## Git Setup - Setting

- Now that you have Git on your system, you'll want to do a few things to customize your Git environment.
- Git comes with a tool called **git config** that lets you get and set configuration variables that control all aspects of how Git looks and operates

```
$ git config --list --show-origin
```

## Git Setup - Setting

These variables can be stored in three different places for different levels

SYSTEM

**All users**

[path]/etc/gitconfig file

GLOBAL

**All repositories of the current user**

~/.gitconfig or ~/.config/git/config file

LOCAL

**The current repository**

config file in the Git directory (that is, .git/config) of whatever repository you’re currently using

# Setting

- Your Identity
- Your Editor
- Your default branch name

# Install & First Config

## 1. Install & Verify

Use platform-specific installers, then verify with `git --version`.

## 2. Set Global User

Configure your identity for all repositories. This information is embedded in every commit every commit you make.

```
$ git config --global user.name "Your Name"
$ git config --global user.email "your.email@example.com"
```

## 3. Define Defaults

Set your preferred default branch name and text editor for commit messages.

```
$ git config --global init.defaultBranch main
$ git config --global core.editor code
```

## Setting- Your Identity

- The first thing you should do when you install Git is to set your username and email address.
- This is important because every Git commit uses this information, and it’s immutably baked into the commits you start creating:

```
$ git config --global user.name "John Doe"
$ git config --global user.email johndoe@example.com
```

```
$ git config user.name "John Doe"
$ git config user.email johndoe@example.com
```

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## Setting - Your Editor

- Now that your identity is set up, you can configure the default text editor that will be used when Git needs you to type in a message.
- If not configured, Git uses your system’s default editor.
- If you want to use a different text editor, such as VsCode, you can do the following:

```
$ git config --global core.editor “code –wait”
```

```
$ git config --global  -e
```

## Setting - Your default branch name

- By default Git will create a branch called master when you create a new repository with git init.
- From Git version 2.28 onwards, you can set a different name for the initial branch.
- To set main as the default branch name do:

```
$ git config --global init.defaultBranch main
```

## Checking Your Settings

- If you want to check your configuration settings, you can use the git config --list command to list all the settings Git can find at that point:

```
$ git config --list
```

```
$ git config user.name
```

## Getting Help

- If you ever need help while using Git, there are three equivalent ways to get the comprehensive manual page (manpage) help for any of the Git commands:
- Git command, you can ask for the more concise “help” output with the –h option, as in:

```
$ git help <verb>
$ git <verb> --help
```

```
$ git help config
```

```
$ git add -h
```

# Starting Your Project: Init vs. Clone

## git init

Creates a new, empty Git repository in your current directory. Perfect for starting a brand-new project from scratch.

```
$ mkdir my-new-project
$ cd my-new-project
$ git init
# Creates a `.git` directory
```

## git clone

Copies an existing remote repository to your local machine. Ideal for Ideal for contributing to existing projects.

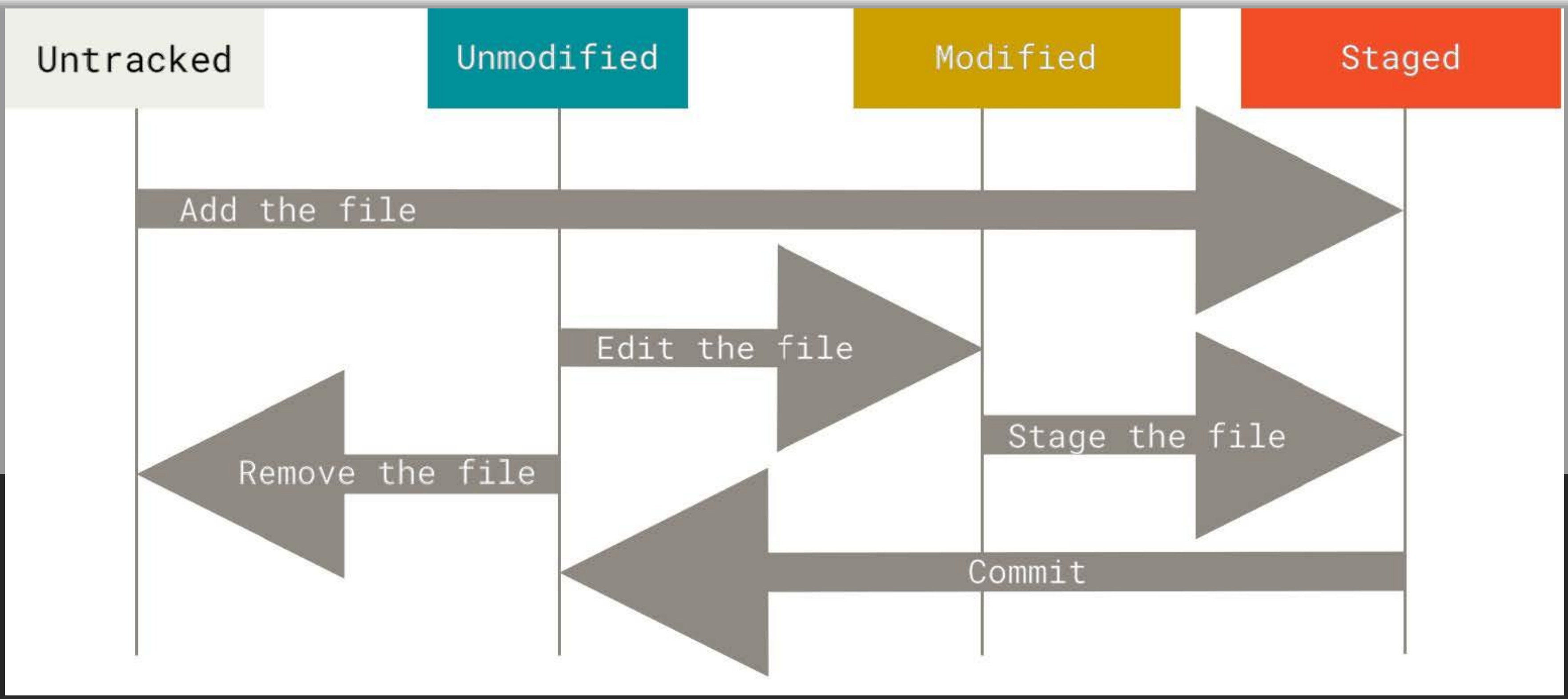
```
$ git clone https://github.com/...
# Clones the repo into a new folder
$ cd repo-name
```

## Initializing a Repository in an Existing Directory

- If you have a project directory that is currently not under version control
- Then you want to start controlling it with Git, you first need to go to that project's directory.
- If you've never done this, it looks a little different depending on which system you're running:

```
$ cd C:/Users/user/my_project
$ git init
```

## Recording Changes to the Repository



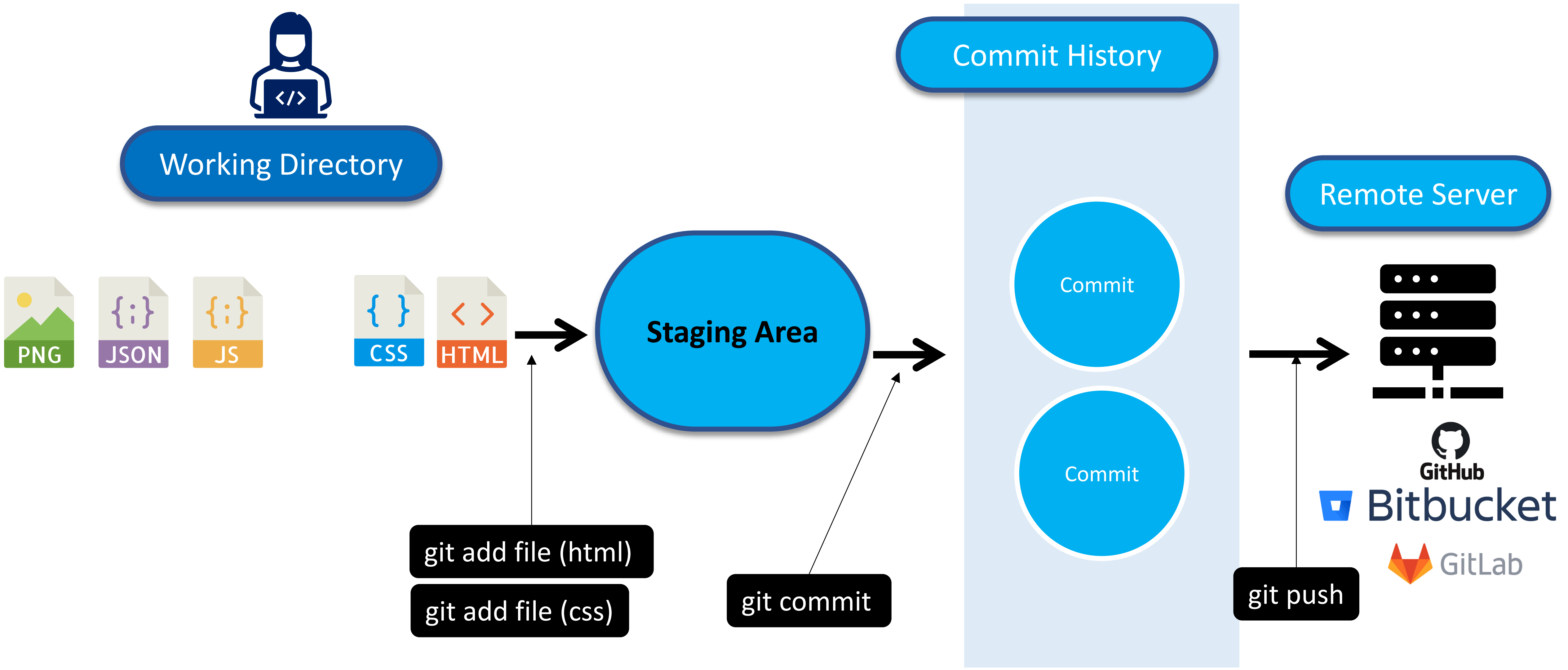
## Checking the Status of Your Files

- The main tool you use to determine which files are in which state is the **git status** command.
- If you run this command directly after a clone, you should see something like this:
- **Short Status**

```
$ git status
```

```
$ git status -s
```

