

YOU NEED TO
GET

press®

Pro Git

on, Ben Straub

.1.141, 2019-04-02

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...	503
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...	508
...	509
...	510
...	511
...	512

example of hosted Git
g what I felt was
e I still don't love
idable. Instead of
deeply describing
Git then knowing
, no matter which

ment and rise of
book have been
obscure version
ol. I'm happy that
oks on the market

l
rly with multiple
te branches and

gning up for and
; to contribute to
d lots of little tips

like mastering the
ision selection in
at you are truly a

g up hook scripts
on settings so you
ripts to enforce a

(SVN) world and
d are not about to
his chapter shows
ort projects from

it is so simple, but accidentally write

simple database that

distributed with many
files) in a special
by adding up all

with developers on
ms (CVCSs) were
erver that contains
entral place. For

single point of failure during that hour and on. If the hard drive has been kept, you lose all snapshots people have made from this same drive, you risk losing

as Git, Mercurial, and so on; rather, they fully support these systems were designed to be distributed, so there is no central point of failure.

atabase

on 3

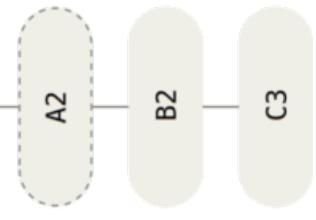
on 2

on 1

repositories they
in different ways
of workflows that

understand what
only be much easier
other VCSs, such
en using the tool.
and thinks about
l help you avoid

(Eluded) is the way
a list of file-based
on) think of the
over time (this is



uses Git reconsider
om the previous
erful tools built on
thinking of your

no information is
e most operations
the gods of speed
the project right

much. In fact, Git
ants.

is hard to get the
with any VCS, you
snapshot into Git, it
repository.

danger of severely
you can recover

at the rest of your
ide in: *committed*,

project. This is the
copy from another

pulled out of the
ify.

information about
x”, but the phrase

mit, which adds

res that snapshot

ed. If it has been

ht not or might
quite excellent
work just fine.

n generally do so
're on Fedora (or
dnf:

stributions on the

Continue

. has an option to
or macOS website,

1 is available for
he download will
separate from Git

, these additional
OS and Scientific
:

you also need the

o need the **getopt**

stomize your Git computer; they'll stick nging through the

ables that control
fferent places:

m and all their
ites from this file
administrative or

the user. You can
n, and this affects

you're currently
te to this file with
ed to be located

en Git will always
override this with a
hand without the

be used when Git
editor.

the full path to its

: to use the 32-bit
s. If you are on a

in different files
one for each unique

ey>:

: refresher on the
#github channel
these channels are
Git and are often

repository files—a
, Git Internals for

down all the data
go into the new
to be worked on or

libgit2, you can

called **mylibgit**.

example uses the
which uses the SSH
ns the server can

command. If you

tracked files are
here. Finally, the
ed from the same
efault; you won't

acked and staged

” heading. If you
at will be in the
, you then ran `git
mand takes a path
l the files in that`

conflicted files as
the next commit”
BUTING .md file, and

you remember one
open it again and
more time:

also has a short
`status -s` or `git`

the entire working

) matches zero or
a, or b, or c); a question
by a hyphen (**[0-**
use two asterisks to

where they are
.)

iple `.gitignore`

you changed, not
`git diff` in more
s: What have you
mit? Although `git`
`ff` shows you the

`NG.md` file without
this:

atch is

PR
S

staging area. The

can use `git diff`

synonyms):

anges. Remember
t you haven't run
modified files on
at everything was
ype `git commit`:

TOR environment
ou want using the

you some output
the commit has
removed in the
area. Anything you

our history. Every
you can revert to or

them, the staging
want to skip the
command makes
it, letting you skip

its own filename
all files that have

you rename a file in
pretty smart about
it.

In Git, you can run

n existing commit
asic and powerful

1

like this:

the *patch* output)
1, such as using -2

entry. This is very
of commits that a
with `git log`. For
the `--stat` option:

d files, how many
ed. It also puts a

ormats other than
ption prints each
ddition, the **short**,
ith less or more

output format. This
use you specify the

The author is the
so last applied the
the patch, both of
We'll cover this

called `--graph`. This

ormation as well.

instead of all 40.

go") instead of

e the log output.

e, short, full,

r.

g options; that is,
already—the **-2**
n is any integer to
y default pipes all

For example, this

options for your

source code history
large commits, you

ese undos. This is

forget to add some
ake the additional

no changes since
previous commit),
t message.

of your previous
ous commit.

a file you wanted

... to unstage. So,

.md file? How can I
submit (or initially
tell you how to do

y)

it says:

age your remote
n the Internet or
ther read-only or
positories and
Managing remote
hat are no longer
and more. In this

sitory that is, in
arly imply that
only that it is
involve all the
remote.

mand. It lists the
ory, you should at

may additionally

in Getting Git on a

and implicitly adds
a new remote Git
> `<url>`:

at remote project
branches from that

y under the name
server since you
only downloads
of your work or
your work when

Git Branching for
and then merge that
able workflow for

on. The command
will automatically
ces. It also lists all

heavily, however,

you want to rename
local branches
run `git pull`.

too. What used to
be no longer using
can either use `git`

repo, for instance,
you can run this:

ify a message for

now command:

The command just

history looks like

have to explicitly
share remote

guish between
vs you to select

example, we could

common variations

will stay the same,
except by the exact
older version, for

than your **v2.0.0**

make your Git
or assume you've

; it for. However,
In that case, you
that work with a

commit, and multiple

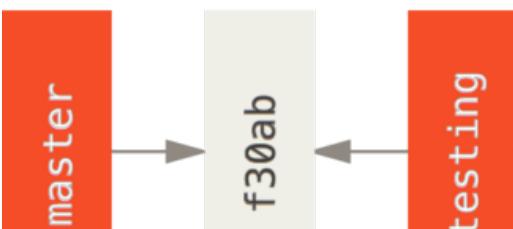
and you stage them
which we mentioned
to them as *blobs*),

directory (in this case,
Git then creates a
can re-create that

contents of one of
which file names are
and all the commit

the default branch
that points to the
. moves forward

like any other
at the `git init`
age it.



called `HEAD`. Note
used to, such as
on. In this case,

ats to the

lab commit.

o the new testing



our `master` branch
ches. Let's switch

and switched to a
other work. Both
orth between the
ith simple branch,

SHA-1 checksum of
the branch is as quick

copying all of the
files, depending on
so, because we're
g is automatically
velopers to create



