



America's Cyber Defense Agency

NATIONAL COORDINATOR FOR CRITICAL INFRASTRUCTURE SECURITY AND RESILIENCE

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CYBERSECURITY ADVISORY

APT Actors Exploiting Newly Identified Vulnerability in ManageEngine ADSelfService Plus

Last Revised: November 22, 2021

Alert Code: AA21-259A



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Summary

This Joint Cybersecurity Advisory uses the MITRE Adversarial Tactics, Techniques, and Common Knowledge (ATT&CK®) framework, Version 8. See the [ATT&CK for Enterprise](#) <<https://attack.mitre.org/versions/v9/techniques/enterprise/>> for referenced threat actor tactics and for techniques.

This joint advisory is the result of analytic efforts between the Federal Bureau of Investigation (FBI), United States Coast Guard Cyber Command (CGCYBER), and the Cybersecurity and Infrastructure Security Agency (CISA) to highlight the cyber threat

associated with active exploitation of a newly identified vulnerability (CVE-2021-40539) in ManageEngine ADSelfService Plus—a self-service password management and single sign-on solution.

CVE-2021-40539, rated critical by the Common Vulnerability Scoring System (CVSS), is an authentication bypass vulnerability affecting representational state transfer (REST) application programming interface (API) URLs that could enable remote code execution. The FBI, CISA, and CGCYBER assess that advanced persistent threat (APT) cyber actors are likely among those exploiting the vulnerability. The exploitation of ManageEngine ADSelfService Plus poses a serious risk to critical infrastructure companies, U.S.-cleared defense contractors, academic institutions, and other entities that use the software. Successful exploitation of the vulnerability allows an attacker to place webshells, which enable the adversary to conduct post-exploitation activities, such as compromising administrator credentials, conducting lateral movement, and exfiltrating registry hives and Active Directory files.

Zoho ManageEngine ADSelfService Plus build 6114

<<https://pitstop.manageengine.com/portal/en/community/topic/adselfservice-plus-6114-security-fix-release>>, which Zoho released on September 6, 2021, fixes CVE-2021-40539. FBI, CISA, and CGCYBER strongly urge users and administrators to update to ADSelfService Plus build 6114. Additionally, FBI, CISA, and CGCYBER strongly urge organizations ensure ADSelfService Plus is not directly accessible from the internet.

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The FBI, CISA, and CGCYBER have reports of malicious cyber actors using exploits against CVE-2021-40539 to gain access [[T1190 <https://attack.mitre.org/techniques/t1190/>](https://attack.mitre.org/techniques/t1190/)] to ManageEngine ADSelfService Plus, as early as August 2021. The actors have been observed using various tactics, techniques, and procedures (TTPs), including:

- Frequently writing webshells [[T1505.003 <https://attack.mitre.org/techniques/t1505/003/>](https://attack.mitre.org/techniques/t1505/003/)] to disk for initial persistence
- Obfuscating and Deobfuscating/Decoding Files or Information [[T1027 <https://attack.mitre.org/techniques/t1027/>](https://attack.mitre.org/techniques/t1027/)] and [T1140 <https://attack.mitre.org/techniques/t1140/>](https://attack.mitre.org/techniques/t1140/)]

- Conducting further operations to dump user credentials [T1003
<https://attack.mitre.org/techniques/t1003/>]
- Living off the land by only using signed Windows binaries for follow-on actions [T1218
<https://attack.mitre.org/techniques/t1218/>]
- Adding/deleting user accounts as needed [T1136 <https://attack.mitre.org/techniques/t1136/>]
- Stealing copies of the Active Directory database (`NTDS.dit`) [T1003.003
<https://attack.mitre.org/techniques/t1003/003/>] or registry hives
- Using Windows Management Instrumentation (WMI) for remote execution [T1047
<https://attack.mitre.org/techniques/t1047/>]
- Deleting files to remove indicators from the host [T1070.004
<https://attack.mitre.org/techniques/t1070/004/>]
- Discovering domain accounts with the `net` Windows command [T1087.002
<https://attack.mitre.org/techniques/t1087/002/>]
- Using Windows utilities to collect and archive files for exfiltration [T1560.001
<https://attack.mitre.org/techniques/t1560/001/>]
- Using custom symmetric encryption for command and control (C2) [T1573.001
<https://attack.mitre.org/techniques/t1573/001/>]

The FBI, CISA, and CGCYBER are proactively investigating and responding to this malicious cyber activity.

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- FBI is leveraging specially trained cyber squads in each of its 56 field offices and CyWatch, the FBI's 24/7 operations center and watch floor, which provides around-the-clock support to track incidents and communicate with field offices across the country and partner agencies.
- CISA offers a range of no-cost [cyber hygiene services](https://www.cisa.gov/cyber-hygiene-services) <https://www.cisa.gov/cyber-hygiene-services> to help organizations assess, identify, and reduce their exposure to threats. By requesting these services, organizations of any size could find ways to reduce their risk and mitigate attack vectors.

