Tracking Unsafe Services that are Hosted by Bots using IP Reputation

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Agenda

1 Introduction & System Overview

2 Analysis & Takeaways

Akamai

Introduction

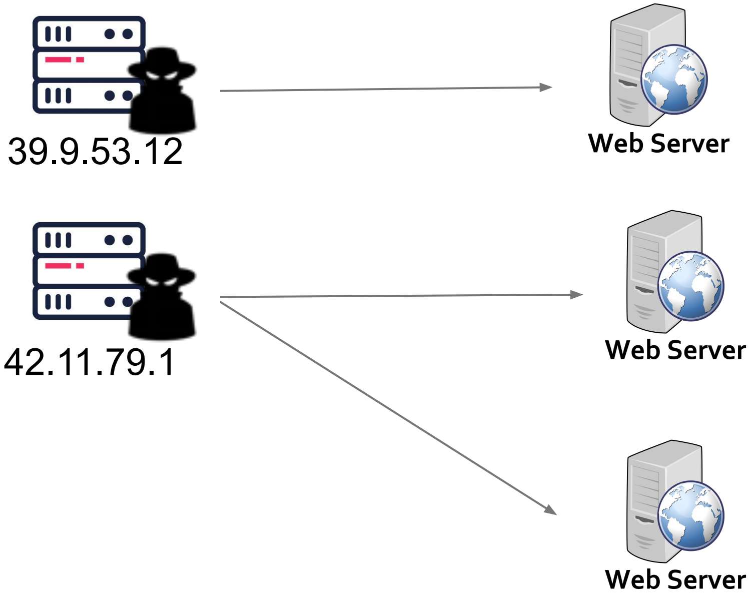
Account Takeover (ATO)

SQL-Injection (SQLi)

Remote File Inclusion (RFI)

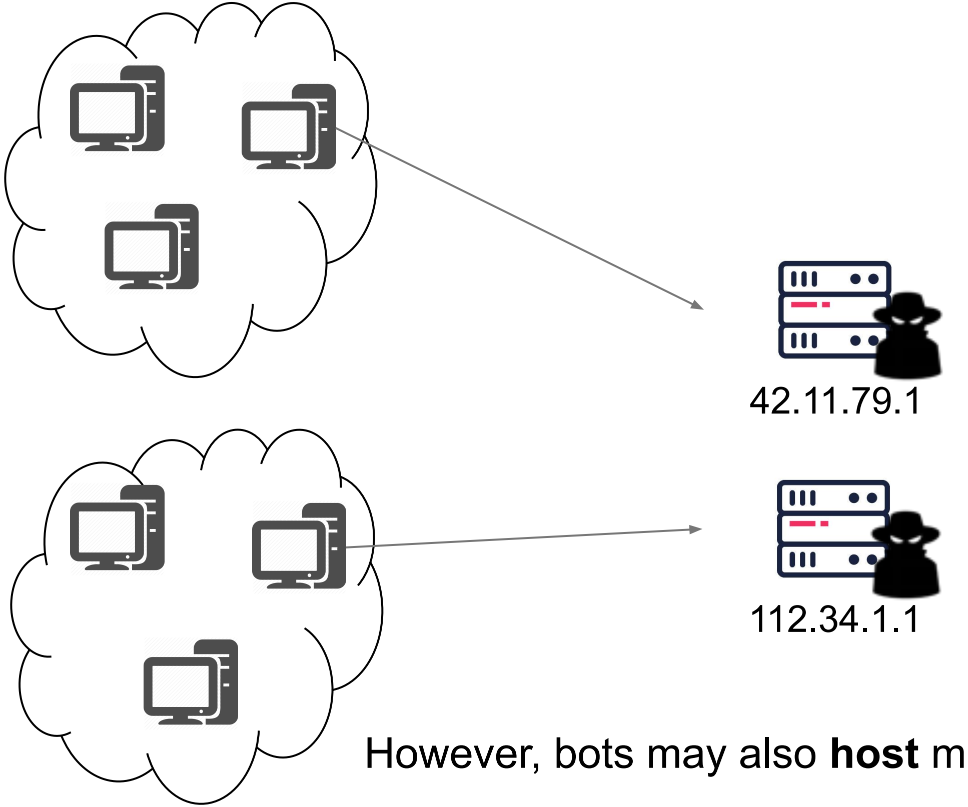
Cross-Site Scripting (XSS)

Distributed Denial-of-Service (DDoS)



Bots are commonly controlled to **deliver** attacks against external services

Introduction



Phishing

Scams and Fraud

Skimmers (Formjacking)

