Open Web Application Security Project

OWASP German Chapter Stammtisch Initiative/Ruhrpott

Android App Pentest Workshop 101

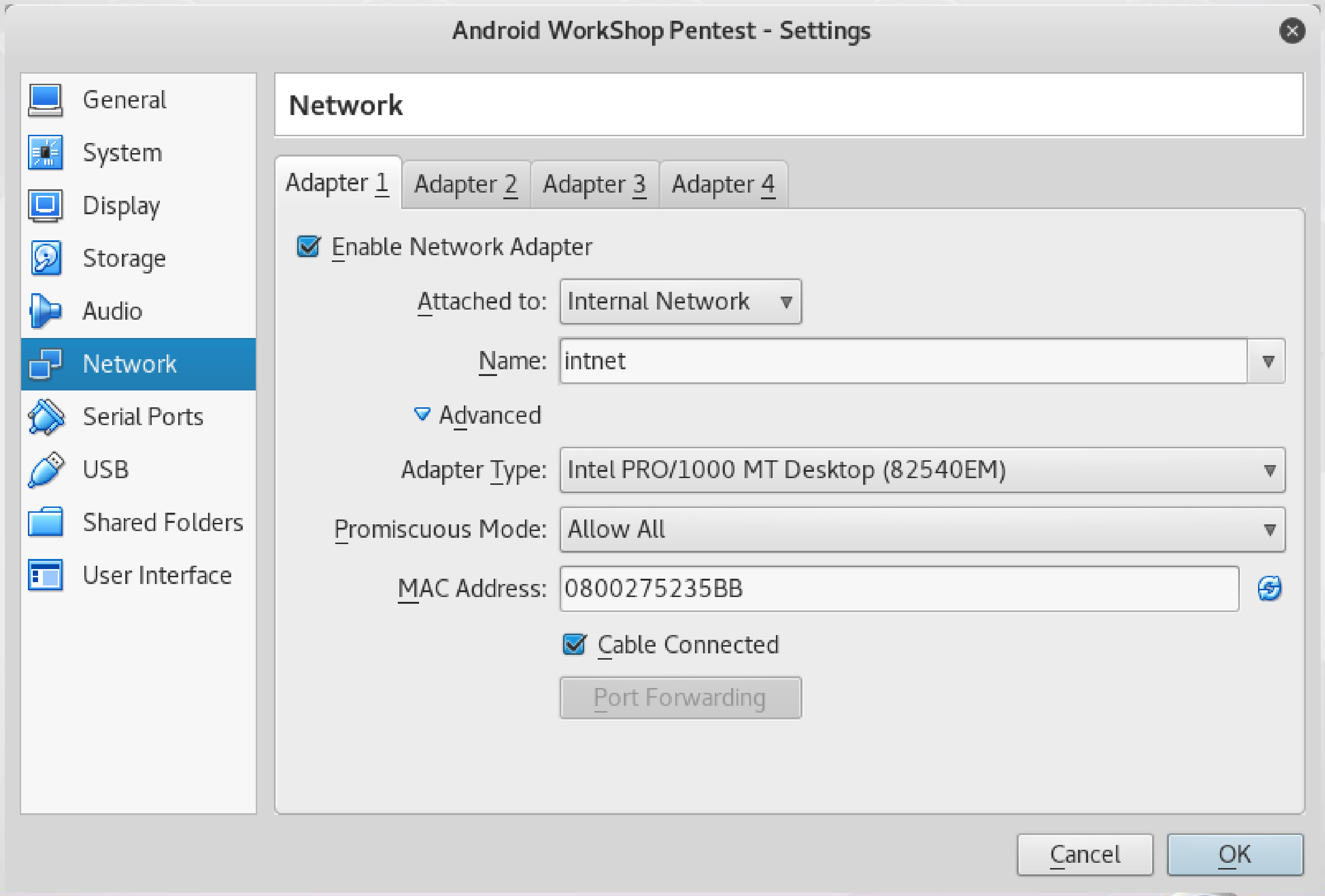
About

- What we will try to cover in the first session:
  - Setup of a Mobile Application Pentest Environment
  - Basics of Mobile Application Pentests
  - Common issues in Mobile Applications‘
- What we try to cover in the second session:
  - Advanced Mobile Application Pentesting
    - Removing smali code
    - Adding smali code

Setup

- You will need the following:
  - A laptop or any hardware that can run a VM
  - VM: Ubuntu 16.10 Yakkety(64bit).vdi
  - Android VM: Android-x86.5.1 rc1.vdi
  - Virtualbox (recommended)
  - Slides: https://docs.google.com/presentation/d/1owwDCtehvEZ4trdKoE7zPFeX52tNhhKOhSypr6Zcow8/edit?usp=sharing (goo.gl/e2rlzy)
  - Internet connection to google up things

