First Binder Exploit Linked to SideWinder APT Group

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Published: 2020-01-06 · Archived: 2026-04-02 10:54:52 UTC

Updated January 8, 2020 5PM EST with a video showing the exploit of CVE-2019-2215.

We found three malicious apps in the Google Play Store that work together to compromise a victim's device and collect user information. One of these apps, called Camero, exploits CVE-2019-2215open on a new tab, a vulnerability that exists in Binder (the main Inter-Process Communication system in Android). This is the first known active attack in the wild that uses the use-after-free vulnerabilityopen on a new tab. Interestingly, upon further investigation we also found that the three apps are likely to be part of the SideWinder threat actor group's arsenal. SideWinder, a group that has been active since 2012, is a known threat and has reportedly targeted military entities' Windows machinesopen on a new tab.

The three malicious apps were disguised as photography and file manager tools. We speculate that these apps have been active since March 2019 based on the certificate information on one of the apps. The apps have since been removed from Google Play.

Figure 1. The three apps related to SideWinder group

Figure 2. Certificate information of one of the apps

Installation

SideWinder installs the payload app in two stages. It first downloads a DEX file (an Android file format) from its command and control (C&C) server. We found that the group employs Apps Conversion Trackingopen on a new tab to configure the C&C server address. The address was encoded by Base64 then set to referrer parameter in the URL used in the distribution of the malware.

Figure 3. Parsed C&C Server address

After this step, the downloaded DEX file downloads an APK file and installs it after exploiting the device or employing accessibility. All of this is done without user awareness or intervention. To evade detection, it uses many techniques such as obfuscation, data encryption, and invoking dynamic code.

The apps Camero and FileCrypt Manger act as droppers. After downloading the extra DEX file from the C&C server, the second-layer droppers invoke extra code to download, install, and launch the callCam app on the device.

Figure 4. Two-stage payload deployment

Figure 5. Code showing how the dropper invokes extra DEX code

To deploy the payload app callCam on the device without the user's awareness, SideWinder does the following:

- 1. *Device Rooting*

This approach is done by the dropper app Camero and only works on Google Pixel (Pixel 2, Pixel 2 XL), Nokia 3 (TA-1032), LG V20 (LG-H990), Oppo F9 (CPH1881), and Redmi 6A devices. The malware retrieves a specific exploit from the C&C server depending on the DEX downloaded by the dropper.

Figure 6. Code snippet from Extra DEX downloaded by Camero

We were able to download five exploits from the C&C server during our investigation. They use the vulnerabilities CVE-2019-2215 and MediaTek-SU to get root privilege.

Figure 7. CVE-2019-2215 exploit

Figure 8. MediaTek-SU exploit

After acquiring root privilege, the malware installs the app callCam, enables its accessibility permission, and then launches it.

Figure 9. Commands install app, launch app, and enable accessibility

- 2. *Device Rooting*

This approach is used by the dropper app FileCrypt Manager and works on most typical Android phones above Android 1.6. After its launch, the app asks the user to enable accessibility.

Figure 10. Steps FileCrypt Manager prompts user to do

Once granted, the app shows a full screen window that says that it requires further setup steps. In reality, that is just an overlay screen that is displayed on top of all activity windows on the device. The overlay window sets its attributions to FLAG_NOT_FOCUSABLEopen on a new tab and FLAG_NOT_TOUCHABLEopen on a new tab, allowing the activity windows to detect and receive the users' touch events through the overlay screen.

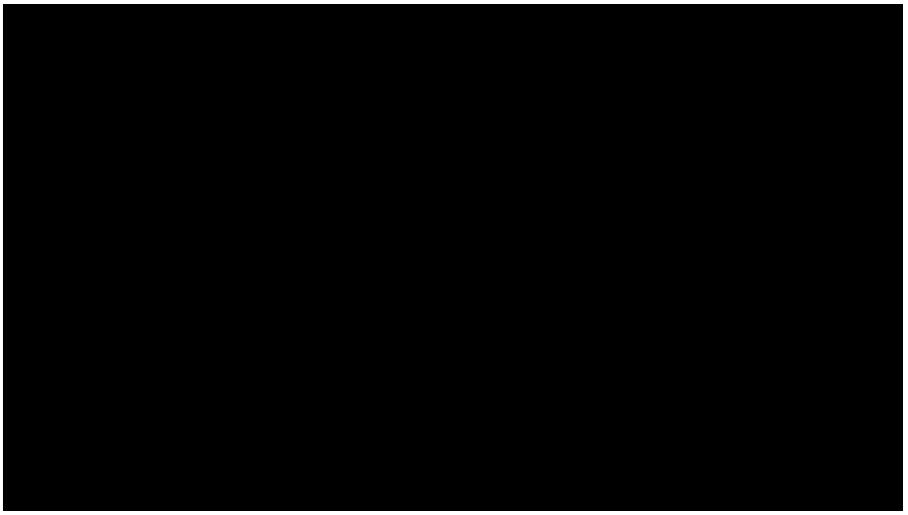
Figure 11. Overlay screen

Meanwhile, the app invokes code from the extra DEX file to enable the installation of unknown apps and the installation of the payload app callCam. It also enables the payload app's accessibility permission, and then launches the payload app. All of this happens behind the overlay screen, unbeknownst to the user. And, all these steps are performed by employing Accessibility.

