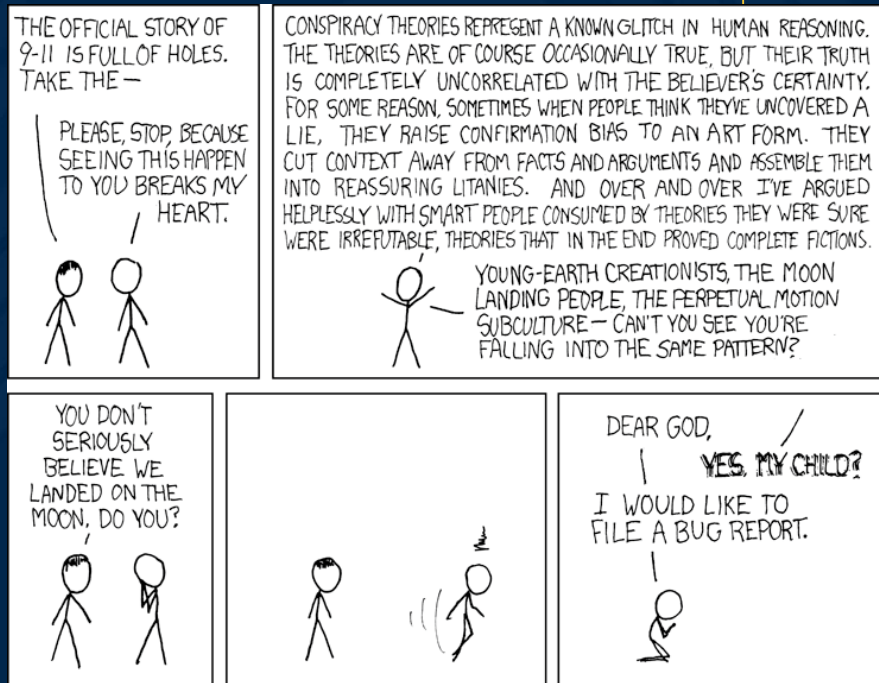


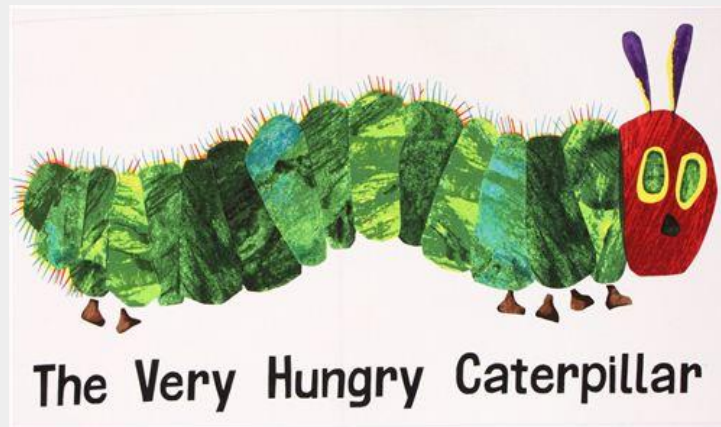
Defect Reporting and Triage

Prof. Kochunas
EECS 481 (W25)



The Story so far...

- **Quality assurance** is critical to software engineering
 - **Testing** is the most common dynamic technique for software quality assurance
 - Testing is **very expensive** and not testing is **even more expensive**
 - And there are **other types of dynamic analysis**
 - We also have static analysis techniques for QA
 - **Code Review** ("passaround") and **code inspection** ("formal") are the most common static approaches to QA.
- Remember our processes should consider that humans are involved
 - So we have things like **pair programming** and static analysis to augment testing
- We do all this analysis to find bugs, but users still report them.
 - What happens to all those **bugs** we find?

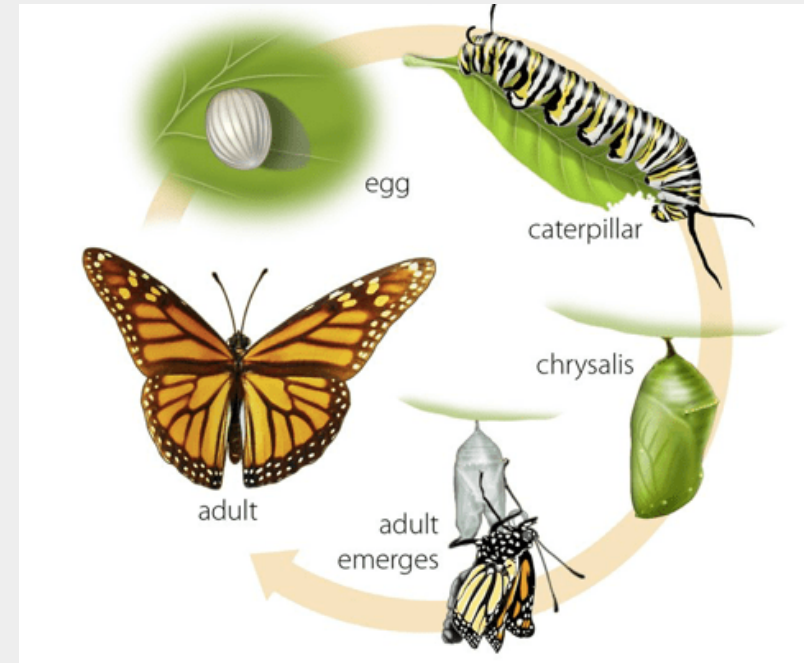


One-Slide Summary

- A software **defect report** includes information and communications related to addressing a software issue.
- Defect reports have many **components**
- Defect reports are subject to **triage** based on **severity** and **priority** information.
- Defect reports have a **lifecycle** that is complicated and non-linear with multiple possible **resolutions**.

Outline (the emotional journey)

- Bugs! What's the problem?
- Defect Lifecycle
 - Reporting
 - Triage
 - Assignment
 - Resolution



Learning Objectives: by the end of today's lecture you should be able to...

1. (*value*) believe that managing defects is a full time job
2. (*knowledge*) explain the components of a defect report
3. (*knowledge*) list the steps in a typical defect lifecycle
4. (*knowledge*) explain how to triage a defect
5. (*knowledge*) list ways that a defect can be resolved

Is this really a problem? (and terminology)



Is This *Really* a Problem?

- “Every day, almost 300 bugs appear that need triaging. This is far too much for only the Mozilla programmers to handle.”
-Mozilla Developer,



Is This *Really* a Problem?

- “Every day, almost 300 bugs appear that need triaging. This is far too much for only the Mozilla programmers to handle.”
-Mozilla Developer, **2005**

Plus ça change ...

- What about in the last year?

m Bugzilla [Browse](#) [Advanced Search](#) [New Bug](#) ... [Log In](#)

Wed Feb 12 2025 10:19:38 PST


Resolution: --- **Classification:** Client Software, Developer Infrastructure, Components, Server Software, Other **Updated:** (is greater than or equal to) 2024-02-11 **Opened:** (changed after) 2024-02-11





10000 bugs found.

ID	Type	Summary	Product	Comp	Assignee	Status	Resolution	Updated
1903641	🔴	Incorrect gamma for background color alpha when Windows ACM is enabled	Core	Graphics: Color Mana	ahale	UNCO	---	2024-12-17
1920664	🔴	Firefox for Windows ARM64 randomly hangs and causing crash in QCDX Display Driver	Core	Graphics: WebRender	ahale	UNCO	---	2025-01-30
1947758	🔴	Moving a tab into a tab group using Ctrl+Shift+PageDwn breaks the tab group indicators	Firefox	Tabbed Browser	dwalker	UNCO	---	08:09:12
1892165	🔴	Firefox 124 Performance Regression on High Intensity Video Streaming	Core	Graphics	nobody	UNCO	---	2024-11-04
1931843	🔴	Webgl on Xubuntu 24.10 under Nvidia broken	Core	Graphics: CanvasWebG	nobody	UNCO	---	2025-01-30
1935929	🔴	remotedesktop.google.com error	Web Compatibility	Site Reports	nobody	UNCO	---	2025-01-24
1882705	🔴	[flatpak] Gnome Inhibitors not Released by Firefox, which prevents OS from sleeping	Core	Widget: Gtk	jhorak	UNCO	---	Sat 22:41

“Just Yesterday”

100,000/year = 270/day: same rate for 20 years in!

 Bugzilla

 Browse
  Advanced Search
  New Bug
 ...
  Log In

Wed Feb 12 2025 10:30:55 PST
 Opened: (changed after) 2025-02-11

Classification: Client Software, Developer Infrastructure, Components, Server Software, Other
 Resolution: ---
 Updated: (is greater than or equal to) 2025-02-11

381 bugs found.

