

```
## git --learning --curve
```

```
# difficulty
```

```
#
```

```
#          ---- nirvana
```

```
#
```

```
#
```

```
#
```

```
#      / \      -----
```

```
#      / \      | conflicts!?!#
```

```
#      / \      | rebase!#
```

```
#      / \      /
```

```
#      / \      ? reset?!
```

```
#      / \      / undo?
```

```
#      / \      / reset?!
```

```
#      / \      | index?
```

```
#      / \      | dag?
```

```
#      / \      -----
```

```
#
```

```
#
```

```
#
```

```
#
```

```
#          time
```

```
#
```

```
#
```

```
#
```

```
#
```

```
#
```

```
#
```

```
#
```

```
# Disclaimer:
```

```
# - I'm not an expert
```

```
# - This should benefit beginners and
```

```
#   intermediates
```

```
# - This covers doubts I had and I was asked
```

```
#   however basic it sounds
```

```
# - Try to ask questions at the end
```

```
# - Try not to treat Git or SCM as secondary
```

```
## git log --gargantuan --intimidating --terrifying
```

```
# log has 100+ options
```

```
# git log man is -git
```

```
$ git log -git
```

```
    -tig
```

```
    -g -i -t
```

```
    -g -t -i
```

consoles

git bash
posh-git
conemu
tortoisegit
...

What I use?

git bash
scite text editor
winmerge2011 (diff, merge)

```
## configs
```

```
# system
```

```
# global
```

```
# local
```

```
# edit
```

```
$ git config --local -e &
```

```
$ git config --global -e &
```

```
# global config
```

```
# editor
```

```
# winmerge
```

```
# set some options in configs
```

```
# include path
```

```
## aliases
```

```
# The freedom to make my own mistakes aliases  
# is all I ever wanted.  
#           - Mance Rayder  
#           Game of Thrones
```

```
# git commit  
$ git c
```

```
# git checkout  
$ git co
```

```
# git status -s|--short  
$ git s
```

```
# log aliases  
# git log --pretty=twoline --graph \  
#   --decorate --abbrev-commit --date=relative  
$ git l -1
```

```
$ git alias alias  
$ git alias conf
```

```
# alias with ! run at root level  
$ cd to/some/dir  
$ git l .
```

data structures

special refs: head, fetch_head
branch

refs: branch, remote, tag:
commit

commit: => hash
(tree, hash)
(parent, hash)[]
author, name, email, date
committer, name, email, date

tree: => hash
(type, hash, name)[]
where type is blob|tree

blob: => hash
binary

cat

\$ git cat-file -p <commit>|<tree>|<blob>

DAG

```
#   root
#   o<---o<---A<---x master
#           \       /
#           `--B<-'
#                dev
#
```

commits are shown as either of following:

o

*

letters A, B, C ...

merge commits are shown as:

x

workings

work offline

commit represents the whole repo at that point

for diff, only the commits involved are required

o---A---o---o---B


```
## upstream
```

```
#          upstream
#
#          --o---B origin/master
#          /
#          /
# ---o---o---A origin/master
#          master
#
#          downstream
```

```
$ git fetch
```

```
#          upstream
#
#          origin/master
#
# ---o---o---A---o---B origin/master
#          master
#
#          downstream
```

```
(master)
```

```
$ git reset --hard master@{u}
          origin/master
```

```
## index
```

```
# commit in flight  
# break a change into logical commits  
# exclude a whole file or a *part* of it
```

```
# show not added to index  
$ git difftool
```

```
# show added to index  
$ git difftool --staged|--cached
```

```
# show both, not added and added to index  
$ git difftool head
```

```
#                                     working dir  
# HEAD|                               git diff head |  
# ---o-----staged-----unstaged  
#      | git diff --staged | git diff |  
#
```

reset

```
#                               topic
#   ---o---A-----B
#                               working dir
```

\$ git reset --hard head~

```
#           topic
#   ---o---A-----B
#           working dir
```

B is unstaged

\$ git reset [--mixed] head~

```
#           topic
#   ---o---A-----B (unstaged)
#                               working dir
```

B is staged

\$ git reset --soft head~

```
#           topic
#   ---o---A-----B (staged)
#                               working dir
```

