Git walk-through

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Outline

About version control systems in general

What is it?

- ”track changes” on steroids
- for complete project, not a single file
- ”Lab notebook” → reproducible research
- save files to a ’repository’
  - local (on your PC)
  - on a central server
  - on other computers
- record snapshots/changes + explanatory log message
- record relationships between snapshots
- → allows ’time travel’
- works for any file, but best for text files (scripts, csv, ...)
- Nothing gets lost (!!)

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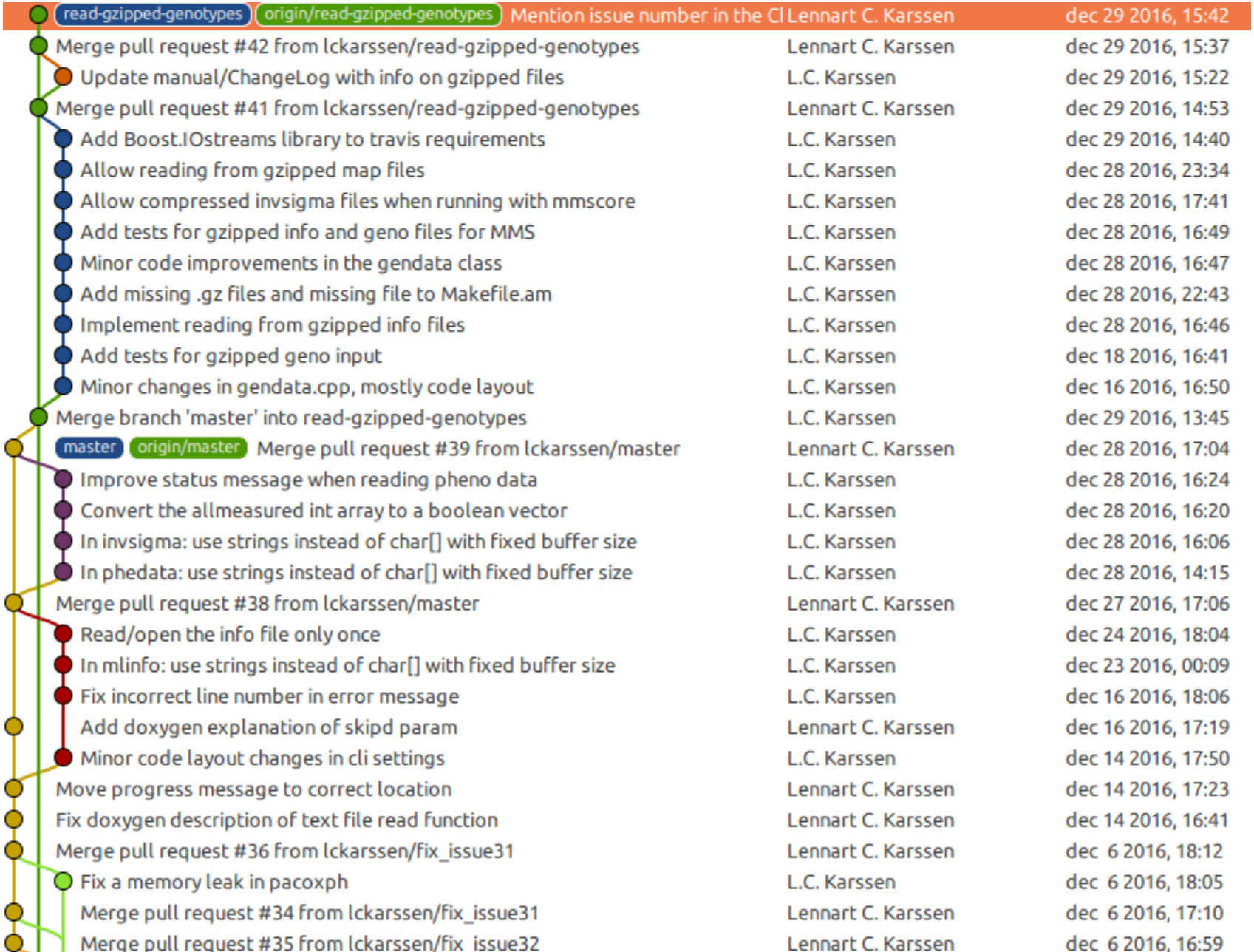
Why version control?

