Git and GitHub

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SWPP Practice Session

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Git and GitHub

- Git is a VCS *version control system*
- GitHub is a web service that hosts git repositories + @
  - Helps collaborative development
    - Issue tracker, pull request, access control, wiki, …
  - Offers automated testing and distribution environment
    - Actions

Git Workspace Structure

Working Directory

- Files (on disk)
  - Including unchanged/unfinished works

Staging Area

- Staged files
  - Changes ready for commit

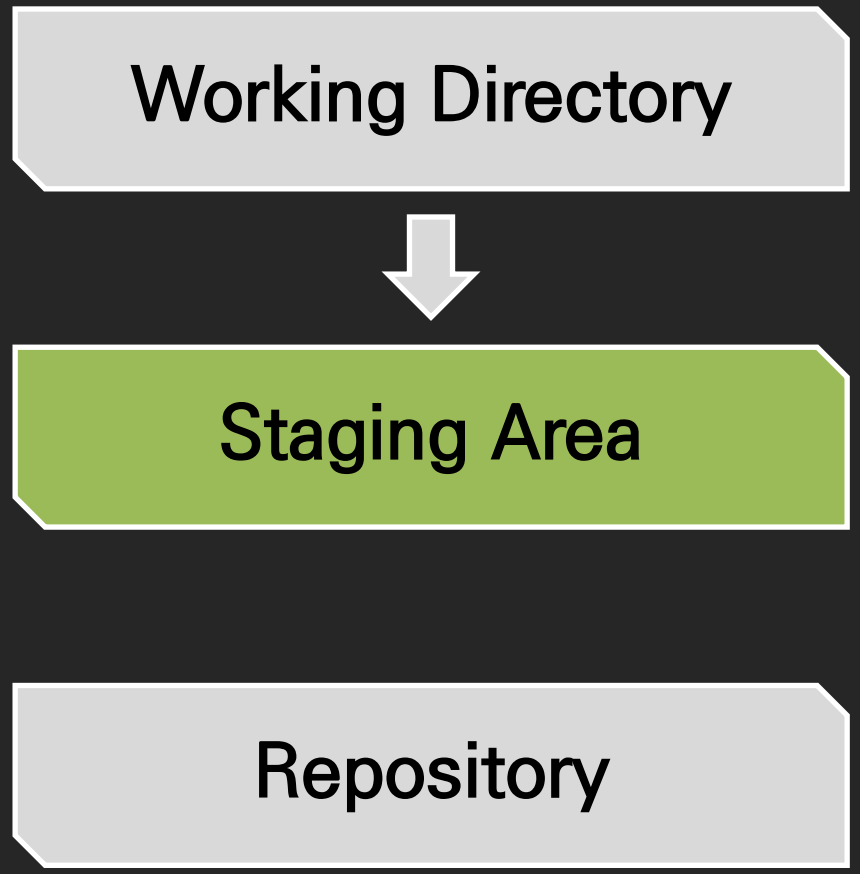
Repository

- Commits
  - Unit of implementation

Git Workspace Setup

- `git init <directory>`
- Creates a local repository of directory name
- Omit the directory name to create one in current directory
  - Initially, all the files are untracked

Staging File



- `git add <file>`
- Marks the file as tracked

  (if it was marked as untracked)
- Caches the changes so far

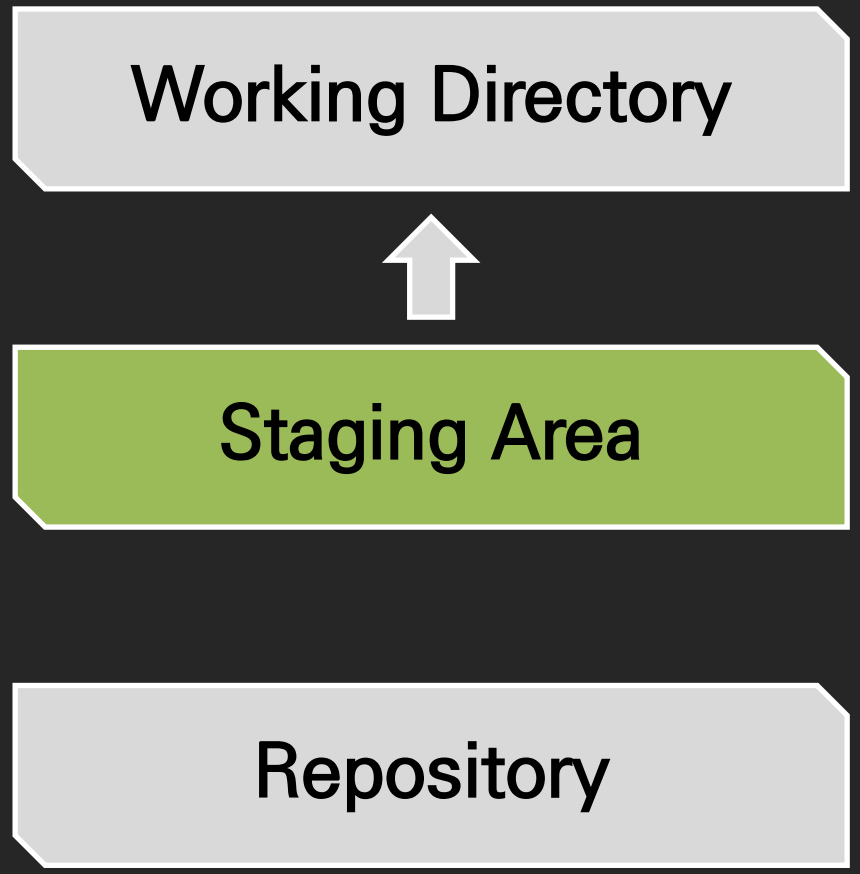
Checking File Status

- `git status`
- Files are categorized into:
  - Untracked files
  - Tracked files with unstaged changes
  - Tracked files with staged changes

.gitignore

- Not a command, but a file!
- List of files/extensions/folders/etc to ignore
- Does not show up in `git status`

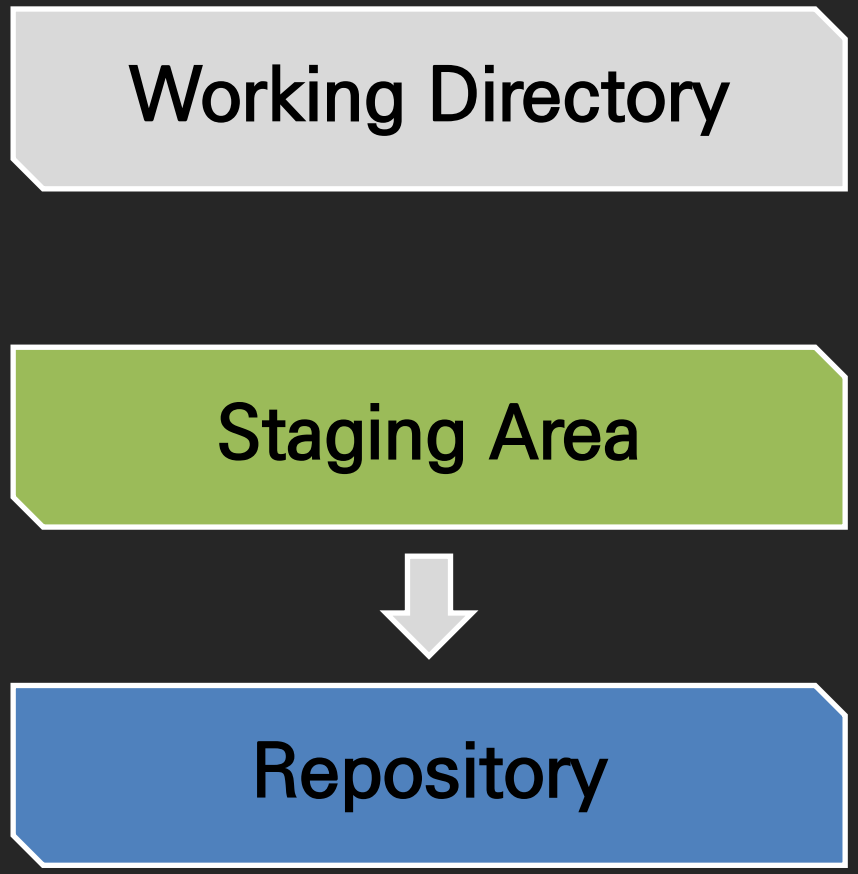
Unstaging File



- `git restore --staged <file>`
- Discards cached changes

- `git rm --cached <file>`
- Discards cached changes
- And marks the file as untracked

