

# Claim What You Need: Towards a Simplified Permission Requests Management for Android Mobile Apps

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IEEE GlobeCom 2016

NC State University

April, 2013

# Outline

- 1 Motivation
- 2 Related Work
- 3 System Model
- 4 Evaluation
- 5 Conclusion

# Outline

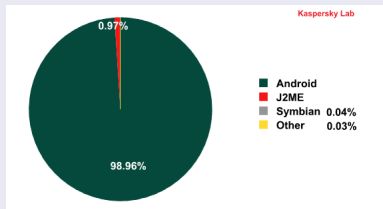
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# Motivation

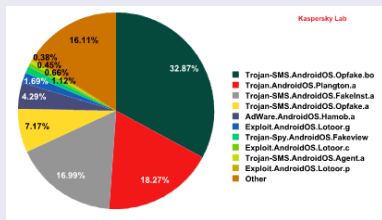
## Malware

Malware, short for malicious (or malevolent) software, is software used or programmed by attackers to disrupt computer operation, gather sensitive information, or gain access to private computer systems.

## Malware in Mobile phone market



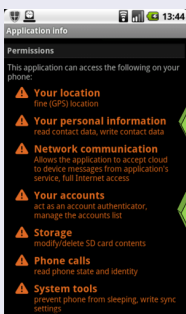
(a) Platform Distribution



(b) Mobile Malware Distribution

# Motivation

## Background: Android permission mechanism



```
<manifest xmlns:android="http://schemas.android.com/apk/res/android" package="com.test.safeDriving"
<uses-sdk android:minSdkVersion="10"/>
<uses-permission android:name="android.permission.INTERNET"/>
<uses-permission android:name="android.permission.CHANGE_NETWORK_STATE"/></uses-permission>
<uses-permission android:name="android.permission.CHANGE_WIFI_STATE"/></uses-permission>
<uses-permission android:name="android.permission.ACCESS_NETWORK_STATE"/></uses-permission>
<uses-permission android:name="android.permission.ACCESS_WIFI_STATE"/></uses-permission>
<uses-permission android:name="android.permission.BLUETOOTH"/></uses-permission>
<uses-permission android:name="android.permission.BLUETOOTH_ADMIN"/></uses-permission>
<uses-permission android:name="android.permission.ACCESS_FINE_LOCATION"/>
<uses-permission android:name="android.permission.READ_PHONE_STATE"/>
<application android:icon="@drawable/ic_launcher" android:label="@string/app_name">
  <activity android:name=".SafeDrivingActivity" android:label="@string/app_name">
    <intent-filter>
      <action android:name="android.intent.action.MAIN"/>
      <category android:name="android.intent.category.LAUNCHER"/>
    </intent-filter>
  </activity>
  <uses-library android:name="com.google.android.maps"/>
</application>
</manifest>
```

# Motivation

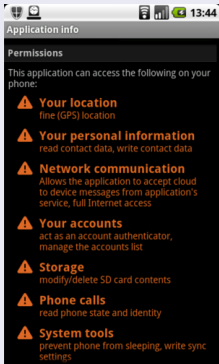
## Background: Android permission mechanism



```
▼ <manifest xmlns:android="http://schemas.android.com/apk/res/android" package="com.test.safeDriving"
  <uses-sdk android:minSdkVersion="10"/>
  <uses-permission android:name="android.permission.INTERNET"/>
  <uses-permission android:name="android.permission.CHANGE_NETWORK_STATE"/></uses-permission>
  <uses-permission android:name="android.permission.CHANGE_WIFI_STATE"/></uses-permission>
  <uses-permission android:name="android.permission.ACCESS_NETWORK_STATE"/></uses-permission>
  <uses-permission android:name="android.permission.ACCESS_WIFI_STATE"/></uses-permission>
  <uses-permission android:name="android.permission.BLUETOOTH"/></uses-permission>
  <uses-permission android:name="android.permission.BLUETOOTH_ADMIN"/></uses-permission>
  <uses-permission android:name="android.permission.ACCESS_FINE_LOCATION"/>
  <uses-permission android:name="android.permission.READ_PHONE_STATE"/>
  <activity android:icon="@drawable/ic_launcher" android:label="@string/app_name">
    <intent-filter>
      <action android:name="android.intent.action.MAIN"/>
      <category android:name="android.intent.category.LAUNCHER"/>
    </intent-filter>
    <activity>
      <uses-library android:name="com.google.android.maps"/>
    </activity>
  </application>
</manifest>
```

# However...

## Android permission mechanism: not effective

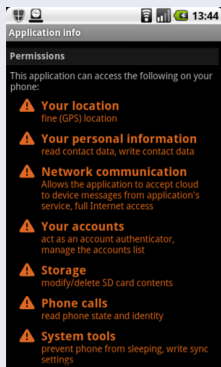


**Don't understand...  
Got used to...**

...



