Bilkent University

Department of Computer Engineering

CS 453 - Application Lifecycle Management

Phase II (Final) Report

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Phase II Report

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1. Introduction

A bug tracking process will be investigated in the project. That is managed by the help of the bug tracking tools. Those tools conceptually help software teams to find, record, and track bugs in their software. Bugs may lead to improper work of the developed software. So bugs should be detected and solved before the delivery of the final software. Bug tracking is generally a part of the testing process of software. The problem in the bug tracking concept is the hardness of changing any part of the project to fix the bug after its implementation finished. This problem was solved with the help of Agile methods which offer the development team to fix bugs during the project's implementation. If we get Scrum as an example, the team tracks bugs at the end of each sprint.

All the bug tracking tools work in the same sense. First, bugs should be detected. There are two alternative ways for detection. Either the bugs may be detected by the customer involvement, that is, bugs are reported by the customer or the development team detects the bugs. Then, bugs should be reported to the development team as they can notice how to fix it. With the help of a bug tracking tool, developers solve the problem by conducting all operations necessary. That should be repeated for all bugs. After solving all of them, the product should be tested repeatedly until making sure that the product works properly. Finally, all the data related to bugs should be added in order not to experience the same problem in the future.

Software teams aim to deliver their product to the customer without any problem by using bug tracking tools. In this project, our team will investigate the working system of Bugzilla which is one of those bug tracking tools.

In the bug tracking life cycle, a new bug from the user or product with the unconfirmed state is created as a bug in the system. After a bug is created, it will be assigned to a developer to solve it. If the developer is finished with the bug, QA should verify that the bug has been solved. If it is verified, the bug will be closed. Otherwise, the bug will be classified as unconfirmed and reopened to solve it again. That means QA was not satisfied with the solution. If the bug is reopened, it is assigned to a developer again and repeats all the processes explained until the bug is closed. Finally, the bug solved will be added to the bug list in order not for developers to face the same problem in the project again.

2. Activity Diagram for Ideal IT

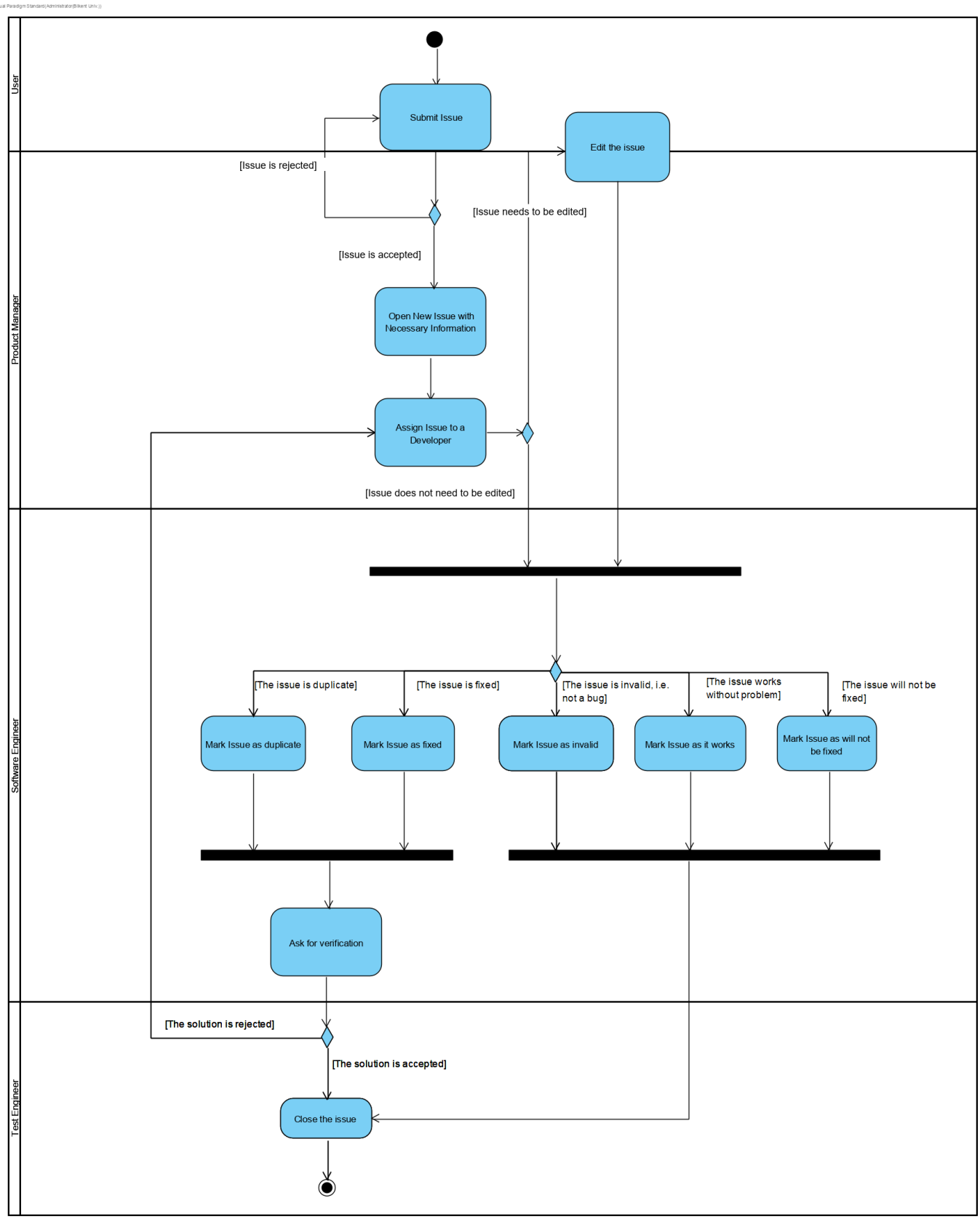

Figure 1: The Activity Diagram for Ideal Bug Tracking Process.

3. State Diagram for Ideal IT

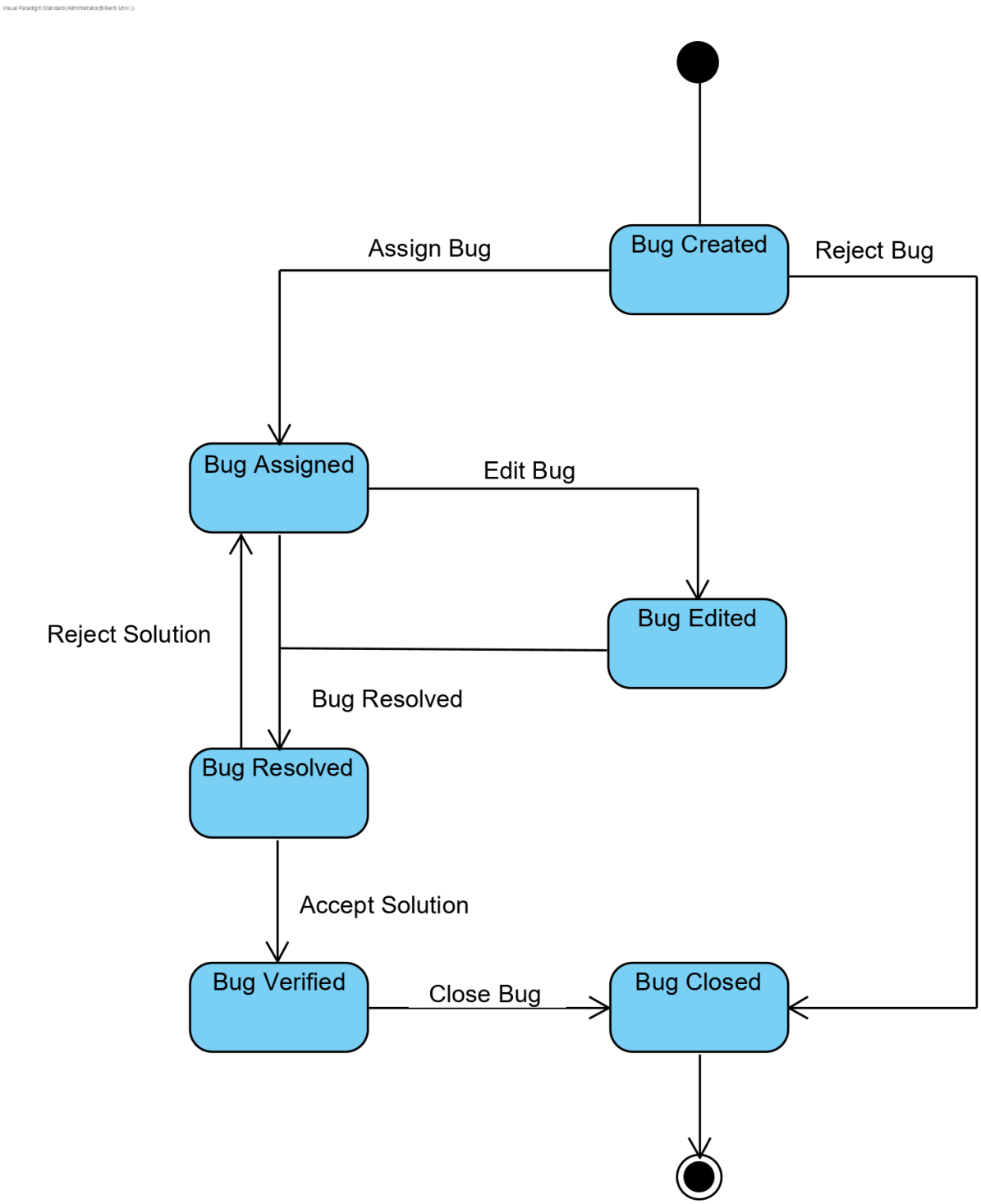

Figure 2: The State Diagram for Ideal Bug Tracking Process.

4. Assessment Criteria

Below will be the ideal set of functionalities for the Issue Tracking from two perspectives such as application and issues.

4.1. General Criteria for the Application

These are the main criteria and set of functionalities about the application itself.

4.1.1 Usability

Creating, closing, updating issues should be simple and user-friendly for both developers and other users. This also means that the tool should be well documented on how to use it as it might be used by users who are not developers (in some open source projects, clients can also submit issues).

4.1.2. Integrability

The tool should be integrable with other tools such as code review, communication, and version control. This would ensure that the development team would be synchronized as well if two people on the same teamwork on the same issue and code. It should also be integrated into database engines such as Oracle or MySQL, and preferably it should have automated sanity checks for inconsistencies within the database (such as duplicate bugs).

4.1.3. Security

Some companies or users may want to keep their information on what features they are working on safe if it is an open-source project. If the users want to be anonymous and do not want to share their information, the application should ensure that the information about the users safe.

4.1.4. Multi-Platform Compatibility

The tool should be accessible from different devices since the developers or the users might not have computers available at all times. For instance, for an open-source mobile application, the users should not be expected to have a computer to report a bug and they should be able to report a bug from their mobile phone.

4.1.5. Ease of Setup

The tool should be easy to set up in order to prevent the developers waste time during the initial integration of the tool to the project.

4.1.6. Reliability

The tool should be able to safely store the data, like user information and issue information. It should not crash frequently as it might cause severe problems for the integration with the other programs.

4.2. Criteria for the Issues

These are the main criteria and set of functionalities about the issues.

4.2.1. Issue Type

Since there might be several types of issues for a project such as a bug or an improvement to a problematic part, the tool should support several types of issues.