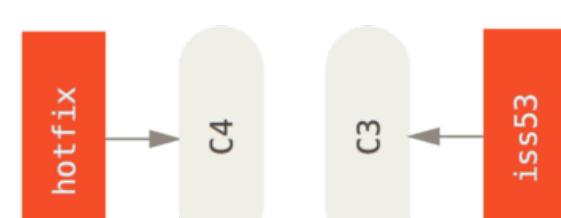
king system your
can run the `git`

C3



iss53

immediately. With
de, and you don't
plying your fix to



the `hotfix` branch
use command:

C4

C3

iss53

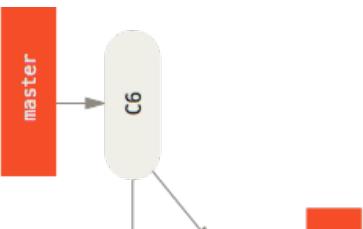
rk you were doing
use you no longer
e -d option to **git**

ue working on it.

ned in the files in
h into your [iss53](#)
ntil you decide to

merged into your
[r](#), much like you
ou wish to merge

our development
you're on isn't a
s case, Git does a



You can close the

of the same file
cleanly. If your fix

had checked out
above the `====`),
in order to resolve
ents yourself. For

licts, we cover

l the script that it
n to verify that all

n staged, you can
ks something like

at some branch-
time.

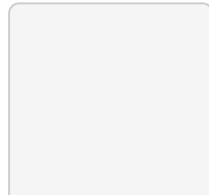
You run it with no

that you currently
commit at this point,
commit on each

`-D`, as the helpful

given a commit
merged or not

merge state with
out first, as in,



should you do with



...ve a **proposed** or **pu**
go into the **next** or
when they reach a
single long-running
with very large or

; and you showed
throw away the
Your history then

ject in [Distributed](#)
sure to read that

completely local.
repository — there

ng branches, tags,

me else pushes to
ward differently.
er pointer doesn't

for those remote
is used only for
`git remote`
e your shortname

note to which you
remotes you write
you can use private
branches you want to

can push it up the

branchname out to
local branch and
part in detail in [Git](#)

tracking branches, in this case, you don't have to worry about what you can't modify.

origin/serverfix. If you want to make changes to your remote repository, you can do so by running the command `git push origin serverfix`.

fix is.

This is what is called a

t pulled down, or
`--set-upstream-to`

upstream branch
branch and it's
- instead of `git`

it's not have yet, it will let you merge it **fetch** immediately demonstrated in the **clone** or **checkout** is tracking, fetch

magic of **git pull**

finished with a branch your stable **sh**. If you want to

C4

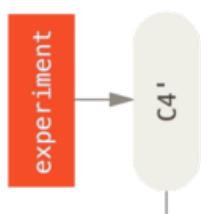
C3



master

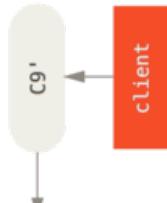
merge command. It
(4) and the most

one you're on and
branch you're on,
mit as the branch



et branch. Take a
You branched a
made a commit.
itted a few times.

d from the `server`
tly off the `master`



branch to include

our server branch



ed and you don't
commit history:

work to the central
your history look

rk on

master

ht help you out. If
ed work on, your

checksum that is

mmits from your
em back on top of

: Someone pushes
run **git rebase**

C3, since C4 is the

at there).

`git pull`. Or you
this case.

`pull.rebase config`

be just fine. If you
om, you'll also be
; may have based
the scorn of your

vs to run `git pull`

which one is better.

of what actually
e tampered with.

SH) and Git. Here
(not want) to use

or directory on the
system such as an
the latter wouldn't
computer, making a

from a local file-
existing project, use
dry, you can run

repository. If you
want something out,
shing to a remote
board to network-

g a shared mount
repository on NFS
run off local disks

every user has full
from changing or

to fall back to the server to be served like a website after setting it up. You must root and set up a user who can access the directory. To allow read

and write command (`git` command is run when something like

rsvers. Other than
P for serving Git

sometimes more
ning tools you can
o make this pretty
caching on your

use SSH access to
an authenticated

with Git; it listens at port 9418 by default. You must create a repository in it — but, other users can clone, or it isn't a public repository. You could push access but, you would need to add a URL to your .gitmodules file.

It's serving a lot of requests for authentication and authorization. It uses the same mechanism as GitHub for authentication.

It's desirable for the Git HTTPS access for

ory.

pose, this is close
ory, and creates a
server and set up
ch you have SSH
ry. Assuming that
ur bare repository

a bare repository
go—nothing else

this discussion will
ss to repositories,
uple of people on

have only a few
f setting up a Git
certain users and
2.

generally easiest to
overed in the last
positories, you can
stem.

itching file with a
ring private key. If
them by running
macOS systems and

ns, see the GitHub

le, you'll use the
nning a standard

the `ssh-copy-id`

the **--bare** option,

repository by adding
machine and create
the hostname of the
internally, and you
pretty much as is

in shell, then that
`ll` instead of bash
e of the `git-shell`

ies and can't shell

you're running a
this up on.

ng system you're

you can use it for
these contents:

on. Therefore, on

er with read-only
git-ro and running
git user that **git-**

back to the server. If you don't

d for this to work

o your web server
the CGI script will

http-backend as the

and implement one
host certainly want

s, since you could
is that Git comes
send and receive
y be controlled at
pable web server,

check out the
[.html](#)

y want to set up a
ometimes used for

am like `lighttpd` or
it to run by typing
preinstalled with
er, you can run it

web browser that
to shut down the

or an open source
normal web server.
via `apt` or `dnf`, so
ery quickly. First,
custom CGI script:

you prefer to use
be able to visit

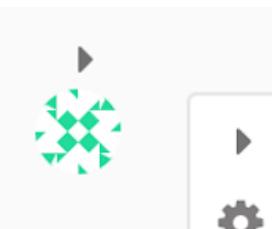
a matured Git server,
GitLab. As GitLab is one
this is a bit more
much more fully

involved than some
of.

up and running
installer from
your particular

Lab running with
, and many other

browser to the
user. The default
will be prompted to
e menu at the top



n logging into the
own will also be
uses are rare.

se and filesystem.
ved, and commits

can access those
he group **training**

belongs to a single
of the project has
the group's user-
project.

at project's pages
access to specific
visible to anyone.
t project.

