

Automatically Translating Bug Reports into Test Cases for Mobile Apps

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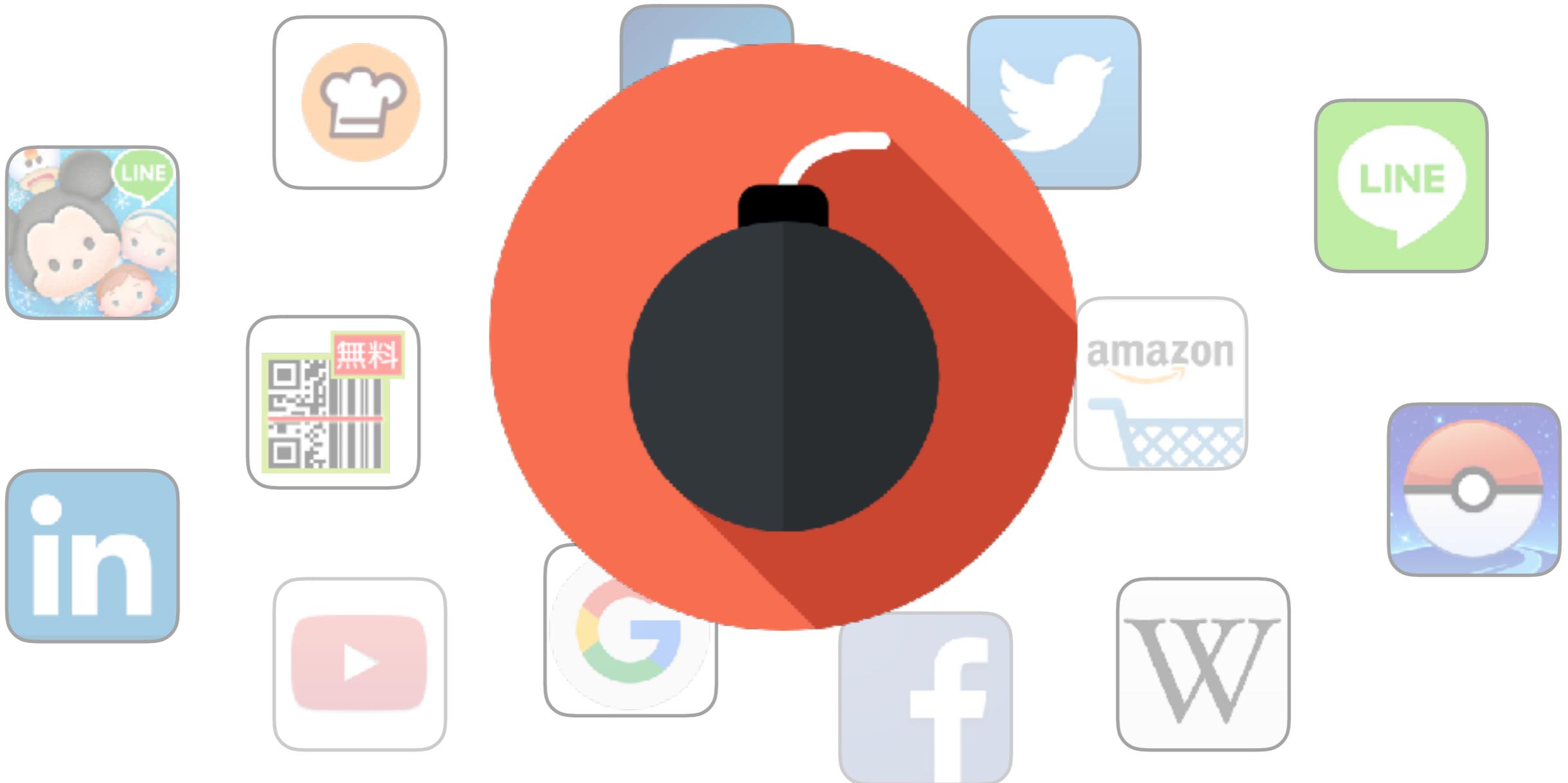
Mobile Applications



Mobile Applications



Failures



Bug Reports



Arkonos commented on Jul 5, 2017

FC upon selecting weekly backup freq

Steps to reproduce:

Settings -> Backup -> Backup freq

100% for me, no other frequency st

Once after such crash, the app wo
reproduce this.

Pretty sure the same thing happen

Version:

Phone: N

Android

LineageOS

Kernel:3.

afwang commented o

I found this crash on v

[redreader_crash_log_f](#)

Reproduction steps:

1. Launch redreader
subscribed subscr

2. Tap the refresh button in the app ba
3. Swipe down while the subscribed si

I think it might help to reproduce if you'r
speed is throttled.

Trolldemorted commented on May 19, 2

I have:

open and closed issues for
<https://github.com/WhisperSyst>



Onko commented on Mar 24, 2017

<Text paragraph>

<Logcat information>

Steps to reproduce the behav

1. Start a new post
2. Type something
3. Tap on the Publish button
4. The app crashes

<Text paragraph>

Mar 28, 201
Runtime(30920): Shutting down due to memory le
Runtime(30920): FATAL EXCEPTION: Java thread [L
Runtime(30920): Process: org.redreader/Java th
Runtime(30920): java.lang.ILLEGALSTATEEXCEPTION
Runtime(30920): at org.redreader.MainActivity\$1.on

Tweet opens with selected account



Actual behavior

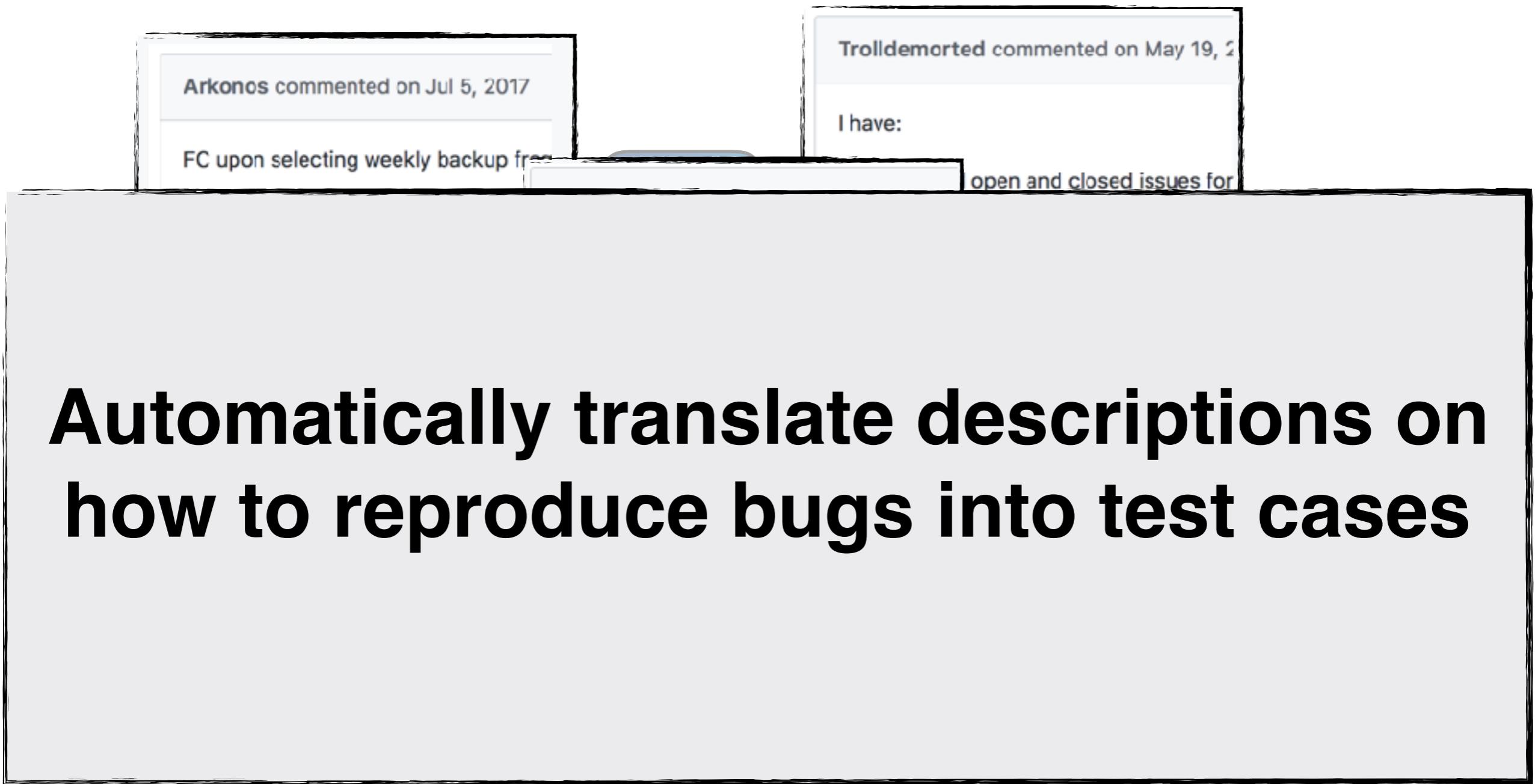
Twidere crashes



Steps to reproduce

Longpress retweet icon underneath t

Goal



The image shows a mobile application interface with a card titled "Steps to reproduce".

Steps to reproduce Card Content:

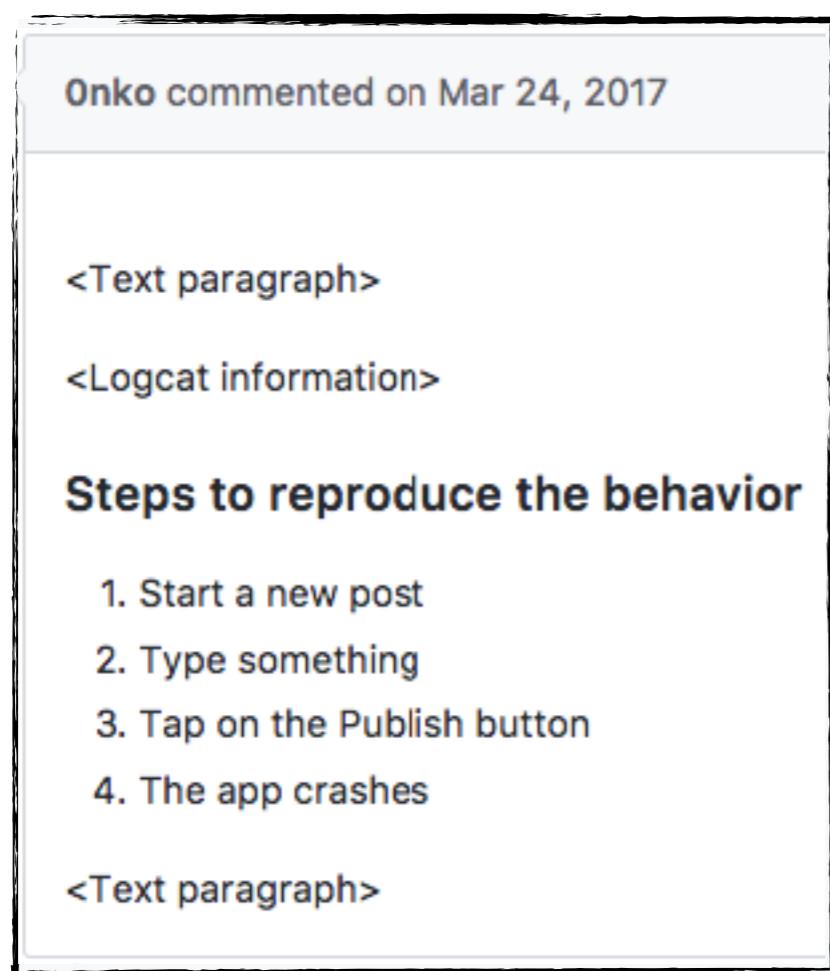
- Step 3: Swipe down while the subscribed si
I think it might help to reproduce if you're speed is throttled.
- Icon: A blue square with a white "T" inside.
- Text: Steps to reproduce
Longpress retweet icon underneath t

Bottom Navigation Bar:

- Home icon: A house icon.
- Profile icon: A person icon.
- QuantumBadger added the link icon: A small icon with the text "QuantumBadger added the link".