# How Git Works



## Tracking New Files

- In order to begin tracking a new file, you use the command **git add.**
- To begin tracking the file1.html file, you can run this:

```
$ git add file1.html
```

## Ignoring Files

- Often, you’ll have a class of files that you don’t want Git to automatically add or even show you as being untracked.
- These are generally automatically generated files such as log files or files produced by your build system.
- In such cases, you can create a file listing patterns to match the named .gitignore. Here is an example .gitignore file:

```
# ignore all .a files
*.a
# but do track lib.a, even though you're ignoring .a files above
!lib.a
# only ignore the TODO file in the current directory, not subdir/TODO
/TODO
# ignore all files in any directory named build
build/
# ignore doc/notes.txt, but not doc/server/arch.txt
doc/*.txt
# ignore all .pdf files in the doc/ directory and any of its subdirectories
doc/**/*.pdf
```

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## Viewing Your Staged and Unstaged Changes

- If the **git status** command is too vague for you — you want to know exactly what you changed, not just which files were changed — you can use the **git diff** command.
- It compares what is in your working directory with what is in your staging area.
- If you want to see what you've staged that will go into your next commit, you can use **git diff --staged**. This command compares your staged changes to your last commit:

```
$ git diff
```

```
$ git diff --staged
```

```
$ git diff --cached
```

## Committing Your Changes

- The simplest way to commit is to type git commit:
- Skipping the Staging Area
  - Adding the -a option to the git commit command makes Git automatically stage every file that is already tracked before doing the commit, letting you skip the git add part

```
$ git commit
```

```
$ git commit -m "Story 182: fix benchmarks for speed"
```

```
$ git commit -a -m 'Add new benchmarks'
```

# Skipping the staging area

- If you want to skip the staging area, Git provides a simple shortcut.
- Adding the -a option to the git commit command makes Git automatically stage every file that is already tracked before doing the commit

```
$ git commit -a -m 'Message'
```

```
$ git commit -am ‘Message’
```

## Removing Files

- To remove a file from Git, you have to remove it from your tracked files
- The git rm command does that, and also removes the file from your working directory
- To untrack the file **$git rm --cached**

```
$ git rm file1.html
```

```
$ git rm -- cached file1.html
```

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## Viewing the Commit History - 1/3

- After you have created several commits, or
- if you have cloned a repository with an existing commit history, you'll probably want to look back to see what has happened. The most basic and powerful tool to do this is the **git log** command.

```
$ git clone https://github.com/schacon/simplegit-progit
```

```
$ git log
```

```
$ git show #code        # Shows the given commit
```

```
$ git show HEAD         # Shows the last commit
```

# Viewing the Commit History -2/3

- A huge number and variety of options to the git log command are available to show you exactly what you’re looking for.
  - One of the more helpful options is -p or --patch, which shows the difference (the patch output) introduced in each commit.

```
$ git log -p -2
```

  - For example, if you want to see some abbreviated stats for each commit, you can use the --stat option:

```
$ git log --stat
```

  - Another really useful option is --pretty.

```
$ git log --pretty=oneline
```

  - The most interesting option value is format, which allows you to specify your own log output format.

```
$ git log --pretty=format:"%h - %an, %ar : %s"
```

# Viewing the Commit History -3/3

## Specifier Description of Output

| | |
|---|---|
| %H | Commit hash |
| %h | Abbreviated commit hash |
| %T | Tree hash |
| %t | Abbreviated tree hash |
| %P | Parent hashes |
| %p | Abbreviated parent hashes |
| %an | Author name |
| %ae | Author email |
| %ad | Author date (format respects the --date=option) |
| %ar | Author date, relative |
| %cn | Committer name |
| %ce | Committer email |
| %cd | Committer date |
| %cr | Committer date, relative |
| %s | Subject |

| Option | Description |
|---|---|
| -p | Show the patch introduced with each commit. |
| --stat | Show statistics for files modified in each commit. |
| --shortstat | Display only the changed/insertions/deletions line from the --stat command. |
| --name-only | Show the list of files modified after the commit information. |
| --name-status | Show the list of files affected with added/modified/deleted information as well. |
| --abbrev-commit | Show only the first few characters of the SHA-1 checksum instead of all 40. |
| --relative-date | Display the date in a relative format (for example, “2 weeks ago”) instead of using the full date format. |
| --graph | Display an ASCII graph of the branch and merge history beside the log output. |
| --pretty | Show commits in an alternate format. Option values include oneline, short, full, fuller, and format (where you specify your own format). |
| --oneline | Shorthand for --pretty=oneline --abbrev-commit used together. |

# Limiting Log Output

- git log takes a number of useful limiting options;

- The time-limiting options such as --since and --until are very useful. For example, this
- command gets the list of commits made in the last two weeks:

| Option | Description |
|---|---|
| -<n> | Show only the last n commits. |
| --since, --after | Limit the commits to those made after the specified date. |
| --until, --before | Limit the commits to those made before the specified date. |
| --author | Only show commits in which the author entry matches the specified string. |
| --committer | Only show commits in which the committer entry matches the specified string. |
| --grep | Only show commits with a commit message containing the string. |
| -S | Only show commits adding or removing code matching the string. |

```
$ git log --pretty="%h - %s" --author='Junio C Hamano' --since="2008-10-01" \ --before="2008-11-01" --no-merges -- t/
```

# Undoing Changes in Git

- Git provides various commands to undo changes at different stages of your workflow. These commands help in:
  - **Unstaging files**
  - **Modifying previous commits**
  - **Restoring files**
- **Why It's Important**
  - Mistakes happen! It's crucial to know how to undo actions in Git to avoid problems and preserve your work effectively.

## Undoing Changes : git commit --amend

- Purpose
  - Modify the most recent commit.
- Usage Scenario
  - You just made a commit but forgot to include a file or made a mistake in your commit message.
- How It Works
  - Allows you to amend the last commit by adding more changes or editing the commit message.

```
git commit --amend
```

Example→ You realize you forgot to include a file in your last commit. Stage the file, and then run, This will update the last commit, including the new file.

```
git add forgotten-file.js
git commit --amend
```

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# Undoing Changes : git reset HEAD <file>

- Purpose
  - Unstage changes that were accidentally added.
- Usage Scenario
  - You've added files to the staging area but decide that you don't want them included in the commit.
- How It Works
  - Moves files from the staging area back to the working directory, without affecting the file’s contents.

```
git reset HEAD <file>
```

Example→ You added file.js to the staging area, but now you want to unstage it,

```
git reset HEAD file.js
```

The file remains in your working directory but is no longer staged for commit.

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## Undoing Changes : git restore --staged <file>

- Purpose
  - Another way to unstage files, similar to git reset, but specific to the git restore command introduced in newer versions of Git.
- Usage Scenario
  - Useful in unstaging files when using modern Git workflows with git restore.
- How It Works
  - Removes a file from the staging area.

```
git restore --staged <file>
```

Example→ You decide not to include file.js in the next commit:

```
git restore --staged file.js
```

This removes the file from staging.

## Undoing Changes : git checkout -- <file>

- Purpose
  - Discard changes in your working directory and revert a file to its last committed state.
- Usage Scenario
  - You've modified a file but realize you want to revert it to its original version from the last commit.
- How It Works
  - Overwrites the changes in your working directory with the version in the last commit.

```
git checkout -- <file>
```

Example→ You want to discard the changes you made to file.js and restore it to the previous commit:

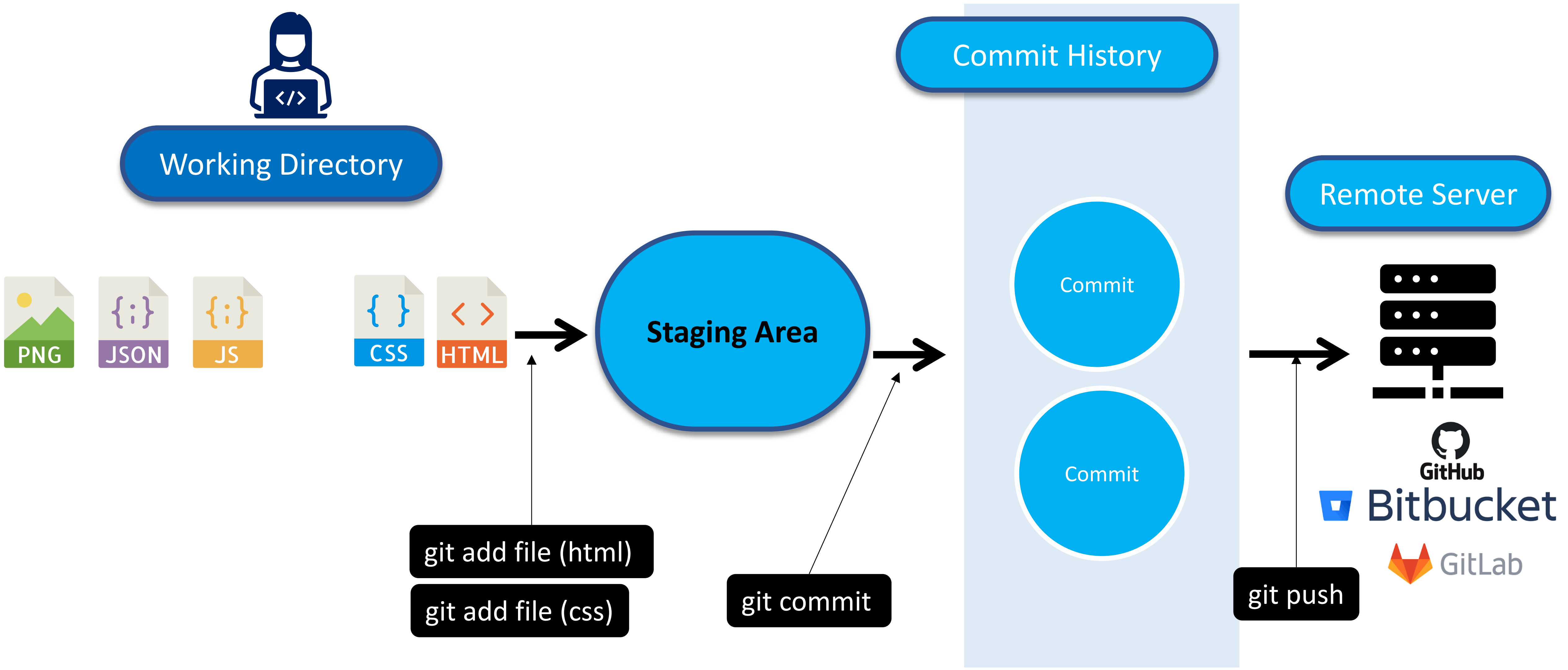
```
git checkout -- file.js
```

This reverts file.js to its last committed state.

