From the Outside In:
How I Uncovered the Cybersecurity Failures of Thousands of Companies

Josephine Pfeiffer, 03/2023

Some background on me

- Coding, tinkering around with Linux for ~9 years
- Most interested in (hybrid) cloud, SRE, cybersecurity
- Previously TPM, SRE at Sygnum
- Currently Cloud Native Consultant at Red Hat

`https://josie.lol`

Disclaimer

The opinions expressed in this presentation are solely those of the presenter and do not necessarily reflect the views or policies of the presenter's past, current or future employers.

The information presented is for educational and informational purposes only and should not be construed as professional advice.

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Once upon a time…

I was bored on PTO waiting to start my new job.

Researching data breaches & started to wonder what is floating around in public…

…what about S3 buckets and `.tfstate` files?

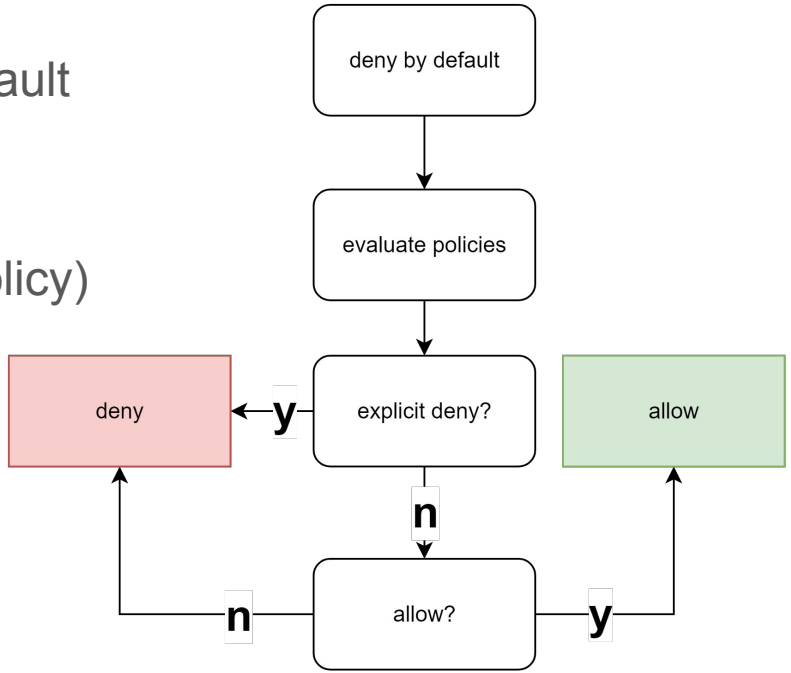
Some facts on S3 endpoints to begin with

- Be unique across all of Amazon S3
- Be between 3 and 63 characters long
- Not contain uppercase characters
- Start with a lowercase letter or number

```
https:\/\/[a-z0-9]([-a-z0-9]{2,61}[a-z0-9])?\.s3\.amazonaws\.com\/
```

S3 bucket access controls

- The bucket policy is always private by default
- One explicit “deny” policy trumps “allow” policies at other levels
  (IAM, S3 object/bucket ACL, S3 bucket policy)



Scraping endpoints (brief for legal reasons)

- Public? (y/N)
- Paths/prefixes make things more complicated
  - Traversing paths, recursively scan for filenames, extensions (`.tfstate`, `production`, `.env`, `secret.yaml`, etc.)

What I found

- In total, I scanned through ~308k AWS S3 buckets.
- Within only a few minutes, I could freely look through production secrets for thousands of large, international companies.