## Android permission mechanism: not effective



**Don't understand...  
Got used to...**

...



**Therefore...**



## Question

*can we precisely summarize the functionality of an app and furthermore predict the corresponding necessary permissions?*

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- 1 Motivation
- 2 Related Work**
- 3 System Model
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# Background and Related Work

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## Related Work

Enck et al: Compare requested permissions against a preset-rule, which defines “dangerous” permissions-combination

Peng et al: App risk ranking based on score, which was derived from studying permission combination pattern

Code based approach.

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Code based approach.

## Shortage

- Computationally intensive: Download package, unzip package, find certain file, parse permission requested, ....
- Code not always available: packages are encrypted
- Error prone: “Dangerous combination” is not dangerous, as long as developers mean it, and users know it

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# System Model: Introduction

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## Intuition

OfficeSuite Pro includes a **File Browser** and integration with **Cloud service** providers: Box, DropBox, Google Drive, SkyDrive and SugarSync to give users a multitude of options on how to manage files and attachments.

### STORAGE

**MODIFY OR DELETE THE CONTENTS OF YOUR USB STORAGE** **MODIFY OR DELETE THE CONTENTS OF YOUR SD CARD**

Allows the app to write to the USB storage. Allows the app to

### NETWORK COMMUNICATION

#### FULL NETWORK ACCESS

Allows the app to create network sockets and use custom network protocols. The browser and other applications provide means to send data to the internet, so this permission is not required to send data to the internet.



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## Goal

- Detect inconsistency between *Description* and *Permission requested*.
- Regulate developers' behavior: write sensible description, request reasonable permission.

# System Model: Example

# System Model: Example

## Example 1: Reasonable

# System Model: Example

## Example 1: Reasonable



# System Model: Example

## Example 1: Reasonable



### YOUR MESSAGES

#### READ YOUR TEXT MESSAGES (SMS OR MMS)

Allows the app to read SMS messages stored on your tablet or SIM card. This allows the app to read all SMS messages, regardless of content or confidentiality. Allows the app to read SMS messages stored on your phone or SIM card. This allows the app to read all SMS messages, regardless of content or confidentiality.

### DEFAULT

#### ACCESS MAIL INFORMATION

Allows the app to access information about your mail.

# System Model: Example

## Example 1: Reasonable



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### DEFAULT

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Allows the app to access information about your mail.

\*Choose from 5 different basketball styles

\*The ability to "shoot baskets" right on your home screen (with sounds)

\*Animated fans in team colors

\*SMS and Email notification in ticker

\*Day and Night detection with in arena lighting.

\*Classic Mode for a top-down court display

\*Made with official release software to ensure quality and performance

\*Officially licensed release from the NBA

\*All 30 teams have a live wallpaper available for in-app purchase:

# System Model: Example

# System Model: Example

## Example 2: Unreasonable



# System Model: Example

## Example 2: Unreasonable



# System Model: Example

## Example 2: Unreasonable



### YOUR LOCATION

#### APPROXIMATE LOCATION (NETWORK-BASED)

Allows the app to get your approximate location. This location is derived by location services using network location sources such as cell towers and Wi-Fi. These location services must be turned on and available to your device for the app to use them. Apps may use this to determine approximately where you are.

#### PRECISE LOCATION (GPS AND NETWORK-BASED)

Allows the app to get your precise location using the Global Positioning System (GPS) or network location sources such as cell towers and Wi-Fi. These location services must be turned on and available to your device for the app to use them. Apps may use this to determine where you are, and may consume additional battery power.

### YOUR PERSONAL INFORMATION

#### READ YOUR WEB BOOKMARKS AND HISTORY

Allows the app to read the history of all URLs that the Browser has visited, and all of the Browser's bookmarks. Note: this permission may not be enforced by third-party browsers or other applications with web browsing capabilities.

#### WRITE WEB BOOKMARKS AND HISTORY

Allows the app to modify the Browser's history or bookmarks stored on your tablet. This may allow the app to erase or modify Browser data. Note: this permission may not be enforced by third-party browsers or other applications with web browsing capabilities. Allows the app to modify the Browser's history or bookmarks stored on your phone. This may allow the app to erase or modify Browser data. Note: this permission may not be enforced by third-party browsers or other applications with web browsing capabilities.

### PHONE CALLS

#### READ PHONE STATUS AND IDENTITY

Allows the app to access the phone features of the device. This permission allows the app to determine the phone number and device IDs, whether a call is active, and the remote number connected by a call.

