Android Application Sandbox

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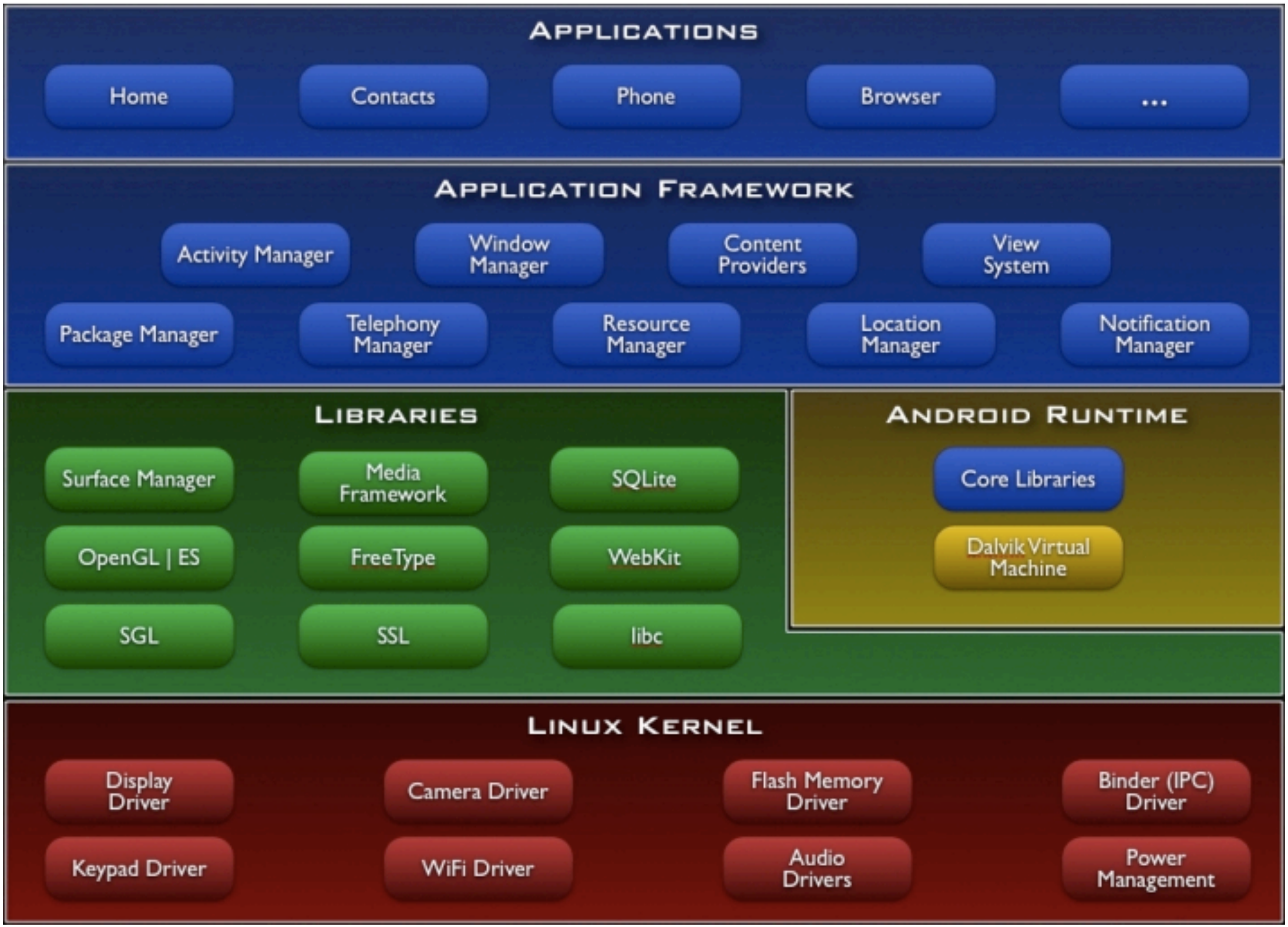
Agenda

- Introduction
  - What is Android ?
  - Malware on smartphones
  - Common countermeasures on the Android platform
- Android Application Sandbox
  - Use-Cases
  - Design
  - Conclusion
- Summary
  - Future work / Bibliography

What is Android?

- mobile OS based on a Linux 2.6 kernel
- initially developed by Google, later by the Open Handset Alliance (OHA)
- open source (Apache license) since oct 2008
  - some drivers for special mobile hardware are still not free
- official supported platform is ARM
  - but there is a port for x86 platforms
- Dalvik VM
  - register-based VM for Java
- still growing (online-)community

What is Android? (technical view)



source: http://www.techflare.com.au/media/102-android%20-%20system-architecture.jpg

Malware on smartphones

- interesting topic
- paper „Android: Next Target?“
  - Schmidt et al
- smartphones getting more and more popular
- 2 main categories of attacks:
  - direct attacks, e.g. bypassing permissions system
  - indirect attacks, e.g. information leakage
- users doesn‘t realize that most smartphones are like normal desktop PCs

Common counteractive measures on Android

- each application process is separated in an own sandbox-like environment
- strict permissions system
  - you have to explicitly grant permissions before installing the application
- all applications have to be signed
  - but signatures do not need to be certified by a trustworthy organization
- there are some Anti-Virus applications on the market
  - but just signature based detection

Problems on Android Security

- ability of using the Java Native Interface (JNI) to speed-up applications
  - bypass SDK restrictions and normal application lifecyle
  - Google provides NDK (Native Development Kit)
- rising amount of Applications for „rooted“ Android phones
  - this applications could have **COMPLETE** control over the mobile device (root access)
- ability to access internal Android packages via reflection
  - access on not officially supported API content
- Security on Android is an issue!

