Security Measures to Improve Internet Public Safety

Internet Systems Consortium
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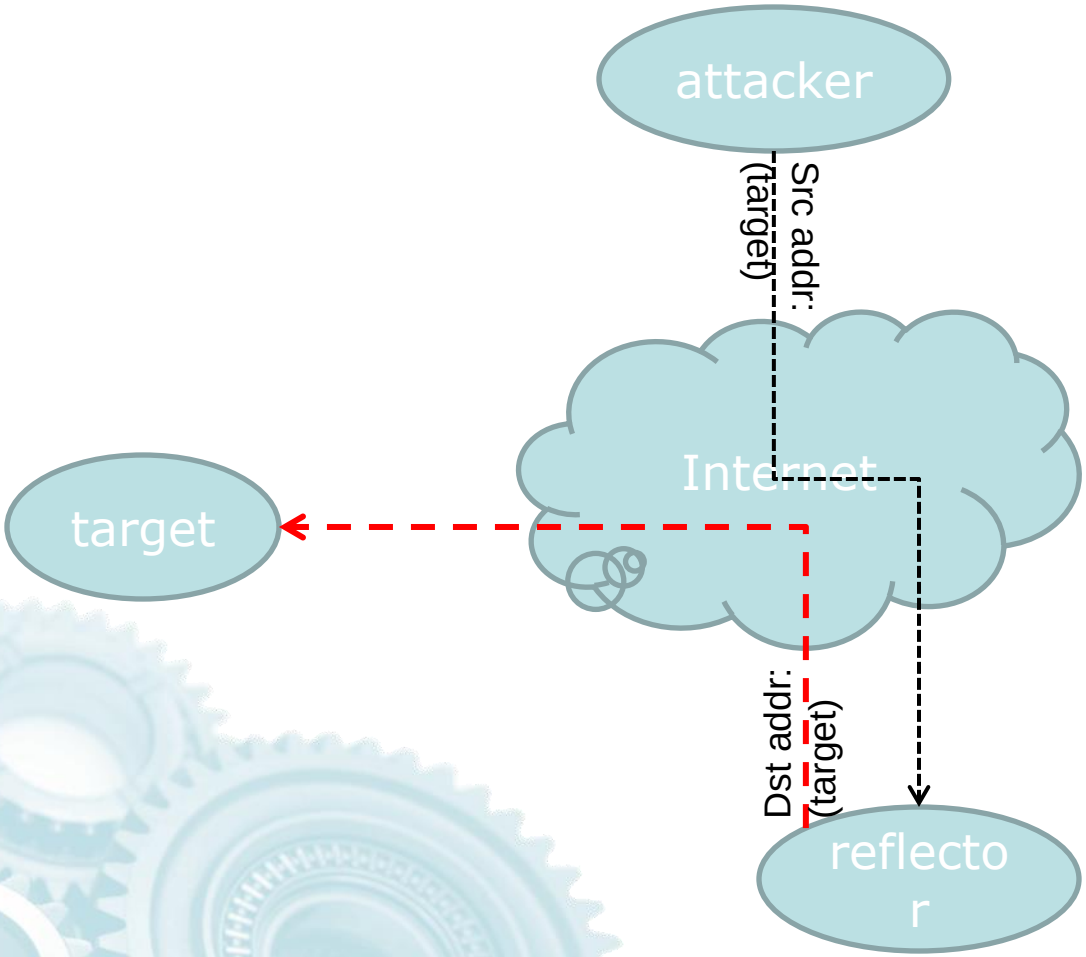
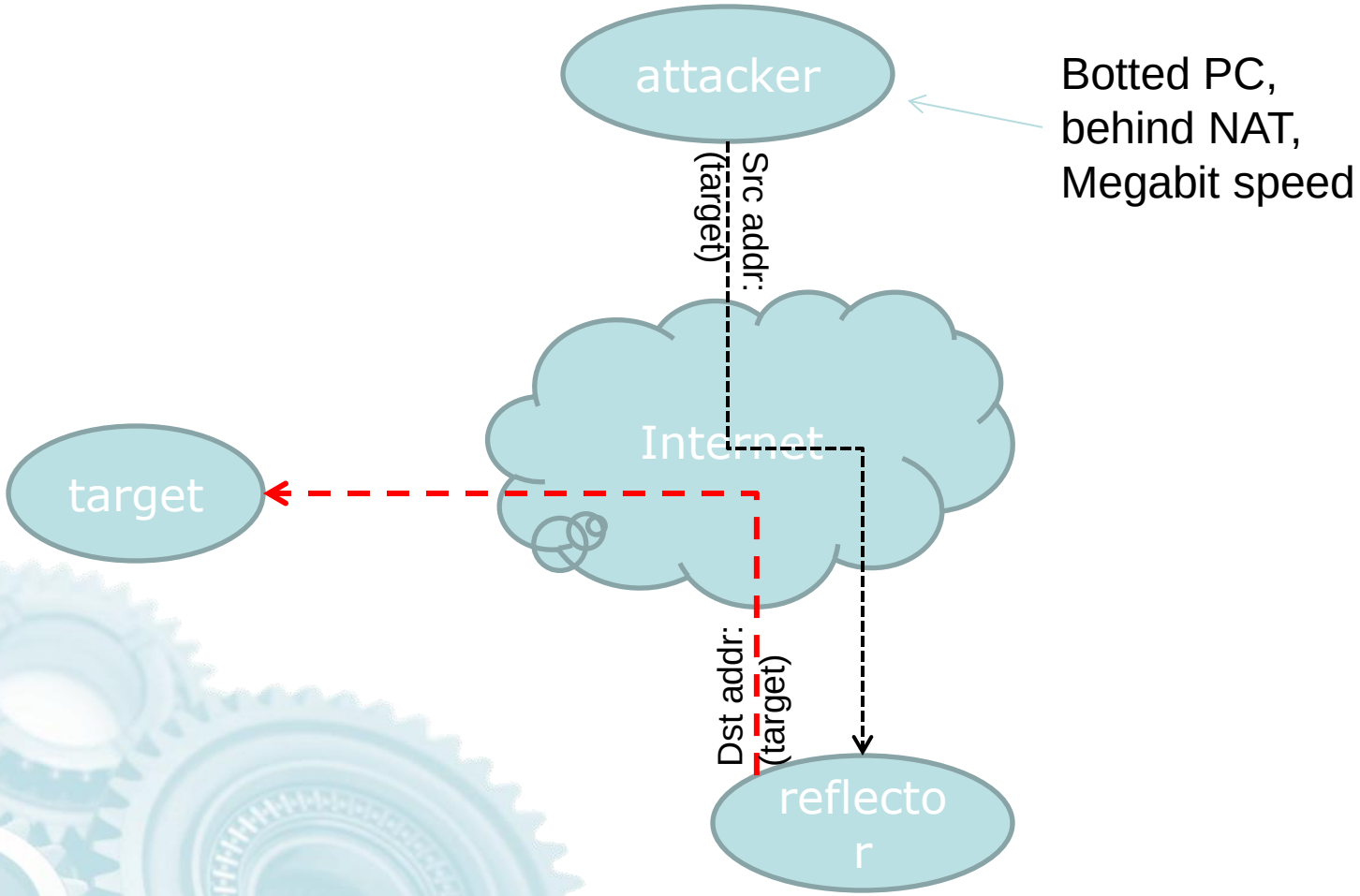
Overview

