Entering the Android Rabbit Hole with Frida:

Deep-Dive into Dynamic Analysis

Women in Cybersecurity
WiCyS

About me

<whoami>

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💻 ***Offensive Security Analyst | Cybersecurity Researcher***

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🎓 **B.Sc. in Computer Engineering – Federal University of Itajubá (Unifei), Brazil – 2024**

🛡️ **Fields of interest: cryptography algorithms, web and android security**

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Introduction

Understanding the Android Landscape

The mind of the security analyst

💻 ***Android Security Framework***

- Key security features: App sandboxing, permissions model, and security updates

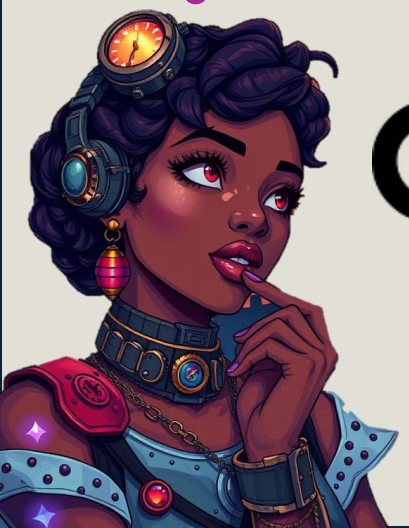
🐞 ***Common Vulnerabilities in Android Apps***

- Exploits like Intent Redirection, Insecure Data Storage, Improper Implementation of Cryptography, and Insecure Communication

🔬 ***Static and Dynamic Analysis Techniques***

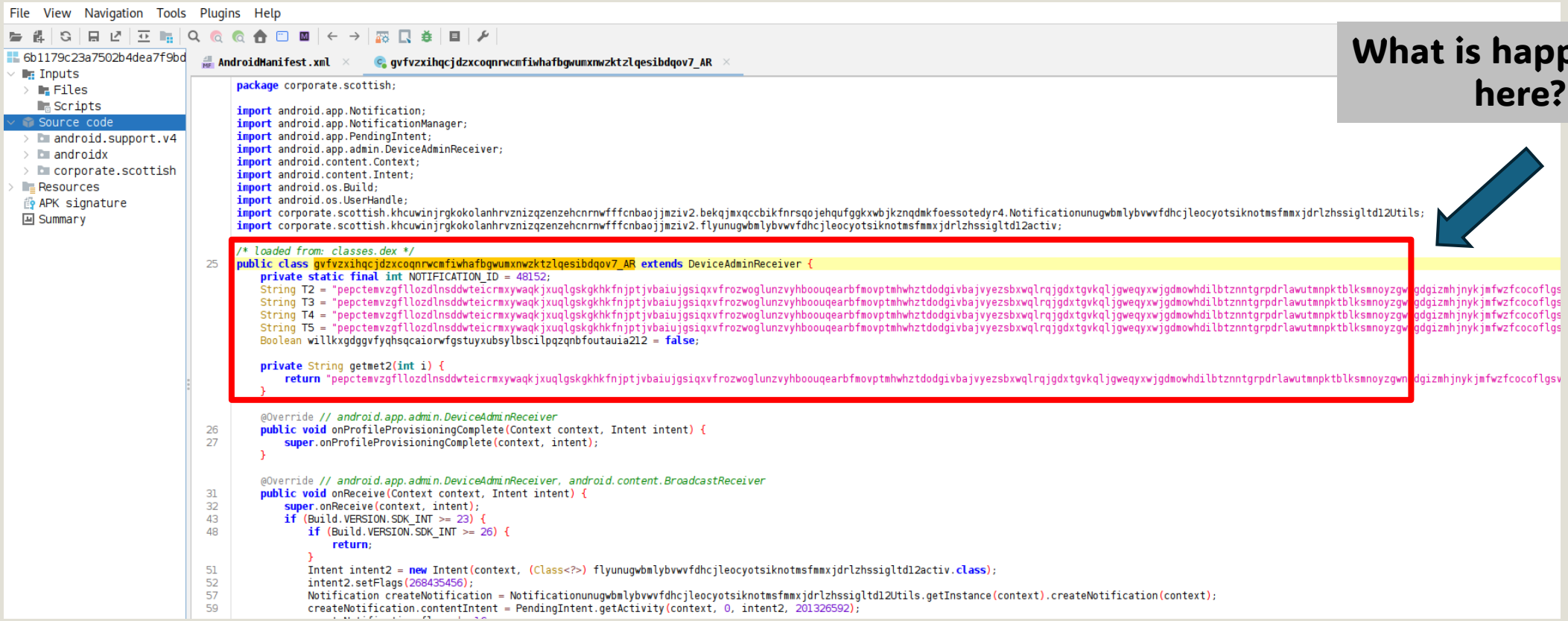
- Tools and methods for analyzing APKs: reverse engineering, code inspection, and runtime behavior monitoring

Why is dynamic analysis essential?



Let’s take a look at an example!

The reference sample (SHA-256):
6b1179c23a7502b4dea7f9bde7dde3d4b5b97c64f634ff3471a1d3d27390f3b1



Source: https://bazaar.abuse.ch/

The path to the unknown

Where the mage finds a powerful source of power

Introducing Frida

- **Frida is a powerful open-source tool which was built focusing on dynamic analysis of applications**
- **It can be used for Android, iOS, Windows, Linux, macOS and a couple of other types of applications**

FRIDA

OVERVIEW DOCS NEWS CODE CONTACT

Dynamic instrumentation toolkit for developers, reverse-engineers, and security researchers.

New apps with encrypted network protocols

Black-box testing

Discover features of the app by interacting with it

Obfuscated code

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Playing hide and seek

- Making code hard to read -> still functional
- Protects network domains, prevents reverse engineering, and enhances security

How exactly is this possible?

- Renaming variables and functions
- Control flow alteration
- String encryption
- Dead code insertion

Original code

```c
int i;

void write_char(char ch)
{
    printf("%c", ch);
}

int main()
{
    for (i = 0; i < 15; i++) {
        write_char("hello, world!\n"[i]);
    }
    return 0;
}
```

Code after obfuscation techniques

```c
int i;main(){for(i=0;i["]<i;++i){--i;}"];
read('-'-'-',i+++"hell\
o,world!\n",'/'/'/'));}read(j,i,p){
write(j/p+p,i---j,i/i);}
```

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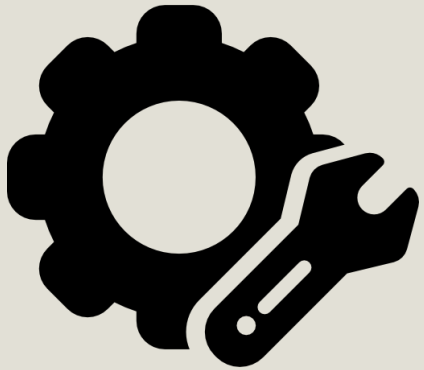
Setting up

- Download **Frida** for your OS: *https://frida.re/docs/installation/*
- You will also need to download **frida-server** for your device: *https://github.com/frida/frida/releases*

- Example on Linux with a **rooted** device:

```
pip install frida-tools
unzip <path>/frida-server.zip
adb root
adb push <path>/frida-server.zip    /data/local/tmp/frida-server
adb shell chmod +x /data/local/tmp/frida-server
adb shell /data/local/tmp/frida-server
```



Done! *Start hacking*!

Main features

frida-ps

List of processes of the device

```
└─$ frida-ps -Uai
 PID  Name           Identifier
────  ─────────────  ──────────────────────────────────────
3212  APK DONE       corporate.scottish.km
4108  Calendar       com.google.android.calendar
4244  Clock          com.google.android.deskclock
4273  Gmail          com.google.android.gm
2600  Google         com.google.android.googlequicksearchbox
2600  Google         com.google.android.googlequicksearchbox
3823  Maps           com.google.android.apps.maps
2421  Messages       com.google.android.apps.messaging
2213  Phone          com.google.android.dialer
3944  Photos         com.google.android.apps.photos
1867  SIM Toolkit    com.android.stk
5194  Settings       com.android.settings
4742  YouTube        com.google.android.youtube
5001  YouTube Music  com.google.android.apps.youtube.music
   -  Camera         com.android.camera2
   -  Chrome         com.android.chrome
   -  Contacts       com.android.contacts
   -  Drive          com.google.android.apps.docs
   -  Files          com.google.android.documentsui
   -  WebView Shell  org.chromium.webview_shell
```

Main features

frida-trace

Trace function calls

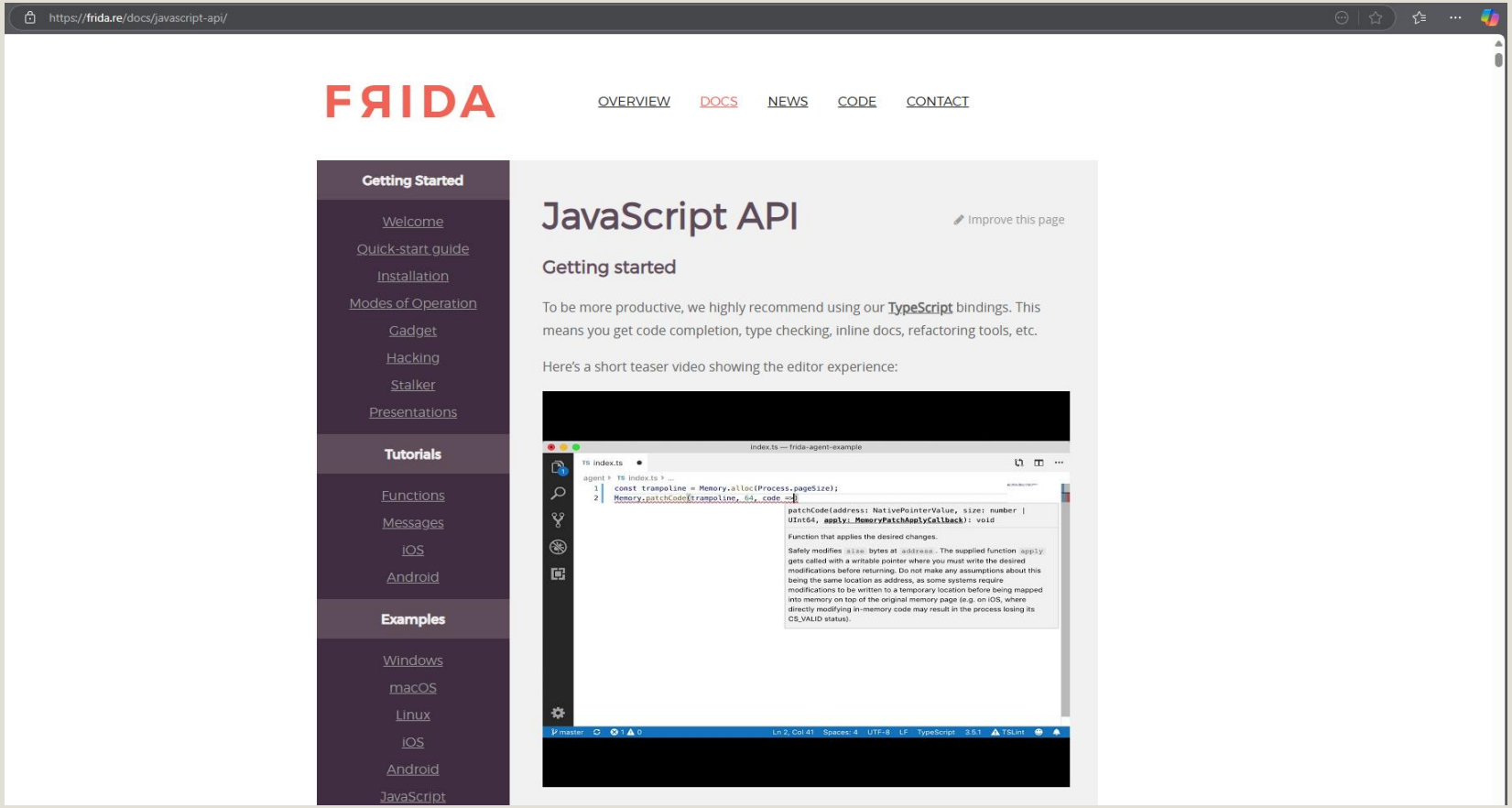
```
└─$ frida-trace -D emulator-5554 -f "corporate.scottish.km" -i "*decrypt*"
Instrumenting ...
_ZN7android9CryptoHal7decryptEPKhS2_NS_12CryptoPlugin4ModeERKNS3_7PatternERK
_handlers__/libmediadrm.so/_ZN7android9CryptoHal7decryptEPK_d1607552.js"
_ZN7android16DrmMetricsLogger7decryptERKNS_6VectorIhEES4_S4_S4_RS2_: Auto-ge
_ZN7android6DrmHal7decryptERKNS_6VectorIhEES4_S4_S4_RS2_: Auto-generated har
_ZN7android10DrmHalAidl7decryptERKNS_6VectorIhEES4_S4_S4_RS2_: Auto-generate
_ZN7android13CryptoHalAidl7decryptEPKhS2_NS_12CryptoPlugin4ModeERKNS3_7Patte
bin/__handlers__/libmediadrm.so/_ZN7android13CryptoHalAidl7decry_71789995.js
_ZN7android10DrmHalHidl7decryptERKNS_6VectorIhEES4_S4_S4_RS2_: Auto-generate
_ZN7android13CryptoHalHidl7decryptEPKhS2_NS_12CryptoPlugin4ModeERKNS3_7Patte
bin/__handlers__/libmediadrm.so/_ZN7android13CryptoHalHidl7decry_2a6c01e5.js
_ZN4aidl7android8hardware3drm11BpDrmPlugin7decryptERKNSt3__16vectorIhNS4_9al
3drm11B_a3e523e4.js"
_ZN4aidl7android8hardware3drm17IDrmPluginDefault7decryptERKNSt3__16vectorIhN
rdware3drm17I_7b8bade0.js"
_ZN4aidl7android8hardware3drm20ICryptoPluginDefault7decryptERKNS2_11DecryptA
_ZN4aidl7android8hardware3drm14BpCryptoPlugin7decryptERKNS2_11DecryptArgsEPi
_ZN7android8hardware3drm4V1_113BpHwDrmPlugin7decryptERKNS0_8hidl_vecIhEES7_S
```

