Atomic Stealer | Threat Actor Spawns Second Variant of macOS Malware Sold on Telegram

By Phil Stokes

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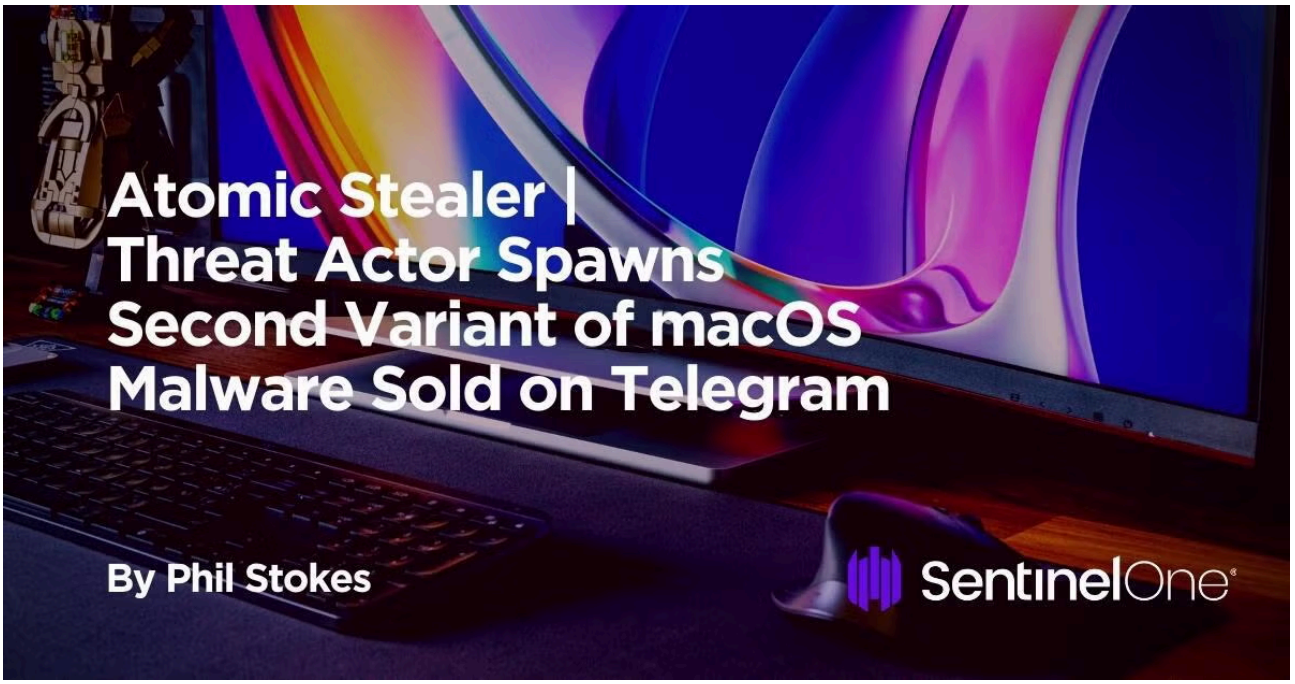
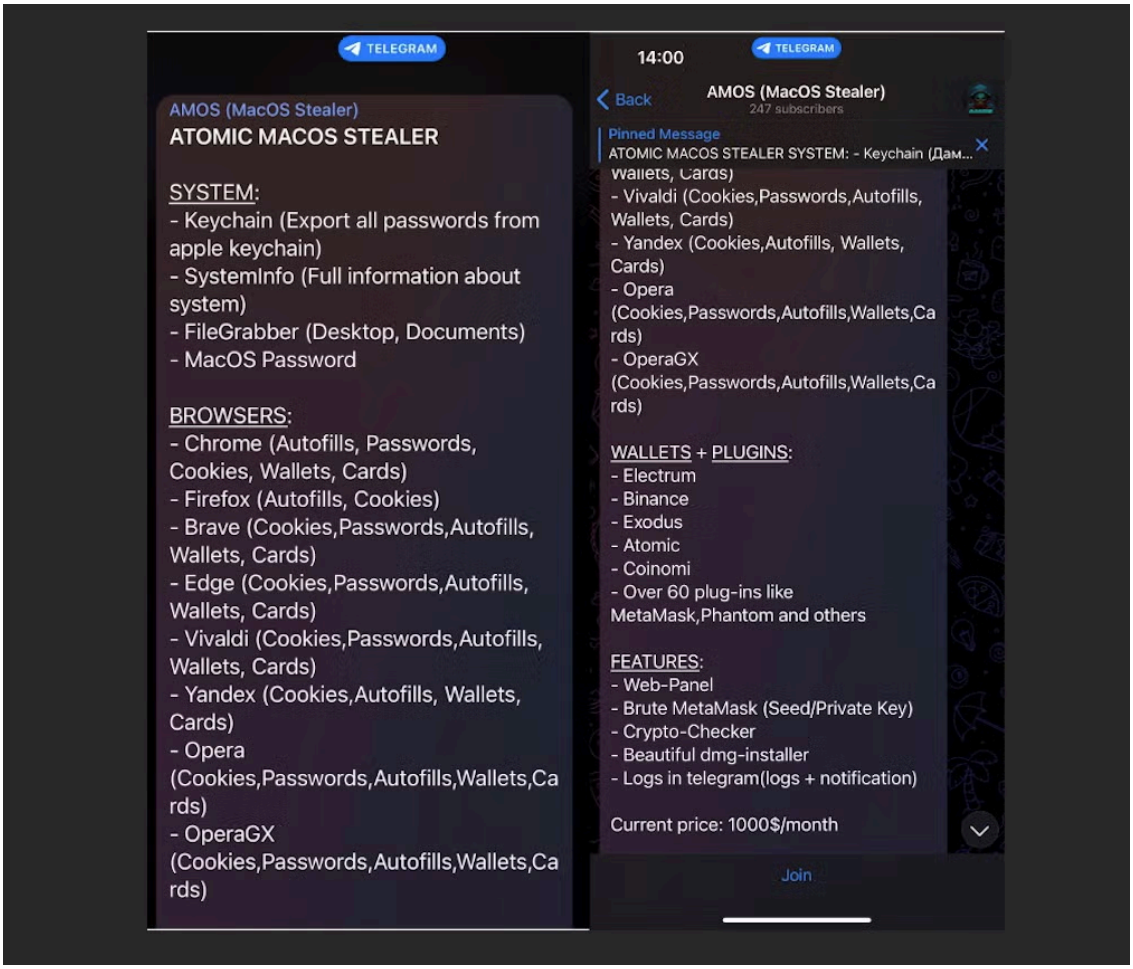
Recent weeks have seen a number of macOS-specific infostealers appear for sale in crimeware forums, including Pureland, MacStealer and Amos Atomic Stealer. Of these, Atomic Stealer has offered by far the most complete package, promising cybercriminals a full-featured if not particularly sophisticated infostealer. Atomic can grab account passwords, browser data, session cookies, and crypto wallets, and in the version being advertised on Telegram, threat actors can manage their campaigns through a web interface rented out from the developer for $1000 per month.

The threat actor, however, has been busy looking for other ways to target macOS users with a different version of Atomic Stealer. In this post, we take a closer look at how Atomic Stealer works and describe a previously unreported second variant. We also provide a comprehensive list of indicators to aid threat hunters and security teams defending macOS endpoints.