ID	Type	Summary	Product	Comp	Assignee▲	Status▲	Resolution	Updated
1947758	☠	Moving a tab into a tab group using Ctrl+Shift+PageDwn breaks the tab group indicators	Firefox	Tabbed Browser	dwalker	UNCO	---	08:09:12
1947621	☠	Firefox is querying public nameservers for HTTPS RRs despite being on VPN and having DoH off	Core	Networking: DNS	valentin.gosu	UNCO	---	00:50:24
1947422	☠	WSL 2 start firefox from ubuntu 22.04.5 lts	Core	Graphics: WebRender	nobody	UNCO	---	Tue 08:50
1947539	☠	macOS modal window disappears causing the main window to be unable to interact	Core	Widget: Cocoa	nobody	UNCO	---	08:53:55
1947677	☠	"Extract canvas data" missing under "Page Info" -> "Permissions" when using FPP overrides to block canvas data extraction	Core	Permission Manager	nobody	UNCO	---	01:31:09
1947457	☠	CSP-report document-uri is wrong	Core	DOM: Security	nobody	UNCO	---	04:34:42
1947350	☠	Reader View does not use my Font Choice	Toolkit	Reader Mode	nobody	UNCO	---	Mon 17:15
1947357	☠	Huge problem on oracle dot com/java/technologies/downloads/	Core	General	nobody	UNCO	---	09:53:11
1947371	☠	The "When you open a link, image or media in a new tab, switch to it immediately" option does not work. It always switches	Core	DOM: Navigation	nobody	UNCO	---	Tue 07:28
1947393	☠	History backward not working as expected	Core	DOM: Navigation	nobody	UNCO	---	Tue 03:25
1947398	☠	The master password query now opens when the browser is started	Toolkit	Password Manager	nobody	UNCO	---	Tue 06:57
1947401	🐞	browser.newtabpage.activity-stream.newtabLayouts.variant	Firefox	New Tab Page	nobody	UNCO	---	Tue 09:54
1947408	🐞	Support DeepSeek in AI chatbot sidebar	Firefox	Sidebar	nobody	UNCO	---	Tue 01:35

“Just Yesterday” (2024 version)

100,000/year = 270/day: same rate for 19 years in!

m Bugzilla [Browse](#) [Advanced Search](#) [New Account](#) [Log In](#) [Forgot Password](#)

Wed Feb 21 2024 10:48:57 PST

Classification: Client Software, Developer Infrastructure, Components, Server Software, Other **Resolution:** --- **Updated:** (is greater than or equal to) 2024-02-20 **Opened:** (changed after) 2024-02-20 **Closed:** (changed before) 2024-02-21 23:59:59

290 bugs found.

ID	Type	Summary	Product	Comp	Assignee	Status	Resolution	Updated
1881123	🔧	Use res_query on must libc instead of res_nquery	Core	Networking: DNS	nobody	UNCO	---	04:56:16
1880923	🔧	Picture-in-picture no longer remembers position and always on top settings	Core	Widget: Gtk	nobody	UNCO	---	Mon 23:20
1881086	🔧	[wayland][sway] fractional scaling - menus are often unusable	Core	Widget: Gtk	nobody	UNCO	---	02:55:08
1881090	🔧	Extensions menu doesn't scroll	Core	Widget: Gtk	nobody	UNCO	---	07:40:39
1881136	🔧	[Regression] Mouse cursor does not change to "hand" upon hovering over links with Firefox 123.0	Core	Widget: Gtk	nobody	UNCO	---	01:28:08

“Just Yesterday” (2023 version)

100,000/year = 270/day: same rate for 18 years in!



Bugzilla

Search Bugs

Browse

Advanced Search >>

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Fri Feb 10 2023 06:28:29 PST

Resolution: --- **Classification:** Client Software, Developer Infrastructure, Components, Server Software, Other **Updated:** (is greater than or equal to) 2023-02-09 **Opened:** (changed after) 2023-02-09

262 bugs found

ID	Type	Summary	Product	Comp	Assignee	Status	Resolution	Updated
1815978	📋	Upgrade Firefox 111 to use NSS 3.88.1	Core	Security: PSM	jschanck	NEW	---	21:13:23
1815979	📋	Upgrade Firefox 110 to use NSS 3.87.1	Core	Security: PSM	jschanck	NEW	---	06:08:59
1815980	📋	Upgrade Firefox 102.9 to use NSS 3.79.4	Core	Security: PSM	jschanck	NEW	---	14:02:01
1815994	📋	stop proxying symbolication API requests	Tecken	General	willkg	ASSI	---	13:37:13
1815838	📋	Split out "returnByValue" tests from "browser_evaluate.js" into a separate file	Remote Protocol	CDP	hskupin	ASSI	---	00:07:25
1815901	⚙️	Further document experimentation for cookie banner handling	Fenix	Privacy	amejamarmol	NEW	---	Thu 07:41
1815956	+	[meta] Sentiment Collection	Firefox	Messaging System	jprickett	ASSI	---	17:40:53
1816074	⚙️	Crash in [@ nsINode::IsInNamespace]	Firefox	Menus	nobody	NEW	---	02:35:59

Same slide from 2018 ...

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Sun Feb 11 2018 04:01:56 PST

This list is too long for Bugzilla's little mind; the Next/Prev/First/Last buttons won't appear on individual bugs.

Status: UNCONFIRMED, NEW, ASSIGNED, REOPENED Creation date: (Is greater than or equal to) -52w

10000 bugs found.

Product	Comp	Assignee	Status	Resolution	Summary	Changed
1433881 Mozilla Developer Ne	Localization	a.topal	UNCO	---	Add option for Bosnian translation to MDN Web docs	Mon 09:05
1406748 Taskcluster	Platform Libraries	anejaalisha	UNCO	---	Add utility function to clients to handle limit/continuationToken automatically for API endpoints	2017-10-09
1409766 NSS	CA Certificate MIS-I	arkadiusz.lawnczak	UNCO	---	Certum: CAA Mis-issuance on CNAME pointing directly to restrictive CAA record	Fri 14:04
1420860 NSS	CA Certificate MIS-I	arkadiusz.lawnczak	UNCO	---	Asseco/Certum: CAA Mis-issuance on mix of wildcard and non-wildcard DNS names in SAN	Wed 23:17
1390709 Marketing	User Engagement	ccollins	UNCO	---	"Join the fight for an open internet" announcement shall include a reference to the info on the Initiative	2017-08-21
1346294 Bugzilla	Bugzilla-General	christophe.jalliet	UNCO	---	When you try to display only the disabled users, the complete list is returned instead	2017-03-15
1433072 Developer Documentat	General	cmills	UNCO	---	Create page: https://developer.mozilla.org/en-US/docs/Learn/Drafts/python_on_the_client/Sharing_code_between_client_and_server	2018-01-30
1388776 Bugzilla	Creating/Changing Bu	create-and-change	UNCO	---	Mandatory text boxes should not be hidden by default	2017-08-09
1399115 Bugzilla	Creating/Changing Bu	create-and-change	UNCO	---	'See Also' rejects 'short' Bugzilla URLs (as suggested by ye ole' mod_rewrite tip)	2017-09-12
1432875 Bugzilla	Database	database	UNCO	---	MariaDB Compatibility Problems	2018-01-24
1401312 Shield	Shield Study	dmarti	UNCO	---	[Shield] write PHD document for filterbubbler study	2017-09-24
1394237 Bugzilla	Documentation	documentation	UNCO	---	Broken link to bug filing guidelines in index 2.2.1 from bugzilla's documentation.	2017-11-16
1433083 Bugzilla	Documentation	documentation	UNCO	---	Documentation for 3.5.1.3. Apache with mod_perl -- broken link	2018-01-25
1347875 Firefox for Android	General	droeh	UNCO	---	ANR executing service org.mozilla.firefox/org.mozilla.gecko.media.MediaControlService	2017-04-26
1341669 Bugzilla	Creating/Changing Bu	dylan	UNCO	---	problem submitting new bug	2017-03-17
1342187 JSS	Library	edewata	UNCO	---	Error reporting improvement for PFX.verifyAuthsafes().	2017-04-10
1376759 Bugzilla	Email Notifications	email-notifications	UNCO	---	Long comments break sending of bug notification emails	2017-06-28

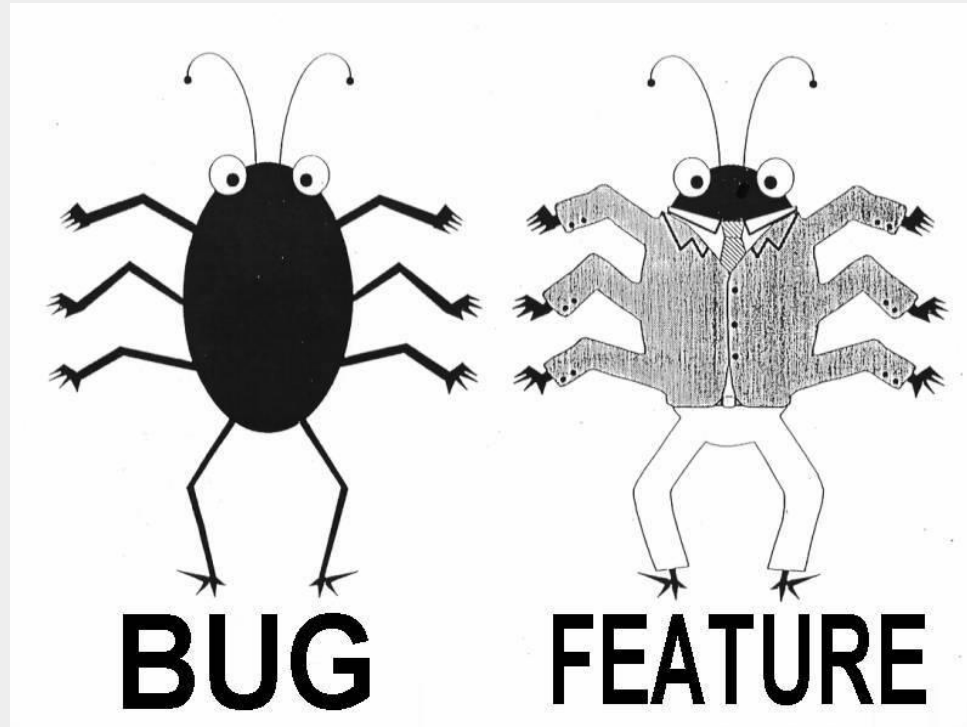
Terminology (1/2)