More examples HERE: **https://codeshare.frida.re/**

Main features

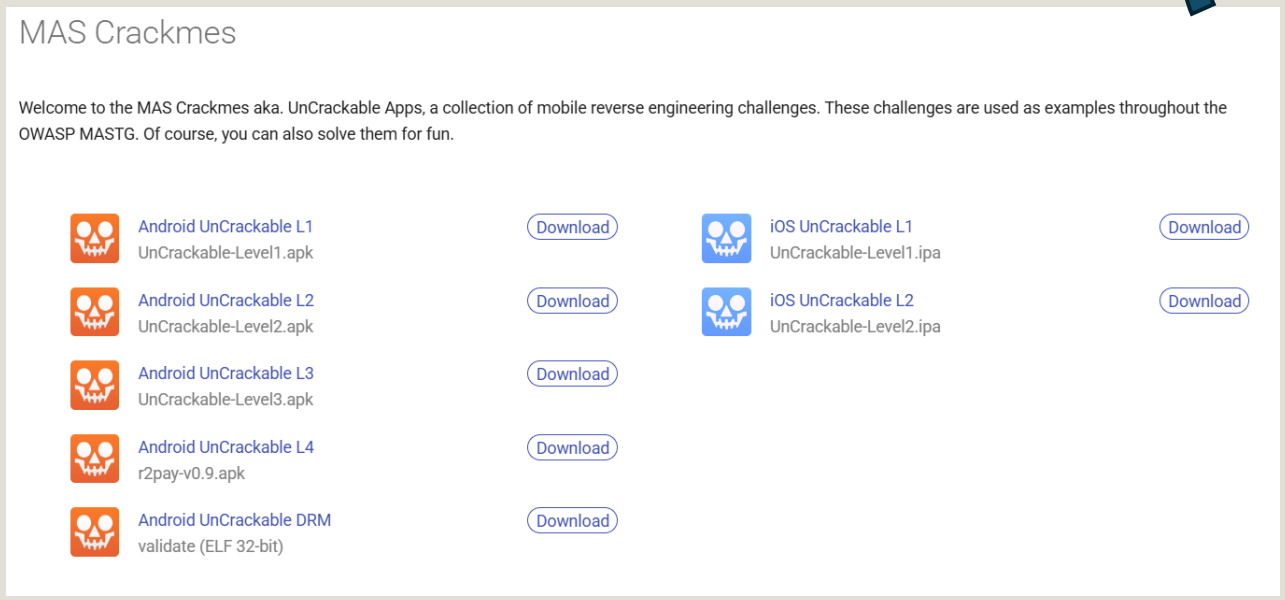
Javascript API

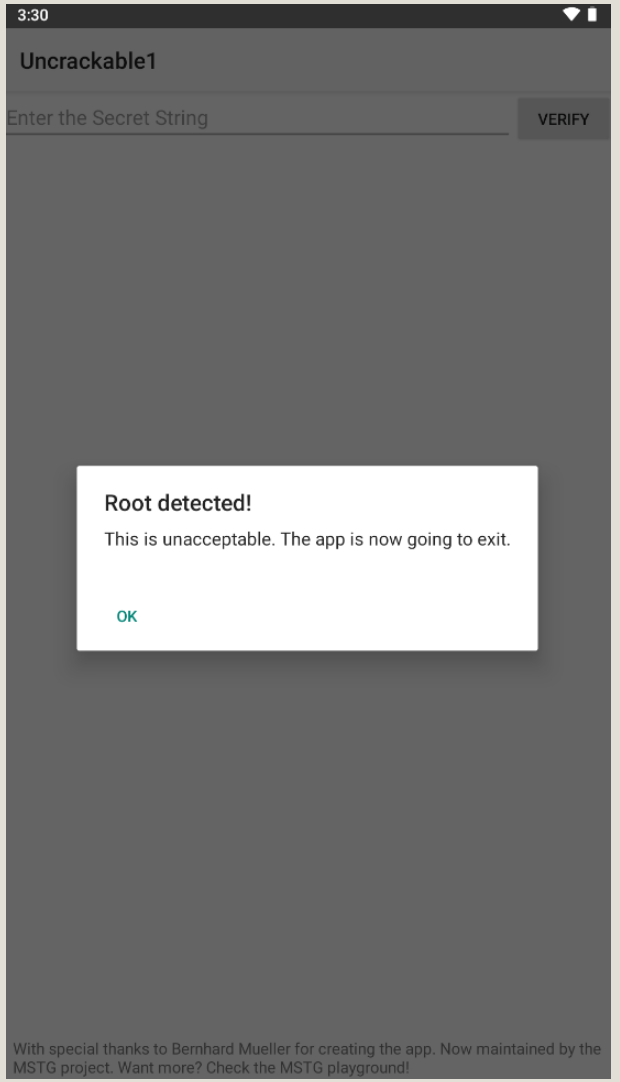
The important Javascript API's to do some hacking, interact with some methods and incept what application classes do: https://frida.re/docs/javascript-api



A simple use scenario

- **OWASP – OWASP Mobile Application Security**

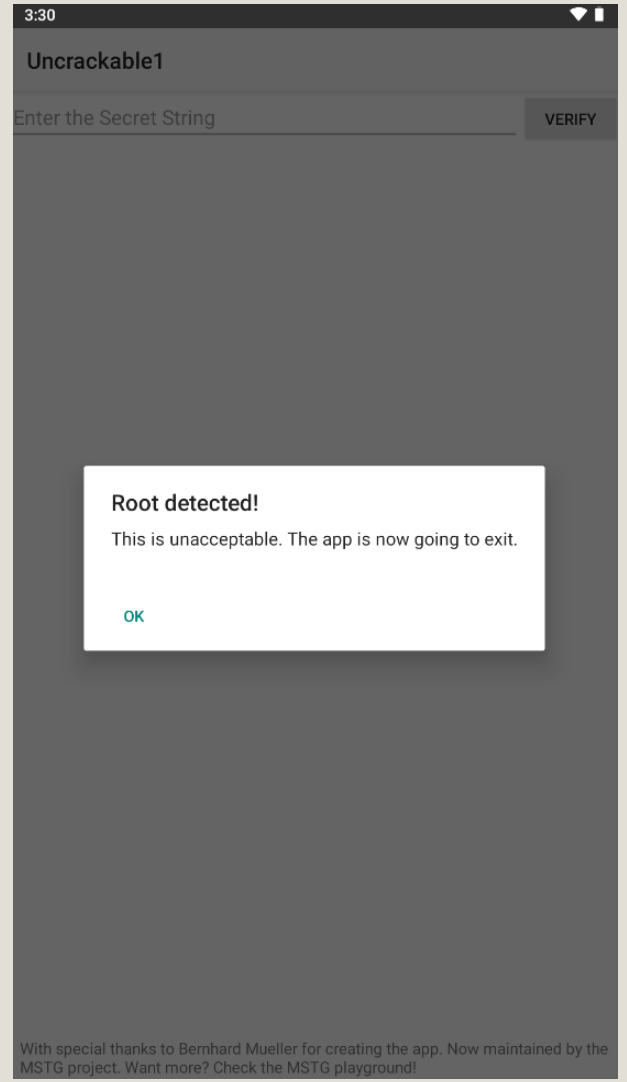




A simple use scenario

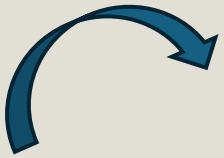
- **OWASP – OWASP Mobile Application Security**

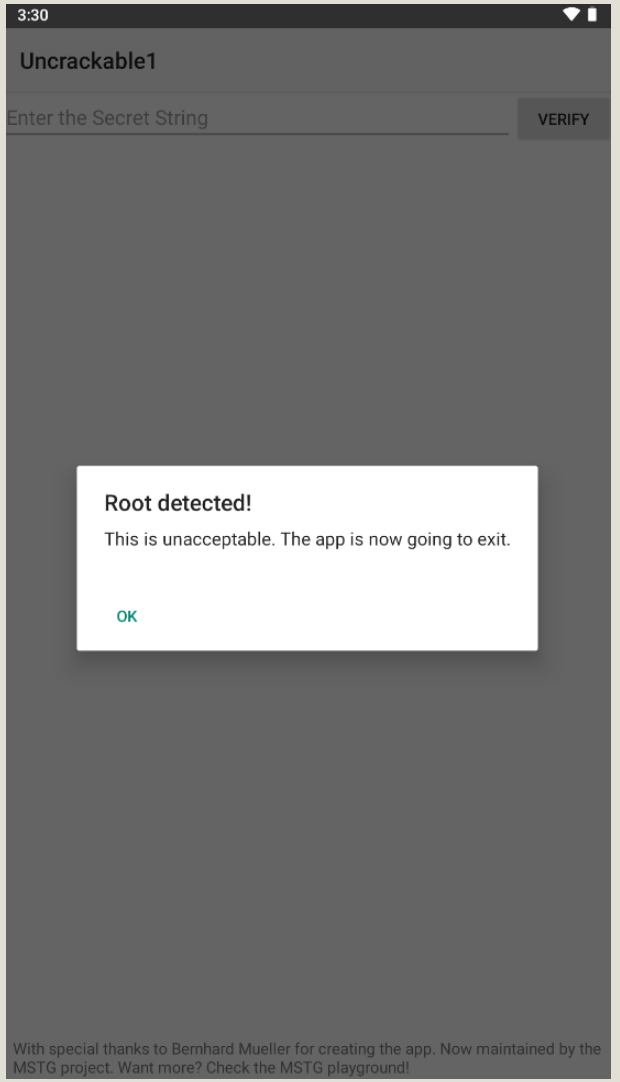
Can we bypass
a situation like this?



A simple use scenario

- **OWASP – OWASP Mobile Application Security**



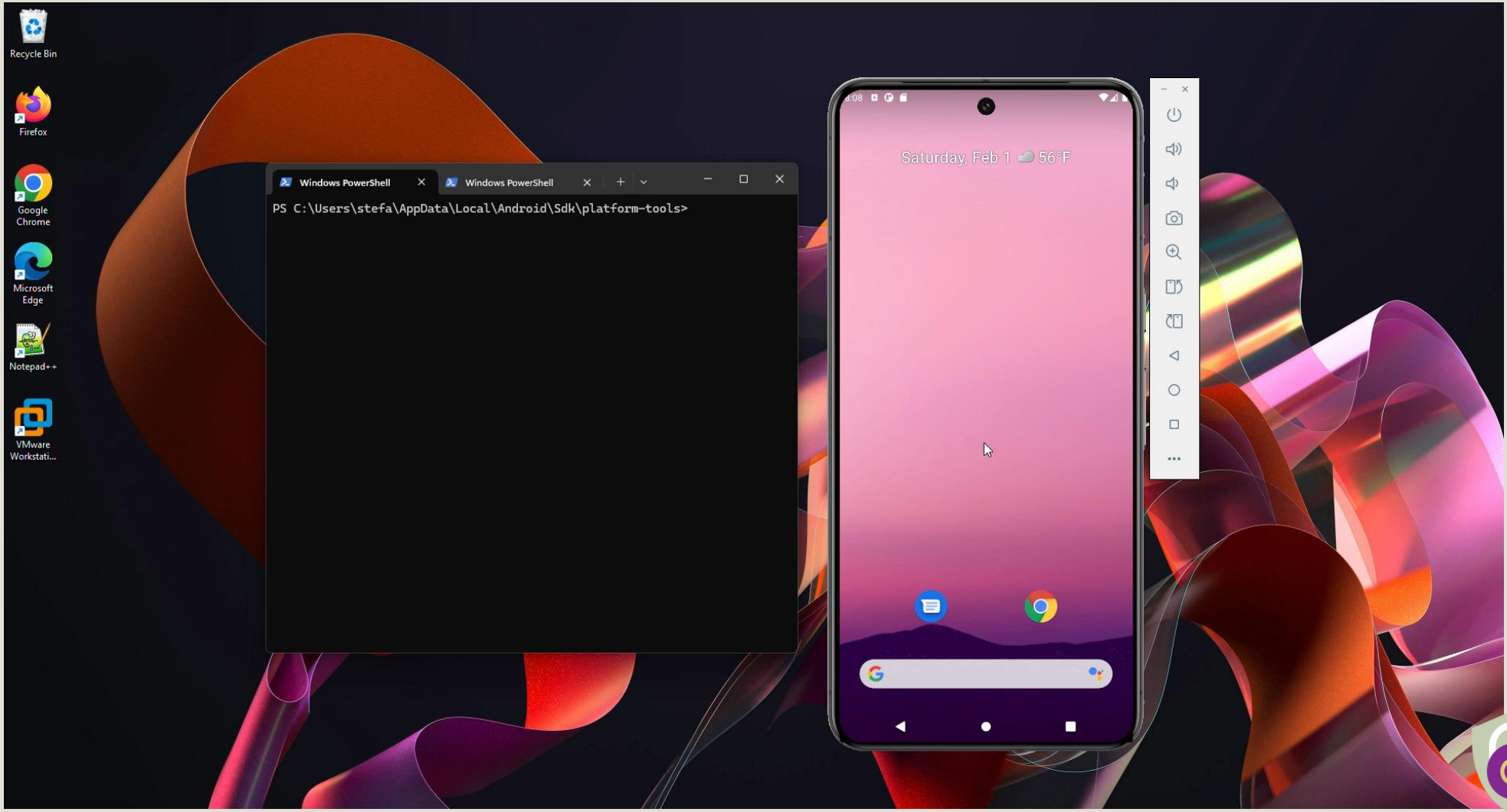


Can we bypass
a situation like this?

