nominum™

Harness Your Internet Activity

Random Subdomain Attacks

Plaguing the Internet

Agenda

- Brief Intro
  - Covered at last OARC
  - Attack overview
- Latest data
  - Progress on open dns proxies in home gateways
  - Impact of Response Rate Limiting?
  - Chinese pornography sites
  - Hong Kong news site
- Testing resolvers
  - (Over) ambitious idea!
- What can we do?
  - Success filtering ingress traffic, some challenges
  - ???

Random Subdomain Attacks

RANDOM **TARGET NAME**

wxctkzubkb. liebiao.800fy.com

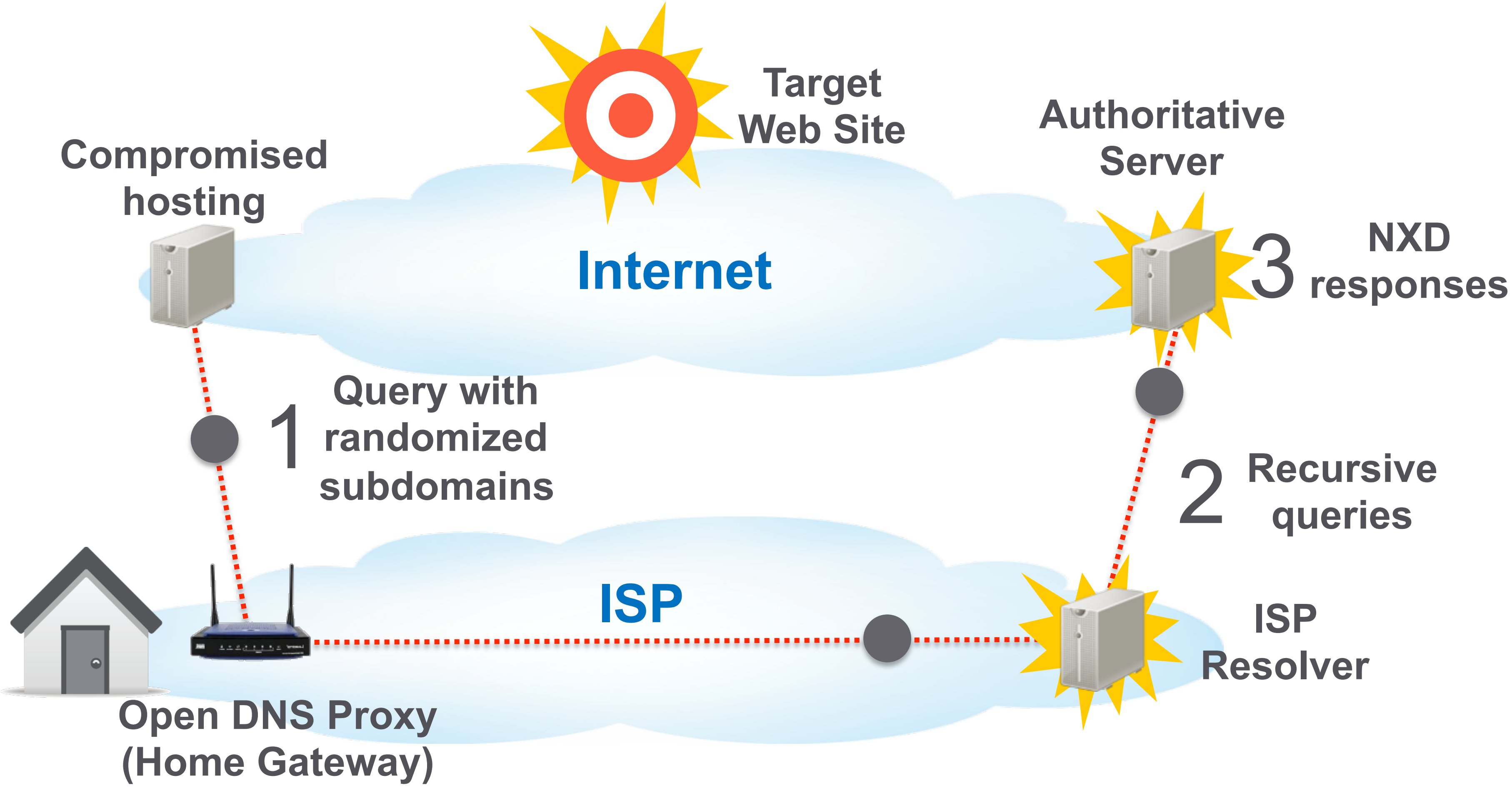
three labels

qzgziliv. 11hehe.com

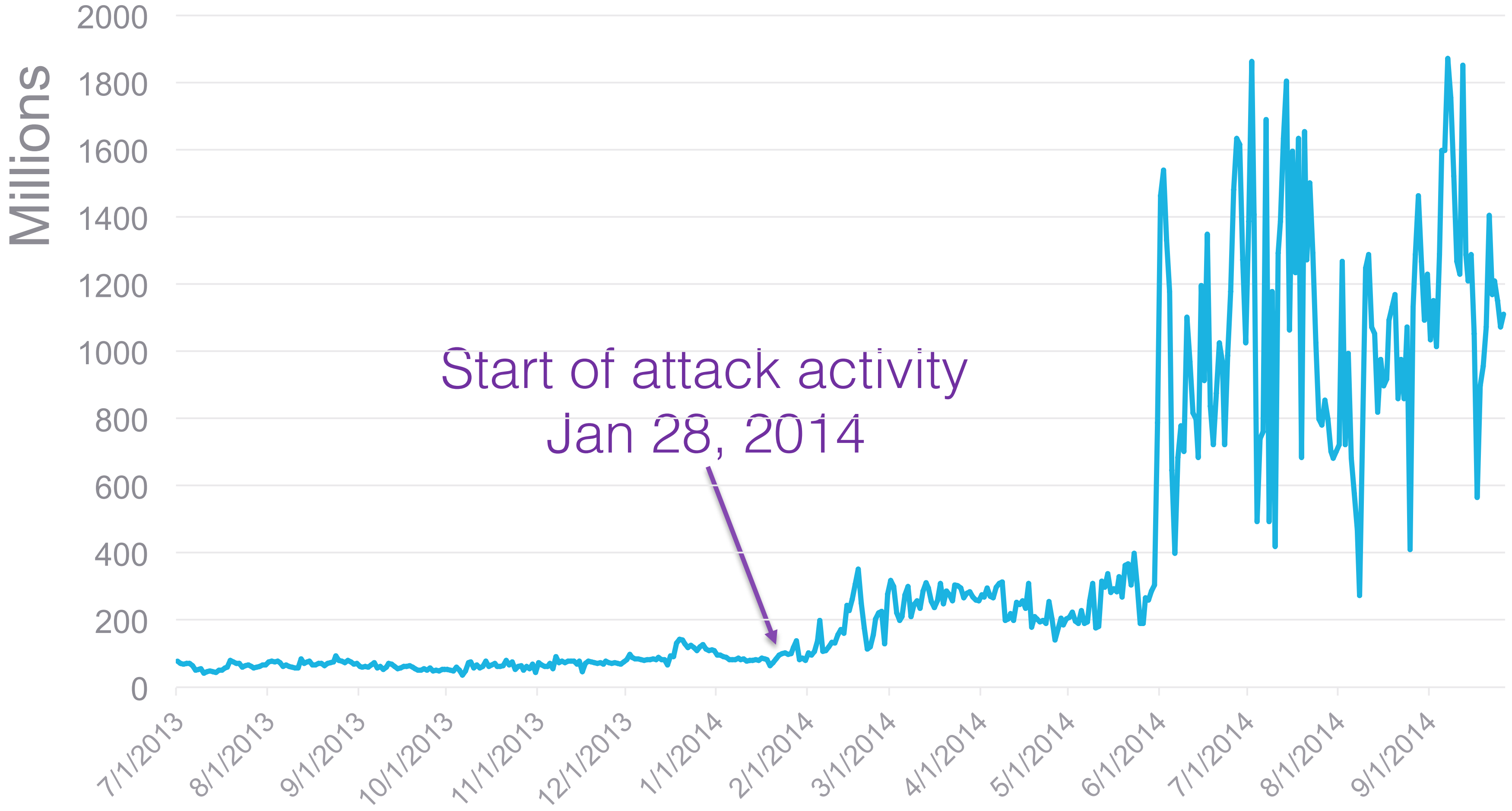
two labels

Random Subdomain Attacks

