APT Actors Exploiting Newly-Identified Zero Day in ManageEngine Desktop Central

Summary
Since at least late October 2021, APT actors have been actively exploiting a zero-day, now identified as CVE-2021-44515, on ManageEngine Desktop Central servers. The APT actors were observed compromising Desktop Central servers, dropping a webshell that overrides a legitimate function of Desktop Central, downloading post-exploitation tools, enumerating domain users and groups, conducting network reconnaissance, attempting lateral movement and dumping credentials.

CVE-2021-44515, which Zoho rated critical, addresses an authentication bypass vulnerability in ManageEngine Desktop Central software that can allow an adversary to bypass authentication and execute arbitrary code on Desktop Central servers.

Zoho released a ManageEngine Desktop Central Security Advisory for the newly identified vulnerability CVE-2021-44515 on December 3, 2021:
Zoho also provided the following vulnerable build numbers for ManageEngine Desktop Central customers:

For Enterprise Customers:
For builds 10.1.2127.17 and below, upgrade to 10.1.2127.18
For builds 10.1.2128.0 to 10.1.2137.2, upgrade to 10.1.2137.3

For MSP Customers:
For builds 10.1.2127.17 and below, upgrade to 10.1.2127.18
For builds 10.1.2128.0 to 10.1.2137.2, upgrade to 10.1.2137.3

Technical Details

Initial exploitation of a Desktop Central API URL allowed for an unauthenticated file upload of two different variants of webshells observed in this campaign with the filenames emsaler.zip (variant 1, late October 2021), eco-inflect.jar (variant 1, mid November 2021) and aaa.zip (variant 2, late November 2021).

The webshell overrides the legitimate Desktop Central API servlet endpoint, /fos/statuscheck, and filters inbound GET (webshell variant 2) or POST requests (webshell variant 1) to that URL path and executes commands as the SYSTEM user with elevated privileges if the inbound requests pass the filter check.

Initial reconnaissance and domain enumeration was conducted through the webshell. After initial reconnaissance, the actors use BITSAdmin to download a likely ShadowPad variant dropper with filename mscoree.dll, and a legitimate Microsoft AppLaunch binary, iop.exe. The dropper is sideloaded through AppLaunch execution, which creates a persistent service to execute the AppLaunch binary moving forward. Upon execution, the dropper creates an instance of svchost and injects code with RAT-like functionality that initiates a connection to a command and control server.

Follow-on intrusion activity is then conducted through the RAT, including attempted lateral movement to domain controllers and credential dumping techniques using Mimikatz, comsvcs.dll LSASS process memory dumping, and a WDigest downgrade attack with subsequent LSASS dumping through pwdump.

The malicious samples were downloaded from likely compromised ManageEngine ADSelfService Plus servers.

Indicators
Log File Analysis

1. Search access log files located at
   %DesktopCentralInstallRoot%\logs\access_logs\access* for:
   a. POST requests to the following URL(s):
      i. /STATE_ID/123/agentLogUploader
   b. GET or POST requests to the following URL(s):
      i. /fos/statuscheck

2. Search serverout log files located at
   %DesktopCentralInstallRoot%\logs\serverout\* for log lines matching a format similar to the following:
   a. [<time>] [<date>] [com.adventnet.sym.webclient-statusupdate.AgentLogUploadServlet] [WARNING] [<num>] [<guid>]: absolute Dir ..\ds-logs\1\.\lib |
   b. [<time>] [<date>] [com.adventnet.sym.webclient-statusupdate.AgentLogUploadServlet] [WARNING] [<num>] [<guid>]: absolute File Name aaa.zip |
      i. Also replace aaa.zip with emsaler.zip, eco-infect.jar or remove it altogether to expand the search.

NOTE: The /fos/statuscheck API URL is a legitimate Desktop Central function, but based on analysis appears to be rarely used, and only expects communications from other internal Desktop Central servers. Any requests between late October 2021 and early December 2021, or those originating from external IP addresses, should be considered suspicious and investigated.

Hashes

febf7f32fed44a4a58a2e0ea402ea181a0e1a519ea41fab1d4ccfb097c8e538c44937538ff3a4316d60f672b7cddc9ba02ceaa2b991e25fafdb8b947622c8fe03e4297e74a59e1e9b125a0b7c0a0f34b1a22010086b302f88d25a5ce18b1b70d4a9b6ef095e16373d914937377bebe78fa9ca319741a3c516c18171073336269ef6223d956df81dcb6135c6ce00ee14d0efede9fb399b56d2ee95b7b0538fe12c4fbc93dd537ca67c3aa9e9082dc5189f81968b26a0cc69f07424b47f27d52049aaa7fffd9f23ce13da059779cdb8df785e9f321bb2044be22213774e1af817
Services

Name: MicrosoftFrameworkLaunchUtility

Executable Path: C:\ProgramData\MicroSoft Framework\Microsoft.Framework.AppLaunch.exe

