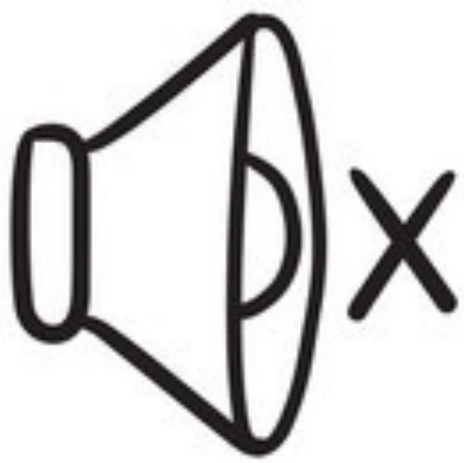
2020: Time to Shutdown DDoS?



Stefano Vissicchio

University College London

@ Cosener's

July 6th, 2018

2020: Time to Shutdown DDoS?

Stefano Vissicchio

NOT a security expert

@ Cosener's

July 6th, 2018

Isn’t the problem old?

Isn’t the problem old?

DDoS techniques from late 90s (Smurf)
Noticeable attacks from 1999-2000

Isn’t the problem old?

- **Still important**

Many DDoS attacks happen every day

- 2,000+ attacks per day, keep growing in number
  e.g., see reports from Arbor Networks

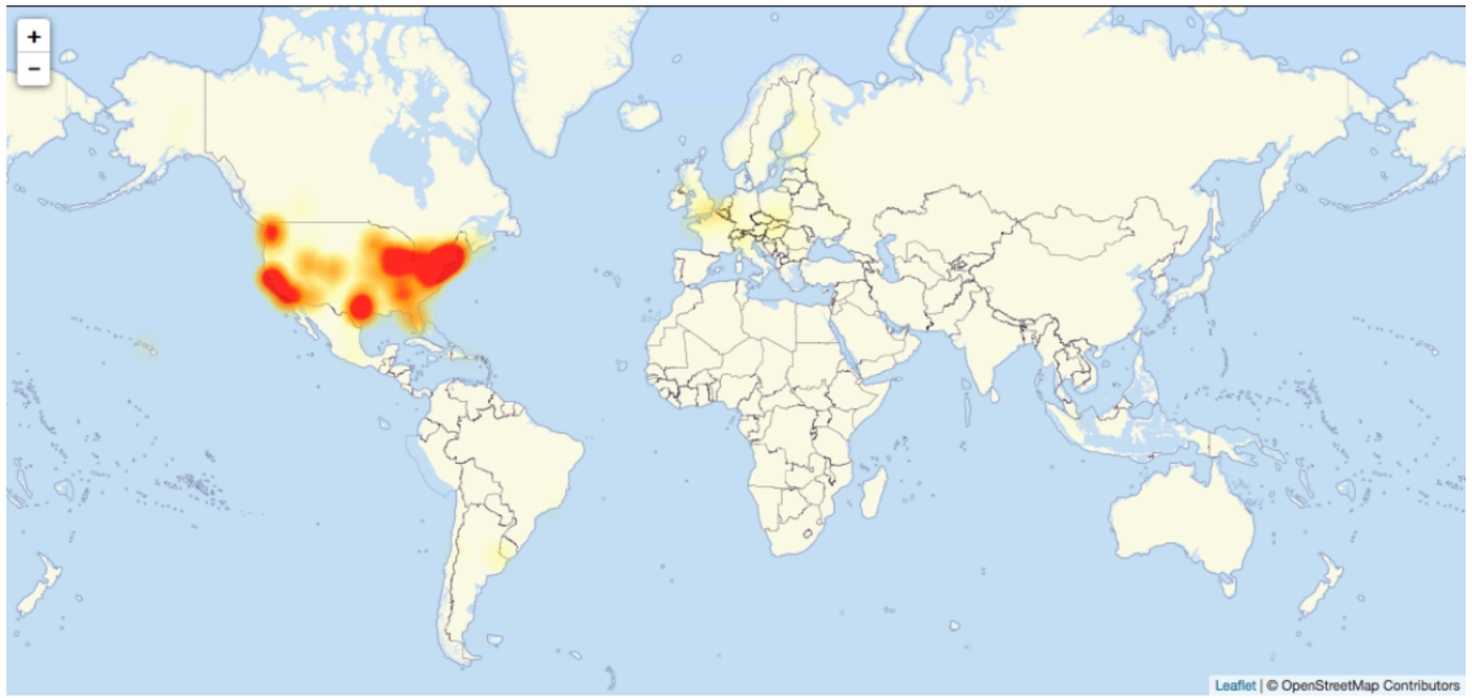
- > 1/3 of the used /24s were attacked in 2015-2017
  as measured in Jonker et al., IMC'17

- 1/3 of all downtime incidents attributed to DDoS
  as reported by Verisign/Merril Research

… the big ones make the news, regularly

The New York Times

Hackers Used New Weapons to Disrupt Major Websites Across U.S.

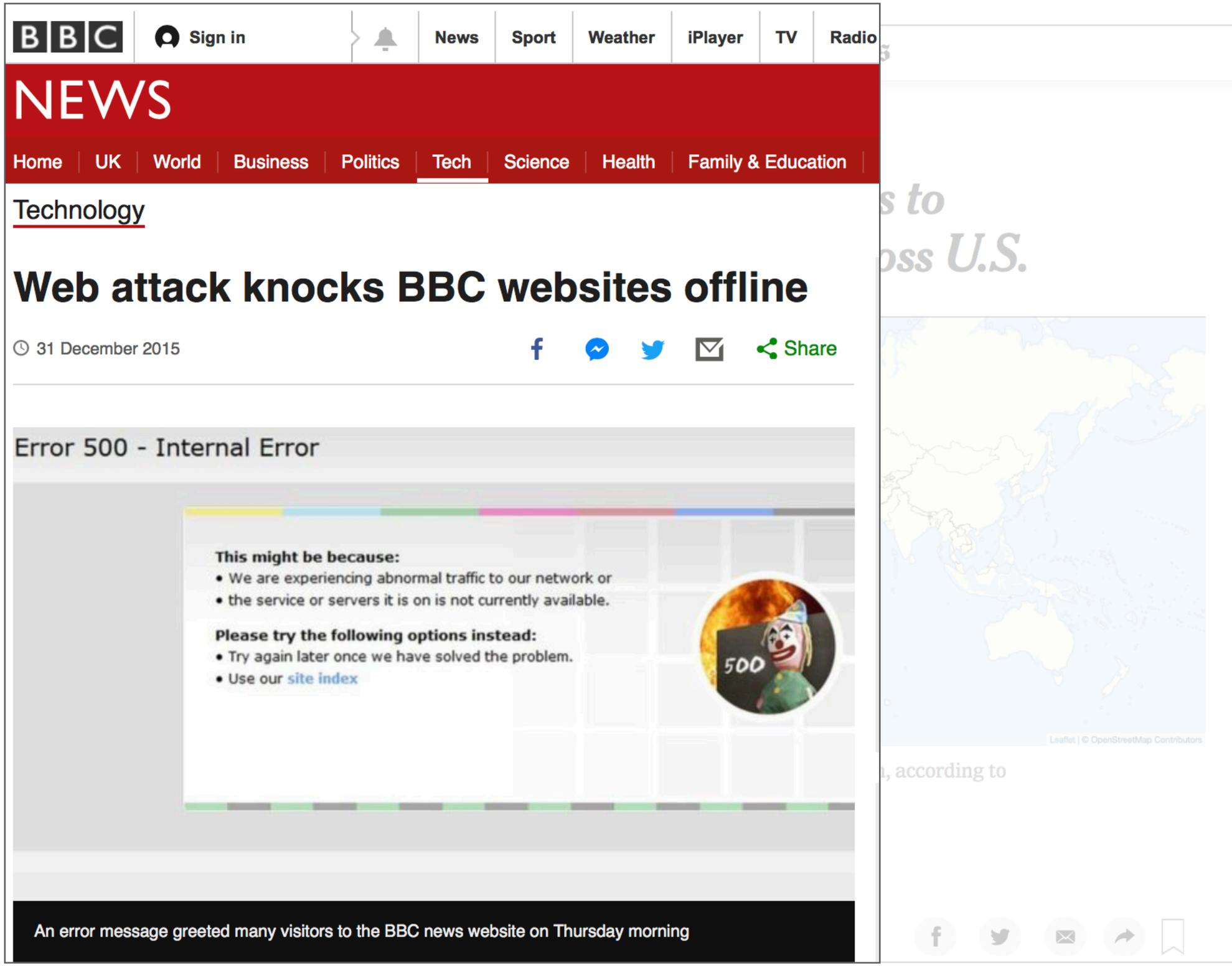


A map of the areas experiencing problems, as of Friday afternoon, according to downdetector.com.

