Version Control with GIT

Key Takeaways

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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**

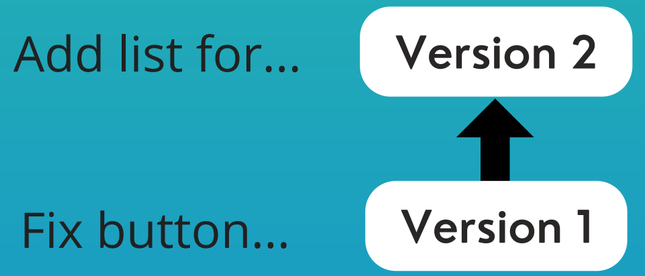
Every code change and file is tracked!

You can revert commits

Each change labelled with commit message

git

Git is the most used version control system



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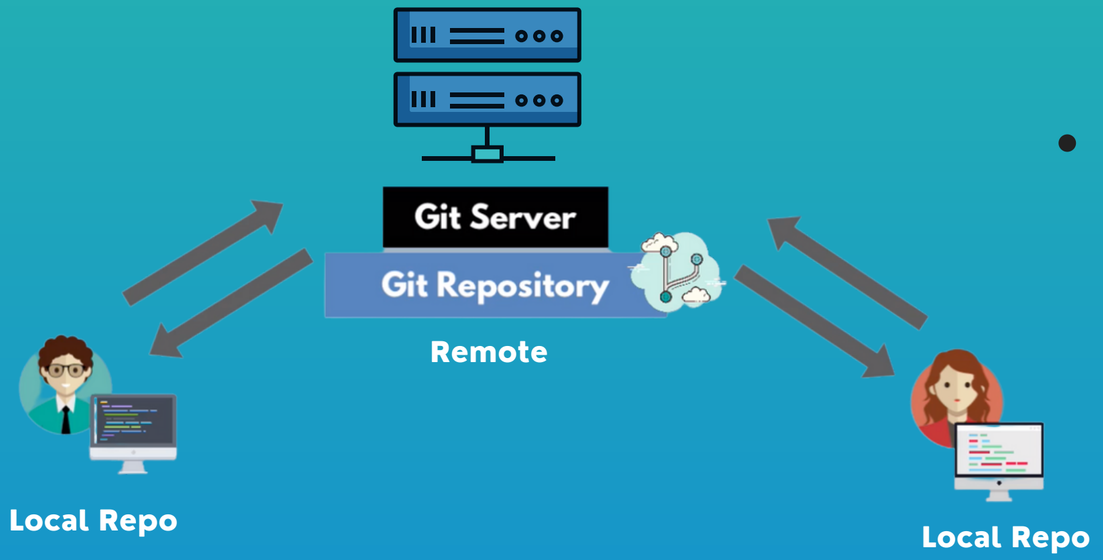
Basic Concepts of Git - 1

- **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

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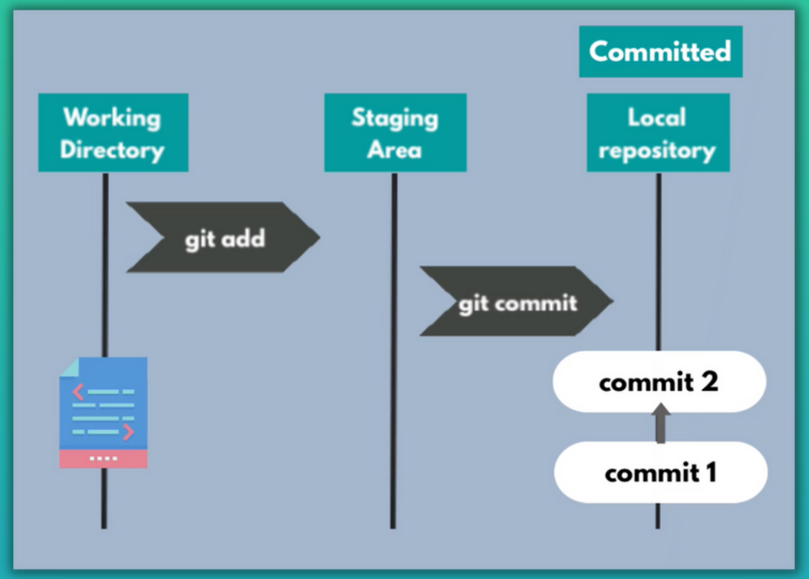
Basic Concepts of Git - 2

