POLITECNICO
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UCSB

There’s a Hole in that Bucket!
A Large-scale Analysis of Misconfigured S3 Buckets

Andrea Continella, Mario Polino, Marcello Pogliani, Stefano Zanero

7 December 2018
ACSAC 2018

Cloud Storage Services

Amazon S3

- Users create **buckets** (storage containers)
- Amazon S3 supports various **access control policies**
  - User-level
  - Bucket-level
  - Resource-level

Amazon S3

- Users create **buckets** (storage containers)
- Amazon S3 supports various **access control policies**
  - User-level
  - Bucket-level
  - Resource-level
- REST API to read/write:
  - `http[s]://<BUCKET_NAME>.s3[-region].amazonaws.com/`
  - `http[s]://s3[-region].amazonaws.com/<BUCKET_NAME>/`

```
HTTP/1.1 403 Forbidden
x-amz-bucket-region: ap-southeast-2
Content-Type: application/xml
Transfer-Encoding: chunked
Date: Mon, 19 Mar 2018 13:22:24 GMT
Server: AmazonS3

<Error>
    <Code>AccessDenied</Code>
    <Message>Access Denied</Message>
    <RequestId>4CBC01F61S808F69</RequestId>
    <HostId>zPQX088xyzUTAH704xQLZFg9toDH</HostId>
</Error>
```

What could possibly go wrong?

Threats

Misconfigurations in access control rules can be really **dangerous**

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Data Leakage

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Resource Infection

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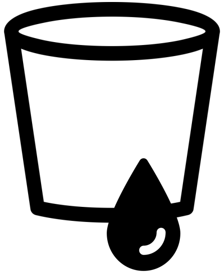

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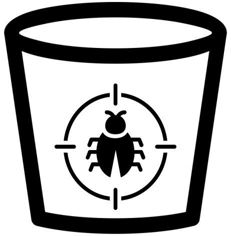

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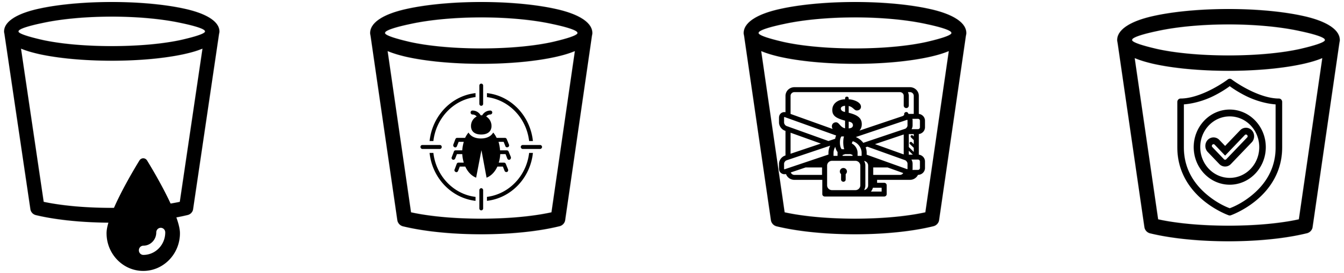

Data Leakage

Resource Infection

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Domain Name Trust Exploiting

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Data Leakage

Resource Infection

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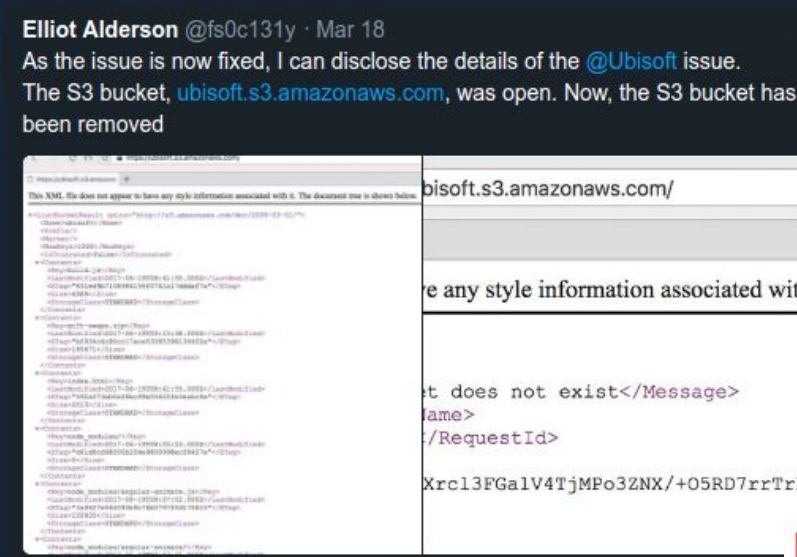
Domain Name Trust Exploiting

Subdomain Takeover



Elliot Alderson @fs0c131y · Mar 18

As the issue is now fixed, I can disclose the details of the @Ubisoft issue.
The S3 bucket, ubisoft.s3.amazonaws.com, was open. Now, the S3 bucket has been removed

