

Privacy Consistency Analyzer for Android Applications

SAYAN MAITRA

BOHYUN SUH

SEPIDEH GHANAVATI

TEXAS TECH UNIVERSITY

AUGUST 20, 2018



Table of Contents

Motivation

Problems Identified

Example of UID Vulnerabilities

Related Work

Privacy Consistency Methodology

Functionalities of *Privacy Consistency*

Privacy Consistency Screenshots

Results

Limitation

Conclusion

Future Work



Motivation

- Smartphones are a necessity.
- 86.1 % of smartphones are Android devices.
- Almost 3.8 million Android applications exist.
- Privacy?



Problems Identified

- Consistency between Android Applications and Privacy Policy
 - Permissions follow privacy policy?
 - Redundant permissions?
 - Proper definition of permissions?
 - No Privacy policy!
- UID – User ID



Example of UID Vulnerabilities

GPSTracker

- Location Data
- UID - 12345

GameFree

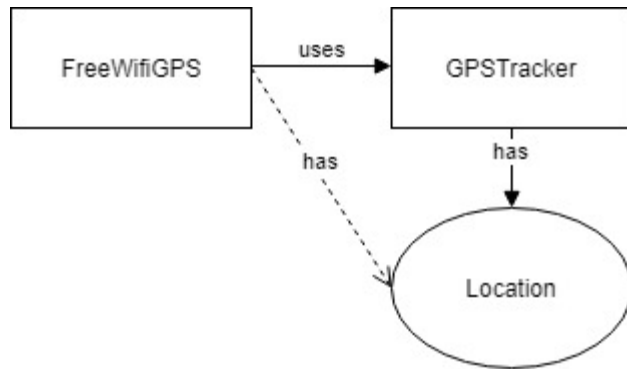
- Internet Access
- UID - 12345

FreeWifiGPS

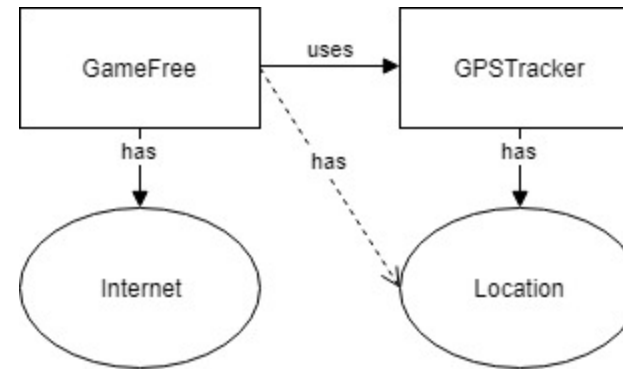
- Location data
- UID - 12346



Example of UID Vulnerabilities (Contd.)



Direct permission →
Indirect permission ->



Direct permission →
return ->



Related Work

Proposed Methodology	Proposed Approach	Reference
Proposed a methodology called Eddy, a privacy requirements specification as part of software development process	<ul style="list-style-type: none">• Eddy maps requirement from natural language to a formal language• Checks consistency among the privacy policies and traces any changes/conflicts	Breaux et al.
Proposed a semi-automated framework and tool called PVDetector (Privacy Policy Violation Detector)	<ul style="list-style-type: none">• Helps detecting the privacy policy violations caused by inconsistencies between the privacy policy and corresponding source code• Maps phrases in privacy policy to the related API calls in implementation	Slavin et al.



Related Work (contd..)

Proposed Methodology	Proposed Approach	Reference
Proposed a tool named PScout to help analyzing the permission system of Android OS	<ul style="list-style-type: none">• Found out redundancies in permission specification• Restricting apps to use only documented APIs would make 22% of non-system permissions unnecessary	Au et al.
Proposed a tool called KAPUER	<ul style="list-style-type: none">• Helps the users manage privacy policies of applications in Android• Shows information about most requested permissions and list of last permissions requested	Oglaza et al.