4.2.2. Status and Resolution

Status is the state of the reported issue like open or close and the resolution is how the issue is currently handled. An issue's resolution could be marked as fixed, cannot duplicate, will not be fixed, duplicate issue, invalid or will be resolved later.

4.2.3. Description

Gives information about how the issue can be duplicated and how it can affect other functionalities of the software.

4.2.4. Assignee and The Reporter Information

The issue should be properly assigned to a person either automatically by the system or manually by an admin or other developers, in order to avoid the confusion and the reporter information could be found if additional information is needed from the reporter.

4.2.5 Priority & Severity

The information about the severity and the priority should be visible to all users. Priority would represent how urgent an issue should be resolved whereas severity would be how much an issue would affect the overall project. Generally, if the severity is high, the urgency should also be high. Priority should be labeled by hand or could be understood by the voting from the users so that the important problems for the users can be seen by the developers.

4.2.6. Labeling and Searching

The labeling of an issue should be possible so that it can be searched within the tool by the users. Custom labeling for each project should also be available so that searching would be easier.

4.2.7. Dates

Dates on the updates of the issue such as when it is created or when it is updated so that other people working on the issue can find additional information about the issue and they can be synchronized.

4.2.8. Platform, OS and Version of the Product

Gives information about which OS, OS version and product version the bug had found so that only people who have those specifications can work on the issue.

4.2.9. Dependencies

Shows information if the current issue has dependencies with the other issues, if it can be solved before the other issues are solved, etc.

4.2.10. Alert Tracking

The developers or users can be informed by email or in-app notification automatically depending on their preferences so that if there is any update on the issue, they can be informed directly.

4.2.11. Worklog and History

Worklog is the job done on the issue so far and the history shows who performed on which issues and what is the status of the issues.

4.2.12. Traceability

After a defect is resolved, the new code snippet will be shown.

5. Use Cases of Bugzilla

5.1. Use Case Diagram for Bugzilla

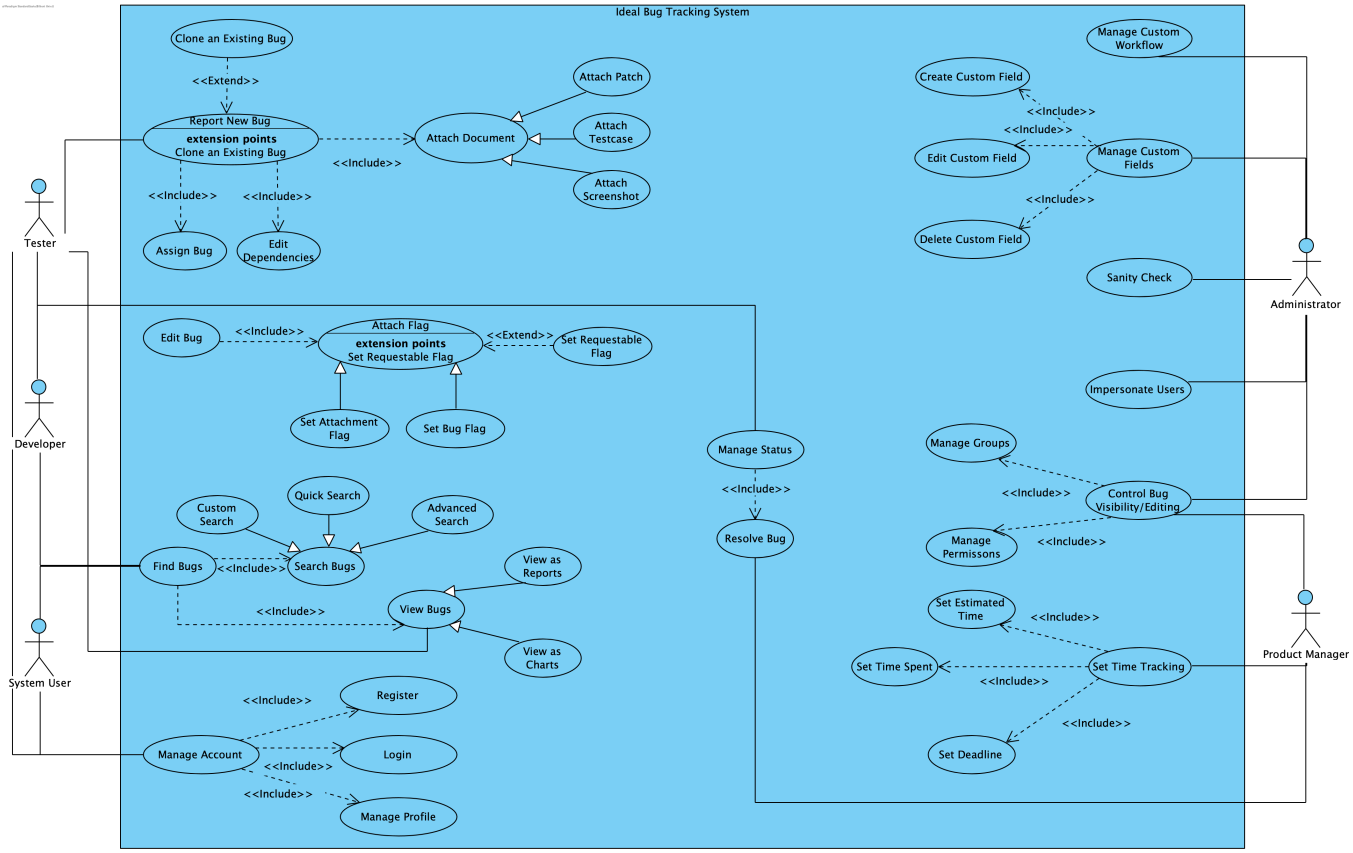

Figure 3: The Use Case Diagram for Bugzilla.

5.2. Scenarios

5.2.1. Scenario 1

Use Case: User creates a bug report

Primary Actor: System User

Entry Conditions:

- The user needs to be already registered to the application.

- User needs to be logged in.
- The user needs to have the required permissions assigned by an administrator.

Exit Conditions:

- The user submits the bug report.
- The user sets the bug status as closed/done.

Main Flow of Events:

1. The user clicks the **New** link available in the header or footer of pages, or the **File a Bug** link on the home page.
2. The user selects the product in which they found a bug.
3. The user specifies the component (part of the product which is affected by the bug they discovered; if they have no idea, they select General if such a component exists).
4. The user selects the version of the program they were using.
5. The user selects the operating system and platform the program is running on.
6. The user selects the severity of the bug.
7. The user provides a short but descriptive summary of the bug they found.
8. In the Description, users give a detailed list of steps to reproduce the problem they encountered.
9. The user assigns the bug to a developer.
10. The User attaches a document (test case, patch, or screenshot of the problem).
11. User makes product-specific requests such as requesting a review for the patch they just attached or requesting their bug to block the next release of the product.
12. Users review and validate their bug reports.
13. Users submit their bug report by clicking the **Submit Bug** button to add their report to the database.

Alternative Flow of Events:

1. The user goes to the bug that they want to clone.
    a. Then clicks on the "**Clone This Bug**" link on the footer of the bug page

3.,4.,5.,6.,7.,8. The User can change the values and/or text if needed.

9. The user may not have the authorization to assign
    a. The system presents an error to the user.

5.2.2. Scenario 2

Use Case: User edits a bug report

Primary Actor: System User

Entry Conditions:

- The user needs to be already registered to the application.
- User needs to be logged in.
- The User needs to have the required permissions assigned by an administrator for seeing and editing features like time tracking, etc.
- The bug report selected by the user needs to exist.

Exit Conditions:

- The user finishes editing the bug report and saves changes.

Main Flow of Events:

1. The user selects a bug report to edit.
2. The user chooses from the available fields such as Status, Alias, Assignee, etc.
3. The user clicks on the edit hyperlink of a particular field, that field will display as editable and the user edits the field accordingly.
4. After the editing is done, the user clicks on the Save Changes button, which is on the top right-hand corner of the page as shown in the screenshot below.

Alternative Flow of Events:

2. During the editing of the bug report:
    a. The user may upload an attachment to the selected bug report such as relevant files to bugs - patches, screenshots, test cases, debugging aids or logs, or anything else binary or too large to fit into a comment
    b. The user may set a flag by selecting either + or - from the drop-down menu next to the name of the flag in the **Flags** list.
    c. The user may see deadlines and estimated times to fix bugs and can provide time spent on these bugs.

5.2.3. Scenario 3

Use Case: Find/trace/locate an existing logged bug

Primary Actor: System User

Entry Conditions:

- The user needs to be already registered to the application.
- User needs to be logged in.

Exit Conditions:

- The user selects a bug id to access its details.

Main Flow of Events:

1. The user clicks on the Browse hyperlink on the header of the home page.
2. The user browses the bug according to the category.
3. After selecting a category a new window shows the components which are sub-sections of a product. A product can have multiple components listed.
4. The user selects from one of the components.
5. This will open another window. All the Bugs created under a particular category will be listed over here. From that Bug-list, the user clicks on the Bug# ID to see more details about that bug.

5.2.4. Scenario 4

Use Case: User searches for finding a specific bug

Primary Actor: System User

Entry Conditions:

- The user needs to be already registered to the application.
- User needs to be logged in.

Exit Conditions:

- The user finds the wanted bug report.

Main Flow of Events:

1. The user clicks on the **Search** hyperlink in the header of the homepage.
2. The user clicks on the **Simple Search** section as shown in the following screenshot.
3. The user chooses the **Status** of the bug from the list to filter. Then, chooses the **Product** from the list and enters some keywords related to the bug.
4. Then clicks on the **Search** button.
5. The result will be as shown as a list.

6. At the bottom of the search page, there are various options for display options.
7. The user customizes these settings for their preference.
8. The user chooses the wanted bug for display.

Alternative Flow of Events:

2. The user clicks on the Advanced Search tab.
    a. The user selects the required option from the **Summary** field. Then, they enter the keyword to identify or filter out the bugs.
    b. The next step is to select the category of Bug from the Classification box.
    c. Then, choose the **Product** under which the Bug is created
    d. In the Component box, the user selects a suitable component.
    e. In the Status box, the user clicks on a suitable status.Â
    f. In the Resolution box, the user chooses a suitable resolution,
    g. Then the user clicks on the **Search** button after entering all the fields based on the requirement of the filter.
    h. Advanced Search will detect the bug and the result will be displayed.

5.2.5. Scenario 5

Use Case: User generates graphical/tabular reports

Primary Actor: System User

Entry Conditions:

- The user needs to be already registered to the application.
- User needs to be logged in.

Exit Conditions:

- The user generates and displays a graphical or tabular report.

Main Flow of Events:

1. To begin with, the user clicks on the **Reports** link at the header of the homepage.
2. The user clicks on the **Graphical Reports** hyperlink, which is listed under the **Current State** section.
3. Now, the user will set various options to present reports graphically.

4. Afterward, they click on **Generate Report** to display a Bar chart, where the Severity of a bug is the vertical axis, while the Component “Widget Gears” is the horizontal axis.
5. The result of the above-mentioned line graph will be presented to the user.

Alternative Flow of Events:

2. The user clicks on the **Tabular Reports** in the **Current State** section.
    a. The user selects Vertical, Horizontal axis along with Multiple tables (if required) and provides details in the other fields.
    b. After selecting all the fields, they click on **Generate Report**. Based on the deadlines, it generates multiple tables.
    c. By clicking on the CSV hyperlink below the table, it converts the report into a CSV file.
    d. Similarly, a Line Graph can be created for Complete Vs Deadline.