- CGCYBER has deployable elements that provide cyber capability to marine transportation system critical infrastructure in proactive defense or response to incidents.

Sharing technical and/or qualitative information with the FBI, CISA, and CGCYBER helps empower and amplify our capabilities as federal partners to collect and share intelligence and engage with victims while working to unmask and hold accountable, those conducting malicious cyber activities. See the Contact section below for details.

[Click here </sites/default/files/publications/aa21-259a-](#)

[apt_actors_exploiting_newly_identified_vulnerability_in_manageengine_adselfservice_plus.pdf>](#) for a PDF version of this report.

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[259a%20apt%20actors%20exploiting%20newly%20identified%20vulnerability%20in%20manageengine%20adselfservice%20plus.stix.xml>](#) for indicators of compromise (IOCs) in STIX format.

Technical Details

Successful compromise of ManageEngine ADSelfService Plus, via exploitation of CVE-2021-40539, allows the attacker to upload a `.zip` file containing a JavaServer Pages (JSP) webshell masquerading as an x509 certificate: `service.cer`. Subsequent requests are then made to different API endpoints to further exploit the victim's system.

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After the initial exploitation, the JSP webshell is accessible at `/help/admin-guide/Reports/ReportGenerate.jsp`. The attacker then attempts to move laterally using Windows Management Instrumentation (WMI), gain access to a domain controller, dump `NTDS.dit` and `SECURITY/SYSTEM` registry hives, and then, from there, continues the compromised access.

Confirming a successful compromise of ManageEngine ADSelfService Plus may be difficult—the attackers run clean-up scripts designed to remove traces of the initial point of compromise and hide any relationship between exploitation of the vulnerability and the

webshell.

(Updated November 19, 2021): APT actors are using the following suite of tools to enable this campaign:

- Dropper – a dropper trojan that drops Godzilla webshell on a system.
- Godzilla – a Chinese language webshell.
- NGLite – a backdoor trojan written in Go.
- KdcSponge – a credential-stealing tool that targets undocumented APIs in Microsoft’s implementation of Kerberos.

The FBI, CISA, and CGCYBER cannot confirm the CVE-2021-40539 is the only vulnerability APT actors are leveraging as part of this activity, so it is key that network defenders focus on detecting the tools listed above in addition to initial access vector. For more information, see:

- Palo Alto Networks blog post: [KdcSponge, NGLite, Godzilla Webshell Used in Targeted Attack Campaign](https://unit42.paloaltonetworks.com/manageengine-godzilla-nelite-kdcspunge/) <<https://unit42.paloaltonetworks.com/manageengine-godzilla-nelite-kdcspunge/>>.
- Microsoft Security blog post: [Threat actor DEV-0322 exploiting ZOHO ManageEngine ADSelfService Plus](https://www.microsoft.com/security/blog/2021/11/08/threat-actor-dev-0322-exploiting-zoho-manageengine-adselfservice-plus/) <<https://www.microsoft.com/security/blog/2021/11/08/threat-actor-dev-0322-exploiting-zoho-manageengine-adselfservice-plus/>>.
- IBM Security Intelligence blog post: [Call to Patch: Zero Day Discovered in Enterprise Help Desk Platform](https://securityintelligence.com/posts/zero-day-discovered-enterprise-help-desk/) <<https://securityintelligence.com/posts/zero-day-discovered-enterprise-help-desk/>>.

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Targeted Sectors

APT cyber actors have targeted entities across the 16 critical infrastructure sectors, including academic institutions, defense contractors as well as transportation, information technology, manufacturing, communications, and finance. Illicitly obtained access and information may disrupt company operations/logistics and subvert U.S. research across critical infrastructure sectors.

Indicators of Compromise

Hashes:

068d1b3813489e41116867729504c40019ff2b1fe32aab4716d429780e66632

4

49a6f77d380512b274baff4f78783f54cb962e2a8a5e238a453058a351fcfbba

a

File paths:

C:\ManageEngine\ADSelfService Plus\webapps\adssp\help\admin-guide\reports\ReportGenerate.jsp

C:\ManageEngine\ADSelfService

Plus\webapps\adssp\html\promotion\adap.jsp

C:\ManageEngine\ADSelfService

Plus\work\Catalina\localhost\ROOT\org\apache\jsp\help

C:\ManageEngine\ADSelfService Plus\jre\bin\SelfSe~1.key

(filename varies with an epoch timestamp of creation, extension
may vary as well)