- Android Application Sandbox
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Use-Cases for AAS

(i) Application Provider (e.g. Android Market)

- detect malware to prevent submission to the market
- improve techniques for Anti-Virus Software

(ii) User

- wants to know what the Application is exactly doing on the phone
- e.g. access personal data although App didn‘t have the permission

Design of the AAS

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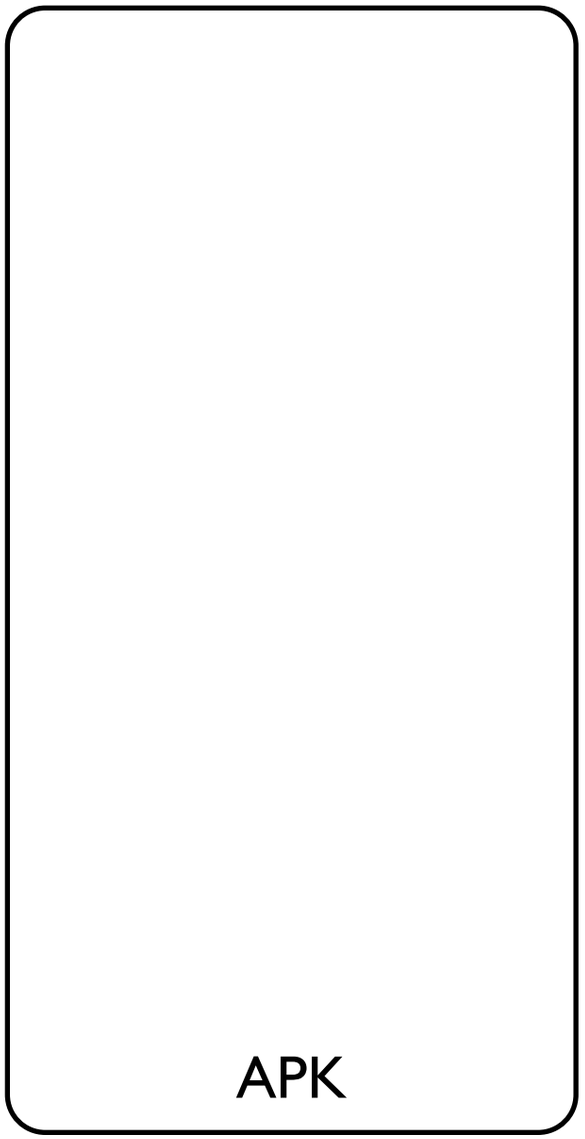

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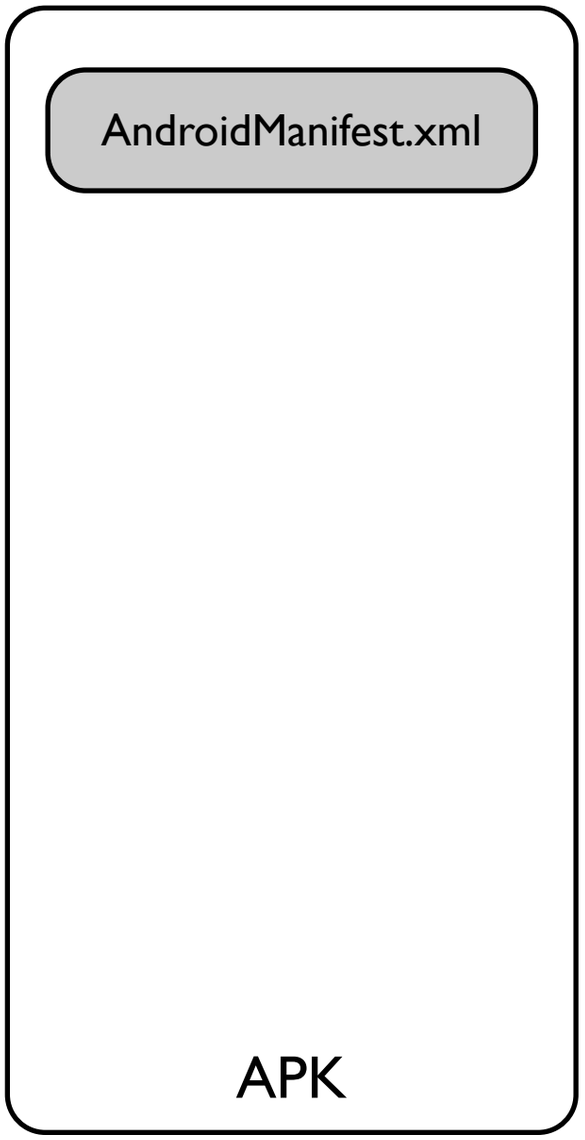

