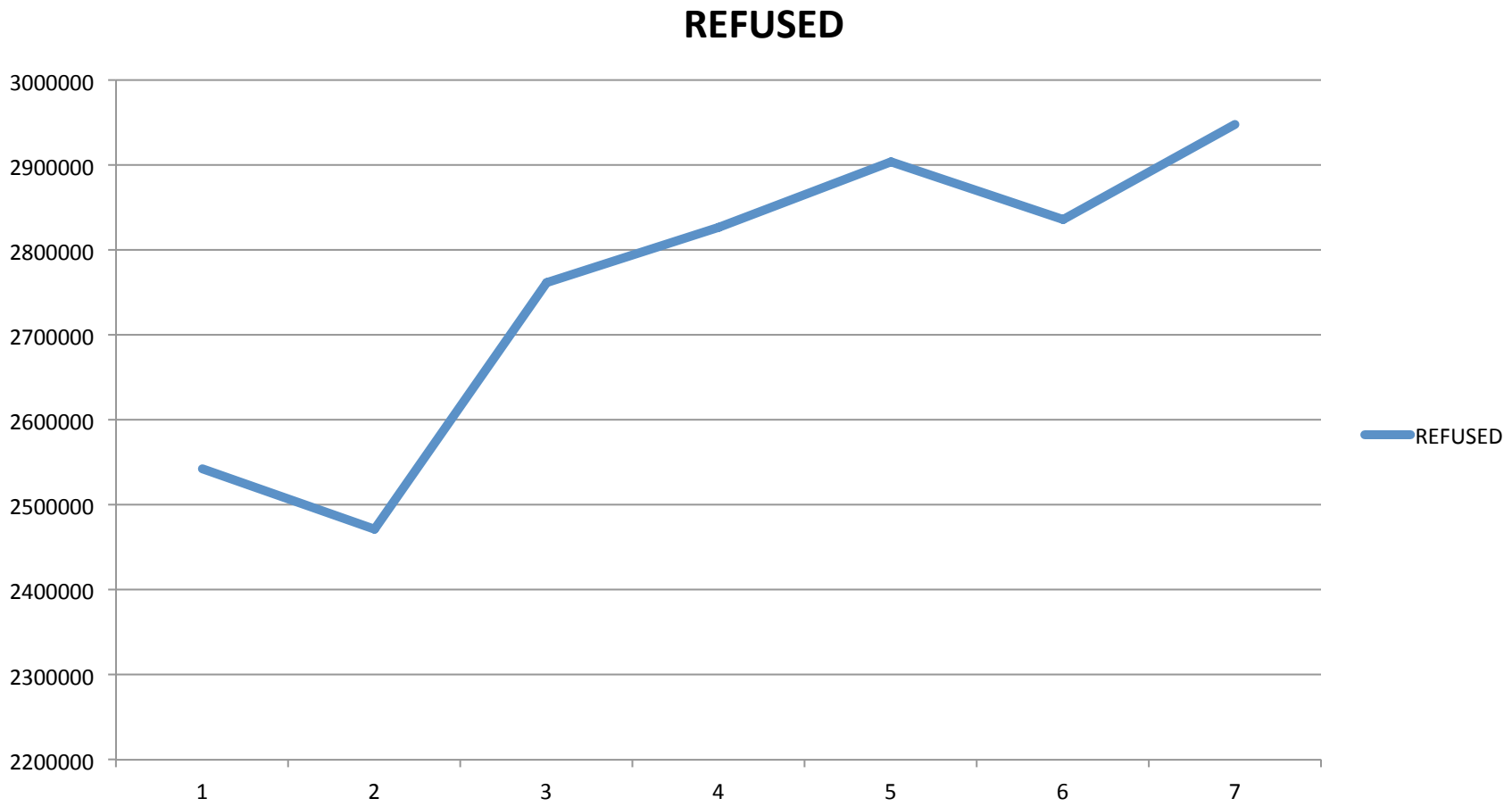
2947866 returned REFUSED (RCODE=5)


