

# Introduction to Software Development

MODULE 4 / UNIT 1 / 0.8

MOISES M. MARTINEZ

FUNDAMENTALS OF COMPUTER ENGINEERING

# What is Software Development?

Software development refers to the process of designing, creating, testing, and maintaining software systems or applications.



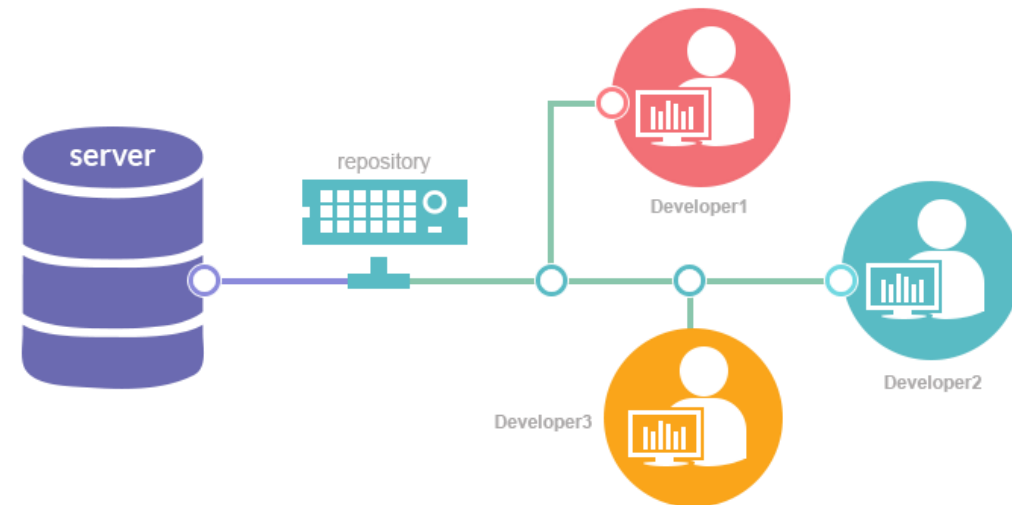
This involves a combination of programming, problem-solving, and creativity to develop software that meets specific requirements or addresses particular challenges.

A significant portion of the software development life cycle revolves around source code:

- Coding and Implementation.
- Testing.
- Deployment.
- Maintenance and Updates.

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**Source code is handled using repositories**

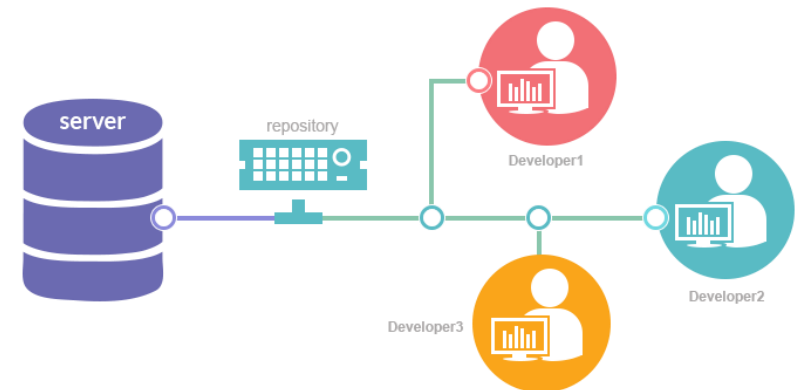
# Repositories

# 01

## Source code repositories

A source code repository, also referred to as a version control repository or code repository, is a centralized hub where software developers store, manage, and organize their source code files.

- It keeps a detailed history of code changes, making it easy to revert to previous versions, compare differences, and manage different development branches.
- Multiple developers can work on the same project simultaneously, merging their changes without overwriting each other's work.
- Ensures that the source code remains intact, and any issues can be traced back to specific changes or contributors.
- It acts as a backup, ensuring that the source code is stored securely and can be accessed when needed, even in case of system failures.

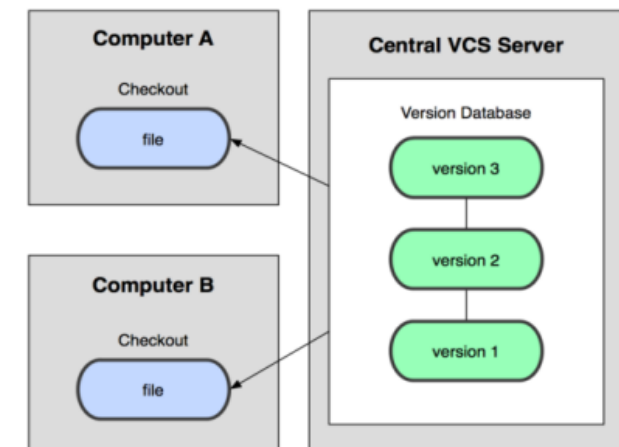
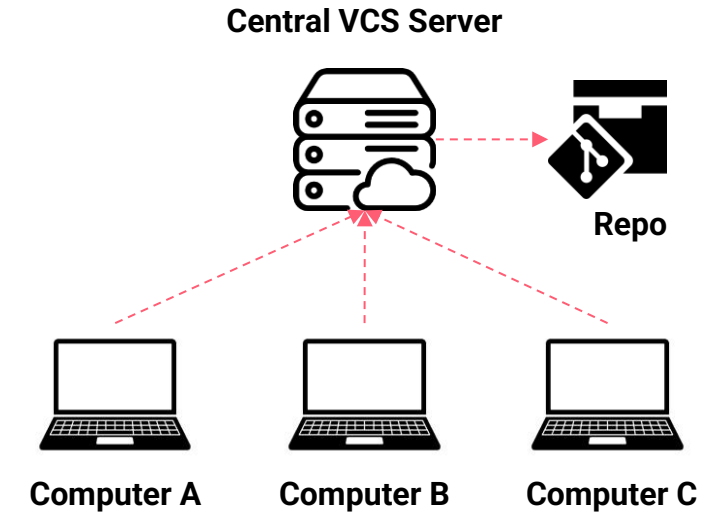


## Source code repositories - Types of repositories

In a centralized version control system (VCS), a central server holds the "official copy" of the source code along with its complete version history.

1. Developers **check out** a copy of the code from the central server to their local machine.
2. Developers make changes to the code on their local machine.
3. Once the local modifications are complete, developers **check in** their changes to the central server. The server then updates the official copy of the code, recording these changes in the version history.

The centralized approach ensures that the server maintains a single, authoritative version history, and all code updates are coordinated through it.



**Concurrent Version System (CVS)**

**Subversion (SVN)**



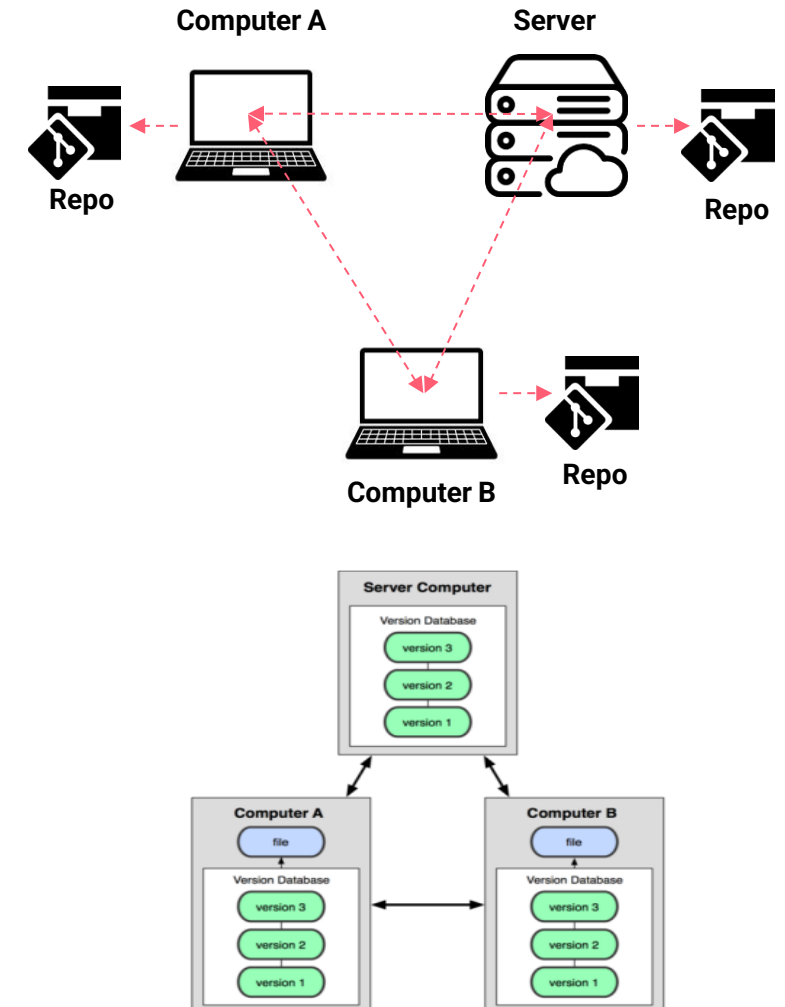
## Source code repositories - Types of repositories

In a distributed version control system (DVCS), there is no central VCS server that holds the only authoritative copy of the code. Every developer's local repository contains a complete copy of the entire project, including the full version history.

1. Each developer's local machine contains a full clone of the repository.
2. Developers can execute most version control operations (e.g., commit, branch, merge) without contacting a remote server.
3. When updates are available on the remote server, developers can "pull" changes from it to synchronize their local repositories.
4. After making local changes, developers can "push" their modifications back to the remote server, which then integrates those changes into the shared repository for other developers to access.

