# MarMic

## Git, GitHub/Gitlab

Nico Harms - 2025-01-21

**Nico Harms**
**Software Engineer**
**AWI**

## Shiva

**Responsible for:**

- Cuddles
- Chaos

## Links

- **Environment**: https://training.hub.gfbio.dev/

**Workshop Repository**

**https://github.com/NicoHarms/marmic-git**

**Fragen**

**https://docs.google.com/document/d/1csV2gaHW5izRbvpf2Wh_WckoSa9Zt6XyjeyLyyaHxmA/edit?usp=sharing**

## Introduction

**In this workshop, we'll explore the fundamentals of modern version control and collaboration using Git, along with platforms like GitHub and GitLab.**

# MarMic - Git, GitHub/Gitlab

## Introduction

- Who is this for?
  - This workshop is crucial for software developers, data scientists, and anyone involved in collaborative projects.
- Why is this important?
  - In today's fast-paced and interconnected world, effective collaboration, code management, and version control are essential.
- By the end of this workshop, you will:
  - Create and manage Git repositories.
  - Know how to collaborate with team members and peers on shared projects.

# MarMic - Git, GitHub/Gitlab

## Schedule

**Day 1 - Introduction to Git and Basic Concepts**

- Welcome and Introduction
- Understanding Version Control
- Introduction to Git
- Git Basics
- Git Workflow

**Day 2 - Branching, Collaboration, and Advanced Topics**

- Recap of Day 1
- Git Branching and Merging
- Remote Repositories
- Collaborative Workflows
- Advanced Topics (time permitting)

## Day 1
## Introduction to Git and Basic Concepts

## Understanding Version Control

## Understanding Version Control

### The Problem

- Have you ever found yourself juggling multiple versions of a file, like "document.txt," "document_v2.txt," and „document_final.txt"?

```
my-project
 ├─── document_v1.txt
 ├─── document_v2.txt
 ├─── document_final_draft.txt
 ├─── document_final_draft2.txt
 ├─── document_final.txt
 ├─── document_final_fixed.txt
 └─── document_FINAL_FINAL.txt
```

## Understanding Version Control

**The Solution**

- A version control system is an invaluable tool that empowers you to monitor changes to your files and collaborate seamlessly on projects.
- Types of VCS (e.g. Subversion, CVS, Mercurial, git)
- Advantages:
  - Chronological record
  - Easily to revert
  - Collaborate efficiently

# Understanding Version Control

## A brief history

- 1970s-1980s: Emergence of early systems like IBM's **Source Code Control System** (SCCS) and the Revision Control System (RCS).
- 1990s: Development of **Concurrent Versions System** (CVS), supporting concurrent work by multiple developers.
- Early 2000s: Introduction of **Subversion** (SVN), offering atomic commits and enhanced branching and merging capabilities.
- 2005: Birth of **Git** by Linus Torvalds, focusing on speed, efficiency, and distributed version control. Git quickly became the global standard for software development.
- „Version Control Light“ - Various Cloud providers since 2007

## Introduction to Git

## Introduction to Git

**Git is a powerful version control system**

- Tracks changes made to files over time
- Allows creation of branches for independent work
- Facilitates seamless collaboration and merging of changes

## Introduction to Git

### Basic Git Commands

- `git init`: Initialize a new Git repository
- `git status`: Check the status of your repository
- `git add`: Add changes to the staging area
- `git commit`: Create a new commit with the staged changes
- `git log`: View a log of your commit history
- `git diff`: Compare changes between different versions of your files

# Introduction to Git

## Real-World Applications of Git

- **Academia**: Tracking changes in research papers and collaboration
- **Data Science**: Managing code and data, fostering team collaboration
- **Design**: Version controlling creative work and collaboration
- **Writing**: Tracking writing versions and collaboration with editors and authors

## Git Basics

## Git Basics

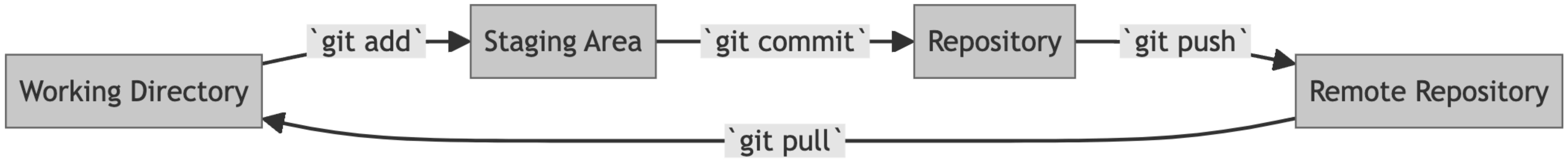
### Git Terminology

- **Repository**: Container for your project, holding all files, directories, and history of changes.
- **Commit**: Snapshot of your project's files at a specific point in time, including changes made since the last commit.
- **Branch**: Parallel version of your repository, allowing work on new features or changes without affecting the main codebase.

# Git Basics

## Three Main Stages of Git

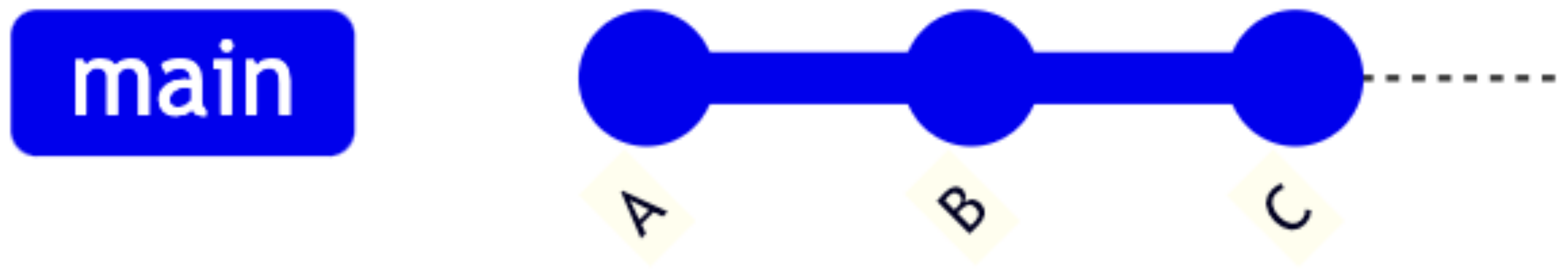
- **Working Directory**: Where you make changes to your code.
- **Staging Area**: Temporary holding space for reviewing and selecting changes for the next commit.
- **Repository**: Stores snapshots of your project's files, creating a history of commits.
- **Remote Repository**: Copy of the repository stored on a remote server, enabling collaboration, backup, sharing, and pulling changes.