YES! We can 😁

A simple use scenario

- OWASP – OWASP Mobile Application Security: ***Bypassing the first obstacle***



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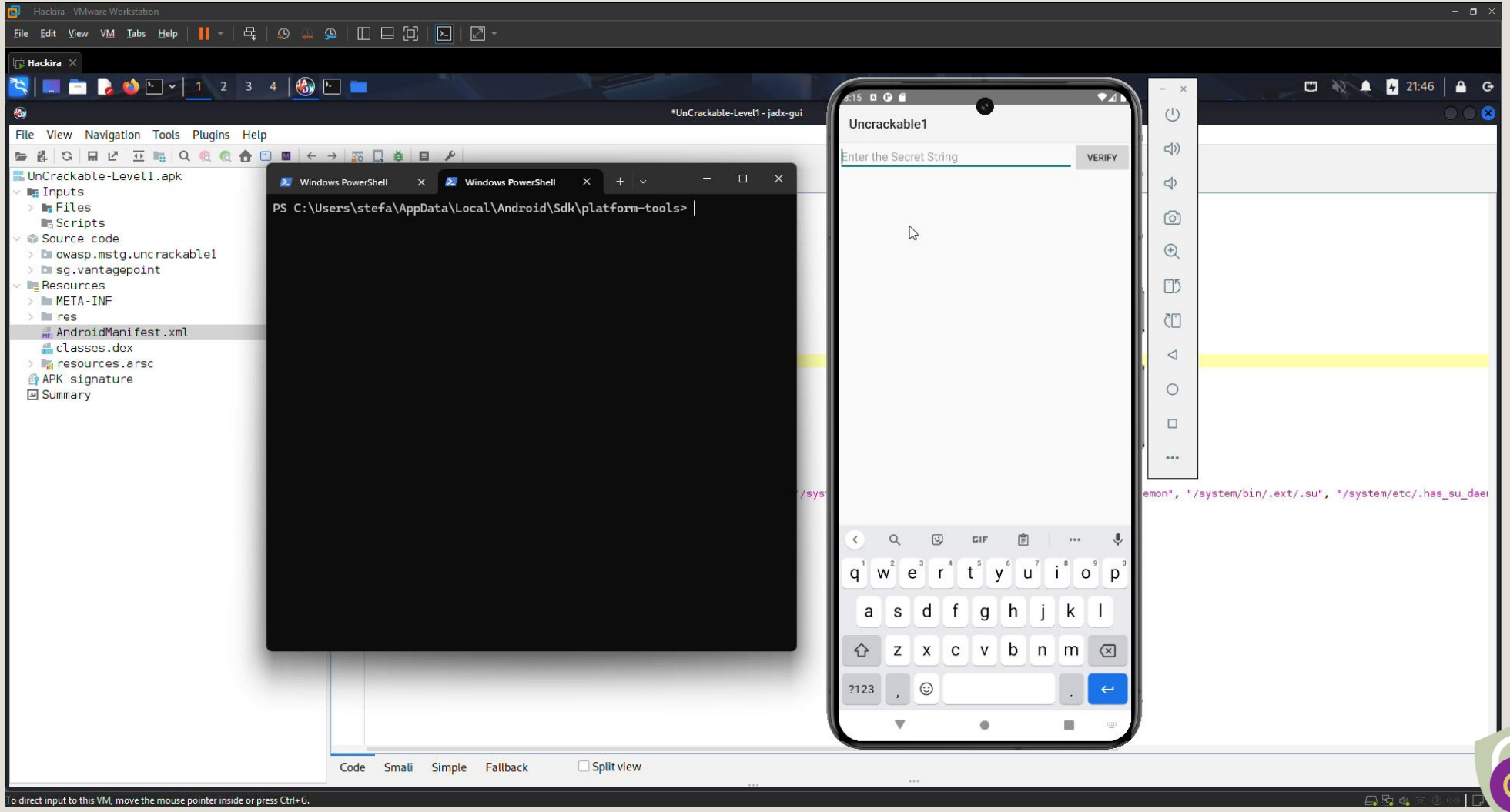
A simple use scenario

- **OWASP – OWASP Mobile Application Security: *Bypassing the second obstacle***



Safe and sound?

When developing or researching...

- ***Build your arsenal.***
  Static and dynamic analysis tools (decompilers, automated scripts, simulated environments)
- ***Have a strategy plan.***
  Order of analysis (based on number and types of components, time and complexity)
- ***Dive into the analysis.***
  Check how the used protocols work, features flows of the application, cryptography characteristics
- ***Take notes.***
  Every discover of a flow or feature of a path, document the process
- ***Take another path.***
  Try to search for a new perspective in the analysis to cover more possibilities

Semgrep

drozer

Level up

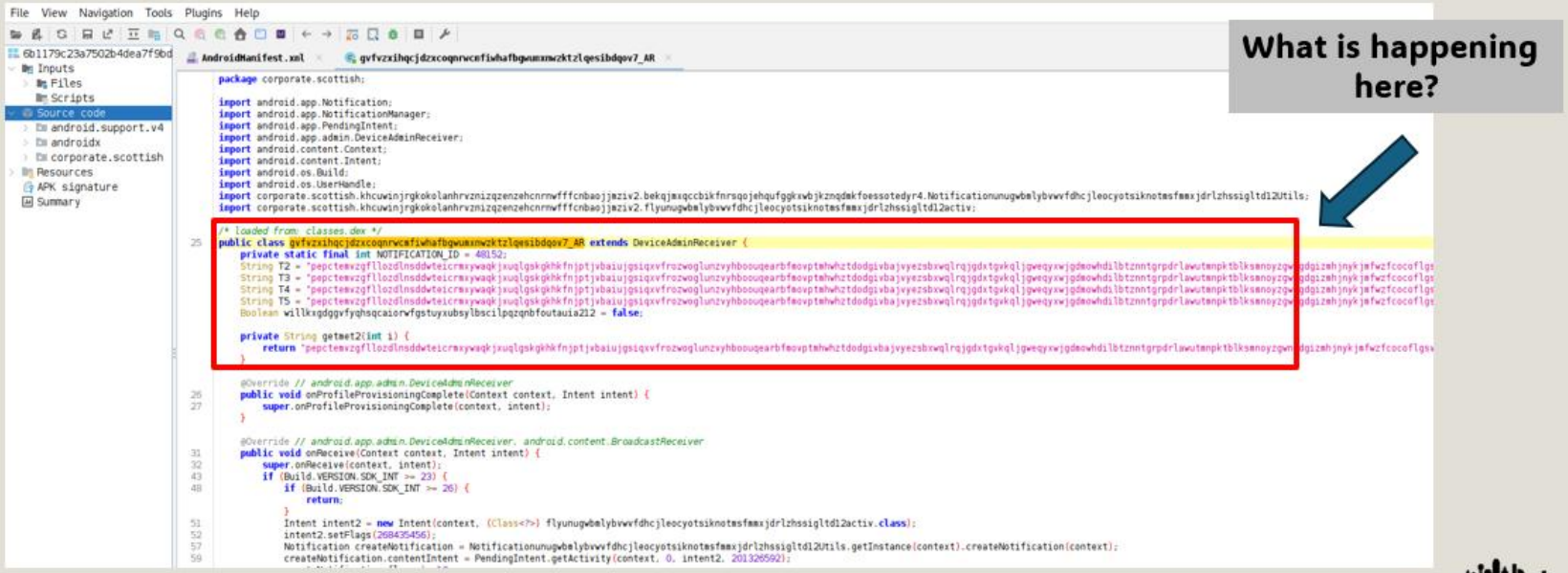
An obstacle lies in the mage's path to the golden treasure

Let's analyze something interesting...

Previously on this presentation...

Let's take a look at an example!

The reference sample (SHA-256):

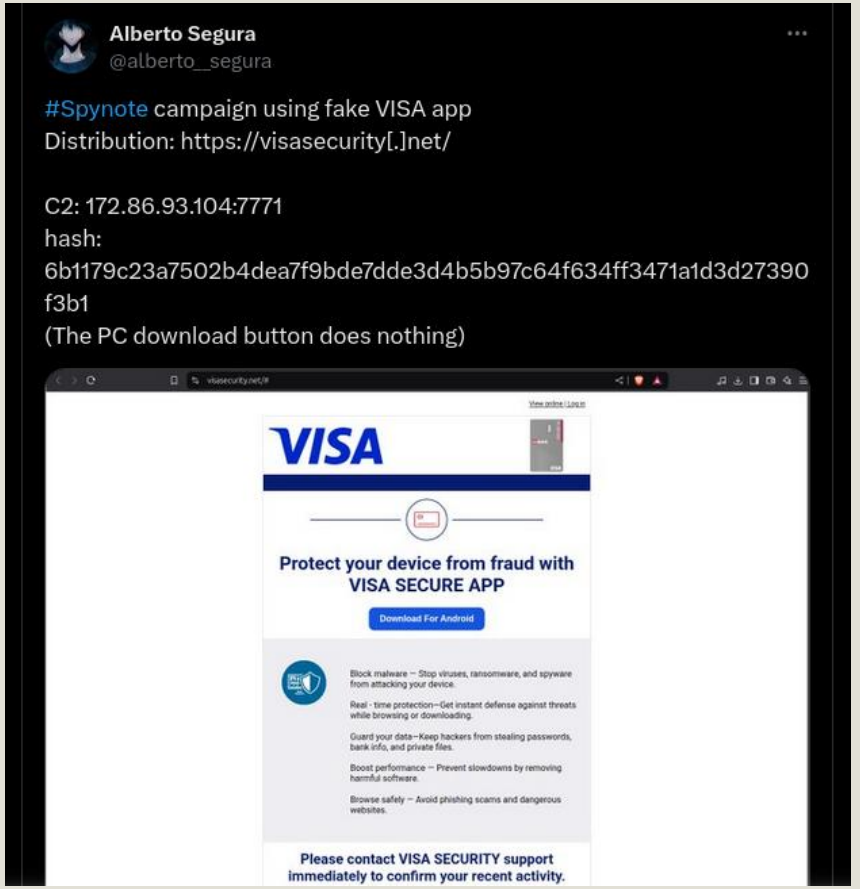


Source: https://bazaar.abuse.ch/

Let's analyze something interesting...

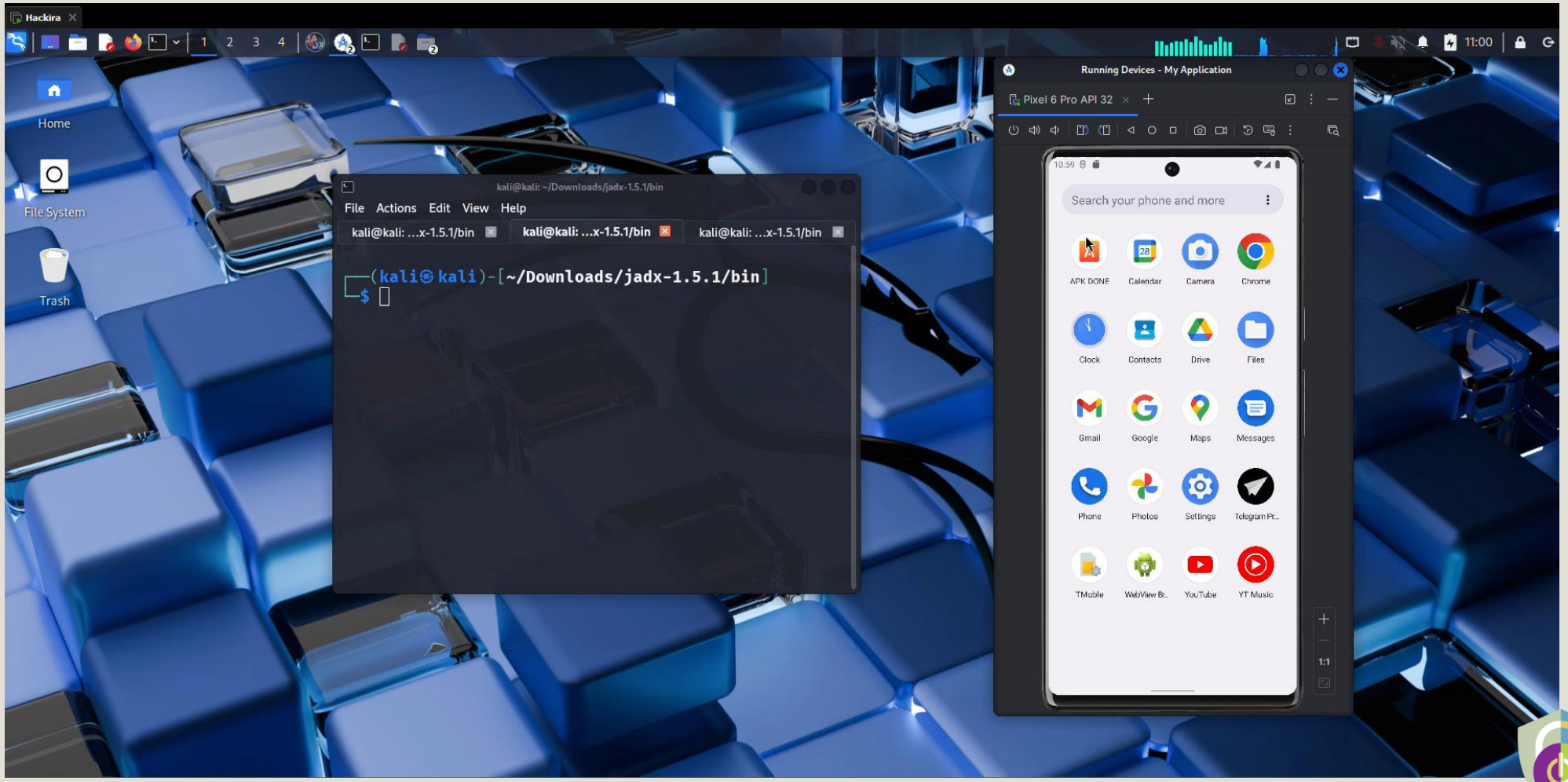
Visa Secure campaign *using fake VISA app Distribution*

https://visasecurity[.].net
(already reported and taken down)



Let's analyze something interesting...