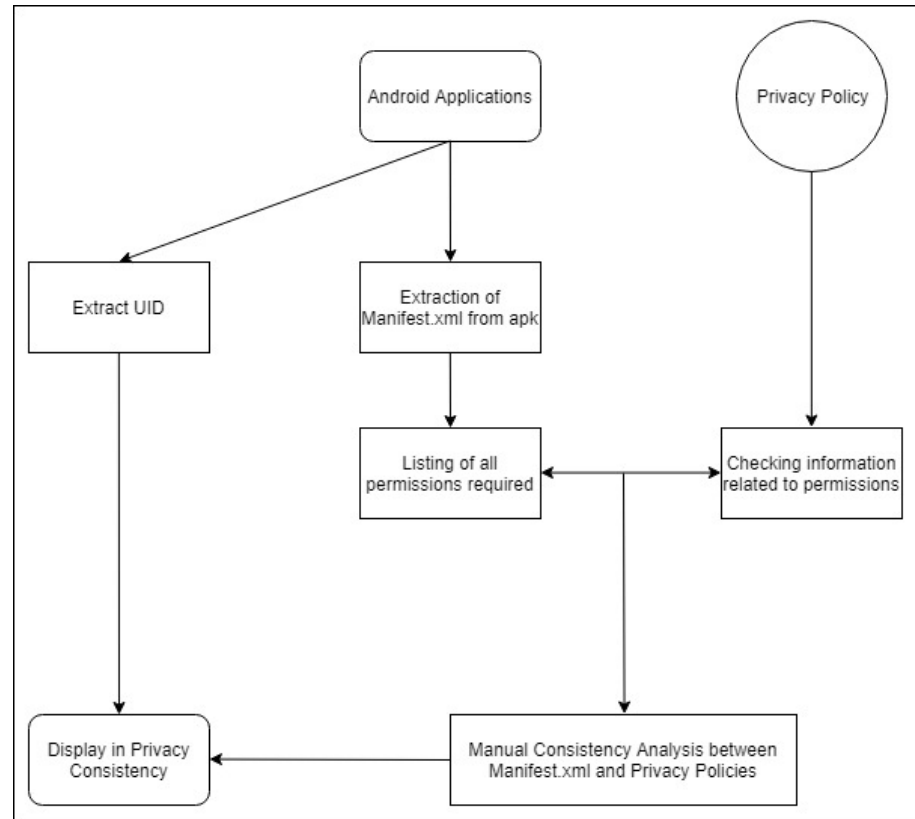


Functionalities of *Privacy Consistency*

- Displays all installed applications.
- Displays all permissions.
- Displays permission details.
- Displays UID.
- Displays manual analysis results.



Privacy Consistency Methodology



Privacy Consistency Methodology (contd..)

- Privacy Policy Analysis

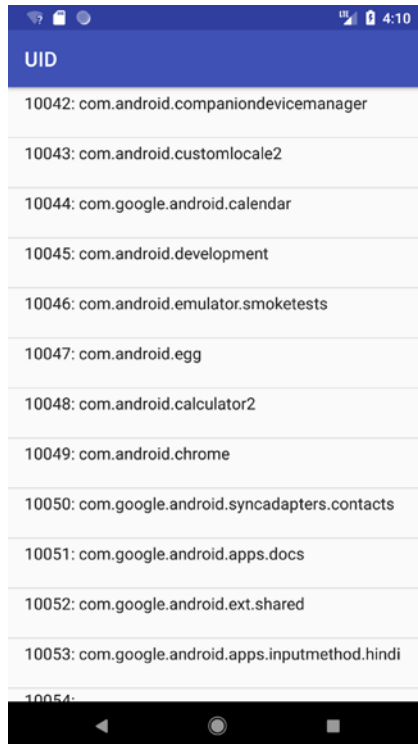
- #D (Definition): What data, privacy and security means
- #A (Action)*: Information about data practices and user's choices
- #F (Fact): Compliance of the device with legal privacy rules
- #NR (Nonrelevant): Parts of privacy policy which is not categorized
- #CR (Cross References): Links to other pages