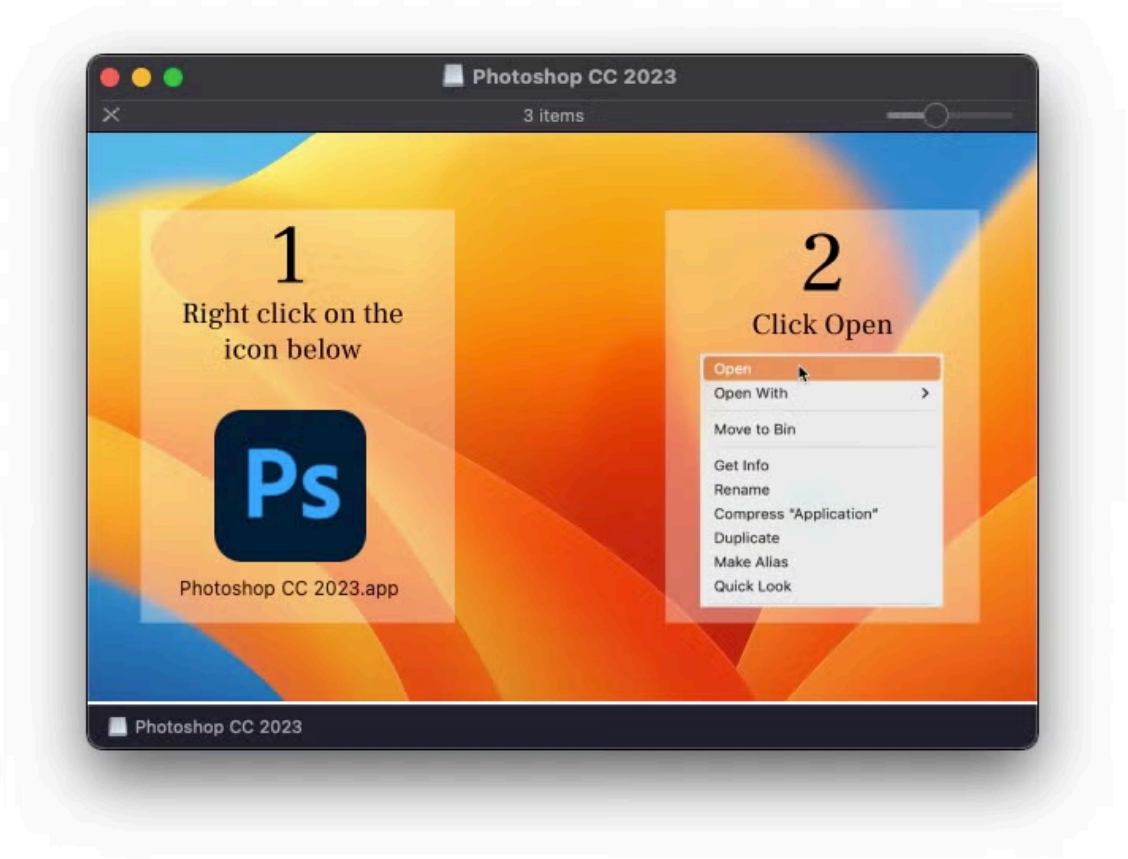
How is Atomic Stealer Distributed?

Cybercriminals are currently being offered “Amos Atomic MacOS Stealer” via a dedicated Telegram channel. In the channel, which was opened on April 9th, the author offers to rent access to a web panel and provide a disk-image based installer for $1000/month.



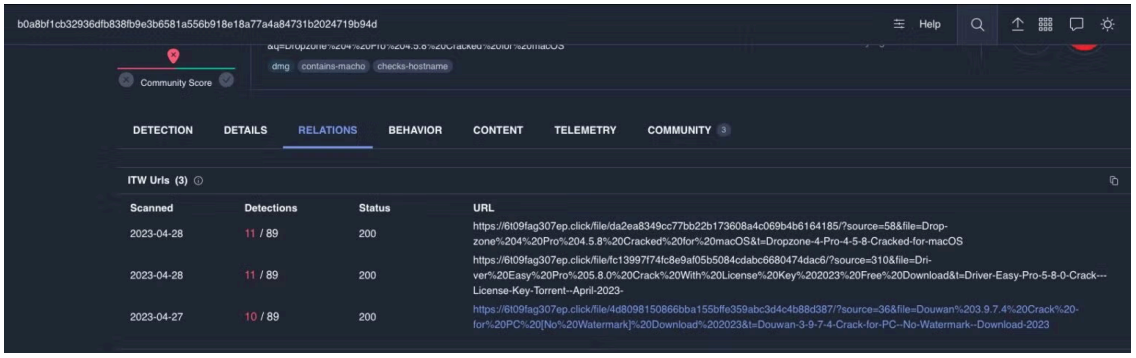
Atomic Stealer as advertised on Telegram

Payload distribution is left up to the crimeware actor renting the package, so methods vary, but so far observed samples have been seen masquerading as installers for legitimate applications like the Tor Browser or pretending to offer users cracked versions of popular software including Photoshop CC, Notion, Microsoft Office and others.



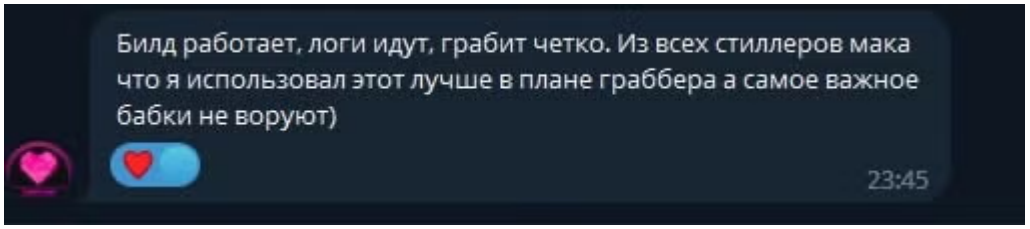
Atomic MacStealer masquerades as legitimate applications

Malvertising via Google Ads has also been noted privately among researchers as a distribution vector for Atomic Stealer.



Some Atomic Stealer ITW URLs (Source: VirusTotal)

The Atomic Stealer channel currently has over 300 subscribers, with some posts – possibly planted – appearing to endorse the efficacy of the malware.



A Telegram message seems to endorse Atomic MacStealer

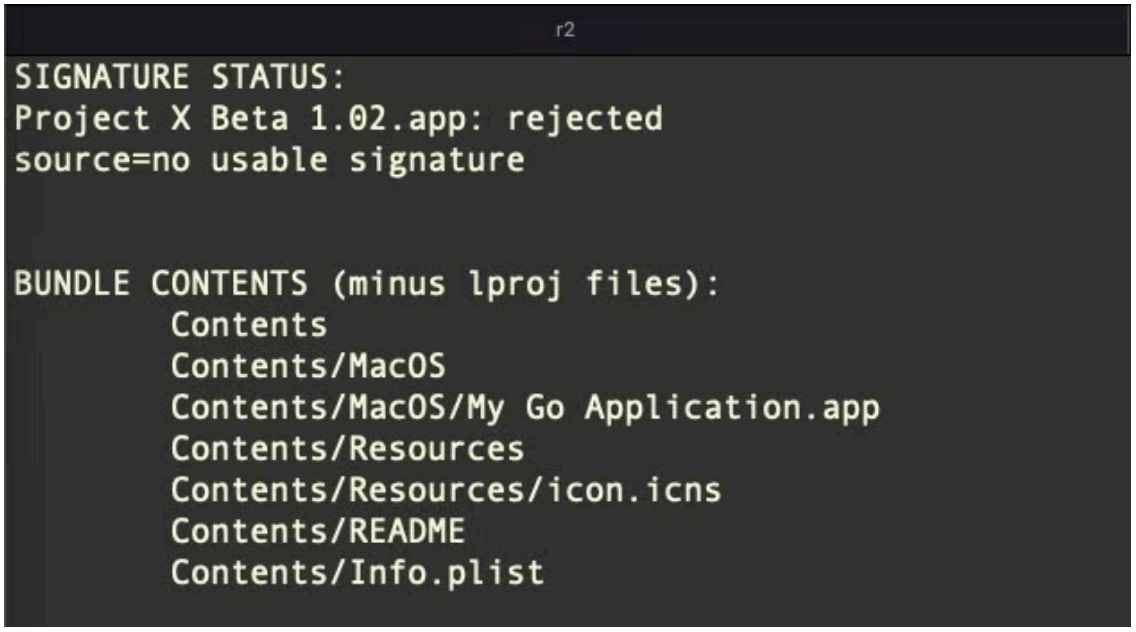
A Google translation of the Russian text reads "*The build works, the logs go, it robs clearly. Of all the poppy stealers that I used, this one is better in terms of a grabber, and most importantly, grandmas do not steal)*".