**Mercurial**

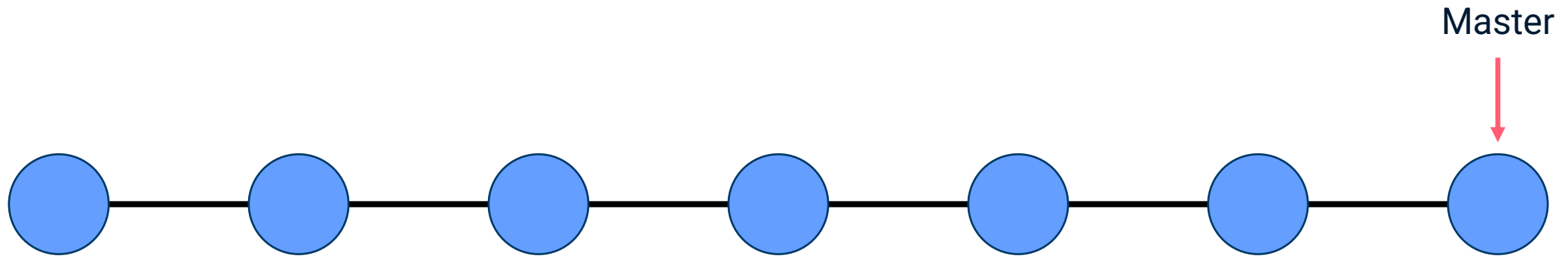
**GIT**



# GIT

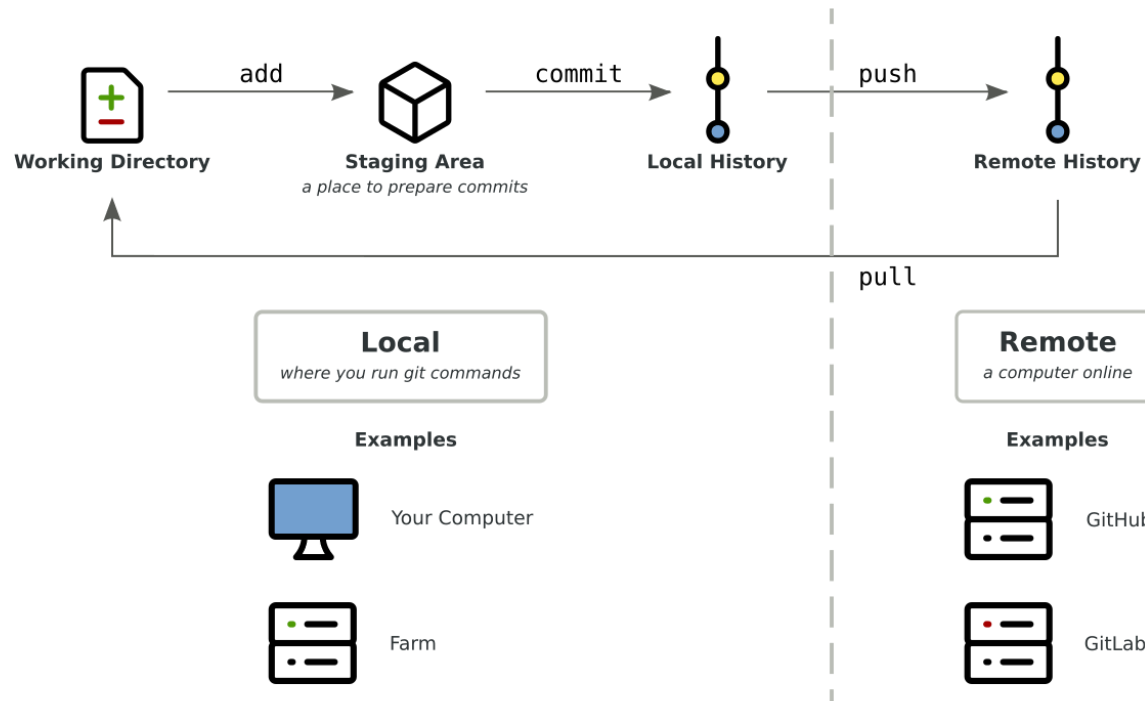
# 02

Git is a distributed, open-source version control system that allows developers and data scientists to efficiently manage and track changes in their codebase enabling team collaboration.



Git has become an industry standard for version control due to its versatility and wide adoption across various development environments. It is compatible with nearly all development tools, command-line interfaces, and operating systems, making it accessible to a broad range of users.

## Git environment: Local and remote

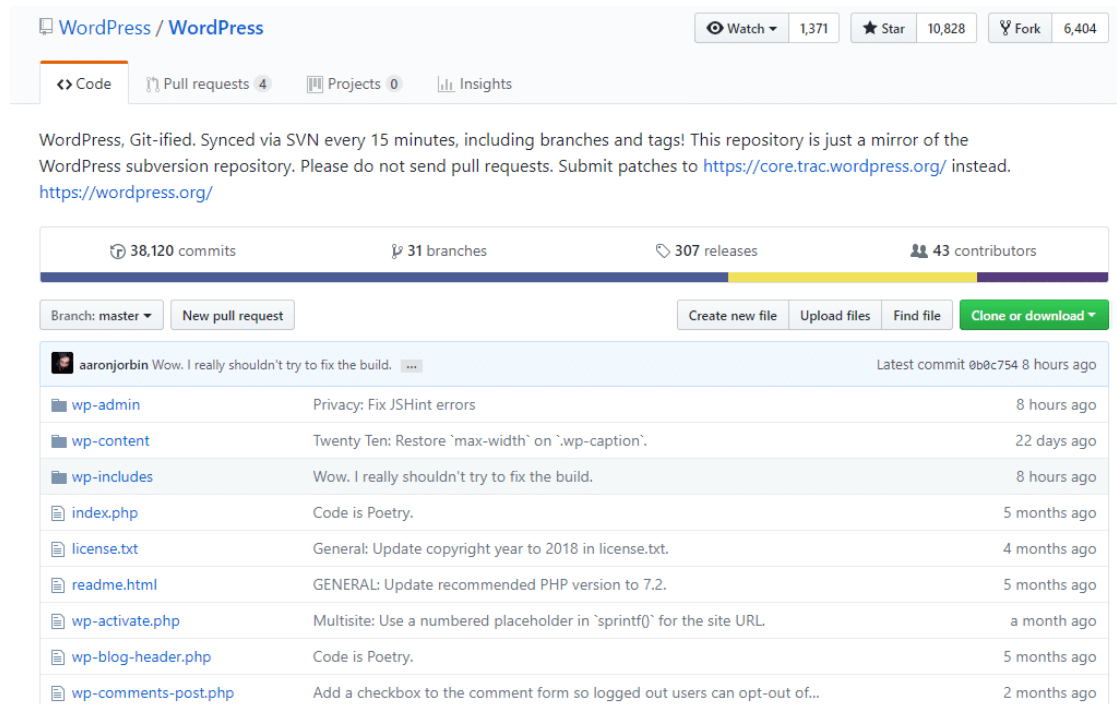


- The working directory is the area where developers modify files representing the current state of the files on the developer's machine.
- The staging area (index) is an intermediate zone between the working directory and the repository where developers add files before committing changes.
- A local repository is a complete copy of the project, stored on each developer's machine, containing the full history of the project and all its branches.
- A shared central repository serves as the remote repository where developers synchronize their local copies by pulling updates from it and pushing their changes to keep the project up-to-date across all contributors.

## Git environment: Repository (repo)

A Git repository, commonly called a "repo," is a data structure that organizes and tracks a project's files, directories, and their complete revision history. It functions as a central hub for managing changes to source code or any collection of files, allowing developers to efficiently monitor, collaborate, and revert to previous versions when needed.

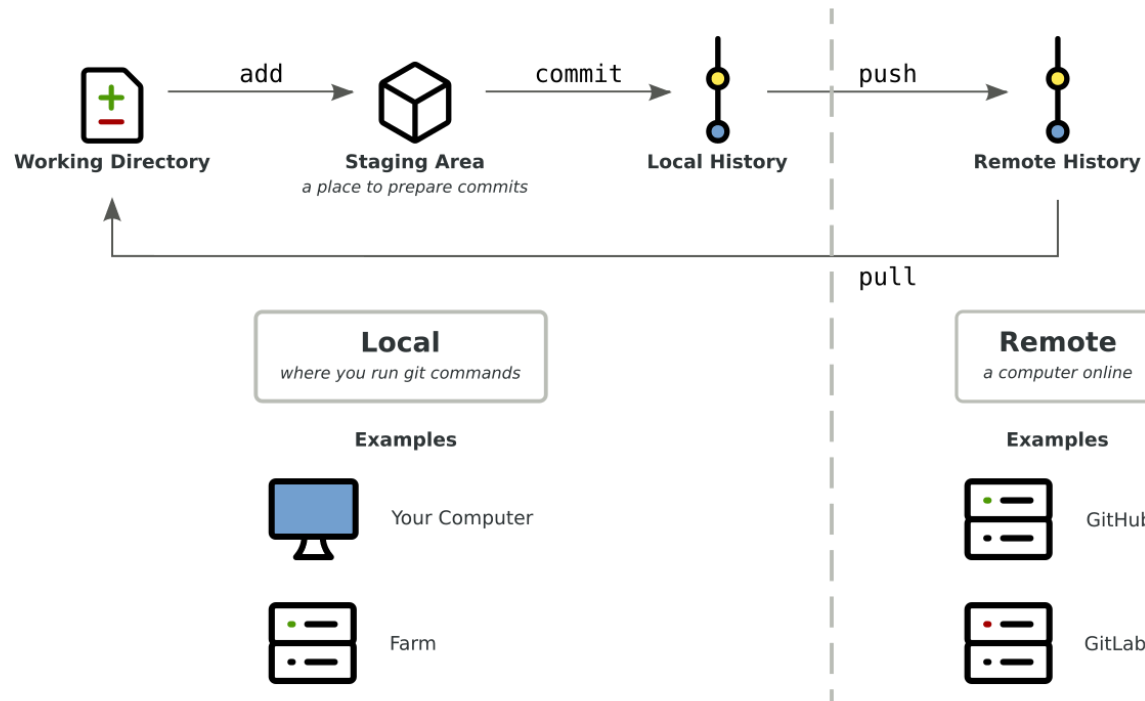
- Files and Directories
- Commit History
- Branches
- Remote Repository Connection



The screenshot shows the GitHub interface for the WordPress repository. At the top, it displays the repository name 'WordPress / WordPress' with options to Watch (1,371), Star (10,828), and Fork (6,404). Below this, there are tabs for Code, Pull requests (4), Projects (0), and Insights. The main content area contains a description: 'WordPress, Git-ified. Synced via SVN every 15 minutes, including branches and tags! This repository is just a mirror of the WordPress subversion repository. Please do not send pull requests. Submit patches to <https://core.trac.wordpress.org/> instead. <https://wordpress.org/>'. Below the description, statistics are shown: 38,120 commits, 31 branches, 307 releases, and 43 contributors. A progress bar is visible. Below the statistics, there are buttons for 'Branch: master', 'New pull request', 'Create new file', 'Upload files', 'Find file', and 'Clone or download'. The commit history table is shown below, with columns for the commit message, the commit hash, and the time since the commit. The latest commit is by 'aaronjorbin' with the message 'Wow. I really shouldn't try to fix the build.' and a hash of '0b8c754', committed 8 hours ago. The table lists several files and their commit history: wp-admin, wp-content, wp-includes, index.php, license.txt, readme.html, wp-activate.php, wp-blog-header.php, and wp-comments-post.php.