By Nicole Perlroth

Oct. 21, 2016

… the big ones make the news, regularly



… the big ones make the news, regularly

BBC

NEW

Home | UK

Technology

Web at

31 December

Error 500

An error mess

WIRED

Technology | Science | Culture | Gear | Business | Politics | More

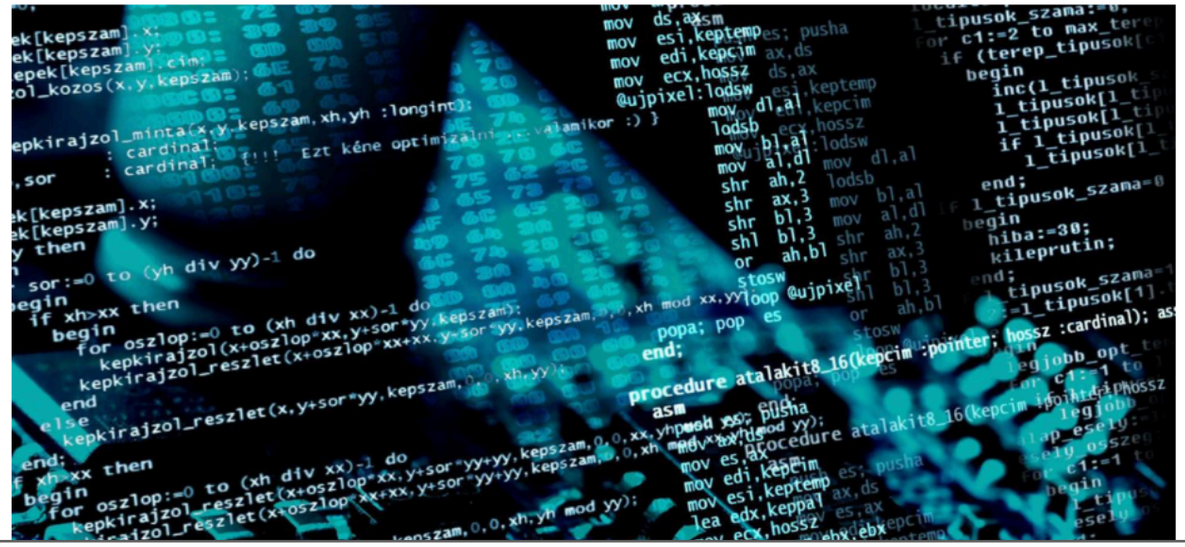
Hacking

UK is second most targeted nation for DDoS attacks

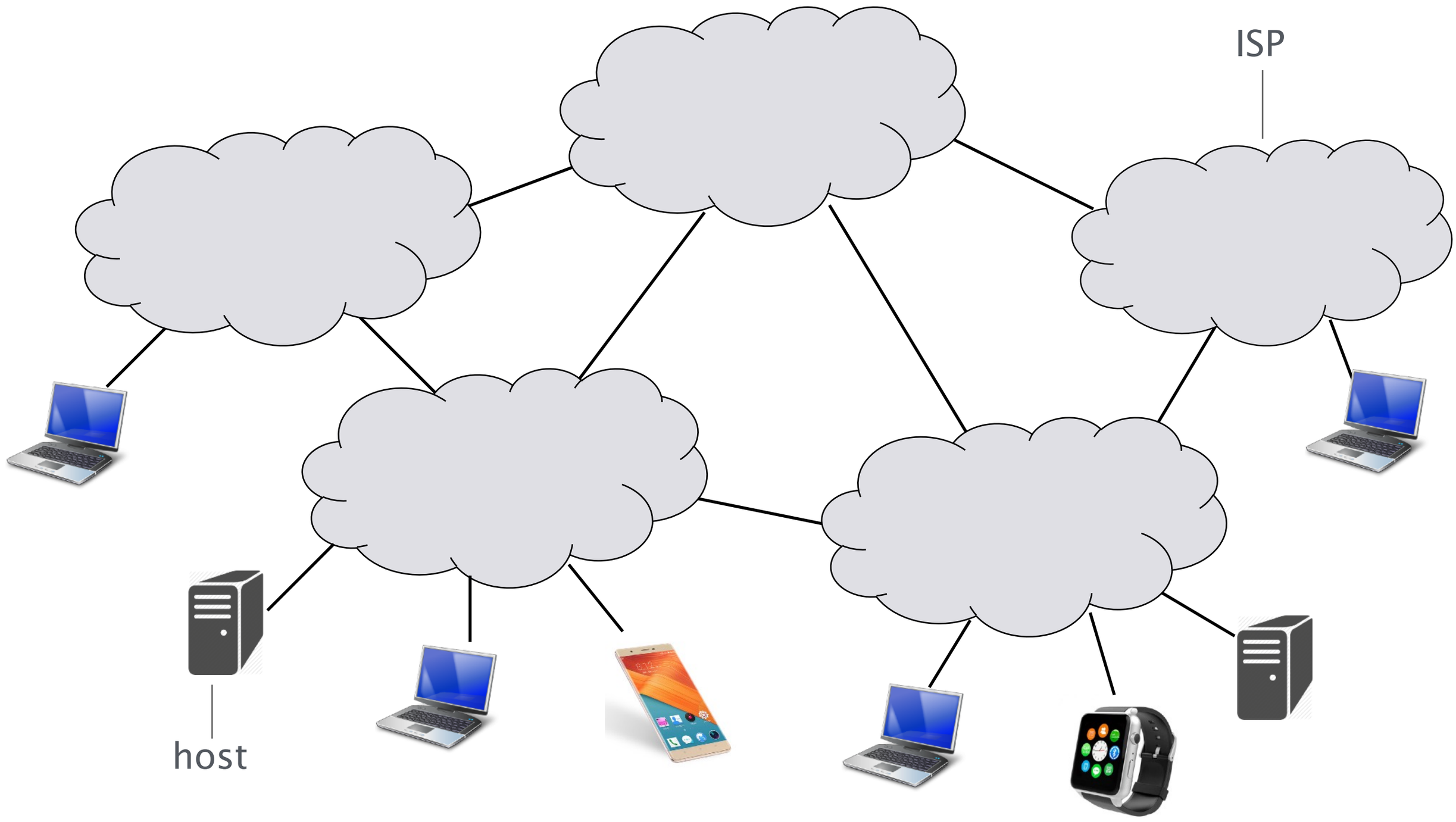
Only the United States is hit by more distributed denial of service attacks