# Git Basics

## What is a Commit?

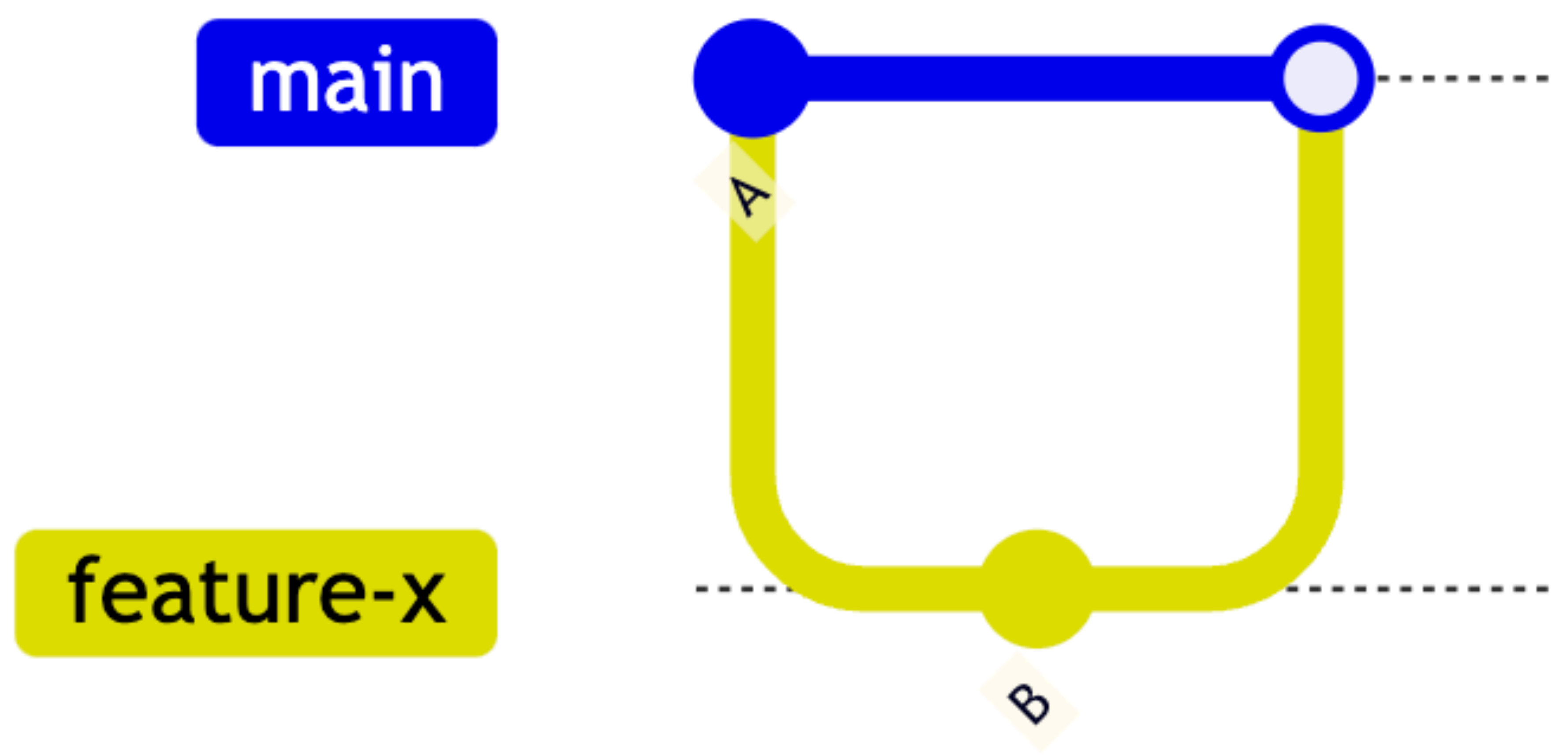
- **Definition**: A snapshot of your project's files at a particular moment in time.
- **Contents**: Changes made to the files since the last commit, metadata, and a unique identifier (SHA).
- **Linear History**: Commits are stored sequentially, helping track progress, collaborate, and revert to previous project versions.



# Git Basics

## What is a Branch?

- **Definition**: A parallel version of your repository for independent work.
- **Creating a Branch**: Starts based on the current state of the repository.
- **Isolation**: Allows experimentation with new features or changes without impacting the main version.



## Git Workflow

# Git Workflow

## Key Concepts

- Git operates with a local repository on your machine.
- Changes are stored locally until you use the `git push` command.

# Git Workflow

## Example Workflow

1. Initialize a new Git repository using the `git init` command.
2. Make changes to the project files.
3. Use the `git status` command to see the changes made in the working directory.
4. Use the `git add` command to add changes to the staging area.
5. Commit your changes using the `git commit` command.
6. View the commit history using the `git log` command.

# Git Workflow

## Additional Commands

- `git diff`: See the differences between the working directory and the latest commit.
- `git show`: See the details of a specific commit.
- `git log --all --graph --oneline`: Show a graphical representation of the commit history, including all branches and commits.

## Hands On

**Workshop Repository**

**https://github.com/NicoHarms/marmic-git**

## Hands On

- Environment: https://training.hub.gfbio.dev/
    - **nharms**@awi.de -> Username: nharms
    - Password: ***

## E0

### Bash basics

- Open https://training.hub.gfbio.dev in your browser
- Go into your terminal Initially set up your user:
    - `bash`
    - `` Create a folder `mkdir <folder>`, e.g. `mkdir frogs` ``
    - `` Navigate into a folder `cd <folder>`, e.g. `cd frogs` ``
    - `` Move/rename something `mv <from> <to>` `mv frogs fish` ``
    - `` Delete something `rm <file`, e.g. `rm -r fish` ``

# E0

## Bash basics

- Open a file via vim, `vim <file>`, e.g. `vim README.md`
-

# E1

## Basic git configuration

- Open https://training.hub.gfbio.dev in your browser
- Go into your terminal Initially set up your user:
    - `bash`
    - `git config --global user.name "Your Name“`
    - `git config --global user.email "your.mail@example.com"`
    - `git config --global init.defaultBranch main`
- Verify that your git user and mail are set correctly
    - `git config --list`

## E2

- Create your first repository

- Create a new directory inside of your home folder for your project
- Initialize a new git repository in that directory by running the command `git init` in the terminal
- In the directory you initialized as a git reposiory create a new file called `README.md`
- Fill the file with some content

## E3

### Create your first commit

- Modify the `README.md` file and save it
- Add this file to the staging area with `git add README.md`
- Now you can commit via `git commit --message "Your specific commit message"` to the repository
- Repeat this process 2 more times and choose good commit messages each time.

## E4
### Multiline Commit Message

- Modify your `README.md` file and save it.
- Add the file to the staging area
- When commiting the file omit the `--message` part. This will open an editor.
- Within this editor you may write longer commit messages. The first line will be most prominent, therefore set is wisely.
- When you are done writing your message, save and close the file (`Ctrl+x` for nano, `:wq` for vi/vim)
- Take a look at `git log` now.

## E5

### Displaying differences

- When entering `git diff` in the terminal you will see the difference between of the unstaged files and the rest of your repository

- By using `git diff [<commit hash>|<branch>]` you may compare the current state of the repository with a specific commit or branch

- With `git diff [<commit hash>|<branch>] [<commit hash>|<branch>]` You can compare branches with branches, commits with commits, branches with commits and the other way around.

