

EECS 448 Smartphone Security

Android Textual Artifacts

Xusheng Xiao

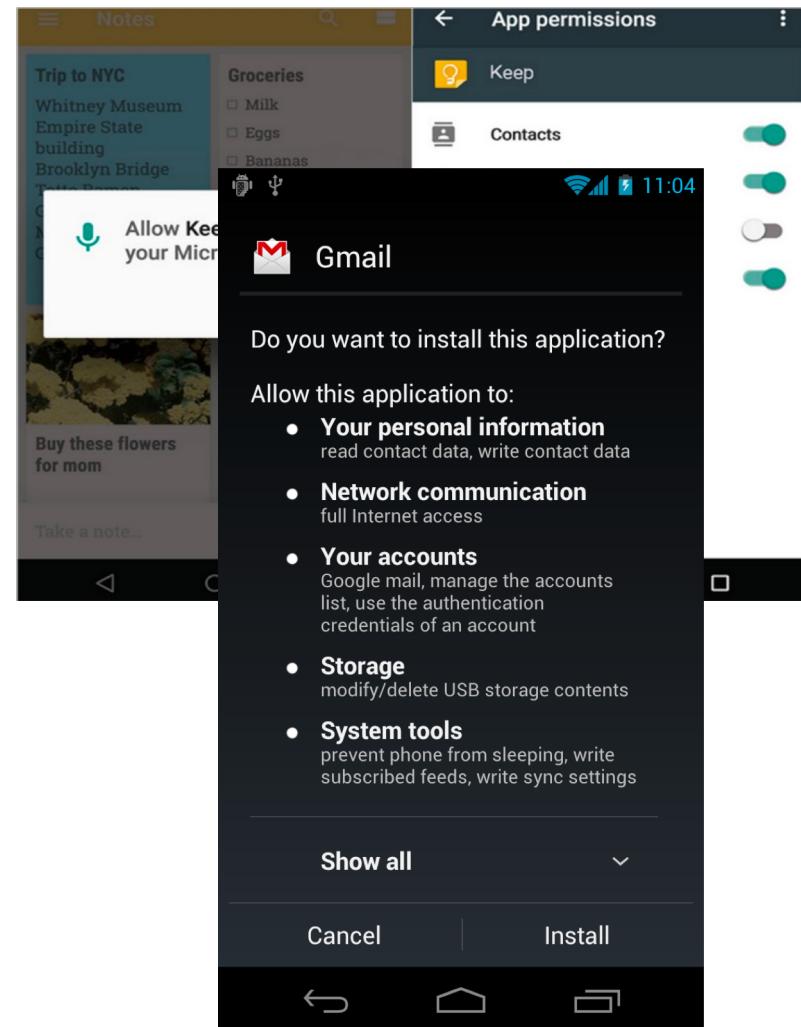
Electrical Engineering and Computer Science
Case Western Reserve University

Survey Paper

- Collect at least 9 papers
- Summarize their findings
 - Not copy abstract one paper by one paper!!
 - What are the problems
 - What are their common techniques
 - What are their findings

Last Lecture: Android Permission

- Normal permissions
 - Automatically granted by the system
- Dangerous permissions
 - Version 6.0+ (23+): granted by users at run time
 - Revoked by any time in the setting.
 - Version <6.0 (<23): granted by users at installation time
 - New permissions granted during update
 - Revoked by uninstalling the apps



Textual Artifacts in Android

← Privacy Policy

If your organization signed a Dropbox for Business Agreement with Dropbox, that Agreement may have modified the privacy policy below. Please [contact your organization's Admin](#) for details.

Dropbox Privacy Policy

Posted: February 13, 2015

Thanks for using Dropbox! Here we describe how we collect, use and handle your information when you use our websites, software and services ("Services").

What & Why

We collect and use the following information to provide, improve and protect our Services:

Account. We collect, and associate with your account, information like your name, email address, phone number, payment info, and physical address. Some of our services let you access your accounts and your information with other service providers.