By **MATT REYNOLDS**

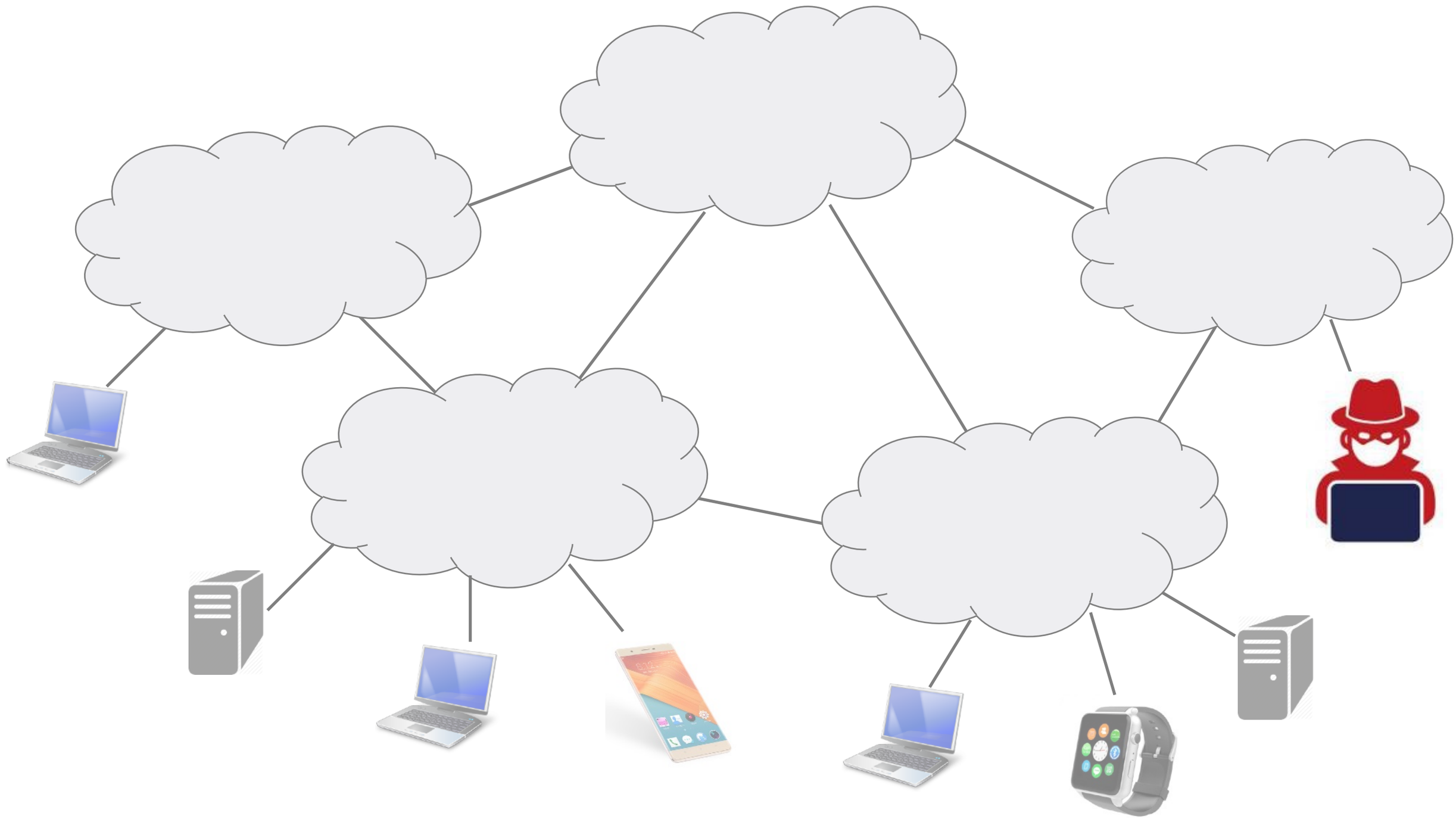
Wednesday 24 August 2016



DDoS thrives because attacks are easy and cheap

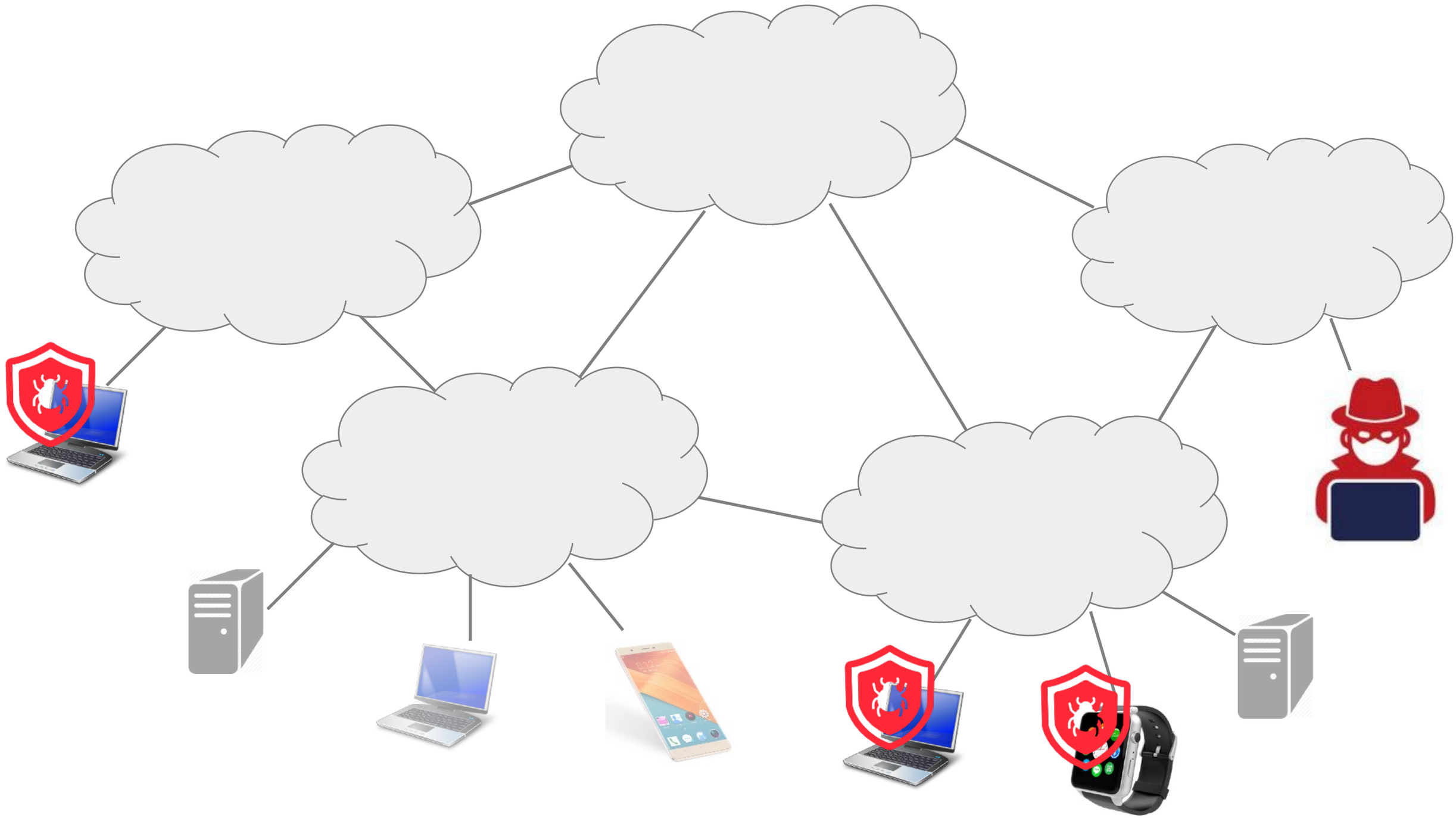


Malicious users can easily connect to the Internet

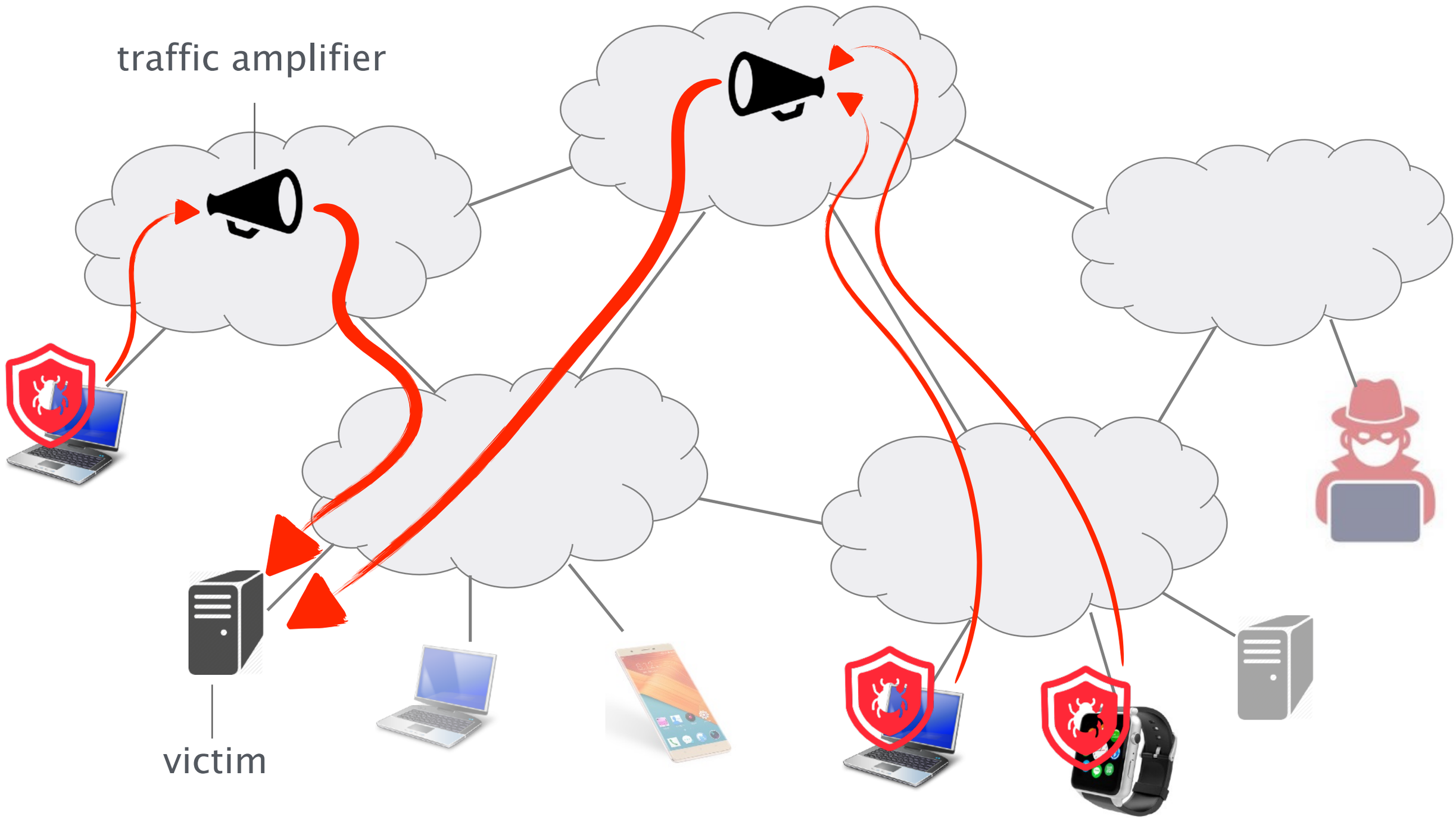


They can easily infect devices — e.g., think of IoT*

* G. Huston's great post blog.apnic.net/2015/04/30/the-internet-of-stupid-things/

