Pseudo Random DNS Query Attacks & Resolver Mitigation Approaches

NANOG63

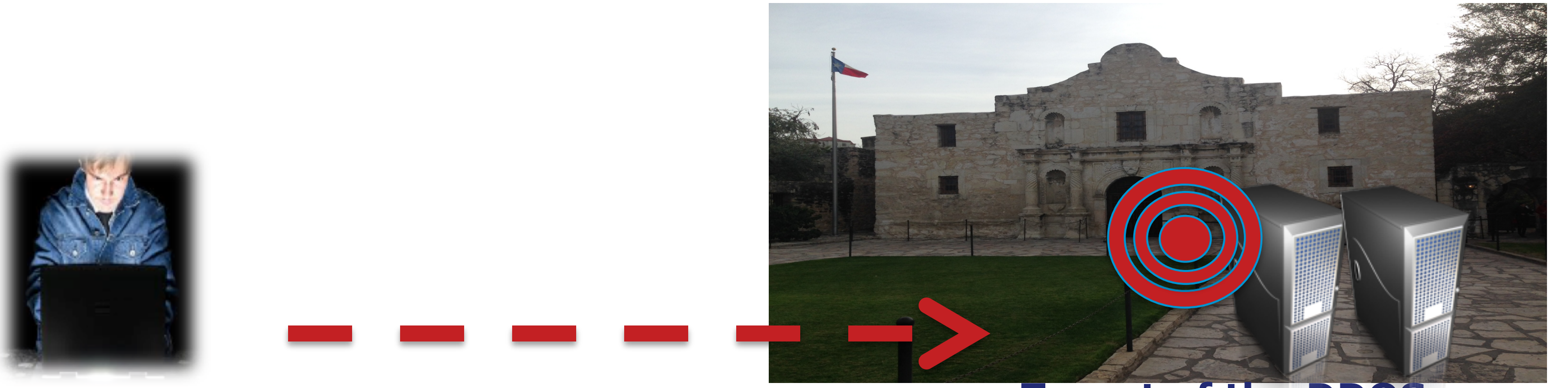
The attacks

- Began in February 2014
- Attack intent is to DDoS DNS authoritative provider, but incidentally degrades ISP resolvers

The parties involved

- Sometimes this is an extortion attack
- Frequently seems to originate and terminate in China

- Target domain may be hosted with many non-targeted domains
- Targets hop from provider to provider