Services. When you use our Services, we store,

Description

The widely acclaimed, ★★★★ news app is now available on Android! With Umano you will hear real people with amazing voices read interesting news articles to you.

Here are some things you can do with Umano:

- ★ Browse the most interesting articles from top news sources
- ★ See what your friends are listening to
- ★ Personalize your listening experience by selecting categories and making a playlist
- ★ Download your playlist for offline listening
- ★ Share interesting articles with your friends

Notes on Permissions:

- Read Sensitive Log Data - we only require this permission to better analyze app crashes so that we can make your Umano experience as smooth as possible. We do "not" store any sensitive personal data on our servers.

Useful if you are not a BIG NAME developer

Clear description of what you CAN do

If you are asking for a permission you dont need. Tell them why

Support channel is clear.

Visit Developer's Website › Email Developer › Privacy Policy › LESS

App descriptions

App privacy policy

User reviews

Lavanya Ganta 10 June 2017
★ ★ ★ ★ ★
Not interested in this

sampa pattanayak 7 June 2017
★ ★ ★ ★ ★
Worst app

Gurmukh Singh 6 June 2017
★ ★ ★ ★ ★
Ridiculous

App reviews

App Privacy Policy

- According to a study made in June of 2012 only a 48% of all free apps and a 32% of paid apps across App Stores (Apple, Android, Kindle) offered in-app access to a privacy policy.

Privacy Policy & Secure Transmission

If your app handles personal or sensitive user data (including personally identifiable information, financial and payment information, authentication information, phonebook or contact data, microphone and camera sensor data, and sensitive device data) then your app must:

- Post a privacy policy in both the designated field in the Play Console and from within the Play distributed app itself.
- Handle the user data securely, including transmitting it using modern cryptography (for example, over HTTPS).

The privacy policy must, together with any in-app disclosures, comprehensively disclose how your app collects, uses and shares user data, including the types of parties with whom it's shared.

What to Write in App Privacy Policy

- Outline which dangerous/sensitive permissions you request
- Outline any other user data you collect, for instance advertisement services!
- Describe what purpose they serve and use them only for that purpose

Example Description For Permissions

- **CAMERA**
 - *Used for permissions that are associated with accessing camera or capturing images/video from the device.*
This permission allows this application to capture the user's selfies in order for them to be viewed in a timeline within this application.
- **PHONE**
 - *Used for permissions that are associated telephony features.*
Allows, for instance, read only access to phone state, including the phone number of the device, current cellular network information, the status of any ongoing calls, and a list of any PhoneAccounts registered on the device. This, more specifically, allows this application to play audio and be muted when a phone call is incoming.

<https://www.iubenda.com/blog/warning-google-play-developer-policy-violation-action-required-policy-issue/>



