



Version Control with Git

Key Takeaways

What is Version Control?

- Also known as "source control"
- Practice of **tracking and managing changes to software code**
- It enables multiple people to **simultaneously work on a single project**



- Code is **hosted centrally on the internet**
- Every developer has an **entire copy of the code locally**

Basic Concepts of Version Control

- Version Control keeps a **history of changes**

Every code change and file is tracked!



You can revert commits



Each change labelled with commit message



**Git is the most used
version control system**

Add list for...

Fix button...

Version 2



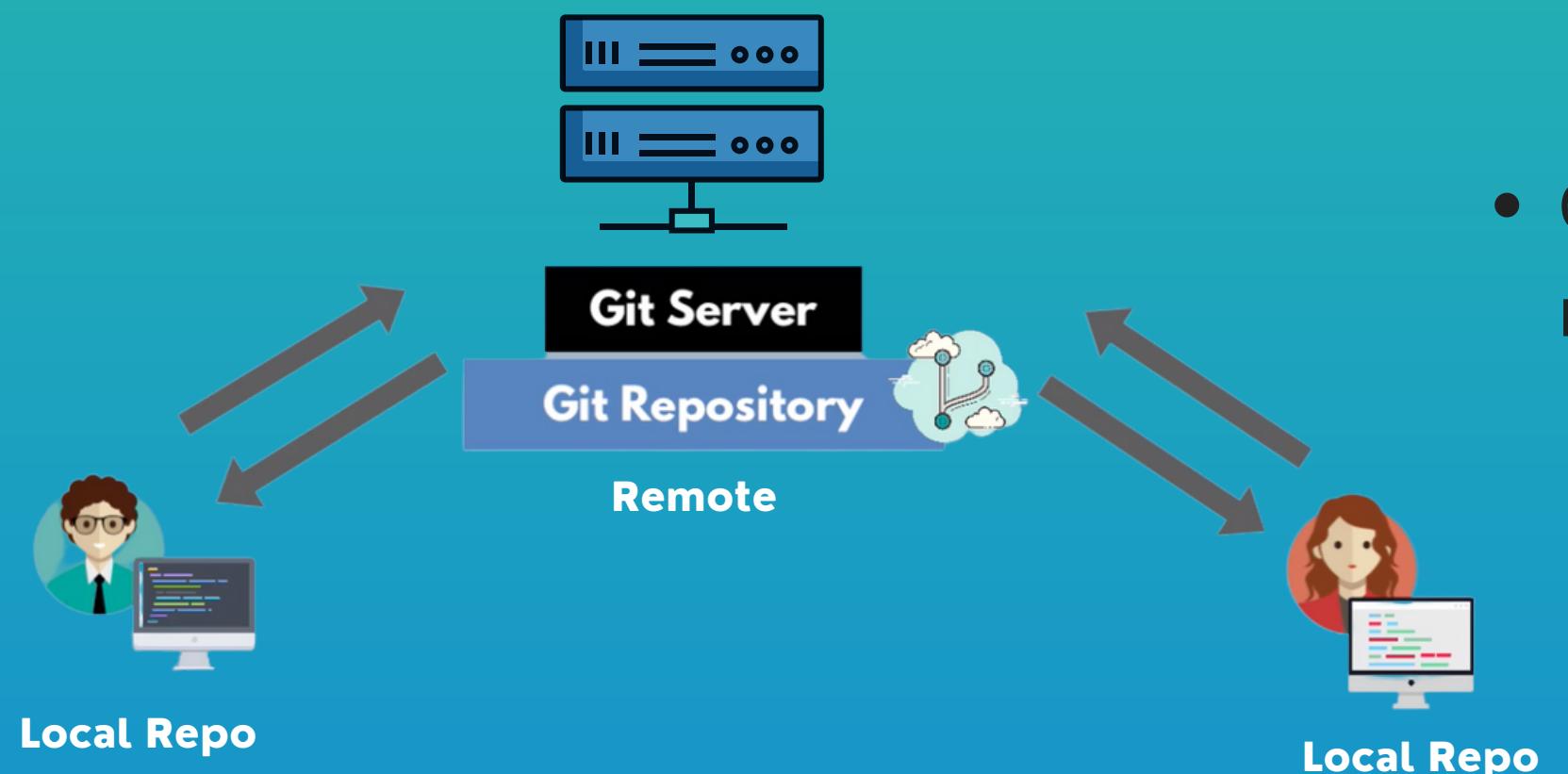
Version 1



**TECHWORLD
WITH NANA**

Basic Concepts of Git - 1

- **Remote Git Repository:** where the **code is hosted**, e.g. on Gitlab or GitHub
- **Local Git Repository:** **local copy** of the code on your machine
- **Git Client:** to connect and **execute git commands** can be UI or Command Line Tool