# Links

- **Environment**: https://training.hub.gfbio.dev/

**Workshop Repository**

https://github.com/NicoHarms/marmic-git

**Fragen**

https://docs.google.com/document/d/1csV2gaHW5izRbvpf2Wh_WckoSa9Zt6XyjeyLyyaHxmA/edit?usp=sharing

## Day 2
## Branching, Collaboration and Advanced Topics

# MarMic

## Git, GitHub/Gitlab - Day 2

Nico Harms - 2025-01-22

## Recap of Day 1

- Git Terminology
- Three Main Stages of Git
- What is a Commit?
- What is a Branch?
- Basic Git Commands

# MarMic - Git, GitHub/Gitlab

## Schedule

**Day 2 - Branching, Collaboration, and Advanced Topics**

- Recap of Day 1
- Git Branching and Merging
- Remote Repositories
- Break and Q&A
- Collaborative Workflows
- Advanced Topics (time permitting)

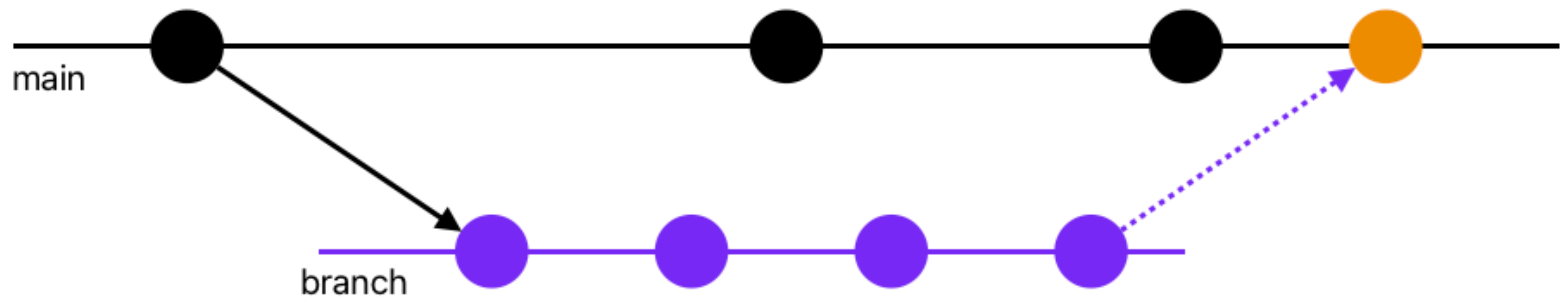
## Day 2
## Branching, Collaboration and Advanced Topics

## Git Branching and Merging

## Git Branching and Merging

### What are Git Branches again?

- Git branches are separate lines of development.
- Developers can work on different features or bug fixes simultaneously.
- Branches don't impact the main codebase until merged.
- Completed work can be merged back into the main branch.



# Git Branching and Merging

## Creating a Branch

- **Creating a Branch**: Use `git switch --create <branch-name>` to create a new branch.
- **Switching Between Branches**: Use `git switch <branch-name>` to switch to a different branch. Changes can be made to the branch files using `git add` and `git commit`.
- **Merging Branches**: Use `git merge <branch-name>` to merge changes from a branch back into the main branch. This creates a new commit representing the merge.
- **Handling Merge Conflicts**: Conflicts occur when the same lines of code are modified in both branches. Git marks conflicts in files with special markers, and they must be resolved manually.

# Git Branching and Merging

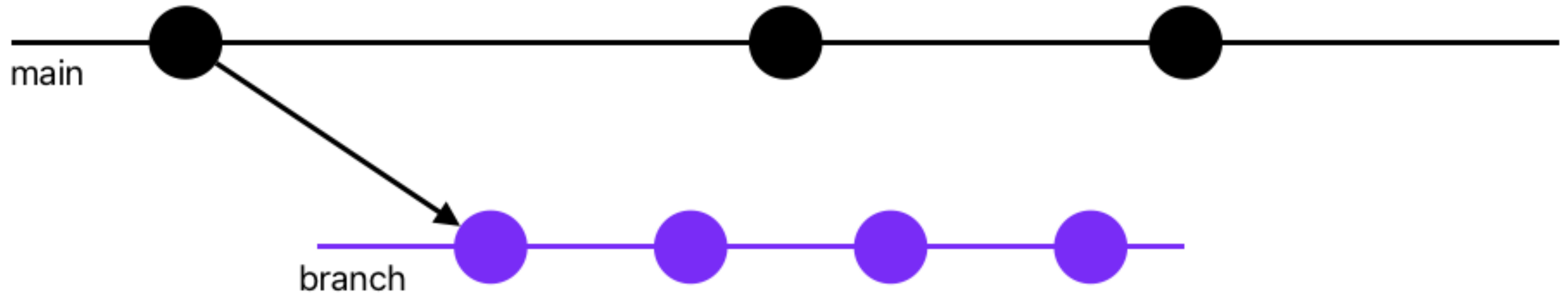
## Merge Strategies

- **Fast-Forward Merge**: Moves the current branch to the latest commit of the branch being merged when branches have not diverged.
- **Merge Commit**: Creates a new commit with multiple parents when merging diverged branches.
- **Forcing a Merge Commit**: Use `git merge --no-ff` to force a merge commit even when a fast-forward merge is possible.
- **Squashing Commits**: Combine all branch commits into a single commit with `git merge --squash`.

# Git Branching and Merging

## Rebasing

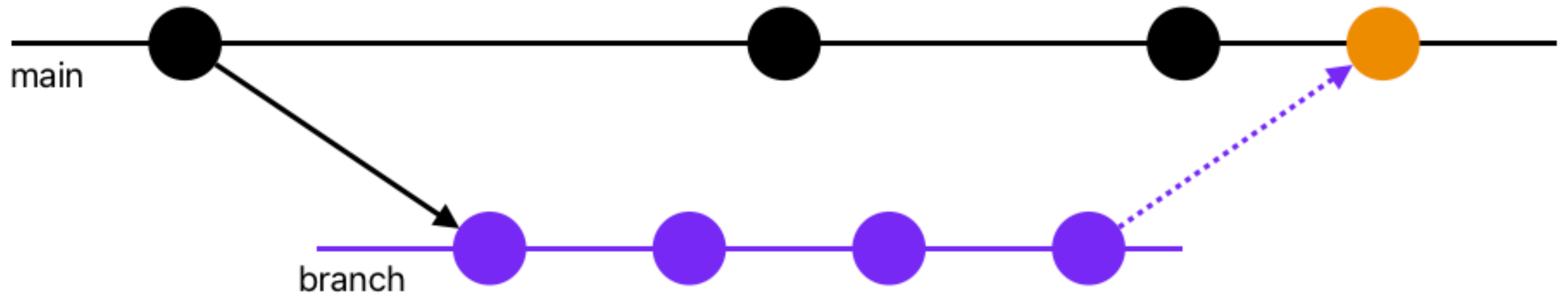
- Include commits from other branches on my work



