JUMPSEC

Offensive TokenCraft

Practical Conditional Access Bypass On Red Team Operations

Sunny Chau 2025

$ whoami

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Agenda

- Why play with Entra tokens, what are they
- A Browser-first Workflow
- Make-your-own-AiTM
- 3 Scenarios

  MFA Gap, ‘Typical Cookie theft’, Intune-bypass Cookie Theft

- Promise it’s packed with TTPs
- All from real engagements

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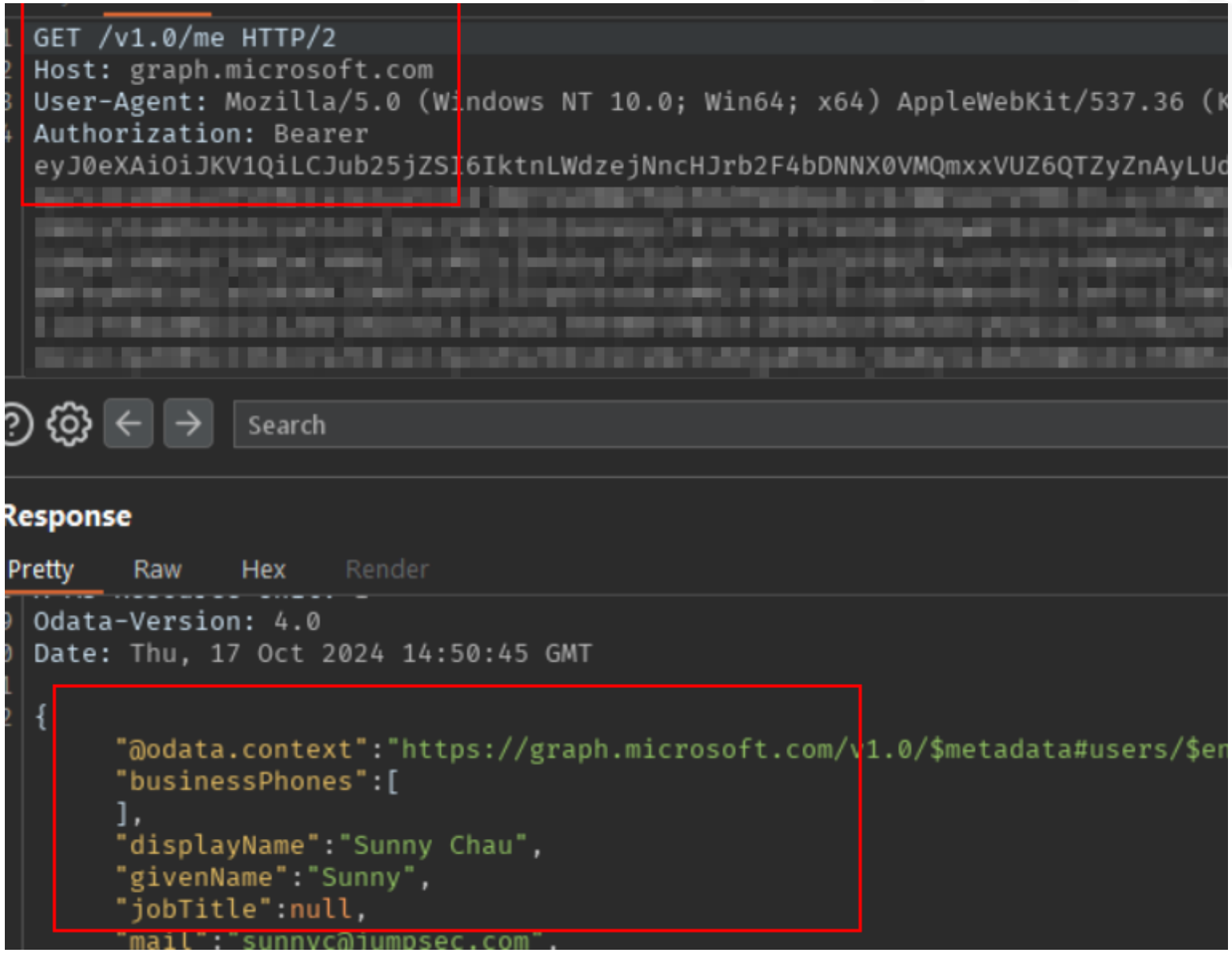
Why Entra Tokens and What are they



Access Tokens

This is what you prob think of ‘Entra tokens’ as

Resource - graph.microsoft.com

API call –

GET /v1.0/me

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Baseline Refresh Tokens

- Lives for 90 days
- 1.A...
- Same or Less scope, Same Resource
- Used to get new Access Tokens

Family of **Refresh Tokens** – it's super cool!

There are boring Ref tokens and there are **Foci Ref Tokens**

Cross-client

Cross-resource

Cross-scope

(with caveat)

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What about Browser Cookies?

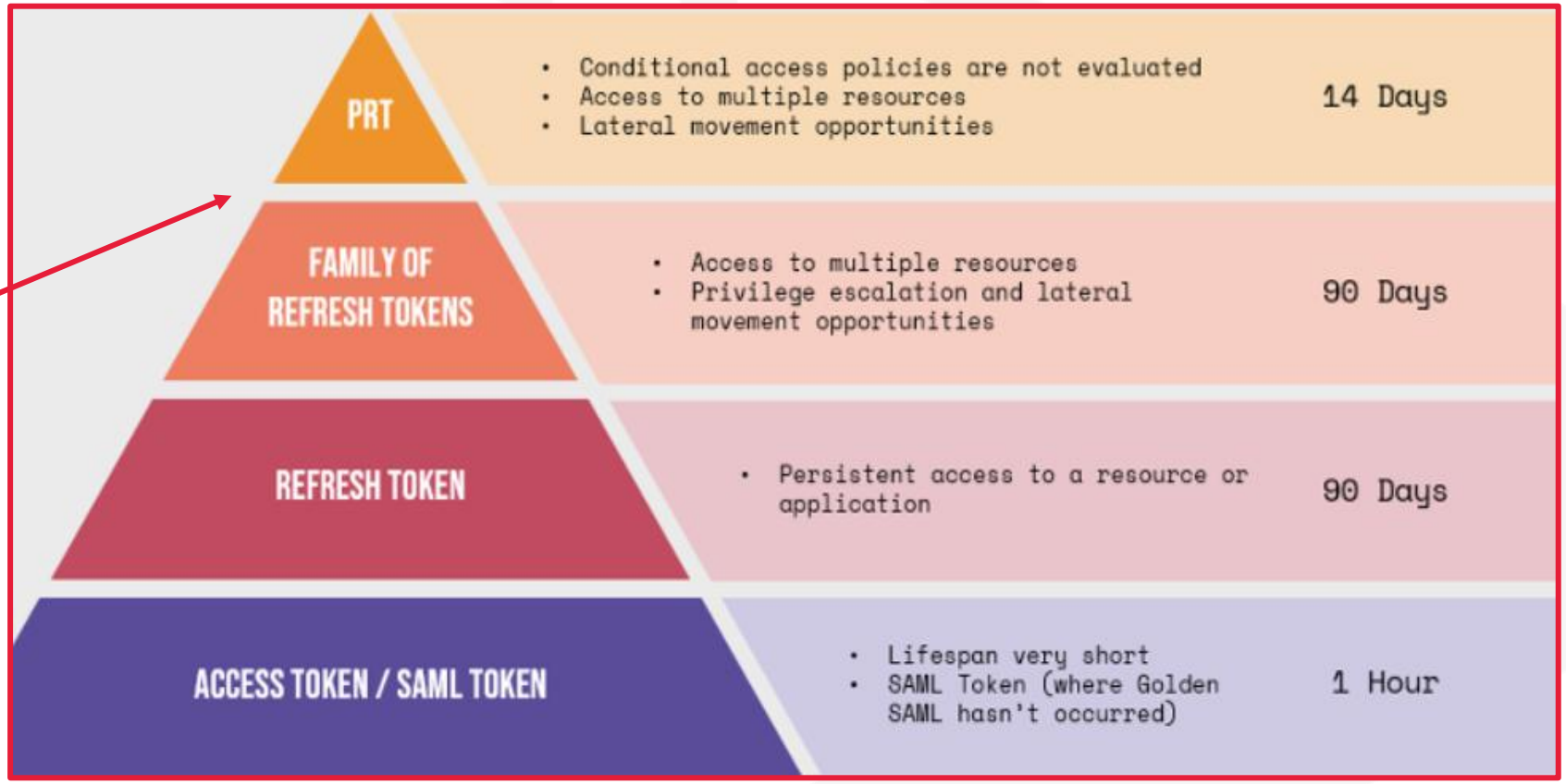
https://www.xintra.org/blog/tokens-in-entra-id-guide

I argue -

Browser cookies:
ESTSAUTH &
ESTSAUTHPERSISTENT

Above “Family tokens”
Below PRT

New ones called BroCi tokens



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Browser as the new frontier

Browser is the new frontier (vs endpoint)

- Our Experience – Entire RT's without touching user endpoint
- Both in Hybrid & Cloud-native land
- TI / Our own IR – TA's go payload-less

  why? Initial access via SSO in VPN, Tooling in Linux

- Or, one of our favorites

  (TTP 0 – ask for VPN provision)
  (TTP 1 – look for a VPN installer in SharePoint)
  (TTP 2 – search for a VPN installer with OSINT tech)

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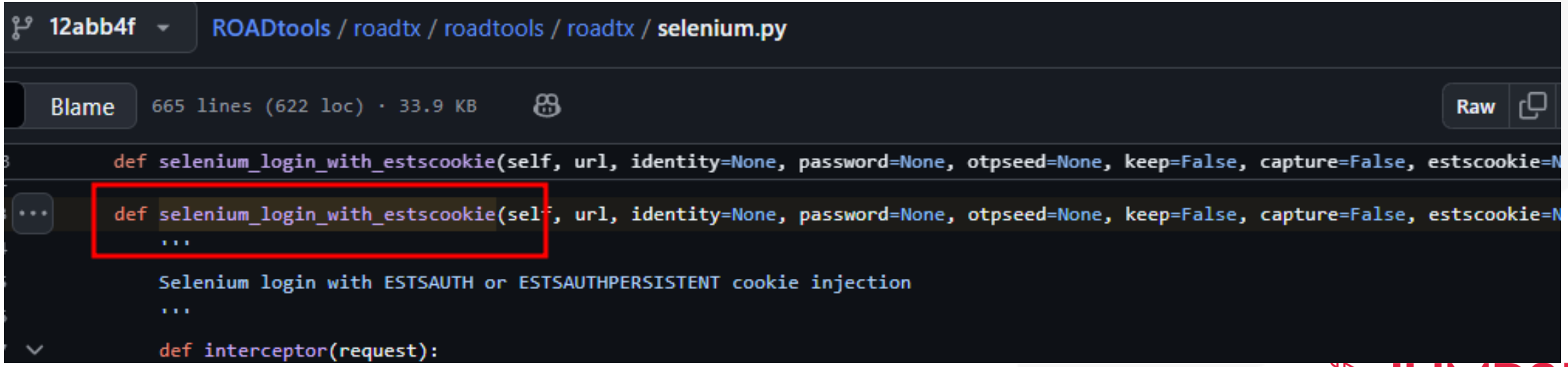
Bridging the Gap between Browser and Tokens

- Your Ref tokens are cool but… how do you get your hands on one?
- **ESTS Cookies (Auth & Persistent)** are what you get from phishing\
- Ref & Access Tokens were what you use to run tools, but …?