Initiator of DDoS traffic

Target of the DDOS Authoritative provider

Identifying the attack

high volume of queries for non-existent sub-domains

<randomstring>.www.example.com
<anotherstring>.www.example.com

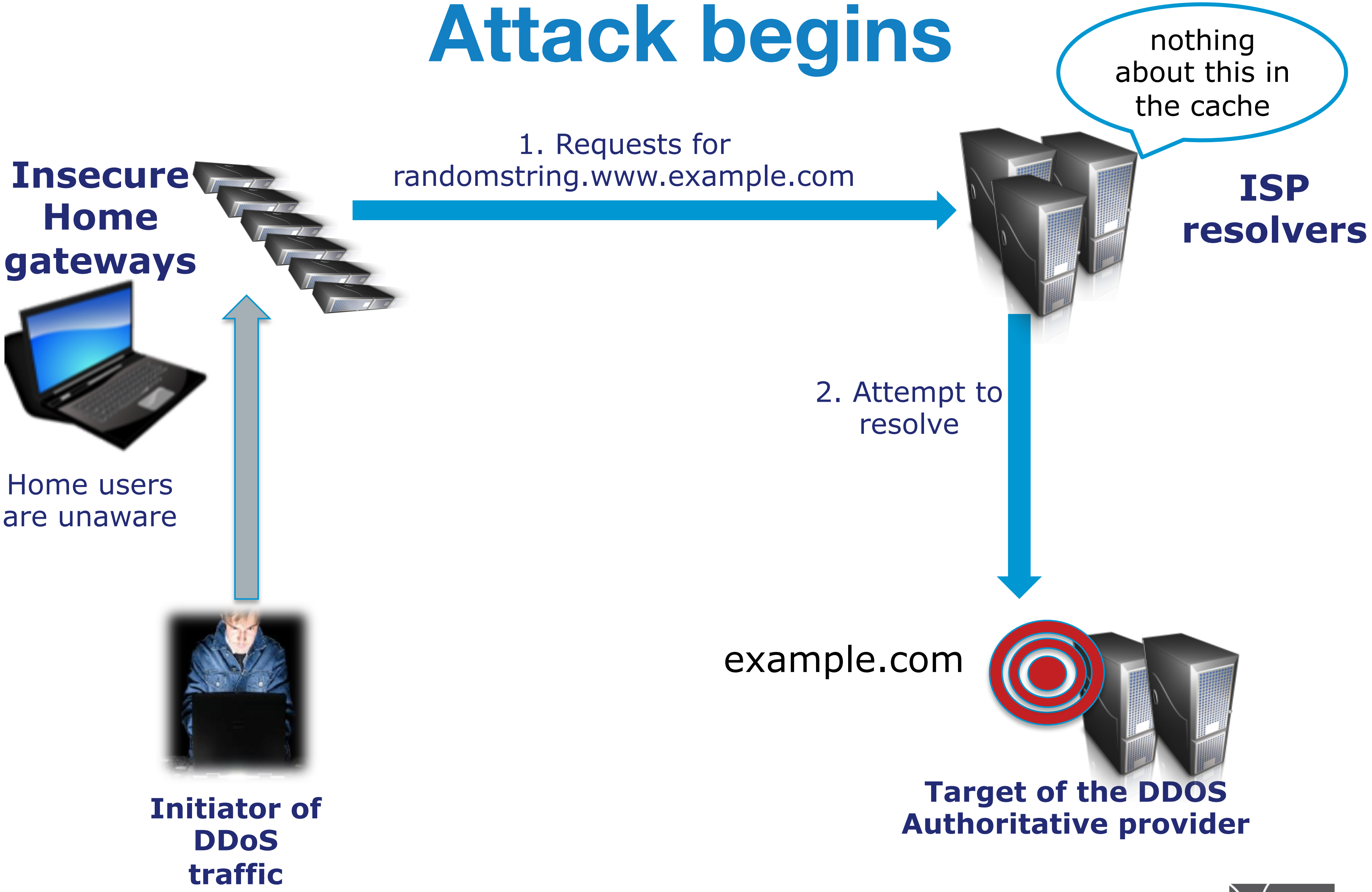
does not exist

??