# Undoing Changes : Summary

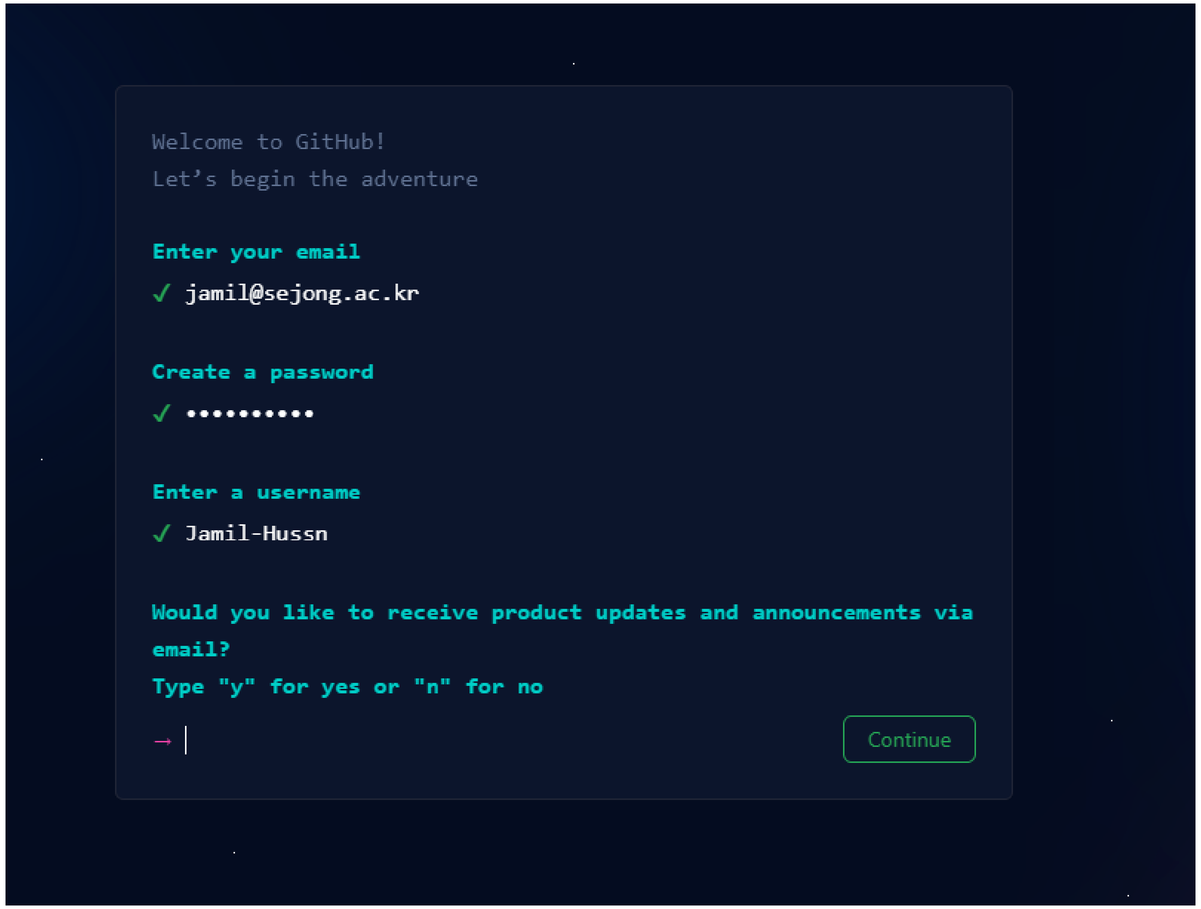
- **git commit --amend:** Edit the last commit by adding new changes or modifying the message.
- **git reset HEAD <file>:** Unstage a file without changing its content.
- **git restore --staged <file>:** Similar to git reset, removes files from the staging area
- **.git checkout -- <file>:** Discards changes in the working directory and restores the file from the last commit.

# How Git Works



GitHub is the single largest host for Git repositories, and is the central point of collaboration for millions of developers and projects.

- The first thing you need to do is set up a free user account.
- Simply visit https://github.com, choose a user name that isn't already taken, provide an email address and a password, and click the big green "Sign up for GitHub" button.



```
Welcome to GitHub!
Let's begin the adventure

Enter your email
✓ jamil@sejong.ac.kr

Create a password
✓ ••••••••••

Enter a username
✓ Jamil-Hussn

Would you like to receive product updates and announcements via
email?
Type "y" for yes or "n" for no
→ |
```

# Syncing Safely with Remote

**git fetch**
Downloads objects and refs refs from remote. Safe, doesn't doesn't integrate changes.

+

**git merge**
Integrates fetched changes into into your local branch. Can create a merge commit.

=

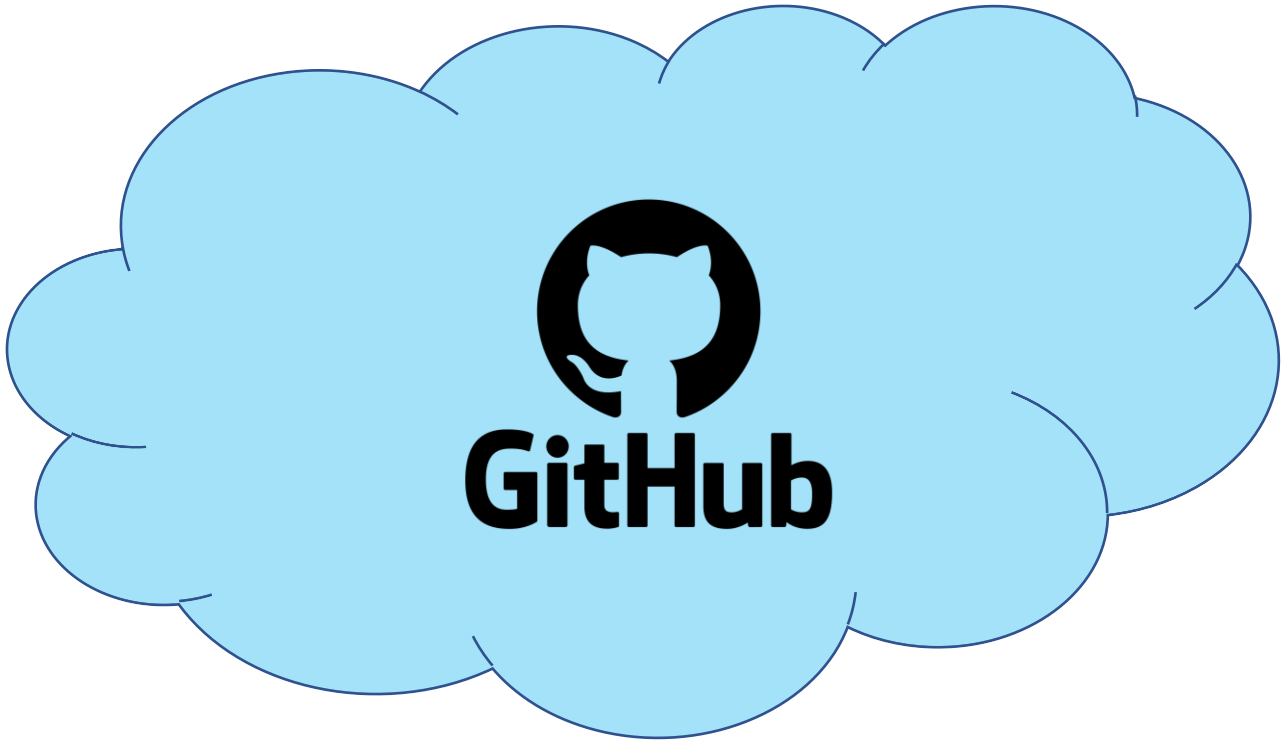
**git pull**
Fetch + merge. Use `--rebase` for a cleaner, linear history.