- Code is fetched ("pulled") from remote repo and "pushed" to it

Basic Concepts of Git - 2

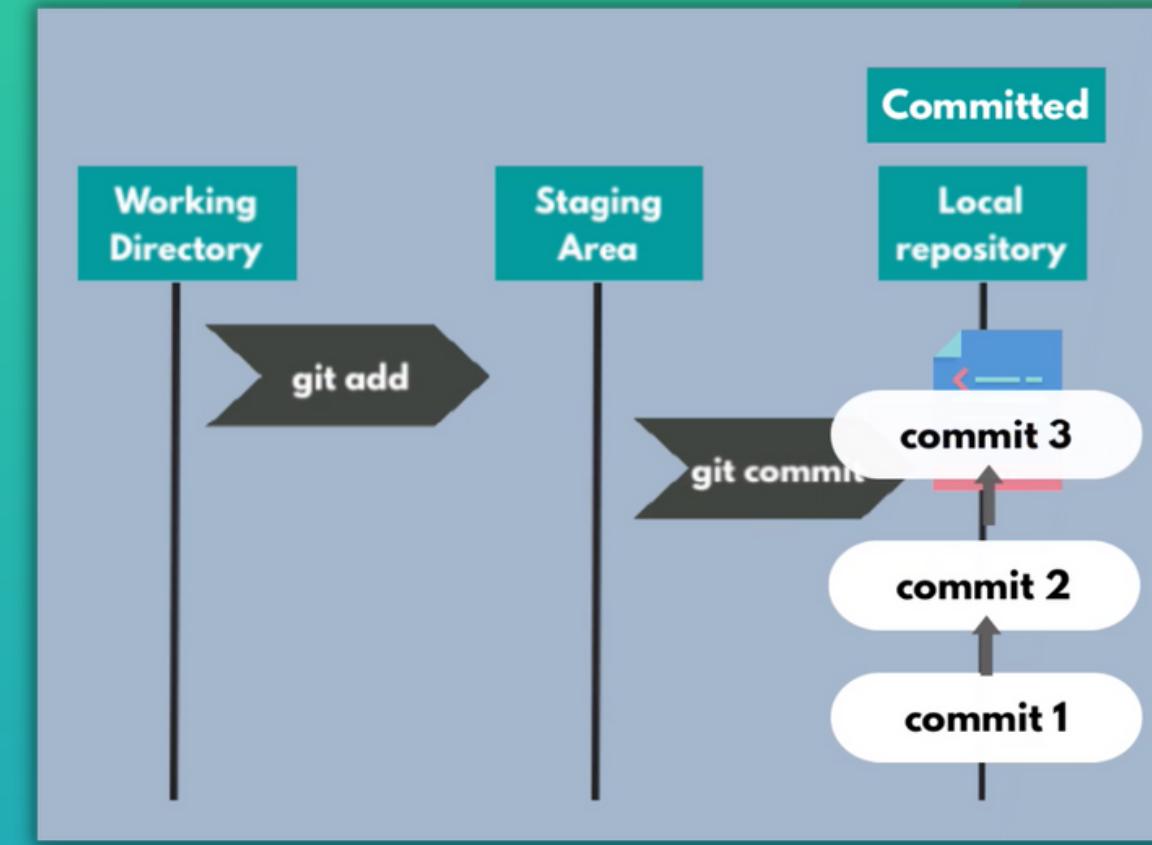
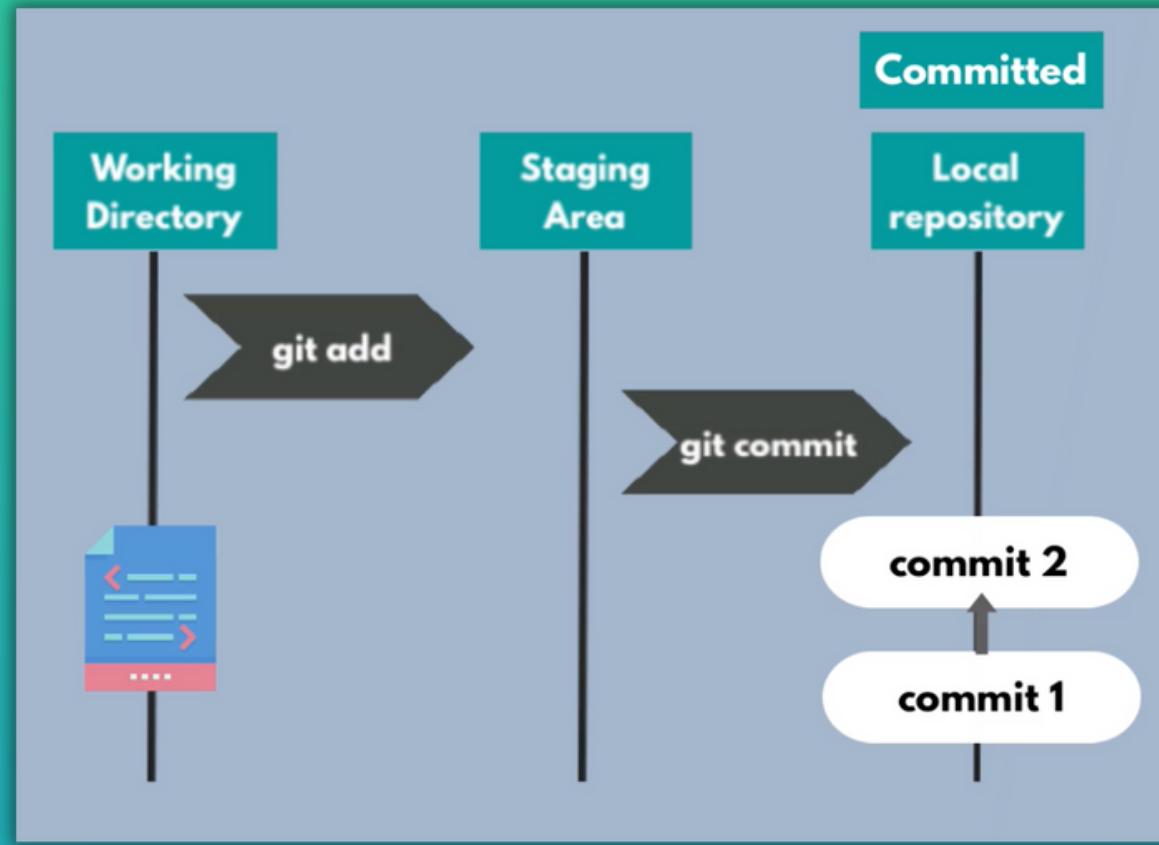
- Most of the time, Git knows how to **merge changes automatically**
- But if you have a "**Merge Conflict**", when e.g. same line was changed.
Then you need to resolve it manually

