

# BUMPER: A Tool for Coping with Natural Language Searches of Millions of Bugs and Fixes

<https://bumper-app.com>

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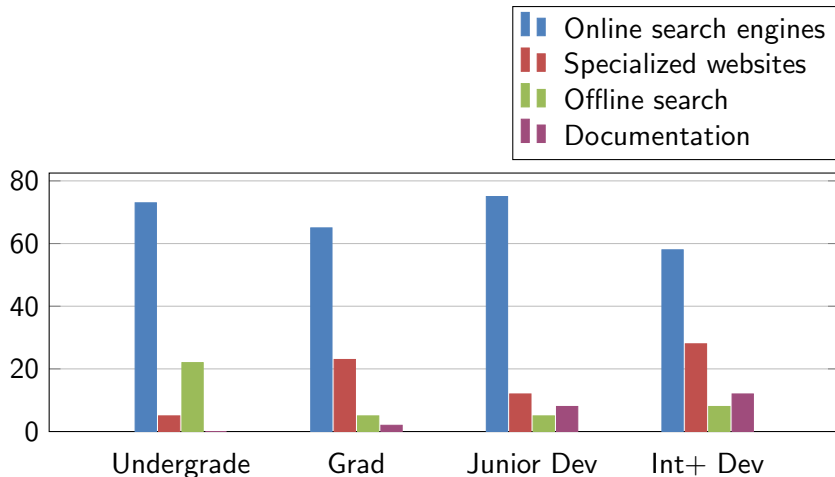
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March 15, 2016

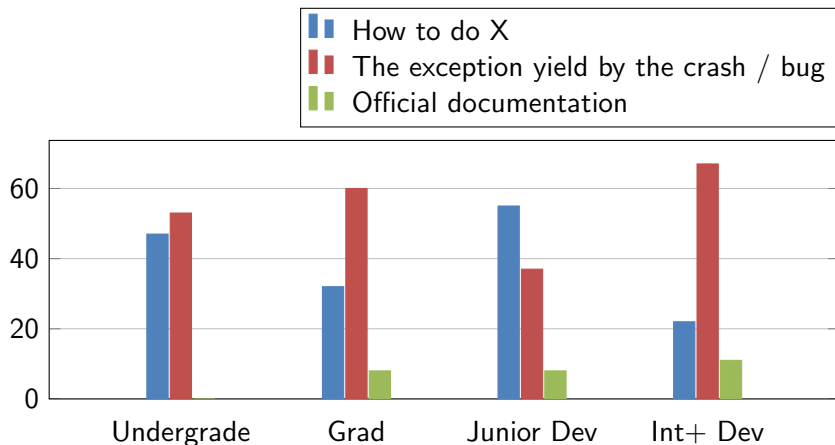
# What developers do when facing an unknow bug ?

- In 2015, we surveyed:
  - ① École de Technologie Supérieure, Montréal, Québec, Canada
  - ② Université du Québec À Montréal, Montréal, Québec, Canada
  - ③ Concordia University, Montréal, Québec, Canada
  - ④ Participants of 2015 the Consortium on Software Engineering and Refactoring, Toronto, Ontario, Canada.
- When facing an unknown bug, crash or exception, where do you look for informations ?
- When facing an unknown bug, crash or exception, what are you searching for ?
- Surveyed 150 people and received 89 responses (59%)

# When facing an unknown bug, crash or exception, where do you look for informations ?



# When facing an unknown bug, crash or exception, what are you searching for?



- Results are not surprising.
  - 1 Online searches
  - 2 How to do X
  - 3 Copy/past the exception at hand
- Usually, a solution is quickly found, but ...
- Pain in navigating between bug report systems and code versionning systems.

