

Solving DDoS Attacks by Standing on the Shoulders of Giants*

DDoS Clearing House, DDoSDB, DDoS Dissector, DDoS Fingerprint and Converters

1 INTRODUCTION

Distributed Denial of Service attacks exist since the beginning of the Internet. The goal of these types of attacks is to make target systems (services, devices, or even entire networks) unreachable to its intended users. Over time, these types of attacks increased in frequency and intensity. In 2011, the peak record was reported as 60Gb/s [1], in 2015 it was 500Gb/s [2], and in 2016 was 1.1Tb/s [3]. As the dependency of our society to online service also increased, the damage caused by DDoS attacks has become extremely big. While in 2015 large corporations reported the average loss of \$US410,000 per attack [4], in 2017 this figure increased to \$US2,500,000 [5].

There are hundreds of companies worldwide offering DDoS protection and a large volume of academic work on DDoS attacks. Overall, DDoS attacks have been addressed as a reactive approach, waiting for attacks to hit a network infrastructure and see whether (i) the usual anomaly-based detection/mitigation solution works, or (ii) the network operators are skilled enough to mitigate the attack as fast as possible, or (iii) by simply paying more to third-party companies for having more network capacity and better protection. From the academic side, by the end of February 2019, Google scholar returned more than 47 thousand works on ‘ddos attack’.

The question that we intend to discuss in this paper is **why and how (we believe), together, we can solve DDoS attacks?** The answer is technically simple and it is **not** by “reinventing the wheel”, instead, facilitating filling the gaps of existing solutions and stakeholders (e.g., victims, network operators, network security community, network security companies, law enforcement agencies, and the academic community). What we propose is a proactive approach that any stakeholder involved with a DDoS attack would benefit and trust.

Overall, we propose to facilitate: (1) victims, (2) network operators, and (3) network security companies to share their attack measurements (filtered and properly anonymized) and to get in return specific rules for detecting and mitigating those attacks based on the already in-place solutions; (4) law enforcement agencies to compare attacks suffered in the society, for enabling legal attribution and prosecution of attackers (and buyers of attacks); (5) network security

community (specially CERT/CSIRT) to get frequent feeds with IP addresses involved in attacks, towards preventing misused machines from performing attacks; and (6) the academic community on getting real/‘fresh’ DDoS attack data for testing and improving their solutions. For satisfying these six stakeholders, we propose and extensively validate the following three elements:

- **DDoS Dissector**: is a tool for analysing any type of network trace containing a DDoS attack (for example, pcap, pcapng, netflow, ipfix, sflow, and apache log), filter only the main characteristics of the attack, called **DDoS fingerprint**, and enable to share only the DDoS fingerprint and the anonymized version of the filtered attack. The requirements, the design and the validation of the tool is presented at section 2;
- **DDoS Fingerprint Converters**: is a set of tools for parsing the generic DDoS fingerprints into specific detection and mitigation technologies, for example, BGP Flowspec, eBPF, IPtables, SNORT, SURICATA, BRO, ModSecurity, and even ‘black-boxes’ from private security companies. An additional, and very important tool added to this set of converters, called **DDoS Mitigation Impact Quantification**, is responsible to validate and adapt detection and mitigation rules. The descriptions and explanations are presented at section 3;
- **DDoS Database (DDoSDB)**: is a distributed database that receives, enriches, distributes, and make available: filtered anonymized attack traces, DDoS fingerprints, signatures/rules for specific hardware/software detecting/mitigating DDoS attacks, lessons learned from network operators, information from law enforcement agencies and feeds for CERT/CSIRT to sanitize their networks. The requirements, the design and the validation of the tool is presented at section 4.

After we describe the DDoS Dissector, the DDoS Fingerprint Converters, and the DDoS Database (DDoSDB), we introduce what we call as **DDoS Clearing House** in section 5. Only at that point we put all the pieces together and show how we have deployed ??? instances of the DDoSDB, collected more than ???, and benefit more than ??? organizations. The development of the tools are available at

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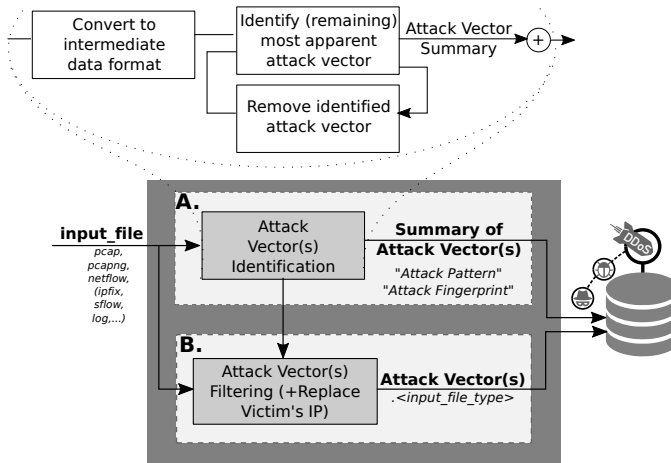


Figure 1: A picture of a gull.

<https://github.com/ddos-clearing-house> and the public version of DDOSDB is available at <https://ddosdb.org>.

2 DDOS DISSECTOR

There are several words used by the academic and security community for defining DDoS attack fingerprint. The words are DDoS ‘characteristics’, ‘fingerprint’, ‘profile’, ‘pattern’, ‘signature’, and ‘rule’. Oxford dictionary defines these words as the following.

- **characteristics**: “a feature or quality belonging typically to a person, place, or thing and serving to identify them”;
- **fingerprint**: “a distinctive identifying characteristic”;
- **profile**: “a graphical or other representation of information relating to particular characteristics of something, recorded in quantified form”;
- **pattern**: “a regular and intelligible form or sequence discernible in the way in which something happens or is done”;
- **signature**: “a distinctive pattern, product, or characteristic by which someone or something can be identified”;

- **rule**: “a principle that operates within a particular sphere of knowledge, describing or prescribing what is possible or allowable”;

Requirements:

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3 DDOS FINGERPRINT CONVERTERS

4 THE DDOSDB

More than a database with DDoS attack fingerprints.

Requirements:

- flexible regarding the number and types of fields;
- flexible access control
- distributed fashion;
- enrich the fingerprint;
- facilitate queries;
- enable download of fingerprints and anonymized data;
- facilitate notification;
- distribute information;
- upload information from only from trusted parties;

5 DDOS CLEARING HOUSE

6 CONCLUSION

DDoS attacks are not likely to stop occurring. However, we strongly believe that an community effort would extinguish the

REFERENCES

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