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[illegible]

```
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/RequestId>
Xrcl3FGalV4TjMPo3ZNX/+O5RD7rrTrLF
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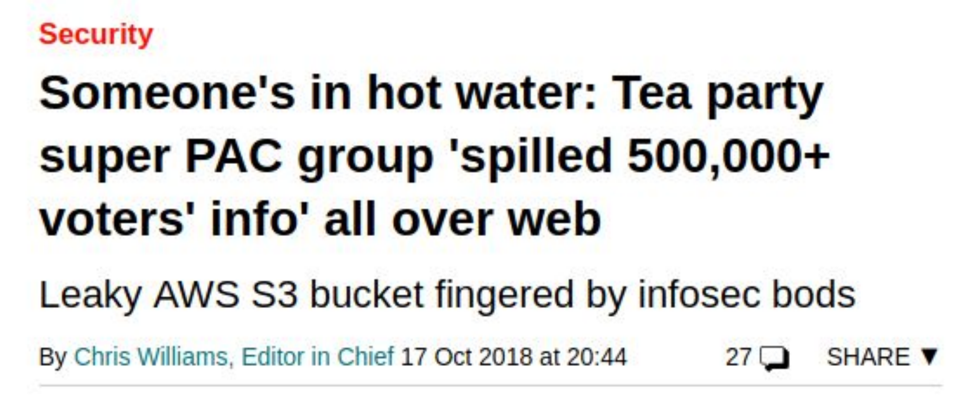
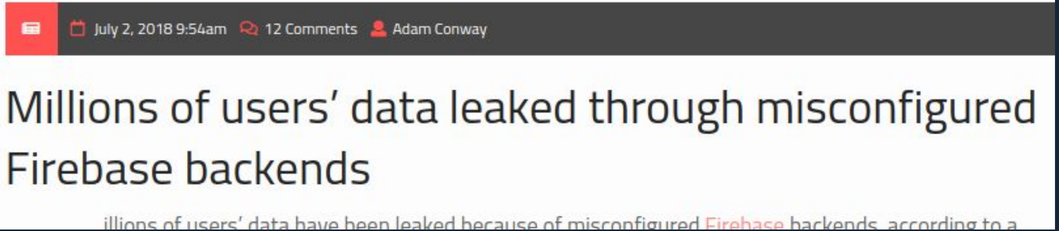


Security

Someone's in hot water: Tea party super PAC group 'spilled 500,000+ voters' info' all over web

Leaky AWS S3 bucket fingered by infosec bods

By Chris Williams, Editor in Chief 17 Oct 2018 at 20:44 27 SHARE ▼



July 2, 2018 9:54am 12 Comments Adam Conway

Millions of users' data leaked through misconfigured Firebase backends

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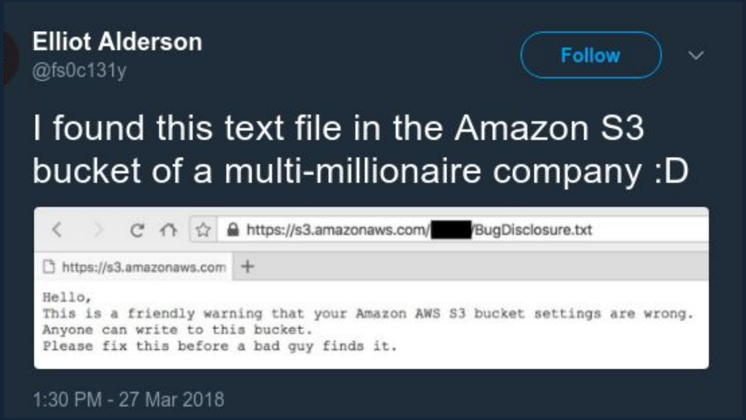

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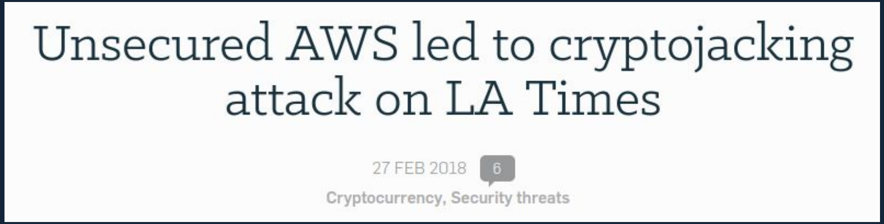
1:30 PM - 27 Mar 2018



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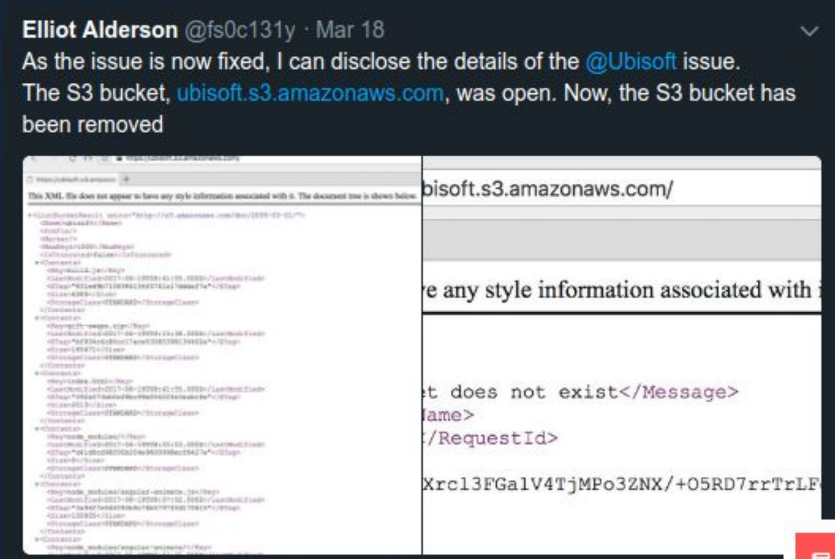
27 FEB 2018 6

Cryptocurrency, Security threats



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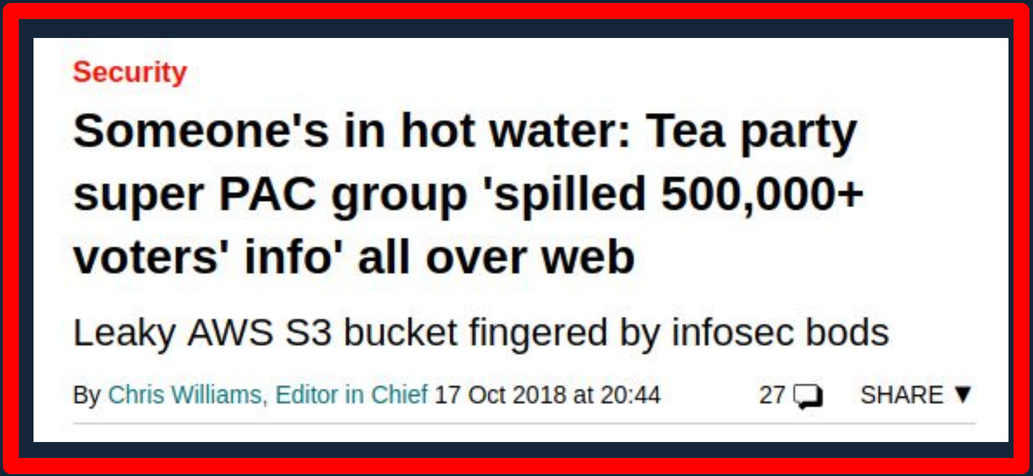