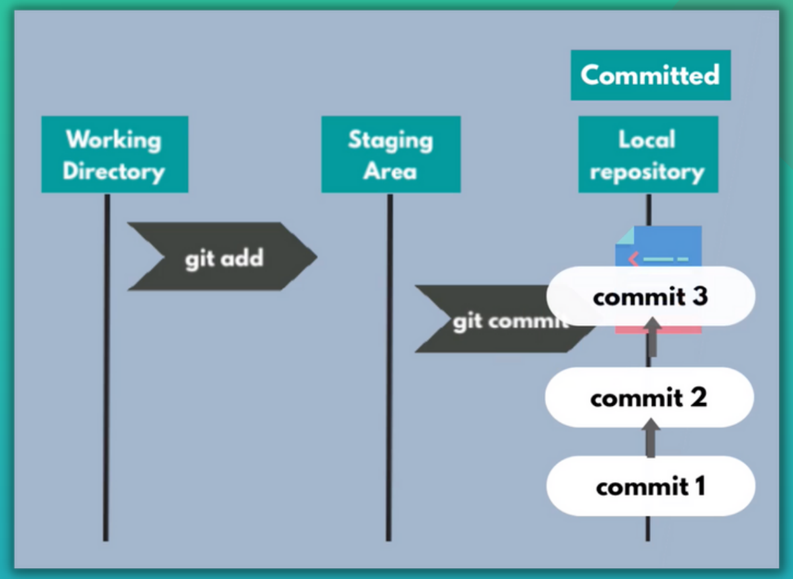
- Most of the time, Git knows how to **merge changes automatically**
- But you have a "**Merge Conflict**", when e.g. same line was changed. Then you need to resolve it manually

- To avoid merge conflicts: **Best Practice:** Push and Pull often from remote repository to stay in sync

- Note: Breaking changes doesn't affect you until you pulled the new code

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

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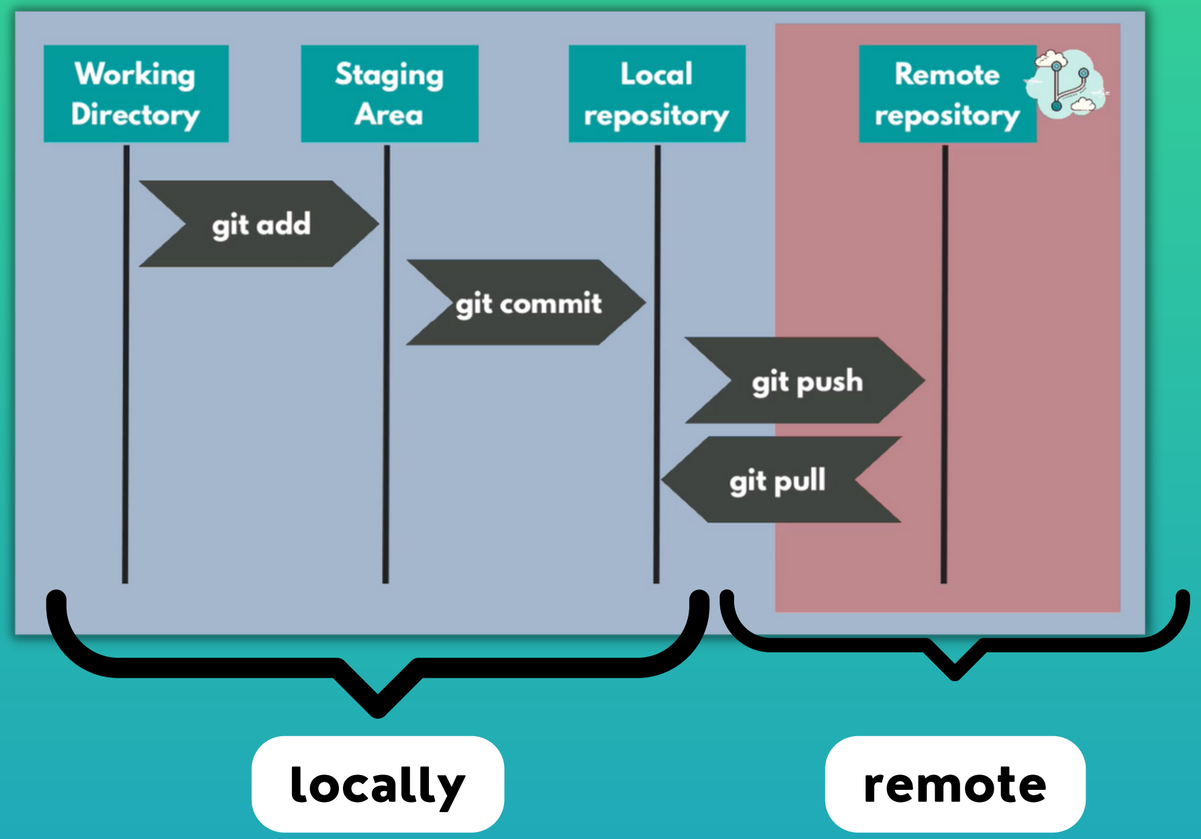
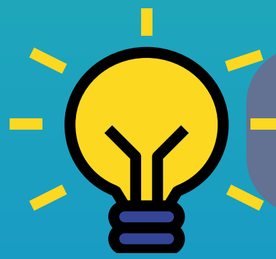
Working with Git - 2

