Defeating DNS Amplification Attacks

Ralf Weber

Senior Infrastructure Architect

History

- DNS amplification attacks aren't new
  - Periodically reemerge as attackers read history books ☺
- NANOG 56
  - Reports of unusual DNS traffic on *authoritative* DNS servers
- Resource Rate Limiting (RRL) proposed for nameservers
  - Subsequently implemented in BIND, NLNet NSD, Knot, more
  - NLNet paper shows effectiveness for certain attacks
- Largest DDoS ever uses open resolvers - April 2013
  - 300Gbps targeted at Spamhaus
- Providers worldwide see attacks using their DNS *resolvers*
  - Trouble for networks: load balancer failures, saturated links, server stress, operational duress
  - No media headlines but lots of targets suffer with traffic spikes

Quick Introduction

Amplification attacks rely on:

- Spoofed IP source addresses
- UDP as transport
- Small DNS questions that generate large DNS answers
  - ANY queries are an old favorite, 80x amplification
  - DNSSEC-signed zones were an early favorite, but seem to have diminished
  - Other query types showing up: TXT, even A/AAAA
  - Attackers appear to be creating "purpose built" RRs

What amplification can be achieved?

One commonly used query in the past   “ANY ripe.net"
Yields an impressively large answer (MSG SIZE rcvd: 2884):

```
; <<>> DiG 9.8.3-P1 <<>> ripe.net any @64.89.232.93 +edns=0 ;; global options: +cmd ;; Got answer: ;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 64292 ;; flags: qr rd ra; QUERY:
1, ANSWER: 26, AUTHORITY: 6, ADDITIONAL: 3  ;; OPT PSEUDOSECTION: ; EDNS: version: 0, flags:; udp: 4096 ;; QUESTION SECTION: ;ripe.net. IN ANY  ;; ANSWER SECTION: ripe.net.
197 IN RRSIG NSEC 5 2 300 20131109122844 20131010112844 2473 ripe.net. dOdaF81ic+j6DscNMdBVVAEPt7SLXpZ0bIR4Jnh+4c53RbhnM8HH46Gx jfYAB2COZKdWnkwMbW/
ifnX3c6gGcz7uRoMFWZMTHBXPtvZjyLDj/thR CrO2ntlLdP8MrM5EUyq35FiSDNIv1uyzaEo9rXNsMGjMH2bd5cQqSpbV yLU= ripe.net. 197 IN NSEC 256cns.ripe.net. A NS SOA MX AAAA RRSIG
NSEC DNSKEY ripe.net. 197 IN RRSIG MX 5 2 300 20131109122844 20131010112844 2473 ripe.net. AJfdeBOkOwdMTfybgvidmHeeQzm6ybwxLEN1qcPp2YQvoWE2VbrLmeUo
JiKvecGHQlACBr1VKuguGq++bEYTXbGkragc7iG19SaisTHwWFZHLjka l3xhXL2q890pnyKpIYFGf6ZPmSYebC92BYQDGXtqnwpyvwghhLoYysQ0 ZAA= ripe.net. 197 IN MX 250 postlady.ripe.net.
ripe.net. 197 IN MX 200 postgirl.ripe.net. ripe.net. 3497 IN RRSIG NS 5 2 3600 20131109122844 20131010112844 2473 ripe.net.
RGDUw6Cu6Sh7zixsKiiJyDIIkEZEK4LagEl09s6ZnGN27GQAFHkSE9up IkAfsaJWe3Nl9fjQFWfJ/hZ5rHcgsz5LD/eK4W5VUWpZc6BX0YuikxPb LSxMoFebAkqRkIEp7TTMRUuaZyTK
+m0UadLgpp0nYX8eE6uzE8Cj2Zv0 xog= ripe.net. 197 IN RRSIG AAAA 5 2 300 20131109122844 20131010112844 2473 ripe.net. CiltCl8jysHsg2MHsU/
4bPlt7jYaFSJGZnMe0NcTACnCocAEO3+B5Y7s 9QQDWXAxVyXTPs9dtiAdEtLOH0R0TBH45I+OExxhS5CWYBJO+TWghV/r
WNyFOuUDAlFmP2KdgPpMRqfw49l7o75owbnAjefcyVZ32OtBX50LTDBe 10A= ripe.net. 197 IN AAAA 2001:67c:2e8:22::c100:68b ripe.net. 21497 IN RRSIG A 5 2 21600 20131109122844
20131010112844 2473 ripe.net. FlR1BIoGLmKUmvDHvhmDBzV6q2YXmLpZ8KpPfVw9Dw2k/O6EBSx+mXwq lvWuUdtSlBhgfYqVgB50HFKCRrDbNzUSZE9E0SQKMJR8PFu6EGckJF2P