#		move	change	working
#		branch	index	dir
#	soft	Y		
#	mixed	Y	Y	
#	hard	Y	Y	Y

diff

head / working dir

\$ git diff

\$ git difftool

commit / working dir

\$ git difftool master

commit1 / commit2

\$ git difftool master dev

commit1 / commit2 for file.txt

\$ git difftool master dev dir/file.txt

\$ git difftool master dev -- "dir/file.txt"

commit1:file1 / commit2:file2

\$ git difftool dev:README.md master:rm.Extensions/Heap.cs

diff of last 2 commits combined w/ head

\$ git difftool head~2 head

diff of last 2 commits combined w/ working dir

\$ git difftool head~2

diff of last 2 commits combined w/ staged working dir

\$ git difftool head~2 --staged

char level diff

\$ git diff --color-words=.

ancestry (parent) refs

^ parent by breadth

~ parent by depth

^ 1st parent (same as ^1)

~ 1st parent (same as ~1)

^2 2nd parent

~2 grandparent (1st parent's 1st parent)

^! no parents (roughly, ^ for parent, ! for no)

How to see a diff of a commit?

\$ git diff 4a5b6c7~ 4a5b6c7

\$ git diff 4a5b6c7^!

```
## commit ranges
```

```
# What's new on origin/master?
```

```
(master)
```

```
$ git log ..origin/master
```

```
# double dot, triple dot
```

```
#             dev..master = { d }
```

```
#
```

```
# a---b---c---d master
```

```
#             \             dev...master = { d, e }
```

```
#             --e dev
```

```
#
```

```
#             master..dev = { e }
```

```
#
```

```
#             dev master = { a, b, c, d, e }
```

```
# .. in e, but not in d
```

```
$ git log d..e
```

```
# ... in d or in e but not both
```

```
$ git log d...e
```

```
# in d or e or both
```

```
$ git log d e
```

```
## commit --amend
```

```
$ git commit
```

```
#           topic
```

```
#  ---o<--o<--A
```

```
#
```

```
$ git commit --amend
```

```
#  ---o<--o<--A
```

```
#           \
```

```
#           A' topic
```

```
## stash
```

```
# -u includes untracked files
```

```
$ git stash save -u "comment"
```

```
# pop will remove if no conflicts, apply does not
```

```
$ git stash apply|pop
```

```
# v2.11+, no need to type stash@{1}
```

```
$ git stash apply|pop 1
```

```
#      // this is the stashed commit
```

```
#
```

```
#      *-.   WIP on dev
```

```
#      | \  \
```

```
#      |  |  |
```

```
#      |  |  | * untracked files on dev
```

```
#      |  |  |
```

```
#      |  |  |
```

```
#      |  |  | * index on dev
```

```
#      |  |  |
```

```
#      |  |  | /
```

```
#      * (dev)
```

```
      // point from where `git stash save -u` is ran
```

```
# use --index to restore index
```

```
$ git stash apply 3 --index
```


commit message convention

50/72:

subject is 50 chars only

body is 72 chars wide. this needs to wrap at 72 chars
like so.

50/*:

subject is 50 chars only

body is freeform. this can go on and on and on and on and on.

```
$ git log --oneline -1
```

```
8624263 (HEAD -> dev) subject is 54 chars only
```

Please do not do this:

my subject is more than 54 chars so i decided to break
it down in this horrible, terrible, criminal way

commit body.

```
$ git log --oneline -1
```

```
8624263 (HEAD -> dev) my subject is more than 54 chars so i decided to break  
it down in this horrible, terrible, criminal way
```

There are exceptions:

- Auto-generated messages

- Quoted text

Merge remote-tracking branch 'origin/really-long-branch-name' into next

commit body.

Commits are forever, branches are not.