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

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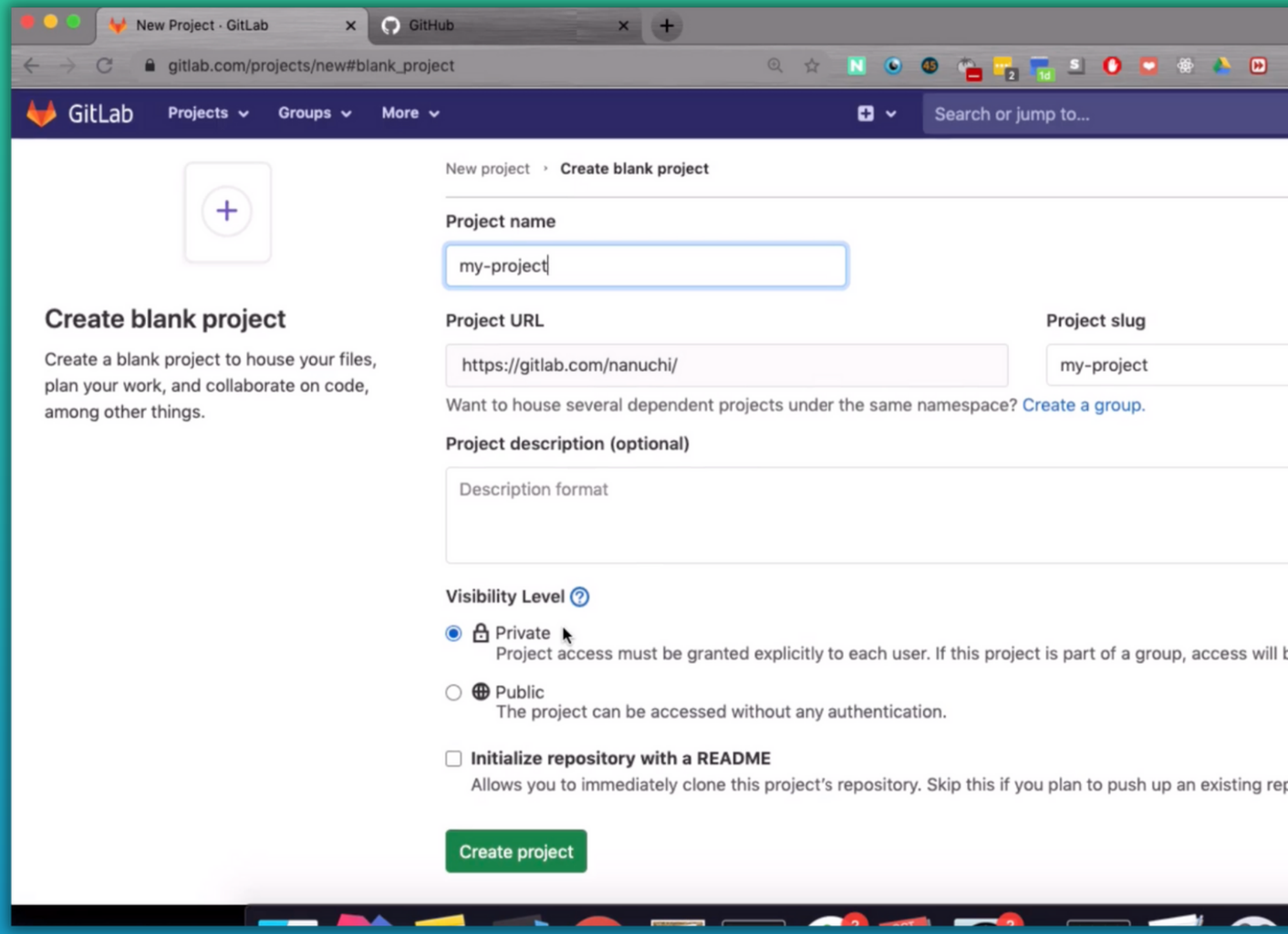
Setup Git Repository - 1