Privacy Policy

Spotify Privacy Policy

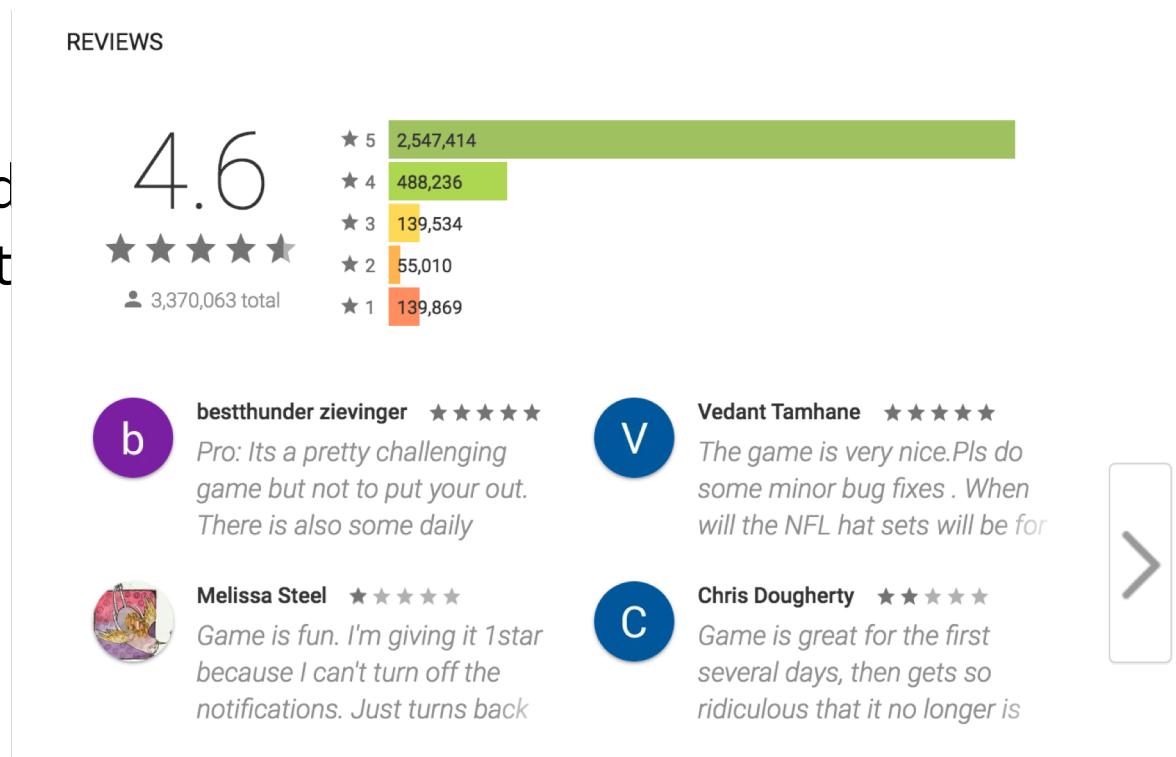
Effective as of September 9, 2015

- 1 [Introduction](#)
- 2 [Key highlights of what you're consenting to](#)
- 3 [The information we collect](#)
- 4 [How we use the information we collect](#)
- 5 [Sharing information](#)
- 6 [Your preferences](#)
- 7 [Transfer to other countries](#)
- 8 [Links](#)
- 9 [Security](#)
- 10 [Children](#)
- 11 [Accessing and updating user information](#)
- 12 [Changes to the Privacy Policy](#)
- 13 [Information about cookies, other technologies, and third-party data collection](#)

<https://www.spotify.com/us/legal/privacy-policy>

App Review

- You can leave a public review for apps, games, and other content on the Play Store. When you review something on Google Play, the review is linked to your Google Account and is public.
- You can installled Account

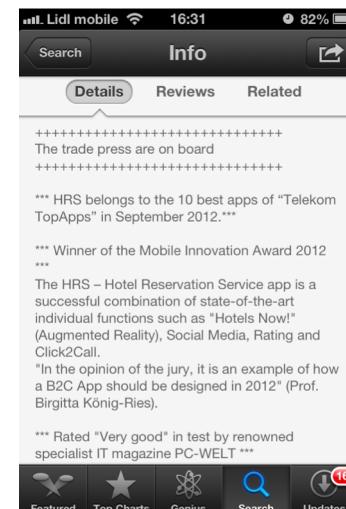
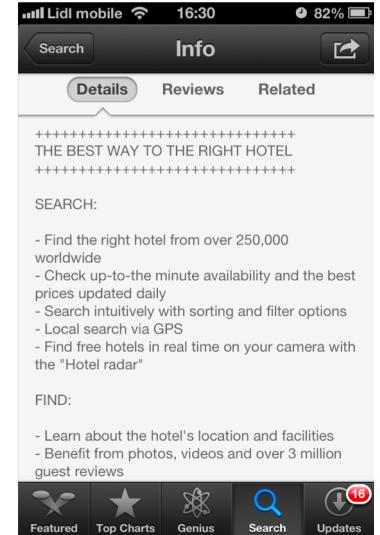
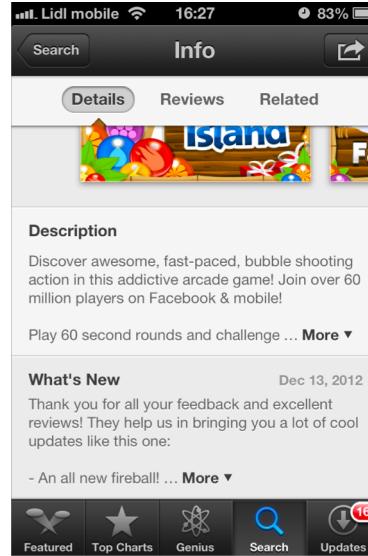