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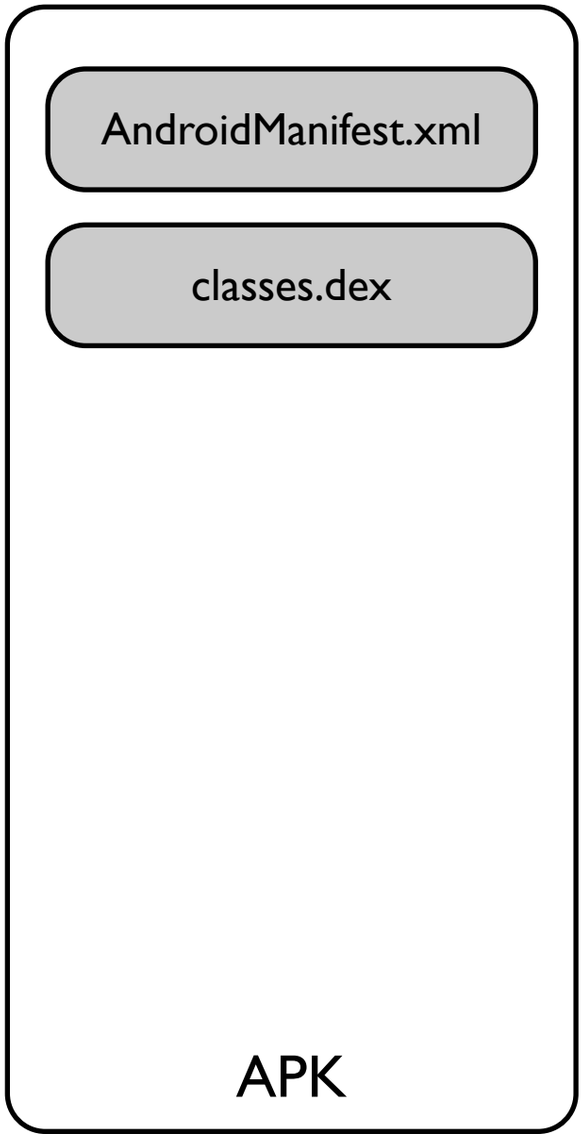

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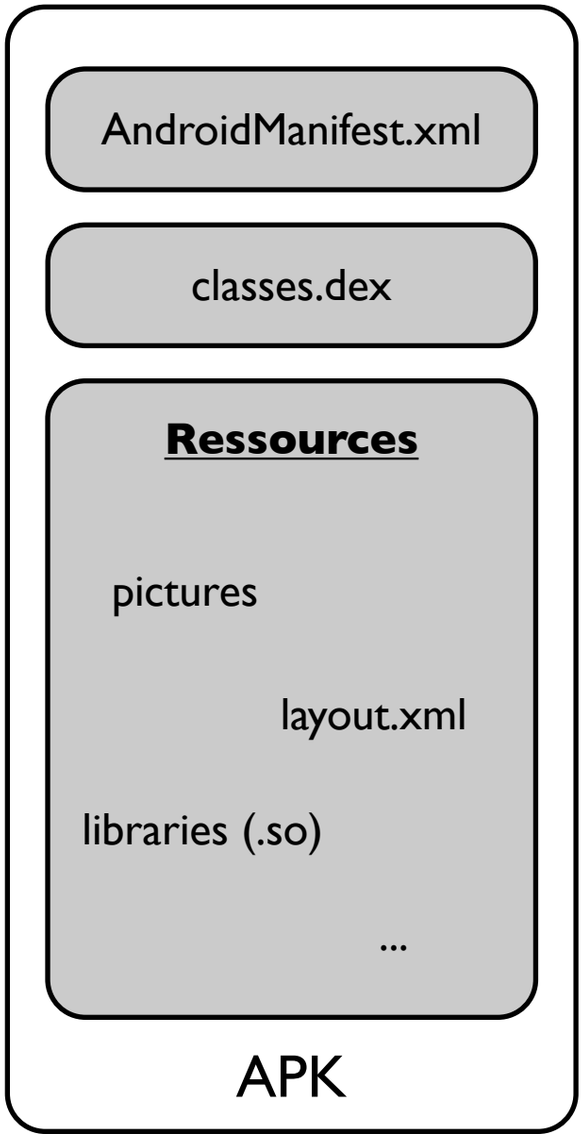

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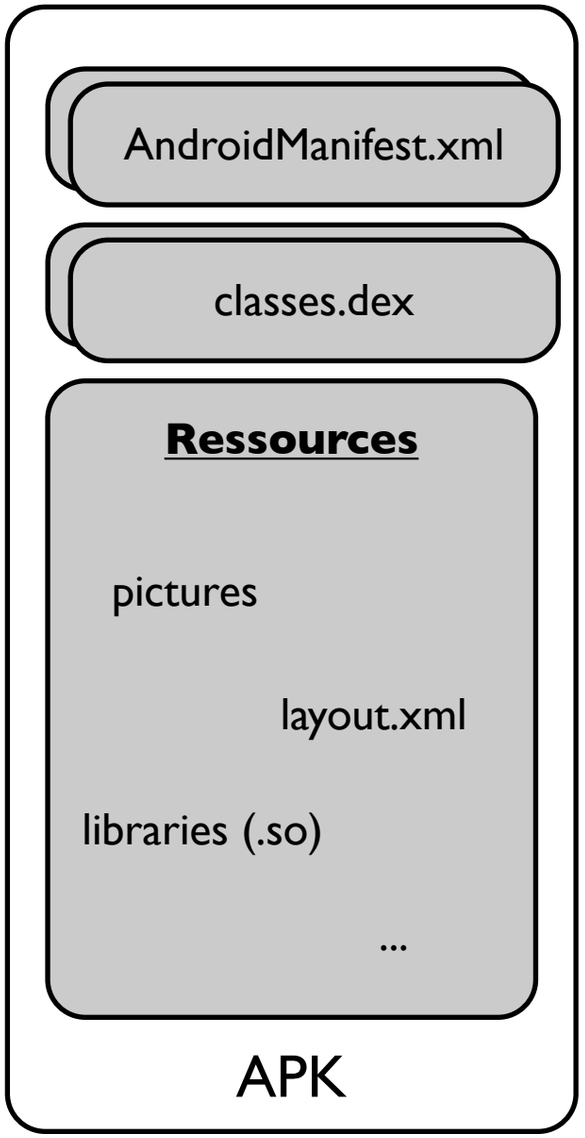