- The software maintenance lexicon is fraught with ambiguity
- Terms adapted from “standard” engineering, etc.
- A **fault** is an exception situation at *run time*
 - In EE: “short circuit”, “stuck-at fault”
 - In CS: “trap”, “exception”
- A **defect** is any characteristic of a product which hinders its usability for its intended purpose
 - IRL: “design defect”, “manufacturing defect”
 - In CS: a **bug** is a *static defect in the source code*

Terminology (2/2)

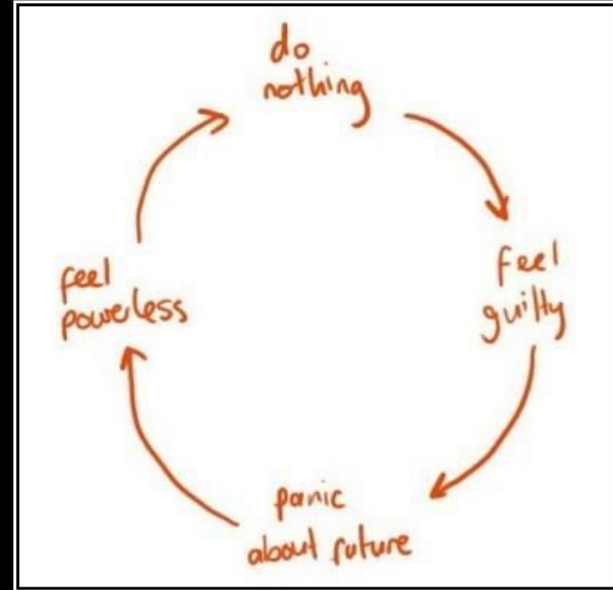
- A **bug report** provides information about a defect
 - Created by testers, users, tools, etc.
 - Often contains multiple types of information
 - Often tracked in a database
- A **feature request** is a potential change to the intended purpose (requirements) of software
 - In CS: an **issue** is either a bug report or a feature request (cf. “issue tracking system”)
- Not used here: “mistake”, “error”, etc.

These Terms are Somewhat Subjective





Defect Lifecycles



THE CIRCLE

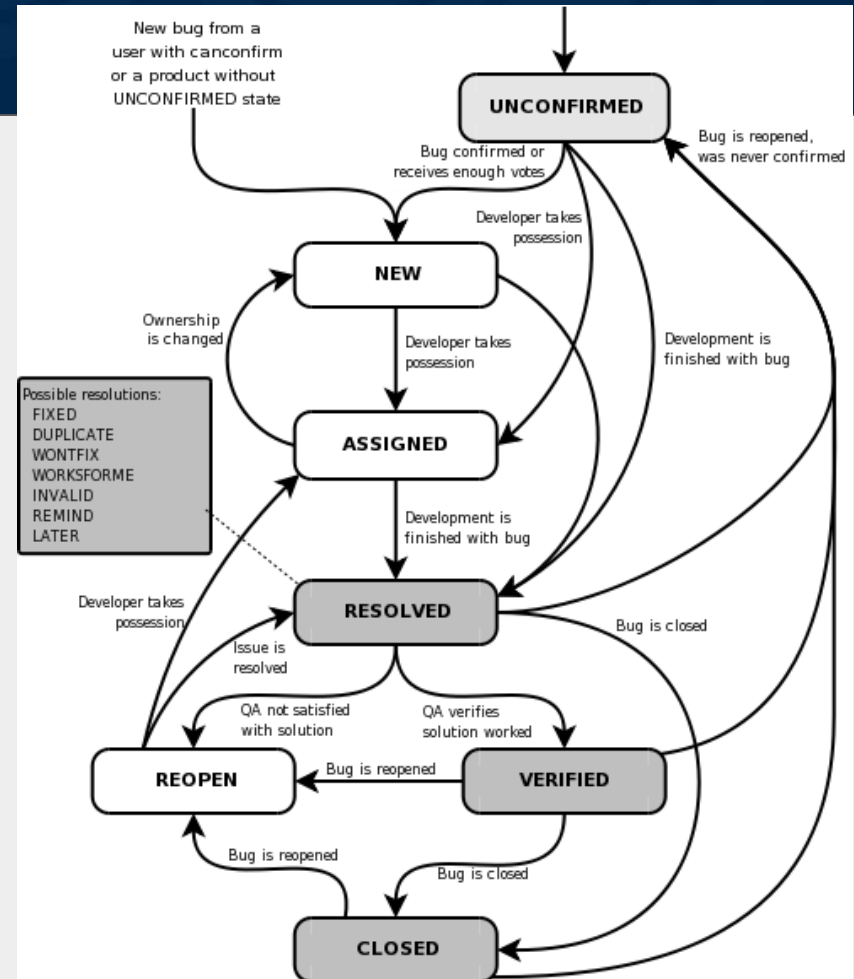
of college life.

Defect Report Lifecycle

- The **defect report lifecycle** consists of a number of possible stages and actions including: reporting, confirmation, triage, assignment, resolution, and verification.
 - Not every defect report follows the same path.
 - The overall process is *not linear*
 - There are multiple entry points, some cycles, and multiple exit points (and some never leave ...)
- The **status** of a defect report tracks its position in the lifecycle (“new”, “resolved”, etc.)

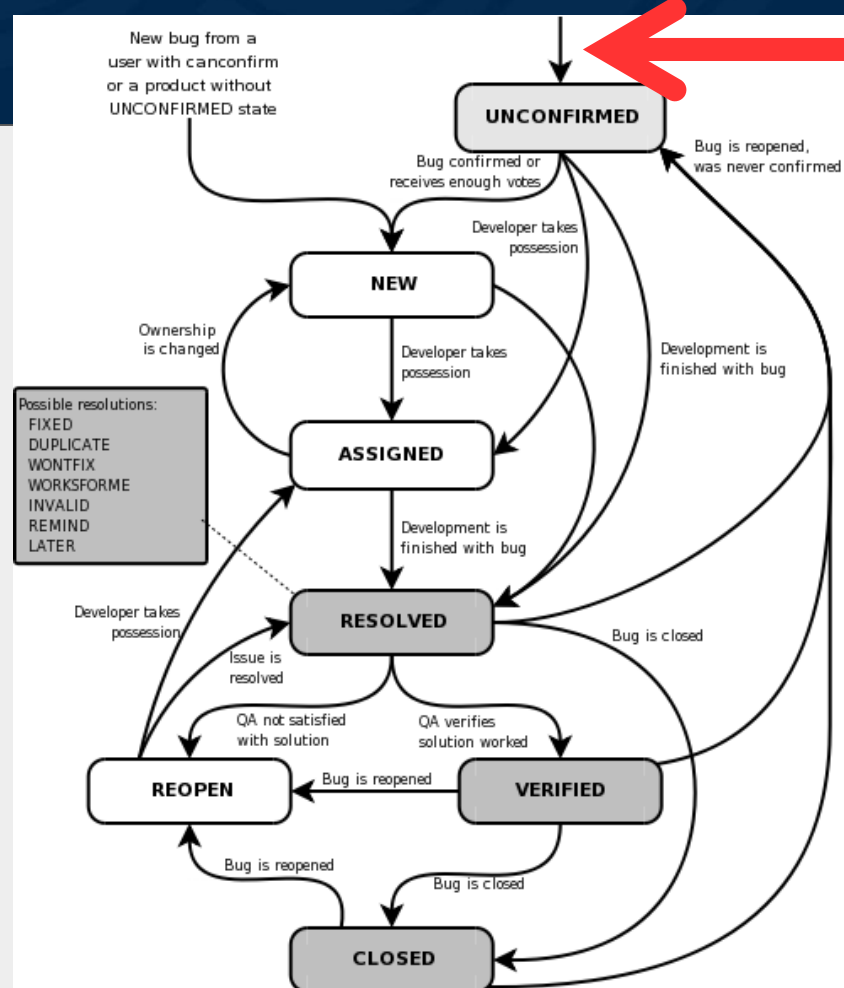
Report Lifecycle

- Bugzilla is a widely-used open-source issue tracker
- Github's built-in issue tracker is similar (less structured)
 - But customizable
 - Same for gitlab



Bug is Reported

- New bug reports enter the system



Bug Report Sources

- Internal
 - Developers
 - QA / Testers
 - Reports are *usually* detailed, sophisticated
- External
 - Beta testers
 - End users
 - Reports are usually more general





