

# Git Basics



## Learning Goals

- Initialize a Git repository with `git init`.
- Check the status of a repository with `git status`.
- Track file changes with `git add`.
- Create a commit and apply a commit message with `git commit`.

## Introduction

In the previous lesson we learned what a Version Control System (VCS) is and that it can help us do things like back up our work, undo mistakes, and document the changes we've made to our project.

In this lesson, we'll begin learning how to use one of the central Git workflows: saving and tracking the changes we make. The basic process consists of the following three steps:

1. Initialize the project directory as a Git repository.
2. Tell Git to track the changes we make to individual files.
3. When we're ready, tell Git to save the changes.

The process is outlined in this diagram:



Source: <https://dev.to/sublimegeek/git-staging-area-explained-like-im-five-1anh>  <https://dev.to/sublimegeek/git-staging-area-explained-like-im-five-1anh>

The "working directory" is what we call our project folder once we've created it and initialized it as a Git repository. From there, we can *add* files to the staging area, which lets Git know that we want them to be tracked in our history. Finally, once we're ready to actually save the changes

we've made to those files, we *commit* them.

Let's walk through each of these steps in turn.

## Initialize a Git Repository with `git init`

There are 3 different ways we can create a Git repository:

1. Create a new project on our local machine and initialize it as a repo.
2. Create a new project in the cloud (on GitHub); in this case, the project will be initialized as a repository automatically.
3. Copy an existing project from GitHub; in this case, the project will already be initialized.

In this lesson, we'll be learning the first option.

Let's go ahead and create a new project and set it up so we can track it using Git. To get started, we'll create a new directory. In your terminal, type the following:

**Note:** Don't type the `$`. That symbol represents the command prompt in your terminal application. Any time you see it, it indicates that the command that follows should be typed into the terminal.

```
$ mkdir my-git-project
```

This command creates a new directory.

Git operates on a directory level. If we have a directory that contains (or will contain) all the files for the project we want to track, we need to tell Git to track that directory by *initializing* it as a Git repository. But before we can do that, we first need to navigate into the directory:

```
$ cd my-git-project
```

So now that we're **in the directory** where we want Git to watch for changes (adding, removing, and editing files), we can *initialize* this directory by typing `git init`. It should look something like this:

```
$ git init
Initialized empty Git repository in /Users/avi/my-git-project/.git/
```

The message above lets us know that our new directory is now being tracked by Git. We only need to do this step once for each project we want to track.

If you take a look at the file path in the message above you'll see that a new subfolder `.git` has been created. You can also see it by typing `ls -a` in the terminal (the `-a` option tells the terminal to list *all* files and folders, including hidden ones). This hidden directory is where Git keeps important stuff, like the commit history. Don't go in there and start randomly deleting things! That said, if ever you run `git init` in the wrong directory, you can run `rm -rf .git` to delete the `.git` folder and all its contents and return the directory to a plain-old, unprotected directory.

**Important:** Be careful not to make a containing directory, like the home directory or the desktop, into a Git repository accidentally. Make sure you only type `git init` *within* the directory you want `git` to track.

## Check the Status of a Repository with `git status`

As we've seen, when we originally run `git init` for a directory, we receive a message telling us the repo has been initialized. However, there will be many other times as you're working with a project that you'll want to see the current status of your files. In fact, this is one of those good Git habits we mentioned earlier: get used to running `git status` frequently, perhaps even every time you're getting ready to run *any* other git command!

The command we use to do this is `git status`.

```
$ git status
```

Since we have not added any files yet, we'll see:

```
On branch main
```

```
No commits yet
```

```
nothing to commit (create/copy files and use "git add" to track)
```

**Note:** Recall from the previous lesson that the name of your default branch may be `master` rather than `main`, depending on how your Git is configured. If that's the case, the message will state `On branch master` instead of `On branch main`. However, whether it says `main` or `master`, it's referring to the same thing: the core (*main, get it?*) branch of a repository.

