SpyNote continues to attack financial institutions

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Key points

- Starting from the end of 2022, an Android Spyware called **SpyNote** was observed to carry out bank fraud due to its many features.
- SpyNote abuses Accessibility services and other Android permissions in order to:
  - Collects SMS messages and contacts list;
  - Record audio and screen;
  - Keylogging activities;
  - Bypass 2FA;
  - Tracking GPS locations.

- The spyware is distributed through email phishing or smishing campaigns and the fraudulent activities are executed with a combination of remote access trojan (RAT) capabilities and vhishing attack.
- During the months of June and July 2023, we have observed an extensive campaign against multiple European customers of different banks.

Figure 1 – SpyNote infection based on Cleafy telemetries

Introduction

During the last years, Cleafy Threat Intelligence Team has discovered and analyzed multiple Android banking trojans (e.g Sharkbot, Teabot etc), namely malicious applications used to carry out bank frauds through ATO or ATS techniques.

However, in recent months, we have observed an increase in spyware infections, particularly **SpyNote** (Figure 1). Although spyware is usually used to collect user data (and profit from them) or conduct espionage campaigns, SpyNote is currently also used to perform bank fraud. Similar campaigns were also reported by other researchers during the current year.

By analyzing these recent campaigns, we observed that the chain of infection usually starts with a fake SMS message (smishing) where the user is asked to install the “new certified banking app”. A second message follows, redirecting the user to the legitimate app of TeamViewer, an app used to receive technical remote support. The right image of Figure 2 shows how the link redirects the user to the official app of TeamViewer QuickSupport on the Google Play Store.

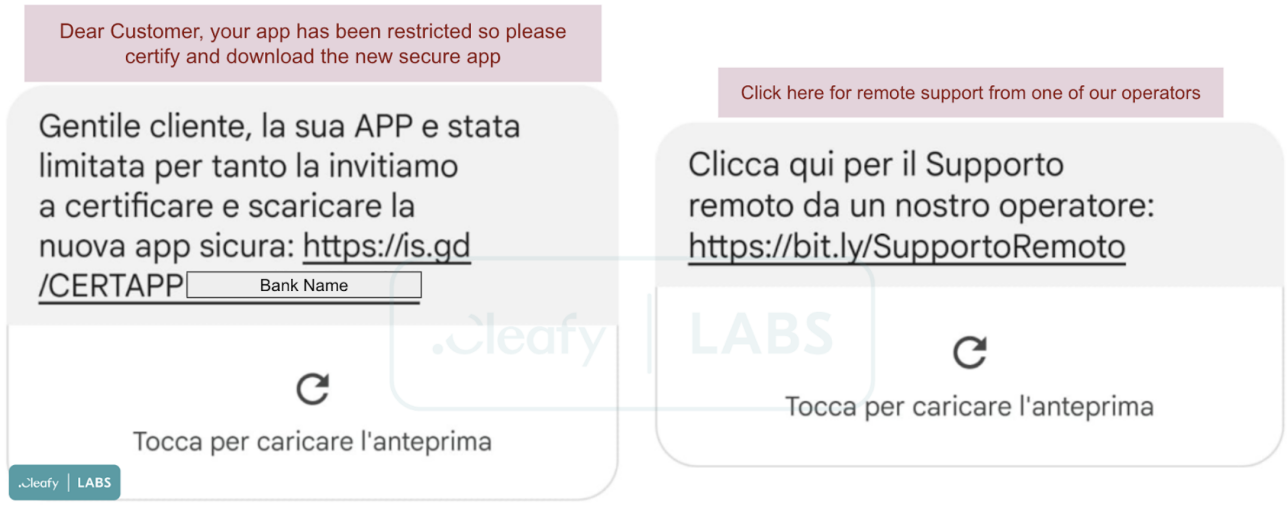


Figure 2 – Examples of sms messages used during the recent SpyNote campaign.
According to our analysis, Teamviewer has been adopted by several TAs to execute fraud operations through social engineering attacks. In particular, the attacker calls the victim, impersonating bank operators, and performs fraudulent transactions directly on the victim’s device.

During our analysis, we have intercepted multiple samples masquerading behind various applications, such as security apps, bank names or Android updates, as shown in Figure 3.

Figure 3 – Examples of icons/names used by SpyNote

Main features

Similar to other Android banking trojans, SpyNote abuses the Accessibility services granted by the victim during the installation of the app. The spyware uses this permission to accept other permissions popups automatically (Figure 4) and perform keylogging activities.

SpyNote has lots of capabilities (e.g., access to the camera or microphone of the infected device, GPS tracking etc.), but in this article we will explain only the main features used to perform banking fraud.