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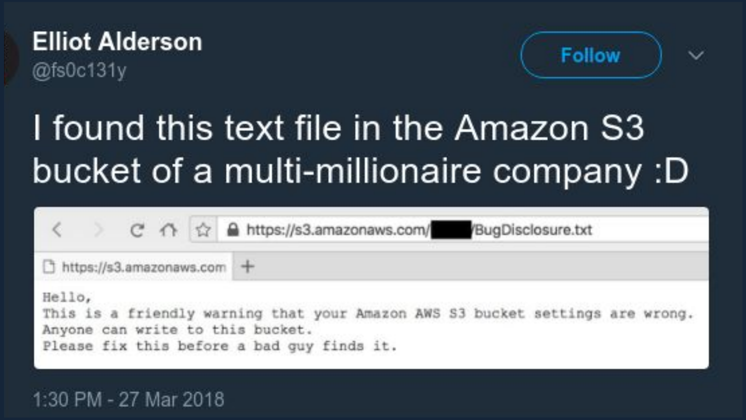

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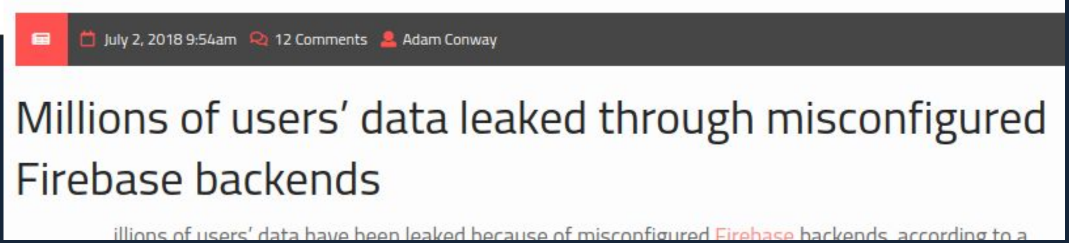

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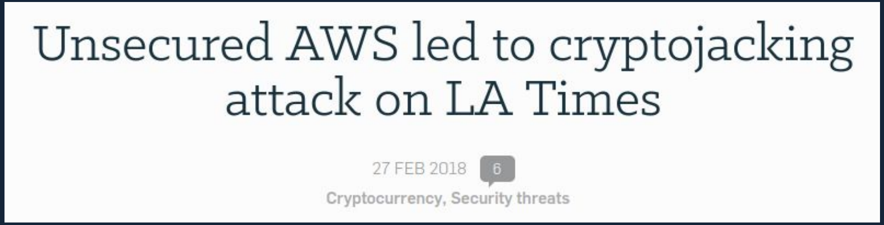

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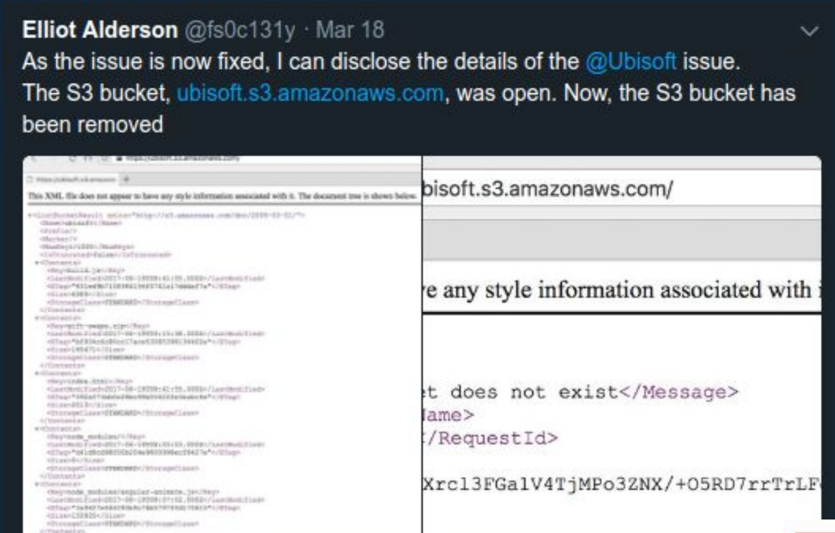

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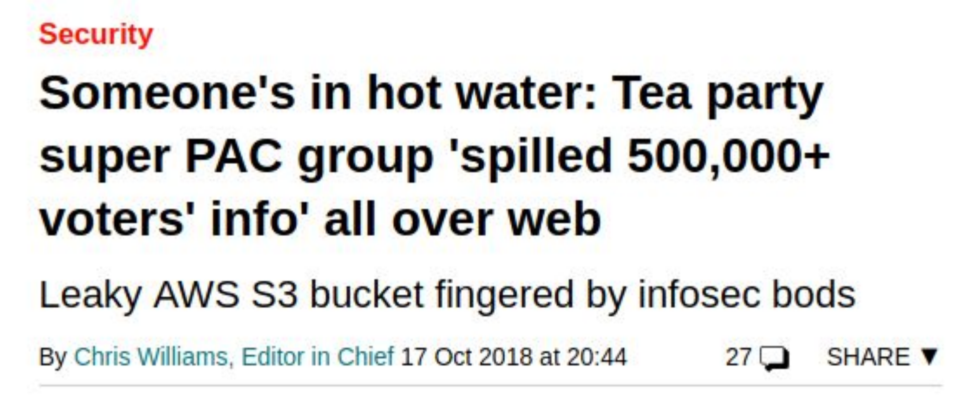

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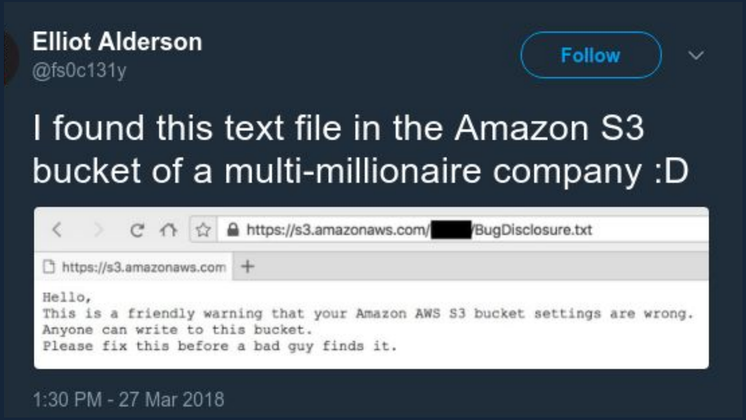

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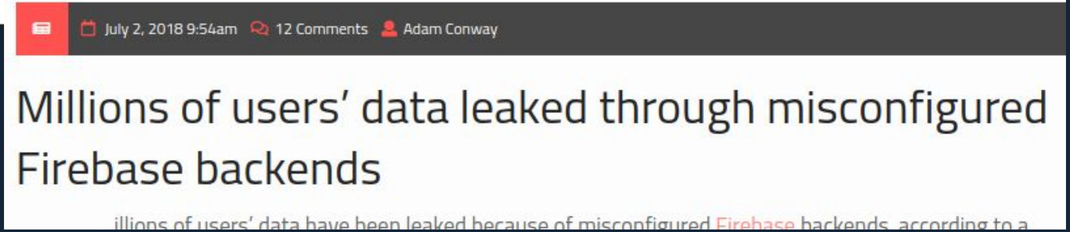

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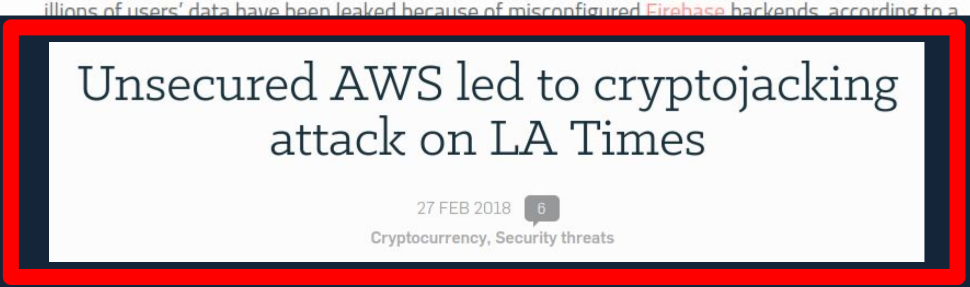

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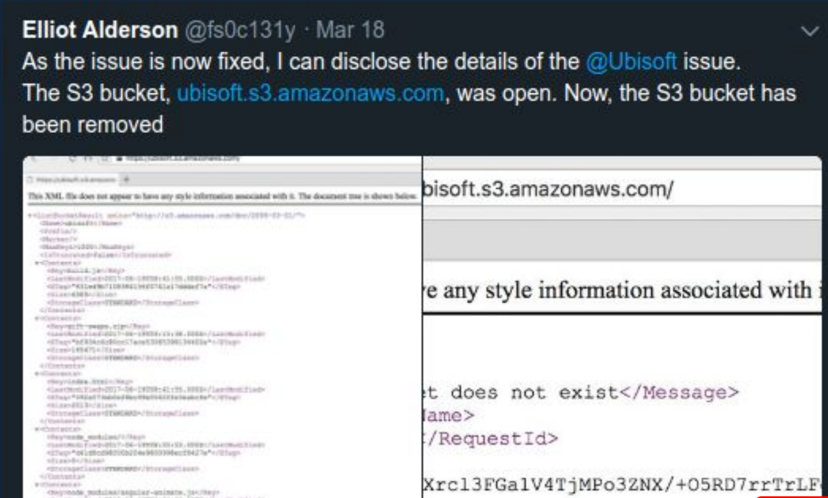

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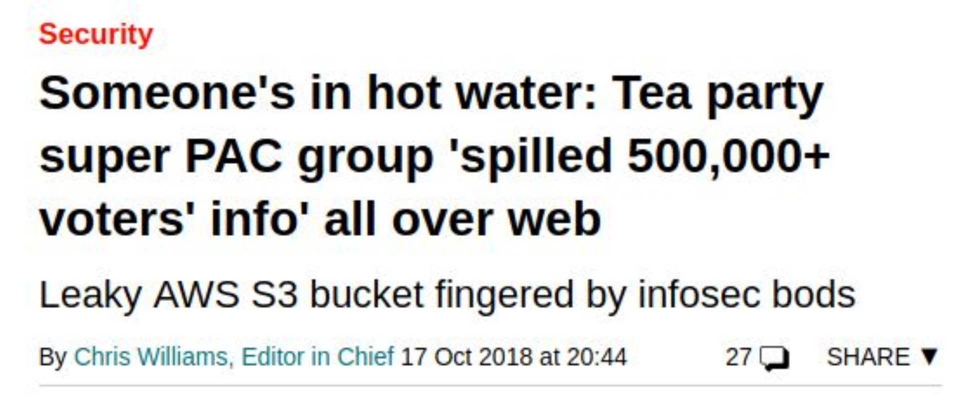

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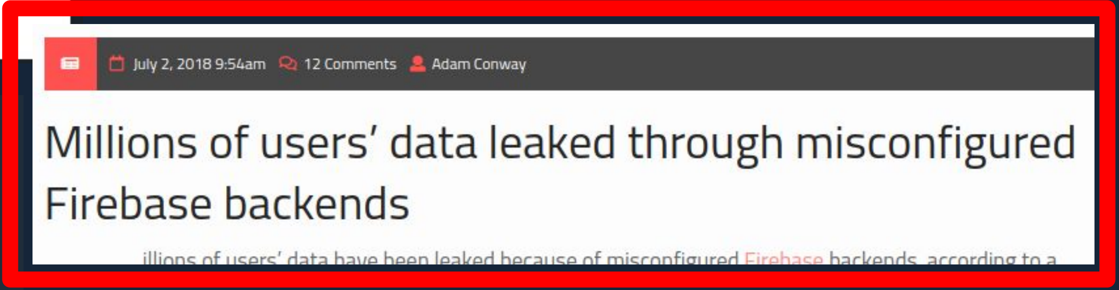

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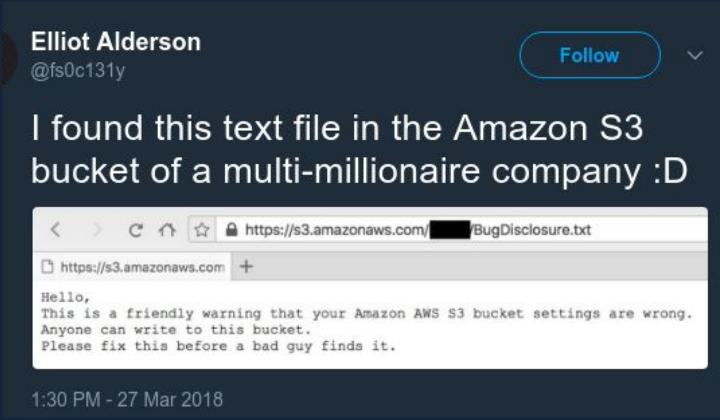