VM Configuration - Network


Android WorkShop Pentest - Settings

Network

Adapter 1 | Adapter 2 | Adapter 3 | Adapter 4

☑ Enable Network Adapter

Attached to: Internal Network

Name: intnet

Advanced

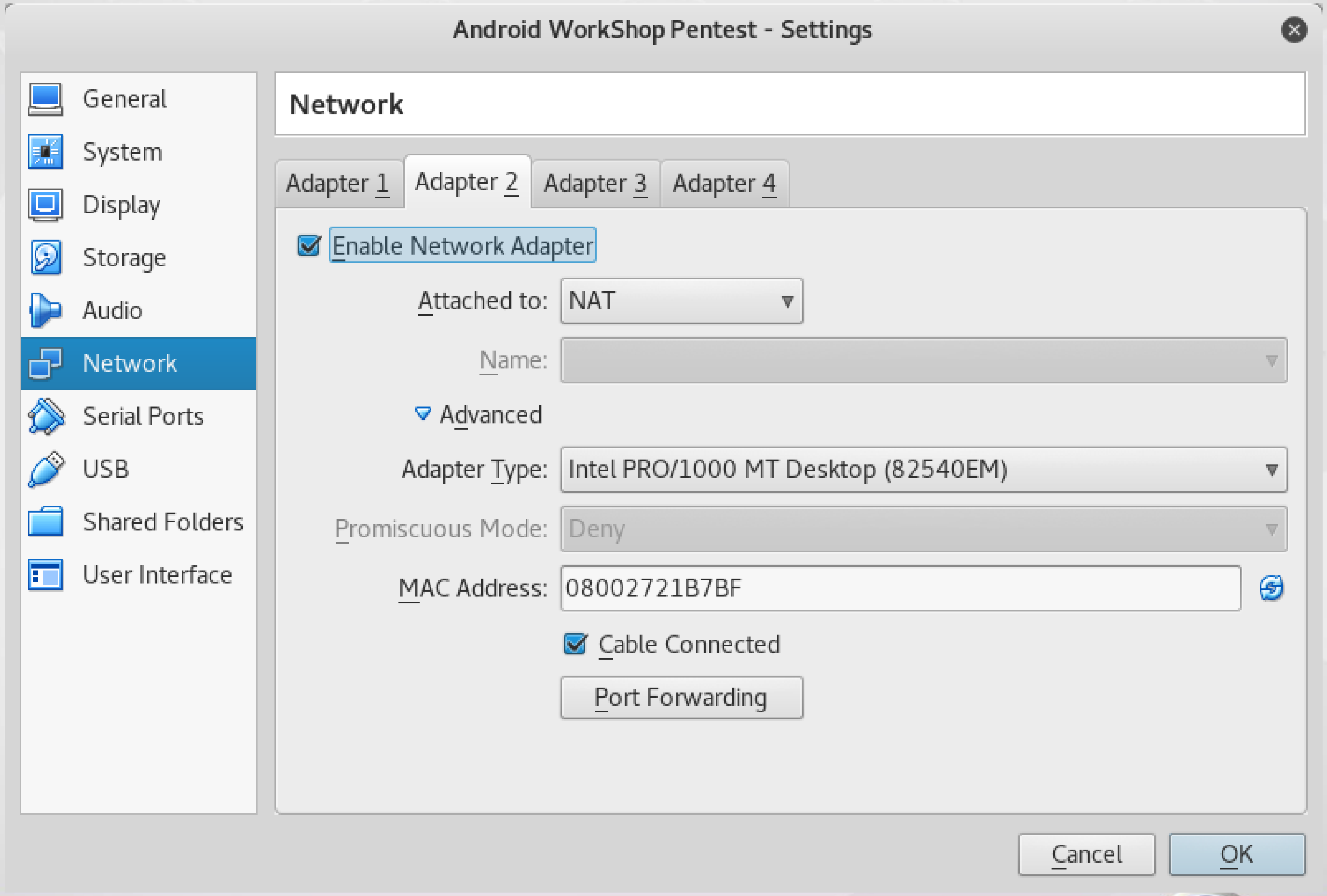
Adapter Type: Intel PRO/1000 MT Desktop (82540EM)

Promiscuous Mode: Allow All

MAC Address: 0800275235BB

☑ Cable Connected

VM Configuration - Network



Network

[✓] Enable Network Adapter

Attached to: NAT

Name:

Advanced

Adapter Type: Intel PRO/1000 MT Desktop (82540EM)

Promiscuous Mode: Deny

MAC Address: 08002721B7BF

[✓] Cable Connected

Virtualbox - Internal Network

- You might need to run the following on your host machine:

```
VBoxManage dhcpserver add --netname intnet --ip
10.13.13.100 --netmask 255.255.255.0 --lowerip
10.13.13.101 --upperip 10.13.13.254 --enable
```