1) Remote Repository

- Different Git Repositories to register:

GitLab github

- 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



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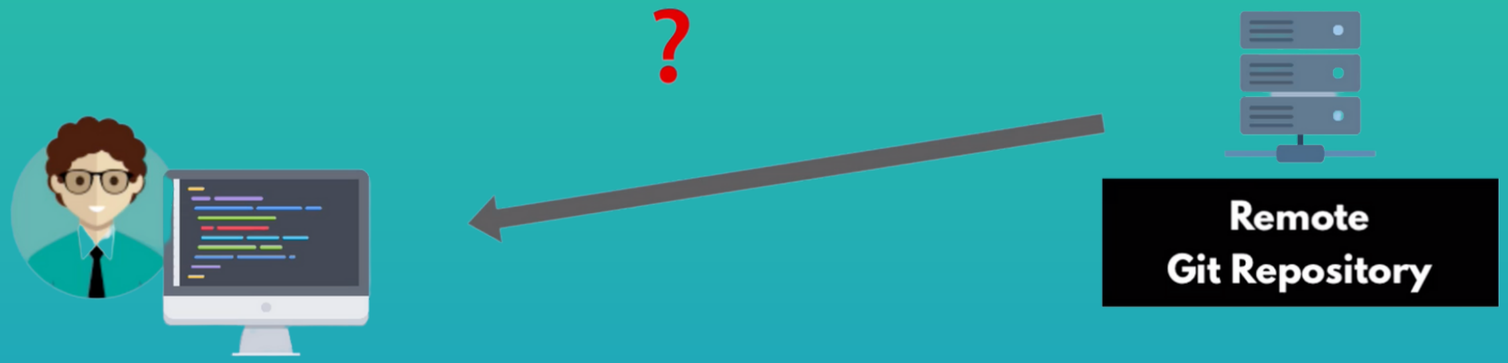
Setup Git Repository - 2