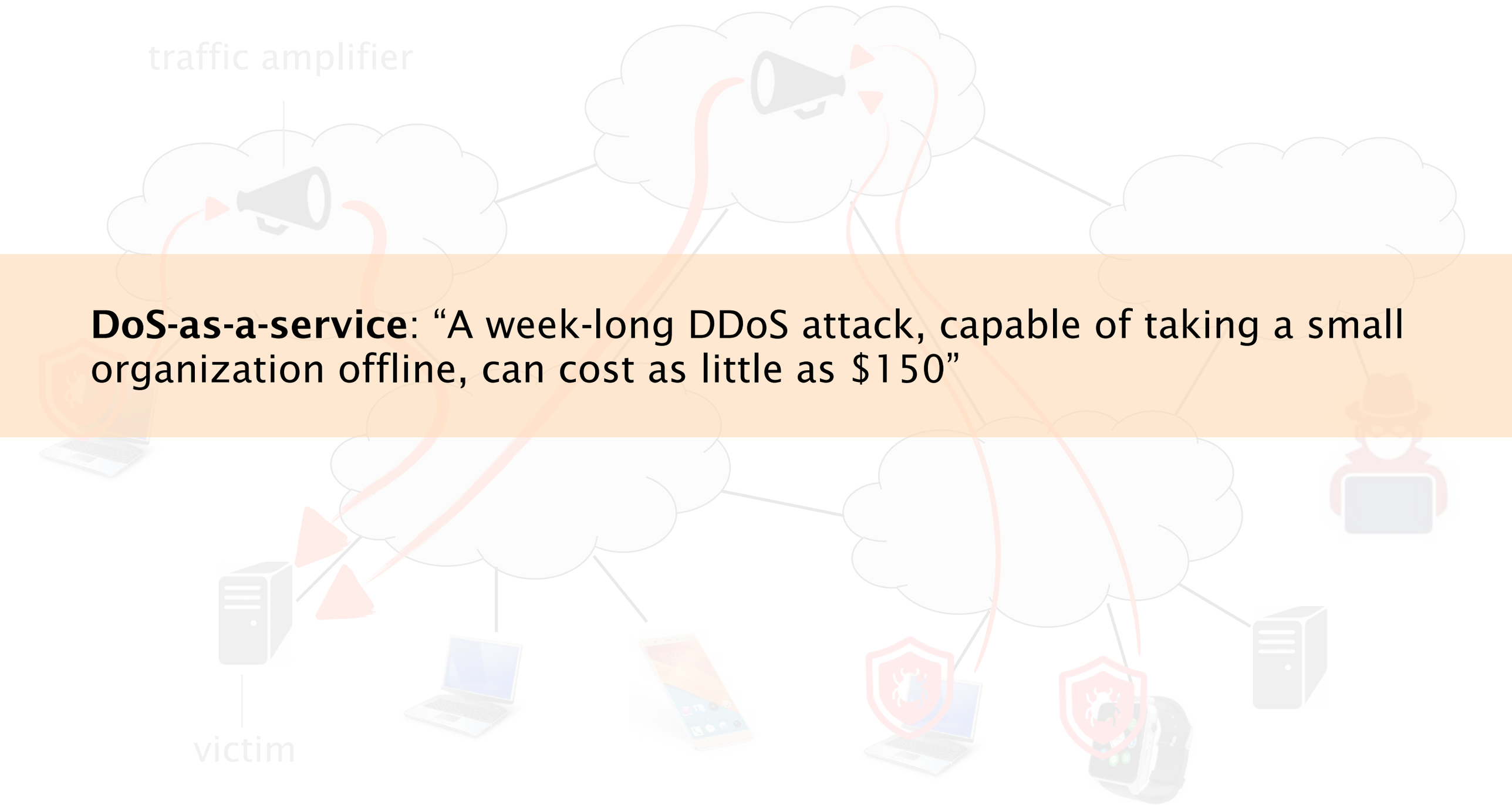


The infected devices are a botnet, ready to attack



Renting a botnet is cheaper than a train to Newcastle*

* “Man flies from Newcastle to London via Spain because it’s cheaper than the train” in Metro, Jun 2017



DoS-as-a-service: “A week-long DDoS attack, capable of taking a small organization offline, can cost as little as $150”

Isn’t the problem old?

- Still important
- **Still unsolved**

DDoS mitigation also makes the “news”