C:\ManageEngine\ADSelfService

Plus\webapps\adssp\Certificates\SelfService.csr

C:\ManageEngine\ADSelfService Plus\bin\service.cer

C:\Users\Public\custom.txt

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```
C:\Users\Public\custom.bat  
C:\ManageEngine\ADSelfService  
Plus\work\Catalina\localhost\ROOT\org\apache\jsp\help  
(including subdirectories and contained files)
```

Webshell URL Paths:

```
/help/admin-guide/Reports/ReportGenerate.jsp
```

```
/html/promotion/adap.jsp
```

Check log files located at `C:\ManageEngine\ADSelfService Plus\logs` for evidence of successful exploitation of the ADSelfService Plus vulnerability:

- In access* logs:

- `/help/admin-guide/Reports/ReportGenerate.jsp`
- `/ServletApi/.../RestApi/LogonCustomization`
- `/ServletApi/.../RestAPI/Connection`

- In serverOut_* logs:

- `Keystore will be created for "admin"`
- `The status of keystore creation is Upload!`

- In adslog* logs:

- `Java traceback errors that include references to
NullPointerException in addSmartCardConfig or
getSmartCardConfig`

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TTPs:

- WMI for lateral movement and remote code execution (`wmic.exe`)
- Using plaintext credentials acquired from compromised ADSelfService Plus host
- Using `pg_dump.exe` to dump ManageEngine databases
- Dumping `NTDS.dit` and `SECURITY/SYSTEM/NTUSER` registry hives

- Exfiltration through webshells
- Post-exploitation activity conducted with compromised U.S. infrastructure
- Deleting specific, filtered log lines

Yara Rules:

```
rule ReportGenerate_jsp {
    strings:
        $s1 = "decrypt(fpath)"
        $s2 = "decrypt(fcontext)"
        $s3 = "decrypt(commandEnc)"
        $s4 = "upload failed!"
        $s5 = "sevck"
        $s6 = "newid"
    condition:
        filesize < 15KB and 4 of them
}
```

```
rule EncryptJSP {
    strings:
        $s1 = "AEScrypt"
        $s2 = "AES/CBC/PKCS5Padding"
        $s3 = "SecretKeySpec"
        $s4 = "FileOutputStream"
        $s5 = "getParameter"
        $s6 = "new ProcessBuilder"
        $s7 = "new BufferedReader"
        $s8 = "readLine()"
    condition:
        filesize < 15KB and 6 of them
}
```

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Mitigations

Organizations that identify any activity related to ManageEngine ADSelfService Plus indicators of compromise within their networks should take action immediately.

Zoho ManageEngine ADSelfService Plus build 6114

<<https://pitstop.manageengine.com/portal/en/community/topic/adselfservice-plus-6114-security-fix-release>>, which Zoho released on September 6, 2021, fixes CVE-2021-40539. FBI, CISA, and CGCYBER strongly urge users and administrators to update to ADSelfService Plus build 6114. Additionally, FBI, CISA, and CGCYBER strongly urge organizations ensure ADSelfService Plus is not directly accessible from the internet.

Additionally, FBI, CISA, and CGCYBER strongly recommend domain-wide password resets and double Kerberos Ticket Granting Ticket (TGT) password resets if any indication is found that the `NTDS.dit` file was compromised.

ACTIONS FOR AFFECTED ORGANIZATIONS

Immediately report as an incident to [CISA](https://us-cert.cisa.gov/report) <<https://us-cert.cisa.gov/report>> or the [FBI](#) (refer to Contact Information section below) the existence of any of the following:

- Identification of indicators of compromise as outlined above.
- Presence of webshell code on compromised ManageEngine ADSelfService Plus servers.
- Unauthorized access to or use of accounts.
- Evidence of lateral movement by malicious actors with access to compromised systems.
- Other indicators of unauthorized access or compromise.

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CONTACT INFORMATION

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

For any questions related to this report or to report an intrusion and request resources for incident response or technical assistance, please contact:

- To report suspicious or criminal activity related to information found in this Joint Cybersecurity Advisory, contact your local FBI field office at <https://www.fbi.gov/contact-us/field-offices> <<https://www.fbi.gov/contact-us/field-offices>>, or the FBI's 24/7 Cyber Watch (CyWatch) at (855) 292-3937 or by e-mail at CyWatch@fbi.gov. When available, please include the following information regarding the incident: date, time, and location of the incident; type of activity; number of people affected; type of equipment used for the activity; the name of the submitting company or organization; and a designated point of contact.
- To request incident response resources or technical assistance related to these threats, contact CISA at Central@cisa.gov.
- To report cyber incidents to the Coast Guard pursuant to 33 CFR Subchapter H, Part 101.305 please contact the USCG National Response Center (NRC) Phone: 1-800-424-8802, email: NRC@uscg.mil.

Revisions

September 16, 2021: Initial Version|November 19, 2021: Updated to include tools used to enable attack campaign|November 22, 2021: Updated Palo Alto reference to Palo Alto Networks

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