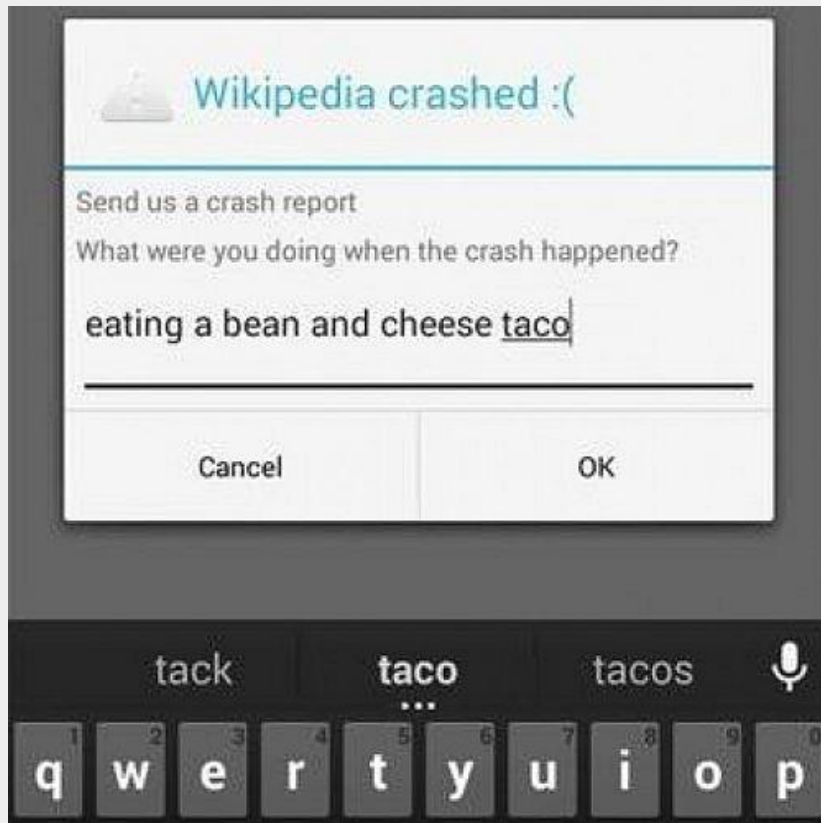
**KEEP
CALM
AND
FILE A
BUG REPORT**

Do End Users Submit Bug Reports?

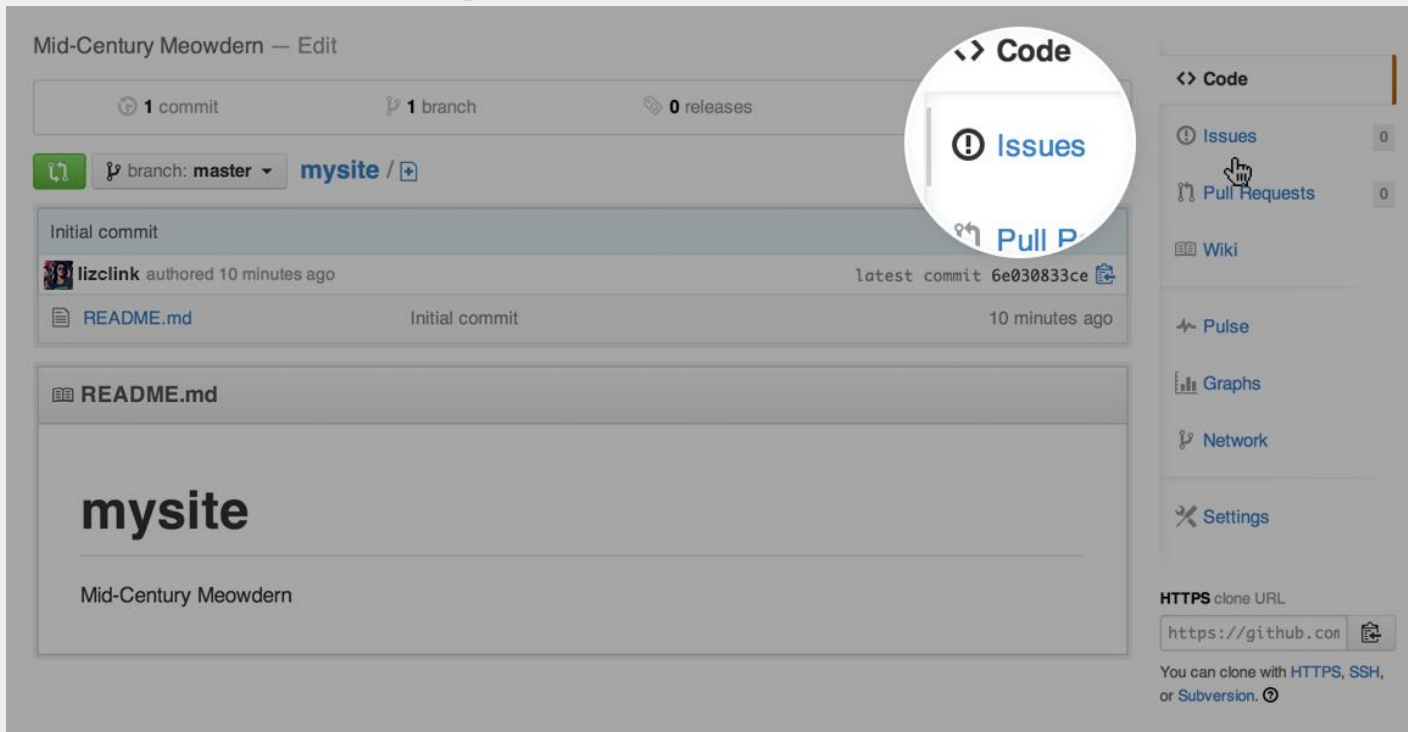


End-User Bug Reports

- Modern view: cannot count on end users to describe bugs in a helpful manner
- The larger your user base is or the more of a “margin” business model you have, the truer this becomes
- Instead: these are **aggregated**.



Bug Reporting: Github





Issues

Pull requests

Labels

Milestones

Filters is:open is:issue

New Issue

104 Open 9,660 Closed

Author Labels Milestones Assignee Sort

.form-group-sm .form-group-lg shrink textarea **confirmed** **css** 4

#13989 opened 11 hours ago by limitstudios v3.2.1

Tooltip unnecessarily breaks into multiple lines when positioned to the right **confirmed** **js** 0

#13987 opened 15 hours ago by hnrc02 v3.2.1

Tooltip Arrows in Modal example facing wrong way **css** 6

#13981 opened a day ago by SDCore

Table improvement **css** 0

#13978 opened a day ago by Tjoosten

docs/dist files **docs** 7

#13977 opened 2 days ago by XhmikosR v3.2.1

Potential solution to #4647 **js** 4

#13976 opened 2 days ago by julioarmandof

Bootstrap site: right-hand navigation text becomes rasterized after scrolling **css** **docs** 4

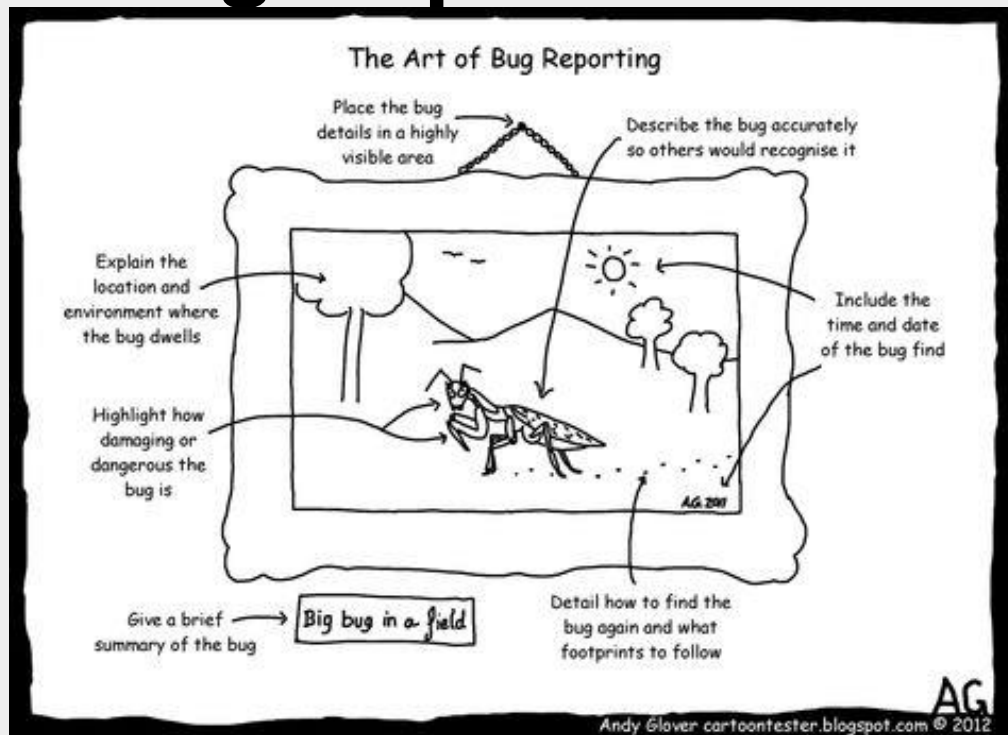
#13974 opened 2 days ago by mg1075 v3.2.1

Dropdown toggle requires two clicks **js** 1

#13972 opened 2 days ago by Kizmar

The Anatomy of a Bug Report

- What should be in a bug report?
What is?