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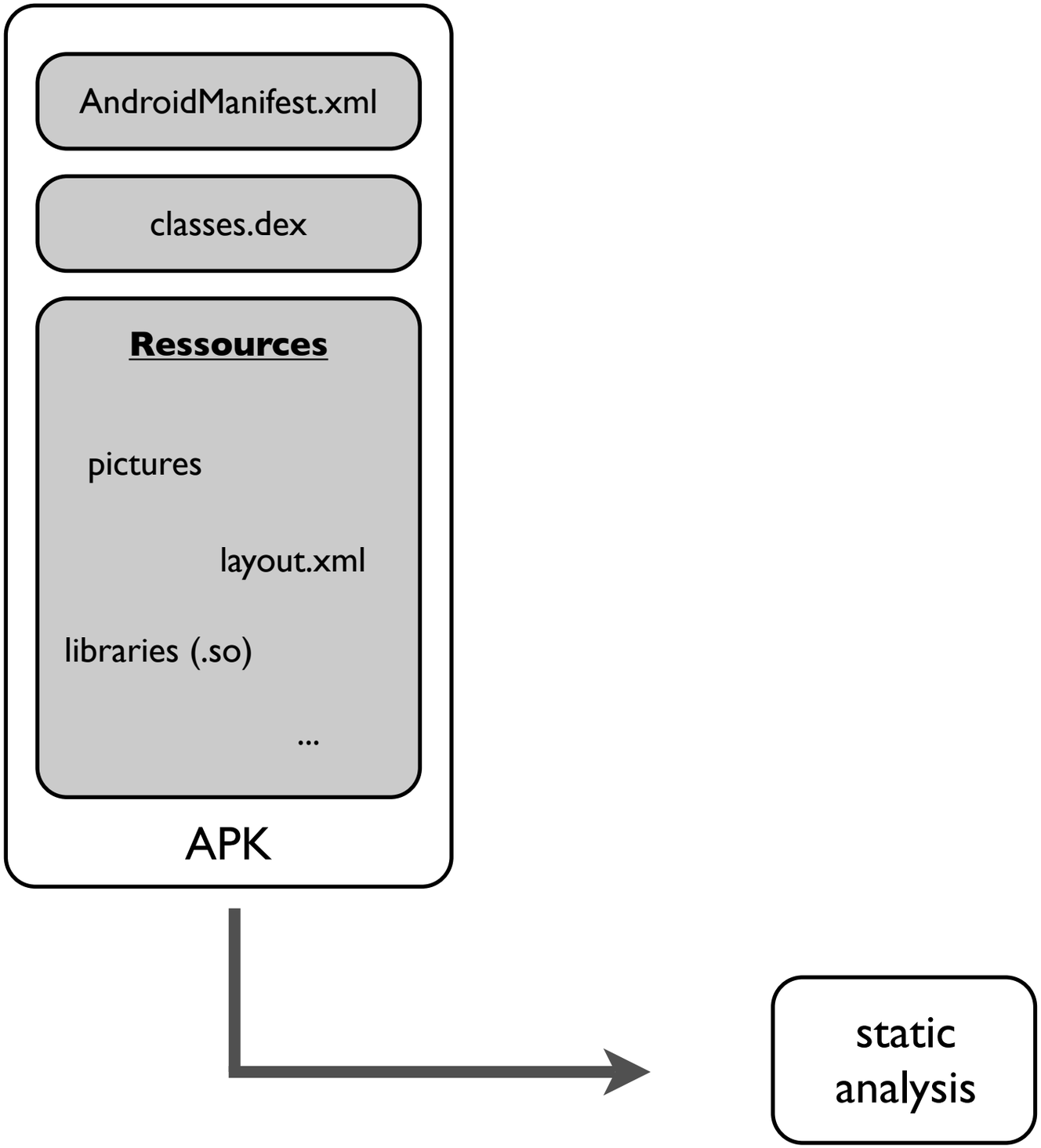

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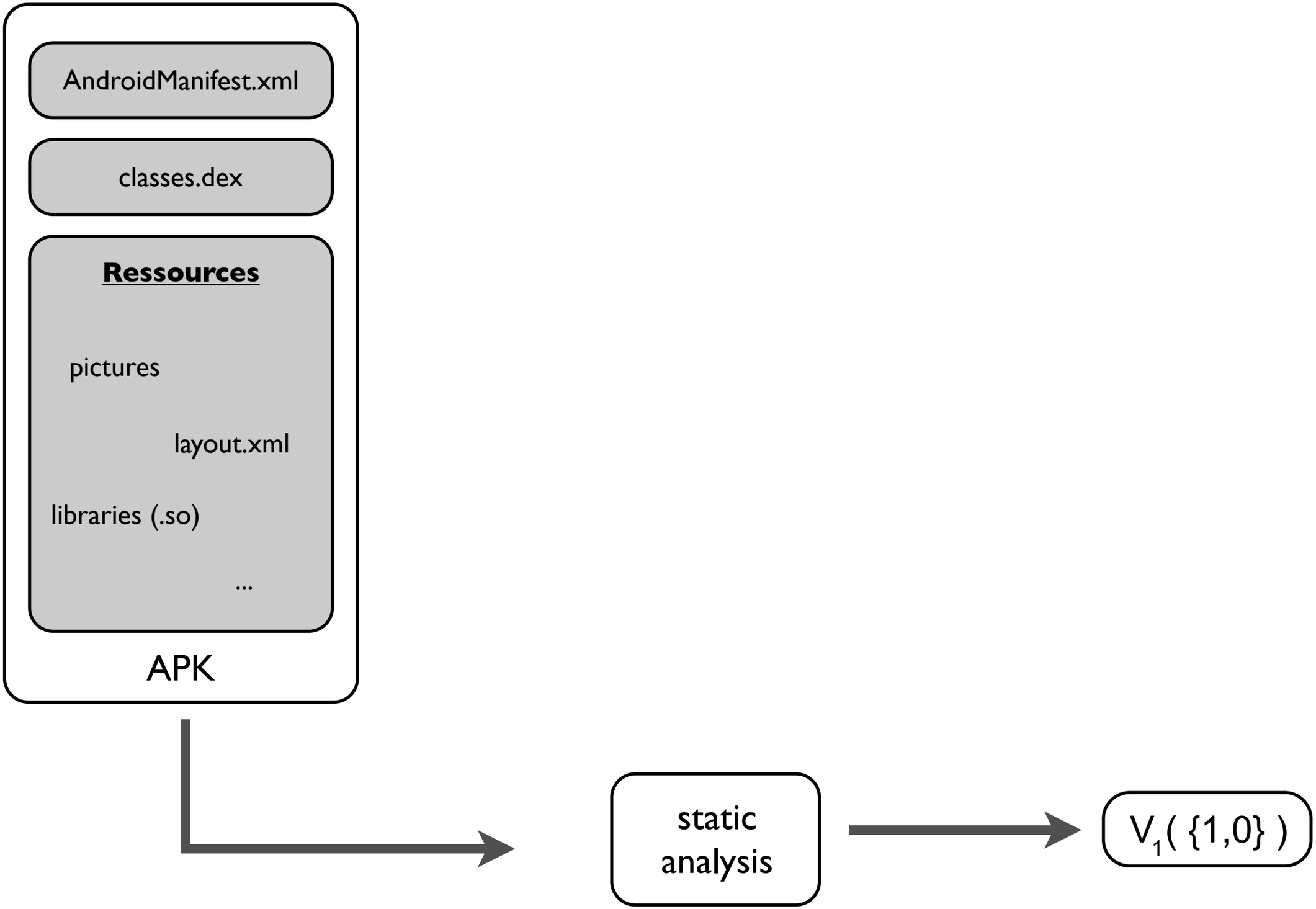