These fake applications are made with a fork of Appify, a legitimate script that can be found on Github for making a barebones macOS application. All Atomic infostealers currently contain the same Go-based main executable that weighs in at around 51.5MB as a Universal binary targeting both Intel and arm64 architectures.

```
[0x012c0bcd]> .(meta)
file     My Go Application.app
type     Executable file
class    MACH064
arch     x86
compiler clang
lang     c
51.6M
[Sections]

nth paddr            size vaddr           vsize perm md5, entropy                                type             name
-----------------------------------------------------------------------------------------------------------------------
0   0x00001000   0x23f579 0x01001000   0x23f579 -r-x 38d1acfebb21208337b705baa728e2c8 6.16609423 REGULAR          0.__TEXT.__text
1   0x00240580      0x258 0x01240580      0x258 -r-x 40520b2d17f7b91840cdbefb32c320b2 4.80426892 SYMBOL_STUBS     1.__TEXT.__symbol_stub1
2   0x002407e0    0xe8756 0x012407e0    0xe8756 -r-x 5b1610a1e74ac2c2c05a68bdbd24cad8 5.01490112 REGULAR          2.__TEXT.__rodata
3   0x00328f40     0x15f4 0x01328f40     0x15f4 -r-x 2b459898e4e45b520bd4fed8b26d1a3a 4.40716826 REGULAR          3.__TEXT.__typelink
4   0x0032a540      0x890 0x0132a540      0x890 -r-x dd2e4c2e2908d0d4f820e2d291b37d23 4.90535331 REGULAR          4.__TEXT.__itablink
5   0x0032add0        0x0 0x0132add0        0x0 -r-x                                             REGULAR          5.__TEXT.__gosymtab
6   0x0032ade0   0x143430 0x0132ade0   0x143430 -r-x b4adcf7d29e1435eac776b18f62bbfe4 6.05306129 REGULAR          6.__TEXT.__gopclntab
7   0x0046f000      0x110 0x0146f000      0x110 -rw- ce26d1a02275c1879836b13895cebc3e 3.79792704 REGULAR          7.__DATA.__go_buildinfo
8   0x0046f110      0x320 0x0146f110      0x320 -rw- 3a2e168a42fa79c56976c388568c8c45 1.61890425 NONLAZY_POINTERS 8.__DATA.__nl_symbol_ptr
9   0x0046f440  0x1352d10 0x0146f440  0x1352d10 -rw-                                             REGULAR          9.__DATA.__noptrdata
10  0x017c2160     0xadf0 0x027c2160     0xadf0 -rw- 0da78689d2df0499474020c91edd29aa 1.88234116 REGULAR          10.__DATA.__data
11  0x00000000        0x0 0x027ccf60    0x30e80 -rw-                                             ZEROFILL         11.__DATA.__bss
12  0x00000000        0x0 0x027fdde0     0x6450 -rw-                                             ZEROFILL         12.__DATA.__noptrbss
13  0x017cd000      0x129 0x02805000      0x129 -r-- 9ee38aeba19f4d46fcd9eda4661325d2 0.00000000 REGULAR          13.__LINKEDIT.__zdebug_abbrev
14  0x017cd129    0x61d61 0x02805129    0x61d61 -r-- 35eae473441af51527ec26d6a0adf2da 7.98816943 REGULAR          14.__LINKEDIT.__zdebug_line
15  0x0182ee8a    0x13a5b 0x02866e8a    0x13a5b ---- 56190729b49edc92a8f0bea8255d4c70 7.94776605 REGULAR          15.__PAGEZERO.__zdebug_frame
16  0x018428e5       0x2a 0x0287a8e5       0x2a ---- 212de006081fe321532470fd28faece1 5.29707933 REGULAR          16.__PAGEZERO.__debug_gdb_scri
17  0x0184290f    0xa8c37 0x0287a90f    0xa8c37 ---- 1c71d1e59bd4480083e9dff171d416c0 7.99801346 REGULAR          17.__PAGEZERO.__zdebug_info
18  0x018eb546    0x772a3 0x02923546    0x772a3 ---- c38fb3b7ada44546963b58c3ede64394 7.99139860 REGULAR          18.__PAGEZERO.__zdebug_loc
19  0x019627e9    0x1bfae 0x0299a7e9    0x1bfae ---- 22e6a840b3367fab558a14e9d6b484c0 7.90101923 REGULAR          19.__PAGEZERO.__zdebug_ranges

0x01000020  cmd        0 0x19 LC_SEGMENT_64
0x01000068  cmd        1 0x19 LC_SEGMENT_64
0x010002e0  cmd        2 0x19 LC_SEGMENT_64
0x01000508  cmd        3 0x19 LC_SEGMENT_64
0x01000780  cmd        4 0x19 LC_SEGMENT_64
0x010007c8  cmd        5 0x32 LC_BUILD_VERSION
0x010007e0  cmd        6 0x5 LC_UNIXTHREAD
0x01000898  cmd        7 0x2 LC_SYMTAB
0x010008b0  cmd        8 0xb LC_DYSYMTAB
0x01000900  cmd        9 0xe LC_LOAD_DYLINKER
0x01000920  cmd       10 0xc LC_LOAD_DYLIB
0x01000958  cmd       11 0xc LC_LOAD_DYLIB
0x01000990  cmd       12 0xc LC_LOAD_DYLIB
0x010009f8  cmd       13 0xc LC_LOAD_DYLIB
[Linked libraries]
/usr/lib/libSystem.B.dylib
/usr/lib/libresolv.9.dylib
/System/Library/Frameworks/CoreFoundation.framework/Versions/A/CoreFoundation
/System/Library/Frameworks/Security.framework/Versions/A/Security
```

Anatomy of the Atomic Stealer binary (variant A)

Despite the heft, no attempt has been made to deliver a working copy of the spoofed apps. Aside from the Appify README, the Bundle contains nothing more than the Go infostealing binary, an icon file and a Info.plist.



Anatomy of an Atomic Stealer application bundle

The application bundles currently being distributed are all built with the default Appify bundle identifier, `Appify by Machine Box.My Go Application`, potentially a deliberate ploy by the author in the hope that detections might be considered false positives.

Execution Behavior of Variant A

Atomic does not attempt to gain persistence, an increasing trend since Apple added login item notifications in macOS Ventura, relying instead on a one-hit smash and grab methodology.