Open DNS Proxies are the Vector for Attacks

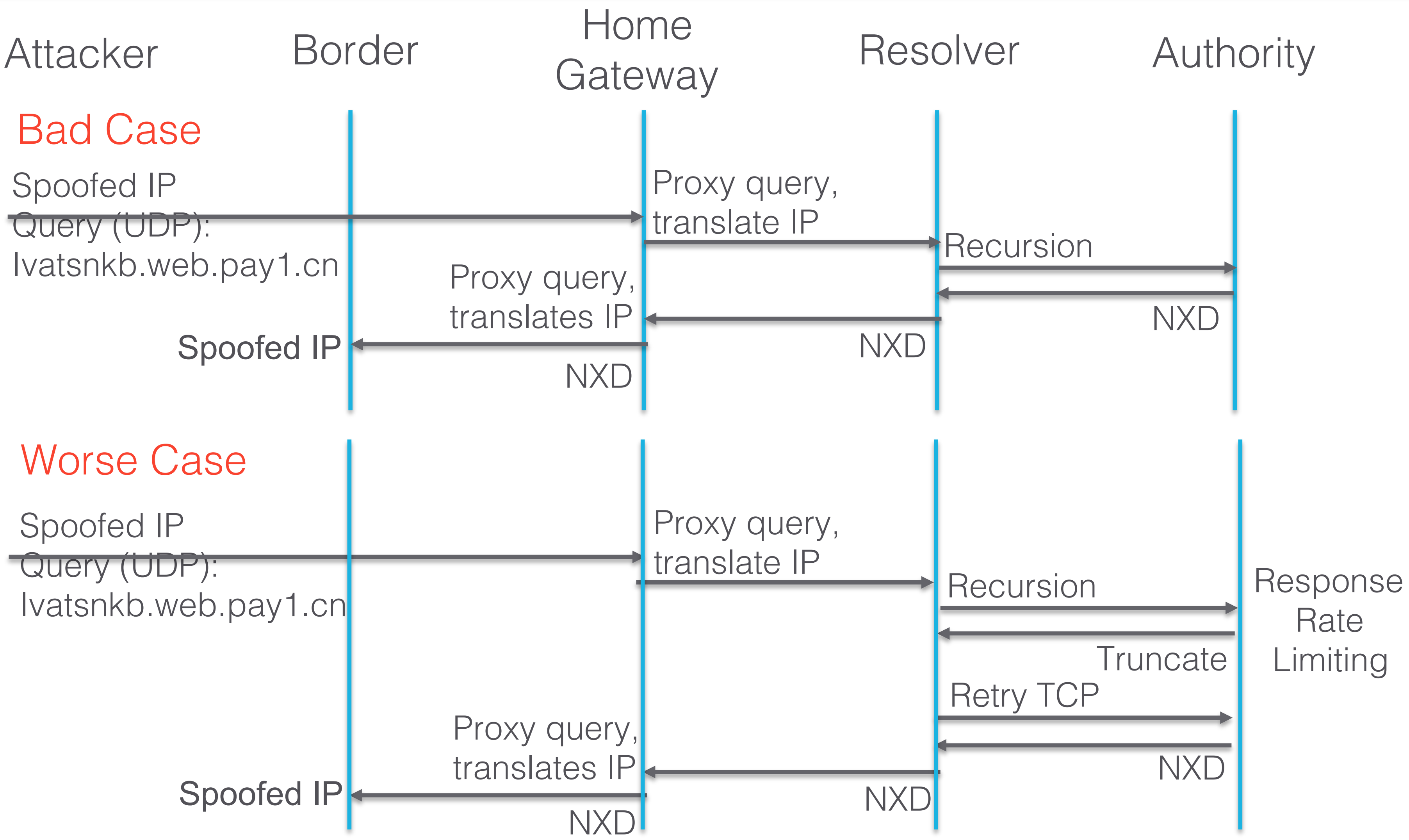


Latest Data: Unique Names



Start of attack activity
Jan 28, 2014

Impact of Response Rate Limiting



Attacker

Border

Home Gateway

Resolver

Authority

Bad Case

Spoofed IP Query (UDP): lvatsnkb.web.pay1.cn

Proxy query, translate IP

Recursion

NXD

NXD

