# Wroba Android banking trojan targets Japan

& avira.com/en/blog/the-android-banking-trojan-wroba-shifts-attack-from-south-korea-to-target-users-in-japan

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The mobile banking trojan Wroba has been around since 2010. It previously <u>targeted</u> <u>smartphone users</u>, mainly in the U.S, China, South Korea, and the Russian Federation. Cybercriminals have now expanded Wroba's targets, shifting their malware campaign to Japan.

This trojan was first developed as an Android-specific mobile banking trojan, capable of stealing files related to financial transactions. Once it has infected a device, Wroba uses SMS to send messages containing malicious links to the host's stolen contact list.

In this blog, Alexandru Frigioiu, a senior threat researcher at Avira Protection Labs, analyzes a new sample of the Wroba trojan found in the wild. This variant shifts targets from South Korea to Japan. It attempts to compromise banking app users in Japan by displaying a counterfeit version of the Chrome browser with the goal of delivering the payload.

# Analysis

We came across a malware sample in the wild. The sample caught our attention because it displayed attributes such as a randomized file name, package name, and activity name. These suggest a packed application and Android malware.

- Filename: "vAdOyCy.apk"
- Package name: "buhb.uabvv.szxkr"
- Main activity name: "zuseoje.QiActivity"

We quickly realized the app is suspicious enough to take a closer look at the app permissions.

```
package = "bubb-makery anake"
platformfuildversionCode = "23"
platformBuildVersionName = "6.0-2438415" >
    uses - permission android: name = "android.permission.SISTEM ALERT MINDOW" / >
    uses - permission android: name = "android.permission.SISTEM OVERLAT NINDOM" / >
    uses - permission android: name - "android.permission.CHANGE NETWORK STATE" / >
    uses - permission android: same = "android.permission.GET ACCOMPE" / >
    uses - permission android: name = "android.permission.CALL SHOWE" / >
    uses - permission android: name = "android.permission.HODIFY_AUDIO_SETTINGS" / >
    uses - permission android: name = "android.permission.DIAADLE REPORTO" / >
    uses - permission android: name = "android.permission.NECEIVE_BOOT_COMPLETED" / >
    uses - permission android: name = "kihounky.emejuqu.jita" / >
    uses - permission android: name = "ndrms.kiflpur.gfabby" / >
    uses - permission android: name = "android.permission.MARE LOCK" / >
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    100
    uses - permission android: name = "android.permission.RECEIVE NMA" / >
    uses - permission android: name = "android.permission.READ_SMS" / >
   uses - permission android: same - "android.permission.MRITE SHA" / >
    uses - permission android: name = "android.permission.SEND_SMS" / >
    uses - permission android: mame = "android.permission.Disasts permission / >
   uses - permission android: name = "android.permission.CHAMDE MIP1 STATE" / >
   application android: icon = "#drawable/ic_launcher"
android: label = "Chrome"
android: name = "gammain-Modepilication" >
    activity android: name = "gasaoja_QiActivity"
```

#### Figure 1: Manifest file

Looking at the "*Chrome*" application label, we identify that the application was trying to pose as a Chrome browser. However, the discrepancy with the package name made it clear that it was not Chrome and most likely malware.

Additionally, the app was signed with a test certificate from the Android Open Source Project used in the past by several other malware families. Although this certificate is used by some legitimate developers to sign their clean Android apps, this is clearly not the case here.

#### Installation screen

During our analysis, we saw that the installation screen was trying to pose as a Chrome browser. It was also using the legitimate Chrome icon to make it look familiar.



Figure 2: Chrome application label and icon displayed on the installation screen

After the permissions were granted, the application was launched, the icon disappeared from the launcher.

## **APK file structure**

After we analyzed the APK file, we saw that apart from typical files found in an android app, there was a random file in the "*assets*" folder:



Figure 3: APK file structure showing the file with a random name in assets

This is typically used by malware to hide a second DEX or APK dropped at installation. Then loaded at runtime when the application is launched.

Looking at the contents of the file, we found that it was encrypted. We decompiled the code to find out what the application was doing with this file.

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49 A5 64 CA	AD 4F 94 45	00 AB A7 B5	98 86 36 1B	I¥1 É-0″E ∝§µ *61
28 A8 BC 38	20 56 C0 EB	47 A8 C7 27	B3 CE 12 7B	X8-VÀěG"Ç'''Î!{
47 A2 05 3A	84 2F 96 5C	26 9B C0 47	D9 6C D4 22	6¢0:0/-\&>A6010"
69 3A 5A F1	27 A6 BF 18	20 C6 0C EB	87 38 86 1E	i:Zñ'   20 - &Be‡;†
78 3A DE D8	6A 86 2F SE	84 F4 1A 0F	48 84 2F 51	{:ÞØjl/^"ôllHl/Q
46 17 1C 07	81 21 F0 40	62 BF 8D 46	44 E3 53 22	FI I Ið@bl FDāS"
15 5F D4 6A	C6 56 B1 56	16 7C 47 C7	A3 8E F4 42	1_0jÆV±VI GCEI 6B
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45 1E 20 51	7E 23 00 DE	85 AE D7 E8	D8 56 A7 87	E Q~# P  *xà@V§

Figure 4: Encrypted payload

#### Hash of the file:

ccdc5c71c18709cea46e8dce04f985e19c054abfcb19a7ee6d875a09e3aa39b1

#### Main DEX file

The main DEX file is tiny (only 9kb) and we conclude its only function was to decrypt and load the randomly named file from assets.