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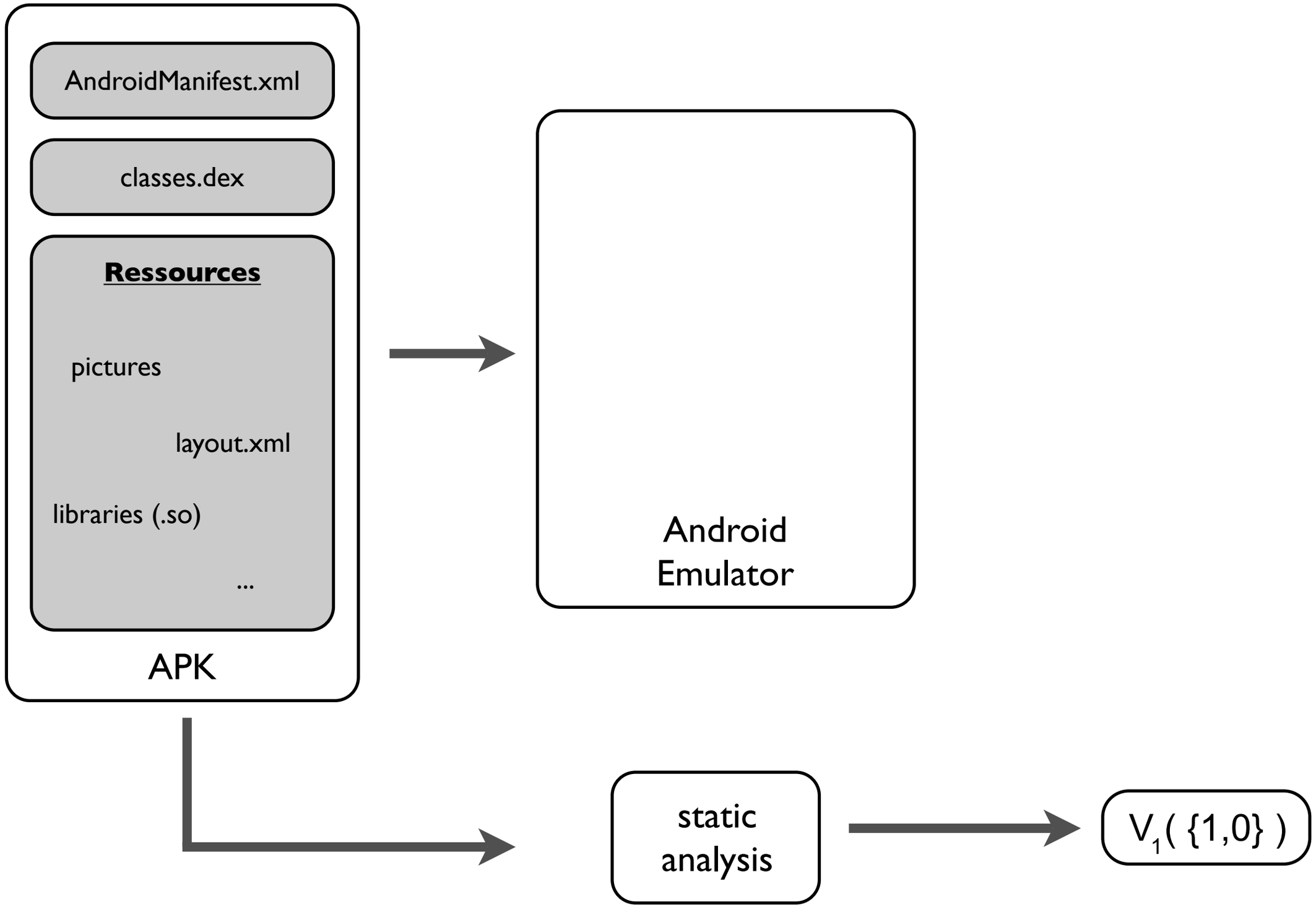