- To avoid merge conflicts:
- Note: Breaking changes doesn't affect you until you pulled the new code

Best Practice: Push and Pull often from remote repository to stay in sync



Working with Git - 1



git add <file>:

- To include the changes of a file into the next commit
- Moves the changes from "working directory" to the "staging area"

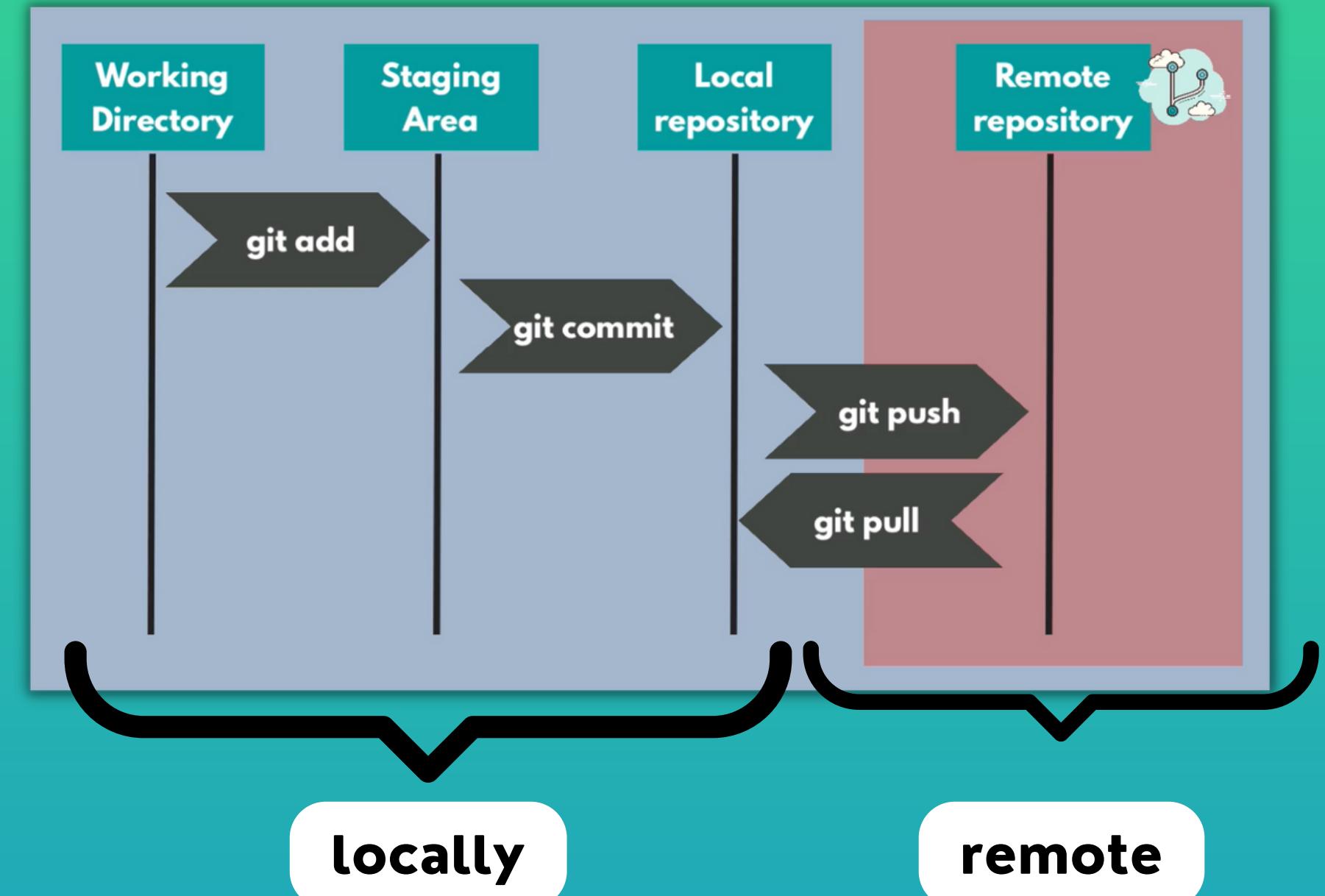
git commit -m "commit message":

- To save your changes in your local repository
- Creates a new commit, which you can go back to later if needed

Working with Git - 2

git push <remote> <branch-name>:

- After committing your changes, you want to send your changes to the remote Git server
 - Uploads your commits to the remote repo



_ At the end of the handout you can find a summary of most important git commands

Setup Git Repository - 1

1) Remote Repository

- Different Git Repositories to register:



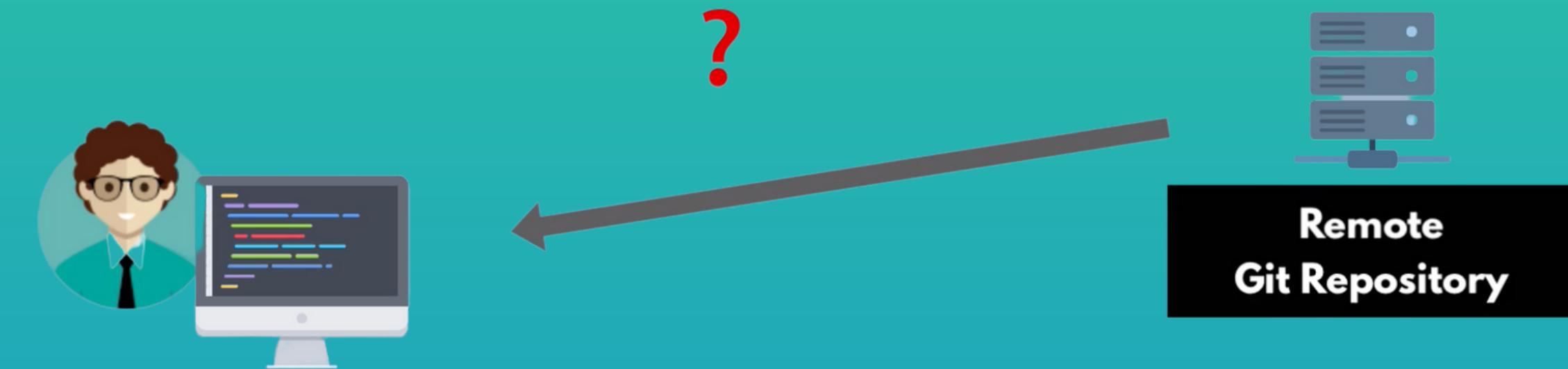
- These are platforms that **host your repository**
- Companies have own Git servers hosted by them
- Your repository can be **private or public**.
E.g. Private for companies, Public for open source projects
- You can do a lot via the Platforms UI