Defect Report Components

Title

Assignee

Status

Product

Bug 1194147

[AriesKK][Lock Screen]The home button will overlap with the lock icon on lockscreen.

NEW Assigned to [prateekjadhvani](#)

▼ **Status**

Product: ▶ Firefox OS
Component: ▶ Gala::System::Lockscreen
Status: NEW

Reported: 3 years ago
Modified: 2 years ago

▶ **People** (Reporter: zouyi(Leave from Mozilla), Assigned: prateekjadhvani)

▼ **Tracking**

Version: unspecified
Target: ---
Platform: ARM Gonk (Firefox OS)

▶ **Firefox Tracking Flags** (b2g-v2.5 affected, b2g-master affected)

▼ **Details** (Whiteboard: [2.5-aries-test-run-1])

Whiteboard: [2.5-aries-test-run-1]
Votes: 0 votes
QA Whiteboard: [MGSEI-Triage+]

Defect Report Attachments

- Screenshots
 - Videos
 - Stack Traces
 - Data Files
 - Inputs
-
- Note: **rarely** present
 - Note: may come from **multiple** sources

▼ Attachments (6 attachments)

[ArlesKK_v2.5.3gp](#)

3 years ago [zouyi](#)(Leave from Mozilla)
3.71 MB, video/3gpp



[ArlesKK_v2.5.png](#)

3 years ago [zouyi](#)(Leave from Mozilla)
741.35 KB, Image/png

[Arleskk_v2.5_1.3gp](#)

2 years ago [zouyi](#)(Leave from Mozilla)
7.50 MB, video/3gpp

[logcatl_1110.txt](#)

2 years ago [zouyi](#)(Leave from Mozilla)
388.33 KB, text/plain

[Bug log: logcat_1412.txt](#)

2 years ago [SandKing](#)
287.58 KB, text/plain

[Bug video: Arles_v2.5.3GP](#)

2 years ago [SandKing](#)
3.45 MB, video/3gpp

“Ideal” Defect Report Comment

```
[1.Description]:
[AriesKK v2.5][Lock Screen]Enable PIN, and enter the EMERGENCY CALL from lockscreen, then launch camera by tapping HW-camera
key, and return to EMERGENCY CALL again, tap home button, you will find the home button overlaps with lock icon.
See attachment: AriesKK_v2.5.3gp and logcat.txt
Found at: 10:33

[2.Testing Steps]:
Precondition: Set the lock screen PIN
1. Lock screen;
2. Slide the circle to unlock icon
3. Tap "EMERGENCY CALL"
4. Long tap HW-Camera key to launch camera
5. Tap home button
6. Repeat step 1-step 3
7. Tap home button

[3.Expected Result]:
7. Return to lock screen, and it is shown normally without any overlap


[4.Actual Result]:
7. Home button will overlap with lock icon

[5.Reproduction build]:
Device: Aries KK 2.5(Affected)
Build ID      20150811234258
Gaia Revision  c7875bbc8b32e7b95cc55c9690b03b140905d84d
Gaia Date     2015-08-11 18:18:36
Gecko Revision https://hg.mozilla.org/mozilla-central/rev/d4f3a8a75577e4af2914a4e899ca2e724f9715c4
Gecko Version  43.0a1
Device Name    aries
Firmware(Release) 4.4.2
Firmware(Incremental) eng.worker.20150811.230622
Firmware Date  Tue Aug 11 23:06:29 UTC 2015
Bootloader     s1

[6.Reproduction Frequency]:
Always Recurrence,5/5
```

Defect Reports: Conversations


- Defect reports are not static
 - Instead, they are **updated over time**
 - Request more info
 - Assign to a dev
 - Discuss solutions
- The report is a log of all relevant activity

 **Gerry Chang** [gchang]
Comment 2 • 3 years ago

This issue still happens in below build.
 Build ID 20150825021113
 Gaia Revision b441bde54293bea5254dc340845effe951fa3906
 Gaia Date 2015-08-24 17:47:19
 Gecko Revision <https://hg.mozilla.org/mozilla-central/rev/04b8c412d9f58fb>
 Gecko Version 43.0a1
 Device Name aries
 Firmware(Release) 4.4.2


Hi Fred,
 Can you help to dispatch this to right owner?

Flags: needInfo?(gasolin)

 **gasolin@mozilla.com**
Comment 3 • 3 years ago


Though its not a priority with soft homescreen button,
 greg could you put it in the backlog?

Flags: needInfo?(gasolin) → needInfo?(gweng)

 **Greg Weng** [snowmantw] [gweng] [A]
Comment 4 • 3 years ago


Could we analyze if it's Software Home Button issue or LockScreen issue first?

Flags: needInfo?(gweng)


 **Prateek Jadhwan** [prateekjadhwan] (Assignee)
Comment 5 • 2 years ago

I will look into it.

Flags: needInfo?(administration)


 **Prateek Jadhwan** [prateekjadhwan] (Assignee)
Updated • 2 years ago

Flags: needInfo?(administration)

 **Prateek Jadhwan** [prateekjadhwan] (Assignee)
Comment 6 • 2 years ago

:gweng Would it be possible for you to assign it to me?
 Thanks

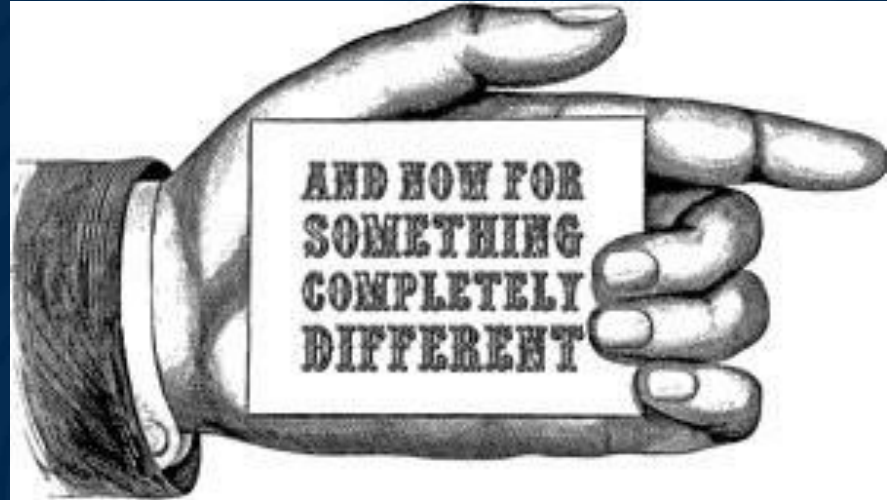
Flags: needInfo?(gweng)

 **[fabrice] Fabrice Desré**
Updated • 2 years ago

Assignee: nobody → prateekjadhwan



Trivia Break



Trivia: Entomology

- This group of insects (order Coleoptera) have hardened wing-cases. They make up 40% of all described insects and 25% of all known animal life-forms. They often feed on plants and fungi, break down animal and plant debris, and eat other invertebrates.



Trivia: Music

- This 1967 Beatles effort was their best-selling album in the UK (17x platinum). In addition to the eponymous fictional-group lead track, it includes *With a Little Help from My Friends*, *Lucy in the Sky with Diamonds*, and *When I'm Sixty-Four*.



“On release, the album was lauded by the vast majority of critics for its innovations in music production, songwriting, graphic design, for bridging a cultural divide between popular music and legitimate art, and for providing a musical representation of its generation and the contemporary counterculture.”

Trivia: Nuclear Engineering

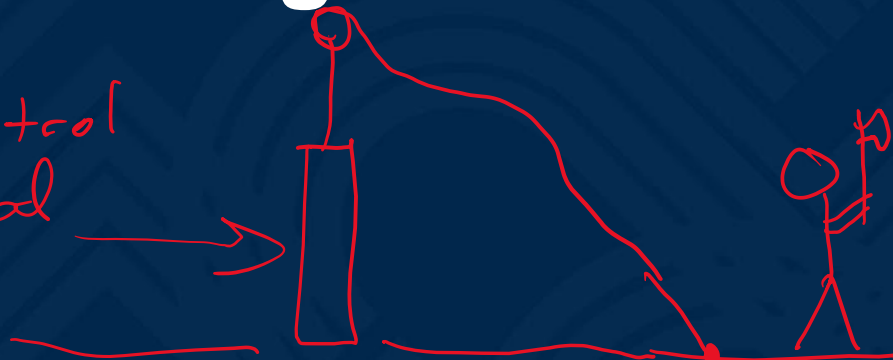
- With nuclear reactors, there is a big red button in the control room that says “SCRAM” that when pressed, will immediately shutdown the reactor. What does the acronym SCRAM stand for?

Trivia: Nuclear Engineering



Norman Hilberry

Control
rod



pile



Trivia: Movies

- This giant, lumbering paranormal monster from the Ghostbusters franchise appears when Gozer tells the heroes that it will take the form of the next thing they think of. Ray tries to think of “the most harmless thing ... that could never possibly destroy us.”