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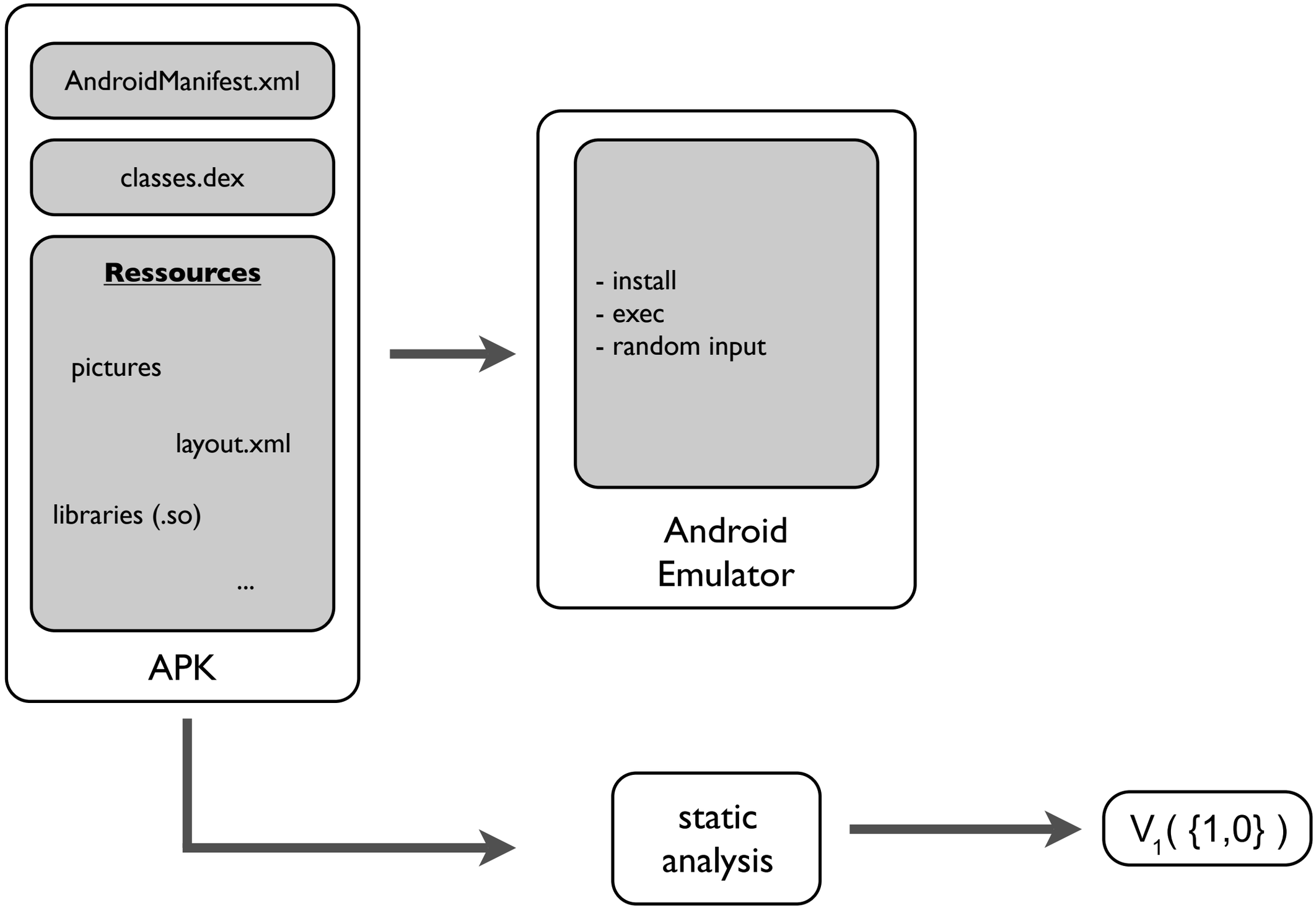

