Backup

## Exploring the Object Database

For Windows users, Git installation will install a special command shell called *Git Bash*. To test your installation, open a new command prompt and run

$ git --version.

**[15] ~/grocery (master)**

**$ git cat-file -p a57d7**

**tree a31c31cb8d7cc16eeae1d2c15e61ed7382cebf40**

this plumbing command lets you peek into the Git objects; with the -p option (which means *pretty-print* here), we ask Git to show an easier way to read what the contents of the object are.

**$ git cat-file -p 637a0**

**banana**

You can see the contents of any commit like this:

$ **git cat-file** commit 5bac93

if you have the hash of a blob, you can look at it's contents.

$ git cat-file -t 54196cc2

$ git cat-file -s 54196cc2

$ git cat-file -p 54196cc2

You can examine the contents of any tree using ls-tree

$ git ls-tree 92b8b694

All of these objects are stored under their SHA1 names inside the git directory and the contents of these files is just the compressed data plus a header identifying their length and their type. The type is either a blob, a tree, a commit, or a tag.

$ find .git/objects/

The simplest commit to find is the HEAD commit, which we can find from .git/HEAD:

$ cat .git/HEAD

ref: refs/heads/master

$ cat .git/refs/heads/master

c4d59f390b9cfd4318117afde11d601c1085f241

$ git cat-file -t c4d59f39

commit

We can list all the heads in this repository with linkgit:git-show-ref

$ git show-ref --heads

$ git show-ref --tags

Computes the object ID value for an object with specified type with the contents of the named file

$ git hash-object

The ever-versatile git-show command can also be used to examine tree objects, but : git-ls-tree will give you more details

The "commit" object links a physical state of a tree with a description of how we got there and why. You can use the --pretty=raw option to git-show or git-log to examine your favorite commit.

A commit is usually created by git-commit, which creates a commit whose parent is normally the current HEAD, and whose tree is taken from the content currently stored in the index.

The Git command git cat-file -p will print the object given as an input. Normally, it is not used in everyday Git commands, but it is quite useful to investigate how it ties the objects together

$ git cat-file -p HEAD

We can now see the commit object, consisting of the root tree (tree), the parent commit object's ID (parent), the author and timestamp information (author), the committer and timestamp information (committer), and the commit message.

A tag object contains an object name (called simply 'object'), object type, tag name, the name of the person ("tagger") who created the tag, and a message, as can be seen using git-cat-file.

$ git cat-file tag v1.5.0

git-tag can also be used to create "lightweight tags", which are not tag objects at all, but just simple references whose names begin with "refs/tags/"

$ ls -al

**$ git cat-file -t 11b8b15**

**$ git cat-file -p 11b8b15**

**$ git checkout -**

**Switched to branch 'berries**

New trick: using the dash (-), you actually are saying to Git: "*Move me to the branch I was before switching*"; and Git obeys, moving us to the berries branch

The index is a binary file (generally kept in .git/index) containing a sorted list of path names, each with permissions and the SHA1 of a blob object; linkgit:git-ls-files[1] can show you the contents of the index:

$ git ls-files --stage

The **git commit** command does a few things:

1. Create blobs and trees to represent your project directory - stored in .git**/**objects

2. Creates a new commit object with your author information, commit message, and the root **tree** from step 1 - also stored in .git**/**objects

3. Updates the HEAD ref in .git**/**HEAD to the hash of the newly-created commit

We can ask git about particular objects with the cat-file command. Note that you can shorten the shas to only a few characters to save yourself typing all 40 hex digits:

I made a commit without first making git add; the *trick* is in the -a (--add) option added to the git commit command, which means *add to this commit all the modified files that I have already committed at least one time before*. In our case, this option allowed us to go faster and skip the git add command.

**$ ls -al .git/**

**$ ls -al .git/refs**

**$ ls -al .git/refs/heads**

**$ cat .git/refs/heads/master**

**0e8b5cf1c1b44110dd36dea5ce0ae29ce22ad4b8**

Git manages all this articulated reference system... with a trivial text file! It contains the hash of the last commit made on the branch

As branches are, HEAD is a **reference**. It represents a pointer to the place on where we are right now, nothing more, nothing less. In practice instead, it is just another plain text file:

**$ cat .git/HEAD**

**ref: refs/heads/berries**

The difference between the HEAD file and branches text file is that the HEAD file usually refers to a branch, and not directly to a commit as branches do. The ref: part is the convention Git uses internally to declare a pointer to another branch, while refs/heads/berries is of course the relative path to the berries branch text file

*In Subversion, we usually have different folders for each different branch.* When you switch a branch, Git goes to the commit the branch is pointing to, and following the parent relationship and analyzing trees and blobs, rebuilds the content on the **working directory** accordingly, getting hold of that files and folders

This gives us an object ID, but before we can inspect items in the object database, we need to know what type of object it is. Again, we can use the -t flag:

$ git cat-file -t 022d0352de4

tree

Of course, change the object ID to an object from your database (don’t forget to combine the folder name with the filename to get the full ID). This will output the type of commit, which we can then pass to a normal call to git cat-file.

git cat-file blob 7a52bb8

My object was a blob, but yours may be different. If it’s a tree, remember to use git ls-tree to turn that ugly binary data into a pretty directory listing.

