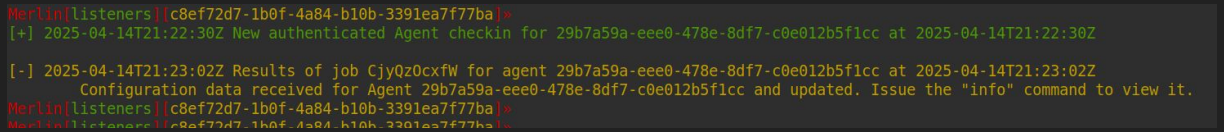
FULLHUNT

Compromising Developers with Malicious Extensions

VS Code, Cursor AI, and the Backdoor You Didn't See Coming



Mazin Ahmed

BLACKHAT MEA 2025 | Riyadh, Saudi Arabia 🇸🇦

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WHO AM I?

Mazin Ahmed

- AppSec Engineering, Security R&D in a Financial Institution
- Founder of FullHunt
- Occasional Bug Bounty Hunter: acknowledged by Meta, Twitter(X), LinkedIn, Zoom, U.S. Department of Defense, and more
- In love 💛 with AI Security, Cloud security, security automation, DevSecOps, distributed systems, and Web-App security

AI-powered IDEs

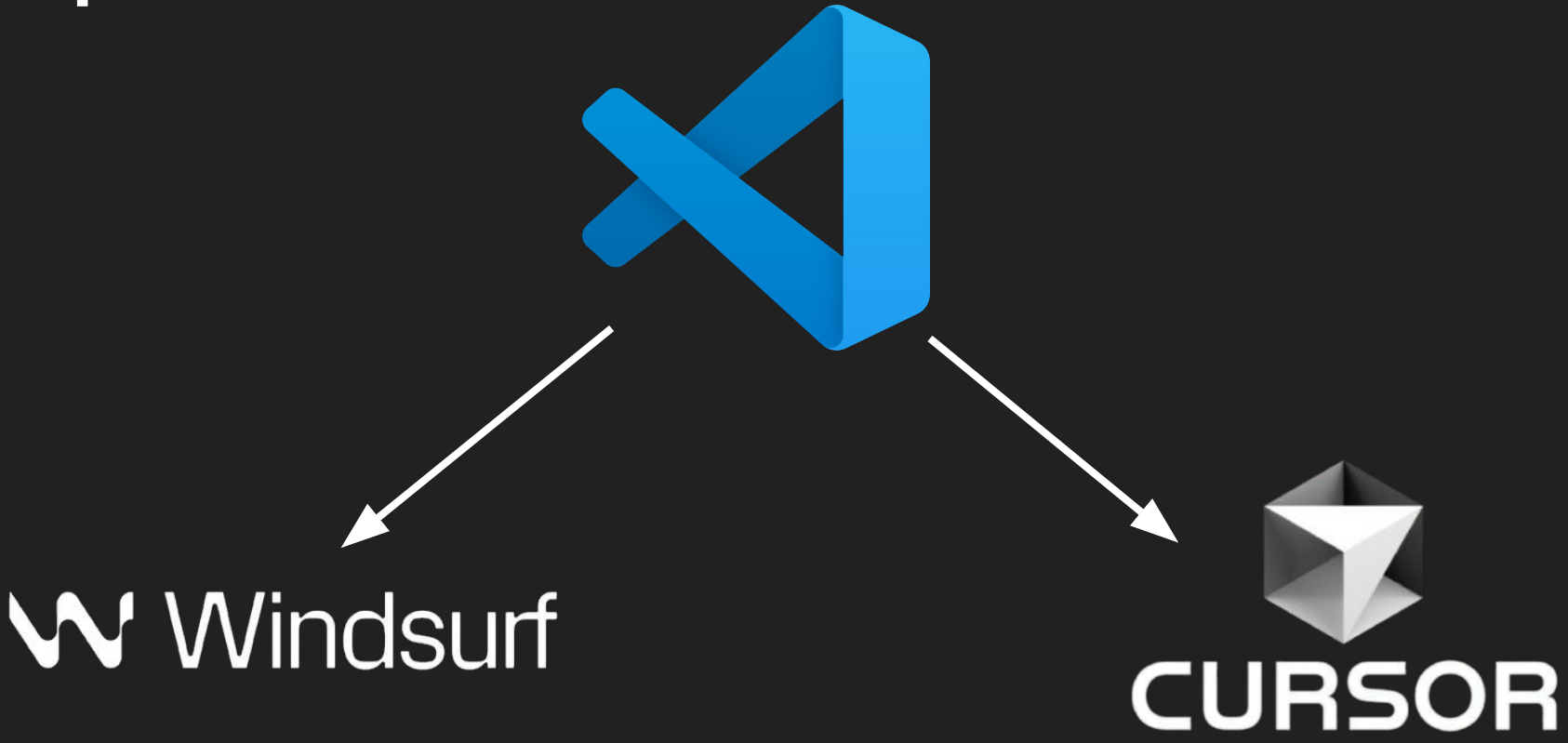
Windsurf

CURSOR

AI-powered IDEs

FULLHUNT

AI-powered IDEs

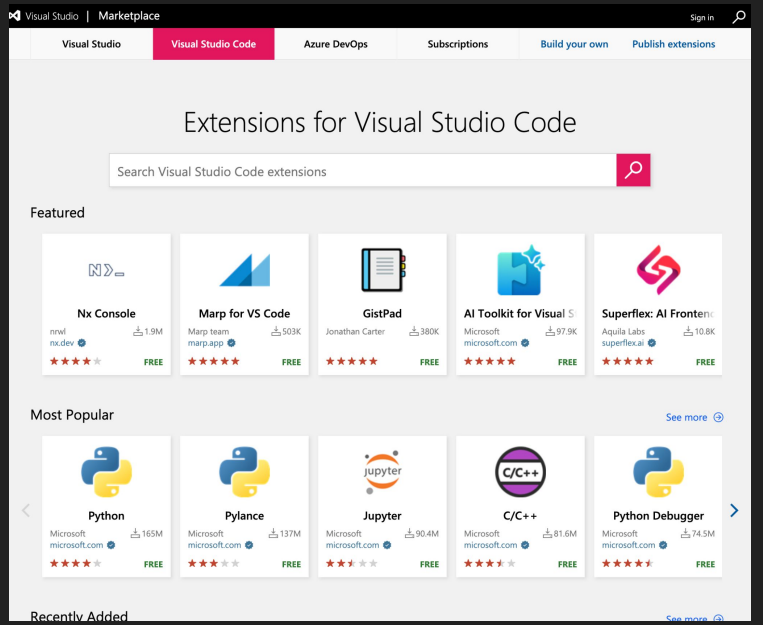


VS Code Marketplace

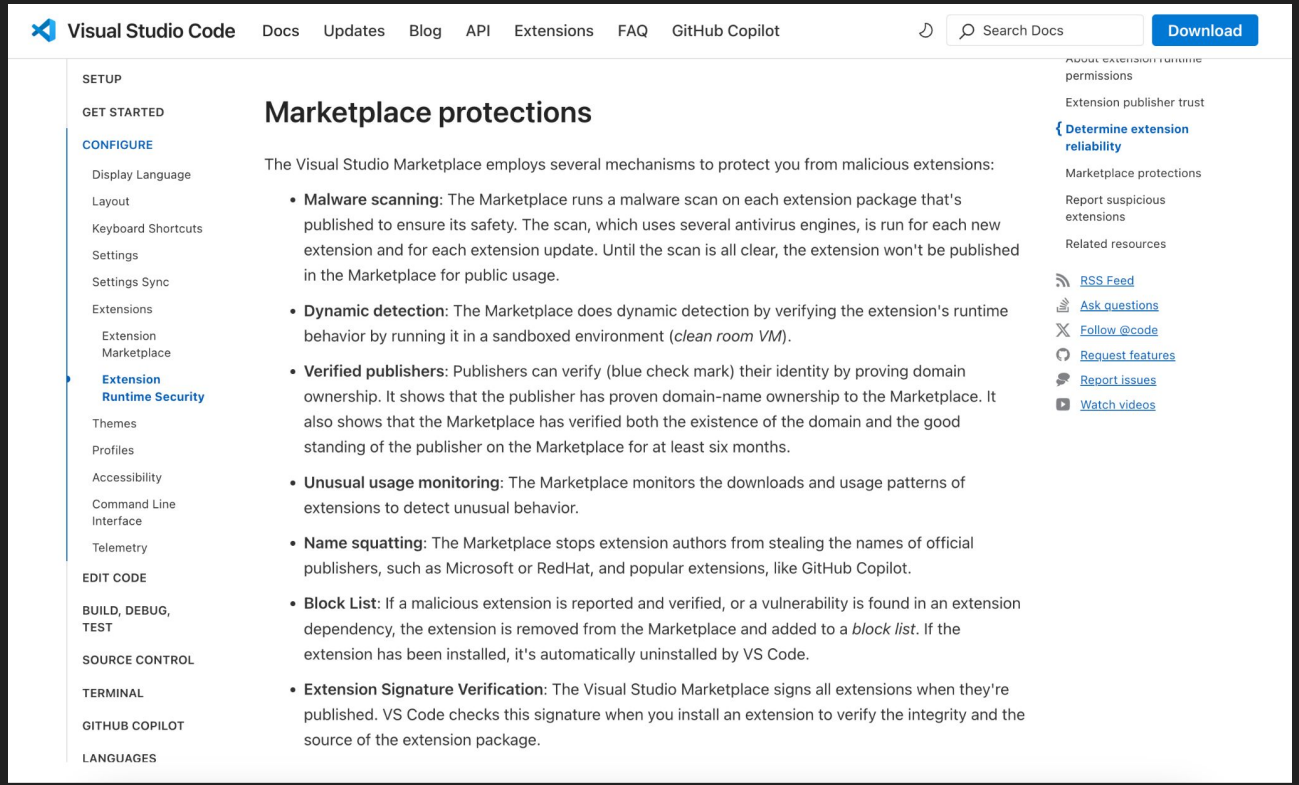
VS Code Marketplace

VSCode Marketplace is owned by Microsoft.