App Description

- Sales page for an app
 - Maximize app downloads
 - Search ranking
- **From Google:** "*Keep your app's description short and to the point; make sure the first sentence sums up your app. Describe key and unique features. If your app works across multiple device types (e.g. Wear, TV, or Daydream), be sure to highlight the compatibility and any important platform-specific features to users. To increase the likelihood of users discovering your app through search, include a variety of words in your app description that represent the core features of your app.*"

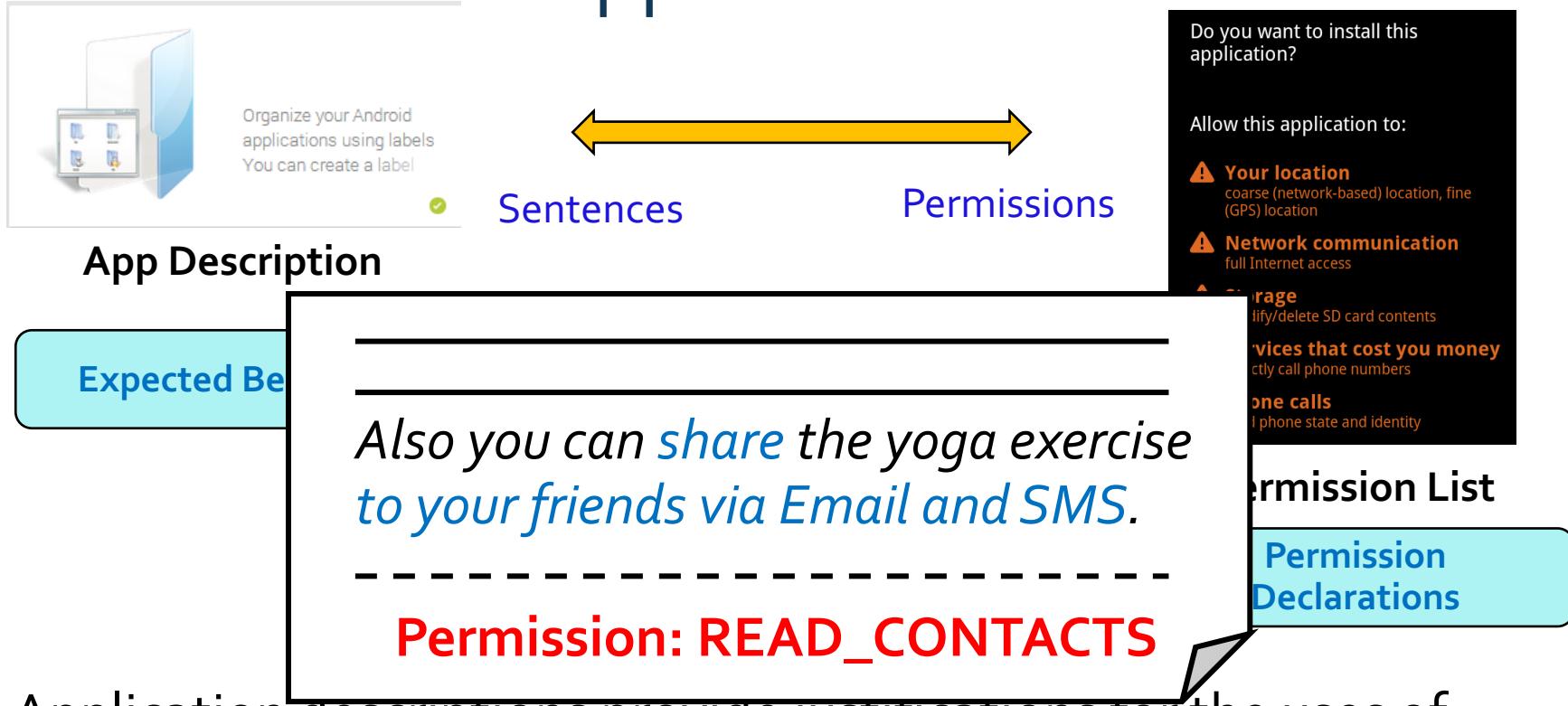
Tips for App Description

- Default fold
 - First few lines
 - Popularity and achievements
- Straight and honest
 - Don't list all features
 - User experience and benefits
 - Don't overpromise
- Include necessary details
 - Positive reviews
 - Press reviews
 - Achievements



<https://www.trademob.com/how-to-write-an-app-description-and-drive-more-downloads-with-examples/>

WHYPER: Bridging User Expectations and App Behavior [USENIX Security 13]