After decompiling the code, we searched for the file name and found the following method:

Figure 5: Decryption routine

We saw that the file from assets is being read and processed to look like a custom decryption routine. After this, a file named "dex" is saved to *"/data/data/buhb.uabvv.szxkr/files/dex*":

```
private File b() {
    File v1 = new File(this.getFilesOir().getAbsoluteFath() + File.separator + "dex");
    if(v1.exists()) {
        v1.delete();
    }
    return v1;
}
```

Figure 6: Resulting file name

We also saw that this file built the string "*dalvik.system.DexClassLoader*" out of separate strings (to avoid detection), which is then used to execute the payload:

```
private static Class<?> d() {
    StringBuffer stringBuffer = new StringBuffer();
    stringBuffer.append("dalvik".substring(e));
    stringBuffer.append(".");
    stringBuffer.append("SYS".toLowerCase());
    stringBuffer.append("Tem.".toLowerCase());
    stringBuffer.append(" Dex".substring(2));
    stringBuffer.append(ClassLoader.class.getSimpleName());
    return Class.forName((String)stringBuffer.toString());
}
```

Figure 7: building "dalvik.system.DexClassLoader"

### **Decryption routine**

The function first opens the file from assets, skips the first 4 bytes, and reads the 5th byte used as an XOR key. Then reads the rest of the file in 1024 byte blocks, XOR-es it with the 5<sup>th</sup> byte, and passes the resulting data to the "this.a" method.



Figure 8: Analysis of decryption routine

The next function is decompressing the data using the deflate method:



Figure 9: The deflate method in function

The data is then base64 decoded:

```
private byts() sityte/reportsotautitrees bytesreayButpatitrees) {
    return street.secosin()Byte()]ButeskreayButpatitrees.toButeskreayE1. [Set]00;
}
```

Figure 10: Base 64 decode mechanism

and the result is written to the file:

```
1 private static void a(String arg2, byte[] arg3) {
2 FileOutputStream v0 = new FileOutputStream(new File(arg2));
3 v0.write(arg3);
4 v0.close();
5 }
```

Figure 11: New file is created

Now that we know where the decrypted file is stored, we can retrieve it from the device to analyze it:

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Figure 12: Decrypted payload (upper left), named "dex"

## Payload analysis

The decrypted dex file

(*0cd2b17aa21cd8de63842da21e3464df7bb2bd4a278fffbbfea6b294c3ca9e6d*) turned out to be a malware, as expected.

It was found to be a banking trojan from the Wroba family. This family has been in the wild since 2010, and its name is a concatenation of two terms, "we" and "rob".

#### Malware functionality:

- tricks the user that the internet connection will be faster if the (suspicious) permission is granted
- spreads itself directly from the victim's smartphone by sending phishing messages to the phone's contact list
- grabs and monitors all incoming and outgoing SMS messages to bypass two-factor authentication

 monitors Android package names that are related to banking apps and overlay over them to capture credentials: "com.wooribank.pib.smart", "com.kbstar.kbbank", "com.ibk.neobanking", "com.sc.danb.scbankapp", "com.shinhan.sbanking", "com.hanabank.ebk.channel.android.hananbank", "nh.smart", "com.epost.psf.sdsi", "com.kftc.kjbsmb", "com.smg.spbs".