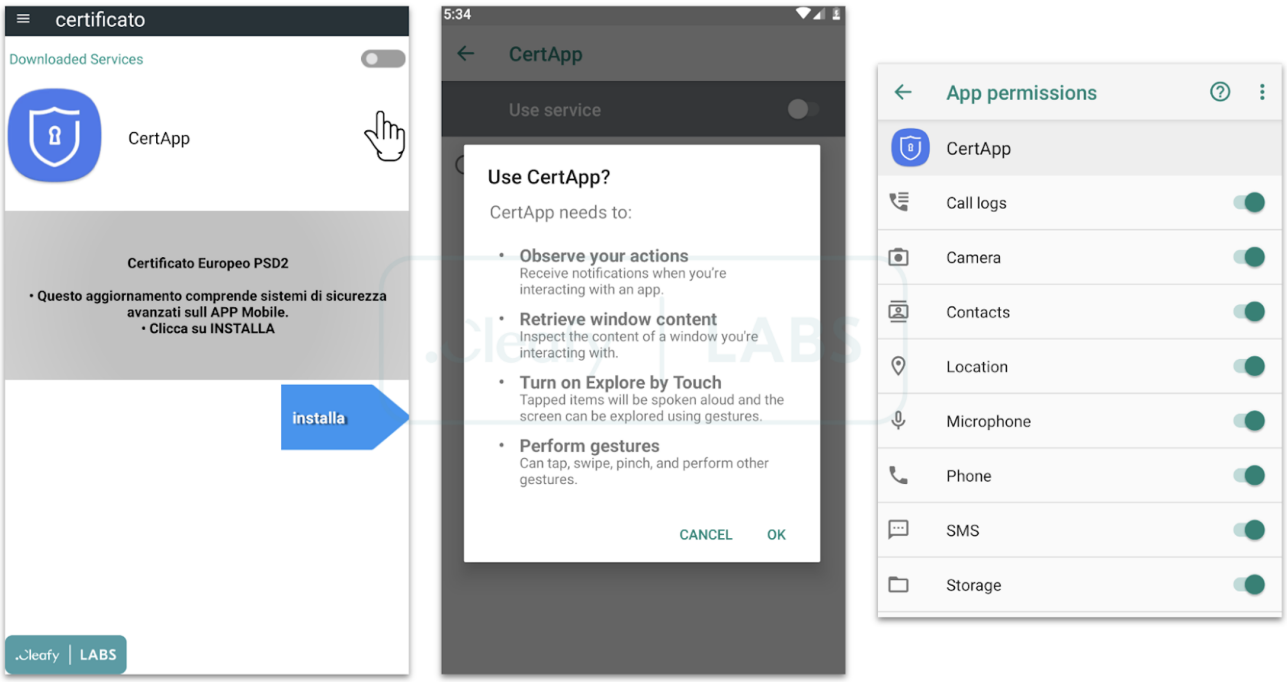


Figure 4 – SpyNote installation phases and permissions automatically accepted

Keylogger

Once the user accepts the Accessibility popup, it allows SpyNote to see every activity done by the user on the compromised device. In particular, the spyware tracks:

- The list of applications installed on the infected device;
- Which application is using the user and, in particular, some specific app properties such as package name, name, label etc.;
- Any text written by the user.

To keep track of the above information, SpyNote saves everything (encoded in Base64) inside a “log-yyyy-mm-dd.txt” file, in a directory created by the spyware, named: “/Config/sys/apps/log”.

```
void H(String s) {
    try {
        String s1 = DateFormat.format("yyyy-MM-dd", new Date()).toString();
        File file0 = Environment.getExternalStorageDirectory();
        File file1 = new File(file0, "/Config/sys/apps/log");
        File file2 = new File(file0, "/Config/sys/apps/log/log-" + s1 + ".txt");
        if(!file1.exists()) {
            file1.mkdirs();
        }
```

Figure 5 - SpyNote keylogger file

The following feature could be used by TAs to identify the bank(s) application(s) used by the user and then to steal the credentials (as shown in Figure 6), credit card information, or other essential data.