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**

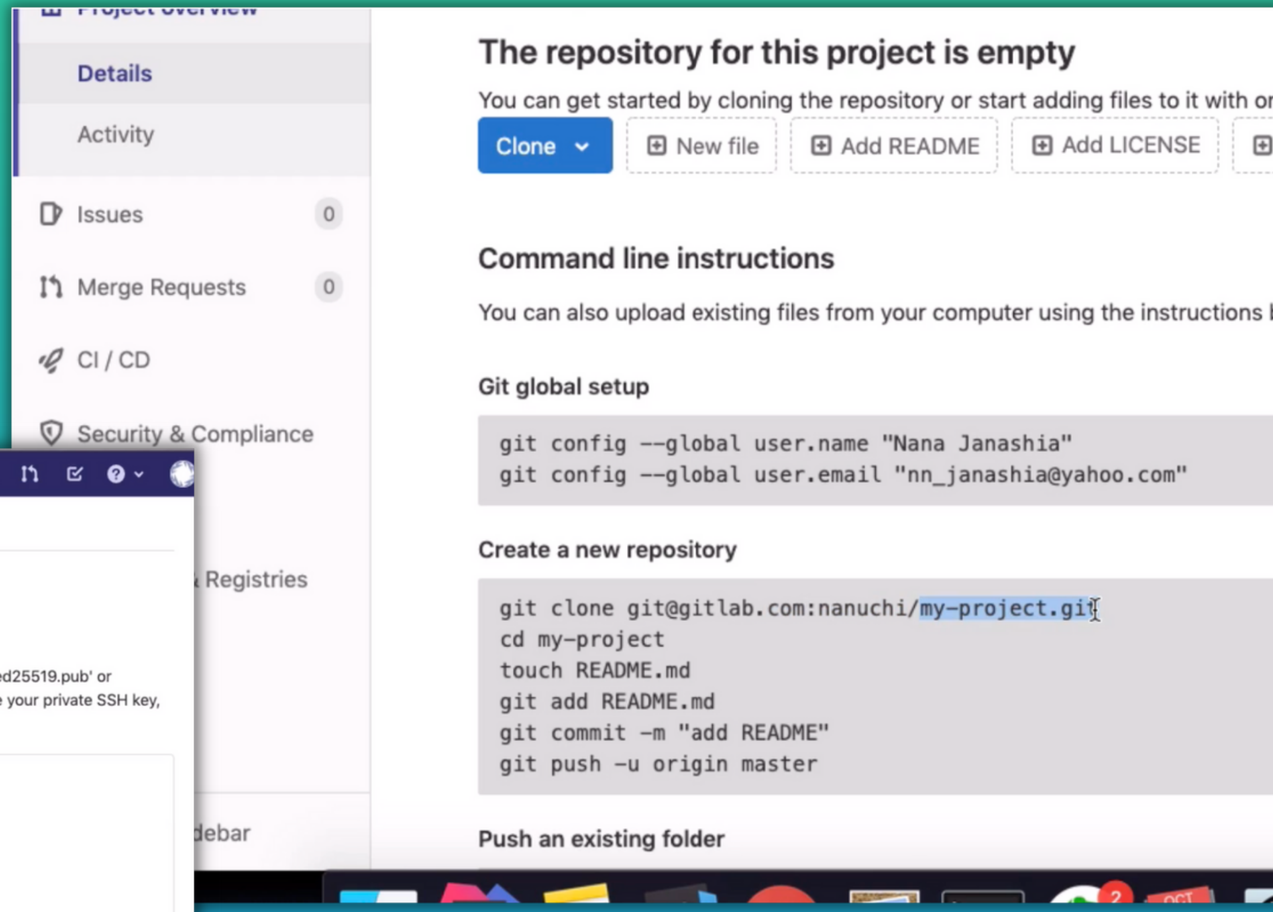
- https://git-scm.com/downloads/guis
- Installation Guide: https://git-scm.com/downloads