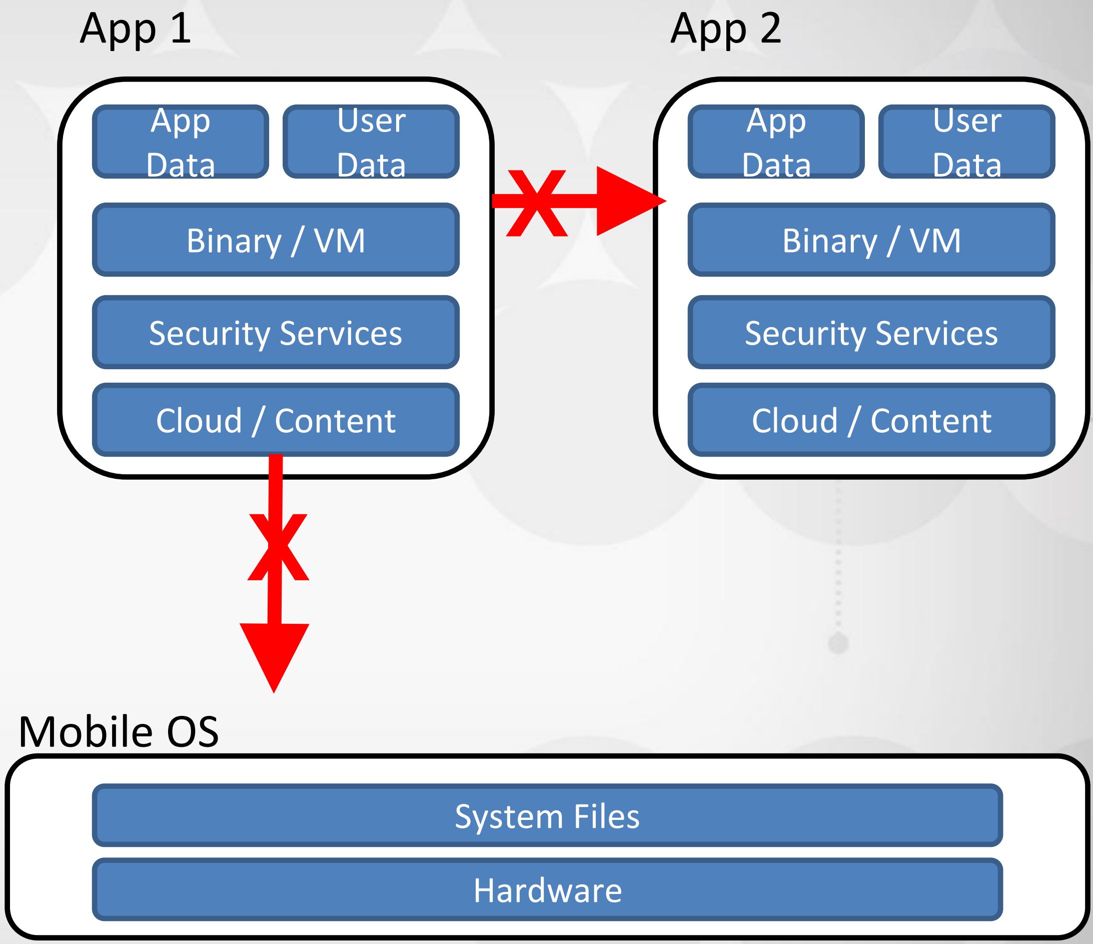
Android Internals

- Various versions by vendors
- 3rd party markets, self-install apps
- Sandboxing
- ASLR, DEP, Stack Canaries
- On demand permission model
- Security services
  - Keystore, Fingerprint, Smartlock
  - Device and storage encryption