# System Model: Example

## Example 2: Unreasonable



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If you are American football fan you will undoubtedly be ardent fan of the American football wallpapers. A great number of wallpapers are offered, just take your time and select your favorite one. Throw a pass on your screen but don't forget the helmet!

- Easy-to-browse interface enables you to find the desired background in no time!

- Customize the wallpaper to fit your taste and screen!

- Zoom, un-zoom, rotate, move, scale, adjust brightness, add various effects and save your background design!

American Football NFL is a tough contact sport that dominates the American sporting scene and is gaining popularity in Europe. It is a game requiring all-round physical fitness. Players have to be fast, strong, and proficient in the six basic skills. Some of them are passing and catching. But running and blocking are not less important. American football has always been associated with a large number of injuries, not surprising when the game commonly involves players in excess of 240 pounds colliding with each other at full speed. In the United States, it is estimated that more than 300 000 high school players, 35 000 college players, and half of the National Football League players are injured to some extent each season. Head and neck injuries are common: there are approximately 250 000 incidents of concussion each year. Some injuries have been fatal or have resulted in players becoming permanent quadriplegics. However, the number of very severe injuries has declined in recent years. This is probably due to rule changes concerning tackling and blocking with the head, and improvements in protective equipment which were introduced in 1976. There has also been a greater emphasis in training on strengthening the muscles of the neck and learning good tackling techniques. This is particularly important in the younger age group.

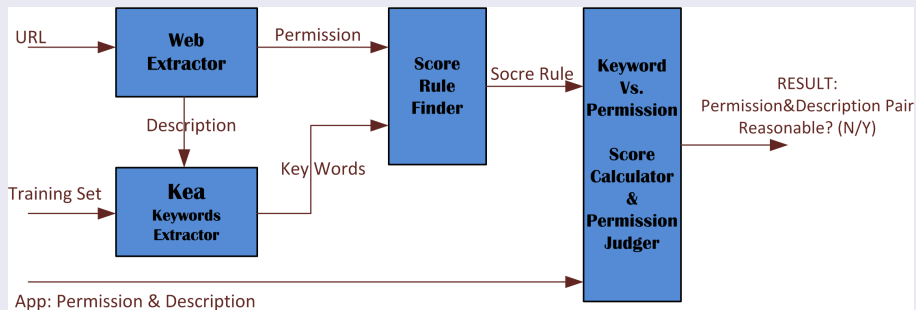
# System Model: Approach

# System Model: Approach

Description-based text-mining approach

# System Model: Approach

## Description-based text-mining approach



# System Model: Approach

## Web Extractor (Python)

The image shows a screenshot of a web browser displaying the Google Play Store page for 'Top Paid in Business' apps. The browser's address bar contains the URL: `https://play.google.com/store/apps/category/BUSINESS/collection/topselling_paid?start=24&num=24`. A red box highlights the parameters `start=24` and `num=24`. A blue arrow points from the browser's address bar to a text box containing the same URL. Another blue arrow points from the text box to a list of app cards. A third blue arrow points from the text box to a separate text box containing four URLs with different `start` values: `start=24`, `start=48`, `start=72`, and `start=96`, all with `num=24`.

Top Paid in Business

[https://play.google.com/store/apps/category/BUSINESS/collection/topselling\\_paid?start=24&num=24](https://play.google.com/store/apps/category/BUSINESS/collection/topselling_paid?start=24&num=24)

[https://play.google.com/store/apps/category/BUSINESS/collection/topselling\\_paid](https://play.google.com/store/apps/category/BUSINESS/collection/topselling_paid)  
[https://play.google.com/store/apps/category/BUSINESS/collection/topselling\\_paid?start=48&num=24](https://play.google.com/store/apps/category/BUSINESS/collection/topselling_paid?start=48&num=24)  
[https://play.google.com/store/apps/category/BUSINESS/collection/topselling\\_paid?start=72&num=24](https://play.google.com/store/apps/category/BUSINESS/collection/topselling_paid?start=72&num=24)  
[https://play.google.com/store/apps/category/BUSINESS/collection/topselling\\_paid?start=96&num=24](https://play.google.com/store/apps/category/BUSINESS/collection/topselling_paid?start=96&num=24)

# System Model: Approach

## Web Extractor (Python)

Google play Search

SHOP MY MUSIC MY BOOKS MY MAGAZINES MY MOVIES & TV MY ANDROID APPS

**GW Mail**  
Ghost Pattern Software

★★★★★ (1,313)  
\$9.99 BUY

✓ This app is compatible with your Motorola MB860.