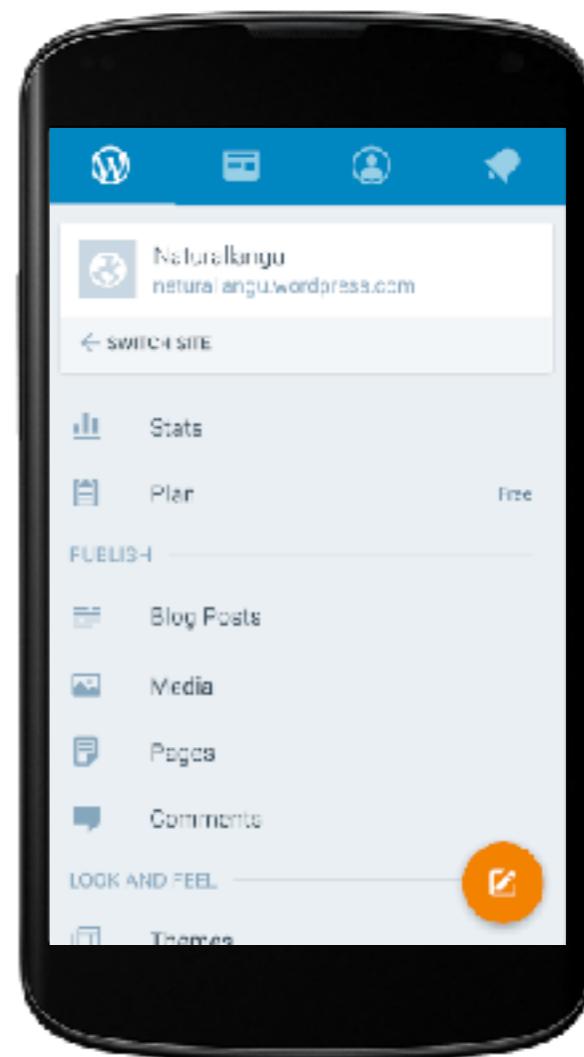
Motivating Example

Bug Report



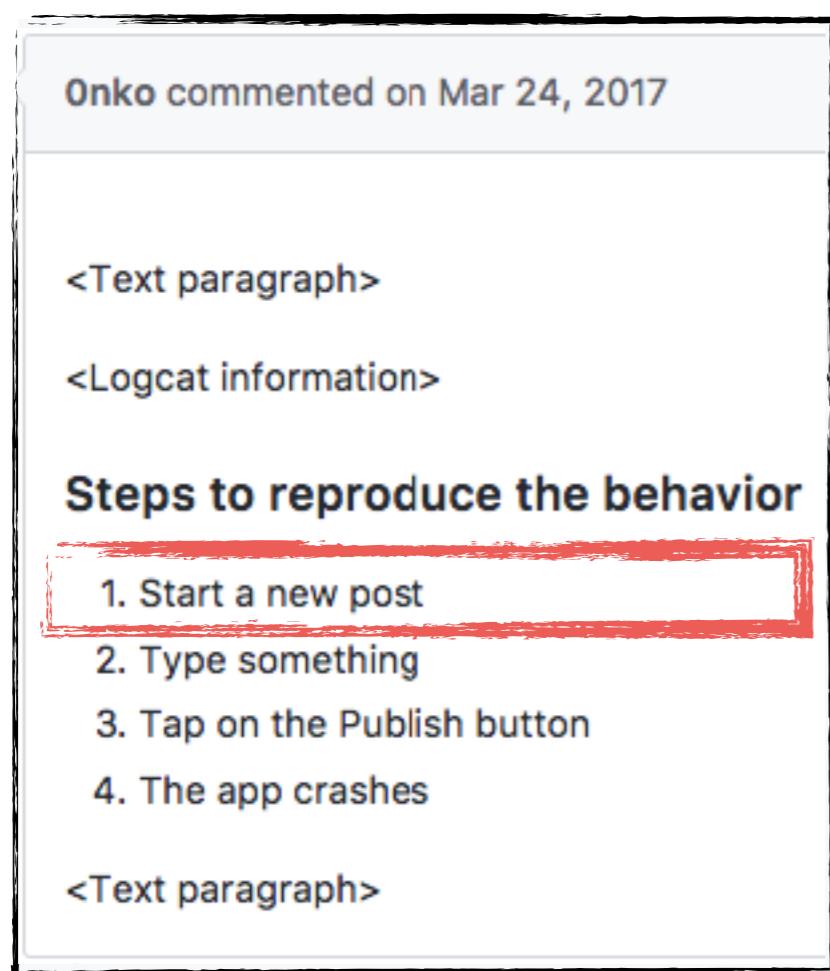
WORDPRESS App

Developer



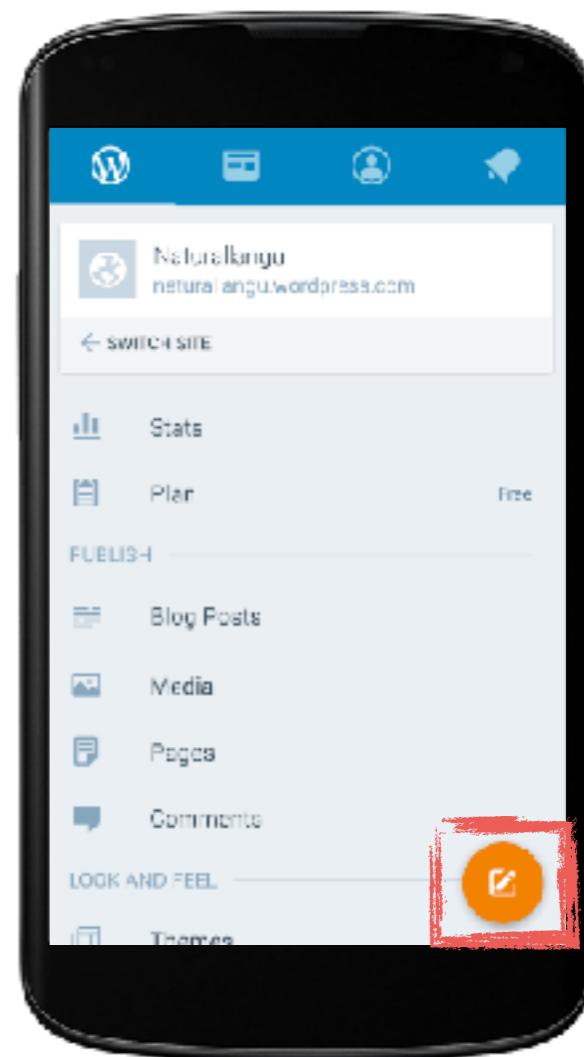
Motivating Example

Bug Report



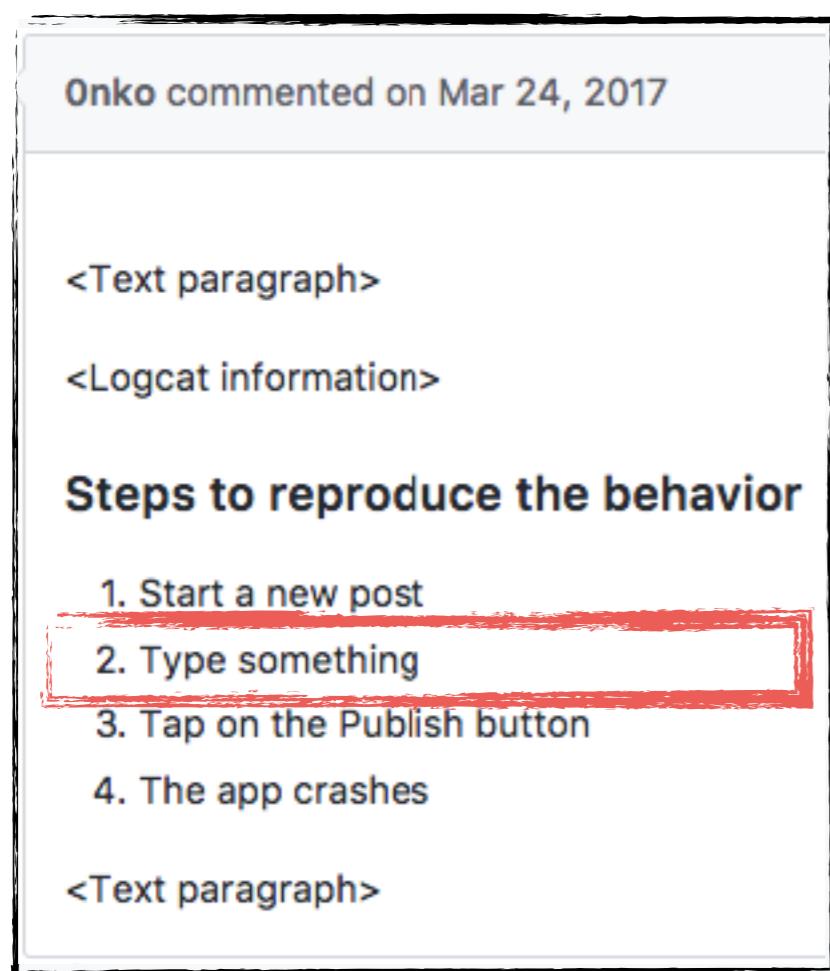
WORDPRESS App

Developer



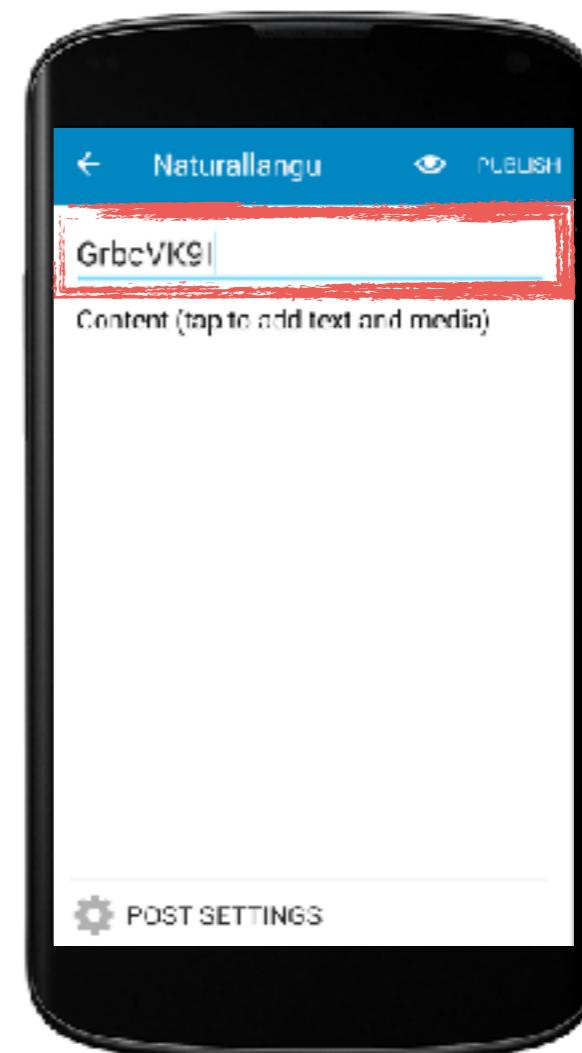
Motivating Example

Bug Report



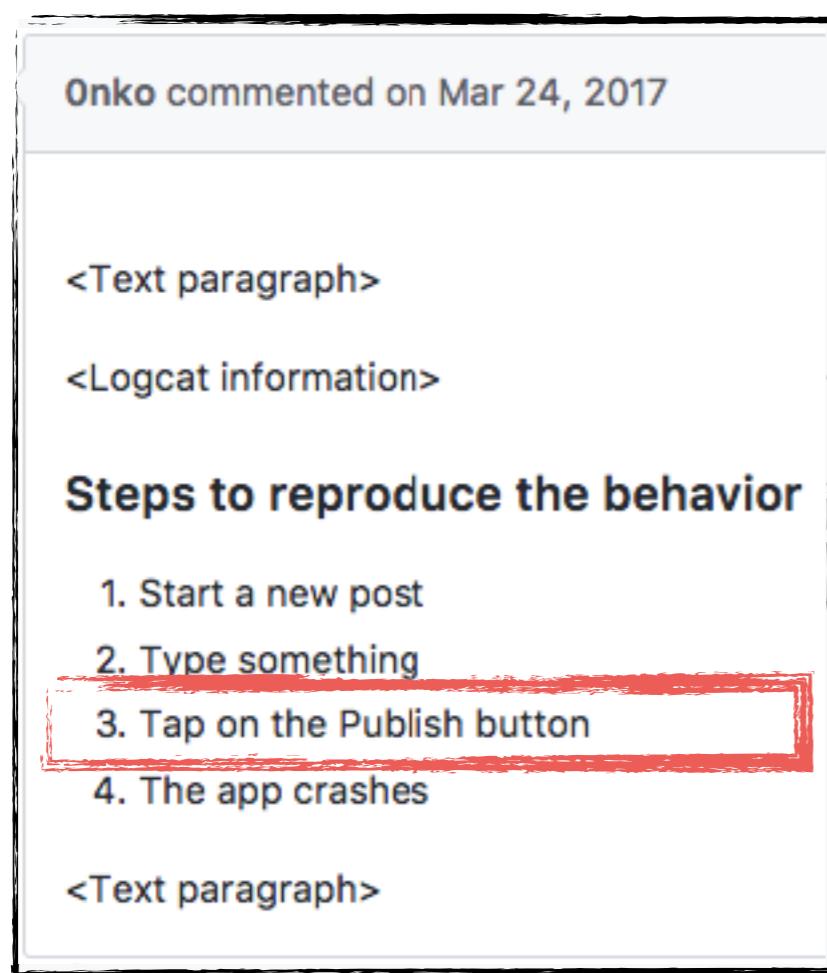
WORDPRESS App

Developer



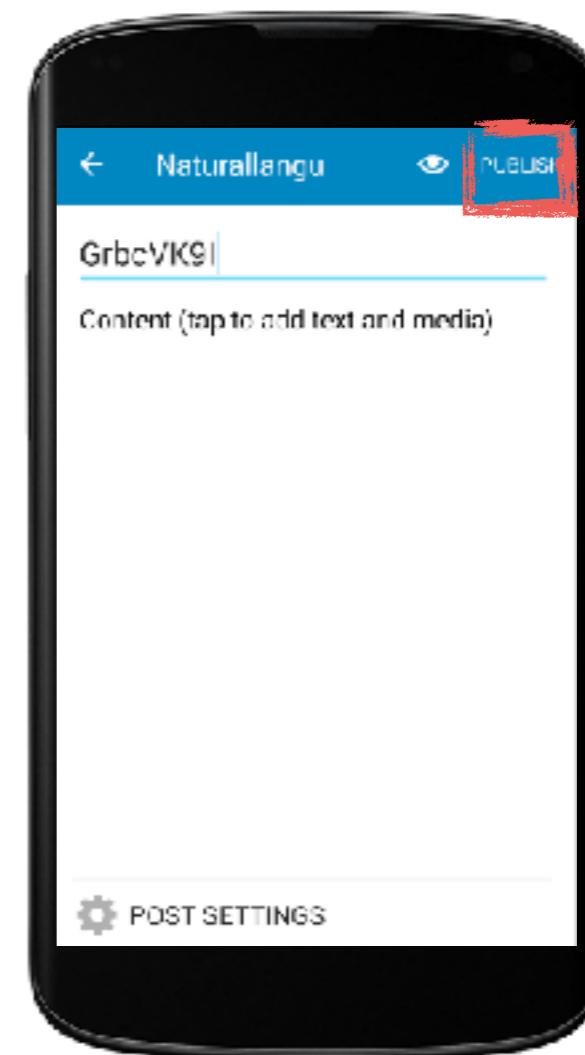
Motivating Example

Bug Report



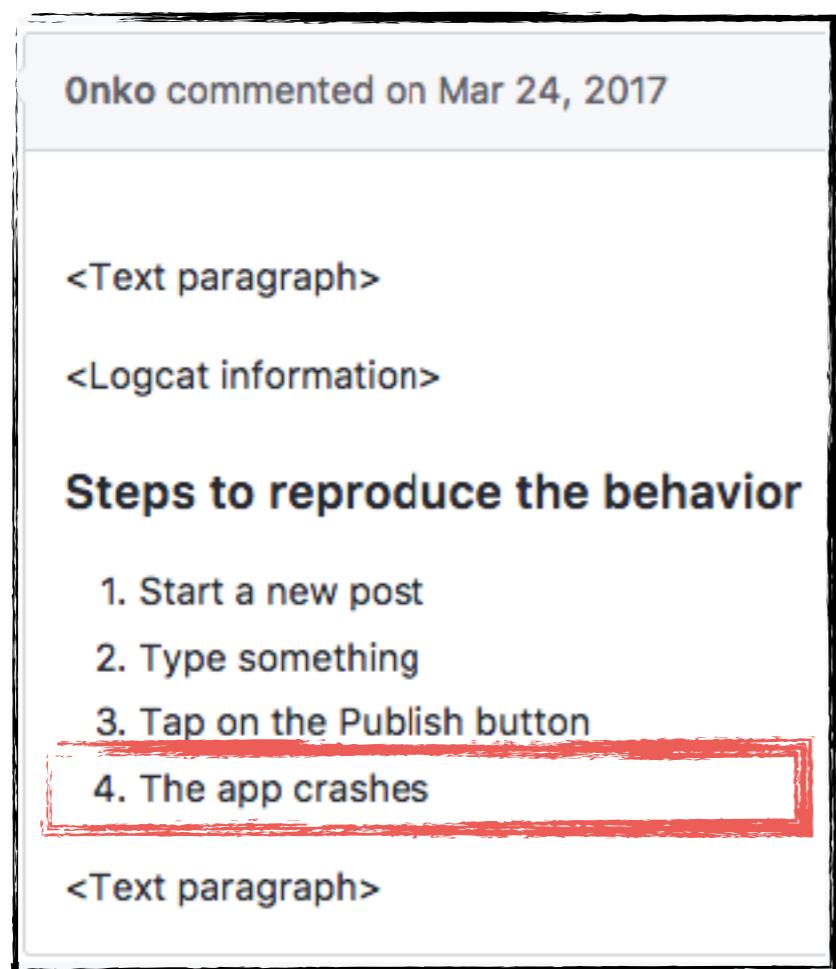
WORDPRESS App

Developer



Motivating Example

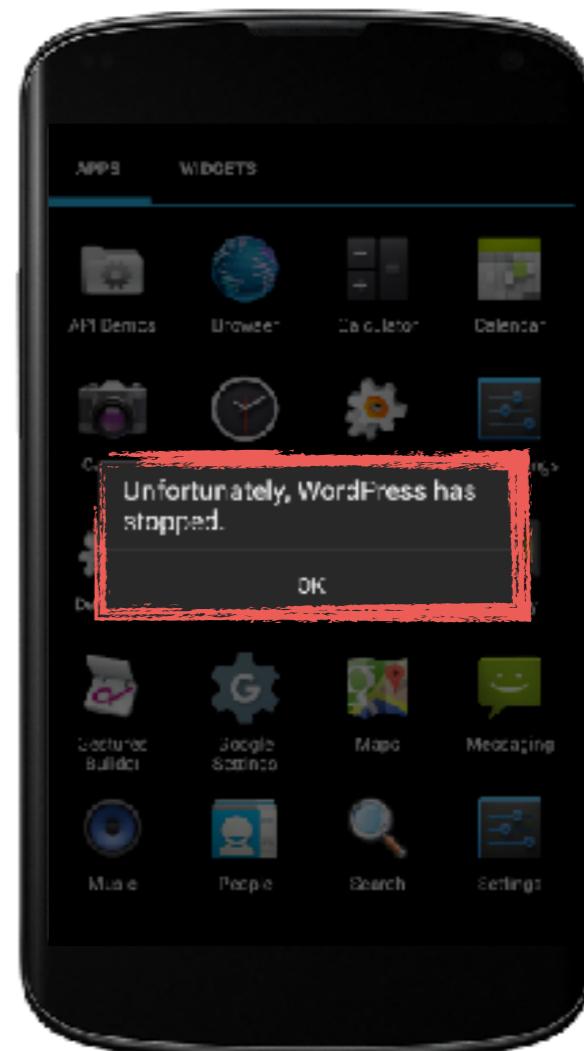
Bug Report



Developer

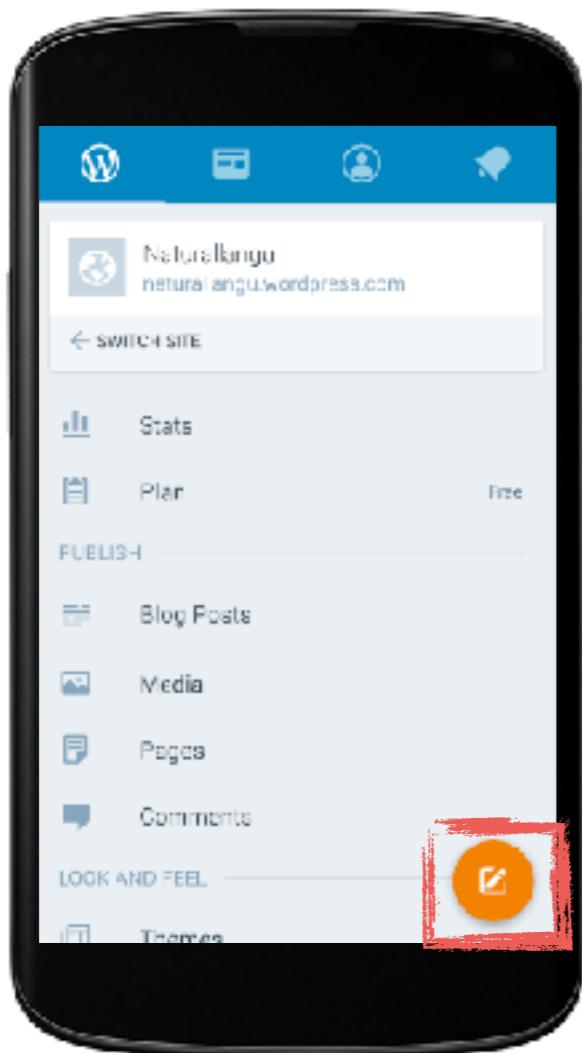


WORDPRESS App



Motivating Example

WORDPRESS
App



Developer

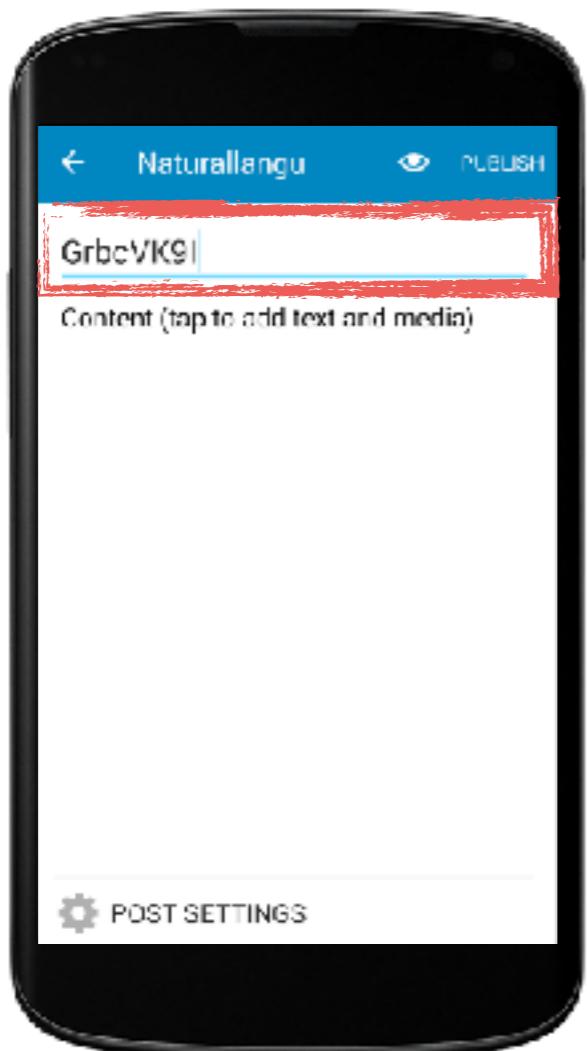


Test
Case

```
public void test() {  
  
    //start a new post  
    onView(  
        withId(R.id.fab_button))  
        .perform(click());  
  
    //type something  
    onView(  
        withId(R.id.post_title))  
        .perform(typeText("GrbcVK9I"));  
  
    //tap on the publish button  
    onView(  
        withId(R.id.menu_save_post))  
        .perform(click());  
}
```

Motivating Example

WORDPRESS
App



Developer



Test
Case

```