- history: what changed when (and by whom)
- clean working directory (no `script_v1`, `script_old`, `script_20170605`, `script1`, etc. lying around)
- allows experimentation (change, test, accept/revert)
- collaborate with others (sharing, integrating changes, conflict resolution) → branches
- sort of backup (when pushing to other computers)

Example: history



Example: changes

```
▶ git diff b7f7bf6566981c62ac4706a594a6abf17960cece f30050a7807b4c947bc45fbed8b611c78dc87391
diff --git a/src/invsigma.cpp b/src/invsigma.cpp
index a2ac618..32bbf23 100644
--- a/src/invsigma.cpp
+++ b/src/invsigma.cpp
@@ -52,7 +52,7 @@ InvSigma::InvSigma(const char * filename_, const phedata& phe) : filename(filena
 {
     npeople = phe.nids;
     std::ifstream myfile(filename_);
-    std::string line;
+    char * line = new char[MAXIMUM_PEOPLE_AMOUNT];
     std::string id;

     matrix.reinit(npeople, npeople);
@@ -63,7 +63,7 @@ InvSigma::InvSigma(const char * filename_, const phedata& phe) : filename(filena
     {
         double val;
         unsigned row = 0;
-        while (std::getline(myfile, line))
+        while (myfile.getline(line, MAXIMUM_PEOPLE_AMOUNT))
         {
             std::stringstream line_stream(line);
             line_stream >> id;
@@ -99,6 +99,8 @@ InvSigma::InvSigma(const char * filename_, const phedata& phe) : filename(filena
         std::cerr << "error: inv file: cannot open file '"
                   << filename_ << "'\n";
     }
+
+    delete[] line;
 }
```

Some version control system history

- Source Code Control System (SCCS)
  - since 1972
- Revision Control System
  - since 1985
- Concurrent Versions System (CVS)
  - since 1990
  - very popular
- Subversion (SVN)
  - since 2000
  - very popular
- Git, Mercurial (Hg), Bazaar (Bzr)
  - since 2005
  - distributed
  - GitLab, GitHub, BitBucket
  - Git currently most popular

Git concepts

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  - generally the `.git` subdirectory in your working directory
  - files are *committed* to the repository
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- Remote (optional):
  - Other location with a copy of the repository (e.g. in the cloud)
  - *clone*, *push*, *pull*
  - histories can diverge (!)