File	Commit Message	Time
wp-admin	Privacy: Fix JSHint errors	8 hours ago
wp-content	Twenty Ten: Restore `max-width` on `.wp-caption`.	22 days ago
wp-includes	Wow. I really shouldn't try to fix the build.	8 hours ago
index.php	Code is Poetry.	5 months ago
license.txt	General: Update copyright year to 2018 in license.txt.	4 months ago
readme.html	GENERAL: Update recommended PHP version to 7.2.	5 months ago
wp-activate.php	Multisite: Use a numbered placeholder in `sprintf()` for the site URL.	a month ago
wp-blog-header.php	Code is Poetry.	5 months ago
wp-comments-post.php	Add a checkbox to the comment form so logged out users can opt-out of...	2 months ago

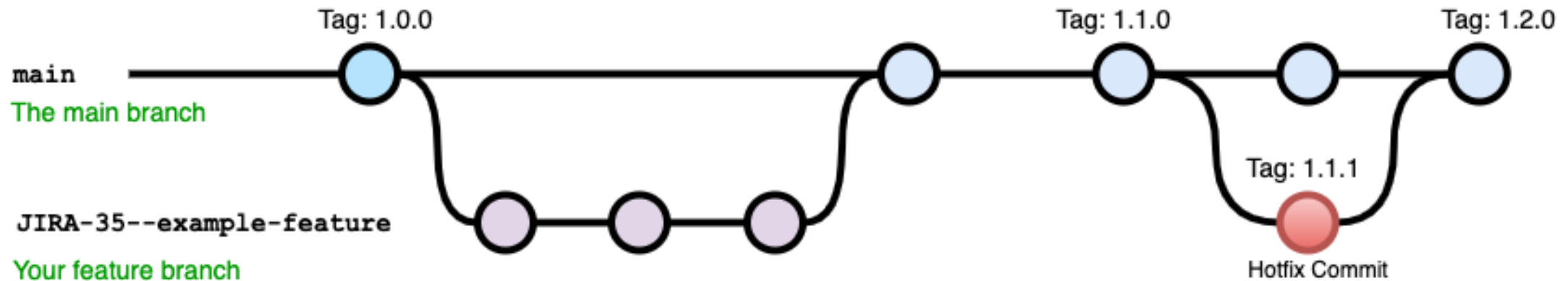
## Git environment: Main operations



- Developers can **clone** repositories, which includes all files, branches, and the complete version history, storing it locally on their machine.
- Developers can make local changes, **commit** them to their repository, create new branches, and manage the code without an Internet connection.
- Developers can **pull** updates from the remote server to synchronize their local repository with the latest changes made by others.
- Developers can **push** their local changes to the remote repository, allowing others to access and integrate their contributions.

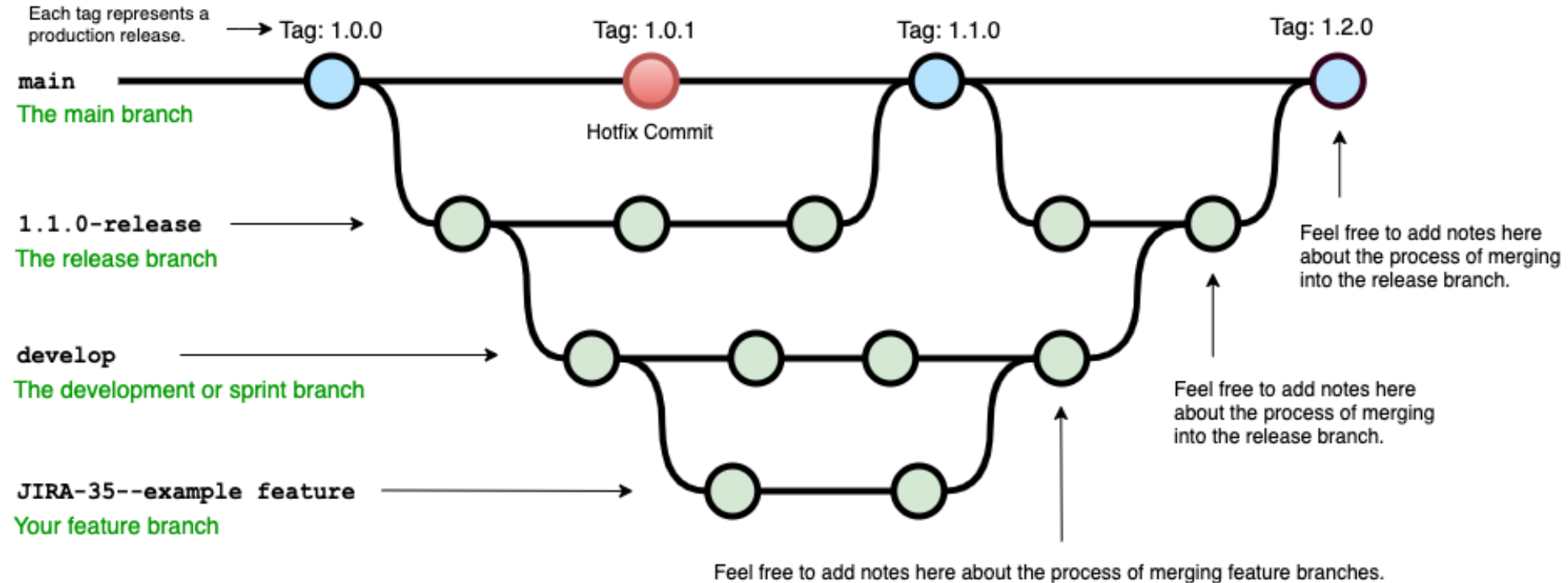
## Git environment: Branches

In Git, a branch is a lightweight, movable pointer that represents an independent line of development within the repository which enables multiple developers to work on separate features, bug fixes, or experimental changes concurrently, keeping their work isolated from the main codebase and from each other.



This isolation ensures that developers can make changes without interfering with others' progress, and once the work is complete, branches can be safely merged back into the main branch.

## Git environment: Branches

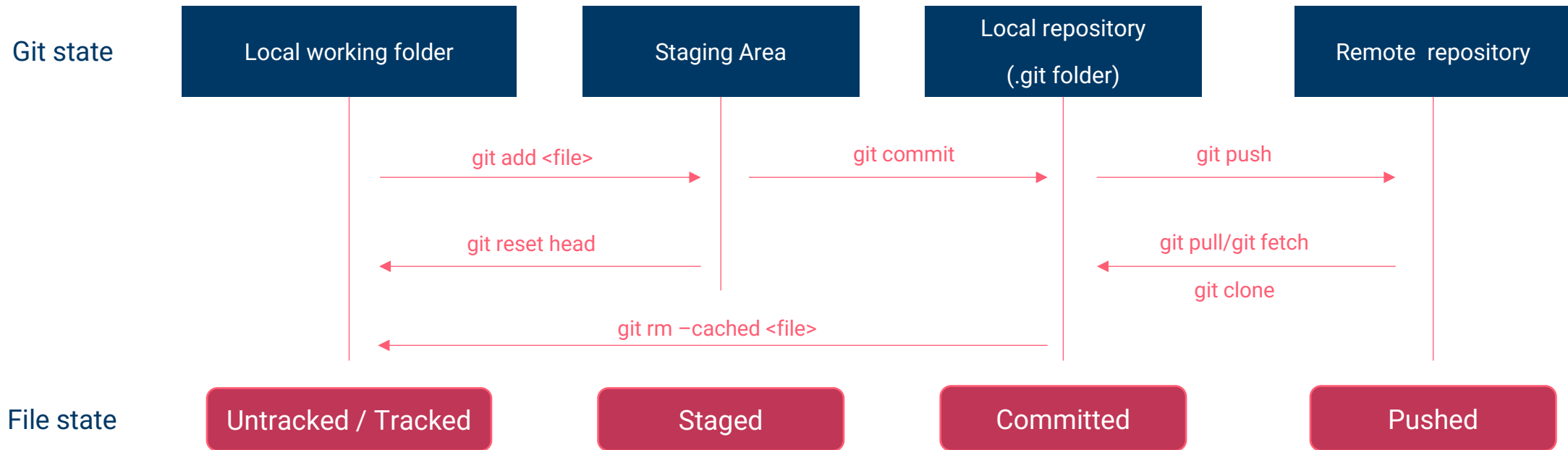


The primary branch in a Git repository is typically called the **main** or **master** branch. It serves as the default branch where the stable, production-ready code is maintained.



## Git environment: file LiveCycle

In Git, files can exist in one of several **states** that represent their position in the Git workflow and their relationship to the repository.



These states are part of the file's lifecycle as it moves between the **working directory**, the **staging area**, and the **repository**.

