Software Reviews

Scalable Software Engineering
WS 2021/22

Enterprise Platform and Integration Concepts

Image courtesy *@EthicsInBricks* in Twitter: https://twitter.com/EthicsInBricks/status/1430556314556669956 (with permission)

Software Reviews

> “a **software** product is [**examined** by] project personnel, managers, users, customers, user representatives, or other interested parties **for comment or approval**”
>
> —IEEE1028

Principles

- Generate **comments** on software
- Several sets of eyes check
- Emphasis on **people over tools**
- **Lower cost** of fixing defects in review than in the field

Software Reviews

Motivations

- **Improve code quality**
  (e.g. maintainability, readability, uniformity)
- Discuss alternative solutions,
  generate ideas for the future
- **Knowledge transfer** regarding codebase
- Increase sense of **Collective Code Ownership**
- Find **defects**
- Check **compliance** (e.g. legal)

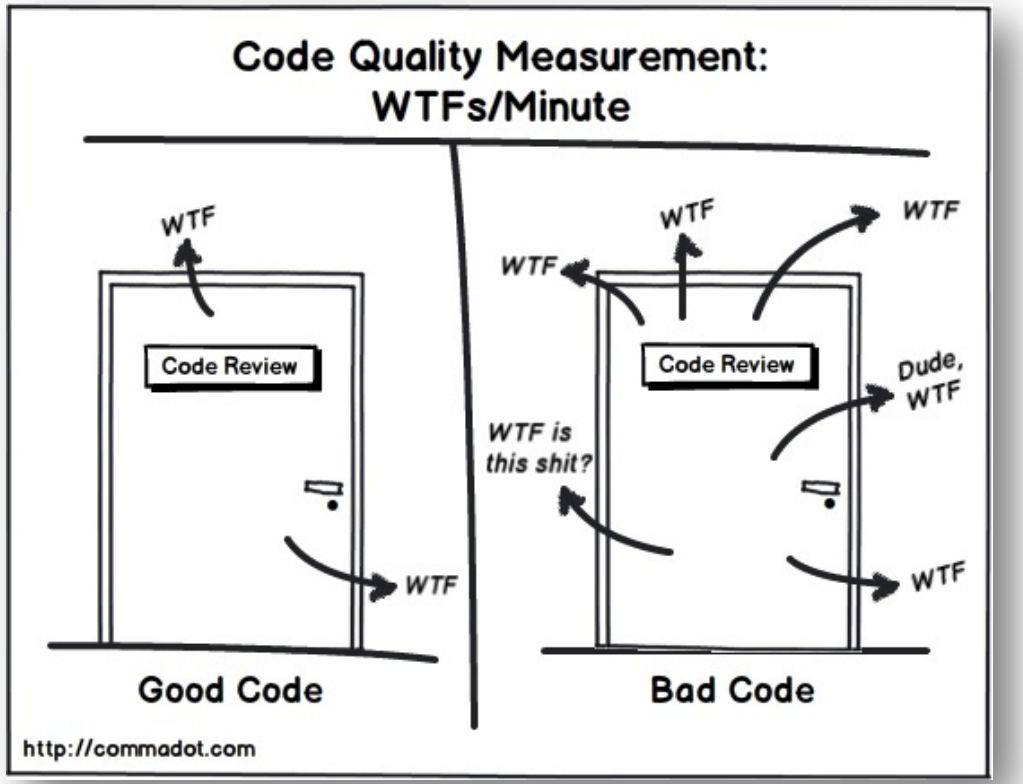
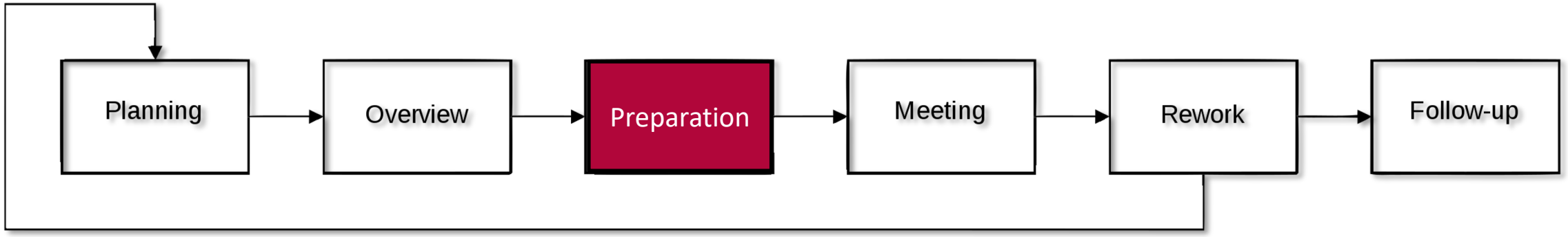


