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Introduction to Git

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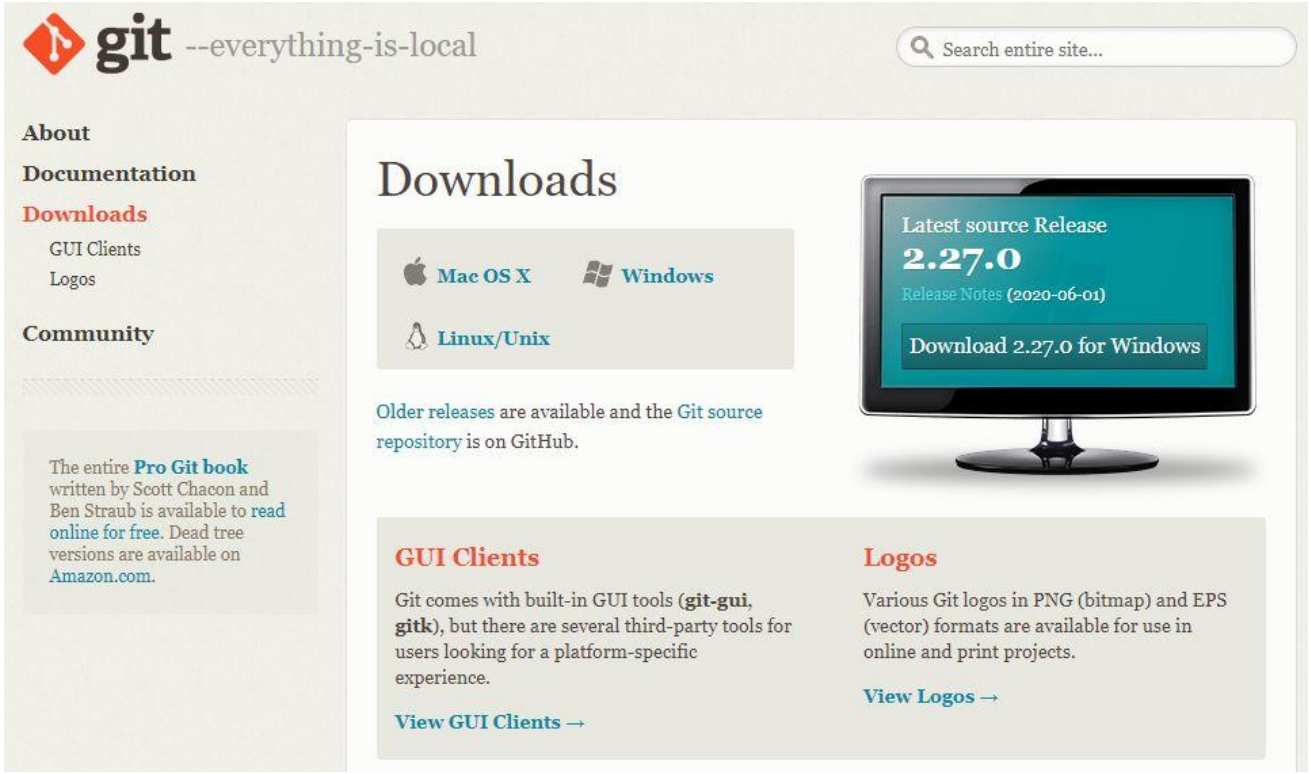
The presentation can be downloaded at
audhiaprilliant.github.io

Prerequisites

- **Install git on Windows (https://git-scm.com/downloads)**



If you are Linux user

- **Install git on Linux Ubuntu**

```
sudo apt-get update
sudo apt-get install git
```

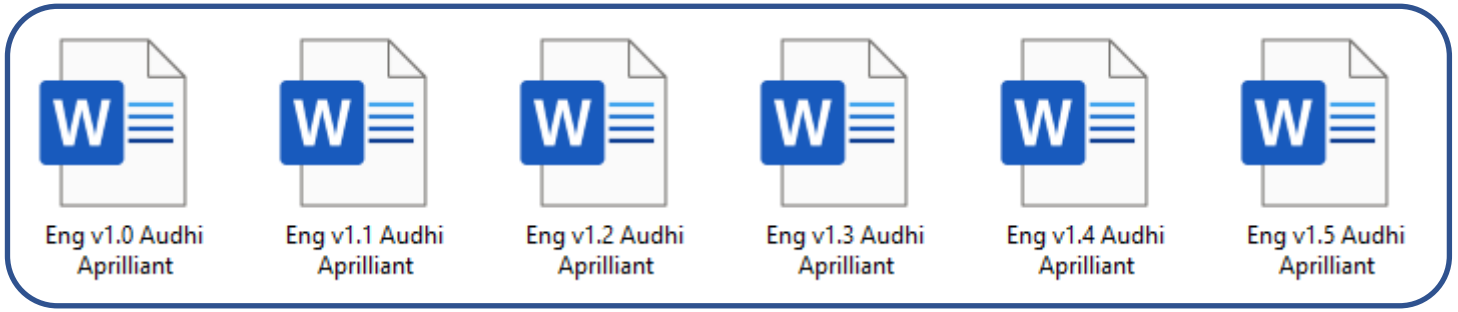
- **Create a GitHub account (https://github.com/)**

Outlines

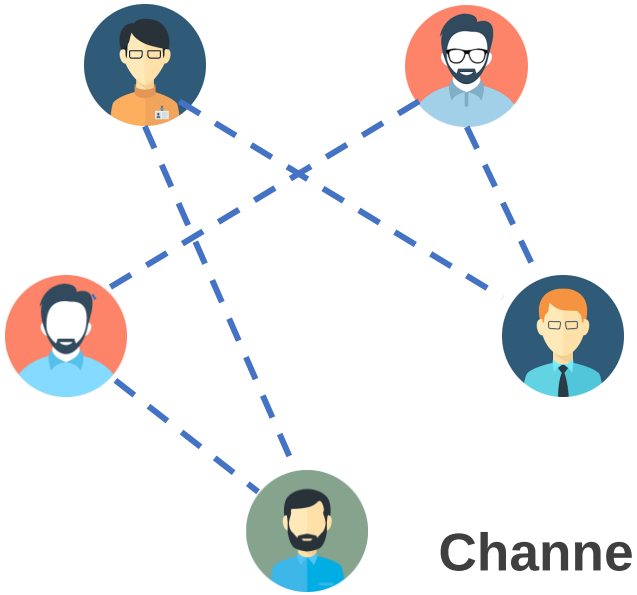
1. **Background**
   - Versioning
   - Collaboration
2. **Git as Version Control System**
   - Overview
   - Initialization and configuration
   - How to create repository
   - Git lifecycle (local, staging, repo)
   - View git logs
   - Revision and diff
   - Reset
3. **Git as Collaboration Tools**
   - Branching
   - Merge
   - Blaming
   - Remote repository
4. **Sources**