dBveonSJowyYgqE7l+4BHB1Cx5csEO+VSCl7uiE99CcqyhvkYnGeJcY0 Ckk= ripe.net. 21497 IN A 193.0.6.139 ripe.net. 3497 IN RRSIG SOA 5 2 3600 20131109122844 20131010112844 2473
ripe.net. GKCyXEz2xtCj0czgyZ6CEPzL7BNldfK1iz7JiFaIw87UEZA1OjY2rP04 qsU1Bt9KPMHWkVY9EqJEshgSwbGRdy/1Y0LDZpYYHszvBOlkpu/JxcVR G/
NI23fvzs96Mc5iTp3ovuhLQfgS0z31oJJMd4yowcRL4dhs1jmgmeL/ nqQ= ripe.net. 3497 IN SOA pri.authdns.ripe.net. dns.ripe.net. 1381407901 3600 600 864000 300 ripe.net. 3497 IN RRSIG
DNSKEY 5 2 3600 20131109122844 20131010112844 60338 ripe.net. EbHIOgtEY/NV4DMXZpcqXFlVfICcaRD+gpXnyRnu11x4EZAFbYXl42HG
OxTZE7Z168qxHuLCeVKat0L0w7nh5ShVpfPUXhdt+fVXoDukI19aAgWy yDmaVd4zm2ZKC8E3LKkNzS9xUksx+laEC7Ff/+3GVuhi/AVL8NC/A3bP vPoxe5MRPZ/
OGwd5aQtvgm811lysdOPZWbqSJDRKTeanAyhIk8FLN2hm tRLTKJFArDakOgpmZI1GA/3dfojRlBIpuNip4c6xDI6Y9gJW+3OMj8lZ cvleUNdJ188ujS9z6fQr6zOdIwVmdZWwCYd
+rbr6dhvEzILrK8hFbJsB LjbkSg== ripe.net. 3497 IN DNSKEY 256 3 5 AwEAAX7Dm18EOseQjbKJQDhhFqkfNMjW4z2miK5/+3j33krF2KungE43 AMmUo3hgjND4A547zCLTYGV
+TchFXtVwdErJtLKs1giAfkrpvl9hYxY+ eOFSLSPFU6n8BQd7lsIqdynQ0iG9aGk6k1DAne9zWUW6x37duiBagLUB 4/yLguoT ripe.net. 3497 IN DNSKEY 256 3 5 AwEAAZYzmLhqQKDgm
+OA5gfvGU6Twt9WuF2P5akXQxZxATZ79apyjW6K 1ZFeZ76Yo3L4EoGEkSBntx0m7Gacr/ry9oGmmyhK5oS9EfeitHdAV14F gkN+Qi0ROmt32rGDSFIY210fbLobwuBCCo6C
+2hYbB2CeNHF6BtYivGL arBaCt2F ripe.net. 3497 IN DNSKEY 257 3 5 AwEAAXf2xwi4s5Q1WHpQVy/kZGyY4BMyg8eJYbROOv3YyH1U8fDwmv6k BVxWZntYtYUOU0rk+Y7vZCvSN1AcYy0/
ZjL7cNlkc3Ordl2DialFHPI6 UbSQkIp3l/5fSWw5xnbnZ8KA7g3E6fkADNIEarMI4ARCWlouk8GpQHt1 1wNW1c65SWB8i958WZJ6LI0pOTNK+BIx8u98b+EVr7C08dPpr9V6Eu/7
3uiPsUqCyRqMLotRFBwK8KgvF9KO1c9MXjtmJxDT067oJoNBIK+gvSO9 QcGaRxuGEEFWvCbaTvgbK4E0OoIXRjZriJj8LXXLBEJen6N0iUzj8nqy XSCm5sNxrRk= ripe.net. 3497 IN DNSKEY 257
3 5 AwEAAYSPd7+AJXOT1k1d6eUKRCsw5cSGpzsWIjVCDjbWdNomt4mCh5of SSnf60kmNCJgeCvPYwlOWX08TPLpCHqvBh8UERkaym8oT0U2lKrOt+0W EyksYc5EnLp7HQVvH
+KaF8XiuPsemLLNbhosGofv5v0Jj2TKxJl/sgf1 n9WtkMY1bCTTaSUn5GmjKDv0XRPKkzA4RCQv8sl8pZ2pzJvIxpN0aBgx
WtRjWXXJ27mUq6+PR7+zgBvLkmSV4F1bNXOgikeN5KBlutEKBKYYcYRb fR5kDYYJ0mV/2uTsRjT7LWNXAYAJ88xuZ4WcBV01EuMzsZU21iGhRO1N Z4HFSr9jb3U= ripe.net. 86297 IN RRSIG
DS 8 2 86400 20131017044449 20131010033449 55565 net. GTgWhptNaMhw9gld4KrnVunBMQwgOwH8rSS16BCkrIiSy9sOLSqTvt6l ElTrEMarfeZ3TL0NlcLkOLtddPtUl791/
lib219s76ekGyysVeoaFkkm OBn0zcvDX9joDHleBb/UuuRA+HFiV3DnicGgZQXnaEZDkfHfUrxOyt2F JMU= ripe.net. 86297 IN DS 60338 5 2
61D99D98D0C374C1157F73282DB3E29E61E365DD9EBA435802D27A69 847C24FC ripe.net. 86297 IN DS 60338 5 1 1CB13971FC7D4DF7CB3C6EB82DF0868687FE6371 ripe.net. 3497 IN
NS ns3.nic.fr. ripe.net. 3497 IN NS pri.authdns.ripe.net. ripe.net. 3497 IN NS sec3.apnic.net. ripe.net. 3497 IN NS sns-pb.isc.org. ripe.net. 3497 IN NS tinnie.arin.net. ripe.net. 3497 IN NS
sec1.apnic.net.  ;; AUTHORITY SECTION: ripe.net. 3497 IN NS sns-pb.isc.org. ripe.net. 3497 IN NS tinnie.arin.net. ripe.net. 3497 IN NS sec3.apnic.net. ripe.net. 3497 IN NS sec1.apnic.net.
ripe.net. 3497 IN NS pri.authdns.ripe.net. ripe.net. 3497 IN NS ns3.nic.fr.  ;; ADDITIONAL SECTION: pri.authdns.ripe.net. 3497 IN A 193.0.9.5 pri.authdns.ripe.net. 3497 IN AAAA 2001:67c:e0::5  ;;
Query time: 337 msec ;; SERVER: 64.89.232.93#53(64.89.232.93) ;; WHEN: Thu Oct 10 16:34:07 2013 ;; MSG SIZE rcvd: 2884
```

