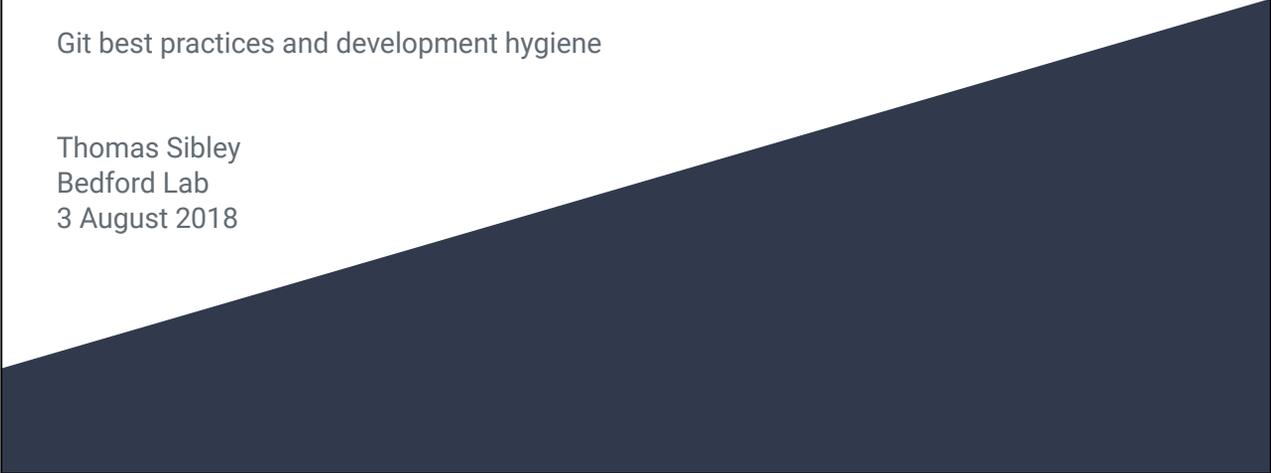


Making the most of version control

Git best practices and development hygiene

Thomas Sibley
Bedford Lab
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Git vs. GitHub

What's the difference?

Git is an open-source program for tracking and sharing changes to files.

GitHub is a commercial product which provides a nice website for developing software with git. It is the place we store our central git repositories.

I want to lead off with some quick background which might be old hat to some but maybe isn't crystal clear to all, which is the difference between git and GitHub.

When you're using the command-line to check your repo status, view the changes you've made so far, commit your work, or pull down updates, you're using git.

When you use the web browser to comment on a PR or browse some code, you're using GitHub. GitHub is where our central repositories live and where other people find our code.

I'm mostly going to be talking about practices that apply generally to git, not just GitHub. And while I'm focusing on git, the same principles apply to other version control systems too.

Caveats

These are my best practices.

...but they're also not *just* mine.

Larger projects benefit more from heavier process/practice than smaller projects.

These aren't hard and fast rules.

I also want to lead with some caveats about what follows. The practices I'll be talking about are definitely based on my own experience with what works well, but I'm certainly not the first to articulate them. There is a long history of thought about how to improve the (often painful) process of writing software, and the practices I'll be talking about have fairly wide acceptance.

What I'll be talking about especially applies to larger software projects with lots of moving parts, like the Nextstrain ecosystem. While these practices apply to smaller scripts and notebooks as well, the cost-benefit analysis is different and not as clear cut.

All of which is to say that what's to come aren't hard and fast rules. They're guidelines and ways of thinking about version control that offer advantages to future development and make it easier for outsiders to get started contributing to your project. Use them in projects where it makes sense.

The Diff, The Commit, and The Log

These are the triumvirate of version control.

The **Diff** is Git's description of **what** you changed.

The **Commit** is your description of **why** a set of changes were made.

The **Log** is Git's record of **when** changes were made.

(Describe each.)

I'm going to touch on each of these in turn and best practices for cultivating them. Each builds upon the previous ones.

The Diff

Programming is Writing

Draft, revise, cut, rinse, repeat

Don't stop at the first thing that seems to work

- It may not work in all cases!
- It is probably not the clearest way to communicate the code's intent.

Read and re-read your diffs frequently

- You'll notice improvements
- Hone them for clarity and correctness

“A programmer is ideally an essayist, who works with traditional aesthetic and literary forms as well as mathematical concepts, to communicate the way that an algorithm works and to convince a reader that it is correct.”

—Donald Knuth, 1992

I came across this quote from Donald Knuth recently and quite liked it.

The Commit

Why not What

Summarize **what** changed briefly, and then describe in detail **why** it changed and **why** you made the choices you did.

The Diff describes in detail **what** changed, but only you can describe **why!**

Good commit messages are a love letter to the future.

Avoid `git commit -m`. Configure git to use your text editor instead.

(Why good commit messages are so important.)

Empowering the log.

The future will often be you, 6 months later, trying to figure out why you did something 6 months ago.

Summarize changes in around 70-80 characters

More detailed explanatory text, if necessary.
Explain the problem that this commit is solving.
Focus on why you are making this change. Are there side effects or other unintuitive consequences of this change? Here's the place to explain them.

- Bullet points are okay, too...
- ...if they're not just enumerating unrelated changes

Links to further discussion that informed this commit can be useful. If you use an issue tracker, put references to them at the bottom, like this:

Resolves: #123
See also: #456, #789

▶ "Also, ..."