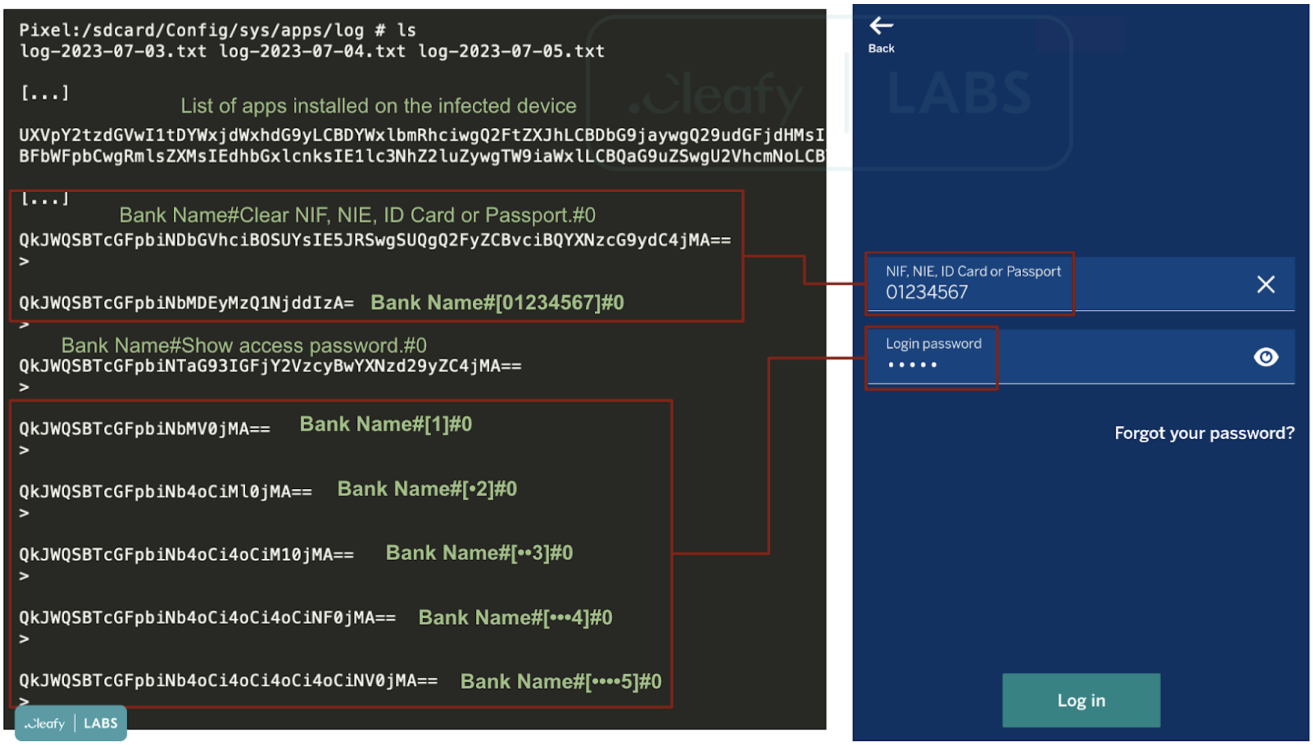


Figure 6 - Example of how SpyNote is able to steal bank credentials

SMS Collection & 2FA Bypass

Multiple apps (e.g., emails, social networks, etc) allow to use two-factor authentication (2FA) codes to add an extra layer of security. This means that, in addition to the password, the user must also enter a code to log into the account; this code can be generated by apps like Google Authenticator or sent via SMS message or email. For banks, as established by the EU's Payment Services Directive 2 (PSD2), it is necessary to use strong customer authentication (SCA) to confirm a money transaction, such as through a pin sent by the bank to the user's device or fingerprint.

SpyNote can gather SMS messages received by the user and transmit them to the C2 server (Figure 7) and it can also gain access to the temporary codes generated by the Google Authenticator app, exploiting the Accessibility services.