exists

◎

Attack begins



nothing about this in the cache

1. Requests for randomstring.www.example.com

Insecure Home gateways

Home users are unaware

ISP resolvers

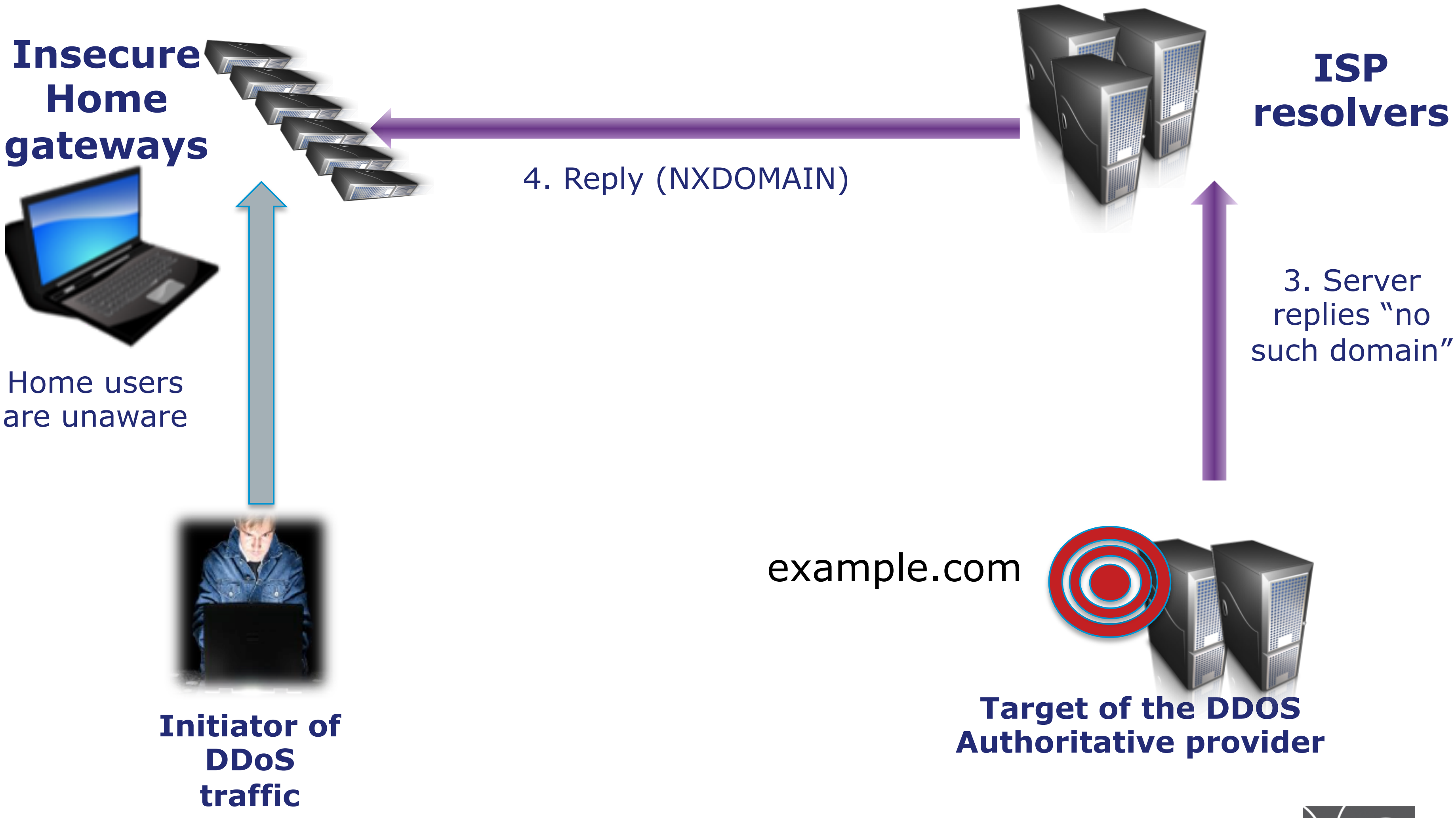
2. Attempt to resolve

example.com

Target of the DDOS Authoritative provider

Initiator of DDoS traffic

Initially, the target responds



Insecure Home gateways

Home users are unaware

4. Reply (NXDOMAIN)

ISP resolvers

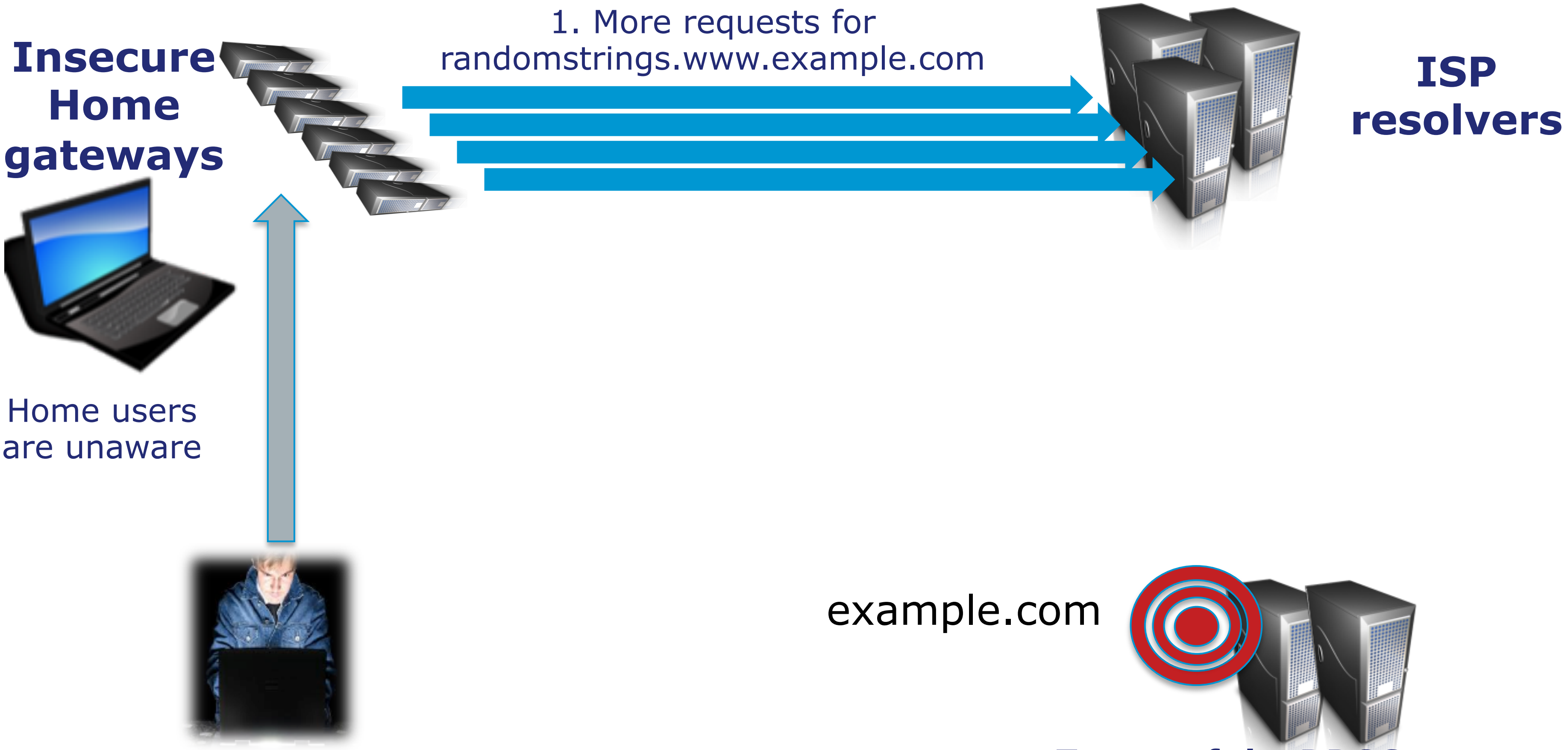
3. Server replies “no such domain”