Atomic Stealer uses a crude but effective means of extracting the user's login password via AppleScript spoofing.

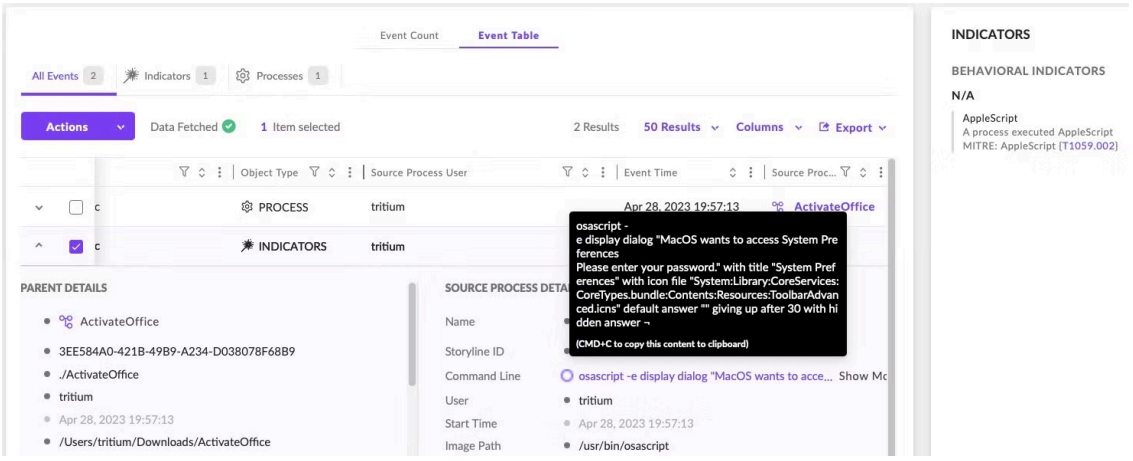
This involves creating a dialog box with osascript and passing the `hidden answer` parameter to the `display dialog` command. These dialog boxes contain an ordinary text field, but the parameter displays the user's typed characters as dots in the text field similar to a genuine authentication dialog. However, the password remains captured in plain text and can be seen in the system logs as such – a good reason why legitimate software developers should never use this insecure method to actually obtain user credentials.

```
display dialog "MacOS wants to access System Preferences

You entered invalid password.

Please enter your password." with title "System Preferences" with icon file "System:Library:CoreServ
```

The dialog box message contains grammatical and syntactic errors, suggesting the developer's first language is not English. The dialog box is generated using an infinite loop: Clicking the "Cancel" button simply pops the dialog box again. If the "OK" button is clicked, the malware checks to see that the user entered a valid password via `/usr/bin/dscl` utility and the `-authonly` option.

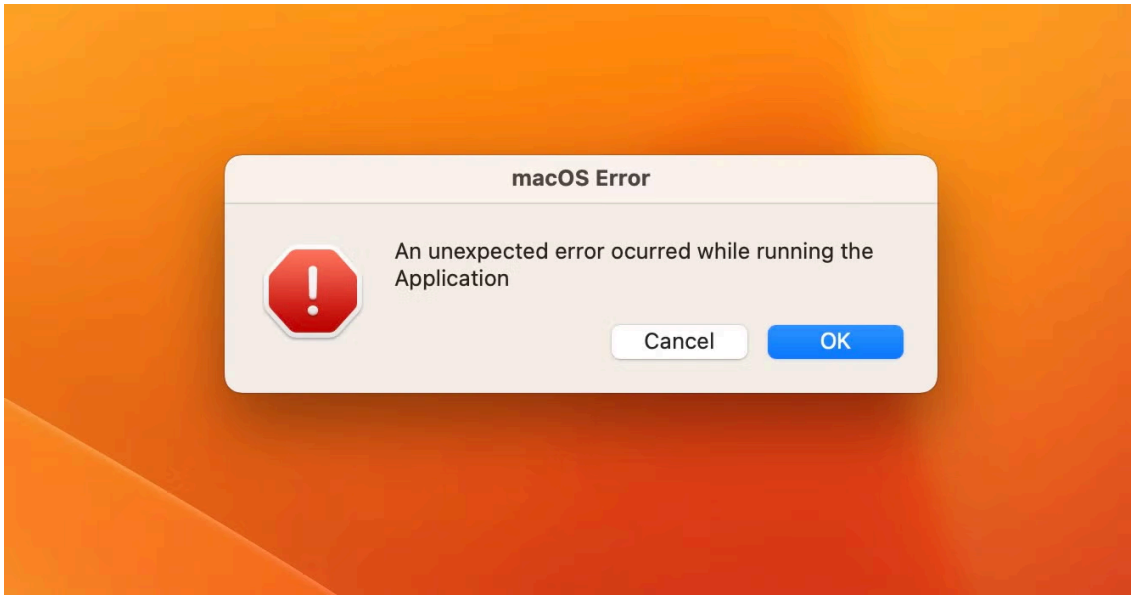
```
  authonly
    Usage: authonly [user [password]]

    Used to verify the password of a named user, or of "root" if no user
is specified.  If a password is supplied, then that password is used for
    authentication, otherwise the command prompts for a password.
```

The dialog box repeatedly pops until the correct password is supplied. All of this occurs via the command line utility `osascript`, so it is easily visible to defenders monitoring command line activity.



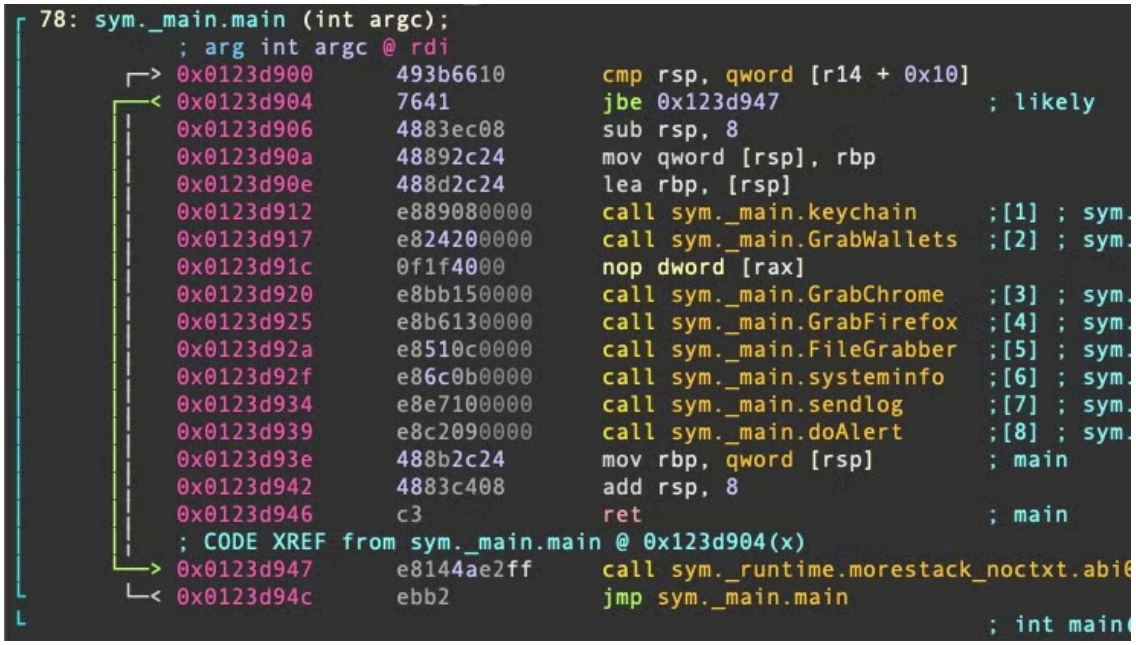
SentinelOne console reveals Atomic Stealer command line activity

Amos Atomic is hardcoded to throw the user an error message after it has stolen the user's password and gone about its business of stealing various credentials. Here and elsewhere, the malware author's lack of familiarity with English and AppleScript provide clues that should raise suspicions: namely, the misspelling of "occurred" and the fact that a genuine error message shouldn't contain a 'Cancel' button.