'these, the GitLab
ant events occur.
the rest of your

accomplished by
ich namespace it
specify here isn't
eate Project", and

ature enables any direct access can branch back into history can “fork” it in their fork back that goes into the

Lab. Each merge a lightweight kind assigned to users, or

mature project, it wikis and system mining, you’ll rarely iteration and general

server, you have

ralized workflow.
ir work with it. A
h that centralized

loper

first developer to
must merge in the

ly.

eloper
blic



eloper
private

Developer Public

highly hierarchical
work and collect

System like Git, but

approved? Are you
submit your work to

tribute to a project
. don't have write
ve a policy? How

at workflows are
use cases, moving
flows you need in

commit messages.
ing with Git and
ays out a number
; in the Git source

is an easy way to
ssible whitespace

message per commit.
Partially stage files
branch is identical
one point, so try to
changes.

you need to later.
and interactively
before sending the

f creating quality
eneral rule, your
nd that describes
planation. The Git
r the change and
ollow. Write your
Here is a [template](#)

other developers.
world. You and the
t do when using
things like offline
very similar; the
commit time. Let's
shared repository.
ally. (The protocol
at.)

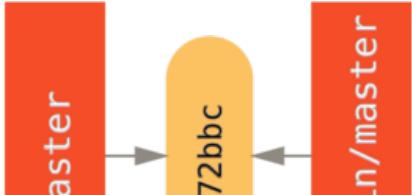
eration. The basic reference, `newref`, `l`, and `toref` is the his below in the various states of

mits them to his

ff5

master

the this:



three commits to
do this:

fetched work she

commits that are
lunch (in this case

de that Jessica has

now completes the
the origin/master



you'll learn how to
those team-based

"featureA"), while
In this case, the

and `featureA` and he
start working on
the server's `master`

with some initial
a. Jessica needs to
Jessica first fetches

Josie's work into

~~DEA~~A branch with:

tent, so she is free
end result back to

origin/
featureBee

A and featureBee
integrators merge
commit, making the

server:
featureBee

issions to directly
the other way. This
sy forking. Many
and many project
cts that prefer to

the patch or patch
oasionally like this:

the maintainers
often called a *pull*
has its own “Pull
st-pull command

our topic branch
summary of all the
pull request, and

e—that you can
each other, like so:

and in order to be
descendant of it. An
r (perhaps called

our second branch
you'll also take this
r. You start a new
here, resolve any

check the specific
er projects which

each patch series
orking the project
commit series and

`git format-patch` to
n commit into an

you don't want to
nning of the patch
patching process.

m or send it via a
ly with “smarter”
Git provides a tool
er for you. We'll
nt we know best;

to the mailing list
in that section, and

value separately
in the demail section in

ral very different tools to help you maintaining a Git

d to know how to **format-patch** and added as remotes by verifying or clearest for other

it out in a *topic* way, it's easy to come back to it. If

ply it with the `git`
you can apply the

ning a `patch -p1`
uzzy matches than
`git diff` format,
either everything
ng your working
. It won't create a
duced manually.

applying it—you

you can point `git`
mail client that can
use `git am`

cketing system or
our disk to `git am`

you. The author
of the commit is
if this patch was
ng like this:

conflicted merge or
solve the conflict,

is a **-3** option to it,
use it doesn't work
that commit—if
smarter about

In the `ruby-client` branch locally:

With a number of remotes you can choose from:

In the `ruby-client` branch locally:

With a single patch consuming than remove remotes to for someone who

used earlier. For
called **contrib** and

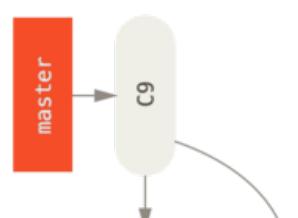
option to **git log**

in another branch,
this:

orthand for doing
you can put three
you're on and its

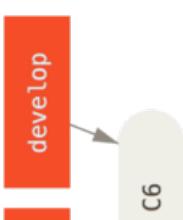
roduced since its

inline branch, the
to maintain your



You're dealing with
introduce.

large cycle. In this
you determine that
integrated into the
ary. Each time you
ge it into **develop**
r to wherever the



master to build the
elop, which is the

wush-cleanup

js/notes

ps/blame

ined that they're
then rebuilt from
sionally, and pu is

ir master branch,
in a topic branch
and run the rebase
so on) branch. If
a linear project

-pick it. A cherry-
picked commit
have a number of
you only have one
base. For example,

master



a0a41

5ddae



by_client

pull in.

can re-create that
sics. If you decide

? key used to sign
air public key as a
o do this, you can

ivalent to go with , you can run `git` name of the most that tag, followed letter "g" meaning

able to people. In `version` gives you
ly tagged, it gives

the `-a` or `-s` flag;
e `--tags` option to
t show command,
valid forever. For
ure SHA-1 object

its since your last

you can email to

more this for now.
do this; it's pretty

limitation that
hub's paid plans
covering those

board page. You're

<https://> protocol,
simply clone public
play when we fork

on't already have
the link at the top-

contents of your
d click “Add key”.

can name each
eed to revoke a

an image of your
ew picture”.

username.

: (often used for
this step.

on or “2FA”. Two-factor authentication is more popular than password-only authentication, so it’s a good idea to enable it on your account.

Check your account settings.

ful in helping you

ss, you can “fork”
is entirely yours;

t, meaning that
times creating a
“fork” is simply the
ges to a project

give them push
ck to the original
This opens up a
en communicate

agger Workflow, but
web based tools.

hosted on GitHub

and has found a

mit it back to the

project. Our user
[ychacon/blink](#) and
code change and

we pushed a new

request a title and
good description
do, whether your
prove the original

[er](#) branch (in this
d this branch get

ct you forked will
hat has all of this

this when the
often used in
e you can keep
ened, it's often
thin a context,

ect it or comment
the light to be off

uest (and indeed,
ing this later, but

scussion page we
nd then leaving a
are brought into



epted. Luckily this
and resubmit it to
push, which will
that the old code
ine that has since

Tony has pushed
hat he made the

ng else you

urge pull request

this Pull Request,
introduced to your
automatically shows
Determining What

merges cleanly and
vs up if you have
hub will perform a
ward, it will still

If you merge this

on contributions. This
solution is more
maintainers or
the difference is
the context of the

at the contributor
new commits and
Pull Request in the
hing the “Merge”
quest so that it’s

will want to fix it
now at the bottom

to see if it merges

at there are many,

Pull Requests and
while, you can't have
from any other one,
specific if the Issue
an Issue or Pull
ence something in

created a new pull
one. We also want
different project. We

afe904a
a5a7751

ion needed.

