Coordinated Disclosure of Vulnerabilities in AVG Antivirus Free Android 5.9.4.1

1 Executive summary

Researchers of MRG Effitas tested the AVG AntiVirus Free Android application. During use, we came across implementation details, which might undermine the Vendor's efforts to provide a comprehensive mobile security solution with the potential to aid users in case of encounters with malware.

Testing covered the following application version.

Application name	AVG AntiVirus
Store URL	https://play.google.com/store/apps/details?id=com.antivirus
Version	5.9.4.1

We considered the situation and opted for a responsible disclosure approach to aid the Vendor in their efforts. In accordance with industry standards, we disclose the issues based on Google's 90-day policy. As a result, after a 90-day plus a 14-day grace period, we make the discoveries public. For further details, refer to the following URL.

Disclosure date: 20. April 17
Grace period begins: 19 July, 2017
Grace period ends: 1 August, 2017

https://security.googleblog.com/2014/07/announcing-project-zero.html

2 Vulnerability description

2.1 No user warning on rooted/compromised devices

Finding

Testing discovered that the application was normally installed and initialized on a rooted test device, provided with a dynamic hooking framework application (xposed framework). This scenario is a highly insecure one, as the hooking framework can be utilized to bypass every security measure of the AVG application. This is by no means something that an Android security suite can be properly prepared for, nevertheless no user warning has been displayed.

Risk

As a result, a highly sophisticated piece of malware using dynamic hooking might even abuse the AVG application to convince the user that there are no threats on the device. Note that no cloaking has taken place and as per the logs, the Xposed installer application has even been scanned by the AVG application.

Consider the following scenario.

1. The Android device with no preliminary protection, gets infected by a highly sophisticated piece of malware.
2. The users suspects that there might be something going on and opts for the AVG suite to run a security scan on his device.
3. Upon installation and scanning, no warning is displayed and the user is reassured that his device is clean from malware.

Recommendation

It is recommended to at least warn the user in such clear cases that there might be something going on with his device and that the scan results are not trustworthy in any way.

Nevertheless, it is important to point out that reliable root detection is theoretically impossible in untrustworthy environments (such as a user controlled Android device). When it comes to root detection, false positive errors are rather uncommon, however false negatives are more dangerous from security perspective. It is possible to install readily prepared tools to fool common root detection methods (e.g. RootCloak), however, presence of the Xposed installer and the RootCloak application itself is a good indication that the device has been rooted. All in all, a comprehensive approach is recommended, where the user is notified at the slightest sign of deviation from a ‘clean’ device state.

As an alternate approach, it is possible to harden the application itself to detect tampering (both off-line patching plus re-packaging and runtime hooking) to some extent. Should any of the below checks fail, assume that the environment is tampered with and notify the user. Note that even a careful implementation of all below methods can only raise the bar in terms of attacker skill, motivation and expertise, it can deter and detect novice users, who solely rely on off-the-shelf tools.

- Upon startup, check if the package has debug mode enabled.
- Regularly check the signature and the signing key of the app package if it deviates from an expected value.

- List the calling stack of security related methods (such as certificate pinning, root detection etc.) Should the RootCloak tool be used, the calling stack contains elements that are clearly not from the originating application.

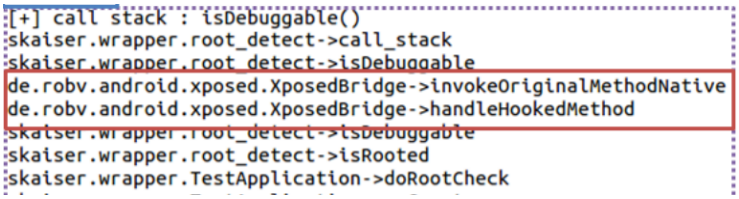

Figure 1 Evidence of dynamic hooking based tampering

For further information, refer to the following whitepaper (An Android Application Protection Scheme against Dynamic Reverse Engineering Attacks. *Lim, Yeong et al*. Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications, issue September 2016.)

http://isyou.info/jowua/papers/jowua-v7n3-3.pdf

2.2 No certificate pinning

Finding

Testing revealed that the application does not utilize certificate pinning. Instead, it utilizes the OS CA store.

Risk

As a result, it is trivial to bypass certificate validation using various methods (e.g consider a social engineering attack, where the user is asked to install a certificate authority on his Android device). Considering the fact that mobile security suites are intended also for non-security conscious users, this design consideration should be re-evaluated.

When a new package is installed the hash of the package is checked from a reputational perspective within AVG's cloud service.
Request:

```
POST /detections.aspx HTTP/1.1
Cache-Control: no-cache
Pragma: no-cache
Host: droid.cloud.avg.com
User-Agent: Dalvik/2.1.0 (Linux; U; Android 5.1; AVG_511 Build/LMY47D)
Connection: close
Content-Type: application/x-www-form-urlencoded
Content-Length: 558

ver=4&hmid=5c005fb0346dce22b4654526c313fcd0&hwid=d1a9ad7800d51af9b8019151
7a2e536d00000000&uuid=a7c641e7-3995-4eb5-b0d0-e5817f4d5ede&type=AVG_511&m
anufacturer=unknown&os=5.1&carrier=Android&lic=0&pid=100&pv=5.9.4.1.22541
6&country=us&dc=1&incavi=14253&msr=1&corlib=4647&dex=b8806d65d97e7578f16b
3642e51daa5cf66ee9c8&man=6e416b6d93b8665b76c5f82bd5fc5394f1e5c7c3&sha256=
086bde2ad53d7e5496892a5db930bf7975f9f213deaa9c77e1bdf2854b5327ae&base=com
.regeemir.jeopardissau&sig=Android%2FC1P.V.117D4FF1488A&loc=3&cat=9&drywe
t=1&&Z=191bc8bd9e9e1865c2e4e9eae110c6f4f131ab05
```

Response:

```
HTTP/1.1 200 OK
Cache-Control: private
Content-Type: text/html; charset=utf-8
Server: Microsoft-IIS/8.5
X-Powered-By: ASP.NET
Date: Thu, 06 Apr 2017 13:06:11 GMT
Content-Length: 87

897f2b4bad04eed34a6acadaf553ef3879d5797a

<ddt ver="2">
    <fps>
    </fps>
</ddt>
```

Testing revealed that an intercepting attacker or a piece of malware can avoid being detected by changing the returned HTTP response.

Recommendation

It is recommended implement certificate pinning on all SSL connections.

2.3 Traces of user activity stored in plain-text format

Finding

Testing revealed that the AVG application maintains traces of user activity within the sandbox. For instance, the %sandbox%/databases/google_analytics_v4.db discloses every application that has been installed since the initialisation of the AVG suite, even if the application has been removed from the device.

Figure 2 Traces of user activity in plain-text format

Risk

An analysis of the application sandbox reveals information regarding user activity (e.g. the names of installed applications). The risk is influenced by the following factors.

The risk is increased by the fact that the application maintains the log, even in case the device is rooted.

Recommendation

It is recommended to encrypt all trace of user activity, even within the sandbox. Furthermore, the user should be provided with options to delete all traces of his activity from the sandbox using the application GUI.

3 Timeline

2017.04.20 – Vendor notified
2017.05.29 – Vendor responded
2017.08.03 – Report published