Hey mom, I inspired people ('s tooling)! (EntraTokenAid, TokenTacticsV2, even roadtx?

github.com/zh54321/EntraTokenAid

README MIT license

2025-04-11

Added

- It is now possible now generate the auth
  authentication, copy the URL containing
  the token. `$tokens = Invoke-Auth -Manua`

Note: Inspired by:

- TokenTacticsV2
- TokenSmith

github.com/f-bader/TokenTacticsV2

README BSD-3-Clause license

0.2.6 (2025-01-04)

- Fix bug custom scopes in `Get-AzureAuthorizationCode` and `Get-AzureTokenFromAuthorizationCode`
- Change default redirect Uri for `Get-AzureAuthorizationCode`

0.2.5 (2025-01-04)

- Added new cmdlets `Get-AzureAuthorizationCode` and `Get-AzureTokenFromAuthorizationCode`
  Those cmdlets are heavily inspired by TokenSmith maintained by @gladstomych
- Added new cmdlet `Invoke-RefreshToDeviceRegistrationToken` which is a TokenTactics version of the AADInternals cmdlet `Get-AccessTokenForAADJoin`
- Added v1 endpoint support for `Invoke-RefreshToToken` with the `UseV1Endpoint`. This was required to add `Invoke-RefreshToDeviceRegistrationToken`

roadtx codeauth

This command exchanges an authorization code for an access / refresh token. This is essentially a helper method for the code grant flow, the most common flow in OAuth2 authentication in Azure AD.

EC

What is the Authorization code flow?

/oauth2/v2.0/**authorize** **response_type=code**

Go through Password/MFA, or **Existing Cookies**

Entra (feeling satisfied): Redirected code=<auth_code>

POST to /**token** to redeem Access & Refresh Tokens

What is the Authorization code flow?

/oauth2/v2.0/**authorize** **response_type=code**

↓

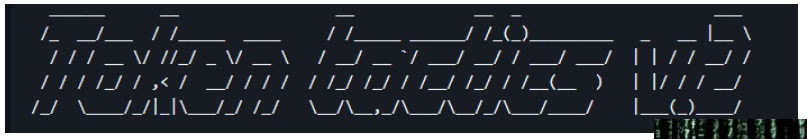
Go through Password/MFA, or **Existing Cookies**

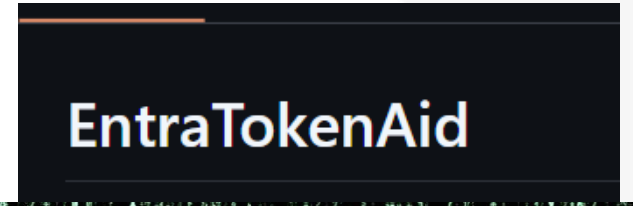
↓

Entra: Redirected code=<auth_code>

↓

(THIS PART CAN BE BROKEN UP)





↓

POST to /**token** to redeem **Access & Refresh Tokens**

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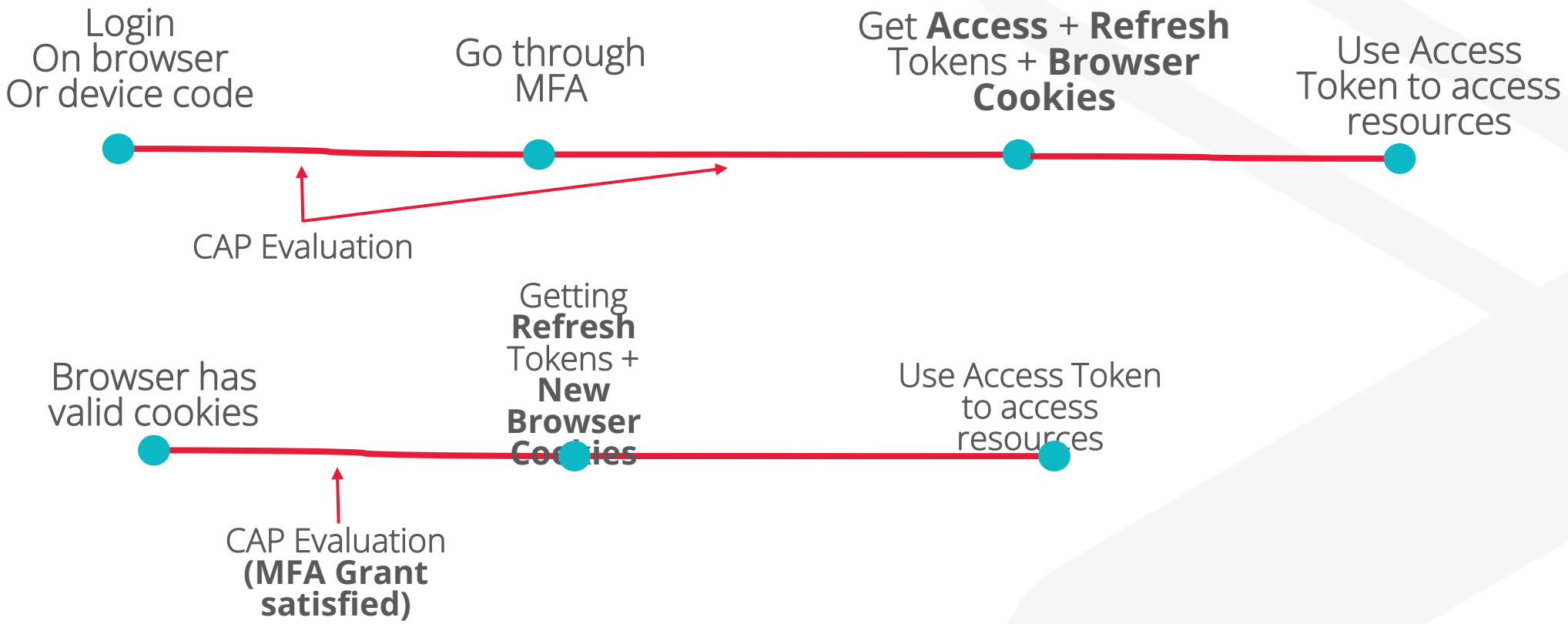
Let’s lay some groundwork first -
What is Grant, When is CAP eval’d

One must imagine Entra ID happy?

Where are CAPs evaluated? (interactive sign in)



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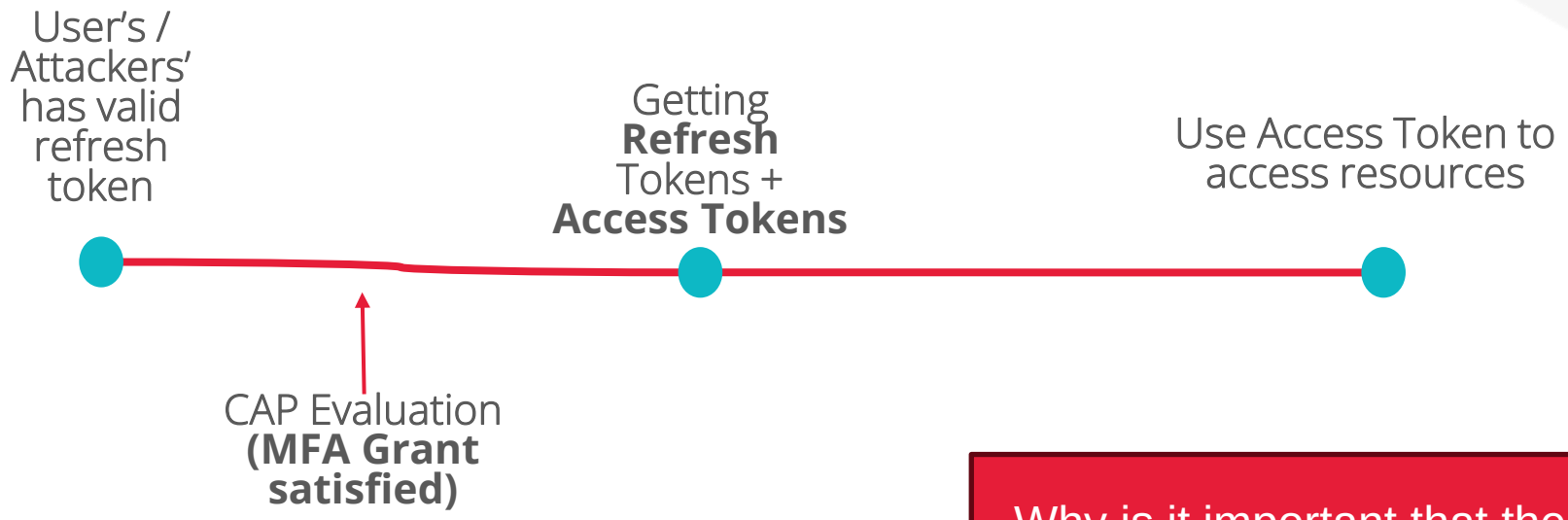
What's with ref tokens? (non-interactive logins)



Why is it important that the Ref token Contains the original MFA grant?

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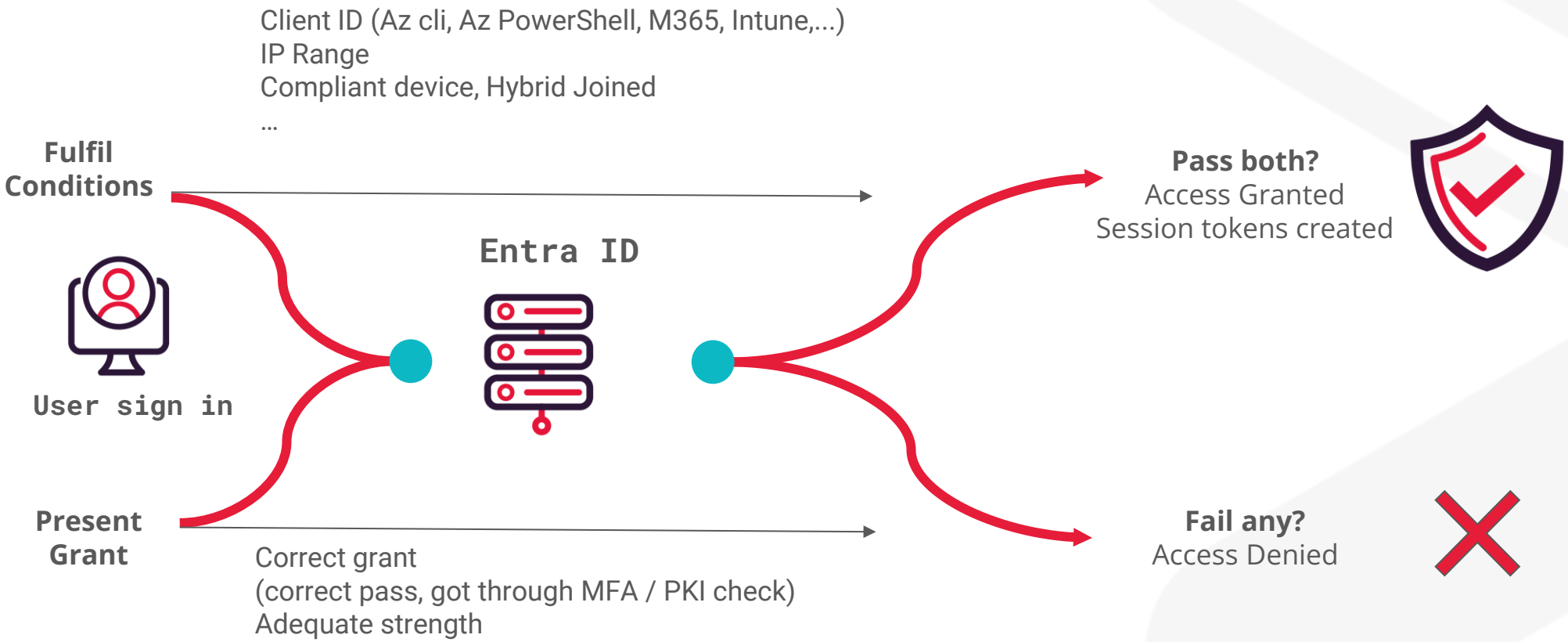
Pictorially



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Let’s lay some groundwork first - AiTM Phishing