y mentioning it in
uest timeline. This
y link back to the
pull Request in the

an example of how

with the code.

allowing issues:

some lucky:

t

Markdown syntax.
s or descriptions.

me on the branch
simply click the
link to check tasks

and show them as
list with tasks and
This helps people
of the branch.



ack your progress

e out of the other
and so useful that
it to directly reply

you could write

use of emoji
that expresses

ddition to adding
URLs for, GitHub

dependently from
informs you by a

is something that

you forked from
like this:

this work for you
[git](#), then push to
the care never to
repository.

er side: creating,

“New repository”
olbar next to your

e; if you need a

Want to share your
project, since the
HTTP as
>/<project_name>.
called based on the

object, since the
thing. Users will
project if you
URL they would

need to add them
you want to give
so will give them
and Git repository.

x

x

x

operators who also

y can come from
rk are often from
eas with internal

- a list of files that
be Pull Request on

merge in a remote
Pulling Out Remote
this command to

s, provide unified
Pull Request work

site. This will do a
was possible. This
is created. As you
Hub gives you all

etty useful.

eudo-branches on
an obscured way

as a “plumbing”
`ls-remote`. This
to show us what

will get a list of all

`ull/958/head`.” Git uses a pointer to the `FETCH_HEAD` into a card. Also, if you’re

ever you connect to the remote. It should

the remote with the remote that are

on of the refspec.
commit that would
merge before even

an actually open a
ther Pull Request.
for a change that
cess to the target

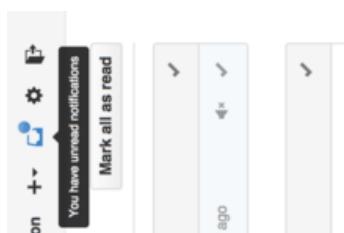
it specifies which
you hit the “Edit”
fork.



bleter can make it

means that this can
g them poll. Very
in their company

the way that GitHub
different ways you can
you can see some



ago	◀	▼
ago	◀	▼

about, grouped by
name in the left
icon next to any

route emails to this
you all the data in
, field would have

that understands
be essentially the
“subscribe” on the

and you read the
you have images

or repository.



We can't automatically
merge these branches.

Don't worry, you can still
create the pull request.

Create pull request

Pull Request sent to
Pull Request.

ject, but there are

[Transfer](#)

[This repository](#)

or if your project

other place, it also
fetches from Git,

a main point of
want if you want to.

on. Like personal
source.

ce of forking it to
reate them either
owner in. You also

alize it a bit. Also
t lists all of your

account.

simply a grouping
nd of access those

side of the page in
s to the team, add
team. Each team
can change that

16 hours ago

16 hours ago

16 hours ago

16 hours ago

e.

any large group or
they may want to

cover how to use

iest way to have

ad-only or moderated a email.		

Enter a URL and a
you want GitHub to
t, when someone

o pushed it, what has tried to make it was successful incredibly easy to

[5c33493*](#)

[bc78c10bc8460c](#)

test your service

does you can listen
[bhooks/](#)

it happen on your
at if you need to

; for doing nearly

ure to use a good application is no

now use this to
because you can

eating, you will be
ests per hour.

e a comment on a
POST request to
an Authorization

inating and setting labels, accessing Pull Requests, and the site and on

with Pull Requests.
to add and query

React to pushes by
l all the tests. You
submitter followed
f things.

that checks for a

each commit that
nally we POST via
tus.

appened, a target
multiple statuses for
ation service like

requests in these frameworks in an idiomatic way.

for your specific needs or common tasks,

and reuse code from others. In complex situations,

at begins with the

functionality, you

`--abbrev-commit` to
defaults to using
the previous:

object. For example,
875,000 commits
whose SHA-1s are

the tip of a branch; it is a reference to a branch, the following command:

```
ab6d...;
```

what any of these commands `rev-parse`. You can run `rev-parse` on

ue only works for
ew months.

g:

reflog as Git's
clearly relevant
else who might

(er) at the end of a
the history of your

ent of HEAD":

parent, so **HEAD~** and
HEAD-2 means
first parents the
and be

ks Git to resolve a
from another. For
selection..



nd into your **master**
experiment—that
r.” For the sake of
diagram are used

than two
several branches that
the ^ character or
commits. Thus, the

es in your query,
e all commits that

are out what is in

commits you want to

raft your commits
1 if you modify a
oned into several
your commits are
g with you.

active shell mode,

after typing nothing

It shows you a list
of the staged diff. This

; if you make two
r, doing so is very
n, type **p** or **5** (for
ach section of the
age them, one by

s are staged and a
it the interactive

you can start the

```
git reset --patch
```

I and for stashing
s on each of these

ate and you want
n't want to do a
to this issue is the

tracked files and
apply at any time

in working on yet,
git stash push:

the changes are stored on your

ng it on the same
branch, switch to
and uncommitted
nfects if anything

staged. To do that,
command to try to
e to your original

quite popular is the staged content in

index file

files as well as the files. If you specify created. However, less; to additionally

index file

from which you
es to modify a file
live it. If you want
<new branchname>,
t the commit you
ops the stash if it

but what has been
a clean build.

re files from your
no retrieving the
ng but save it in a

can do so with `git`
`git clean -f -d`,
l. The `-f` means
`requireForce` is not

`--dry-run` (or `-n`)

ignored. Any file
ed. If you want to

on interactively.

ful in asking Git
directory under
s submodules),
s like that, you

om others on the
as a few ways to

GPG to verify the
file:

DA

9A

hem in its output

commits are not.

when merging a
command.

Workflow, you'll have
n't, you'll end up
n signed versions.
ng this as part of

alled or defined, or
through the code
em.

marize the output
hes there were in

losing method or

like `grep` and `ack`.
in Git, not just the
older version of the

ound in the `zlib.c`
what the bounds
that was made to

language, you can
we done the same
`,/^}/:z!b.c`. You
ort of output.

history. One of the
moment. You can
ing area, you can
d you can rewrite
i. This can involve
commit, squashing

, where you can
ose the editor, the
s it your new last
it.