6. Integration Diagram for IT

Below is the integration diagram which shows how bug tracking fits into the application lifecycle management.

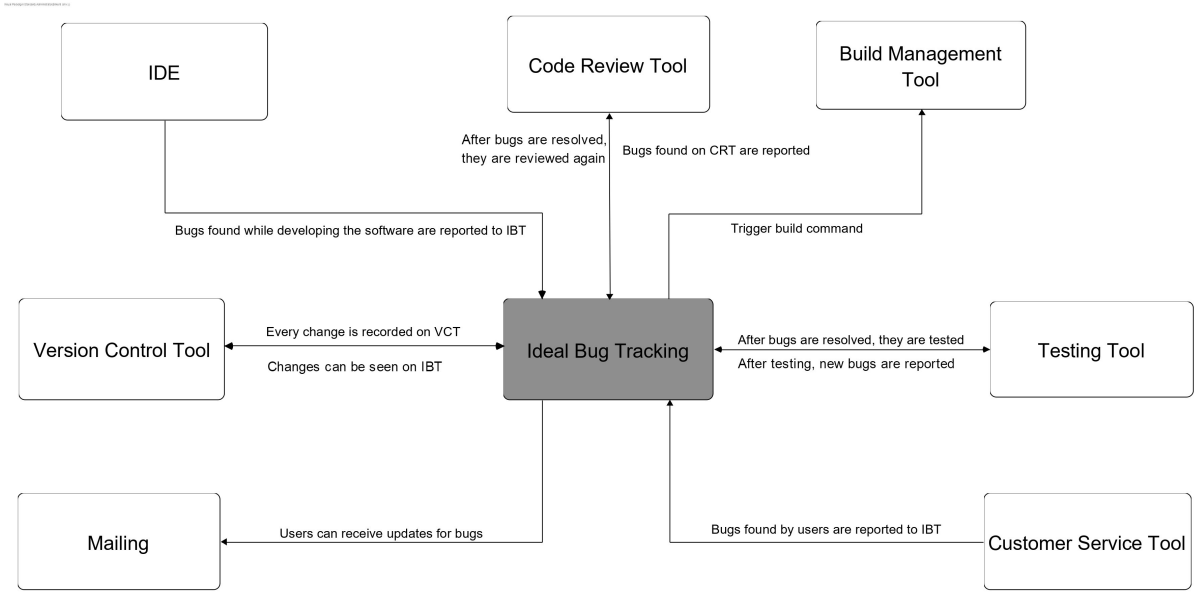

Figure 4: The Integration Diagram for Ideal IT.

An ideal bug tracking tool needs to communicate with several other tools in the lifecycle of an application. After developers complete their parts in their IDE's, they

can submit any bugs they find to the ideal bug tracking tool. Afterward, when the code is reviewed by another developer, the bugs should be reported to the ideal bug tracking tool and after they are resolved, the code should be reviewed again. The tool should also communicate with a version control tool as every change should be recorded on the version control tool and these changes should also be visible on the ideal bug tracking tool. These changes in a submitted bug should be mailed to related individuals via a mailing service. Afterward, the tool should communicate with the testing tools in order to record any bugs found within the code and if they are resolved, they should be tested from this tool again. The tool should also be able to automate the builds with a build management tool. After the release, any issues found by the customers will be reported to the ideal bug tracking tool from a customer service tool.

7. Integration Diagram for Bugzilla

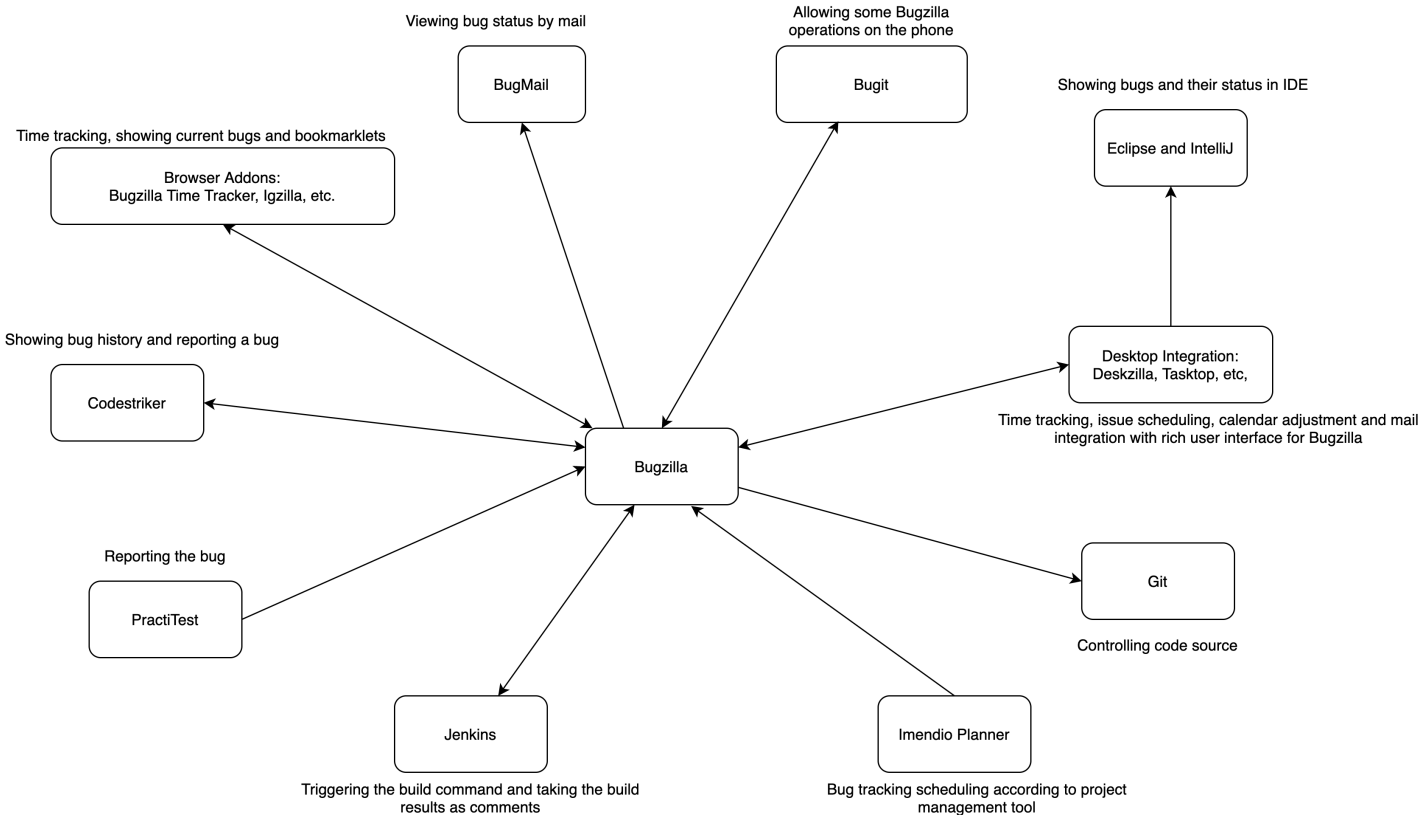

Figure 5: The Integration Diagram for Bugzilla.

7.1 Jenkins

When a bug is resolved with Bugzilla, the solved bug's build can be automatically triggered to Jenkins with this integration. Also, the build results of Jenkins can be added as a comment of the bug in Bugzilla. It can be said that they integrate bi-directionally. Jenkins and Bugzilla integration can be managed by using ops hub.

7.2 Git

Git can be integrated with Bugzilla to make easier source code management. Before committing anything, users can check the bug status of the code. Also, it supports multiple bug references in commit messages and it controls allowing and rejecting any commits with Bugzilla. The integration can be managed by GitZilla.

7.3 PractiTest

PractiTest is a test management solution and provides to organize tests, runs, and requirements. PractiTest allows users to open a new bug form in Bugzilla with all the steps and actual results of the test run in a pre-entered way. The integration can be managed by one of the PractiTest plug-ins.

7.4 Desktop Integration

There are multiple desktop integration plugins and tools for Bugzilla. The important ones are Deskzilla and Tasktop. Both of them are desktop applications that allow you to use Bugzilla with a rich interface. There are features that facilitate planning and managing projects, like nested queries, by-field distributions, arranging bugs in a hierarchy, query counters that immediately show the number of bugs satisfying a query. For Agile development, Deskzilla can be used to maintain backlog order by using a custom field to hold order value. The integration can be managed by the ALM Works Deskzilla application itself. Another Desktop tool for Bugzilla, which is Tasktop supports offline reading and editing as well as task change notifications so there's no need to receive emails from Bugzilla. Tasktop also provides time tracking and reporting for bugs, helps for estimations, and complete timesheets. Tasktop also offers you integrate with your web browser, Google/Outlook calendar, and email so that it allows you to organize your entire workday.

7.5 IntelliJ and Eclipse

The integration allows users to monitor issues and loads Bugzilla bugs into IntelliJ through Deskzilla. Also, It can detect Java stack traces in an issue and apply IntelliJ's "Analyze Stack trace" action to them. In addition, Eclipse integration allows users to edit and query for Bugzilla tasks. Also, offline reading and editing are providing by this integration. Eclipse integration can be done with Tasktop. Therefore, users can access a subset of Tasktop features for Bugzilla in Eclipse with this integration.

7.6 Codestriker

The integration allows you to read a bug record, and how it has been resolved, Codestriker can add in a link to the code review topic, which shows the actual code which fixed the bug. The integration can be managed by manipulating the configuration file of Codestriker.

7.7 Imendio Planner

Imendio planner is a project management tool that can be integrated with Bugzilla. This integration offers time tracking information, updating bug deadlines according to the project plan, and generating a mail report with a set of warnings highlighting inconsistencies between the Planner file and Bugzilla. The integration can be managed by the Jujunie-Integration tool.

7.8 Browser Addons

There are many browser extensions for Bugzilla. Bugzilla Time Tracker allows users to track all working time spent in Bugzilla by Firefox extension. Jesse Rudderman’s Bugzilla Bookmarklets provides bookmarklets for multiple browsers to make using Bugzilla easier. Bugs Dashboard provides reporting and visualizing bugs in users’ browsers. There are also other browser integration plug-ins/tools that provide sidebar, keyboard shortcuts, visualizing bugs such as Igzilla, BuggyBar, Interclue, Interdiff Link, TidyBug and bzhome.

7.9 BugMail

BugMail is a Thunderbird add-on that adds bug status to the mail preview header pane. The integration can be managed by BugMail itself.

7.10 Bugit

There are many phone applications for Bugzilla. The most popular one is Bugit which allows users to work with unlimited projects, create new tickets, conduct an advanced search, sort tickets, and upload attachments. Bugit offered only for IOS devices but there are also some other apps such as bugzilla-mobile and BugTender for mobile.

8. Data Samples

The data provided below is obtained from https://bugzilla.mozilla.org/ by specifying the search to columns to the features described below. Since the website contains all of the issues for every Mozilla product, we also specified the product to Mozilla Firefox in order to get this data.