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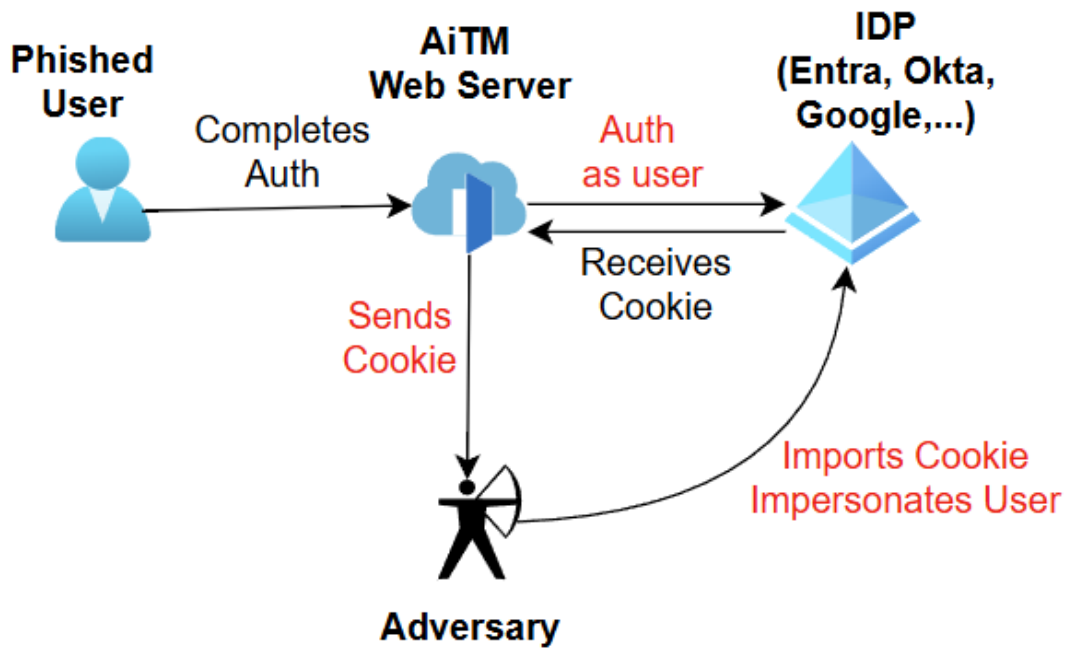
AiTM Flow for Microsoft Entra ID - 1

User lured to AITM site (acting as a reverse proxy)

User enters credentials and MFA.

Malicious Server intercepts the returning ESTS* cookies for authentication



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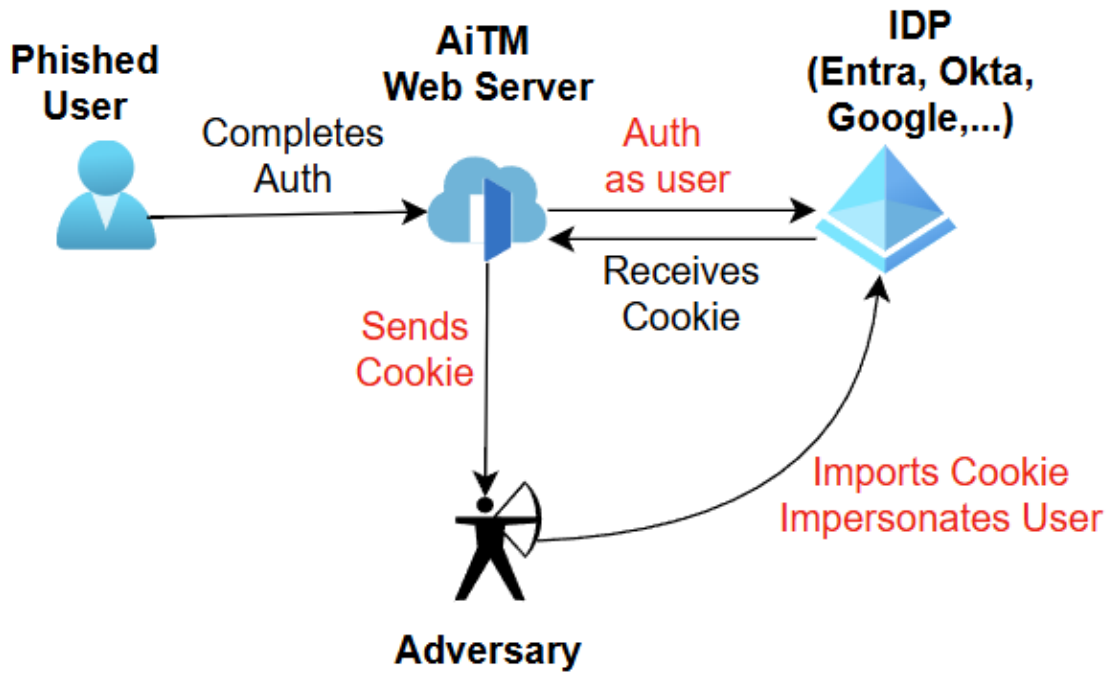
AiTM Flow for Microsoft Entra ID - 2

User returned to attacker-controlled redirection site

Attacker Imports ESTS* Tokens into the browser for session theft

OAUTH Flow for swapping the ESTS* cookie for Graph and Refresh tokens



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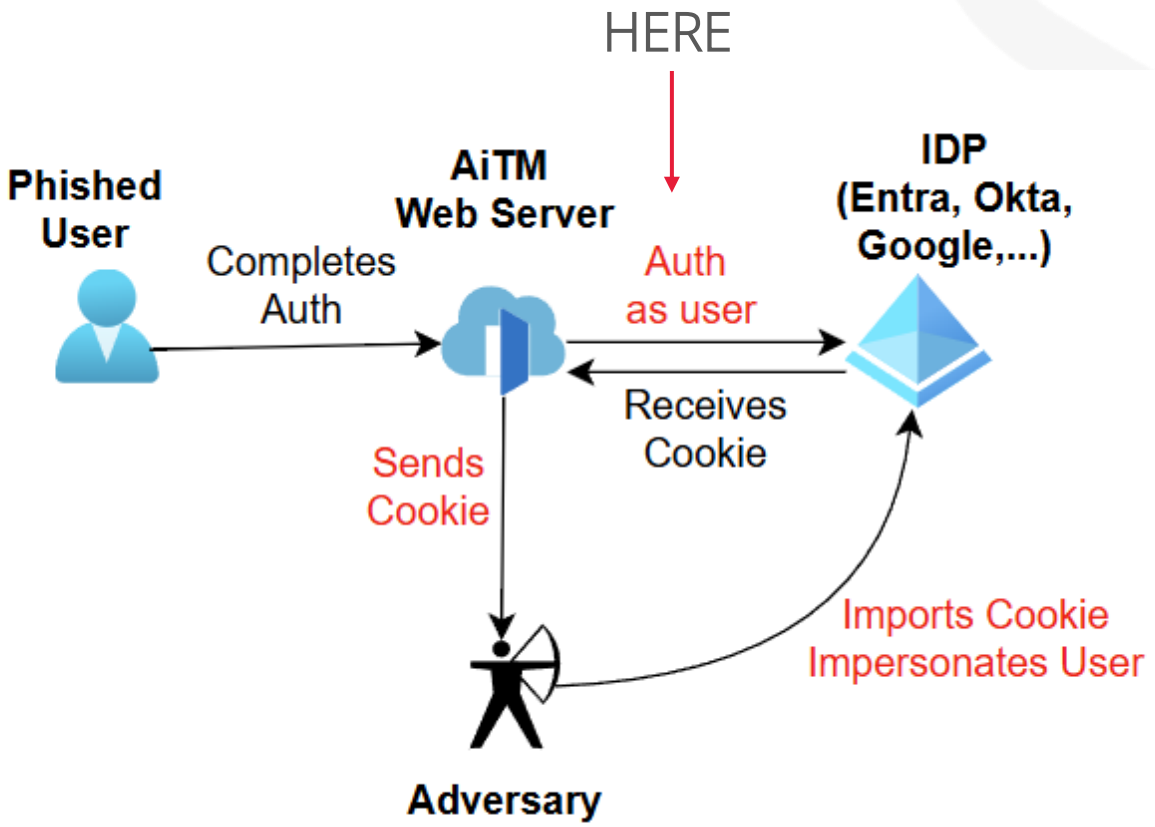
Where's CAP eval in this?



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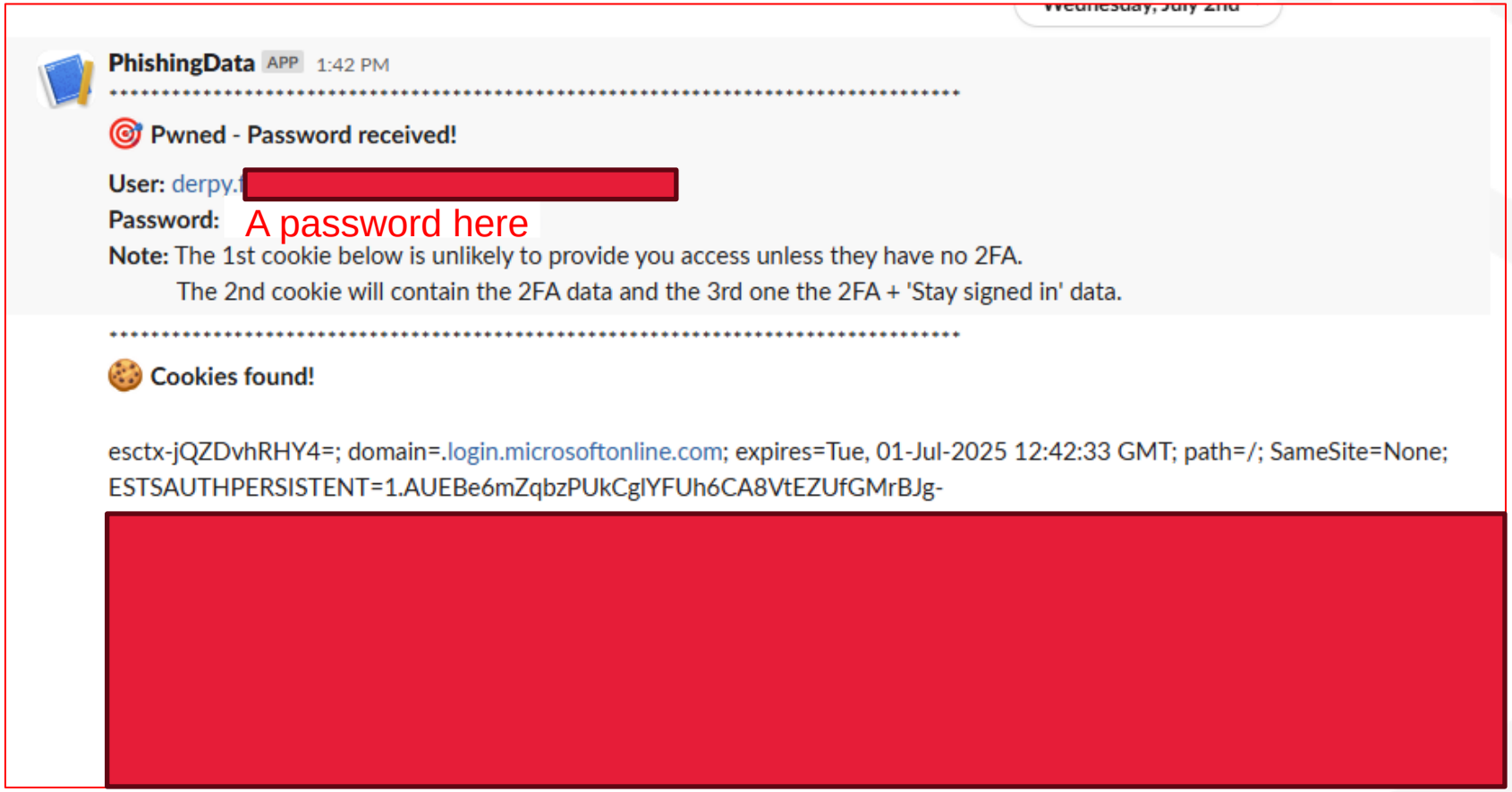
ESTSAUTH Tokens