public void test() {  
  
    //start a new post  
    onView(  
        withId(R.id.fab_button))  
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    onView(  
        withId(R.id.menu_save_post))  
        .perform(click());  
}
```

Motivating Example

WORDPRESS
App



Developer

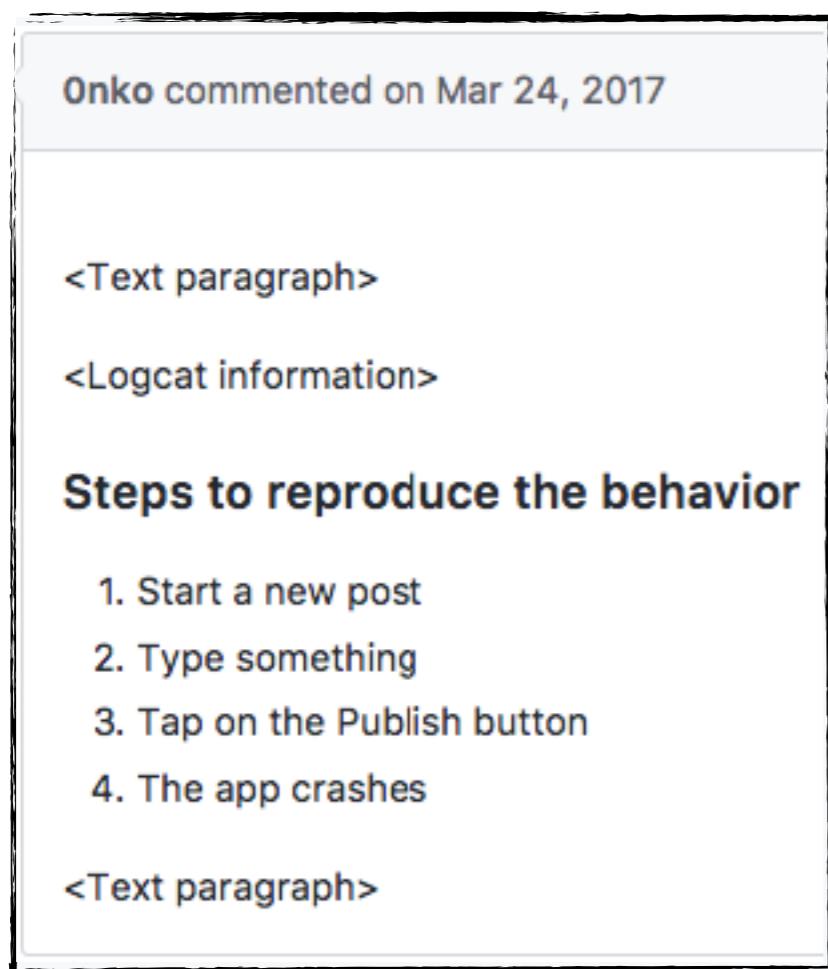


Test
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public void test() {  
  
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    onView(  
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    .perform(typeText("GrbcVK9I"));  
  
    //tap on the publish button  
    onView(  
        withId(R.id.menu_save_post)  
    .perform(click());  
}
```

Motivating Example

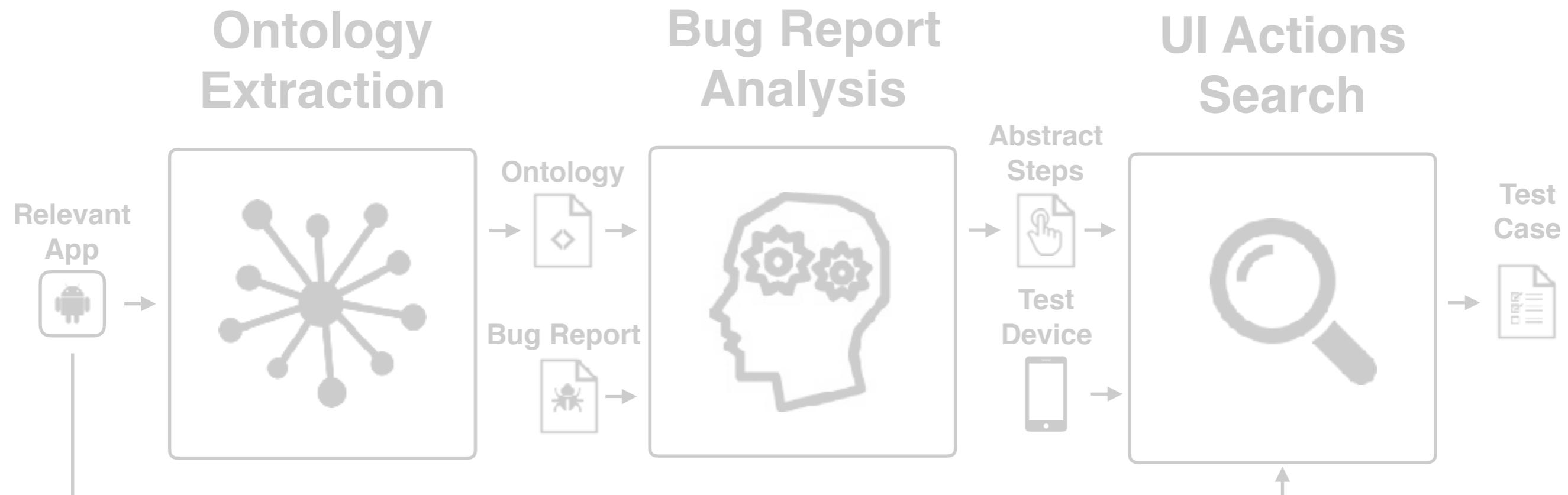
Bug Report



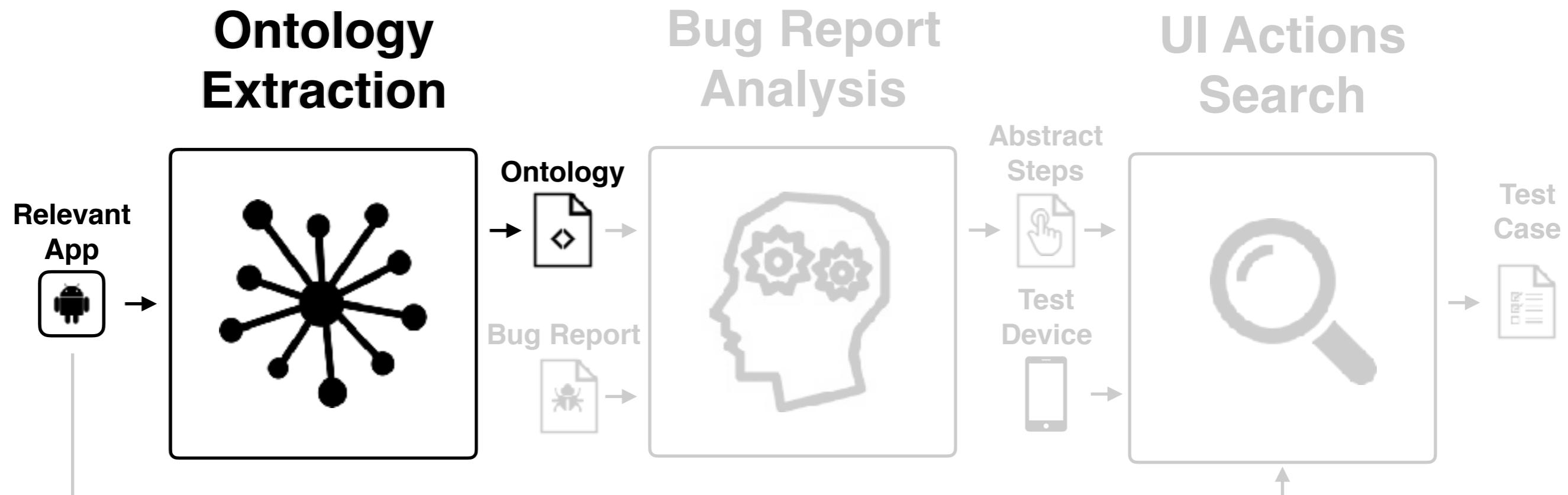
Test Case

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    //start a new post  
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        withId(R.id.fab_button)  
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    //type something  
    onView(  
        withId(R.id.post_title)  
        .perform(typeText("GrbcVK9I"));  
  
    //tap on the publish button  
    onView(  
        withId(R.id.menu_save_post)  
        .perform(click());  
}
```