Image by Glen Lipka: http://commadot.com/wtf-per-minute/

Types of Reviews [IEEE1028-2008]

Inspections

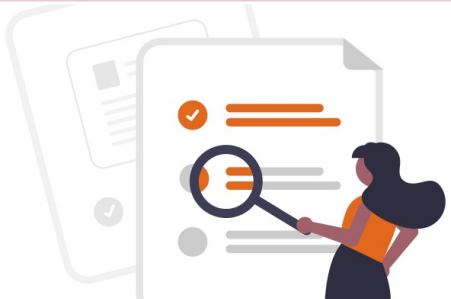
- Identify software product anomalies
- Since the 1970's, aka "Fagan Inspection"
- **Formal process**, can involve hard copies of the code and documents
- Review team checks artifacts independently before, consolidation meeting with developers



Fagan inspection basic model: https://en.wikipedia.org/wiki/Fagan_inspection#/media/File:Fagan_Inspection_Simple_flow.svg (CC0)

Focus in Reviews

Reviewed first	Reviewed later
Implementations of complex algorithms	Well-understood problem domains
Code where faults or exceptions lead to system failure	Code which won’t break the functionality if faults occur
Parts using new technologies/libraries	Parts similar to those previously reviewed
Parts constructed by inexperienced team members	Reused and already reviewed parts
Code that features high code churn	Code with few changes

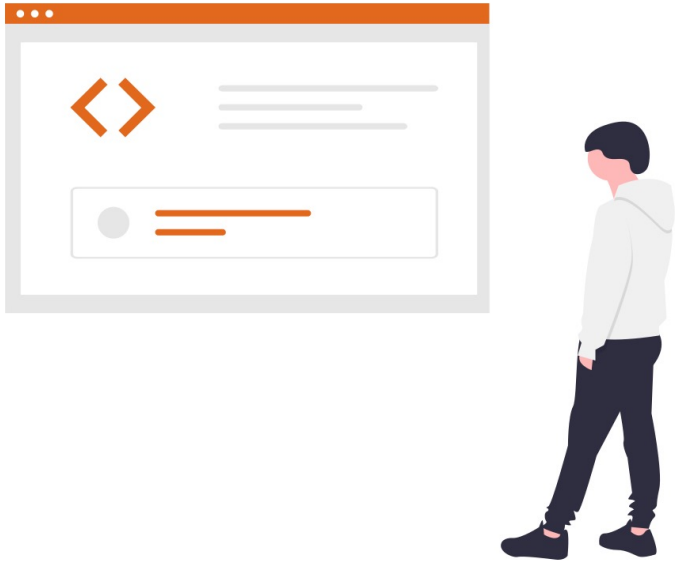


Change-based Code Reviews

[Rigby'13]
[Bacchelli'13]