The process works
changes, and the
commit.
of the commit. It's
it.

commit you want to
edit in the range
you're trying to edit
any commits ago, the

Elude any commit
by providing an

something like this:

you normally see

o run. It will start
introduced in each
the newest, because

, change the word
. For example, to

one. If you change
change to edit. Each

you want to remove
ts are introduced,

the change
you want to make a

you back into the

the changes that exit the editor, Git (f3f6d), applies the commit with that commit with unstaged. Now rebase --continue

project and then
in every snapshot,
backup files, you

lunch pointer at the
subdirectories that
our master branch
ranch on all your

subdirectories that
actory be the new

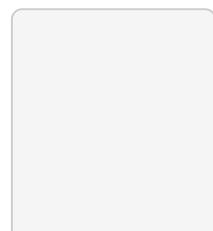
: commits contain
your history, not

`ckout` commands.
under them. They
oy them properly.

it being a content
s", not specifically
a tree, but for our

ed for lower level
here.

ot as Gir's "Staging
red out into your
ed out. You then
it into the tree for



mand that shows

. We'll call this v1
it repository with

as a permanent
er to point to that

name process; first,
ite it in red.

commit,” because
add on it to stage it

to be committed"
different from our

checkout a branch, it
snapshot of that

and committed it a

will always try to

usually undid the last move if you moves the branch tip, you are moving away. You could now

would have done

the index and what

or snapshot HEAD

AD~

default, so if you
and will stop.

ill undid your last
: `git add` and `git`

dex. If you use the

 **old** and **git commit**

mand dangerous,
avocation of **reset**
writes files in the
n a commit in our
mited it, Git still

you tell it to:

king
actory

.txt
2

at command and

nstage a file. (See

” by specifying a
`git reset eb43bf`

file to v1 in the
but actually going
erts that file back

--patch option to
content.

ing commits.

this file". You can
look really smart.
to use **reset**.)

mit added a new
cond commit was

cking
actory

.txt v3

.txt v1

ooks like you had
3 and added file-

ke reset, checkout
the command a

commit B

reset

develop



commit B

out

The HEAD. It is just
commit, but it also

YES
NO

: branch multiple
to date as you go,
at the end of the

systems, Git does
to be smart about
does not try to be
two branches that

: gives you to help
standard types of

u perhaps weren't
simply back out of

the merge. The only
changed, uncommitted

format everything

s of changes that
s pretend that Git

`dos2unix` program

n of the file, their
where both sides
e merge again for

ions in the index
common ancestor,
ng in (“theirs”).

`git show` command

than the `ignore`-
merge instead of
a few lines with
changed between
directory that

maybe manually

branches that each

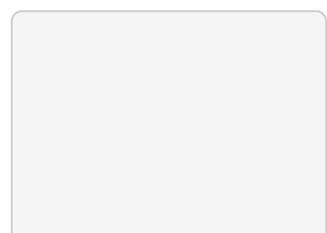
see others that live

the file again and
markers and try to

diff3, Git will use
“theirs” versions,

you get context on
member why two
sometimes.

h involved in this



development each

we add the `-merge`

ach line. The first
“ours” branch and the
“theirs” branch

ng copy but were
m in there for our

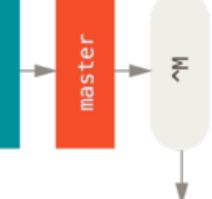
: it's a little more

y mistake. One of
, it's possible (and

identially merged

: out what's going

here it was before



's as if the merge
history. Git will get

f you add work to
;

what is called the
er however. Let's

mode of merging.
are passed with a

dd merge conflict
you would prefer
ng you manually

one side and “holo
conflicting changes

riier by running

om the other side
ifferent from the

both branches as
cord as the result

ult of the merge.

`e/master`.

own project in the
different project

ically. You can also
n and then merge
n them upstream.

workflow without
with other related
It is nice in some
her drawbacks in
es or accidentally

rack subdirectory
you can't use the
want to compare

ches together into
you can rewind the
out having to re-

repository, but the
e named `hello.rb`

use it should look
gs. Normally, you

er with git rerere

[diff](#) again to see

'Hello mundo'
'Hola mundo'

ad. We can move

it by just running

can now add and

in V)" ,

```
VERBOSE = $(V)
) VERBOSE
VERBOSE = 0
```

```
LD_VERBOSE),1)
```

line. The next two
ored date of that
e the line number
prefix designates
l unchanged ever
ways that Git uses

are you copied the
is you the original

don't know what is
where you know
es a binary search
commit introduced

you're getting bug
ent, and you can't
ou can reproduce
find out. First you
ne system that the
m good state was,

where the issue was
committed information
that may have

where you were

; sure every client
s that any custom
e.

git repository as a
your project and

project and a few

that we're working
absolute or relative
I a library called

ortant to note that
ushed and pulled
where to get the

will first try to
if possible. For
o pull from, use
ocally with `git`
hen applicable,

`diff` on that, you

it basically means

by default you get

tered for path

```
'8892c7b29bc'
```

ited earlier.

ecursive-submodules
submodule in the

actually modifying

and run `git fetch`

can see that the
don't want to type
at by setting the

s “stable” branch,
just in your local

`^4585aee6687``

probably makes more

commits” on the

gitmodules file and
to commit to our

`submodule update`
the submodule you

`merge` option to our module and it gets

`'362ab5ea'`

merged into our local
to the library and

whatever remote

module update that
your submodule

checkout:

the path

at you know when

ule changes up as
nce they will have
only exist on our

submodules have
akes the `--recurse`
“check” option will
shed.

pushing the main
also fail. You can
and.

ay run into some
tted to diverging

is the commit that
1d76 as the merge
e and checkout a

I'll have to merge
n create a branch
ake a nicer merge

and SHA-1 from **git**

in the submodule
possible solution. It
training these two

works and you have

a submodule. This

the main project.
is may be useful.

quite long and you
red setting up Git
I plan on working

"

ules, or `git spush`

due:

where those files are

FTP, SSH, etc), there
quite useful.

scenarios. Maybe
os you're working
ons. Maybe your
r for the moment,
[a format-patch](#).

will package up
and into a binary
ther repository.

a specific range of
elsewhere else, you

talk it over.

the project. You can

whatever branch

via a bundle on a

to our partner, she
alone there in the
imports it into her
the file is actually
properly.

ch as well as any

s when you don't

e to commit four -
- that will be the

try and then push

dry:

dry

story down so it's

ually meant to be
smaller jobs. On
o do really low-
about plumbing

on top of that with
a `commit-tree` and
to keep, `9c68fdc`:

commit that now has
an push that new
only see the most

wants the entire
should have to add a

replace and then
mit in the master

place one commit
tt, blame, etc) will

the `c6e1e95` commit
will show you the

`9c68fdce` as
`9c68fdce`), not

me. None of the
5 minutes.