- Try not to make typos in commits

- Try not to make mistakes by putting incorrect ticket

branch

What branches is my branch merged into?

```
$ git fetch
```

```
$ git branch -r --contains origin/branch
```

tracking branch info

```
$ git branch -v # verbose
```

```
$ git branch -vv # very verbose
```

force move a branch

```
$ git branch -f <branch> <commit|branch>
```

```
$ git branch -f dev origin/dev
```

checkout/clean

undo all unstaged changes

\$ git checkout .

undo a file's unstaged changes

\$ git checkout file.txt

delete untracked files, dirs, build files

\$ git clean -f [-d] [-x]

delete interactive

\$ git clean -i

alias: git undo

\$ git reset --hard && git clean -f

to delete dirs also

\$ git undo -d

```
## revert
```

```
# revert a commit
```

```
$ git revert <commit>
```

```
# revert a merge commit
```

```
$ git revert <merge-commit>
```

```
error: commit <commit> is a merge but no -m option was given.
```

```
fatal: revert failed
```

```
#
```

```
# * Merge branch 'jwt' into next
```

```
# | \
```

```
# | * jwt: Use 'commonName' from 'sub' or 'iss'
```

```
# | |
```

```
# * | Merge branch 'scite' into next
```

```
# |
```

```
#
```

```
# revert a merge commit to 1st parent
```

```
$ git revert -m 1 <merge-commit>
```

```
## merge
```

```
#   ---o---o master
#       \
#         --o
#         dev
```

```
(master)
$ git merge dev
```

```
#   ---o---o---x master
#       \       /
#         --o--
#         dev
```

```
(master)
$ git merge pu maint
```

```
#   ---o---o---x master
#       |\       /|
#       | --o--  | pu
#       \       /
#       `--o--' maint
```

```
# Linux kernel has 66 branches merged together
# in 2014
```

```
## --ff (fast-forward) merge
```

```
#   ---o master
#       \
#       --o---o
#               dev
#
```

```
(master)
$ git merge dev
```

```
#   ---o
#       \      master
#       --o---o
#               dev
#
```

```
# Where was master previously?
```

```
## --no-ff merge
```

```
#   ---o master
#       \
#       --o---o
#               dev
```

```
(master)
```

```
$ git merge dev --no-ff
```

```
#   ---o-----x master
#       \       /
#       --o---o
#               dev
```

```
# .gitconfig
```

```
[merge]
```

```
ff = false
```

```
# --no-ff flag default
```

```
$ git merge dev
```

```
# for ff merge
```

```
$ git merge dev --ff
```

```
# .gitconfig
```

```
[branch "master"]
```

```
mergeOptions = --no-ff
```

```
# same for next, dev
```

```
## merge conflicts
```

```
# There are 3 things certain in life.
```

```
(death)
```

```
$ git merge taxes
```

```
<<<<<< HEAD
```

```
death
```

```
||||||| merged common ancestors
```

```
merge conflicts
```

```
=====
```

```
taxes
```

```
>>>>>> taxes
```

```
(master)
```

```
$ git merge dev
```

```
# conflicts
```

```
$ git status -s
```

```
UU a.txt # conflict (Unmerged, Updated)
```

```
  M b.txt # modified
```

```
  A c.txt # added
```

```
  R d.txt # renamed
```

```
  D e.txt # deleted
```

```
# get current|other branch's copy
```

```
$ git difftool --ours|--theirs file.txt
```

```
# get current branch's copy
```

```
$ git checkout --ours    file.txt  
                    --theirs
```



```
# undo merge, even a successful merge
$ git reset --merge orig_head
# use again to go back to merge commit
```

```
[alias]
```

```
    undomerge = reset --merge orig_head
$ git undomerge
```

```
# How to see resolved conflicts before push?
$ git show head
diff --cc file.txt
- my change
- other change
++resolved change
```

```
# this does not work
$ git difftool head^!
```

```
## rebase
```

```
#           master
#  ---o---o---o
#      \
#      A---B topic
```

```
(topic)
```

```
$ git fetch
```

```
$ git rebase master
```

```
#           master
#  ---o---o---o
#      \       \
#      A---B   A'---B' topic
```

why rebase?

```
#                                     master
#  ---o---o---o---o---x
#      \           \       /
#      A---B---x---C topic
```

```
(topic)
$ git commit
$ git commit
$ git merge master
$ git commit
(master)
$ git merge topic
```