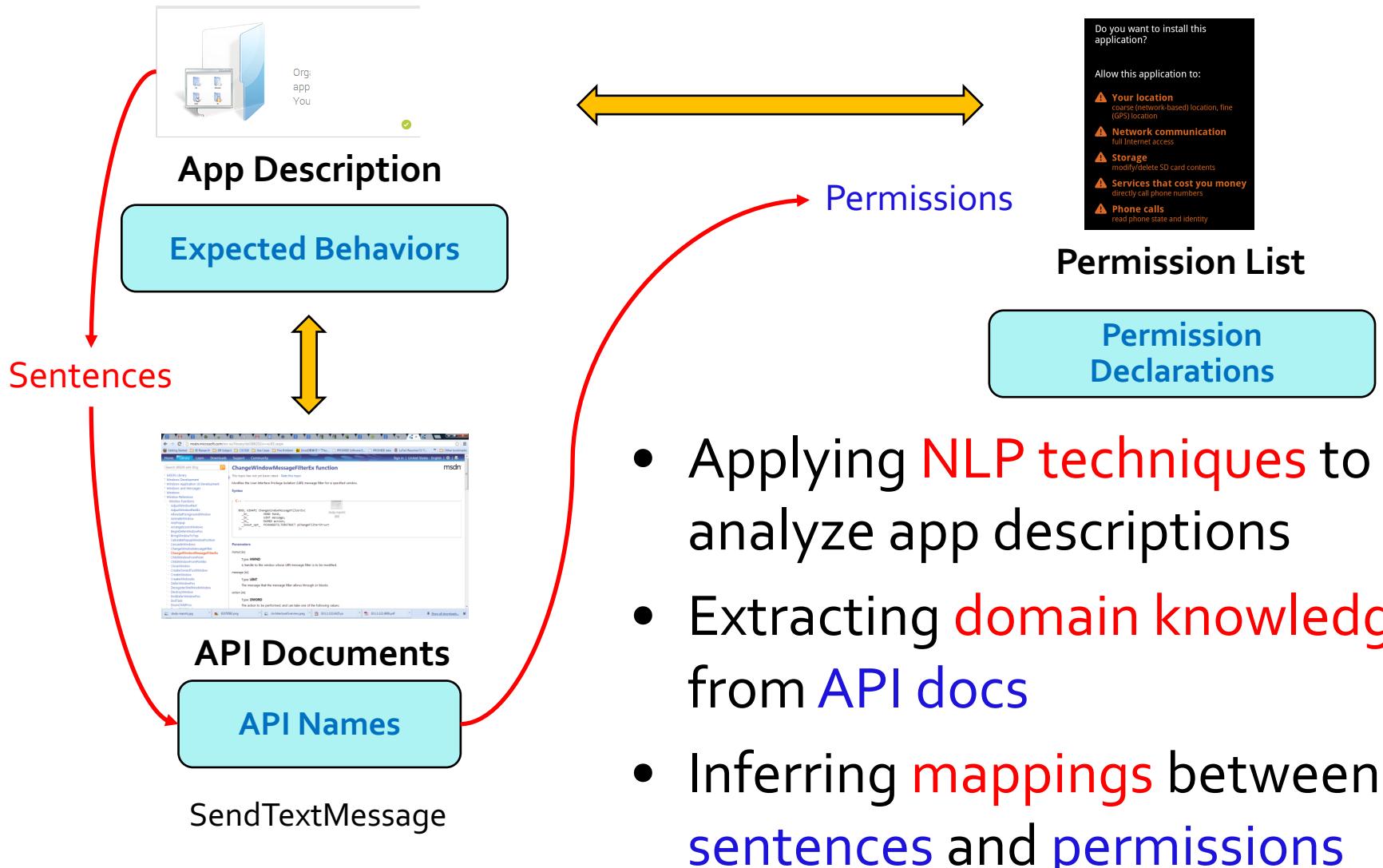


- Application descriptions provide justifications for the uses of private information
- WHYPER identifies sentences in application descriptions to explain **why** an application uses a permission

Can Ctrl + F (Keyword Search) Work?

- **Confounding effects:**
 - Certain keywords such as “**contact**” have a confounding meaning
 - E.g., “... displays user **contacts**, ...” vs “... **contact** me at abc@xyz.com”.
- **Semantic inference:**
 - Sentences often describe a sensitive operation without actually referring to keywords
 - E.g., “share yoga exercises with your friends via Email and SMS”

Overview of *WHYPER*



Part Of Speech (POS) Tag

- Marking up a word in a text (corpus) as corresponding to a particular part of speech, based on both its definition and its context—i.e., its relationship with adjacent and related words in a phrase, sentence, or paragraph.
- https://www.ling.upenn.edu/courses/Fall_2003/ling001/penn_treebank_pos.html

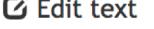
Example POS Tagging

Enter a **complete sentence** (no single words!) and click at "POS-tag!". The tagging works better when grammar and orthography are correct.