never expire. This
have to type in your
stored in cleartext

credentials in the
he credentials on
that stores HTTPS

er for Windows.”
indows Credential
[om/Microsoft/Git-](https://docs.microsoft.com/Microsoft/Git)

For the `get` action, I don't know anything about the provided properties of assignment.

straight for git-

not much of a leap by Git cover many credentials that are stored directory, but often. None of the there are several key

operations, so we'll

[credential-store](#).

pass a custom path

as long as Git can
per.

ut file. The default

stored in the **known**

protocol and host

PATH and mark it

is specific to each

repository (`.git/config`)
single repository,
level you want to

level, so values in

es by manually
r to run the `git`

d server-side. The
ferences. Many,
ul only in certain
to see a list of all

port (for the sake of
issue or bug tracker

run `git commit`, set

message when you

g they are.

setting your GPG

tag command:

untracked files or

do it. If you set

presents tenths of
before executing the

command output
ference.

you don't like this

`allow, blue, magenta,`
choose from `bold`,

as shown in this
merge-conflict-
rate setting up the
because it's a nice

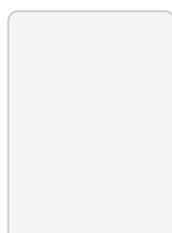
I'll be able to do so.
For Windows, you'll

scripts to run your
will be where your
calls your binary

`tool.<tool>.cmd` to
exit code of that
to tell Git what

run the command
ol.

ge tools easily. For
all you have to do



ving to set up the

merge resolution,

KDiff3 for merge

problems that many
systems for patches or
silently introduce
replaced. Git has a

(vice-versa), you'll
use both a carriage-
return and a linefeed.

inary whitespace
ed by default but

the end of a line;
, which looks for

`-tab`, which looks
h option); `tab-in-`
`ol`, which tells Git

values you want
nt of its name, or
f you want all but
and to cover both

t, but there are a

; SHA-1 checksum
ensive operation,
f you want Git to
ve.fsckObjects** to**

) make sure faulty

or otherwise try to
e remote branch

ettings only for a routes and are set project) or in the project.

ndividual files or content before you es you can set on file.

inary (in cases it out how to handle ple, whereas some

s binary data. For ; basically a JSON records your build don't want to treat

manually, right?
ing line in your

” filter when you
it up. Here you’ll
eadable text files,

forge.net/projects/
I can find it. Next,
eate a file that’s

ce code as the
early any type

an image or
n (VCS) is a
state, revert
see who last
use and when,
- lose files,
erhead.

Other
proach is very
is easy to
or copy over

which is correct.
S.

One way to do this
a that is recorded

ose systems. The
about the commit
ect text into a file
ributes offers you

omaticaly. If you
t branch, Git will
the SHA-1 of the

a.txt'

b.txt'

eC.rb

the indent program
backs them back out
when it comes in. This
is good for consistency.

With this properly, you
can work on this project, and

Now, you need to
format into any \$Date\$
or language you're

. You have to be
with the project,
design these filters,

an archive of your

hive. If there is a
do want checked

it doesn't make sense to
line to your Git

`git`, and `git log` can

MIT

and
..

we it isn't suitable

pts when certain
server-side. Client-
server-side hooks
hooks for all sorts

st projects, that's
e hooks directory
ey also document
some Perl thrown
them in Ruby or
dled hook scripts,

ry that is named
ard, it should be

ually isn't useful for generated, such as commits. You may on.

file that contains aborts the commit before allowing a This hook to check

doesn't take any generally, this script

invoked by the `git` skip to the next one of these may

of the temporary

ng in large binary
something along

store data in the
wise validate the
the working tree

ed but before any
parameters, and a
tes before a push

ng **git gc --auto**.
and can be used to

hooks as a system
s run before and
ne push as well as

checks for a custom
categories in a project.
jected and server

inertia, but also
any language will
o you can also see

update hook runs

aking the `$newrev`
`rev-list`. This is
ues and no other
commit SHA-1 and

message for it, and
to test. To get the
We'll go over all
t command gives

have messages that

at specifies which
; have full access,
nforce this, you'll
erver. You'll have
ne commits being
ose files.

like the CVS ACL.

data structure that

paths the commits

, for each of those
g has access to all

classified files outside

update script exited

, and it tells you

commit containing
to push a commit

o match:

it with a message

the proper pattern,

ferences. First, the
try, not from your

have been changed.

This tool allows features of Git and means you can do cloning, and so on, a good way to sneak in while efficient while the migration bridge is the

takes quite a few workflows.

version, which is a linear history; and merging, it's better and avoiding doing

Git repository to have only a single linear history. If you're using SVN and doing so will make

inal repository to
hour, even though
; and then push it
y to do this.

can go through a
entire Subversion

time, and comment
ally take hours or

follows the basic
differently, you can
rt with **-S**, which
uivalent:

nes and tags:

ct and push your
e of the files and
version server:

ay you work with
to the Subversion

1 committed now
server, you have to
commit data.

push, and then the
until you merge in

even if you're not
`git svn rebase` does

)

to date. You need
ive local changes,
`git svn rebase` –
conflict.

branches, do work
`git svn`, you may
thes together. The
with merges like
s into Subversion

ng it much, that's
ng **git** **svn**.

es/opera...
est-

)

Subversion and
you out into that

culations will be
`merge --squash`.
this information,
r. To avoid issues,
κ.

o Git by providing
v commands that

u can run `git svn`

the Protocol

to Subversion in

it svn info:

You're the only Git project.

otherwise in a should consider it you and your

merge. Rebase any

eed up clones for **d** entry. You may a **git-svn-id** and

rable. However, if

.org/ and install it

Fortunately, everyone uses to

ical workflow. As

under the hood it's
`fs/hg` directory is
`es/default` is a Git
`aster` points to. So
added distinction

shes to Mercurial

erial and Git use a
t a `.gitignore` file
cal to an on-disk
oy it over:

branch, and you're
nt now:

a `makefile`

ie

k with the rest of

In Mercurial, this
is a Git branch.

reset is made on is
history. Here's an

doesn't need to; both
to understand the

the Git side, with
of remote helpers).

in the **branches**

checkout, commit,
is that Mercurial
repository looks like

branch, but the old
one using Mercurial,

it is painless. If you
you may not even

and is part of the
g as with Git, you
t have the same

block use. That's why

branches, and `git-`

nevertheless, it is

" rule.

expression (Git only

in you can simply

e

exactly the same

`.gitignore` to make
`ignore` file were to
able to interpret
files as the ones
link, you'll have to
adapt the latter.
e a file if a parent

mands. Supposing

working across the
server, that the remote

It's been around
designed with the
ever, and only one
l-suited to several
child actually work

one we'll cover is
subtrees of your
ridge that lets you
server.