Mapping

- UID Extraction
- Permission Extraction
- Consistency Analysis

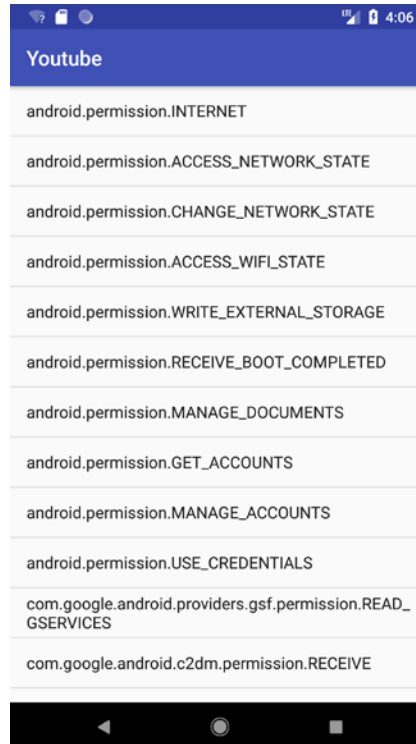


Privacy Consistency Application



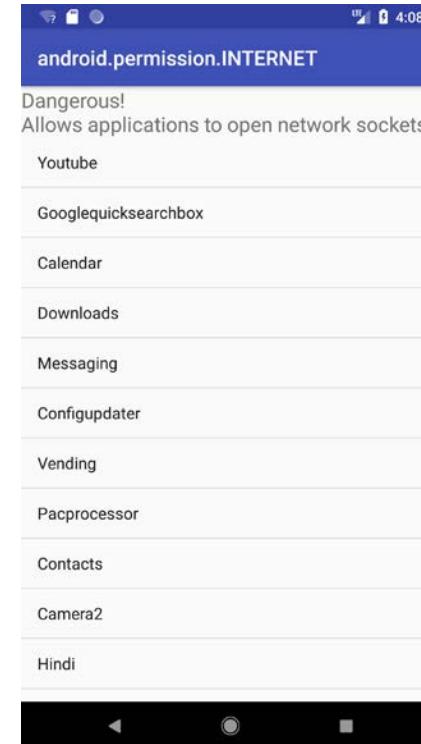
UID

10042:	com.android.companiondevicemanager
10043:	com.android.customlocale2
10044:	com.google.android.calendar
10045:	com.android.development
10046:	com.android.emulator.smoketests
10047:	com.android.egg
10048:	com.android.calculator2
10049:	com.android.chrome
10050:	com.google.android.syncadapters.contacts
10051:	com.google.android.apps.docs
10052:	com.google.android.ext.shared
10053:	com.google.android.apps.inputmethod.hindi
10054:	



Youtube

android.permission.INTERNET
android.permission.ACCESS_NETWORK_STATE
android.permission.CHANGE_NETWORK_STATE
android.permission.ACCESS_WIFI_STATE
android.permission.WRITE_EXTERNAL_STORAGE
android.permission.RECEIVE_BOOT_COMPLETED
android.permission.MANAGE_DOCUMENTS
android.permission.GET_ACCOUNTS
android.permission.MANAGE_ACCOUNTS
android.permission.USE_CREDENTIALS
com.google.android.providers.gsf.permission.READ_GSERVICES
com.google.android.c2dm.permission.RECEIVE