Text:

This class is very interesting !

▲
Noun, NN

 Edit text



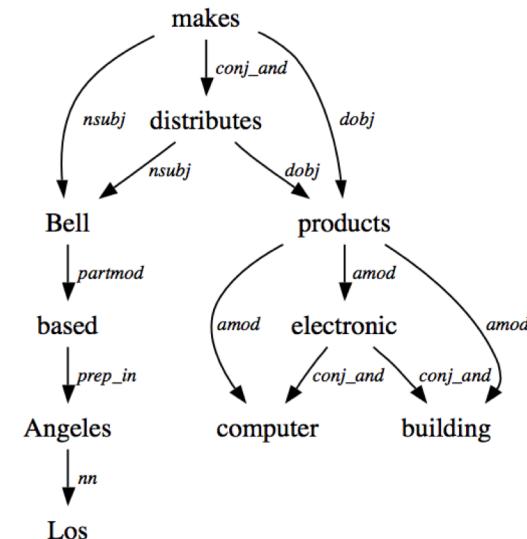
<https://parts-of-speech.info/>

Stanford Typed Dependency

- Description of grammatical relationships in a sentence that can easily be understood and effectively used by people without linguistic expertise who want to extract textual relations.

Bell, based in Los Angeles, makes and distributes electronic, computer and building products

```
nsubj(makes-8, Bell-1)
nsubj(distributes-10, Bell-1)
vmod(Bell-1, based-3)
nn(Angeles-6, Los-5)
prep_in(based-3, Angeles-6)
root(ROOT-0, makes-8)
conj_and(makes-8, distributes-10)
amod(products-16, electronic-11)
conj_and(electronic-11, computer-13)
amod(products-16, computer-13)
conj_and(electronic-11, building-15)
```



Example Dependencies

dobj: direct object

The direct object of a VP is the noun phrase which is the (accusative) object of the verb.

“She gave me a raise”	<i>dobj(gave, raise)</i>
“They win the lottery”	<i>dobj(win, lottery)</i>

iobj: indirect object

The indirect object of a VP is the noun phrase which is the (dative) object of the verb.