There are lots of similar queries
Attackers also creating “purpose built” amplification zones (more later)

Some Simple Math

A relatively low bandwidth home broadband connection (~2-3 Mbps) can generate 58 Mbps at a DNS server!

18 home connections = ~ 1Gbps of traffic

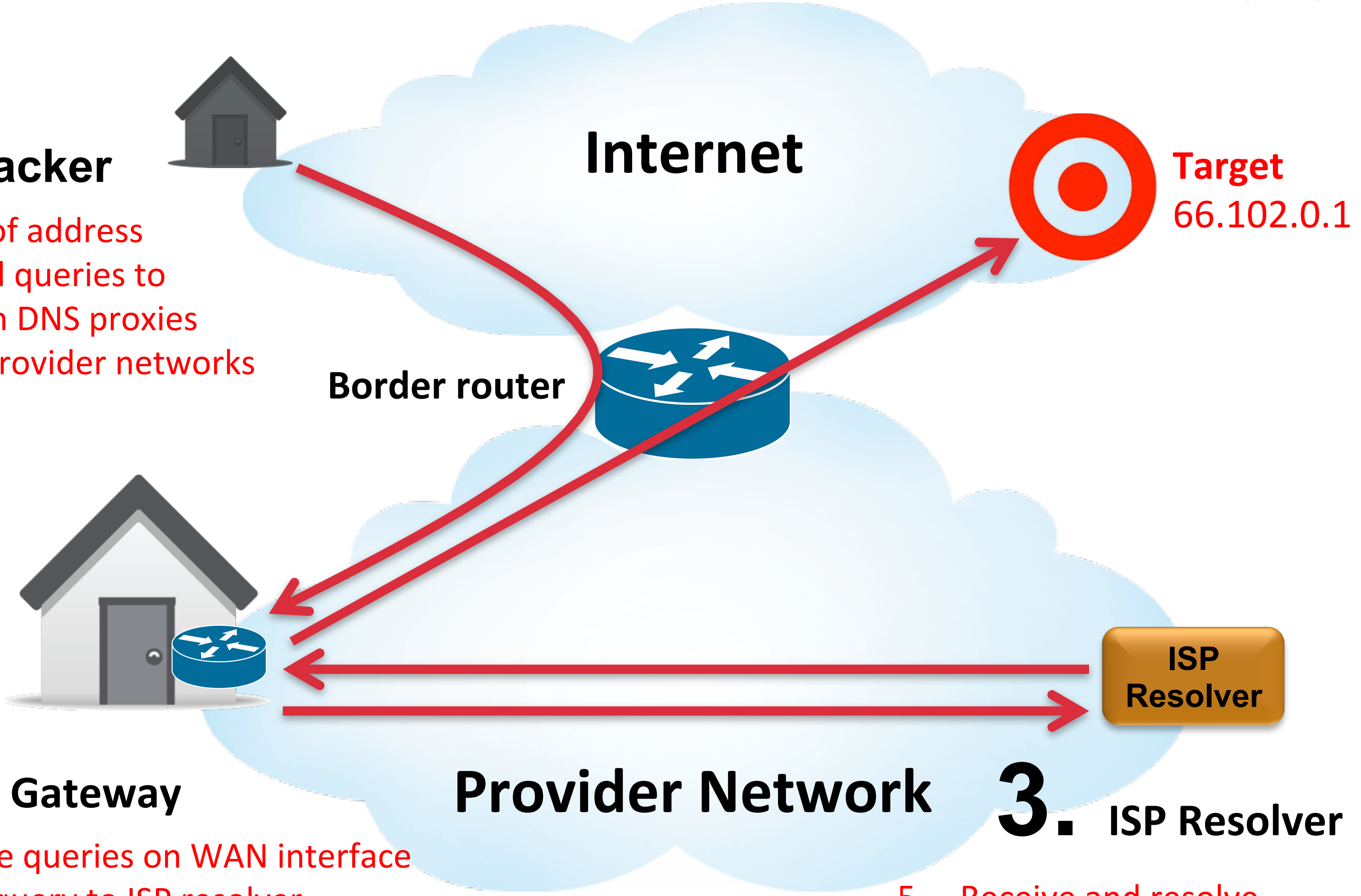
A few thousand connections = 100s of Gbps as was seen with attack on spamhaus