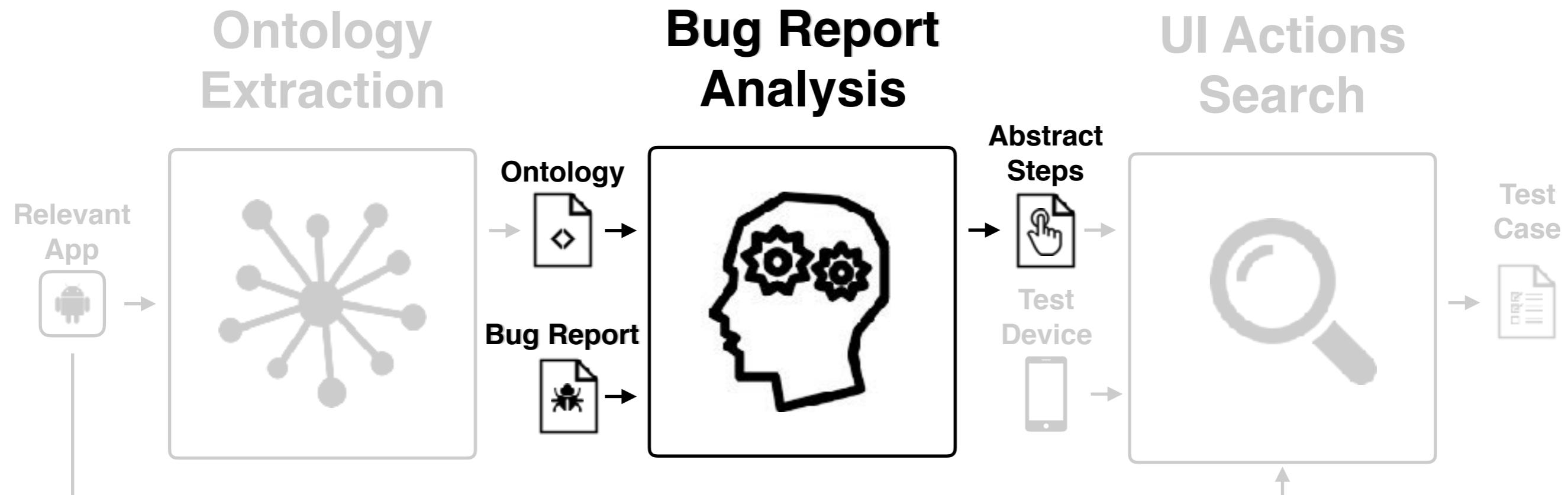
Yakusu Overview



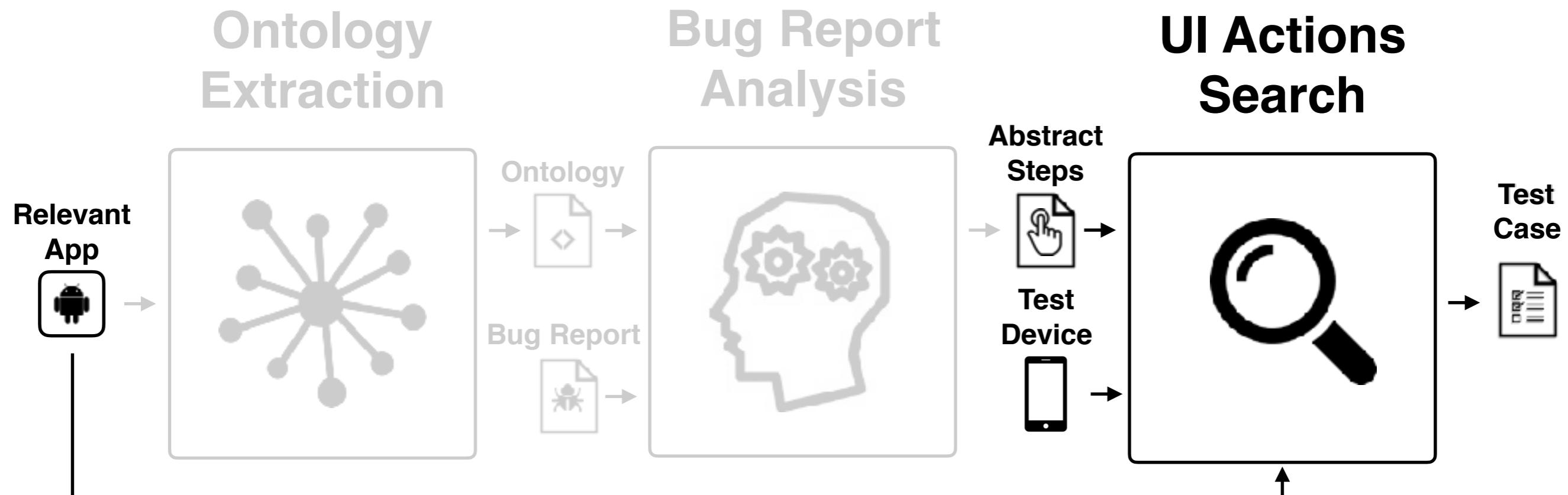
Yakusu Overview



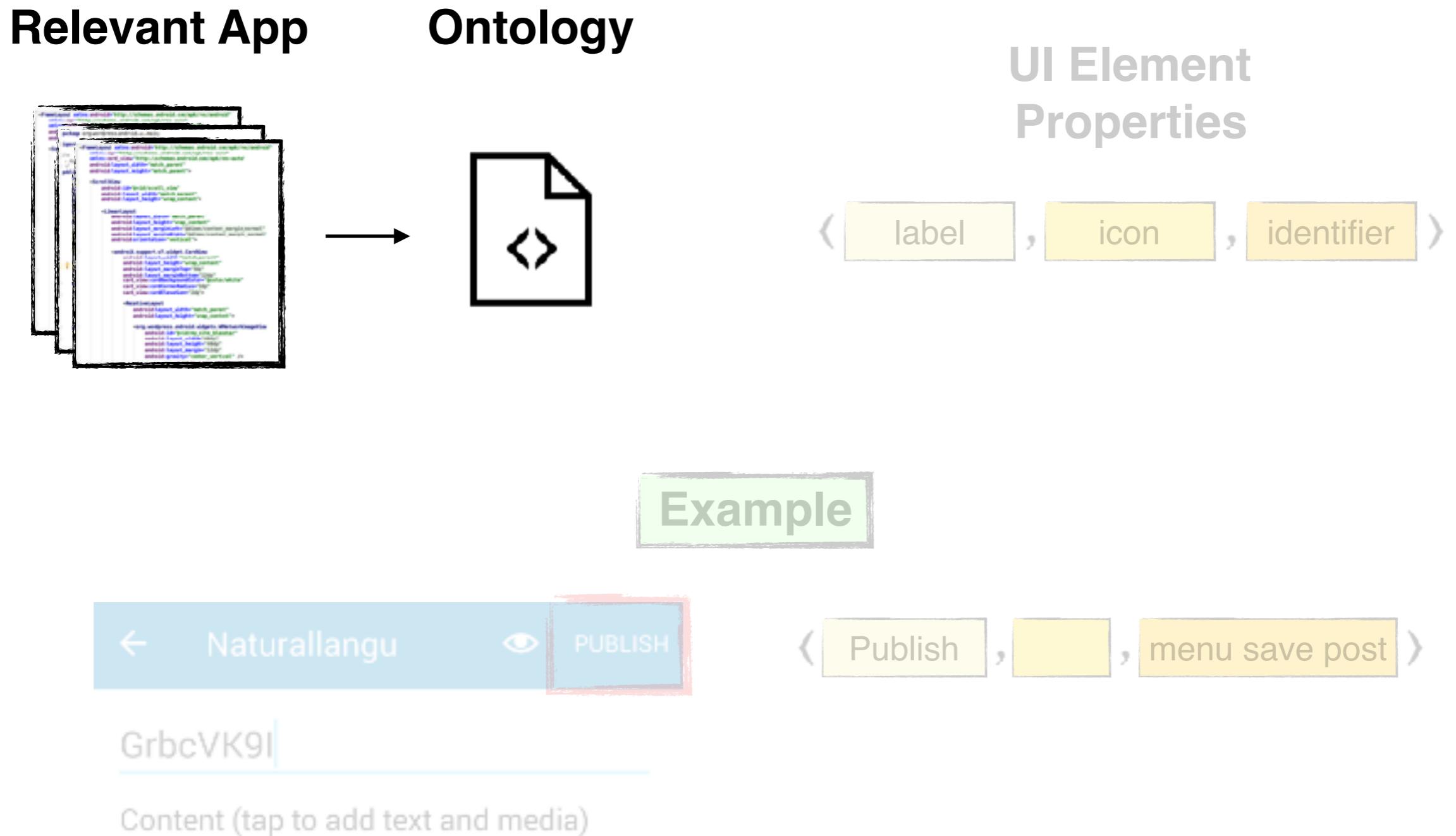
Yakusu Overview



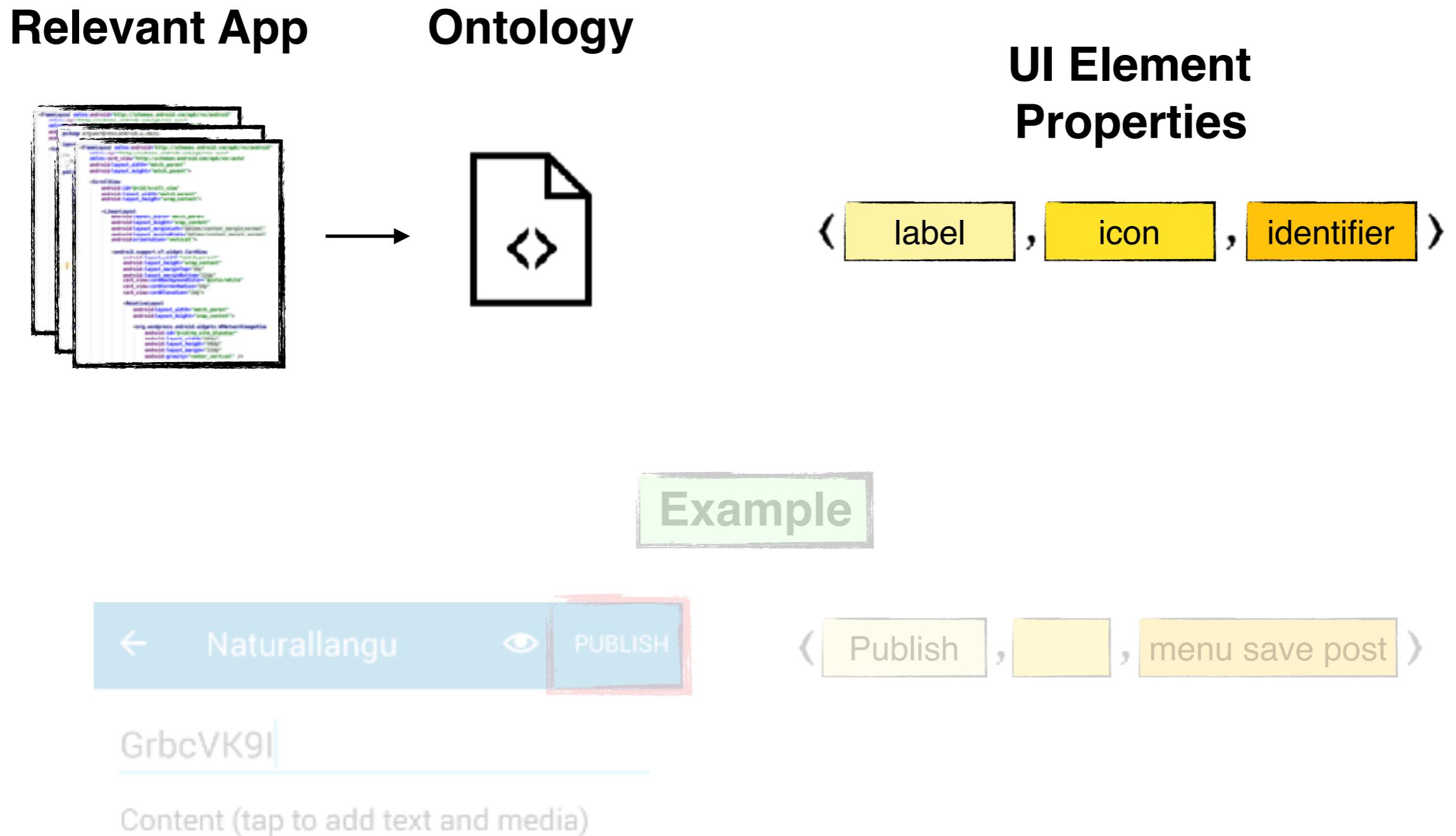
Yakusu Overview



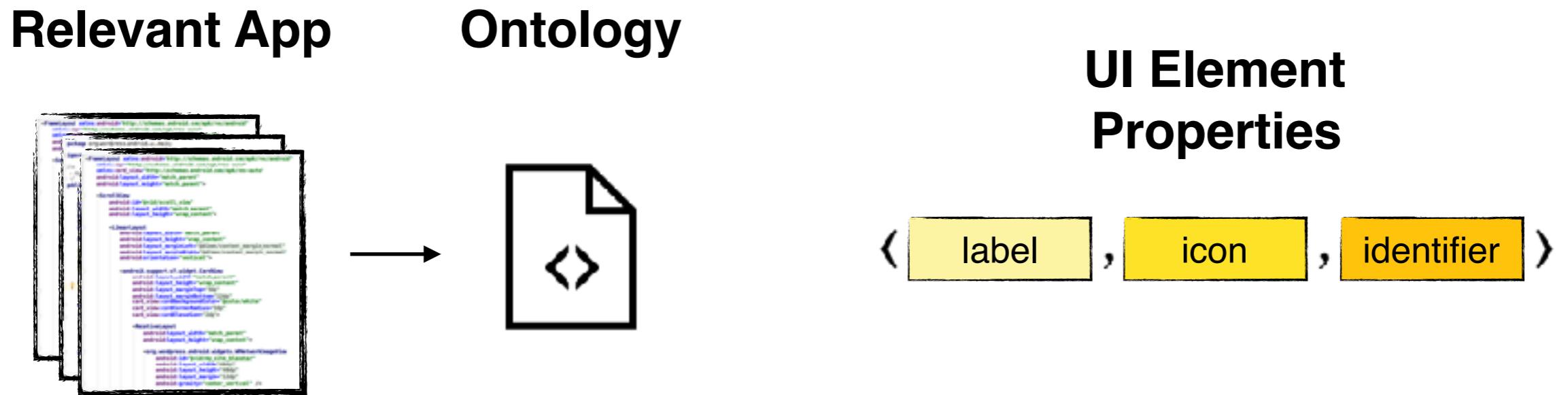
Ontology Extraction



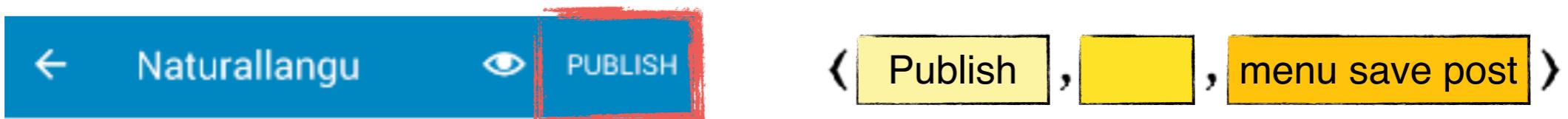
Ontology Extraction



Ontology Extraction



Example

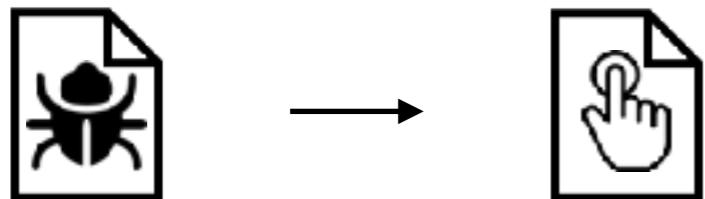


GrbcVK9I

Content (tap to add text and media)

Bug Report Analysis

Bug Report Abstract Steps



Abstract Step

< action , target , properties >

Dependency Tree (Case #1)

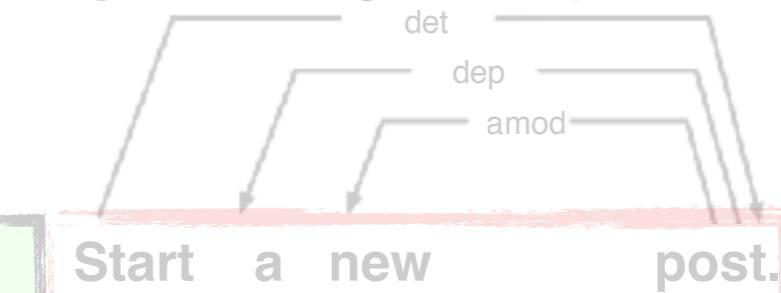


Example

Tap on the Publish button.

Example

Dependency Tree (Case #2)



Example

Start a new post.

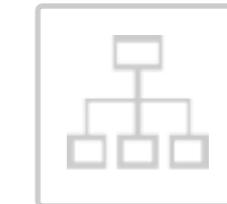
Ontology



< Tap , Publish , [] >

Clause
Vector

word2vec



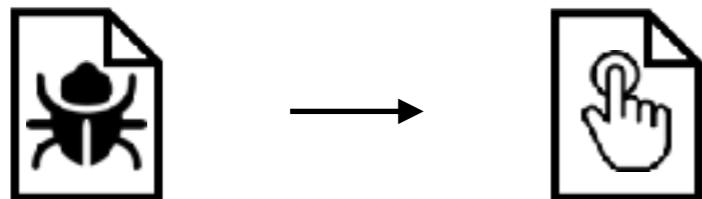
Property
Vector

Cosine
Similarity

< ? , Start a new post , [] >

Bug Report Analysis

Bug Report Abstract Steps



Abstract Step

< action , target , properties >

Dependency Tree (Case #1)

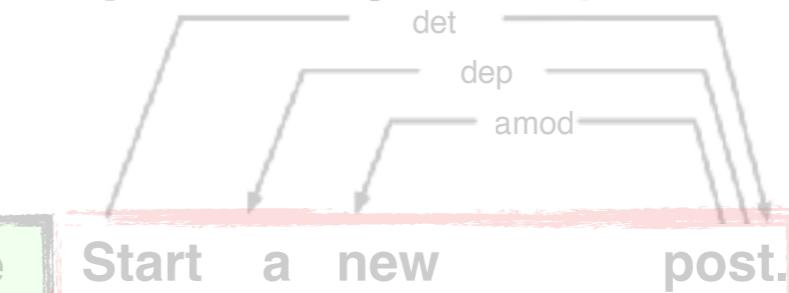


Example

Tap on the Publish button.

< Tap , Publish , [] >

Dependency Tree (Case #2)



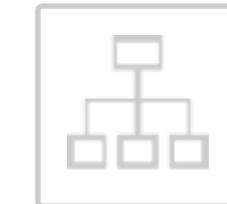
Example

Start a new post.

Ontology



word2vec