More from developer

**OVERVIEW** USER REVIEWS WHAT'S NEW PERMISSIONS

**Description**

GW Mail is an email client for Novell GroupWise. With this app you get a much better interface than Novell delivers by default through GroupWise WebAccess. This app gives you some of

ABOUT THIS APP

```
<div id="doc-original-text" itemprop="description">GW Mail is an email client ... Please include information about your device and the version of GroupWise that you are using.</div>
```

```
<div class="doc-permission-description">full network access</div>
```



# System Model: Approach

## Web Extractor (Python)

The image displays two screenshots of a Windows file explorer window and a Notepad window. The file explorer shows a directory structure under 'Programs > PermissionStudy > Descriptions > BUSINESS'. The files listed include:

Name	Date modified	Type	Size
air.dstmobile2.txt	4/21/2013 12:09 PM	Text Document	1 KB
air.edu.un1.BCS.key	4/21/2013 12:10 PM	Text Document	0 KB
air.edu.un1.BCS.txt	4/21/2013 12:10 PM	Text Document	1 KB
air.FlexinaMM.txt	4/21/2013 12:09 PM	Text Document	1 KB
air.FlexinaMM.txt	4/21/2013 12:11 PM	Text Document	1 KB
and.dev.avi.key	4/21/2013 12:11 PM	Text Document	1 KB
and.dev.avi.txt	4/21/2013 12:10 PM	Text Document	1 KB
app.Appstevan.MobiMail.key	4/21/2013 12:07 PM	Text Document	1 KB
app.Appstevan.MobiMail.txt	4/21/2013 12:07 PM	Text Document	1 KB
appinventor_ai_4ayush.BizTalkTranslator...	4/21/2013 12:11 PM	Text Document	1 KB
appinventor_ai_derevedale.AccountSav...	4/21/2013 12:10 PM	Text Document	1 KB

The Notepad window shows the content of the file 'air.FlexinaMM.txt', which is a document describing the 'Agenda Meeting Minutes' application. The text includes:

Agenda Meeting Minutes now on Android!!!!!! Record Useful Meeting Minutes in your smartphone or tablet with your easy to use Agenda / Planning software. Benefits : Record useful Meeting Minutes with our software : - Use the Planning / Agenda / Calendar to plan your meeting. - Prepare carefully the meeting : purpose of the meeting, attendees, topics, discussions. - During the meeting, don't miss any informations and use your smartphone or your tablet to record topics conclusions, actions to take with responsible, deadline... - After the meeting, review your notes and export a professional PDF version of your Meeting Minutes to print it or send it to all people involved in the meeting. - Don't lose informations about your meetings, the Planning / Agenda / Calendar will help you to see directly upcoming and recent meetings from the main view of the applications. - Search in the Planning/Agenda to find a meeting by date, purpose of topic. - Customize you Agenda with date format and time format. - Simplify the user interface with only needed informations. Main Functionalities Home Screen Agenda with direct access to upcoming and recent Meeting. Search screen to find by date, purpose or topic. Agenda ordered by date, time and showing Meeting purpose directly. contact List. General informations of the meeting : purpose, date, time, location and optional informations : chair/facilitator, meeting caller, note taker, timekeeper. Selection of the attendees from the contact database. Topics linked to meeting with title, description of the discussion and optional informations : conclusions, presenter. Actions linked to meeting with title, description and optional informations : deadline and person responsible. Export of each meeting in a professional Meeting Minute PDF document that can be use to print or send by mail to attendees.

## Kea Keyword Extractor (Java)

[Overview](#)[Download](#)[Description](#)[Examples](#)[Publications](#)

**Keywords and keyphrases** (multi-word units) are widely used in large document collections. They describe the content of single documents and provide a kind of semantic metadata that is useful for a wide variety of purposes. The task of assigning keyphrases to a document is called *keyphrase indexing*. For example, **academic papers** are often accompanied by a set of keyphrases freely chosen by the author. In **libraries** professional indexers select keyphrases from a controlled vocabulary (also called *Subject Headings*) according to defined cataloguing rules. **On the Internet**, digital libraries, or any depositories of data (flickr, del.icio.us, blog articles etc.) also use keyphrases (or here called *content tags* or *content labels*) to organize and provide a thematic access to their data.

KEA is an algorithm for extracting keyphrases from text documents. It can be either used for **free indexing** or for **indexing with a controlled vocabulary**.

KEA is implemented in Java and is platform independent. It is an open-source software distributed under the [GNU General Public License](#).

In real life, the Kea is one of New Zealand's native parrots, famed for theft, destroying cars and cameras, forming street gangs, pecking sheep to death for their delicious kidney fat, and other cutesy antics.