→

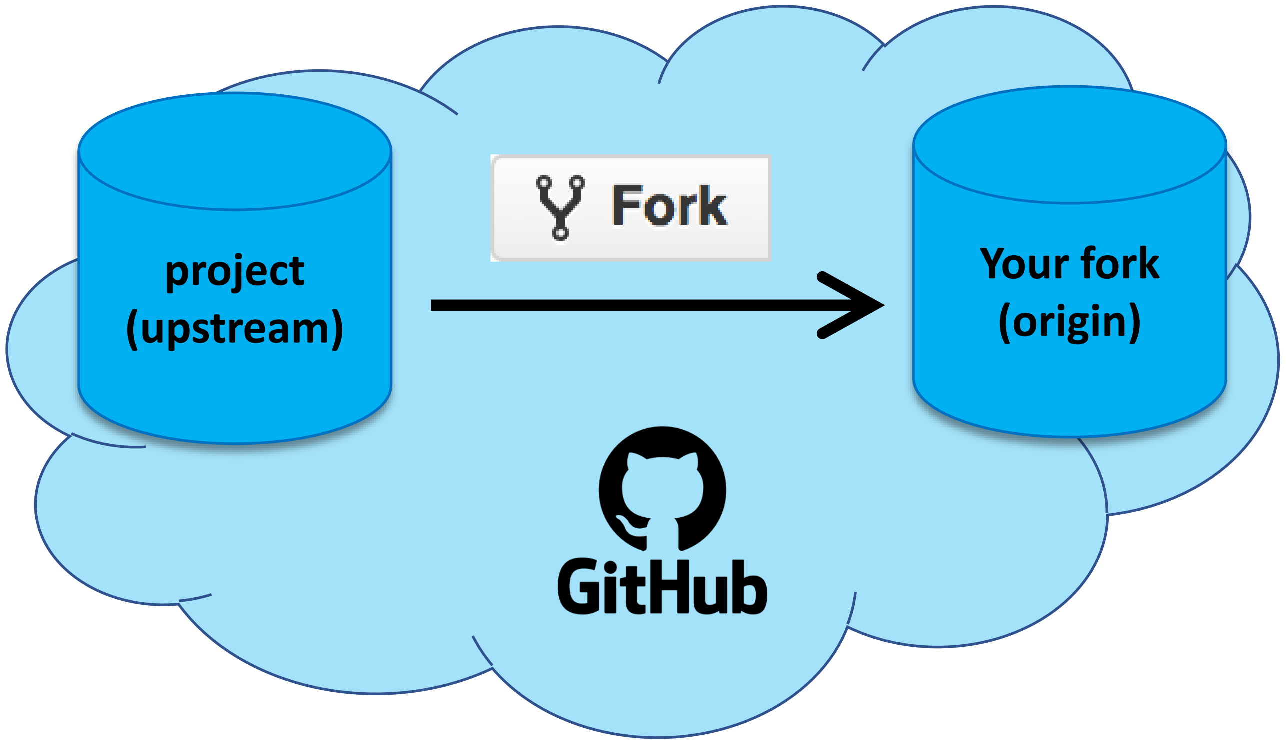
**git push**
Uploads local commits. Use `--force-with-lease` to avoid overwriting remote work.

Always sync before you push to handle non-fast-forward rejections gracefully. Configure tracking with `git push -u origin` .