merge commits do not add value
difficult to read history

```
(topic)
$ git rebase master
#                                     master
#  ---o---o---o---o
#      \                   \
#      A---B---C   A'---B'---C' topic
```

```
## rebase -i
```

```
# Commit often, perfect later.
```

```
#           master
#  ---o---o---o
#           \
#           A---B---C---D topic
```

```
(topic)
```

```
$ git rebase -i master|head~4
```

```
pick A
```

```
pick B
```

```
pick C
```

```
pick D
```

```
# Commands:
```

```
# p, pick = use commit
```

```
# r, reword = use commit, but edit the commit message
```

```
# e, edit = use commit, but stop for amending
```

```
# s, squash = use commit, but meld into previous  
commit
```

```
# f, fixup = like "squash", but discard this commit's  
log message
```

```
# x, exec = run command (the rest of the line) using  
shell
```

```
# d, drop = remove commit
```

```
# scenario 1: edit, pick, drop
```

```
edit A  
pick B  
drop C  
drop D
```

```
stopped at A...  
(some changes...)  
$ git add .  
$ git rebase --continue
```

```
#               master  
#   ---o---o---o  
#           |\  
#           | A---B---C---D  
#           \  
#           A'--B' topic
```

```
# scenario 2: reorder commits
```

```
pick A  
pick C  
pick B  
pick D
```

```
#               master  
#   ---o---o---o  
#           |\  
#           | A---B---C---D  
#           \  
#           A'--C'--B'--D' topic
```

```
# scenario 3: pick, fixup, reorder, drop
```

```
pick A
```

```
fixup C
```

```
pick B
```

```
#edit D (dropping D by commenting)
```

```
# results in
```

```
AC (commits A+C)
```

```
B (commit B)
```

```
#               master
#   ---o---o---o
#           | \
#           |  A---B---C---D
#           \
#           AC'--B' topic
```

```
## push after rebase
```

```
(topic)
```

```
$ git push
```

```
$ git fetch
```

```
$ git rebase master
```

```
#                               master
#  ---o---o---o
#      \      \
#      \      \ A'---B' topic
#      \      \
#      \      \ A---B topic{-1}
#              \ origin/topic
```

```
$ git push topic
```

```
rejected (non-fast-forward)
```

```
do a pull/merge first
```

```
$ git push -f
```

```
#                               master
#  ---o---o---o
#      \      \
#      \      \ A'---B' topic
#      \      \ origin/topic
#              \
#              A---B
```

```
# golden rule of rebase
```

```
# I normally don't rebase a branch,  
# but when I do, I do master.  
#     - The Most Interesting Rebaser in the World  
#     #yolo
```

```
# don't rebase public branches
```

```
#     last      hotfix  
#   ---o---o---o  
#       \  
#     A---B master (me, others)
```

```
# I rebase master  
(master)  
$ git rebase hotfix  
$ git push -f
```

```
#             hotfix      origin/master  
#   ---o---o---o---A'---B' master (me)  
#       \  
#     A---B master (others)
```



```
# Others merge origin/master
(master)
$ git merge origin/master
$ git push
```

```
#                      hotfix
#  ---o---o---o---A'---B'
#      \                      \ origin/master
#      A---B-----x master (me, others)
```

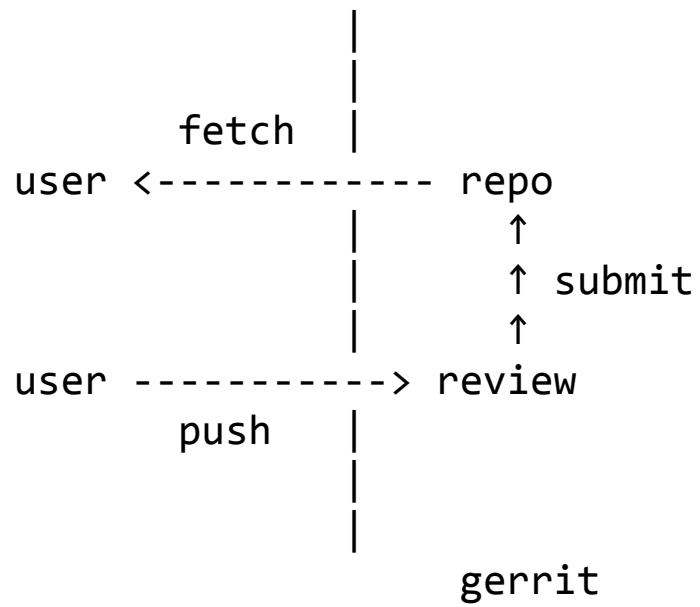
```
# Merge is better compared to rebase
```

```
# I merge master
(master)
$ git merge hotfix
$ git push
```

```
#                      hotfix
#  ---o---o---o
#      \          \
#      A---B---x master (me, others)
#                      origin/master
```

```
# Others can fast-forward master now
```