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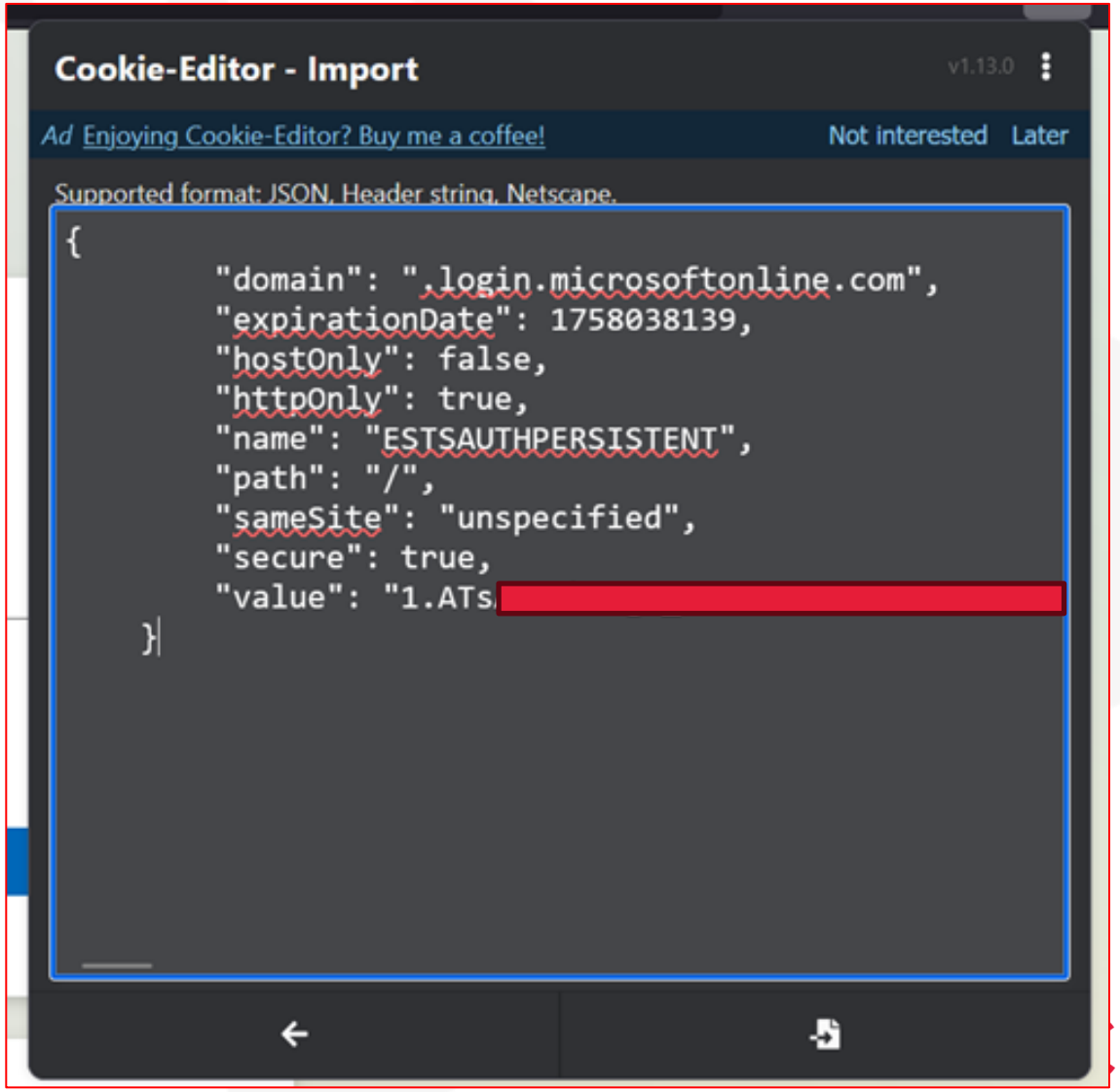
Session Theft

```
te@tdejmp:/mnt/c/Users/te/Downloads$ cat oi.cok
[redacted]; domain=.login.microsoftonline.com; expires=Tue, 17-
ESTSAUTHPERSISTENT=1.ATs[redacted]
```



Let’s build our AiTM logic

- Reverse Proxy over – login.microsoftonline.com
- Starts user on an appropriate /oauth2/v2.0/**authorize** URL when they hit your Lure path
- THERE WILL ALWAYS BE a final redirect, today it’s still by Location header
  - Check it in your proxy, and redirect your victim accordingly
- Set-Cookies: ESTSAUTH, ESTSAUTHPERSIST
  - Send it to you
- User punch in username & password? –
  - Sent it to you

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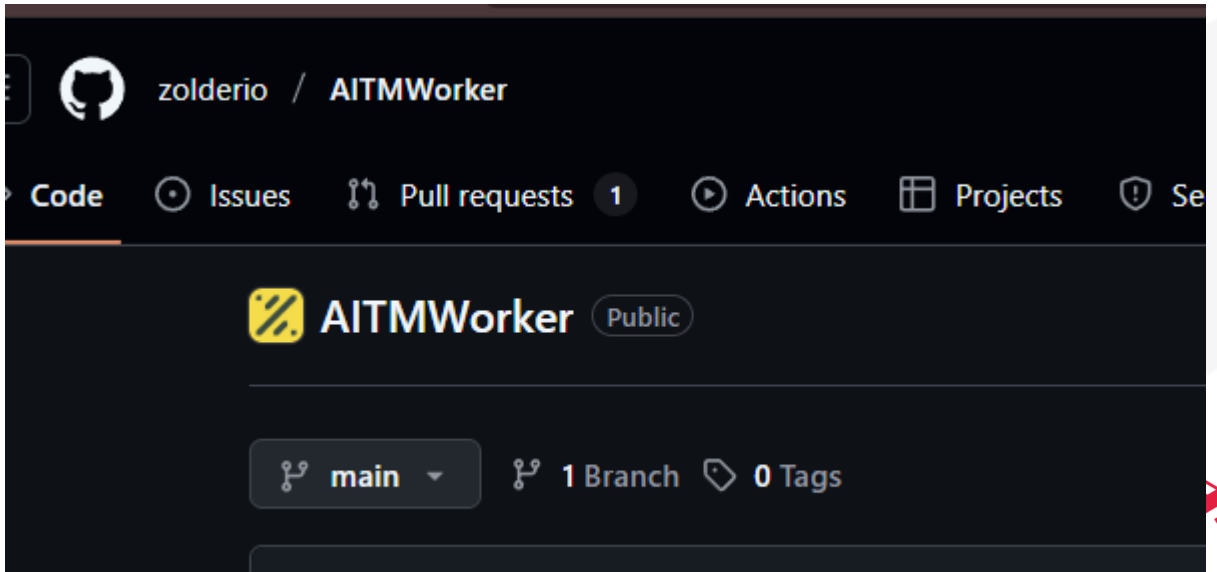
Let’s build our AiTM logic

- Reverse Proxy over – login.microsoftonline.com
- Starts user on an appropriate /oauth2/v2.0/**authorize**
- Check redirect by Location header
- Set-Cookies: ESTSAUTH, ESTSAUTHPERSIST > to attacker
- User punch in username & password? > to attacker

Is it really that simple???



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Let’s build our AiTM logic

*Is it really that simple??? **Actually no***

Opsec requirement

- Blocking bots
- Allowlisting your IP before goes live
- Maybe reCAPTCHA
- Visits without proper lure URL would be redir to harmless 302

Sensible SSL

Client Branding..

If you don’t like xxxxGinx (or any available tooling), it is something that can be sensibly build in a week (or 4) in fact

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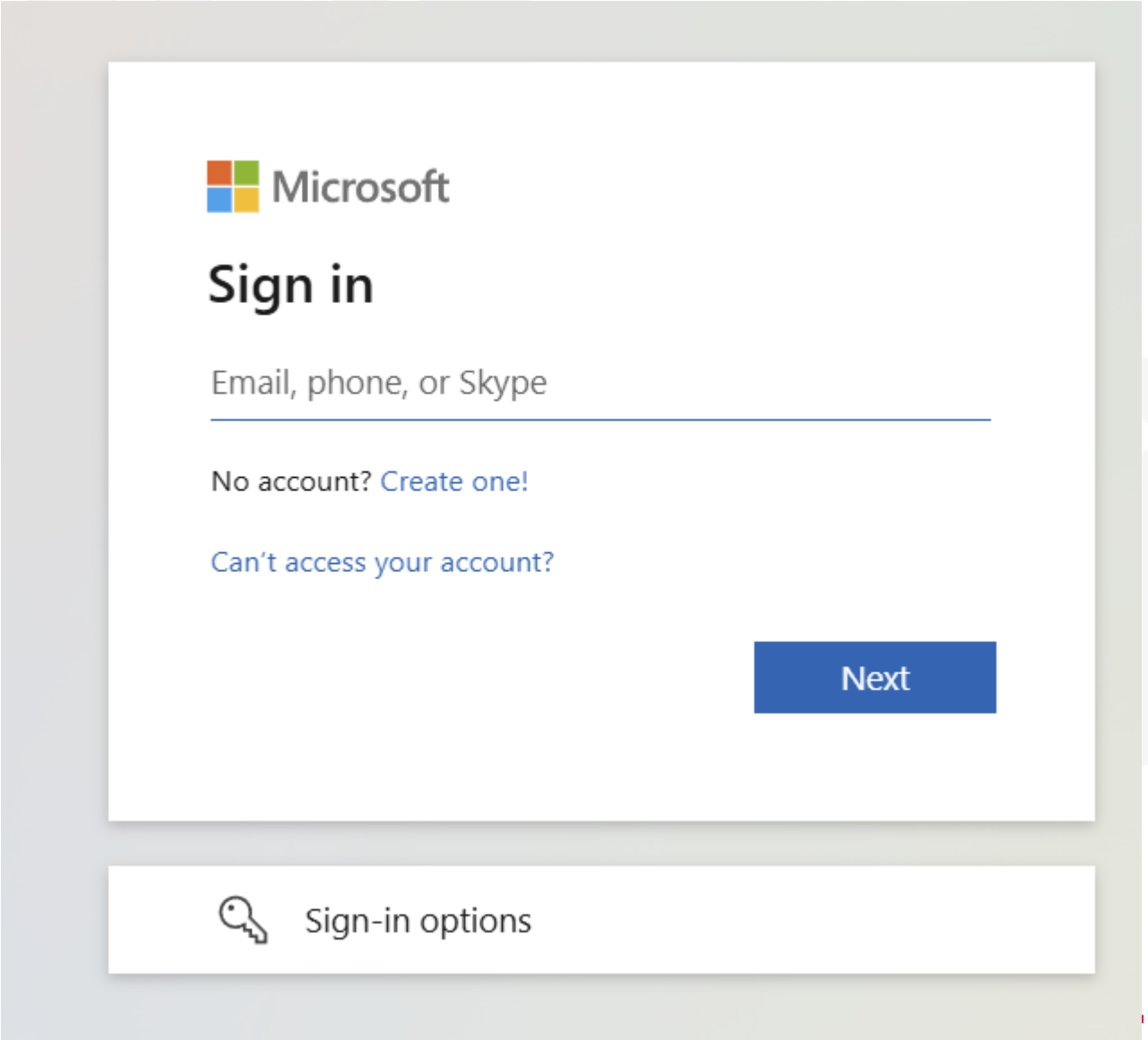
TTP3: ‘common’ trick