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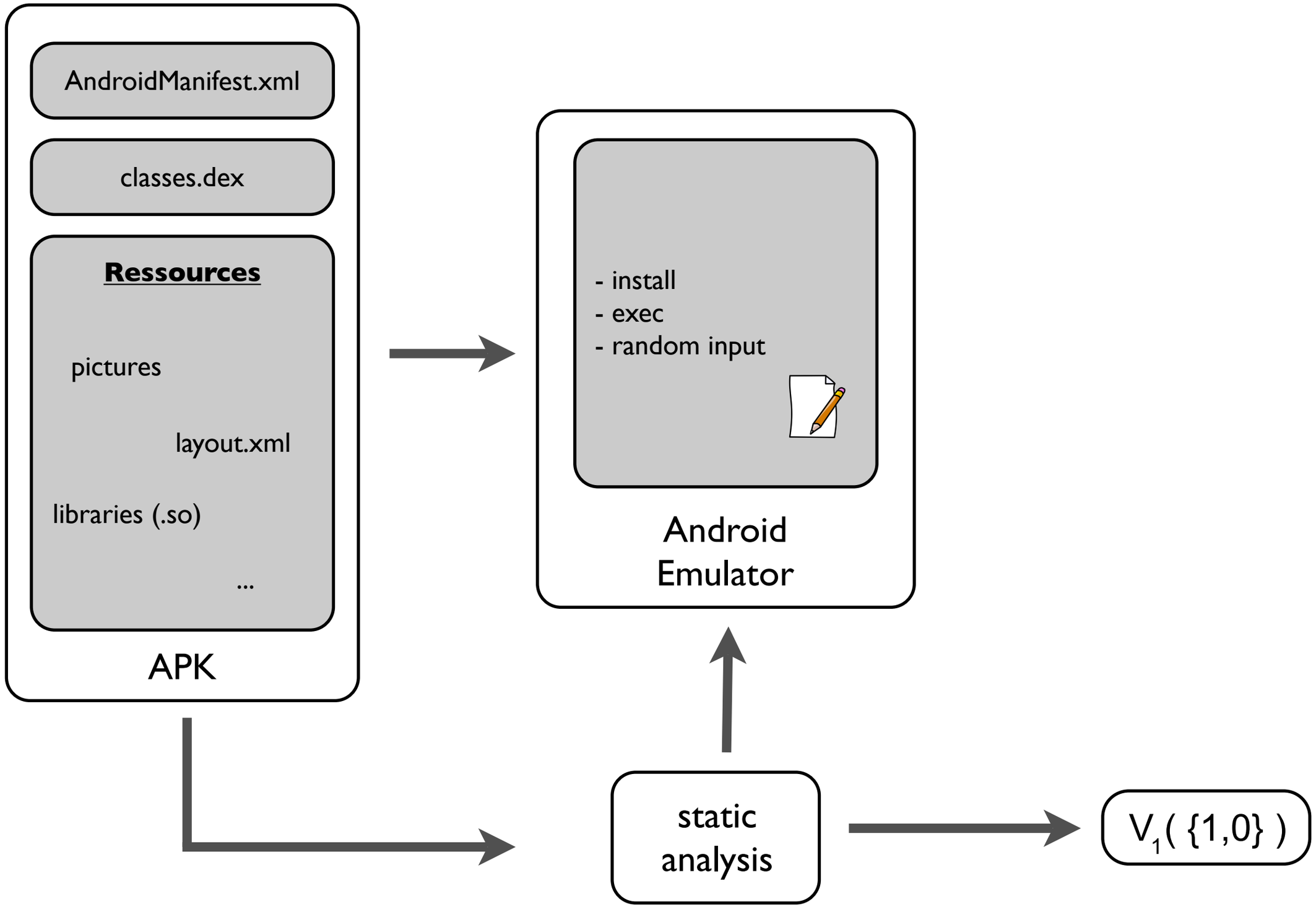