Committing Changes

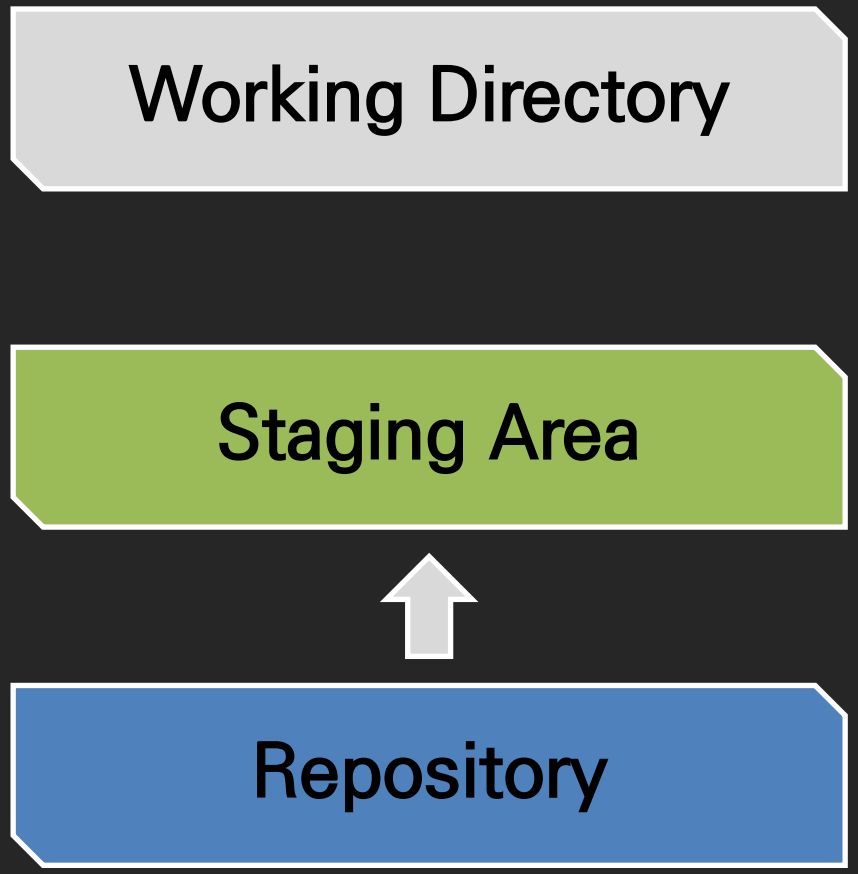


- `git commit -m “commit message”`
- Push staged changes into repo with given message
- Commit message is mandatory!
- Add `--amend` to append changes into the last commit

Checking Commit History

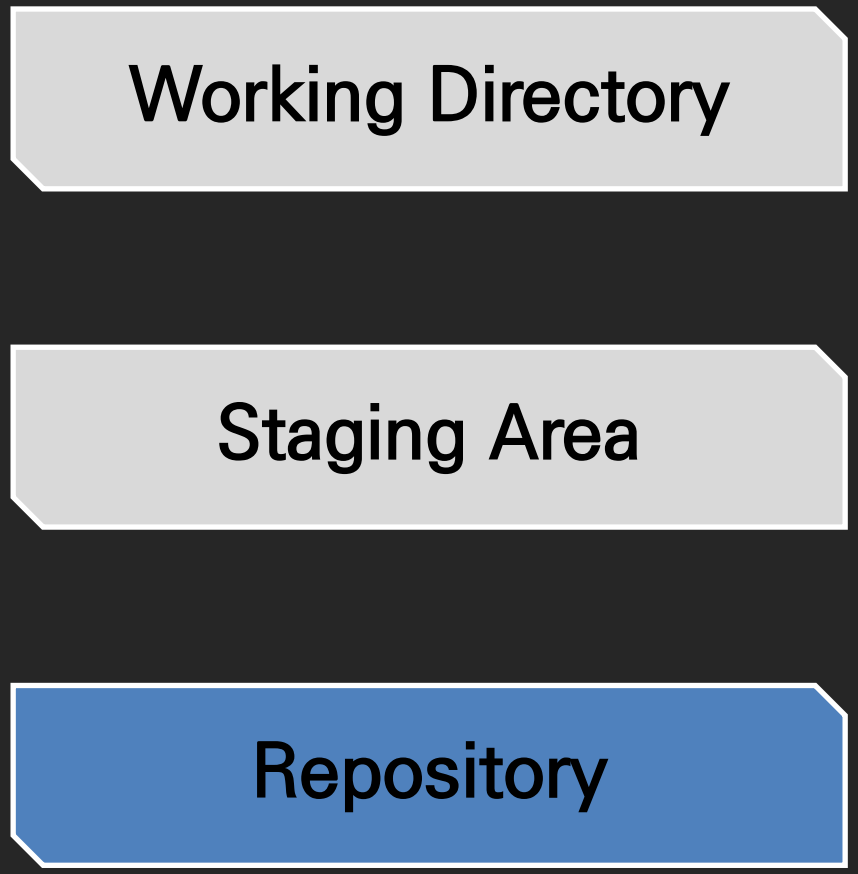
- `git log`
- View history of previous commits with timestamp and commit hash
- Each commit can be identified using commit hash
- Press q to exit

Undoing Commit



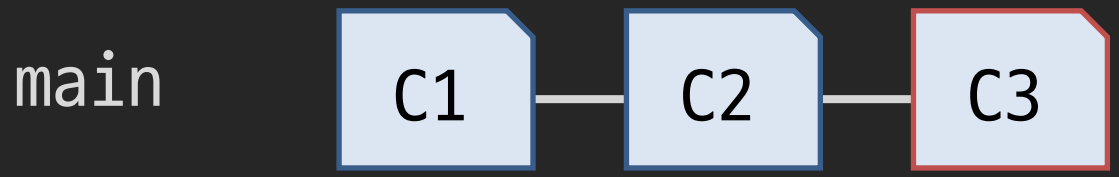
- `git reset --soft HEAD~1`
- Remove last commit from repo and restore changes into staging area
- Increase number after `HEAD~` to remove and restore more commits

Creating Branch



- `git branch <name>`
- Create a branch
  using current commit as parent
- Branches of duplicate names
  are not allowed

Creating Branch



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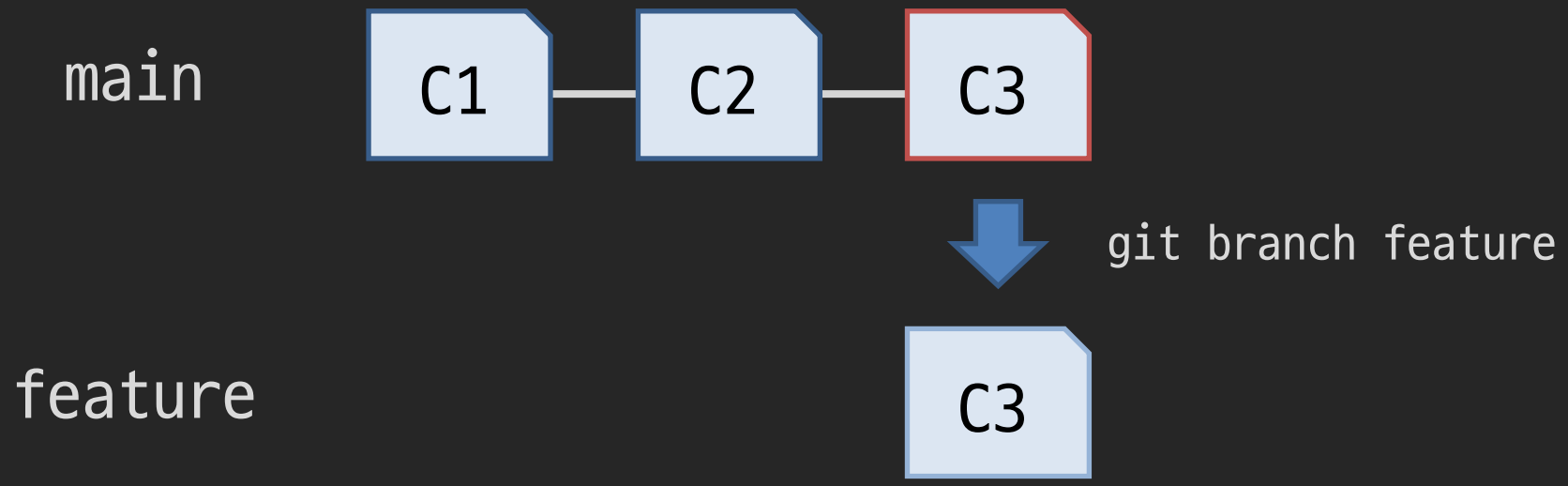


