Mitigating DNS Amplification Attacks using a set of Geographically-Distributed SDN Routers.

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Outline

- Motivation
- Proposed method
- Experimental results
- Summary
- Future work

Motivation

Network DoS attacks

- Denial of Service (DoS) attack.
- Network DoS attack [Mirkovic and Reiher].
- Github received a 1.35 Tb/s attack on 2018-02-28.

DNS amplification attack

- Attacker sends DNS request flood to DNS servers.
  Source address of packet = Victim's address.
- DNS servers send response flood to victim.
- Since response size >> request size, amplification!

Current results

- Filtering by victim only happens in victim's network.
- This is unsuitable for huge attacks.

Proposed Method

Basic idea of solution

- Spread many routers (called barrier) across internet.
- Route all incoming and outgoing traffic through barrier.
- Victim has 2 addresses: Secret and Public.
- Routers will filter out attack traffic and forward rest to victim.

Details

- How to ensure that barrier itself isn't DDoSed?
- How exactly does forwarding happen?
- How does filtering happen?

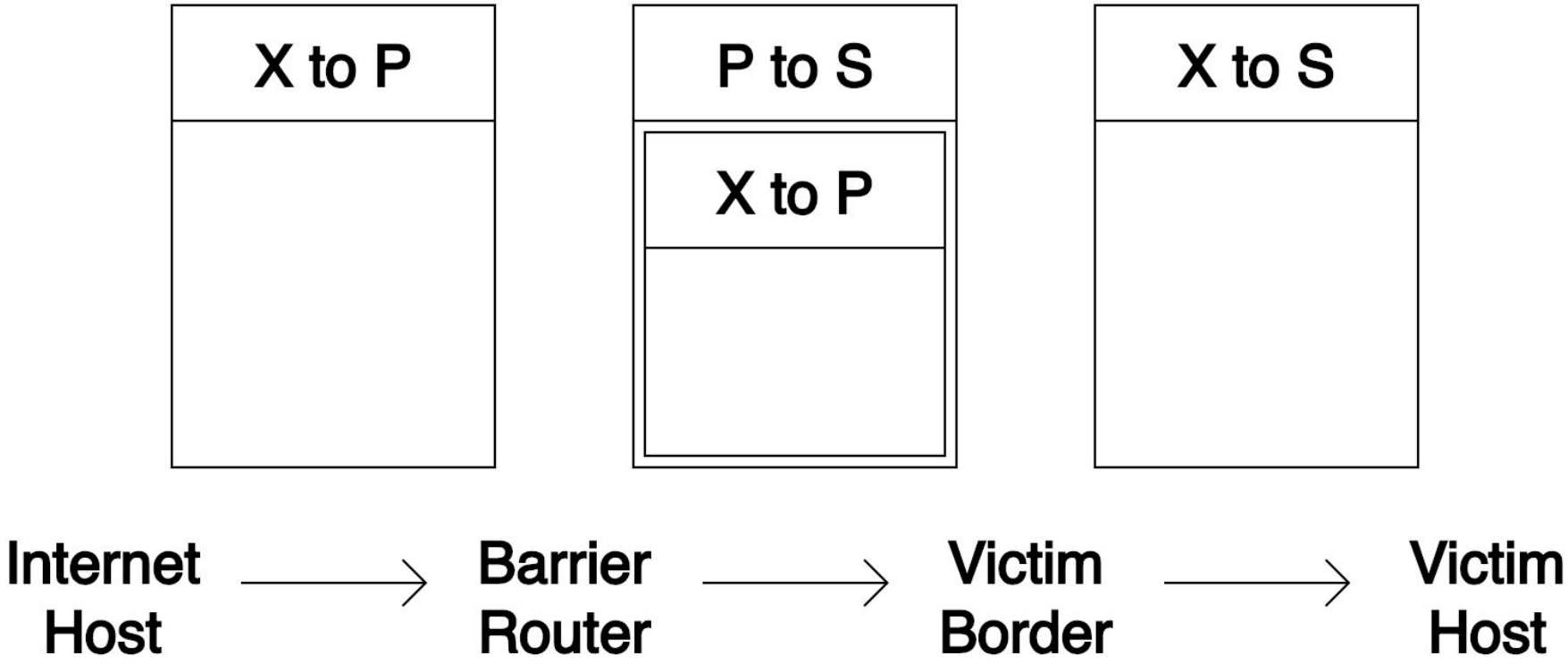
Anycasting

- Definition: Multiple hosts sharing the same IP address.
- Catchment area.