Publishing an extension goes through iterations of quality and ***security*** checks.



How safe is the Visual Studio Code Marketplace?



Visual Studio Code | Docs | Updates | Blog | API | Extensions | FAQ | GitHub Copilot | Search Docs | Download

SETUP
GET STARTED
CONFIGURE
- Display Language
- Layout
- Keyboard Shortcuts
- Settings
- Settings Sync
- Extensions
  - Extension Marketplace
  - Extension Runtime Security
- Themes
- Profiles
- Accessibility
- Command Line Interface
- Telemetry

EDIT CODE
BUILD, DEBUG, TEST
SOURCE CONTROL
TERMINAL
GITHUB COPILOT
LANGUAGES

Marketplace protections

The Visual Studio Marketplace employs several mechanisms to protect you from malicious extensions:

- **Malware scanning**: The Marketplace runs a malware scan on each extension package that's published to ensure its safety. The scan, which uses several antivirus engines, is run for each new extension and for each extension update. Until the scan is all clear, the extension won't be published in the Marketplace for public usage.
- **Dynamic detection**: The Marketplace does dynamic detection by verifying the extension's runtime behavior by running it in a sandboxed environment (*clean room VM*).
- **Verified publishers**: Publishers can verify (blue check mark) their identity by proving domain ownership. It shows that the publisher has proven domain-name ownership to the Marketplace. It also shows that the Marketplace has verified both the existence of the domain and the good standing of the publisher on the Marketplace for at least six months.
- **Unusual usage monitoring**: The Marketplace monitors the downloads and usage patterns of extensions to detect unusual behavior.
- **Name squatting**: The Marketplace stops extension authors from stealing the names of official publishers, such as Microsoft or RedHat, and popular extensions, like GitHub Copilot.
- **Block List**: If a malicious extension is reported and verified, or a vulnerability is found in an extension dependency, the extension is removed from the Marketplace and added to a *block list*. If the extension has been installed, it's automatically uninstalled by VS Code.
- **Extension Signature Verification**: The Visual Studio Marketplace signs all extensions when they're published. VS Code checks this signature when you install an extension to verify the integrity and the source of the extension package.

permissions
Extension publisher trust
{ Determine extension reliability
Marketplace protections
Report suspicious extensions
Related resources
RSS Feed
Ask questions
Follow @code
Request features
Report issues
Watch videos

https://code.visualstudio.com/docs/configure/extensions/extension-runtime-security

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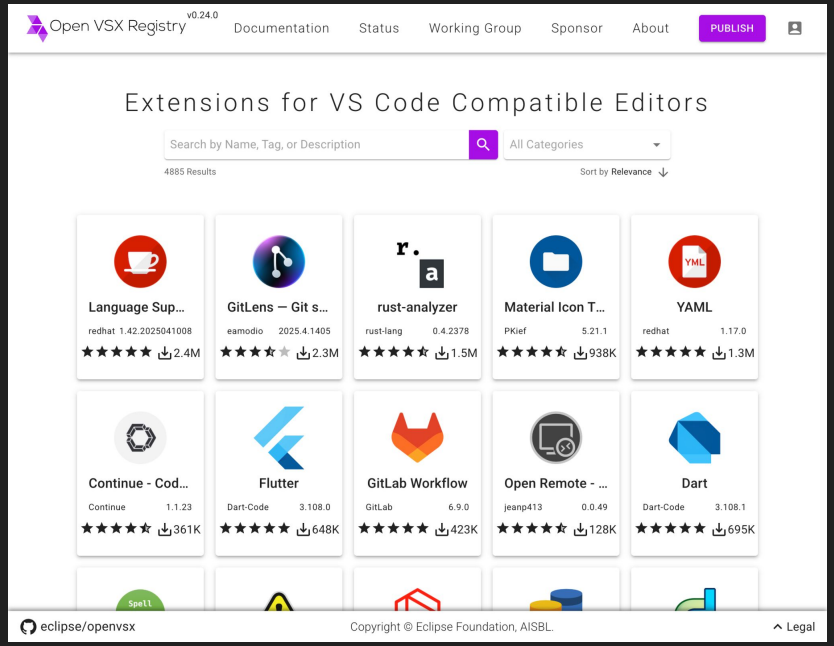
OpenVSX Marketplace