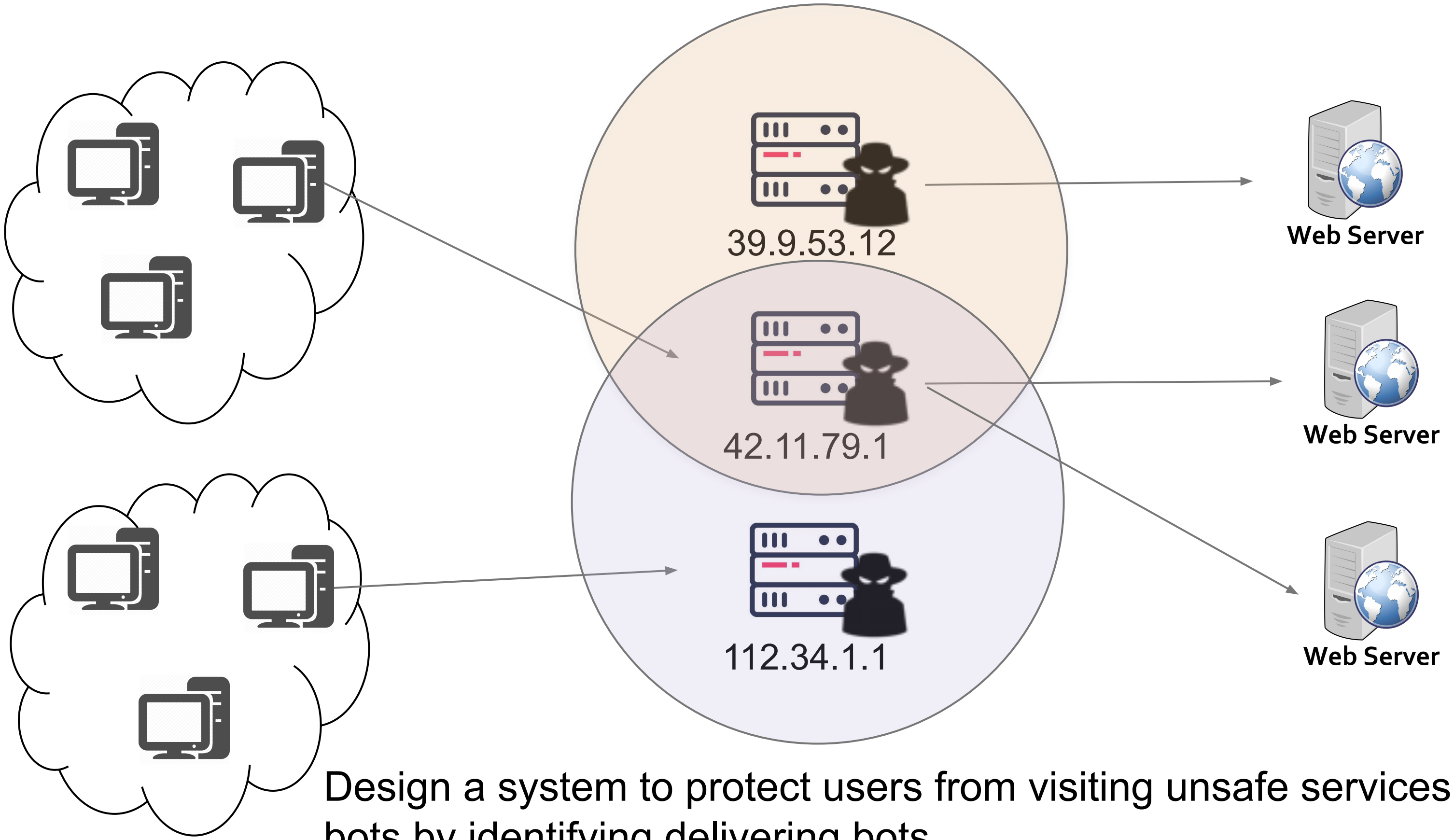
Drive-By Attacks

Callhome Communication

Data Exfiltration

However, bots may also **host** malicious content on behalf of a botmaster

Motivation



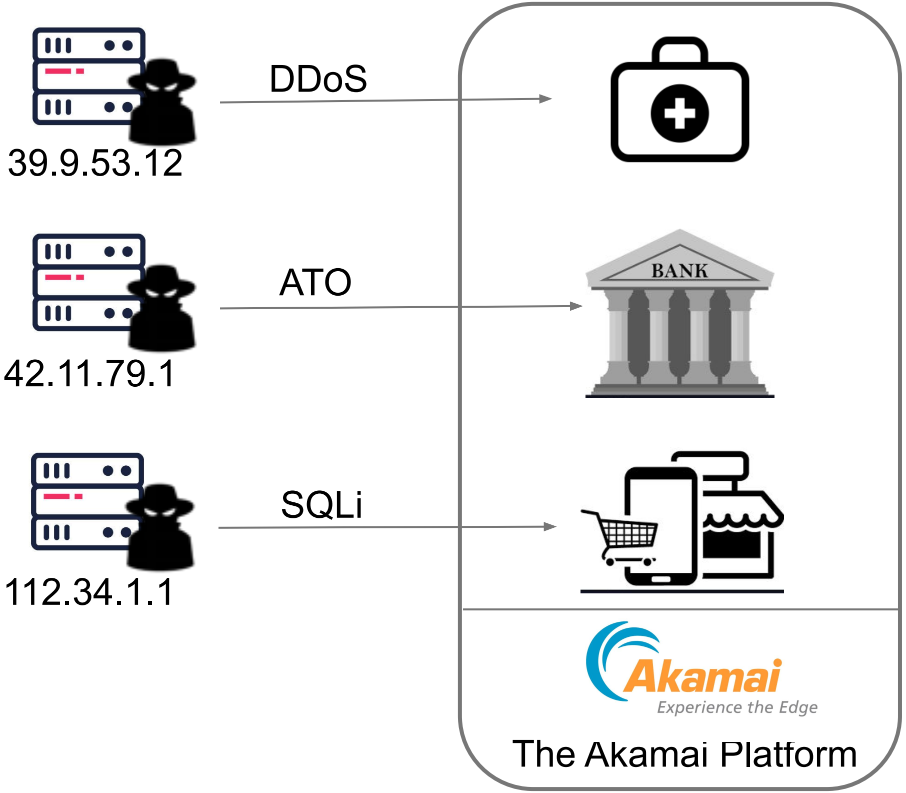
Design a system to protect users from visiting unsafe services hosted on bots by identifying delivering bots