The screenshot shows the GitLab web interface for creating a new project. The URL in the browser is `gitlab.com/projects/new#blank_project`. The main title is "Create blank project" with the sub-instruction "Create a blank project to store your files, plan your work, and collaborate on code, among other things.". A sidebar on the left contains various icons for project management. The "Project name" field is filled with "my-project". Below it, a note says "Must start with a lowercase or uppercase letter, digit, emoji, or underscore. Can also contain dots, pluses, dashes, or spaces". The "Project URL" field shows "https://gitlab.com/" followed by a dropdown menu with "Pick a group or namespace" and a "/ my-project" suffix. A note below says "Want to organize several dependent projects under the same namespace? [Create a group](#)". The "Project deployment target (optional)" field has "Select the deployment target" in a dropdown. The "Visibility Level" section shows two options: "Private" (selected, indicated by a blue circle) and "Public" (indicated by a white circle). A note for "Private" says "Project access must be granted explicitly to each user. If this project is part of a group, access is granted to members of the group". A note for "Public" says "The project can be accessed without any authentication".

Setup Git Repository - 2

2) Local Repository

- Having the remote repository set up, you need a way to connect with the remote repository to copy or "**clone**" git project to your local machine



- Git client** needs to be installed

UI client

or

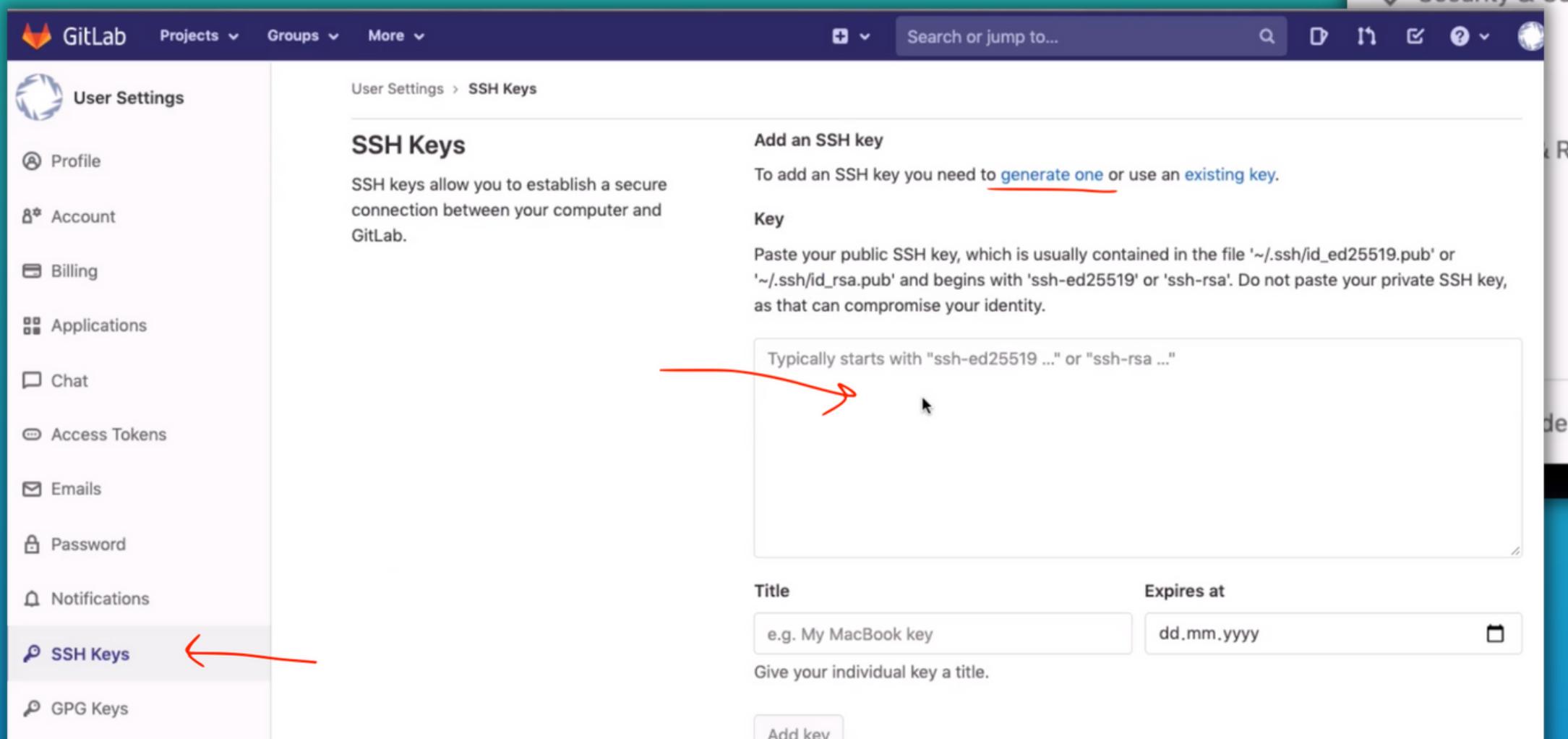
Git Command Line Tool

- <https://git-scm.com/downloads/guis>
- Installation Guide: <https://git-scm.com/downloads>