<http://git-fusion.com/git-fusion>),

ice.

Right #

Next, we'll create
a connection to the machine),

clone. Here we're
credentials for this
ent requests.

This is actually fairly
y on the Perforce

users, and which
commit, Git Fusion's
full name stored
by default is to look up
the user's name, and submit the
'will do just fine,

mapping. The first
. This is useful if
email addresses),
it commit from a
ship information.

: Git commits that
t want to publish
full names should

mission is converting
events locally on the
time. Subsequent

might work with.
anch that tracks

eb15 commit was
it's point of view,
mmit:



ame concepts as a
the directory tree
we have a visual
of this graph is at

entials, of course).
do most of what

t-p4. As of this
[ds/Perforce/20-](#)

on OVA as shown
in control.

to set a couple of

self, and you can't

important feature,

the state at

er. Let's check if

`sync` followed by
multiple branches,

to Perforce. The
commit between
parts of the file look


```
#head
```

what actually did

et; if you want to
ve rebase before
were submitted as
mit it converts:

its, then a merge
t these on top of a
ubmit now:

john_bens-

submit command
changesets, which
rver. That sounds

“main” and “dev”

; smart enough to
fix shallow clones
than one branch,

can only sync and
If you merge two
is a bunch of file
be lost.

pretty good at it.
you’re only using
remote that other

flexibility. With the
ver the difference
e are no artificial
y mature, since it
ll need access to
udio (any edition
..

uch runs on any
rough JGit (a JVM
of Git functions.
ort branches, for

le over the other.

ng with these
on repositories,
n.codeplex.com)
h good choices

which Git commits
you can see with a
so exists in TFVC.
tag false) – git-if

\

starting point of the
: the **tfss** “remote”
. Git-tfs maps the

of tags, git-tfs uses
tion that your Git
to TFVC.

d you're ready to

me \

TFVC server. First

of converting each
options open, we
pull --rebase.

\

oice of making a
(which is the default)
'll just create one

of the same TFVC
of headaches.
y with TFVC, only

we've made to the

server. We'll use
path from HEAD
changeset, sort of

the remaining work
from the commit
there's nothing to
sharing Git commits

as work items,
with these features
checkin tool very

exists, and this is
branch, but **HEAD**
want to base your
commit.

now you to use the
server, and make

nt to map this to
authors. Create a

uthor information,
achine with `grep`,
you can add the

. You can also tell
`grep --no-metadata` to
adata, feel free to

're, either.

ean up the weird
ther than strange

```
gs); do git
```

emotes/tags/ and

```
do git branch
```

: (where xxx is a
ion feature called

rt.

I since Git is a bit
ward, using a tool

u want to convert:

than Git for what
Generating this is

) convert, and the
s are specified by
verts them into a
y verbose.

for the

jin

1

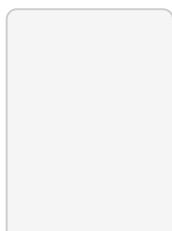
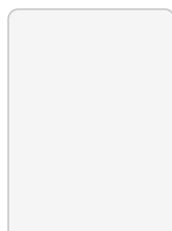
neck whether it is

a few seconds to a

that you have two
the working branch

he same files that

migration:



, configured with
to `git p4 clone` to
s.

`log`, you can see

changed, but the

the highest-fidelity

this format.

side of the equals

VCS project you're

ect_git

nit messages. The

-all

riting with "git-tfs-

data. As you may snapshot of content, emit data points to one at a time and the previous one.

use it's what we pretty easily in to **stdout**. And, if introduce carriage line feeds (LF)

each of which is a story and print the

e for the commit
e it out. The next

ing from another
be expressed in a

d finally the data.
u create a helper

se you have each
ntents of each file

as the way you

the next iteration:

I add one extra
acters while **git**
git fast-import

ctory you want to
-arting point, and

ics about what it
nch. Now, you can

`; checkout, branch`,
item rather than a
and were designed
generally referred to
as called “porcelain”

exclusively with
user-level plumbing
demonstrate how
to do it manually on the
scripts.

repository, which is where
you can check out, update,
up or clone your
git repository as you need. This
is what a newly-

at the core of Git
of content into a
r to retrieve that

takes some data,
e unique key that
ing in the **objects**

in it, but there are

n the `git cat-file`
Passing `-p` to `cat-`
appropriately:

With content in files.
new file and save its

form of storing the content in a manner and blob objects, one or less to inodes is the SHA-1 hash of the most recent tree

commit on your



the state of your object, you first entry — the first **index**. You use this

well:

`new.txt`. Write out
what it looks like:

ree

..txt

"ion 1"

rent snapshots of
member all three
about who saved

that came directly

you created. Oddly
hand, if you run it

about using any of
dd and **git commit**
dites out trees, and
ame immediately
re initially stored
example directory

to your Git object
v to store a blob
ting language.

is case, a blob. To
ntent, and adding

ne the path of the
the subdirectory
y, you can use the
open the file with
a `write()` call on

mmmit is, you can

value in your Git

e safer command

149b0
new file"

baae
version 1"

-ref command to
reference you want to

SHA-1 of the last

symbolic reference, we
value but rather a
like this:

(its), but there is a
date, a message,
commit rather than a
same commit but

.. You can make a

is more complex,
uses a reference to

tag created points

note and push to it,
remotes directory.
::

, so all these files
the repository to
file from the Grit

```
o.rb >
```

ted for your new

gle line to the end

pproximately 7K).
t only as the delta

ed a “loose” object
inary file called a
e too many loose
ote server. To see
rc command:

l is that although
in size, the new

nd sized similarly,
o the packfile and
u to see what was

or `repo.rb` file, is
column in the output
file, but that **033b4**
is the one that is
you're most likely to

occasionally repack
manually repack at

al references, but
sections and had

le, specifying the

one-time only fetch,
er branch on the

several branches

forward reference.

QA team get their specs to push.

or, they can run

they can add a `push`

remote `qa/master`

ocol is likely what
ode on the server
quests, where the

secure or make
refuse to use it.
bit further on.

en by the **update-**
ok in order for the

that the commit

et a 404 response
e repository, or it

iles there – this is

server. Git checks
.D reference you

ta from the client
, but it requires a
figure out what the
; of processes for

accesses. The `send-`
ite side.

defined as a URL
connection over SSH
t looks something

and SHA1, the new
hashing capabilities. The
server is running the experiment
on the right side.