Mustering these kinds of resources is pretty easy

Several Variants of Amplification Attacks

- Send queries directly to authoritative servers
  - Response Rate Limiting helps
  - But attackers probably will adapt
  - More work needed here, but *not* the topic of this presentation
- Send queries to open resolvers on the Internet
  - Works well but Best Practices will deter these attacks
    - Shut down open resolvers or limit IP ranges that can access the server when possible
    - *Closely* monitor for attack activity
    - Not the focus of this presentation, but some techniques discussed here apply
- Send queries to open DNS proxies on home gateways
  - Huh?

Using ISP Resolvers for DNS Amplification



Internet

Border router

Target
66.102.0.1

ISP Resolver

Provider Network

1. Attacker

1. Spoof address
2. Send queries to open DNS proxies on provider networks

2. Home Gateway

3. Receive queries on WAN interface
4. Proxy query to ISP resolver
7. Forward answer to Target

3. ISP Resolver

5. Receive and resolve query
6. Answer the query as it’s from a legitimate user!

Advantages of This Attack (for Attackers)

- ISP resolvers are a great resource
  - Lots of them out there
  - Usually high capacity
  - Reliable and available
- ISP Best Practices won't deter this attack!
  - Restricting resolver IP Ranges doesn't work
    - Queries appear to be sourced from internal IP ranges
- Filtering DNS queries at the border isn't an easy option
  - Other DNS traffic: incoming answers to recursive queries from provider resolvers, incoming queries to authoritative servers, source port 53
  - Subscribers may run DNS servers
- Upgrading Home Gateways is challenging (impossible?) - lots of running room

How Did We Figure this Out?

- Many reports from ISPs about attacks on their networks
  - isc.org/ripe.net in the most used domains
- Interesting work from openresolverproject.org
  - Millions of open resolvers
  - Scan with CHAOS query returns versions of resolvers
- A BIG surprise
  - *445,881* Open Vantio Resolvers What?
  - We have not sold *anywhere near* 445,881 copies of Vantio
  - If we had I guess I would not be giving this talk here today!
  - Someone is stealing our SW? (and they're not even using it right!)
- No… something else must be going on
  - Customers seeing attacks restrict IP ranges ("closed" resolvers)
  - Queries have to be coming from legitimate IPs
  - What's going on?????

Testing to Find "Real" Resolvers

- Setup special domain: restest.rwdns.de
- Ask every unique open resolver/proxy:

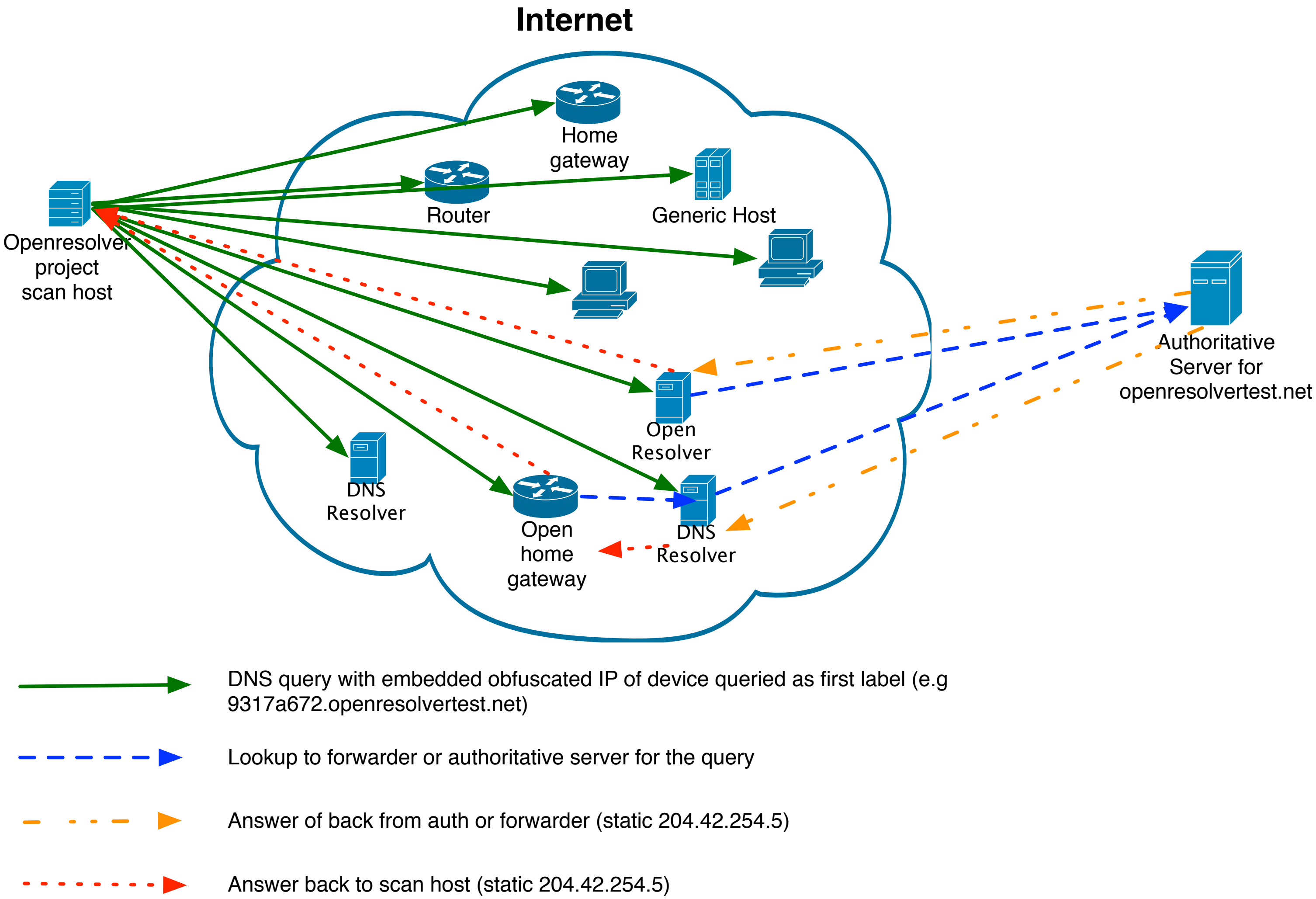
  dig 64.195.2.130.restest.rwdns.de @64.195.2.130

- On auth server the resolver query source is seen::

```
querystore.replay duration=10m filter=((zone (true (restest.rwdns.de))))
{client-address =>   '74.125.183.18#56355'
local-address => '78.46.109.173#53'
name =>          '64.195.2.130.restest.rwdns.de’
```

- Leverage excellent work from openresolverproject.org (Jared Mauch NTT)
  - periodic scans to identify open resolvers
  - map open proxies to actual resolvers

How the scan works



DNS query with embedded obfuscated IP of device queried as first label (e.g 9317a672.openresolvertest.net)

Lookup to forwarder or authoritative server for the query

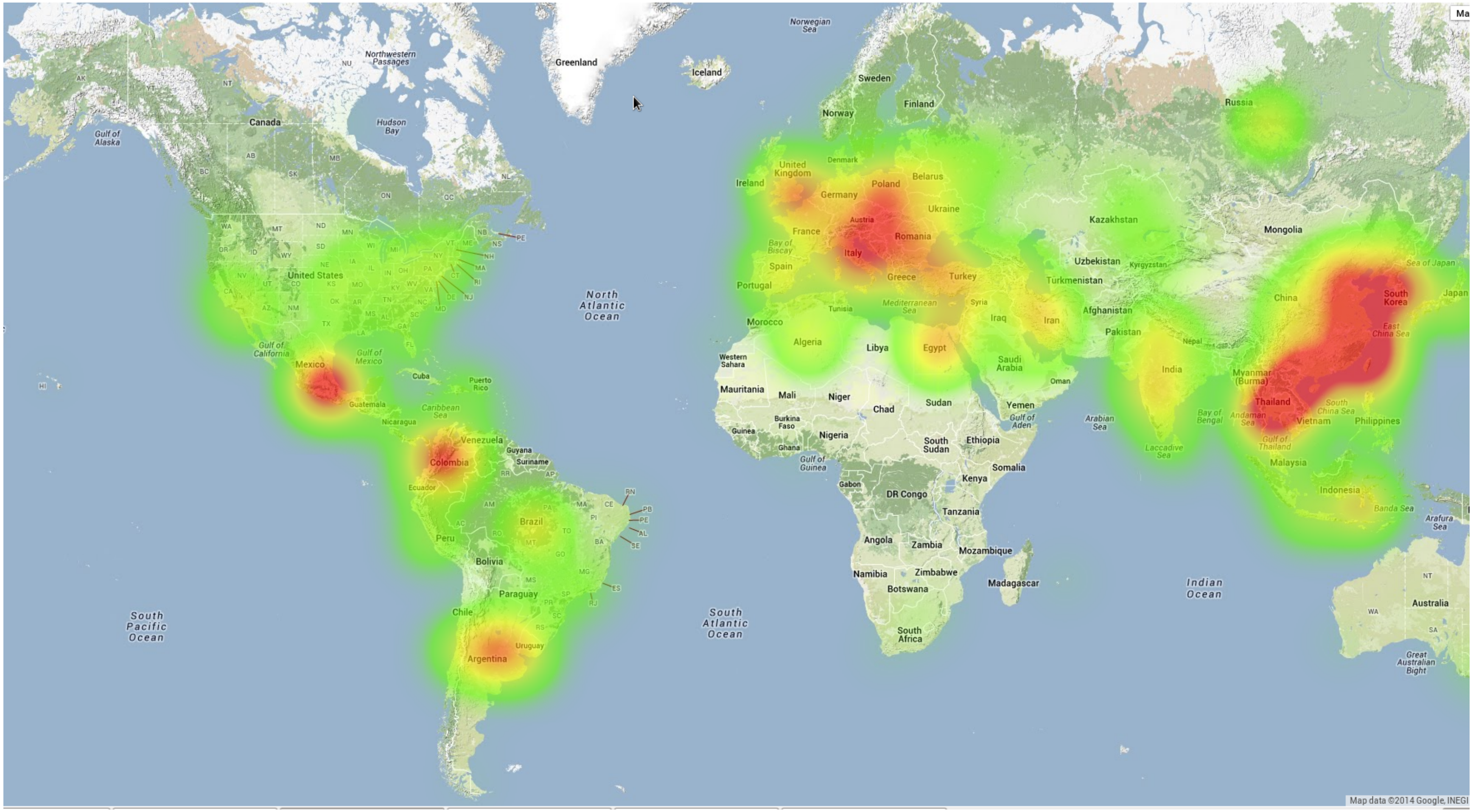
Answer of back from auth or forwarder (static 204.42.254.5)