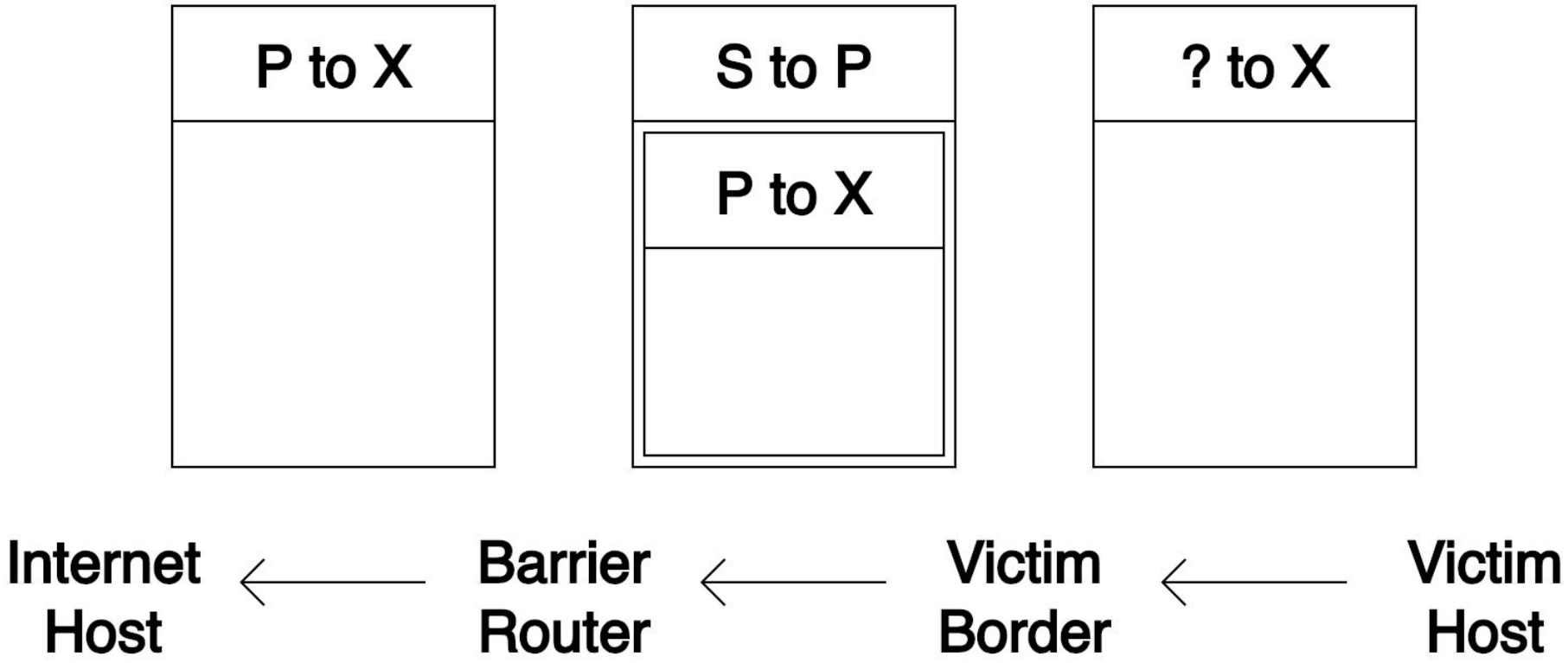
Anycast barrier

- Public address is advertised from each barrier router.
- Strategically placing routers.
- Filter attack traffic
- Wrap and forward the rest to victim.

Incoming


X to P
P to S
X to P
X to S
Internet Host
Barrier Router
Victim Border
Victim Host

Outgoing


P to X
S to P
P to X
? to X
Internet Host
Barrier Router
Victim Border
Victim Host

DAAD

- By Kambourakis, Moschos, Geneiatakis, Gritzalis.
- Keep track of outgoing DNS requests and match DNS responses with them.

Anycast Barrier Filtering

- Different barrier routers for request and response.
- DNS requests will be broadcast.
- Responses will probably reach after requests.