Background

- Before using Git



6

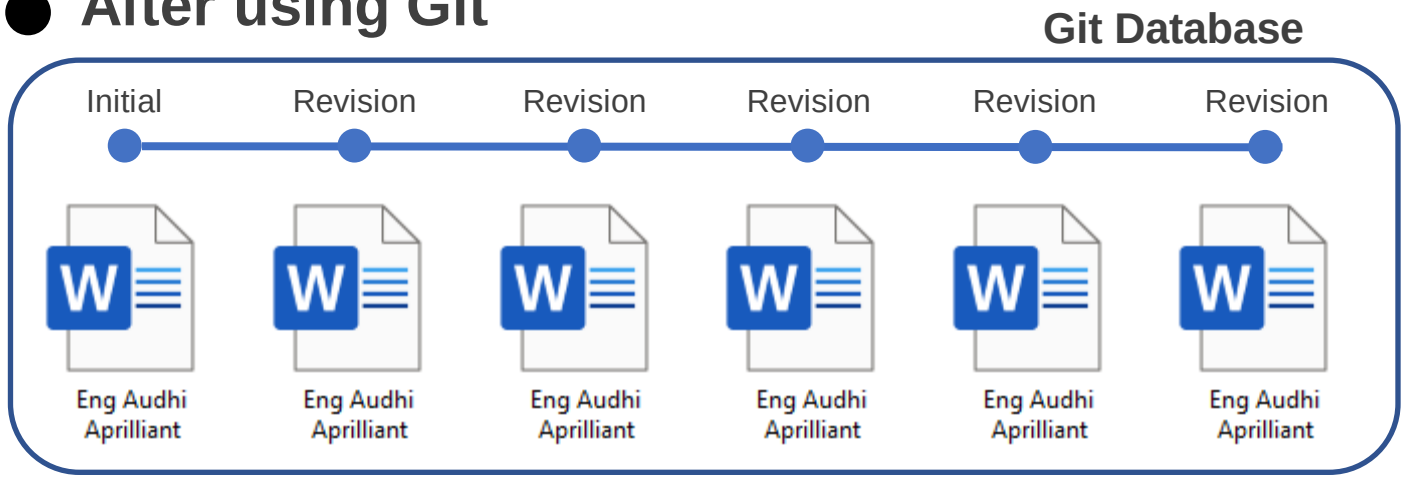


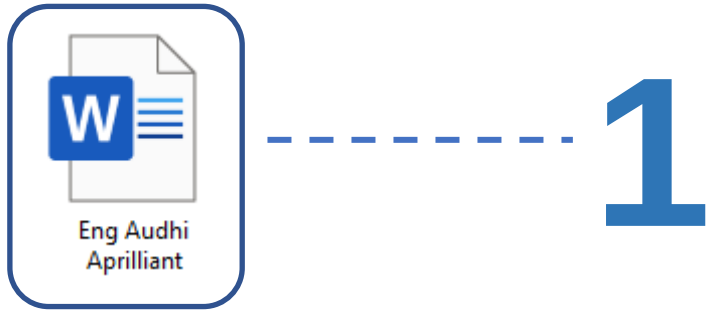
Channel

- Not integrated
- Misunderstanding
- Bad logs
- Inefficient for big project

Background

- After using Git





- Integrated
- Great logs
- Efficient for big project

Channel

Git as VCS

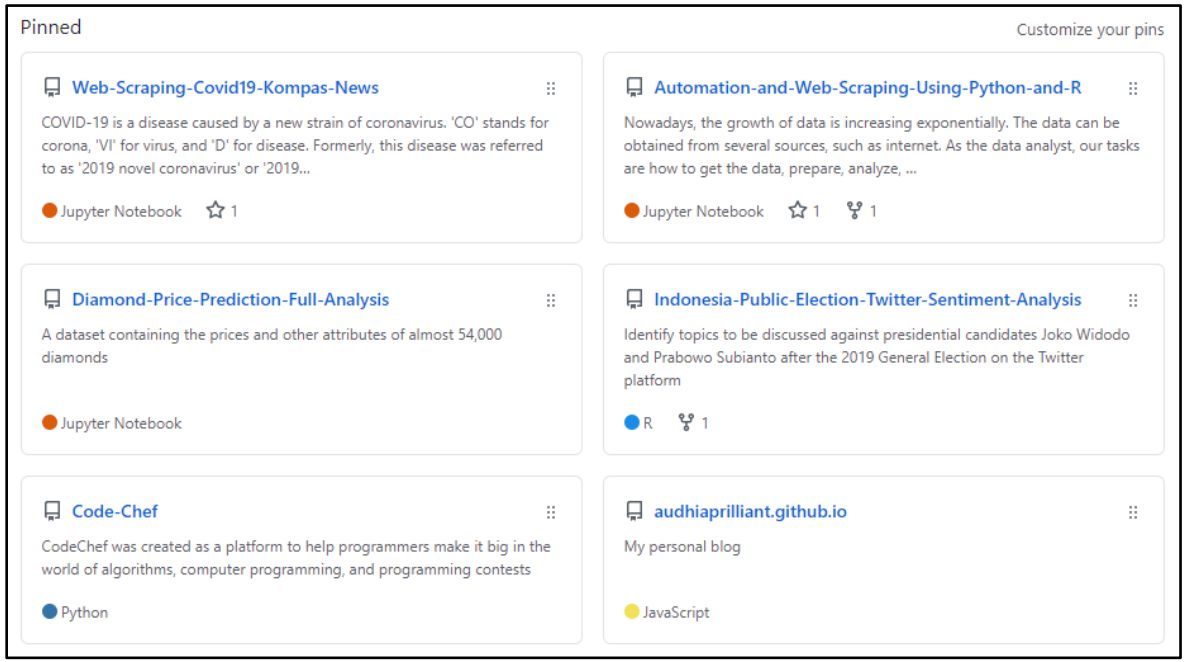
Git is a **free** and **open source** distributed version control system designed to handle everything from small to very large projects with speed and efficiency.