Thanks to Gordon Reunter, who has created the original



# System Model: Approach

## Kea Keyword Extractor (Java)

The diagram illustrates the workflow of the Kea Keyword Extractor. It shows three folders: 'test', 'train', and 'model'. A blue arrow labeled '1' points from the 'train' folder to the 'model' folder, indicating the extraction process. A blue arrow labeled '2' points from the 'model' folder back to the 'test' folder, indicating the application of the model to new data. Below the diagram are two screenshots of a file explorer showing the extracted files.

Name	Date modified	Type	Size
ai.datamobile.key	4/9/2013 2:33 PM	KEY File	1 KB
ai.datamobile.bt	4/9/2013 2:29 PM	Text Document	4 KB
app.Appsterwan.MobiMail.key	4/9/2013 2:33 PM	KEY File	1 KB
app.Appsterwan.MobiMail.bt	4/9/2013 2:29 PM	Text Document	3 KB
at.co.hiv.remoteclient.bt	4/9/2013 2:33 PM	KEY File	1 KB
at.co.hiv.remoteclient.bt	4/9/2013 2:29 PM	Text Document	4 KB
com.abbey.mobile.bcr.bt	4/9/2013 2:33 PM	KEY File	1 KB
com.abbey.mobile.bcr.bt	4/9/2013 2:29 PM	Text Document	3 KB
com.androidmetria.businessringtone.key	4/9/2013 2:33 PM	KEY File	1 KB
com.androidmetria.businessringtone.bt	4/9/2013 2:30 PM	Text Document	2 KB
com.berrywing.scantospreadsheet.key	4/9/2013 2:33 PM	KEY File	1 KB
com.berrywing.scantospreadsheet.bt	4/9/2013 2:29 PM	Text Document	1 KB
com.bswwim.workshifts.key	4/9/2013 2:33 PM	KEY File	1 KB
com.bswwim.workshifts.bt	4/9/2013 2:29 PM	Text Document	1 KB
com.bulldcalc.bulldcalc.key	4/9/2013 2:33 PM	KEY File	1 KB
com.bulldcalc.bulldcalc.bt	4/9/2013 2:29 PM	Text Document	4 KB
com.calculated.ashley3415.key	4/9/2013 2:33 PM	KEY File	1 KB
com.calculated.ashley3415.bt	4/9/2013 2:29 PM	Text Document	3 KB
com.dataviz.docstogoapp.key	4/9/2013 2:33 PM	KEY File	1 KB
com.dataviz.docstogoapp.bt	4/9/2013 2:29 PM	Text Document	4 KB
com.dataviz.readynkey1.key	4/9/2013 2:33 PM	KEY File	1 KB
com.dataviz.readynkey1.bt	4/9/2013 2:29 PM	Text Document	1 KB
com.denysoft.thebusinessplanmobile.key	4/9/2013 2:33 PM	KEY File	1 KB

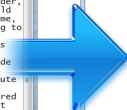
Name	Date modified	Type	Size
CamCard - BCR (Western).key	3/30/2013 2:30 PM	KEY File	1 KB
CamCard - BCR (Western).bt	3/30/2013 2:23 PM	Text Document	4 KB
DocumentsToGo Full Version Key.key	3/30/2013 10:23 AM	KEY File	1 KB
DocumentsToGo Full Version Key.bt	3/30/2013 10:23 AM	Text Document	4 KB
Enhanced Email.key	3/30/2013 2:37 PM	KEY File	1 KB
Enhanced Email.bt	3/30/2013 2:33 PM	Text Document	3 KB
Exchange by TouchDown Key.key	3/30/2013 10:40 AM	KEY File	1 KB
Exchange by TouchDown Key.bt	3/30/2013 10:36 AM	Text Document	3 KB
Jump Desktop (RDP & VNC).key	3/30/2013 2:03 PM	KEY File	1 KB
Jump Desktop (RDP & VNC).bt	3/30/2013 1:58 PM	Text Document	4 KB
Locales.key	3/30/2013 1:58 PM	KEY File	1 KB
Locales.bt	3/30/2013 1:52 PM	Text Document	3 KB
OfficeSuite Fort Package.key	3/30/2013 1:51 PM	KEY File	1 KB
OfficeSuite Fort Package.bt	3/30/2013 1:49 PM	Text Document	1 KB
OfficeSuite Pro 7.key	3/30/2013 10:11 AM	KEY File	1 KB
OfficeSuite Pro 7.bt	3/30/2013 10:03 AM	Text Document	4 KB
Outlook Web Mobile Key	3/30/2013 1:42 PM	KEY File	1 KB
Outlook Web Mobile.bt	3/30/2013 1:38 PM	Text Document	3 KB
PocketCloud Remote Desktop Pro.key	3/30/2013 1:48 PM	KEY File	1 KB
PocketCloud Remote Desktop Pro.bt	3/30/2013 1:43 PM	Text Document	4 KB
PrinterShare Premium Key.key	3/30/2013 10:27 AM	KEY File	1 KB
PrinterShare Premium Key.bt	3/30/2013 10:25 AM	Text Document	2 KB