Easiest way to do client branding

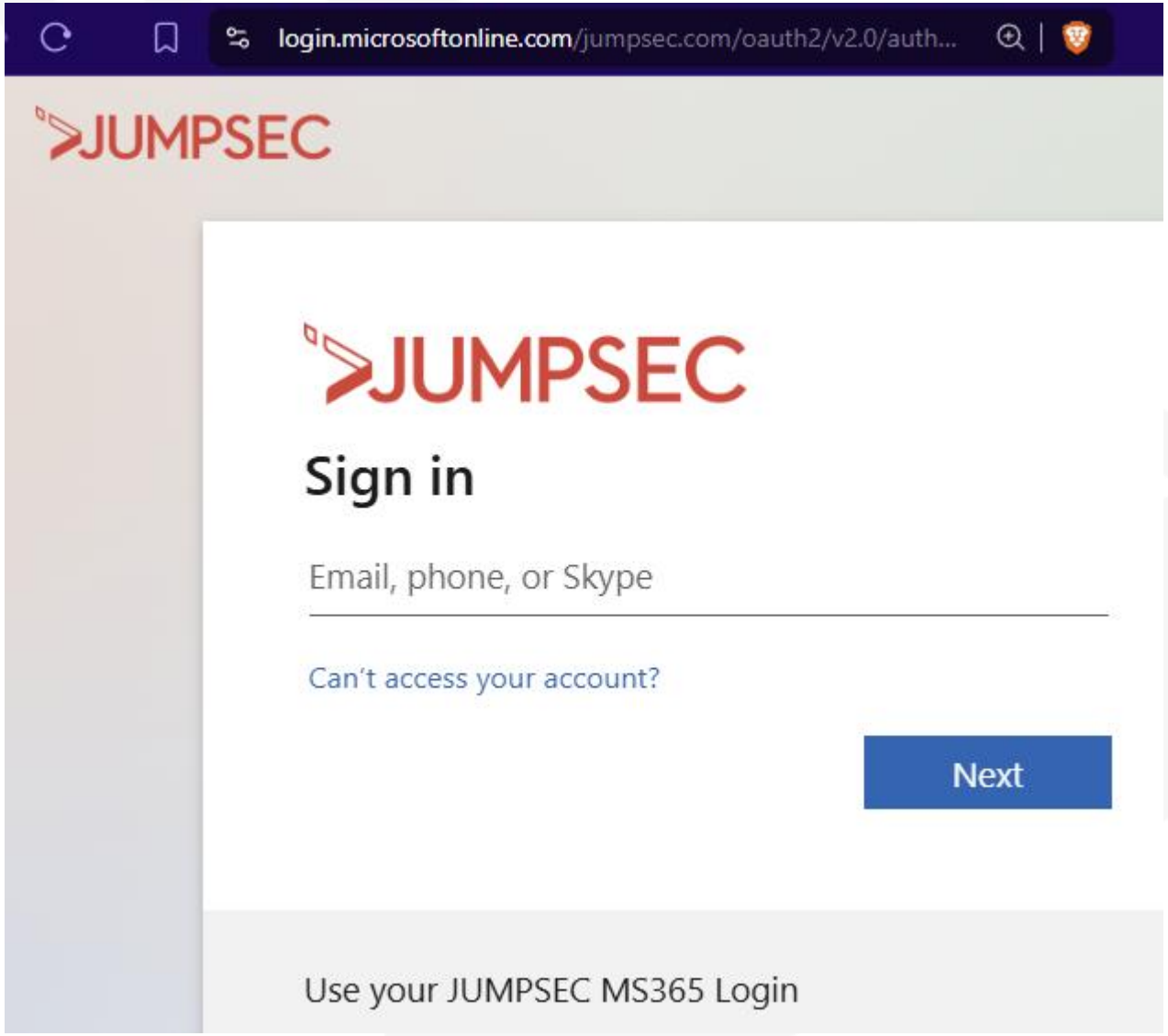
login.microsoftonline.com/**common**/oauth2/v2.0/authorize…



Trick 1: ‘common’ trick

Easiest way to do client branding

login.microsoftonline.com/**client.domain**/oauth2/v2.0/authorize…



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Practical RT Scenarios

Scenario 1 – RT has valid creds but no MFA

My first time ever hacking into an M365 environment – there was a gap with Teams on iPhone

TTP4 – Teamfiltration & MFA gap bruteforcing


```
.\beac0n\ --exfil --username derpy.fonder@defi[redacted] --password [redacted] --config .\TeamF

es does not use FireProx, ORIGIN IP WILL BE LOGGED, are you an adult? (Y/N)

2025 5:46:20 PM EST Sprayed derpy.fonder@def:[redacted] => VALID BUT MFA (76)
PM EST Attemping to enumerate potential conditional access policy
2025 5:46:20 PM EST  URI: https://api.spaces.skype.com/ APP: Microsoft Teams PLATFORM: Android => VALID BUT MFA (76)
2025 5:46:21 PM EST  URI: https://api.spaces.skype.com/ APP: Microsoft Teams PLATFORM: iPhone => CAN ACCESS
nny\Tools\TeamFiltration]-(10/09 22:46:21)
```

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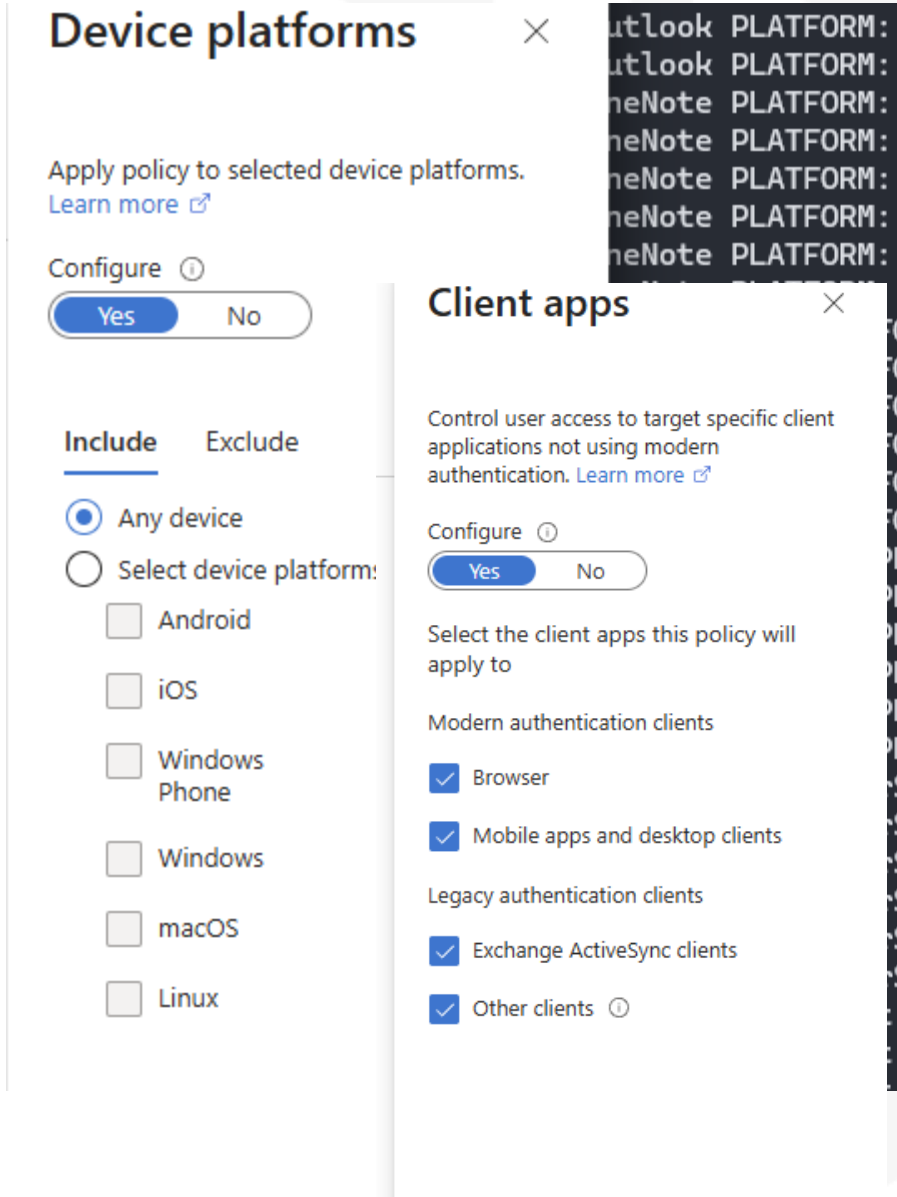
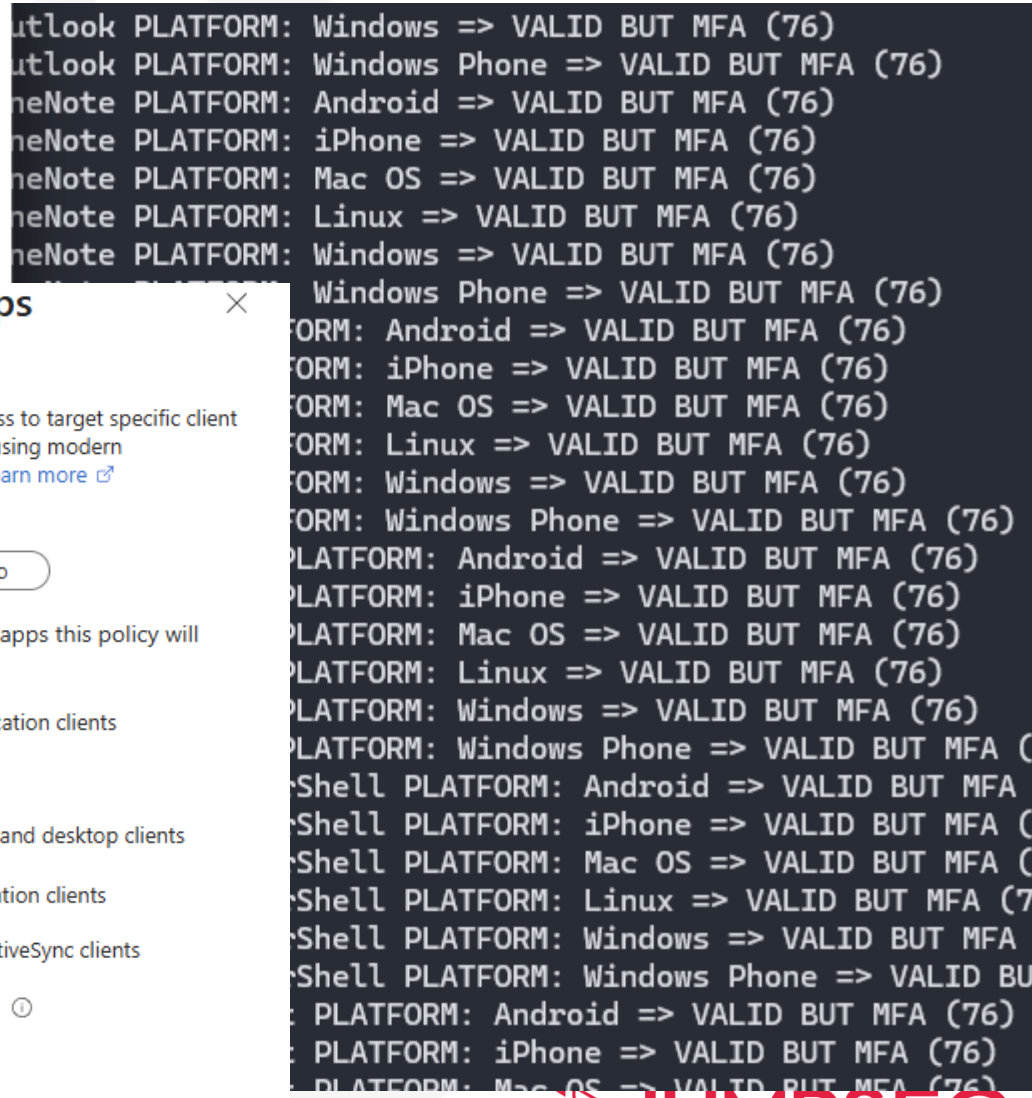
What do you mean, Teams on iPhone gap

- Device Platforms
- Include: ANY
- Client Apps: ALL

- This is the correct setting





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Scenario 1 – RT has valid creds but no MFA

Okay you got Teams token with Graph access now

- You can Enum now right?
- Yes – by calling Graph API with the Token Directly
- Why does GraphRunner / RoadRecon not working

Answer: Inadequate Grant (no MFA grant in Ref Token)

How to bypass MFA?