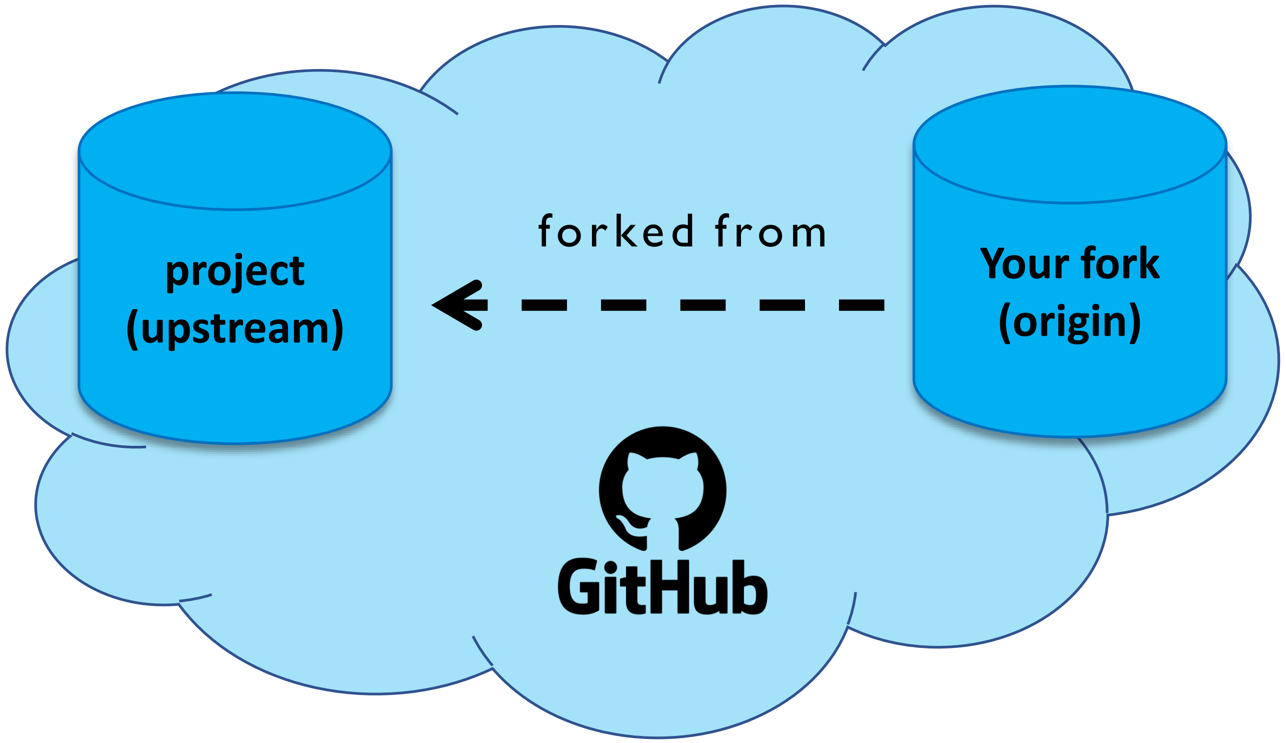
# Contributing to a Project



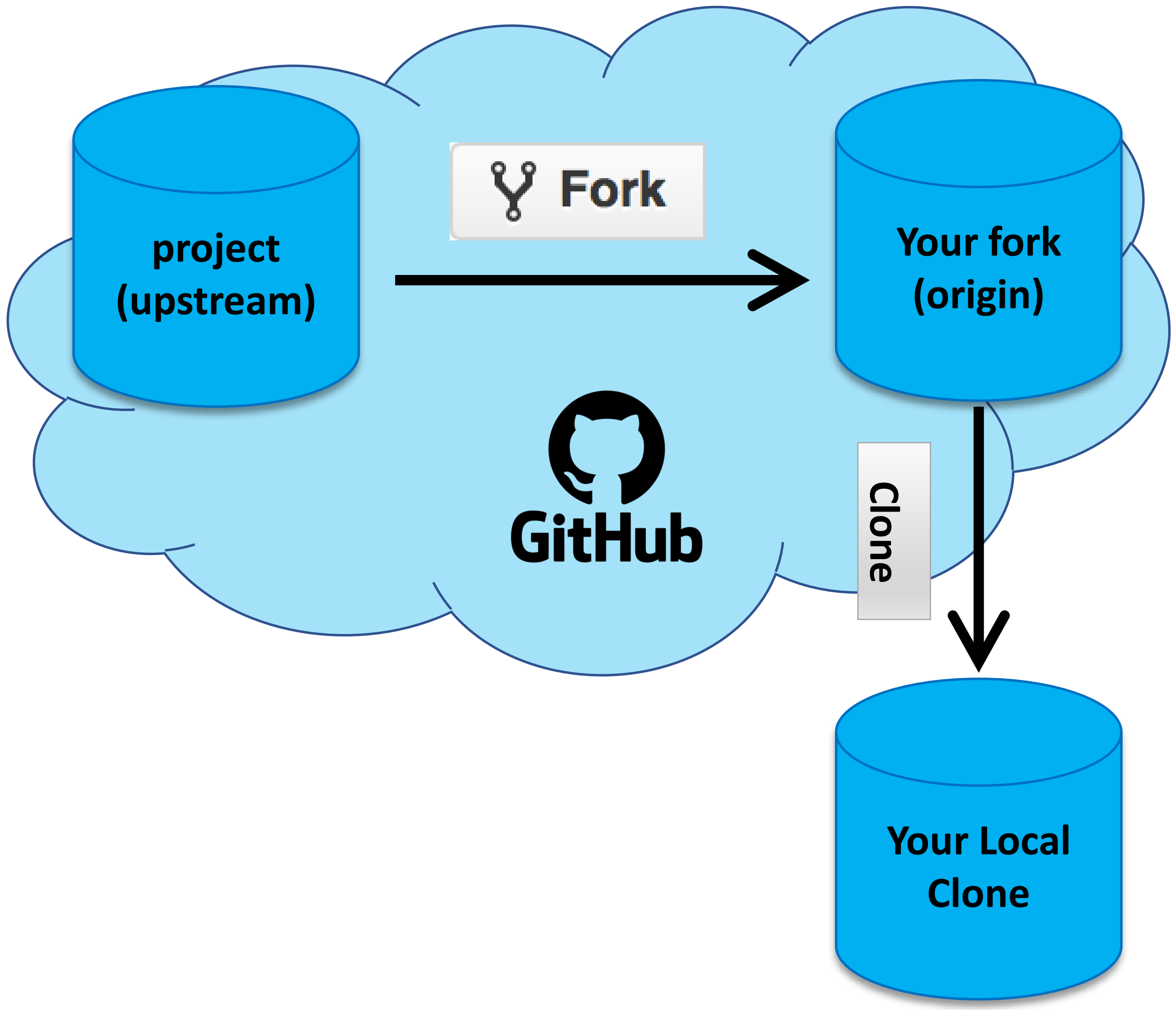
# Contributing to a Project



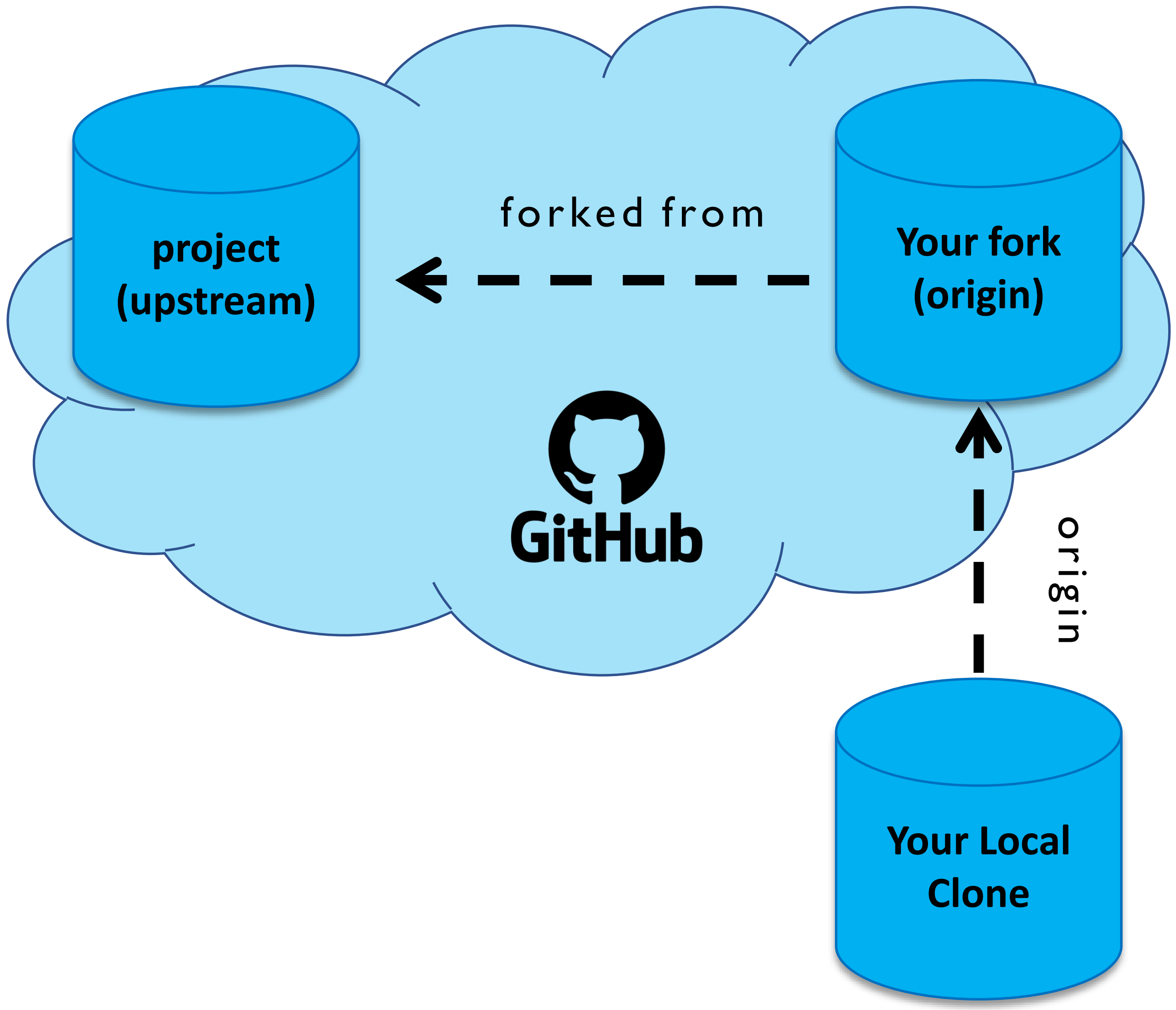
# Contributing to a Project



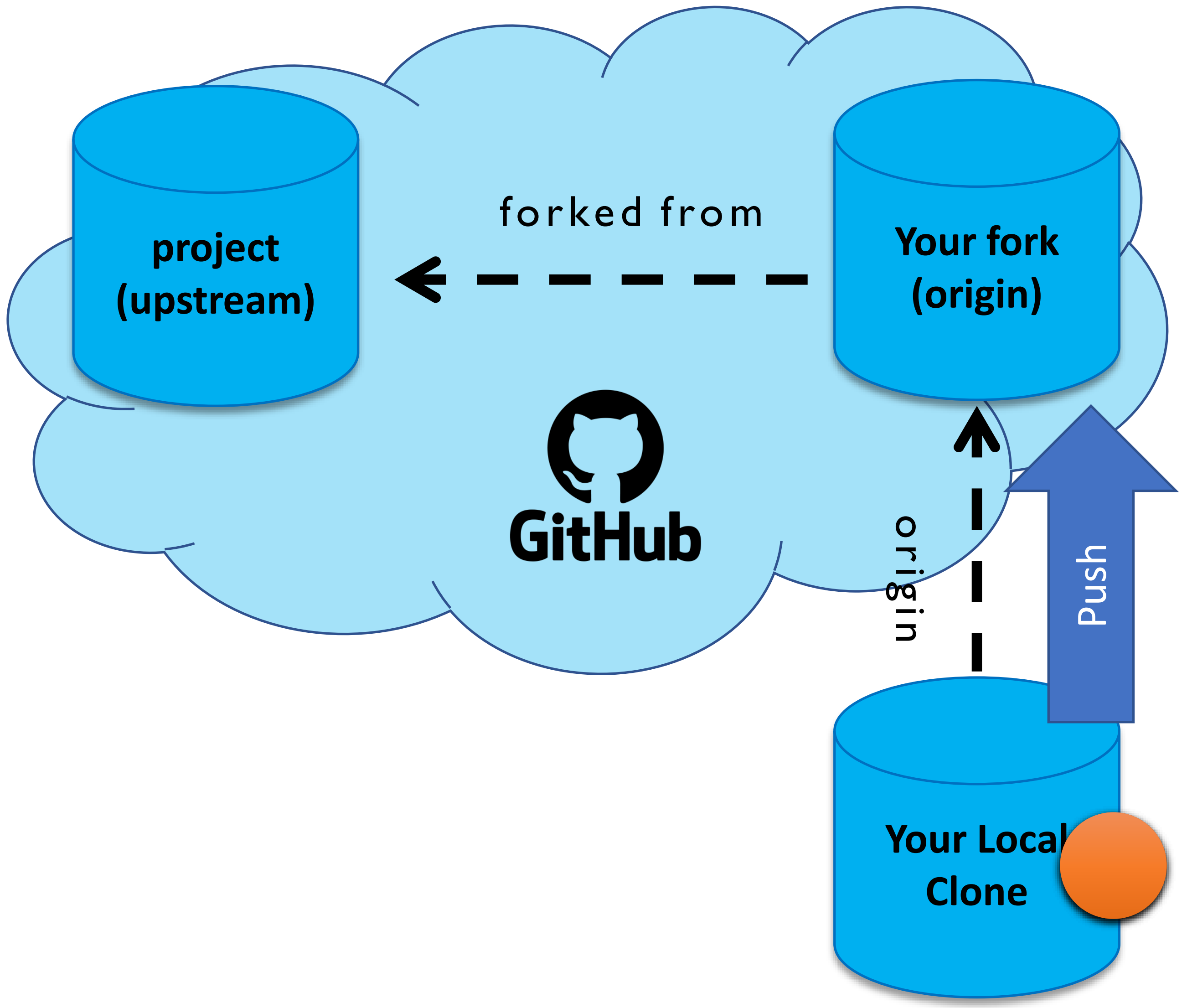
# Contributing to a Project



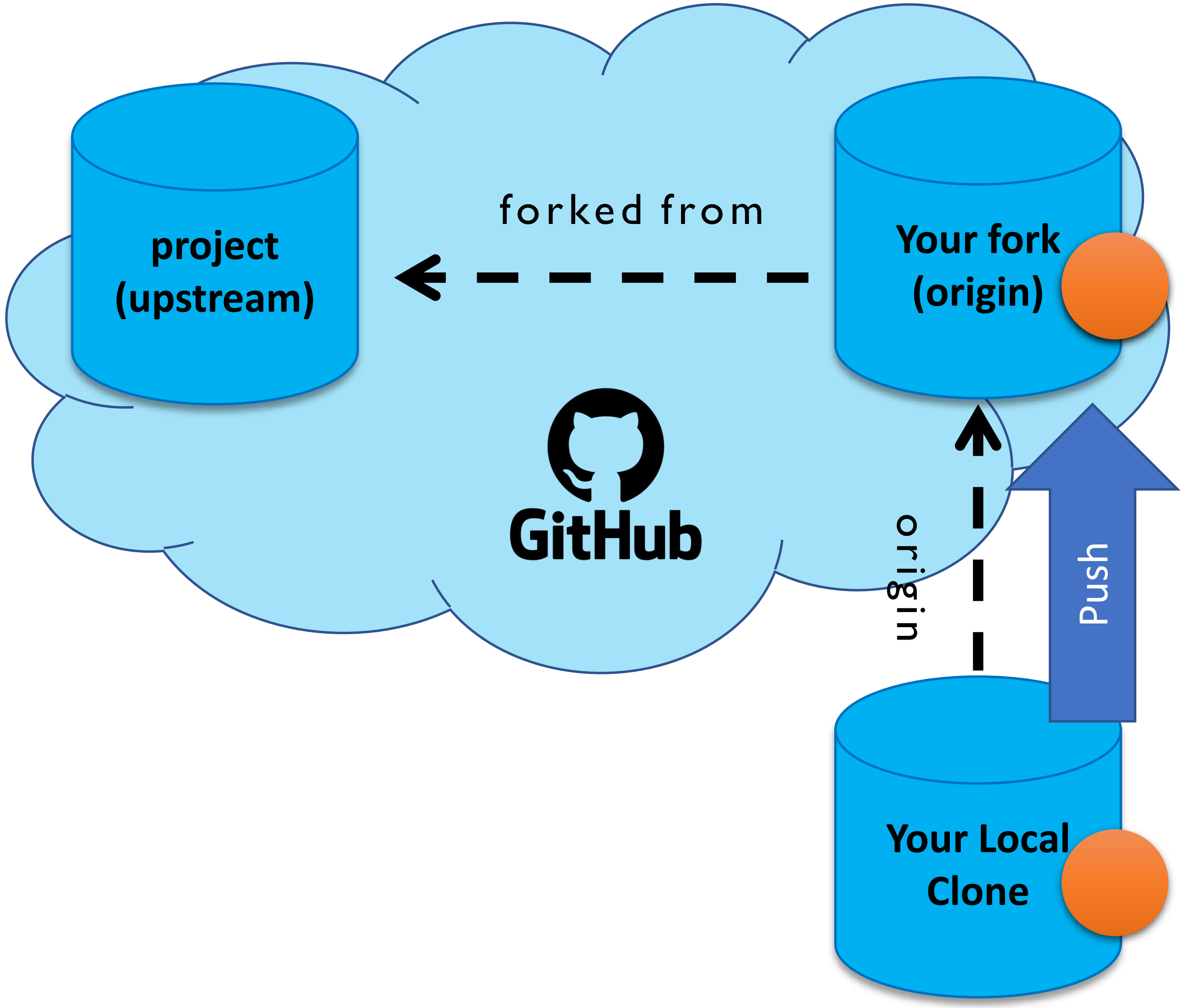
# Contributing to a Project



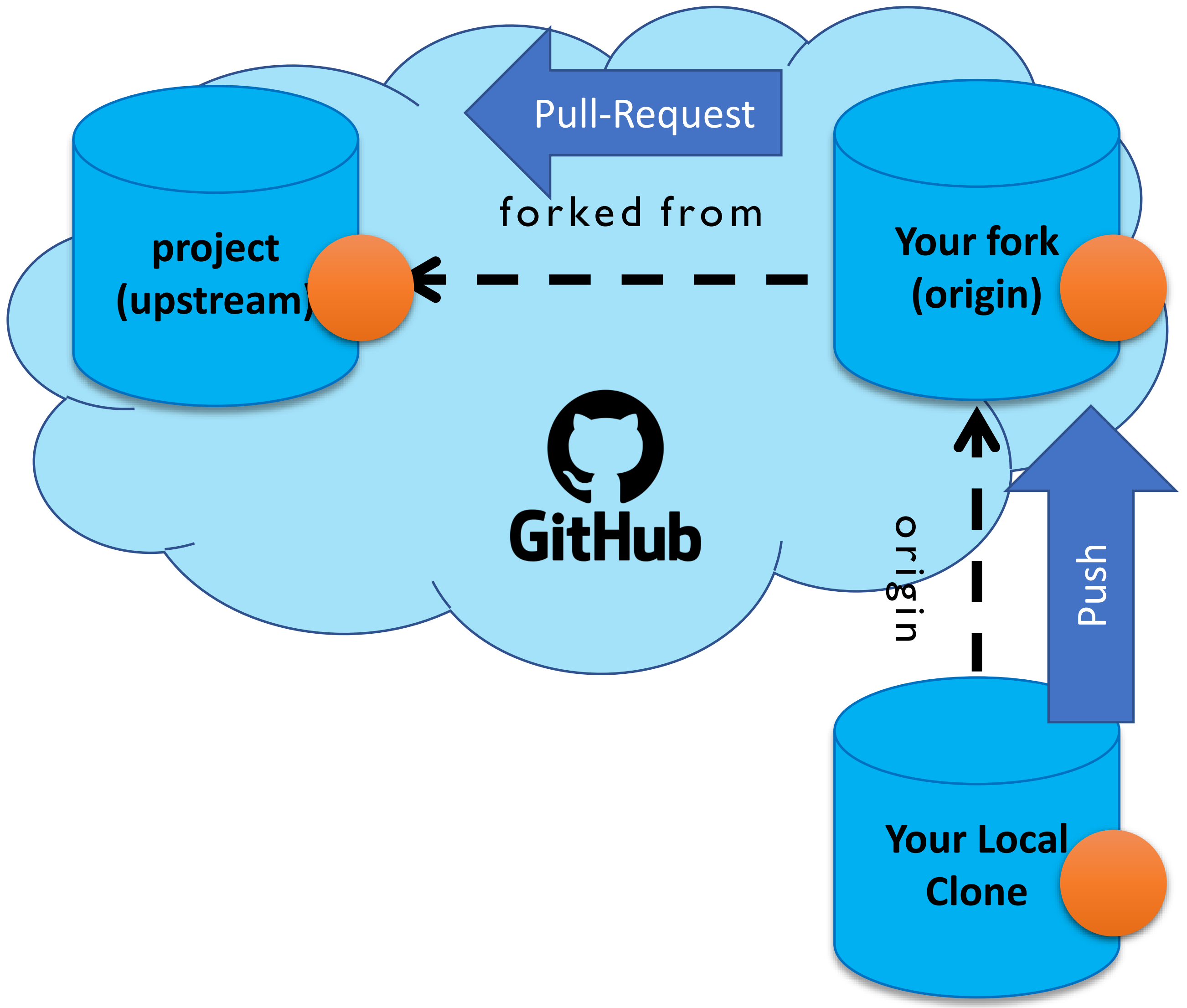
# Contributing to a Project



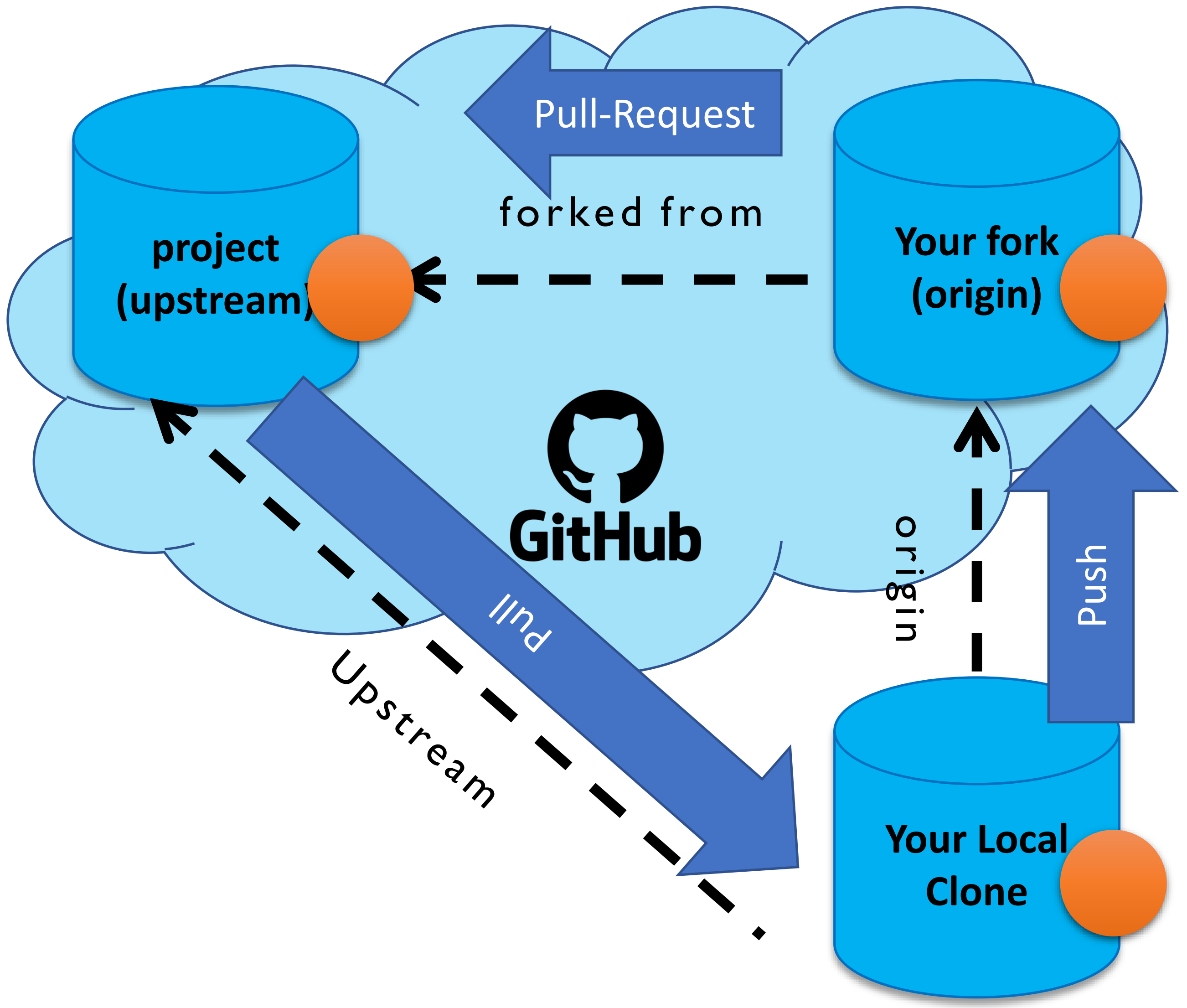
# Contributing to a Project



# Contributing to a Project



# Contributing to a Project



## Working with Remotes

- To be able to collaborate on any Git project, you need to know how to manage your remote repositories.
- To add a new remote Git repository as a shortname you can reference easily, run git remote add <shortname> <url>:

```
$ git clone https://github.com/schacon/simplegit-progit
```

```
$ git remote -v
```

```
$ git remote add pb https://github.com/paulboone/ticgit
```

```
$ git fetch pb
```

## Fetching and Pulling from Your Remotes

- As you just saw, to get data from your remote projects, you can run:

```
$ git fetch <remote>
```

- If you clone a repository, the command automatically adds that remote repository under the name “origin”.

```
$ git fetch origin
```

## Fetching and Pulling from Your Remotes

- git pull is a command used in Git to fetch changes from a remote repository and automatically merge them into the current branch.

```
git pull = git fetch + git merge
```

```
$ git pull origin main
```

## Pushing to Your Remotes

- When you have your project at a point that you want to share, you have to push it upstream
- The command for this is simple: git push <remote> <branch>

```
$ git push origin master
```

# Tagging – 1/4

- Like most VCSs, Git has the ability to tag specific points in a repository’s history as being important.
- Typically, people use this functionality to mark release points (v1.0, v2.0 and so on).
- Listing Your Tags

```
$ git tag
```

```
$ git tag -l
```

```
$ git tag -l "v1.8.5*"
```

## Tagging - Creating Tags – 2/4

- **Git supports two types of tags:**
  - Annotated
  - Lightweight
- **Annotated Tags**
  - Creating an annotated tag in Git is simple. The easiest way is to specify -a when you run the tag command, -m specifies a tagging message, which is stored with the tag

```
$ git tag -a v1.4 -m "my version 1.4"
```

- **Lightweight Tags**
  - To create a lightweight tag, don’t supply any of the -a, -s, or -m options, just provide a tag name:

```
$ git tag v1.4-lw
```