Background: IP Reputation

BANK
Akamai
Experience the Edge

The Akamai Platform

Background: IP Reputation

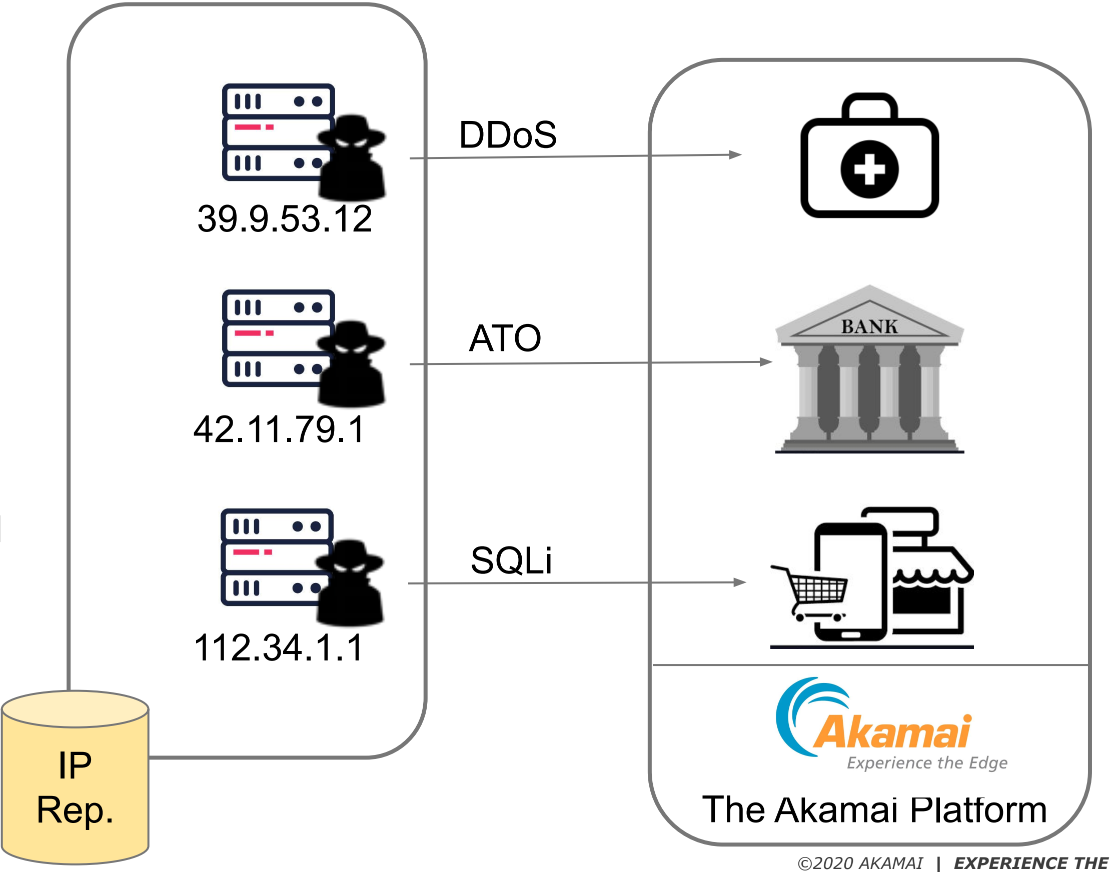


Background: IP Reputation

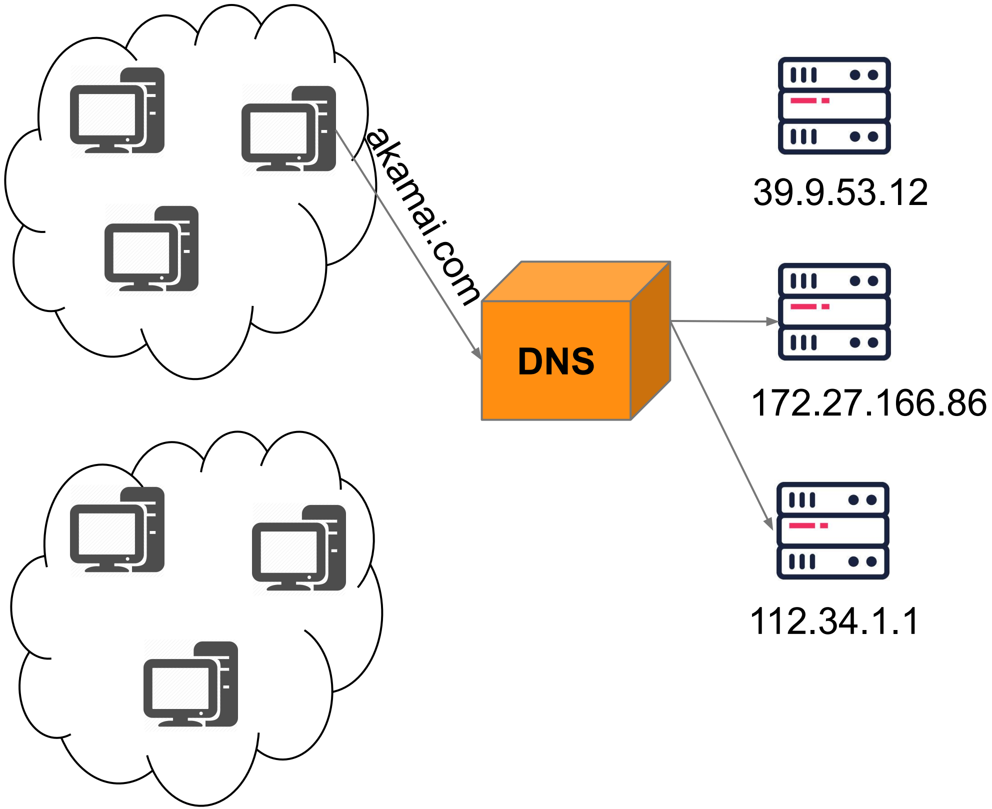
- Akamai CDN hosts 30% of the world's web content, and is accessed by more than 1.3B devices daily

- Akamai Client Reputation (CR) system provides accessing devices with a reputation score

- Devices that carry attacks against websites on the CDN (e.g., D-DoS) receive a low IP reputation score and can be regarded as delivering bots



Background: Domain Name System (DNS)