- TTP5 - TI backed – Call helpdesk

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Scenario 2 – RT has phished post MFA cookies

Now we have post MFA grant, what should we do?

- Assuming No full coverage passwordless requirement
- Assuming No full coverage compliant device requirement

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Scenario 2 – RT has phished post MFA cookies

Now we have post MFA grant, what should we do?

- TTP6 – Get on myaccount.Microsoft.com and reg your malicious MFA device!
- And do your usual post-ex business, looting emails, files, get on VPNs and etc

- Now you have a **Hot** browser window, GraphRunner gettoken and RoadRecon Auth should work unless client blocks device code

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Scenario 3 – We know the client requires, or probably requires compliant device

We have post MFA grant but blocked by CAP, what should we do?

Why did we leave this till last?

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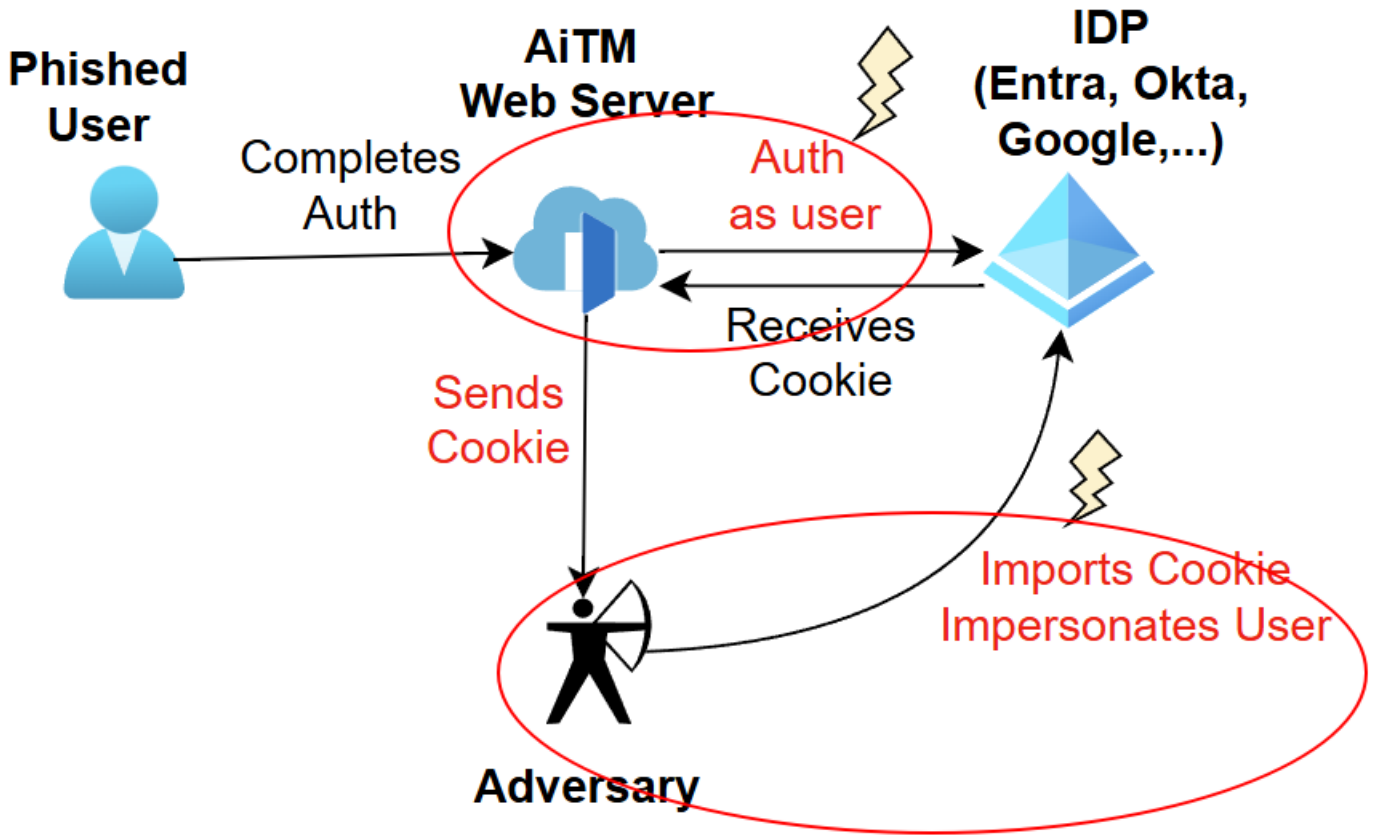
What happens on a RT?

Something the **user** possesses

But

The AiTM server, and the Adversary does **not**

If the AiTM server does not fit the CAP reqs – then no valid session cookies would be minted



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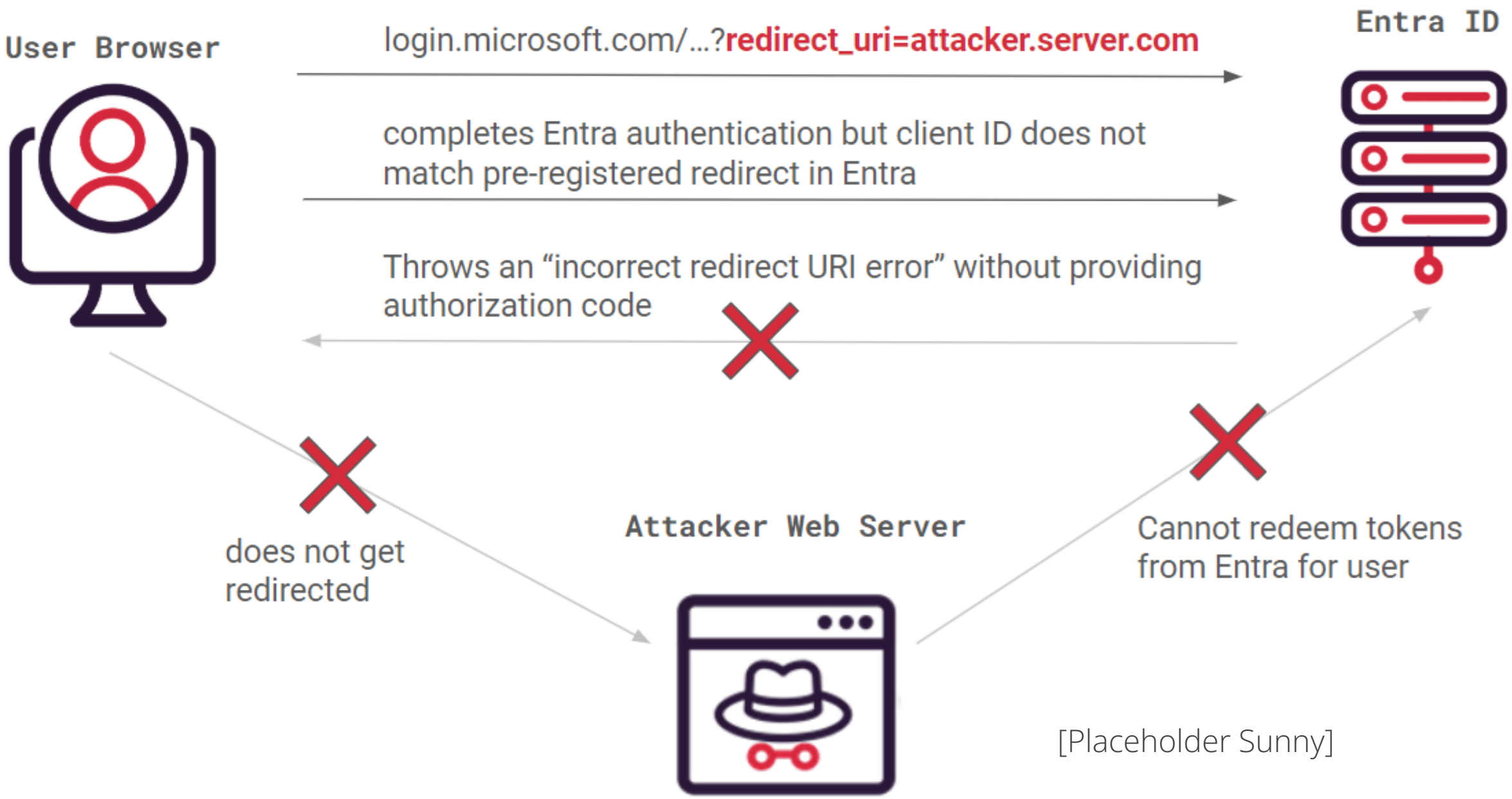
December whispers

- **HINT 1:**
  - **Client ID: ‘9ba1a5c7-f17a-4de9-a1f1- 6178c8d51223’**
- **HINT 2:**
  - **[Intune Company Portal]**


User Browser
login.microsoft.com/...?redirect_uri=attacker.server.com
Entra ID
completes Entra authentication but client ID does not match pre-registered redirect in Entra
Throws an “incorrect redirect URI error” without providing authorization code
does not get redirected
Attacker Web Server
Cannot redeem tokens from Entra for user
[Placeholder Sunny]

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Message after RTFM

- Redirect URI is not Arbitrary
- Microsoft doesn’t publish their first party App redirectors
- So, this is probably the main thing we need to reverse engineer

How would you approach this?

WHAT – being able to run offensive tools

HOW - Authenticate into Entra ID with compliant device CAP, without using a compliant device

The red team, using a Microsoft 0-day on the next engagement

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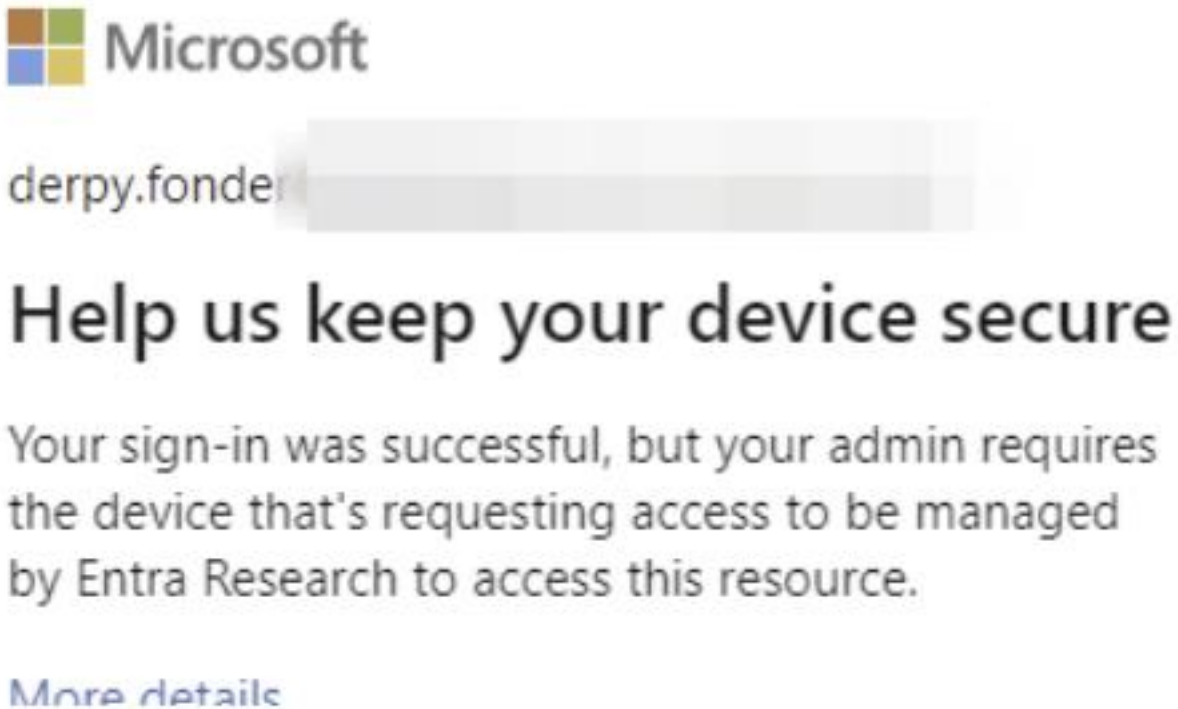
We’re blocked on baseline login