Managing Branch

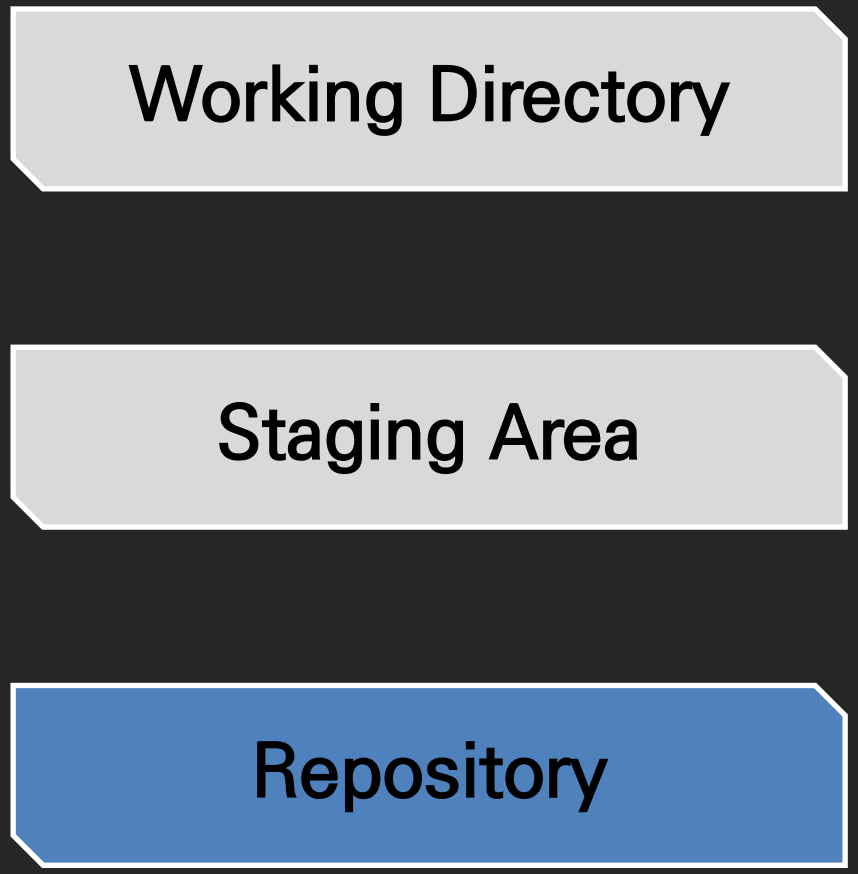
Working Directory

Staging Area

Repository

- `git branch`
- List the branches in the repo
- Press q to exit

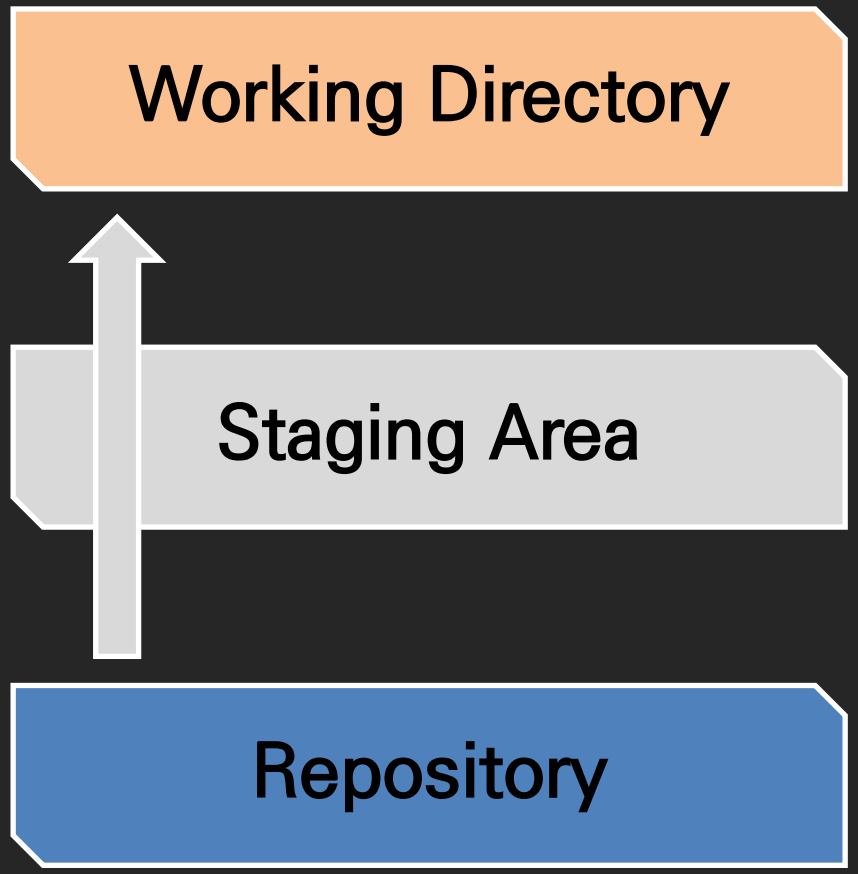
Managing Branch



- `git branch -D <branch>`
- Delete the branch

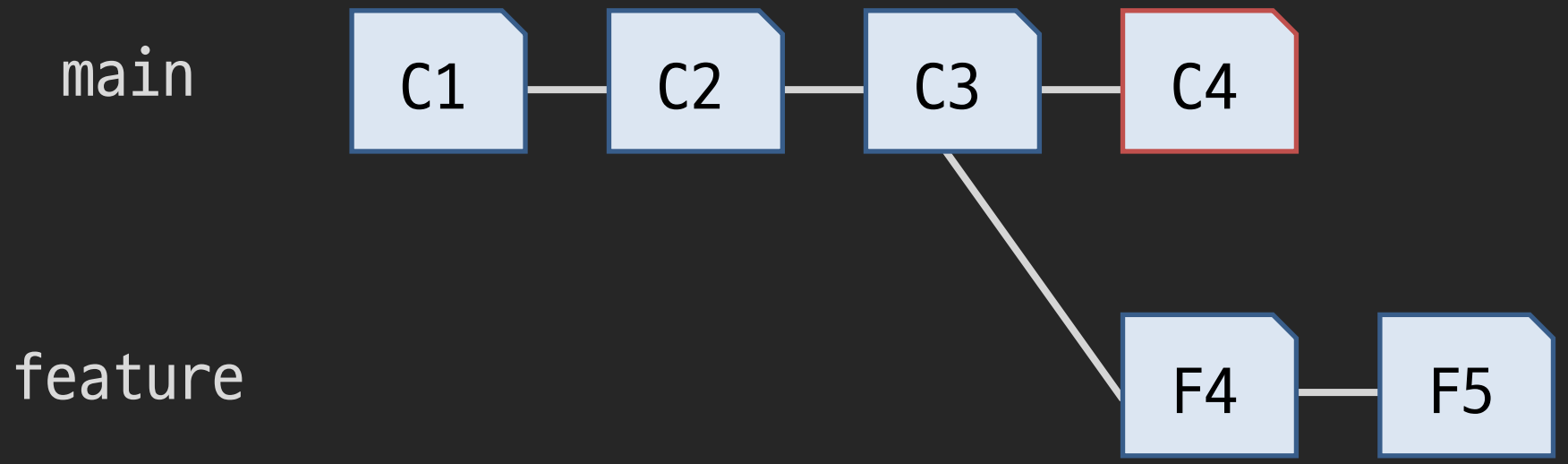
- `git branch -m <old> <new>`
- Rename the branch `old` to `new`

Switching Branch

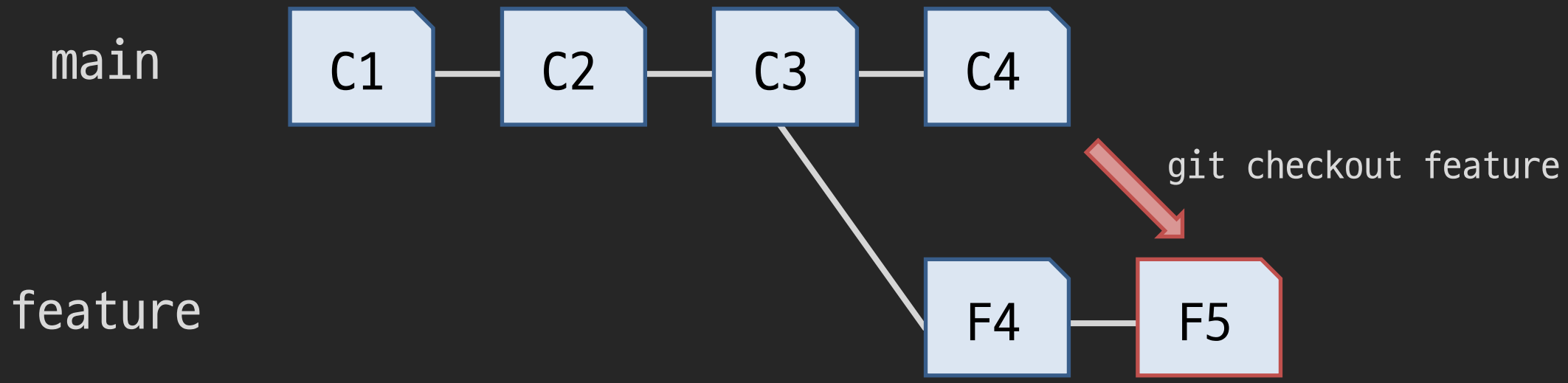


- `git checkout <branch>`
- Change to context of target branch
- Update working directory
- Staging area must be clean
  - Checkout will be aborted otherwise
  - Commit, unstage, or *stash*