Different Review Approach

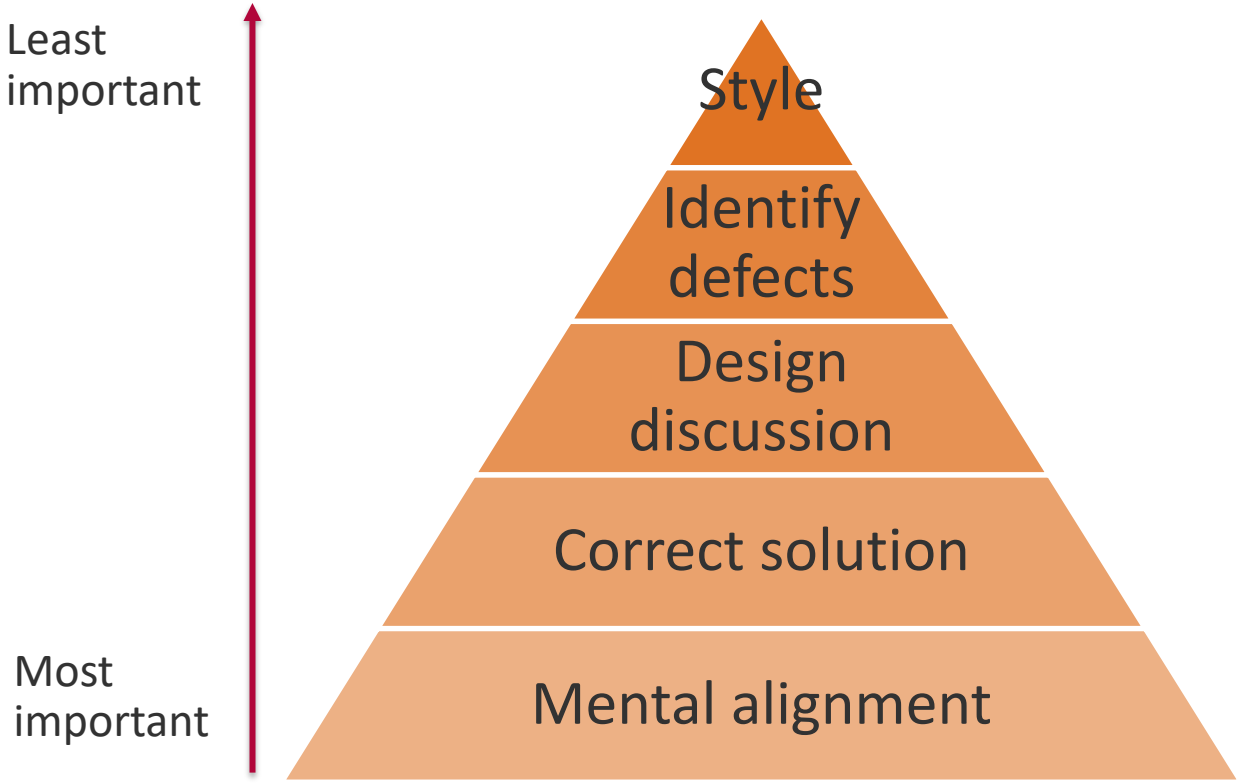
- **Lightweight** process
- Size of reviewed code is *(should be)* **small**
- Performed **regularly** and **quickly**,
  mainly before code enters main branch



Shift in Focus

- From defect finding to **group problem solving**
- Prefer discussion and fixing code over reporting defects

Code Review Goals



Hierarchy of Review Goals

- Build a **shared mental model**
- Ensure **sane design**
- Find defects vs. understanding code

http://blakesmith.me/2015/02/09/code-review-essentials-for-software-teams.html

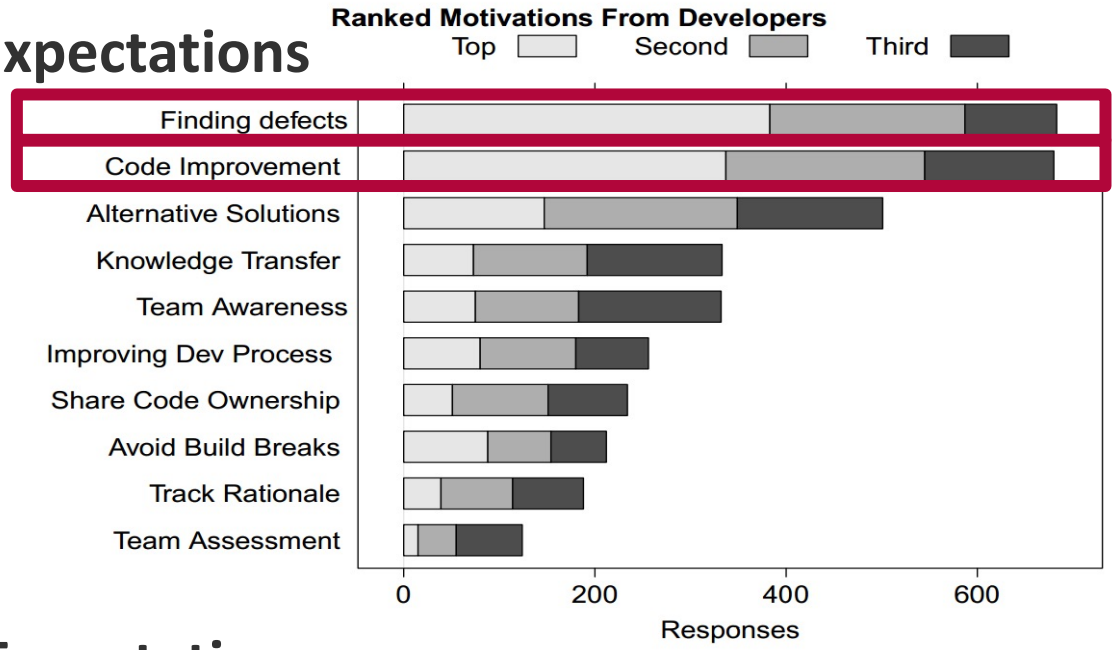
Recent Research

[Bosu'17]
[McIntosh'14]
[Bacchelli '13]

