Kharon dataset: Android malware under a microscope

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Learning from Authoritative Security Experiment Results

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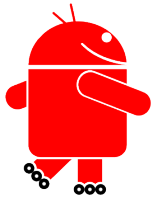


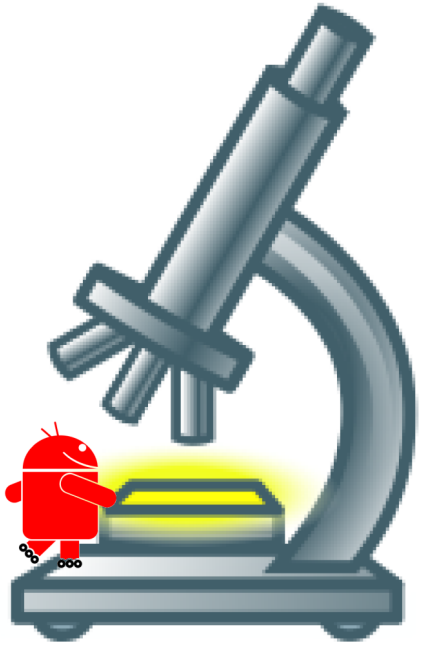
Lessons learned

Android malware findings

- malware hide themselves from dynamic analysis
- triggering malware is not obvious

Methodology:

- manual reverse engineering of 7 malware
- manual triggering (not obvious)
- execution and information flow capture



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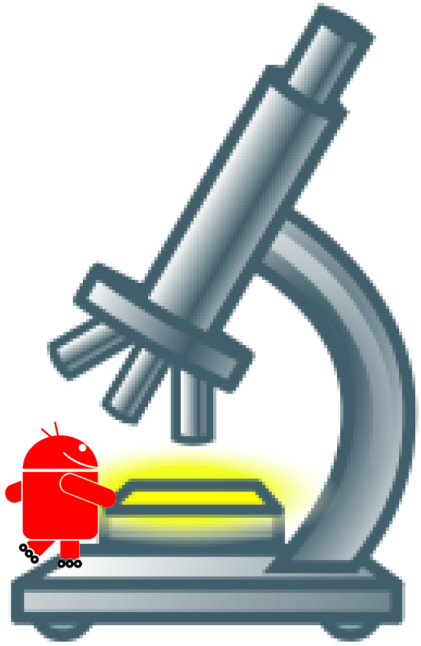

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Why building such a dataset ?

Papers with **Android malware experiments**:

- use **extracts of reference datasets**:
  - The Genome project (stopped !) [Zhou et al. 12]
  - Contagio mobile dataset [Mila Parkour]
  - Hand crafted malicious apps (DroidBench [Artz et al. 14])
  - Some Security Challenges' apps
- need to be **significant**:
  - Tons of apps (e.g. 1.3 million for PhaLibs [Chen et al. 16])
  - Some apps (e.g. 11 for TriggerScope [Fratantonio et al. 16])

- A **well documented** dataset does not exist !
- Online services give **poor information** !

contagio mobile

virustotal

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Analyzing malware

Main analysis methods are:

- **static analysis**:
  ⇒ try to recognize known characteristics of malware in the code/ressources of studied applications

- **dynamic analysis**:
  ⇒ try to execute the malware

Analyzing malware

Main analysis methods are:

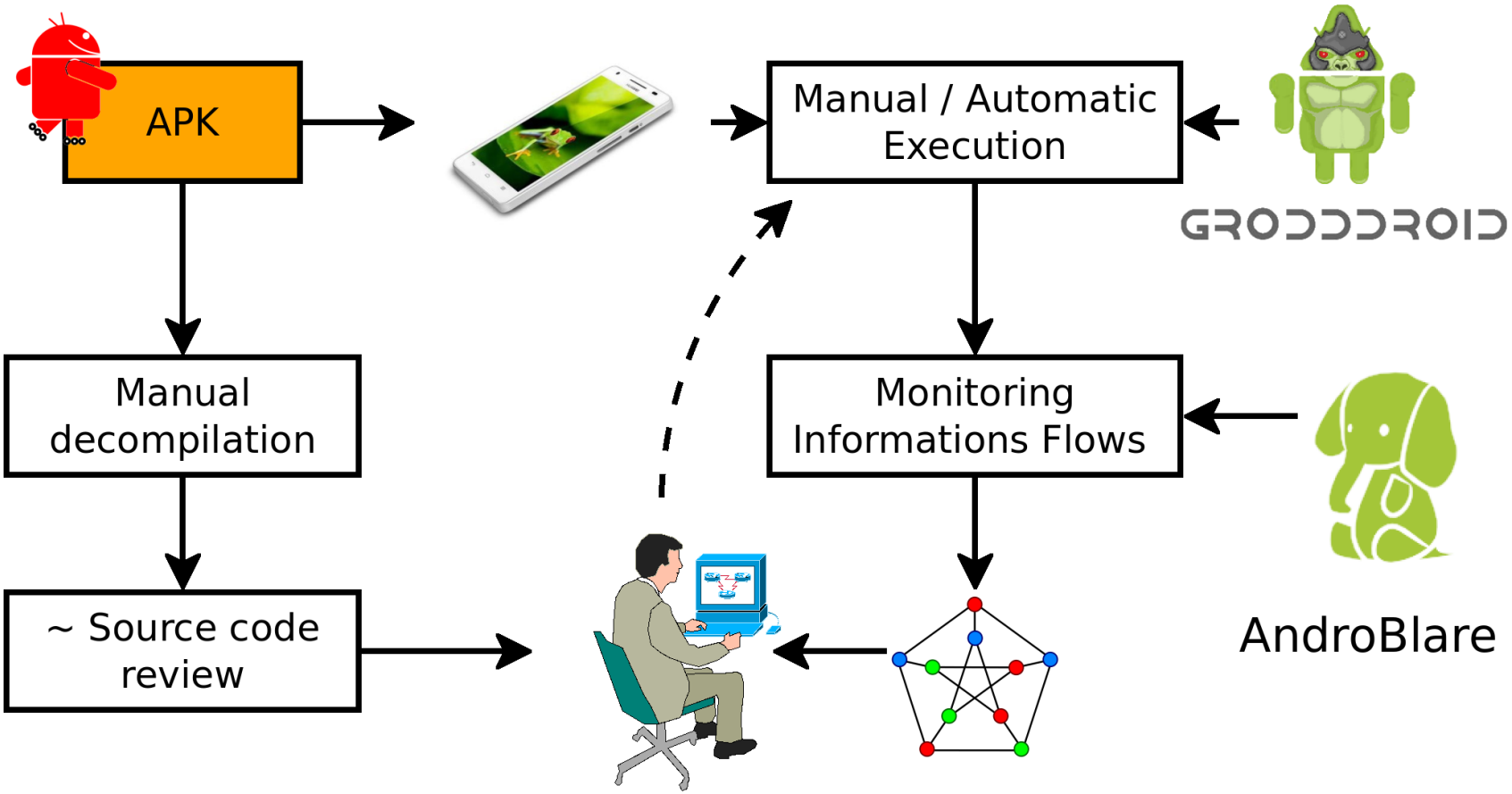
- **static analysis**:
  ⇒ try to recognize known characteristics of malware code/ressources

Countermeasures:
reflection, obfuscation, dynamic loading, encryption

- **dynamic analysis**:
  ⇒ try to execute the malware

Countermeasures:
logic bomb, time bomb, remote server

Methodology



A collection of malware totally reversed

Kharon dataset: **7** malware[1]:

`http://kharon.gforge.inria.fr/dataset`

- DroidKungFu, BadNews (2011, 2013)
- WipeLocker (2014)
- MobiDash (2015)
- SaveMe, Cajino (2015)
- SimpleLocker (2014)

[1] Approved by **Inria's Operational Legal and Ethical Risk Assessment Committee**: We warn the readers that these samples have to be used for research purpose only. We also advise to carefully check the SHA256 hash of the studied malware samples and to manipulate them in a sandboxed environment. In particular, the manipulation of these malware impose to follow safety rules of your Institutional Review Boards.

Remote admin Tools

Install malicious apps:

- **Badnews**: Obeys to a remote server + delays attack
  Triggering: Patch the bytecode + Build a fake server
- **DroidKungFu1** (well known): Delays attack
  Triggering: Modify 'start' to 1 in `sstimestamp.xml` and reboot the device

Blocker / Eraser

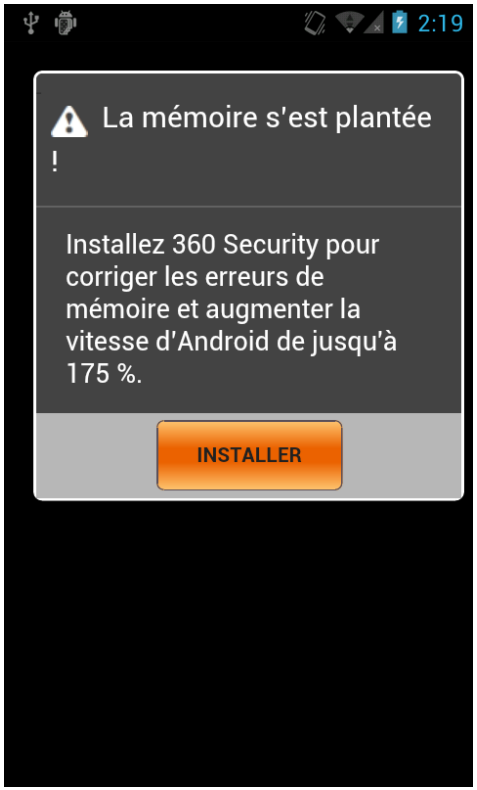
Wipes of the SD card and block social apps:

- **WipeLocker**: Delayed Attack
  Triggering: Launch the app and reboot the device

Adware

Displays adds after some days:

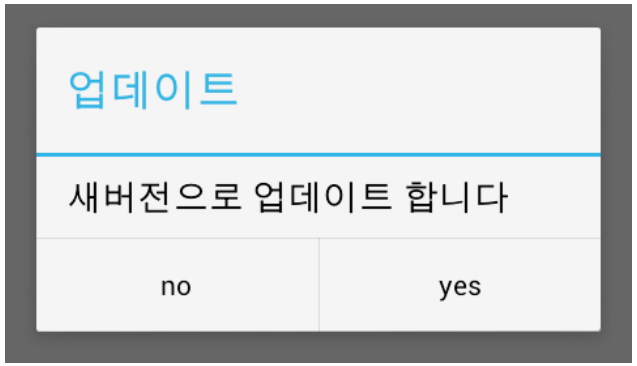
- **MobiDash**: Delayed Attack
  Triggering: Launch the application, reboot the device and modify `com.cardgame.durak_preferences.xml`



Spyware

Steals contacts, sms, IMEI, . . .

- **SaveMe**: Verifies the Internet access
  Triggering: Enable Internet access and lauch the app
- **Cajino**: Obeys a Baidu remote server
  Triggering: Simulate a server command with an Intent

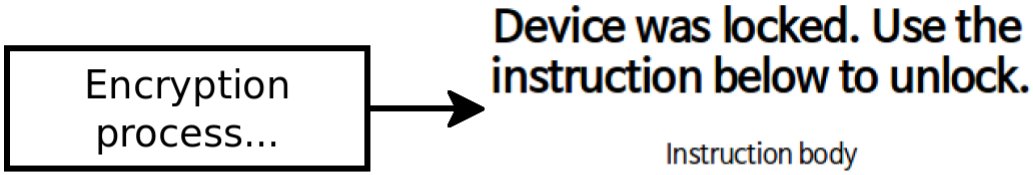


Ransomware

Encrypts user's files and asks for paying:

SimpleLocker

- Waits the reboot of the device
  Triggering: send a BOOT_COMPLETED intent



More details about SimpleLocker...

Example: SimpleLocker

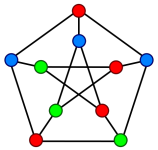
The main malicious functions:

```
org.simplelocker.MainService.onCreate()
org.simplelocker.MainService$4.run()
org.simplelocker.TorSender.sendCheck(final Context context)
org.simplelocker.FilesEncryptor.encrypt()
org.simplelocker.AesCrypt.AesCrypt(final String s)
```

The encryption loop:

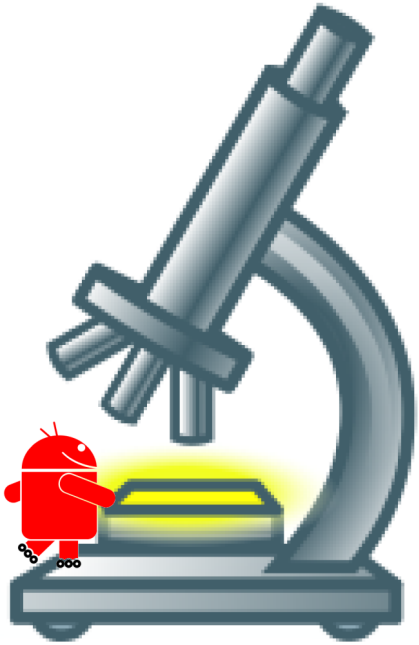
```
final AesCrypt aesCrypt = new AesCrypt("jndlasf074hr");

for (final String s : this.filesToEncrypt) {
  aesCrypt.encrypt(s, String.valueOf(s) + ".enc");
  new File(s).delete();
}
```

The System Flow Graph: 

Discussion

Let's discuss :)



Dataset overview

Type	Name	Protection against dynamic Analysis → *Remediation*
RAT	Badnews	Obeys to a remote server and delays the attack → *Modify the apk* → *Build a fake server*
Ransomware	SimpleLocker	Waits the reboot of the device → *send a BOOT_COMPLETED intent*
RAT	DroidKungFu	Delayed Attack → *Modify the value* `start` *to* `1` *in sstimestamp.xml*
Adware	MobiDash	Delayed Attack → *Launch the infected application, reboot the device and modify com.cardgame.durak_preferences.xml*
Spyware	SaveMe	Verifies the Internet access → *Enable Internet access and launch the application*
Eraser+LK	WipeLocker	Delayed Attack → *Press the icon launcher and reboot the device*
Spyware	Cajino	Obeys to a remote server → *Simulate the remote server by sending an intent*

Conclusion

You are know able to execute the malicious code in a real environment and conduct precise experiments

Kharon dataset is **online** !

- descriptions and code extracts
- malicious method names
- Graph representation:
  $\Rightarrow$ replay the malware !

http://kharon.gforge.inria.fr/dataset