## Git environment: file LiveCycle

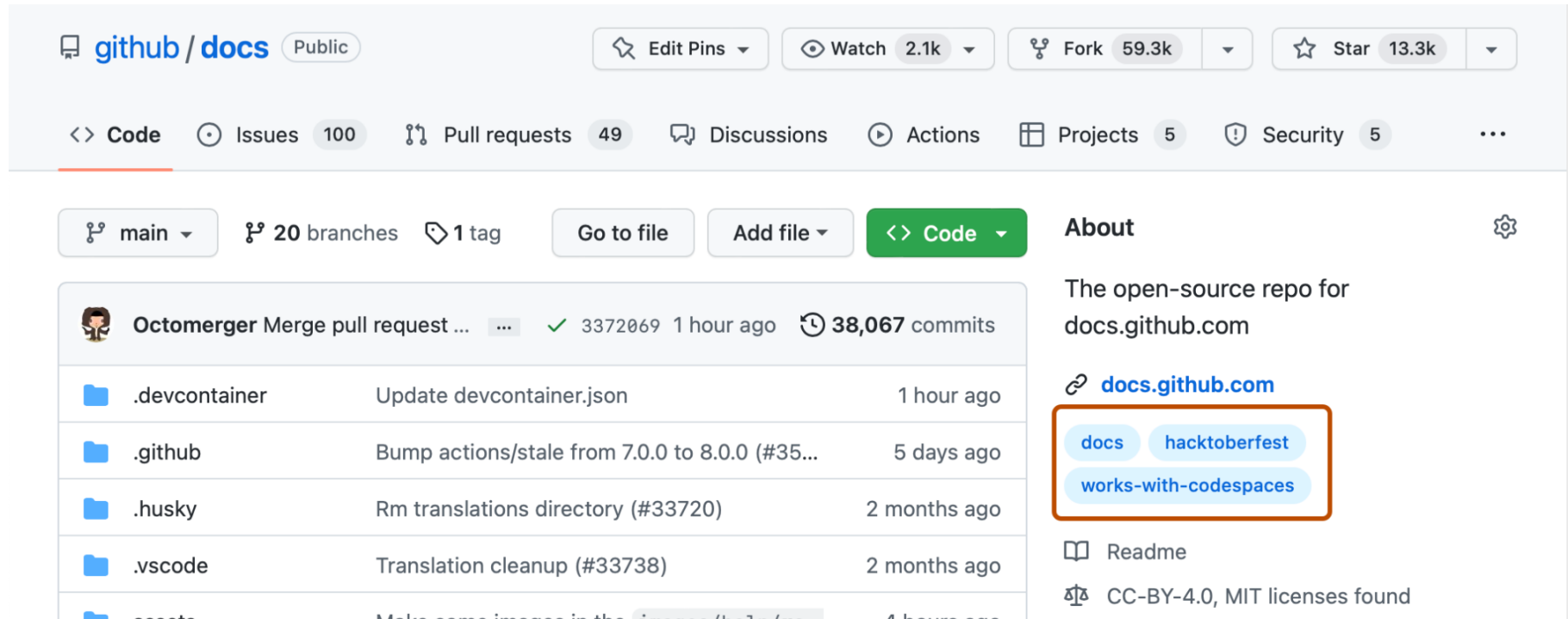
Git file states represent the lifecycle of files as they move through different states within the Git version control system:

- **Untracked:** Files that exist in your working directory but are not being tracked by Git. These files are new and have not yet been added to the staging area.
- **Tracked:** Files that Git is actively monitoring. Tracked files can exist in one of two sub-states:
  - **Unmodified:** Tracked files that have not been changed since the last commit.
  - **Modified:** Tracked files that have been changed in the working directory but have not yet been staged for a commit.
- **Staged (or Indexed):** Files that have been added to the staging area and are ready to be included in the next commit.
- **Committed:** Files that have been saved to the Git repository. These files are stored in Git's database and are part of the repository's history.
- **Pushed:** Files that have been committed locally and then uploaded to a remote Git repository. These files are now stored on the remote server and are accessible to other collaborators.

# GitHub account

# 03

## Create a GitHub account



The screenshot shows the GitHub repository page for 'github/docs'. The repository is public and has 2.1k watches, 59.3k forks, and 13.3k stars. It has 100 issues, 49 pull requests, 5 projects, and 5 security alerts. The repository is currently on the 'main' branch, with 20 other branches and 1 tag. The file list shows several files, including '.devcontainer', '.github', '.husky', and '.vscode'. The 'About' section describes the repository as the open-source repo for docs.github.com, with links to 'docs', 'hacktoberfest', and 'works-with-codespaces'.

github / docs Public

Edit Pins Watch 2.1k Fork 59.3k Star 13.3k

<> Code Issues 100 Pull requests 49 Discussions Actions Projects 5 Security 5

main 20 branches 1 tag Go to file Add file <> Code

Octomerger Merge pull request ... 3372069 1 hour ago 38,067 commits

File	Commit Message	Time
.devcontainer	Update devcontainer.json	1 hour ago
.github	Bump actions/stale from 7.0.0 to 8.0.0 (#35...	5 days ago
.husky	Rm translations directory (#33720)	2 months ago
.vscode	Translation cleanup (#33738)	2 months ago
assets	Make some images in the images folder	4 hours ago

About

The open-source repo for docs.github.com

docs.github.com

docs hacktoberfest works-with-codespaces

Readme

CC-BY-4.0, MIT licenses found



**Join to GH**

GitHub is a web-based platform that offers repository hosting services for version control, utilizing Git as the underlying system.

## How to choose my a GitHub username

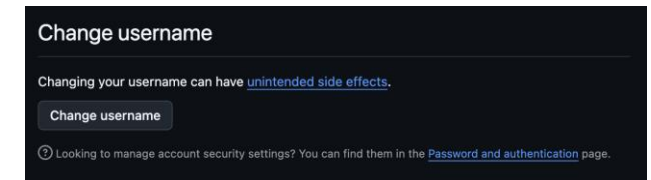
You must to create a GitHub username following these rules:

**first name-surname1-surname2**

- Use lowercase letters (a–z), numbers (0–9), and the hyphen (-).
- Do not use accents or special characters (including “ñ”; use n instead).
- Do not exceed 39 characters in total.

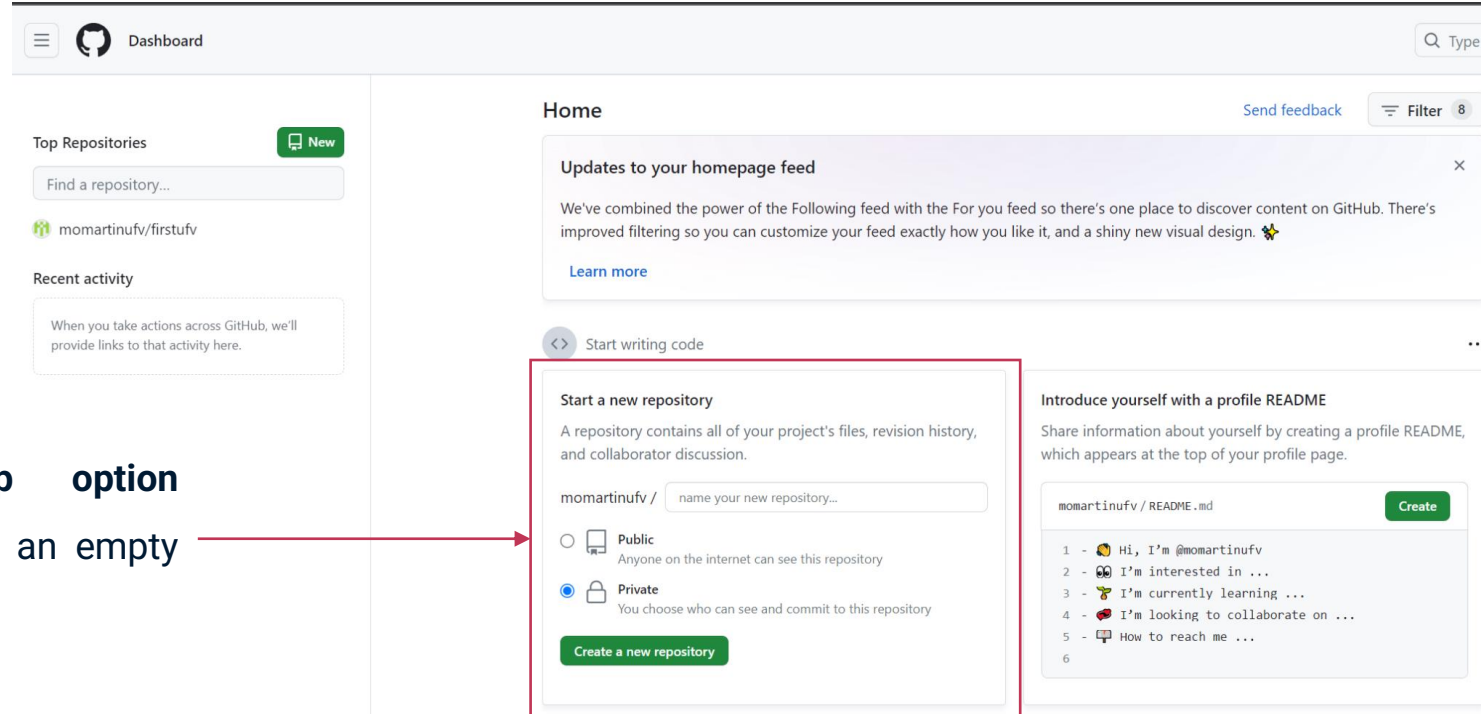
## If you need to change your username

- Go to GitHub and log in.
- Click your profile picture (top right).
- Click Settings.
- In the left menu, click Account or Profile (where your current username appears).



- Find your Username and click Change username.
- Type your new username and check it is available.
- Click confirm.

## Create a GitHub repo



The **Quick setup option** consists on creating an empty repository quickly.

You can create repositories using various options on your GitHub dashboard. The quick setup option allows you to create an empty repository without including files like README.md or a license file.


## Create a GitHub repo (Standard version)

### Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? [Import a repository.](#)

Required fields are marked with an asterisk (\*).

Owner \*

 momartinufv

Repository name \*

/ yourreponame

✔ yourreponame is available.

Great repository names are short and memorable. Need inspiration? How about [reimagined-adventure](#) ?

Description (optional)

☐

Public

Anyone on the internet can see this repository. You choose who can commit.

☒

Private

You choose who can see and commit to this repository.