- Code review coverage and review participation share **significant link with software quality**
- Most comments concern code improvements, understandability, social communication
- Only ~15% of comments indicate possible defects
- Developers spend approximately five hours per week (10-15% of their time) in code reviews

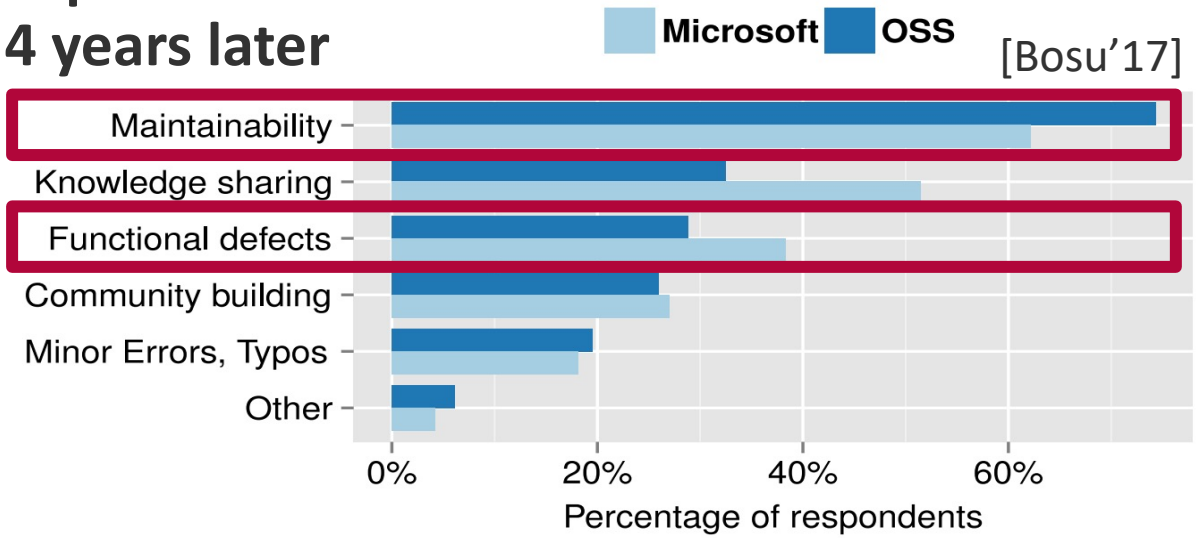
Recent Research

Expectations



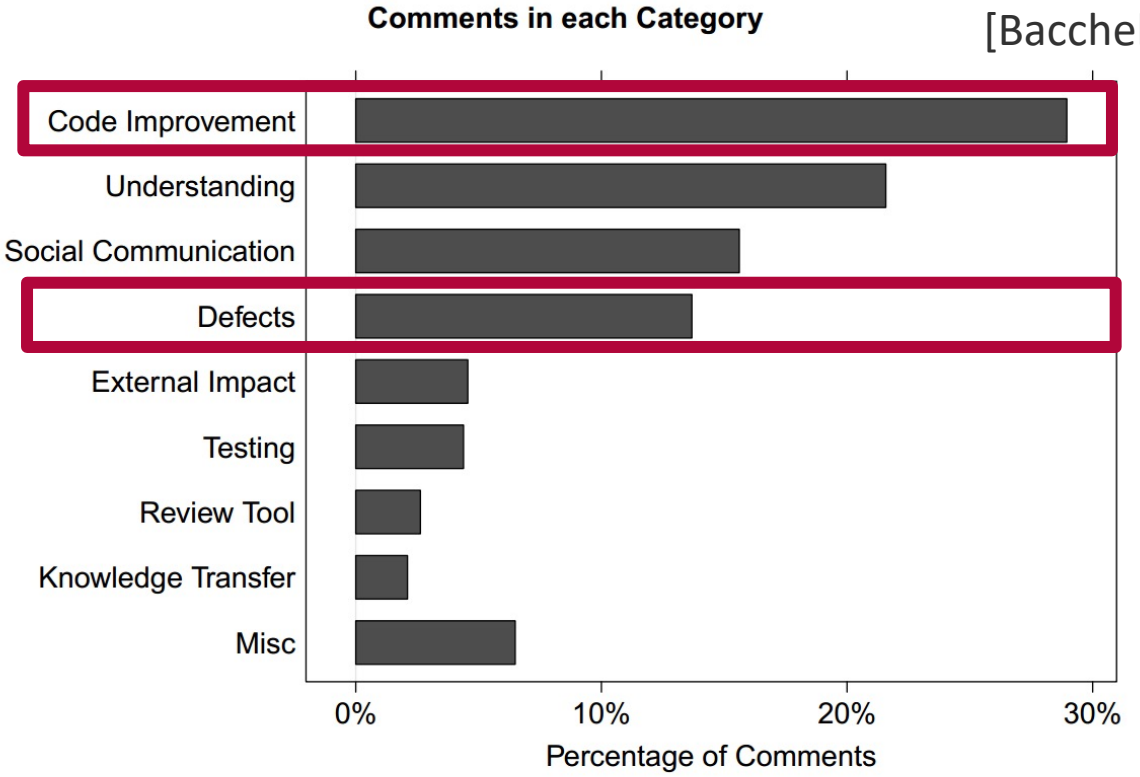
Expectations 4 years later

[Bosu'17]



Empirical study outcomes

[Bacchelli '13]



Maintainability and code improvements identified as most important aspects of modern code reviews

Challenges of Change-based Review

- **Delay** the shipping of implemented features
- Force reviewers to **switch context**
- Little feedback for **legacy code**

- **Overloading** (too many files), developers create large patches

- **Overcrowding** (too many reviewers), assigning too many reviewers may lower review quality