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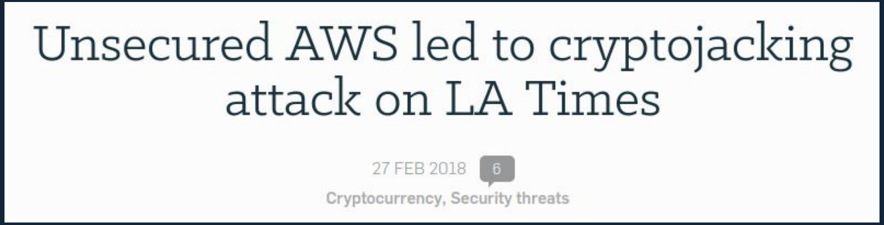

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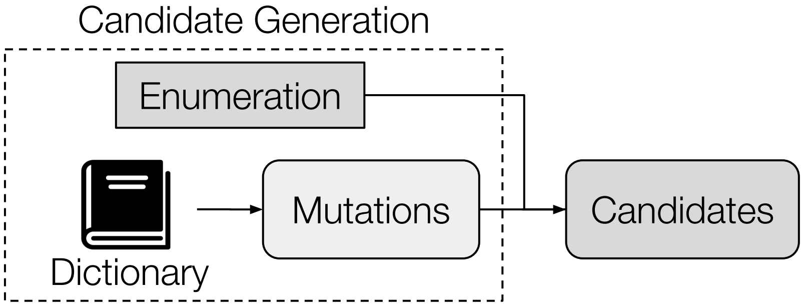
Methodology



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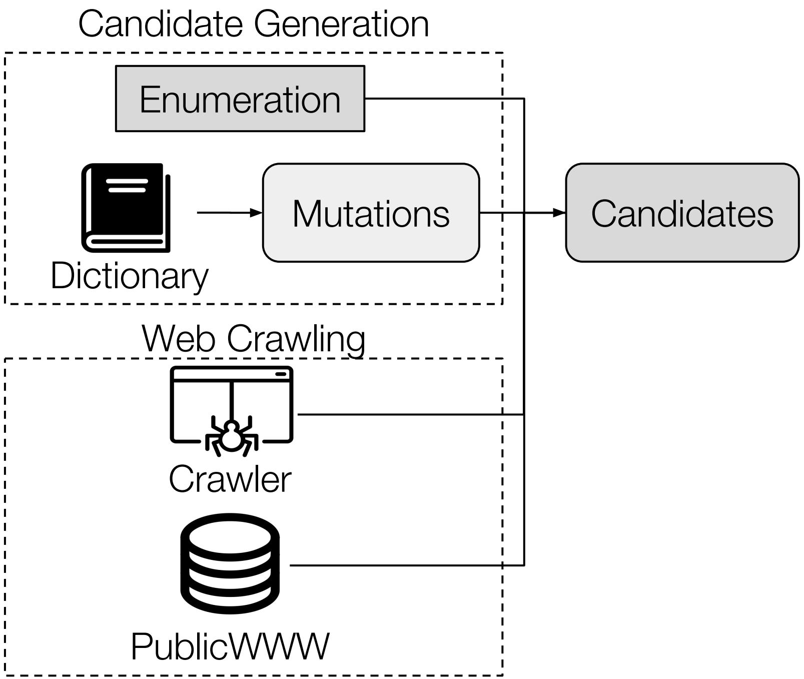

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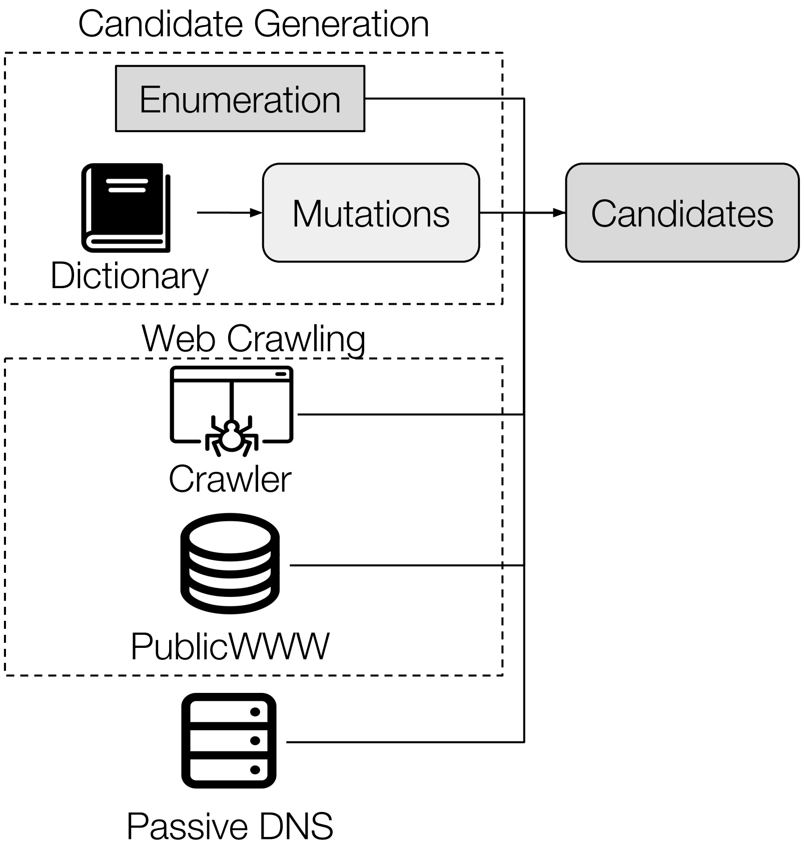

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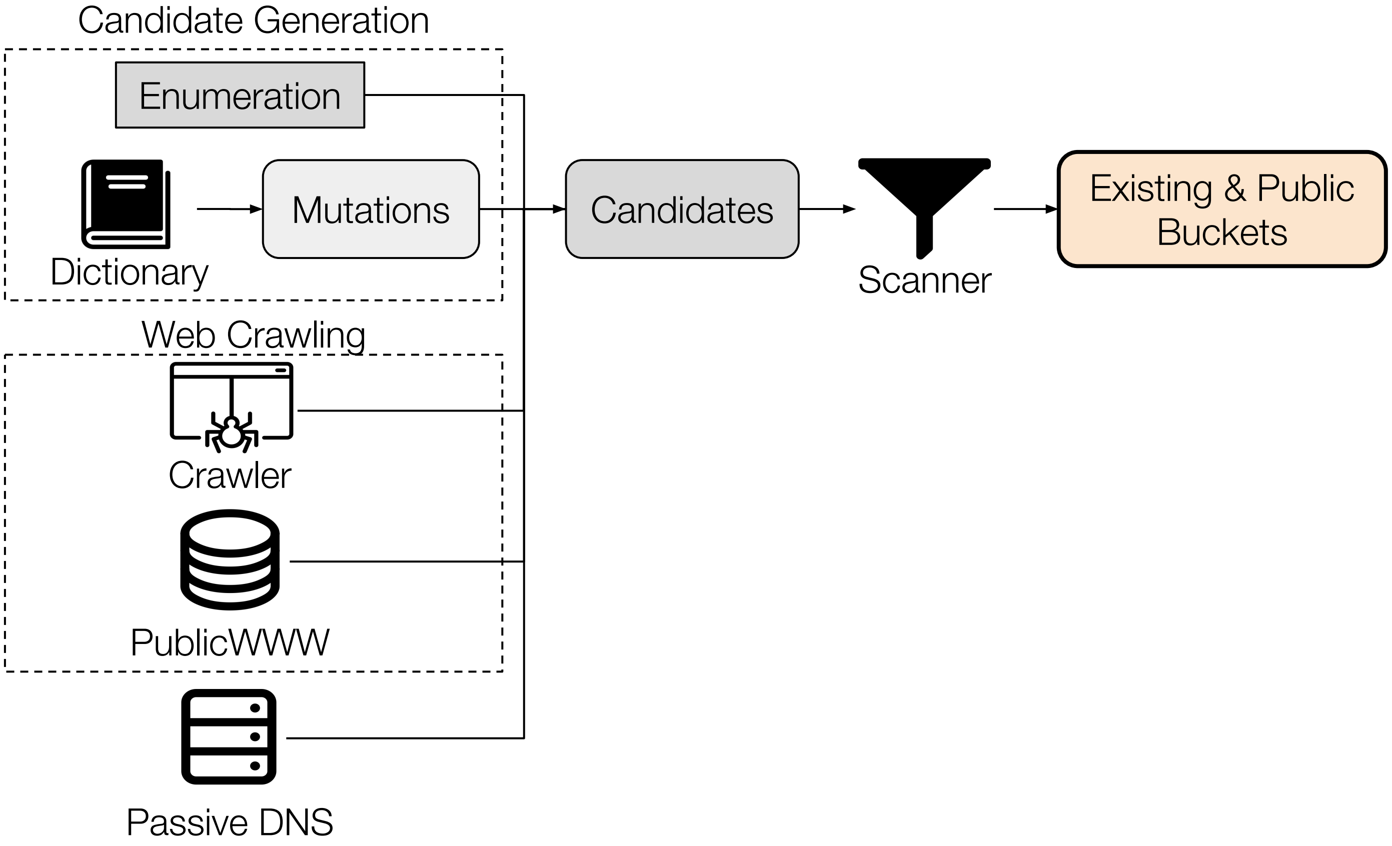

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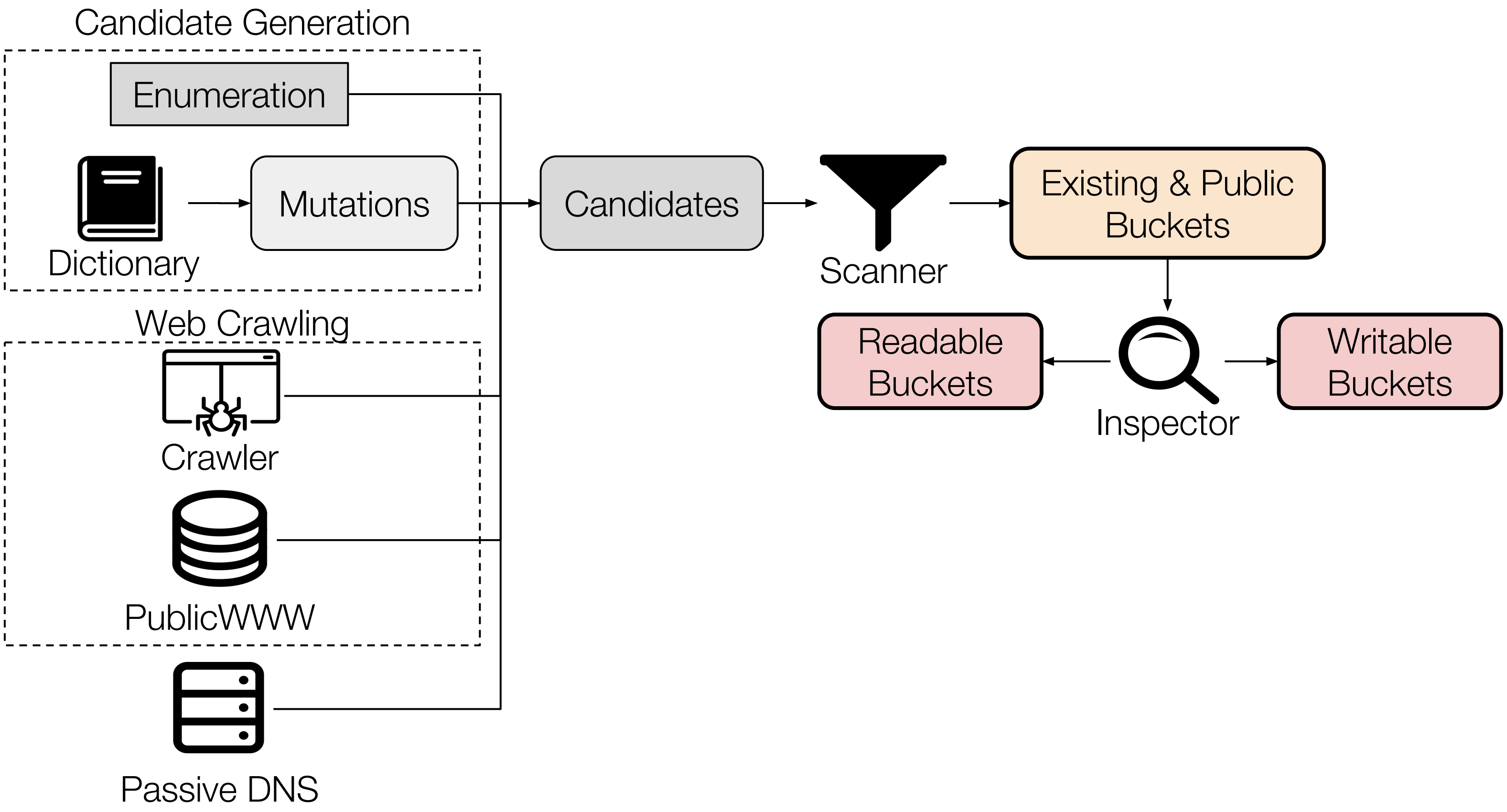

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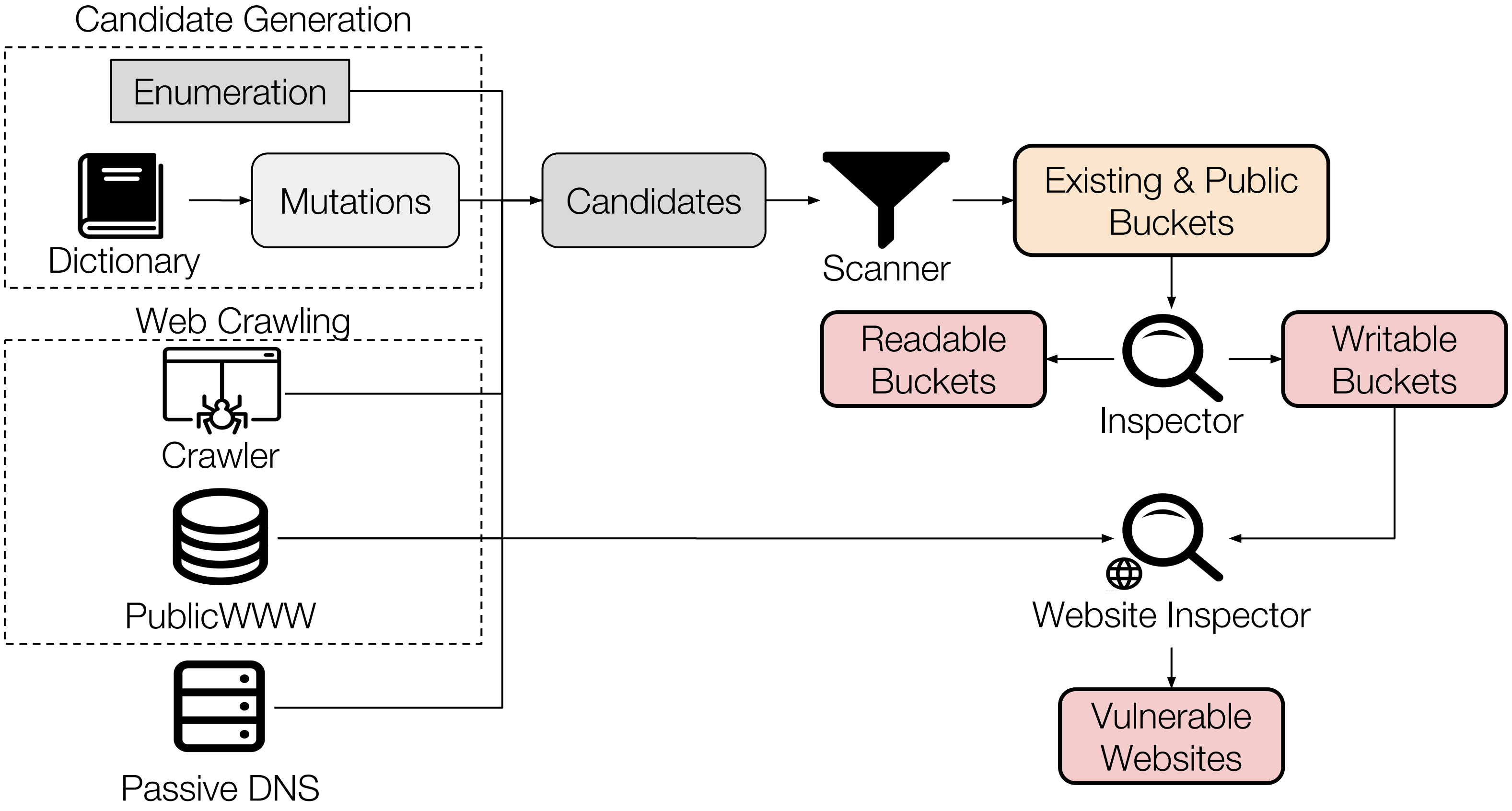
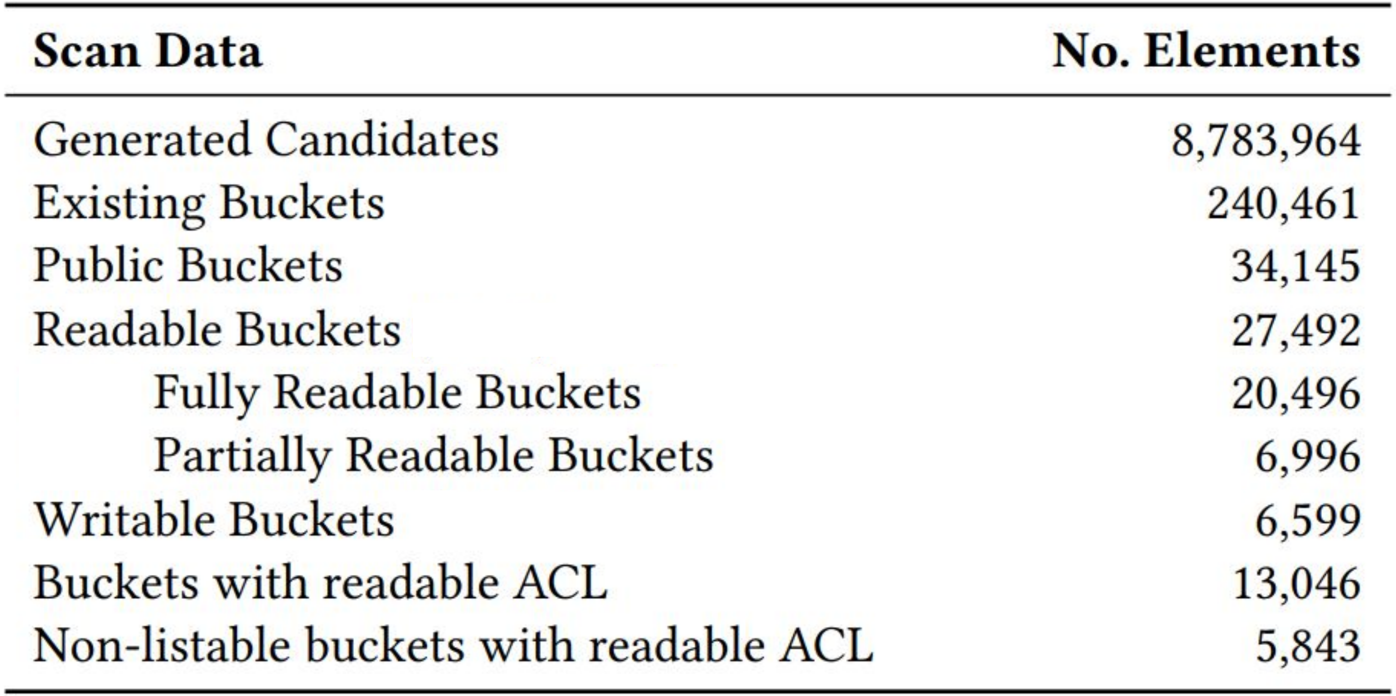


Scanning Result Summary



Scan Data	No. Elements
Generated Candidates	8,783,964
Existing Buckets	240,461
Public Buckets	34,145
Readable Buckets	27,492
Fully Readable Buckets	20,496
Partially Readable Buckets	6,996
Writable Buckets	6,599
Buckets with readable ACL	13,046
Non-listable buckets with readable ACL	5,843

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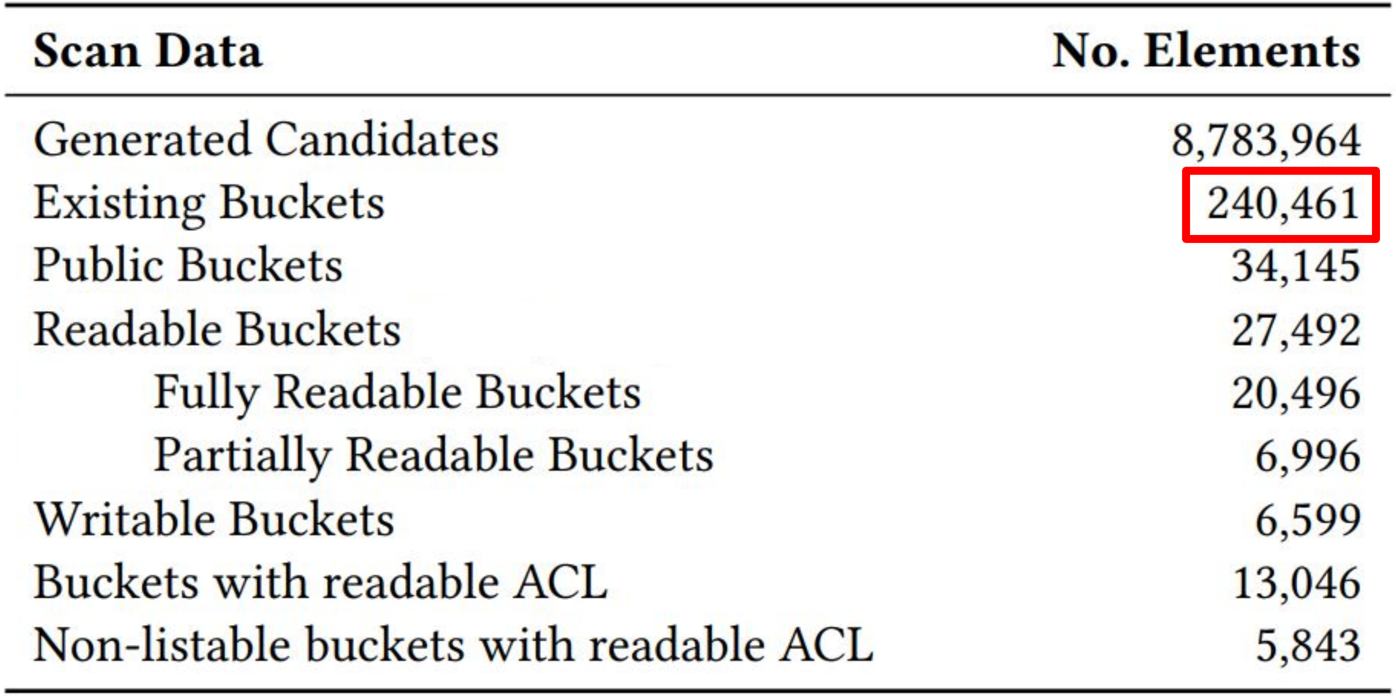