WIRED

GitHub Survived the Biggest DDoS Attack Ever Recorded

LILY HAY NEWMAN SECURITY 03.01.18 11:01 AM

GITHUB SURVIVED THE BIGGEST DDOS ATTACK EVER RECORDED

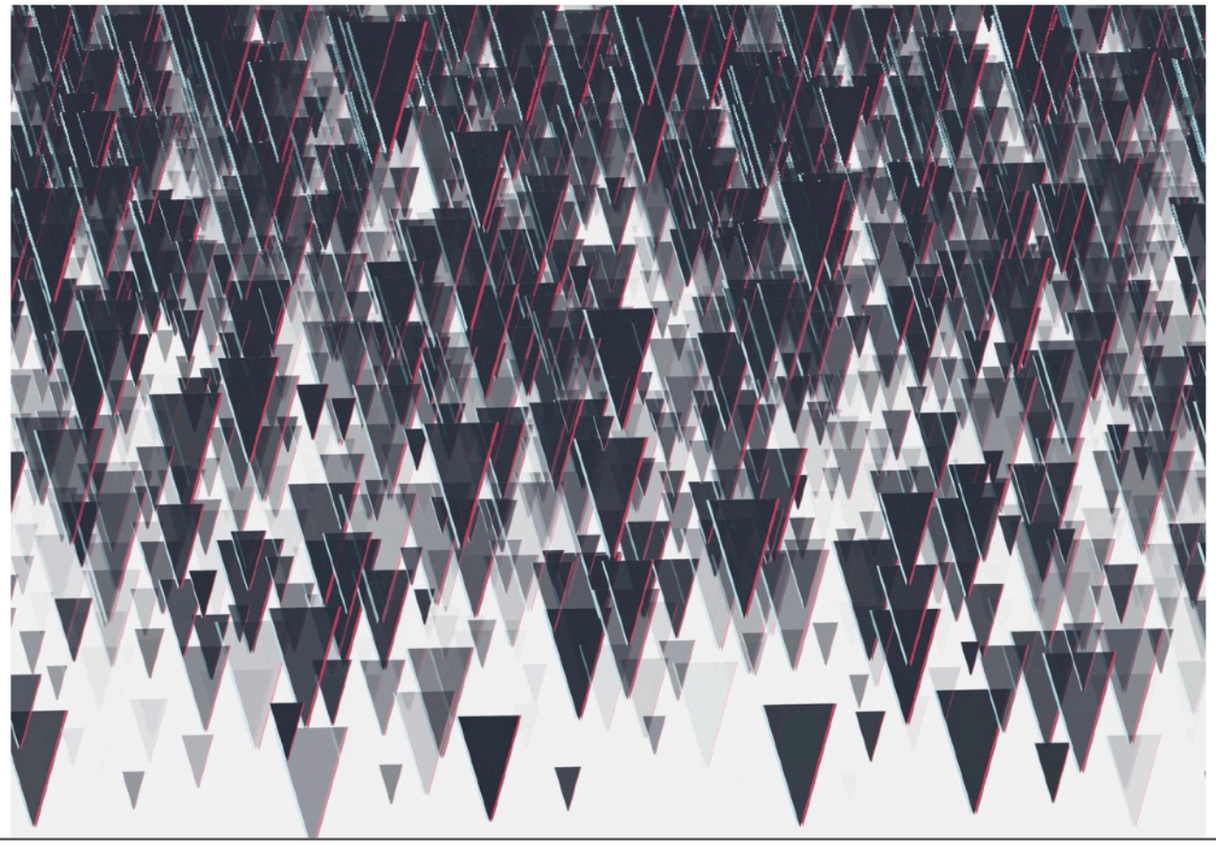
SHARE

SHARE 14009

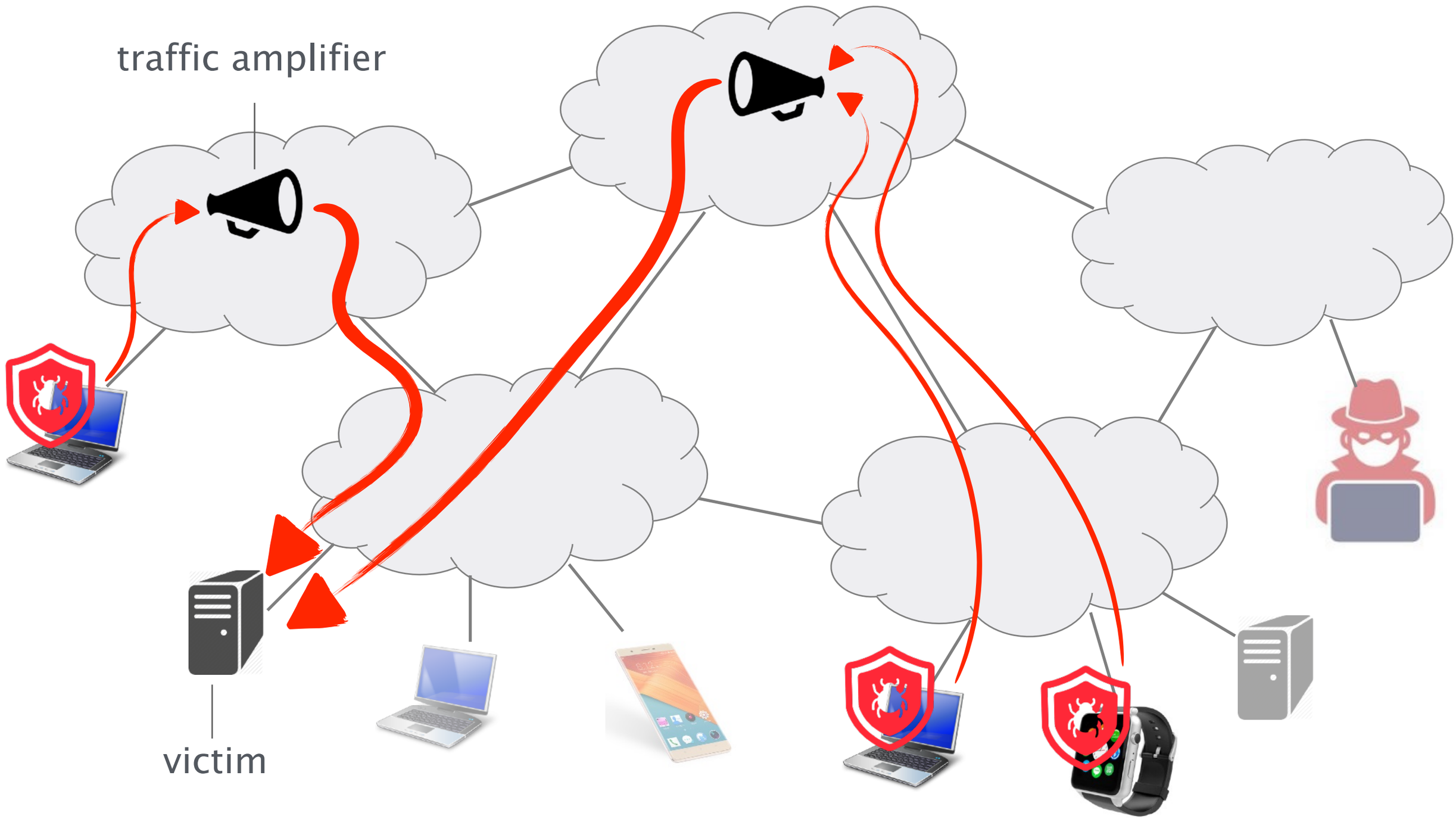
TWEET

COMMENT

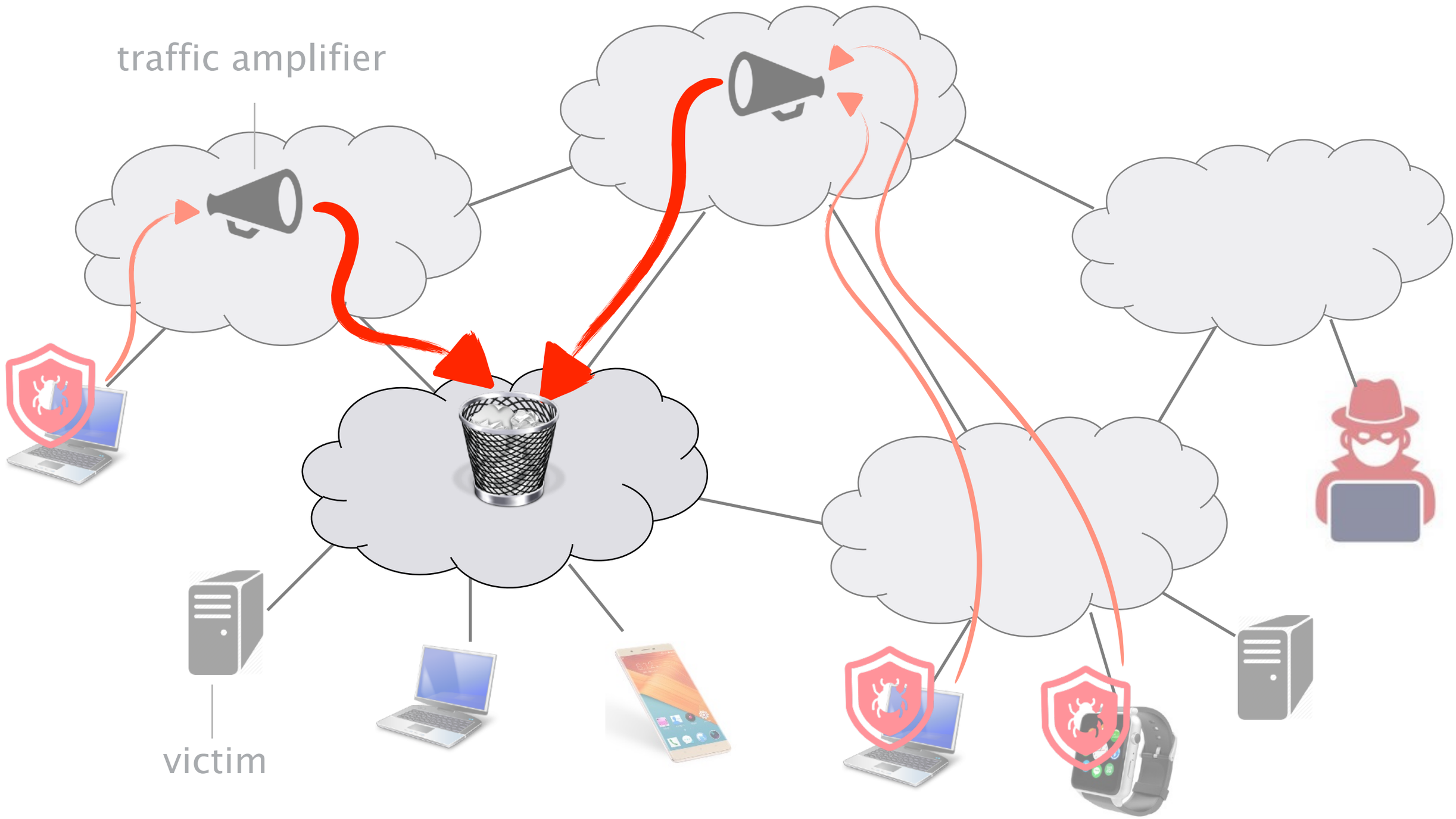
EMAIL



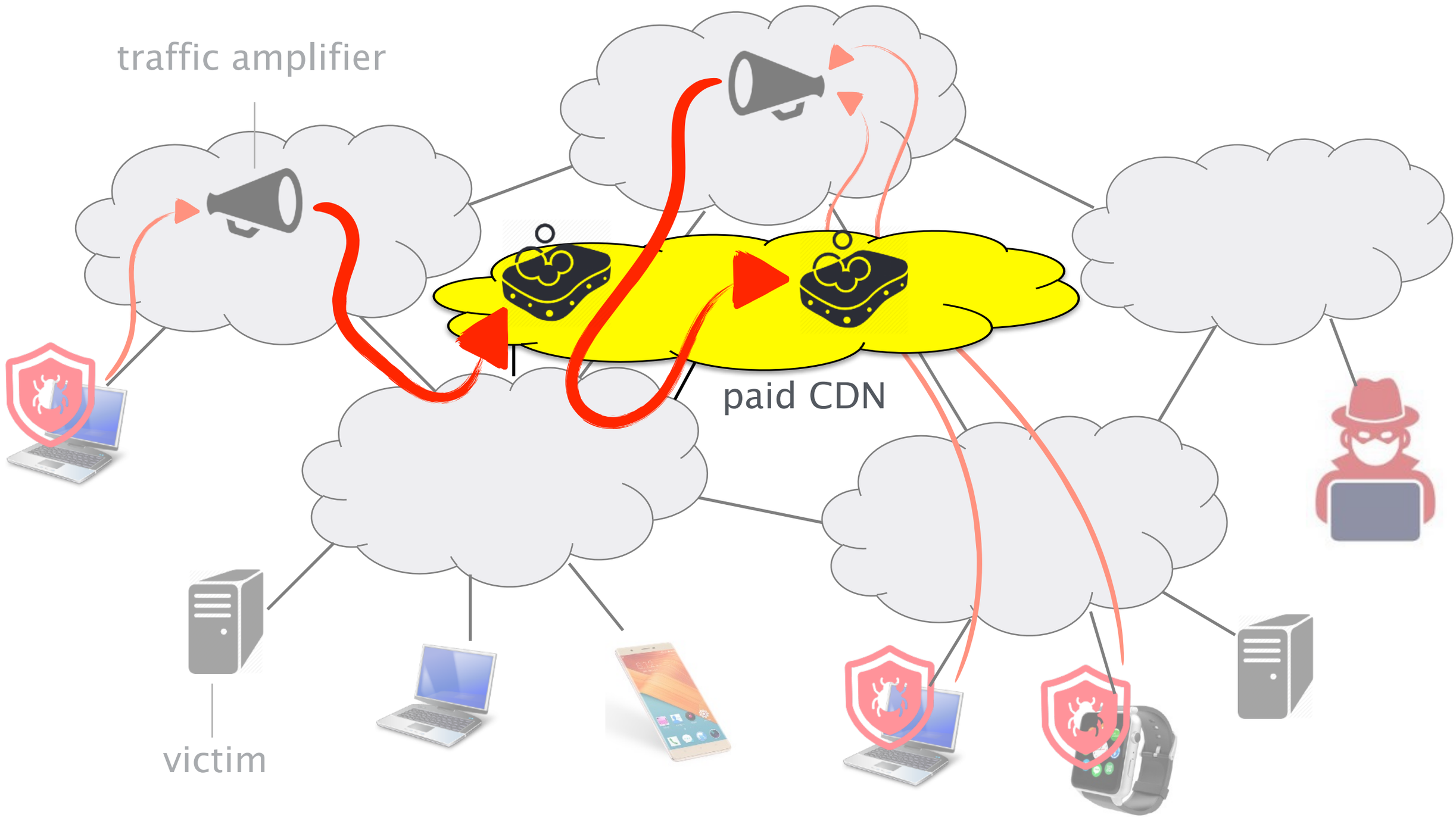
Let’s take back our DDoS example



Mitigation 1: Ask ISPs to drop all traffic



Mitigation 2: Pay reverse-proxy providers to scrub traffic



Current solutions may not be a great deal for victims

- Customers **pay fees,** plus **extras** for surge protection*
  protection may be more expensive than ransoms

- Dropping or scrubbing can **block legitimate** traffic
  DDoS can still affect service availability and reputation

* except Google's Project Shield and the very recent Cloudflare's Unmetered Mitigation

… and also have technical limitations

- **slow**: 3-5 hours *at least* to even detect attacks
  according to the Neustar 2017 survey

- Current solutions may not **scale** indefinitely
  attackers may potentially generate HUGE traffic volumes

- Current solutions are **not universal**
  e.g., can't block attacks to the network infrastructure

What if attackers are smarter and more tenacious?

(e.g., think of country-level attackers)

- Can evolve the attack over time
  e.g., pause and resume the attack after mitigation

- Can follow moving targets
  e.g., attack the new IP of a Web site, when updated

- Can focus on hard-to-mitigate attacks
  e.g., those on the network infrastructure

Isn’t the problem old?