- Malware (Spyware): Visa Secure.apk
- Sample analyzed in: 03/26/2025



Let's analyze something interesting...

Since we are in an emulated device, LET'S JUST CHANGE IT FOR A REAL DEVICE and continue our analysis!

Let's analyze something interesting...

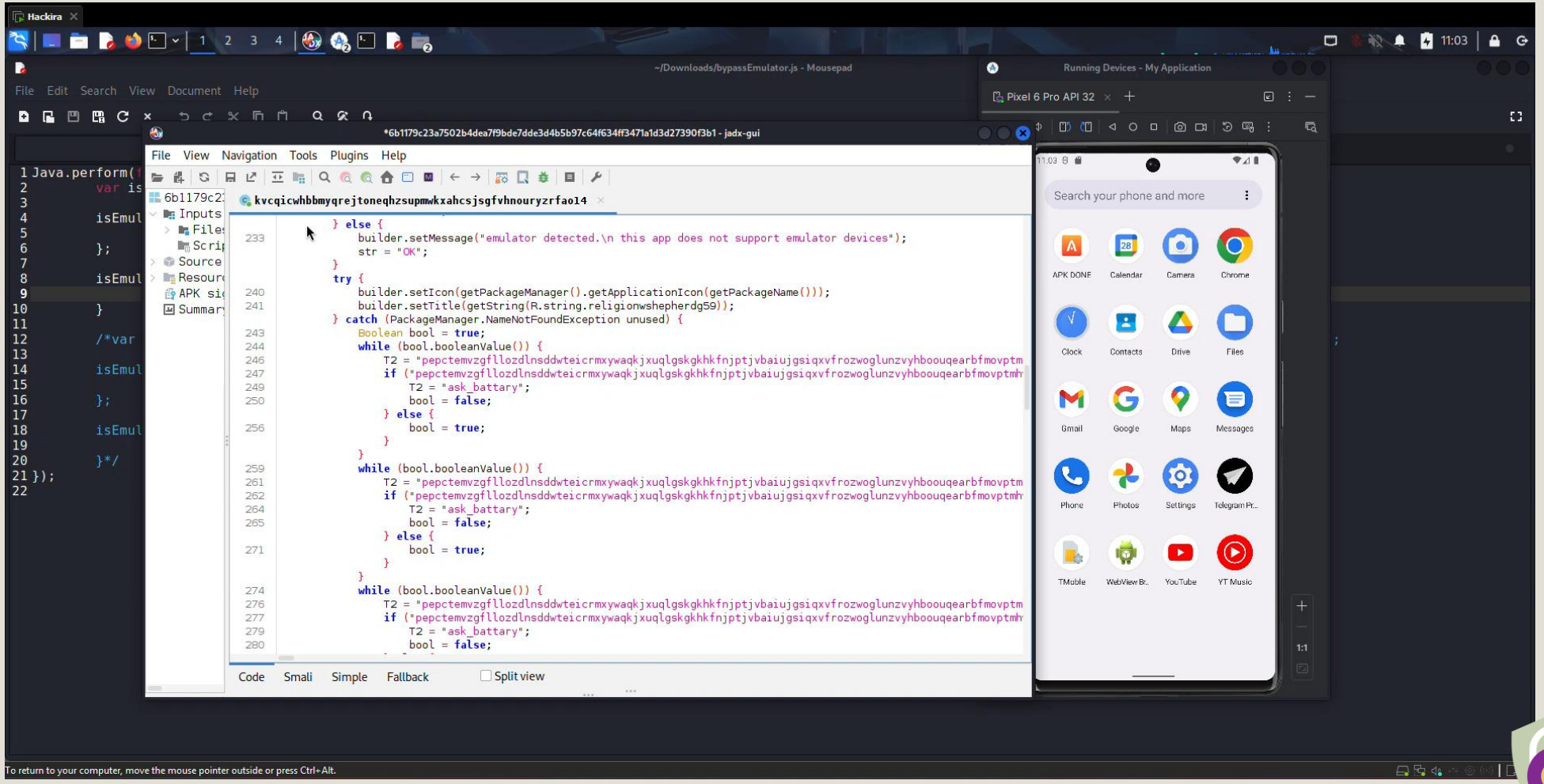
Since we are in an emulated device, LET'S JUST CHANGE IT FOR A REAL DEVICE and continue our analysis!

Let's analyze something interesting...

NEVER download malware on your device. If you suspect it is one and want to make sure, analyze it on an emulator!

Let's analyze something interesting...

- **Malware (Spyware): Visa Secure.apk**
- **Sample analyzed in: 03/26/2025**

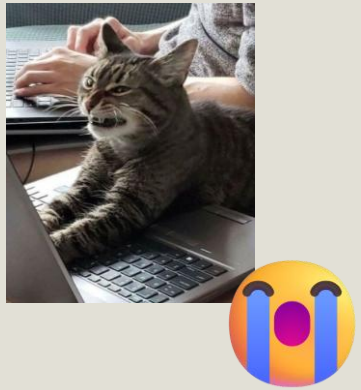


Let's analyze something interesting...

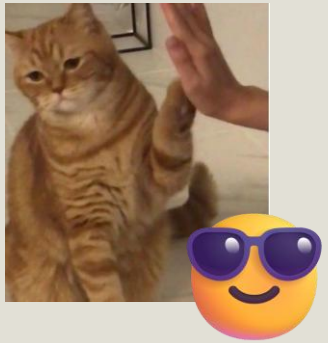
- **Malware (Spyware): Visa Secure.apk**
- **Sample analyzed in: 03/26/2025**

Class:
kvcqicwhbbmyqrejtoneqhzsupmwkx
ahcsjsgfvhnouryzrfao14

Method:
isEmu_DIV_ID_lator()

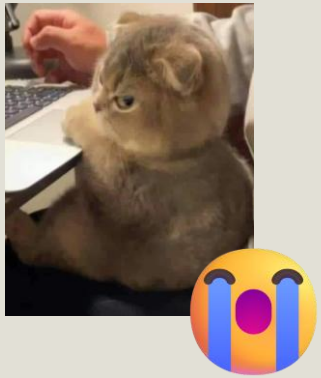


Hook
isEmu_DIV_ID_lator()
return false



Class:
jqdnvoioolafpvdvrvruzwolernmyztqhj
rjfsyfvlhbydgoog31

Method:
isEmu_DIV_ID_lator()



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Let's analyze something interesting...

- **Malware (Spyware): Visa Secure.apk**
- **Sample analyzed in: 03/26/2025**

Aspect	Value
Fingerprint	Generic
Model	Emulator, Android SDK built for x86
Brand	generic_x86
Hardware	Goldfish
Manufacturer	Unknown, Genymotion
Contains	Emulator, simulator

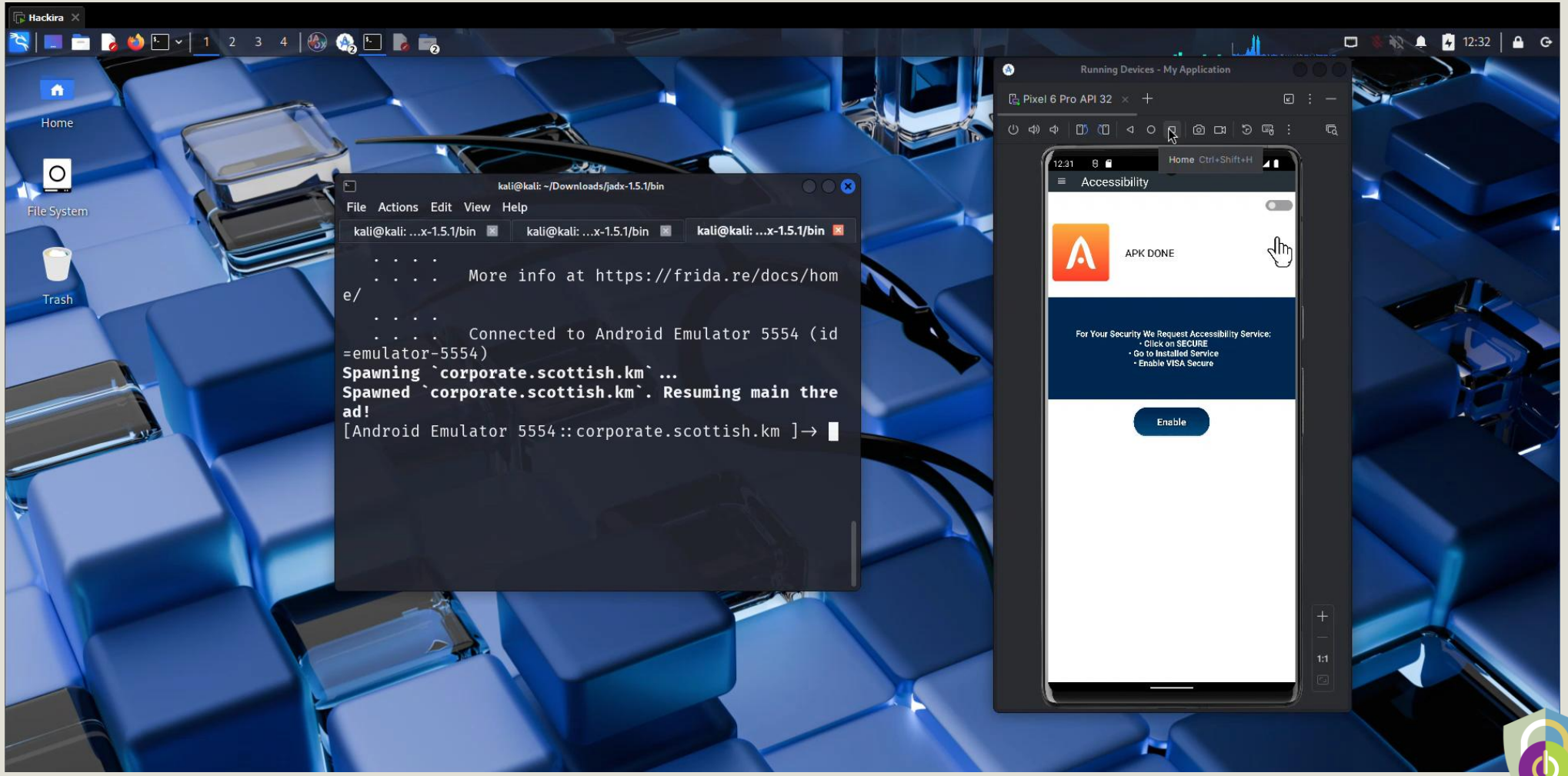
Let's analyze something interesting...

- **Malware (Spyware): Visa Secure.apk**
- **Sample analyzed in: 03/26/2025**

```
Java.perform(function() {
        var isEmulator = Java.use("corporate.scottish.khcuwinjrgkokolanhrvznizqzenzehcnrnwfffcnbaojjmziv2.kvcqicwhbbmyqrejtoneqhzsupmwkxahcsjsgfvhnouryzrfao14");

        isEmulator["isEmu_DIV_ID_lator"].implementation = function() {
                return false;
        };

        isEmulator["AsknoEmu"].implementation = function() {
                console.log("I AM HERE!!!");
        }

        var isEmulator2 = Java.use("corporate.scottish.khcuwinjrgkokolanhrvznizqzenzehcnrnwfffcnbaojjmziv2.jqdnvoioolafpvdvrvruzwolernmyztqhjrjfsyfvlhbydgoog31");

        isEmulator2["isEmu_DIV_ID_lator"].implementation = function() {
                return false;
        };

        isEmulator2["AsknoEmu"].implementation = function() {
                console.log("I AM HERE!!!");
        }
});
```

Let's analyze something interesting...

- But what the app seems to be doing anyway?

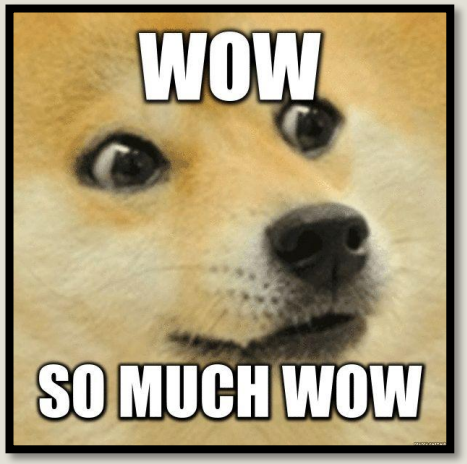


Why does it want to access *accessibilities*?