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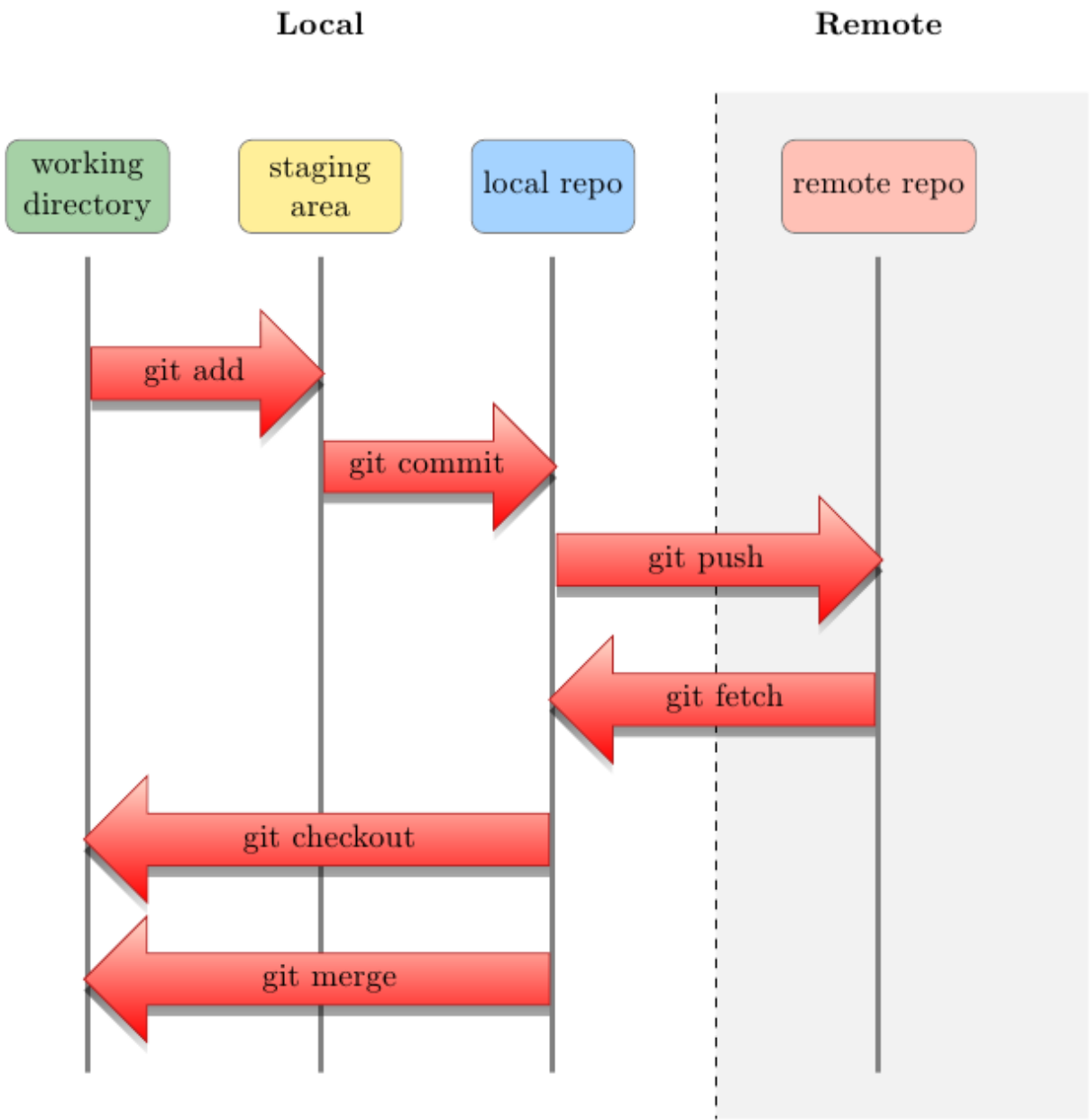
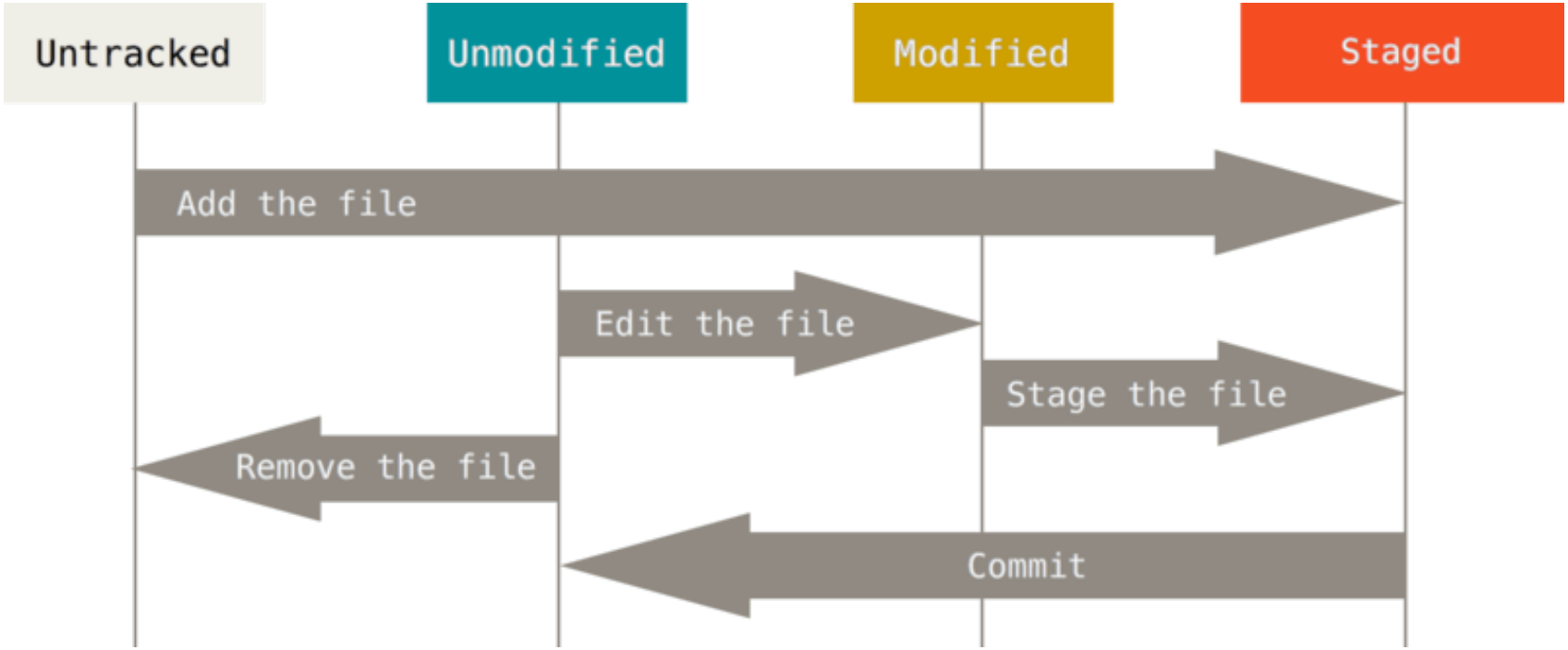