Next, let's create a `README.md` that describes the project. Make our new file by typing `touch README.md` from within the `my-git-project` directory. We won't see any output after we run the `touch` command so to see that our new file has been created, we'll also run the `ls` command.

```
$ touch README.md
$ ls
README.md
```

Now, if we type `git status`, we should see:

```
$ git status
On branch main
```

```
No commits yet
```

```
Untracked files:
```

```
(use "git add <file>..." to include in what will be committed)
```

```
README.md
```

```
nothing added to commit but untracked files present (use `git add` to track)
```

Git confirms that our `README.md` has been created, but note that it's listed as **untracked**. In order for Git to keep track of the changes we make to our `README.md` file, we need to tell Git to track our file. So let's do that!

**Remember:** Whenever you want to check the status of your Git repository — which you will often — type `git status`.

## Keep Track of File Changes with `git add`

Currently, the file in our repository is not being tracked by Git. Git doesn't automatically track our files because there will often be files in our project directory that we *don't* want to be tracked (more about this later). This means we have to tell Git about all the files we want it to keep track of and consider as part of our project. We can do this by *adding* the files to our `git` repository with `git add <filename or path> .`

This process is also often referred to as *staging* the file. When a file is *staged*, we've told Git we want changes to that file to be tracked, but we haven't yet actually saved the changes and committed them to the file's history.

So let's add our new `README.md` to the repository and check the status:

```
$ git add README.md
```

```
$ git status
```

```
On branch main
```

```
No commits yet
```

```
Changes to be committed:
```

```
(use "git rm --cached <file>..." to unstage)
```

```
new file:   README.md
```

We can now see that Git is ready to keep track of `README.md`. All the changes in the file at the time we *added* it (in this case, creating it as an empty file) are **staged**. Now, to save these changes and add the current version of our repo to the Git history, we need to *commit* the set of changes.

**NOTE:** When we stage a file, the version of the file at the time we staged it is what will be saved when we *commit* our changes. If we make additional changes to a file *after* staging the file and we want those changes to be included in the commit, we need to re-add the file.

## Create a Commit and Apply a Commit Message with `git commit`

Remember: we ran `git add` to *stage* our changes in the previous step. Those changes are the ones that will be "captured" in the commit.

To make our first commit, we will type:

```
$ git commit -m "Initial commit"
```

The `-m` flag tells Git that we are including a commit message, in this case `"Initial commit"`. *Any time you make a commit, you should include a message using this flag.* When you run this command, you should see something similar to this:

```
$ git commit -m "Initial commit"
[main (root-commit) e55477d] Initial commit
1 file changed, 0 insertions(+), 0 deletions(-)
create mode 100644 README.md
```

In the message above, you can see that we have committed one file. Git has added this commit — which contains the current "picture" of our repo — to the Git history. It has also created an *SHA* (Secure Hash Algorithm) — `e55477d` in this example — to refer to this commit (your SHA will be different). You can think of the SHA as similar to a variable name: it provides a "handle" you can use to refer to a particular point in time in your project's history.

**Aside:** SHA's are the identification system that `git` uses to keep track of versions. They're long complex series of numbers and letters that are unlikely to be duplicated, ensuring that we have a unique "handle" to use to refer to each of our commits. The SHA shown in the commit message above is actually just the first few characters of the full SHA. In some cases, Git may display the full version of the SHA, but if it has the same first few characters as the abbreviated version, they're both referring to the same commit.

Now that we've committed our changes, if we type `git status`, we'll see that it is at a "clean state". There are no new changes which means there's nothing to commit:

```
$ git status
On branch main
nothing to commit, working tree clean
```

## Modifying our File

Next, let's open our project in our text editor and make a change to our README.md file:

`code .`

**NOTE:** in the examples in this module, we use Visual Studio Code (VS Code) as our text editor, and have configured it to open the folder we are currently in with the `code .` command. If you are using a different text editor, or have not configured VS Code to use the `code` command, your process will be different.