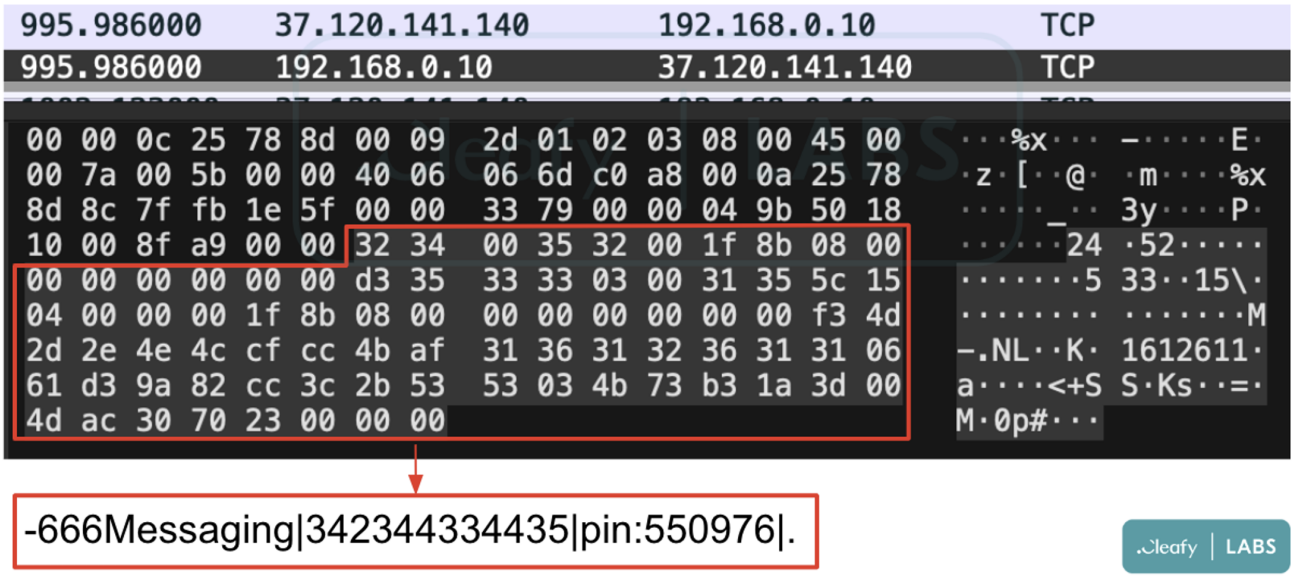


Figure 7 - Example of SMS message stolen by SpyNote

C2 Communications

Once installed, SpyNote contacts the C2 via socket communication using a hardcoded IP address and port within the application code, both encoded in Base64.

By analyzing multiple samples, we observed that a characteristic of SpyNote is the use of different uncommon ports (in the following sample, it uses the 7771 port) to communicate with the C2 server.

The data exchanged between the spyware and the C2 server are packaged with a custom scheme (Figure 8), where the first bytes represent the length of the data, followed by a null byte, and then the compressed data using the GZip algorithm.

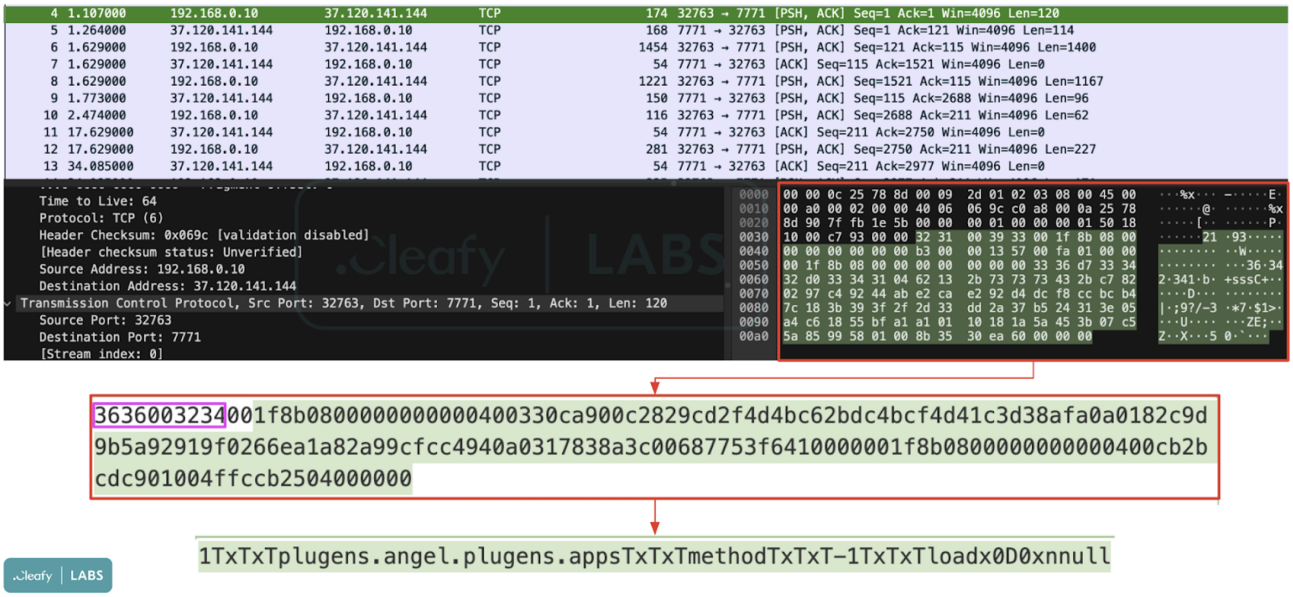


Figure 8 – Example of SpyNote communication with the C2

Screen Recording and Defense Evasion

Another interesting technique adopted by TAs to observe user actions and collect more information is the Media Projection APIs. This Android feature allows capturing the screen content of the device display. As shown in Figure 9, the user can see, in the notification panel, that an application, in that case “CERTIFCATO”, is projecting his screen.