# System Model: Approach

## Kea Keyword Extractor (Java)

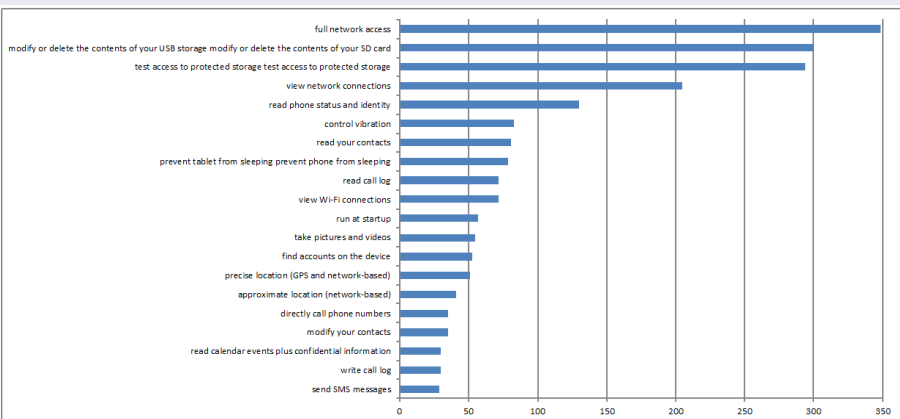
```
com.dw.contacts.txt - Notepad
File Edit Format View Help
Dw Contacts & Phone; PhoneIS a powerful (MUST HAVE) extension for your stock
dialer, contacts and phone management application! focuses on business
functions. Improve the efficiency of your work.KEY FEATURES-----+ you
can write a note for the call records- In call widget: extended incoming
call view (show organization, group, notes, group picture, edit note in
calling)+ Call filter: blocking incoming calls on free definable date- and
time zones+ Call Statistics: Show the duration of your call. When the end of
the free talk time to be notified.+ Quick-jump: show a window, where you can
click the first letter of your contact and quickly jump/scroll to it+
Contact details: Displays all the contact information together (sms, call
log, call Statistics, events)+ multi-language support (Thank all the
enthusiastic user provides translation for Dwc)+ most functions are
accessible by using the "LONG PRESS" (tap and hold) on any item or use
"MENU" key+ very flexible to configure the design of every view (sort order,
fonts size, color, transparency)+ configurable contact view, how it should
show the list ("show contacts as" / "sort order" for last name, first name,
nick name, ...)+ tab bars: hide & sortable, include gesture switching to
different views (phone, history, favorites, contacts, search, groups,
organization, titles, events, toolbox)+ full management for your contacts
(create, add, change, delete, copy contacts, copy to another account,
groups, organization, titles in single- and multi select mode)+ batch mode
for mass delivery with SMS, MMS, emails on single- and multi selection
(contacts, groups, organizations, titles)+ search contacts by any attribute
(name, nick name, phone number, organization), notes, address, email,
relationships, websites, birthday, ...) + voice search+ support for layered
groups, sub-groups (sub-group via Business.VIP = Business -&gt; VIP)+ set
ringtones on single- and multi select (contacts, groups, organizations,
titles)+ contact event notification and contact event management (birthday,
anniversary) + support for lunar calendar format+ easy sending event
greetings to your contacts+ create shortcut to home on any contact item or
on any tab via toolbox+ share contacts (text,vcard) via SMS, email, ...+
display call history with summary for single- or multi-select contacts
(groups, organization, titles, ... dialer(phone) with T9-search - has many
options to make it exactly to your wishes -&gt; dialer and dialpad scalable
and adjustable in size, background, color, font size can be changed -&gt;
full T9-search on all contacts fields and configurable -&gt; quick dial
manager: Supports up to 1000 speed-dial numbers. Dialing 100th number by
entering #100 -&gt; quick dial last number: -&gt; display call history on
dialer -&gt; edit number before dialingPlease honor our work and buy the PRO
version, which is very favorable in the light of functionality!Hints: we can
not contact you in the Google market, if you post your questions or
thoughts. If you have any suggestion for improvements -&gt; please write on
forum: http://forum.dw-p.net or use the "Feedback via email" function in
settings menu. If you upgrade to a newer version and it fails to start (if
download or install is not possible), please try to uninstall previous
version before. More tips & tricks see on forum http://forum.dw-
p.net/viewforum.php?f=9Please try our software and recommend it to your
friends.Free version is limited on some functions: - advertising messages -
theme customizations are limited - multi-select limited to 5 items per
```

```
com.dw.contacts.key - Notepad
File Edit Format View Help
Contacts
sms
sending
emails
note
business
MMS
ringtones
call
group
```