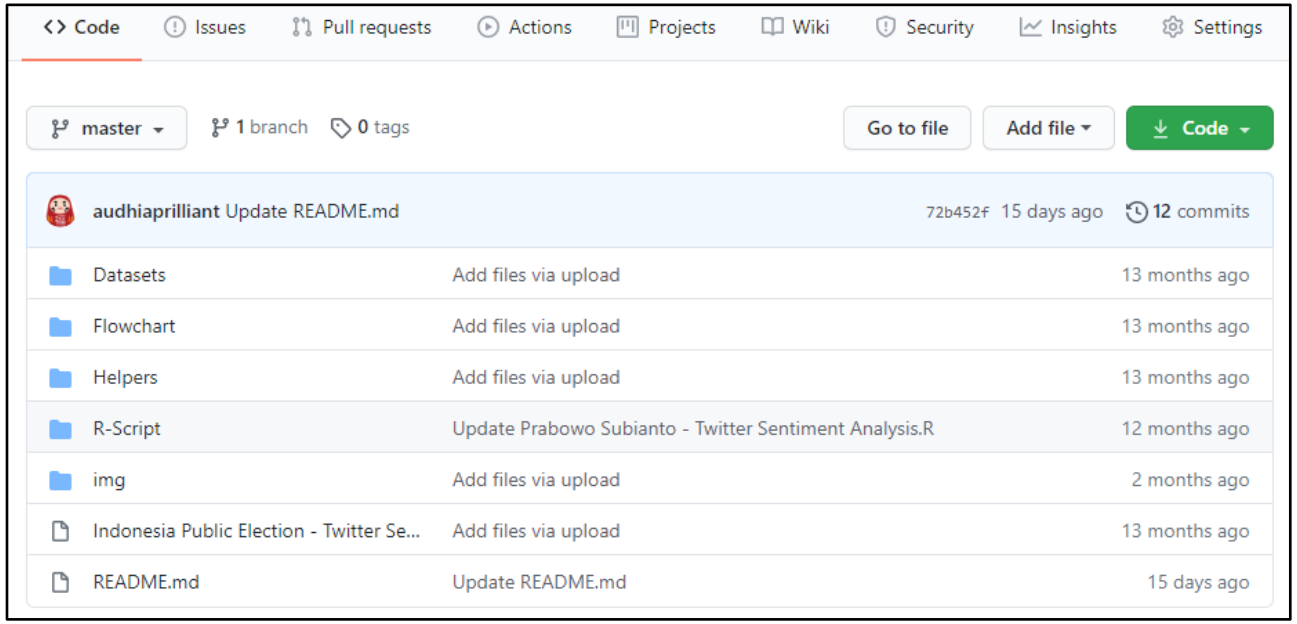
On a very basic level, there are two awesome things git allows us to do

- We can track changes in our files
- It simplifies working on files and projects with multiple people

Git as VCS

Github is a **web-based platform** used for version control. Git simplifies the process of working with other people and makes it easy to collaborate on projects.





Initialization and Configuration

`git config`

- Check your git version (optional)

```
audhi@audhi-hp-notebook:~/github$ git --version
git version 2.17.1
```

- Set up your global configuration of username and email

```
audhi@audhi-hp-notebook:~/github$ git config --global user.name "audhiaprilliant"
audhi@audhi-hp-notebook:~/github$ git config --global user.email "audhiaprilliant@gmail.com"
```

- Check your global configuration

```
audhi@audhi-hp-notebook:~/github$ git config user.name
audhiaprilliant
audhi@audhi-hp-notebook:~/github$ git config user.email
audhiaprilliant@gmail.com
```

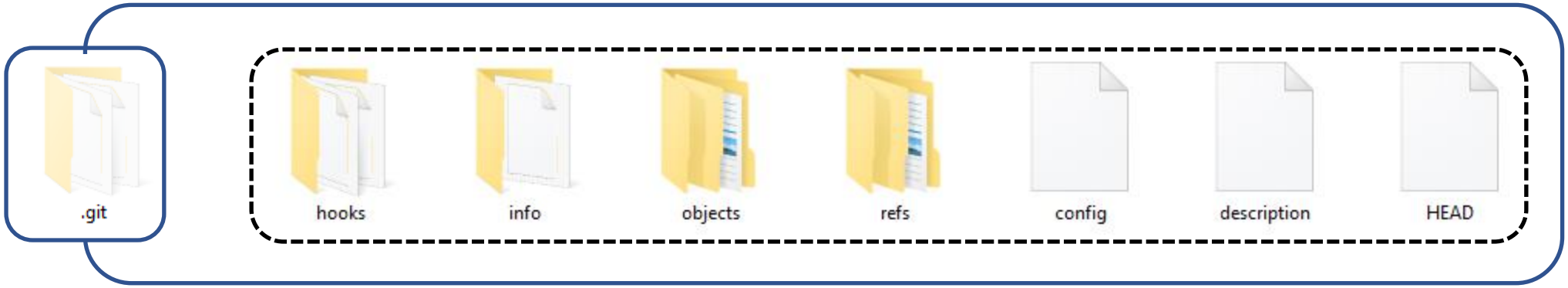
Git as VCS

How to Create Repository

`git init`

- Create a directory as your local repository

```
audhi@audhi-hp-notebook:~/github$ mkdir git-stk
audhi@audhi-hp-notebook:~/github$ cd git-stk
audhi@audhi-hp-notebook:~/github/git-stk$ git init
Initialised empty Git repository in /home/audhi/github/git-stk/.git/
audhi@audhi-hp-notebook:~/github/git-stk$ git status
On branch master

No commits yet

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



How to Create Repository

`git status`

- Create a new file namely README.md

```
audhi@audhi-hp-notebook:~/github/git-stk$ touch README.md
audhi@audhi-hp-notebook:~/github/git-stk$ echo "First line of README.md file" > README.md
audhi@audhi-hp-notebook:~/github/git-stk$ cat README.md
First line of README.md file
```

- Check the status when we create or modify any files

```
audhi@audhi-hp-notebook:~/github/git-stk$ git status
On branch master

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)
```

How to Create Repository

`git add` `git commit`

- Check the status again! Look what is the differences?

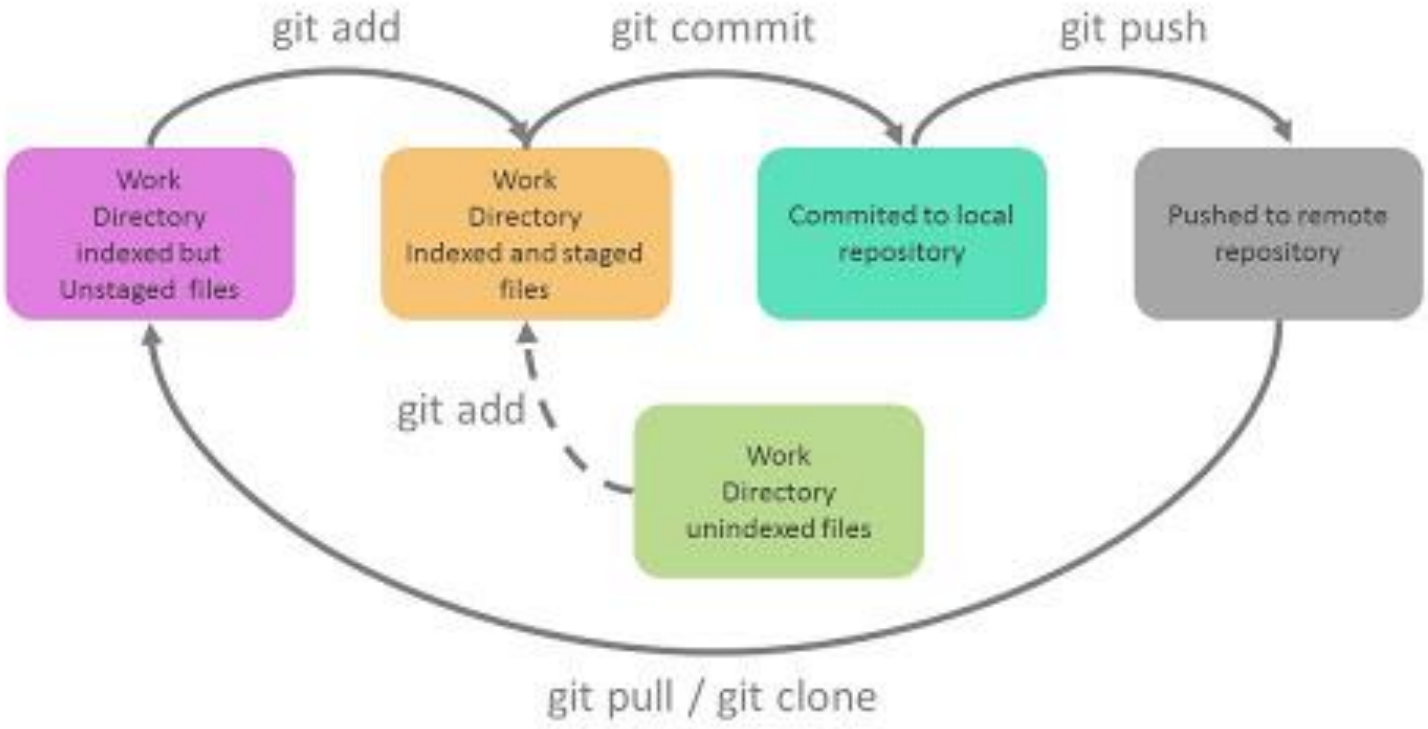
```
audhi@audhi-hp-notebook:~/github/git-stk$ git add README.md
audhi@audhi-hp-notebook:~/github/git-stk$ git status
On branch master