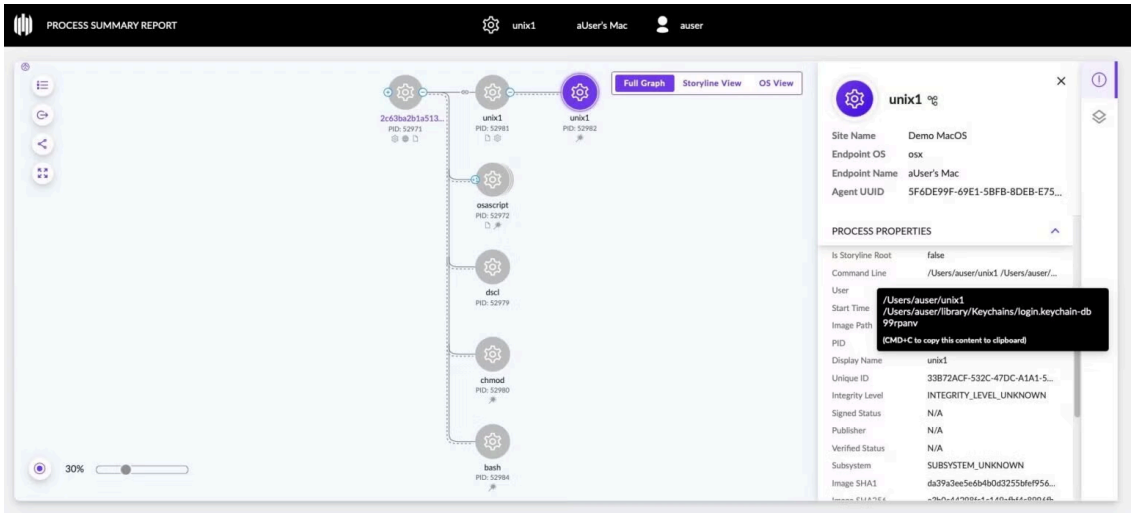
Amos Atomic throws an error message and quits after successfully stealing user data

Written in Go, the disassembled source code reveals a comprehensive suite of functions to achieve the infostealers primary aim: financially-motivated cybercrime.



Infostealing functions in Amos Atomic

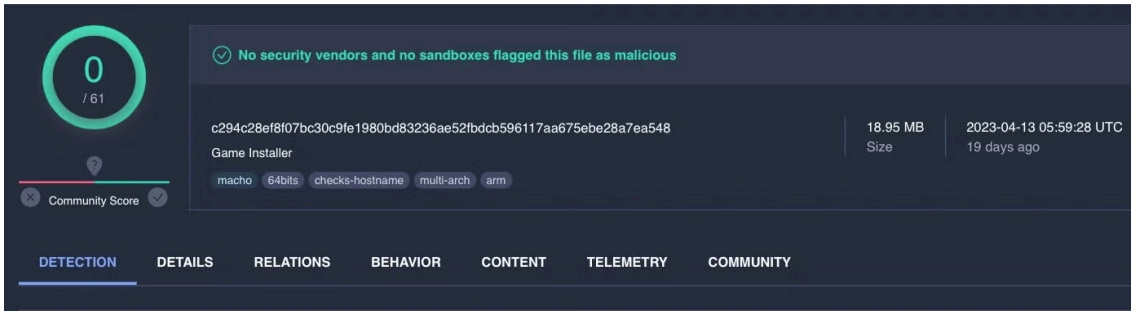
The malware contains logic to steal the user's keychain and crypto wallet contents, including those for Atomic, Binance, Electrum and Exodus. A process called 'unix1' is spawned in memory to obtain the keychain. Atomic stealer also targets both Chrome and Firefox browsers and has an extensive hardcoded list of crypto-related browser extensions to attack. A detailed walk through of the functions above has been previously described here.



Atomic Stealer execution chain

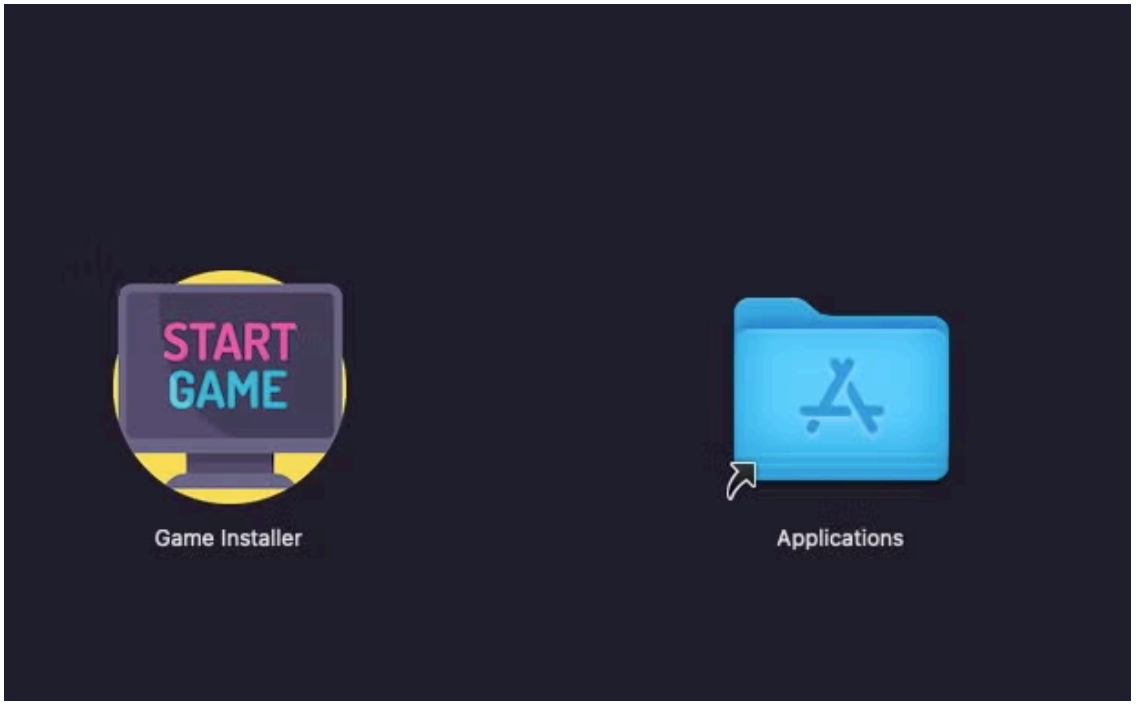
Atomic Stealer Variant B

Pivoting off the IP address `37.220.87.16` seen in some Atomic Stealer samples leads to another variant of the stealer, `c70fdf4362eb56032793ab08e6aeb892f1bd4a9b`, currently undetected on VirusTotal, masquerading as a Game Installer.