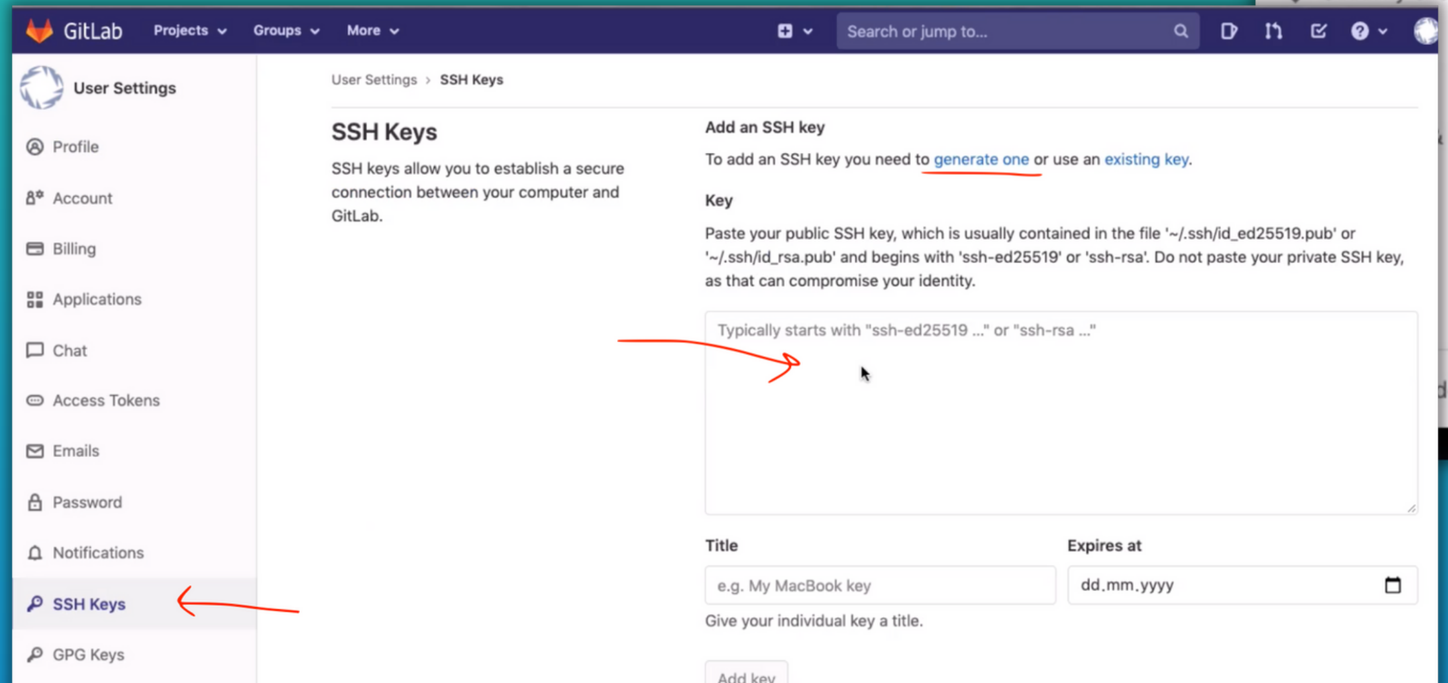
Setup Git Repository - 3

2) Local Repository

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

Getting started guide available:





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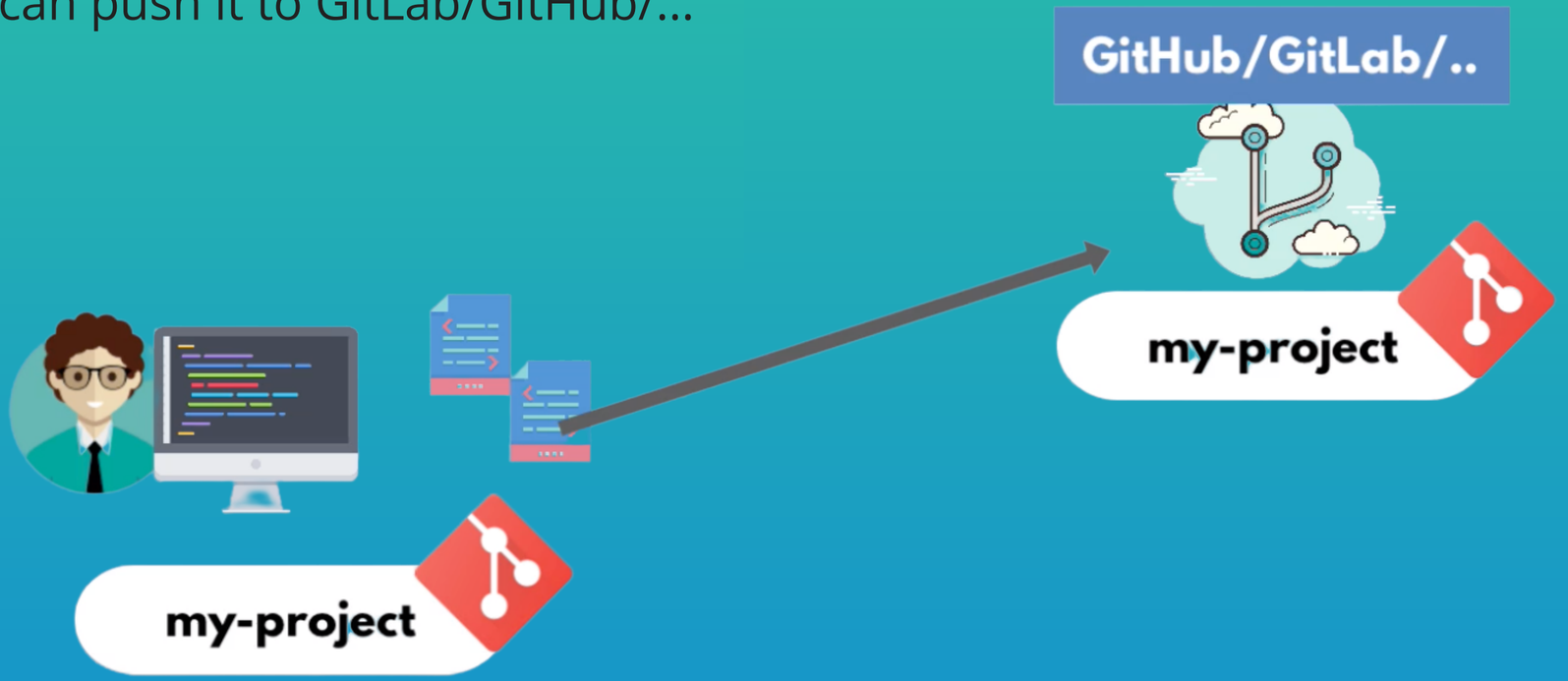
Setup Git Repository - 4