Answer back to scan host (static 204.42.254.5)

What is happening

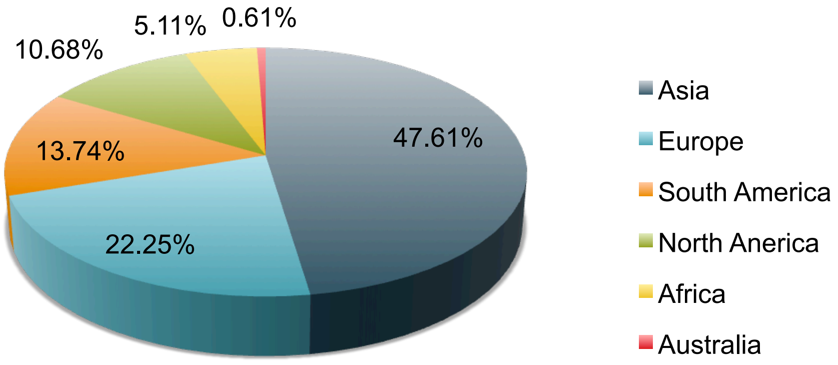
- Host at NTT sends every IPv4 address a unique DNS query that encodes the IP in the 1st label
  - Proxies will forward to the actual resolvers
  - Open DNS resolvers will directly ask the authoritative
- ANS serves answers on the authoritative side and stores
  - Embedded IP of original request from the scan host
  - Client IP of the actual resolver
- Lets look at the data….

A New View of the World Courtesy of DNS Data!



Continent Distribution

Continent	Open DNS proxies	Percentage
Asia	11363728	47,61%
Europe	5311353	22,25%
South America	3278751	13,74%
North Anerica	2550481	10,68%
Africa	1220340	5,11%
Australia	146179	0,61%



Countries in Asia

Country	Open DNS proxies	Percentage
China	3371991	29,67%
Vietnam	1309030	11,52%
India	1028875	9,05%
Thailand	996433	8,77%
Korea	803480	7,07%
Taiwan	743249	6,54%
Indonesia	698873	6,15%
Iran	643808	5,67%
Kazakhstan	299325	2,63%
Japan	228980	2,02%

Some interesting data points

- Number of open proxies as of 21st of February is 23879713
  - Roughly 24 Million
- But only 209850 resolvers are seen on the authoritative server
  - **That’s less than 1%**
- AS with most open proxies has 1721490
- Resolver with most open proxies has 322086
  - Probably hierarchical caching
- 76% of proxies use resolvers in their AS
  - Presumambly ISP resolvers
  - ISPs are not responsible for these attacks
  - Home gateway vendors are….
  - But ISPs can help to defend against them

DNS Proxies that use ISP resolvers

nominum™

AS Number	Open Proxies	Country
4134	1474360	CN
4837	772736	CN
3462	668435	TW
17974	503252	ID
24560	336223	IN
4766	321681	KR
18403	313602	VN
4812	308644	CN
9318	299766	KR
9737	260716	TH

Total of 5259415 = 26% of the world or 46% of Asia

What can be Done? Basic DNS Housekeeping

- Have DNS logging turned on all the time
  - Essential resource to identify attack activity
- Get a “dashboard” up so baseline DNS operation is always visible
  - Familiarity with "normal" makes it easier to spot changes
  - Queries per second, settable graph window
  - Top domains queried – scrollable through a few hundred domains
  - Distribution of Query Types
  - Check for domains that yield the biggest responses