Figure 9 – Screen recording in action

Defense Evasion

SpyNote uses different defense evasion techniques, such as the obfuscation of all class names (Figure 10), the use of junk code to slow down the static analysis of the code, and anti-emulator controls to prevent it from being launched and analyzed within an emulator or sandbox by security analysts. It is also capable of downloading additional files from the C2 server (Figure 11).

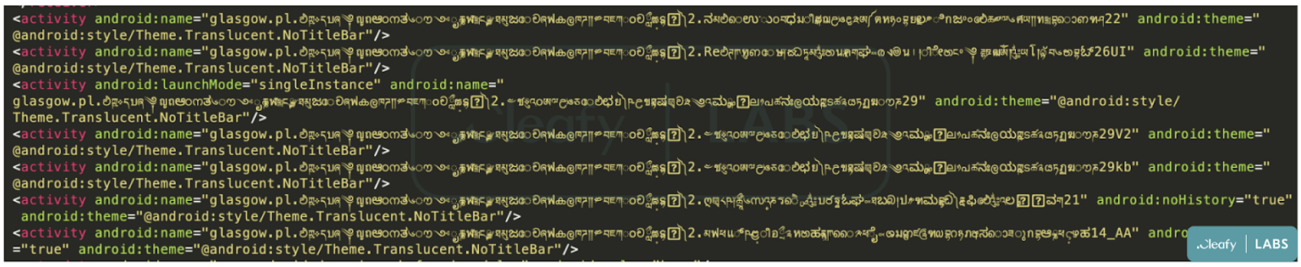
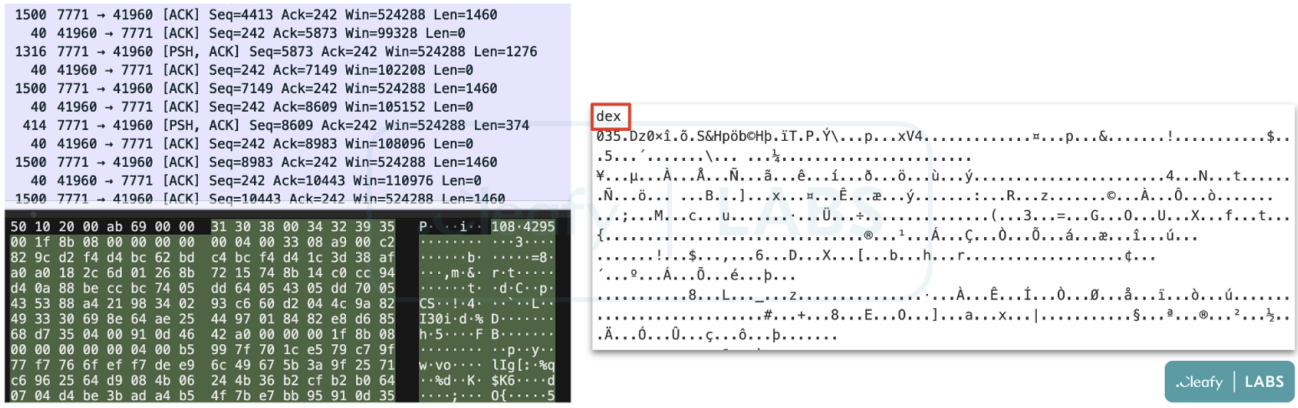


Figure 10 – Example of SpyNote code obfuscation

Furthermore, after the installation, the application icon is not shown on the device display, and it prevents the user from manually removing the application via settings.



Conclusion

Although this is not the first time that spyware has been used to carry out bank fraud (e.g, Revive: from spyware to Android banking trojan), this SpyNote campaign is certainly one of the most aggressive in recent times.

This research aims to show some new details about how TAs are using SpyNote and social engineering techniques to perform Account Takeover attacks (ATO) and on-device fraud (ODF) against customers of several banks in Europe.

Finally, by observing the aggressiveness and extension of this recent SpyNote campaign, we assume that TAs will continue to use this spyware to carry out bank fraud due to the multiple functionalities.

Appendix 1: IOCs

IoC	Description
9e185dd6d7137357b61941525e935124	Md5 SpyNote (CERTIFCATO)
291c24d9b3f4a5793a2600610671eb42	Md5 SpyNote (CertApp)
37.120.141.]144:7771	SpyNote C2 Server
37.120.141.]140:7775	SpyNote C2 Server