Bug ID	Type	Summary	Component	Assignee	Status	Resolution	Priority	Severity	Opened	Updated	Closed	Depends on	Duplicates	Keywords	Number of	Reporter	Votes	Flags
1427651	defect	Animated pngs can cause migraines and seizures	Preferences	nobody	RESOLVED	WORKSFORME	--	normal	02-01-18 15:24	02-01-18 19:18	03-01-18 03:05			access	3	erwinm	0	
1427572	enhancem	Contradictory statement in 'about:config' page	Preferences	nobody	RESOLVED	DUPLICATE	--	normal	01-01-18 19:48	03-01-18 09:01	03-01-18 17:01				2	kaarticsiva	0	
1427834	defect	Missing context menu option "view background image" on hyperlinks	Menus	nobody	RESOLVED	DUPLICATE	--	normal	03-01-18 11:24	03-01-18 14:06	03-01-18 22:06				4	nielsl	0	
1427982	enhancem	[Enhancement] Add a clear field content Button (URL, Search, other input	Address Bar	nobody	RESOLVED	DUPLICATE	--	normal	04-01-18 00:42	04-01-18 01:58	04-01-18 09:58				2	murznn	0	
1429202	defect	[UX] Address bar shows remote results before local ones (even tho they loa	Address Bar	nobody	RESOLVED	DUPLICATE	--	normal	09-01-18 12:21	10-01-18 02:37	10-01-18 10:37				2	alex94puc	0	
1429355	defect	Bookmarks Toolbar should be seen on Customize page and automatically a	Toolbars and Customizatio	nobody	RESOLVED	DUPLICATE	--	normal	10-01-18 03:30	10-01-18 07:08	10-01-18 15:08				6	oana.botis	0	
1428965	defect	Disable the Remove Selected cookies button if no cookie selected	Preferences	nobody	NEW	---	P5	normal	08-01-18 20:45	11-01-18 10:27					1	magicp.jp	0	
1429659	defect	The "Use Current Page" button is not disabled when no current page	Preferences	nobody	NEW	---	P5	normal	10-01-18 18:45	11-01-18 14:59					3	magicp.jp	0	
1429895	defect	No search suggestion for division calculation in the address bar	Address Bar	nobody	RESOLVED	DUPLICATE	--	normal	11-01-18 12:27	11-01-18 19:15	12-01-18 03:15				2	didaio	0	
1428606	defect	Connection is not secure page turn green after reloading the page	Security	nobody	RESOLVED	WORKSFORME	--	normal	06-01-18 22:17	12-01-18 02:22	12-01-18 10:22	1424917			6	magicp.jp	0	
1429456	enhancem	Use "in" instead of "as" in "Open links in / as tabs instead of new windows'	Preferences	gijskruitbo	RESOLVED	FIXED	P5	trivial	10-01-18 08:23	12-01-18 07:53	11-01-18 09:47	1424970			6	gijskruitbo	0	
1429716	enhancem	Stop resetting border properties for the translation info bar's buttons and	Theme	ashish150(	RESOLVED	FIXED	P3	normal	11-01-18 01:58	12-01-18 14:08	12-01-18 22:08	1334429, 1423453		good-first-	24	dao+bmo	0	
1430128	enhancem	Remove remnants of the iconsize attribute	Toolbars and Customizatio	dao+bmo	RESOLVED	FIXED	--	normal	12-01-18 07:03	12-01-18 14:09	12-01-18 22:09	1428938			5	dao+bmo	0	
1429364	defect	The "Save Link as" context menu option do not work in the "Firefox Notes'	General	pastith	VERIFIED	FIXED	P2	normal	10-01-18 04:29	15-01-18 07:37	12-01-18 22:08				14	mcoman	0	
1429334	defect	Missing title for New tabs after restarting Firefox	New Tab Page	nobody	RESOLVED	DUPLICATE	--	normal	10-01-18 02:00	16-01-18 12:10	16-01-18 20:10				2	mihai.bold	0	
1430485	defect	about:addons displayed for only half a second	General	nobody	RESOLVED	INVALID	--	normal	14-01-18 11:46	16-01-18 14:09	16-01-18 22:09				2	ruedin	0	
1430953	enhancem	Feature request: File -> New Private Tab	Private Browsing	nobody	RESOLVED	DUPLICATE	--	normal	16-01-18 18:23	16-01-18 20:29	17-01-18 04:29				2	public	0	
1430507	defect	Context menu Open Link In New Window does not work on svg element	Menus	gijskruitbo	RESOLVED	FIXED	--	normal	14-01-18 17:33	17-01-18 01:55	17-01-18 09:55	1429709	1225052		12	david.new	0	
1431006	defect	Pop-up menus not showing without a navigation bar	Toolbars and Customizatio	nobody	RESOLVED	WONTFIX	--	normal	16-01-18 23:29	17-01-18 06:00	17-01-18 14:00				3	buch1-1	0	
1431098	enhancem	New tab created with element full screened does not receive address bar	Untriaged	nobody	RESOLVED	INCOMPLETE	--	normal	17-01-18 06:38	17-01-18 11:43	17-01-18 19:43				1	fahimazulf	0	
1431318	enhancem	Show fragment in brackets in bookmark title when bookmarked	Bookmarks & History	nobody	UNCONFIRM	---	P5	normal	18-01-18 00:48	18-01-18 04:50					3	combettav	0	
1431317	enhancem	Firefox Sync doesn't sync search engines in "One-Click Search Engines" in "	Sync	nobody	RESOLVED	DUPLICATE	--	normal	18-01-18 00:43	18-01-18 07:05	18-01-18 15:05				2	combettav	0	
1430357	defect	Error: createFromField requires a password or username field in a docume	Preferences	nobody	NEW	---	P3	normal	12-01-18 22:25	18-01-18 10:38					2	magicp.jp	0	
1430396	defect	TypeError: event.target is undefined when check on/off "Allow Nightly to	Preferences	myk	RESOLVED	FIXED	--	normal	13-01-18 05:47	19-01-18 02:13	19-01-18 10:13				12	magicp.jp	0	
1431888	enhancem	Open the Library in a tab rather than in a window	Bookmarks & History	nobody	RESOLVED	DUPLICATE	--	normal	19-01-18 18:19	19-01-18 20:22	20-01-18 04:22				2	public	0	
1430848	defect	Add an option to move add-ons to the Overflow Menu automatically	Toolbars and Customizatio	nobody	VERIFIED	WONTFIX	--	normal	16-01-18 10:25	22-01-18 08:09	18-01-18 21:37				9	public	1	
1431958	defect	"Unknown label for categorical histogram" is logged when click "Update P	Preferences	nobody	NEW	---	P4	normal	20-01-18 18:44	22-01-18 13:29					1	magicp.jp	0	
1431959	defect	"Unknown label for categorical histogram" is logged when go to about:pre	Preferences	nobody	NEW	---	P4	normal	20-01-18 19:11	22-01-18 13:30					1	magicp.jp	0	
1432408	defect	History: not possible to sort by date.	Bookmarks & History	nobody	RESOLVED	DUPLICATE	--	normal	23-01-18 00:29	23-01-18 01:12	23-01-18 09:12				2	3rlendhl	0	
1432062	enhancem	Require dangling commas via eslint for the migration component	Migration	samreadin	RESOLVED	FIXED	P4	normal	21-01-18 13:21	23-01-18 02:06	23-01-18 10:06				4	MattN+bn	0	
1432161	defect	Yandex.Maps API doesn't work with tracking protection enabled	Protections UI	nobody	RESOLVED	DUPLICATE	--	normal	22-01-18 06:18	23-01-18 15:35	23-01-18 23:35				2	arinasmar	0	
1432729	enhancem	Reword "Import and Backup" to "Restore and Backup" in Library" (Ctrl+Sh	Bookmarks & History	nobody	RESOLVED	WONTFIX	--	trivial	24-01-18 00:24	24-01-18 00:48	24-01-18 08:48				2	combettav	0	
1432734	enhancem	Reword Import to Restore in Library/Import and Backup	Bookmarks & History	nobody	RESOLVED	WONTFIX	--	trivial	24-01-18 00:32	24-01-18 01:02	24-01-18 09:02				3	combettav	0	
1432735	enhancem	Reword Export to Backup in Library/Import and Backup	Bookmarks & History	nobody	RESOLVED	WONTFIX	--	trivial	24-01-18 00:34	24-01-18 01:03	24-01-18 09:03				2	combettav	0	
1432723	enhancem	Make sidebar(Ctrl+H/B)black when using preinstalled Dark Theme	Theme	nobody	RESOLVED	DUPLICATE	--	normal	24-01-18 00:12	24-01-18 06:22	24-01-18 14:22				2	combettav	0	
1432722	enhancem	Make hamburger option black when using preinstalled Dark Theme	Theme	nobody	RESOLVED	DUPLICATE	--	normal	24-01-18 00:10	24-01-18 06:22	24-01-18 14:22				2	combettav	0	
1432772	defect	Korean search autocomplete issue	Search	nobody	RESOLVED	DUPLICATE	--	normal	24-01-18 05:21	24-01-18 06:36	24-01-18 14:36				2	pdj5096	0	
1430467	defect	autorefresh notification bar disappears when moving the tab to a differen	Tabbed Browser	nobody	NEW	---	P3	normal	14-01-18 07:06	24-01-18 07:56					1	combettav	0	
1432533	enhancem	Avoid file.exists() --> read file antipattern in migrator code	Migration	nobody	NEW	---	P3	normal	23-01-18 09:26	24-01-18 23:45		862127		perf	1	dothayer	0	

Figure 6: Data sample for the issues in Mozilla Firefox from Bugzilla.

8.1 Description of the Features

The descriptions of the features represented in the data sample table in Figure 6 are given below.

- **Bug ID:** ID of the issue.
- **Type:** Type of the issue like a defect, enchantment task.
- **Summary:** Summary of the issue.
- **Component:** Which component of the software is affected by the bug.
- **Assignee:** Assignee of the issue.
- **Status:** Current status of the issue.
- **Resolution:** Resolution of the issue.
- **Updated:** Last update date of the issue.
- **Priority:** Priority of the issue.
- **Closed:** Closing date of the issue.
- **Depends On:** Other issues that the current bug depends on.
- **Duplicates:** Duplicates of the current issue if there is any.
- **Flags:** Custom tags.
- **Keywords:** Keywords that define the issue.
- **Number of Comments:** Number of comments on the issue. This would express the popularity of the issue.
- **The number of CC's:** Number of CC in the issue. This would express the popularity of the issue.
- **Opened:** Opening date of the issue.
- **Reporter:** Reporter of the issue.
- **Severity:** How much will it affect the software
- **Votes:** Shows how much other users are affected by the same issue.

9. Process Smells

In this section, several smells that observed on Bugzilla for the Mozilla open source project will be discussed and described. Screenshots regarding the smells are given where available.

9.1 Priority Not Set

Priority has not been set so there are several unresolved issues with high severity due to not having priorities like an issue from 2008.

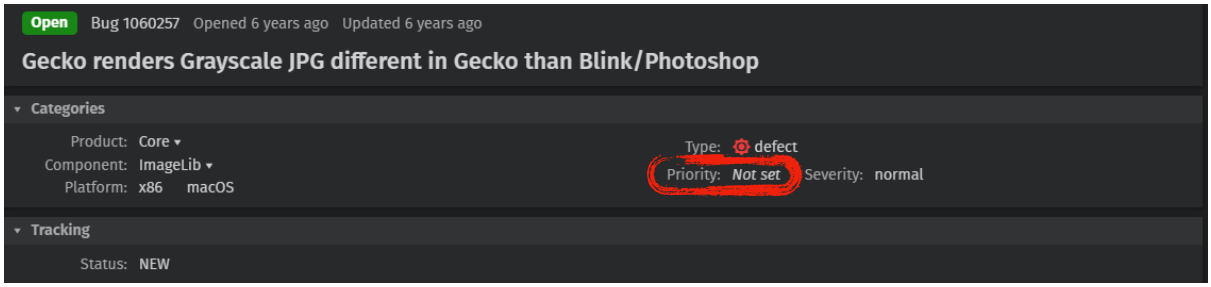

Figure 7: Example Screenshot for Priority not Set [3].