No commits yet

Changes to be committed:
  (use "git rm --cached <file>..." to unstage)

        new file:   README.md
```

- Commit our file with following command

```
audhi@audhi-hp-notebook:~/github/git-stk$ git commit README.md -m "Initial commit"
[master (root-commit) dafc153] Initial commit
 1 file changed, 1 insertion(+)
 create mode 100644 README.md
```

Git as VCS

- It’s the git lifecycle



http://www.tsbakker.nl/git.html

Git as VCS

- Before looking our logs, let's modify README.md

```
audhi@audhi-hp-notebook:~/github/git-stk$ echo "Second line of README.md file" >> README.md
audhi@audhi-hp-notebook:~/github/git-stk$ cat README.md
First line of README.md file
Second line of README.md file
audhi@audhi-hp-notebook:~/github/git-stk$ git status
On branch master
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git checkout -- <file>..." to discard changes in working directory)

        modified:   README.md

no changes added to commit (use "git add" and/or "git commit -a")
audhi@audhi-hp-notebook:~/github/git-stk$ git add README.md
audhi@audhi-hp-notebook:~/github/git-stk$ git commit README.md -m "Add some text for second line"
[master bb5c917] Add some text for second line
 1 file changed, 1 insertion(+)
audhi@audhi-hp-notebook:~/github/git-stk$ git status
On branch master
nothing to commit, working tree clean
```

It means "Modified"

Git as VCS

Git Logs

`git log`

- Let’s check logs for our file README.md

```
audhi@audhi-hp-notebook:~/github/git-stk$ git log --graph
* commit 601ae7bd17608e5f4a6726f4360501c2149b23d6 (HEAD -> master)
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
| Date:   Mon Jul 20 12:40:17 2020 +0700
|
|     Add some text for second line
|
* commit 1ceee1f957ac09a4d0174145a657a6052bf0f3eb
  Author: audhiaprilliant <audhiaprilliant@gmail.com>
  Date:   Mon Jul 20 12:39:21 2020 +0700

      Initial commit
```

`git --oneline`
`git log --graph`
`git --author=<username>`
`git log <filename>`

Git as VCS

Git Logs

`git diff`

- Can we look any differences between our last two commits? Of course!

```
audhi@audhi-hp-notebook:~/github/git-stk$ git diff 1ceee1f957ac09a4d0174145a657a6052bf0f3eb 601ae7bd17608e5f4a6726f4360501c2149b23d6
diff --git a/README.md b/README.md
index 357c151..ae76c1a 100644
--- a/README.md
+++ b/README.md
@@ -1 +1,2 @@
 First line of README.md file
+Second line of README.md file
```

Before

After

```
diff --git a/README.md b/README.md
index 357c151..ae76c1a 100644
--- a/README.md
+++ b/README.md
@@ -1 +1,2 @@
 First line of README.md file
+Second line of README.md file
```

First line of README.md file — **Initial commit**

First line of README.md file
Second line of README.md file — **Add some text for second line**

Git as VCS

Git Reset

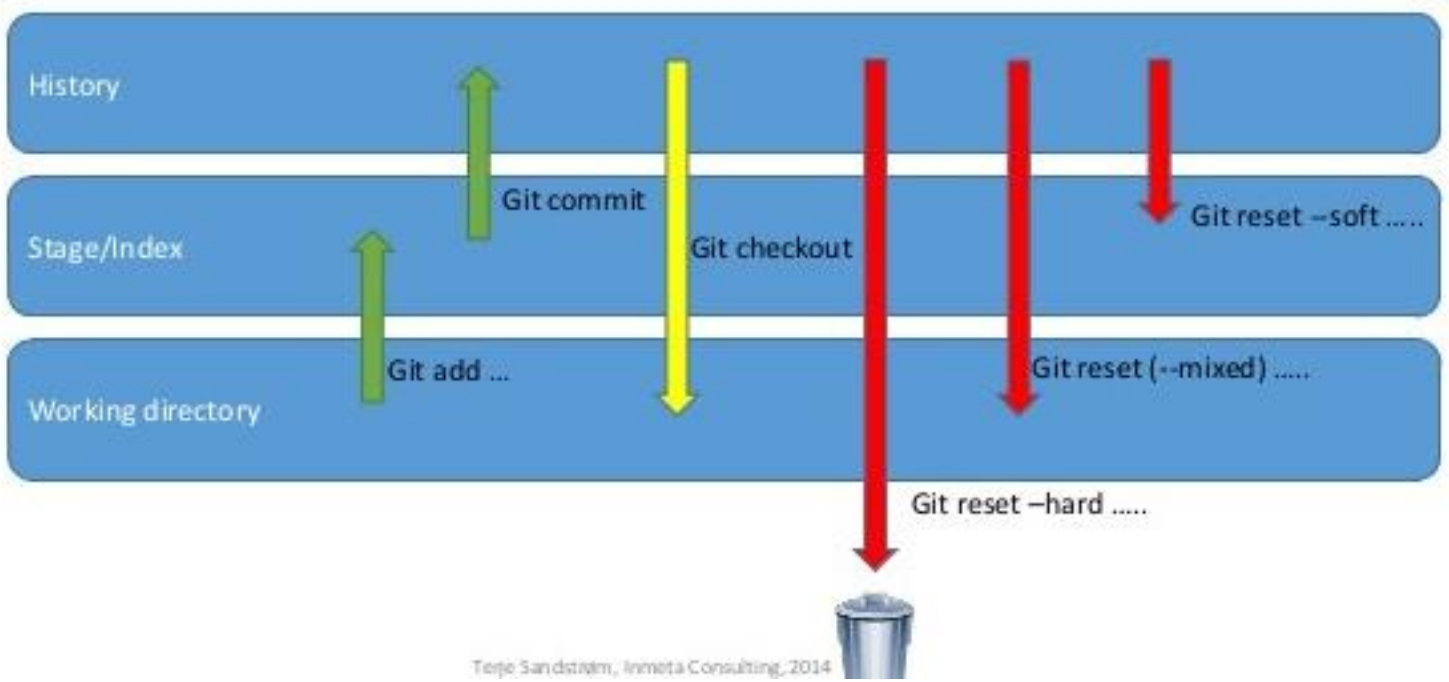
`git reset`

- Go back to our first unstaged file!