Marketplace used by Cursor AI, Windsurf, AWS Kiro, and other IDEs

OpenVSX Marketplace

- Verified Publishers and Namespaces
- Mandatory Licensing and Publisher Agreement
- Abuse Reporting Mechanism
- Transparent Governance

Compliance != Security



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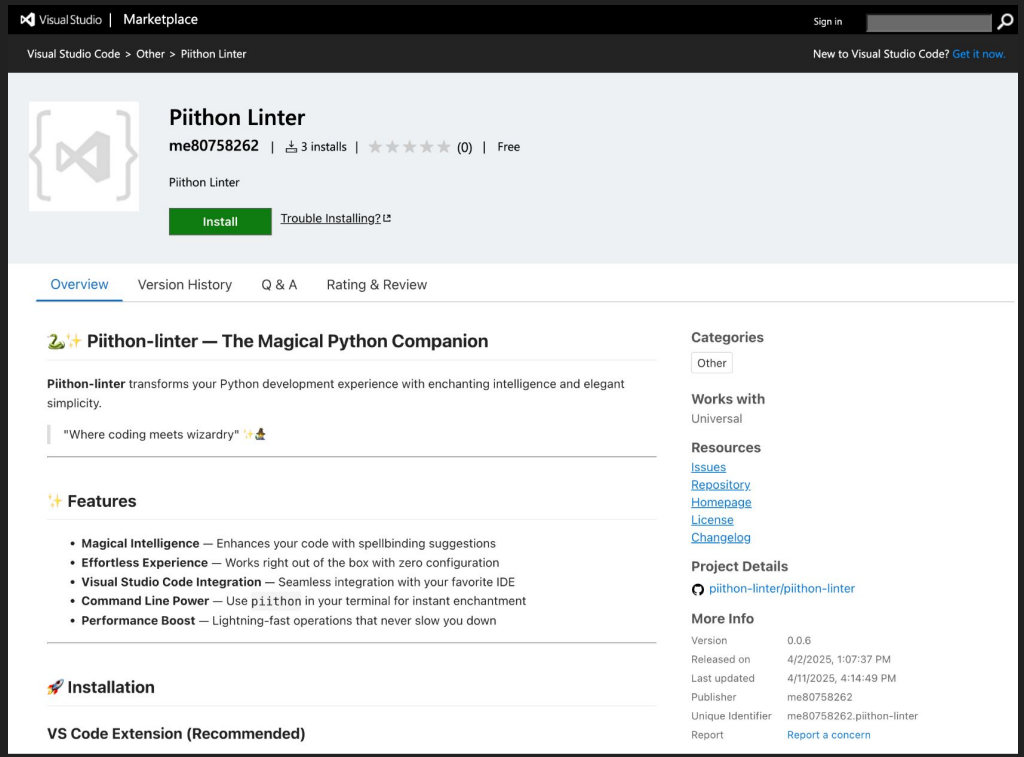
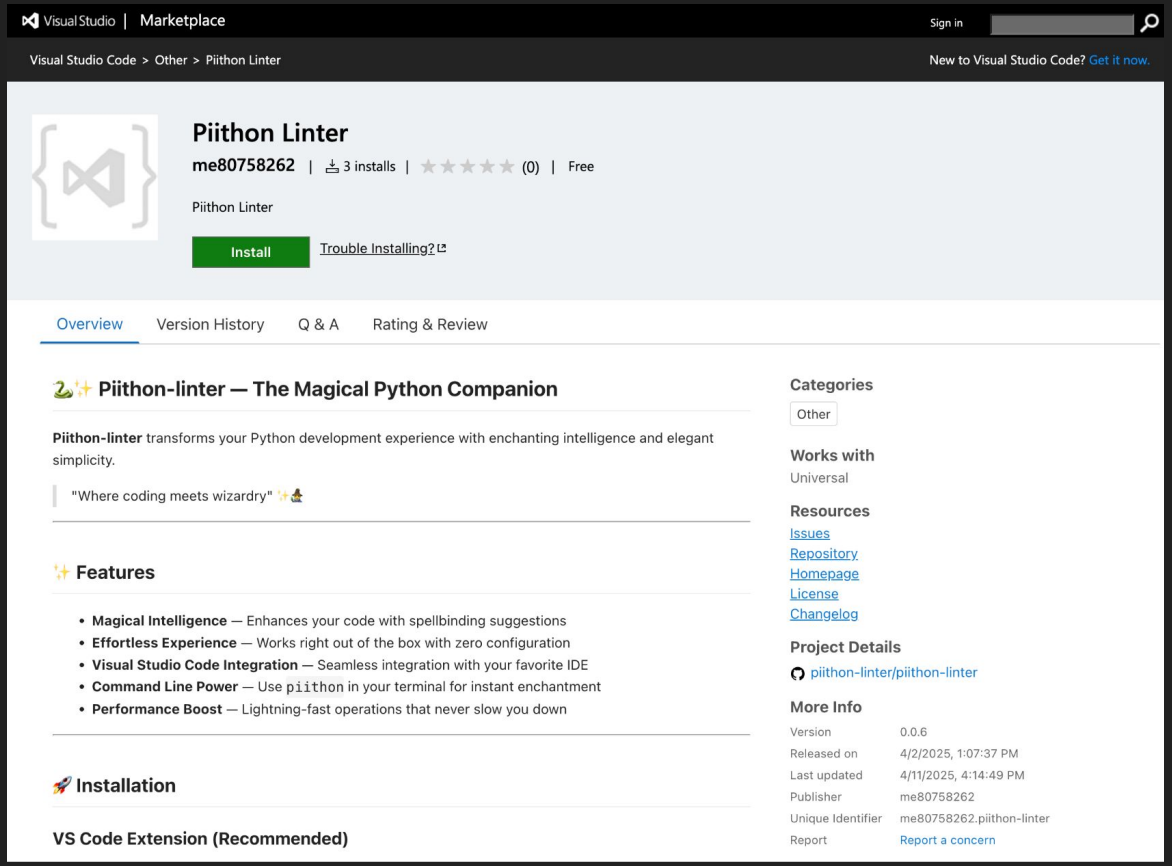
Developing a malicious VS Code Extension