“She gave me a raise”	<i>iobj(gave, me)</i>
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conj: conjunct

A conjunct is the relation between two elements connected by a coordinating conjunction, such as “and”, “or”, etc. We treat conjunctions asymmetrically: The head of the relation is the first conjunct and other conjunctions depend on it via the *conj* relation.

“Bill is big and honest”	<i>conj(big, honest)</i>
“They either ski or snowboard”	<i>conj(ski, snowboard)</i>

Demo Website

- <http://nlp.stanford.edu:8080/corenlp/>

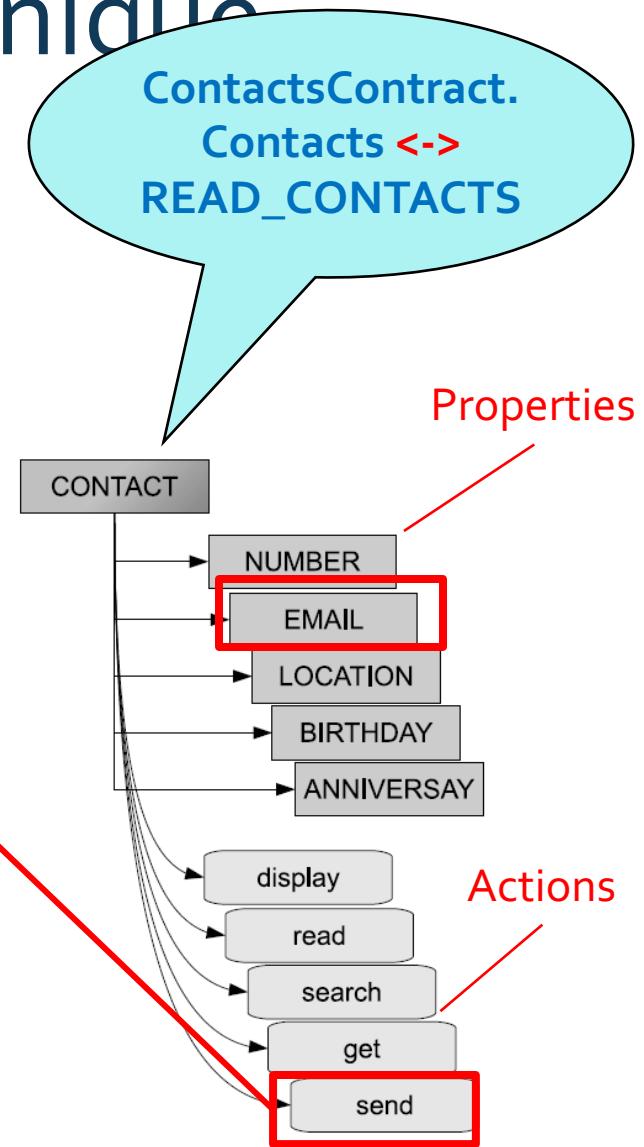
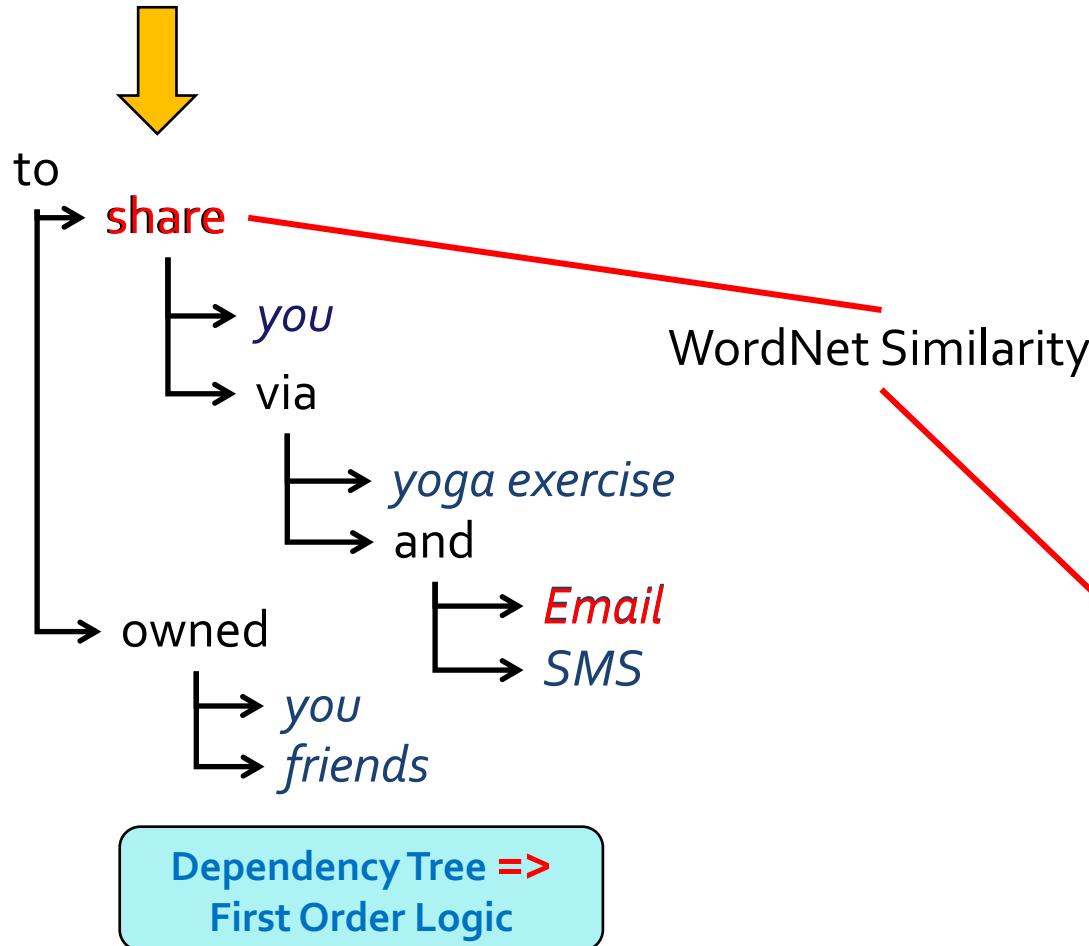
Android API Documentation