- Features that make an app usable by people with disabilities (e.g., screen readers, high-contrast modes, touch accommodations)
- Examples: Voice Access, TalkBack, magnification gestures)

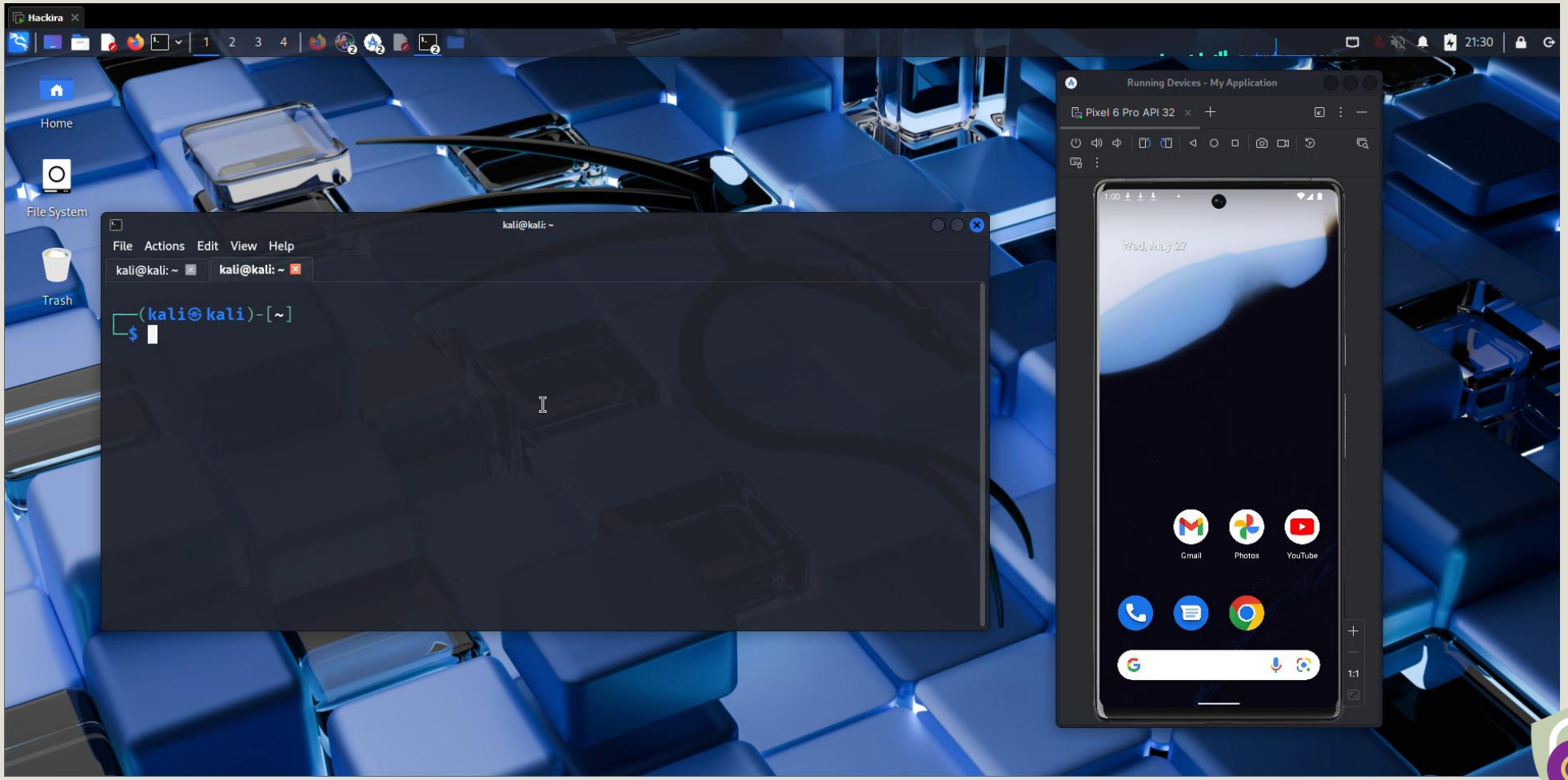
Why would a malware want that then?

- It can allow applications to click buttons and enter text without user interaction
- Capture keystrokes and intercept sensitive information (e.g., passwords, OTPs)
- Malware can create fake overlays on legitimate apps (e.g., banking apps) to steal user credentials and other sensitive data and monitor all user's activities



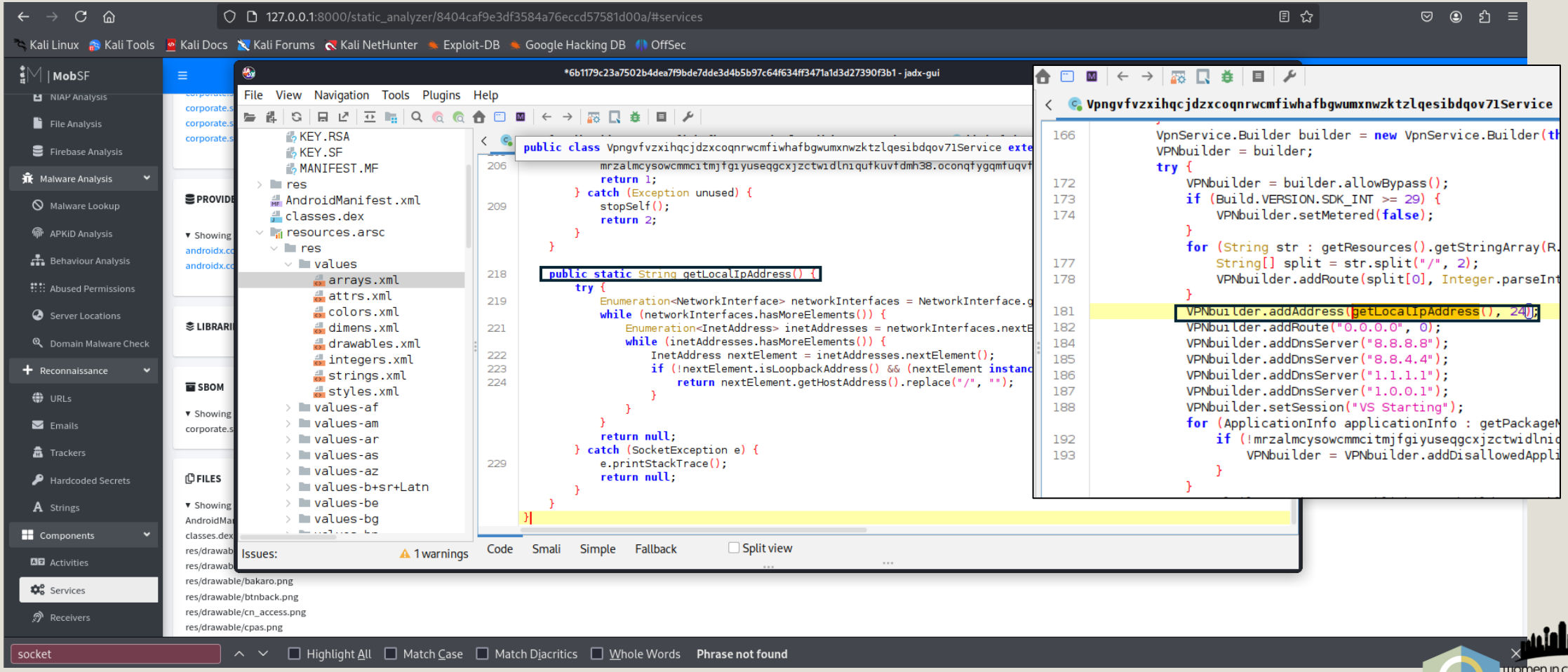
Let's analyze something interesting...

- Since it seems to be an apk to download other files, let's try to see if there are any sockets trying to be accessed by the application...



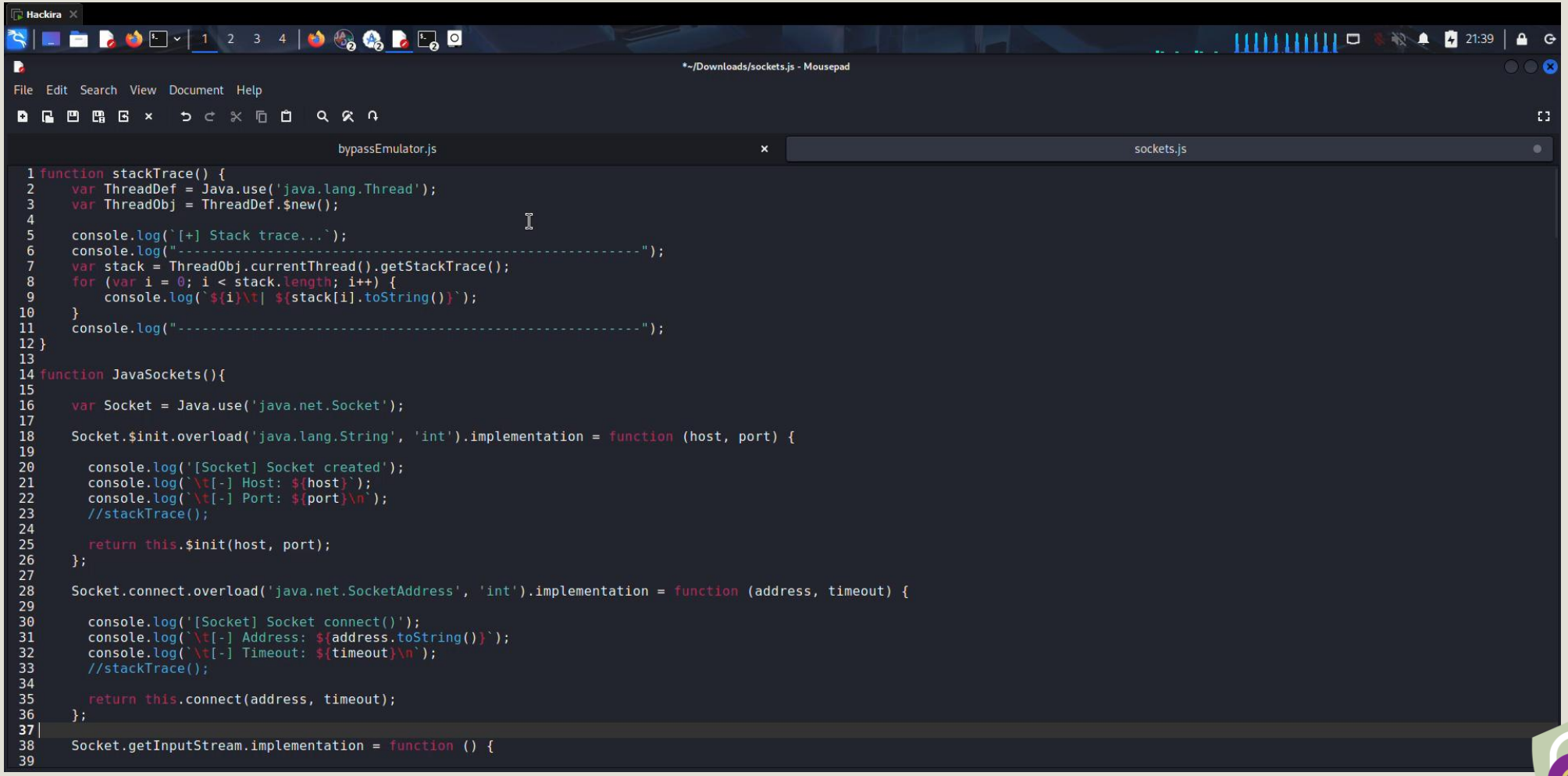
Let's analyze something interesting...

- The MAGIC happens when you combine DYNAMIC + STATIC analysis!



Let's analyze something interesting...

- Show me the code!

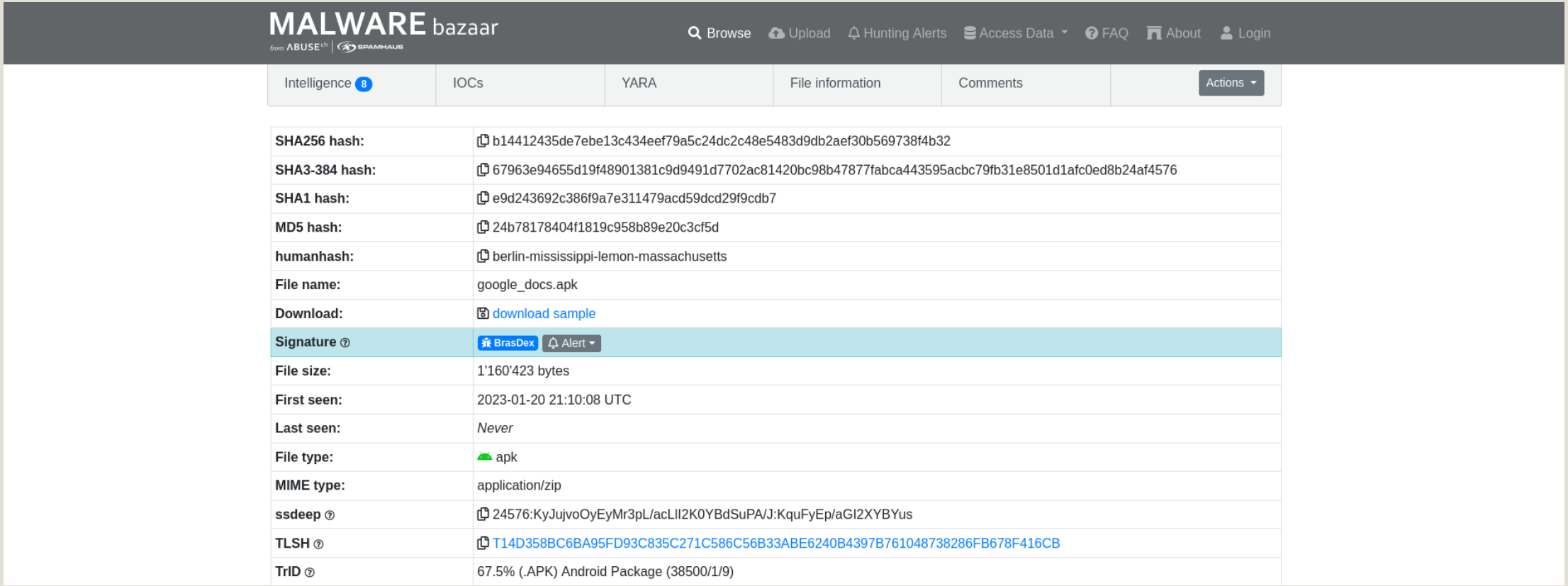



```
function stackTrace() {
    var ThreadDef = Java.use('java.lang.Thread');
    var ThreadObj = ThreadDef.$new();

    console.log(`[+] Stack trace...`);
    console.log("------------------------------------------------------------");
    var stack = ThreadObj.currentThread().getStackTrace();
    for (var i = 0; i < stack.length; i++) {
        console.log(`${i}\t| ${stack[i].toString()}`);
    }
    console.log("------------------------------------------------------------");
}

function JavaSockets(){

    var Socket = Java.use('java.net.Socket');

    Socket.$init.overload('java.lang.String', 'int').implementation = function (host, port) {

      console.log('[Socket] Socket created');
      console.log(`\t[-] Host: ${host}`);
      console.log(`\t[-] Port: ${port}\n`);
      //stackTrace();

      return this.$init(host, port);
    };

    Socket.connect.overload('java.net.SocketAddress', 'int').implementation = function (address, timeout) {

      console.log('[Socket] Socket connect()');
      console.log(`\t[-] Address: ${address.toString()}`);
      console.log(`\t[-] Timeout: ${timeout}\n`);
      //stackTrace();

      return this.connect(address, timeout);
    };

    Socket.getInputStream.implementation = function () {

```

Source: TFG-Frida-Scripts/Network and Traffic/Sockets.js at main · ineesdv/TFG-Frida-Scripts · GitHub

What about a Brazilian flavor?