Piithon-linter: A malicious Python linter/formatter

I built piithon-linter

A malicious Python linter/formatter with “magical” capabilities to format your code.





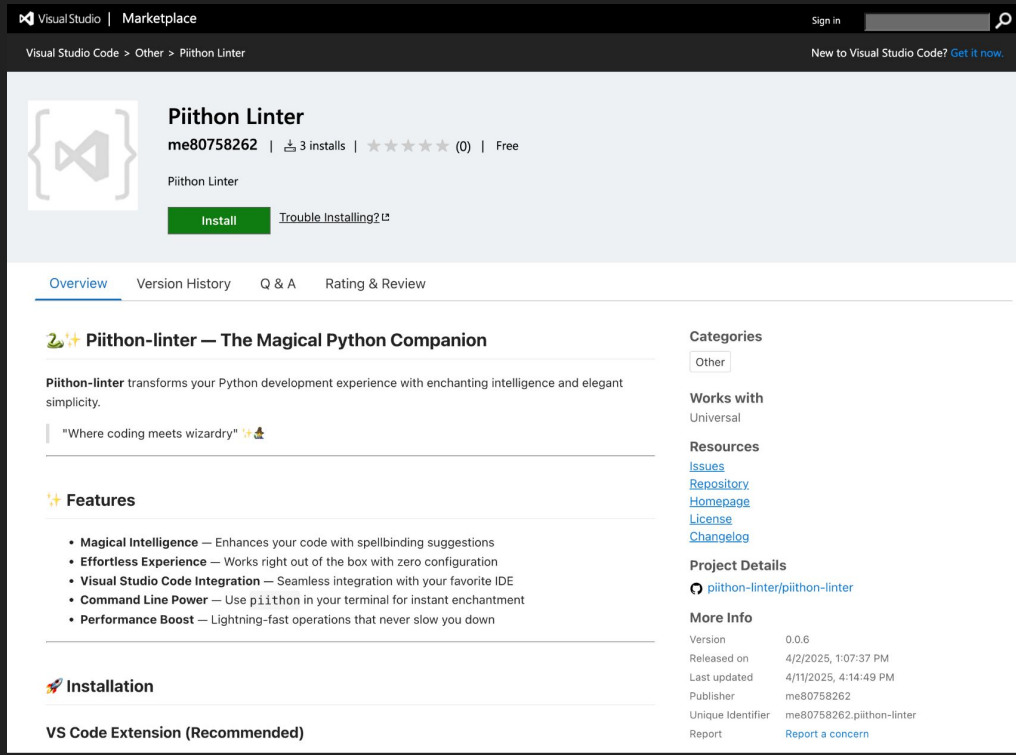
Want to install this extension?

Piithon-linter: A malicious Python linter/formatter

First iteration

Every time VS Code starts, the malicious VS Code extension exfiltrates the developer's environment variables and metadata to a C2 server.

It does not actually have any formatting/linting capabilities.



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Piithon-linter: A malicious Python linter/formatter

First iteration

Every time VS Code starts, the malicious VS Code extension exfiltrates the developer's environment variables and metadata to a C2 server.