2) Local Repository

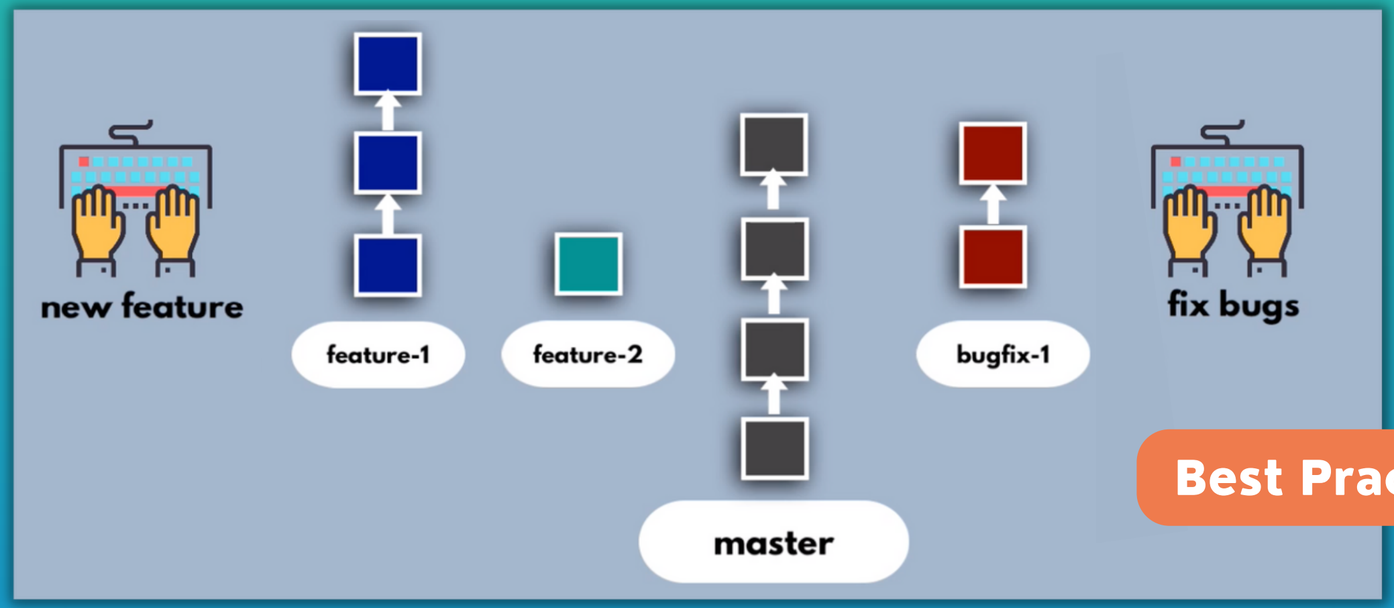
As an **alternative**:

- If you have already 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



Here we have 4 different branches

- **Common branch names**: main, dev, feature, bugfix
  E.g. bugfix/ticket-2134

Best Practice: 1 branch per bugfix or feature

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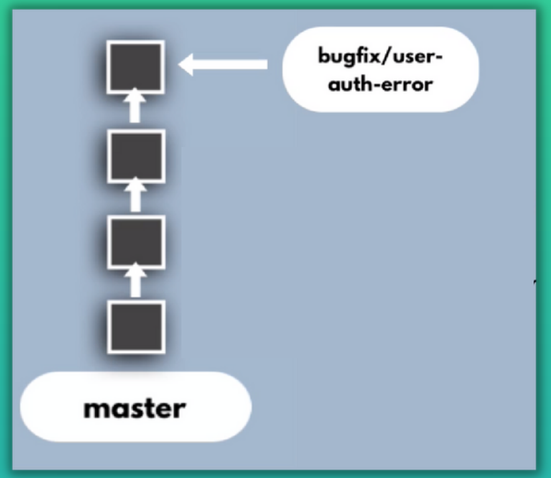
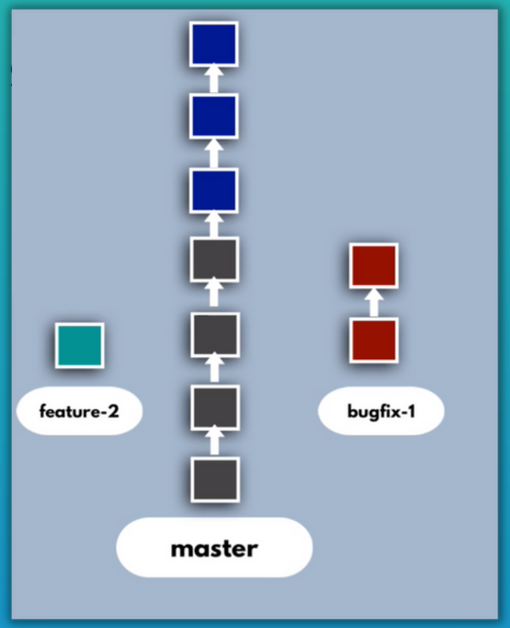
Concept of Branches - 2