RAT Path: C:\ProgramData\MicroSoft Framework\mscoree.dll

Processes

svchost.exe running MicrosoftFrameworkLaunchUtility

Domains

ns2.latincop[.]com

Filepaths

\ManageEngine\DesktopCentral_Server\lib\aaa.zip
\ManageEngine\DesktopCentral_Server\lib\emsaler.zip
\ManageEngine\DesktopCentral_Server\lib\eco-inflect.jar
C:\windows\ime\ssp.dll
C:\windows\ime\iop.exe
C:\windows\ime\mscoree.dll
C:\ProgramData\MicroSoft Framework\Microsoft.Framework.AppLaunch.exe
C:\ProgramData\MicroSoft Framework\mscoree.dll
Tactics, Techniques, and Procedures

- DLL sideloading
- Executing “live off the land” tools, e.g. bitsadmin
- Network scanning, e.g. nbtscan, nb.exe
- Powershell for command execution
- Persistence through Windows Service
- Downloading staged post-exploitation tools from other victim infrastructure
- Credential dumping, e.g. Mimikatz, comsvcs.dll, WDigest downgrade and pwdump

Yara Rules

```python
import "pe"

rule mscorere_RAT_loader_func {
    strings:
        $s1 = { FF 15 ?? AF 00 00 80 B8 04 41 00 00 48} // GetModuleHandleA initial load
        $s2 = { 33 C9 BA A3 4F 01 00 } // size allocation: 85923 bytes, could vary
        $s3 = { 41 B8 00 10 00 00 44 8D 49 40 } // 0x40 RWX allocation
        $s4 = { FF 15 17 AF 00 00 }

    condition:
        (uint16(0) == 0x5A4D and uint32(uint32(0x3C)) == 0x00004550) and filesize < 350KB and 3 of them
}

rule mscorere_RAT {
    condition:
        (uint16(0) == 0x5A4D and uint32(uint32(0x3C)) == 0x00004550)
        and filesize < 350KB
        and pe.dll_name == "MSCOREE.dll"
        and pe.exports("IEE")
        and pe.imports("kernel32.dll", "VirtualAlloc") and pe.imports("kernel32.dll", "IsDebuggerPresent")
```
rule StatusCheck_backdoor_zip {
    strings:
        $s1 = "com/zoho/clustering/agent/api/StatusCheck.class"
        $s2 = "META-INF/MANIFEST.MF"
    condition:
        uint32(0) == 0x04034B50 and filesize < 15KB and all of them
}

rule aaa_fos_statuscheck_class {
    strings:
        $s1 = "decodeBase64"
        $s2 = "APIKEYS" fullword
        $s3 = "slaveId"
        $s4 = "processRequest"
        $s5 = "com/zoho/clustering/agent/remotemonitor/MonitorPool"
        $s6 = "destnAbsoluteFileName"
        $s7 = "Fail" fullword
        $s8 = "lognames" fullword
        $s9 = "receivedFileSize"
        $s10 = "<TITLE>ManageEngine Desktop Central</TITLE>"
    condition:
        uint32(0) == 0xbefeca and filesize < 15KB and 7 of them
}

rule APT_backdoor_class {
    strings:
        $s1 = "cmd.exe /c"
        $s2 = "Authorization-Expires"
        $s3 = "encrypt"
        $s4 = "encodeBase64"
        $s5 = "prepareDownload"
        $s6 = "application/octet-stream; charset=UTF-8"
        $s7 = "getUploadedFile"
        $s8 = "Agent64Com"
        $s9 = "cmd_flag"
    condition:

uint32(0) == 0xbebafeca and filesize < 15KB and 6 of them
}

rule APT_backdoor_RC4_class {
strings:
    $s1 = "com/zoho/clustering/agent/api/RC4"
    $s2 = "StackMapTable"
    $s3 = "RC4.java"
    $s4 = "in_offset"
    $s5 = "out_offset"
    $s6 = "encrypt"

c-condition:
    uint32(0) == 0xbebafeca and filesize < 5KB and 5 of them
}

**Information Requested:**

Please report to FBI the existence of any of the following:

- Identification of indicators of compromise (IOCs) as outlined above
- Presence of webshell code on compromised Desktop Central servers
- Unauthorized access to or use of accounts
- Evidence of lateral movement by malicious actors with access to compromised systems
- Malicious IPs identified through conducted log file searches and session activity
- Malicious samples identified through IOCs
- Other indicators of unauthorized access or compromise

Recipients of this information are encouraged to contribute any additional information that they may have related to this threat.

**Recommended Mitigations:**

Organizations that identify any activity related to these IOCs within their networks should take action immediately.

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**Reporting Notice**

The FBI encourages recipients of this document to report information concerning suspicious or criminal activity to their local FBI field office. With regards to specific information that appears in this communication; the context, individual indicators, particularly those of a non-deterministic or ephemeral nature (such as filenames or IP addresses), may not be indicative of a compromise. Indicators should always be evaluated in light of your complete information security situation.

Field office contacts can be identified at www.fbi.gov/contact-us/field-offices. When available, each report submitted should include the date, time, location, type of activity, number of people, type of equipment used for the activity, the name of the submitting company or organization, and a designated point of contact.
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