Proxy query, translates IP

Spoofed IP

NXD

Worse Case

Spoofed IP Query (UDP): lvatsnkb.web.pay1.cn

Proxy query, translate IP

Recursion

Response Rate Limiting

Truncate

Retry TCP

NXD

Proxy query, translates IP

NXD

Spoofed IP

NXD

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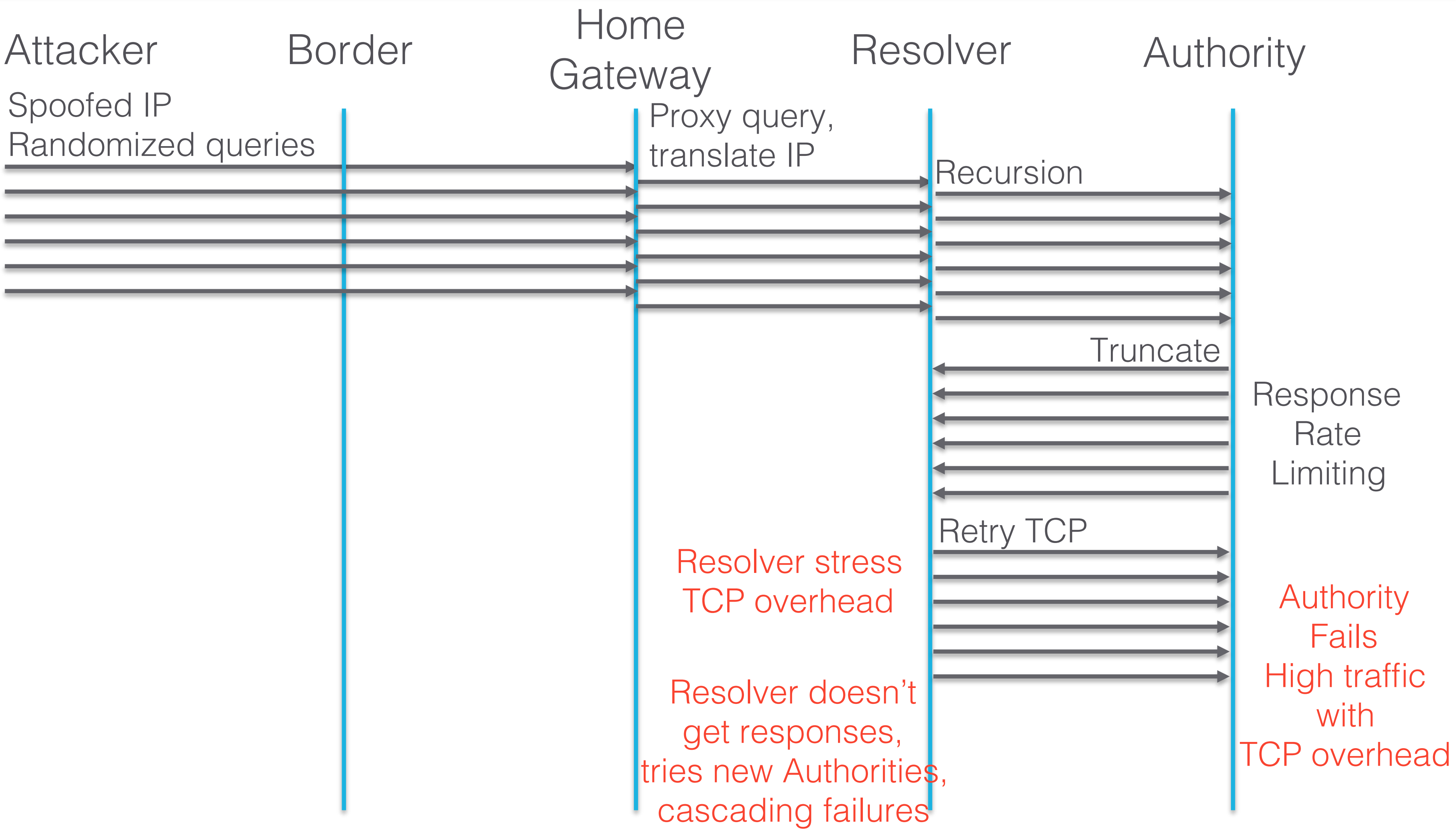
Attacks at Scale