Psychology: Delayed Gratification

- A child is offered a choice between one reward *now* or two rewards *15 minutes later*.
- Over 600 children took part.
- Some would “cover their eyes with their hands or turn around so that they can’t see the tray, others start kicking the desk, or tug on their pigtails, or stroke the marshmallow as if it were a tiny stuffed animal,” while others would simply eat the marshmallow as soon as the researchers left.

Psychology: Delayed Gratification

- Results:
 - A minority choose the single reward immediately
 - A majority attempted to wait 15 minutes
 - One-third of those who attempted succeeded
 - Age was a major correlated factor
 - Trust/belief in reward was also a major factor
- This work is well-known because of the associated follow-up studies and correlations.



Psychology: Delayed Gratification

- The ability to delay gratification also correlates with higher SAT scores
- Brain imaging study of a sample of the original Stanford participants when they reached mid-life showed key differences between those with high delay times and those with low delay times in two areas: the prefrontal cortex (more in high delayers) and the ventral striatum (more active in low delayers) when they were trying to control their responses to temptations.

Psychology: Delayed Gratification

- Also correlates with educational attainment, body-mass index, cognitive and academic competence, and ability to cope with frustration and stress in adolescence

[Mischel, Walter; Ebbesen, Ebbe B. 1970. "Attention in delay of gratification". Journal of Personality and Social Psychology. 16 (2): 329–337]

- Implications for SE: “quick and dirty” fix (aka kluge) or desire to “just start coding” vs. planning and using an SE process

Triage



Medical Triage


- Which patients should we address first?

WHO GOES FIRST IN THE EMERGENCY DEPARTMENT?

Emergency departments triage (sort) patients based on physical and mental need for care. While all patients are important and will be seen, some need care more quickly than others. Please let us know if your symptoms change.

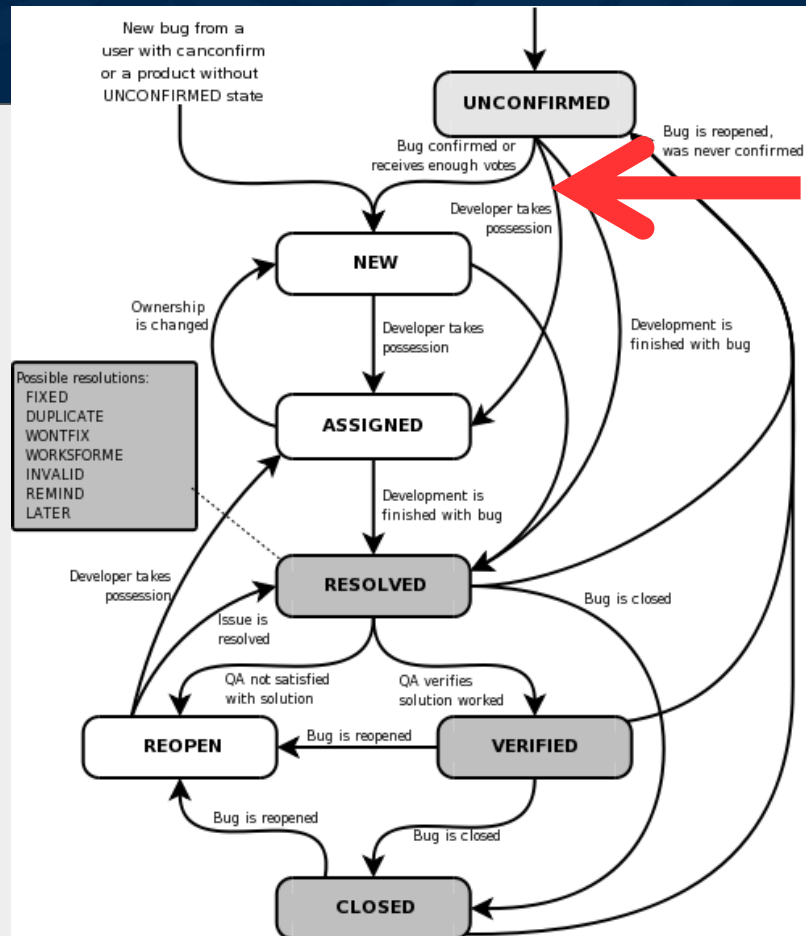
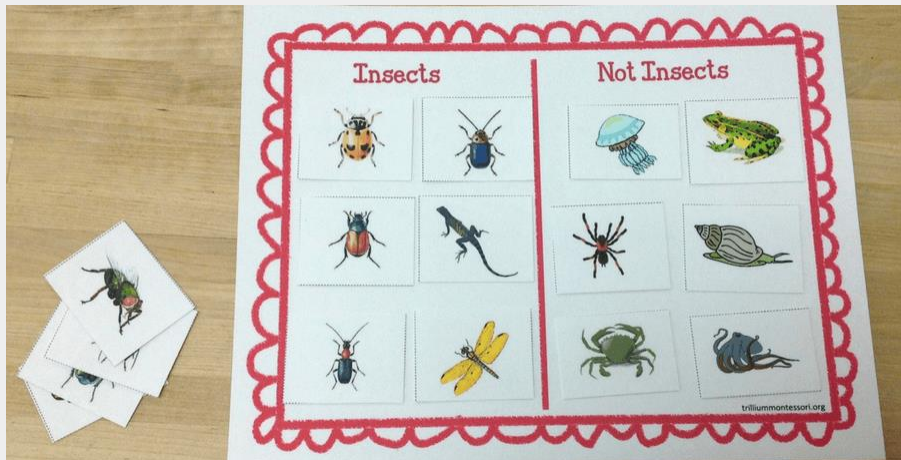
MOST URGENT	SERIOUS CAR CRASH HEART STOPPED BEATING SUSPECTED STROKE	
VERY URGENT	SUSPECTED HEART ATTACK SEVERE TROUBLE BREATHING LARGE BROKEN BONES	
URGENT	FAINTING SEIZURE HEAD INJURY	ASTHMA ATTACK TEMPERATURE OVER 104° ALLERGIC REACTION
LESS URGENT	NEED STITCHES BROKEN ANKLE OR ARM SORE EAR, EYE OR THROAT	
NOT URGENT	REMOVAL OF STITCHES RENEWING A PRESCRIPTION COUGH OR CONGESTION	

PEOPLE HAVING A MENTAL HEALTH CRISIS ARE TRIAGED DIFFERENTLY THAN EXAMPLES ABOVE.

 **Franciscan** HEALTH

Bug Triage

- Which bugs should we address first?



Triage

- **Triage** is the assignment of degrees of urgency to wounds or illnesses to decide the order of treatment of a large number of patients or casualties.
- There are always more defect reports than resources available to address them.
- Cost-benefit analysis
 - How expensive is it to **fix** this bug?
 - How expensive is it to **not** fix this bug?

Which Bugs should we fix?

- Common **Myth**:



Severity

- **Severity** is the degree of impact that a defect has on the development or operation of a component or system
 - “cost of not fixing it”
 - Bugzilla severity labels

Severity	Meaning
Blocker	Blocks further development and/or testing work.
Critical	Crashes, loss of data (internally, not your edit preview!) in a widely used and important component.
Major	Major loss of function in an important area.
Normal	Default/average.
Minor	Minor loss of function, or other problem that does not affect many people or where an easy workaround is present.
Trivial	Cosmetic problem like misspelled words or misaligned text which does not really cause problems.
Enhancement	Request for a new feature or change in functionality for an existing feature.

Priority

- **Defect Priority** (Bug Priority) indicates the importance or urgency of fixing a defect.
- Phabricator examples:
 - **Needs Triage** – Default option, priority has not yet been determined
 - **Unbreak Now!** – Something is broken and needs to be fixed immediately, setting anything else aside
 - **High** – Someone is working or planning to work on this task soon
 - **Normal** – Less than High, but someone still plans to work on it
 - **Low** – Less than Normal, but someone still plans to work on it
 - **Lowest** – Nobody plans to work on this task

Priority Assignment Example

- Phabricator Agile example:
 - **High priority** for tasks committed for the current sprint, or that need to find an owner who can start working on them soon
 - **Normal priority** for tasks that are not critical for the current sprint or candidates for a next sprint
 - **Low priority** for tasks that we can live without, usually sitting in the backlog, sometimes added to a sprint
 - “As a rule of thumb, limit High priority task assignments for a single person to three, five in exceptional times.”