example.com

Initiator of DDoS traffic

Target of the DDOS Authoritative provider

More requests flood in



1. More requests for randomstrings.www.example.com

Insecure Home gateways

ISP resolvers

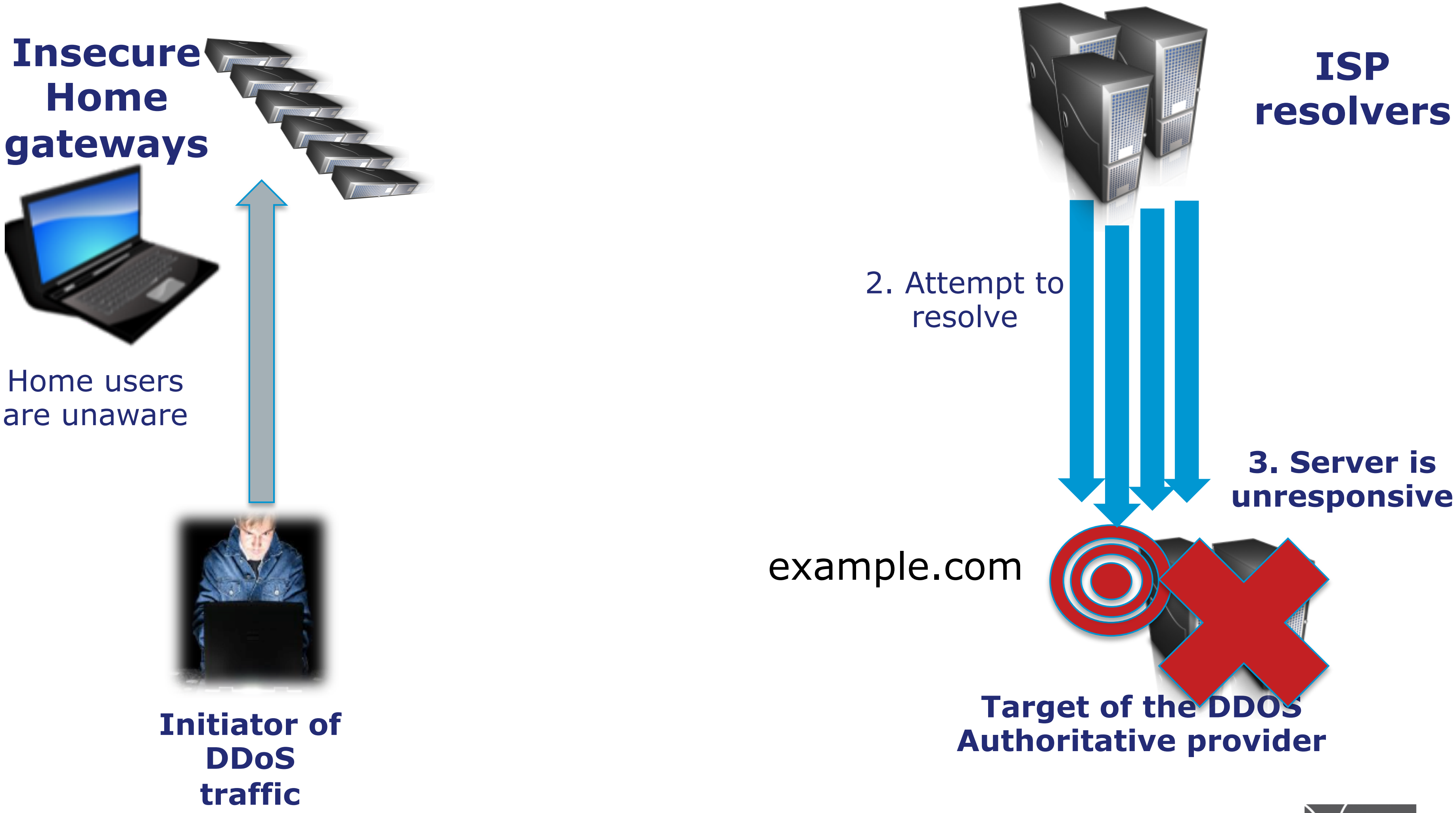
Home users are unaware

example.com

Initiator of DDoS traffic

Target of the DDOS Authoritative provider

Target is overwhelmed



Insecure Home gateways

Home users are unaware

Initiator of DDoS traffic

ISP resolvers

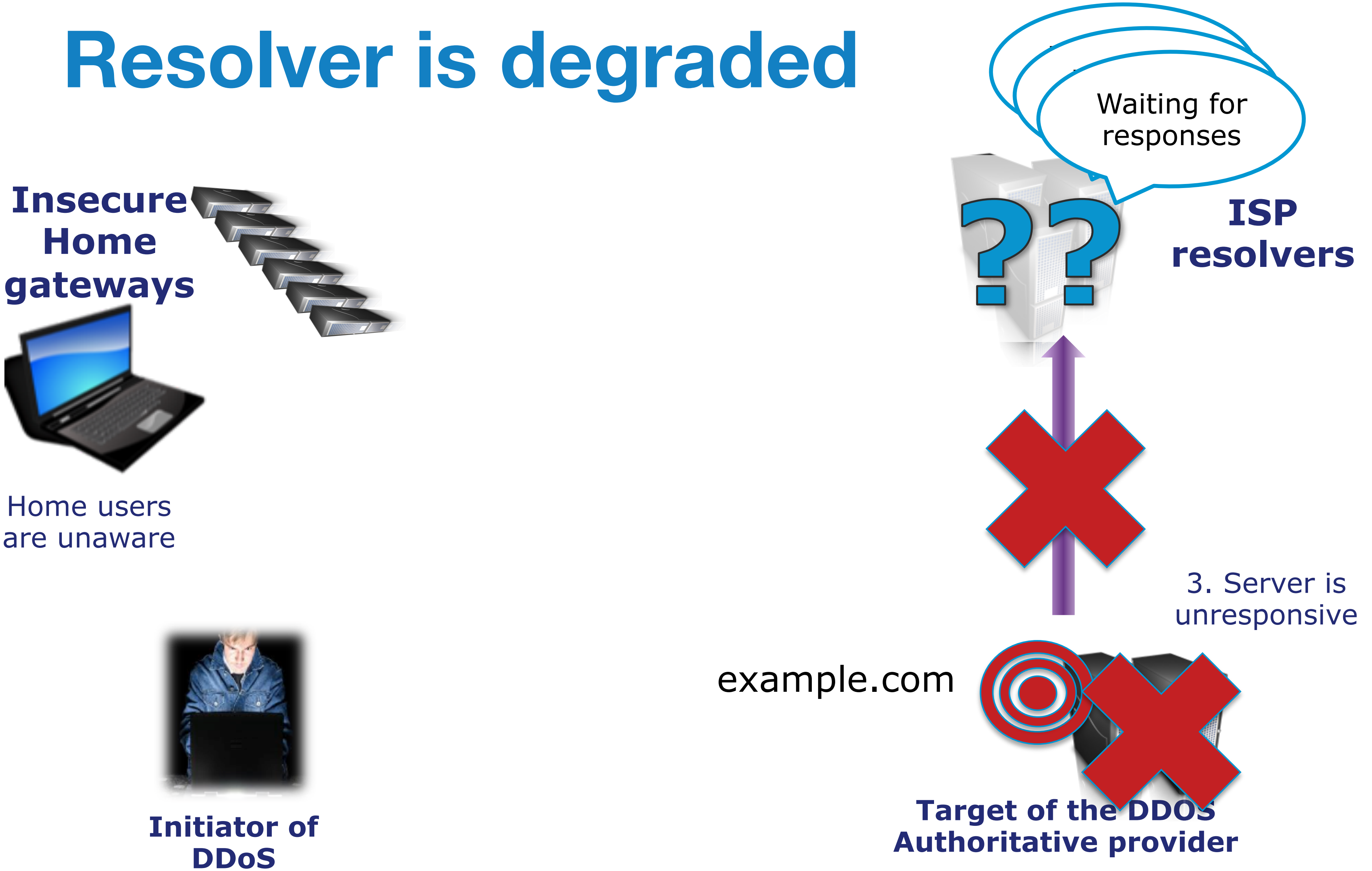