SANBOXING

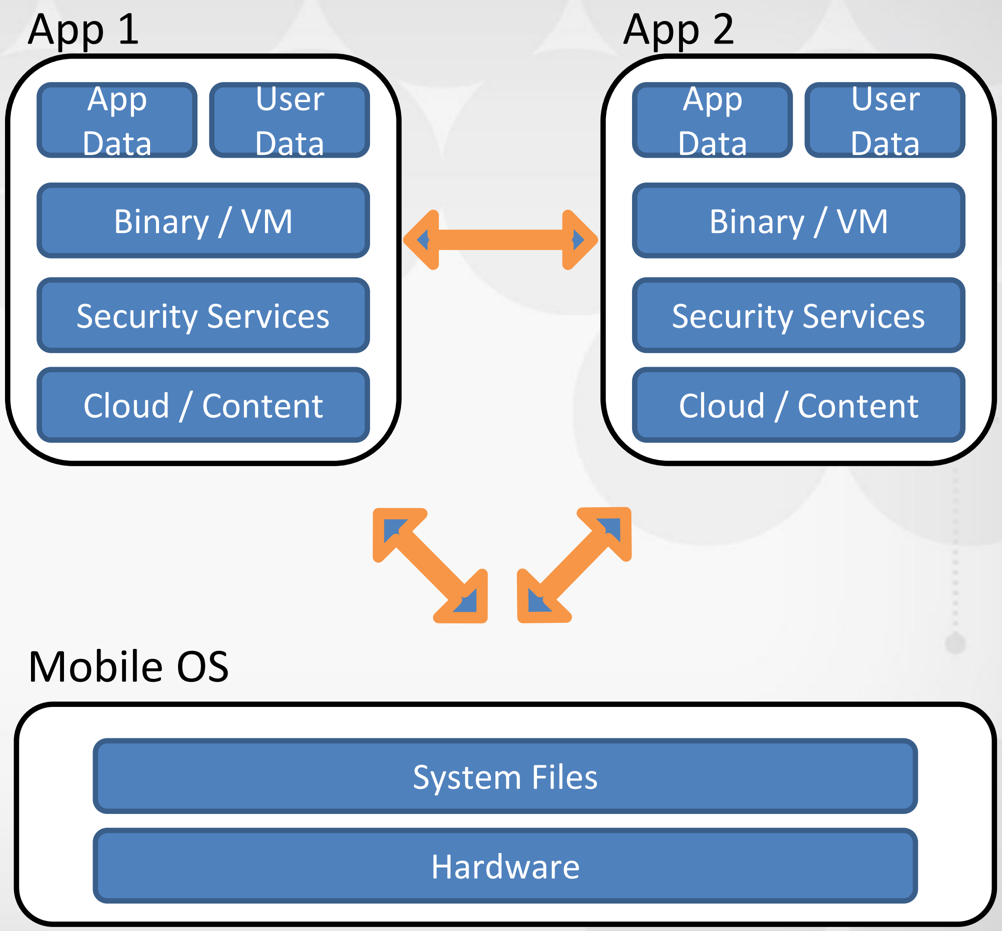
Access to
- App data
- Restricted filesystem
- Temp
- Security Services