It does not actually have any formatting/linting capabilities.

```
=BEGIN
GIT_EMAIL=developer@acme.org
IP_ADDRESS=1.2.3.4
HOSTNAME=INV5966
ENVs:
ALLUSERSPROFILE=C:\P***Data
APPDATA=C:\U***ming
COMPUTERNAME=INV5***5966
ComSpec=C:\W***.exe
CommonProgramFiles=C:\P***iles
CommonProgramFiles(x86)=C:\P***iles
CommonProgramW6432=C:\P***iles
DOTNET_CLI_TELEMETRY_OPTOUT=true***
DriverData=C:\W***Data
```

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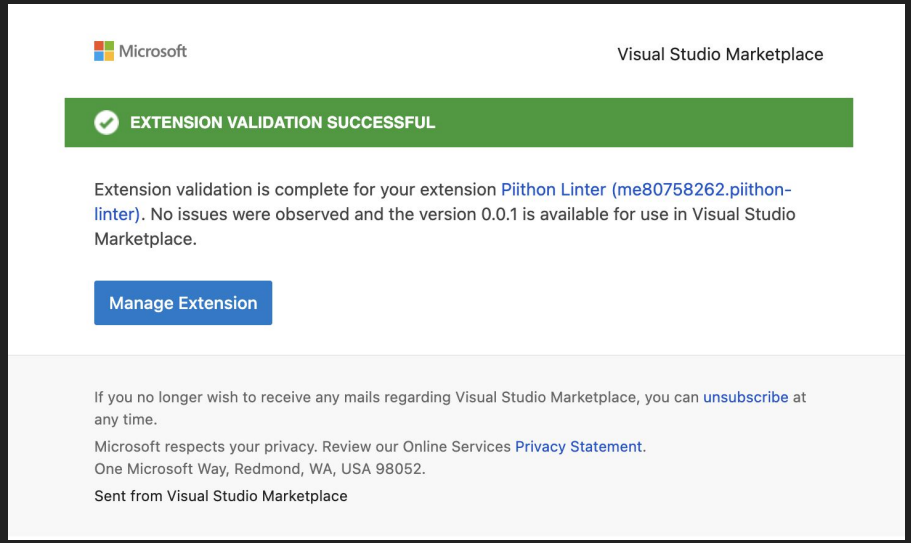
Piithon-linter: A malicious Python linter/formatter



Microsoft

Visual Studio Marketplace

EXTENSION VALIDATION SUCCESSFUL

Extension validation is complete for your extension Piithon Linter (me80758262.piithon-linter). No issues were observed and the version 0.0.1 is available for use in Visual Studio Marketplace.

Manage Extension

If you no longer wish to receive any mails regarding Visual Studio Marketplace, you can unsubscribe at any time.

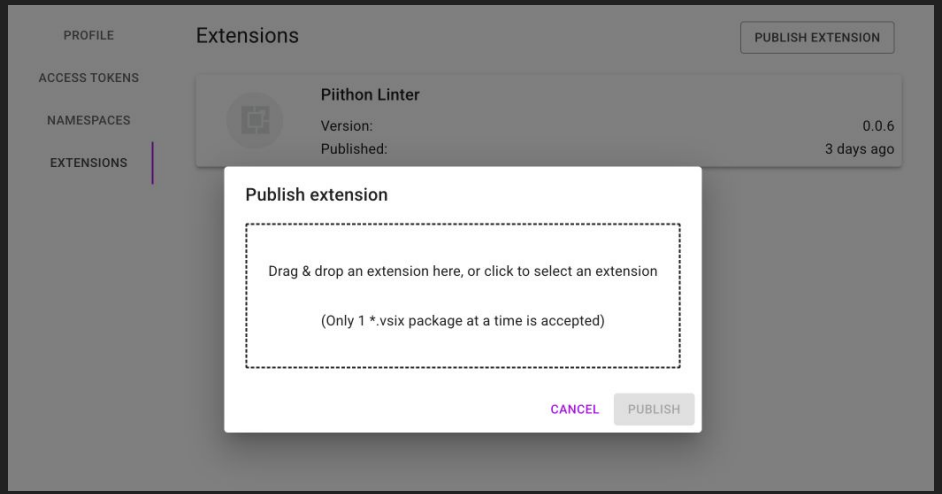
Microsoft respects your privacy. Review our Online Services Privacy Statement.
One Microsoft Way, Redmond, WA, USA 98052.

Sent from Visual Studio Marketplace

Microsoft Marketplace accepted the initial version.

The build was not flagged.

Piithon-linter: A malicious Python linter/formatter



Open-VSX also accepted the malicious extension.

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Piithon-linter: A malicious Python linter/formatter

The second Piithon-linter had more realistic offensive capabilities:

- **Sends Environment Variables to a C2 server.**
- **Runs detection checks to check whether an endpoint security solution is installed.**
- **Check if the developer is from a particular country (e.g., US).**
- **Deploy a Merlin agent depending on the developer's machine: Windows/MacOS/Linux.**
- **Once VS Code is launched, the extension connects back to a C2 server.**