A previously undiscovered variant of Atomic Stealer

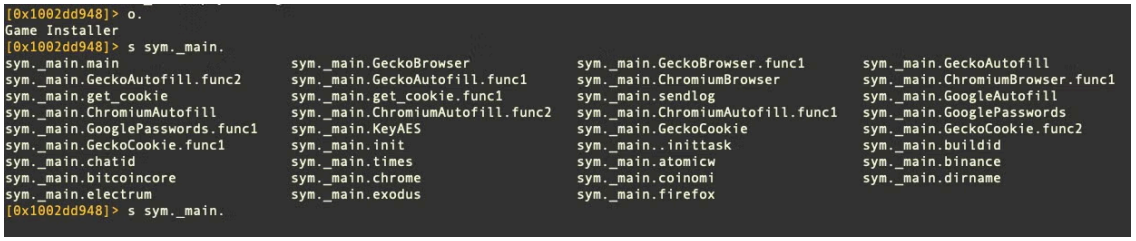
This version is not distributed in an application bundle, but rather as a raw Go binary. The unsigned “Game Installer” Mach-O was uploaded to VirusTotal on April 13th and is contained in a disk image called “ALMV_launcher”. The DMG mounts with the name “Game Installer” and contains a binary of the same name, displaying an icon showing the text “Start Game”.



Background image of the ALMV_launcher.dmg

As the universal binary is unsigned, it will need to be manipulated by the user on both Intel and arm64 architectures in order to run.

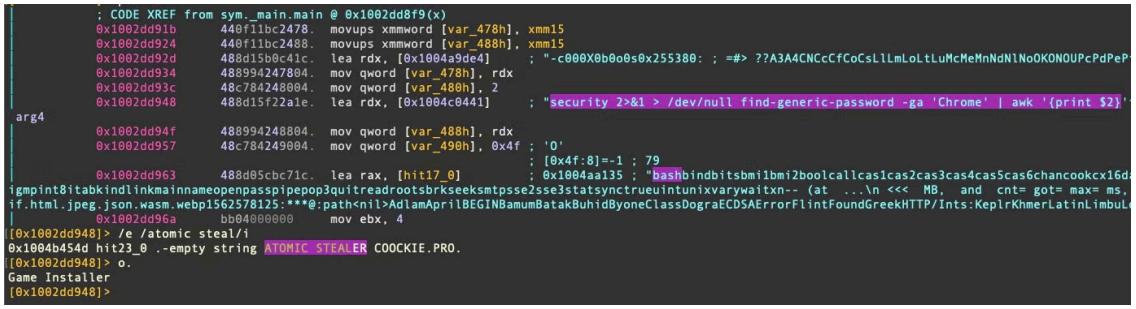
Variant B’s list of Go main functions differs from the version being packaged and sold on Telegram and shows a larger number of functions focusing on Firefox and Chromium browsers. Variant B also targets Coinomi wallets.



Atomic Stealer variant B primary functions

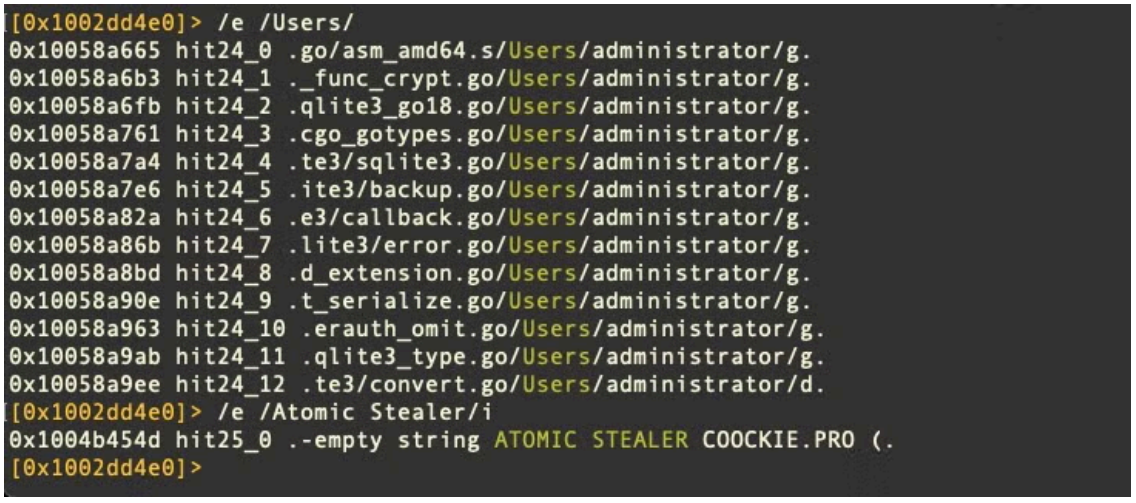
Both variant A and B utilize the `/usr/bin/security` utility to find Chrome passwords.

```
security 2>&1 > /dev/null find-generic-password -ga 'Chrome' | awk '{print $2}
```



Atomic Stealer B calls the */usr/bin/security* utility to find Chrome passwords

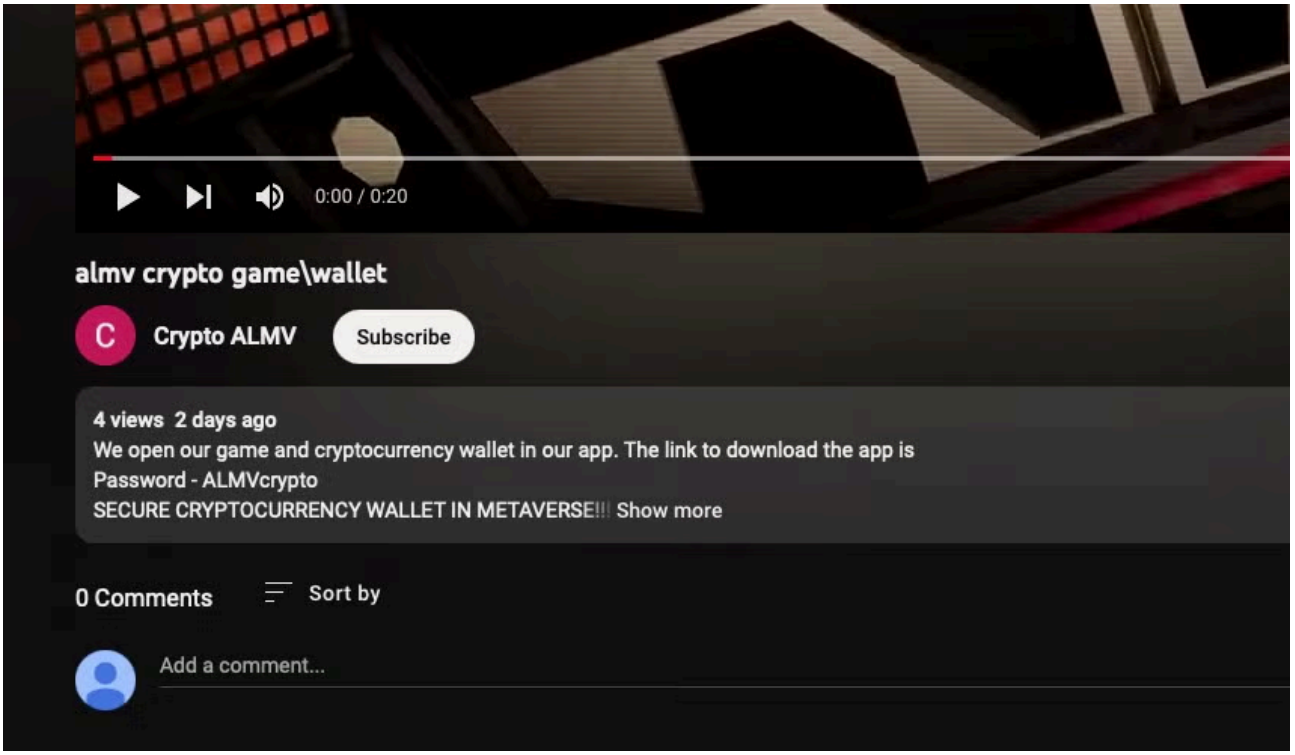
In Variant B, the user name “administrator” appears from the development machine; this differs from variant A, which included the username “iluhaboltov”. The string “ATOMIC STEALER COOCKIE” is also found in variant B but not A.