Clause Vector



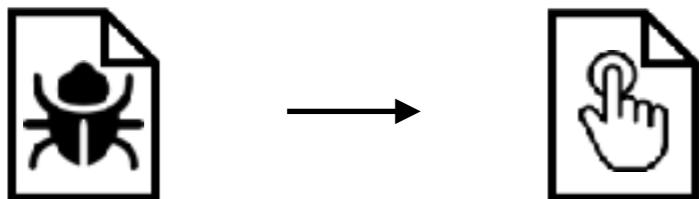
Property Vector

Cosine Similarity

< ? , Start a new post , [] >

Bug Report Analysis

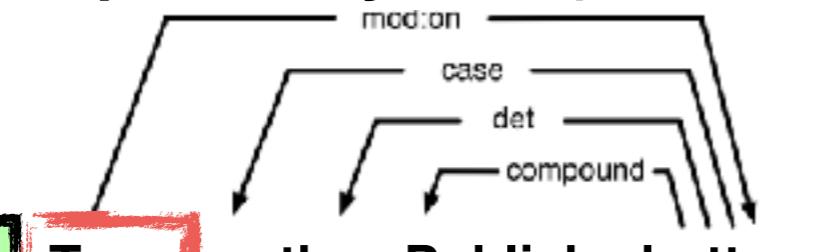
Bug Report Abstract Steps



Abstract Step

< action , target , properties >

Dependency Tree (Case #1)



Example

Tap on the Publish button.

< Tap , Publish , [] >

Dependency Tree (Case #2)



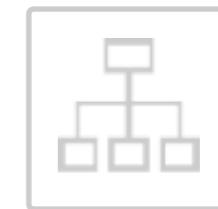
Example

Start a new post.

Ontology



word2vec



Clause
Vector



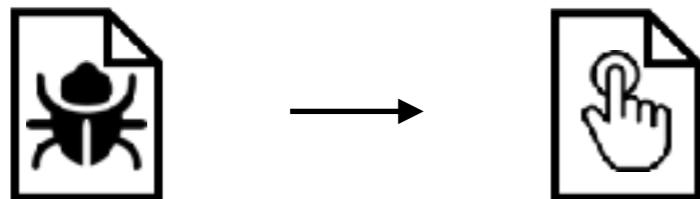
Property
Vector

Cosine
Similarity

< ? , Start a new post , [] >

Bug Report Analysis

Bug Report Abstract Steps



Abstract Step

< **action** , **target** , **properties** >

Dependency Tree (Case #1)

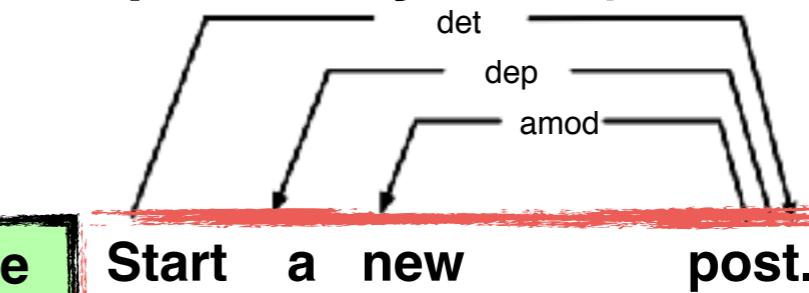


Example

Tap on the Publish button.

Example

Dependency Tree (Case #2)

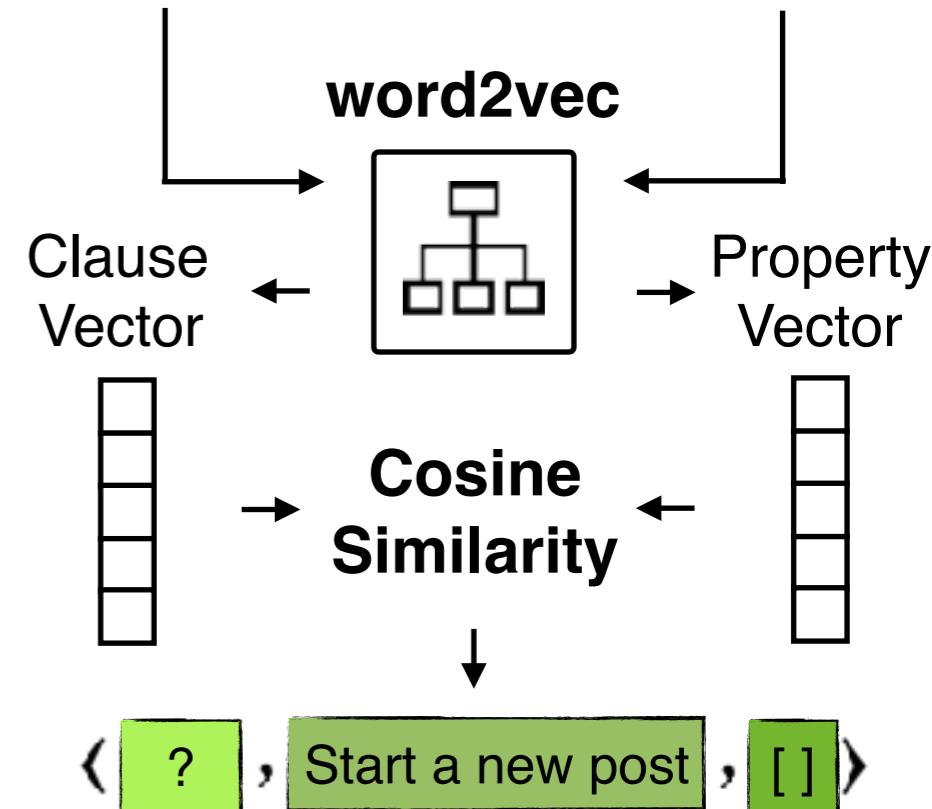


Start a new post.

Ontology



< **Tap** , **Publish** , [] >



UI Actions Search

**Abstract
Steps**



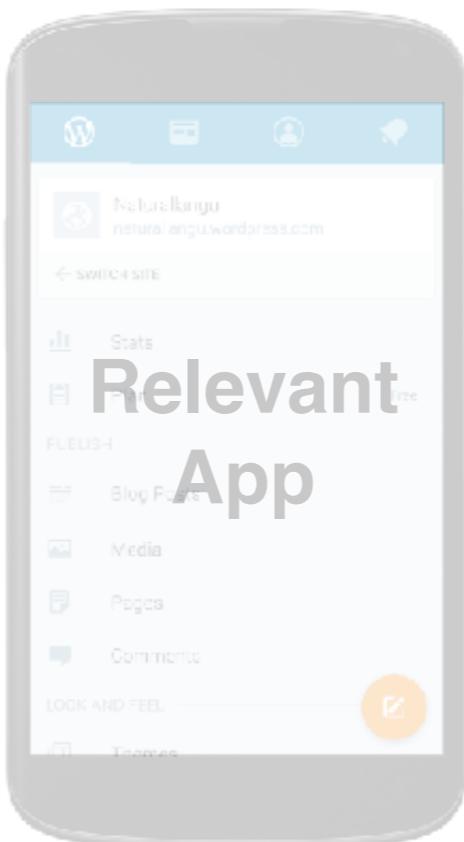
Test Case

Abstract Step

action , target , properties

UI action , UI element , properties

Test Device



UI Actions Search

**Abstract
Steps**



Test Case

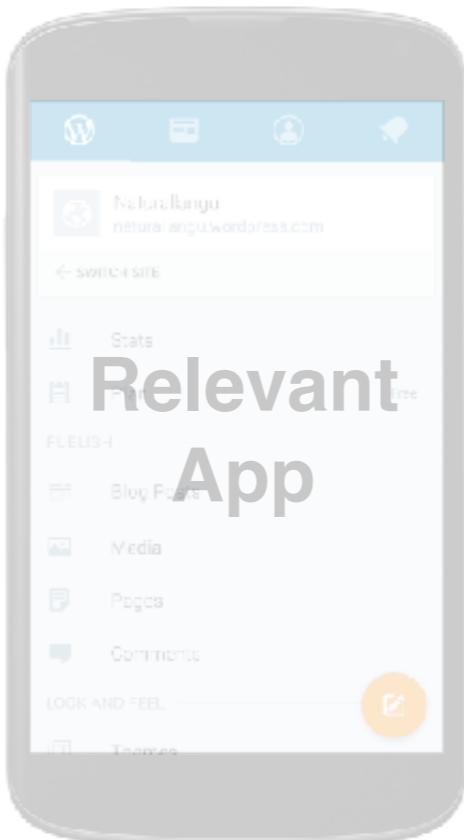
Abstract Step

UI Action

(**action** , **target** , **properties**)