$ git ls-tree 022d0352de4

100644 blob 1d09ca3ac33e045ccde753b47f81a9e980c90774 .gitconfig-template

100644 blob 139597f9cb07c5d48bed18984ec4747f4b4f3438 .gitignore

100644 blob 812e4df6163374ffb1ffbd1dac2cf8ec5460684e Basic-Tutorials-master.zip

040000 tree b9e065e8380804fcc424dc08128b3163ecf3ae6b Chapters

100644 blob 42ca1cef8e65effe2ad5bae228bcfc406c058f85 Links.txt

100644 blob 3aa637263b63eaaa57a2f34419374cfe7fc0701a Separating Collated Code with Branching Strategies.docx

040000 tree ba6aabea140dfdd02d0b4d84844dbe95410a78dd book-svg

100644 blob 2c6500fd68bb673ba4a5f571ced1e9cbdee31bf9 borderl.txt

100644 blob 6f6305ebd02adcfc9967d396246d5b0bc0183e37 instaLL.rtf

040000 tree e950201e1a88e43226e5d497656125936a514286 ppt

100644 blob 87701586a37307d58549e39dcdfc70bd8db51936 script.sh

100644 blob 0fe633e30c461e9e5e08d545fe06d909243955dd txt1.txt

Any file is compressed and transformed into a blob before archiving it into a Git repository. Each file is marked with a *hash*; this hash uniquely identifies the file within our repository, and it is thanks to this ID that Git can then retrieve it when needed, and detect any changes when the same file is altered (files with different content will have different hashes).

SHA-1 hashes are unique

**$ echo "banana" | git hash-object --stdin**

**637a09b86af61897fb72f26bfb874f2ae726db82**

The git hash-object command is the plumbing command to calculate the hash of any object; in this example, we used the --stdin option to pass as a command argument the result of the preceding command, echo "banana"; in a few words, we calculated the hash of the string "banana",

**Using the git log command again, we can enable x-ray vision using the --format=raw option:**

**$ git log --format=raw**

**$ git cat-file -p a57d7**

**the output is the same of git log --format=raw**

You can initialize a Git repository anywhere with the git init command. Take a look inside the .git folder to get a glimpse of what a repository looks like.

$ git init

Initialized empty Git repository in C:/temp/demo/.git/

$ ls -la .git

total 11

drwxr-xr-x 1 asaki 1049089 0 Jun 22 13:50 ./

drwxr-xr-x 1 asaki 1049089 0 Jun 22 13:49 ../

-rw-r--r-- 1 asaki 1049089 130 Jun 22 13:50 config

-rw-r--r-- 1 asaki 1049089 73 Jun 22 13:49 description

-rw-r--r-- 1 asaki 1049089 23 Jun 22 13:49 HEAD

drwxr-xr-x 1 asaki 1049089 0 Jun 22 13:49 hooks/

drwxr-xr-x 1 asaki 1049089 0 Jun 22 13:49 info/

drwxr-xr-x 1 asaki 1049089 0 Jun 22 13:50 objects/

drwxr-xr-x 1 asaki 1049089 0 Jun 22 13:49 refs/

The special HEAD pointer that refers to the branch/commit currently being checked out

* The tree object:

There are many ways to see the objects in the Git database. The git ls-tree command can easily show the content of trees and subtrees, and git show can show the Git objects, but in a different way.

We can also specify that we want the tree object from the commit pointed to by HEAD by specifying:

$ git cat-file -p HEAD^{tree}

The special notation HEAD^{tree} means that from the reference given, HEAD recursively dereferences the object at the reference until a tree object is found. The first tree object is the root tree object found from the commit pointed to by the master branch, which is pointed to by HEAD.

A generic form of the notation is <rev>^<type>, and will return the first object of <type>, searching recursively from <rev>.

* The blob object:

The branch object

we can take a look at the branch inside the .git folder where the whole Git repository is stored. If we open the text file .git/refs/heads/master, we can actually see the commit ID that the master branch points to. We can do this using cat, as follows:

**$ cat .git/refs/heads/master**

**13dcada077e446d3a05ea9cdbc8ecc261a94e42d**

We can also see that HEAD is pointing to the active branch by using cat with the .git/HEAD file:

**$ cat .git/HEAD**

The branch object is simply a pointer to a commit, identified by its SHA-1 hash.