The reference sample (SHA-256):
b14412435de7ebe13c434eef79a5c24dc2c48e5483d9db2aef30b569738f4b32



MALWARE bazaar
from ABUSE.ch | SPAMHAUS

Browse | Upload | Hunting Alerts | Access Data | FAQ | About | Login

Intelligence 8 | IOCs | YARA | File information | Comments | Actions

SHA256 hash:	b14412435de7ebe13c434eef79a5c24dc2c48e5483d9db2aef30b569738f4b32
SHA3-384 hash:	67963e94655d19f48901381c9d9491d7702ac81420bc98b47877fabca443595acbc79fb31e8501d1afc0ed8b24af4576
SHA1 hash:	e9d243692c386f9a7e311479acd59dcd29f9cdb7
MD5 hash:	24b78178404f1819c958b89e20c3cf5d
humanhash:	berlin-mississippi-lemon-massachusetts
File name:	google_docs.apk
Download:	download sample
Signature	BrasDex Alert
File size:	1'160'423 bytes
First seen:	2023-01-20 21:10:08 UTC
Last seen:	*Never*
File type:	apk
MIME type:	application/zip
ssdeep	24576:KyJujvoOyEyMr3pL/acLlI2K0YBdSuPA/J:KquFyEp/aGI2XYBYus
TLSH	T14D358BC6BA95FD93C835C271C586C56B33ABE6240B4397B761048738286FB678F416CB
TrID	67.5% (.APK) Android Package (38500/1/9)

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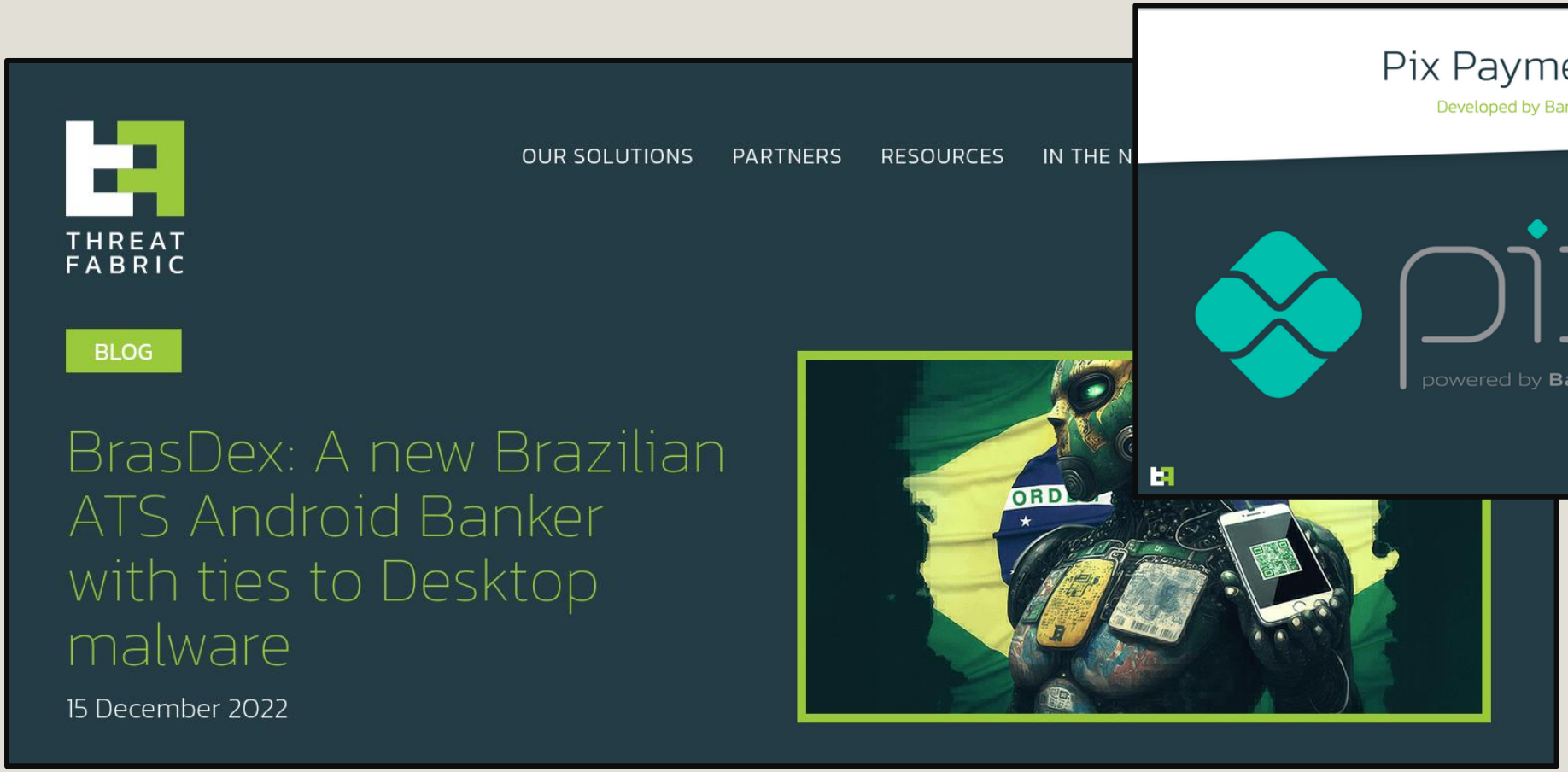
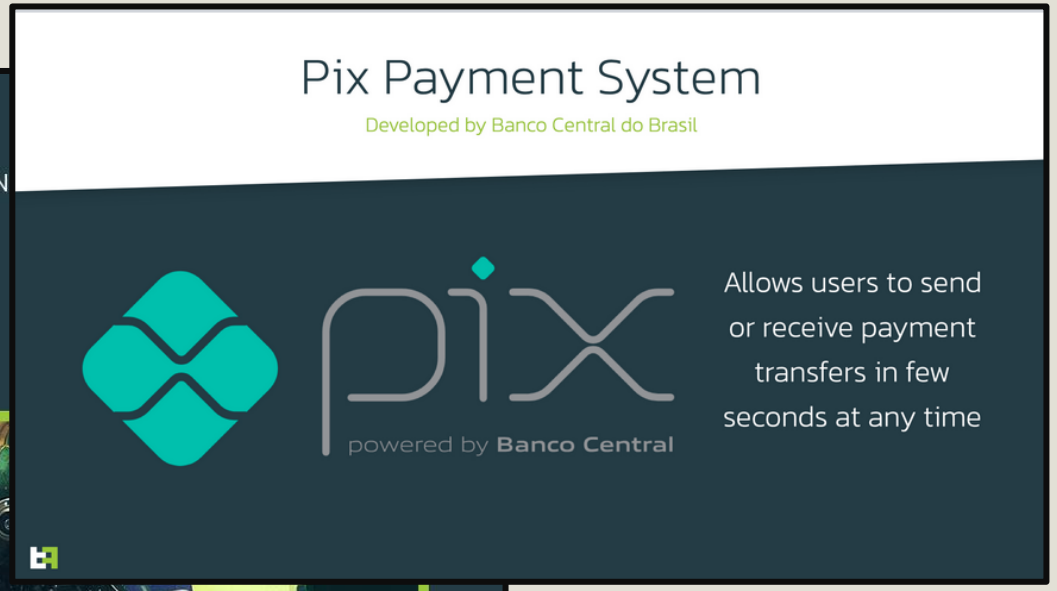
WiCyS

What about a Brazilian flavor?

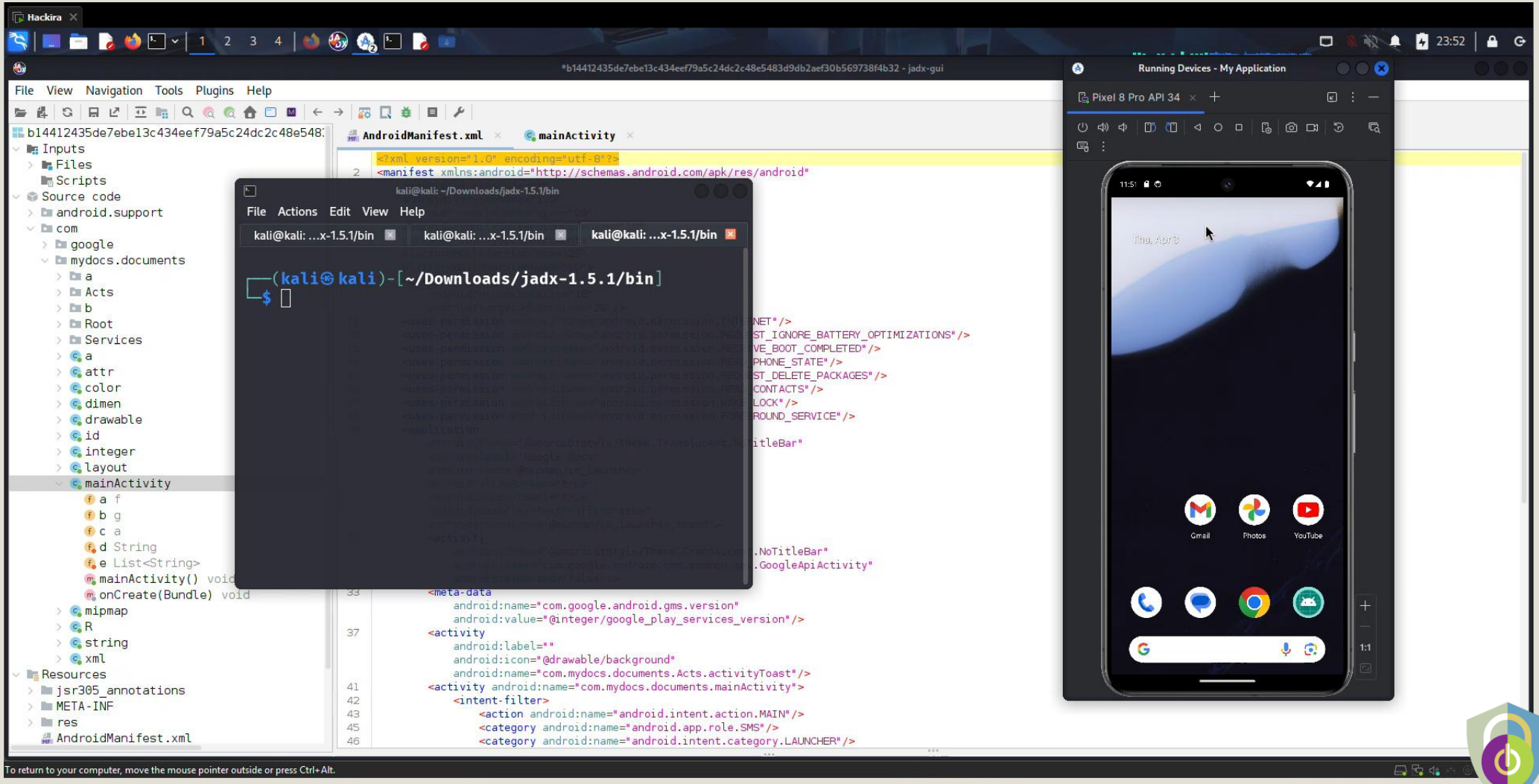
About the campaign:
https://www.threatfabric.com/blogs/double-trouble-in-latam





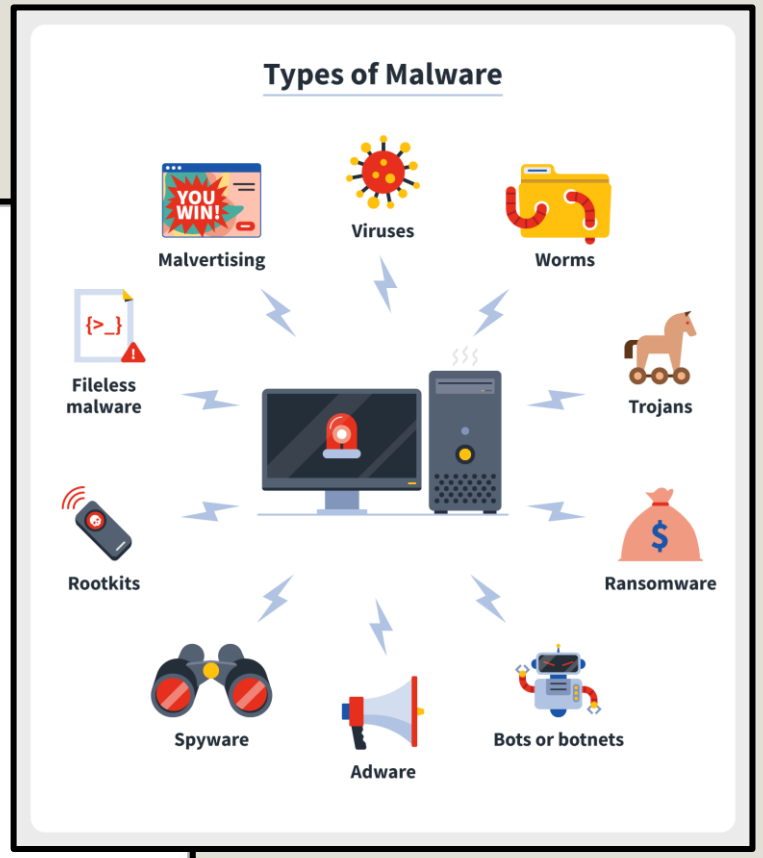
What about a Brazilian flavor?