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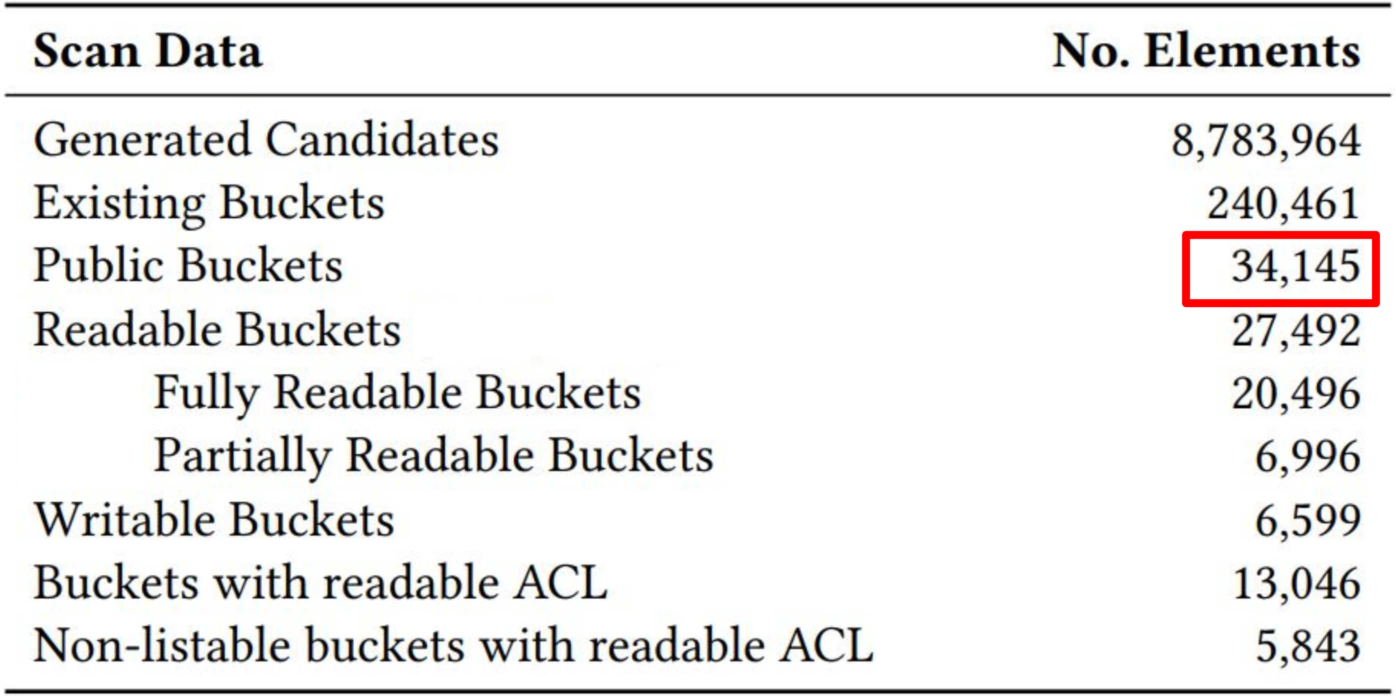

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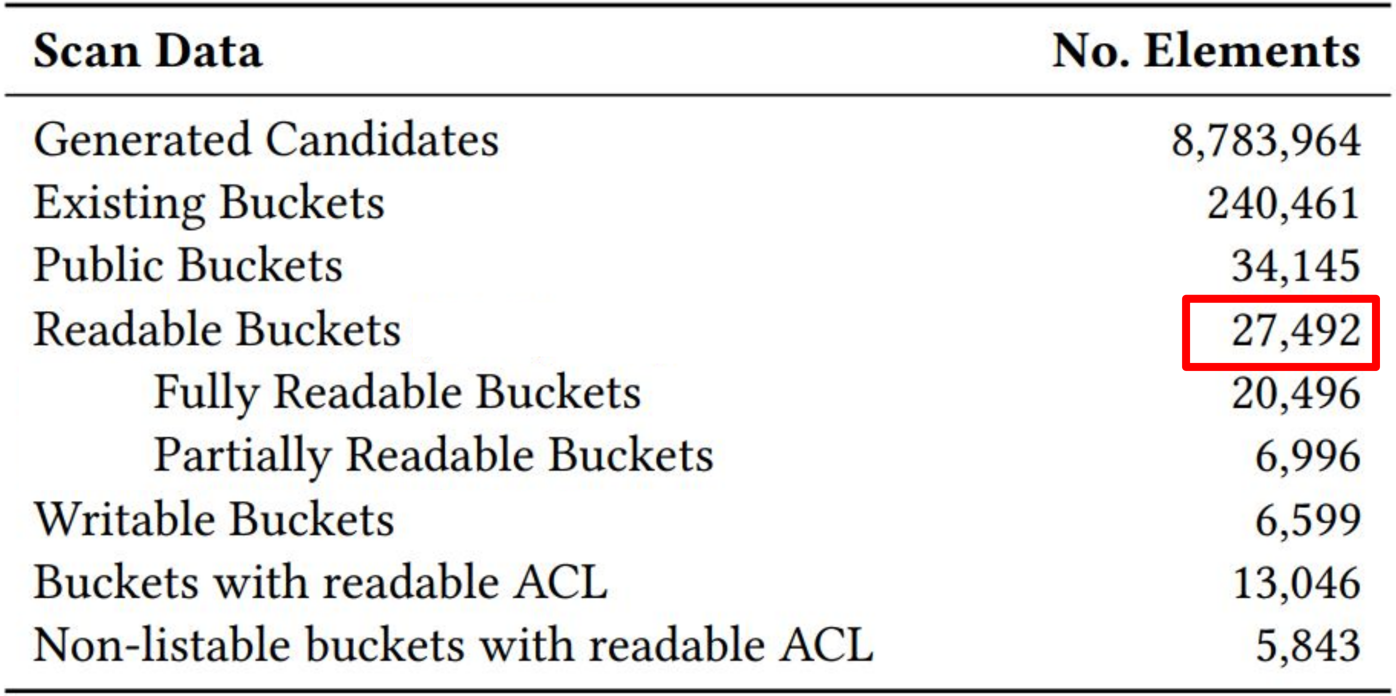

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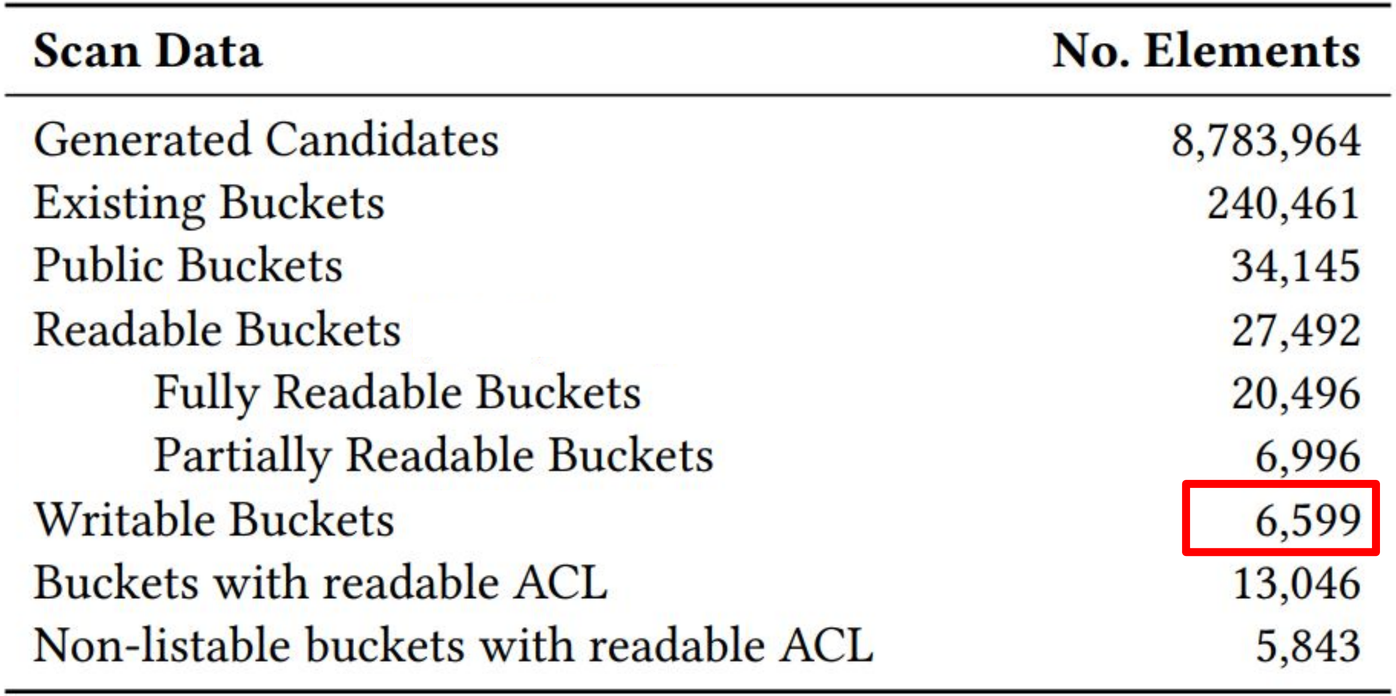

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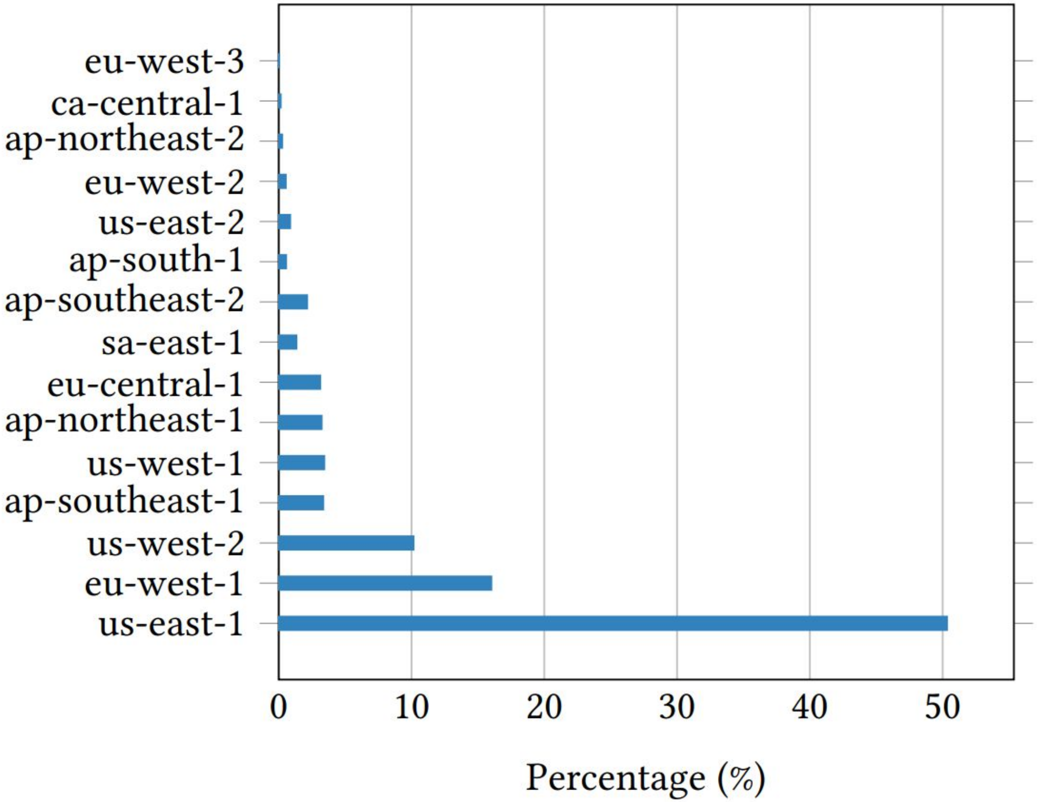
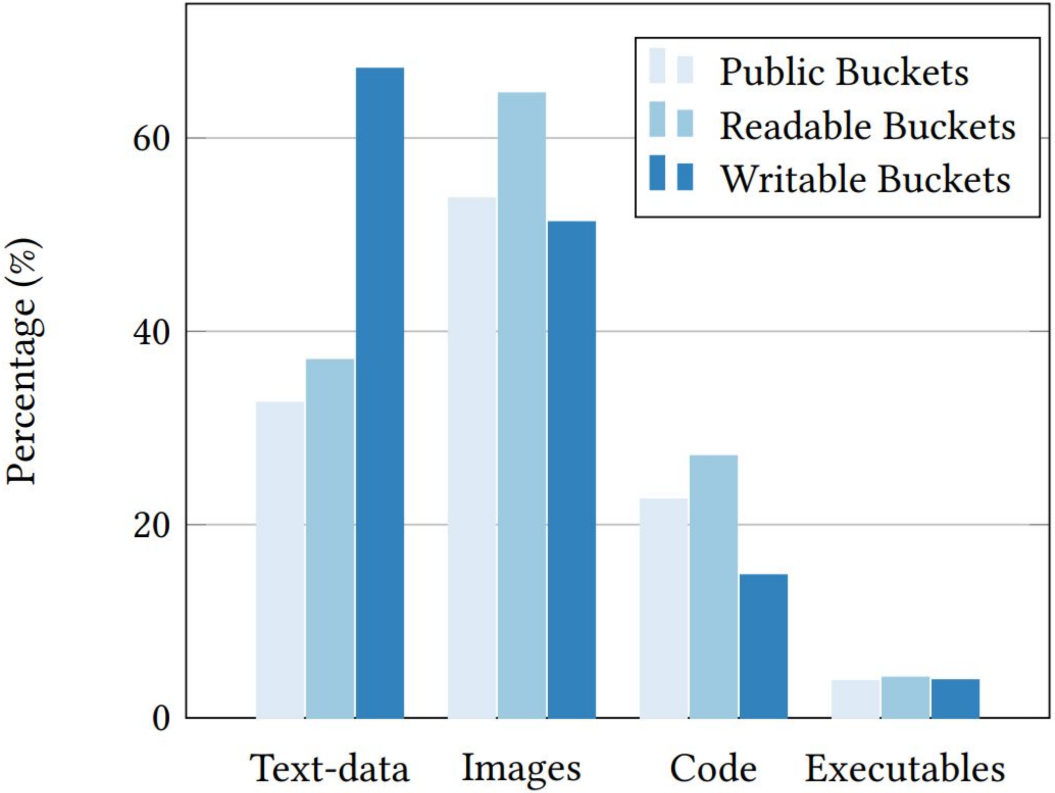
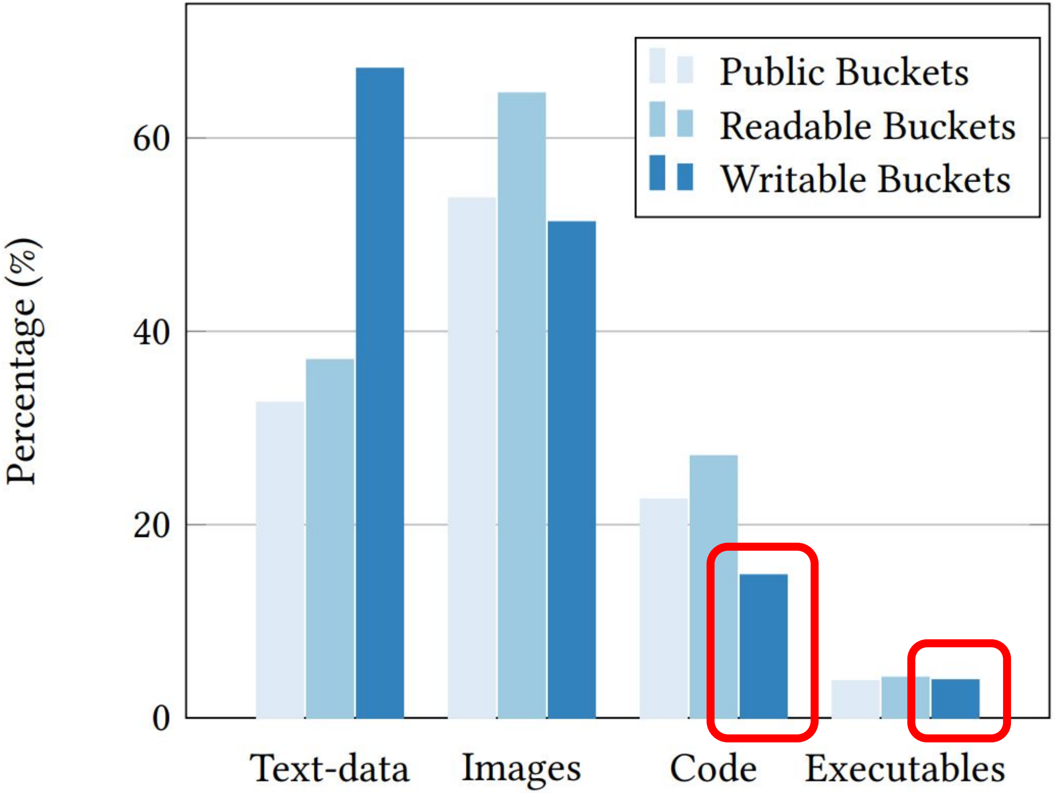
Region Distribution



File Types


Public Buckets
Readable Buckets
Writable Buckets
Percentage (%)
60
40
20
0
Text-data
Images
Code
Executables

File Types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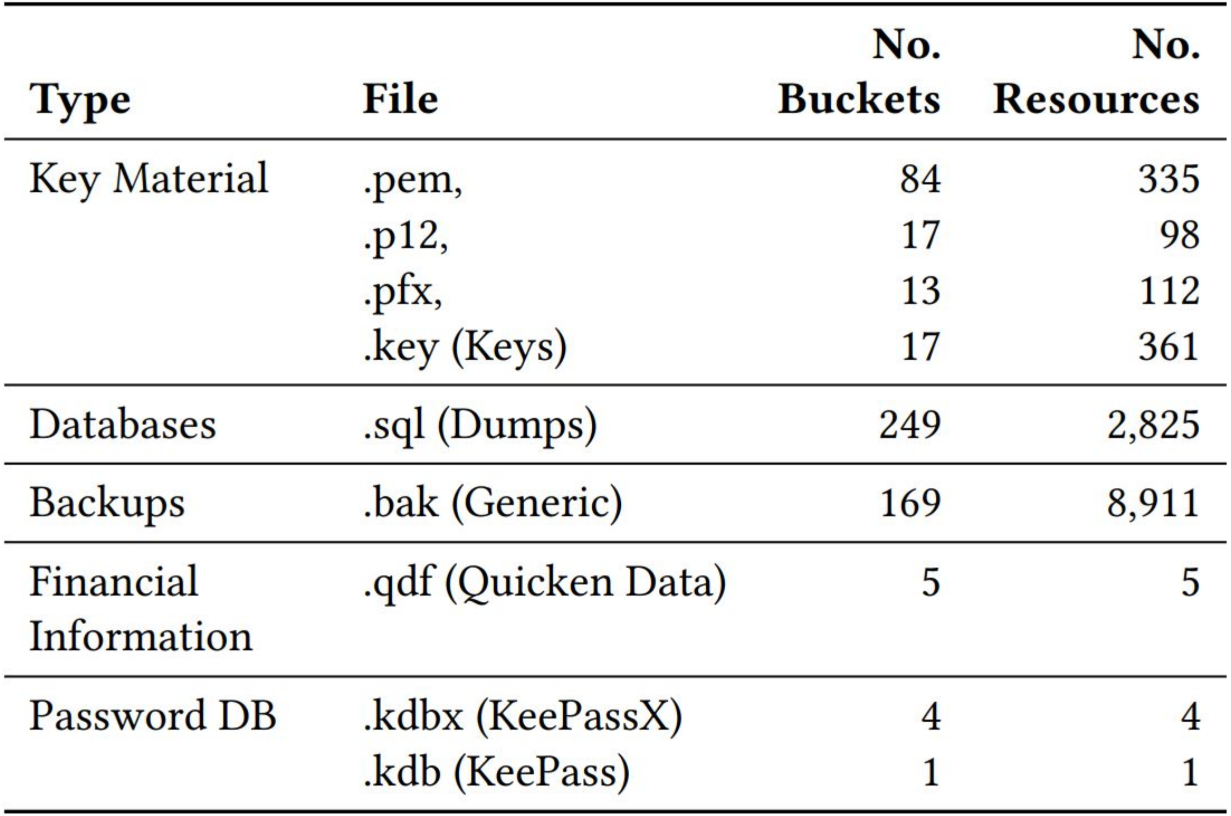
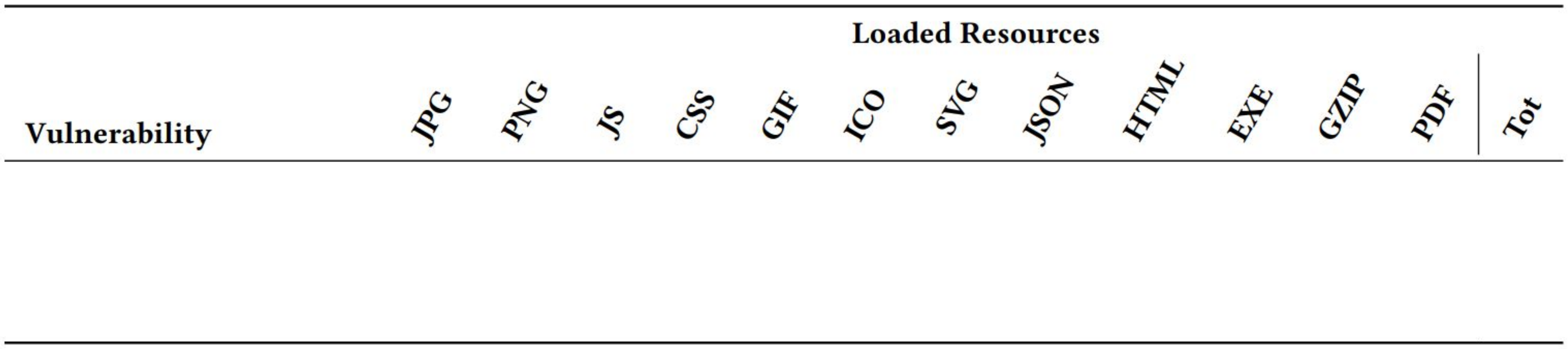
Sensitive Exposure



Type	File	No. Buckets	No. Resources
Key Material	.pem,	84	335
	.p12,	17	98
	.pfx,	13	112
	.key (Keys)	17	361
Databases	.sql (Dumps)	249	2,825
Backups	.bak (Generic)	169	8,911
Financial Information	.qdf (Quicken Data)	5	5
Password DB	.kdbx (KeePassX)	4	4
	.kdb (KeePass)	1	1

Vulnerable Websites