Responses
40000000
35000000
30000000
25000000
20000000
15000000
10000000
5000000
0
1
2
3
4
5
6
7
Responses

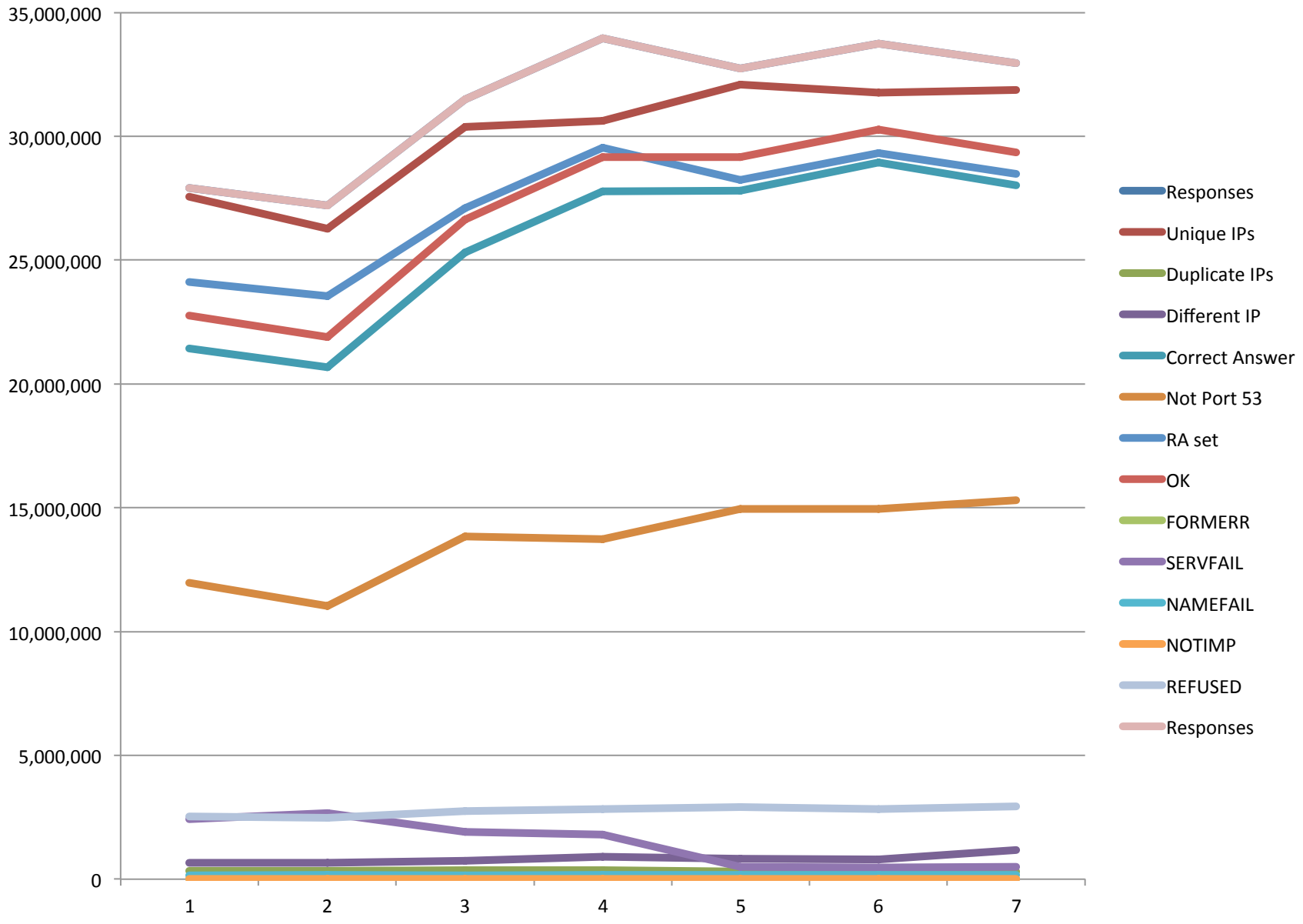

Unique IPs
35000000
30000000
25000000
20000000
15000000
10000000
5000000
0
1
2
3
4
5
6
7
Unique IPs