- IP Spoofing: the root of most evil
- DNS RRL: radical DDoS opt-out
- Recursive DNS access control
- Final Thoughts

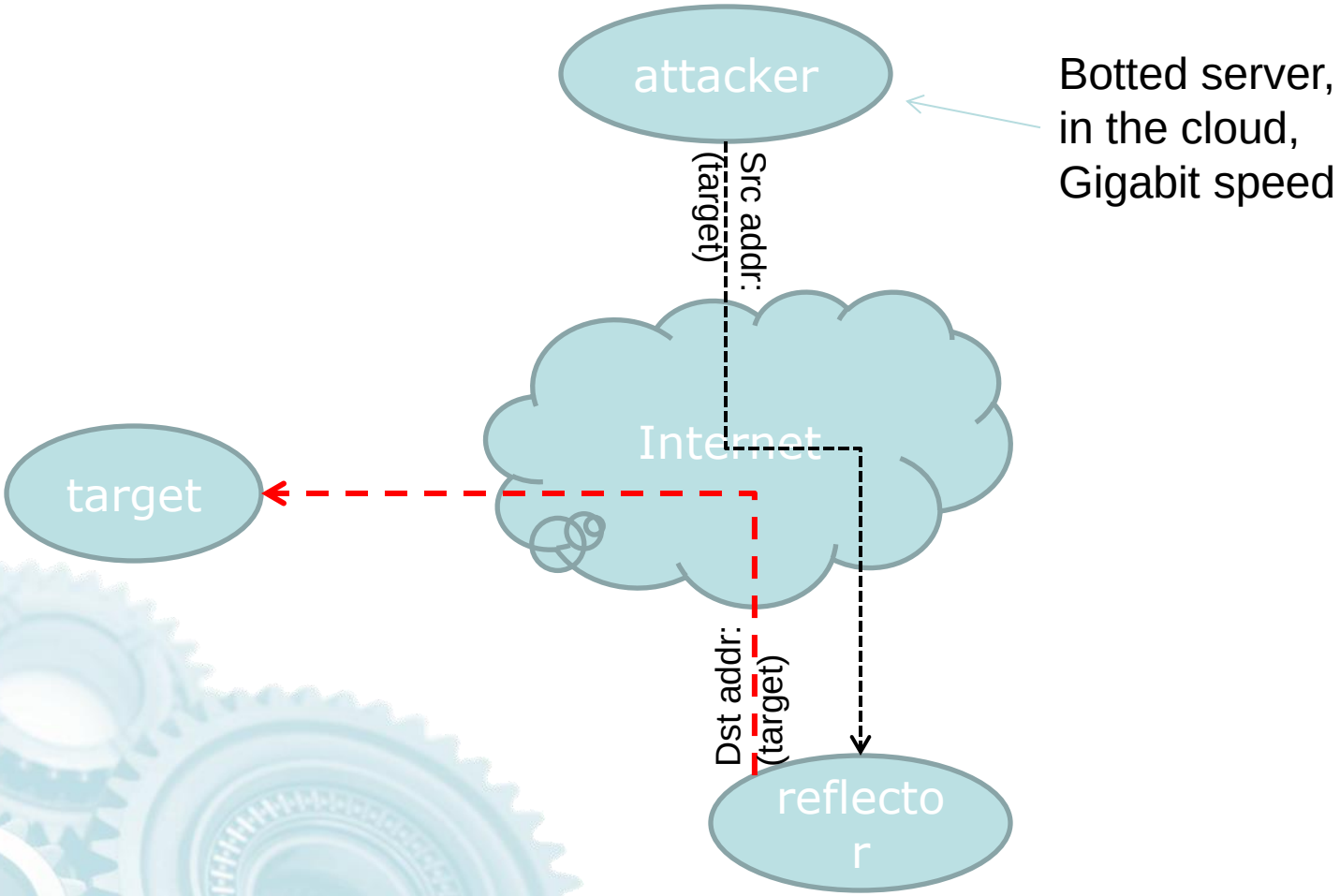
Spoofed Source Attacks: Essence



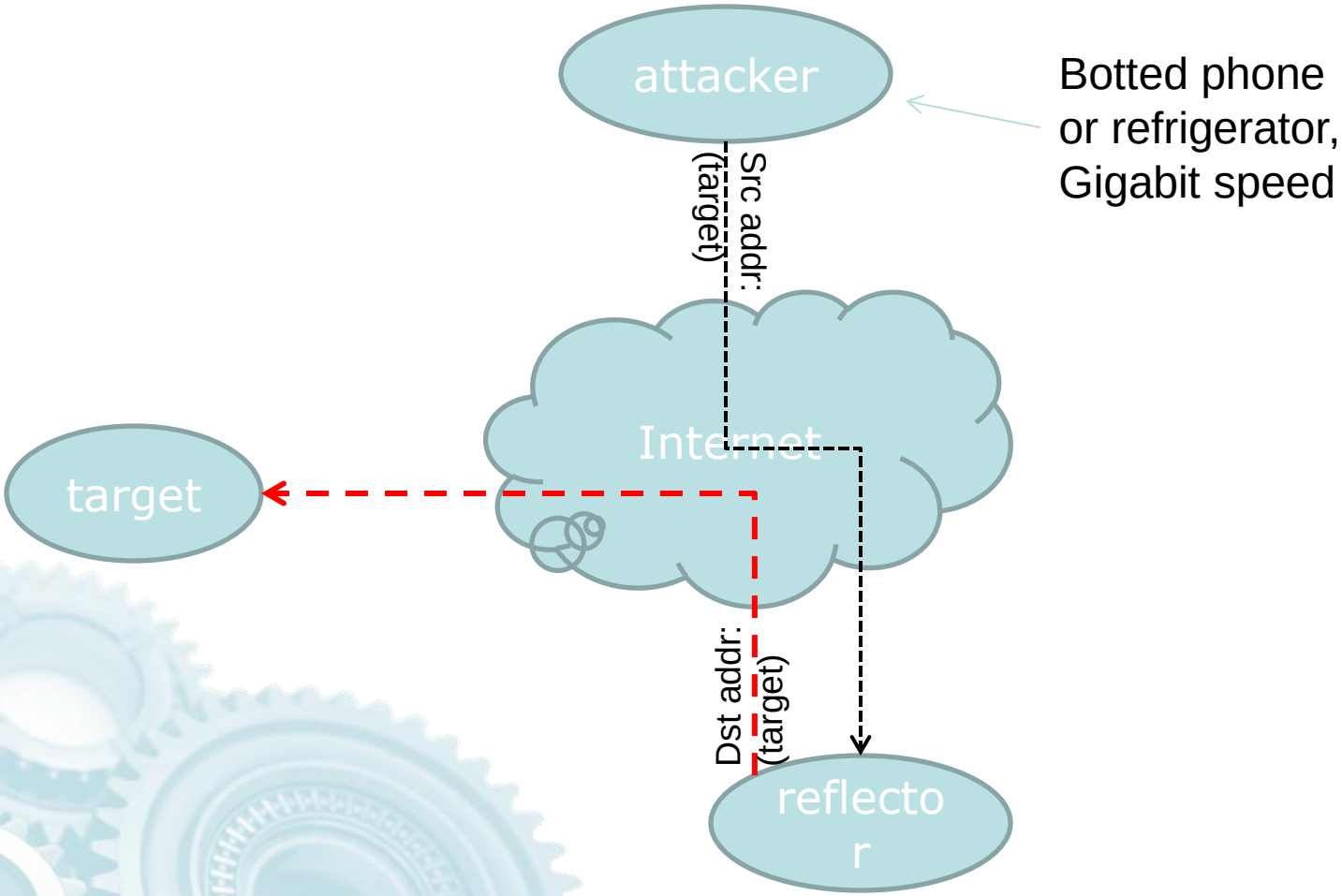
Spoofed Source Attacks: Past



Spoofed Source Attacks: Present



Spoofed Source Attacks: Future



Crazy Lessons of History

- Wide area UDP services must never amplify
  - In this light, DNS was crazy
  - And: DNSSEC is even crazier
  - But: NTP is (strangely) OK
- Promoting data to executable code is crazy
  - Like: Java, Flash, ActiveX, Autorun, JavaScript, or the conficker worm's "click to permit" hack
- Expecting users to be sysadmins is crazy
  - Like: PC, Mac, cloud servers, smart phones

Action Items for Industry

- All recursive name servers need access control
  - They should *only* answer for their customers
- All authority name servers need rate limiting
  - Quickly repeated responses are *never* necessary
- Edge networks should validate their src addrs
  - This *can't* be done closer to the Internet "core"
- Cloud/VM providers should offer sys admin
  - Webmasters *can't* be expected to update Joomla
- References
  - BCP38, "Network Ingress Filtering", 2000
  - SAC004, "Securing the Edge", 2002

RRL On The Wire

```
[nsa:amd64] repeat 25 \
       dig +novc +ignore +retries=0 +time=1 vix.com aaaa \
              @ns.sql1.vix.com \
       | grep tc
;; flags: qr aa tc rd ad; QUERY: 1, ANS: 0, AUTH 0, ADD: 1
;; flags: qr aa tc rd ad; QUERY: 1, ANS: 0, AUTH: 0, ADD: 1
;; flags: qr aa tc rd ad; QUERY: 1, ANS: 0, AUTH: 0, ADD: 1
```