- BUMPER: BUg Metarepository search engine for develoPErs and Researchers
  - Aggregates information from bug report and code versionning systems
  - Online Search Engine with million bug reports AND fixes from major open-source repositories
  - Apache Software Foundation, Netbeans, Eclipse, Gnome, FireFox, Chrome, Kde, ...
  - Imports bugs reports from Bugzilla, JIRA and Github, ... and fixes from SVN, Mercurial, Git, ...
  - Natural language for developers
  - Advanced API for researchers

# BUMPER Data (as of now)

<b>Dataset</b>	<b>R/F BR</b>	<b>CS</b>	<b>Files</b>	<b>Projects</b>
Gnome	550,869	1,231,354	367,245	512
Netbeans	53,258	122,632	30,595	39
Apache	49,449	106,366	38,111	349
Eclipse	78,830	184,900	21,712	190
Total	732,406	1,645,252	457,663	1,930

# Google-like usage for developers

## bumper

Find Out How Others Fixed It

Type your search



SHOWCASE

ADVANCED QUERY MODE

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# Bug reports and bug fixes, side by side

## Null Pointer Exception

About 27626 results (0.01 seconds)

LANGUAGES  DATASETS 

DOWNLOAD 

▲ **NullPointerException at org.netbeans.api.java.source.JavaSource\$JavaSourceAccessorImpl.  
38**  
[https://netbeans.org/bugzilla/show\\_bug.cgi?id=189412](https://netbeans.org/bugzilla/show_bug.cgi?id=189412) **java, netbeans, java**  
Build: NetBeans IDE 6.9 (Build 201006101454) VM: Java HotSpot(TM) Client VM, 16.2-b04, Java(TM) SE Runtime Environment, 1.6.0\_19-b04 OS: Windows 7 Stacktrace: java.lang.NullPointerException...

▲ **NullPointerException at org.netbeans.modules.java.source.usages.LuceneIndex\$DirCache.clc  
10**  
[https://netbeans.org/bugzilla/show\\_bug.cgi?id=189499](https://netbeans.org/bugzilla/show_bug.cgi?id=189499) **java, netbeans, java**  
Build: NetBeans IDE Dev (Build 201008130001) VM: Oracle JRockit(R), R28.0.1-21-1333993-1.6.0\_20-20100512-2131-windowsx86\_64, Java(TM) SE Runtime Environment, 1.6.0\_20-b02 OS: Windo more...

▲ **Enable collecting thread cpu timestamps by default  
4**  
[https://netbeans.org/bugzilla/show\\_bug.cgi?id=189621](https://netbeans.org/bugzilla/show_bug.cgi?id=189621) **java, netbeans, profiler**  
Given the fact that thread cpu timestamps are available to JVM (1.6+) on all major operating systems and obtaining them is reasonably quick [1] we can enable collecting them by def more.

▲ **NullPointerException at java.util.Arrays\$ArrayList.<init>  
2**  
[https://netbeans.org/bugzilla/show\\_bug.cgi?id=177814](https://netbeans.org/bugzilla/show_bug.cgi?id=177814) **java, netbeans, platform**  
Build: NetBeans IDE Dev (Build 200911281400) VM: Java HotSpot(TM) Client VM, 1.4.2,

176129.80dc07f52485 #189412 NullPointerException at  
org.netbeans.api.java.source.JavaSource\$JavaSourceAccessorImpl.setJavaSource  
• java.source/src/org/netbeans/modules/java/source/JavaSourceAccessor.java  
• java.source/src/org/netbeans/modules/java/source/parsing/JavadocParserResult.java  
(2) files, (10) insertions, (4) deletions.

Index: java.source/src/org/netbeans/modules/java/source/JavaSource  
Accessor.java

```
@@ -84,6 +84,7 @@
import org.openide.text.PositionRef;
import org.openide.util.Exceptions;
import org.openide.util.Mutex;
+import org.openide.util.Parameters;
```

```
/**
 *
```

Index: java.source/src/org/netbeans/modules/java/source/JavaSource  
Accessor.java

```
@@ -316,9 +317,14 @@
}
}
```

```
@Override
public void run(Result result, SchedulerEvent event) {
+ public void run(@NonNull Result result, SchedulerEvent ev
```

SHOWCASE

ADVANCED QUERY MODE

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# Using BUMPER for bug-fixing tasks