We collected 5,196 websites relying on 2,468 buckets



	Loaded Resources												
Vulnerability	JPG	PNG	JS	CSS	GIF	ICO	SVG	JSON	HTML	EXE	GZIP	PDF	Tot

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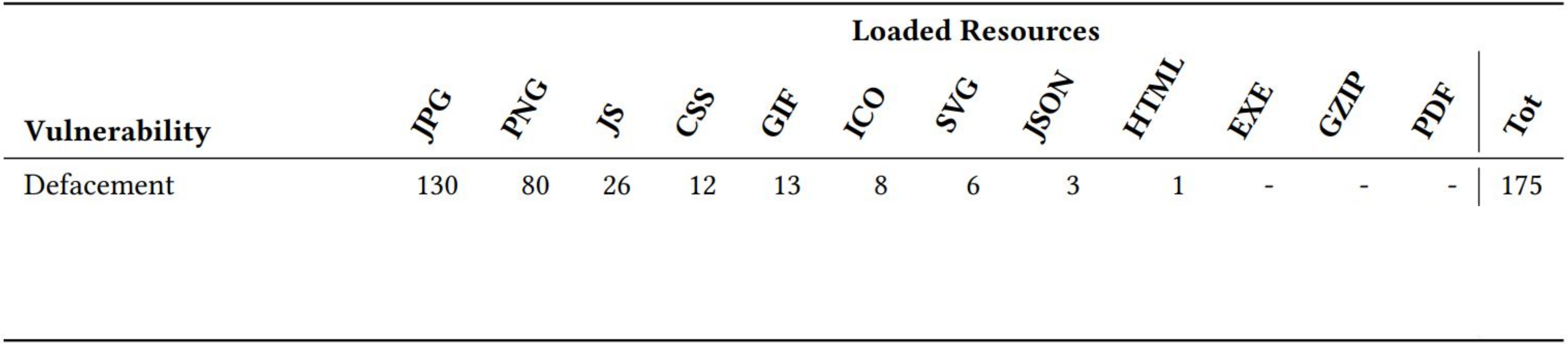

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Vulnerability	JPG	PNG	JS	CSS	GIF	ICO	SVG	JSON	HTML	EXE	GZIP	PDF	Tot
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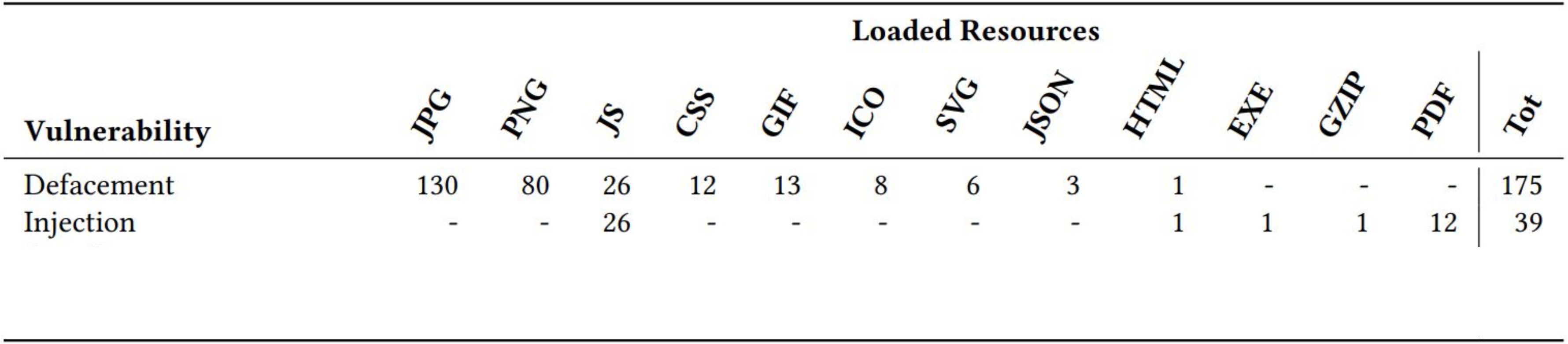

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Injection	-	-	26	-	-	-	-	-	1	1	1	12	39

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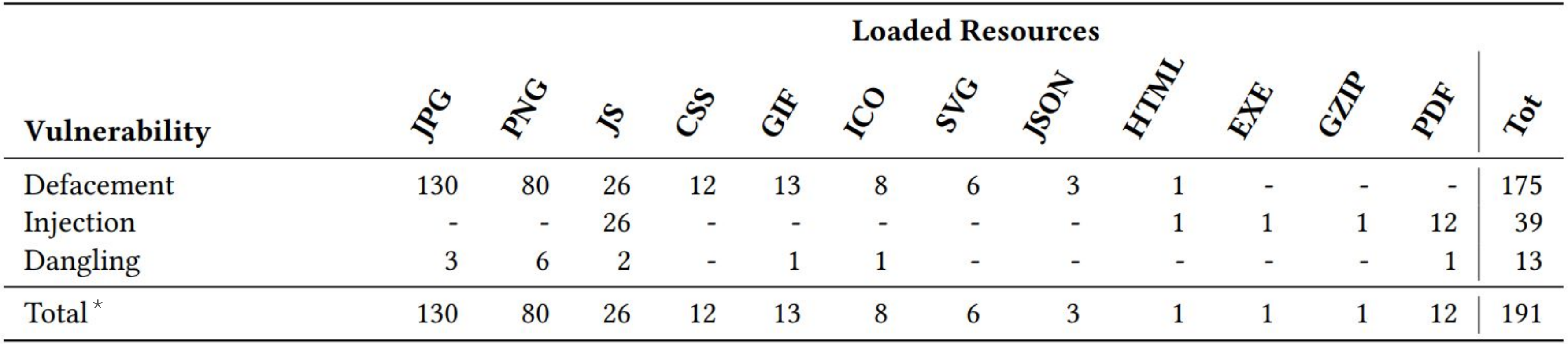

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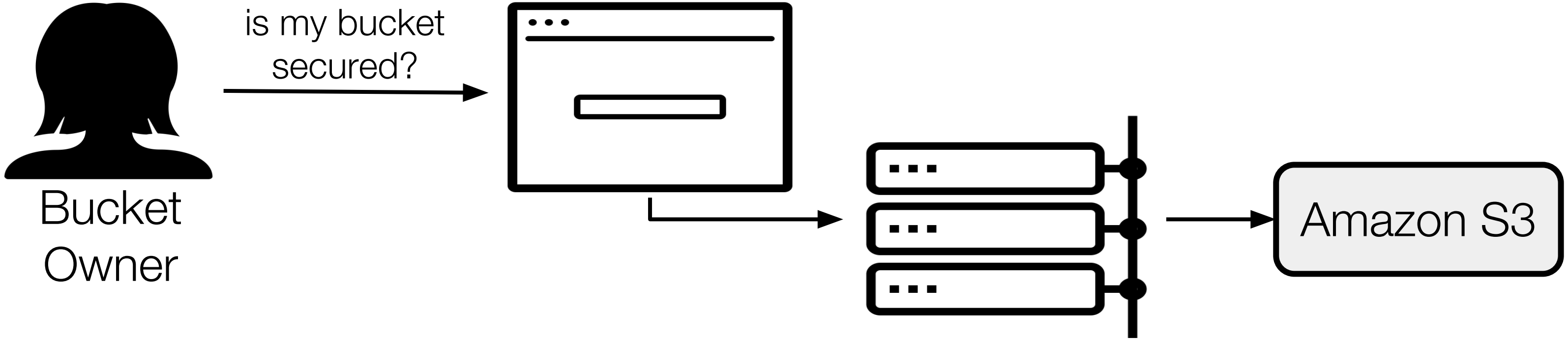
Defacement	130	80	26	12	13	8	6	3	1	-	-	-	175
Injection	-	-	26	-	-	-	-	-	1	1	1	12	39
Dangling	3	6	2	-	1	1	-	-	-	-	-	1	13
Total *	130	80	26	12	13	8	6	3	1	1	1	12	191

*Note that websites can overlap among the different types of vulnerability

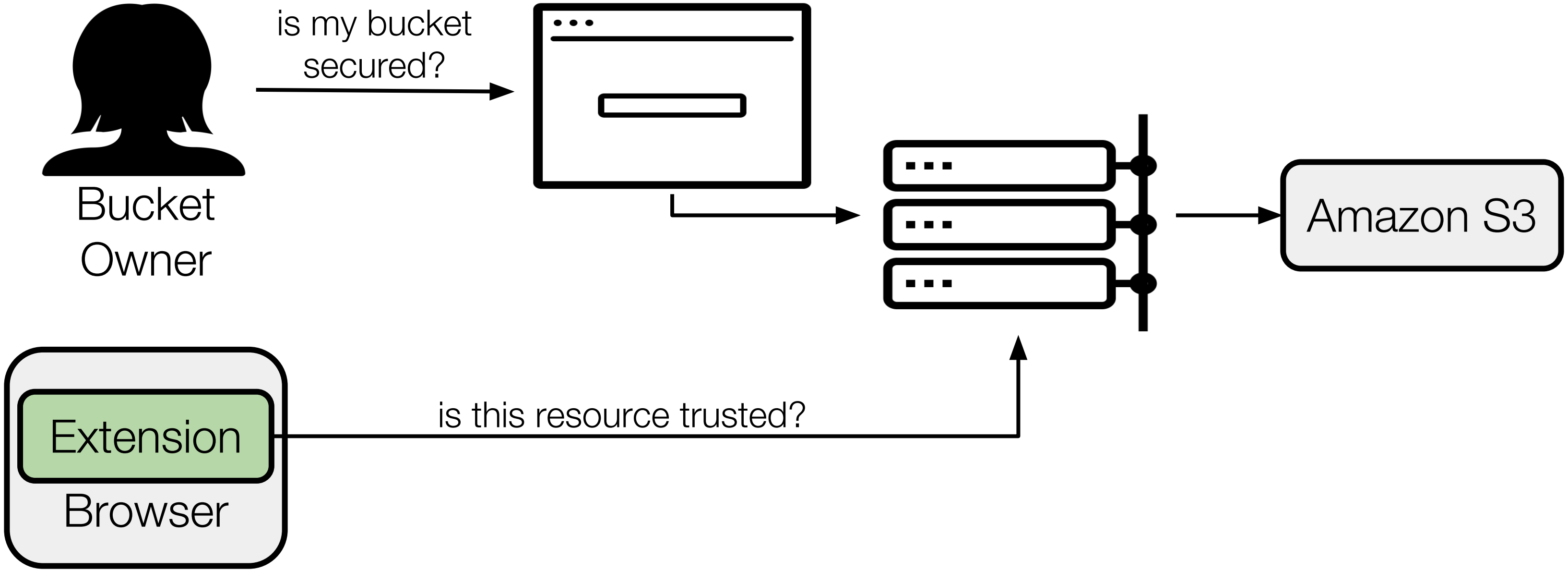
Mitigation

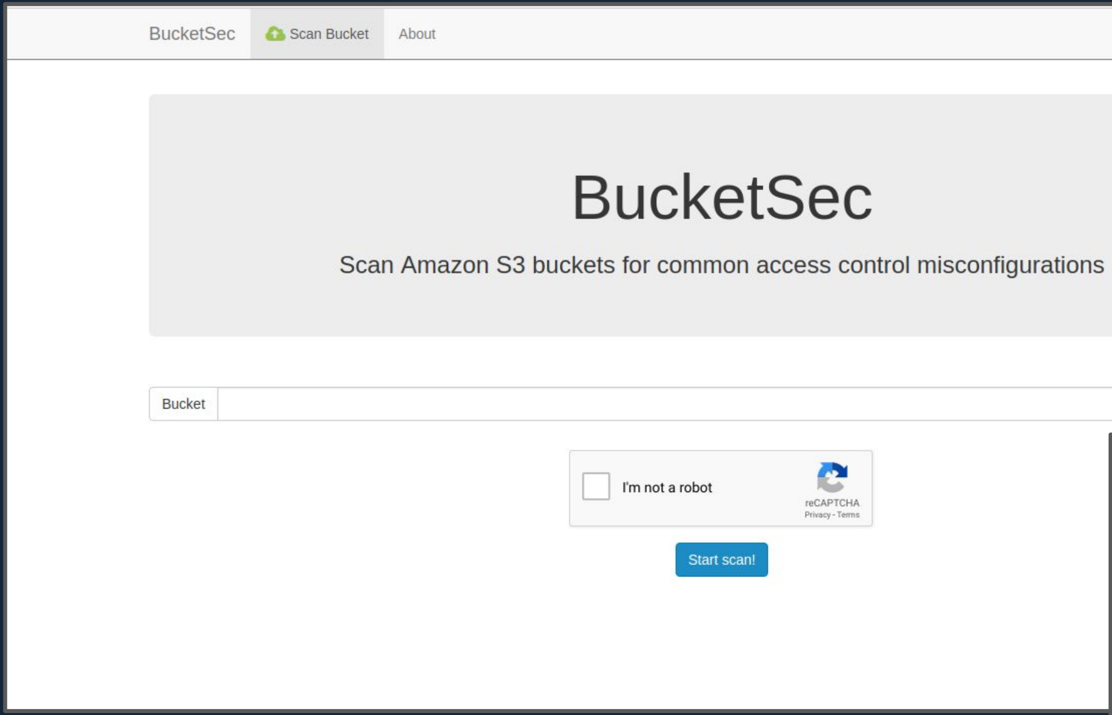
Fix the damn permissions!