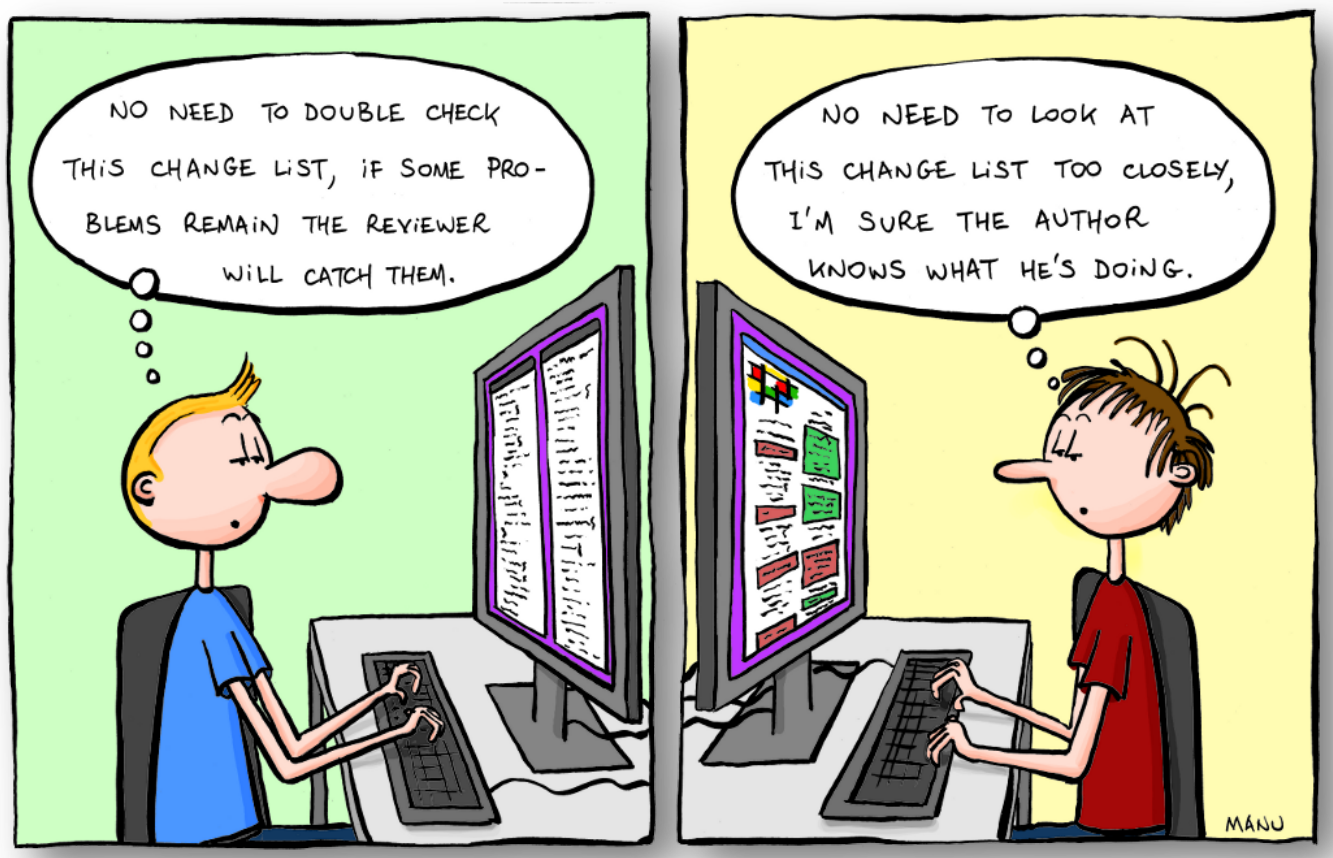


Image: https://devops.com/dark-side-infrastructure-code/

Post-commit Code Review

Review after committing to VCS

- pull requests are one(!) way of doing this
- Used by most projects on GitHub and BitBucket

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- Developers commit and push continuously
- Team members see code changes in VCS and can adapt their work

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- Chance of unreviewed code in repository
  - Need to/can set restrictions
- Requires branches or similar to work effectively

https://www.devart.com/review-assistant/learnmore/pre-commit-vs-post-commit.html