Initialize this repository with:

☒ Add a README file

This is where you can write a long description for your project. [Learn more about READMEs.](#)

Add .gitignore

.gitignore template: None

Choose which files not to track from a list of templates. [Learn more about ignoring files.](#)

Choose a license

License: GNU General Public License v3.0

A license tells others what they can and can't do with your code. [Learn more about licenses.](#)

This will set `main` as the default branch. Change the default name in your [settings](#).

① You are creating a private repository in your personal account.

Create repository

The visibility of a GitHub repository can be set to either public or private. For most projects, it is recommended to choose private visibility.

You can define a license for your source code to specify how others can use, modify, and distribute it.

The repository name must be unique and available within your GitHub account or organization.

The README file includes key information about the repository.

It is recommended to include a license for the code stored in a repository.

# GitHub tokens

# 04



## Create a GitHub token

GitHub tokens are secure authentication credentials used to interact with GitHub's API and perform actions programmatically without using your regular password.

**abcdefghijklmnopqrstuvwxyz1234567890**

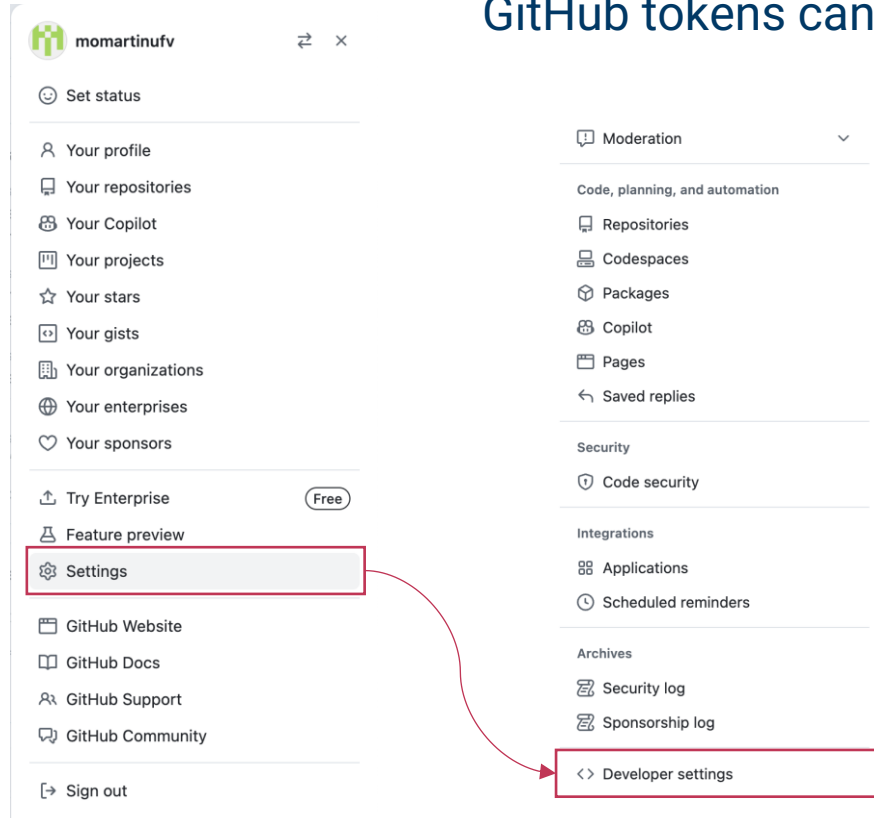
**This token is your new password  
to access to your repository**

These tokens provide a way to access GitHub resources without using a username and password, enhancing security and enabling automation.

**In macOS (and other operating systems), GitHub no longer allows using a password for Git operations (like cloning, pulling, or pushing) over HTTPS because of a security enhancement introduced by GitHub.**

## Create a GitHub token

GitHub tokens can be created in your GitHub settings.



### Log in to GitHub:

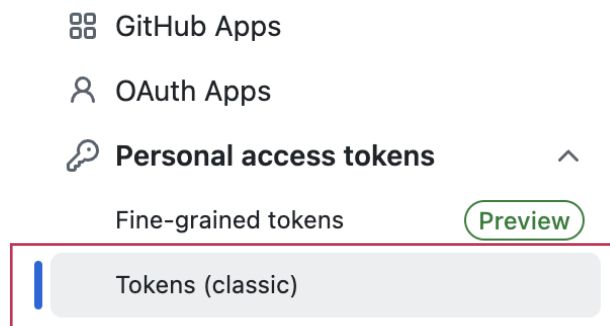
- Go to GitHub and log in with your account.

### Navigate to Developer Settings:

- In the upper-right corner, click your profile picture, and then click **Settings**.
- Scroll down and find **Developer Settings** in the left-hand menu.

## Create a GitHub token

There are different type of tokens: (1) **Tokens (classic)** for the traditional token type, or (2) **Fine-grained Tokens** for more scoped and precise control.



**We are going to use classic tokens.**

### Personal access tokens (classic)

[Generate new token ▼](#)

Tokens you have generated that can be used to access the [GitHub API](#).

**ufv** — *admin:enterprise, admin:gpg\_key, admin:org, admin:org\_hook, admin:public\_key,* Last used within the last week  
*admin:repo\_hook, admin:ssh\_signing\_key, audit\_log, codespace, copilot, delete:packages, delete\_repo, gist,*  
*notifications, project, repo, user, workflow, write:discussion, write:packages*  
Expires *on Sat, Jan 25 2025*.

[Delete](#)

Personal access tokens (classic) function like ordinary OAuth access tokens. They can be used instead of a password for Git over HTTPS, or can be used to [authenticate to the API over Basic Authentication](#).

**These are the current available tokens.**

## Create a GitHub token

A classic token in GitHub is a personal access token (PAT) used to authenticate API requests or Git operations, configured with specific scopes to control permissions.

**New personal access token (classic)**

Personal access tokens (classic) function like ordinary OAuth access tokens. They can be used instead of a password for Git over HTTPS, or can be used to [authenticate to the API over Basic Authentication](#).

**Note**

This is a test token for slides.

What's this token for?

**Expiration \***

30 days ▼ The token will expire on Mon, Dec 30 2024

**Select scopes**

Scopes define the access for personal tokens. [Read more about OAuth scopes.](#)

<input checked="" type="checkbox"/> <b>repo</b>	Full control of private repositories
<input checked="" type="checkbox"/> repo:status	Access commit status
<input checked="" type="checkbox"/> repo_deployment	Access deployment status
<input checked="" type="checkbox"/> public_repo	Access public repositories
<input checked="" type="checkbox"/> repo:invite	Access repository invitations
<input checked="" type="checkbox"/> security_events	Read and write security events
<input checked="" type="checkbox"/> <b>workflow</b>	Update GitHub Action workflows

We need to include a description for the token to identify its purpose (e.g., "This is a test token for slides").

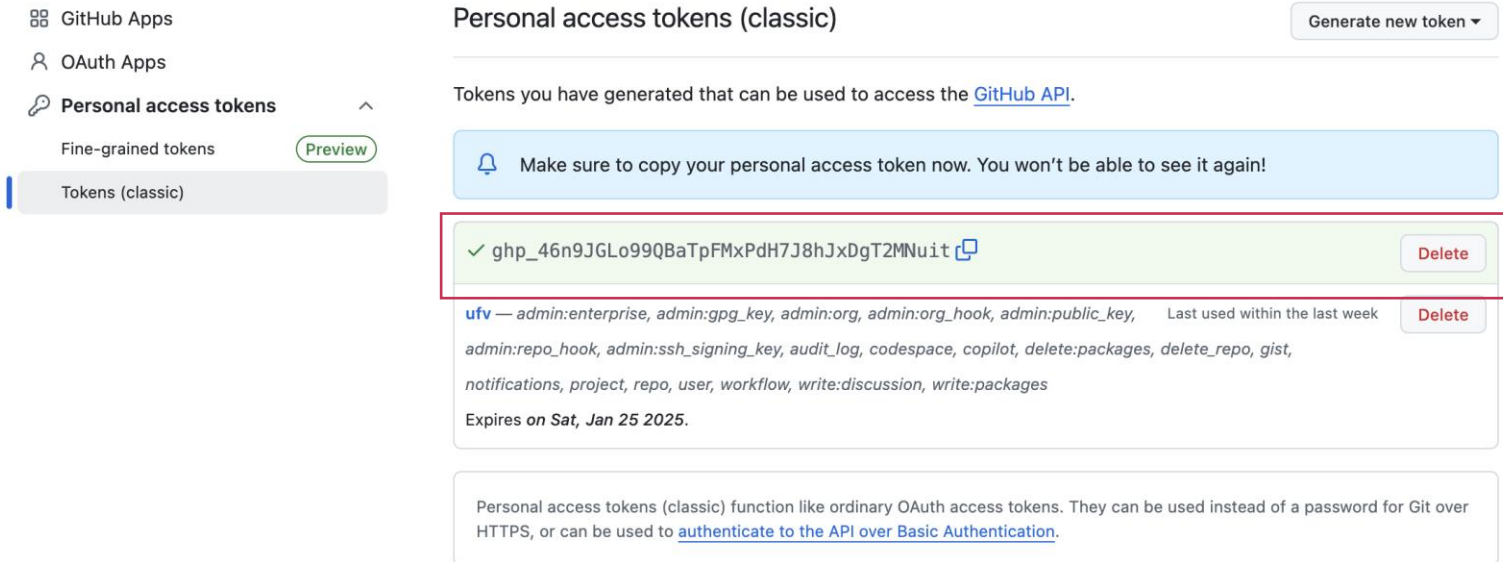
→ Set the **expiration date** (e.g., 30 days, 60 days, etc., or no expiration for permanent tokens).

→ Select the necessary **scopes** (permissions over the functionalities). For example:

- repo: Access to repositories.
- read:org: Read access to organization data.
- admin:org: Manage organization settings.

## Create a GitHub token

Once the GitHub token is generated, it will be displayed through the application's web interface.



Personal access tokens (classic) Generate new token ▼

Tokens you have generated that can be used to access the [GitHub API](#).

Make sure to copy your personal access token now. You won't be able to see it again!