2. Attempt to resolve

3. Server is unresponsive

example.com

Target of the DDOS Authoritative provider

Resolver is degraded



Insecure Home gateways

Home users are unaware

Initiator of DDoS traffic

Waiting for responses

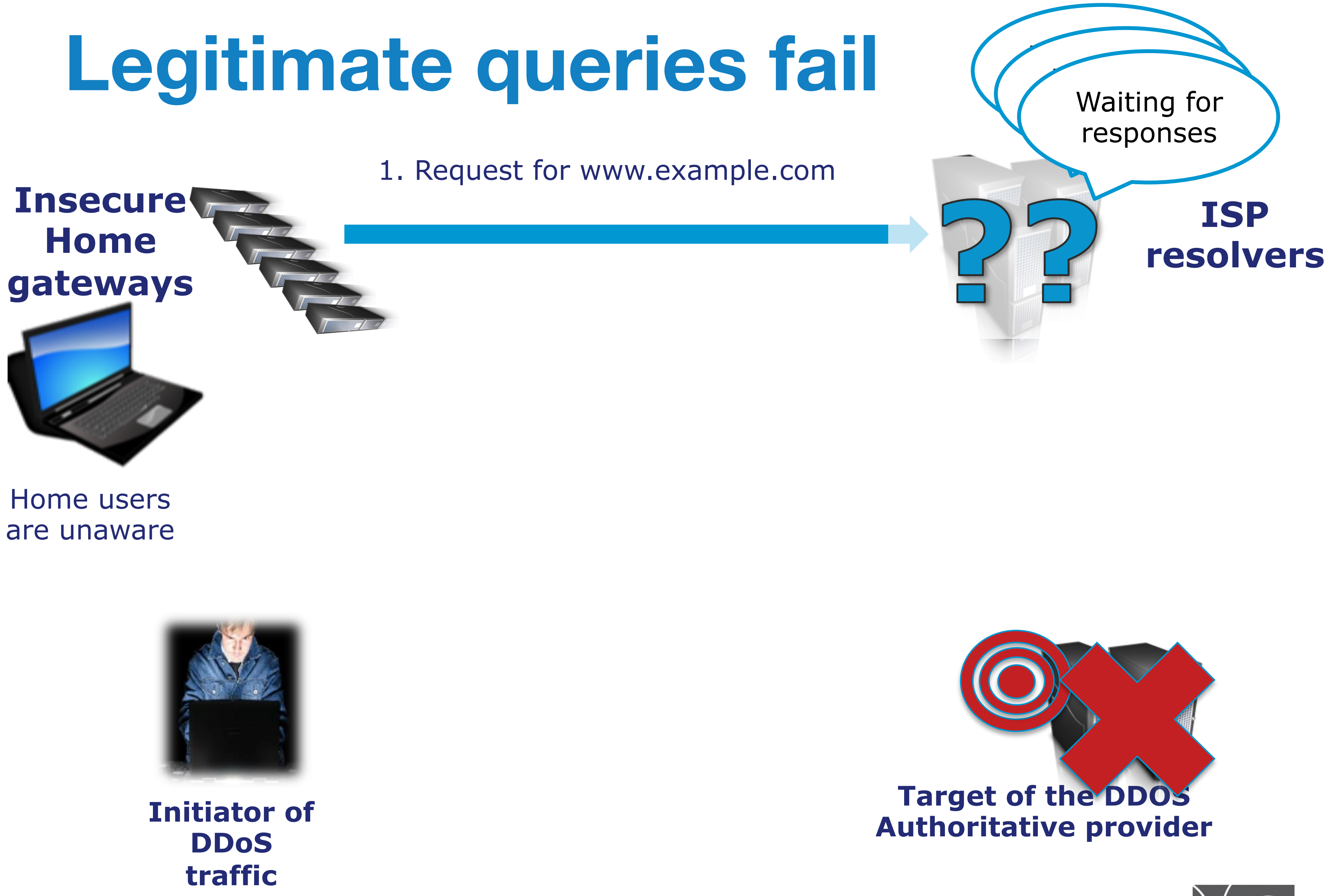
ISP resolvers

3. Server is unresponsive

example.com

Target of the DDOS Authoritative provider

Legitimate queries fail



Waiting for responses
1. Request for www.example.com
Insecure Home gateways
ISP resolvers
??
Home users are unaware