Figure 12. Code enabling install of unknown apps and new APK

Figure 13. Code enable accessibility permission of the newly installed app

The video below demonstrates payload deployment via CVE-2019-2215 on Pixel 2:



callCam's Activities

The app callCam hides its icon on the device after being launched. It collects the following information and sends it back to the C&C server in the background:

- Location
- Battery status
- Files on device
- Installed app list
- Device information
- Sensor information
- Camera information
- Screenshot
- Account
- Wifi information
- Data of WeChat, Outlook, Twitter, Yahoo Mail, Facebook, Gmail, and Chrome

The app encrypts all stolen data using RSA and AES encryption algorithms. It uses SHA256 to verify data integrity and customize the encoding routine. When encrypting, it creates a block of data we named headData. This block contains the first 9 bytes of origin data, origin data length, random AES IV, the RSA-encrypted AES encrypt key, and the SHA256 value of AES-encrypted origin data. Then the headData is encoded through the customized routine. After the encoding, it is stored in the head of the final encrypted file followed by the data of the AES-encrypted original data.

Figure 14. Data encryption process

Figure 15. Customized encoding routine done

Relation to SideWinder

These apps may be attributed to SideWinder as the C&C servers it uses are suspected to be part of SideWinder's infrastructureopen on a new tab. In addition, a URL linking to one of the apps' Google Play pages is also found on one of the C&C servers.

Figure 16. Google Play URL of FileManager app found in one of the C&C servers.

Trend Micro Solutions

Trend Micro solutions such as the Trend Micro™ Mobile Security for Android™open on a new tab can detect these malicious apps. End users can also benefit from its multilayered security capabilities that secure the device owner's data and

privacy and safeguard them from ransomware, fraudulent websites, and identity theft.

For organizations, the Trend Micro Mobile Security for Enterpriseopen on a new tab suite provides device, compliance, and application management, data protection, and configuration provisioning. It also protects devices from attacks that exploit vulnerabilities, prevents unauthorized access to apps, and detects and blocks malware and fraudulent websites. Trend Micro's Mobile App Reputation Serviceopen on a new tab (MARS) covers Android and iOS threats using leading sandbox and machine learning technologies to protect users against malware, zero-day and known exploits, privacy leaks, and application vulnerabilities.

Indicators of Compromise

SHA256	Package Name/File type	App Name/Detecti
ec4d6bf06dd3f94f4555d75c6daaf540dee15b18d62cc004e774e996c703cb34	DEX	AndroidOS_SWind
a60fc4e5328dc75dad238d46a2867ef7207b8c6fb73e8bd001b323b16f02ba00	DEX	AndroidOS_SWind
0daefb3d05e4455b590da122255121079e83d48763509b0688e0079ab5d48886	ELF	AndroidOS_MtkSu
441d98dff3919ed24af7699be658d06ae8dfd6a12e4129a385754e6218bc24fa	ELF	AndroidOS_Binder
ac82f7e4831907972465477eebafc5a488c6bb4d460575cd3889226c390ef8d5	ELF	AndroidOS_Binder
ee679afb897213a3fd09be43806a7e5263563e86ad255fd500562918205226b8	ELF	AndroidOS_Binder
135cb239966835fefbb346165b140f584848c00c4b6a724ce122de7d999a3251	ELF	AndroidOS_MtkSu
a265c32ed1ad47370d56cbd287066896d6a0c46c80a0d9573d2bb915d198ae42	com.callCam.android.callCam2base	callCamm

Package Name/File type	App Name/Detection Name
com.abdulrauf.filemanager	FileCrypt Manager
com.callCam.android.callCam2base	callCamm
com.camero.android.camera2basic	Camero

C&C Servers

- ms-ethics.net
- deb-cn.net
- ap1-acl.net m
- s-db.net
- aws-check.net
- reawk.net

MITRE ATT&CK Matrix™

Source: https://blog.trendmicro.com/trendlabs-security-intelligence/first-active-attack-exploiting-cve-2019-2215-found-on-google-play-linked-to-sidewinder-apt-group/