Mitigating Attacks

- First characterize the attack
- Use your logged data!
- Identify and Classify (current findings) :
  - Purpose built amplification domains.
  - ANY queries to legitimate domains.
  - Dual use domains
- Watch out for new patterns

Mitigating Attacks

- “Purpose built” amplification domains
  - No need to ever answer these queries
  - Use reputation lists – DROP action
- ANY queries
  - Rate limit to low QPS – TRUNCATE action
  - Allows legitimate requests to be answered
- Dual use domains
  - Filters based on Query Type to capture
  - Rate limit to low QPS – TRUNCATE action
- Last Resort
  - Size based rate limiter
  - Set up a reasonable QPS threshold for queries with large answers (measure first – mine is 0.5% of normal traffic)

Summary

- DNS Amplification attacks are increasingly coming from home gateways
- ISP can help to defend against them
  - BCP 38 (will help other ISPs and the community)
  - Monitor your DNS traffic
  - Use resolvers for mitigation
- Home gateway vendors should pay more attention to DNS
  - Default configuration should not be open to the Internet
  - Use better toolboxes for building them
    - There is some cool work going on in the IETF homenet WG

Thank You

Backup slides

So what are these hosts doing

- Answering DNS queries
- Very large message sizes have been observed: ~ 4000 bytes!
- Domains "purpose built" for amplification are being uncovered
  - A, MX, and Text records
  - Dummy data
  - Some domains have real data with some record types (A, AAA) and bad with others (TXT, ANY)
- Also finding "dual use " domains
  - Legitimate domains inadvertently optimized for amplification?
  - Some admins may not understand effects of their entries ;-)
    - 250 different MX entries might not be a good idea
    - Several 4096 bits DNSKEY might be more secure but…

Samples

- isc.org ANY
- doc.gov ANY
- irlwinning.com A or ANY
- 34.30.46.207.in-addr.arpa PTR
- outmail.zyngamail.com A
- www.djcgrafix.netfirms.com A
- ‘.’ ANY

isc.org

```
dig isc.org any

[..]
;; ANSWER SECTION:
isc.org.      6836 IN   TXT "$Id: isc.org,v 1.1855 2013-09-26 21:27:44
bicknell Exp $"
isc.org.      6836 IN   TXT "v=spf1 a mx ip4:204.152.184.0/21
ip4:149.20.0.0/16 ip6:2001:04F8::0/32 ip6:2001:500:60::65/128 ~all"
isc.org.      6836 IN   RRSIG   TXT 5 2 7200 20131031022653 20131001022653
50012 isc.org. lgN51hBVR3EDuDL7MyfYdQ+Is3VzA2rvEZNSM2eZS4zKmwY+YlELi4Yh
BXuzFtK9Rg3N0CON6/SQJYA8TuUG78UE9OoP4/nLkOaDHLkHMTgq1yHz
8oJ0n5mzHIcNgYqphd34yRjBoldjtE9Rhrp4Q3aGVyzW21nPY6NIRlAW BNk=
[..]
;; Query time: 1 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Thu Oct  3 12:31:07 2013
;; MSG SIZE  rcvd: 2045
```

doc.gov any

```
dig doc.gov any
;; Truncated, retrying in TCP mode.
[..]
;; ANSWER SECTION:
doc.gov.     25   IN   DNSKEY   256 3 8 AwEAAeBP9cEQR3eTa4u1x3WpLwnCog7rw/
l22hXgwiHZIjGAz26+l/cW
+QEHS9bAlJnRtZhmlBYN72DvfpshuEL2o6hh2yVw7wcRC4fNOTxOeury
wLrkKZQEOWC4fyaxlXJsIWRwLEb3H4YYQibGbPRWyGy1NDnapp/sj4AX
53p7RM2rHWcFc89KZ7vJMMzgmZF2v+jo96OGJU7g2Nu4vEZzj8iMJCT6 BGolQRVE/
svYmrqdWpQoIJ/SCPIp//tkZlKo5J2JNwgO4H01ZPr+Bse3
mdznrJ33FYj2waOL8d9Km2GN3h6U8UhAS9GHUMc2IsjCF1GN6OdnC0KI s8KKshwLLK0=
[..]
;; Query time: 11 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Thu Oct  3 12:34:09 2013
;; MSG SIZE  rcvd: 8161
```

irlwinning.com

```
dig +trace irlwinning.com any
[..]
;; ANSWER SECTION:
irlwinning.com.       4045 IN   NS   ns1.irlwinning.com.
irlwinning.com.       4045 IN   NS   ns2.irlwinning.com.
irlwinning.com.       21578     IN   A    1.1.1.172
[..]
irlwinning.com.       21578     IN   A    1.1.1.170
irlwinning.com.       21578     IN   A    1.1.1.171
irlwinning.com.       73   IN   SOA  ns1.irlwinning.com.
packets.irlwinning.com. 2013230901 900 900 900 900

;; ADDITIONAL SECTION:
ns1.irlwinning.com.   3647 IN   A    94.102.56.150
ns2.irlwinning.com.   3647 IN   A    94.102.56.150

;; Query time: 39 msec
;; SERVER: 199.187.216.12#53(199.187.216.12)
;; WHEN: Mon Oct  7 10:45:20 2013
;; MSG SIZE  rcvd: 4011
```