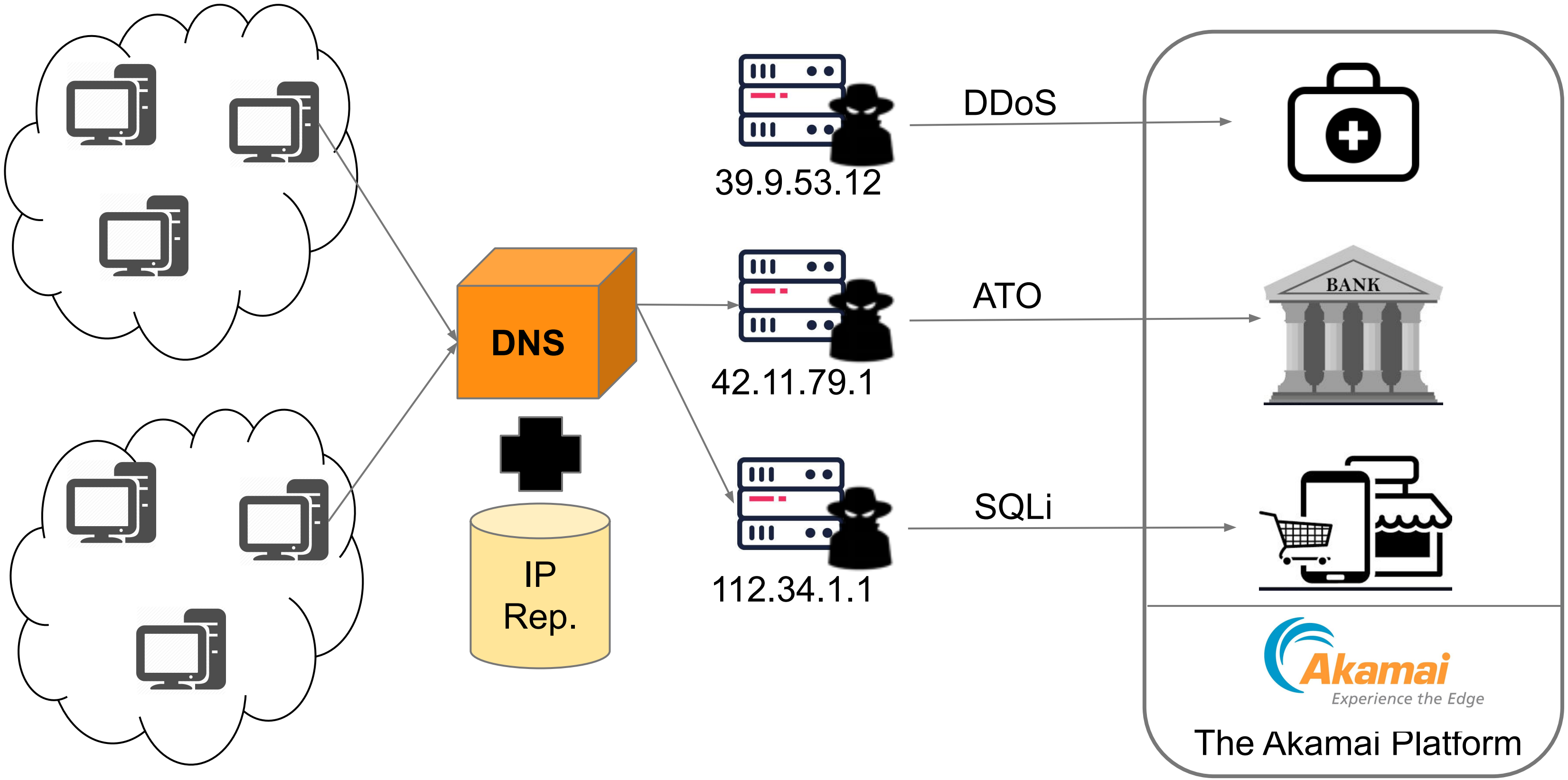


- The DNS protocol to translates human-memorable domain names into Internet-routable IP addresses (e.g., akamai.com to 172.27.166.86)

- Akamai processes >2.2T DNS queries / day

- DNS resolvers can apply security policies on their queries and responses. For instance: don’t translate domain names that resolve to known bots

DNS + IP Reputation to Track Services Hosted on Bots



DNS + IP Reputation to Track Services Hosted on Bots

- The proposed system has two steps

- **Identify IP addresses of bots**: using IP reputation