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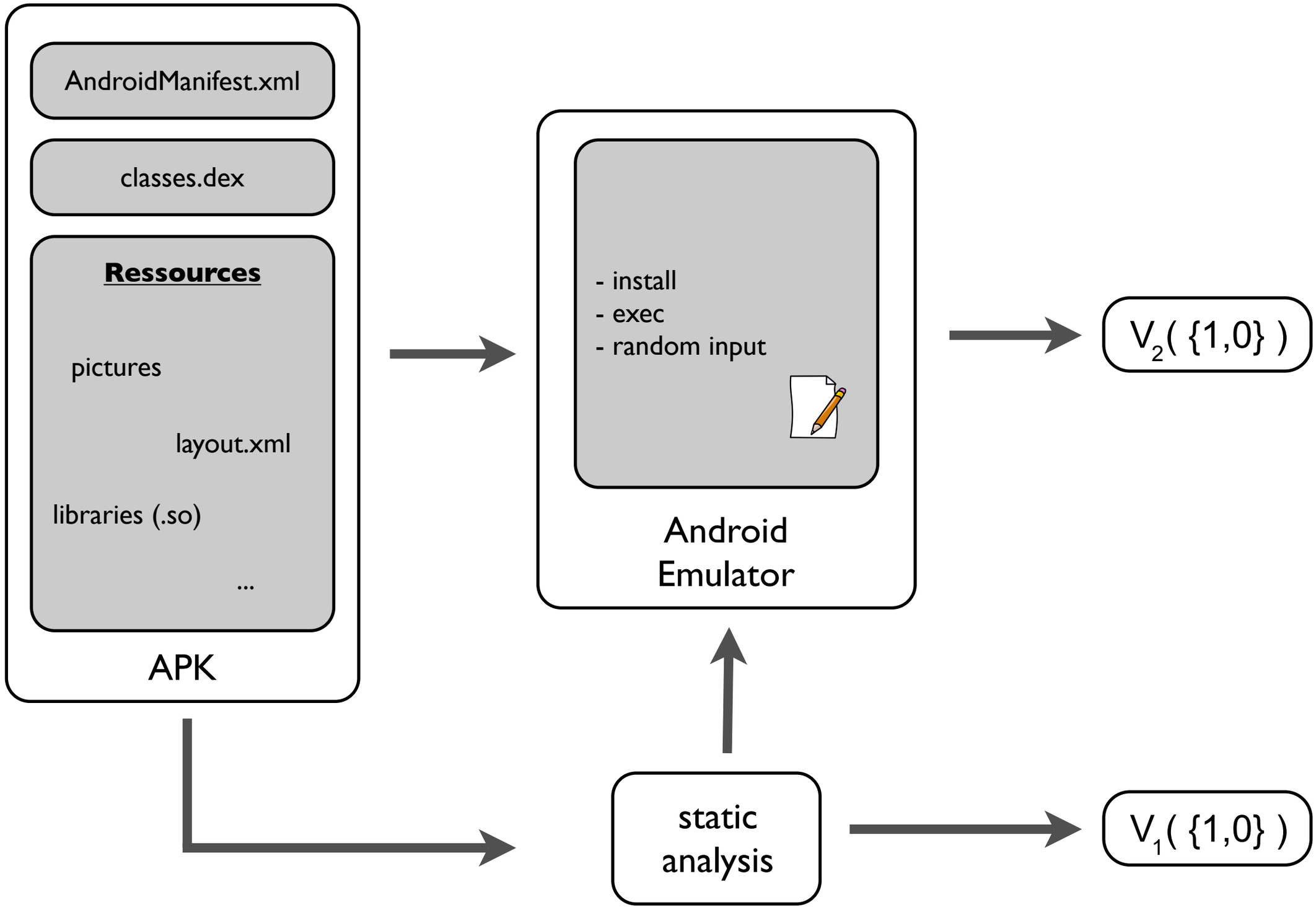
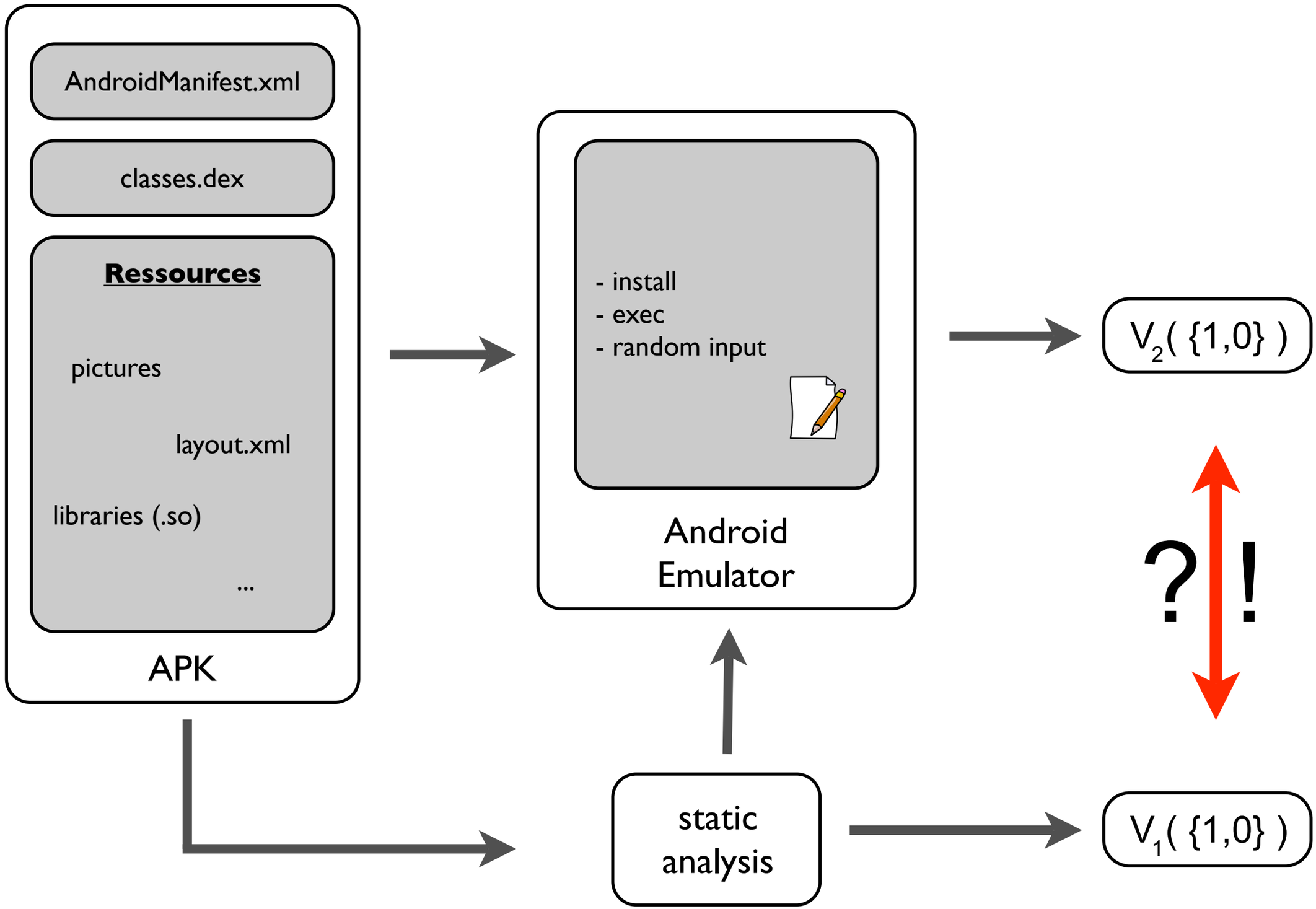


Design of the AAS



Design of the AAS (2)

- first step done via ‚disassemble' and ‚grep'
  - disassemble of .dex file with baksmali (http://code.google.com/p/smali/)
- second step, LKM which hijacks some syscalls
  - LKM acts like a rootkit
  - logging of syscall usage into logfile which will be analysed after execution time

Conclusion / Thesis

- 2 step analysis
  - Does the result of the static analysis imply the result of the dynamic analysis ?
- first step **really** fast
- second step very **expensive**
- consider the 2 Use-Cases! (User/AppMarket)
  - Do you always need the 2 steps or just one of them, and if so: which one ?
- to prove thesis I need a **lot** of applications
  - Problem: Google AppMarket closed source, no direct access, only via mobile phone
  - I wrote a robot which has downloaded ~150 APKs for researching :)

- Summary
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Future Work

- better reverse engineering of mobile applications
- real-time malware detection on smartphones
  - anomaly detection possible with AAS, but actually not in real-time!
- Android Honeypot
  - Honeynet

Bibliography

- MOBILE APPLICATION SECURITY ON ANDROID: Context on Android security (Burns, Black Hat 2009)
- Smartphone Malware Evolution Revisited: Android Next Target? (Aubrey-Derrick Schmidt et al., 4th International Conference on Malicious and Unwanted Software (Malware 2009), Montreal, Quebec, Canada - to appear)
- Developing and benchmarking native linux applications on android. (Leonid Batyuk et al., In mobile Wireless-middleware, Operating Systems, and Applications, 2009)

End

thanks
for your
attention