Figure 13: *HTML code of overlay* 

```
private final void e() (
    d.e.a.b v2 = (d.e.a.b)new Loader.r(this);
    this.g.a("sendims", v2);
    d.e.a.b v2_1 = (d.e.a.b)new Loader.ac(this):
    this.g.a("setWifi", v2 1);
    d.e.a.b v2 2 = (d.e.a.b)new Loader.ag(this);
    this.g.a("gcont", v2_2);
    d.e.a.b v2 3 = (d.e.a.b)new Loader.ah(this);
    this.g.a("lock", v2 3);
    d.e.a.b v2.4 = (d.e.a.b)new Loader.ai(this);
    this.g.a("bc", v2_4);
    d.e.a.b v2_5 = (d.e.a.b)new Loader.aj(this);
    this.g.a("setForward", v2_5);
    d.e.a.b v2 6 = (d.e.a.b)new Loader.ak(this);
    this.g.s("getForward", v2_6);
    d.e.a.b v2_7 = (d.e.a.b)new loader.al(this);
    this.g.a("hasPkg", v2_7);
    d.e.a.b v2_8 = (d.e.a.b)new Loader.am(this);
    this.g.a("setRingerMode", v2_8);
    d.e.a.b v2_9 = (d.e.a.b)new Loader.s(this);
    this.g.a("setRecEnable", v2_9);
    d.e.a.b v2_10 = (d.e.a.b)new Loader.t(this);
    this.g.a("regState", v2 10);
    d.e.a.b v2_11 = (d.e.a.b)new Loader.u(this);
    this.g.s("showHome", v2_11);
    this.g.a("getnpki", ((d.e.a.b)Loader.v.o));
    this.g.a("http", ((d.e.a.b)Loader.m.e));
    d.e.a.b v2_12 = (d.e.a.b)new Loader.x(this);
    this.g.a("onRecordAction", v2_12);
    d.e.a.b v2 13 = (d.e.a.b)new Loader.v(this):
    this.g.a("call", v2_13);
    d.e.a.b v2 14 = (d.e.a.b)new Loader.z(this);
    this.g.a("get_apps", v2_14);
    d.e.a.b v2_15 = (d.e.a.b)new Loader.aa(this);
    this.g.a("show fs float window", v2 15);
    d.e.a.b v2_16 = (d.e.a.b)new Loader.ab(this);
```

Figure 14: Class showing some of the malware functionalities

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Figure 15: Preparing overlay HTML content



Figure 16: Targeting Japanese banking apps

### Conclusion

Avira detects the original APK, dex file, decrypted payload, and other APKs from the Wroba family as Android/Wroba.

We strongly recommend Android phone users use an anti-virus package. These are available from <u>Avira</u> and other quality digital security providers.

Consumers should always keep the "*Unknown Sources*" option disabled in their Android device's settings to avoid installing apps from unknown sources. Android applications should only be installed from official stores such as Google Play, and even then care should be taken!

Everyone, on any device, Android, Windows, macOS and iOS should avoid clicking on unknown links received through SMS messages, emails, ads, and social media posts from untrusted sources.

Finally, mobile phone providers and network operators need to take steps to protect their customers and consider integrating anti-malware technologies such as Avira's own <u>Anti-malware SDK for Android</u>, and explore <u>threat intelligence solutions</u> that deliver mobile application reputation information.

### Mitre attack matrix

Wroba							Android, iOS								
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#### APKs containing encrypted dex files:

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438cd827722e897248695e3c4c8b73acfdc7a6f58133bc13d7a90582ef30a76a ed57cd7911b42a1d49b45b92776941f2be1aa2aab38f0a0c148acc2dcf9ed6fd 9f1a27161cd02e7a01d6677da4b1c6386031e33728ab5a6d2194a8006d6c047f e169f1866e3f5acf38d384b5b1448e12bc94d6810b442e5cfd3c89686fac8064 7cc2d90ae871d2d5ca655c277aea99aca7fb401078dce6f8e94bf03065b0bf2d 0bc9de71f90d958acb36e5649ace3cfd747a53da26e71fec378e0c851a0b1d83 f8a74e5ead7b79c2c60cda43200379bfdea2d56bb9a1a44f7fedf615b60ac0f2 87921e3a6306a1fd6258be9c38a24d80b93e99ce590f1235d4e321b6e752c7cb 1ecd07bc8fd3f00825621297b92df88b65b1c5ec02a7f57b2758377bb46ac631 6e24e2663079fb8cda87bfa0dfa4254871b2bb10185caf402b277b3cfe91f926 1de1be19fb1a49f150a899fbd72aca861d12930e5d3f608574f84ba20dd53ddc bb27ab16b50450004b1eaf1ea1cd93fc8fa16fbc670114e59a4839b254fa7580 e5ac90c1635208b6272af261d63c6d4a1ceecd5d2385564ed01b631439ceb364 3f0116ac154c75ca395ca9a4aa83b5452d4c106742188fac0f4038f9d758cb7d 068e06332271edb928696861a35b0a83b4fb34a9cac2b3ba7484c9107bacb991 77c2b592e454e6ed55605a847c43c80dd2ab662e868b41e3b8a02311ccbbbee4 f17e0353cf75e8c1ee552b811a4b60763210272b3d740f93278124499c8e63f3 79ffef47c6c306c3a3b3fbb99150a2e0006f19077adaa554b613f56df72cefdf 9a7d9c4dabface125e2d2a34e2553e0cfe0db53abd5b1d7e0671e4a197975339 254261568e55775c1a17a8342ca1f9de672cf02a80bf868d92031bd8d8dd7a90 d2c5f5dcbbc1f1236165c89c3caa46078ced0c456a950d12efb2d43095ee7504 457b7e19fd979f7cfb3e3fe07bb70efb0e6c3691c96c08bef0192786c5674237 b610207aa43a24ce7775e34711c448ebe3a3256fd14fe9569099f09d6f9be2e1 b2dd8e20f56defc742506009aca5b9541569d09f01fab31a800d40402f11fbd2 275748b01394bedb904e9b0f71577616c9d2bad921e47f926038cf8bf3121557

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