9.2 No Traceability of Bugs

No linking between some commits and issues has been created. It should be located in the attachments.

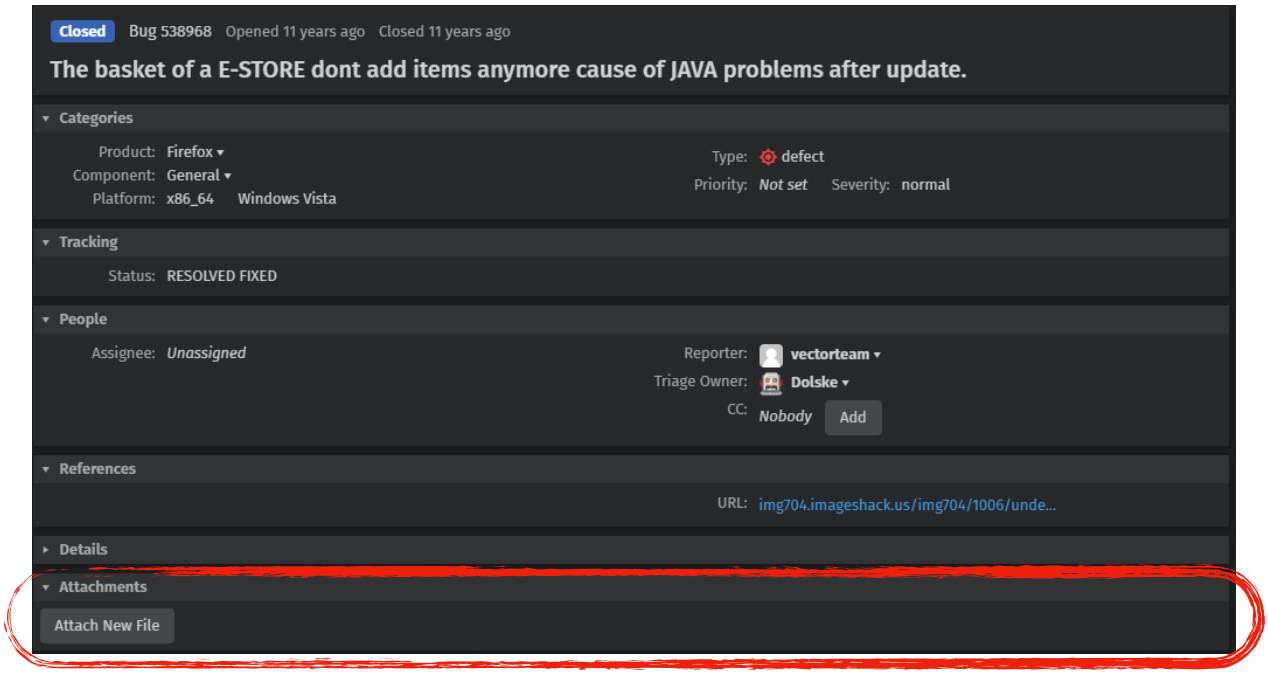

Figure 8: Example Screenshot for No Traceability of Bugs [3].

9.3 Assignees Not Set

No assignee has been set for an issue so it has not been resolved even if it is really old like a bug from 2005. Also, some issues are solved but have no assignee.

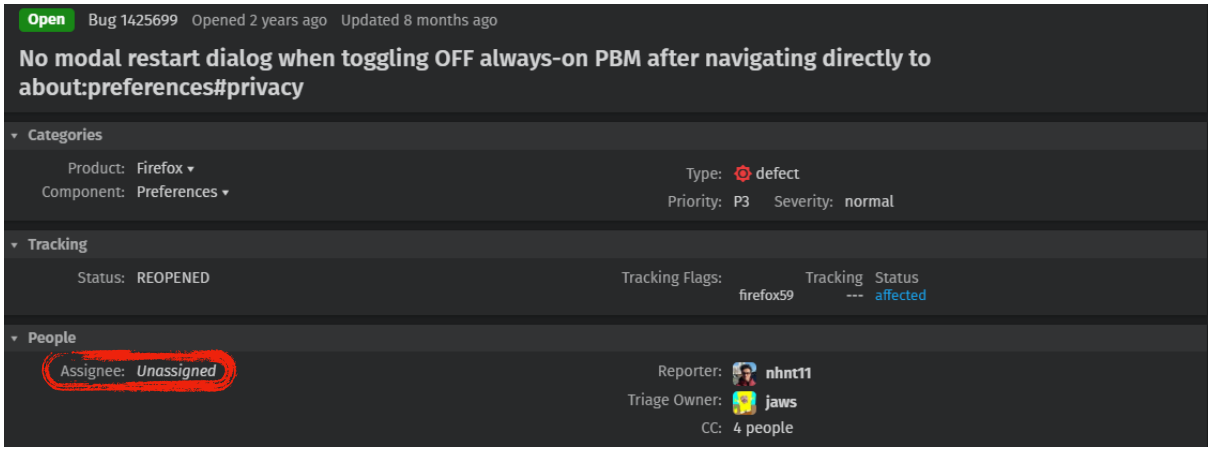

Figure 9: Example Screenshot for Assignees Not Set [3].

9.4 Unsolved Bugs

Bugs that are not solved at all even if it is really old like a bug from 2002.

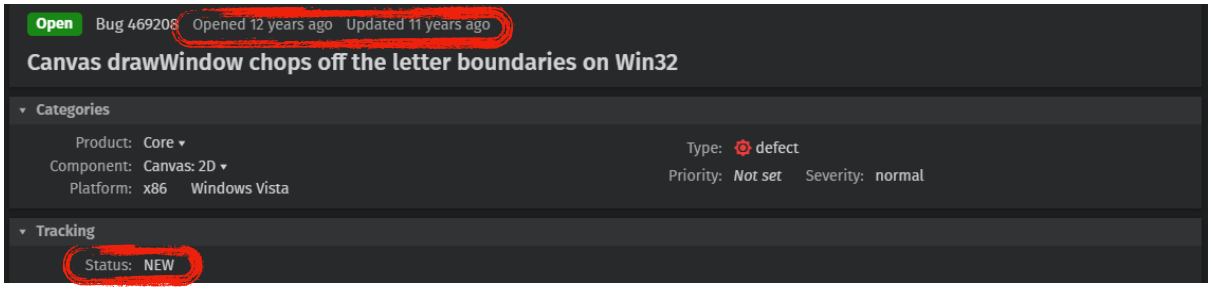

Figure 10: Example Screenshot for Unsolved Bugs [3].

9.5 Zombie Tasks

Bugs are not marked as solved even if they have been solved.

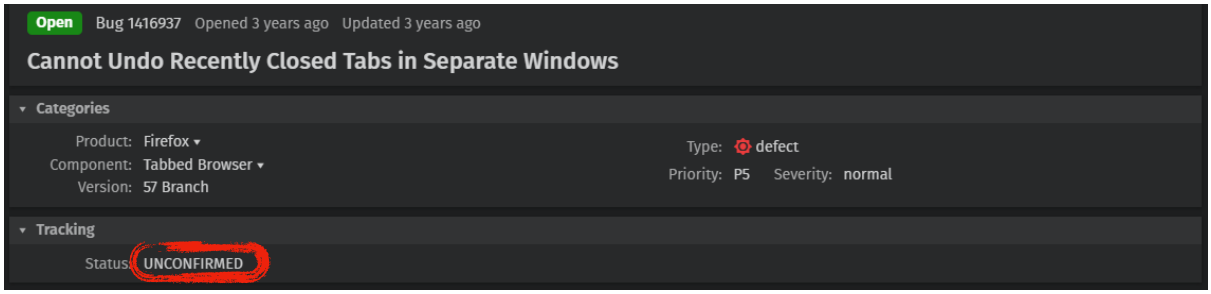

Figure 11: Example Screenshot for Zombie Tasks 1 [3].

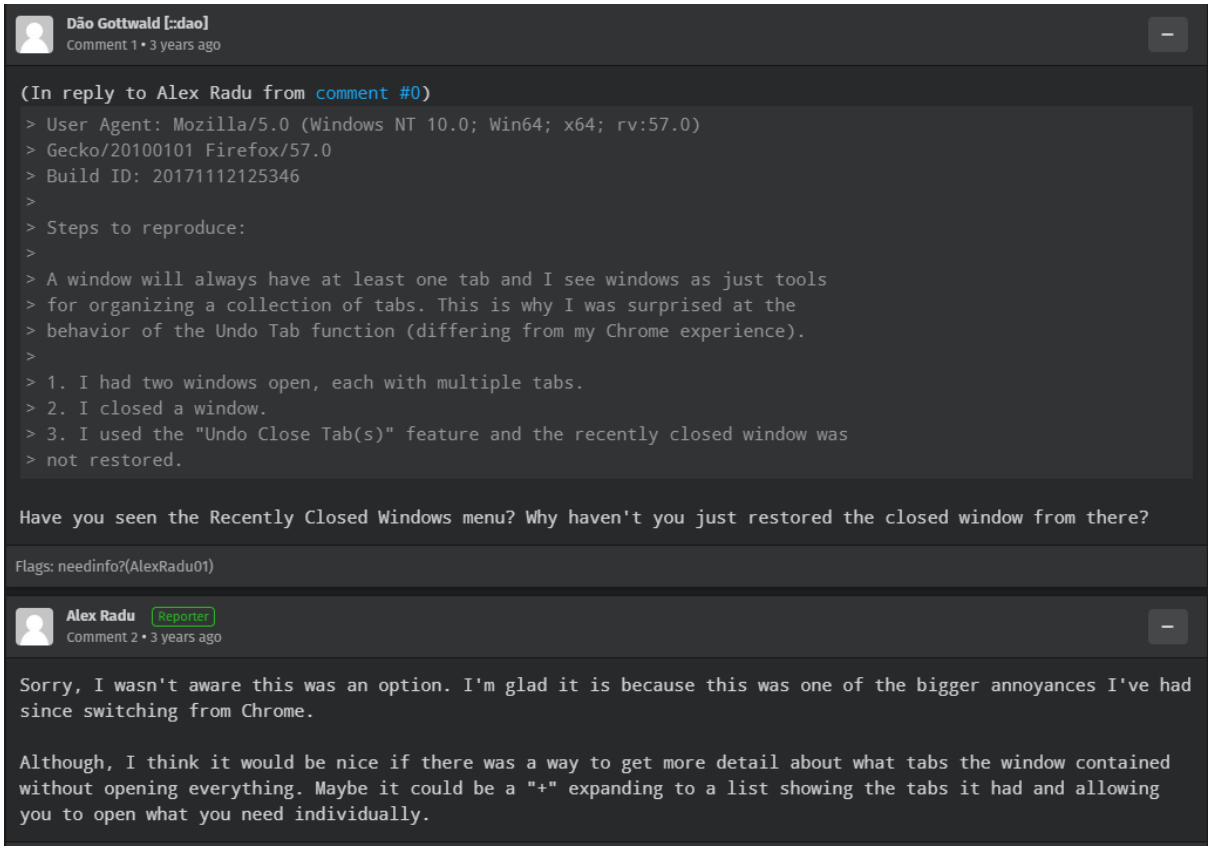

Figure 12: Example Screenshot for Zombie Tasks 2 [3].