```
audhi@audhi-hp-notebook:~/github/git-stk$ git reset 1ceee1f957ac09a4d0174145a657a6052bf0f3eb
Unstaged changes after reset:
M       README.md
audhi@audhi-hp-notebook:~/github/git-stk$ cat README.md
First line of README.md file
Second line of README.md file
audhi@audhi-hp-notebook:~/github/git-stk$ git status
On branch master
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git checkout -- <file>..." to discard changes in working directory)

        modified:   README.md

no changes added to commit (use "git add" and/or "git commit -a")
audhi@audhi-hp-notebook:~/github/git-stk$ git log
commit 1ceee1f957ac09a4d0174145a657a6052bf0f3eb (HEAD -> master)
Author: audhiaprilliant <audhiaprilliant@gmail.com>
Date:   Mon Jul 20 12:39:21 2020 +0700

    Initial commit
audhi@audhi-hp-notebook:~/github/git-stk$ git add . && git commit -m "Add some text for second line"
[master 1ccf897] Add some text for second line
 1 file changed, 1 insertion(+)
```

Git as VCS

- The diagram of command `git reset`



`--soft`

`--mixed`

`--soft`

!! We should never use git **`reset <commit>`** when any snapshots after `<commit>` have been pushed to a public repository.

https://v0cgit.blogspot.com/2016/12/git-reset-soft-mixed-hard.html

Git as VCS

Git Reset

`git reflog`

- Look our activities!

```
audhi@audhi-hp-notebook:~/github/git-stk$ git reflog
1ccf897 (HEAD -> master) HEAD@{0}: commit: Add some text for second line
1ceee1f HEAD@{1}: reset: moving to 1ceee1f957ac09a4d0174145a657a6052bf0f3eb
601ae7b HEAD@{2}: commit: Add some text for second line
1ceee1f HEAD@{3}: commit (initial): Initial commit
```

```
audhi@audhi-hp-notebook:~/github/git-stk$ git log --graph
* commit 1ccf897160f6851dc9cf2771bacb3b3d91a8928c (HEAD -> master)
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
| Date:   Mon Jul 20 12:44:05 2020 +0700
|
|     Add some text for second line
|
* commit 1ceee1f957ac09a4d0174145a657a6052bf0f3eb
  Author: audhiaprilliant <audhiaprilliant@gmail.com>
  Date:   Mon Jul 20 12:39:21 2020 +0700

      Initial commit
```

Git as VCS

- **Modify our file again!**

```
audhi@audhi-hp-notebook:~/github/git-stk$ echo "Third line of README.md file" >> README.md
audhi@audhi-hp-notebook:~/github/git-stk$ cat README.md
First line of README.md file
Second line of README.md file
Third line of README.md file
audhi@audhi-hp-notebook:~/github/git-stk$ git add .
audhi@audhi-hp-notebook:~/github/git-stk$ git commit -m "Add some text for third line"
[master 494a510] Add some text for third line
 1 file changed, 1 insertion(+)
```

First line of README.md file

Initial commit

First line of README.md file
Second line of README.md file

Add some text for second line

First line of README.md file
Second line of README.md file
Third line of README.md file

Add some text for third line

Git as VCS

- It’s our logs!

```
audhi@audhi-hp-notebook:~/github/git-stk$ git log --graph
* commit c65525418cc37a2eb9c6f9e01a4487936722f10b (HEAD -> master)
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
| Date:   Mon Jul 20 12:48:17 2020 +0700
|
|     Add some text for third line
|
* commit 1ccf897160f6851dc9cf2771bacb3b3d91a8928c
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
| Date:   Mon Jul 20 12:44:05 2020 +0700
|
|     Add some text for second line
|
* commit 1ceee1f957ac09a4d0174145a657a6052bf0f3eb
  Author: audhiaprilliant <audhiaprilliant@gmail.com>
  Date:   Mon Jul 20 12:39:21 2020 +0700

      Initial commit
```

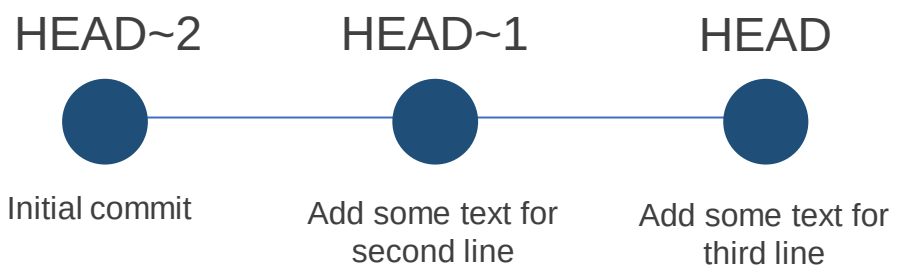
Git as VCS

Git Checkout

`git checkout`

- **Check our content each commits!**