- Still important
- Still unsolved
- **We can do better** *with programmable networks*

We can extract information from traffic behaviour

- The control-plane can track unexpected patterns

  e.g., links impossible to offload, unusual mixes of traffic type, …

- Example: reaction to traffic engineering (TE)

  provocation: maybe, this pile of TE work on minimising link utilisation is useful for security

We can extract information from traffic behaviour

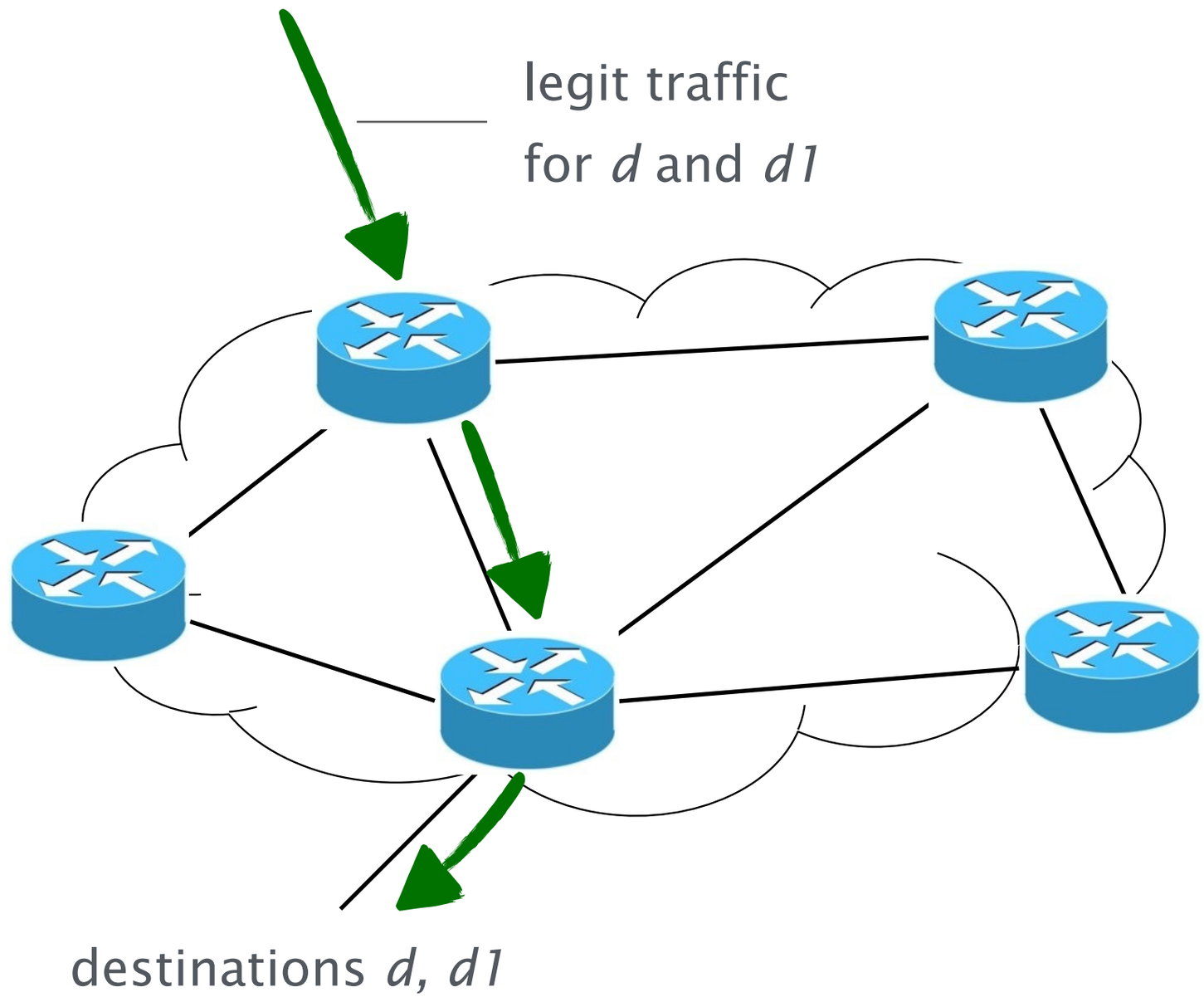
For better resource utilisation with TE, you may be interested in "On low-latency-capable topologies, and their impact on the design of intra-domain routing", to appear in SIGCOMM 2018

- Example: reaction to traffic engineering (TE)

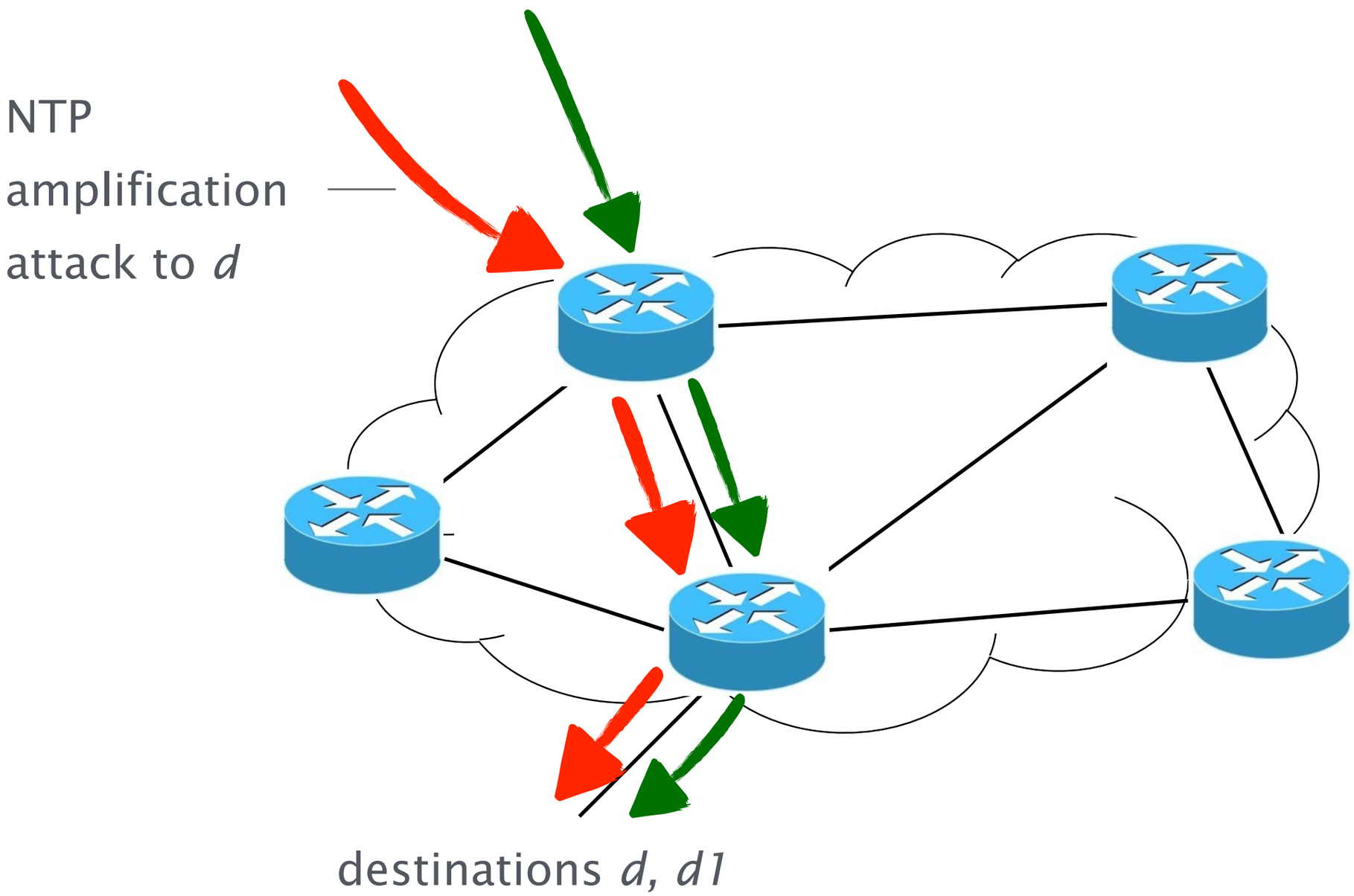
  provocation: maybe, this pile of TE work on minimising link utilisation is useful for security