✓ ghp\_46n9JGLo99QBATpFMxPdH7J8hJxDgT2MNuit Delete

ufv — admin:enterprise, admin:gpg\_key, admin:org, admin:org\_hook, admin:public\_key, Last used within the last week Delete

admin:repo\_hook, admin:ssh\_signing\_key, audit\_log, codespace, copilot, delete:packages, delete\_repo, gist, notifications, project, repo, user, workflow, write:discussion, write:packages

Expires on Sat, Jan 25 2025.

Personal access tokens (classic) function like ordinary OAuth access tokens. They can be used instead of a password for Git over HTTPS, or can be used to [authenticate to the API over Basic Authentication](#).

**Tokens in GitHub can only be viewed during their creation, so it is crucial to copy or securely store the token immediately after generating it.**

**This token will serve as your password from now on for executing Git commands with your GitHub repository.**

# Git – Basic commands

# 05

## Install Git in your laptop

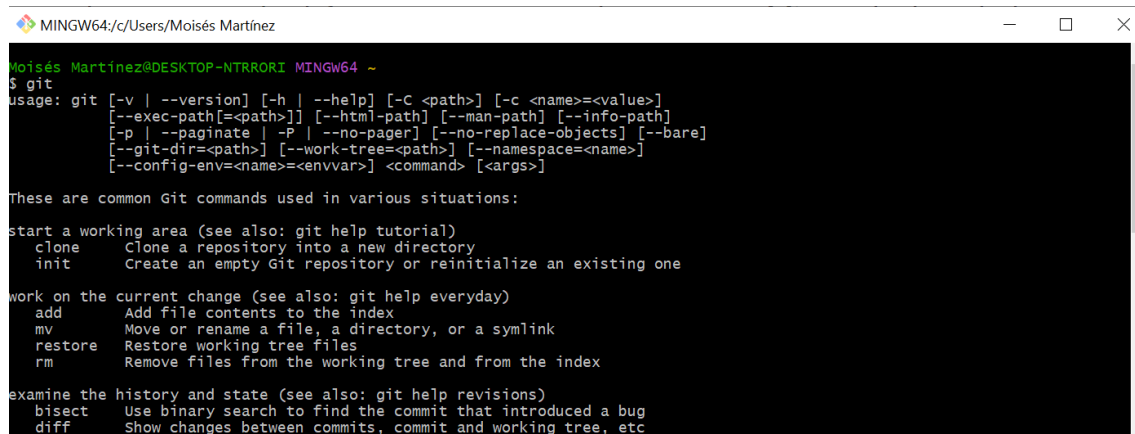
- Linux (Ubuntu) → Command `sudo apt-get install git`
- Windows → <http://git-scm.com/download/win>
- Mac → <http://git-scm.com/download/mac>



## Fundamental concepts: Running Git in your command line

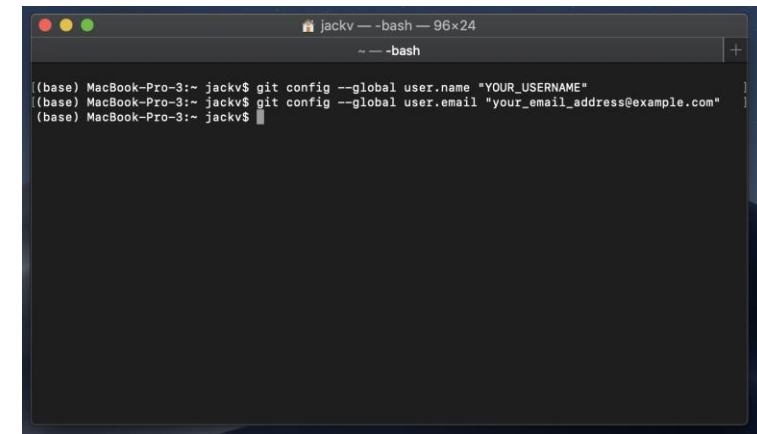
The primary method for using Git is through the command line, which provides direct access to all Git functions and features.

- For Windows users, Git Bash is commonly used, offering a Unix-like shell to run Git commands.
- For macOS and Linux, the native terminal can be used for running Git commands.

A screenshot of a Windows terminal window titled "MINGW64/c/Users/Moisés Martínez". The terminal shows the command prompt with the user's name "Moisés Martínez@DESKTOP-NTRRORI" and the shell "MINGW64 ~". The user has entered the command "\$ git", which has triggered the Git help text. The help text includes usage information, a list of common Git commands, and a list of Git subcommands. The subcommands listed are: clone (Clone a repository into a new directory), init (Create an empty Git repository or reinitialize an existing one), add (Add file contents to the index), mv (Move or rename a file, a directory, or a symlink), restore (Restore working tree files), rm (Remove files from the working tree and from the index), bisect (Use binary search to find the commit that introduced a bug), and diff (Show changes between commits, commit and working tree, etc).

```
Moisés Martínez@DESKTOP-NTRRORI MINGW64 ~  
$ git  
usage: git [-v | --version] [-h | --help] [-C <path>] [-c <name>=<value>]  
        [--exec-path[=<path>]] [--html-path] [--man-path] [--info-path]  
        [-p | --paginate] [-P | --no-pager] [--no-replace-objects] [--bare]  
        [--git-dir=<path>] [--work-tree=<path>] [--namespace=<name>]  
        [--config-env=<name>=<envvar>] <command> [<args>]  
  
These are common Git commands used in various situations:  
  
start a working area (see also: git help tutorial)  
  clone Clone a repository into a new directory  
  init  Create an empty Git repository or reinitialize an existing one  
  
work on the current change (see also: git help everyday)  
  add   Add file contents to the index  
  mv    Move or rename a file, a directory, or a symlink  
  restore Restore working tree files  
  rm    Remove files from the working tree and from the index  
  
examine the history and state (see also: git help revisions)  
  bisect Use binary search to find the commit that introduced a bug  
  diff   Show changes between commits, commit and working tree, etc
```

**Git Bash on Windows**

A screenshot of a macOS terminal window titled "jackv — -bash — 96x24". The terminal shows the prompt "(base) MacBook-Pro-3:~ jackv\$". The user has entered the command "git config --global user.name \"YOUR\_USERNAME\"", which has been executed. The prompt has changed to "(base) MacBook-Pro-3:~ jackv\$". The user has then entered the command "git config --global user.email \"your\_email\_address@example.com\"", which has also been executed. The prompt has changed to "(base) MacBook-Pro-3:~ jackv\$".

```
(base) MacBook-Pro-3:~ jackv$ git config --global user.name "YOUR_USERNAME"  
(base) MacBook-Pro-3:~ jackv$ git config --global user.email "your_email_address@example.com"  
(base) MacBook-Pro-3:~ jackv$
```

**Terminal on Mac**



## Fundamental concepts: Running Git in your command line

There are some basic commands for using the command line (Bash/Unix) that will be useful for you.

Command syntax	Description
<b>cd <code>folder_name</code></b>	The cd command, short for "change directory," allows users to switch from their current working directory to a specified directory
<b>ls -la</b>	The ls command allows users to list files and directories in the current working directory. It provides a concise view of the contents, displaying names of files and folders. Adding options like -l provides detailed information, while -a shows hidden files.
<b>mkdir <code>folder_name</code></b>	The mkdir command allows users to create a new directory or folder. By specifying a "folder name" as an argument, it instantly generates the specified directory in the current working directory
<b>rmdir <code>folder_name</code></b>	The rmdir command allows users to remove an empty directory or folder. It deletes the specified directory if it contains no subdirectories or files.
<b>cat <code>file_name</code></b>	The cat command allows users to concatenate and display the contents of one or more files. It can be employed to view the entire content of a file.
<b>mv <code>file_name</code> <code>new_file_name</code></b>	The mv command allows users to move files and directories from one directory to another or rename a file or directory. If you move a file or directory to a new directory, it retains the base file name.

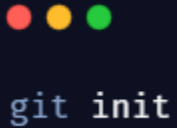
## Fundamental concepts: Running Git in your command line

There are some basic commands for using the command line (Windows) that will be useful for you.

Command syntax	Description
cd <b>folder_name</b>	The cd command, short for "change directory," allows users to switch from their current working directory to a specified directory
dir /p	The dir command allows users to list files and directories in the current working directory.
mkdir <b>folder_name</b>	The mkdir command allows users to create a new directory or folder. By specifying a "folder name" as an argument, it instantly generates the specified directory in the current working directory
rmdir <b>folder_name</b>	The rmdir command allows users to remove an empty directory or folder. It deletes the specified directory if it contains no subdirectories or files.
cat file_name	The cat command allows users to concatenate and display the contents of one or more files. It can be employed to view the entire content of a file.
rm <b>file_name new_file_name</b>	The mv command allows users to moves files and directories from one directory to another or renames a file or directory. If you move a file or directory to a new directory, it retains the base file name.

## Fundamental concepts: Create a local repo

The `git init` command is used in Git to initialize a new Git repository in a directory on your local machine. This command sets up the necessary Git infrastructure, creating an empty repository with an initial commit.



```
git init
```

After executing `git init`, you will see a new subdirectory named **.git** created within the current directory. This directory is where Git stores all the necessary files and metadata to manage version control for your project.

## Fundamental concepts: Clone a repo

The git clone command is used in Git to create a local copy of a remote repository. When you clone a repository, you retrieve all of its files, commit history, and branches onto your local machine.