9.6 Undefined/Unclear Tasks

Descriptions for the issues are not sufficient. Usually, bugs are explained how they can be reproduced step by step for developer. However, some bugs' steps to reproduce are not explained by the reporter. Therefore, they cannot be clearly understand by the developer.

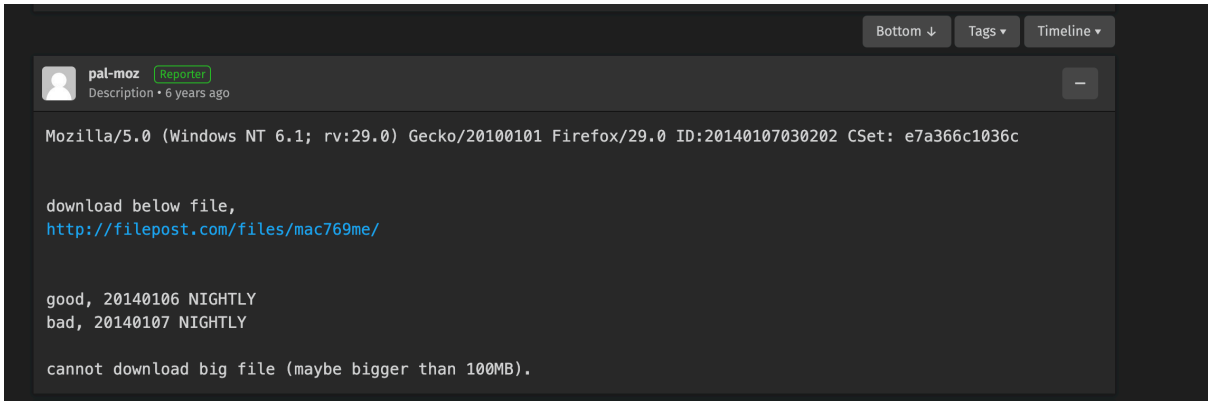

Figure 13: Example Screenshot for Undefined/Unclear Tasks [3].

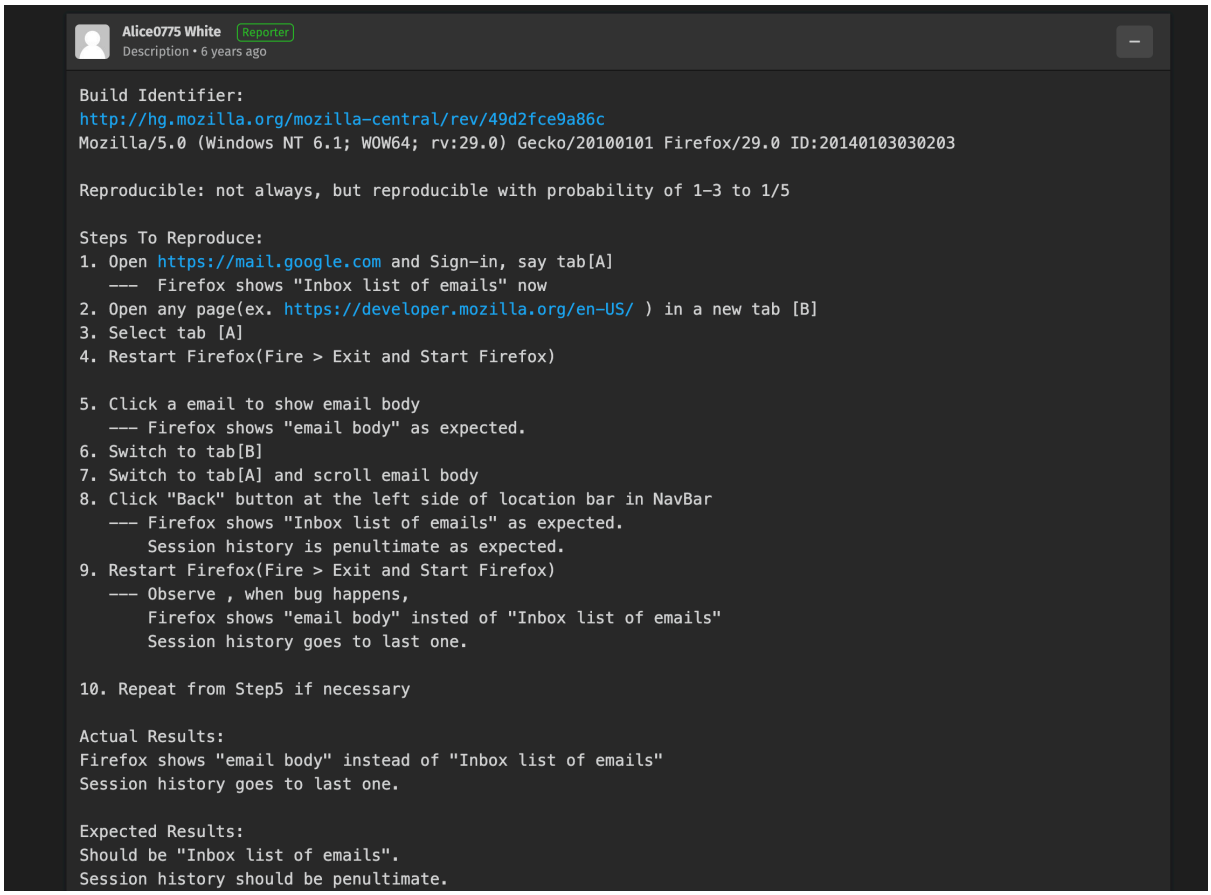

Figure 14: Example Screenshot for Undefined/Unclear Tasks 2 [3].

9.7 Works for Me

Issues that are marked as works for me are sometimes problematic and due to that they are reopened after a while.

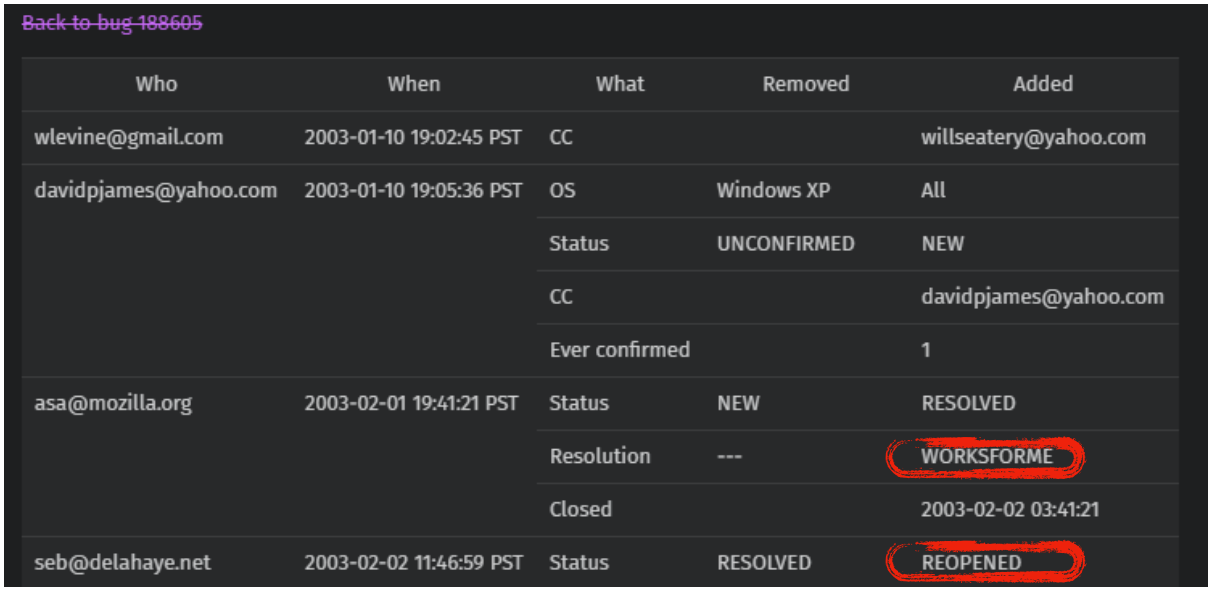

Figure 15: Example Screenshot for Works for Me [3].

seb@delahaye.net	2003-02-02 11:46:59 PST	Status	RESOLVED	REOPENED
		Resolution	WORKSFORME	---
		CC		seb@delahaye.net
david@coffeefish.org	2003-02-02 20:37:13 PST	CC		dkoppenh@null.net
djst@mozilla.com	2003-02-19 08:11:54 PST	CC		david.tenser@telia.com
seb@delahaye.net	2003-03-18 12:04:59 PST	Status	REOPENED	RESOLVED
		Resolution	---	WORKSFORME
		Closed	2003-02-02 03:41:21	2003-03-18 20:04:59

~~Back to bug 188605~~

Figure 16: Example Screenshot for Works for Me 2 [3].

9.8 Due Date Not Set

Due date has not been set.

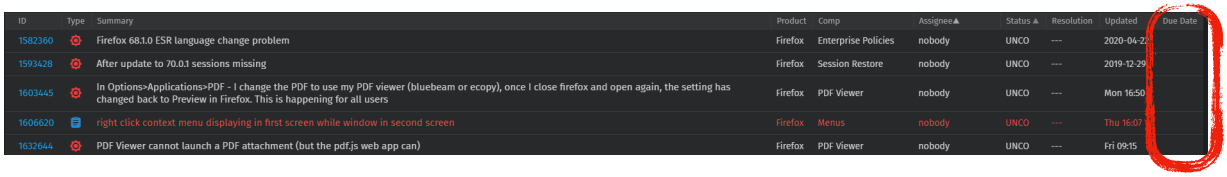

Figure 17: Example Screenshot for Due Date Not Set [3].

9.9 Not Referenced as Duplicate

Some issues that are marked as duplicate are not referenced to the original issue within their References section. Instead, the reporters put the duplicate keyword into Status section which reduces the traceability.

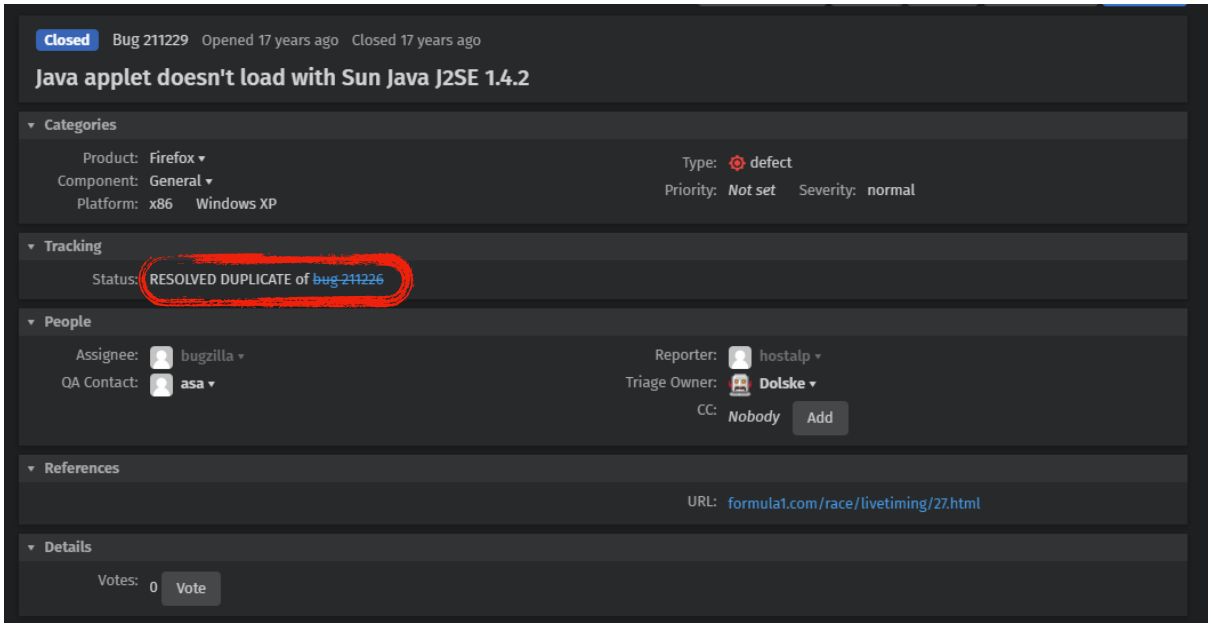

Figure 18: Example Screenshot for Not Reference as Duplicate [3].