(**UI action** , **UI element** , **properties**)

Test Device



UI Actions Search

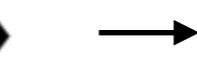
**Abstract
Steps**



Test Case

Abstract Step

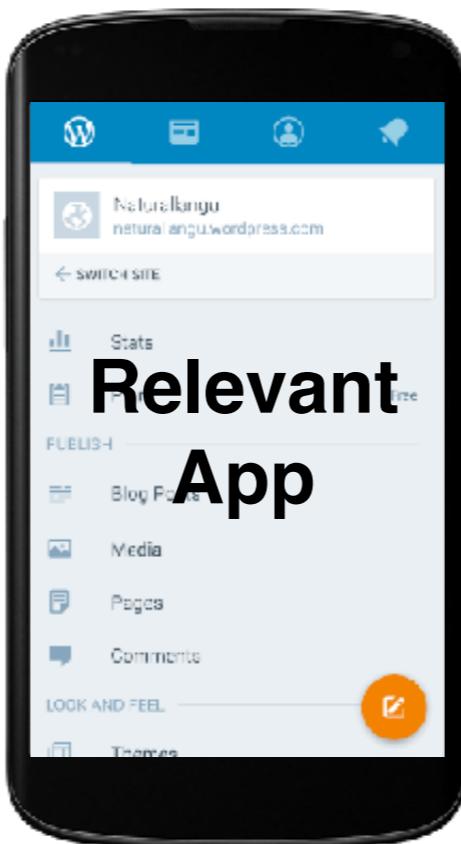
(**action** , **target** , **properties**)



UI Action

(**UI action** , **UI element** , **properties**)

Test Device

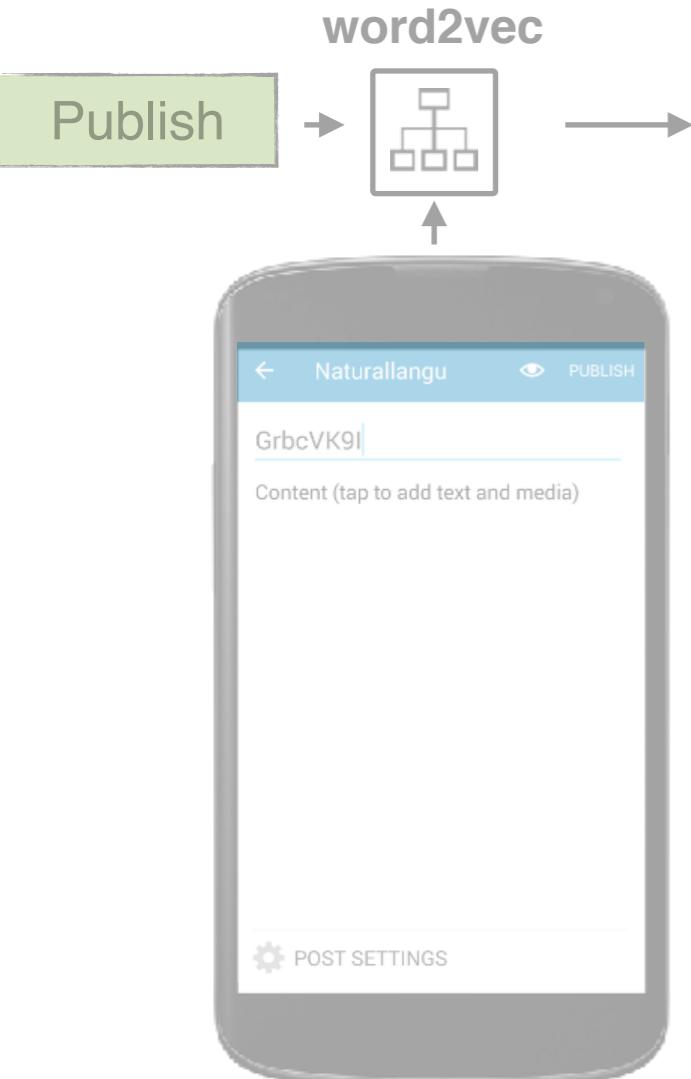


UI Actions Search

Abstract Step

⟨ **Tap** , **Publish** , **[]** ⟩

Find UI Element



Current Execution

⟨ **Tap** , **Publish** , **[]** ⟩

Forked Executions

⟨ **Tap** , **UI element #2** , **[]** ⟩
...
⟨ **Tap** , **UI element #N** , **[]** ⟩