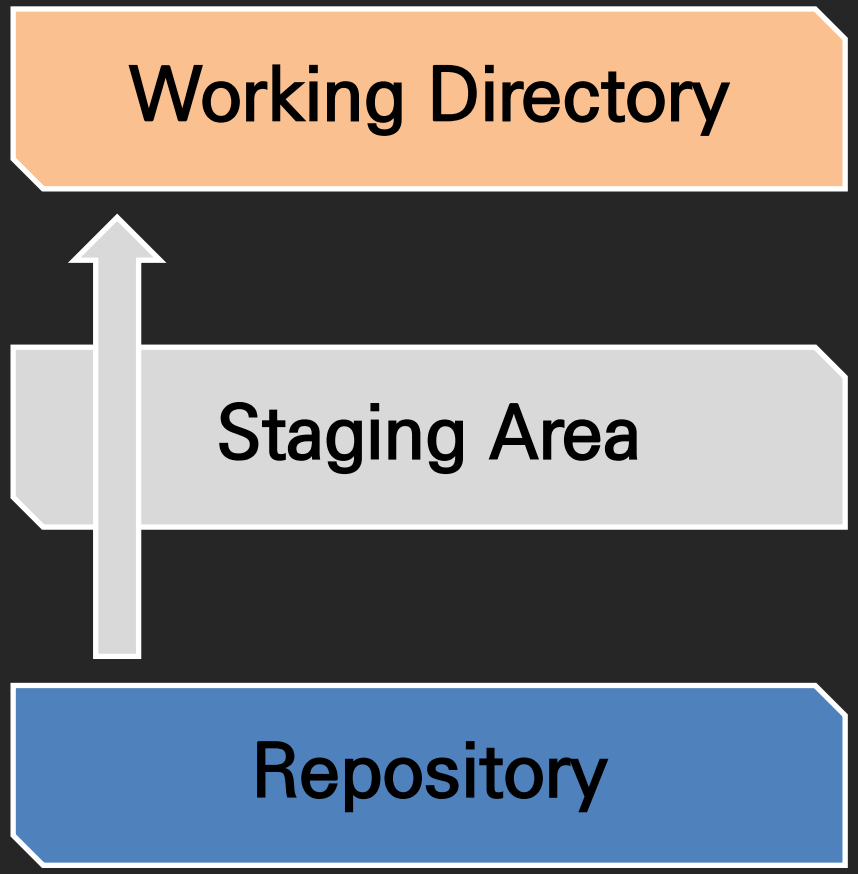
Switching Branch



Switching Branch

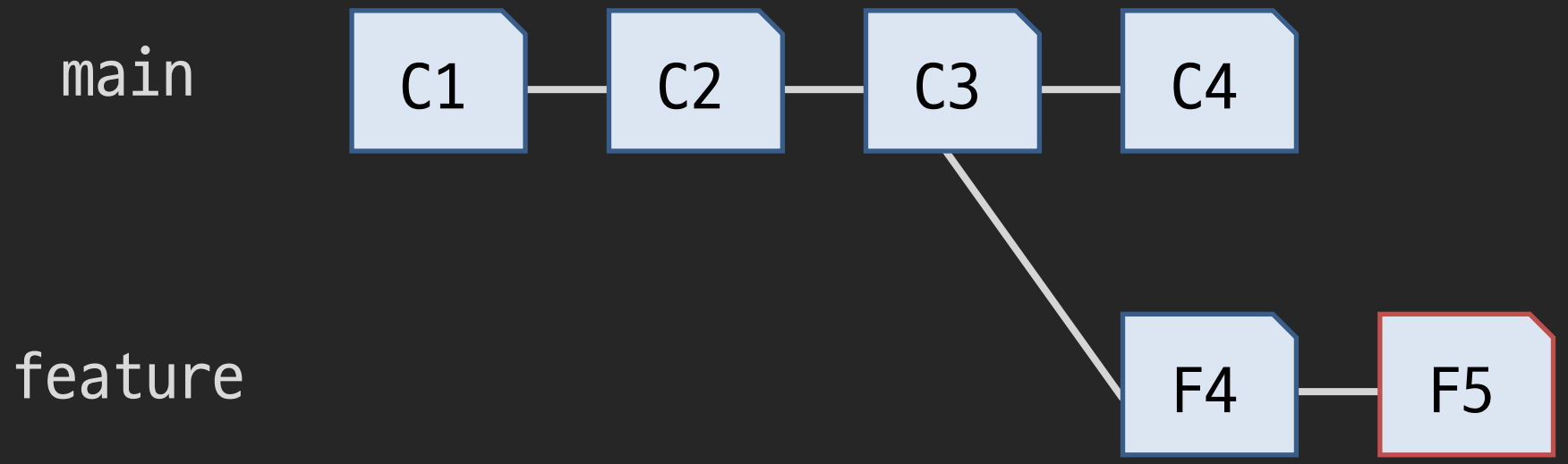


Applying Changes From Other Branch



- `git merge <branch>`
- Collapse the changes in the other branch since the last shared commit into a merge commit
- Merge conflict may occur, which should be resolved manually

Applying Changes From Other Branch



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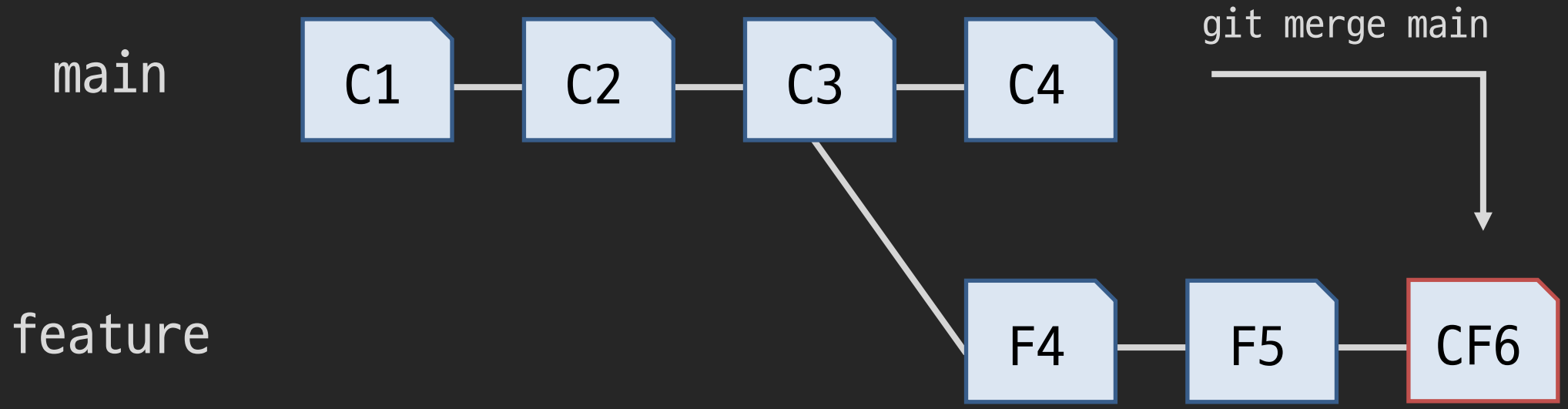
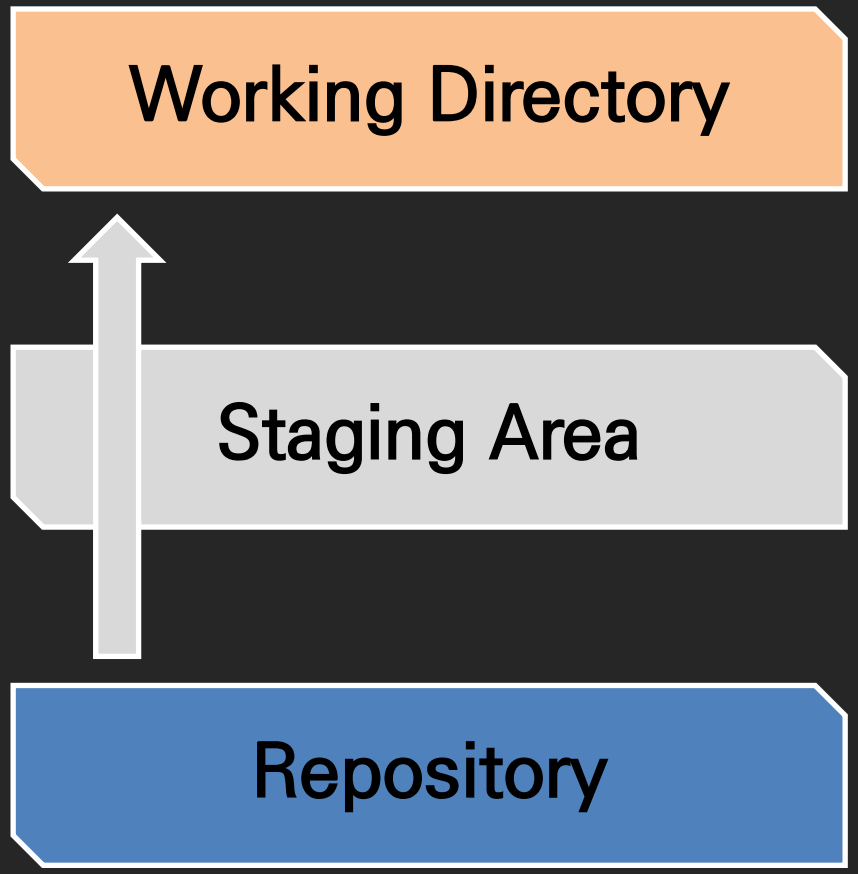
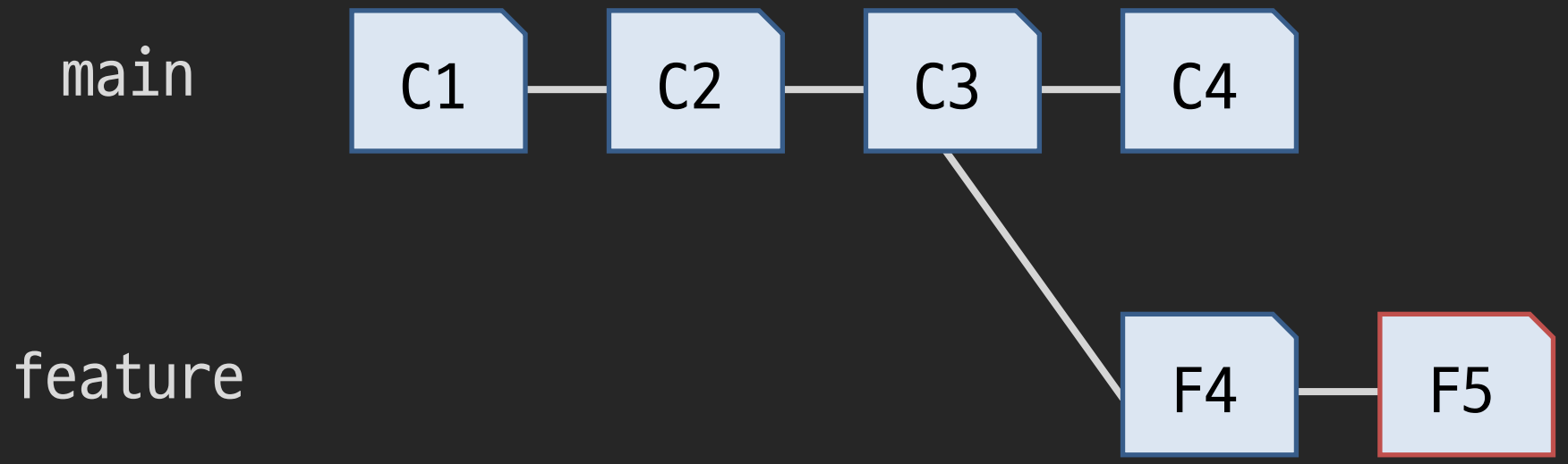