10. Detailed Analysis of Mozilla

In this section, detailed information and quantitative graphical charts about process smells observed on Bugzilla for Mozilla will be shown. Some of the data is collected directly from Bugzilla using its graphical reports features whereas some collected through the scripts we wrote.

10.1 Priority Not Set

As can be seen below, more than 60% of the bugs contains no priority set (--). This is a very big problem for the developers since they cannot know which issues they need to prioritize and they might miss important bugs.

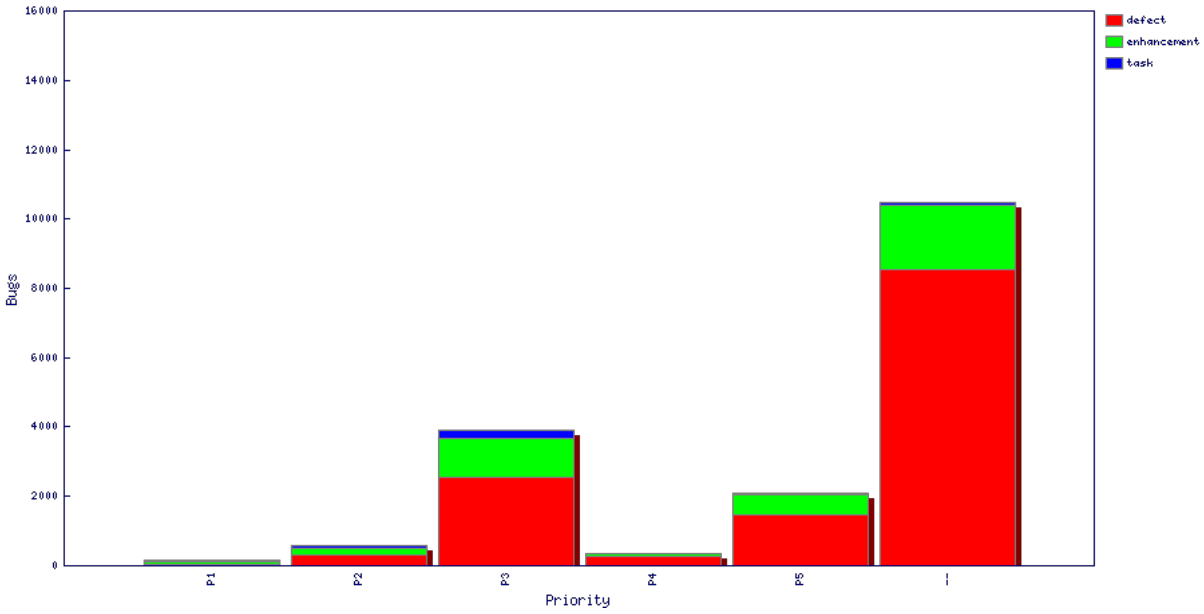

Figure 19: Bar Chart for Priority Not Set [3].

10.2 No Traceability of Bugs

Here, 0 represents there is no linking between the code and the bug in the issue after it resolved and 1 represents there is a linking in the issue. As can be seen below, almost 15% of the issues contains no traceability which may reduce the solving time of the issue if it is duplicated in the future or the issue reopens again.

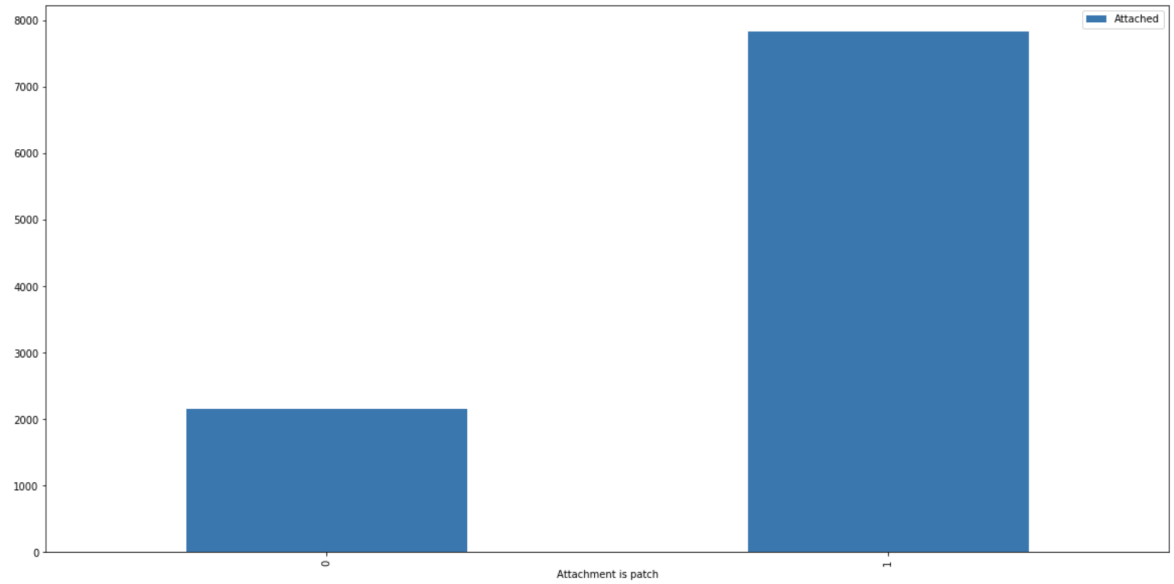

Figure 20: Bar Chart for No Traceability of Bugs [3].

10.3 Assignees Not Set

In the chart below, we see the type distribution of bugs having no assignee on types. The name of not having assignee was defined with the name of "nobody@mozilla.org" in the Bugzilla. When entered into the description of the bug, there is a detail of "Assignee" have the string of "No Assignee".

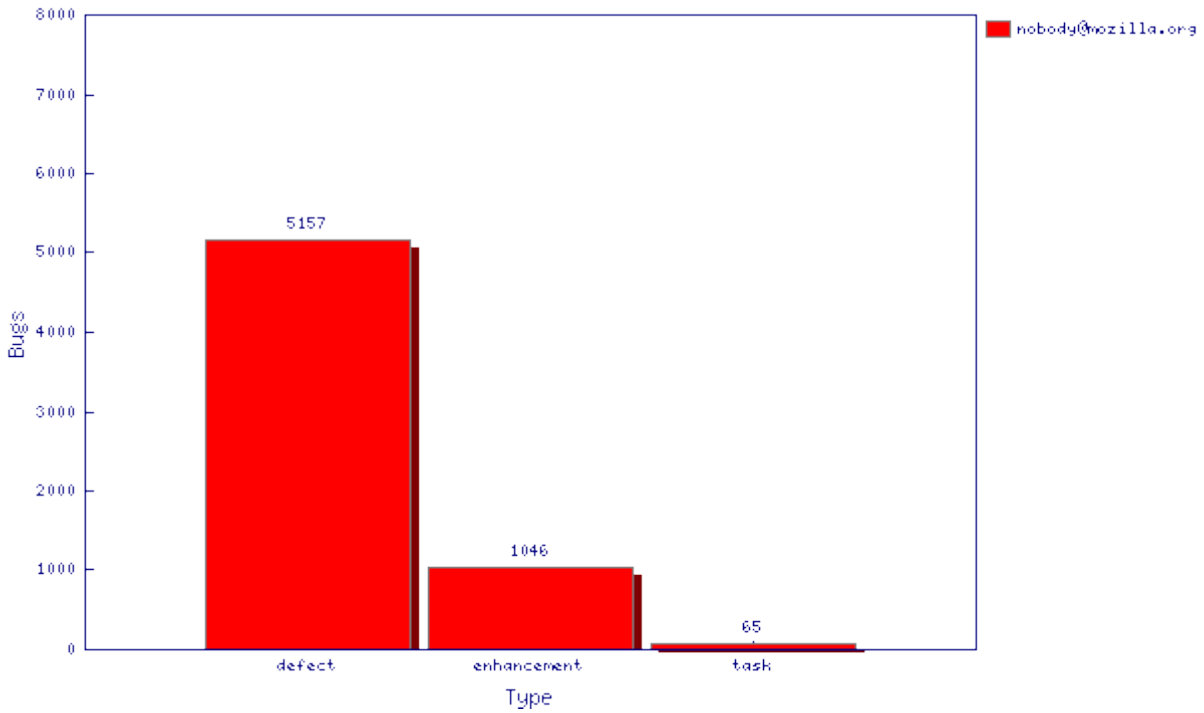

Figure 21: Bar Chart for Assignees Not Set [3].

10.4 Unsolved Bugs

In the chart below, we see the unsolved bugs and its distribution on years. We checked after 2000. The unsolved bugs are accepted as a process smell. We see some accumulation on years going. In the year of 2008, the majority of the unsolved bugs were closed, most probably, by solving them by the developers.

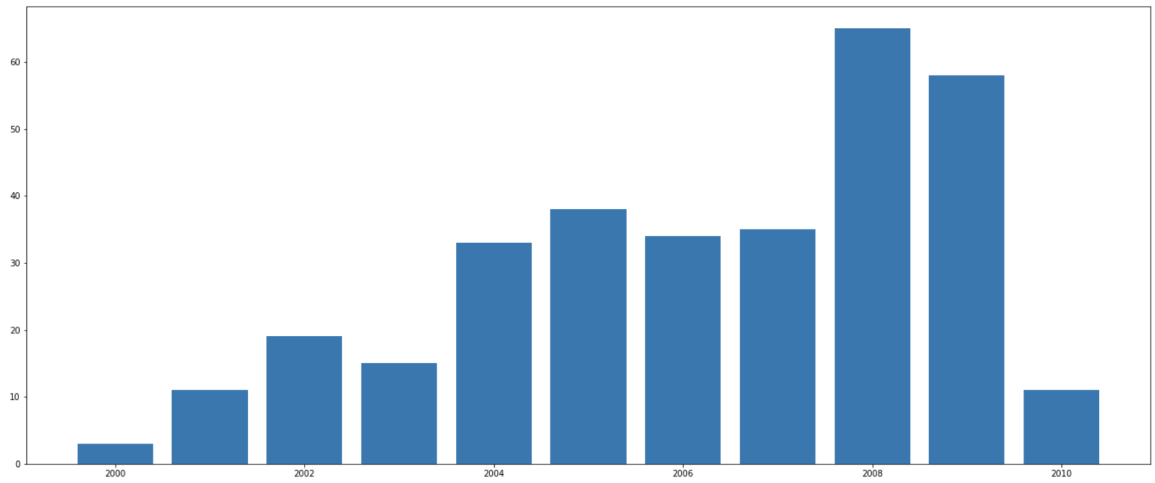

Figure 22: Bar Chart for Unsolved Bugs [3].