Pre-commit Code Review

Review before committing to version control system
(e.g. using mailing lists, Gerrit, Crucible tools)

- Used by e.g. Linux Kernel, Google

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- No code enters unreviewed
- Code quality standards met before commit, no 'fixes'
- No repository access for reviews
- Flexible definition of code to review (set of commits, branch, some files)

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- Reviewing all changes takes time
- Another complex system to handle
- Context switch to another system

Reviewer Assignment

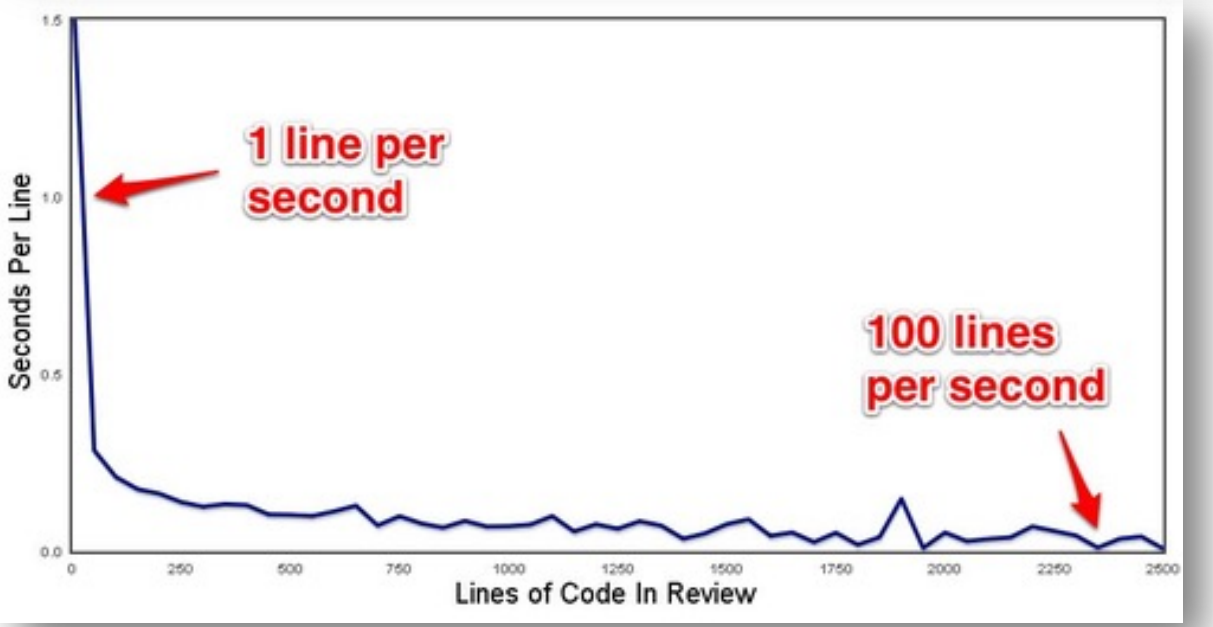
Usually, **two reviewers** find optimal number of defects