Changing Parent to Other Branch



- `git rebase <branch>`
- Change the parent of current branch to the other branch's commit
- Merge conflict may occur, which should be resolved manually

Changing Parent to Other Branch



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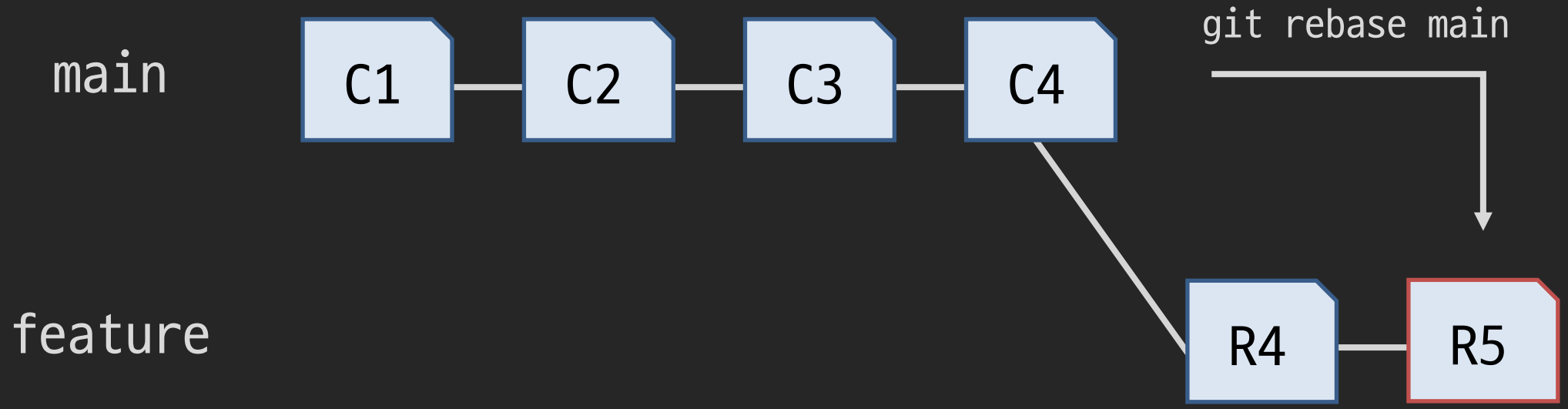


Merge or Rebase?

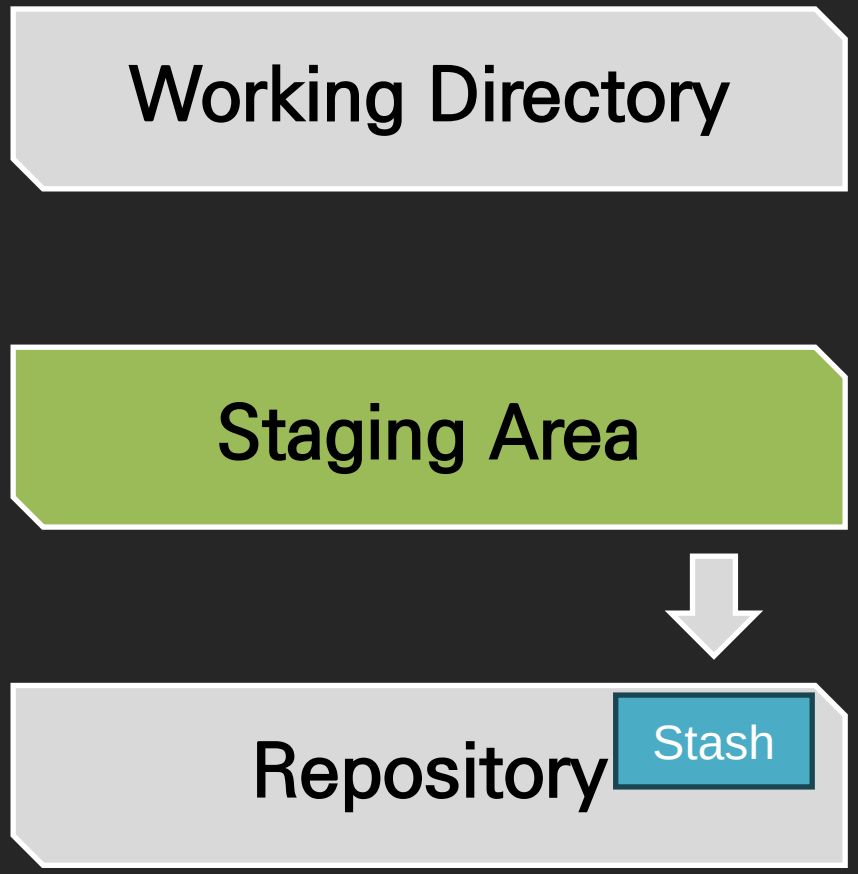
Merge

- Branch has two parents
  - Complicates commit history
- Preserves commit history
- Updating published branch

Rebase

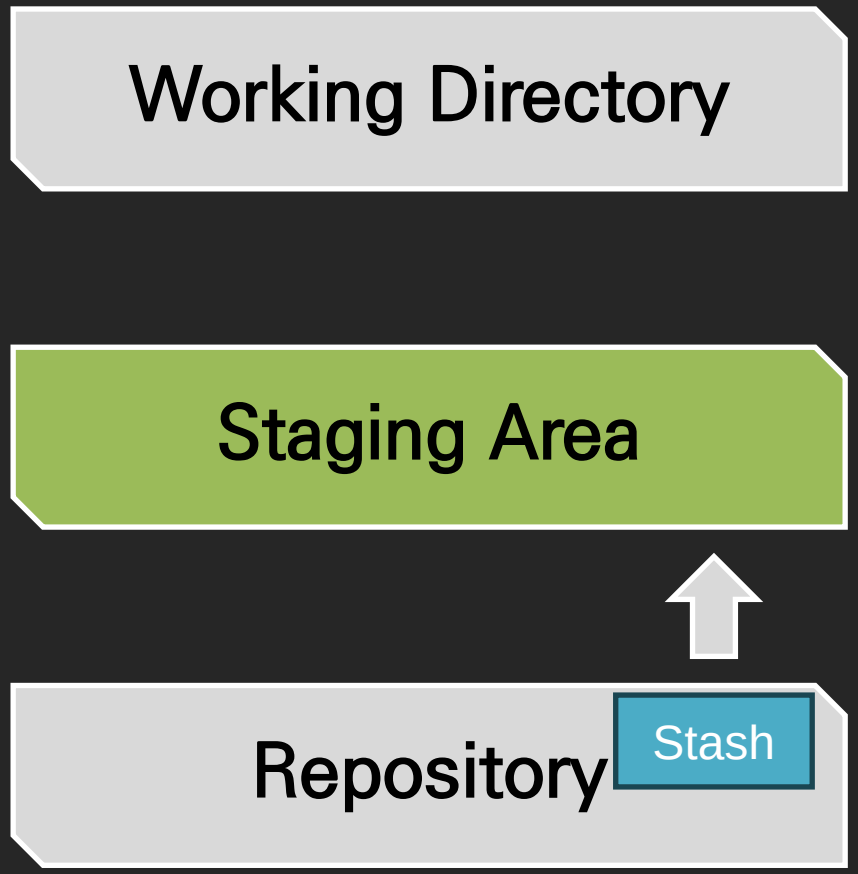
- Branch has one parent
  - Simplifies commit history
- Rewrites commit history
  - Breaks sync with collaborator
  - Never use on published branch!
- Updating local branch

Stashing Undone Works



- `git stash`
- Caches changes in all tracked files as a stash
- Adds the stash into stash list
- Discards all changes in working directory and staging area

Restoring Stashed Works



- `git stash apply`
- Restores last stashed changes

- `git stash pop`
- Restores last stashed changes
- And removes that stash from list

Remote Repository

- Hosts a repository online
- Fundamentals of collaborative development using git
- May be public, under restricted access, or private
- GitHub is just one way of hosting remote repositories

Downloading from Remote Repository

- `git clone <repository>`
- Downloads entire repository
- Repository can be really big if it has long commit history
  - Add `--depth N` to restrict the number of commits to clone

Managing Remote Repository

- `git remote add <name> <repository>`
- Connect to remote repository

- `git remote remove <name>`
- Disconnect from remote repository

Interacting with Remote Repository

- `git fetch`
- Updates remote changes

- `git pull`
- Updates remote changes
- And apply the changes to working directory