Duplicate IPs
400000
350000
300000
250000
200000
150000
100000
50000
0
1
2
3
4
5
6
7
Duplicate IPs

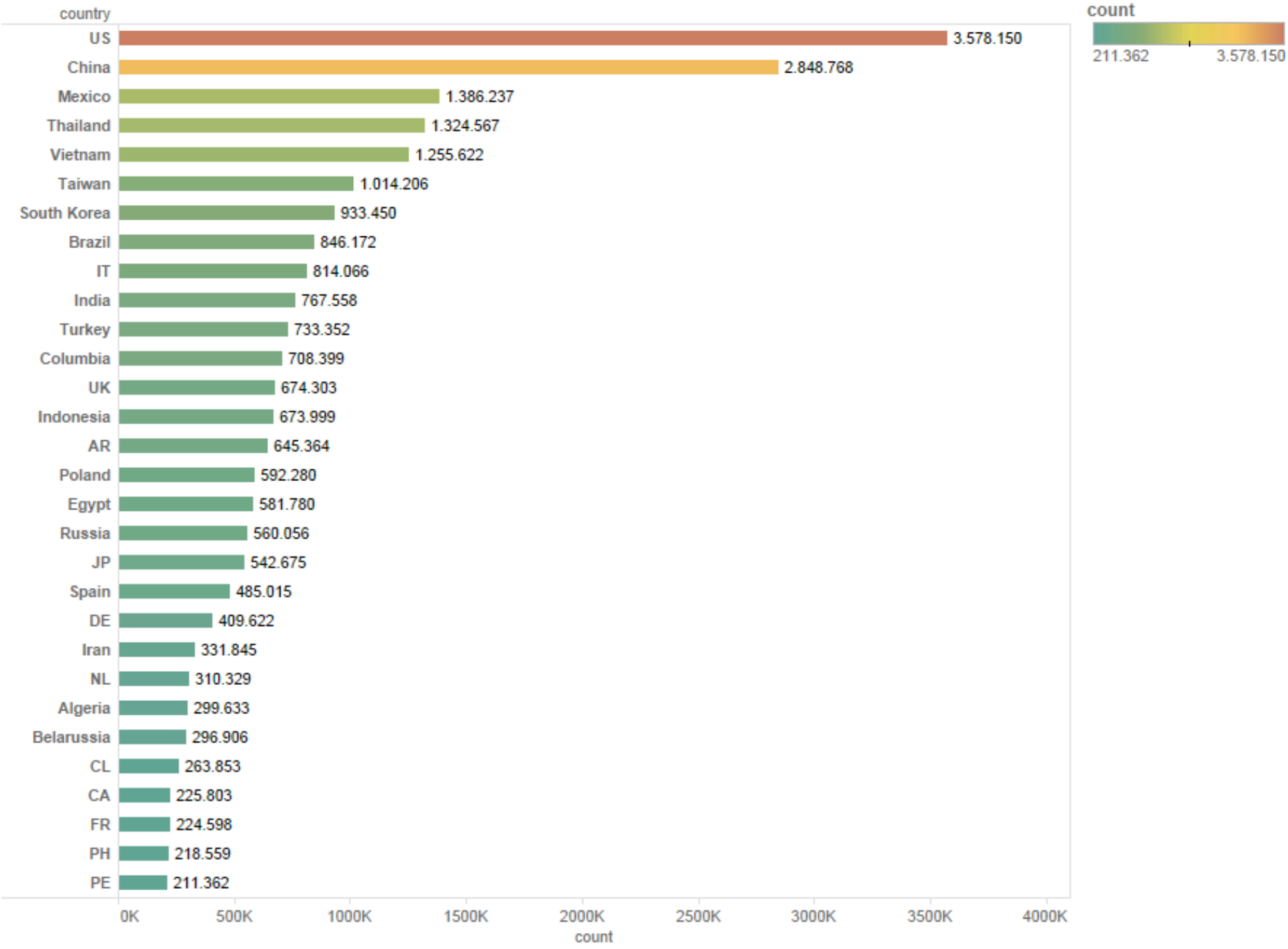
REFUSED trend



REFUSED	2542521	2471484	2761880	2827137	2904256	2835696	2947866
Responses	27904057	27200613	31485130	33974185	32737746	33750145	32959644
	9.11%	9.09%	8.77%	8.32%	8.87%	8.40%	8.94%


35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
1
2
3
4
5
6
7
Responses
Unique IPs
Duplicate IPs
Different IP
Correct Answer
Not Port 53
RA set
OK
FORMERR
SERVFAIL
NAMEFAIL
NOTIMP
REFUSED
Responses

Number of ORNs per country



Many devices do something odd..

- Many CPE devices listen on WAN interface
  - skbroadband is most common CH TXT version.bind
- Android phones when tethering become open resolvers
- 0.18% respond with RA but not with right answer
- 46% of hosts respond from something not port 53

UDP/53 is for DNS, right?

Sending a packet to UDP/53 gets a reply from another port

```
02:17:56.649949 IP x.x.x.x.45946 > 88.248.189.4.domain: 34307+ [1au]
TXT CHAOS? version.bind. (41)
    0x0000:  4500 0045 72ca 0000 4011 28b4 xxxx xxxx  E..Er...@.(..*..
    0x0010:  58f8 bd04 b37a 0035 0031 df6c 8603 0120  X....z.5.1.l....
    0x0020:  0001 0000 0000 0001 0776 6572 7369 6f6e  .........version
    0x0030:  0462 696e 6400 0010 0003 0000 2910 0000  .bind.......)...
    0x0040:  0000 0000 00                             .....
02:17:56.908332 IP 88.248.189.4.10002 > x.x.x.x.45946: UDP, length 62