# System Model: Approach

## Score-Rule Finder: The Observation



# System Model: Approach

## Score-Rule Finder: The Idea

### Statistics

```
1 340 full network access
2 280 modify or delete the contents of your USB storage modify or delete the contents of your SD card
3 284 test access to protected storage test access to protected storage
4 285 view network connections
5 130 read phone status and identity
6 83 control vibration
7 81 read your contacts
8 79 prevent tablet from sleeping prevent phone from sleeping
9 72 read call log
10 72 view wi-fi connections
11 57 run at startup
12 55 take pictures and videos
13 53 find accounts on the device
14 51 precise location (GPS and network-based)
15 41 approximate location (network-based)
16 35 directly call phone numbers
17 35 modify your contacts
18 30 read calendar events plus confidential information
19 30 write call log
20 29 send SMS messages
21 24 receive data from Internet
22 23 add or modify calendar events and send email to guests without owners; knowledge
23 22 modify system settings
24 18 receive text messages (SMS)
25 18 pair with Bluetooth devices
26 17 use accounts on the device
27 17 retrieve running apps
28 16 read sensitive log data
29 14 connect and disconnect from Wi-Fi
30 13 read email
```

```
5 130 read phone status and identity
6 83 control vibration
7 81 read your contacts
8 79 prevent tablet from sleeping prevent phone
9 72 read call log
10 72 view Wi-Fi connections
11 57 run at startup
```

```
1 110 email
2 94 business
3 74 file
4 66 contact
5 47 send
6 39 text
7 24 office
8 24 calendar
9 23 sms
10 23 download
11 22 app
12 21 notes
13 19 location
14 18 calculator
15 17 phrases
16 17 speak
17 16 learn
18 15 share
19 15 sd card
20 14 tasks
21 14 outlook
22 14 audio
23 13 call
24 13 sales
25 13 sync
26 13 tool
27 13 scan
28 12 it
29 12 video
30 12 Dropbox
```

```
1 38 contact
2 27 email
3 19 text
4 19 business
5 18 sms
6 18 file
7 17 send
8 10 notes
9 10 call
10 9 calendar
11 8 location
12 7 download
13 7 tasks
14 6 office
15 6 exchange
16 6 caller
17 5 photos
18 5 outlook
19 5 sync
20 5 secure
21 4 card
22 4 events
23 4 usb
24 4 scan
25 4 invoice
26 4 gps
27 4 battery
28 4 box
29 4 sending
30 3 text messages
```

# System Model: Approach

## Score-Rule Finder: Keyword Score

1	38	contact
2	27	email
3	19	text
4	19	business
5	18	sms
6	18	file
7	17	send
8	10	notes
9	10	call
10	9	calendar
11	8	location
12	7	download
13	7	tasks
14	6	office
15	5	change
16	5	outlook
17	5	sync
18	5	secure
19	5	sync
20	5	secure
21	4	card
22	4	events
23	4	usb
24	4	scan
25	4	invoice
26	4	gps
27	4	battery
28	4	box
29	4	sending
30	3	text messages

**427 words**

$$Score(contact) = \frac{38}{38 + 27 + 19 + \dots + 1}$$

•  
•  
•

$$Score(location) = \frac{8}{38 + 27 + 19 + \dots + 1}$$

•  
•  
•

# System Model: Approach

## Final Score Calculator



OVERVIEW USER REVIEWS WHAT'S NEW PERMISSORS

### Description

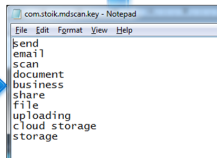
Mobile Doc Scanner (MDScan) is a new business tool exclusively for your Android device! Extremely useful mobile tool gives users the power to transform any file into PDF format and share it right from your device.

- ★ Ranked in Top 5 Business application in 35 countries (March 12, 2013).
- ★ Ranked in Top 10 Business application in 43 countries (March 12, 2013)

With MDScan users are free to scan any type of document, ranging from receipts to test pages and almost everything in between, on the go anywhere and anytime. A perfect companion for busy users, MDScan allows anyone to transform everything from invoices to whiteboards and classes notes, magazine articles and more into a PDF format in order to easily export them, share and e-mail it to others, or for any other reason they can come up with. MDScan automatically detects borders, corrects distortion, and equalizes brightness to create clear, legible documents at a very high speed for your convenience.

Going above and beyond other mobile scanning solutions MDScan offers Batch shooting mode for a super fast scanning so users can easily scan within seconds multiple pages and save scanned files for batch processing later.