Review of logs:

- Did not satisfy the CAP



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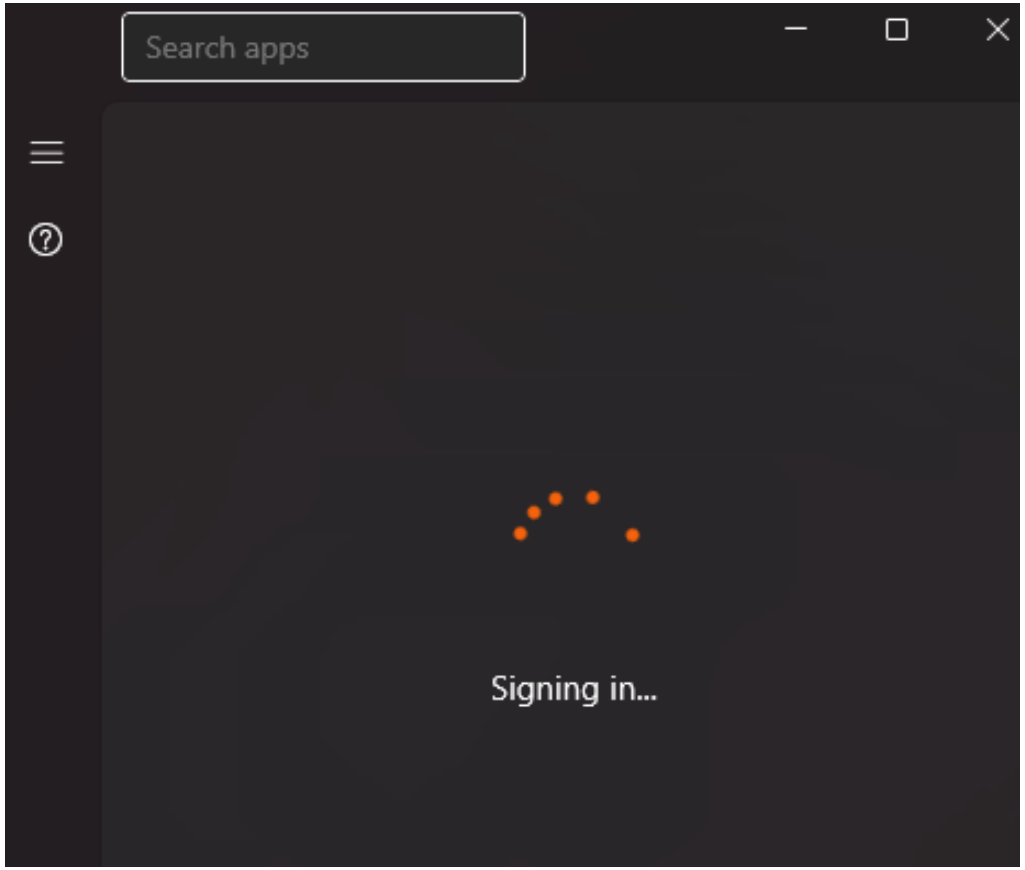
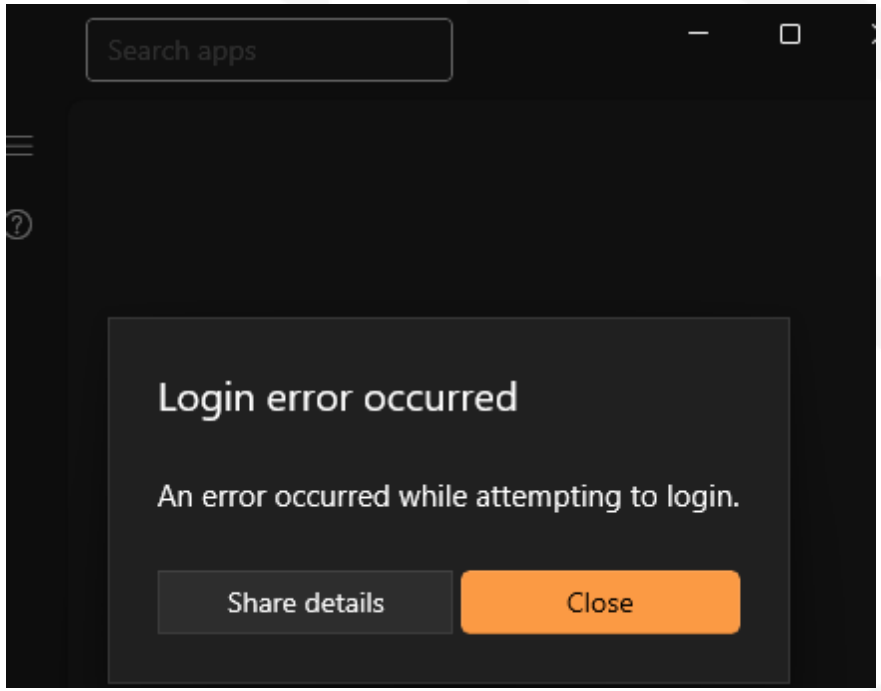
But for what we needed … it did not work out





Reason?
mTLS check?

Proxy
detection?

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anoopcnair.com/fix-intune-company-portal-app-login-issues/

AAD::Core::WebAccountProcessor::ReportOperationError.

Error: 0xCAA82EE2 The request has timed out.

Log Name: Microsoft-Windows-AAD/Operational
Source: Microsoft-Windows-AAD
Date: 15/07/2020 16:00:58
Event ID: 1098
Task Category: AadTokenBrokerPlugin Operation
Level: Error
Keywords: Operational,Error
User:
Computer:
Description:
Error: 0xCAA82EE2 The request has timed out.
Exception of type 'class HttpException' at xmlhttpwebrequest.cpp, line: 163, method: XMLHTTPWebRequest::ReceiveResponse.
Log: 0xcaa10083 Exception in WinRT wrapper.
Logged at authorizationclient.cpp, line: 233, method: ADALRT::AuthorizationClient::AcquireToken.
Request: authority: **https://login.microsoftonline.com/common**, client: 8ba1a5c7-f19a-5de9-a1f1-7178c8d51343, redirect URI: ms-appx-web://Microsoft.AAD.BrokerPlugin/S-1-15-2-2666988183-1750391847-2906264630-3525785777-2857982319-3063633125-1907478113

wait what?

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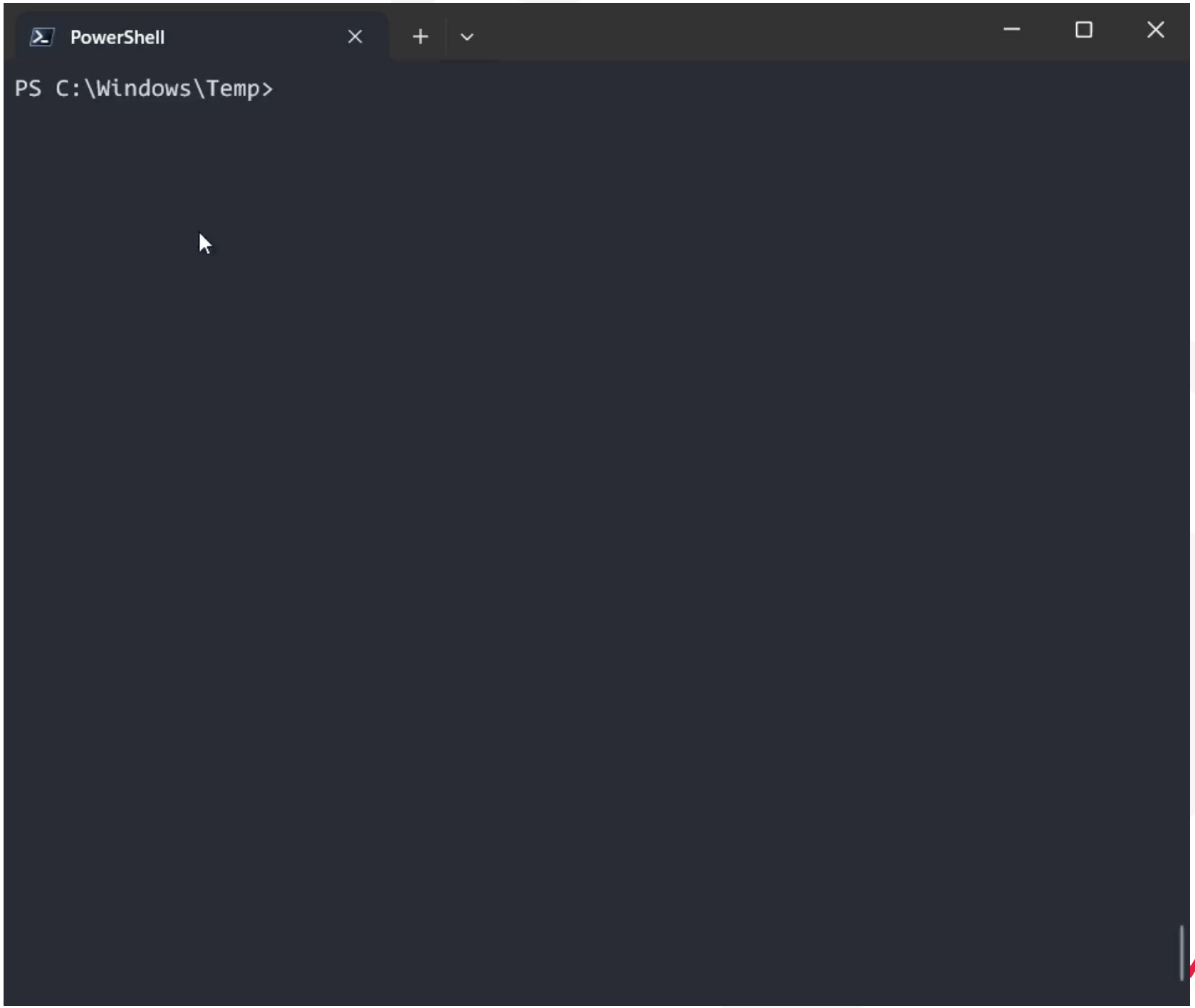
Demo time



The shadow patch

- **Roughly 20th Feb 2025** Microsoft quietly reduced the scope for the token you could get from company portal
- Noticeably narrower than the original, notably only on top of the Intune related ones:
  - **ServicePrincipalEndpoint.Read** & **User.Read**
- Also, Tokensmith's executable has become 'malware'

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So … is it now useless?