Setup Git Repository - 3

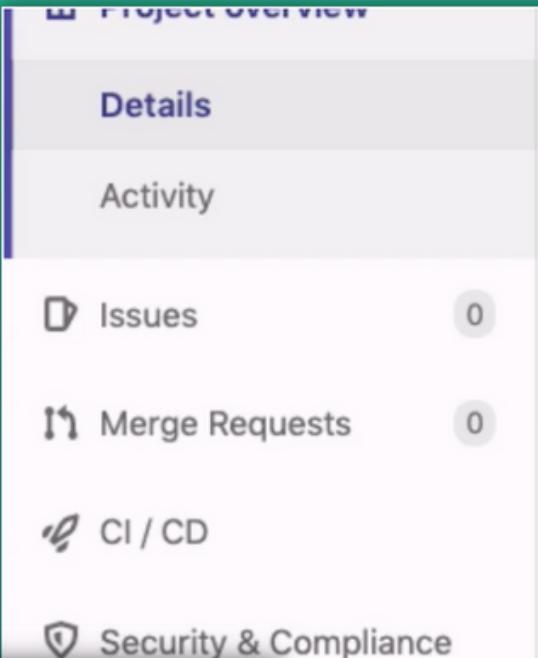
2) Local Repository

- You need to **authenticate** with GitHub/GitLab/...
- For that, your public SSH Key must be added to the remote platforms:



The screenshot shows the GitLab user settings interface. On the left, there's a sidebar with links like User Settings, Profile, Account, Billing, Applications, Chat, Access Tokens, Emails, Password, Notifications, SSH Keys (which is highlighted with a red arrow), and GPG Keys. The main content area is titled 'User Settings > SSH Keys'. It has a sub-section 'SSH Keys' with a brief description and a 'Key' input field where users can paste their public SSH key. Below this is a text box for generating a new key.

Getting started guide available:



The repository for this project is empty

You can get started by cloning the repository or start adding files to it with or

Clone ▾

+ New file

+ Add README

+ Add LICENSE

+

Command line instructions

You can also upload existing files from your computer using the instructions

Git global setup

```
git config --global user.name "Nana Janashia"  
git config --global user.email "nn_janashia@yahoo.com"
```

Create a new repository

```
git clone git@gitlab.com:nanuchi/my-project.git  
cd my-project  
touch README.md  
git add README.md  
git commit -m "add README"  
git push -u origin master
```