```
audhi@audhi-hp-notebook:~/github/git-stk$ git checkout HEAD~2 README.md
audhi@audhi-hp-notebook:~/github/git-stk$ cat README.md
First line of README.md file
audhi@audhi-hp-notebook:~/github/git-stk$ git checkout HEAD README.md
audhi@audhi-hp-notebook:~/github/git-stk$ cat README.md
First line of README.md file
Second line of README.md file
Third line of README.md file
audhi@audhi-hp-notebook:~/github/git-stk$ git checkout HEAD~1 README.md
audhi@audhi-hp-notebook:~/github/git-stk$ cat README.md
First line of README.md file
Second line of README.md file
```

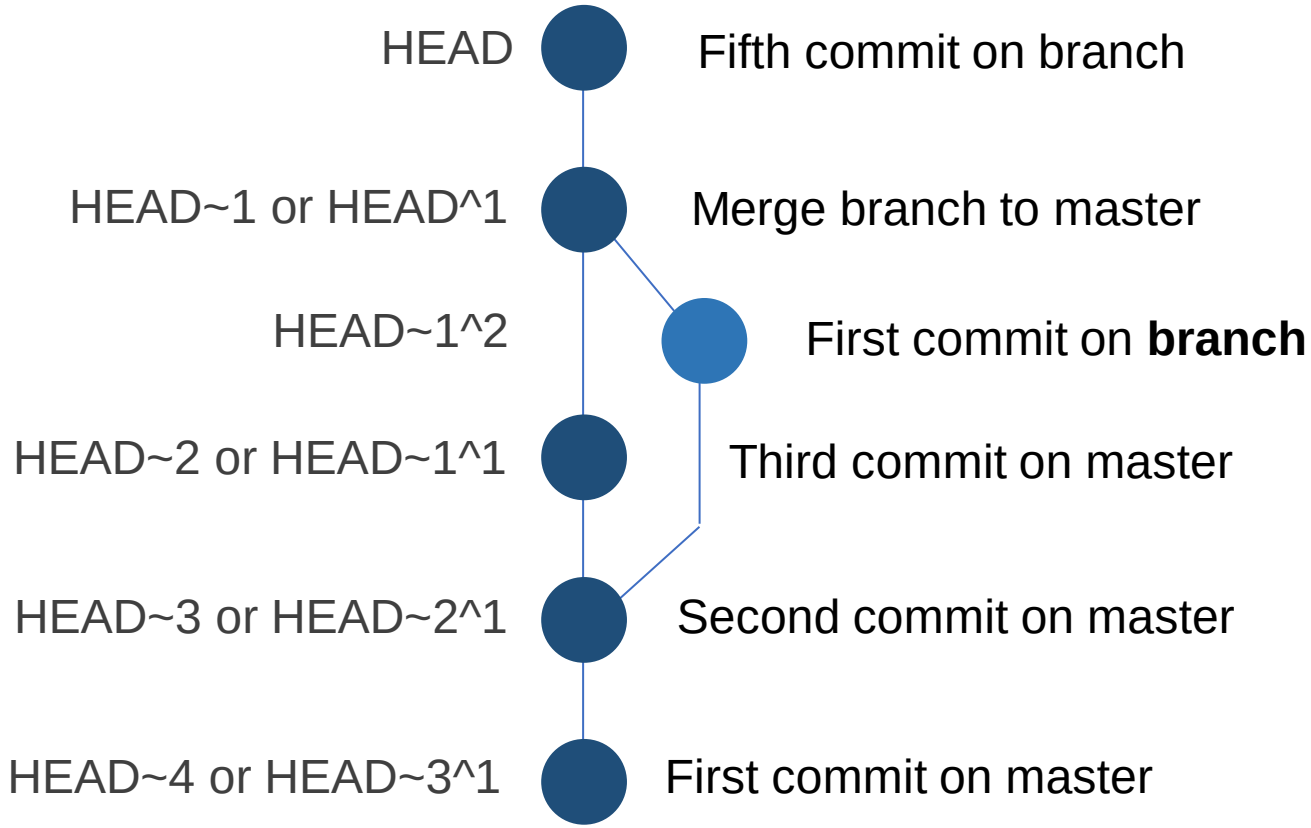


HEAD

It always refers to the most recent commit on the current branch

Git as VCS

- **Tilde (~) and caret (^)**



tilde (~) ~N indicates the previous N-th commit

caret (^) ^N indicates the N-th parent commit

- It’s uncommited yet!

```
audhi@audhi-hp-notebook:~/github/git-stk$ git status
On branch master
Changes to be committed:
  (use "git reset HEAD <file>..." to unstage)

        modified:   README.md

audhi@audhi-hp-notebook:~/github/git-stk$ git commit -m "Checkout HEAD~2 README.md"
[master 563d990] Checkout HEAD~2 README.md
 1 file changed, 1 deletion(-)
```

```
audhi@audhi-hp-notebook:~/github/git-stk$ git log --graph
* commit 563d990ed2a17f5f7dc99fb0502b6966efdd677a (HEAD -> master)
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
| Date:   Mon Jul 20 12:51:27 2020 +0700
|
|     Checkout HEAD~2 README.md
|
* commit c65525418cc37a2eb9c6f9e01a4487936722f10b
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
| Date:   Mon Jul 20 12:48:17 2020 +0700
```

Git as Collaboration Tools

Branching

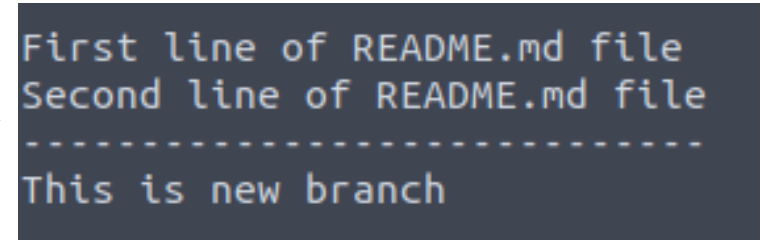
`git branch`

- Create new branch!

```
audhi@audhi-hp-notebook:~/github/git-stk$ git branch
* master
audhi@audhi-hp-notebook:~/github/git-stk$ git branch new_branch
audhi@audhi-hp-notebook:~/github/git-stk$ git branch
* master
  new_branch
```

- Go to new branch, work in new branch!

```
audhi@audhi-hp-notebook:~/github/git-stk$ git checkout new_branch
M       README.md
Switched to branch 'new_branch'
audhi@audhi-hp-notebook:~/github/git-stk$ git branch
  master
* new_branch
audhi@audhi-hp-notebook:~/github/git-stk$ nano README.md
audhi@audhi-hp-notebook:~/github/git-stk$ cat README.md
First line of README.md file
Second line of README.md file
----------------------------
This is new branch
```



Git as Collaboration Tools

- Commit our modification on new branch

```
audhi@audhi-hp-notebook:~/github/git-stk$ git add .
audhi@audhi-hp-notebook:~/github/git-stk$ git commit -m "Add some text to README.md - new branch"
[new_branch 7dda007] Add some text to README.md - new branch
 1 file changed, 2 insertions(+)
```

- Go to master branch and modify README.md file

```
audhi@audhi-hp-notebook:~/github/git-stk$ git checkout master
Switched to branch 'master'
audhi@audhi-hp-notebook:~/github/git-stk$ cat README.md
First line of README.md file
Second line of README.md file
audhi@audhi-hp-notebook:~/github/git-stk$ echo "Third line of README.md file" >> README.md
audhi@audhi-hp-notebook:~/github/git-stk$ cat README.md
First line of README.md file
Second line of README.md file
Third line of README.md file
audhi@audhi-hp-notebook:~/github/git-stk$ git add .
audhi@audhi-hp-notebook:~/github/git-stk$ git commit -m "Add some text for third line"
[master 378e16b] Add some text for third line
 1 file changed, 1 insertion(+)
```

Git as Collaboration Tools

- Our logs on README.md file!

```
audhi@audhi-hp-notebook:~/github/git-stk$ git log --graph --all
* commit 378e16b73e6cfafaf8a4a8bbfb4d425c61e8ad95 (HEAD -> master)
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
| Date:   Mon Jul 20 12:58:15 2020 +0700
|
|     Add some text for third line
|
| * commit 7dda007aeb7371f58d11cea3f20f1dbf621bcd32 (new_branch)
|/  Author: audhiaprilliant <audhiaprilliant@gmail.com>
|   Date:   Mon Jul 20 12:55:22 2020 +0700
|
|       Add some text to README.md - new branch
|
* commit 563d990ed2a17f5f7dc99fb0502b6966efdd677a
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
| Date:   Mon Jul 20 12:51:27 2020 +0700
|
|     Checkout HEAD~2 README.md
|
* commit c65525418cc37a2eb9c6f9e01a4487936722f10b
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
| Date:   Mon Jul 20 12:48:17 2020 +0700
|
|     Add some text for third line
|
* commit 1ccf897160f6851dc9cf2771bacb3b3d91a8928c
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
```

Master branch

New branch

Git as Collaboration Tools

`git merge`

- Merge our file on master branch!