Initiator of DDoS traffic
Target of the DDOS Authoritative provider

MITIGATION TECHNIQUES

What can we do?

What has been tried in production?

Stage 1: “hair on fire”

LIE
(about authority)

Create a local answer

- Make recursive server temporarily authoritative for the target domain

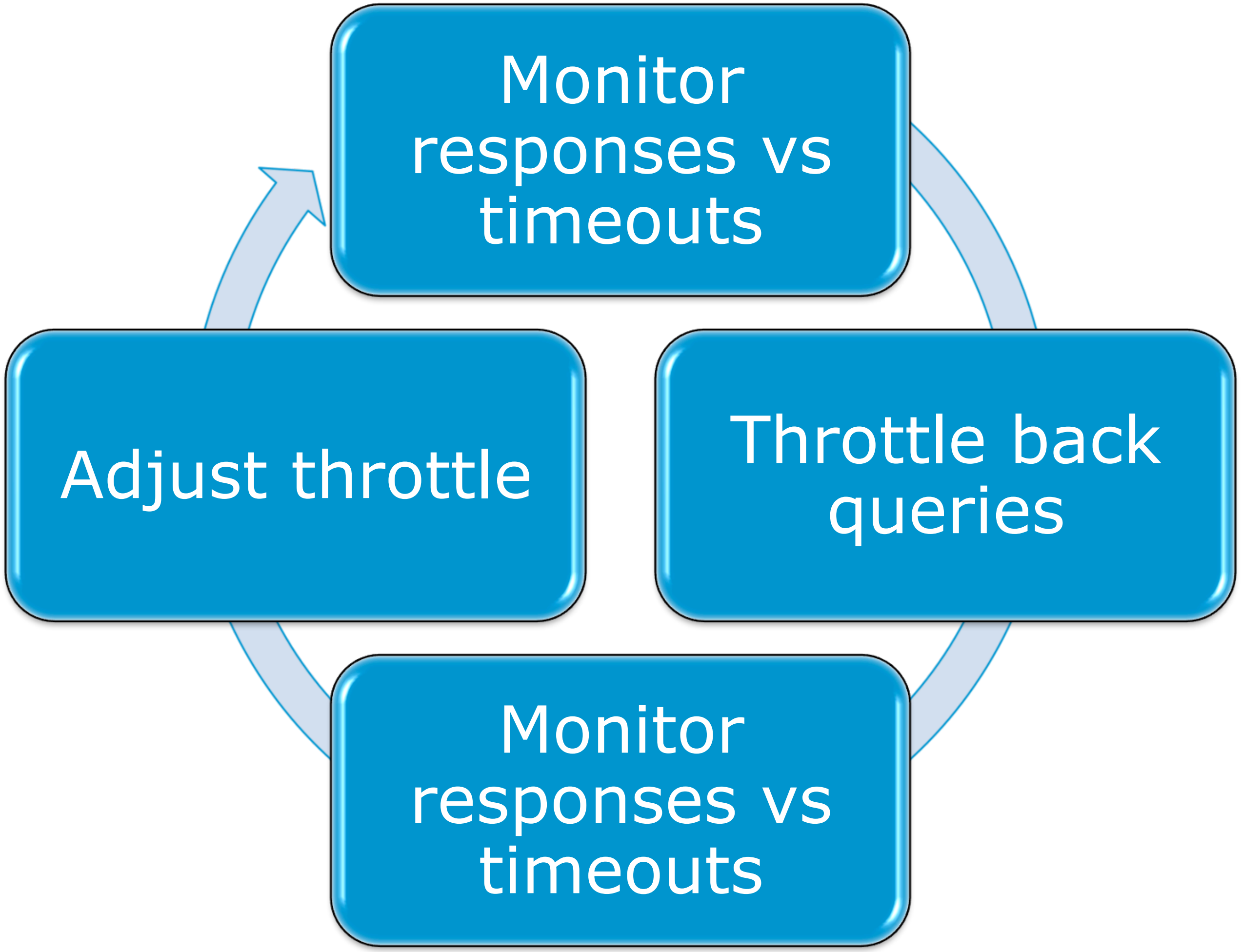
- *Problem of false-positives (might need white-lists if using scripted detection)*
- *Manual configuration change*
- *Need to undo the mitigation afterwards*