The tag object

There are three different kinds of tag: a lightweight (just a label) tag, an annotated tag, and a signed tag. In the example repository, there are two annotated tags:

**$ git cat-file -p v1.0**

As you can see, the tag consists of an object—which, in this case, is the latest commit on the master branch—the object's type (commits, blobs, and trees can be tagged), the tag name, the tagger and timestamp, and finally the tag message.

There are many ways to see the objects in the Git database. The git ls-tree command can easily show the content of trees and subtrees, and git show can show the Git objects, but in a different way.

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The HEAD in Git is the pointer to the current branch reference, which is in turn a pointer to the last commit you made or the last commit that was checked out into your working directory. That also means it will be the parent of the next commit you do. It's generally simplest to think of it as **HEAD is the snapshot of your last commit**.

$ cat .git/HEAD

ref: refs/heads/master

$ cat .git/refs/heads/master

e9a570524b63d2a2b3a7c3325acf5b89bbeb131e

$ git cat-file -p e9a570524b63d2a2b3a7c3325acf5b89bbeb131e

tree cfda3bf379e4f8dba8717dee55aab78aef7f4daf

author Scott Chacon 1301511835 -0700

committer Scott Chacon 1301511835 -0700

initial commit

$ git ls-tree -r cfda3bf379e4f8dba8717dee55aab78aef7f4daf

100644 blob a906cb2a4a904a152... README

100644 blob 8f94139338f9404f2... Rakefile

040000 tree 99f1a6d12cb4b6f19... lib

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It's simplest to think of it as the Index is the snapshot of your next commit.

Git populates it with a list of all the file contents that were last checked out into your working directory and what they looked like when they were originally checked out

$ git ls-files -s

100644 a906cb2a4a904a152e80877d4088654daad0c859 0 README

100644 8f94139338f9404f26296befa88755fc2598c289 0 Rakefile

100644 47c6340d6459e05787f644c2447d2595f5d3a54b 0 lib/simplegit.rb

Again, here we’re using git ls-files, which is more of a behind the scenes command that shows you what your index currently looks like

$ git cat-file

$ git ls-files

the plumbing command, *cat-file*. You use two options here:

-t = type—shows the type of the object

-p = pretty—prints information about the object

This is why we use the git cat-file –p command, which decompresses them on the fly for us

**$ ls –al**

**$ ls -al .git/**

**$ ls -al .git/objects**

**$ ls -al .git/objects/63**

Therefore, any content in **git** can be looked up by it's hash:

git cat-file -p 4bb6f98

$ cat .git/HEAD

ref: refs/heads/master

$ cat .git/refs/heads/master

e9a570524b63d2a2b3a7c3325acf5b89bbeb131e

$ git cat-file -p e9a570524b63d2a2b3a7c3325acf5b89bbeb131e

tree cfda3bf379e4f8dba8717dee55aab78aef7f4daf

author Scott Chacon 1301511835 -0700

committer Scott Chacon 1301511835 -0700

initial commit

$ git ls-tree -r cfda3bf379e4f8dba8717dee55aab78aef7f4daf

100644 blob a906cb2a4a904a152... README

100644 blob 8f94139338f9404f2... Rakefile

040000 tree 99f1a6d12cb4b6f19... lib

# Chapitre 3

### Bare repositories --- git init --bare

git init --bare <directory>

Initialize an empty Git repository, but omit the working directory. Shared repositories should always be created with the --bare flag (see discussion below). Conventionally, repositories initialized with the --bare flag end in .git. For example, the bare version of a repository called my-project should be stored in a directory called my-project.git.

The --bare flag creates a repository that doesn’t have a working directory, making it impossible to edit files and commit changes in that repository. You would create a bare repository to git push and git pull from, but never directly commit to it. Central repositories should always be created as bare repositories because pushing branches to a non-bare repository has the potential to overwrite changes. Think of --bare as a way to mark a repository as a storage facility, as opposed to a development environment. This means that for virtually all Git workflows, the central repository is bare, and developers local repositories are non-bare.

### git clone -mirror vs. git clone -bare

#### git clone --bare

Similar to git init --bare, when the -bare argument is passed to git clone, a copy of the remote repository will be made with an omitted working directory. This means that a repository will be set up with the history of the project that can be pushed and pulled from, but cannot be edited directly. In addition, no remote branches for the repo will be configured with the -bare repository. Like git init --bare, this is used to create a hosted repository that developers will not edit directly.

#### git clone --mirror

Passing the --mirror argument implicitly passes the --bare argument as well. This means the behavior of --bare is inherited by --mirror. Resulting in a bare repo with no editable working files. In addition, --mirror will clone all the extended refs of the remote repository, and maintain remote branch tracking configuration. You can then run git remote update on the mirror and it will overwrite all refs from the origin repo. Giving you exact 'mirrored' functionality.

the --bare option to create a copy of a Git repository with no working directory