

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

<https://bumper-app.com>

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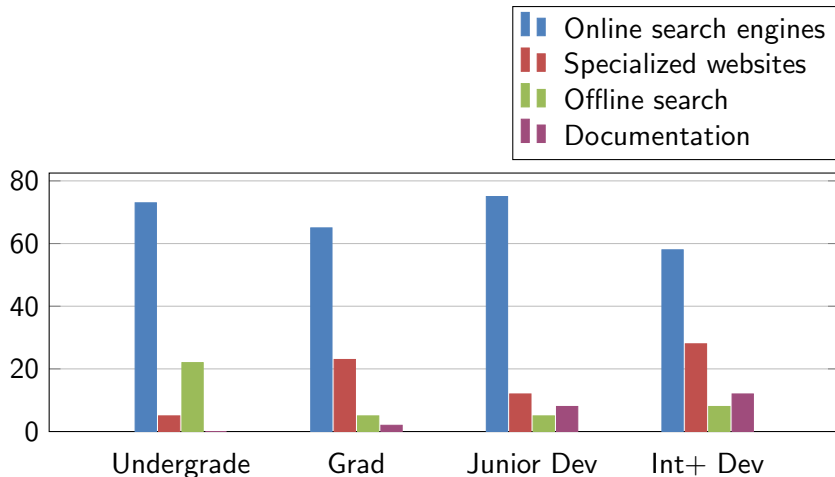
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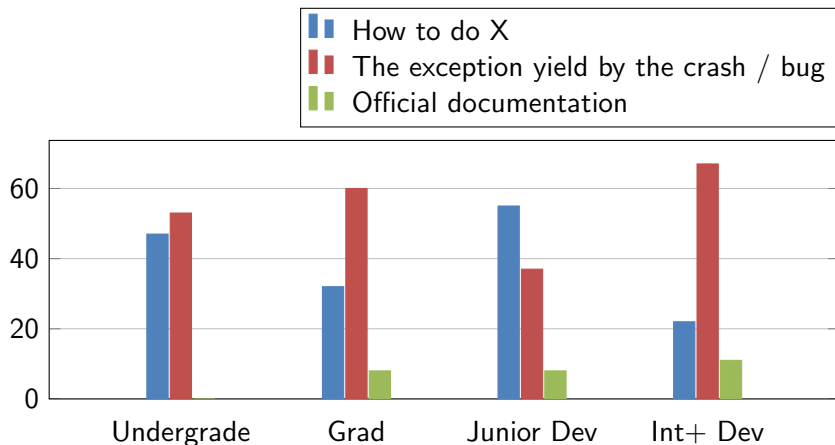
What developers do when facing an unknow bug ?

- 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.
- Open questions in face-to-face interviews with 10 undergrads, 5 graduates, 7 junior dev. & 3 senior dev.
 - ① When facing an unknown bug, crash or exception, where do you look for informations ?
 - ② When facing an unknown bug, crash or exception, what are you searching for ?
- Build an online multiple choices survey with their responses
- 150 people and got 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 suprizing.
 - 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)

Dataset	R/F BR	CS	Files	Projects
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

API

DATASETS

PUBLICATIONS

ABOUT

Bug report and bug fix, 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 **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 **java, netbeans, java**

▼ Build: NetBeans IDE Dev (Build 201008130001) VM: Oracle JRockit(R), R28.0.121-1333993-1.6.0_20-20100512-2131-windowsx86_64, Java(TM) SE Runtime Environment, 1.6.0_20-b02 OS: Windows 7...

▲ **Enable collecting thread cpu timestamps by default**
4 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 **java, netbeans, platform**

▼ Build: NetBeans IDE Dev (Build 2000111981.600) 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

API

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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

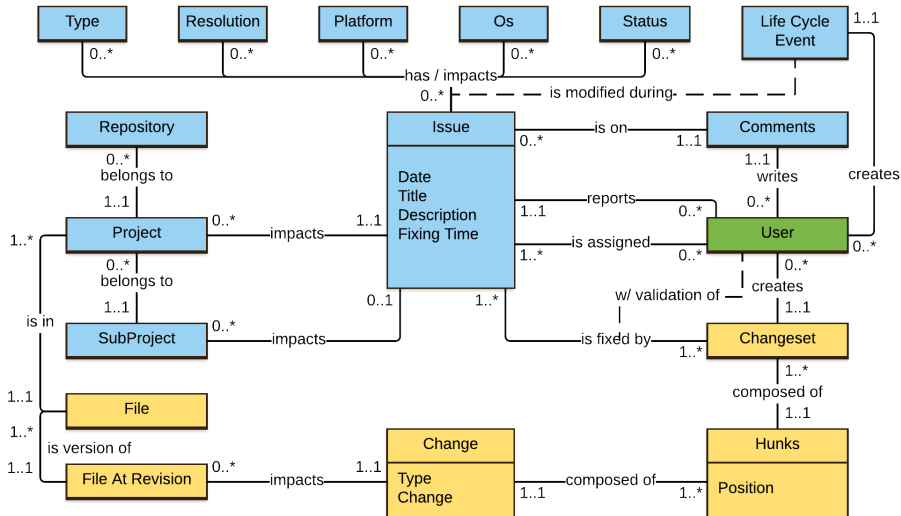
```
CsvFileUtils csvFileUtils = 1
    new CsvFileUtils(" quebec.txt" ); 2
3
for (int i = 0; i < 2000; i++) { 4
    printArray(csvFileUtils 5
        .readOneLine()); 6
} 7
```

*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)
- Find a suitable solution for 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 and Future work

- <https://bumper-app.com>
- 1 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
- Currently assessing how much faster a suitable solution can be found using BUMPER rather than Google/Stack Overflow/Books ...

QUESTIONS?