gerrit



```
## git review
```

```
# this will push to branch rm/1234-topic  
(rm/1234-topic)  
$ git review
```

```
# push to gerrit for code review
```

```
git review:
```

```
    branch = $1 ?? currentBranch()  
    if <branch> == null:  
        throw "gerrit requires branch"  
    if !gerrit-exists-branch <branch>:  
        gerrit-create-branch master:<branch>  
    git push origin head:refs/for/<branch>
```

```
# rebase and gerrit
```

```
# merge master in to topic
```

```
(topic)
```

```
$ git fetch
```

```
$ git merge origin/master
```

```
# resolve conflicts if any
```

```
# push
```

```
$ git review
```

```
# Problems with merge:
```

```
# - Logic in merge commits with conflicts
```

```
# rebase topic on master
```

```
(topic)
```

```
$ git fetch
```

```
$ git rebase origin/master
```

```
# resolve conflicts if any
```

```
# push
```

```
$ git review
```

```
## gerrit and push -f
```

```
# no force push rights - why?  
# to avoid bypassing reviews  
$ git push -f  
( ! [remote rejected])
```

```
## git log --name-status|--name-only
```

```
# show file names and statuses
```

```
$ git log -1 --name-status
```

```
commit 714a14ef23acb056e3ad0b03c2fd515e3c308603 (HEAD -> dev, github/dev)
```

```
...
```

```
M    README.md
```

```
A    rm.Extensions/BitSet.cs
```

```
M    rm.Extensions/Properties/AssemblyInfo.cs
```

```
M    rm.Extensions/rm.Extensions.csproj
```

```
A    rm.ExtensionsTest/BitSetTest.cs
```

```
M    rm.ExtensionsTest/rm.ExtensionsTest.csproj
```

```
# show file names
```

```
$ git difftool head~ --name-only
```

```
## grep, log grep, ls-files
```

```
# greps in working directory only
```

```
$ git grep "woohoo"
```

```
$ git grep -i "woohoo"          # ignore case
```

```
$ git grep "woohoo" -- *.gtt    # in .gtt files only
```

```
# greps in entire repo (slow)
```

```
$ git log -G "woohoo"
```

```
# greps in log messages only
```

```
$ git log --grep "woohoo"
```

```
# greps in tip of all branches (not just current)
```

```
$ git branch -a \
```

```
    | cut -c3- | xargs git grep "woohoo"
```

```
## git add -i|-p
```

```
$ git status  
(changes)
```

```
$ git add -i
```

```
# *** Commands ***
```

```
# 1: status      2: update      3: revert      4: add untracked
```

```
# 5: patch      6: diff        7: quit        8: help
```

```
# What now>
```

```
(some work to add/remove/patch to index)
```

```
$ git commit
```

```
# --patch for reset, checkout also
```

```
$ git add -p
```

```
$ git reset -p
```

```
$ git checkout -p
```



```
## rev-list
```

```
# get total commit count
```

```
$ git rev-list --all --count
```

```
# get total commit count for master
```

```
$ git rev-list master --count
```

```
#   ---o---o---o master
```

```
#           \
```

```
#           o---o topic
```

```
# get left-right commit count
```

```
$ git rev-list topic...master --left-right --count
```

```
2    1
```

```
# get left-right commit
```

```
$ git rev-list topic...master --left-right
```

```
# Where did I branched from?
```

```
# alias: git bfrom
```

```
$ git bfrom master@{u} next@{u}
```

```
## template dir and git hooks
```

```
# template for when you init a repo  
# also works for existing repo  
# .gitconfig
```

```
[init]
```

```
    templateDir = ~/.git-templates
```

```
# copy contents of template dir to .git/ dir  
$ git init
```

```
# to apply git hooks to all repos
```

```
[core]
```

```
    hooksPath = ~/.git-hooks
```

```
# to skip the commit hooks
```

```
$ git commit -n
```