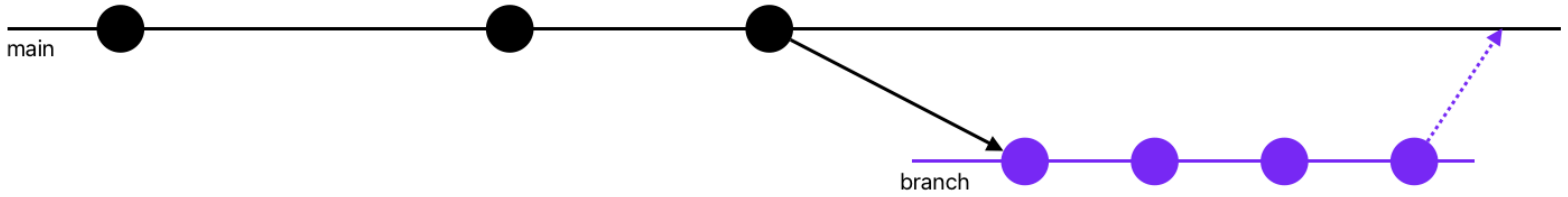
Current state of the repository

# Git Branching and Merging

## Rebasing



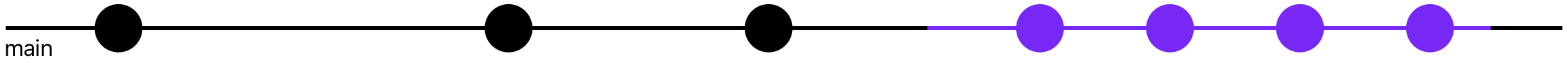
Creating a branch, doing work and merging without rebase



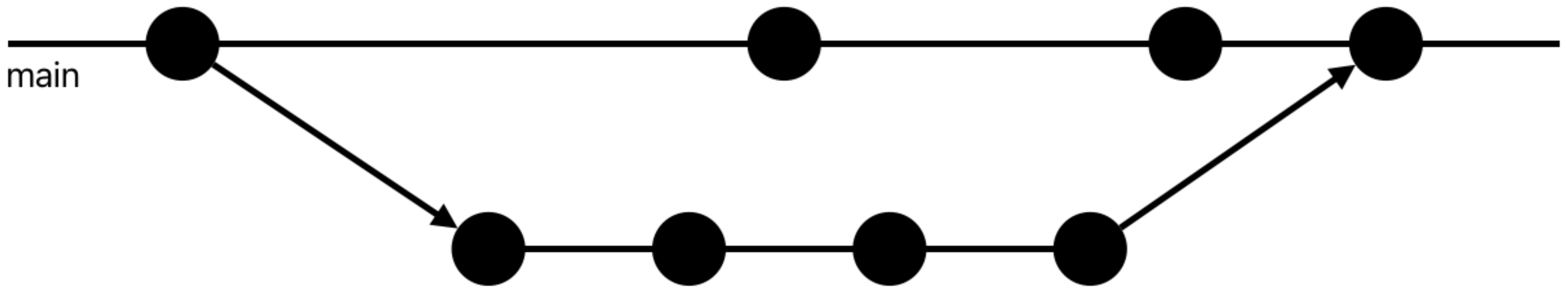
Using `git rebase` before merging

# Git Branching and Merging

## Rebasing



Resulting graph of main branch with rebasing



Resulting graph of main branch without rebasing

## Collaborative Workflows

# Collaborative Workflows

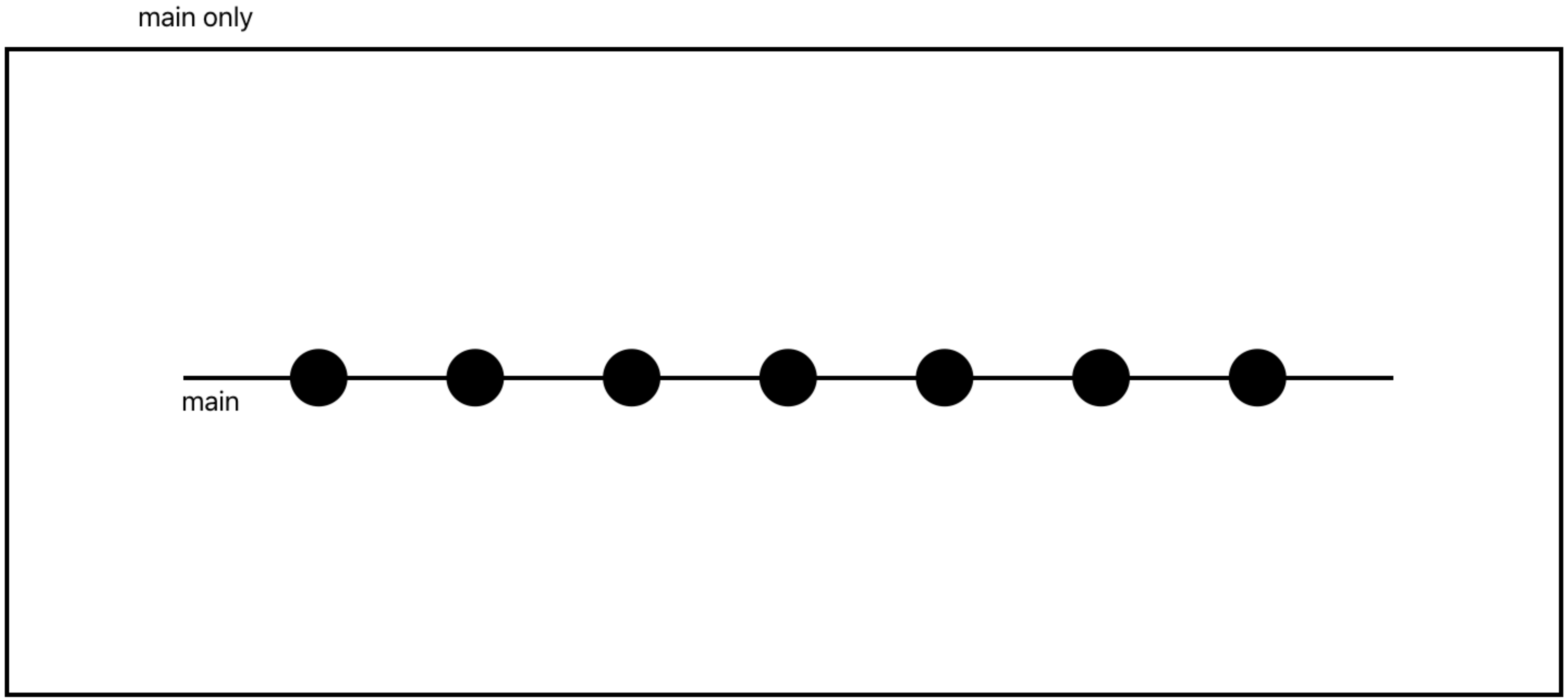
## Project Factors to Consider

- **Project Type & Size**: Match the workflow to your project's complexity and scale.
- **Team Dynamics**: Ensure the workflow fits your team's size and collaboration style.
- **Developer Expertise**: Choose a workflow that suits your team's Git proficiency.
- **Agility vs. Structure**: Decide on the level of flexibility and organization your project needs.
- **Project Lifecycle**: Adjust the workflow according to your project's maturity.