Resolver stress
TCP overhead

Resolver doesn't
get responses,
tries new Authorities,
cascading failures

Authority
Fails
High traffic
with
TCP overhead

Hong Kong News Site

- Sept 28, 2014 UTC
- Height of Hong Kong democracy protests
- Distinct shift in tactics – 98% of attacks on one domain
  - Typical day 4-6 domains attacked, usually gaming sites
- Hong Kong online news Passion Times
- Website offline 13 hours

Chinese Pornography Sites

- Sept 25/26 2014 (UTC)
- Another shift in tactics 42 domains attacked simultaneously
- Attack lasted 6 hours
- Most web sites went down

- Motive for most attacks remains unclear
  - Monetization is likely very modest
  - Collateral damage across the Internet far exceeds revenue from DDoS for hire

Sept 25/26 Attacks

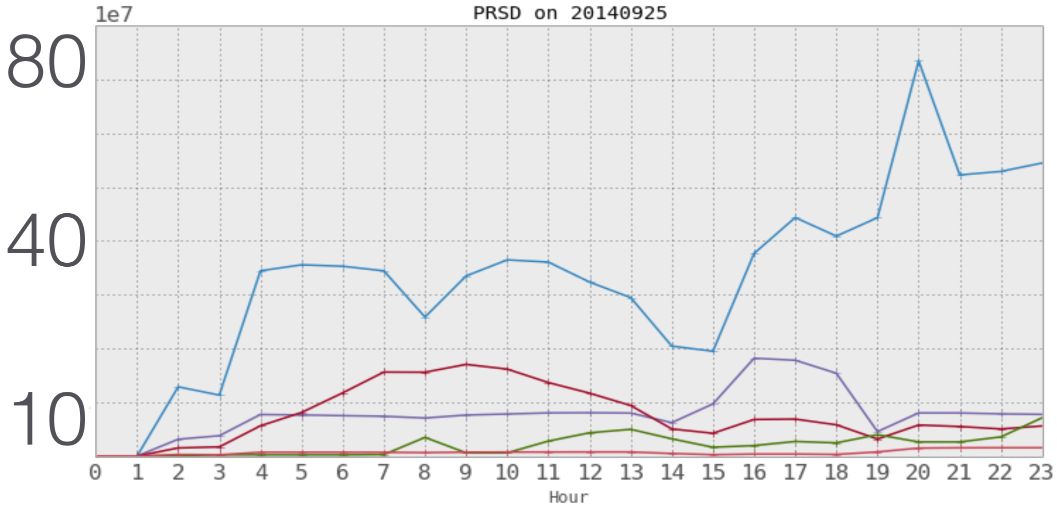
Data from 5 providers

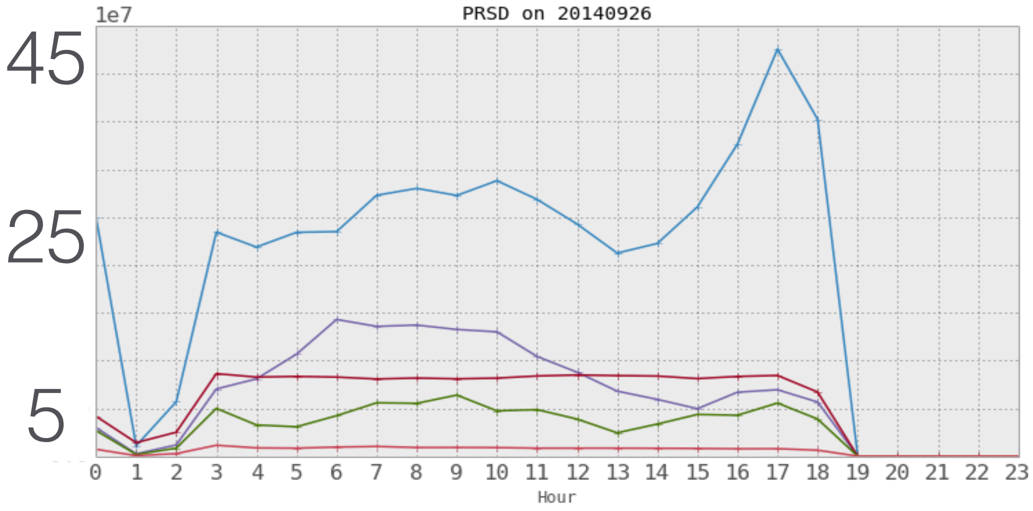
Volume of attack queries

In Millions

Small fraction of overall attack activity

Nominum est << 5%

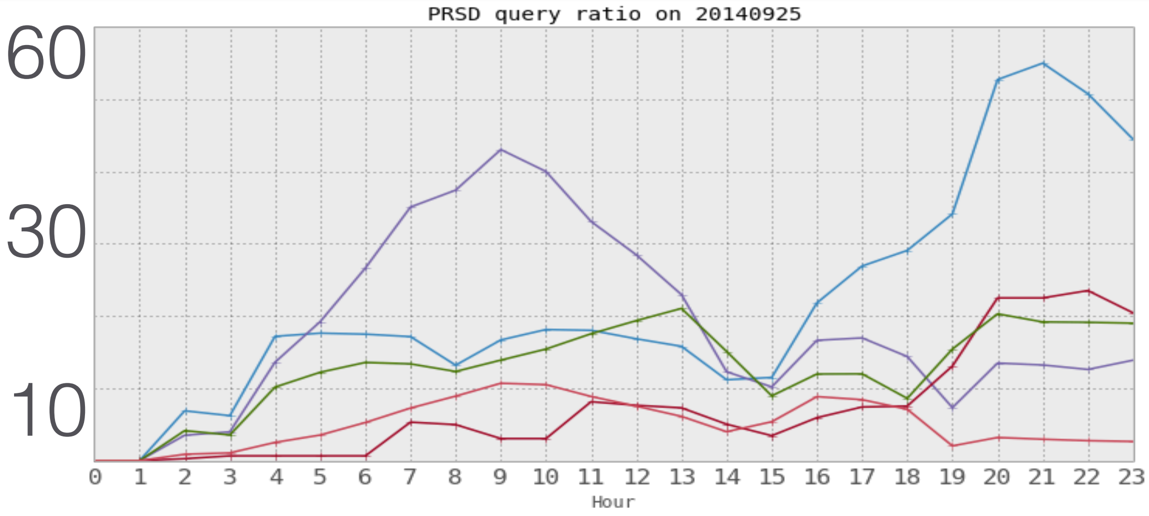


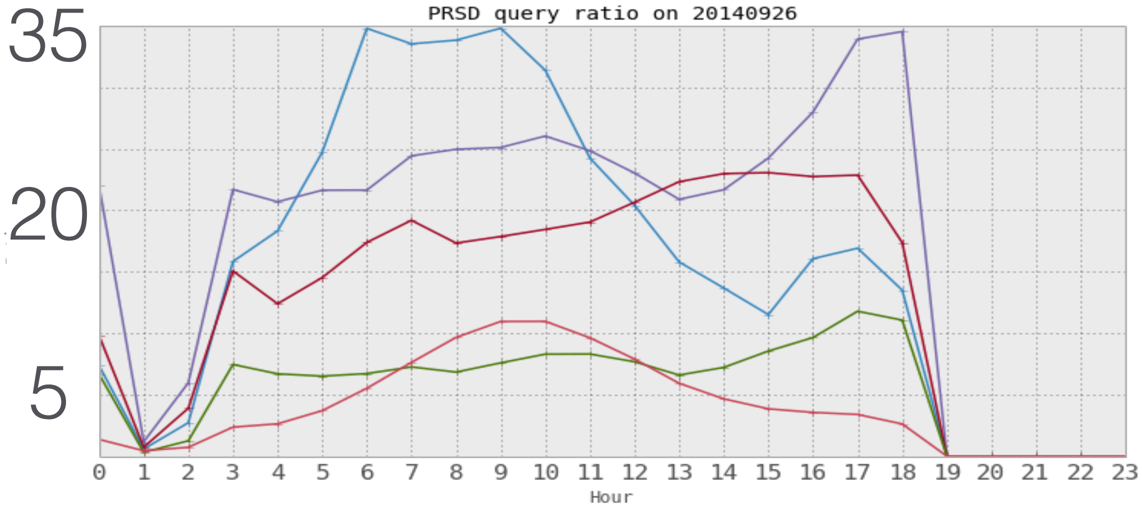


Sept 25/26 Attacks

Data from 5 providers

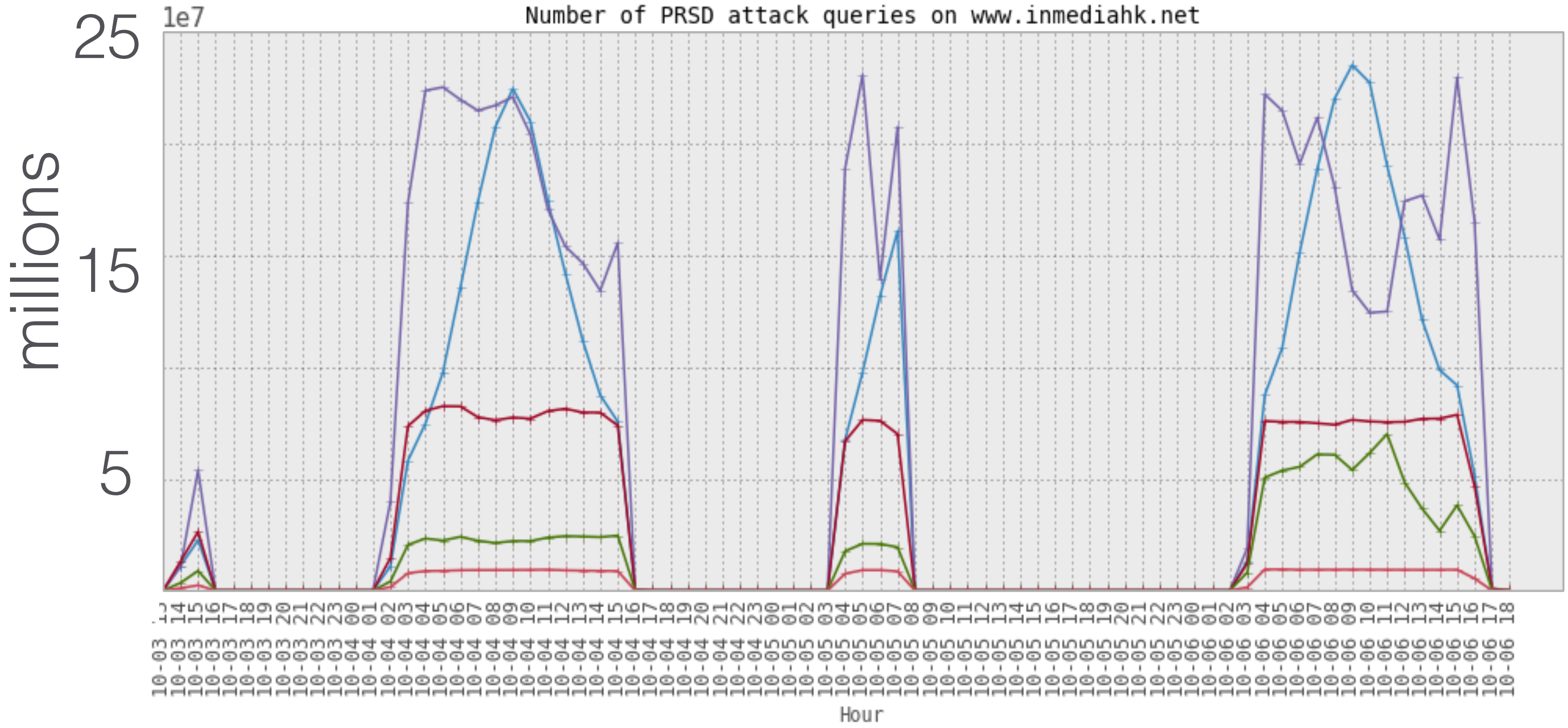
% attack queries





Oct 3- 6 Attacks

In-media is an Independent Hong Kong news site



Many Problems to Address

- Home Gateways mask the spoofed source IP
  - “Challenges”, “DNS cookies” won’t work at either resolvers OR authorities
  - Queries are from legitimate IPs – blacklisting eliminates all traffic for those IPs
- Response Rate Limiting by authorities increases the workload for *both* resolvers and authorities