*When I run the CSVReader with a simple main like this:*

## Listing 1: Java Bug

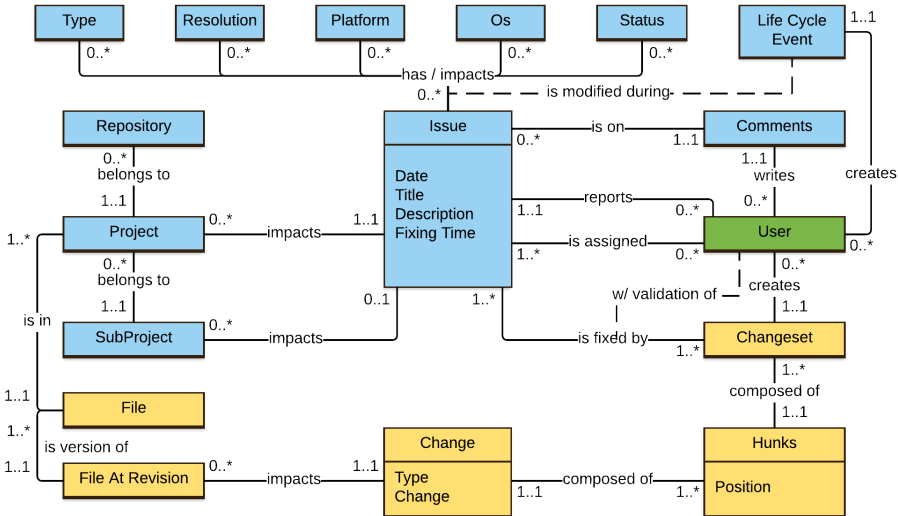
```
CsvFileUtils csvFileUtils = 1
    new CsvFileUtils(" quebec.txt" ); 2
3
for (int i = 0; i < 2000; i++) { 4
    printArray( csvFileUtils 5
        .readOneLine()); 6
} 7
```

*I got the following Exception: Exception in thread "main"  
java.lang.NullPointerException at  
CsvFileUtils.readOneLine(CsvFileUtils.java:22) at  
Main.main(Main.java:11). Can you please fix CsvFileUtils ?*

# Using BUMPER for bug-fixing tasks (cont'd)

- New survey (20 developers, 40% response rate)
- Find a suitable code snippet to fix the bug using:
  - Google search engine
  - Bumper search engine
- Google 6.94 minutes and 7.57 web pages
- BUMPER 4.5 minutes and 1 web page (<https://bumper-app.com>)

# BUMPER Metamodel



# API Usage for researchers

- All fields are indexed for fast search
- Two special indexes:
  - `report_t`: Contains a concatenation of all the bug-related fields
  - `fix_t`: Contains a concatenation of all the fix-related fields
- Search for "*YOUR TERMS*" in bug reports and bug fixes:

*(type : "BUG" AND report\_t : "YOUR TERMS"*  
*AND - churns : 0)*

*OR*

*({!parent which = "type : BUG"} type : "CHANGESET"*  
*AND fix\_t : "YOUR TERMS")*

- Bug reports with at least one fix having:
  - The word “Exception” in the bug report
  - Belonging to “Axis2” or “ide” projects
  - Reported by “Rich” or is “fixed”
  - With a “major” severity or a fixing time greater than 10 days

*(type : “BUG” AND report\_t : “Exception”  
AND (project : “Axis2” OR project : “ide”)  
AND (reporter : “Rich” OR resolution : “fixed”)  
AND (severity : “Major” OR fixing\_time : [10 TO \*])  
AND — churns : 0)*

# Conclusion

- <https://bumper-app.com>
- Million bugs and associated fixes
- Apache Software Foundation, Netbeans, Eclipse, Gnome, FireFox, Chrome, Kde, ...
- Imports bugs from Bugzilla, JIRA and Github, ... and fixes from SVN, Mercurial, Git, ...
- Natural Language Search for developers
- Advanced API for researchers

# QUESTIONS?