## Collaborative Workflows

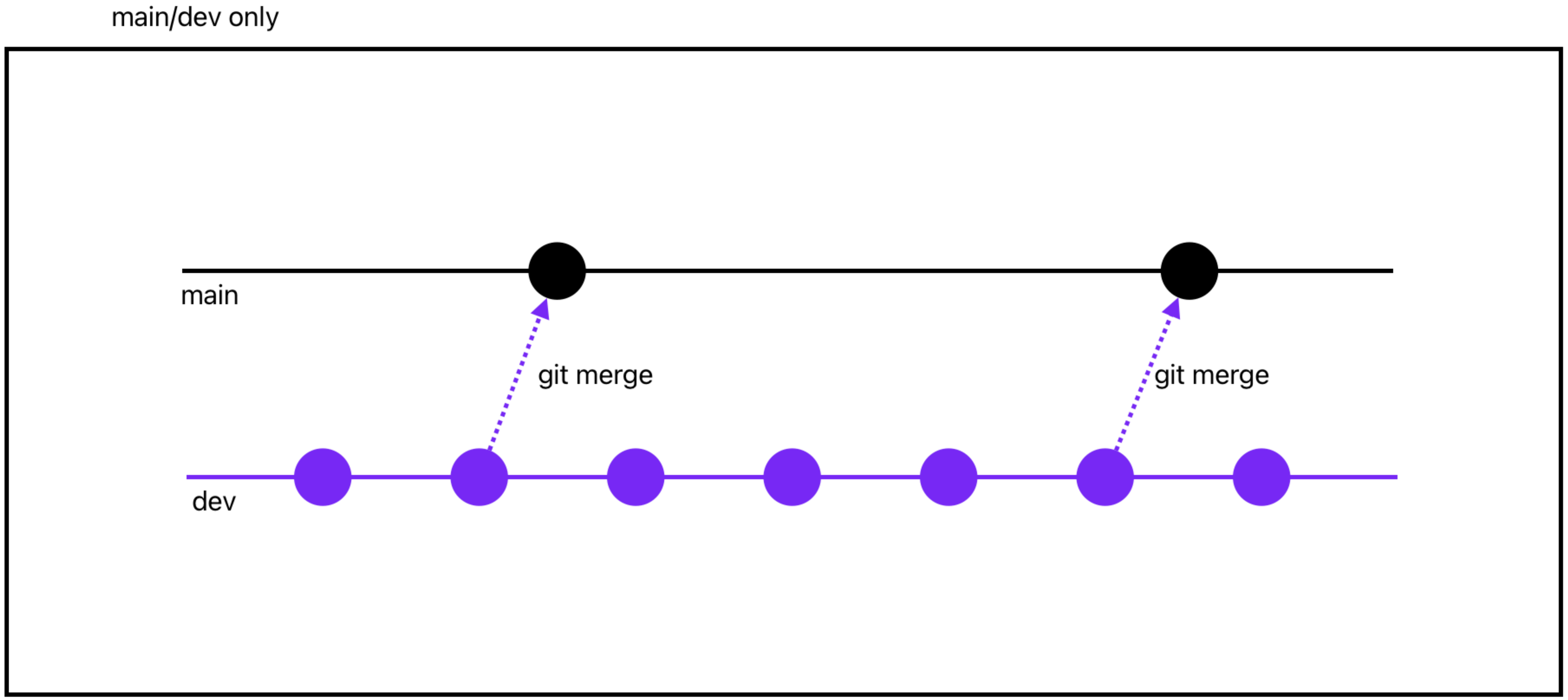
- main only
- main/dev
- Feature Branch/Forking
- GitHub/GitLab Flow
- Trunk-Based Development
- Gitflow