void	<code>injectSmsPdu(byte[] pdu, String format, PendingIntent receivedIntent)</code> Inject an SMS PDU into the android application framework.
void	<code>sendDataMessage(String destinationAddress, String scAddress, short destinationPort, byte[] data, PendingIntent sentIntent, PendingIntent deliveryIntent)</code> Send a data based SMS to a specific application port.
void	<code>sendMultimediaMessage(Context context, Uri contentUri, String locationUrl, Bundle configOverrides, PendingIntent sentIntent)</code> Send an MMS message
void	<code>sendMultipartTextMessage(String destinationAddress, String scAddress, ArrayList<String> parts, ArrayList<PendingIntent> sentIntents, ArrayList<PendingIntent> deliveryIntents)</code> Send a multi-part text based SMS.
void	<code>sendTextMessage(String destinationAddress, String scAddress, String text, PendingIntent sentIntent, PendingIntent deliveryIntent)</code> Send a text based SMS.

- <https://developer.android.com/reference/android/provider/ContactsContract.CommonDataKinds.html>

WHYPER Technique

Also you can *share* the yoga exercise to your friends via Email and SMS.



Evaluation Results

- Precision and recall of **WHYPER**
 - 581 application descriptions and **9,953** sentences
 - Average precision (**82.8%**) and recall (**81.5%**)

Permission	Keywords
READ_CONTACTS	contact, data, number, name, email
READ_CALENDAR	calendar, event, date, month, day, year
RECORD_AUDIO	record, audio, voice, capture, microphone

- Comparison to keyword search
 - Improving precision (**41.6%**) and recall (**-1.2%**)

Thank You !



Questions ?