- **Track services hosted on bots**: in DNS traffic the service (i.e., domain) is hosted on a bot IP, and that IP is not used by any other services for the past 14 days

Analysis & Takeaways

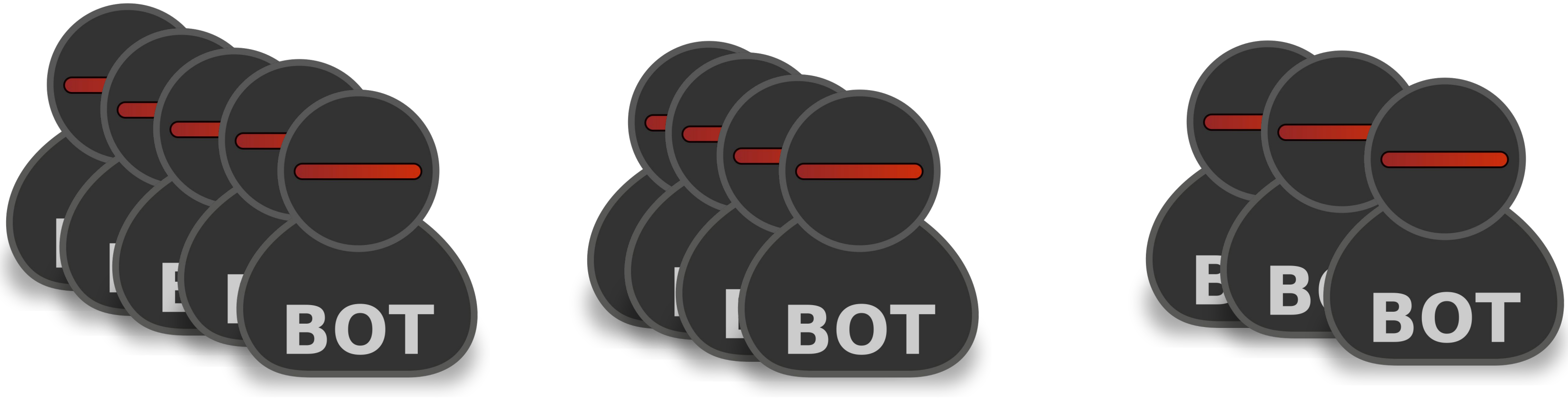
Research Questions for Analysis

- 1. What malicious content is typically hosted on bots ?

- 2. What novel threats are discovered by the system?

Datasets: Bots

- **DS - IP reputation (CDN)**: 737k IP addresses engaged in inbound attacks
  - 721k bots involved in credential abuse and ATO (97.8%)
  - 11k bots involved web attacks such as: SQLi, RFI or XSS attacks (1.5%)
  - 6k bots involved in DDoS attacks (0.7%)