No access to
- Other users' data
- Other apps' data
- System files
- Hardware

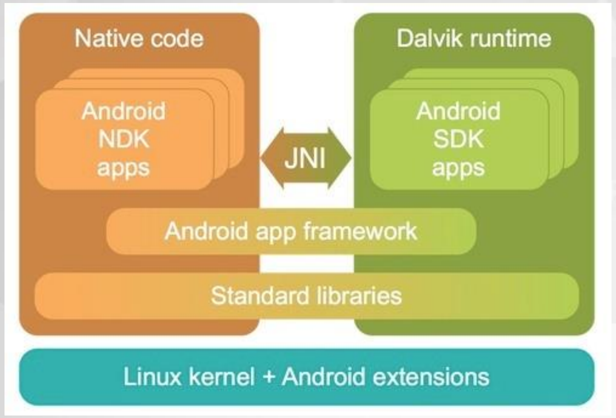


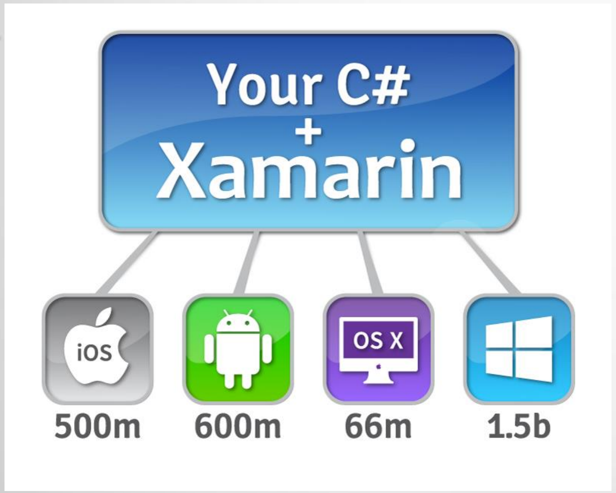
Inter-APP Communication

- Intents
  - ACTIVITY
  - SERVICE
  - BROADCAST
- Content providers



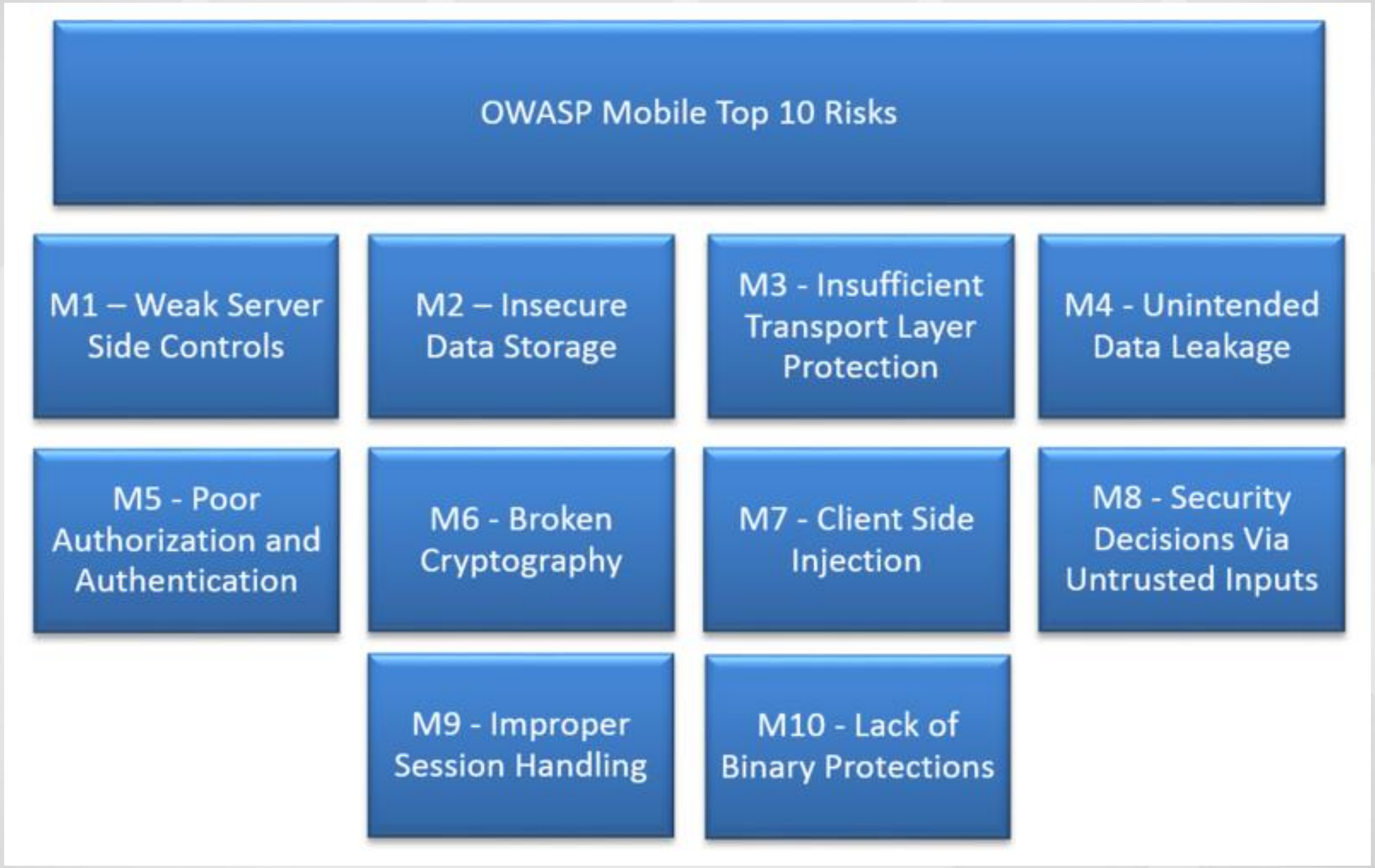
Virtual Machines



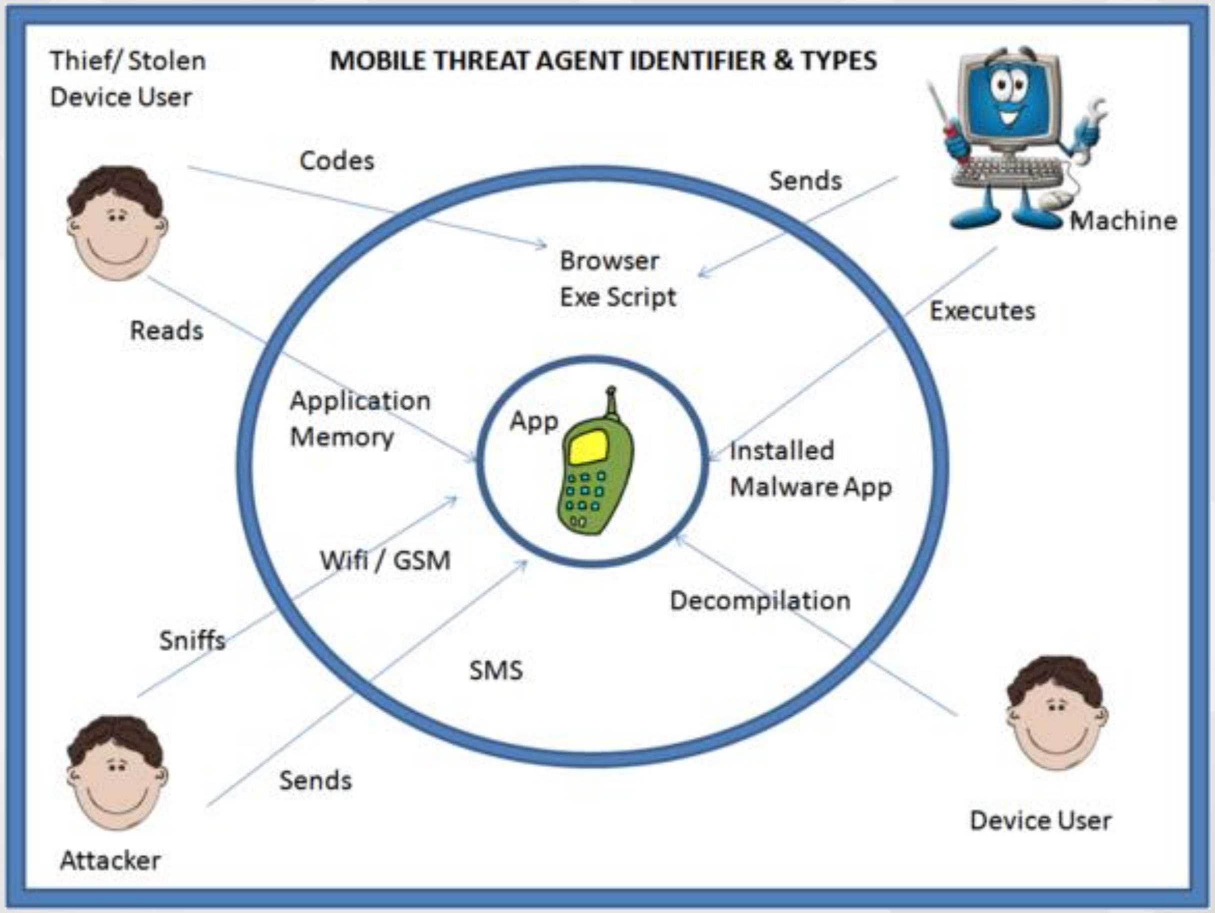


- Android Runtime (ART)
  - Replaced Dalvik VM
  - Apps have codes for both
- Xamarin Studio
  - Mono based VM for C#
  - Runs on iOS,Android & Win
- Apache Cordova
  - Framework for HTML & JS
  - Runs on iOS,Android & Win

OWASP Top 10 Mobile Risks


OWASP Mobile Top 10 Risks
M1 – Weak Server Side Controls
M2 – Insecure Data Storage
M3 - Insufficient Transport Layer Protection
M4 - Unintended Data Leakage
M5 - Poor Authorization and Authentication
M6 - Broken Cryptography
M7 - Client Side Injection
M8 - Security Decisions Via Untrusted Inputs
M9 - Improper Session Handling
M10 - Lack of Binary Protections