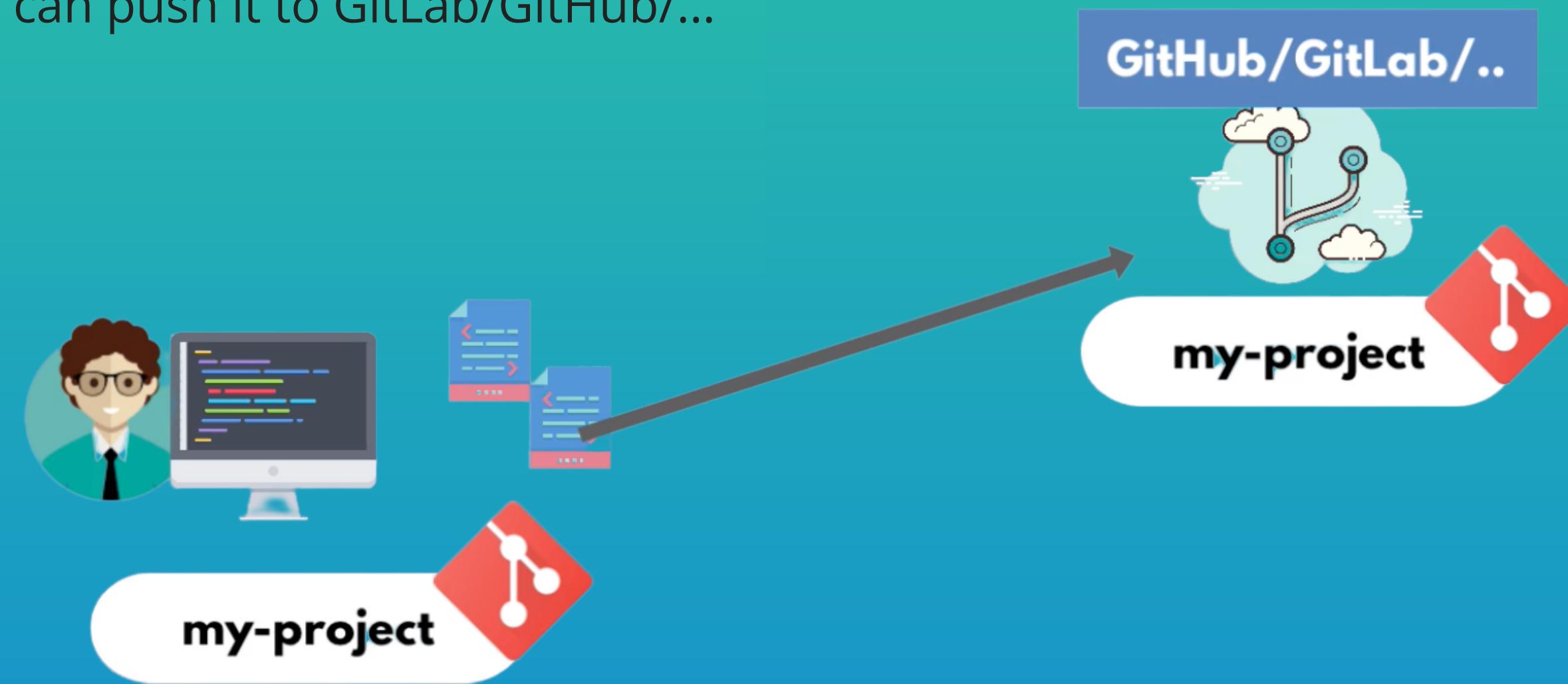
Push an existing folder

Setup Git Repository - 4

2) Local Repository

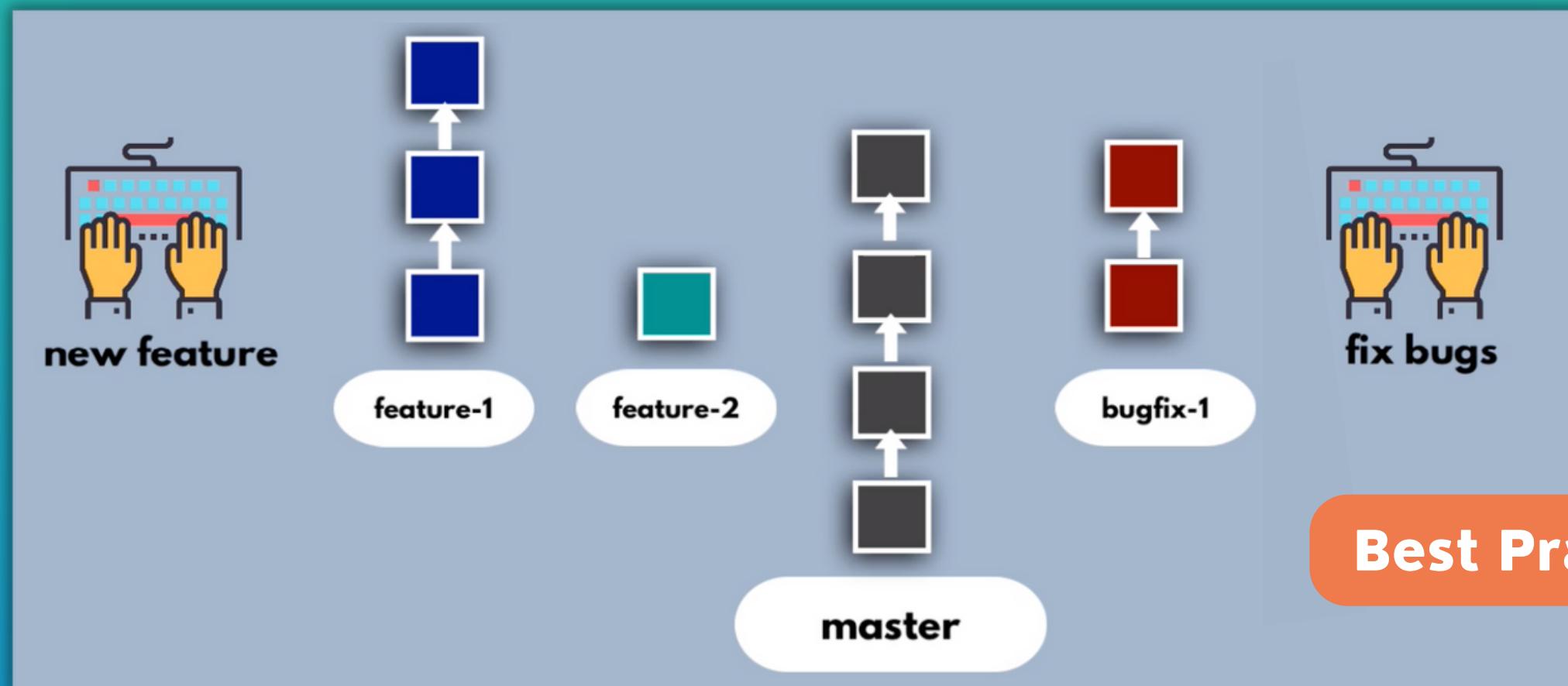
As an **alternative**:

- If you already have an existing project locally, you can **initialize a git repository with "git init"**
- Then you can push it to GitLab/GitHub/...



Concept of Branches - 1

- Branches are used for better collaboration
- A "**main**" branch (**also called "master"**) is created by default when a new repository is initialized
- Each developer can then create temporary branches e.g. for a feature or bugfix and work on it without worrying to break the main branch