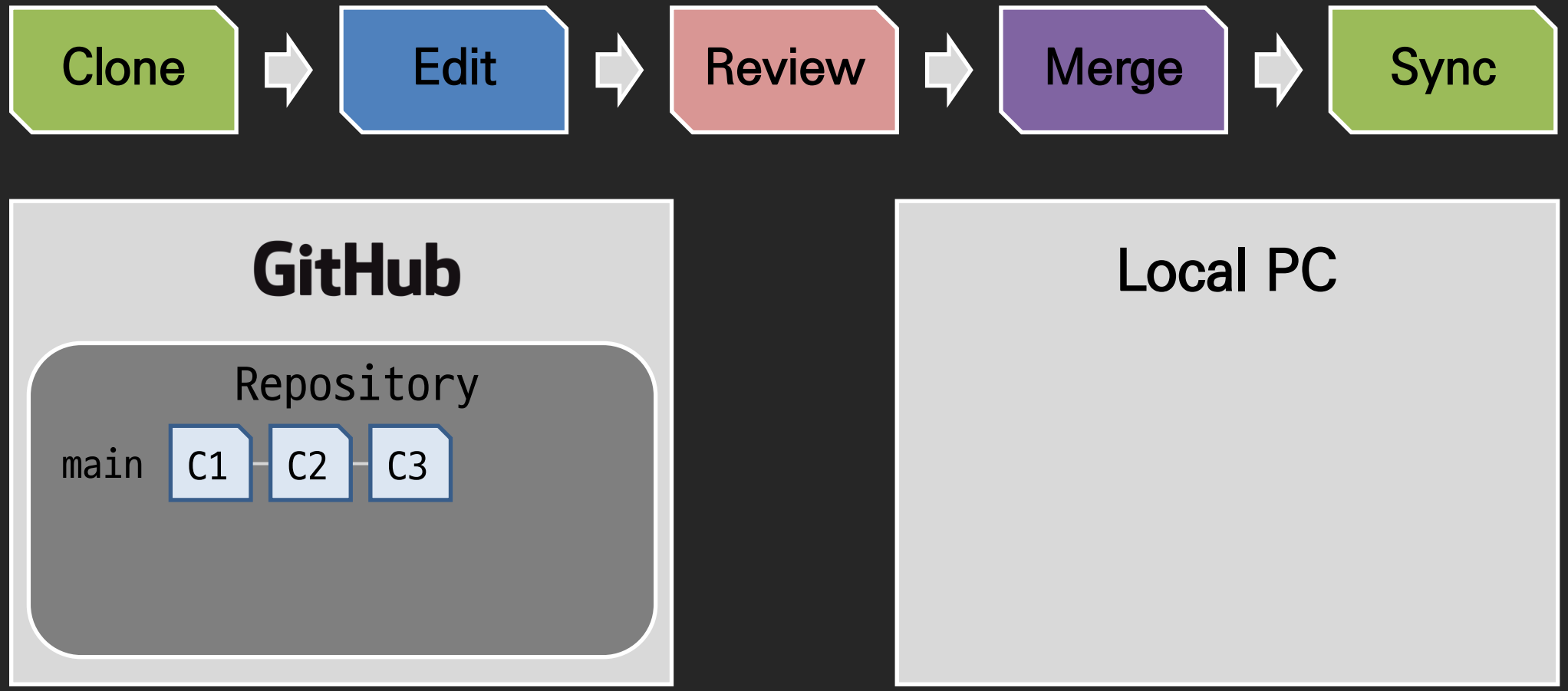
- `git push`
- Upload local changes
- Fails if local changes diverged from remote
  - Don’t force push!
  - It may overwrite others’ works
  - Rebase or merge instead

Branch and Remote Repository

- `git checkout -t <remote branch>`
- Copy remote branch into local repository

- `git push <remote> <branch>`
- Upload local branch to remote repository

Collaborative Development Steps



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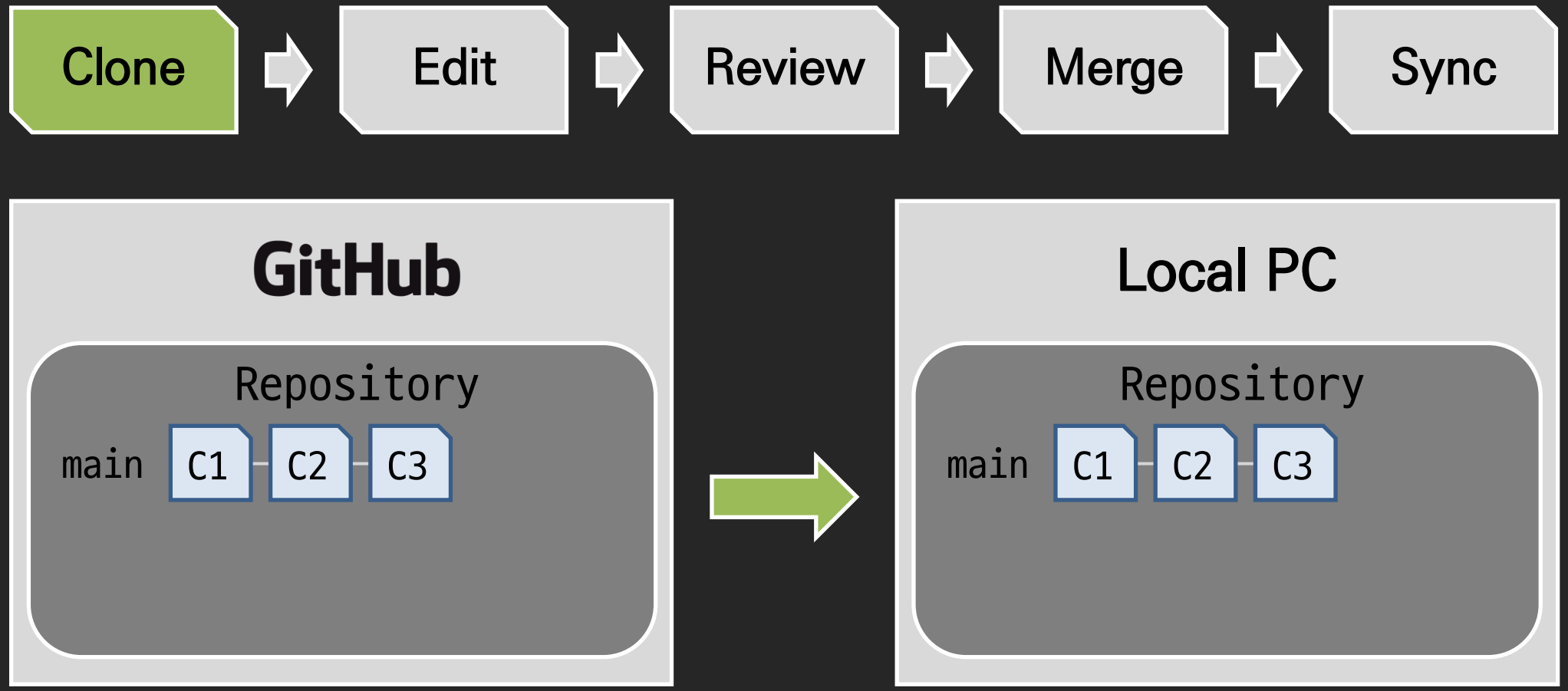

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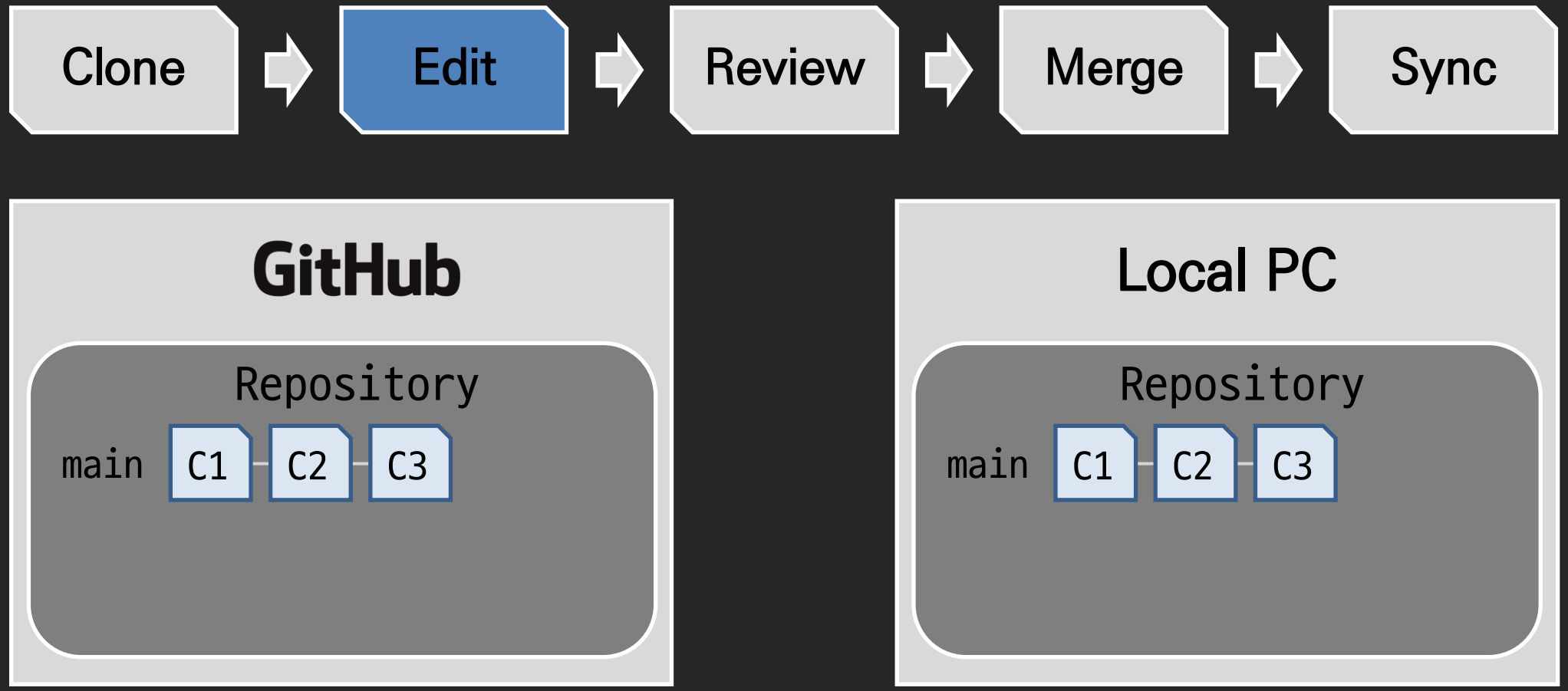