Datasets: Services Hosted on Bots

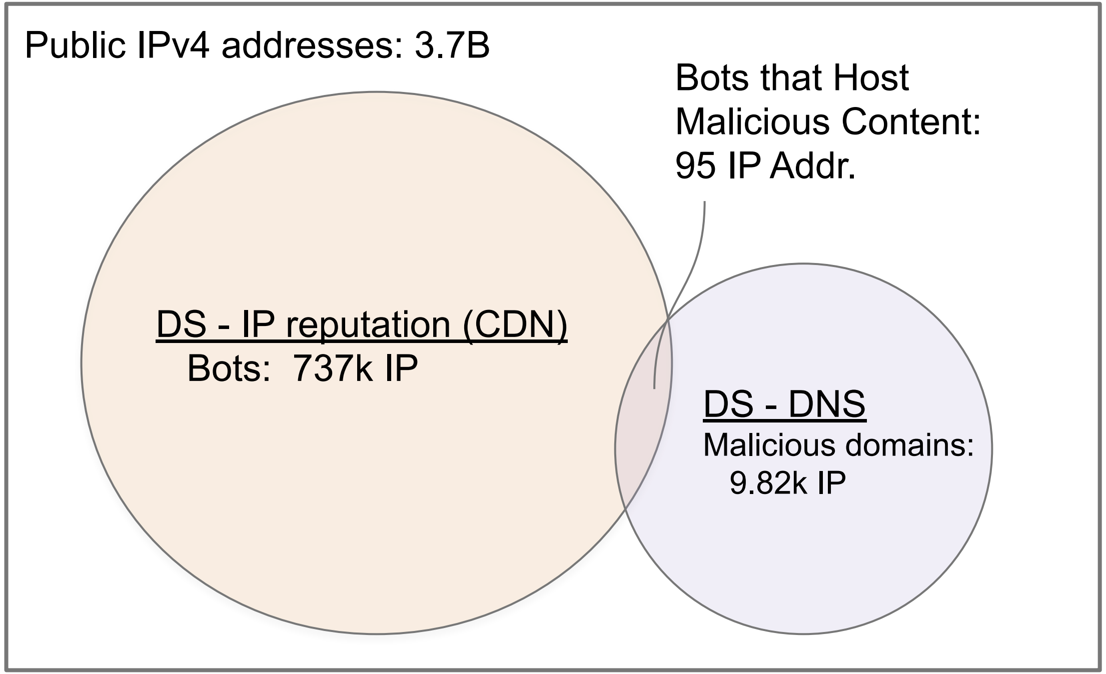
- **Two weeks** of sampled Enterprise DNS traffic with 11B DNS queries / day

- Unique second-level domains: 11.1M (100%)
  - Resolved to a single IP address: 7.87M (70.9%)
  - Resolved IP is unique: 1.66M (14.95%)
  - Identified as outbound attacks: **9.82k (0.1%**)

- **DS - DNS**: **9.82k** domains (100%) with a single and unique IP
  - 4.30k domains that host phishing campaigns (37.97%)
  - 6.26k domains that host malware (55.34 %)
  - 0.76k domains that are used for call home communications (6.69%)

Prevalence of Bots Hosting Malicious Content

~1% of all malicious content (i.e., outbound attacks)
are also involved in inbound attacks (ATO, SQLi, DDOS…)



Public IPv4 addresses: 3.7B

Bots that Host
Malicious Content:
95 IP Addr.

DS - IP reputation (CDN)
Bots: 737k IP

DS - DNS
Malicious domains:
9.82k IP

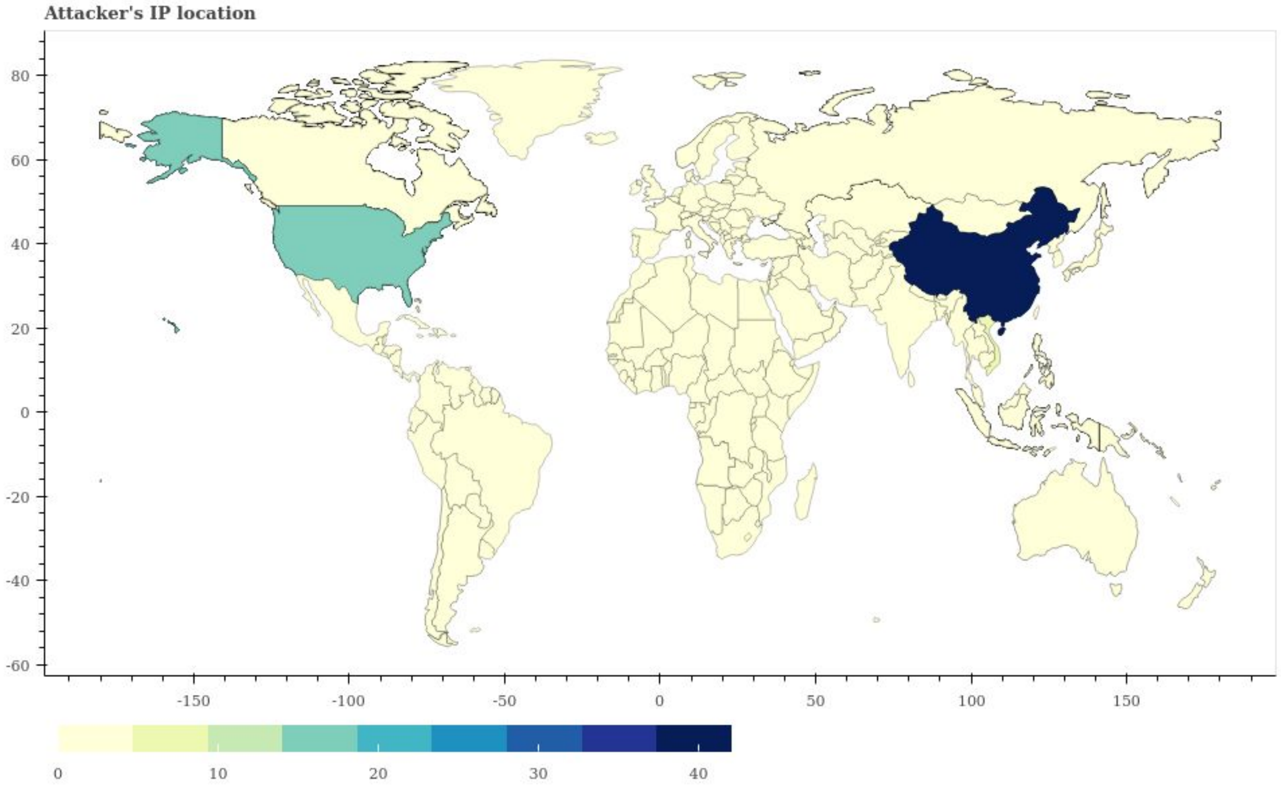
Note:

DS - DNS contains only labelled malicious domain. We can expect a higher correlation than 1%

Prevalence of Bots Hosting Malicious Content

> 61% of inbound/outbound attacks take place from **Asia** and the US

Country	# Machines
China	42 (44.21%)
US	17 (17.89%)
Hong Kong	6 (6.32%)
Vietnam	5 (5.26%)
Singapore	4 (4.21%)
...	...
Total	95 (100%)



The inter-relationships between Bots and Malicious Hosting

>88% of inbound/outbound attacks include a combination of phishing or malware campaigns, with web attacks (SQLi, RFI, LFI, XSS, etc.)

Outbound / Inbound	Web Attack (N=11k)	ATO (N=721k)	DDoS (N=6k)
Phishing-campaigns (N=4.3k)	51	1	0
Malware-hosting (N=6.2k)	33	5	0
C&C Endpoint (N=0.7k)	3	2	0

Detections on Enterprise DNS traffic.

Is it a known issue among the cyber community ?

On a daily basis on Enterprise DNS traffic

- 500 domains blocked **- ~80% not detected by any engine on VT**

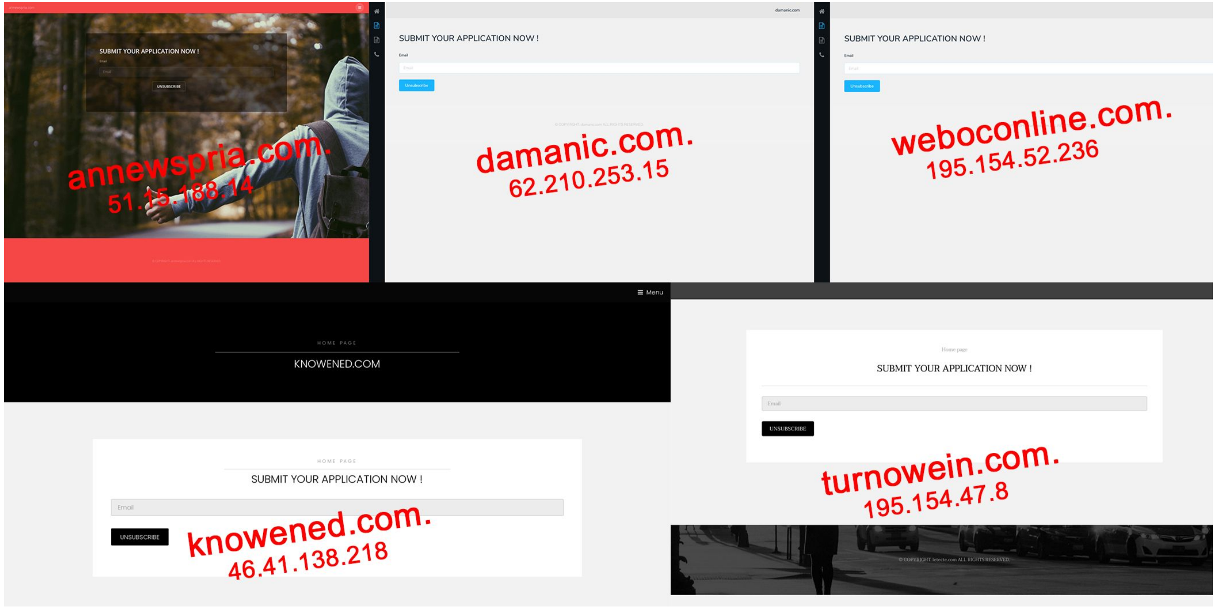
Reminder: By having used very strong filters and high threshold, we can ensure that **those domains are involved in web attacks.**

- 8k domains suspicious

Example: Group of websites under attackers control

October 12th 2020:

- Detection of group of IP issuing ATO attack against a popular French streaming platform
- Some of them get some detections on VT
- Most of them are hosted in France on the same AS
- Websites under attacker's control.