# Collaborative Workflows



## Collaborative Workflows

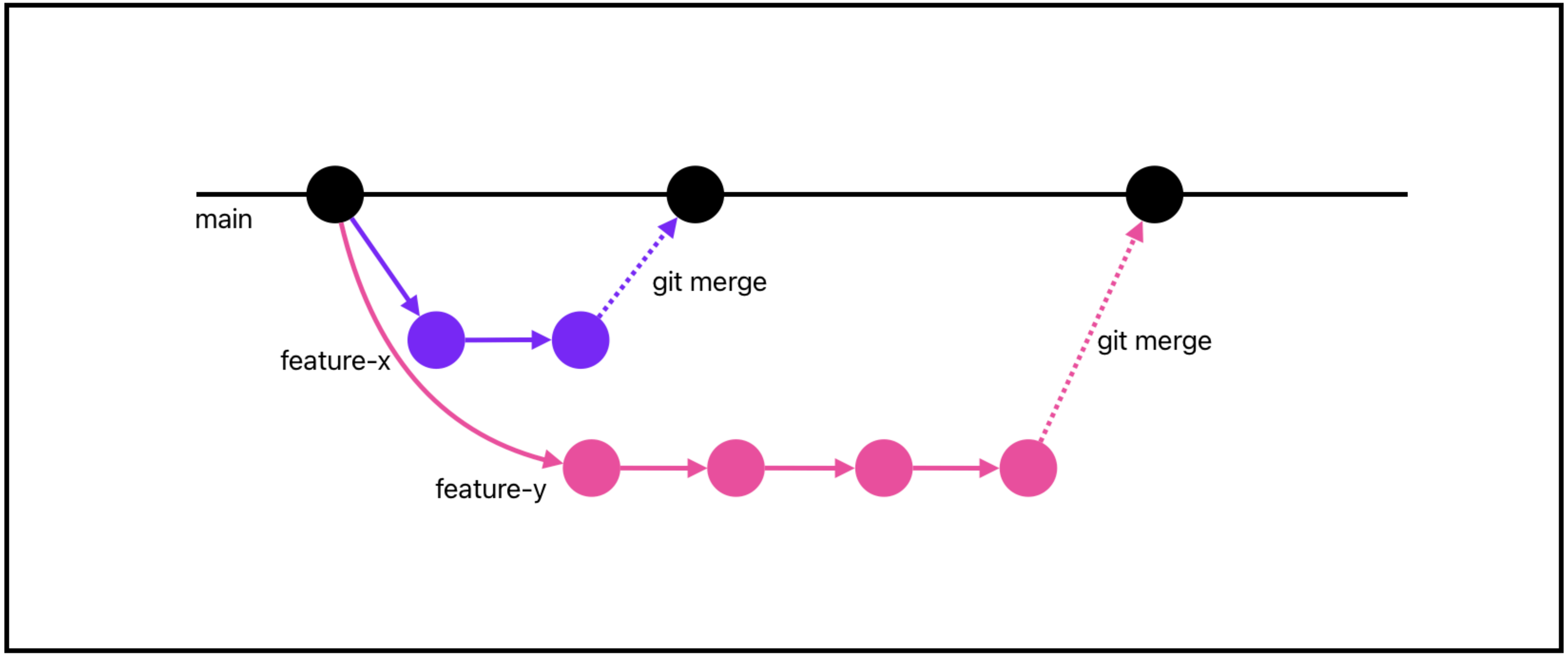
### main/dev



# Collaborative Workflows

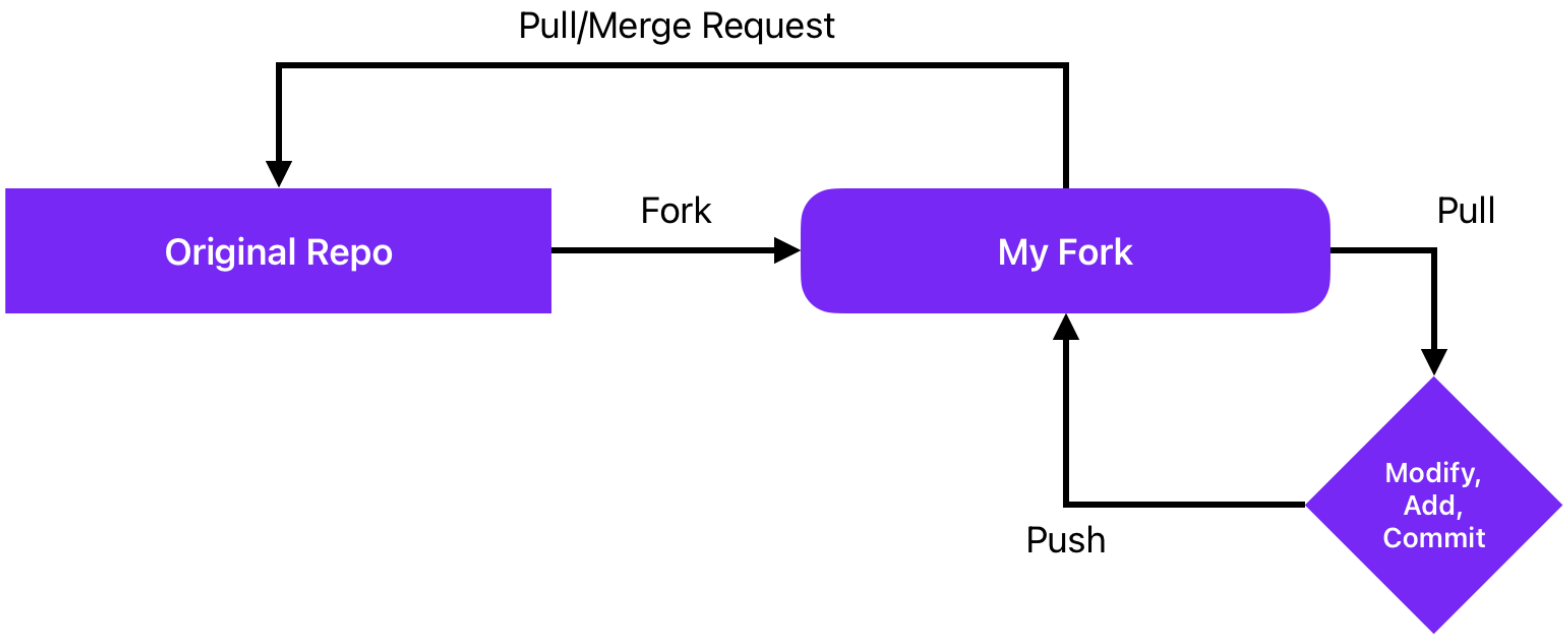
## Feature Branch/Forking

Feature Branch/Forking



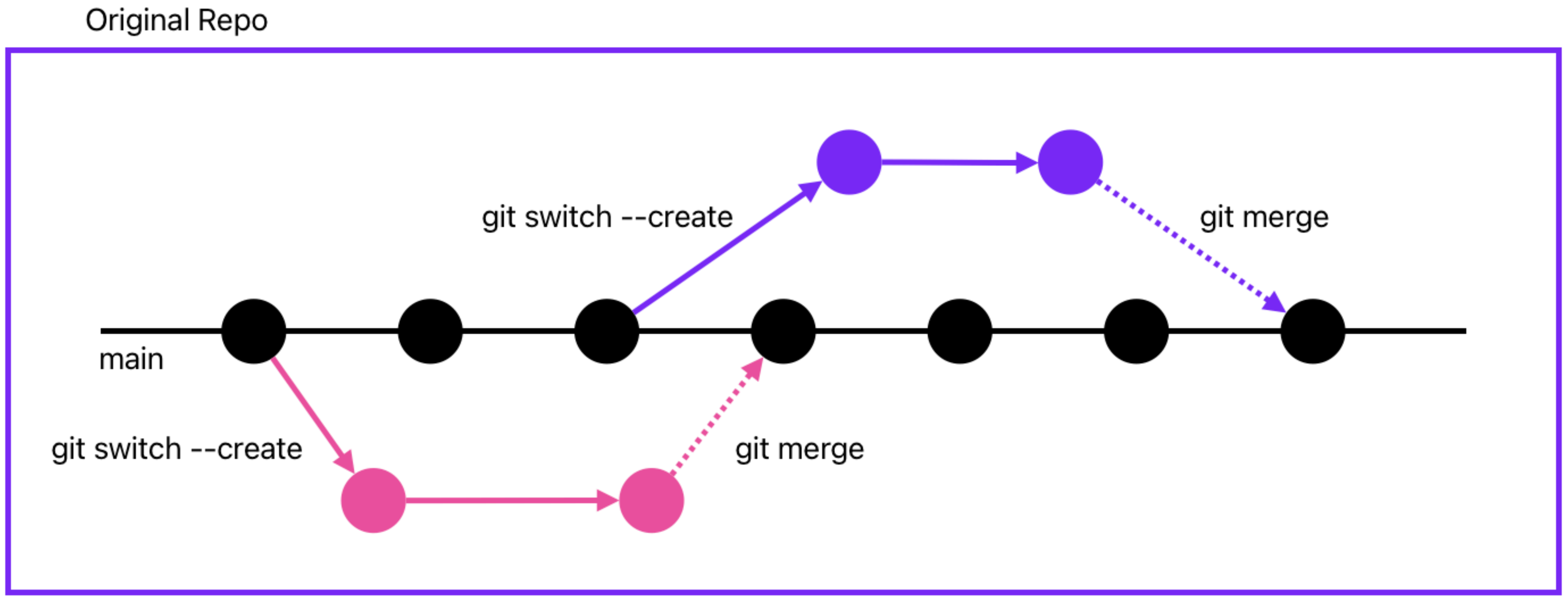
## Collaborative Workflows

### GitHub/GitLab Flow



# Collaborative Workflows

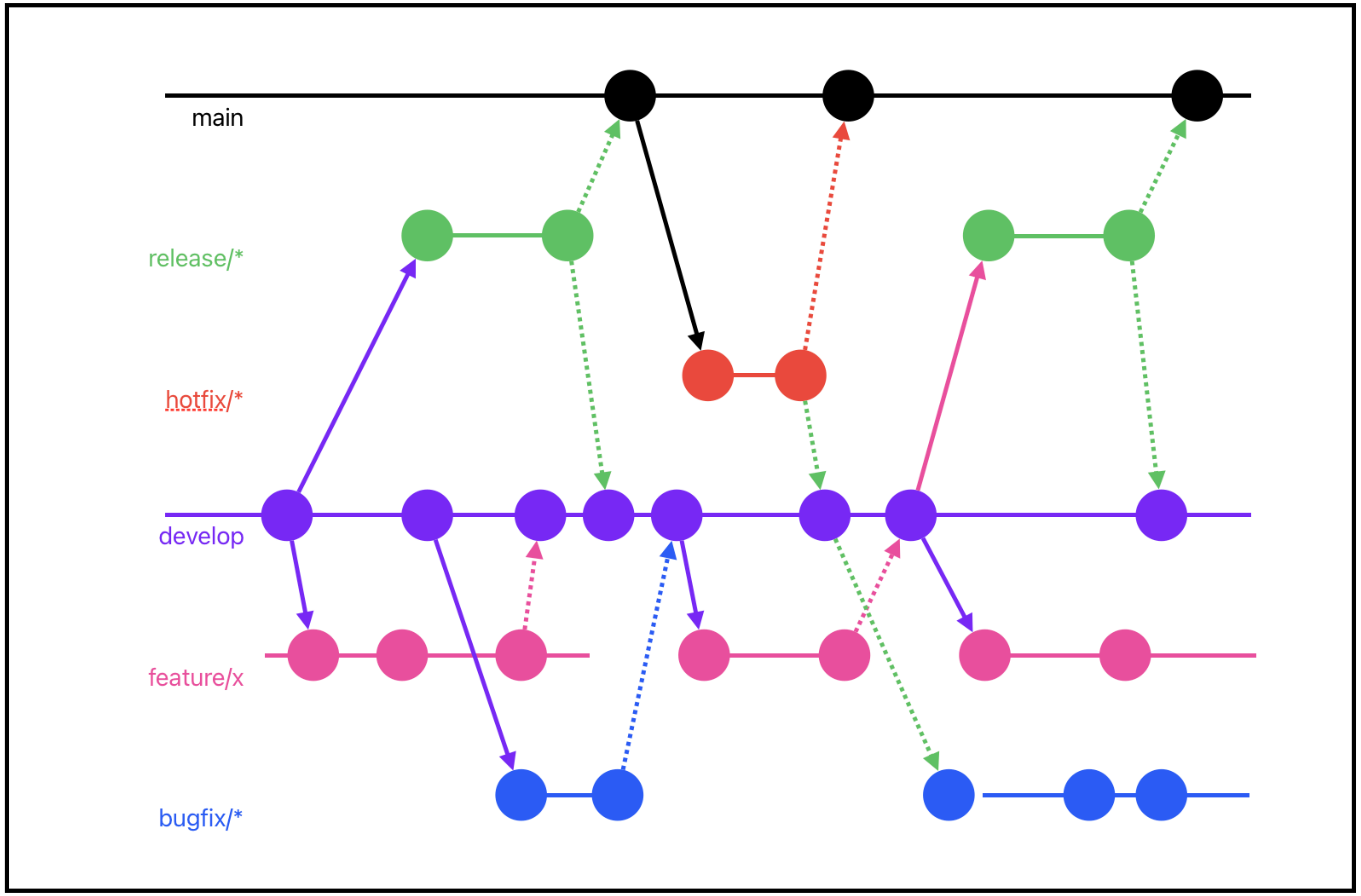
## Trunk-Based Development



# Collaborative Workflows

## Gitflow

Trunk base development



## E06-E08

## Remote Repositories

# Remote Repositories

## GitHub and GitLab

- Web-based interface for viewing and editing files
- Collaborative coding with team members
- Built-in code review tools