Programmable networks can do even better

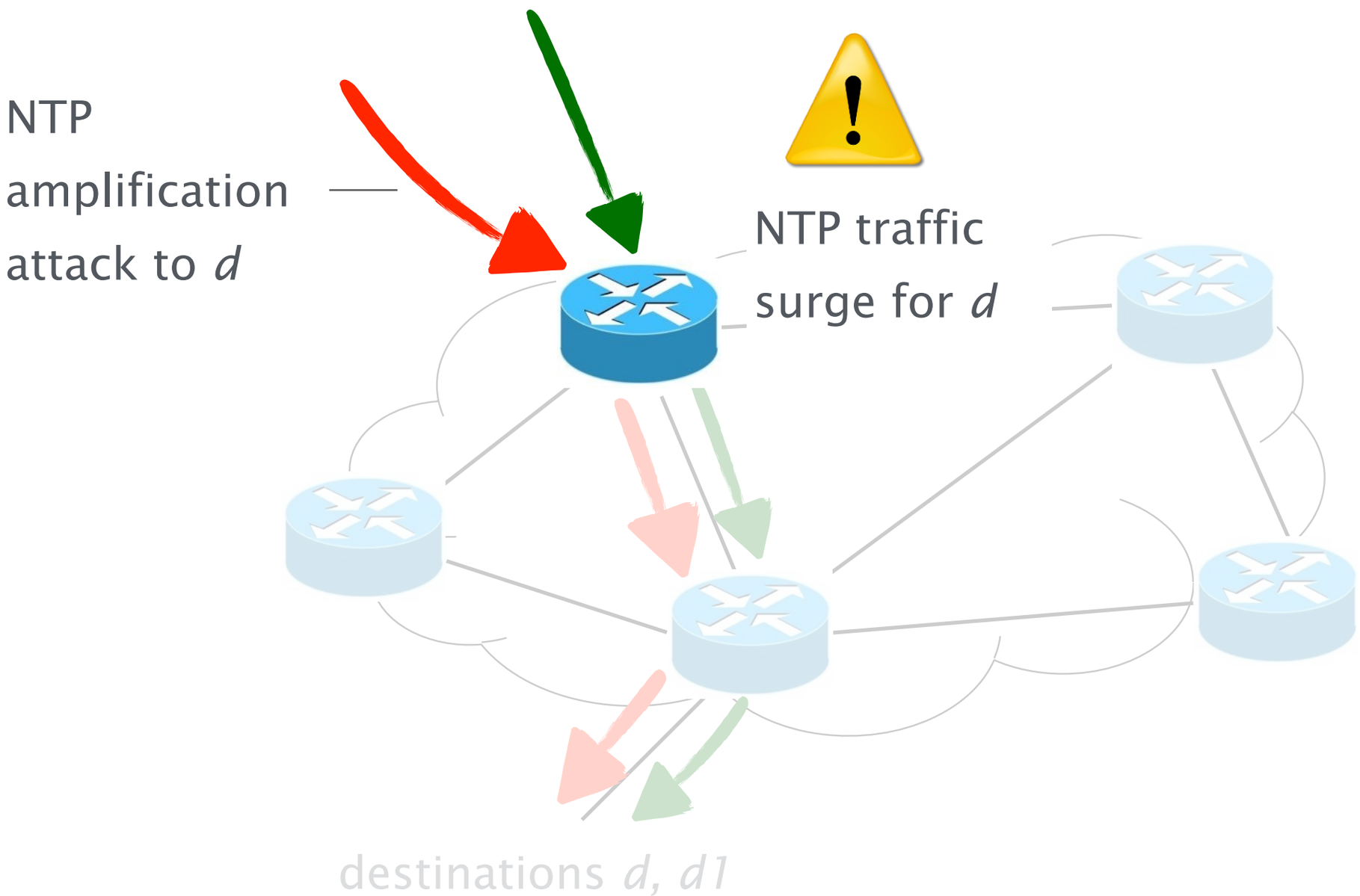
The control-plane decides traffic paths



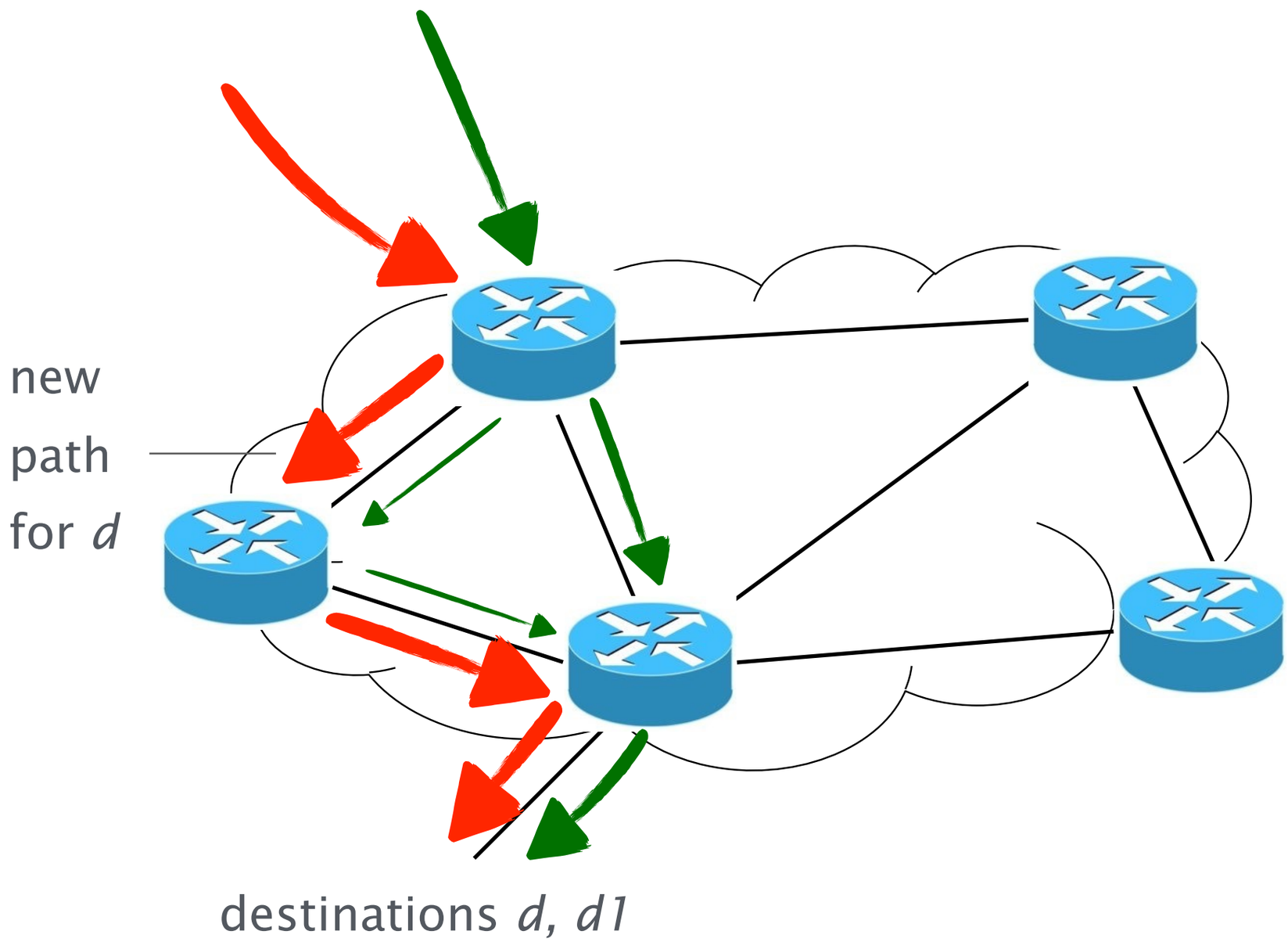
Currently, paths don't depend on traffic type