Mitigation



Mitigation


is my bucket secured?
Bucket Owner
Amazon S3
Extension
Browser
is this resource trusted?

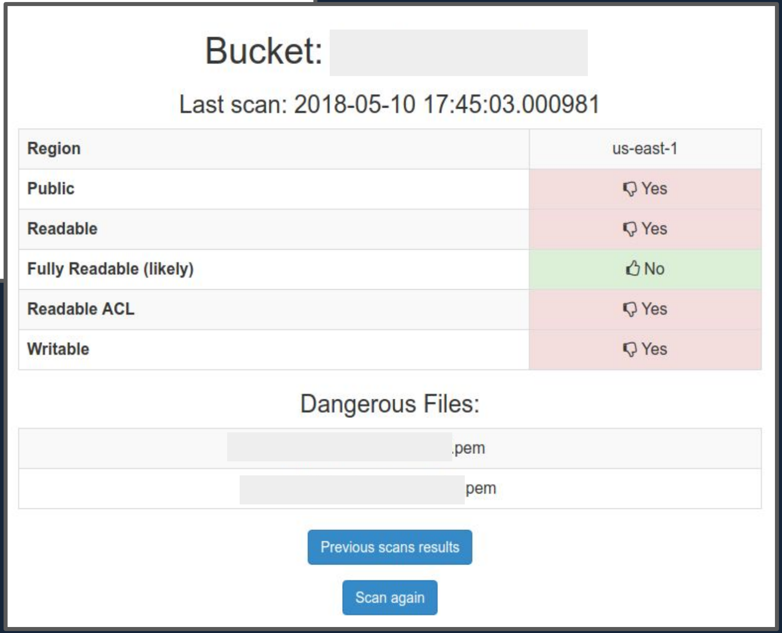


BucketSec

Scan Amazon S3 buckets for common access control misconfigurations

Bucket:

□ I'm not a robot



Bucket: [redacted]

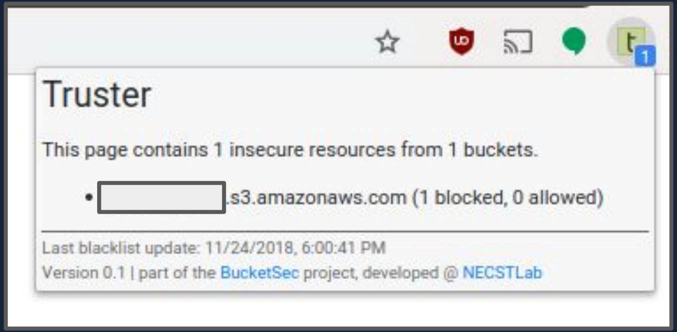
Last scan: 2018-05-10 17:45:03.000981

Region	us-east-1
Public	👎 Yes
Readable	👎 Yes
Fully Readable (likely)	👍 No
Readable ACL	👎 Yes
Writable	👎 Yes

Dangerous Files:

[redacted].pem
[redacted]pem

https://bucketsec.necst.it

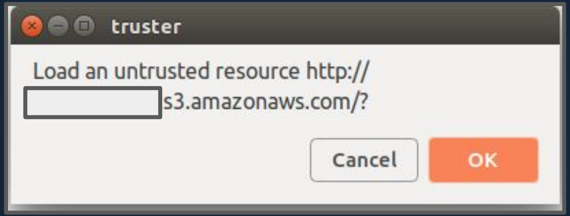


Truster

This page contains 1 insecure resources from 1 buckets.

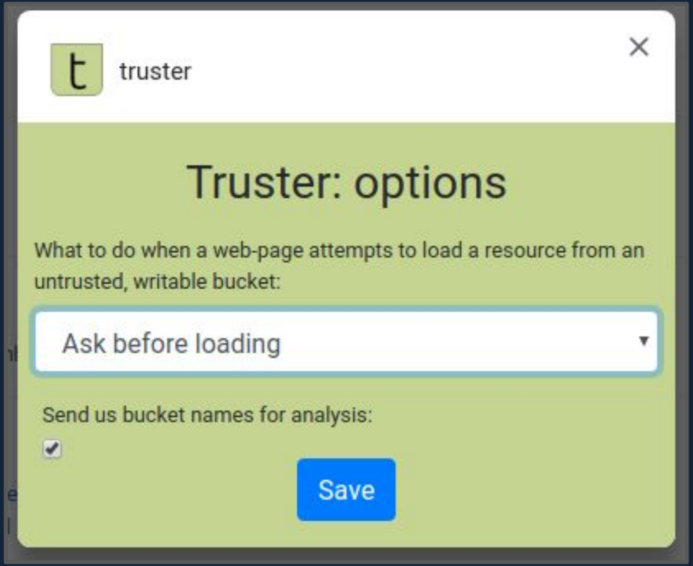
- [redacted].s3.amazonaws.com (1 blocked, 0 allowed)

Last blacklist update: 11/24/2018, 6:00:41 PM
Version 0.1 | part of the BucketSec project, developed @ NECSTLab



truster

Load an untrusted resource http://[redacted]s3.amazonaws.com/?



truster

Truster: options

What to do when a web-page attempts to load a resource from an untrusted, writable bucket:

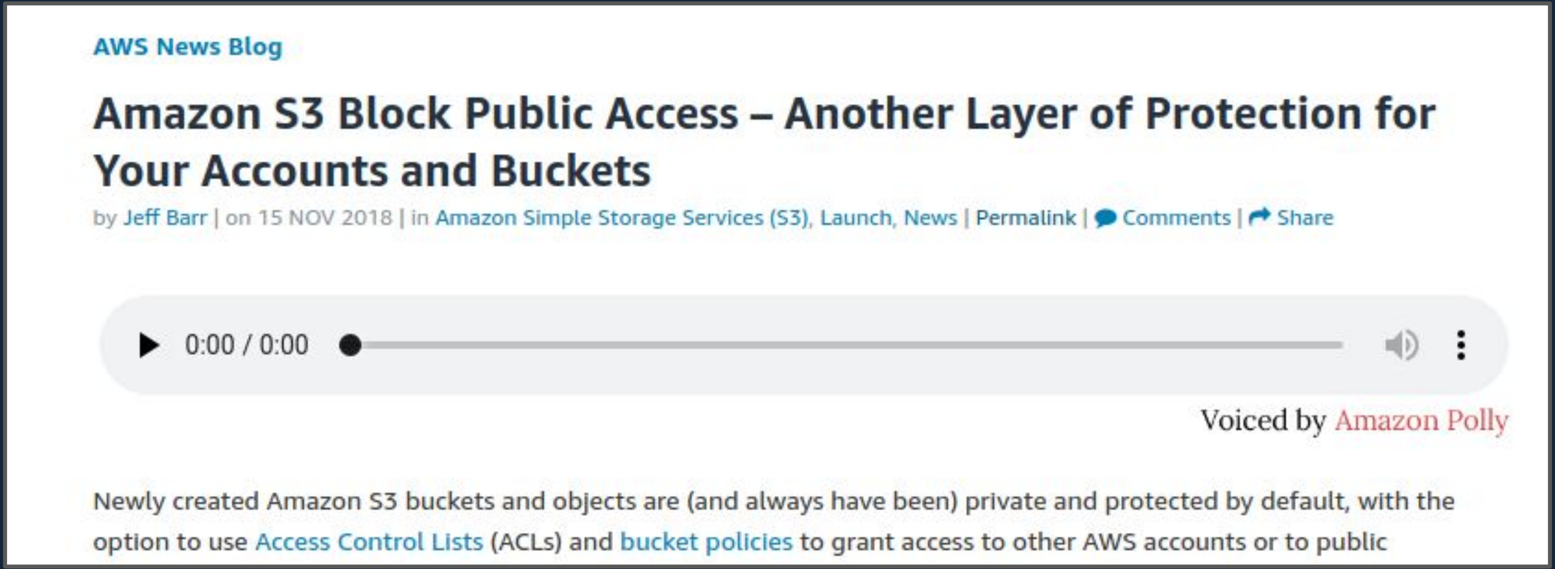
Ask before loading ▾

Send us bucket names for analysis:

☑

https://github.com/necst/truster

Responsible Disclosure



AWS News Blog

Amazon S3 Block Public Access – Another Layer of Protection for Your Accounts and Buckets

by Jeff Barr | on 15 NOV 2018 | in Amazon Simple Storage Services (S3), Launch, News | Permalink | Comments | Share

Voiced by Amazon Polly

Newly created Amazon S3 buckets and objects are (and always have been) private and protected by default, with the option to use Access Control Lists (ACLs) and bucket policies to grant access to other AWS accounts or to public

Conclusions

- We investigated **security implications** of using the Amazon S3 service
- Raise the **awareness** of a real-world security problem and warn users of its security implications
- **~14%** of S3 buckets are **public**
- **~2%** of S3 buckets are **publicly writable**
- **191** vulnerable websites
- We need **automated** solutions
  - Automatically **check** for potential misconfigurations
  - **Protect** client-side users

Thanks!
Questions?

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