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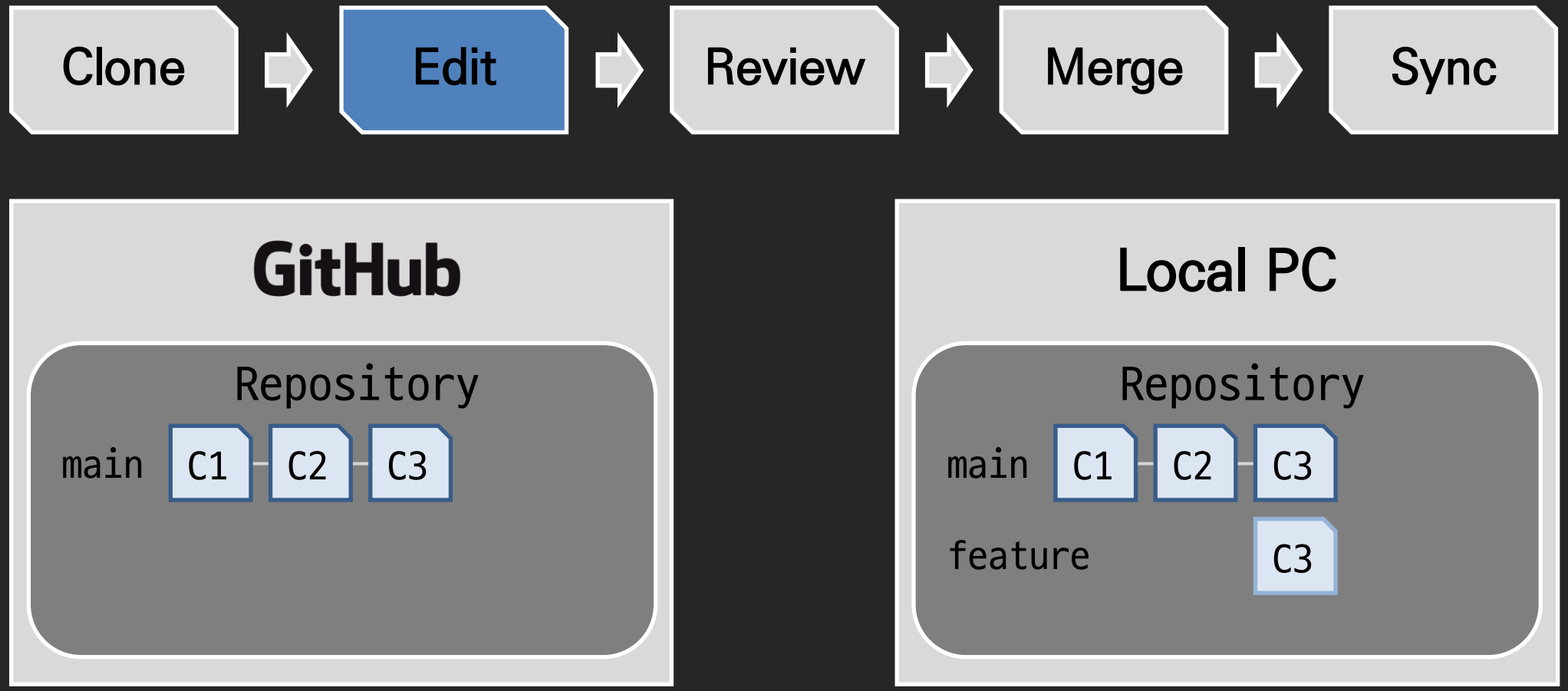

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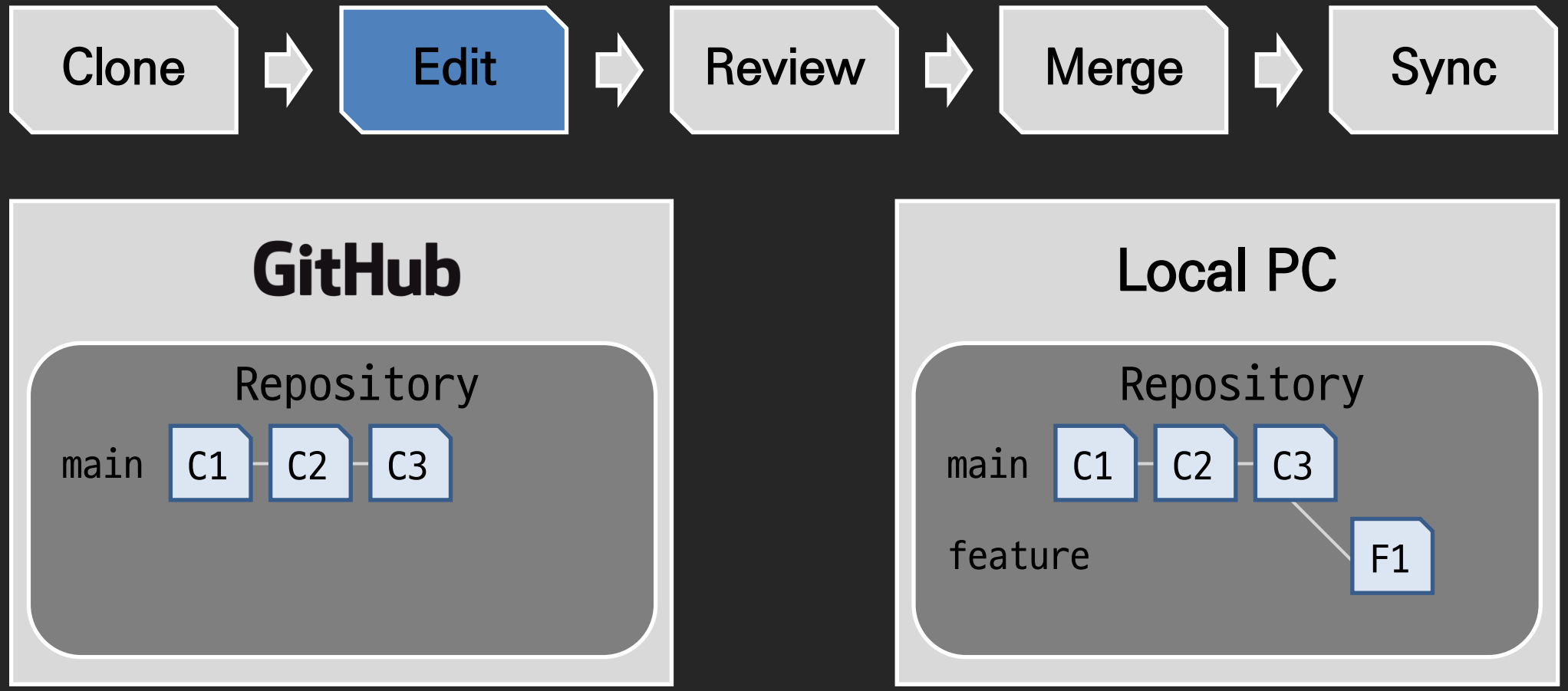