## Tagging - Sharing Tags – 3/4

- By default, the git push command doesn't transfer tags to remote servers.
- You will have to explicitly push tags to a shared server after you have created them.
- This process is just like sharing remote branches — you can **run git push origin <tagname>**.
- **If you have a lot of tags that you want to push up at once, you can also use the --tags option to the git push command.**

```
$ git push origin v1.5
```

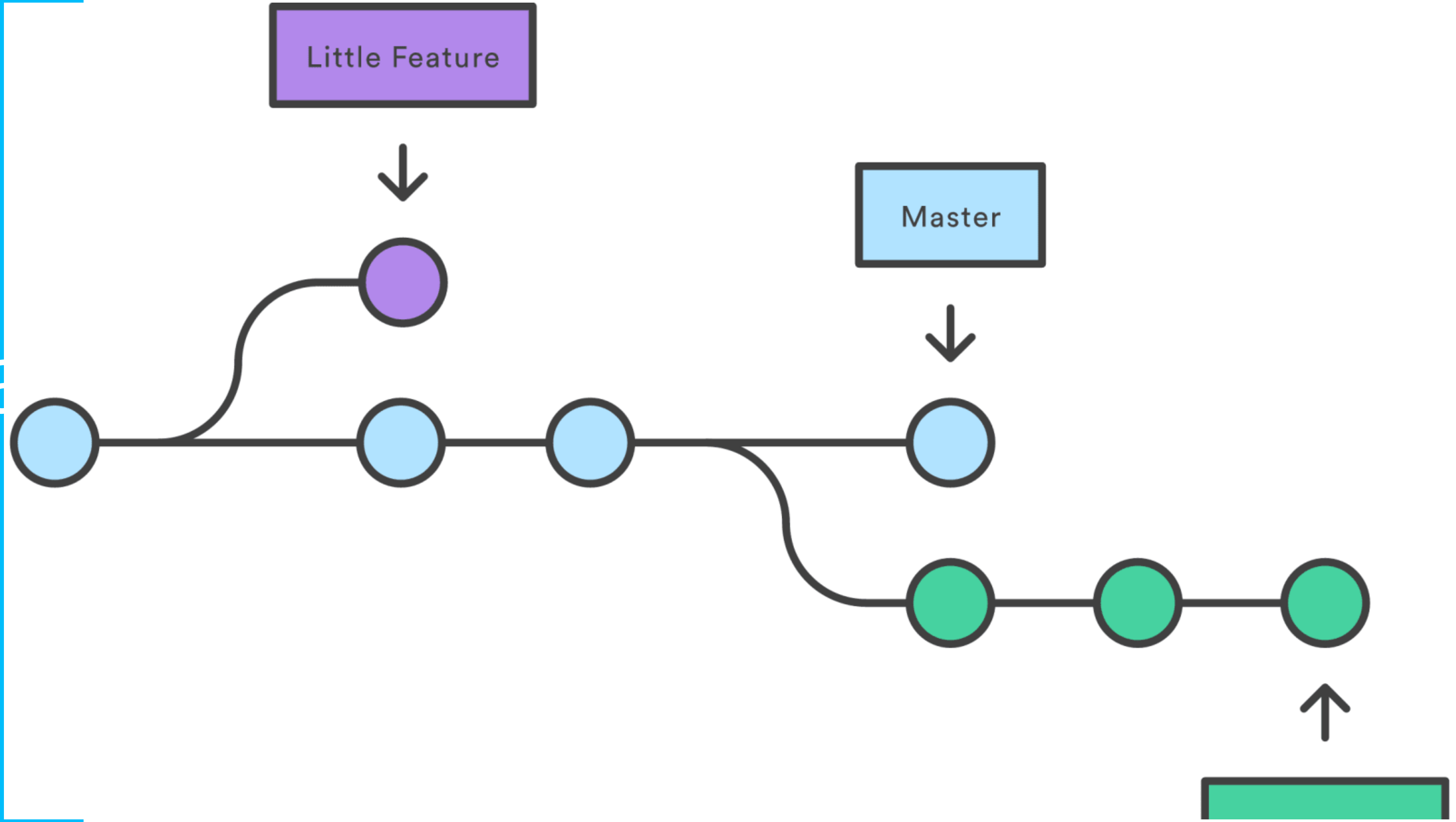
```
$ git push origin --tags
```

## Tagging - Deleting Tags – 4/4

- To delete a tag on your local repository, you can use **git tag -d <tagname>**
- For example, we could remove our lightweight tag above as follows:

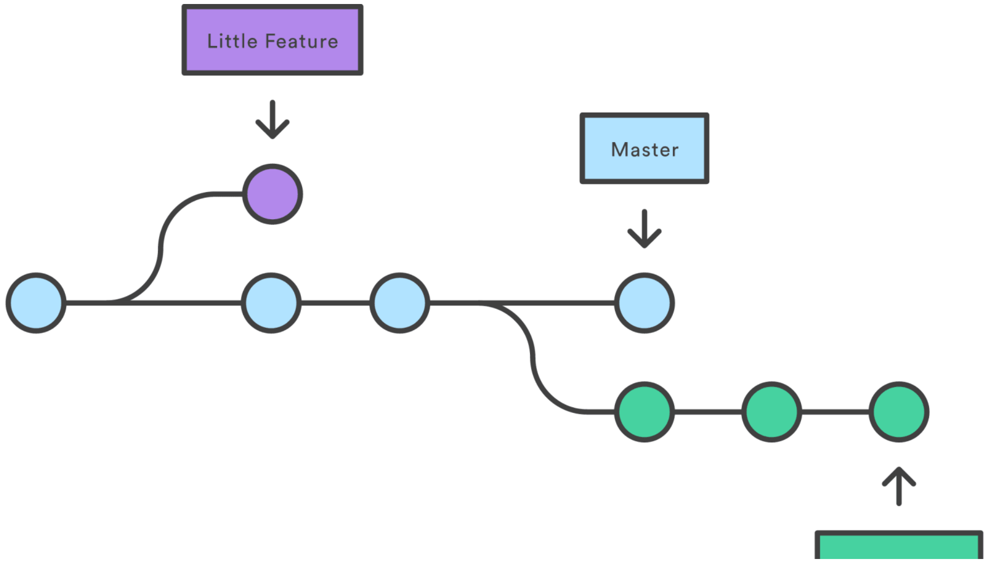
```
$ git tag -d v1.4-lw
```

Bra



# Git Branching

- Branching means you diverge from the main line of development and continue to do work without messing with that main line
- The way Git branches is incredibly lightweight, making branching operations nearly instantaneous, and switching back and forth between branches generally just as fast.



# Branch Management: Create, Switch, Rename

### Create

Create lightweight topic branches to isolate isolate your work.

```
$ git branch new-feature
$ git switch -c new-feature
```

### Switch

Move between branches safely. Your working working directory updates automatically. automatically.

```
$ git switch main
# Modern replacement for checkout
```

### Rename

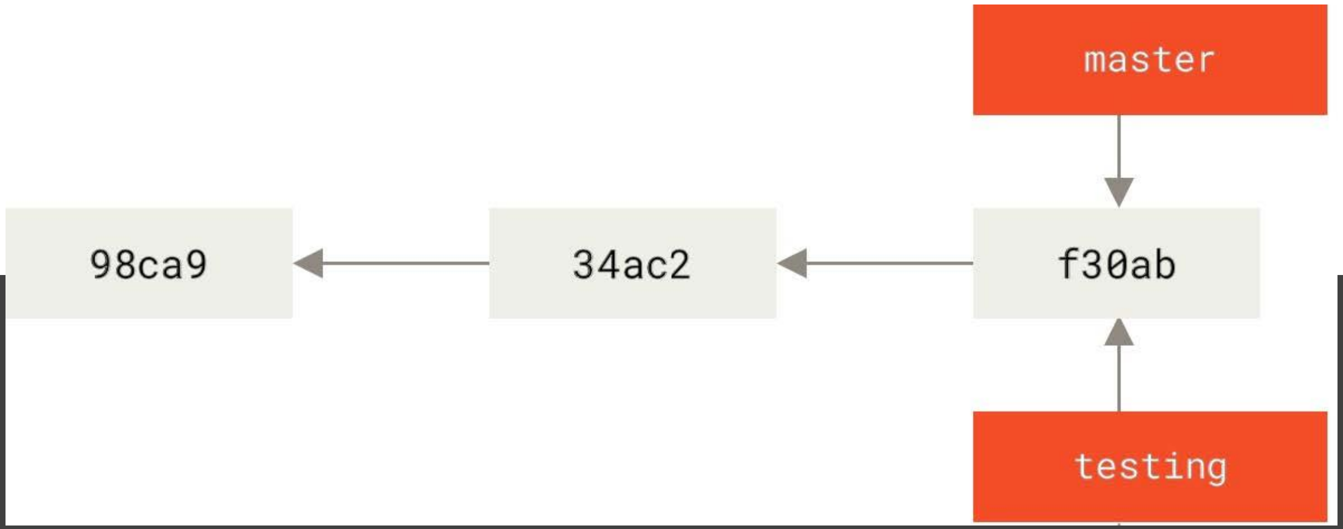
Keep branch names meaningful and consistent.

```
$ git branch -m old-name new-name
# `-m` for "move"
```

The reflog is your safety net, allowing you to recover from any branch mishaps.