ISFRADR

- Use SDN routers instead of original DAAD.
- Installing SDN Flow Rules for Anticipated DNS Responses.

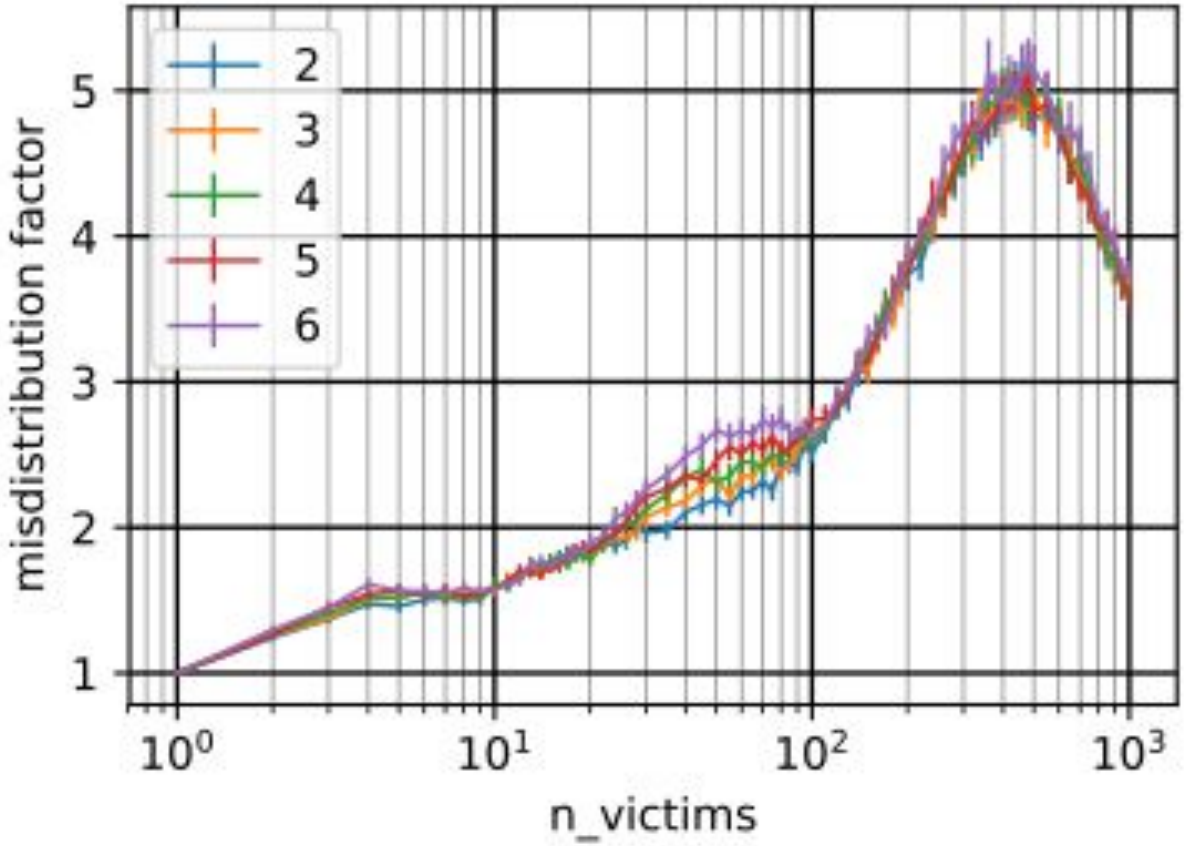
Experiments and Results

Catchment area sizes

- Make a small model of internet.
- Place anycast barriers intelligently.
- Calculate catchment areas.
- n = Number of barrier routers.
- r = Max relative catchment area.

- m = Misdistribution factor = r * n.
- Plot m and r as functions of n for different hyperparameters of the internet model.

Hyperparameter: Average node degree



Observations

- m and r aren't affected much by choice of hyperparameters.
- m is low. This means attack can be well-divided.

Summary

- DNS Amplification attacks.
- Current literature doesn't consider huge attacks.
- How Anycast Barrier works.
- Traffic can be divided almost equally across routers.

Future work

- Implement and benchmark ISFRADR.
- Try out Anycast barrier in real life. In simulation we don't know attack distribution.
- Extend to non-reflection attacks.
- Better router placement algorithm.

Questions