Family Type: BrasDex (Banking trojan)



But all existing malwares are not just the same?

Nexus	Godfather	Pixpirate	Saderat	Hook	PixBankBot	Xenomorph v3	Vultur	BrasDex
498 Known Variants	1,171 Known Variants	123 Known Variants	300 Known Variants	14 Known Variants	4 Known Variants	6 Known Variants	9 Known Variants	1 Known Variants
39 Banking Apps Targeted	237 Banking Apps Targeted	10 Banking Apps Targeted	8 Banking Apps Targeted	468 Banking Apps Targeted	4 Banking Apps Targeted	83 Banking Apps Targeted	122 Banking Apps Targeted	8 Banking Apps Targeted
9 Countries Targeted	57 Countries Targeted	1 Countries Targeted	23 Countries Targeted	43 Countries Targeted	1 Countries Targeted	14 Countries Targeted	15 Countries Targeted	1 Countries Targeted
Offered as MaaS	Offered as MaaS	Not offered as MaaS	Not offered as MaaS	Offered as MaaS	Not offered as MaaS	Offered as MaaS	Not offered as MaaS	Not offered as MaaS
Stolen Data Exfiltrated to: USA, Netherlands, Turkey, Spain	Stolen Data Exfiltrated to: USA, Turkey, Spain, Canada, France, Germany, UK, Italy, Poland	Stolen Data Exfiltrated to: Brazil	Stolen Data Exfiltrated to: Thailand, Philippines, Peru	Stolen Data Exfiltrated to: Russia	Stolen Data Exfiltrated to: Brazil	Stolen Data Exfiltrated to: USA	Stolen Data Exfiltrated to: USA	Stolen Data Exfiltrated to: Australia, Poland



No, let's *bridge* into another tool*!*

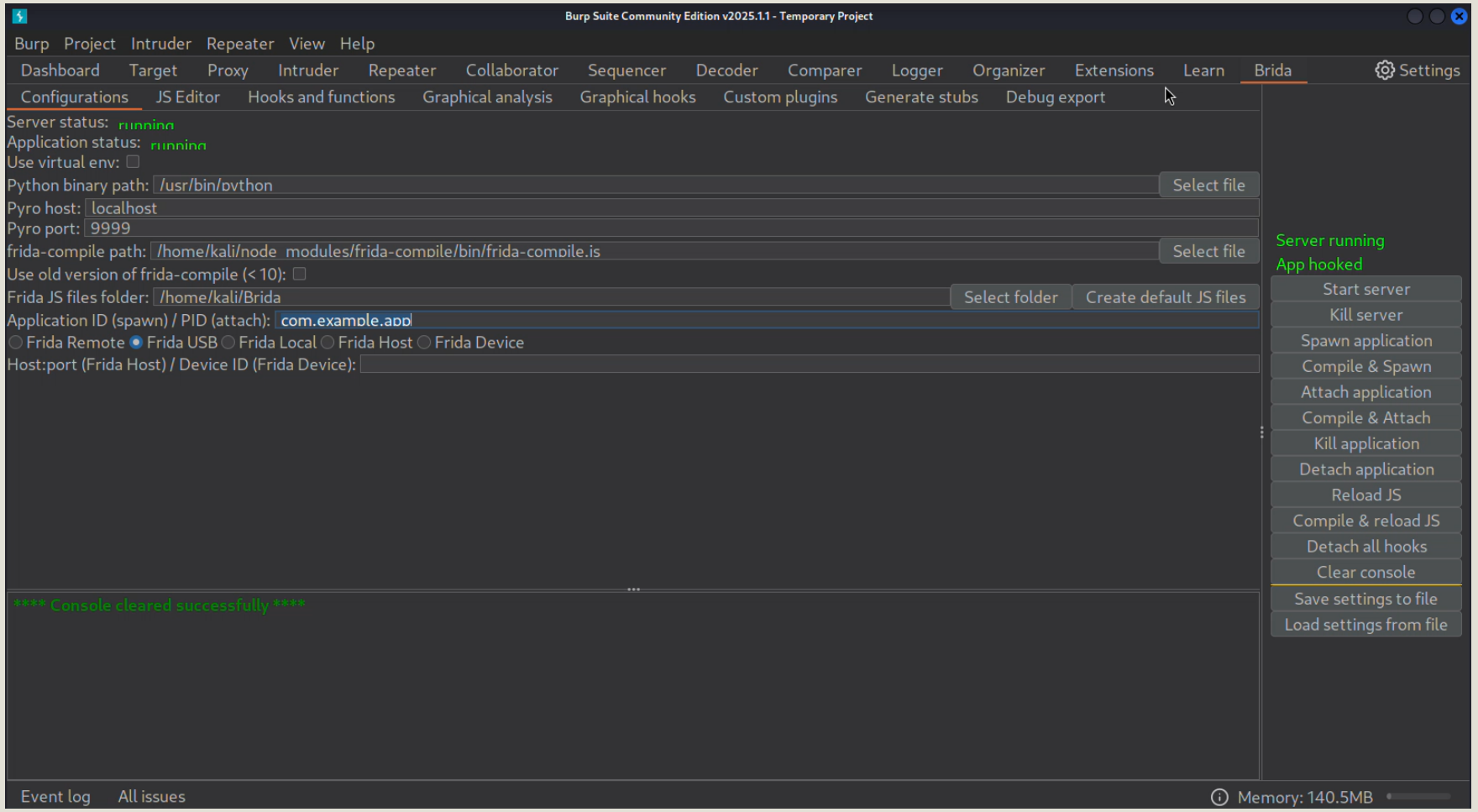
No, let's *bridge* into another tool*!*

by *federicodotta and mustafairan*

- **Burp Suite Extension**
- **Born to turn some complex analysis of applications less time consuming**
- **Integrates function's hooks, native libraries' inspection with the amazing Burp Suite environment, limiting the reversing effort and by completely removing (in most situations) the developing one**
- **Provides an engine to visually create custom plugins for inspecting and editing HTTP requests/responses using the mobile app's own functions via Frida**
- **AND all that is included in *Burp Suite Community*!**

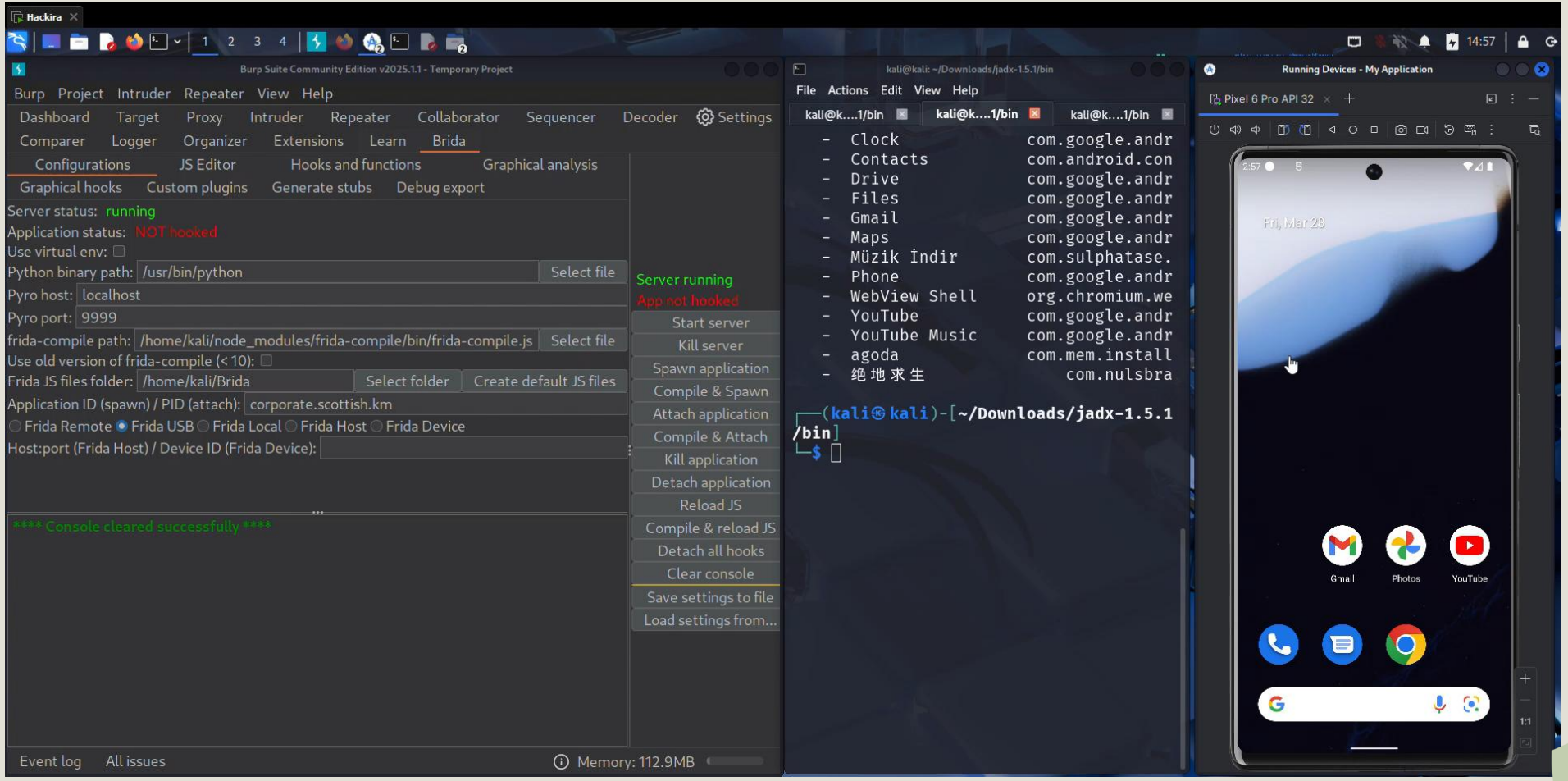
No, let's *bridge* into another tool*!*

by *federicodotta and mustafairan*



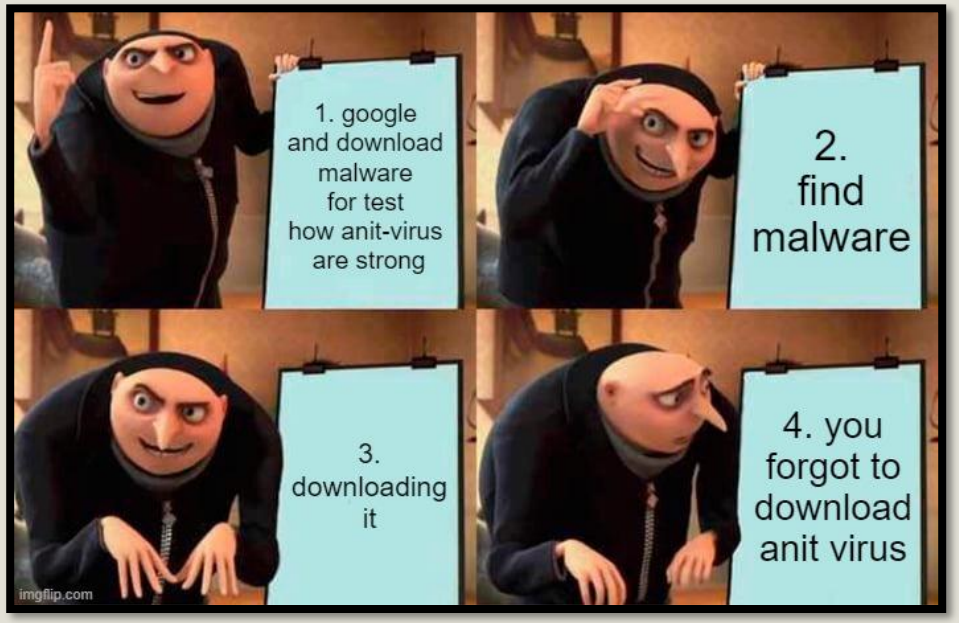
No, let's *bridge* into another tool!

- **Nothing is better than a good EXAMPLE USING BRIDA**



Download and analyze *malware samples*!