Finally, the server



is bit different. The

are different. In
the client knows

In the objects that
already has with
load-pack process

success or failure,

which includes many
outside the scope of
client and server; if
source code.

pact, clean up an
enarios.

one, this command
(or file) or too many

`refs/heads`. To get
`refs` directory and
reference in the `refs`

reality above is an

branch after
something from.

here is not much
n run `git log -g`,

branch used to be, some reason not in log. Now the first

reflog. How can which checks your objects that aren't

es every commit
ce. If you do this
mit, you're fine –
k onto your new

next commit, find
history:

..tar.gz

at 5MB. Before the previous commit will have to clone get rid of it.

you didn't; how `gc`, all the objects command called `git gc` can also pipe it files:

ng History, except
e modifying your

ove it with `git rm`
his way is speed –
filter, the process
if you want. The
ng to remove isn't
[30847](#) commit up,
om the beginning

l a new set of refs
o, so you have to
t has a pointer to

ables to determine
they can be used
the environment

ectory tree until it

ry. If you access
a slow network
especially if Git is

repository. If `--git
one` is specified, the

usually resides at

`/one:/dir/two:...`)

If you happen to
be used to avoid

n't set. If *this* isn't

tells Git to emit all
command line.

necessary if you're
middle of setting

es per second for
e values override

added, and all you

This includes the

'-og' '-graph'

'-ph' '- -'

now-diff-func-

s how long each

git

connect to an SSH
that this isn't the
parameters, so
easier just to use the

commands you've
already learned
should make it
easier to create
tools and helper

use as more than
just simple
commands.
You can even
implement your own
advanced ways.

`log` and `git grep`.
past, or visualize

type:

the underlying `git`
to show commits

A dot represents a
box. The yellow
a commit. At the
a summary view

est to invoke from

text box and click the last commit by with the contents commit message,

a specific purpose necessary for that

for macOS. These Git's functionality, together. They look

"with your best friend."
Joyfully build with LEGO.
With themselves, something
the shoulders of a thousand

realized something was

single product in this
documentation),
(time) is in order.

pository (either by

and select which
tly below this; on

on Git tasks. The
this in more detail
uch, and (b) you'll

here's a button at
g widget:

elopers and non-developers, and the best practices may be different, or you may recommend you use

specialized, single-purpose Git website clients/guis. A more detailed explanation can be found at <http://git-scm.com>.

Git is built directly into the command line interface, but they are a good match for this feature, and the

he "Add" link and repositories leads [Visual Studio..](#) This end most of your your teammates,

history view, a diff
mentation of this
[50437.aspx.](#)

to Git operations.
ther... and select

lications you have

Sublime Text. (This

<https://immetext.com/docs/>

r experience with

the prompt, and
g argument. Now
project:

contents of [git-](#)

terminal window,
well, of course; just

s with Git, called
`t-prompt.sh` for

letter. One of them
`/zsh`. oh-my-zsh's
prompt "themes",
`theme`. is just one



o set your local
restricted). If you
be digitally signed
er" set to Internet
istrator and want
mal user, without

[powershell/module/](#)

[powershell/module/](#)

Force

alled, you can use

[powershell/gallery/](#)

d uncompress it.

the next time you
ved in the prompt
mary-information
om/dahlbyk/posh-

ng your everyday

ment on a separate
f these processes
(es) can be quite a

implementation of
u can find it at

on this) to get the
which represents
actually a “parent”
“child” types is the
`object_type(commit)`

uses a `git_oid` type;

call will probably
error.

will become invalid

ogit2. Fortunately,
y to work with Git
ne above example
can be found at

h newfile.txt.

is uses the tip of

.

then use to get a

container for the

your own ODB
; you fill in the

context, and
a look at the
signatures; your

a few of the more
languages, including
a crucial collection of
The code we'll
HEAD (sort of like

git2/libgit2sharp)
en taken to wrap
am looks like:

book. If you want to use GitHub's libgit2 library instead, check the bundled code here.

A library called JGit. It is widely used in Java and can be found at [here](http://www.eclipse.org/jgit/).

g code against it. Using the following

The Git command-line interface provides direct access to Git's internal objects.

You'll want to do this for other storage

repository, whether or not environment variables are set. For example, you can run `git ls-tree -r .` to see the contents of the current directory and its subdirectories.

Quick sampling:

actual master ref, information about the direct reference of objects are also being that it points to

`ObjectId` instance. This list in Git's object syntax (for more on this, see the `ObjectLoader` class), and JGit will

example, we call `ObjectLoader.load` on the array. For large `Stream`-like object

`ffUpdate` instance,

ne" ,

',

ject that lets you
In this case, we're
alsProvider object

ited to add, blame,

form mutations on

you want more
[-d/go-git.v4](#), and a

is hosted under
(local and remote)

preference before

at expand to long

ent coming in and

ith Git about any
; in this appendix,
an always run `git`

use it to find more

repository, adds a
runs a `git fetch`
working directory

we'll just list a few

we go through a

git repository with

`s` option to make

that are somewhat

yet committed. In
en these stages.

simplified forms.
h the `git status`

o trees. This could
`it diff` by itself),
two commits (`git`

anges, where we

--check option in

the `git diff A...B`

ifferent stages of

ound and how it's

ell by the verb. It
rea and can also
kes it possible for
it before using it.

where we use it to

oted to explaining

so use `git merge`

ing and merging

bl. It can list the

ughout the entire
most of its other

nto your working

you have issues

implement your own

ect from the most
he branch you're
which to traverse.
mit level.

ory of a project.

History. There we
commit and the
e simple date and

in the code history.

practice in [Tagging](#)

with the `-v` flag in

of the commands
will changes from

es down all the

n to it in order to

e what your local
e other repository.
mehow.

over the basics of
pushing specific
automatically push
e server with **git**

to share work on

aring Tags.

ck that all of our
n be really helpful

ormal repositories.
mand has several

ay. Normally you

various revision

merging to extract

as the last one to
. This is helpful in
our code.

of the files in your

es in terms of the
e commands help

a new commit that
getting, essentially

Git has a number
you can easily email

diff command. It is

ying Patches from

format-patch over

the git send-email

body to email to
, how to integrate
and send the

Public Project.

nsistencies.

ches have been as

age to and how to

recovery.

o certain patterns,
e subdirectory for

several different