  - It was designed for attacks directly on authoritative servers
  - Rate limiting resolvers is counter productive
- Surrounding recursion with too much logic can be problematic
  - D*oesn’t* address root cause
  - Collateral damage is observed:
    - Servers marked as non-responsive by recursor recovering but still not being used
    - Nameservers serving multiple domains taken out of service by traffic for one domain
- Tendency for cascading failures
  - Authorities successively fail increasing stress on remaining authorities
  - This in turn increases stress on resolvers

Solutions

- Filter traffic at ingress to the resolver
  - Near real time block lists
    - Randomized subdomains used for attacks
- Protect good traffic
  - Whitelist
- Fine grained policy
  - Tie the lists together:
    Block bad traffic
    Answer good traffic

IDEAS?

Testing Resolvers

- Goal: Understand impact of PRSD on resolvers
  - BIND
  - PowerDNS
  - Undound
  - Vantio
- Method: Simulate DNS E-E behavior

– Attack behavior	Easy
– Resolvers	Easy
– Authorities	Hard
– Variability of Internet	Very hard

- Whoops!

Current Test Plan

- Authoritative server answers up to threshold, then randomly drops
- Authoritative server switches to TCP at threshold, then restricts tcp connection slots
- Authoritative server drops traffic for attack domains, answers other domains
- Authoritative server doesn't answer, other servers for domain successively fail, vary latency response latency

IDEAS?