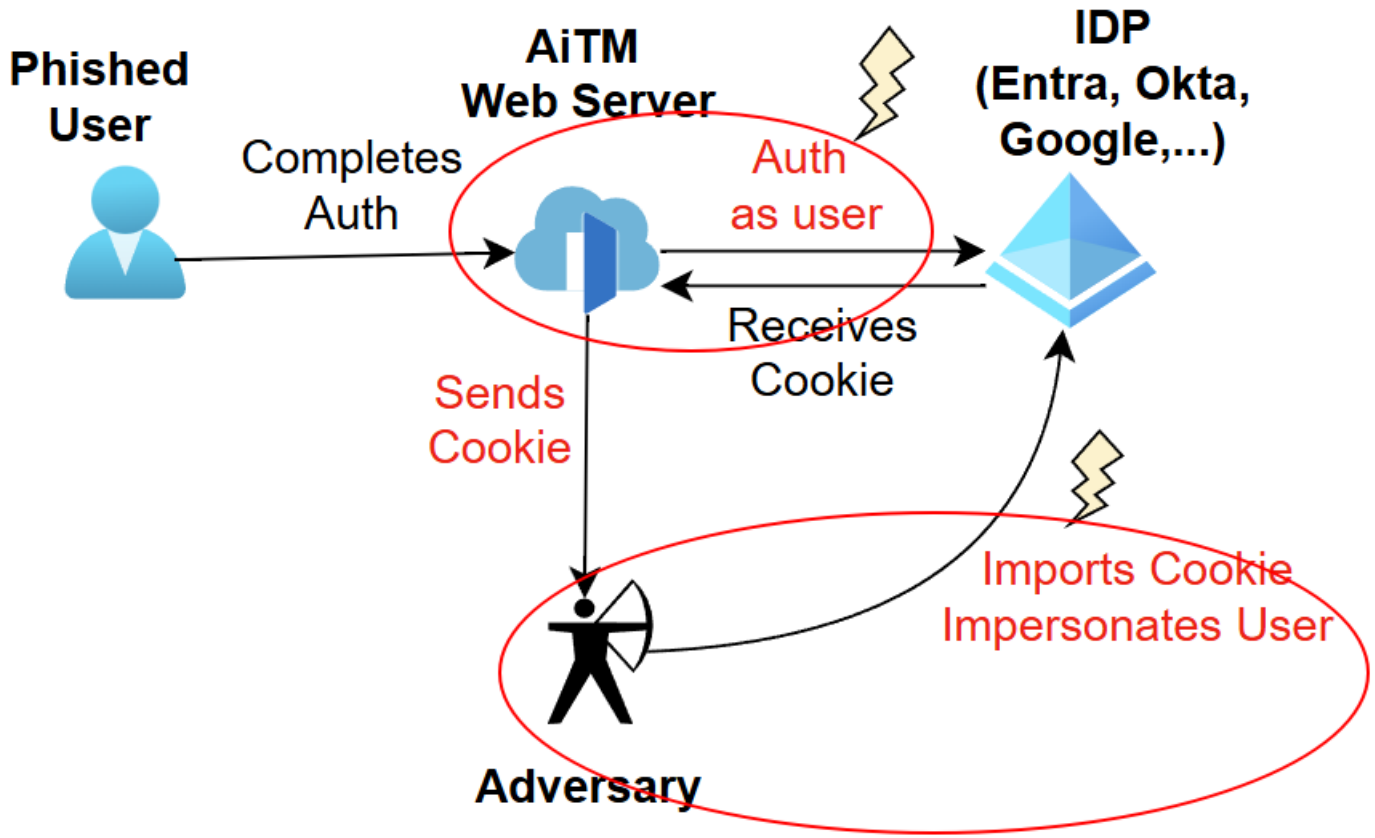
Remember again

That the

Blank device > Compliant device

Enrollment process

Can never require a Compliant device



What if the AiTM Web Server tries to sign in to device enrollment?

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Yes it can be done

TTP7 – use Intune device enrollment endpoint on AiTM web server

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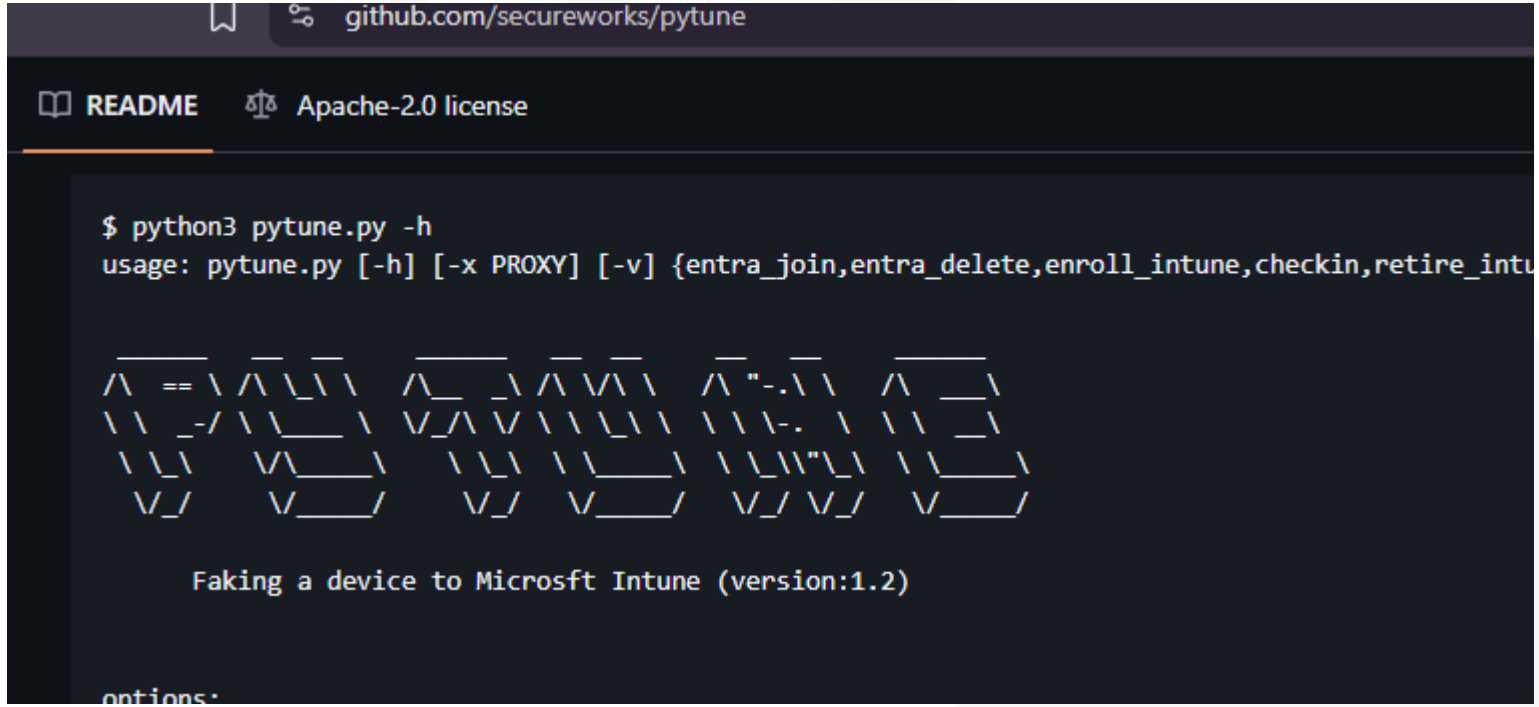
What do you do with the ESTS Cookies then?

TTP8 – Register a malicious device in client's Entra, Enroll into Intune

And *potentially* fake compliance

RoadTune (if you're on Outflank OST?)



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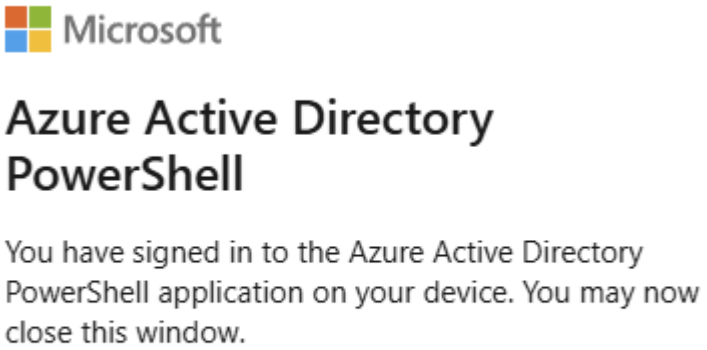
What do you do with the ESTS Cookies then?

You can use the same cookies on any assumed breach device, yes

Also can try other User-Agent, yes



What's even better?

```
└─$ roadtx auth --device-code
Requesting token for resource https://graph.windows.net
To sign in, use a web browser to open the page https://microsoft.com/devicelogin and enter th
Tokens were written to .roadtools_auth
```

TTP9 – roadtx auth – device-code bypass

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RECAP

Why play with Entra tokens, what are they

A Browser-first Workflow

Make-your-own-AiTM

3 Scenarios

MFA Gap, ‘Typical Cookie theft’, Intune-bypass Cookie Theft

- Promise it’s packed with TTPs
- All from real engagements

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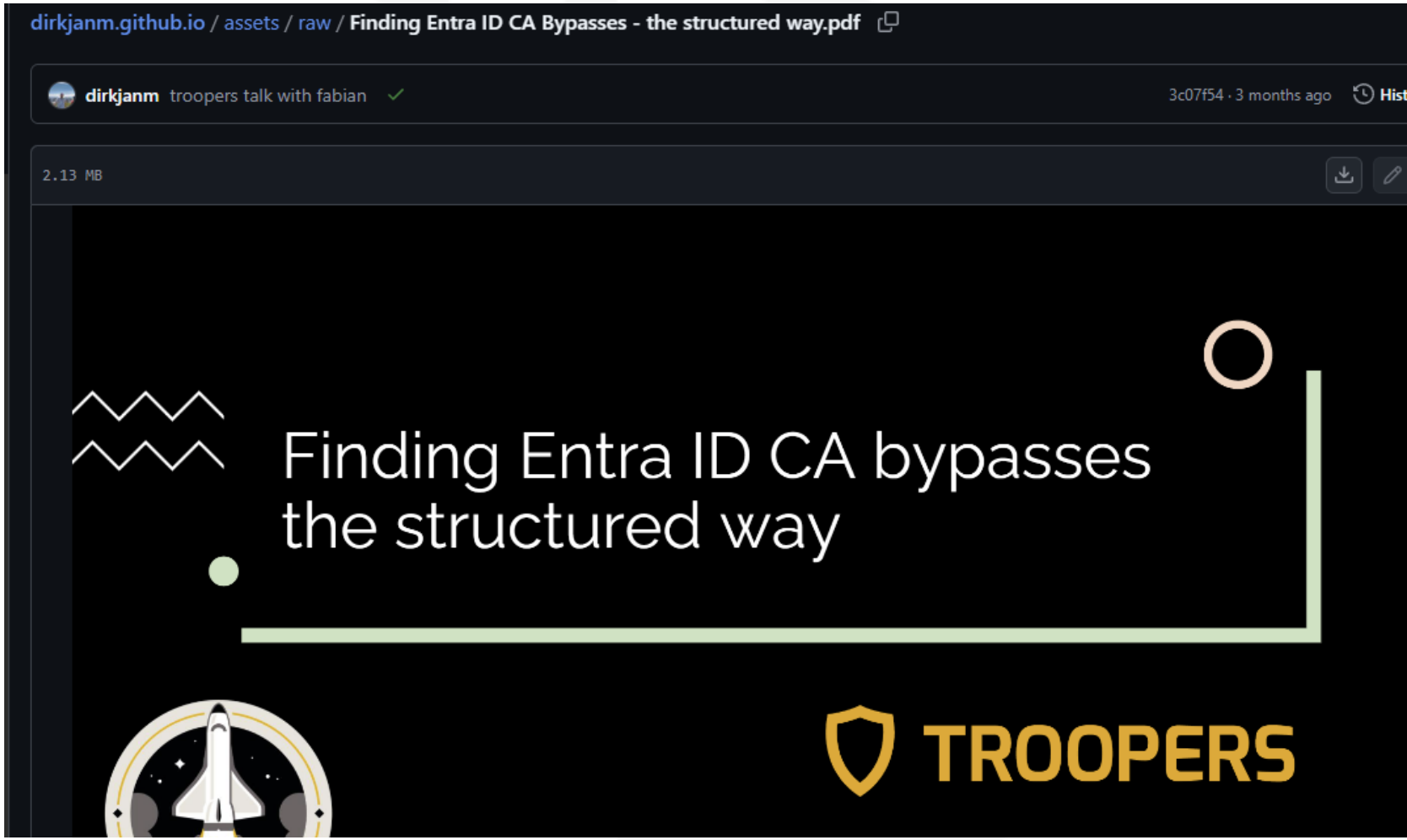
Latest Work in the area

- EntraScopes.com
- Dirk-jan's work on bruteforcing CAP bypasses



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