What I found

An international digital healthcare company from MENA

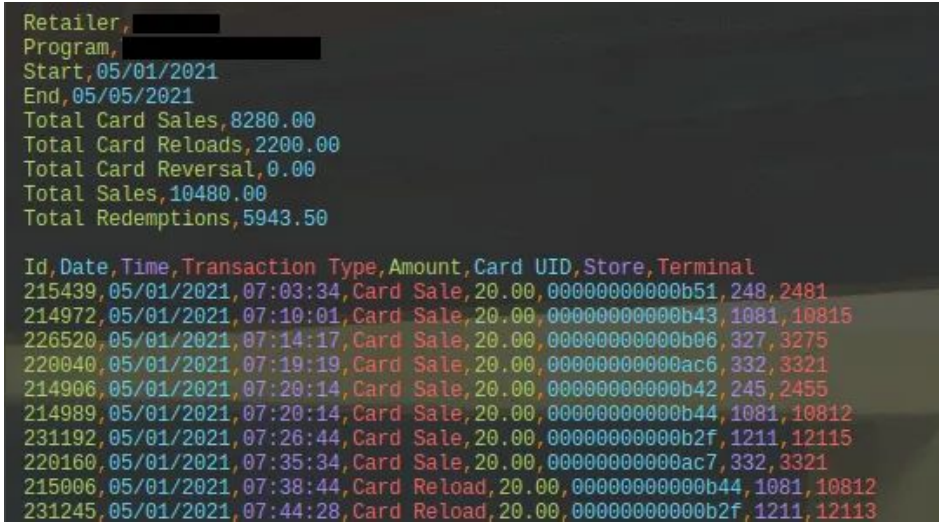
Stored a `production.env` file in a publicly accessible S3 bucket.

The file contained API keys and admin credentials to a CRM, patient database, and other internal systems.

What I found

A US lottery company

Directly stored customer and transaction data as `.csv` files in a publicly accessible S3 bucket.



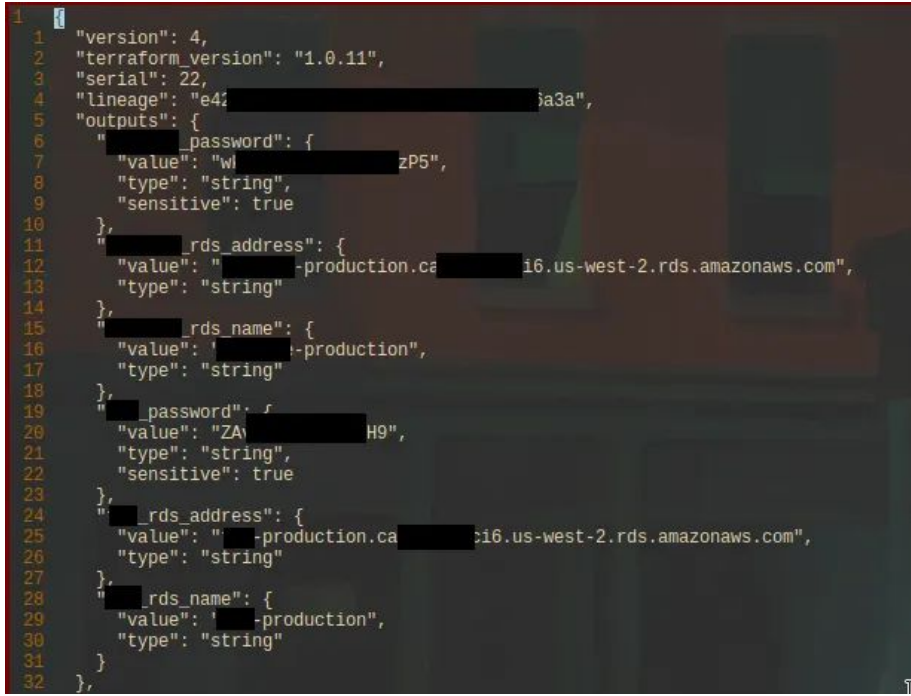
```
Retailer,[redacted]
Program,[redacted]
Start,05/01/2021
End,05/05/2021
Total Card Sales,8280.00
Total Card Reloads,2200.00
Total Card Reversal,0.00
Total Sales,10480.00
Total Redemptions,5943.50

Id,Date,Time,Transaction Type,Amount,Card UID,Store,Terminal
215439,05/01/2021,07:03:34,Card Sale,20.00,00000000000b51,248,2481
214972,05/01/2021,07:10:01,Card Sale,20.00,00000000000b43,1081,10815
226520,05/01/2021,07:14:17,Card Sale,20.00,00000000000b06,327,3275
220040,05/01/2021,07:19:19,Card Sale,20.00,00000000000ac6,332,3321
214906,05/01/2021,07:20:14,Card Sale,20.00,00000000000b42,245,2455
214989,05/01/2021,07:20:14,Card Sale,20.00,00000000000b44,1081,10812
231192,05/01/2021,07:26:44,Card Sale,20.00,00000000000b2f,1211,12115
220160,05/01/2021,07:35:34,Card Sale,20.00,00000000000ac7,332,3321
215006,05/01/2021,07:38:44,Card Reload,20.00,00000000000b44,1081,10812
231245,05/01/2021,07:44:28,Card Reload,20.00,00000000000b2f,1211,12113
```

