Privacy Consistency Analyzer for Android Applications

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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.)
### Related Work

<table>
<thead>
<tr>
<th>Proposed Methodology</th>
<th>Proposed Approach</th>
<th>Reference</th>
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| Proposed a methodology called **Eddy**, a privacy requirements specification as part of software development process | • 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) | • 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..)

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| Proposed a tool named PScout to help analyzing the permission system of Android OS | • 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                             | • 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.companion/devicesmanager
10043: com.android.customlocale2
10044: com.google.android.calendar
10045: com.android.deviceremotecontrol
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

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

dangerous!
Allows applications to open network sockets.

youtube
Google quicksearchbox
Calendar
Downloads
Messaging
Configurator
Vending
Pacman
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?