# Creating a New Branch

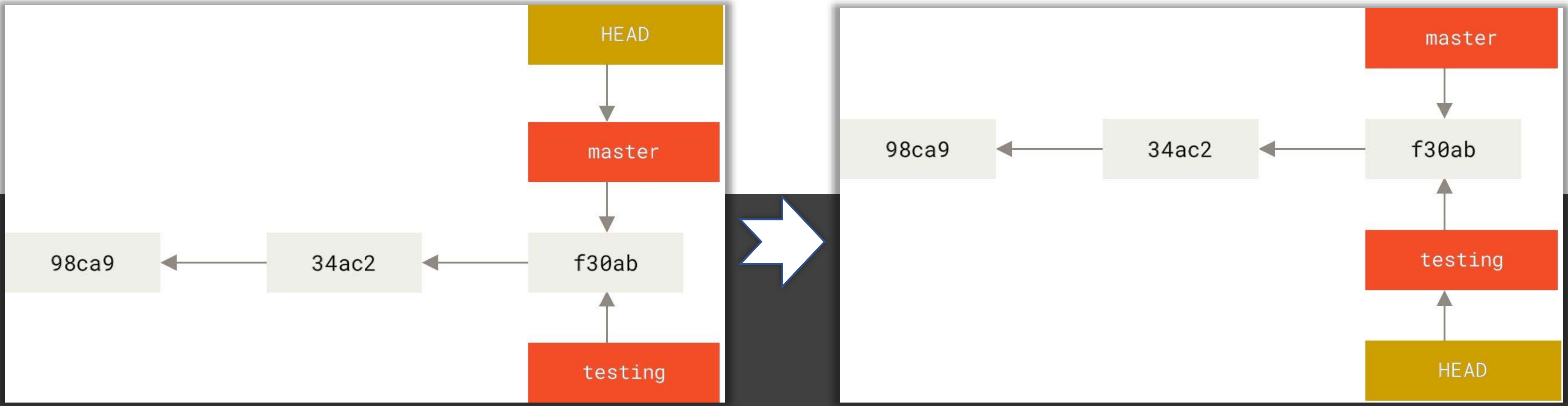
- What happens when you create a new branch? Well, doing so creates a new pointer for you to move around.
- Let’s say you want to create a new branch called testing. You do this with the git branch command:



```
$ git branch testing
```

# Switching Branches – 1/2

- To switch to an existing branch, you run the git checkout command.
- Let’s switch to the new testing branch:



```
$ git checkout testing
```

## Switching Branches – 2/2

- To create a new branch and switch to it at the same time, you can run the git checkout command with the -b switch:

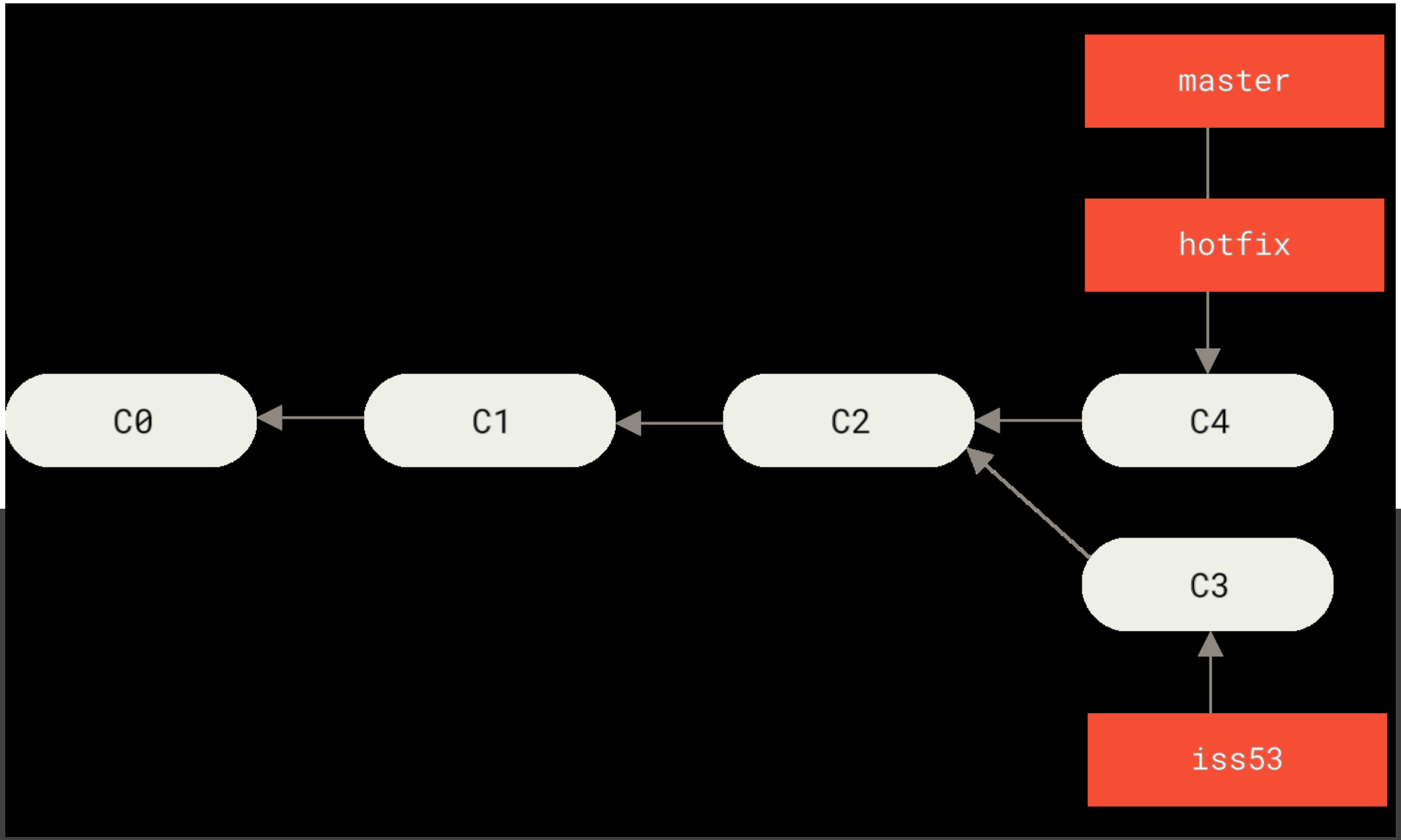
```
$ git checkout -b iss53
```

- This is shorthand for:

```
$ git branch iss53
$ git checkout iss53
```

# Delete Branches

- you can delete it with the -d option to git branch:



```
$ git branch -d hotfix
```

# Integration Strategies: Merge vs. Rebase

## Merge

Creates a new "merge commit" that ties two branches together, together, preserving the full historical context of the feature branch. branch.

- ✓ Preserves full history and branch topology.
- ✓ Accurately reflects the development process.

```
git merge feature
```

## Rebase

Re-applies your commits on top of the target branch, creating a linear, cleaner project history without merge commits.

- ✓ Creates a linear, easy-to-follow history.
- ✓ Avoids "merge commit" clutter.

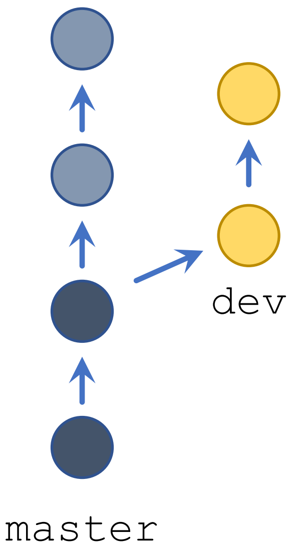
```
git rebase main
```

# Branching and merging with `git`

- There are multiple methods to bring parallel developments back together

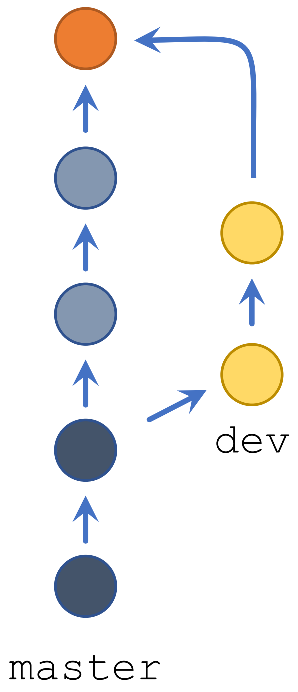
Getting started with branching

● ... a commit

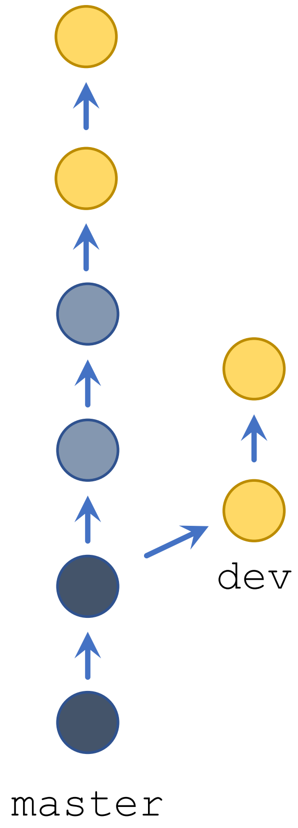


Three options to ***merge*** the changes from `dev` into `master`

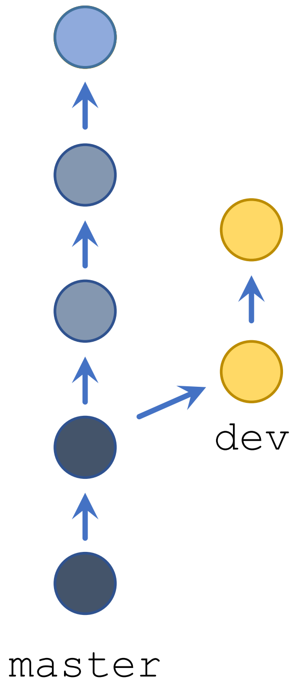
1) A merge commit



2) Rebase



3) Squash and merge



## Basic Merging

- Suppose you've decided that your issue #53 work is complete and ready to be merged into your master branch.
- In order to do that, you'll merge your iss53 branch into master, much like you merged your hotfix branch earlier.
- All you have to do is check out the branch you wish to merge into and then run the git merge command:

```
$ git checkout master'
$ git merge iss53
```

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## Reading Materials

- Karl Fogel, *Producing Open Source Software: How to Run a Successful Free Software Project*, O'Reilly Media, 2009.
- https://choosealicense.com/
- https://opensource.guide/starting-a-project/
- Book : Pro Git Scott Chacon, Ben Straub
- https://git-scm.com/book/en/v2/Git-Basics-Getting-a-Git-Repository

# Thanks

Office Time: Monday-Friday (1000 - 1800)

You can send me an email for meeting, or any sort of discussion related to class matters.

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