Severity vs. Priority

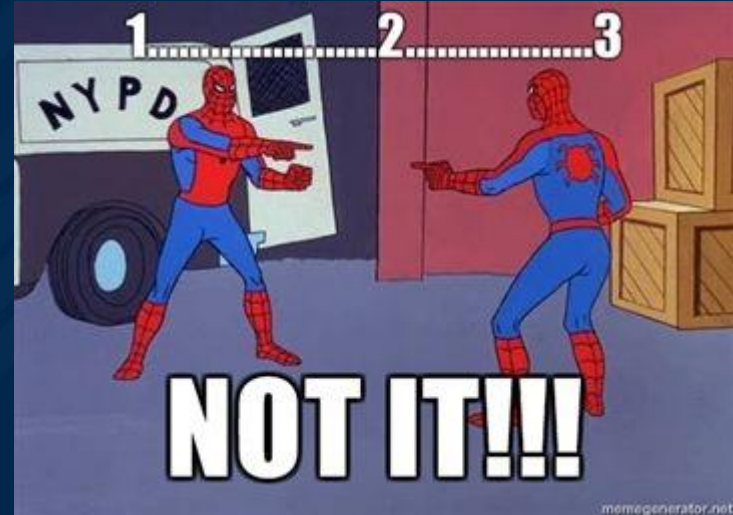
- Severity and Priority are often correlated, but are officially independent
 - A “Normal” Severity issue could currently be “Low” Priority if there are many outstanding “Critical” Severity issues, etc.
- Severity and Priority are used together (along with complexity, risk, etc.) to evaluate prioritize and assign the resolution of reports
 - Distributed on-line voting (e.g., in open source)
 - In-person meeting (e.g., commercial)

Simple Lie

- Supply + Demand \rightarrow Price
- Severity + Priority \rightarrow Triage

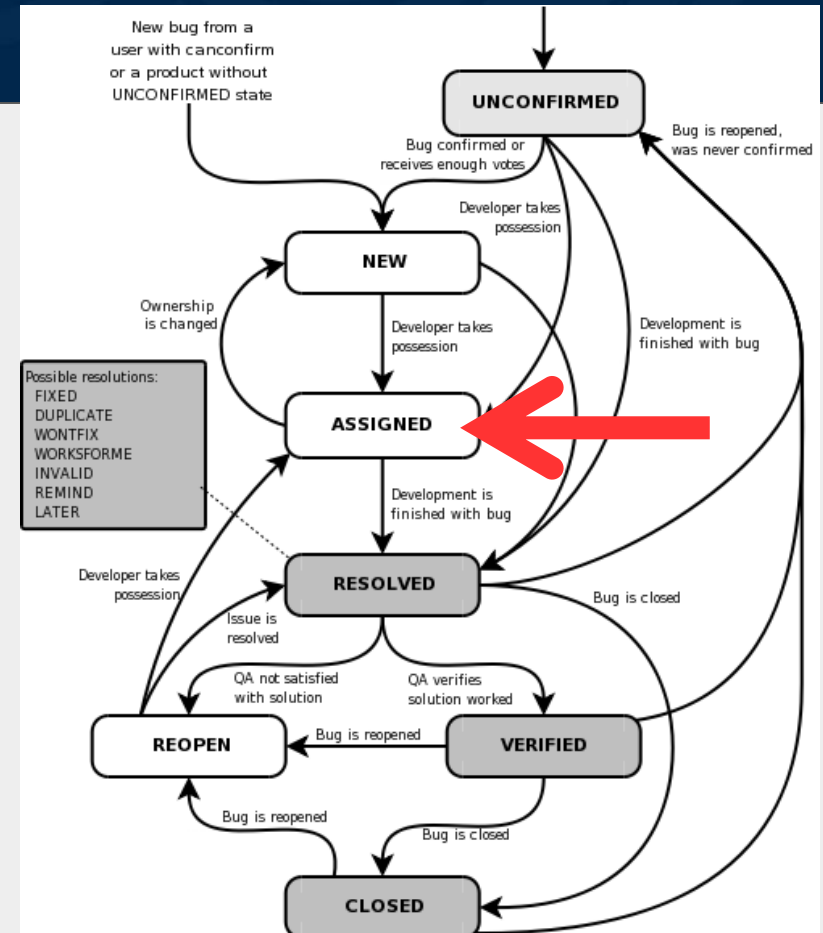


Bug Assignment



Bug Assignment

- Who should fix this bug?



Example

- **Severity** and **Priority** discussions
- **Assignment** discussions

Bug 1383052
**Intermittent dom/canvas/test/test_bitmapre
Host::Lock]**

NEW Unassigned

▼ **status** (NEW bug which is in the backlog of work)

Product: ► Core
Component: ► Canvas: 2D
Importance: **P3 critical**
Status: **NEW**

Gerry Chang [:gchang]
Comment 2 • 3 years ago

This issue still happens in below build.

Build ID	20150825021113
Gaia Revision	b441bde54293bea5254dc340845effe951fa3906
Gaia Date	2015-08-24 17:47:19
Gecko Revision	https://hg.mozilla.org/mozilla-central/ rev/04b8c412d9f58fb
Gecko Version	43.0a1
Device Name	aries
Firmware(Release)	4.4.2

Hi Fred,
Can you help to dispatch this to right owner?

Flags: needInfo?(gasoln)

gasoln@mozilla.com
Comment 3 • 3 years ago

Though its not a priority with soft homescreen button,
greg could you put it in the backlog?

Flags: needInfo?(gasoln) → needInfo?(gweng)

Greg Weng [:snowmantw][:gweng][:A]
Comment 4 • 3 years ago

Could we analyze if it's Software Home Button issue or LockScreen issue first?

Flags: needInfo?(gweng)

Prateek Jadhvani [:prateekjadhvani] (Assignee)
Comment 5 • 2 years ago

I will look into it.

Flags: needInfo?(administration)

Prateek Jadhvani [:prateekjadhvani] (Assignee)
Updated • 2 years ago

Flags: needInfo?(administration)

Prateek Jadhvani [:prateekjadhvani] (Assignee)
Comment 6 • 2 years ago

:gweng Would it be possible for you to assign it to me?
Thanks

Flags: needInfo?(gweng)

[fabrice] Fabrice Desré
Updated • 2 years ago

Assignee: nobody → prateekjadhvani

Defect Assignment

- An **assignment** associates a developer with the responsibility of addressing a defect report.
- The current state of the art is “manual”
 - *Distributed*: developers watch the incoming bug report queue and claim defects for themselves
 - *Centralized*: one or more people in QA watch the incoming bug report queue and assign reports to a pool of developers
- Usually based on who “owns” the implicated code

Near Future: *Automagic* Assignment

Who Should Fix This Bug?

John Anvik, Lyndon Hiew and Gail C. Murphy
Department of Computer Science
University of British Columbia
{janvik, lyndonh, murphy}@cs.ubc.ca

ABSTRACT

Open source development projects typically support an open bug repository to which both developers and users can report bugs. The reports that appear in this repository must be triaged to determine if the report is one which requires attention and if it is, which developer will be assigned the responsibility of resolving the report. Large open source developments are burdened by the rate at which new bug reports appear in the bug repository. In this paper, we present a semi-automated approach intended to ease one part of this process, the assignment of reports to a developer. Our approach applies a machine learning algorithm to the open bug repository to learn the kinds of reports each developer resolves. When a new report arrives, the classifier produced by the machine learning technique suggests a small number of developers suitable to resolve the report. With this approach, we have reached precision levels of 57% and 64% on the Eclipse and Firefox development projects respectively.

However, this potential advantage also comes with a significant cost. Each bug that is reported must be *triaged* to determine if it describes a meaningful new problem or enhancement, and if it does, it must be assigned to an appropriate developer for further handling [13]. Consider the case of the Eclipse open source project¹ over a four month period (January 1, 2005 to April 30, 2005) when 3426 reports were filed, averaging 29 reports per day. Assuming that a triager takes approximately five minutes to read and handle each report, two person-hours per day is being spent on this activity. If all of these reports led to improvements in the code, this might be an acceptable cost to the project. However, since many of the reports are duplicates of existing reports or are not valid reports, much of this work does not improve the product. For instance, of the 3426 reports for Eclipse, 1190 (36%) were marked either as invalid, a duplicate, a bug that could not be replicated, or one that will not be fixed.

As a means of reducing the time spent triaging, we present

Near Future: *Automagic* Assignment

Seven Years Later

Who Should Fix This Bug?

Abstract—Large software development projects receive many bug reports and each of these reports needs to be triaged. An important step in the triage process is the assignment of the report to a developer. Most previous efforts towards improving bug report assignment have focused on using an activity-based approach. We address some of the limitations of activity-based approaches by proposing a two-phased location-based approach where bug report assignment recommendations are based on the predicted location of the bug. The proposed approach utilizes noun extraction process on several information sources to determine bug location information and a simple term weighting scheme to provide a bug report assignment recommendation. We found that by using a location-based approach, we achieved an accuracy of 89.41% and 59.76% when recommending five developers for the Eclipse and Mozilla projects, respectively.

Index Terms—Bug Report Assignment, File Activity Histories, Named Entity Recognition, POS Filtering, Mining Software Artifacts.

ABSTRACT

Open source development bug repository to which port bugs. The reports to be triaged to determine attention and if it is, the responsibility of resolving developments are burdened ports appear in the bug repository. A semi-automated approach process, the assignment approach applies a machine repository to learn the keywords. When a new report by the machine learning of developers suitable to approach, we have reached the Eclipse and Firefox development projects respectively.