▶ "While I was at it..."

▶ Whole message is a bulleted list

The Commit

Split up your changes

Don't lump changes together simply because they happened close in time.

Commits should be discrete, cohesive chunks with a clear purpose.

Make commits incrementally, even from work done simultaneously.

```
git add --patch
```

```
git commit --patch
```

```
git rebase --interactive
```

The Log

The past is the key
to the present

	COMMENT	DATE
○	CREATED MAIN LOOP & TIMING CONTROL	14 HOURS AGO
○	ENABLED CONFIG FILE PARSING	9 HOURS AGO
○	MISC BUGFIXES	5 HOURS AGO
○	CODE ADDITIONS/EDITS	4 HOURS AGO
○	MORE CODE	4 HOURS AGO
○	HERE HAVE CODE	4 HOURS AGO
○	AAAAAAA	3 HOURS AGO
○	ADKFJSLKDFJSDKLFJ	3 HOURS AGO
○	MY HANDS ARE TYPING WORDS	2 HOURS AGO
○	HAAAAAAAAANDS	2 HOURS AGO

AS A PROJECT DRAGS ON, MY GIT COMMIT
MESSAGES GET LESS AND LESS INFORMATIVE.

xkcd.com/1296/

Charles Lyell, Scottish Enlightenment (18th-19th century)

Importance of history

This is a rather extreme example of a poorly tended git log from XKCD to get a laugh, but poorly tended logs don't have a clear sense of direction. A good log should tell a story. This is different from your train of thought while hacking on code, where there are dead ends and distractions along the way. Using the commands from the previous slide you can craft that story after the fact, once you've done the work and know how the story should end.

The Log

The present is the
key to the future

Tending to a good Log now is an investment in the future.

Why does this code do something confusing?

Do we still need this bit of code? Why was it added?

`git bisect`

`git blame` (yes, it's a bad name)

Writing good commits now and tending to a clean log is an investment in the future and the only way to get to a useful history.

There are many git commands which rely on a useful history, such as bisect for automatically finding when a bug or behaviour started happening or blame/annotate for tracing the origin of a bit of code.

The messier a log is, the less useful it is, and so there's less reason to tend to it. But investing in a good log will provide a valuable tool for longevity in a software project.

Code review



Comparable to asking someone to read your draft before you send it off

Different eyes see different things

Review process improves outcomes for everyone, not just “newbies”

Any requested changes should be incorporated directly into your existing commits, not as new commits on top.

One way to improve on all of these things I've talked about is via code review. This comes back to the Programming is Writing philosophy. Code review is just like asking someone to read your draft of a manuscript. Can they follow the story you're trying to tell? Do they understand why things happened? Importantly, just like editing a manuscript, the code review process is for everyone; it's beneficial to experts as well as newbies.

(Material on slide)

When working on a document, you don't tack on edits at the end, you incorporate them into the body of work. Your code should be no different.

Code smells



Copies of files/code to preserve old versions

- Defeats point of version control
- Barrier to understanding what's in use

Dead code / commented out code

- If it's not in use, delete it!
- Comments are explicatory material, not version control methods

Generic variable names ("item", "object")

- Like using too many pronouns in English, it reduces clarity

 blog.codinghorror.com/code-smells/

One thing that comes up in review can be code smells. Code smells are things that are indicative of poor development practices. They often don't affect current functionality, but they hinder development and future changes, often by decreasing clarity or flexibility or increasing the frequency of bugs.

XXX TODO

The link has a reasonable list of many common code smells, but know that code smells are very subjective and variable project-to-project. For example, in a combined code plus data repo for a manuscript, it may be completely justified to use multiple copies of files as a way to have side-by-side versions of a dataset or resultset.

“Move fast and
break things”

“We used to have this famous mantra. [The idea] is that as developers, moving quickly is so important that we were even willing to tolerate a few bugs in order to do it. What we realized over time is that it wasn’t helping us to move faster because we had to slow down to fix these bugs and it wasn’t improving our speed.”

—Mark Zuckerberg, 2014

mashable.com/2014/04/30/facebooks-new-mantra-move-fast-with-stability

“Take your time and do it right”

Aim for clarity and correctness above all else. Code is read more often than written.

Paying attention to how diffs read, writing good commit messages, and tending to the log help others understand your changes.

Cut corners sparingly, and acknowledge when you are doing so.

If there's a mantra I'm more fond of, it might be “Take your time and do it right.”

Clarity and correctness are hard to come by, but they're harder to beat. There's a time to cut corners in every project, but do it sparingly and only when necessary to meet a real deadline.

This leads into my final point, which is...

**Leave the code better than
you found it.**

Leave the code better than you found it. Not just in what new things you add, but also in fixing things along the way that you notice are broken or could be done better.



"That's all Folks!"

Rebasing:

What changed?

git tbdiff exists to show you what changed between two versions of a topic branch.

git range-diff is the new, core version of this!

Topic branch is a fancy term for a branch that adds a feature or fixes a bug. It draws a distinction between those short-lived branches and branches that persist indefinitely, like “master”.

👉 github.com/tsibley/git-tbdiff

Further reading

chris.beams.io/posts/git-commit/

git-scm.com/book/en/v2/Git-Tools-Rewriting-History

git-scm.com/book/en/v2/Git-Tools-Reset-Demystified

sourcemaking.com/refactoring/smells

sourcemaking.com/refactoring/refactorings