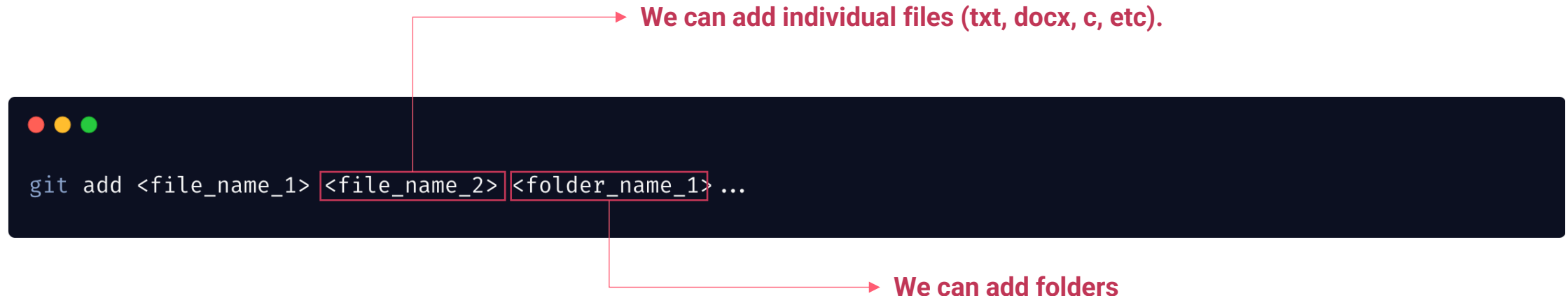
```
git clone https://github.com/your-username/your-repository.git
```

The image shows a terminal window with the command `git clone https://github.com/your-username/your-repository.git`. Two red arrows point from text annotations to parts of the command. The first arrow points from the text "This is the account or organization that owns the repository." to the `your-username` part of the URL. The second arrow points from the text "This is the specific repository within that account." to the `your-repository` part of the URL.

Once you have created a repository on GitHub, you can proceed to clone it, thereby creating a local copy on your machine. To initiate this process, please follow the subsequent [instructions](#) for creating your repository.

## Fundamental concepts: Add changes/files to the repo

The git add command is used in Git to add changes or new files to the **staging area**. The staging area is a critical part of Git's workflow, where you select and prepare specific changes or files to be included in the next commit.



```
git add <file_name_1> <file_name_2> <folder_name_1> ...
```

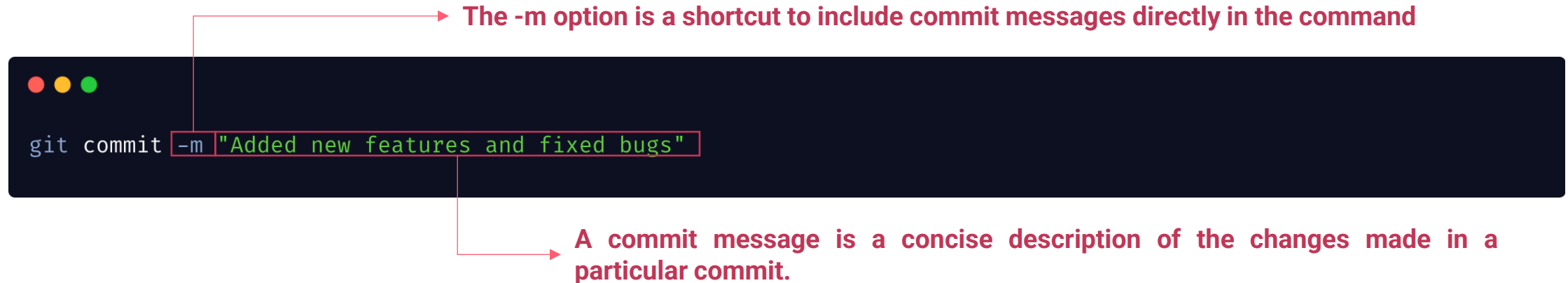
The terminal window shows the command `git add <file_name_1> <file_name_2> <folder_name_1> ...`. A red box highlights `<file_name_2>` with an arrow pointing to the text "We can add individual files (txt, docx, c, etc)". Another red box highlights `<folder_name_1>` with an arrow pointing to the text "We can add folders".

After running git add, the specified changes or files are added to the staging area, ready to be committed.

**Git add is used to adding change to existing files and add new files.**

## Fundamental concepts: Commit changes to the local repo.

The git commit command is used in Git to create a new commit in a Git repository. A commit represents a snapshot of the current state of your project's files and serves as a permanent record of changes made to the repository.




It is possible to execute a git commit command without using the -m option; however, it is considered best practice to always include a clear and descriptive commit message.

**A well-crafted message helps provide context and clarity to developers.**

## Fundamental concepts: Push to the remote repo.

The git push command is used in Git to upload local commits from your repository to a remote repository. It allows you to synchronize your changes with the remote repository, ensuring that others can access your updates.

The **<remote>** in the git push command specifies the name of the remote repository where you want to upload your local commits. The **<remote>** allows Git to know which repository to interact with, making it an essential part of synchronizing your local work with a remote source.




```
git push <remote> <branch>
```

The **<branch>** in the git push command specifies the branch you want to upload to the remote repository.

**You can omit the **<branch>** in the git push command if your current branch is tracking a remote branch.**

## Fundamental concepts: Push to the remote repo.

During the initial push, there is a chance that Git credentials might not be configured correctly. In such cases, it's important to set up your username and email address to properly associate commits with your identity before proceeding.



The image shows a terminal window with two lines of code. The first line is `git config --global user.name "My super name"` and the second line is `git config --global user.email "username@alumnos.ufv.es"`. Red boxes highlight `user.name` and `user.email` in the code. Red arrows point from these boxes to explanatory text. The arrow from `user.name` points to the text "user.name specifies the name of the user associated with the commits being pushed to the repository." The arrow from `user.email` points to the text "user.email specifies the email address associated with the user making commits and pushing changes to the repository."

```
git config --global user.name "My super name"
git config --global user.email "username@alumnos.ufv.es"
```

user.name specifies the name of the user associated with the commits being pushed to the repository.

user.email specifies the email address associated with the user making commits and pushing changes to the repository.

**For GitHub, the user.email must match the one registered with your GitHub account to properly link your commits to your profile.**




## Fundamental concepts: Pull from the remote repo.

The git pull command is used in Git to fetch and integrate changes from a remote repository into your current branch.

The **<remote>** specifies the name of the remote repository from which you want to pull changes, with origin being the default remote in most cases.

This option is optional if your branch is already tracking a branch on a remote.



```
git pull <remote> <branch>
```

The **<branch>** specifies the branch in the remote repository from which you want to pull changes into your current branch.


This option is optional if your local branch is already tracking a specific remote branch.

## Fundamental concepts: Fetch from the remote repo.

The git fetch command is used in Git to retrieve updates from a remote repository without automatically merging them into your local branch, giving you the opportunity to review and integrate changes at your discretion.

The **<remote>** specifies the name of the remote repository from which you want to pull changes, with origin being the default remote in most cases.

This option is optional if your branch is already tracking a branch on a remote.



```
git fetch <remote> <branch>
```

The **<branch>** specifies the branch in the remote repository from which you want to pull changes into your current branch.

This option is optional if your local branch is already tracking a specific remote branch.

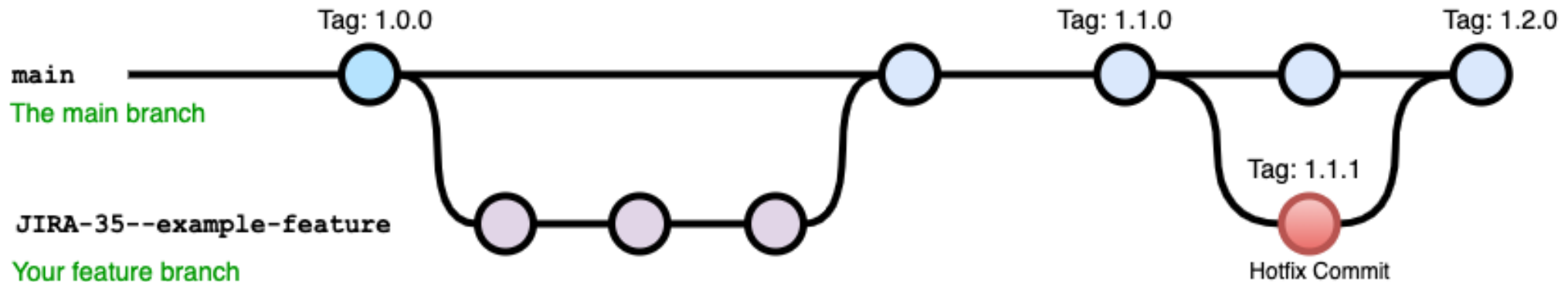
# Git – Branches

# 06

## Branches of code

A **branch** in Git is a lightweight pointer to a specific commit in the repository's history. These branches exist in two forms:

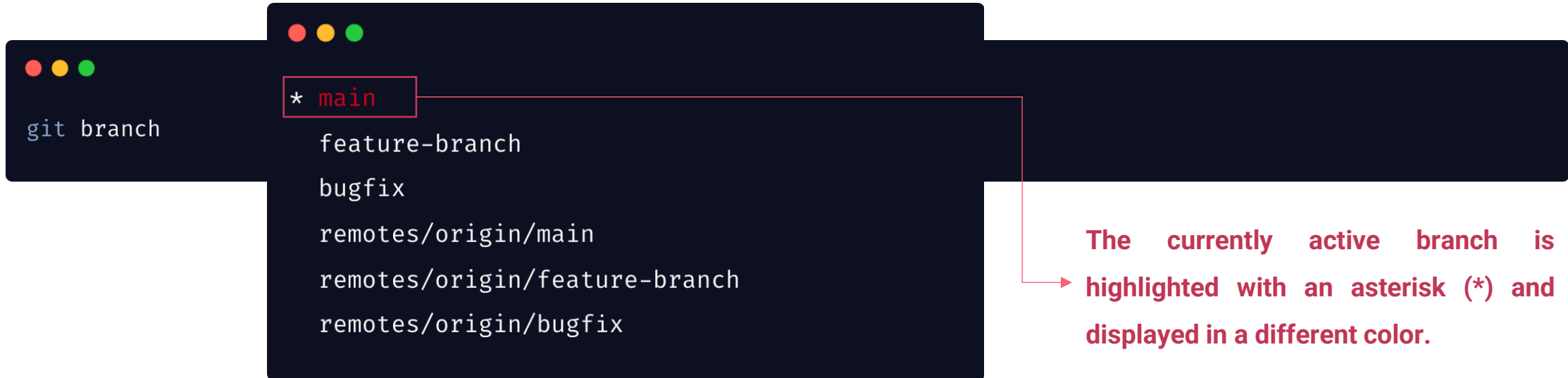
- **local branches** (stored on your machine)
- **remote branches** (stored on a remote repository, such as GitHub or GitLab).