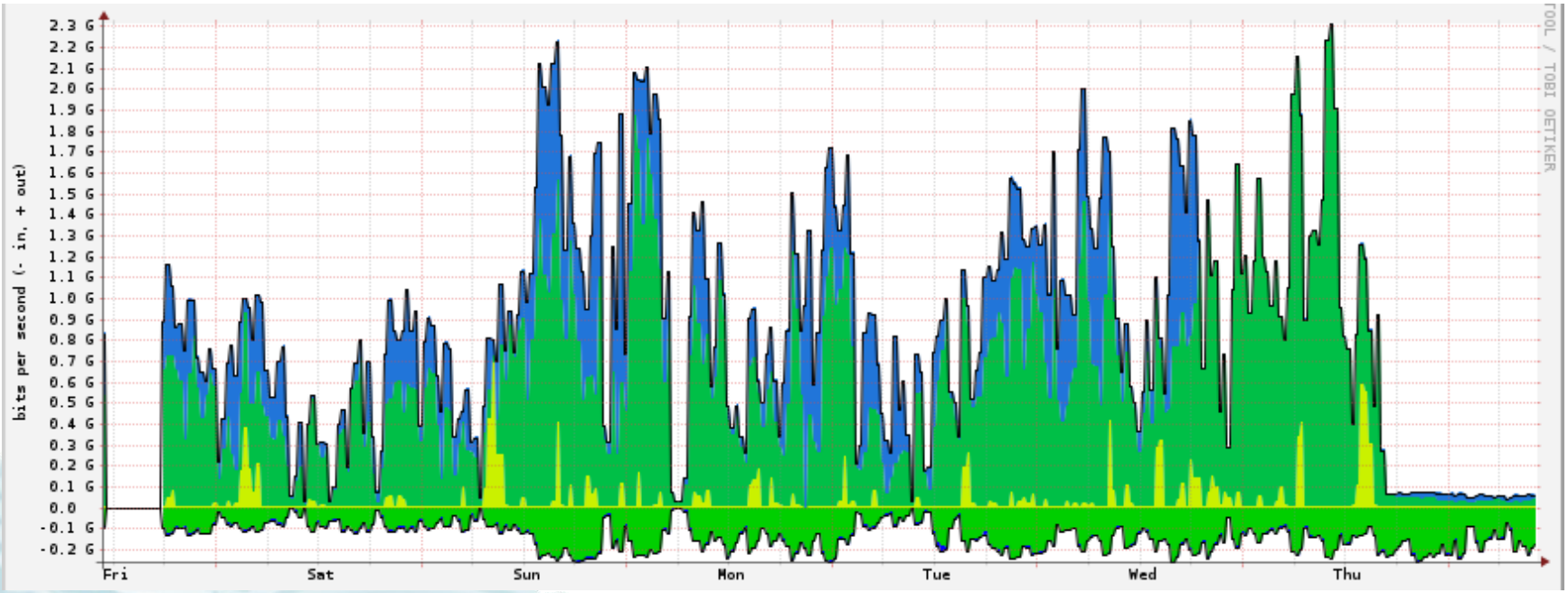
RRL Configuration

```
options {
        directory "/var/local/named";
        pid-file "/var/run/named-nsa.pid";
        query-source address 149.20.48.227 port *;
        listen-on-v6 { ::1; 2001:4f8:3:30::3; };
        listen-on { 127.0.0.1; 149.20.48.227; };
        recursion yes;
        notify yes;
        dnssec-enable yes;
        dnssec-lookaside . trust-anchor dlv.isc.org.;
        dnssec-validation yes;
        rate-limit {
                responses-per-second 5;
                window 5;
        };
};
```

Using RRL In Your Servers

- In authority servers
  - RRL has no negative impact on real flows, because real clients have caches, will retry with UDP, will try TCP if given a truncated response
- In recursive servers
  - RRL would have a negative impact on real flows, because real clients do not have caches
  - It should not be necessary, just use ACLs

RRL In Action: Afilias



Recursive DNS Anti-Abuse

- Clients of RDNS are *stubs* – no cache
  - Thus they repeat queries all the time
  - RRL has no model for this right now
- So, properly configured RDNS *must*:
  - Either: ACL to serve only local/customer
  - Or: 24x7 monitoring like OpenDNS does
- Alas, most open RDNS are embedded
  - Operator has no idea it's happening

Final Thoughts: DNS RRL

- RRL was first implemented in BIND but is intended for use in *all* name servers
  - NSD as of 3.2.15, February 2013
  - Knot DNS as of 1.2-RC3, March 2013
- Please study the DNS RRL specification carefully, it's intended to be implemented literally
- Specification, patches, pointers, and specification are available online
  - http://www.redbarn.org/dns/ratelimits

Final Thoughts: IP Spoofing

- Economics at the edge aren't just misaligned, they're pessimal
- There will always be spoofing, although regulation isn't impossible
- Meanwhile we have to get rid of all DDoS amplifiers
- Fortunately, the economics are better aligned for this