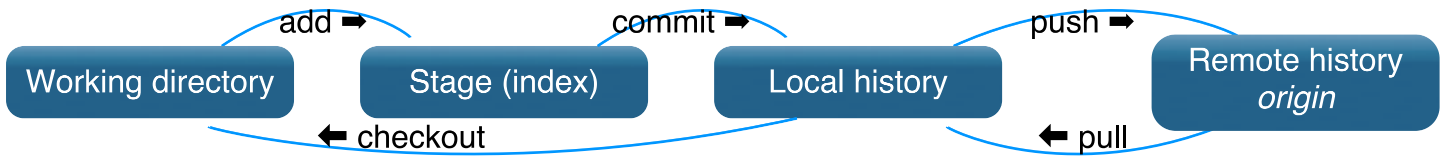
Version Control with Git



Using Git with a Feature-Branch Workflow

1. **Create, checkout branch.**

2A. **Create, modify, delete code.**

2B. **Add files to stage and review work.**

2C. **Commit files to history often. Repeat 2A.**

3. **Ready? Clean up and combine commits using rebase.**

4. **Merge branch into master.**

5. **Tag it, push, delete branch.**

Create

git clone <url>
From remote history
git clone git@github.com:mikec/myproj.git

git init
Create a new Git repository from your current directory. Now add and commit files as desired.

git remote add origin <url>;
git push --set-upstream origin master
From local history to blank remote history
git remote add origin git@github.com:mikec/ myproject.git

git remote --verbose # verify origin url
If the url is wrong you can use:
git remote remove origin

Branch

git branch [--all | --verbose]
List branches. --all shows local and remotes

git branch <new-branch> [src-branch]
Create branch locally based on HEAD or src.

git checkout <branch1>
Switch to branch

git branch --move <branch1> <branch2>
Rename branch1 to branch2

git branch --delete <branch1>
Delete branch 1

Add/Reset

git add . | --update | <files>
Add all new/modified/deleted or specified files to stage. --update skips new files.

git mv <files>
Rename or move files; update stage

git rm [--cached] <files>
Delete file from working area and index. --cached removes from history only.

git reset [files]
Remove all (or specified) files from stage without changing working directory.

git reset --hard
DANGER! Deletes uncommited files.

git clean [--dry-run | --force]
DANGER! Deletes unstaged files.

Review Work

git status
Files staged and in working directory.

git diff [file] # working v stage code changes
Code changes between working and stage

git diff HEAD # working v last commit code changes
Code changes between working and last commit

git diff --cached # stage v last commit code changes
Code changes between stage and last commit

git diff <commit1> <commit2> # history code changes

git log [–oneline | --graph | --decorate]
History of commits

git log <branch> **--not master**
History of commits for branch

git show <commit>[:<file>]
History of commits and code changes. :file narrows scope

git reflog [--relative-date | --all]
Show changes to local HEAD.

Commit/Revert

git commit [--all | --message "<description title>"]
Commit with only description title instead of launching editor for full description

Commit description: title, blank line, body

git commit --amend
Combine new changes with last commit, overwrite last description

git revert HEAD | <commit>
Revert last commit; create new commit

git checkout <commit> <file>
Revert last commit; create new commit

git rebase --interactive master <branch>
Clean up/combine commits and modify history of branch against master. Edit 1st word of each line, usually with fixup.

Resolve Merge Conflicts

Git will try to resolve merges. Successes will be staged, conflicts will be unmerged. Use git status to list them. *See Figures 1, 2 on back.*

git merge <branch1> [branch2]
Merge branch1 into current branch

git merge --no-ff [branch1]
Merge without fast-forward to create a merge commit. This aids history visualization.

git diff [--base | --ours | --theirs] <file>
Compares file to base (base) file, your (ours) changes, other (theirs) changes, or all.

git mergetool <file>
Launches previously configured GUI mergetool. Make appropriate changes, then confirm at CLI.

Push/Pull

git tag [--annotate | -n] <tag>
Tags current branch. -n lists tags annotations

git push --set-upstream origin <branch>
Creates upstream branch, sends branch to remote history (origin)

git push origin [branch] [--all | --tags]
Pushes current branch, if upstream branch exists. --all pushes all branches, --tags pushes tags.

git push origin --all --tags**;**
git push --delete origin <branch>;
git branch --delete <branch>
Push all branches, delete branch on remote origin, delete local branch

git pull origin <branch>
Get changes from remote and merge

git fetch origin <branch>
Get changes from remote without merge

git cherry-pick <commit>
Brings changes (not all files) from commit to working directory

Fix Merge Conflicts Manually

1. Identify which files have merge conflicts with git status.
2. Manually resolve conflicts in each file with **vim** or **mergetool**, look for <<<< through >>>>.

```
unchanged code for context
<<<< HEAD (current branch marker)
current code
==== (branch separator)
incoming code
>>>> branch-name (incoming branch
marker)
```

3. Chose current or incoming code or merge the contents, then delete markers and separator.
4. Use git add for resolved file, delete .orig file.
5. Use git commit when all files are resolved.

Git Basics

The Feature Branch Workflow assumes a new branch for every new feature. The master branch never has broken code.

Feature branches are pushed to the repository. Commits should be atomic: Self-contained and no code should span multiple commits.

The Mike Flow workflow is from Mike McQuaid's book **Git In Practice**. It's modified GitHub Flow but branches are Stable releases are tagged on the master branch.