Go ahead and open the README.md file, type something in, and save the file. Now, let's go back to the terminal and check our status:

```
$ git status
On branch main
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
    modified:   README.md

no changes added to commit (use "git add" and/or "git commit -a")
```

Now we can see that our README.md file has been modified, but that it's not yet staged. To add it so it will be included in our next commit, we'll use the `git add` command again:

```
$ git add README.md
$ git status
On branch main
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
    modified:   README.md
```

This status message looks similar to what we saw when we originally *added* the file, but now Git shows the file as modified rather than new.

Finally, let's commit our changes:

```
$ git commit -m "Add text"
[main 29e6774] Add text
```

```
1 file changed, 1 insertion(+)
```

And that's it! You have now successfully:

- Created a project directory and initialized it as a Git repo.
- Added a file to the project and used `git add` to tell Git to track it.
- Used `git commit` to create a *commit* that contains the current version of the files, so the change will be saved in the project's Git history.
- Modified the file and used `git add` and `git commit` again to create a new commit with the updated version of the project files.

## A Couple of Shortcuts

The workflow you've learned in this lesson is one developers use over and over (and over) when using Git. As a result, Git has created some shortcuts we can use.

You may have wondered why every directory you look at has both `.` and `..`. In the file system, these are used to refer to a specific level of the directory. You likely know that `..` refers to the parent directory of your current directory, but did you know that `.` simply refers to the directory you are in currently? This may become more apparent using the following shortcut.

If you're working in a project that has multiple files and you want to stage all of the files that have been changed since the last commit, you can use `.` in the `git add` command instead of the file name. This tells Git to add all files changed in the current directory:

```
$ git add .
```

You can also combine the two steps of adding and committing our file into a single command:

```
$ git commit -am "Update README.md"
```

The `a` flag takes the place of running `git add <filename>` or `git add .` before we run the `commit` command. As with the `add .` shortcut, the `a` flag tells git to add 'all changes', i.e., all files that have been changed since the last commit. The `-m` flag, like before, tells git that we want to specify a commit message, in this case, `"Update README.md"`.

The command above could also be written as:



```
$ git commit -a -m "Update README.md"
```

**Note:** we can only combine staging and committing with files that have **previously been staged**. In other words, the *first* time you stage a file in your project, you must do so explicitly using `git add`.

## Exercise

Now, let's practice what we've learned. Before starting, make sure you navigate out of the repo we created in this lesson by typing the following:

```
$ cd ..
```

**Important:** Any time you initialize a new repo it's important to make sure you aren't already inside a directory that is itself a repo — it will cause problems down the road!

## Instructions

Complete the following steps. As you're working, be sure to run `git status` often.

1. Create a new directory called `todos` to contain a new project.
2. Navigate into the new directory.
3. Initialize the new directory as a Git repo.
4. Create a new file inside the folder called `todo-list.txt`. You can either do this from the terminal or in your text editor.
5. Stage your changes using the `add` command, then commit them with the commit message `initial commit`.
6. Open the `todo-list.txt` file in your text editor, and add a title and a few todo's of your choosing.
7. Return to the terminal, then add and commit your changes with the commit message `added todos`.

That's it! Before you know it, the steps we've learned in this lesson will be so natural you won't even need to think about them — just keep practicing!

## Check for Understanding

Before moving on to the next lesson, check for your understanding of this material by describing in your own words the three steps of the Git workflow used to track and save changes in our work.

## Conclusion

In this lesson, we've learned the basics of using Git to track a directory. Specifically, we learned how to:

- Make a new Git repository out of a directory using `git init` .
- Check the status of our repo using `git status` .
- Track files that have been changed using the `git add <filename or path>` command.
- Save (commit) the changes with an explanatory message using `git commit -m "A message"` .

So far, however, we've only been using Git with our local repo. In the next two lessons, we'll learn how we can use Git in combination with GitHub to *share* code with other developers.

## Resources

- [Git Basics at git-scm.com](https://git-scm.com) ➦ <https://git-scm.com/book/en/v2/Git-Basics-Getting-a-Git-Repository>