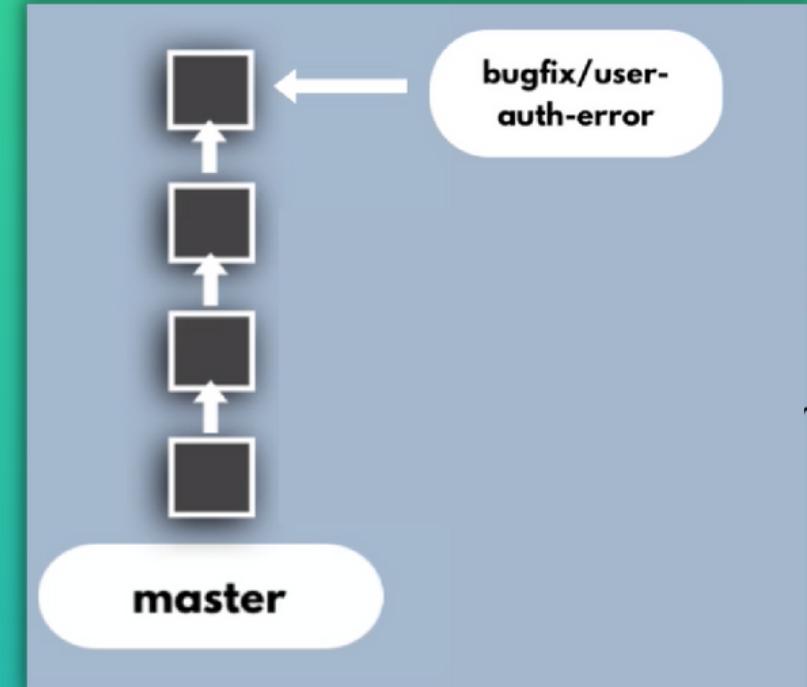
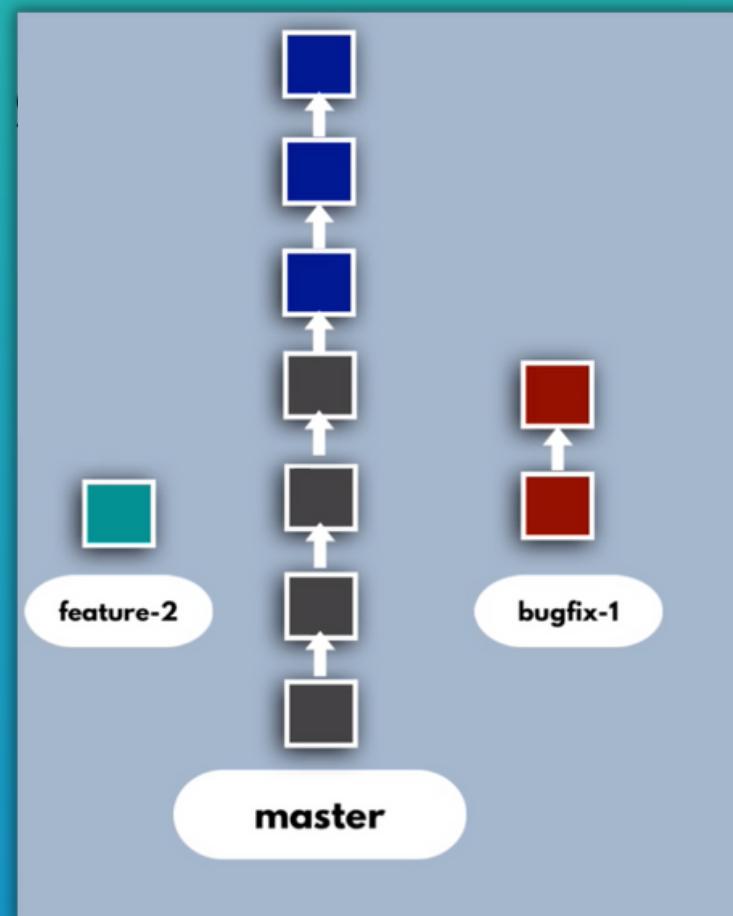
Best Practice: 1 branch per bugfix or feature

Here we have 4 different branches

Concept of Branches - 2

- Branches are **based on the main branch**. So, it starts from same code base:
- When finished, the complete branch can be merged back to the main branch

Branch for "feature-1" was merged into the main branch:



Goal is to have a stable main branch, ready for production deployment

Merge Requests or Pull Requests



Best Practice: Other developer **reviews code changes before merging**

- For that we have "merge request" or also called "pull request"
- It's basically a **request to merge one branch into another** (usually in the main branch)



- Reviewer can see the changes made and either **approve or decline** the merge request

A screenshot of a pull request interface on a remote git repository. The commit message is "adjusted smth" by Nana Janashia. The pull request has 1 file, +1 changes, and -1 deletions. The reviewer, Nana Janashia (@nanuchi), is assigned to the pull request. The interface shows a diff view of the Readme.md file with changes highlighted. At the bottom, there are "approve" and "decline" buttons, with a "reviewer" label next to the decline button. A blue callout box labeled "on remote git repo" points to the "pull request" section.

Why know Git as a DevOps Engineer? - 1

Use Case 1) Infrastructure as Code

- As a DevOps engineer you **write code** (configuration files and scripts) to create and provision infrastructure

Use Case 2) Automation Scripts

- As a DevOps engineer you **write automation scripts** e.g. with Python to automate different tasks

Just like software code, files should be:



Tracked - history of changes



Securely stored in one place



Shareable to collaborate as team



Git Repository



Why know Git as a DevOps Engineer? - 2

Use Case 3) CI/CD Pipeline and Build Automation

- CI means: On each merge, checkout code from repository, test and build application
- For that, you need integration between the build automation tool and the application git repository
- You need to **setup integration with build automation tool and git repository**
- You need to **know git commands for example for:**



Getting commit hash of specific commit



Check if changes happened in frontend or backend code



Jenkins

Git Cheatsheet - 1

Source: <https://www.atlassian.com/git/tutorials/atlassian-git-cheatsheet>



GIT BASICS

git init <directory>	Create empty Git repo in specified directory. Run with no arguments to initialize the current directory as a git repository.
git clone <repo>	Clone repo located at <repo> onto local machine. Original repo can be located on the local filesystem or on a remote machine via HTTP or SSH.
git config user.name <name>	Define author name to be used for all commits in current repo. Devs commonly use --global flag to set config options for current user.
git add <directory>	Stage all changes in <directory> for the next commit. Replace <directory> with a <file> to change a specific file.
git commit -m "<message>"	Commit the staged snapshot, but instead of launching a text editor, use <message> as the commit message.
git status	List which files are staged, unstaged, and untracked.
git log	Display the entire commit history using the default format. For customization see additional options.
git diff	Show unstaged changes between your index and working directory.

GIT BRANCHES

git branch	List all of the branches in your repo. Add a <branch> argument to create a new branch with the name <branch>.
git checkout -b <branch>	Create and check out a new branch named <branch>. Drop the -b flag to checkout an existing branch.
git merge <branch>	Merge <branch> into the current branch.