piping

```
# There are more things in git and piping, Horatio,  
# than are dreamt of in your philosophy.
```

```
#           - echo "WS" \  
#             | sed 's/WS/R/' \  
#             | awk '{print $0"M}'  
#
```

```
# text tools that support piping
```

```
sed streaming editor
```

```
awk text processing tool
```

```
# files with different statuses
```

```
$ git status -s | grep "^UU"
```

```
$ git status -s | grep "^ M"
```

```
# o is shortcut for my text editor, scite
```

```
# open conflicted files
```

```
$ git status -s | grep "^UU" | cut -c3- | xargs o
```

```
# open files with BitSet in name
```

```
$ git ls-files *BitSet* | xargs o
```

```
# alias hidden: show hidden files
```

```
$ git ls-files -v | grep '^h' | cut -c3-
```

```
$ git hidden
```

```
# hide and unhide are aliases
```

```
$ git hide
```

```
$ git unhide
```

```
# hide modified files and then unhide them
```

```
$ git status -s | grep "^ M" | xargs git hide
```

```
$ git hidden | xargs git unhide
```

```
# open files with space in them
```

```
$ git ls-files "<sp>proc"
```

```
    | sed 's/^/"/' | sed 's/$/"/'
```

```
    | xargs o
```

```
$ git ls-files *<sp>proc*
```

```
    | awk '{print "\""$0"\""}'
```

```
    | xargs o
```

```
$ git ls-files -z *<sp>proc*
```

```
    | xargs -0 o
```

```
# 'wrap' wraps all paths in quotes to handle spaces
```

```
$ git ls-files "<sp>proc" | wrap | xargs o
```

```
# 'wrap' is piping-friendly
```

```
$ o ~/bin/wrap
```

```
# open files with "next"
```

```
$ git grep "next" | cut -d':' -f1 | wrap | xargs o
```

```
# delete merged branches except few
```

```
$ git branch --merged  
  | egrep -v "(\*|master|pu|maint|next)"  
  | egrep "cr/"  
  | xargs git branch -d
```

```
# delete oldest 3 cr/* branches except current
```

```
$ git branch --sort=committerdate  
  | egrep -v "\*"  
  | egrep "cr/"  
  | head -3  
  | xargs git b -d
```

```
# top 2 items
```

```
$ ... | head -2
```

```
# last 2 items
```

```
$ ... | tail -2
```

```
# 2nd line item
```

```
$ ... | sed -n '2 p'
```

advanced aliases

```
$ git coe <partial branch>
```

multiple branches

```
$ git coe e
fatal: multiple branches matched
  master
  dev
```

fuzzy checkout to branch

```
$ git coe z
Switched to branch 'temp/lazy'
```

custom commands

```
$ git l
l = git log --pretty=two
```

pretty formats

```
two
one
```

aliases running as shell scripts run from /

```
l = !"git lg2"
# this will still run from /
$ cd to/some/dir && git l .
```

```
## reflog
```

```
# <commit> (refs) HEAD@{<i>} summary of operation  
#      where <commit> is after the operation
```

```
# ref log
```

```
$ git reflog -3
```

```
# 87dce5f (HEAD -> dev, master) HEAD@{0}: reset: moving to master  
# 0733641 HEAD@{1}: rebase -i (finish): returning to refs/heads/dev  
# 0733641 HEAD@{2}: rebase -i (pick): Adding BitSet implementation.
```

```
$ git reset --hard HEAD@{1}
```

bisect

```
$ git bisect start
# head is bad
$ git bisect bad
# some commit in past is good
$ git bisect good <commit>
(bisecting)
$ git bisect good|bad
(bisecting)
(08b9bd4 is the first bad commit)
# exit bisect state
$ git bisect reset
```



```
## shortlog
```

```
#
```

```
# The owls stats are not what they seem.
```

```
#
```

```
# shortlog with summary, sort, email
```

```
$ git shortlog -sne
```

```
# .mailmap
```

```
- consolidate name/emails
```

```
# What to do?
```

```
- place at root OR
```

```
  outside of repo with mailmap.file path in config
```

```
- log.mailmap true
```