What I found

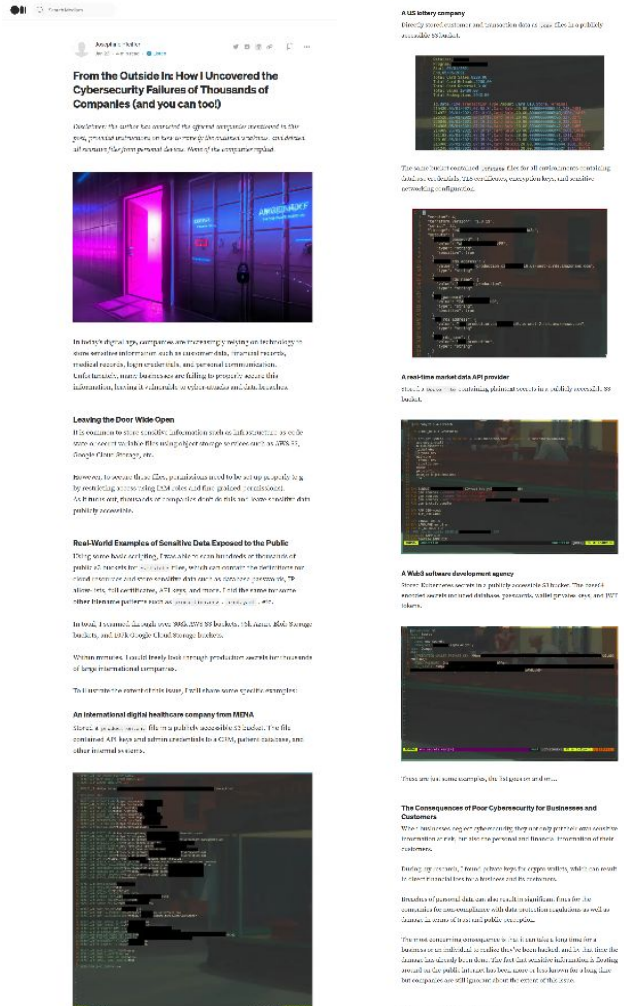
A US lottery company

The same bucket contained `.tfstate` files for all environments containing database credentials, TLS certificates, encryption keys, and sensitive networking configuration.



Blog post

- Reached out to companies (none responded)
- Published blog post
- ~5k reads on medium
- Discussed at length on r/cybersecurity, and hackernews



[redacted] · 1st

Security Intelligence Engineer @ AWS.