File lifecycle



Source: https://git-scm.com/book/en/v2/

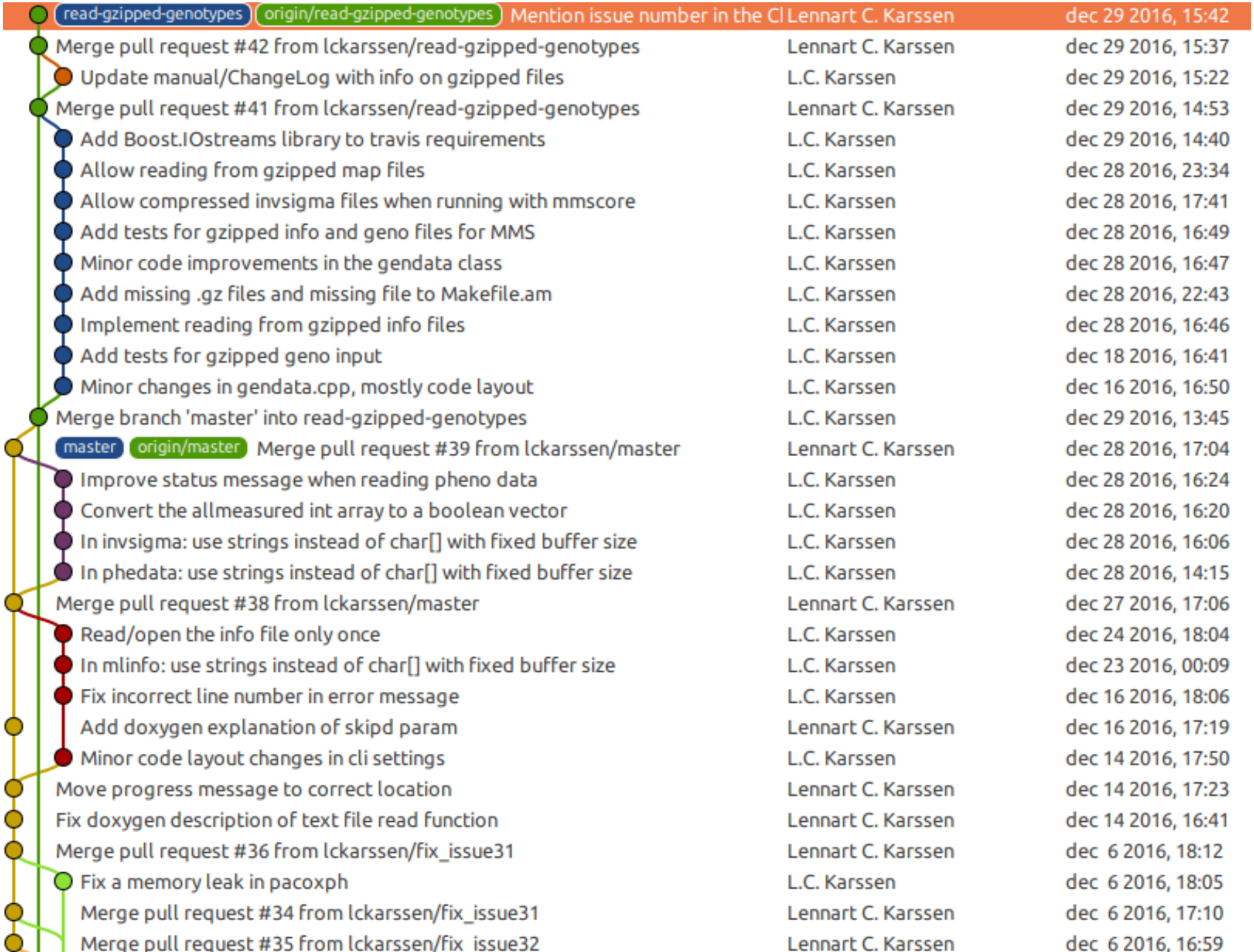
Collaborating with others

- Cloud services like GitLab, GitHub and BitBucket
- A central company/university Git server
- No single repo is the 'truth',
- unless all collaborators agree otherwise

Branches

- allows separate development, experimenting, etc.
  - branch with stable/tested code
  - branch for development of feature X
  - branch for bug fixes in stable version `x.y.z`
  - etc.
- create new branch using `git branch`
- merge one branch into another using `git merge`
- default: `master`
- although `master` is present by default, it is just a regular branch

Branches: example history



Git commands

Typical structure of a Git command

A Git command typically looks like this:

```
git verb
```

Options can be added too:

```
git verb --option_A --option_B
```

Getting help from the command line

Two ways to get more information on a git command:

For a quick list of options for `verb`

```
git verb -h
```

Show the manual page for the given `verb`

```
git verb --help
man git verb
```

Final notes

Dos and don'ts

- Store only scripts, not their output
- Works best for plain text files, not binary files
  - e.g. for MS Word documents you are better of with its internal versioning.
- Not well suited for large (data) files (→ Git LFS)
- Make clear, concise commit messages:
  - 1st line: describe what is done
  - 2nd line: empty
  - 3rd line and further: explain the changes, reasoning, etc.
- Use explanatory names for branches

Tips

- Start small
  - one project
  - only for yourself
  - add, commit, show log
- Continue with branching or remote repositories

Links

Cheat sheets

- GitLab cheat sheet; has nice figure with work spaces etc.
- GitHub cheat sheet

Git courses/tutorials

- `http://swcarpentry.github.io/git-novice/`

Other links

- *A Quick Introduction to Version Control with Git and GitHub* in PLoS Comp Biol