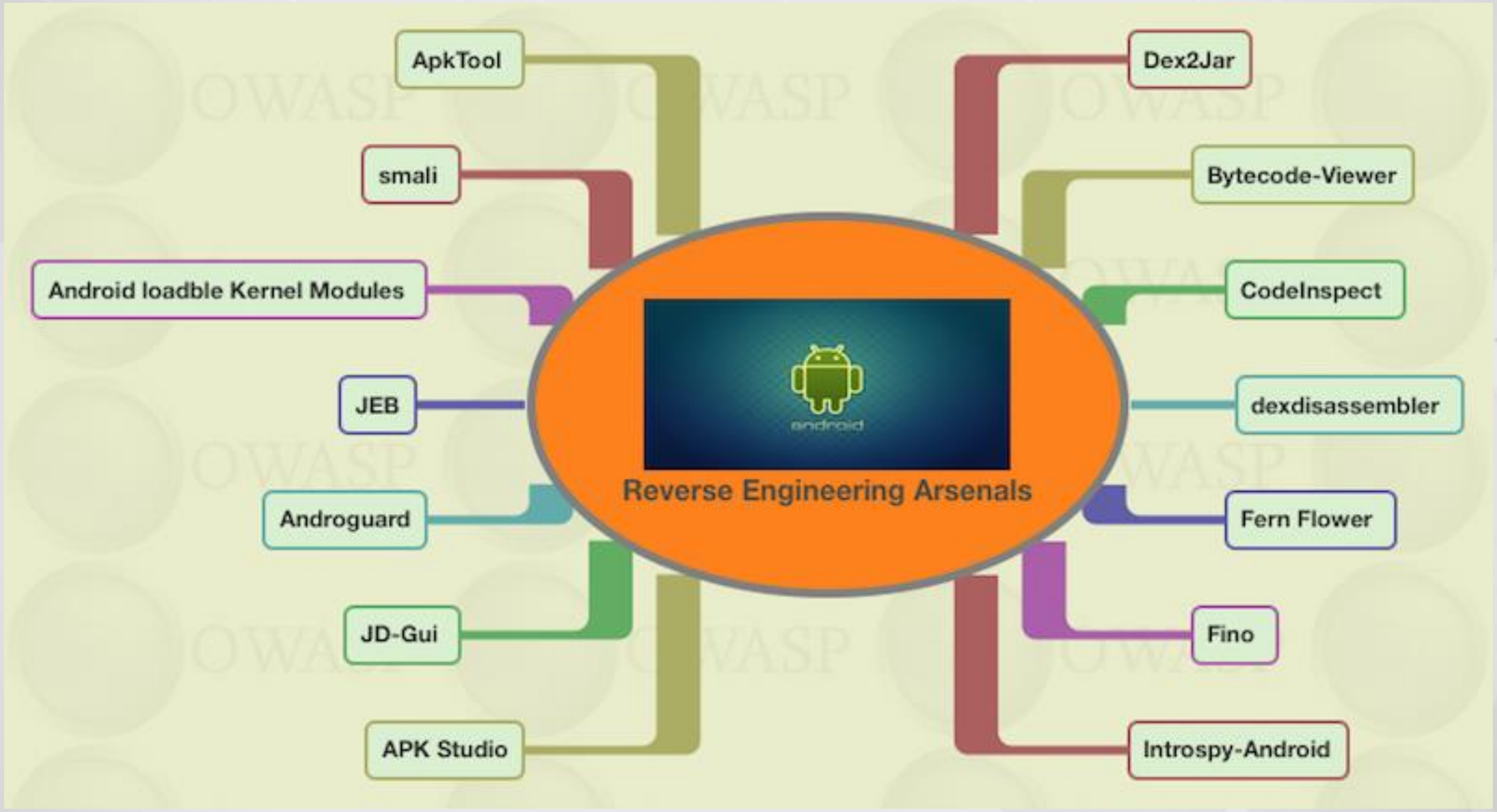
OWASP – Threat Model for Mobile



Common tools for android

- Latest Android SDK
  - Compilers and debugging tools
  - Viewers and analysers
  - Android virtual devices
- Androguard Assessment Tool
  - Anthony Desnos
  - https://github.com/androguard
- Drozer by MWR Labs
  - https://labs.mwrinfosecurity.com/tools/drozer
- Androbugs by Yu-Cheng
  - http://www.androbugs.com

Further OWASP recommended Tools



The Workshop VM

- Your VM comes with several pre-installed tools such as:
  - Android Studio
  - apktool
  - dex2-jar
  - JD-GUI
  - Jarsigner
  - drozer
  - and others

The Mobile Application

- GIT: https://github.com/OWASP-Ruhrpott/owasp-workshop-android-pentest
- Android
  - applicationId "ruhrpott.owasp.com.vuln_app_1"
  - compileSdkVersion 23
  - minSdkVersion 22
- 10 challenges/vulnerabilities (so far)

About Android Applications

- Android apps are compiled into .dex (Dalvik Executable) files which are then packed (archive)
- It might be possible to „reverse“ dex into Java code

=> However, you cannot recompile it back to an app (normally)

- AndroidManifest.xml: Contains information about the application such as needed permissions, needed android version and others
- /res: Resources (e.g. Images) and certain XML configurations can be placed in this directory

Task 1 – „Get used to the tools“

- Power On your VMs
- Open „OWASP Ruhrpott Workshop App“ in your Android VM and open the „Get used to the tools page“

1. Download the application from the device [adb]
2. Get the smali code [apktool]
3. Try to decompile the source code [dex2jar, JD-GUI]

Side note: run “adb connect <android IP>” first

[10 min]

OWASP
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Task 1 - Commands

Command	Comment
adb shell	Android Debug Bridge (adb) is a command line tool that lets you communicate with an emulator or connected Android device. 'shell' is used to spawn a shell for further actions
pm list packages	list installed packages
adb pull /data/app/ruhrpott.owasp.com.vuln_app_1/base.apk .	download APK file to current folder
d2j-dex2jar.sh base.apk	retrieve dex files from apk
java –jar jd-gui-1.4.0.jar base-dex2jar.jar	graphical interface to browse source code
java –jar apktool_2.2.0.jar d base.apk	retrieve dex files and decode resources

How to proceed

- You will notice that the code is obfuscated – unfortunately this is very common and a default configuration in Android Studio
- Task: Try to identify the MainActivity Class and how „fragments“ are loaded

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- You will notice that the code is obfuscated – unfortunately this is very common and a default configuration in Android Studio
- Task: Try to identify the MainActivity Class and how „fragments“ are loaded

- You will notice that the MainActivity Class uses fragments and that each page of the application is labelled with a number (0-X). Now you know which class belongs to which page

Side Note: Feel free to have a look at the source code (https://github.com/OWASP-Ruhrpott/owasp-workshop-android-pentest)