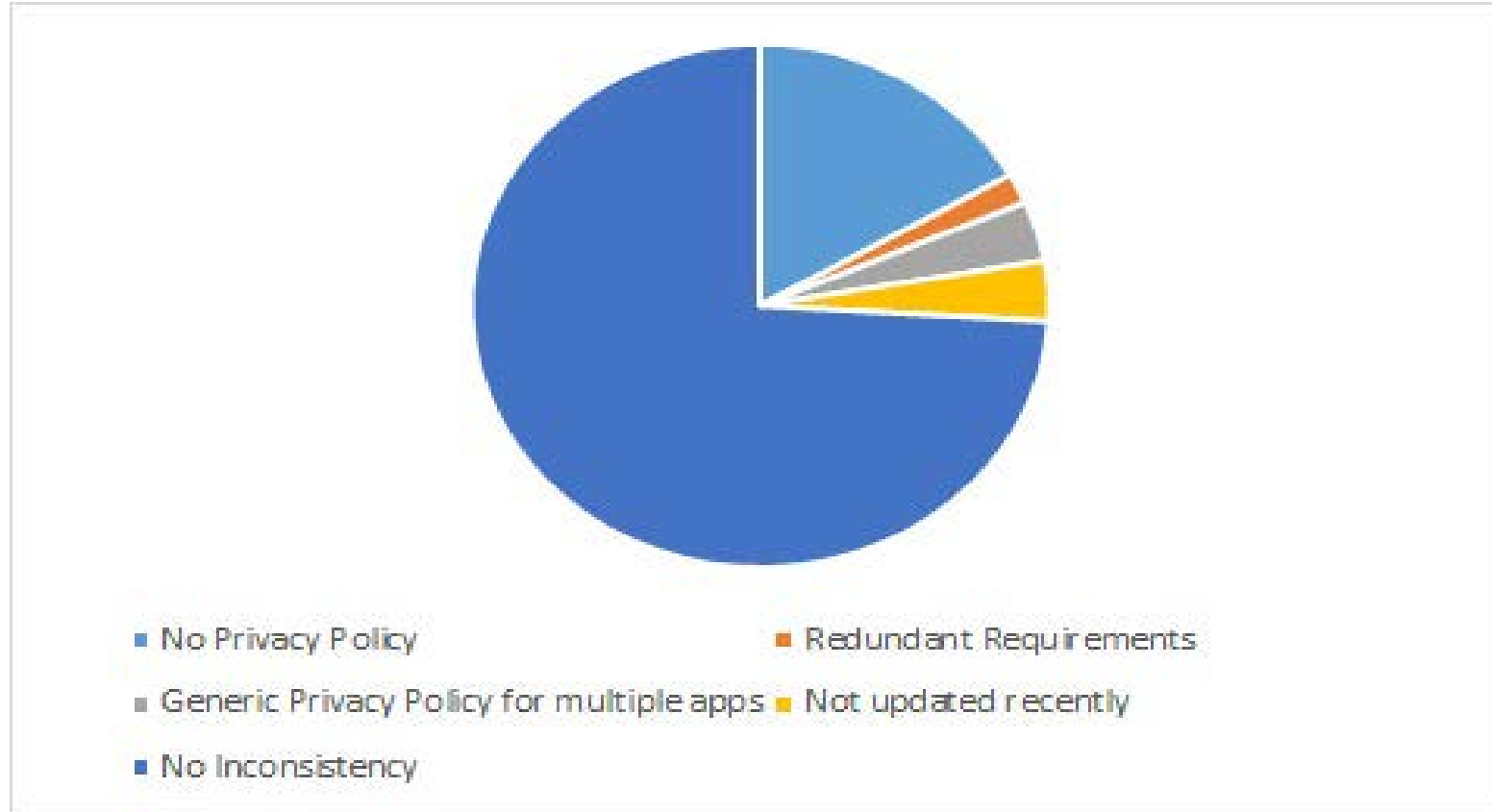
android.permission.INTERNET

Dangerous!
Allows applications to open network sockets.

Youtube
Googlequicksearchbox
Calendar
Downloads
Messaging
Configupdater
Vending
Pacprocessor
Contacts
Camera2
Hindi



Results



Limitations

- Activating/Deactivating Permissions
- Manual Analysis



Conclusion

Privacy Consistency:

- *Permissions*
- *Descriptions*
- *UID*
- *Manual Analysis*



Future Work

- Automation of analysis
- More work on UID
- Permission activation/deactivation
- Expanding to IoTs
- Issues with Android Application development



Thank You



Questions?