Programmable data-plane can raise custom alerts

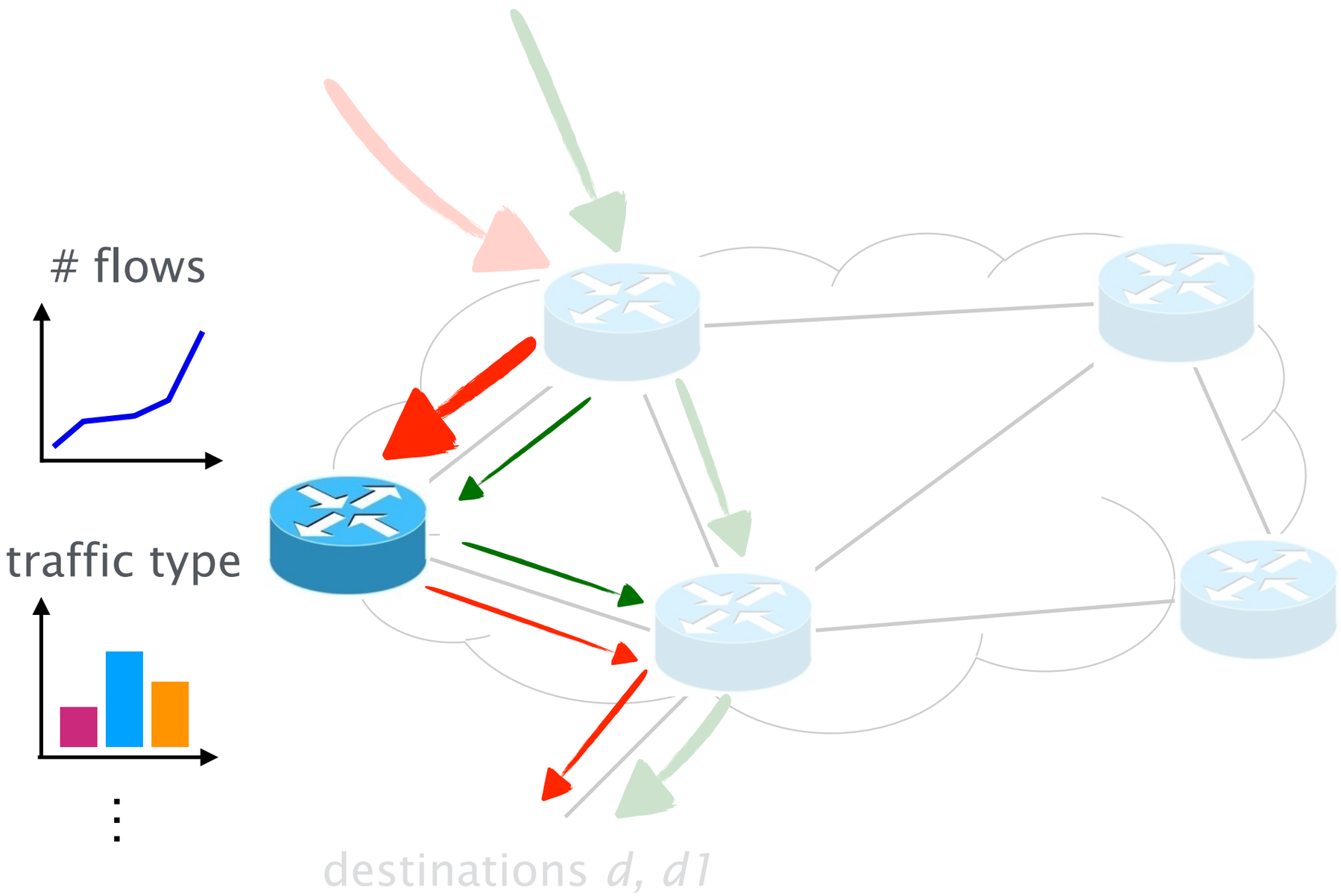


New control-planes can install attack-exposing paths

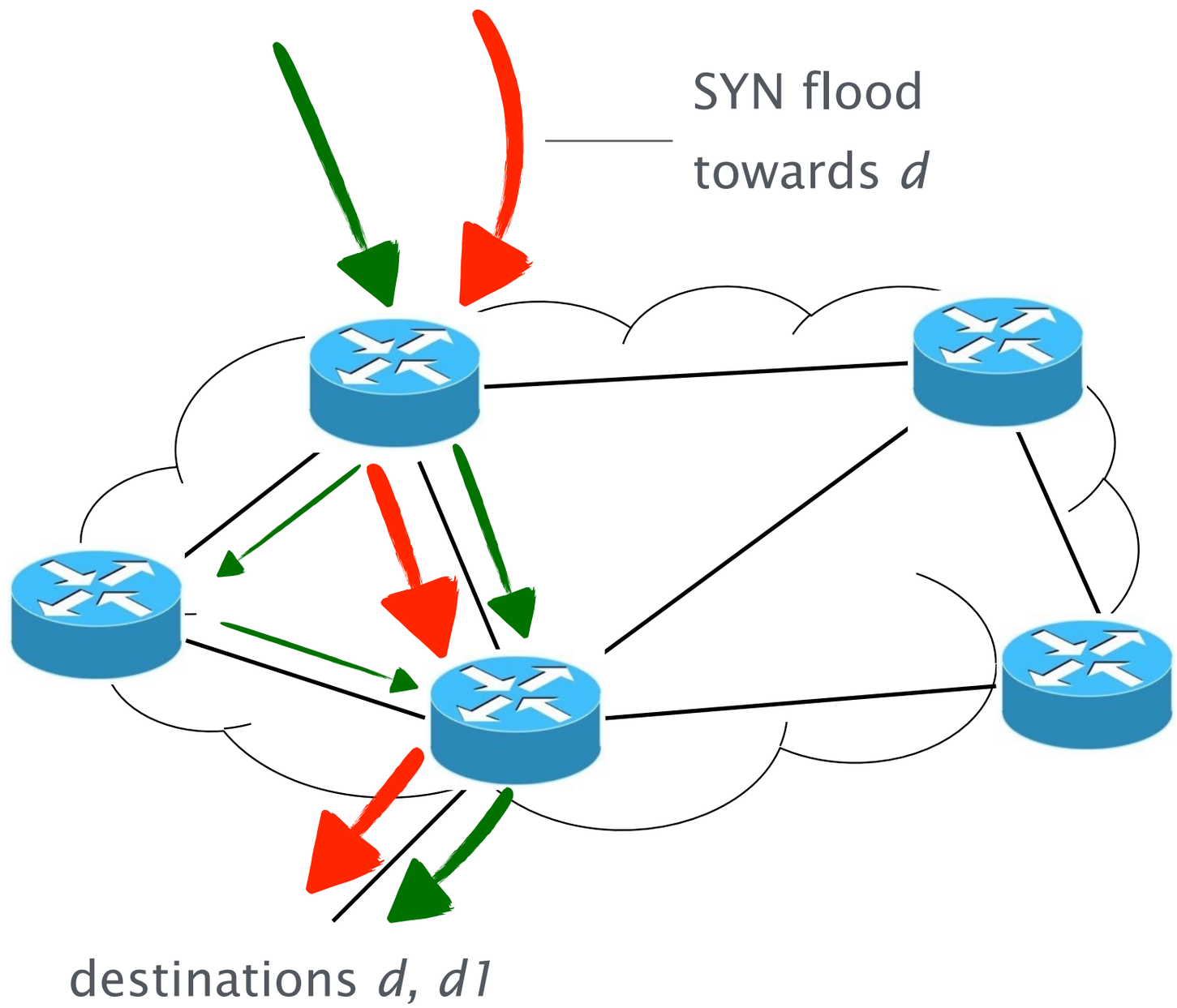


… and program the data-plane to further zoom in

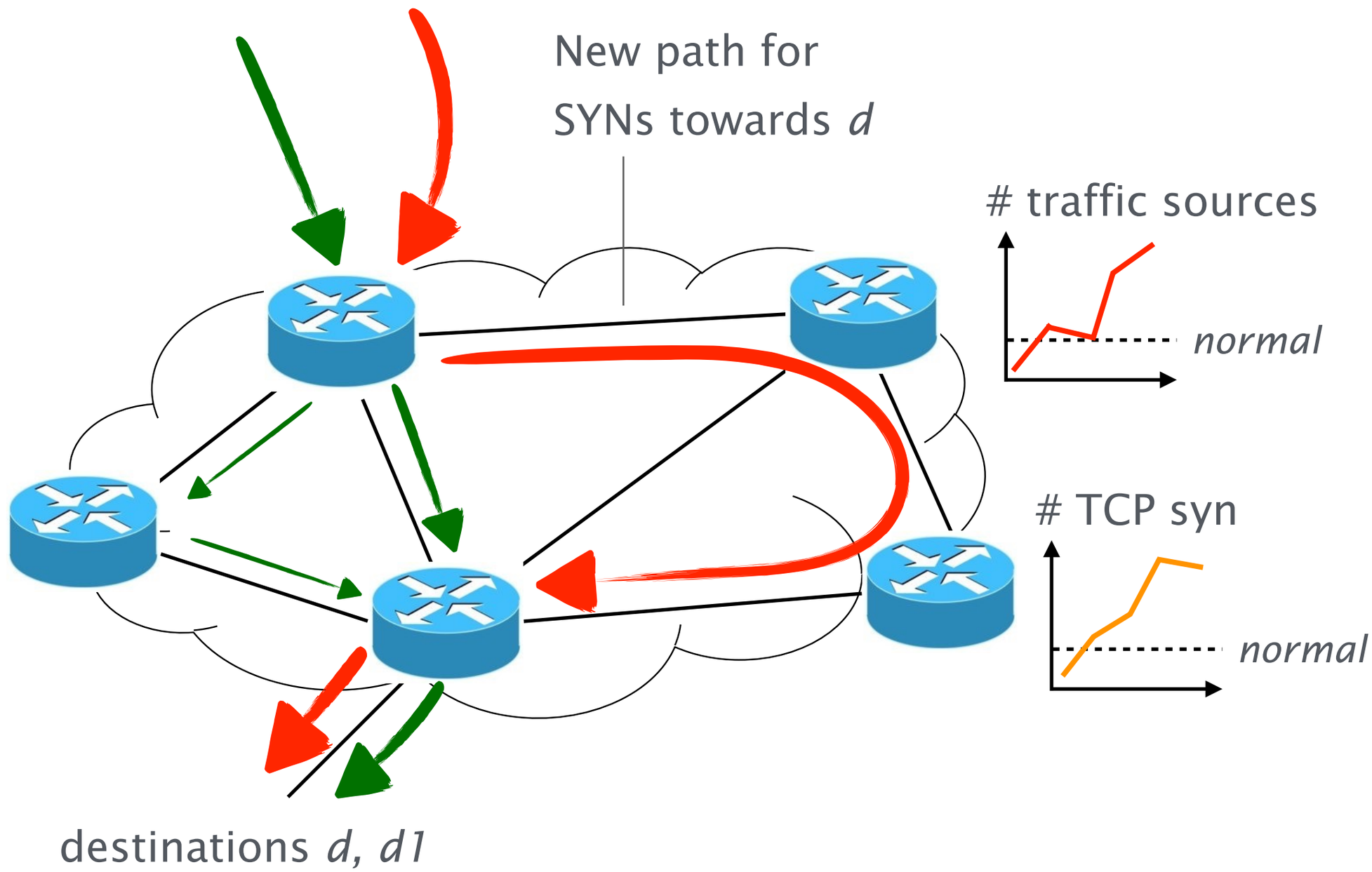
(to detect, characterise, mitigate the attack)



The attack can evolve, reacting to mitigation



Programmable networks can react again



The interesting questions remain open

- Monitoring: Which stats to monitor? How, where, at which level of granularity? How to quickly and scalably zoom in/out on some traffic?
- Algorithms: How to select paths? Can the path selection avoid to affect non-DDoSed traffic? How to avoid oscillations in path decisions?
- System: How fast can the system be? When to look for an attack, and when to declare an attack finished? Can the system itself be DDoS-ed?
- Approach: Which other possibilities are opened by programmability? For example, can a defender create disincentives for attackers during an attack?