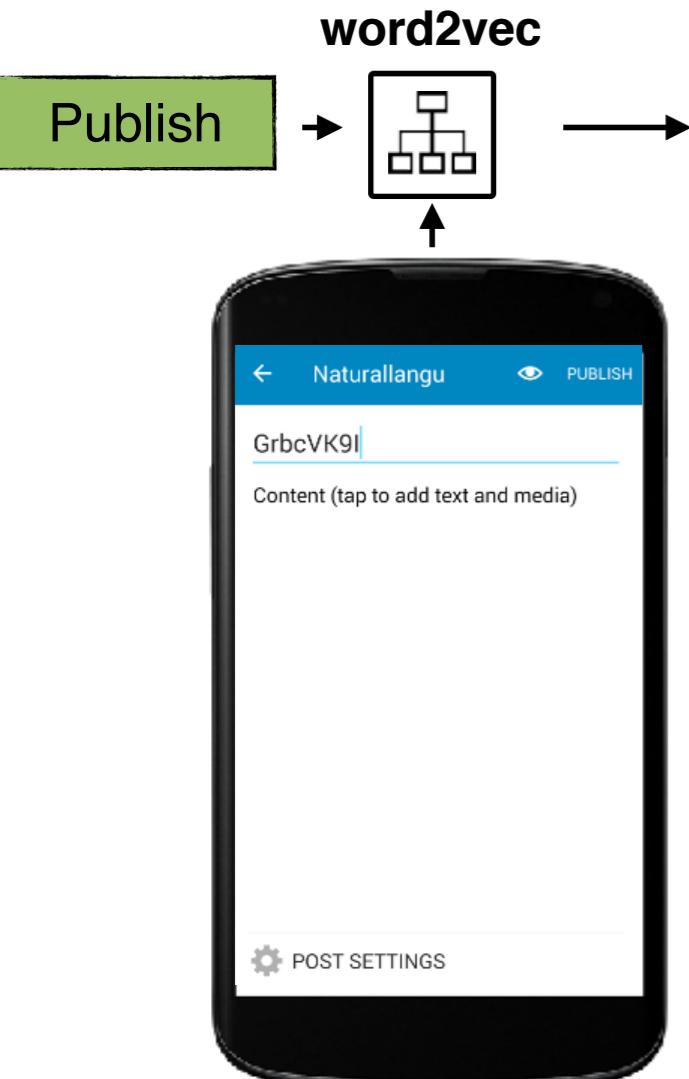
Random UI Action Generation

UI Actions Search

Abstract Step



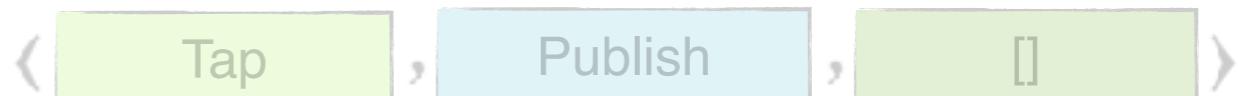
Find UI Element



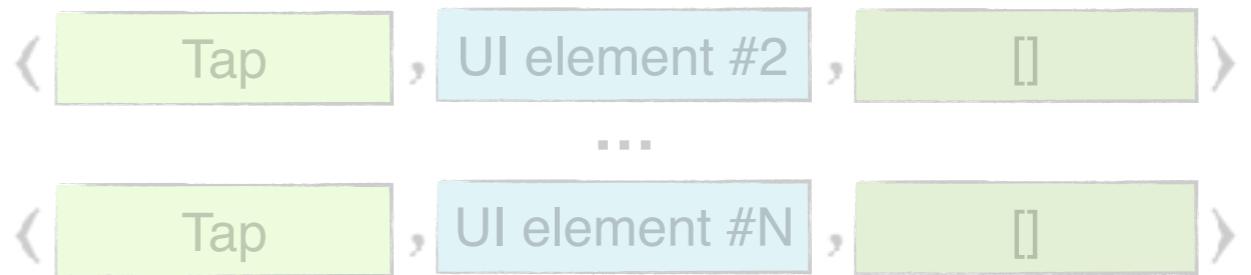
UI Elements

- Publish
- UI element #2
- ...
- UI element #N

Current Execution



Forked Executions



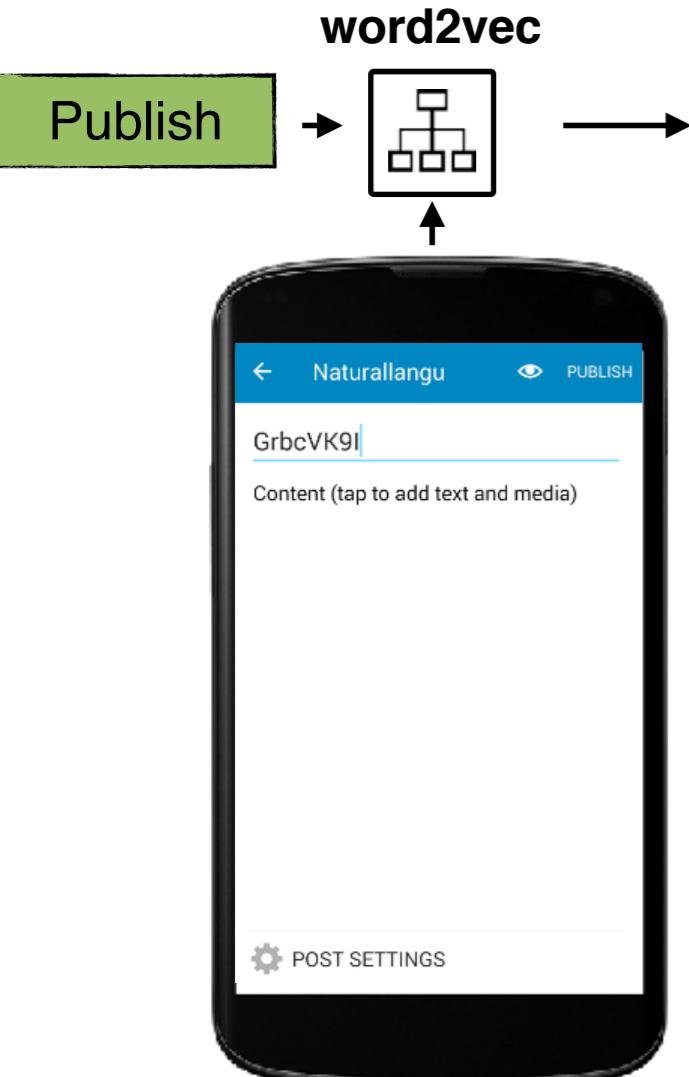
Random UI Action Generation

UI Actions Search

Abstract Step

< Tap , Publish , [] >

Find UI Element



Current Execution

< Tap , Publish , [] >

Forked Executions

< Tap , UI element #2 , [] >
...
< Tap , UI element #N , [] >

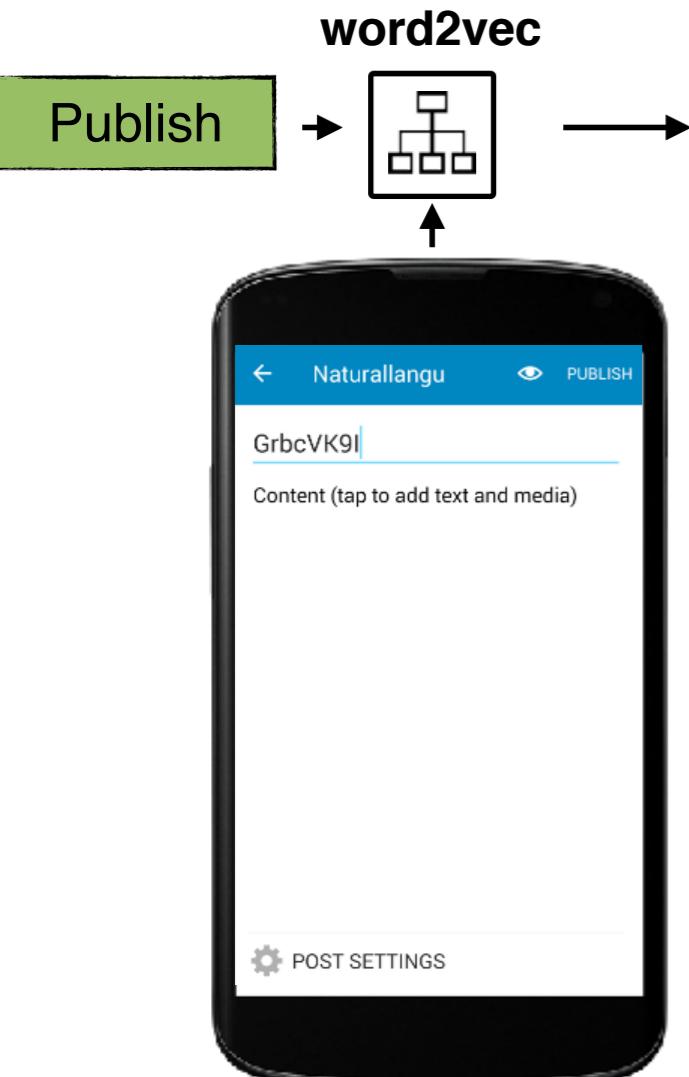
Random UI Action Generation

UI Actions Search

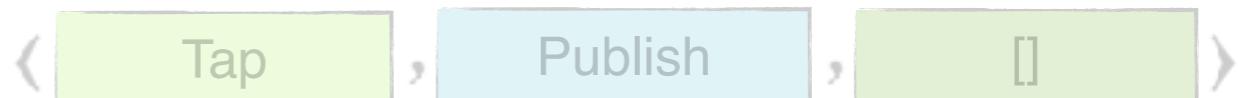
Abstract Step



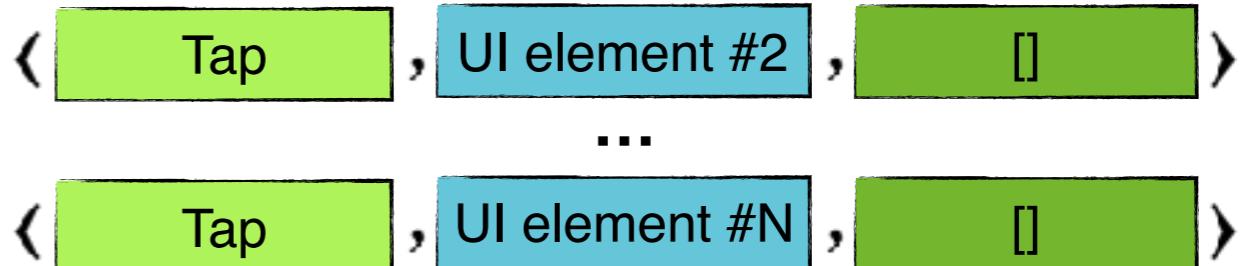
Find UI Element



Current Execution



Forked Executions



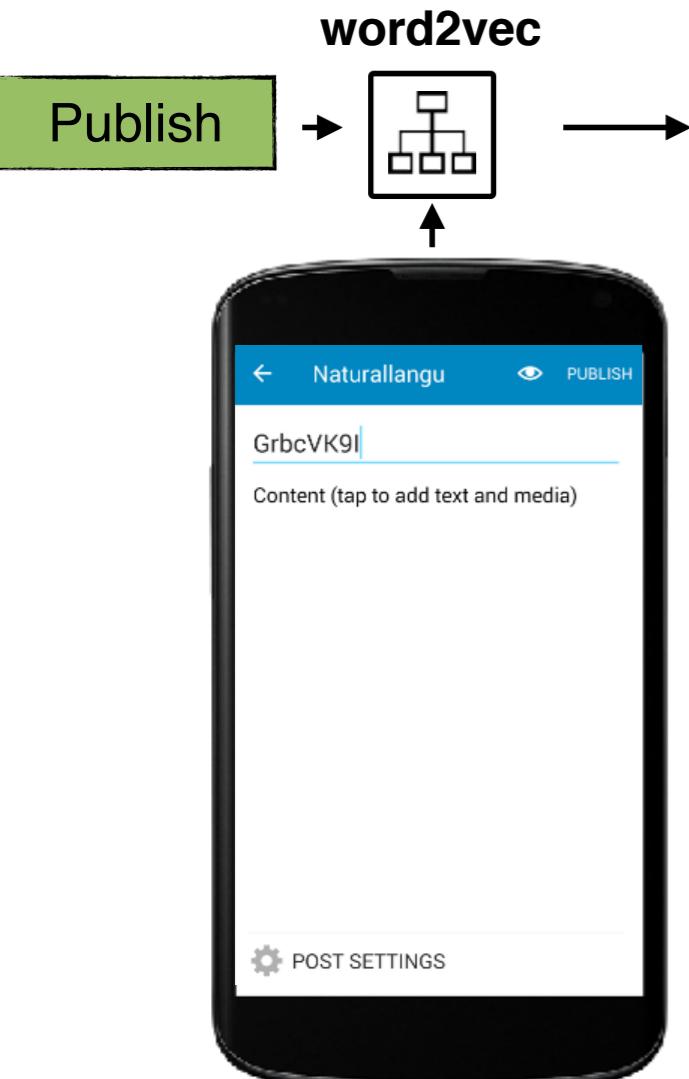
Random UI Action Generation

UI Actions Search

Abstract Step



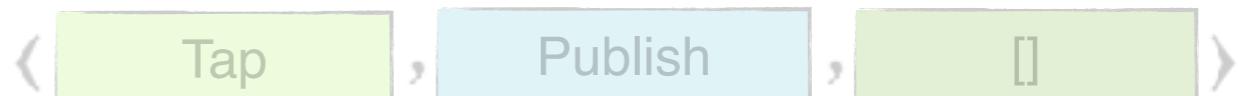
Find UI Element



UI Elements

- Publish
- UI element #2
- ...
- UI element #N

Current Execution



Forked Executions



Random UI Action Generation

UI Actions Search

UI Actions

“Start a new post”

Tap , New Post , [] →

“Type something”

Type , post_title , ["GrbcVK9I"] →

“Tap on the publish button”

Tap , Publish , [] →

Test Case

```
public void test() {  
  
    //start a new post  
    onView(  
       (withId(R.id.fab_button))  
        .perform(click());  
  
    //type something  
    onView(  
       (withId(R.id.post_title))  
        .perform(typeText("GrbcVK9I"));  
  
    //tap on the publish button  
    onView(  
       (withId(R.id.menu_save_post))  
        .perform(click());  
}
```

Empirical Evaluation

Research Questions:

RQ1: Can YAKUSU translate bug reports written in natural language into executable test cases?

RQ2: What is the cost of running YAKUSU?

Empirical Evaluation

Research Questions:

RQ1: Can YAKUSU translate bug reports written in natural language into executable test cases?

RQ2: What is the cost of running YAKUSU?

Empirical Evaluation

Research Questions:

RQ1: Can YAKUSU translate bug reports written in natural language into executable test cases?

RQ2: What is the cost of running YAKUSU?

Benchmarks and Setup

GitHub



Bug Report



x 100

Could not
Build



x 9

Could not
Reproduce Manually



x 29

Available
Reports



x 62

Successfully
Generated Tests



x 37

Benchmarks and Setup

GitHub



Bug Report



x 100

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Benchmarks and Setup

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Bug Report



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Benchmarks and Setup

GitHub



Bug Report



x 100

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x 9

**Could not
Reproduce Manually**



x 29

**Available
Reports**



x 62

**Successfully
Generated Tests**



x 37

RQ1

ID	Name	Actions		Steps		Search				Tests	
		A_e	A_i	AS	AS_g	S_g	S_p	H	R	TC_s	TC_a
01	TACHIYOMI	4	1	-	4	10	1	1	-	5	-
03	TWIDERE	2	-	2	-	12	1	-	-	2	-
05	SIGNAL	1	-	1	-	2	1	-	-	1	-
08	REDREADER	2	-	2	2	5	1	-	-	4	2
14	SILENCE	1	-	1	-	2	1	-	-	1	-
23	K-9 MAIL	3	-	3	-	8	1	-	-	3	-
25	NEXTCLOUD	1	2	1	-	1	1	1	1	3	-
27	BUTTERKNIFE	1	-	1	-	3	1	-	-	1	-
35	ODK COLLECT	2	-	1	4	11	3	-	-	2	-
39	PIX-ART MESSENGER	3	-	3	-	2	1	-	-	3	-
40	YALP STORE	5	-	4	1	11	1	-	-	5	-
50	OCREADER	3	-	3	-	8	2	-	-	3	-
51	WORDPRESS	3	-	2	1	2	1	-	-	3	-
52	SIGNAL	2	1	2	-	3	1	-	4	6	3
57	OPEN EVENT	1	1	1	1	3	2	1	-	2	-
68	TAGMo	1	1	1	1	10	1	-	3	4	2
69	ANKIDROID	5	-	5	-	8	1	-	-	5	-
73	K-9 MAIL	2	-	2	-	6	3	-	-	2	-
74	CLUTTR	2	-	2	-	6	1	-	-	2	-
78	NEXTCLOUD	2	1	2	-	1	1	1	-	3	-
84	K-9 MAIL	1	-	-	1	2	1	-	-	1	-
95	MIFOSX	2	3	2	-	3	1	1	2	5	-
96	SCREENRECORDER	3	2	3	-	1	1	2	-	5	-
97	NEXTCLOUD	1	1	-	2	4	2	1	-	2	-
99	FLASHCARDS	3	-	2	1	6	2	-	3	4	1

RQ1

ID	Name	Actions		Steps		Search				Tests	
		A_e	A_i	AS	AS_g	S_g	S_p	H	R	TC_s	TC_a
01	TACHIYOMI	4	1	-	4	10	1	1	-	5	-
03	TWIDERE	2	-	2	-	12	1	-	-	2	-
05	SIGNAL	1	-	1	-	2	1	-	-	1	-
08	REDREADER	2	-	2	2	5	1	-	-	4	2
14	SILENCE	1	-	1	-	2	1	-	-	1	-
23	K-9 MAIL	3	-	3	-	8	1	-	-	3	-
25	NEXTCLOUD	1	2	1	-	1	1	1	1	3	-
27	BUTTERKNIFE	1	-	1	-	3	1	-	-	1	-
35	ODK COLLECT	2	-	1	4	11	3	-	-	2	-
39	PIX-ART MESSENGER	3	-	3	-	2	1	-	-	3	-
40	YALP STORE	5	-	4	1	11	1	-	-	5	-
50	OCREADER	3	-	3	-	8	2	-	-	3	-
51	WORDPRESS	3	-	2	1	2	1	-	-	3	-
52	SIGNAL	2	1	2	-	3	1	-	4	6	3
57	OPEN EVENT	1	1	1	1	3	2	1	-	2	-
68	TAGMo	1	1	1	1	10	1	-	3	4	2
69	ANKIDROID	5	-	5	-	8	1	-	-	5	-
73	K-9 MAIL	2	-	2	-	6	3	-	-	2	-
74	CLUTTR	2	-	2	-	6	1	-	-	2	-
78	NEXTCLOUD	2	1	2	-	1	1	1	-	3	-
84	K-9 MAIL	1	-	-	1	2	1	-	-	1	-
95	MIFOSX	2	3	2	-	3	1	1	2	5	-
96	SCREENRECORDER	3	2	3	-	1	1	2	-	5	-
97	NEXTCLOUD	1	1	-	2	4	2	1	-	2	-
99	FLASHCARDS	3	-	2	1	6	2	-	3	4	1

RQ1

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01	TACHIYOMI	4	1	-	4	10	1	1	-	5	-
03	TWIDERE	2	-	2	-	12	1	-	-	2	-
05	SIGNAL	1	-	1	-	2	1	-	-	1	-
08	REDREADER	2	-	2	2	5	1	-	-	4	2
14	SILENCE	1	-	1	-	2	1	-	-	1	-
23	K-9 MAIL	3	-	3	-	8	1	-	-	3	-
25	NEXTCLOUD	1	2	1	-	1	1	1	1	3	-
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50	OCREADER	3	-	3	-	8	2	-	-	3	-
51	WORDPRESS	3	-	2	1	2	1	-	-	3	-
52	SIGNAL	2	1	2	-	3	1	-	4	6	3
57	OPEN EVENT	1	1	1	1	3	2	1	-	2	-
68	TAGMo	1	1	1	1	10	1	-	3	4	2
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78	NEXTCLOUD	2	1	2	-	1	1	1	-	3	-
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4 test cases with additional actions

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RQ1: Can YAKUSU translate bug reports written in natural language into executable test cases?

We consider the results encouraging as YAKUSU is already able to generate test cases for a good number of bug reports.

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Future Work

Extend ontology

Learn macro-step associated with the app

Interpret non-crashing failures from bug reports

Generate test cases from written/spoken test specifications

Identify duplicate bug reports

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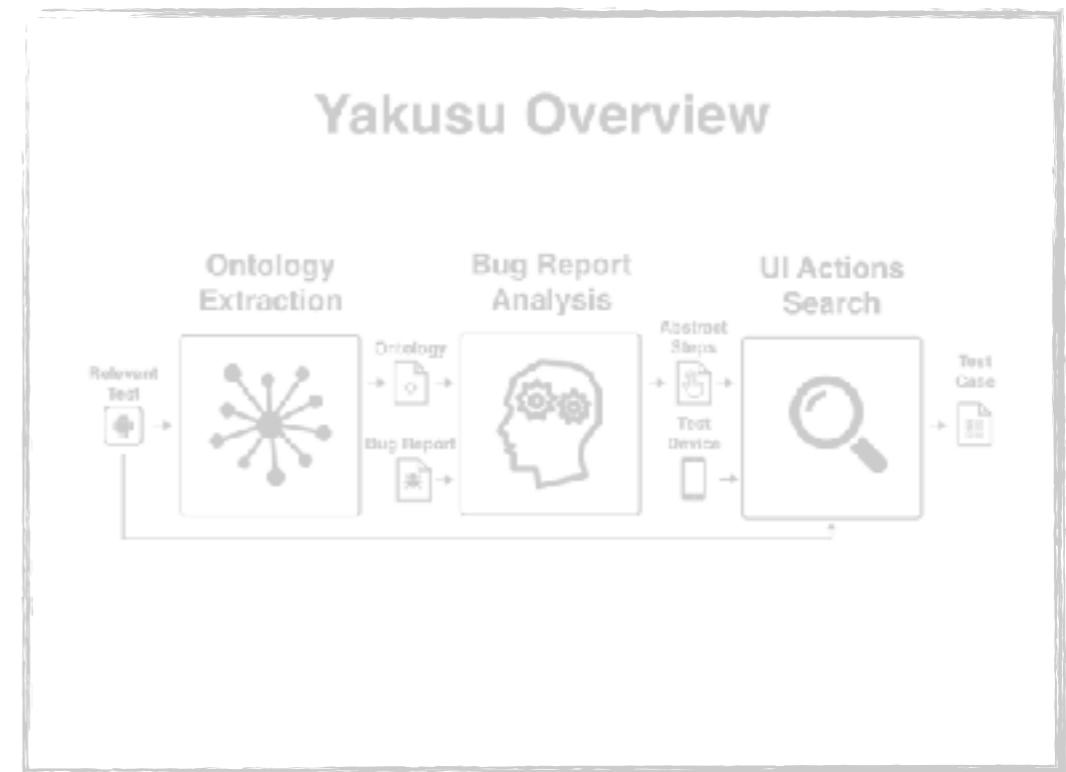
Identify duplicate bug reports

Summary

Bug Reports

Akhona commented on Jul 5, 2017
Steps to reproduce:
Settings > Backup > Backup files
Crash for me, no other frequency
Once after each crash, the app will reproduce this.
Pretty sure the same thing happens
Version 1
Phone: H
Android: 4.4.2
Image: Screenshot
Reproducer: magic
I found this crash one
rebooting, crashing.
Reproducer steps:
1. Launch reddit
2. Tap the refresh button in the app
3. Swipe down while the subscriber
I think it might help to reboot if you're
crashed.
1. Open the app
2. To clear memory, open the file
3. To clear memory again, file
4. To clear memory again, file

BRIK commented on May 24, 2017
Steps to reproduce the behav.
1. Start a new post
2. Type something
3. Tap on the Publish button
4. The app crashes
Actual behavior
Inbox crashes
Steps to reproduce
longest answer can undermine it



Empirical Evaluation

Research Questions:

- RQ1: Can Yakusu translate bug reports written in natural language into executable test cases?
- RQ2: What is the cost of running Yakusu?