Stage 2: Consider Automated filtering

(Near) Real Time Block Lists

- Detect 'bad' domain names or just the problematic queries & filter them at ingress to the resolver
- Nominum Vantio
- BIND DNS-RPZ
- There are usually fees associated with feeds

Stage 3: Consider making your resolvers smarter



PER ZONE

PER SERVER

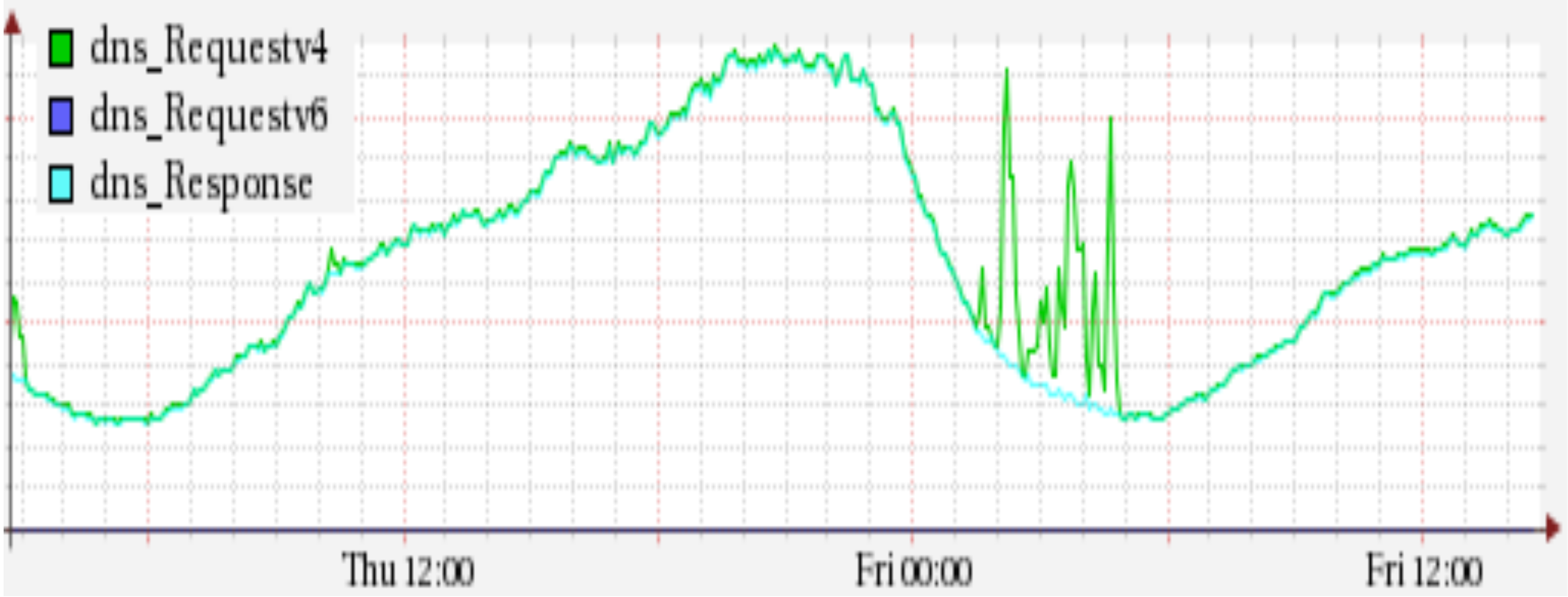
fetches-per-server

- Per-server quota dynamically re-sizes itself based on the **ratio of timeouts to successful responses**
- Completely non-responsive server eventually scales down to fetches quota of 2% of configured limit.
- Similar in principle to what NLNetLabs is doing in Unbound

fetches-per-zone

- Works with unique clients
- Default 0 (no limit enforced)
- Tune larger/smaller depending on normal QPS to avoid impact on popular domains
- In practice, this has been the winner so far for those using BIND