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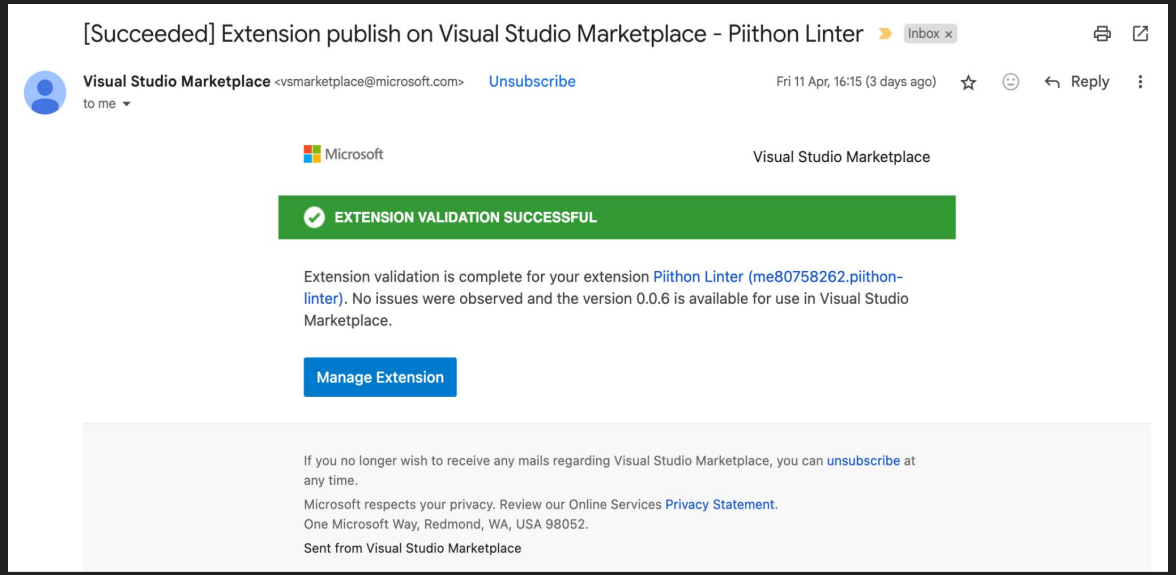
Piithon-linter: A malicious Python linter/formatter



VS Code Marketplace accepted the malicious extension again.

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Backdooring the Extension via automatic malware execution

```
Merlin[listeners][c8ef72d7-1b0f-4a84-b10b-3391ea7f77ba]»
[+] 2025-04-14T21:22:30Z New authenticated Agent checkin for 29b7a59a-eee0-478e-8df7-c0e012b5f1cc at 2025-04-14T21:22:30Z

[-] 2025-04-14T21:23:02Z Results of job CjyQzOcxfW for agent 29b7a59a-eee0-478e-8df7-c0e012b5f1cc at 2025-04-14T21:23:02Z
        Configuration data received for Agent 29b7a59a-eee0-478e-8df7-c0e012b5f1cc and updated. Issue the "info" command to view it.
Merlin[listeners][c8ef72d7-1b0f-4a84-b10b-3391ea7f77ba]»
```

Whenever anyone installs the malicious extension, or launches VS Code or Cursor AI after the malicious extension is installed, you will get access to the developer's machine through the Merlin framework.

Works on Windows, macOS, and Linux

Wait

Microsoft VS Code Marketplace runs analysis on the extension in a sandboxed environment.

How did the extension bypass the security checks?

Bypassing Microsoft Azure Sandbox Analysis

The extension blocked all execution from the Microsoft IP Ranges and networks.

No payloads are dropped when the extension is executed on Microsoft owned-environment.

```
sh-3.2$ whois 20.22.211.83
% IANA WHOIS server
% for more information on IANA, visit http://www.iana.org
% This query returned 1 object

refer:        whois.arin.net

inetnum:      20.0.0.0 - 20.255.255.255
organisation: Administered by ARIN
status:       LEGACY

whois:        whois.arin.net

changed:      1994-10
source:       IANA

# whois.arin.net

NetRange:       20.0.0.0 - 20.31.255.255
CIDR:           20.0.0.0/11
NetName:        MSFT
NetHandle:      NET-20-0-0-0-1
Parent:         NET20 (NET-20-0-0-0-0)
NetType:        Direct Allocation
OriginAS:
Organization:   Microsoft Corporation (MSFT)
RegDate:        2017-10-18
Updated:        2021-12-14
Ref:            https://rdap.arin.net/registry/ip/20.0.0.0



OrgName:        Microsoft Corporation
OrgId:          MSFT
Address:        One Microsoft Way
City:           Redmond
StateProv:      WA
```

Wait

Microsoft VS Code Marketplace runs static analysis.

How did the extension bypass the static security analysis?