TUESDAY

[redacted] • 9:55 PM

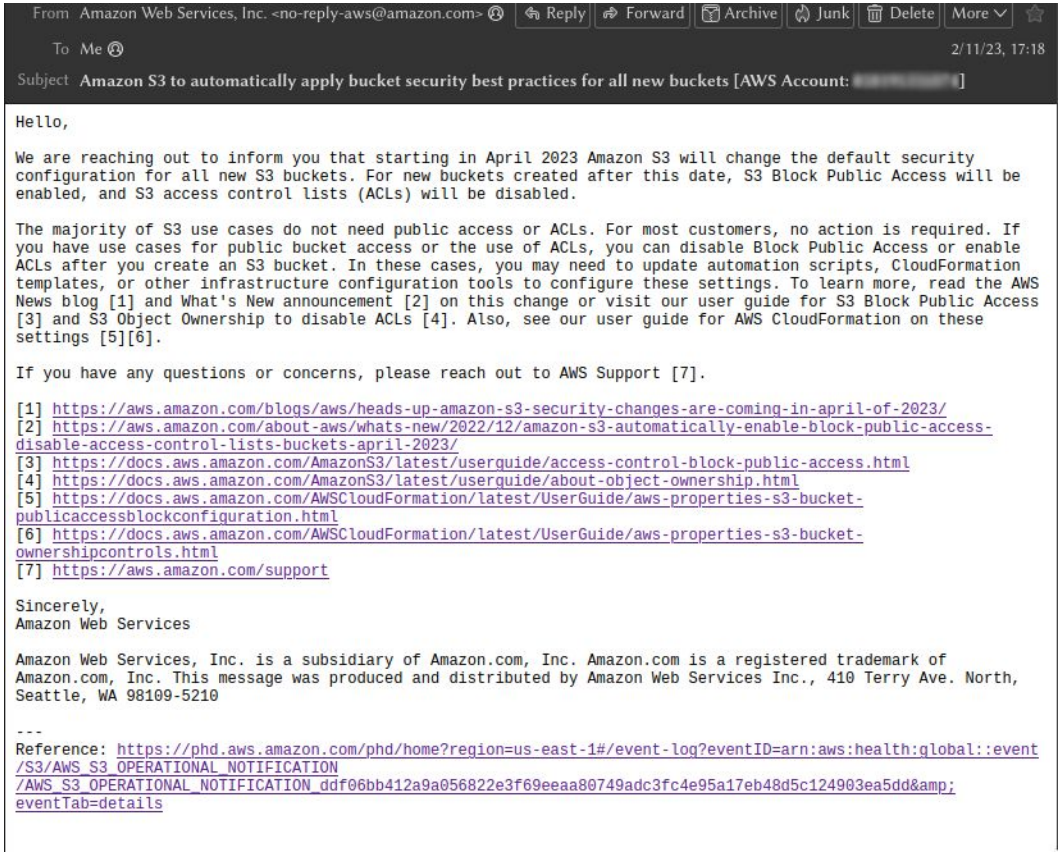
Hi Josephine,

I work in AWS's threat intel team, and I just read your medium post regarding unsecured sensitive data in S3 buckets--would you be open to discussing your findings in more detail? I'd like to surface this with folks in AWS Security.

Thanks!

--[redacted]

Results



From Amazon Web Services, Inc. <no-reply-aws@amazon.com> Reply Forward Archive Junk Delete More

To Me 2/11/23, 17:18

Subject **Amazon S3 to automatically apply bucket security best practices for all new buckets [AWS Account: [redacted]]**

Hello,

We are reaching out to inform you that starting in April 2023 Amazon S3 will change the default security configuration for all new S3 buckets. For new buckets created after this date, S3 Block Public Access will be enabled, and S3 access control lists (ACLs) will be disabled.

The majority of S3 use cases do not need public access or ACLs. For most customers, no action is required. If you have use cases for public bucket access or the use of ACLs, you can disable Block Public Access or enable ACLs after you create an S3 bucket. In these cases, you may need to update automation scripts, CloudFormation templates, or other infrastructure configuration tools to configure these settings. To learn more, read the AWS News blog [1] and What's New announcement [2] on this change or visit our user guide for S3 Block Public Access [3] and S3 Object Ownership to disable ACLs [4]. Also, see our user guide for AWS CloudFormation on these settings [5][6].

If you have any questions or concerns, please reach out to AWS Support [7].

[1] https://aws.amazon.com/blogs/aws/heads-up-amazon-s3-security-changes-are-coming-in-april-of-2023/
[2] https://aws.amazon.com/about-aws/whats-new/2022/12/amazon-s3-automatically-enable-block-public-access-disable-access-control-lists-buckets-april-2023/
[3] https://docs.aws.amazon.com/AmazonS3/latest/userguide/access-control-block-public-access.html
[4] https://docs.aws.amazon.com/AmazonS3/latest/userguide/about-object-ownership.html
[5] https://docs.aws.amazon.com/AWSCloudFormation/latest/UserGuide/aws-properties-s3-bucket-publicaccessblockconfiguration.html
[6] https://docs.aws.amazon.com/AWSCloudFormation/latest/UserGuide/aws-properties-s3-bucket-ownershipcontrols.html
[7] https://aws.amazon.com/support

Sincerely,
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Reference: https://phd.aws.amazon.com/phd/home?region=us-east-1#/event-log?eventID=arn:aws:health:global::event/S3/AWS_S3_OPERATIONAL_NOTIFICATION/AWS_S3_OPERATIONAL_NOTIFICATION_ddf06bb412a9a056822e3f69eeaa80749adc3fc4e95a17eb48d5c124903ea5dd&eventTab=details

TL;DR

Default security config for new buckets now have public access disabled.

Key takeaways

- This is a really simple attack vector
  - Scary how easy it was: Awareness is important
- Impact can be catastrophic for businesses & customers
  - Financial, reputational, privacy violations
- Humans are the weakest link
  - The tech works fine, if used right
- A lot of companies are doing it right:
  - <1% of the scraped endpoints were public
    (excluding buckets that were obviously meant to be public – e.g. static website hosting)
- Cloud providers are taking steps
  - Making it even harder for users to leak data

Q&A