- Issue tracking and project management
- Automatic backups and versioning of code

## Remote Repositories

### Features

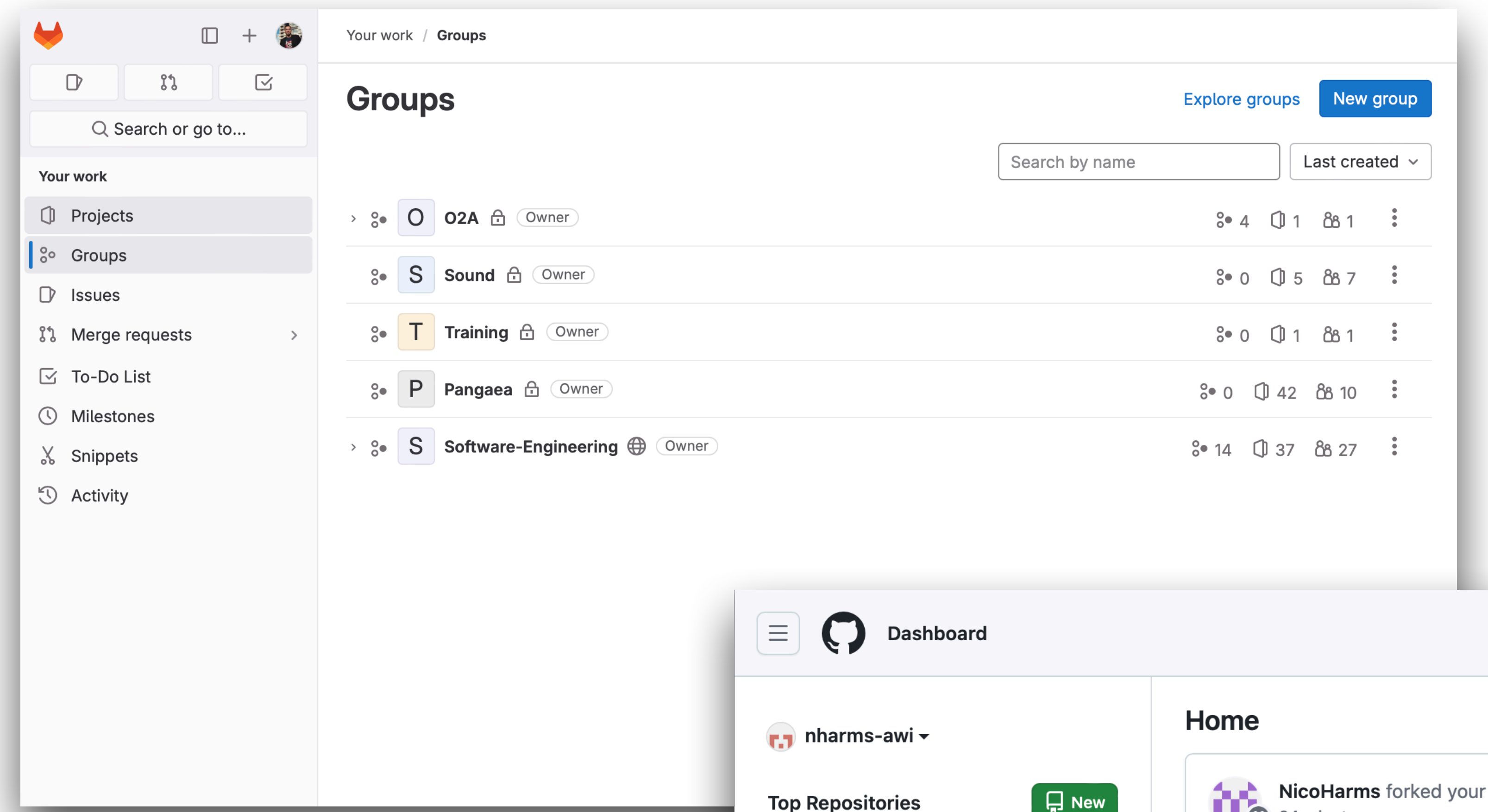
- More Features
- Pull/Merge Requests
- Collaboration
- Wikis and Pages
- Continuous Integration
- More…

## Remote Repositories

### Working with remotes

- git clone: Copy the default branch to your drive
- git fetch: Update the current branch of the local repository with changes from remote
- git pull: Update the current branch of the local repository and working area with changes from remote
- git push: Push the current branch to the remote, with all committed changes

# GitHub/GitLab



Your work / Groups

Search or go to...