The “ATOMIC STEALER” string is hardcoded into the malware

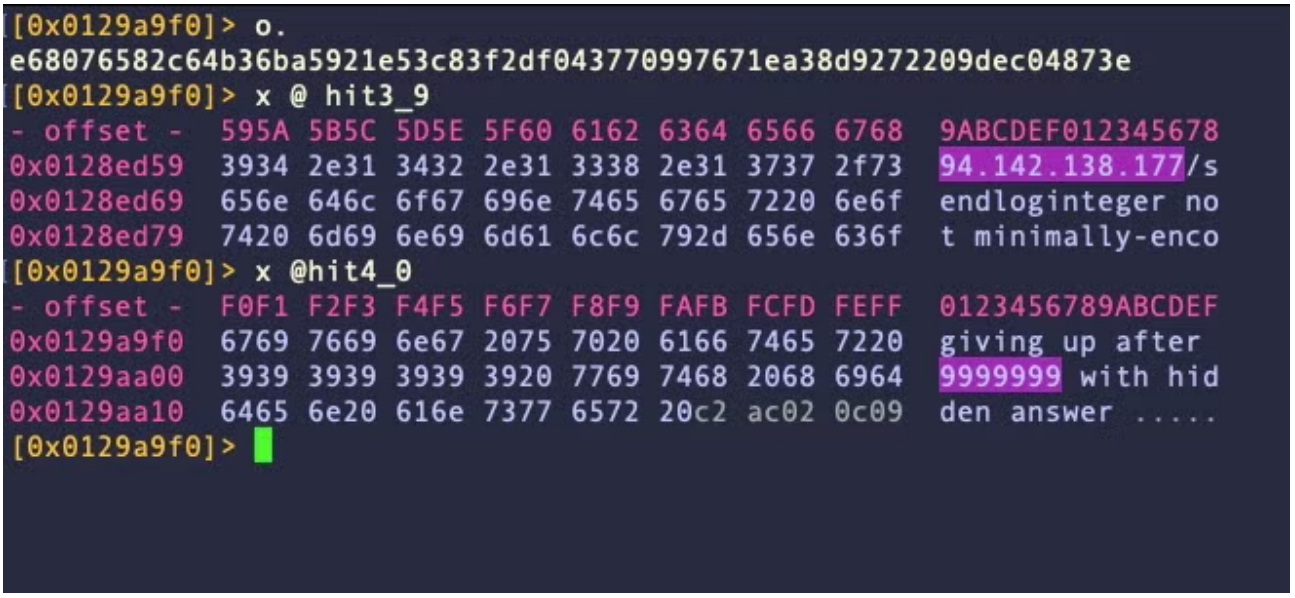
Unlike the package offered in the Atomic Telegram channel, this version of Atomic stealer is more selective in the information it tries to steal and seems to be aimed specifically at games and users of cryptocurrency.

An associated Youtube channel by user @Crypto-ALMV was created on April 29th, apparently advertising a product that offers cryptowallet access within a game. The channel, user, and video appear to be in the early stages of development and may indicate a campaign that is yet to be launched.

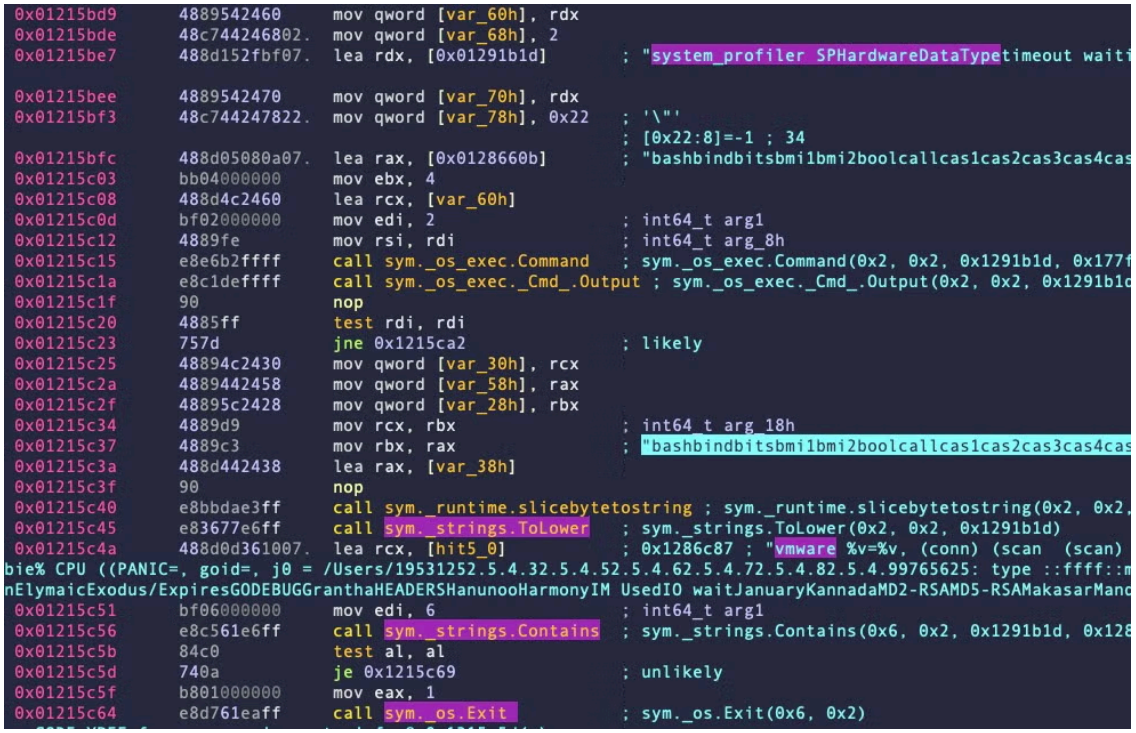


Atomic Stealer Variant C

A third variant appeared in mid-May that reduces the file size of these Go bins markedly to between 4.45 and 9.13MB. Variant C changes the C2 to `http[:]//94[.]142[.]138[.]177/` and uses a slightly different form of the "display dialog" command, adding a timeout of 9999999, although its uncertain that this timeout would actually work, as Apple events ordinarily have a max timeout of around 150 seconds.