Task 2 – „Hidden Things“

- Strings are not always referenced in a class
- Your task is to identify the difference between dex2-jar and apktool

[5 min]

Task 2 – Commands

Command	Comment
java –jar apktool_2.2.0.jar d base.apk	retrieve dex files and decode resources
Open values.xml in AppFolder/res/values/strings.xml	
Look for „superhiddenstring“	

- Apps used this technique as part of obfuscation and/or to hide encryption keys

Task 4 – „Logcat Output“

*“**Logcat** is a command-line tool that dumps a log of system messages, including stack traces when the device throws an error and messages that you have written from your app with the Log class. This page is about the command-line **logcat** tool, but you can also view log messages from the **Logcat** window in Android Studio.”*

- Developer often use this feature to retrieve debug output
  - Side Note: Sometimes you can activate the „debug“ privilege within the AndroidManifest.xml to retrieve logcat messages, as this is just deactivated in production releases
- Your task: Get familiar with logcat and use its filter feature to find the „specific“ logcat message

[5 min]

Task 4 – Commands

Command	Comment
adb logcat –s „owasp-key“	filters for logcat messages with the tagname „owasp-key“

Task 3 – „Basic HTTP Request“

- Please change the network settings of the Android VM to 1 active adapter (NAT)

[5 min]

Task 3 – Commands

Command	Comment
Set Android proxy to burp	
Sniff traffic via burp	

Task 5 – „Basic HTTPS Request“

- Please change the network settings of the Android VM to 1 active adapter (NAT)

[5 min]

Task 5 – Commands

Command	Comment
Set Android proxy to burp	
Install burp root CA	
Sniff traffic via burp	

Undo Network configuration

Android - Intents

"An intent is an abstract description of an operation to be performed. It can be used with startActivity to launch an Activity, broadcastIntent to send it to any interested BroadcastReceiver components, and startService(Intent) or bindService(Intent, ServiceConnection, int) to communicate with a background Service.

An Intent provides a facility for performing late runtime binding between the code in different applications. Its most significant use is in the launching of activities, where it can be thought of as the glue between activities. It is basically a passive data structure holding an abstract description of an action to be performed."

Drozer

drozer allows you to search for security vulnerabilities in apps and devices by assuming the role of an app and interacting with the Dalvik VM, other apps' IPC endpoints and the underlying OS.

drozer provides tools to help you use, share and understand public Android exploits. It helps you to deploy a drozer Agent to a device through exploitation or social engineering. Using weasel (MWR's advanced exploitation payload) drozer is able to maximise the permissions available to it by installing a full agent, injecting a limited agent into a running process, or connecting a reverse shell to act as a Remote Access Tool (RAT).

- https://github.com/mwrlabs/drozer

Task 6 – „Authorised Area“

- You will be asked for a password on this page
- Task: Circumvent the password check in order to view the „authorised“ Area of the application

- Side Note: There are several ways to solve this – In this case you should try to use drozer

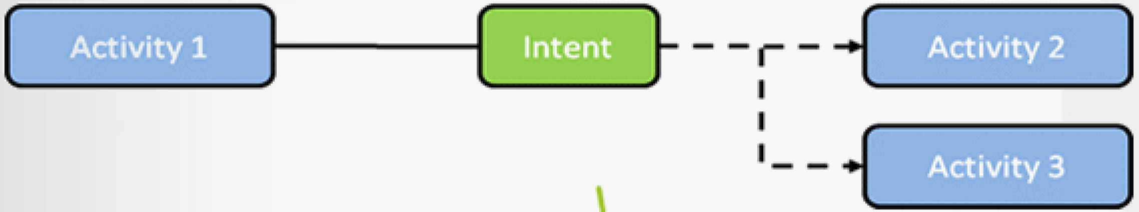
[10 mins]

Task 6 – Commands

Command	Comment
Execute drozer.apk	Starts drozer Agent
adb forward tcp:31415 tcp:31415	Forwards tcp traffic between emulator/device and your system
drozer console connect	Connect to drozer interface
run app.package.list	List all installed packages
run app.package.info –a ruhrpott.owasp.com.vuln_app_1	General Information about the app
run app.package.manifest ruhrpott.owasp.com.vuln_app_1	Leaks manifest and available intents
adb shell	
am start –a „ruhrpott.owasp.com.vuln_app_1.loggeddin“ – t „text/plain“	

Task 7 – „Auth Brute“

- You have probably noticed in the last task that another intent is exposed by the application
- Task: Brutefoce the login via the intent



[15 min]

Task 7 – Commands

Command	Comment
adb shell	start shell
am start –a „ruhrpott.owasp.com.vuln_app_1.auth“ –e „x“ „91337“ – t „text/plain“	Launch intent with extras (parameter)

END OF SESSION 1