34.30.46.207.in-addr.arpa PTR

```
dig 34.30.46.207.in-addr.arpa PTR
;; Truncated, retrying in TCP mode.
[..]
;; ANSWER SECTION:
34.30.46.207.in-addr.arpa. 3600    IN   PTR windowsmobilelive.gr.
34.30.46.207.in-addr.arpa. 3600    IN   PTR windowsmobilelive.ie.
34.30.46.207.in-addr.arpa. 3600    IN   PTR windowsmobilelive.in.
34.30.46.207.in-addr.arpa. 3600    IN   PTR windowsmobilelive.com.es.
[..]
34.30.46.207.in-addr.arpa. 3600    IN   PTR windowsmobilelive.com.sg.
34.30.46.207.in-addr.arpa. 3600    IN   PTR windowsmobilelive.fr.

;; Query time: 14 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Thu Oct  3 12:42:31 2013
;; MSG SIZE  rcvd: 12453
```

outmail.zyngamail.com A

```
dig outmail.zyngamail.com A
[..]
;; ANSWER SECTION:
outmail.zyngamail.com.    300  IN   A    74.114.9.183
outmail.zyngamail.com.    300  IN   A    74.114.9.184
outmail.zyngamail.com.    300  IN   A    74.114.9.185
outmail.zyngamail.com.    300  IN   A    74.114.9.186
outmail.zyngamail.com.    300  IN   A    74.114.9.187
[..]
outmail.zyngamail.com.    300  IN   A    74.114.9.178
outmail.zyngamail.com.    300  IN   A    74.114.9.179
outmail.zyngamail.com.    300  IN   A    74.114.9.180
outmail.zyngamail.com.    300  IN   A    74.114.9.182

;; Query time: 19 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Thu Oct  3 12:45:01 2013
;; MSG SIZE  rcvd: 1778
```

netfirms.com

```
dig www.netfirms.com
[..]
;; ANSWER SECTION:
www.netfirms.com. 3600 IN   A    65.254.227.16

;; Query time: 104 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Thu Oct  3 12:45:47 2013
;; MSG SIZE  rcvd: 61
```

somethingstrange.netfirms.com

```
dig somethingstrange.netfirms.com
;; Truncated, retrying in TCP mode.
[..]
;; ANSWER SECTION:
somethingstrange.netfirms.com. 3600 IN A   67.23.129.35
somethingstrange.netfirms.com. 3600 IN A   67.23.129.33
somethingstrange.netfirms.com. 3600 IN A   67.23.129.32
somethingstrange.netfirms.com. 3600 IN A   67.23.129.31
somethingstrange.netfirms.com. 3600 IN A   67.23.129.30
somethingstrange.netfirms.com. 3600 IN A   67.23.129.29

;; Query time: 8 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Thu Oct  3 12:50:25 2013
;; MSG SIZE  rcvd: 4026
```

'.' the root

```
dig any .
[..]
;; ANSWER SECTION:
.               42321    IN   NSEC ac. NS SOA RRSIG NSEC DNSKEY
.               42321    IN   RRSIG    NSEC 8 0 86400 20131014000000
20131006230000 59085 . Ntf5bDYSPNFwQiD
+BWYxV2dfroUhPUs3tV4q20eaM5mbDfYEHuMlwr9u lNp8wV/
uaZyzmHrqZB2XL0nKjwD3AkY1W15y+ACxEghtQAaBhbX/1xM8 L6XYr/uyfhiY/
BCnIvwWlOUoK/7m/20LIuNyiaBlYISVcloYJwwxFtYT e8s=
[..]
.               86382    IN   SOA a.root-servers.net. nstld.verisign-grs.com.
2013100701 1800 900 604800 86400
.               86382    IN   RRSIG    SOA 8 0 86400 20131014000000
20131006230000 59085 . DoGy06dHpVdSKwx9nn82m7pSZCHOg5x1/
n36+4wvKaenFLX22TSlvWYL
b0pvKZVV8dXEI4z5jqtU9XWPXurVhDw29Q2FUmb7fS87T0Ve9R4lu87x
3t0pvqYB5+uqCdxVkhO1iIRROXhrMX2q253qtmfAVhtdfCeXAvoIZxBO yqk=

;; Query time: 38 msec
;; SERVER: 199.187.216.12#53(199.187.216.12)
;; WHEN: Mon Oct  7 10:50:40 2013
;; MSG SIZE  rcvd: 1649
```