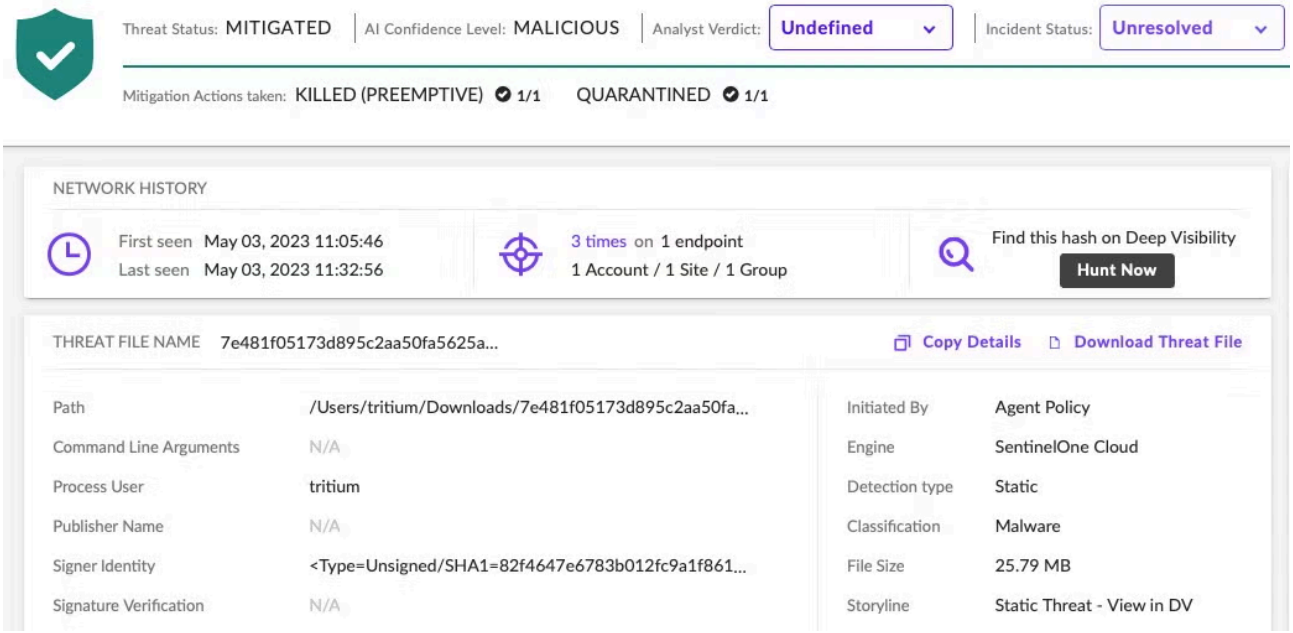
Variant C is most similar to Variant A, but lighter and with some rudimentary attempt at anti-analysis in the `sym._main.systeminfo` function, which does not appear in earlier variants. This function queries the built-in `system_profiler` tool's output for `SPHardwareDataType`, converts the output to lowercase, then searches it for the substring "vmware". If the substring is found, the malware then exits.



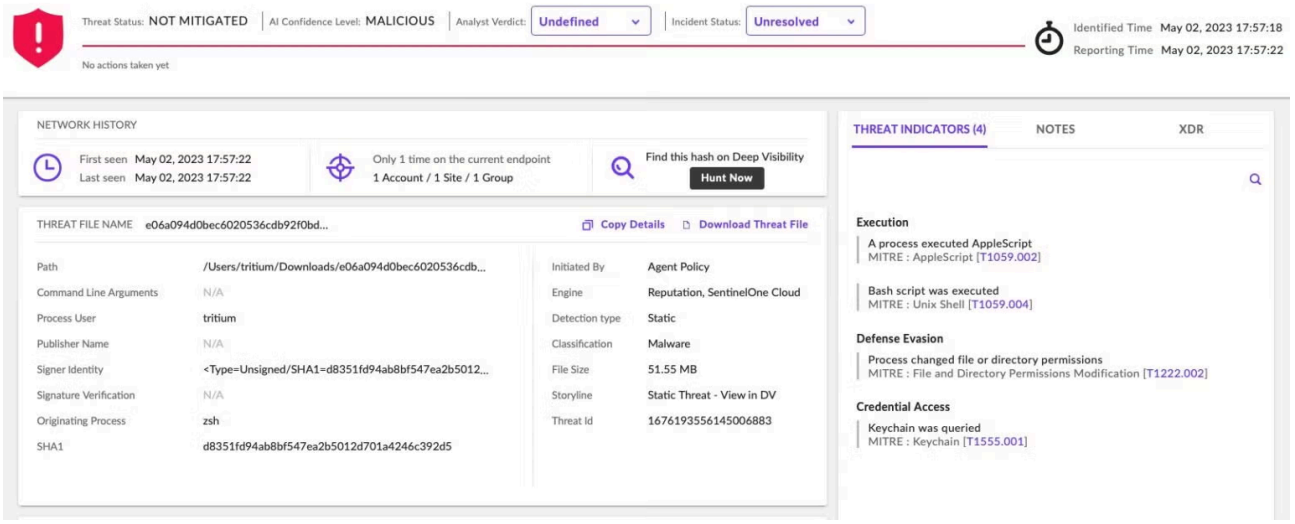
Atomic Stealer Variant C attempts to test if the malware is running in a Virtual Machine.

How to Protect Against Atomic Stealer

SentinelOne customers are protected against all known versions of Atomic Stealer. When the agent is set to 'Protect' mode, Atomic Stealer is prevented from executing.



In Detect Only mode, the malware's execution causes an alert and behavioral and threat indicators are available in the console.



Threat hunters and security teams not protected by SentinelOne are encouraged to review the list of Indicators of Compromise provided at the end of this post.

Conclusion

Infostealers targeted at Mac users have become increasingly viable for threat actors now that Macs have reached widespread use in organizations, both for work and personal use. As many Mac devices lack good external security tools that can provide both visibility and protection, there is plenty of opportunity for threat actors to develop and market tools to aid cybercriminals.

Atomic Stealer's advertised price suggests there is money to be made by "selling shovels" as cybercrime actors rush for the 'Gold' of data that can be harvested by tricking users into running untrustworthy software. However, the existence of a second variant that appears to be aimed at infecting users first-hand suggests the threat actor isn't averse to a bit of gold digging, too.

Indicators of Compromise

Communications

94[.]142[.]138[.]177/sendlog
amos-malware[.]ru/sendlog
37[.]220.87[.]16:5000/sendlog

October 2023 Update

078dd6122694cbc6e637a11fec77d6cab94bac3b
07fb38e48529490da73dcb9a0812bd3bb3337189
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f025a8d501833ff4c35cd9444f2e49f05539da8e
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f5682819b8adf51d7472b9487adf817dd0159216
fc71769a4bebb3f19e9a0111e16bd8fa2343ea13
fe3ca30da39f57ee5cdcf4ffe61afccc7bbfd181
ff6da20c870601023b8ebbdc3cb73e99226f237b

SHA1 Variant A DMG

0a87b12b2d12526c8ba287f0fb0b2f7b7e23ab4a
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36997111b5e7aa81b430a72df9f54bac2a9695ba
7534b4ef7727d14b4fdd32d18651d32572c7747b

SHA1 Variant A Mach-O

0db22608be1172844c0ebf08d573ea4e7ef37308
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aab3a2897950e85a2b957f77d2f100e61e29061c
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ca05f80fe44174d1089077f4b2303c436653226f
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d9d46ecfc1100d2b671ad97dc870e879d2634473
de465aad6cde9f0ce30fce0157bc18abf5a60d40
e114f643805394caece2326fb53e5d3a604a1aa9
f28025717f9db8a651f40c8326f477bf9d51a10f

SHA1 Variant B DMG

1f29b00c18bc0b7e1dfee5e79f8111da09f8fab8

SHA1 Variant B Mach-O

a02730f734032ed0f3b3705926b657aa4b88d720
c70fdf4362eb56032793ab08e6aeb892f1bd4a9b
e951b889aabca7ee5b0ff9d06a057884ed788b70

SHA1 Variant C Mach-O

00a20cf506e169b99e75e937e55c4b156a56304a
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