- Branch is **based on main branch**. So, it starts from same codebase:

- When finished, the complete branch can be merged back to the main branch

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

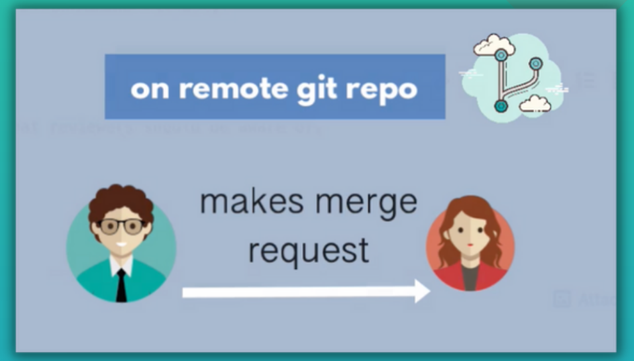


Goal is to have a stable main branch, ready for production deployment

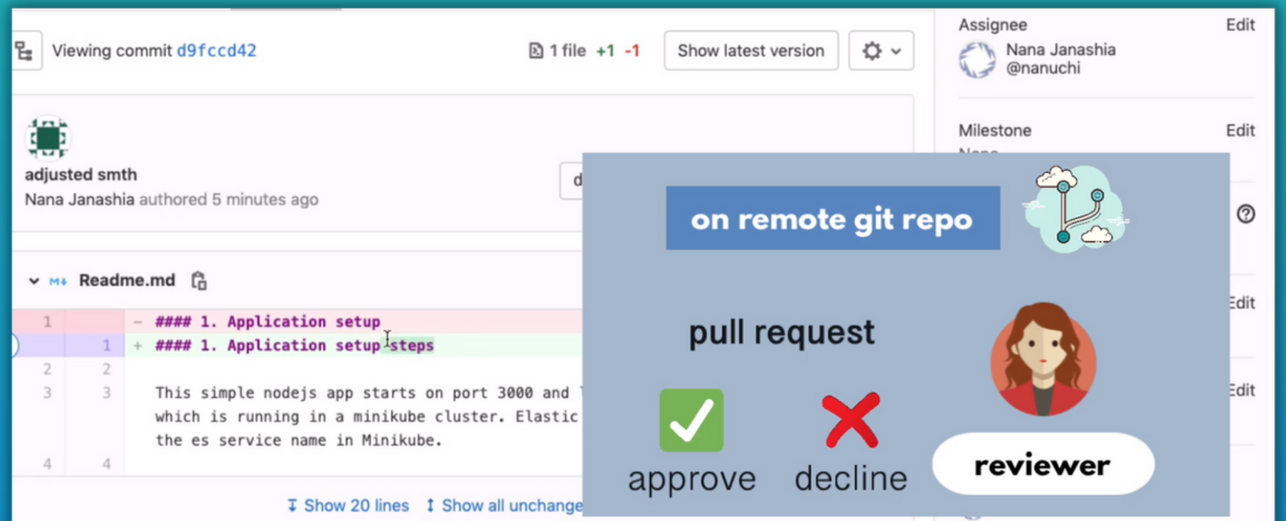
Merge Requests or Pull Requests

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



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Why to know Git as 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

- So these files should also "live" in a remote repository and be **tracked and versioned by Git**

Just like software code, files should be:

- Tracked - history of changes
- Securely stored in one place
- Shareable to collaborate as team

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Why to know Git as 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 for the build automation tool with 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

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.

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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 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 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 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.

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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

Avoiding 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