Reviewer candidates

- People who contributed changes (find defects)
- New developers (transfer knowledge)
- Team members with a small review queue
- Reviewers with different fields of expertise

Image: http://geek-and-poke.com/geekandpoke/2010/11/1/how-to-make-a-good-code-review.html [Rigby'13]

Review Content



- Size of artifact to review matters
- **Semantically coherent changes** easier to review than interleaved concerns

Images: http://atlassianblog.wpengine.com/developer/assets_c/2011/07/mt-perloc-thumb-500x263-7290.png
https://twitter.com/girayozil/status/306836785739210752?lang=en

Code Review In Industry

[Rigby'13]

Microsoft

- Median completion times: 14.7h (Bing), 18.9h (Office), 19.8h (SQL Server)
- Median number of reviewers: 3-4
- Developers spend **4-6 hours per week on reviews**

Google

- Mandatory review of every change
- Median completion times: 15.7h (Chrome), 20.8h (Android)
- Median **patch size: 78 lines** (Chrome), 44 lines (Android)
- Median number of reviewers: 2

Code Review Tools

Gerrit (https://www.gerritcodereview.com/)

- Integrated with Github: http://gerrithub.io
- Used by, e.g., Chromium, Eclipse, Qt, Typo3, Wikimedia, etc.
- Plug-ins available (e.g. EGerrit for Eclipse)

FishEye (https://www.atlassian.com/software/fisheye/overview)

- Visualize, Review, and organize code changes

GitHub Pull Requests

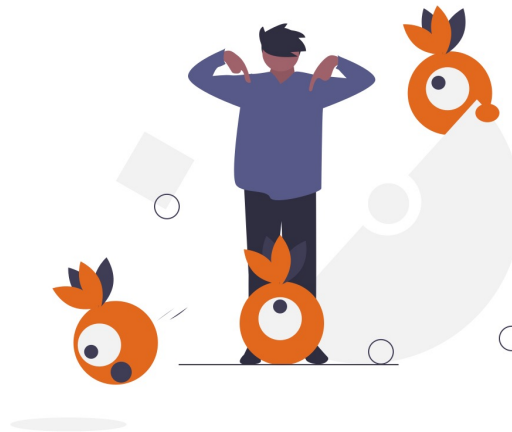
- Branches with comments and checks

Software Review Helpers

- Testing checks functionality via dynamic analysis
- Code reviews manually check code **quality** via static analysis

Automated static analysis (linters)

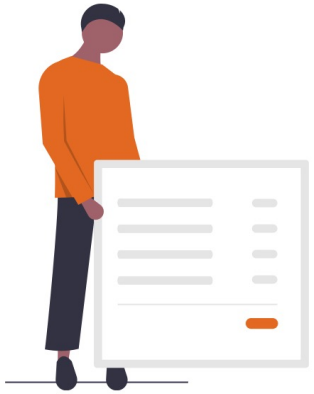
- Code coverage (e.g. SimpleCov https://github.com/simplecov-ruby/simplecov)
- Coding conventions (e.g. RuboCop, https://github.com/rubocop-hq/rubocop)
- Code smells (e.g. reek https://github.com/troessner/reek)



Summary

Software Reviews

- Not a new thing, good reasons to do them (goals & motivation)
- Focus of reviews
- Different types of review techniques
  - Software Inspections
  - Change-based code reviews
- Reviewer assignment & best practices
- Reviews in industry



References

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[McIntosh'14] McIntosh, Shane, et al. "The impact of code review coverage and code review participation on software quality: A case study of the qt, vtk, and itk projects." *MSR'14.*

[Rigby'13] Rigby, Peter C., and Christian Bird. "Convergent contemporary software peer review practices." *FSE'13*.

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[Feitelson'13] Feitelson, Dror G., Eitan Frachtenberg, and Kent L. Beck. "Development and deployment at facebook." *IEEE Internet Computing* 17.4 (2013): 8-17.