```
audhi@audhi-hp-notebook:~/github/git-stk$ git merge new_branch
Auto-merging README.md
CONFLICT (content): Merge conflict in README.md
Automatic merge failed; fix conflicts and then commit the result.
audhi@audhi-hp-notebook:~/github/git-stk$
audhi@audhi-hp-notebook:~/github/git-stk$ nano README.md
```

```
First line of README.md file
Second line of README.md file
<<<<<<< HEAD
Third line of README.md file
=======
----------------------------
This is new branch
>>>>>>> new_branch
```

- Commit our merged file “Merge README.md file”

```
audhi@audhi-hp-notebook:~/github/git-stk$ git status
On branch master
You have unmerged paths.
  (fix conflicts and run "git commit")
  (use "git merge --abort" to abort the merge)

Unmerged paths:
  (use "git add <file>..." to mark resolution)

        both modified:   README.md

no changes added to commit (use "git add" and/or "git commit -a")
audhi@audhi-hp-notebook:~/github/git-stk$ git add .
audhi@audhi-hp-notebook:~/github/git-stk$ git commit -m "Merge README.md file"
[master cd7f7d8] Merge README.md file
```

Both modified

```
First line of README.md file
Second line of README.md file
Third line of README.md file
```

Git as Collaboration Tools

- Our logs! It indicates that our file has been merged