The local repository is called *history* and the remote repository is called *remote history* (or ***origin***, its most common name). The default branch name in a new history is ***master***. A remote tracking branch (like *origin/master*) is called an upstream branch.

HEAD: current commit (and branch)
<commit>: HEAD, tag name, branch name, or leading substring of the commit SHA-1
<commit>^: 1st parent of commit
<commit>~2: nth gen ancestor (grandparent) of commit (following only 1st parents)
<file>: filespec
<branch>: branch names cannot contain spaces

exact <required> [optional] choice | alternate repeatable…
Explanation of the code
# example code

Command options are shown in long form for better mnemonics; --message instead of -m

Don't forget: **git help** [command]

References

Git in Practice — Mike McQuaid, Manning Publications

https://git-scm.com/docs

https://www.atlassian.com/git/tutorials

http://ndpsoftware.com/git-cheatsheet.html

https://backlog.com/git-tutorial/

Configure

git config --global user.name "Mike Combs"

git config --global user.email "mike@combsnet.com"

git config --global core.editor "vim"

git config --global merge.tool "diffmerge"

git config --global credential.helper osxkeychain
Use keychain for passwords instead of reprompting. Also: git-credential-gnome-keyring or git-credential-winstore

git config --global --edit
Open ~/.gitconfig global config file in editor for editing

vim .gitignore
Edit this to ignore temporary, object, project, and other files. Find examples at https://github.com/github/gitignore. For example:

```
.Rhistory
.RData
.Rproj.user/
.DS_Store
__pycache__/
*.py[cod]
*$py.class
```

git rm --cached <files>
Remove files from history in case they got there before you put them in .gitignore

git status --ignored
Show files ignored due to .gitignore

git config --global alias.<name> <cmd>
Define an alias for <cmd>
git config --global alias.log1 "log --graph --decorate --oneline"

git <alias>
Use previously defined alias

Log Options

git log <since id>..<until id> # show range of commits
git log -<limit> # limit number of commits shown
git log --author="<pattern>"
git log --decorate # show branch and tag names
git log --graph # show graph of commits
git log --grep="<pattern>"
git log --oneline # show each commit on 1 line
git log -p # show full diff
git log --stat # show files and changed line counts

Regression

git blame --date=short -w -s -L 40,60 <file>
For each line in file, show author, date, and commit. -w ignores white space, -s hides author name, -L specifies range of lines

Bisect helps find a commit that introduced a bug through a binary search of history.

git bisect start; git bisect bad;
git bisect good <commit>
Start regression process, indicate this commit is bad, identify last known good commit. Bisect will now checkout a revision within these bounds.

git bisect <bad | good>
User should check for problem, then use this to mark revision and checkout the next one. Repeat until

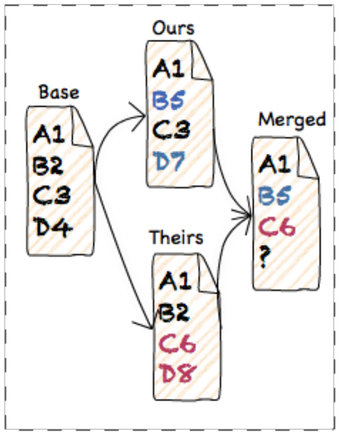
git bisect reset
End regression process, return to HEAD

git bisect log
Show bisect steps

3-Way Merge

In this merge, Git cannot automatically resolve line D because it has been changed in two different branches. Usually *ours* is the current and master branch, and *theirs* is the feature branch.

Fig 4: Three-Way Merge



FF-Merge, Merge Commit

Fig 1: Master and Feature branches

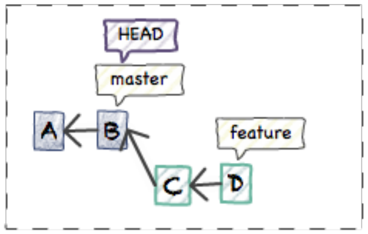


Fig 2A: After merge commit

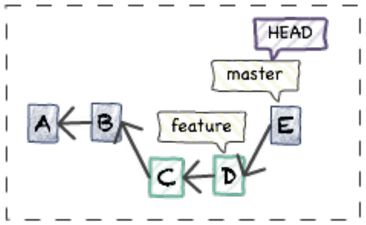


Fig 2B: After fast-forward merge

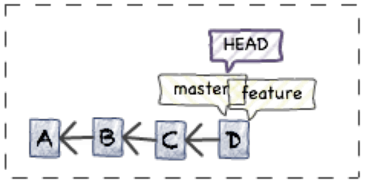


Fig 3A: New commit added to Master

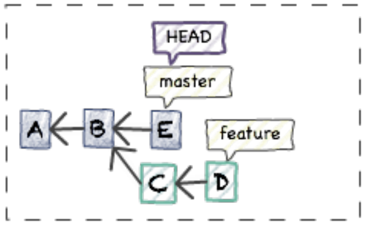
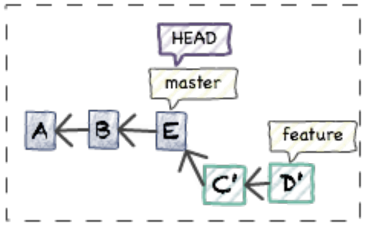


Fig 3B: Feature rebased on Master



HEAD
master
feature
A
B
E
C'
D'