**Branches allow developers to isolate their work, enabling parallel development, experimentation, and collaboration without affecting the main codebase.**

## Branches of code: Check for branches

The git branch command is used in Git to manage and interact with branches in a Git repository.



```
git branch
* main
feature-branch
bugfix
remotes/origin/main
remotes/origin/feature-branch
remotes/origin/bugfix
```

The currently active branch is highlighted with an asterisk (\*) and displayed in a different color.

The plain git branch command show all the branches that exist in your local repository.


## Branches of code: Check for branches

The git branch command is used in Git to manage and interact with branches in a Git repository.

Command syntax	Description
git branch	List local branches.
git branch -r	List remote branches.
git branch -a	List all branches (local + remote).
git branch -M <branch_name>	Rename the current branch to branch_name.
git rev-parse --abbrev-ref HEAD	Show the current branch.
git remote show origin	Show details about remote branches.
git log --oneline --graph --decorate --all	Show a graphical view of all branches.

## Branches of code: Change to another branch

The git checkout command is used in Git to manage branches by switching branches, restoring files, and detaching the HEAD to inspect specific commits or states in a repository.




```
git checkout branch_name
```

The `branch_name` must exist. This command switches the working directory to the `branch_name` branch and updates the files to match the state of that branch.

**After switching branches, it is necessary to run a git pull to download any changes made by other developers.**

## Branches of code: Change to another branch

The git checkout command is used in Git to manage branches by switching branches, restoring files, and detaching the HEAD to inspect specific commits or states in a repository.



```
git checkout -b branch_name
```

The **-b** flag in the git checkout command is used to create a new branch and immediately switch to it. It combines two basic operations into one:

1. Creating a new branch (equivalent to `git branch branch_name`).
2. Switching to the new branch (equivalent to `git checkout branch_name`).



## Branches of code: Change to another branch

The git checkout command is used in Git to manage branches by switching branches, restoring files, and detaching the HEAD to inspect specific commits or states in a repository.

Command syntax	Description
<code>git checkout branch_name</code>	It switch to a branch. The branch must be existed.
<code>git checkout -b new_branch_name</code>	It create and switch to a branch.
<code>git checkout branch_name -- file_name</code>	It restore a file in the branch.
<code>git checkout commit_hash</code>	It inspect a commit.

**The git checkout command has been partially replaced by the git switch and git restore commands.**

## Branches of code: GitHub

Branches can be created using the GitHub web interface pressing in the branch list button






### Branches

[New branch](#)

Overview Yours Active Stale All

Q Search branches...

#### Default

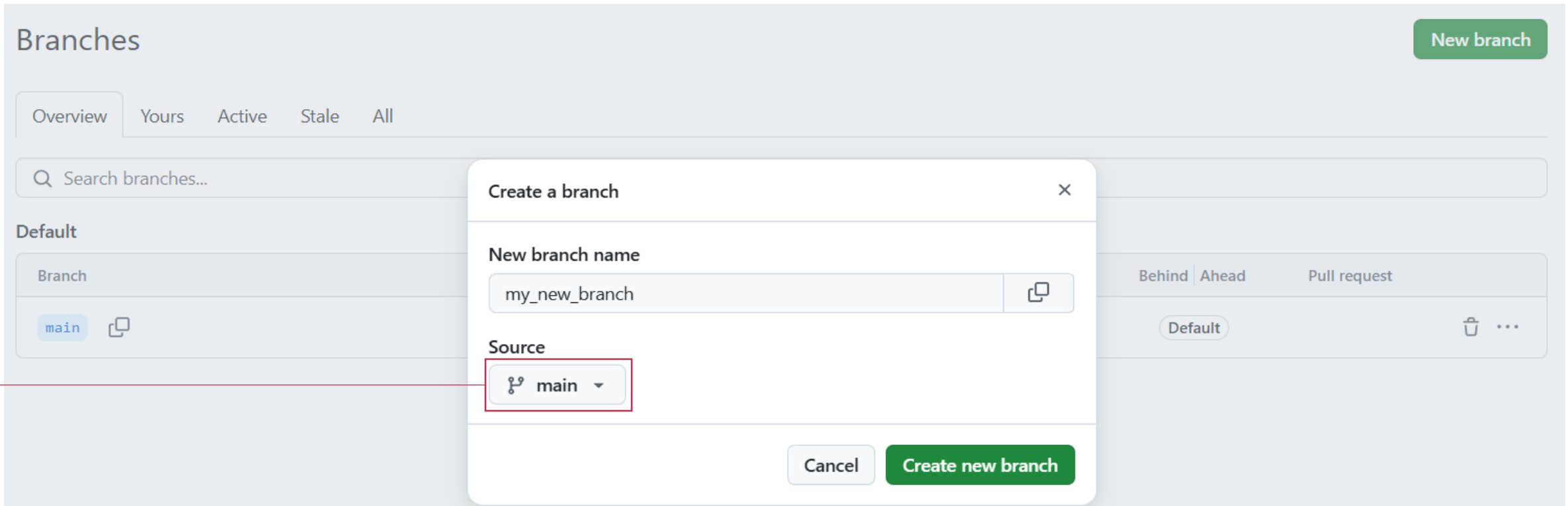
Branch	Updated	Check status	Behind	Ahead	Pull request
main 	 last week			Default	 ...

→ The page provides an overview of the status and activity of all branches in the repository.

New branches can be created by clicking the New Branch button. ←

## Branches of code: GitHub

Branches can be created using the GitHub web interface pressing in the branch list button  main ▾  1 Branch



The screenshot shows the GitHub 'Branches' page. At the top right is a 'New branch' button. Below it are tabs for 'Overview', 'Yours', 'Active', 'Stale', and 'All'. A search bar 'Search branches...' is present. Under the 'Default' section, a table lists branches, with 'main' highlighted. A modal dialog 'Create a branch' is open in the center. It has a title bar with a close button. The 'New branch name' field contains 'my\_new\_branch'. The 'Source' section shows a dropdown menu with 'main' selected, which is highlighted by a red rectangle. At the bottom of the modal are 'Cancel' and 'Create new branch' buttons. A red arrow points from the 'main' branch in the table to the 'main' source in the modal.

→ Branches are created from an existing branch, duplicating its content into the new branch as a starting point.

# Git – Files

# 07

## Git files

In a Git repository, certain **special files** serve specific purposes to help manage the project, provide documentation, or configure Git's behavior.

- Git ignore file: It specifies files and directories that Git should ignore and not track.
- Readme file: It provides a project overview, including its purpose, installation instructions, usage examples, and other documentation.
- ChangeLog file: It serves as a historical reference and is especially useful for developers and users to understand what has changed between versions of the project.
- License file: It specifies the terms and conditions for using, modifying, and distributing the project.

## Git files: README.md

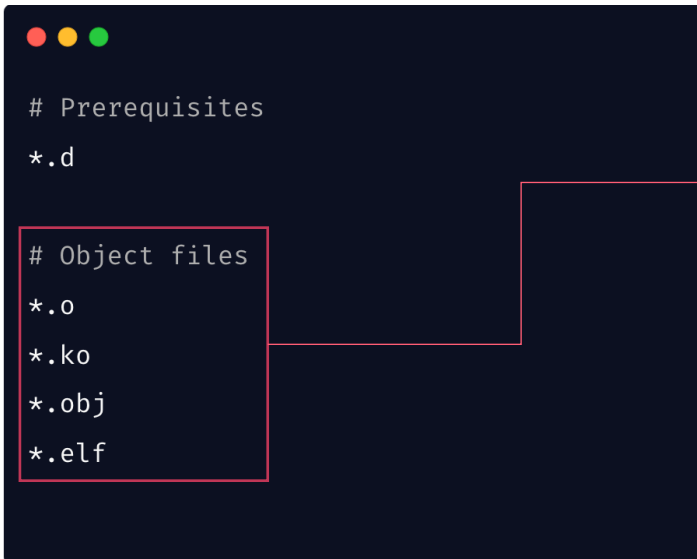
A README.md file is a widely used document in software development projects, especially in open-source projects hosted on platforms like GitHub.

Markdown Input (editable)	Rendered
<pre># Foobar  Foobar is a Python library for dealing with word pluralization.  ## Installation  Use the package manager [pip](https://pip.pypa.io/en/stable/) to install foobar.  ```bash pip install foobar ```</pre>	<p><b>Foobar</b></p> <hr/> <p>Foobar is a Python library for dealing with word pluralization.</p> <p><b>Installation</b></p> <hr/> <p>Use the package manager <a href="#">pip</a> to install foobar.</p> <pre>pip install foobar</pre>

It is written in Markdown, a lightweight and flexible markup language that allows for clear, structured text formatting, making it simple to create organized and visually appealing documentation.

## Git files: .gitignore

A .gitignore file is a configuration file in a Git repository that specifies intentionally untracked files or directories that Git should ignore.



```
# Prerequisites
*.d

# Object files
*.o
*.ko
*.obj
*.elf
```

The files with extensions like \*.o, \*.ko, \*.obj, and \*.elf are typically not included in a Git repository because they are generated files (build artifacts) that are produced during the build or compilation process.

There are general gitignore templates in the official github repository.

<https://github.com/github/gitignore/blob/main/C.gitignore>

These files are excluded from version control, ensuring they are not accidentally added to the repository.

## Git files: .gitignore

The .gitignore file helps keep the repository clean by excluding unnecessary files or sensitive data file such as:

- Temporary files created by editors or IDEs.
- Build artifacts, such as .o files or node\_modules/.
- Logs and caches.
- API keys, passwords, credentials or environment variables.

By ignoring these files, the repository focuses only on the important files (e.g., source code and configuration files), making it secure and easier to navigate and manage for developing teams.



## Git files: licenses

In Git, a license file is a document that outlines the legal terms and conditions for sharing and using a software project. It defines the permissions, restrictions, and obligations related to the use, modification, distribution, and licensing of the project's source code. Commonly used licenses include popular open-source options such as:

- **MIT License**
- **Apache License 2.0**
- **GNU General Public License (GPL)**
- **Creative Commons Licenses**

**The license file is a vital component of open-source projects. It clarifies how others can utilize, modify, and share the project's code while ensuring adherence to legal requirements.**