SUBMIT YOUR APPLICATION NOW !

annewspria.com.
51.15.188.14

SUBMIT YOUR APPLICATION NOW !

damanic.com.
62.210.253.15

SUBMIT YOUR APPLICATION NOW !

weboconline.com.
195.154.52.236

KNOWENED.COM

SUBMIT YOUR APPLICATION NOW !

knowened.com.
46.41.138.218

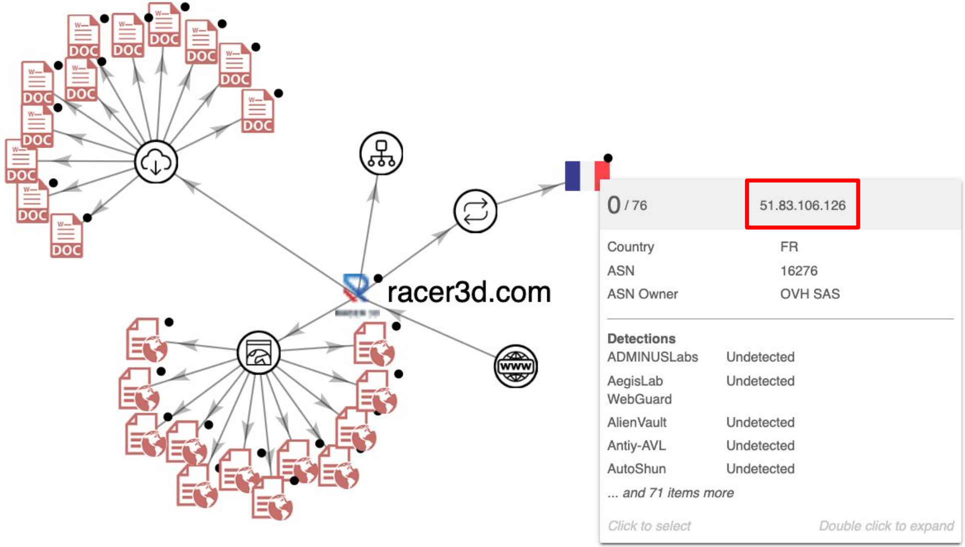
SUBMIT YOUR APPLICATION NOW !

turnowein.com.
195.154.47.8

Would you put your email under the "Submit your application now " ?

We don't recommend it...

Example 2: Classic malicious website



0 / 76	51.83.106.126
Country	FR
ASN	16276
ASN Owner	OVH SAS

Detections	
ADMINUSLabs	Undetected
AegisLab WebGuard	Undetected
AlienVault	Undetected
Antiy-AVL	Undetected
AutoShun	Undetected

... and 71 items more

Click to select *Double click to expand*

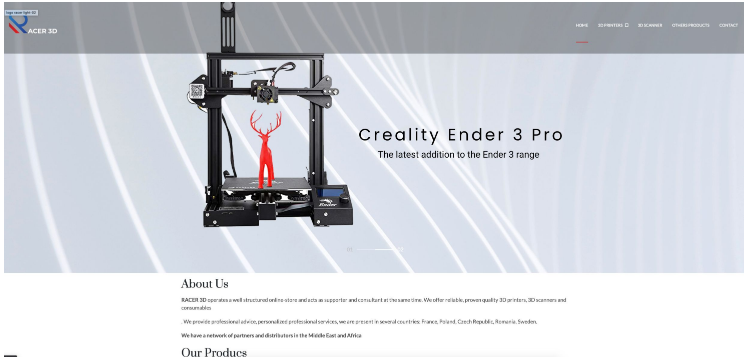
VT graph of racer3d[.]com - November 1st 2020

- 9 detections on VT

EMOTET distributor with .doc files

Started October 30th 2020

- Attacks from 51.83.106.126:
  SQLi, Wordpress vulnerability scans
  on big online retailers ,banks and
  even online pharmacy.
- Our algorithm resolved it to racer3d[.]com
- Domain registered on September 22th 2020



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We have a network of partners and distributors in the Middle East and Africa

Our Producs

Home page of racer3d[.]com on November 1st 2020

Conclusions

- More than **1%** malicious websites are involved in web attacks
  - Generally uncommon but exist in specific scenarios
  - Majority appears in non-hosting companies within Asia and US.
  - When looking at phishing or malware-hosting websites, there is a chance that web attacks (SQLi, XSS, LFI…) are issued from the same place

- Protection of users by blocking unsafe web services hosted by bots:
  - > 500 detected domains / day + 8k suspicious domains/day
  - 80% not detected by any AV on VT even though there are definitely linked to malicious activities

Future work

- Convert the suspicious domains to known with metadata (geolocation, AS, website templates, hints from other sources...)

- When it’s possible, convert malicious domains to unique IP to enrich IP reputation

- Release source code/more detailed view the algorithm

Thank you

Q&A