10.5 Zombie Tasks

Since we cannot search for the zombie tasks, we looked the issues case by case and consider the number of basic opened issues as zombie tasks from 2002 to 2015 that we know it is resolved or should be closed since they are very basic problems such as "cannot close tab" or we know there is a resolved duplicate of them. Since we cannot graphically represent those cases, we looked for some issues left open on 2002-2015 time period and observed that around half of those issues were resolved in a later release as we did not see these issues in our current version of Firefox 76.0.

10.6 Undefined/Unclear Tasks

Here, we looked for the sentence "Steps to Reproduce" which explains the occurrence process of the bug and more than 75% of the issues do not include a Steps to Reproduce section in their description which makes it hard to solve the problem without properly reproduce it.

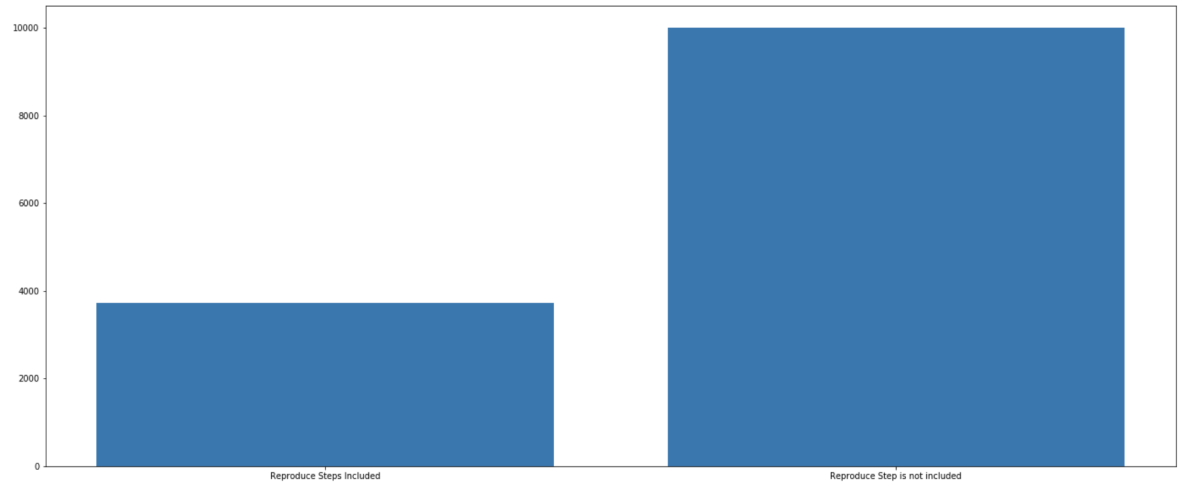

Figure 23: Bar Chart for Undefined/Unclear Tasks [3].

10.7 Works for Me

For this section, we looked for the number of REOPENED cases which tagged as WORKSFORME previously. Only 317 issues were found for this case and the ratio is less than 99%. However, this still shows that WORKSFORME tag is problematic.

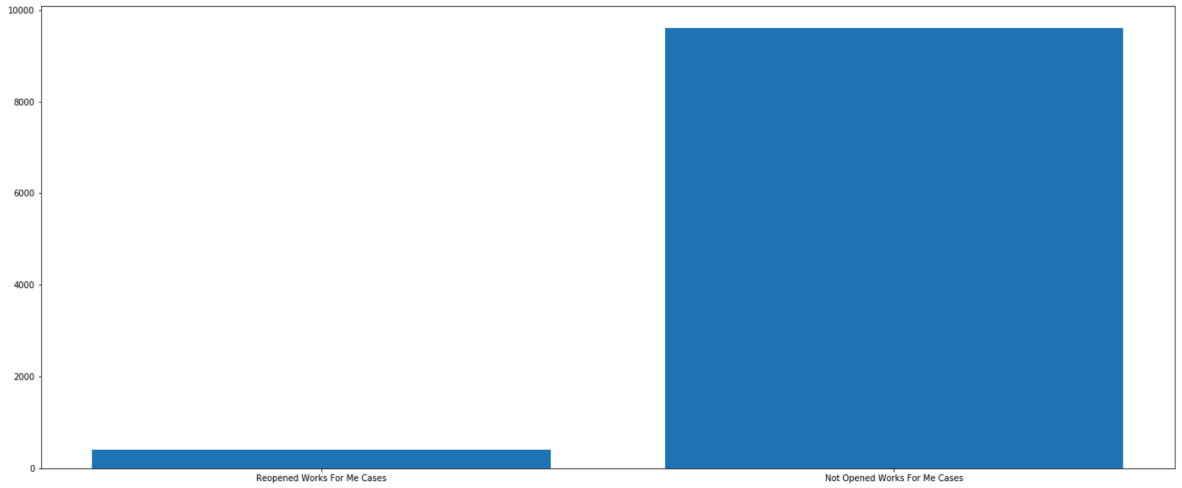

Figure 24: Bar Chart for Works for Me [3].

10.8 Due Date Not Set

Due Date is an important process smell for the projects. However in the project of Firefox, due date has not been used. That causes some side effects. Even if Bugzilla has due date as a preference, developers of the project did not prefer to use it. In

the graphic, we showed that number of cases which have the NEW status, no due date set as a side effect of not using due date. Between 2010 and 2015, we found 50 of this case and in 2016, we found 20 of this case.

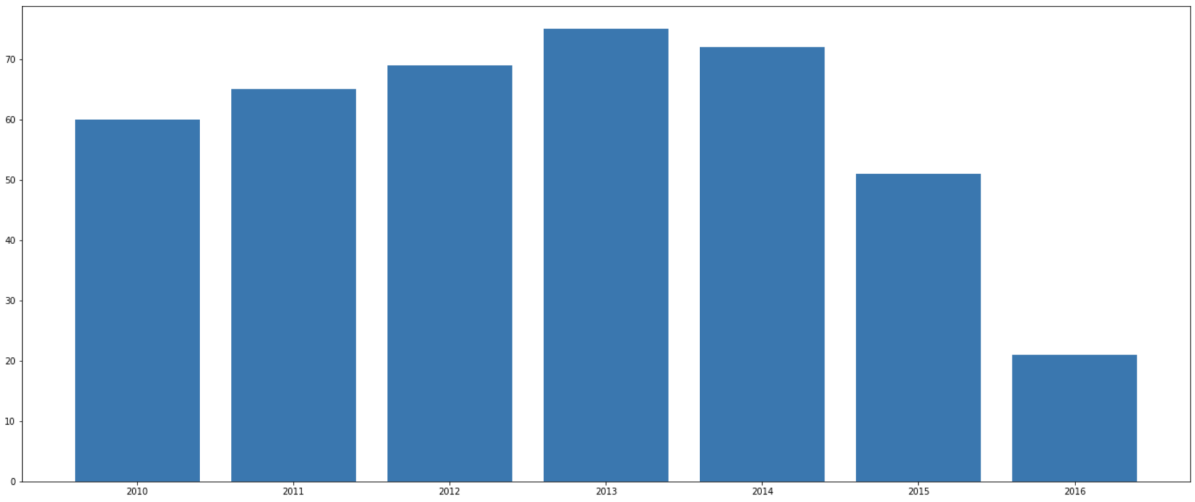

Figure 25: Bar Chart for Due Date Not Set [3].

10.9 Not Referenced as Duplicate

Here, you can see the bugs that are marked as duplicate in their resolution. Most of them have their duplicate bug referenced correctly on the references section which increases the traceability of the bug. However, some of them do not put their duplicate bug ids to the references section. As far as we have observed, most of these bugs still reference the duplicate bug in some way such as referring it in the comment section but some of them are marked as duplicate and do not have any reference to the duplicate bug.

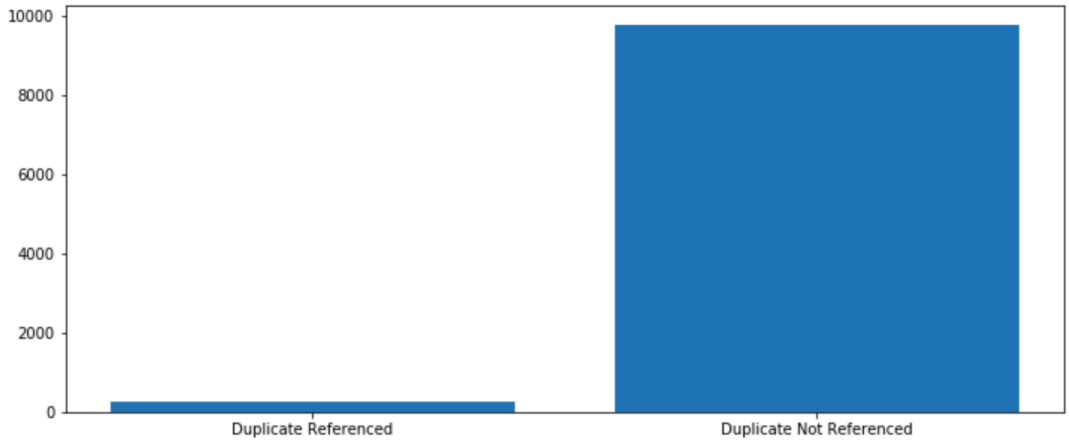

Figure 26: Bar Chart for Not Referenced as Duplicate [3].

11. Workload Distribution

The workload distribution between all the group members are given below.

11.1 Bartu Atabek — 21602229

Use case diagram(s), Sample use cases of Bugzilla/IT, Scenario Walkthrough, Presentations, Report Formatting, Data Samples, Description of the Features, Initial Process Smells, Demo Video.

11.2 Barış Can — 21501886

Activity Diagram, State Diagram, Integration Diagram for IT, Assessment Criteria, Data Samples, Description of the Features, Initial Process Smells.

11.3 Faruk Oruç — 21601844

Activity Diagram, State Diagram, Integration Diagram for IT, Assessment Criteria, Data Samples, Description of the Features, Initial Process Smells, Demo Editing.

11.4 Yusuf Samsum — 21501651

Integration Diagram for Bugzilla, Data Samples, Description of the Features, Initial Process Smells. Final Process Smells, Process Smell Mining and Graphical Representation.

11.5 Fırat Yıldız — 21502717

Introduction, Data Samples, Description of the Features, Initial Process Smells. Final Process Smells, Process Smell Mining and Graphical Representation.

12. References

[1] “JIRA - Issue Types,” Tutorialspoint. [Online]. Available: https://www.tutorialspoint.com/jira/jira_issue_types.htm. [Accessed: 02-Apr-2020].

[2] “Bugzilla:Addons.” Bugzilla:Addons - MozillaWiki, Bugzilla:Addons. https://wiki.mozilla.orgBugzilla:Addons#Test_case_management_systems [Accessed: 02-Apr-2020].

[3] “Bugzilla Main Page,” Main Page. [Online]. Available: https://bugzilla.mozilla.org/home. [Accessed: 10-May-2020].