```
*   commit cd7f7d872c364dc7afc7a999b9d802fa23bd6530 (HEAD -> master
|\  Merge: 378e16b 7dda007
| | Author: audhiaprilliant <audhiaprilliant@gmail.com>
| | Date:   Mon Jul 20 13:13:24 2020 +0700
| |
| |     Merge README.md file
| |
| * commit 7dda007aeb7371f58d11cea3f20f1dbf621bcd32 (new_branch)
| | Author: audhiaprilliant <audhiaprilliant@gmail.com>
| | Date:   Mon Jul 20 12:55:22 2020 +0700
| |
| |     Add some text to README.md - new branch
| |
* | commit 378e16b73e6cfafaf8a4a8bbfb4d425c61e8ad95
|/  Author: audhiaprilliant <audhiaprilliant@gmail.com>
|   Date:   Mon Jul 20 12:58:15 2020 +0700
|
|       Add some text for third line
|
* commit 563d990ed2a17f5f7dc99fb0502b6966efdd677a
| Author: audhiaprilliant <audhiaprilliant@gmail.com>
| Date:   Mon Jul 20 12:51:27 2020 +0700
|
```

Git as Collaboration Tools

- **Show what revision and author last modified each line of a file**

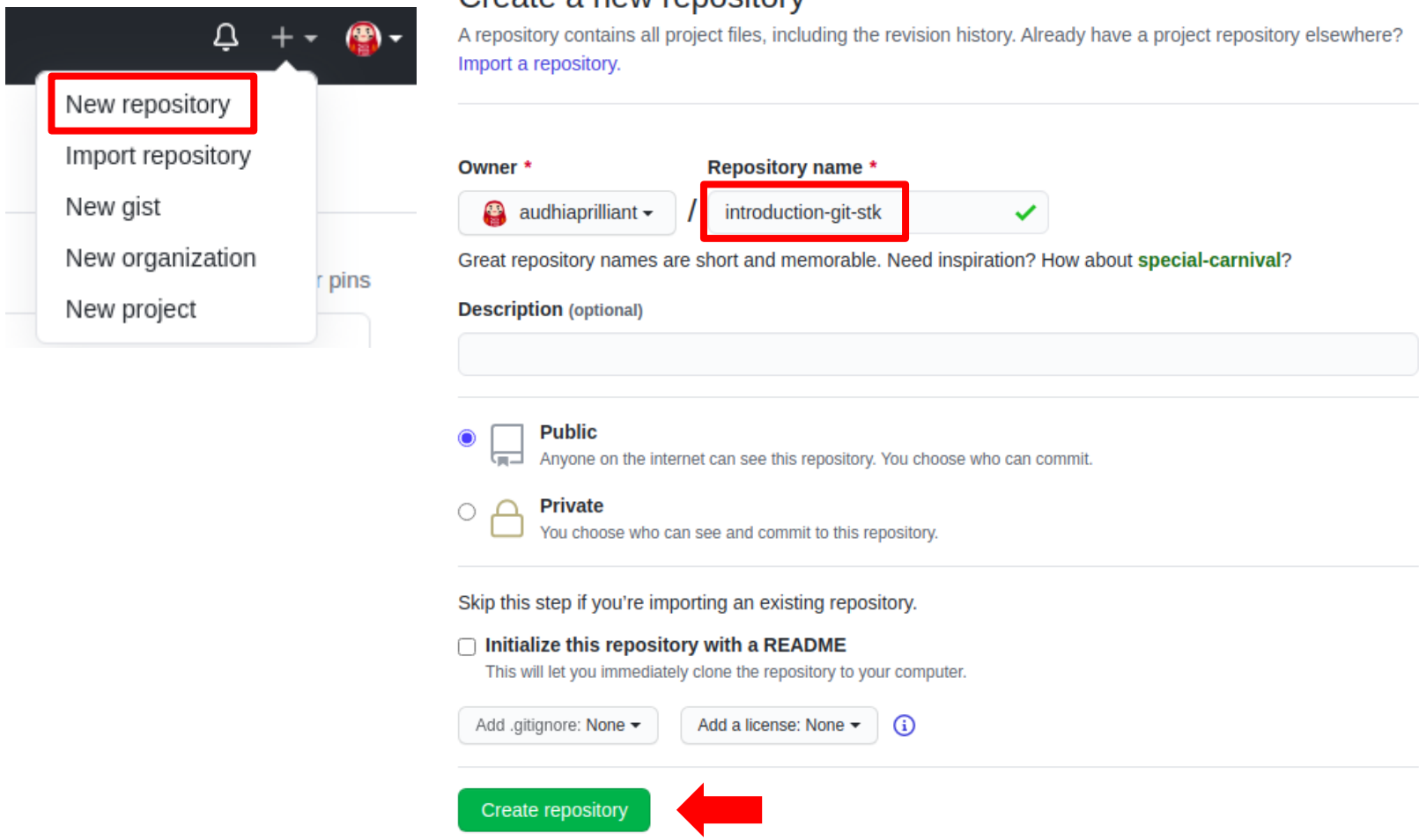
```
audhi@audhi-hp-notebook:~/github/git-stk$ git blame README.md
^1ceee1f (audhiaprilliant 2020-07-20 12:39:21 +0700 1) First line of README.md file
1ccf8971 (audhiaprilliant 2020-07-20 12:44:05 +0700 2) Second line of README.md file
378e16b7 (audhiaprilliant 2020-07-20 12:58:15 +0700 3) Third line of README.md file
audhi@audhi-hp-notebook:~/github/git-stk$ git blame -L 1,2 README.md
^1ceee1f (audhiaprilliant 2020-07-20 12:39:21 +0700 1) First line of README.md file
1ccf8971 (audhiaprilliant 2020-07-20 12:44:05 +0700 2) Second line of README.md file
```

-L <start><end>

- Annotate only the given line range
- May be specified multiple times
- Overlapping ranges are allowed

Git as Collaboration Tools

- Log in to your GitHub and create new repo!

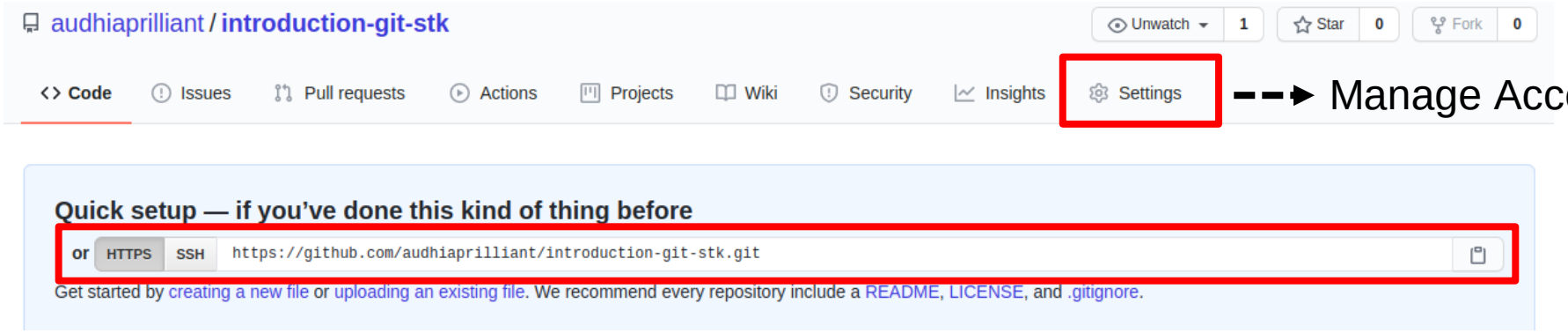


Git as Collaboration Tools

Remote Repository

`git remote` `git push`

- Choose HTTPS instead of SSH

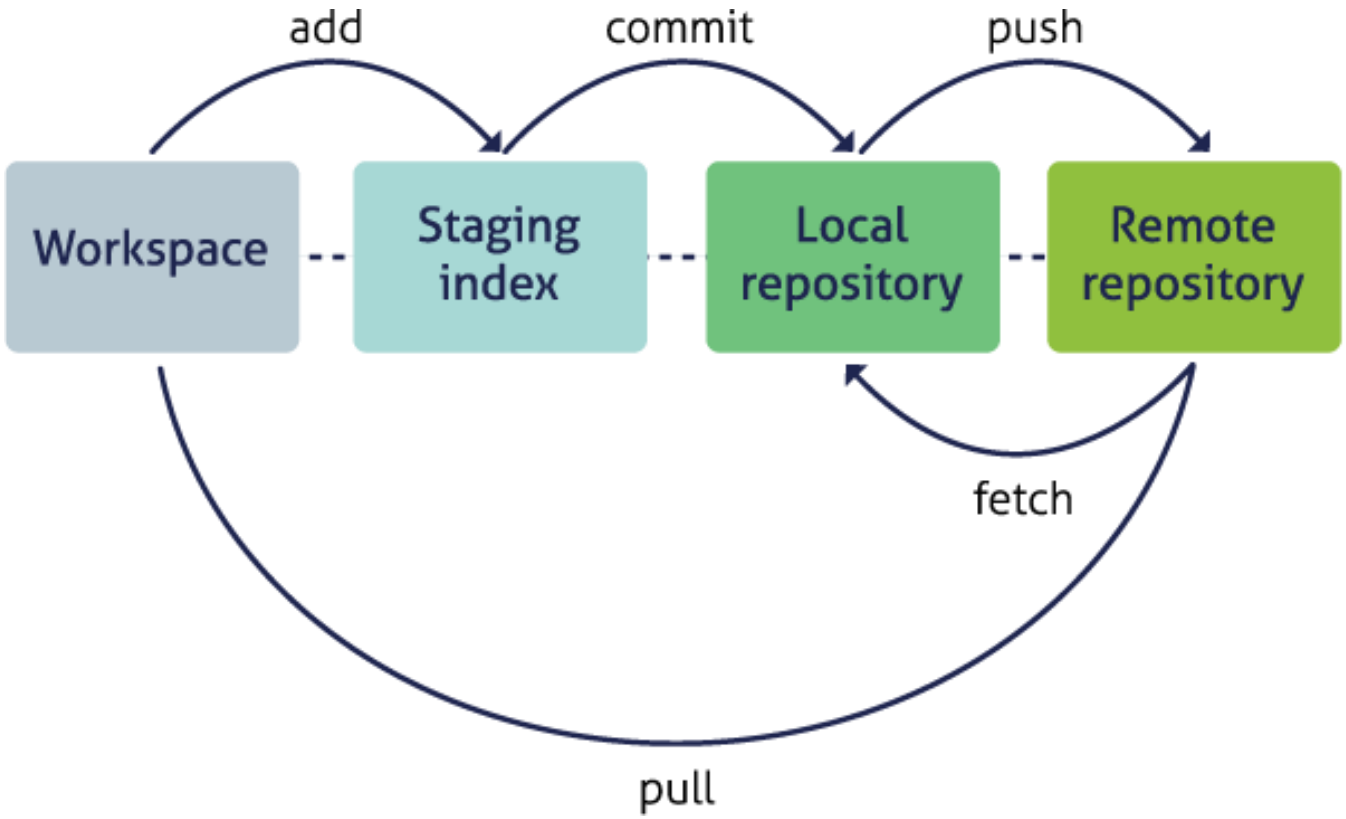



```
audhi@audhi-hp-notebook:~/github/git-stk$ git remote add origin https://github.com/audhiaprilliant/introduction-git-stk.git
audhi@audhi-hp-notebook:~/github/git-stk$ git push -u origin master
Username for 'https://github.com': audhiaprilliant
Password for 'https://audhiaprilliant@github.com':
Counting objects: 12, done.
Delta compression using up to 4 threads.
Compressing objects: 100% (7/7), done.
Writing objects: 100% (12/12), 964 bytes | 321.00 KiB/s, done.
Total 12 (delta 2), reused 0 (delta 0)
remote: Resolving deltas: 100% (2/2), done.
To https://github.com/audhiaprilliant/introduction-git-stk.git
 * [new branch]      master -> master
Branch 'master' set up to track remote branch 'master' from 'origin'.
```

We must enter our username and password!

Git as Collaboration Tools

- It’s the git lifecycle



https://nceas.github.io/sasap-training/materials/reproducible_research_in_r_fairbanks/version-control-with-git-and-github.html

Sources to learn it more!

- Official git page `https://git-scm.com/doc`
- Git cheatsheet `https://education.github.com/git-cheat-sheet-education.pdf`

Thank You

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