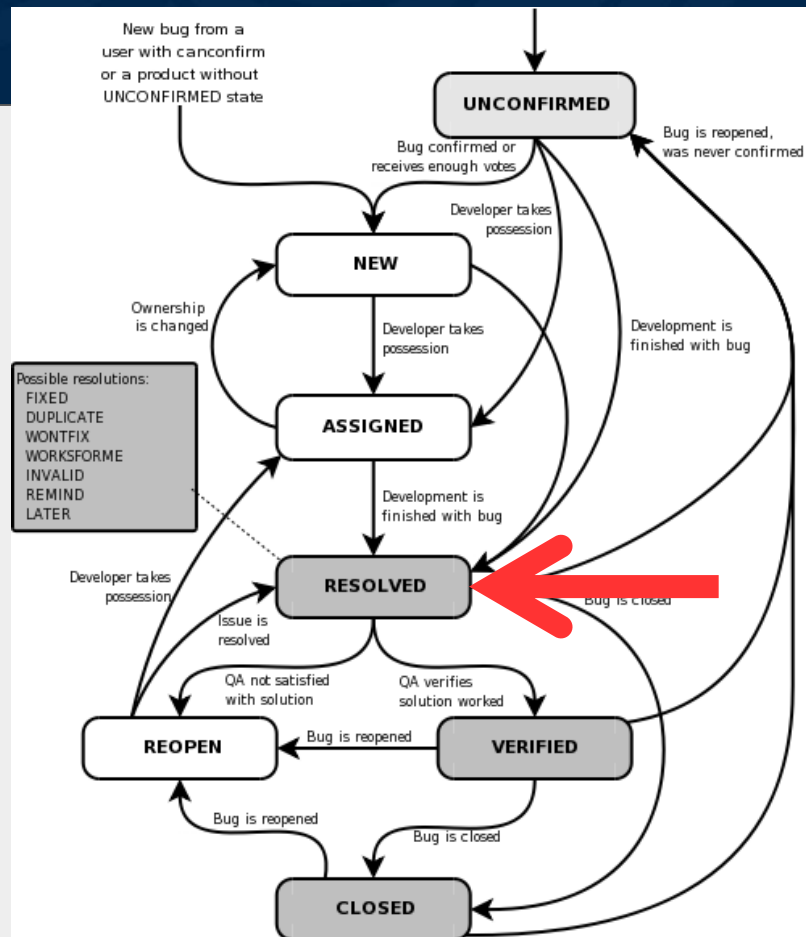
As a means of reducing the time spent triaging, we present

Resolution



Bug Resolution

- Did we fix it?



Defect Resolution

- Now that the defect report has been assigned to a developer, it can be localized, debugged, etc. Those are future lecture topics!
- A defect report **resolution** status indicates the result of the most recent attempt to address it.
 - Important: resolved need **not** mean “fixed”



Possible Resolutions

- Bugzilla resolution options:
 - **FIXED** (give commit #)
 - **INVALID** (bug report is invalid)
 - **WONTFIX** (we don't ever plan to fix it)
 - **DUPLICATE** (link to other bug report #)
 - **WORKSFORME** (cannot reproduce, a.k.a. "WFM")
 - **MOVED** (give link: filed with wrong project)
 - **NOTABUG** (report describes expected behavior)
 - **NOTOURBUG** (is a bug, but not with our software)
 - **INSUFFICIENTDATA** (cannot triage/fix w/o more)

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Thought question:
What fraction of
bug reports
end up with each
Resolution?

Duplicate, Invalid

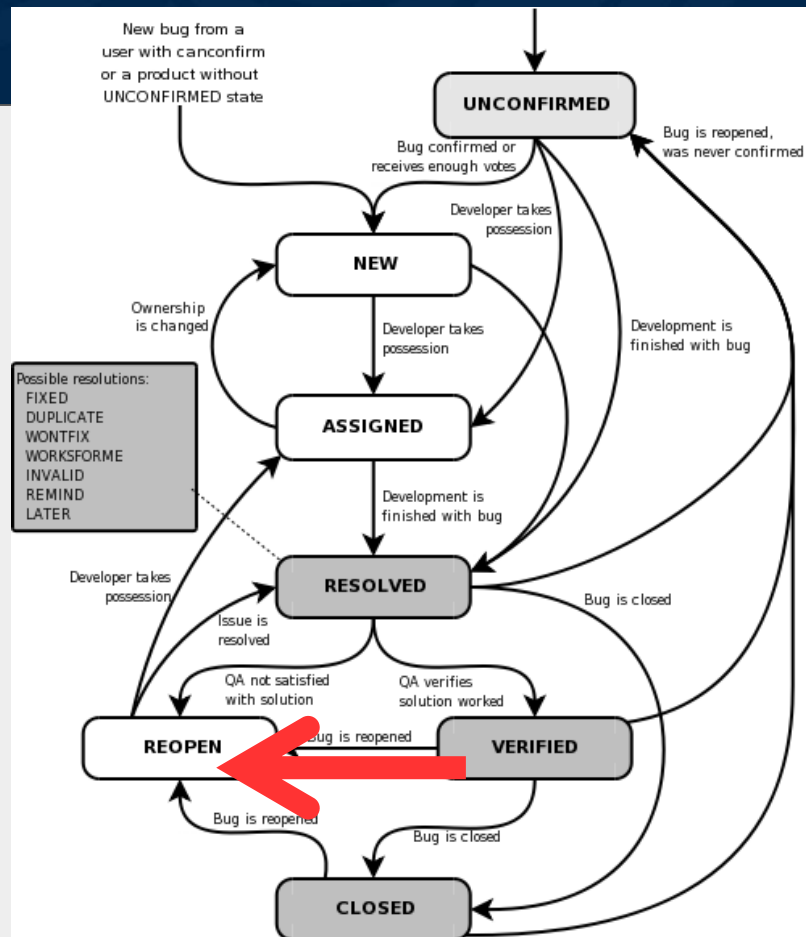
A significant fraction of submitted bug reports are spurious duplicates that describe already-reported defects. Previous studies report that as many as 36% of bug reports were duplicates or otherwise invalid [2]. Of the 29,000 bug reports used in the experiments in this paper, 25.9% were identified as duplicates by the project developers.

[Jalbert et al. Automated Duplicate Detection for Bug Tracking Systems. DSN 2008.]

Reopen?

- I thought we fixed it!

Unfortunately Due To Personal Reasons:



Reopened

- A defect report that was previously resolved (e.g. “FIXED”) may be **reopened** if later evidence suggest the old resolution is no longer adequate
 - “We thought this fixed it, but now others are reporting it.”
 - “We thought this was out of scope, but now we really need to address it.”
- Compare: **regression** testing
- Surely this only happens rarely?

Many Fixes are Wrong Even on Mature, Critical Software

This paper presents a comprehensive characteristic study on incorrect bug-fixes from large operating system code bases including Linux, OpenSolaris, FreeBSD and also a mature *commercial* OS developed and evolved over the last 12 years, investigating not only the mistake patterns during bug-fixing but also the possible *human reasons* in the development process when these incorrect bug-fixes were introduced. Our major findings include: (1) at least 14.8%~24.4% of sampled fixes for post-release bugs ¹ in these large OSES are incorrect and have made impacts to end users. (2) Among several common bug types, concurrency bugs are the most difficult to fix correctly: 39% of concurrency bug fixes are incorrect. (3) Developers and reviewers for incorrect fixes usually do not have enough knowledge about the involved code. For example, 27% of the incorrect fixes are made by developers who have never touched the source code files associated with the fix. Our results provide useful guidelines to design new tools and also to improve the development process. Based on our findings, the commercial software

[Yin et al. How Do Fixes Become Bugs? ESEC/FSE 2011.]

Bug Report Characteristics



Large Study of Bug Reports

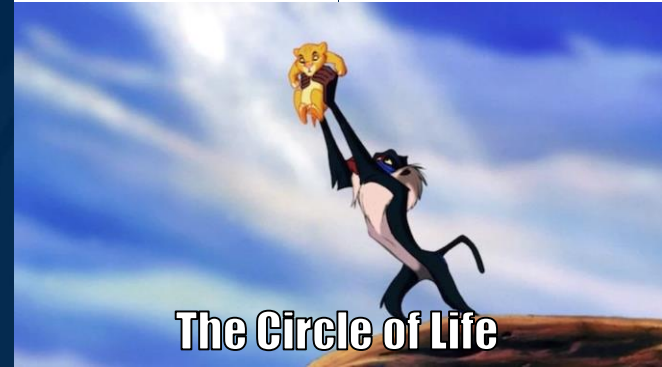
- 2000 defect reports in Linux, Mozilla, Apache
- Memory Bugs: ~15%, Semantic Bugs: ~75%, Concurrency Bugs: ~10%
- Bug → Crash: ~20%; Bug → Wrong Behavior: ~80%
 - Why Crash? Memory Bugs ~55%
- Most common? ~50% of Mozilla bugs are GUI issues
- Whence security bugs? 30% memory bug causes (severe), 70% semantic bugs causes

[Tan et al. Bug Characteristics in Open Source Software. EMSE 2014.]

The Story so far...

- **Quality assurance** is critical to software engineering
 - **Testing** is the most common dynamic technique for software quality assurance
 - Testing is **very expensive** and not testing is **even more expensive**
 - And there are **other types of dynamic analysis**
- We also have static analysis techniques for QA
 - **Code Review** (“passaround”) and **code inspection** (“formal”) are the most common static approaches to QA.
- Remember our processes should consider that humans are involved
 - So we have things like **pair programming**
- We have ways of automating dynamic analysis...
- But are there other less manual ways of doing static analysis?

When you write more code to fix defects which... ..introduces more defects



Questions?

- HW 3 over a week away...
so before that Disney Land!

***Python Installation Was Successful** ✓



for the last time, simply closing a bug report doesn't
fix the bug