UNDOING CHANGES

git revert <commit>	Create new commit that undoes all of the changes made in <commit>, then apply it to the current branch.
git reset <file>	Remove <file> from the staging area, but leave the working directory unchanged. This unstages a file without overwriting any changes.
git clean -n	Shows which files would be removed from working directory. Use the -f flag in place of the -n flag to execute the clean.

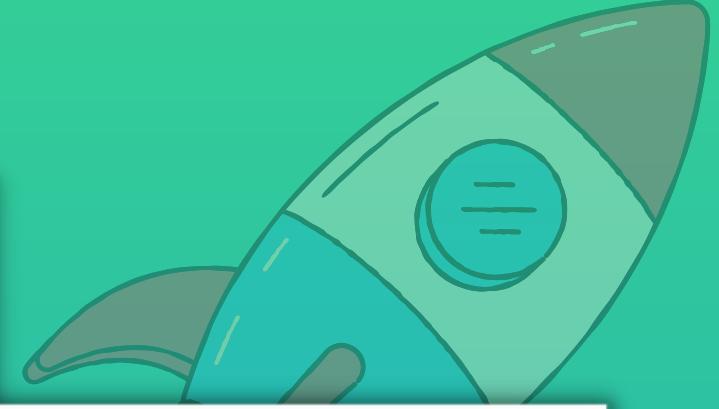
REWRITING GIT HISTORY

git commit --amend	Replace the last commit with the staged changes and last commit combined. Use with nothing staged to edit the last commit's message.
git rebase <base>	Rebase the current branch onto <base>. <base> can be a commit ID, branch name, a tag, or a relative reference to HEAD.
git reflog	Show a log of changes to the local repository's HEAD. Add --relative-date flag to show date info or --all to show all refs.

REMOTE REPOSITORIES

git remote add <name> <url>	Create a new connection to a remote repo. After adding a remote, you can use <name> as a shortcut for <url> in other commands.
git fetch <remote> <branch>	Fetches a specific <branch>, from the repo. Leave off <branch> to fetch all remote refs.
git pull <remote>	Fetch the specified remote's copy of current branch and immediately merge it into the local copy.
git push <remote> <branch>	Push the branch to <remote>, along with necessary commits and objects. Creates named branch in the remote repo if it doesn't exist.

Git Cheatsheet - 2



GIT CONFIG

`git config --global user.name <name>`

Define the author name to be used for all commits by the current user.

`git config --global user.email <email>`

Define the author email to be used for all commits by the current user.

`git config --global alias. <alias-name> <git-command>`

Create shortcut for a Git command. E.g. `alias.glog "log --graph --oneline"` will set "git glog" equivalent to "git log --graph --oneline".

`git config --system core.editor <editor>`

Set text editor used by commands for all users on the machine. `<editor>` arg should be the command that launches the desired editor (e.g., vi).

`git config --global --edit`

Open the global configuration file in a text editor for manual editing.

GIT LOG

`git log --<limit>`

Limit number of commits by `<limit>`.
E.g. "git log -5" will limit to 5 commits.

`git log --oneline`

Condense each commit to a single line.

`git log -p`

Display the full diff of each commit.

`git log --stat`

Include which files were altered and the relative number of lines that were added or deleted from each of them.

`git log --author=<pattern>`

Search for commits by a particular author.

`git log --grep=<pattern>`

Search for commits with a commit message that matches `<pattern>`.

`git log <since>..<until>`

Show commits that occur between `<since>` and `<until>`. Args can be a commit ID, branch name, HEAD, or any other kind of revision reference.

`git log -- <file>`

Only display commits that have the specified file.

`git log --graph --decorate`

--graph flag draws a text based graph of commits on left side of commit msgs. --decorate adds names of branches or tags of commits shown.

GIT DIFF

`git diff HEAD`

Show difference between working directory and last commit.

`git diff --cached`

Show difference between staged changes and last commit

GIT RESET

`git reset`

Reset staging area to match most recent commit, but leave the working directory unchanged.

`git reset --hard`

Reset staging area and working directory to match most recent commit and overwrites all changes in the working directory.

`git reset <commit>`

Move the current branch tip backward to `<commit>`, reset the staging area to match, but leave the working directory alone.

`git reset --hard <commit>`

Same as previous, but resets both the staging area & working directory to match. Deletes uncommitted changes, and all commits after `<commit>`.

GIT REBASE

`git rebase -i <base>`

Interactively rebase current branch onto `<base>`. Launches editor to enter commands for how each commit will be transferred to the new base.

GIT PULL

`git pull --rebase <remote>`

Fetch the remote's copy of current branch and rebases it into the local copy. Uses git rebase instead of merge to integrate the branches.

GIT PUSH

`git push <remote> --force`

Forces the git push even if it results in a non-fast-forward merge. Do not use the --force flag unless you're absolutely sure you know what you're doing.

`git push <remote> --all`

Push all of your local branches to the specified remote.

`git push <remote> --tags`

Tags aren't automatically pushed when you push a branch or use the --all flag. The --tags flag sends all of your local tags to the remote repo.

Best Practices - 1

Commit-related best practices:

- Use descriptive and meaningful commit messages
- Commit in relatively small chunks
- Commit only related work
- Adequately configure the commit authorship (name and email address) with git config



Avoid very large deviations between local and remote repository:

- Keep your feature/bugfix branch up-to-date with remote master and/or develop branch. So pull often from remote git repository
- Branches shouldn't be open for too long or master branch should be merged into your feature/bugfix branch often

Best Practices - 2



Other:

- Don't "git push" straight to main branch
- Use **--force** push carefully! Do NOT force push into master or develop branches or better only when working alone in a branch
- Create a separate branch for each feature or bugfix and name the branch with prefix "feature/xx" and "bugfix/xxx" respectively
- Doing Code Reviews via Merge Requests
- Use .gitignore file to ignore e.g. editor specific files, build folders