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Piithon-linter: A malicious Python linter/formatter

```
if (await isAVRunning()) {
        log('AV running, skipping');
        return;
}
```

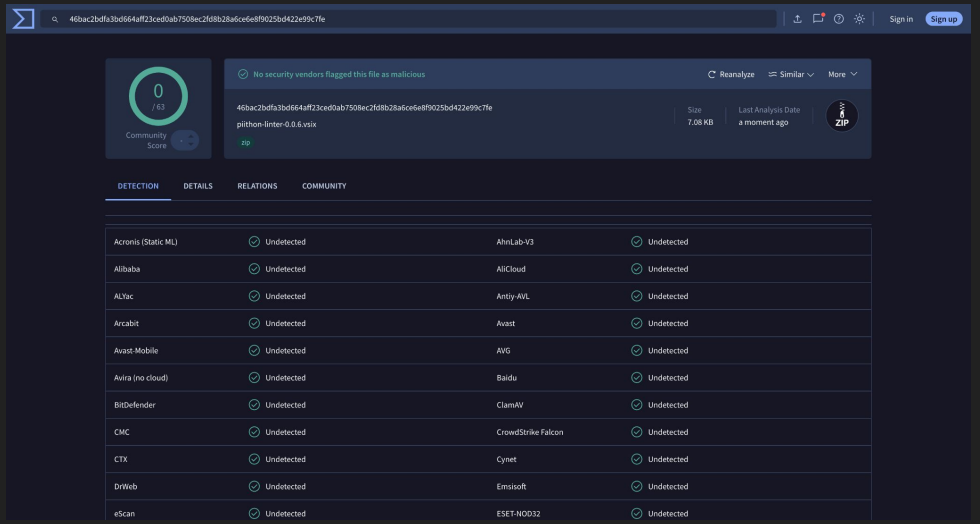
This line is copied from piithon-linter extension code.

The code contained plain-text indicators of malicious intent.
I'm not certain how the static analysis is currently functioning.

Malicious Extensions as an attack vector for Red Teamers

VS Code extensions provide a stealthy mechanism to stay under the radar.

You can also enable automatic updates, and allow VS Code Marketplace to distribute and deliver automatic malicious updates on developers' machines.



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LIVE DEMO

A realistic malicious extension with offensive capabilities

DEMO


Compromising Developers
with Malicious Extensions
Windsurf
CURSOR
THE BACKDOOR YOU DIDN'T SEE COMING
mazinahmed.net

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DEMO

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Responsible Disclosure

This is not going to be fixed soon

Responsible Disclosure

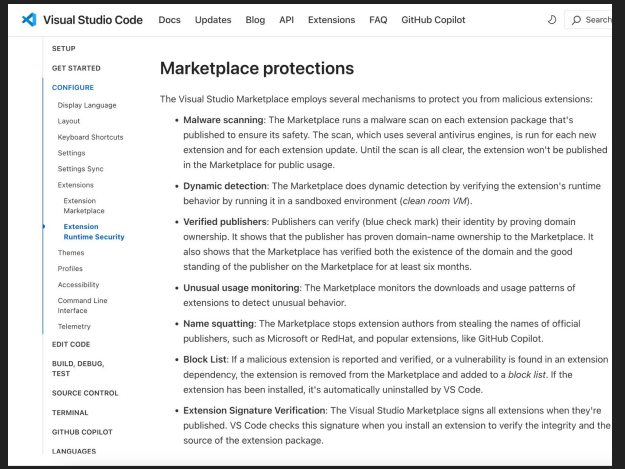
This is not going to be fixed soon.

Microsoft

› After careful investigation, this case has been assessed as low severity and does not meet MSRC's bar for immediate servicing due to:

› There will be ways to bypass static analysis checks that are put in place to detect the problematic code. Therefore, it is the user's responsibility to ensure that they are not installing malicious extensions.

I do not expect Microsoft to be resolving any of my findings within this research. All attack vectors mentioned here are available to adversaries to use and to bypass Microsoft VSCode Marketplace security controls.



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Responsible Disclosure

This is not going to be fixed soon.

OpenVSX

> OpenVSX is an open-source and free project by the Eclipse Foundation (Non-profit organization).

> AI-Powered IDEs rely on OpenVSX, and OpenVSX needs support to maintain the marketplace.

New key initiatives that the Eclipse Foundation is working on:

- **Security scanning**
- **Improved authentication controls**
- **Provenance and verification**

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Responsible Disclosure

This is not going to be fixed soon.

Cursor AI

The Cursor Security team shared that they've rolled out new security features for users (built on top of Open VSX).

› Do additional publisher verification
› Changed the order Cursor presents extensions to further highlight legitimate ones
› Integrated malware scanning on our side

I tried testing the malware scanning on Cursor AI and it did not detect the piithon-linter extension as malware.

Takeaways

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Takeaway

The next big supply chain compromise

could be from the editor we use every day

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Takeaway

Microsoft's sandbox analysis and antivirus checks can be bypassed with simple evasion techniques. OpenVSX, meanwhile, performs virtually no security screening at all.

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Questions?

Mazin Ahmed
mazin@mazinahmed.net
Twitter: @mazen160
Linkedin: @infosecmazinahmed

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Thank you!

Mazin Ahmed
mazin@mazinahmed.net
Twitter: @mazen160
Linkedin: @infosecmazinahmed