Fetches-per-zone at Jazztel



Spanish triple-play ADSL carrier & ISP
Roberto Rodriguez Navio, Jazztel Networking Engineering
used with permission

Still experimental

- Some controversy about adaptive approach vs blacklists
- Whitelists may be needed
- Per-server/zone settings
  - *Configurable override parameters for fetch limits on a per zone or per server basis*
- SERVFAIL cache (for client retries)
- Improved reporting & statistics

Options Summary

1) Configure your resolver to **LIE**

   answer authoritatively yourself

2) Configure a **BLACK LIST** of domains under attack

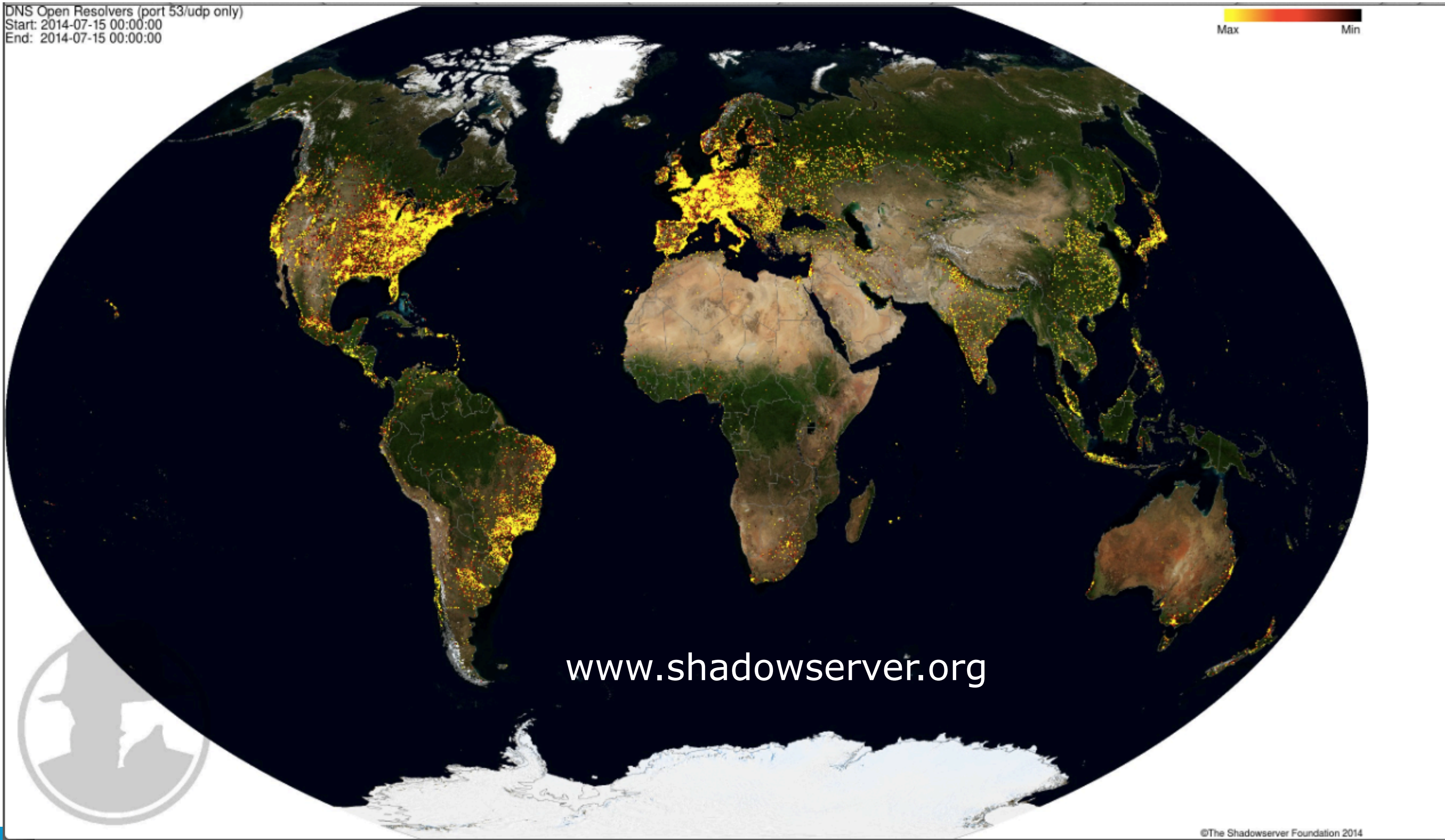
   possibly subscribe to a feed for this

3) Consider **ADAPTIVE LIMITS**

   per server

   per zone

Ideally, close the open resolvers!!


DNS Open Resolvers (port 53/udp only)
Start: 2014-07-15 00:00:00
End: 2014-07-15 00:00:00
Max
Min
www.shadowserver.org
©The Shadowserver Foundation 2014

Good Luck!!!