- *MalwareBazaar*
- *vx-underground*
- *ANY.RUN*: Registration required
- Hybrid Analysis: Registration required
- InQuest Malware Samples on GitHub
- KernelMode.info: Registration required
- MalShare: Registration required
- MalwareSamples Malware-Feed: Curated
- VirusBay: Registration required
- VirusShare: Registration required
- VirusSign: Registration required



Conclusion and some *insights*

- Analyze applications is **HARD**!
- **API Interception**: Allows monitoring and altering of API calls to understand better the application
- **Real-time script injection** to modify app behavior
- It is **not** just spent time looking at the code
- **Careful** with the time, complexity and your goals
- **ALWAYS** be aware of the news and new patches

References

- https://www.fortinet.com/blog/threat-research/fortinet-identifies-malicious-packages-in-the-wild-insights-and-trends
- https://www.fortinet.com/blog/threat-research/defeating-an-android-packer-with-frida
- https://medium.com/@urban.vidergar/attacking-android-malware-with-frida-93c7cc0e1f50
- https://github.com/ineesdv/TFG-Frida-Scripts
- https://frida.re/docs/javascript-api/
- https://source.android.com/docs/security/bulletin/2025-03-01?hl=pt-br
- https://www.forbes.com/sites/zakdoffman/2024/03/15/samsung-s24-ultra-s23-free-update-warning-for-galaxy-android-users/
- https://thehackernews.com/2025/04/triada-malware-preloaded-on-counterfeit.html

Questions?

Let's connect!

linkedin.com/in/stefany-coimbra/

WOMEN IN CYBERSECURITY
WiCyS

Entering the Android Rabbit Hole with Frida:

Deep-Dive into Dynamic Analysis

Women in Cybersecurity
WiCyS

Frida scripts

Bypass of Uncrackable.apk (OWASP Level 01)

```
// First Part
Java.perform(function(){
  var c_function = Java.use("sg.vantagepoint.a.c");

  c_function["a"].implementation = function () {
    return false;
  };

  c_function["b"].implementation = function () {
    return false;
  };

  c_function["c"].implementation = function () {
    return false;
  };

  // Second Part
  function convertToString(arg) {
    var buffer = Java.array('byte', arg);
    var result = "";
        //Converting each byte to an individual char
    for(var i = 0; i < buffer.length; ++i){
      result += (String.fromCharCode(buffer[i] & 0xff));
    }
    return result;
  }

  Java.use("sg.vantagepoint.a.a").a.implementation = function(ba1, ba2) {
    const retval = this.a(ba1, ba2);
    console.log("secret code is: " + convertToString(retval));
    return retval;
  };
});
```

Frida scripts

Bypassing Root (Malware: Visa Secure.apk)

```
Java.perform(function() {
        var isEmulator = Java.use("corporate.scottish.khcuwinjrgkokolanhrvznizqzenzehcnrnwfffcnbaojjmziv2.kvcqicw-hbbmyqrejtoneqhzsupmwkxahcsjsgfvhnouryzrfao14");

        isEmulator["isEmu_DIV_ID_lator"].implementation = function() {
                return false;
        };

        isEmulator["AsknoEmu"].implementation = function() {
                console.log("I AM HERE!!!");
        }

        var isEmulator2 = Java.use("corporate.scottish.khcuwinjrgkokolanhrvznizqzenzehcnrnwfffcnbaojjmziv2.jqdnvoi-oolafpvdvrvruzwolernmyztqhjrjfsyfvlhbydgoog31");

        isEmulator2["isEmu_DIV_ID_lator"].implementation = function() {
                return false;
        };

        isEmulator2["AsknoEmu"].implementation = function() {
                console.log("I AM HERE!!!");
        }
});
```

Frida scripts

Searching for sockets (Malware: Visa Secure.apk)

```
function stackTrace() {
    var ThreadDef = Java.use('java.lang.Thread');
    var ThreadObj = ThreadDef.$new();

    console.log(`[+] Stack trace...`);
    console.log("------------------------------------------------------------");
    var stack = ThreadObj.currentThread().getStackTrace();
    for (var i = 0; i < stack.length; i++) {
        console.log(`${i}\t| ${stack[i].toString()}`);
    }
    console.log("------------------------------------------------------------");
}

function JavaSockets(){

    var Socket = Java.use('java.net.Socket');

    Socket.$init.overload('java.lang.String', 'int').implementation = function (host, port) {

      console.log('[Socket] Socket created');
      console.log(`\t[-] Host: ${host}`);
      console.log(`\t[-] Port: ${port}\n`);
      //stackTrace();

      return this.$init(host, port);
    };

    Socket.connect.overload('java.net.SocketAddress', 'int').implementation = function (address,
timeout) {

      console.log('[Socket] Socket connect()');
      console.log(`\t[-] Address: ${address.toString()}`);
      console.log(`\t[-] Timeout: ${timeout}\n`);
      //stackTrace();

      return this.connect(address, timeout);
    };

    Socket.getInputStream.implementation = function () {

```

Frida scripts

Searching for sockets (Malware: Visa Secure.apk)

```
40          console.log('[Socket] Socket getInputStream()');
41          console.log(`\t[-] Local Address: ${this.getLocalAddress().getHostAddress()}`);
42          console.log(`\t[-] Local Port: ${this.getLocalPort()}`);
43          console.log(`\t[-] Remote Address: ${this.getInetAddress().getHostAddress()}`);
44          console.log(`\t[-] Remote Port: ${this.getPort()}\n`);
45          //stackTrace();
46
47          var inputStream = this.getInputStream();
48          return inputStream;
49      };
50
51      Socket.getOutputStream.implementation = function () {
52
53          console.log('[Socket] Socket getOutputStream()');
54          console.log(`\t[-] Local Address: ${this.getLocalAddress().getHostAddress()}`);
55          console.log(`\t[-] Local Port: ${this.getLocalPort()}`);
56          console.log(`\t[-] Remote Address: ${this.getInetAddress().getHostAddress()}`);
57          console.log(`\t[-] Remote Port: ${this.getPort()}\n`);
58          //stackTrace();
59
60          var outputStream = this.getOutputStream();
61          return outputStream;
62      };
63
64      Socket.close.implementation = function () {
65          console.log('[Socket] close()');
66          return this.close();
67      };
68
69
70
71      var LocalServerSocket = Java.use('android.net.LocalServerSocket');
72
73      LocalServerSocket.$init.overload('java.lang.String').implementation = function (name) {
74          console.log(`[LocalServerSocket] Socket '${name}' created\n`);
75          //stackTrace();
```

Frida scripts

Searching for sockets (Malware: Visa Secure.apk)

```
76
77          return this.$init(name);
78      };
79
80      LocalServerSocket.accept.implementation = function () {
81          console.log('[LocalServerSocket] Socket.accept()\n');
82          //stackTrace();
83
84          return this.accept();
85      };
86
87      LocalServerSocket.close.implementation = function () {
88          console.log('[LocalServerSocket] Socket.close()\n');
89          //stackTrace();
90
91          return this.close();
92      };
93
94
95
96
97      var ServerSocket = Java.use('java.net.ServerSocket');
98
99      ServerSocket.$init.overload('int').implementation = function (port) {
100         console.log('[ServerSocket] Socket created');
101         console.log(`\t[-] Port: ${port}\n`);
102         //stackTrace();
103
104         return this.$init(port);
105     };
106
107     ServerSocket.accept.implementation = function () {
108         console.log('[ServerSocket] Socket.accept()\n');
109         //stackTrace();
110
111         return this.accept();
112     };
113
114     ServerSocket.close.implementation = function () {
115         console.log('[ServerSocket] Socket.close()\n');
```

Frida scripts

Searching for sockets (Malware: Visa Secure.apk)

```
116         //stackTrace();
117
118         return this.close();
119     };
120
121
122
123     var SSLSocket = Java.use('javax.net.ssl.SSLSocket');
124
125     SSLSocket.$init.overload('java.lang.String', 'int').implementation = function (host, port) {
126
127         console.log('[SSLSocket] Socket created');
128         console.log(`\t[-] Host: ${host}`);
129         console.log(`\t[-] Port: ${port}\n`);
130         //stackTrace();
131
132         this.$init(host, port);
133     };
134
135     SSLSocket.getOutputStream.implementation = function () {
136
137         console.log('[SSLSocket] Socket.getOutputStream()\n');
138         // stackTrace();
139
140         var outputStream = this.getOutputStream();
141         // To log the data OutputStream.write needs to be intercepted
142
143         return outputStream;
144     };
145
146     SSLSocket.getInputStream.implementation = function () {
147
148         console.log('[SSLSocket] Socket.getInputStream()\n');
149         //stackTrace();
150
151         var inputStream = this.getInputStream();
152         // To log the data InputStream.read needs to be intercepted
153
154         return inputStream;
155     };
```

Frida scripts

Searching for sockets (Malware: Visa Secure.apk)

```
156
157 }
158
159
160 function NativeSockets(){
161
162     // Ref: https://gist.github.com/zihadmahiuddin
163
164     var getaddrinfoPtr = Module.findExportByName(null, 'getaddrinfo')
165     var connectPtr = Module.findExportByName(null, 'connect')
166     var sendPtr = Module.findExportByName(null, 'send')
167     var recvPtr = Module.findExportByName(null, 'recv')
168
169     var getaddrinfoFunction = new NativeFunction(getaddrinfoPtr, 'int', ['pointer', 'pointer',
    'pointer', 'pointer'])
170     var connectFunction = new NativeFunction(connectPtr, 'int', ['int', 'pointer', 'int'])
171     var sendFunction = new NativeFunction(sendPtr, 'int', ['int', 'pointer', 'int', 'int'])
172     var recvFunction = new NativeFunction(recvPtr, 'int', ['int', 'pointer', 'int', 'int'])
173
174     /**
175      * Returns hex from an ArrayBuffer object
176      * @param {ArrayBuffer} array Array to work with
177      * @param {Boolean} hex Whether to convert to hex or plain string
178      */
179     function getReadable(array, hex) {
180         var result = new Uint8Array(array.byteLength)
181         result.set(array, 0)
182         if (hex === false) {
183             var str = ''
184             for (var i = 0; i < result.length; i++) {
185                 str += String.fromCharCode(result[i])
186             }
187             return str
188         } else {
189             var hexStr = ''
190             for (var j = 0; j < result.length; j++) {
191                 hexStr += result[j].toString(16)
192             }
193             return hexStr
194         }
```

Frida scripts

Searching for sockets (Malware: Visa Secure.apk)

```
195     }
196
197     /**
198      * Returns a nice formatting of a function with parameters
199      * @param {string} functionName The name of the function to format
200      * @param {string[]} params The function parameters as strings
201      */
202     function formatFunction(functionName, params, retval) {
203
204         var result = `[NATIVE SOCKET] Function ${functionName} called\n`;
205         for (var i = 0; i < params.length; i++) {
206             result += `\t[-] Parameter ${i+1}: ${params[i]}\n`;
207         }
208         if (retval !== undefined) {
209             result += `\t[-] Return value: ${retval}\n`;
210         }
211         return result;
212
213     }
214
215     function replaceGadp() {
216         Interceptor.replace(getaddrinfoPtr, new NativeCallback(function(name, service, req, pai) {
217             var nameStr = Memory.readUtf8String(name)
218             console.log(formatFunction('getaddrinfo', [nameStr, service, req, pai]))
219             return getaddrinfoFunction(name, service, req, pai)
220         }, 'int', ['pointer', 'pointer', 'pointer', 'pointer']))
221     }
222
223     function replaceConnect() {
224         Interceptor.replace(connectPtr, new NativeCallback(function(socket, address, addressLen) {
225             var endpoint = {
226                 ip: '',
227                 port: 0
228             }
229             var portPtr = ptr(parseInt(address) + 2)
230             var portHigh = Memory.readU8(portPtr)
231             var portLow = Memory.readU8(ptr(parseInt(portPtr) + 1))
232             endpoint.port = (portHigh & 0xFF) << 8 | (portLow & 0xFF)
233
234             var ipPtr = ptr(parseInt(address) + 4)
```

Frida scripts

Searching for sockets (Malware: Visa Secure.apk)

```
235             var ip = []
236
237             ip.push(Memory.readU8(ipPtr))
238             ip.push(Memory.readU8(ptr(parseInt(ipPtr) + 1)))
239             ip.push(Memory.readU8(ptr(parseInt(ipPtr) + 2)))
240             ip.push(Memory.readU8(ptr(parseInt(ipPtr) + 3)))
241
242             endpoint.ip = ip.join('.')
243
244             var result = connectFunction(socket, address, addressLen)
245
246             console.log(formatFunction('connect', [socket, JSON.stringify(endpoint), addressLen],
    result));
247             return result
248         }, 'int', ['int', 'pointer', 'int']));
249     }
250
251     function replaceSend() {
252         Interceptor.replace(sendPtr, new NativeCallback(function(fd, buf, len, flags) {
253             var buffer = Memory.readByteArray(buf, len)
254             var result = sendFunction(fd, buf, len, flags)
255             console.log(formatFunction('send', [fd, getReadable(buffer, false), len, flags],
    result))
256             return result
257         }, 'int', ['int', 'pointer', 'int', 'int']));
258     }
```

Frida scripts

Searching for sockets (Malware: Visa Secure.apk)

```
259
260     function replaceRecv() {
261         Interceptor.replace(recvPtr, new NativeCallback(function(fd, buf, len, flags) {
262             var result = recvFunction(fd, buf, len, flags)
263             if (result > -1) {
264                 var buffer = Memory.readByteArray(buf, result)
265                 console.log(formatFunction('recv', [fd, getReadable(buffer, false), len, flags],
    result))
266             } else {
267                 console.log(formatFunction('recv', [fd, getReadable(buffer, false), len, flags],
    result))
268             }
269             return result
270         }, 'int', ['int', 'pointer', 'int', 'int']));
271     }
272
273     replaceGadp();
274     replaceConnect();
275     replaceSend();
276     replaceRecv();
277
278 }
```

Frida scripts

Searching for sockets (Malware: Visa Secure.apk)

```
279
280
281 Java.perform(function () {
282
283
284     console.log('');
285     console.log('[*] Hooking Java sockets ...');
286     console.log('');
287     JavaSockets();
288     console.log('[*] Hooking Native sockets ...');
289     console.log('');
290     NativeSockets();
291
292 });
293
```