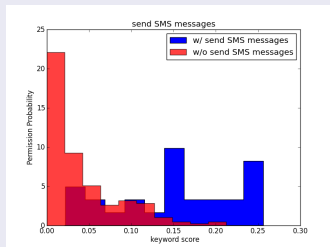
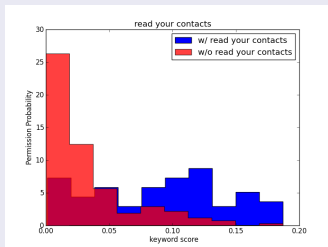
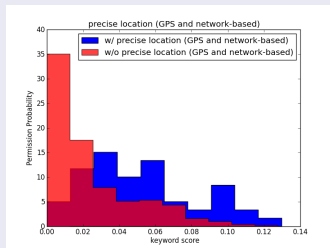
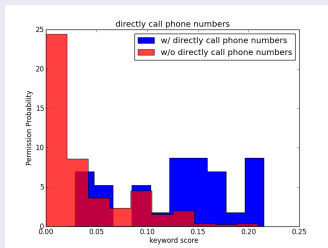
$$\begin{aligned} \text{Final Score} &= \text{Score}(\text{send}) + \text{Score}(\text{email}) + \dots \\ &= \dots \% \end{aligned}$$





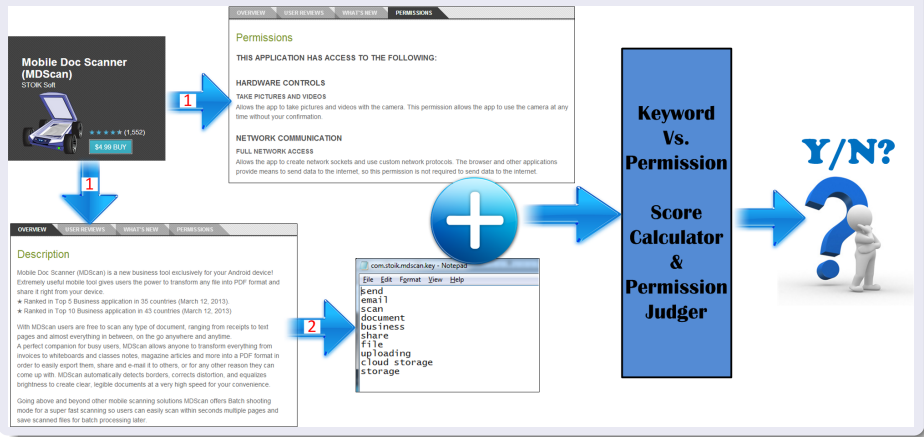
# System Model: Approach

## Score-Rule Finder: Distribution



# System Model: Approach

## Score-Rule based Classification Model



# Outline

- 1 Motivation
- 2 Related Work
- 3 System Model
- 4 Evaluation**
- 5 Conclusion

## Evaluation

Table: Prediction Summary

	Precision	False Positive
directly call phone numbers	0.695652	0.304348
precise location	0.652174	0.347826
read your contacts	0.782609	0.173913
send SMS messages	0.739130	0.173913

# Outline

- 1 Motivation
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# Conclusion

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## Conclusion

We propose a machine learning based framework discovering permission-description patterns behind Android apps, and utilize this framework to detect the potential inconsistency between the *description* and the *permission* of a untrusted app.

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## Contribution



# Conclusion

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## Contribution

1. First to propose permission-abuse detection from *text-mining* approach

# Conclusion

## Conclusion

We propose a machine learning based framework discovering permission-description patterns behind Android apps, and utilize this framework to detect the potential inconsistency between the *description* and the *permission* of a untrusted app.

## Contribution

1. First to propose permission-abuse detection from *text-mining* approach
2. First to propose finding relationship link between *description* and *permission*

# Conclusion

## Conclusion

We propose a machine learning based framework discovering permission-description patterns behind Android apps, and utilize this framework to detect the potential inconsistency between the *description* and the *permission* of a untrusted app.

## Contribution

1. First to propose permission-abuse detection from *text-mining* approach
2. First to propose finding relationship link between *description* and *permission*
3. Rudimentary study shows a promising result (Our future work!)

# Conclusion: Future Work

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## Future Work

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## Future Work

### 1. Diversity

- Larger data set within one category
- More categories
- Category-less

# Conclusion: Future Work

## Future Work

### 1. Diversity

- Larger data set within one category
- More categories
- Category-less

### 2. More precise key word extraction:

- More, more comprehensive training set for Kea
- More precise keyword extractor algorithm?

**Thank You!**  
**Questions please**