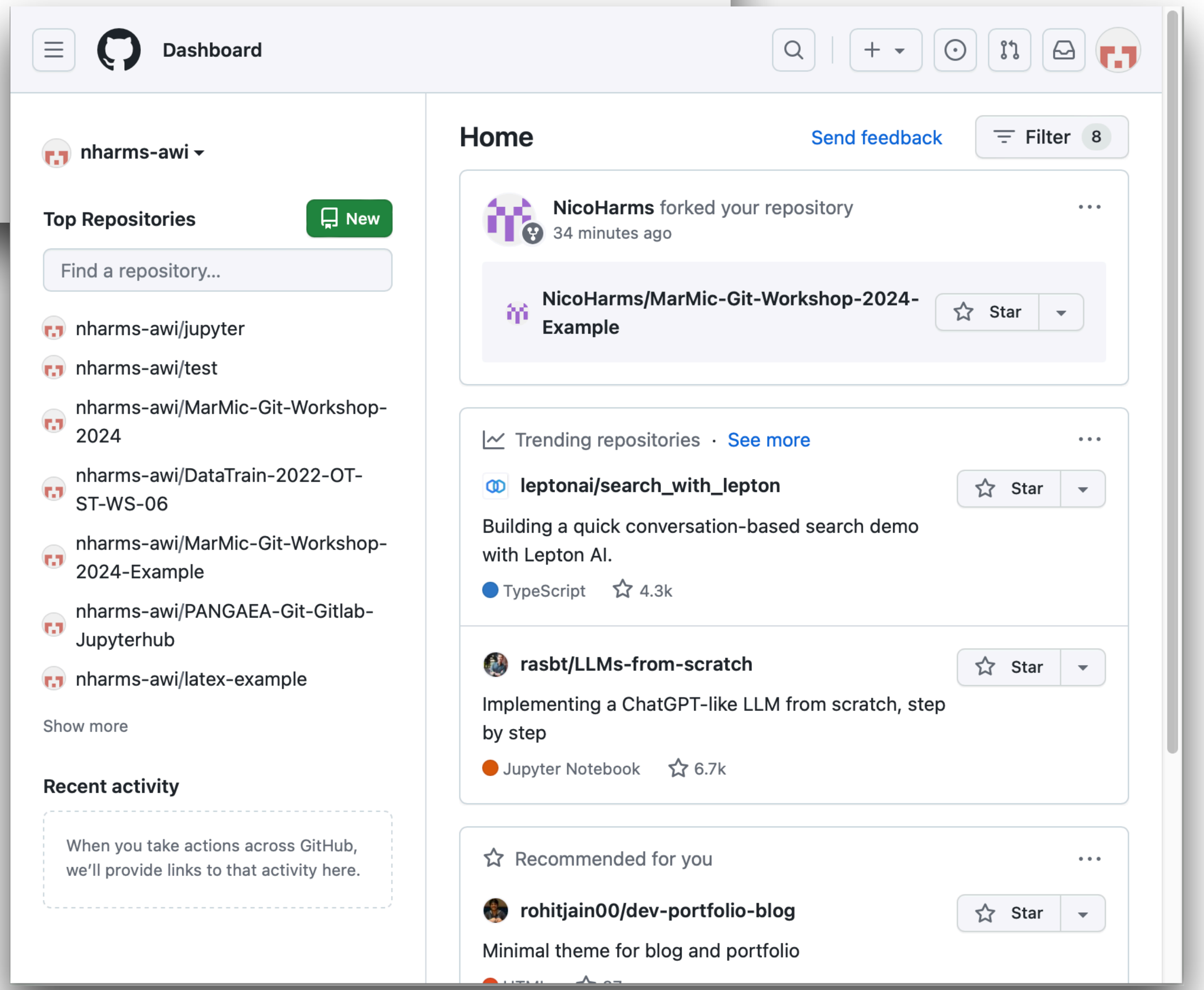
Your work
- Projects
- Groups
- Issues
- Merge requests
- To-Do List
- Milestones
- Snippets
- Activity

## Groups

Explore groups | New group

Search by name | Last created

| | | | | |
|---|---|---|---|---|
| O O2A | Owner | 4 | 1 | 1 |
| S Sound | Owner | 0 | 5 | 7 |
| T Training | Owner | 0 | 1 | 1 |
| P Pangaea | Owner | 0 | 42 | 10 |
| S Software-Engineering | Owner | 14 | 37 | 27 |



Dashboard

nharms-awi

Top Repositories | New

Find a repository...

- nharms-awi/jupyter
- nharms-awi/test
- nharms-awi/MarMic-Git-Workshop-2024
- nharms-awi/DataTrain-2022-OT-ST-WS-06
- nharms-awi/MarMic-Git-Workshop-2024-Example
- nharms-awi/PANGAEA-Git-Gitlab-Jupyterhub
- nharms-awi/latex-example

Show more

Recent activity

When you take actions across GitHub, we'll provide links to that activity here.

Home | Send feedback | Filter 8

NicoHarms forked your repository
34 minutes ago

NicoHarms/MarMic-Git-Workshop-2024-Example | Star

Trending repositories · See more

leptonai/search_with_lepton | Star
Building a quick conversation-based search demo with Lepton AI.
TypeScript ☆ 4.3k

rasbt/LLMs-from-scratch | Star
Implementing a ChatGPT-like LLM from scratch, step by step
Jupyter Notebook ☆ 6.7k

Recommended for you

rohitjain00/dev-portfolio-blog | Star
Minimal theme for blog and portfolio

## Links

https://github.com/NicoHarms/marmic-git

## Links

- **Environment**: https://training.hub.gfbio.dev/

**Workshop Repository**

**https://github.com/NicoHarms/marmic-git**

**Fragen**

**https://docs.google.com/document/d/1csV2gaHW5izRbvpf2Wh_WckoSa9Zt6XyjeyLyyaHxmA/edit?usp=sharing**

## Advanced Topics

# Advanced Topics

## Troubleshooting and Special Files

- **Troubleshooting**: Common issues include conflict resolution, unwanted commits, and recovering lost commits. Understanding how to troubleshoot these issues is crucial for effective Git usage.
- **Special Files**: Git and GitHub treat certain files differently, using them for configuring repositories and providing documentation. These include `.gitignore` and `README.md`.

# Advanced Topics

## Rebasing, Tags, and Stashing

- **Rebasing**: Allows you to integrate changes from one branch into another by reapplying commits. Useful for keeping your branch up to date with the main branch without creating a new merge commit.

- **Tags**: Labels you can apply to specific commits. Useful for marking significant versions of your code, such as release versions.

- **Stashing**: Allows you to store your work in progress and switch to another branch or address unexpected changes. Useful when navigating complex workflows and addressing unforeseen challenges.

## Wrap-up and Next Steps