    0x0000:  4500 005a 45a6 4000 f411 61c2 58f8 bd04  E..ZE.@...a.X...
    0x0010:  xxxx xxxx 2712 b37a 0046 85bb 8603 8500  .*..'..z.F......
    0x0020:  0001 0001 0000 0001 0776 6572 7369 6f6e  .........version
    0x0030:  0462 696e 6400 0010 0003 c00c 0010 0003  .bind...........
    0x0040:  0000 0000 0009 0839 2e38 2e31 2d50 3100  .......9.8.1-P1.
    0x0050:  0029 1000 0000 0000 0000                 .).........
```

Other hosts respond

- 3.6% of IPs probed had another IP respond back
- Typically CPE that did NAT on WAN interface
  - CPE is allowed to spoof my IP
  - Provides small map of providers without BCP-38

Remediation Response

- Given out thousands of ASN reports
  - LINX contacting members
- Some providers have mitigated most resolvers
- At least one managed hosting provider threatened customers with suspension if they didn't disable open resolver
- Continue to get more feedback
- Japan Telecom-ISAC started project to fix networks, including CPE
- E-Mailed reports to top-ASNs with open resolvers

Remediation Response

- NTT has restarted project to lock-down packet spoofing at network edge
  - First weeks of reports had more bogons that replied
  - Much better now
- Many folks reconfigured bind
  - additional-from-auth no;
  - additional-from-cache no;
- Hosting providers are changing defaults

Thank You & Questions?

- Thanks to:
  - NTT Communications
  - Merike Kaeo
  - Aaron Kaplan
  - Heather Schiller
- QUESTIONS?