- ## Future Work
- Extend ontology
 - Learn macro-step associated with the app
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 - Identify duplicate bug reports

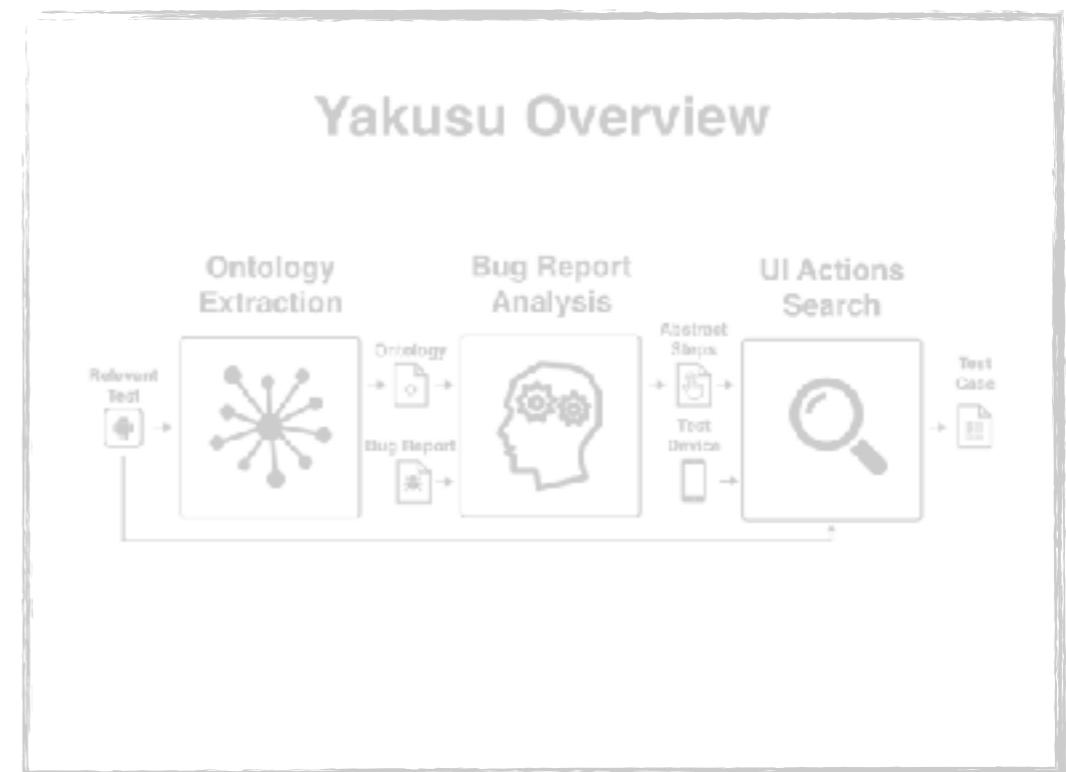
Summary

Bug Reports

Akbaros commented on Jul 6, 2017
PC upon selecting weekly backup it
Steps to reproduce:
Settings > Backup > Backup freq.
It's fine for me, no other frequency is
Decs after such crash, the app won't
reproduce this.
Pretty sure the same thing happens
Version: 1
Phone: H
Email: [redacted]
Usage: [redacted]
Reported: [redacted]
Reproduction steps:
1. Launch reproducer subscribed account
2. Tap the refresh button in the app bar
3. Swipe down while the subscriber
4. The app crashes
Actual behavior:
twice crashes
Steps to reproduce:
longpress menu icon underneath it
I think it might help to reproduce if you're
asleep.

TRELLIS commented on May 18, 2017
Issue:
open and closed issues for
a/ygithub.com/WhisperSync
LINE
Apr 28, 2017
[redacted] (40405): Shuffling item
[redacted] (40405): FATAL EXCEPTION
[redacted] (40405): Process: my
[redacted] (40405): JavaLang: E
[redacted] (40405): at [redacted]
There's open with selected account

BBK commented on Mar 24, 2017
<Text paragraph>
<Text paragraph>
Steps to reproduce the behavior
1. Start a new post
2. Type something
3. Tap on the Publish button
4. The app crashes
<Text paragraph>
Actual behavior:
twice crashes
Steps to reproduce:
longpress menu icon underneath it



Empirical Evaluation

Research Questions:

RQ1: Can Yakusu translate bug reports written in natural language into executable test cases?

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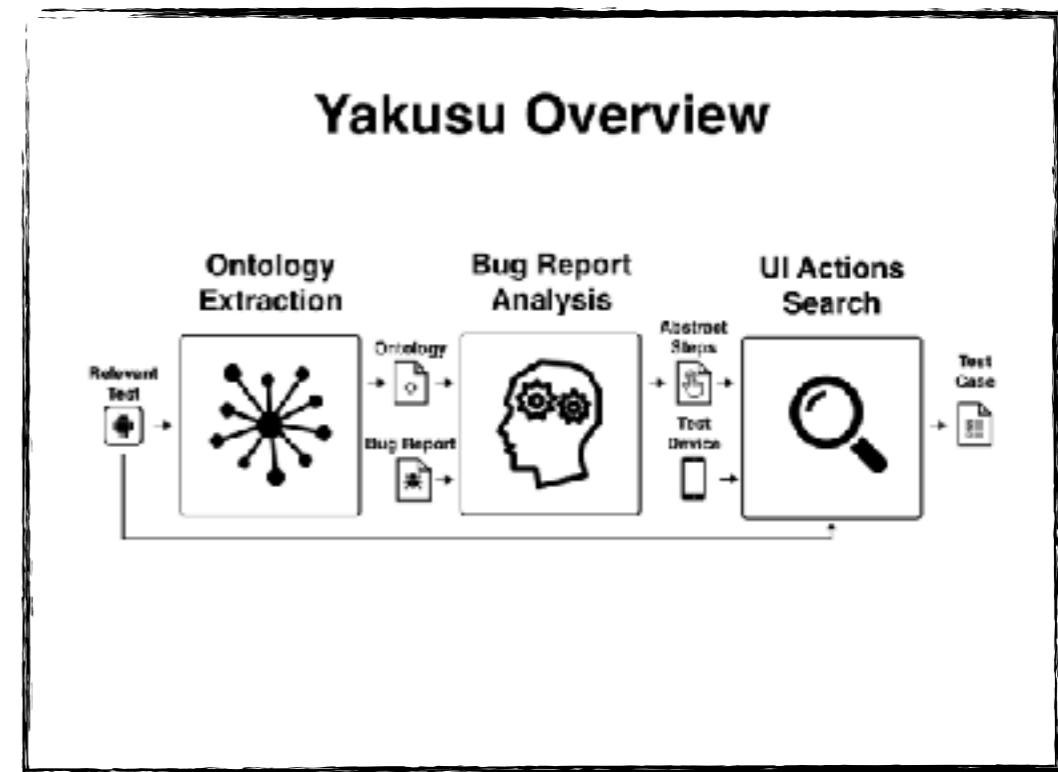
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Summary

Bug Reports

Akhilesh commented on Jul 5, 2017
PC upon selecting weekly backup it
crashes
Settings > Backup > Backup freq.
100% for me, no other frequency is
decent after such a select, the app won't
reproduce this.
Pretty sure the same thing happens
Version: 1
Phone: H
Market: Unknown
Usage: General
Reported: 1 hour ago
Reproduction steps:
1. Open LINE
2. Select weekly backup
3. Select a date
4. Select a time
Actual behavior:
LINE crashes
Steps to reproduce:
1. Open LINE
2. Select weekly backup
3. Select a date
4. Select a time
I think it might help to reproduce if you're
on a slow connection.

Treli commented on May 18, 2017
open and closed issues for
https://github.com/WheeeeSpiri
t
LINE
Apr 28, 2017
Version: 1
Phone: H
Market: Unknown
Usage: General
Reported: 1 hour ago
Reproduction steps:
1. Start a new post
2. Type something
3. Tap on the Publish button
4. The app crashes
Actual behavior:
LINE crashes
Steps to reproduce:
1. Start a new post
2. Type something
3. Tap on the Publish button
4. The app crashes
Then open with selected account
LINE crashes
I think it might help to reproduce if you're
on a slow connection.



Empirical Evaluation

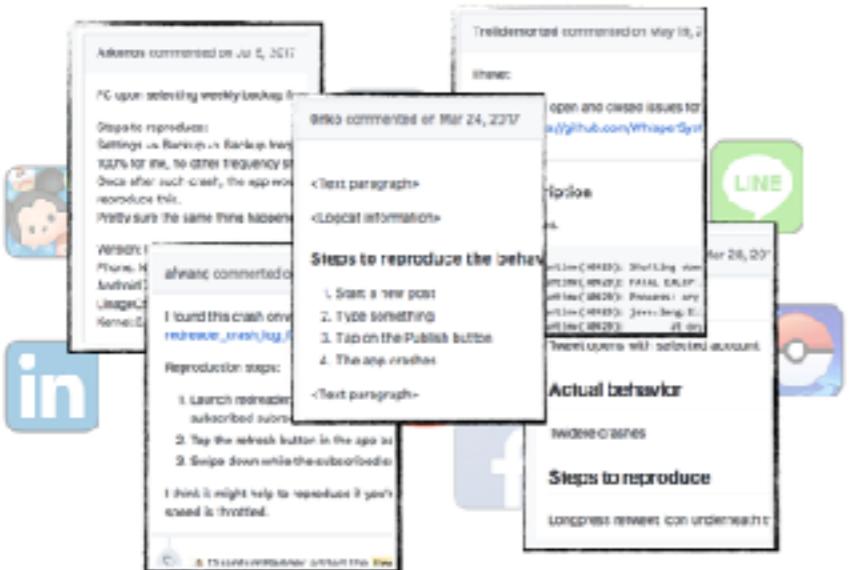
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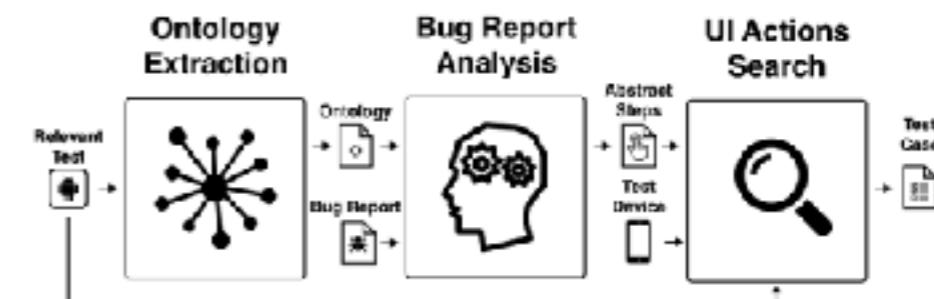
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Summary

Bug Reports



Yakusu Overview



Empirical Evaluation

Research Questions:

RQ1: Can Yakuza translate bug reports written in natural language into executable test cases?

R92: What is the cost of running Yakusui?

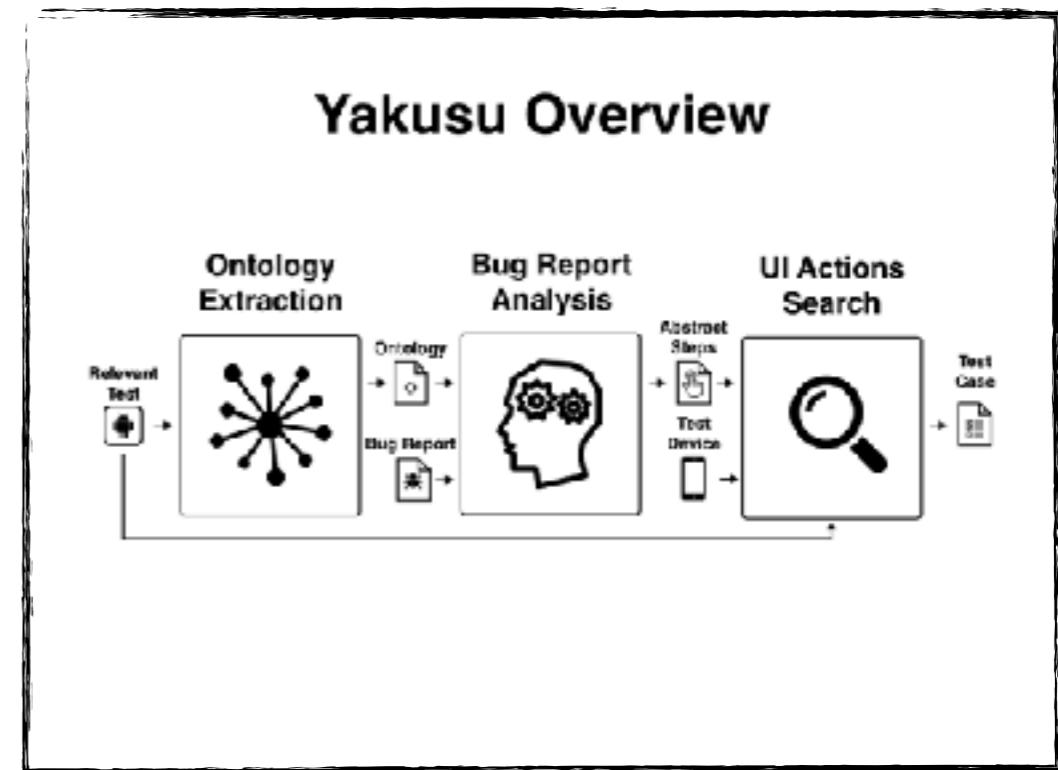
Future Work

Summary

Bug Reports

Akhilesh commented on Jul 5, 2017
Steps to reproduce:
Settings → Backup & Sync → Backups →
Select after such crash, the app won't
reproduce this.
Pretty sure the same thing happens
Version: 1
Phone: H
Market: Unknown
Usage: General
Reported: 1 hour ago
Reproduction steps:
1. Open Settings
2. Go to Backup & Sync
3. Select a backup
4. Tap on the "Sync now" button
Actual behavior:
The app crashes
Steps to reproduce:
I think it might help to reproduce if you're
not connected to the internet.

Treel commented on May 18, 2017
Issue: open and closed issues for
https://github.com/Wkphr/Sysf
Profile
Apr 28, 2017
Version: 1.0.0
Phone: iPhone 6s
Market: Unknown
Usage: General
Reported: 1 month ago
Reproduction steps:
1. Start a new post
2. Type something
3. Tap on the Publish button
4. The app crashes
Actual behavior:
The app crashes
Steps to reproduce:
There's a bug in the code where the app
crashes when trying to publish a post.



Empirical Evaluation

Research Questions:

- RQ1: Can Yakusu translate bug reports written in natural language into executable test cases?
- RQ2: What is the cost of running Yakusu?

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