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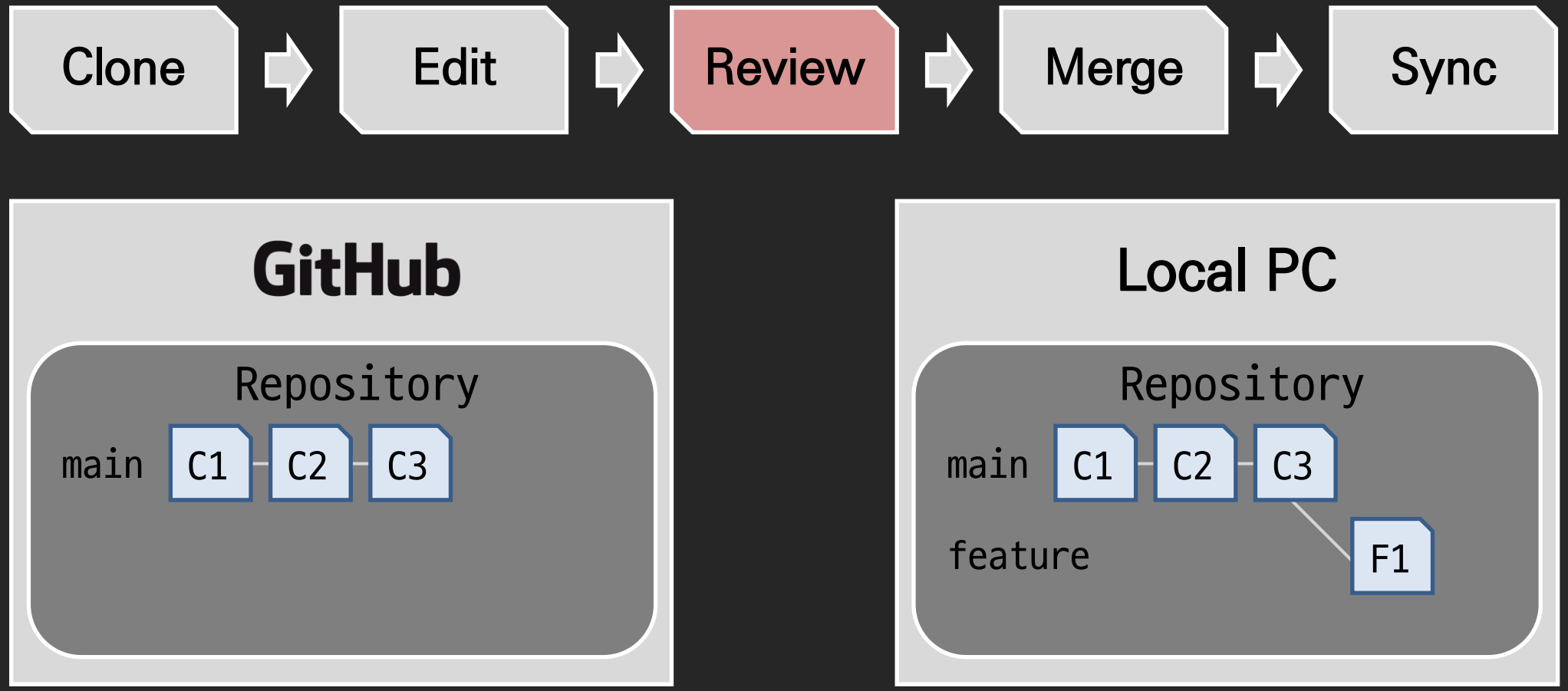

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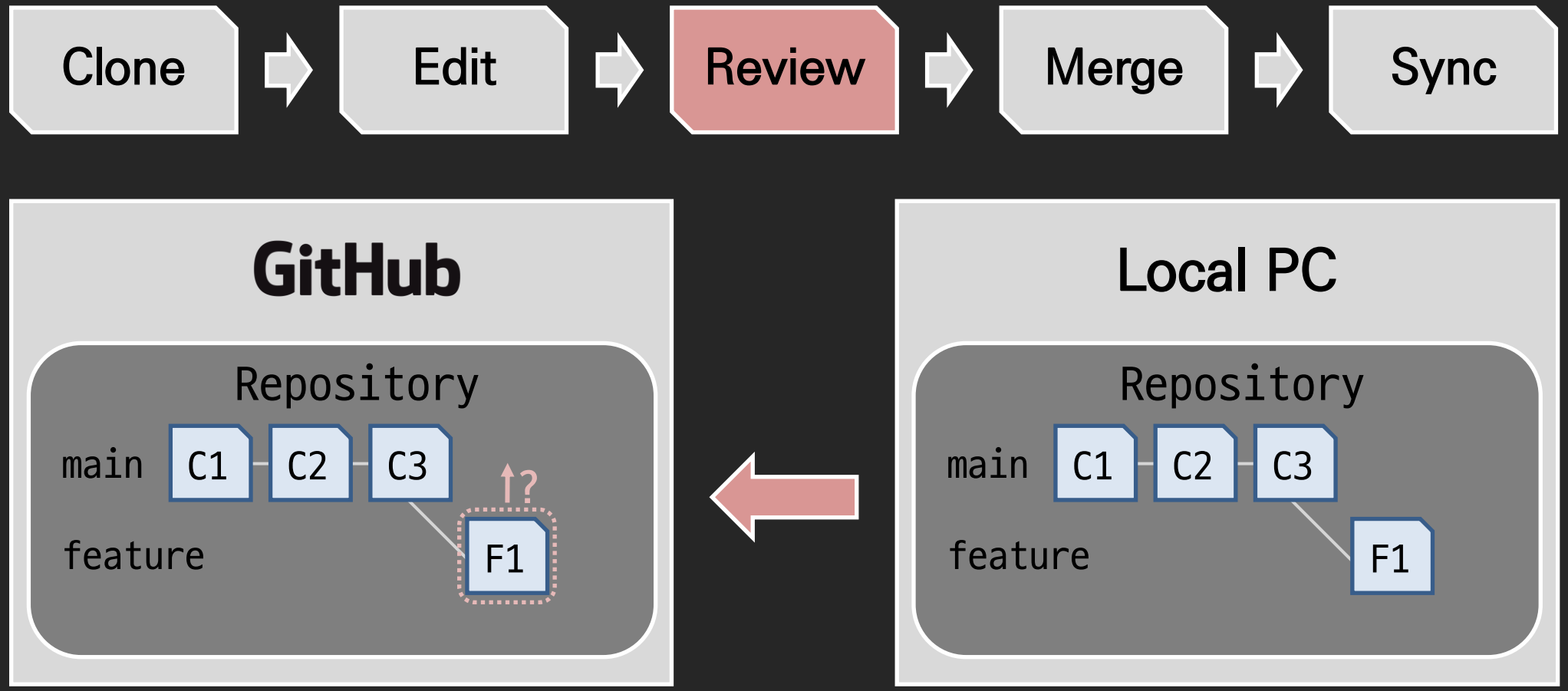

Collaborative Development Steps

Clone → Edit → Review → Merge → Sync

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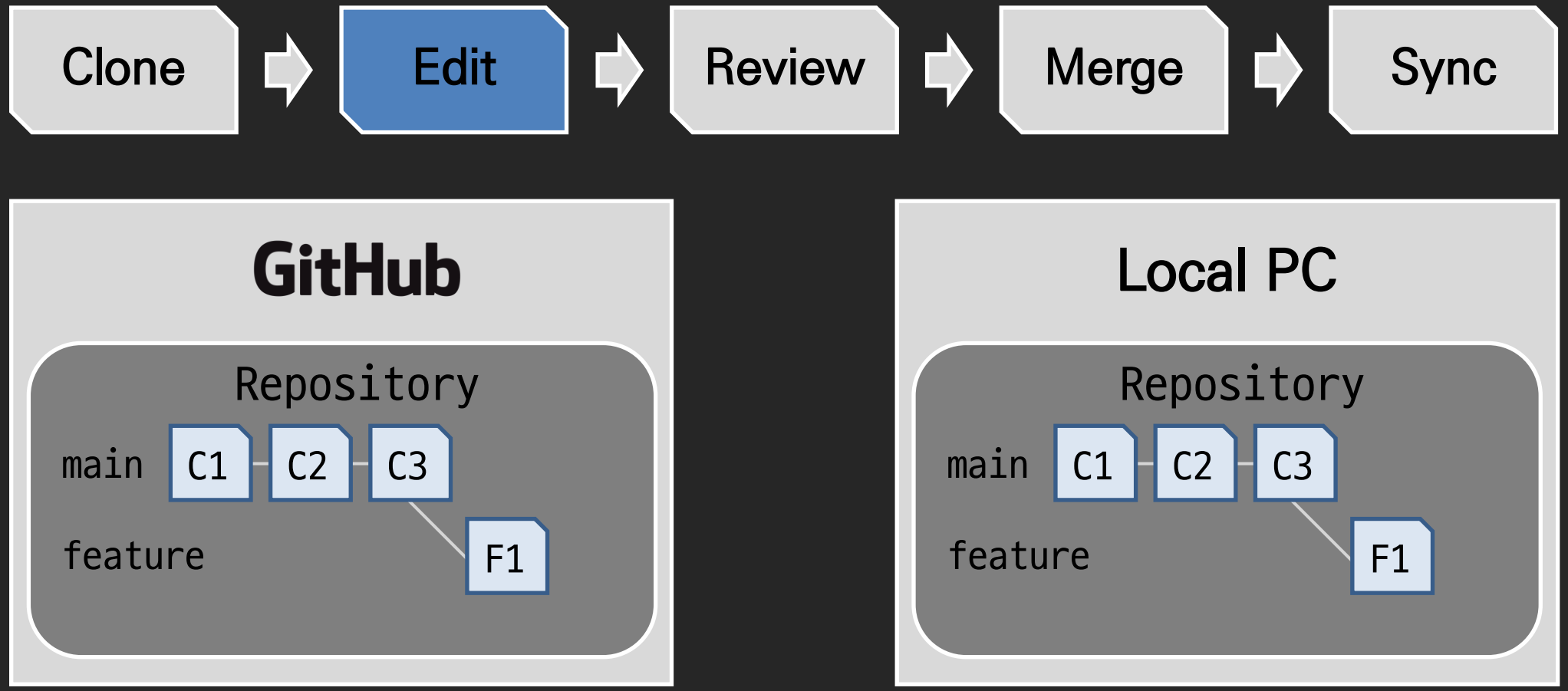

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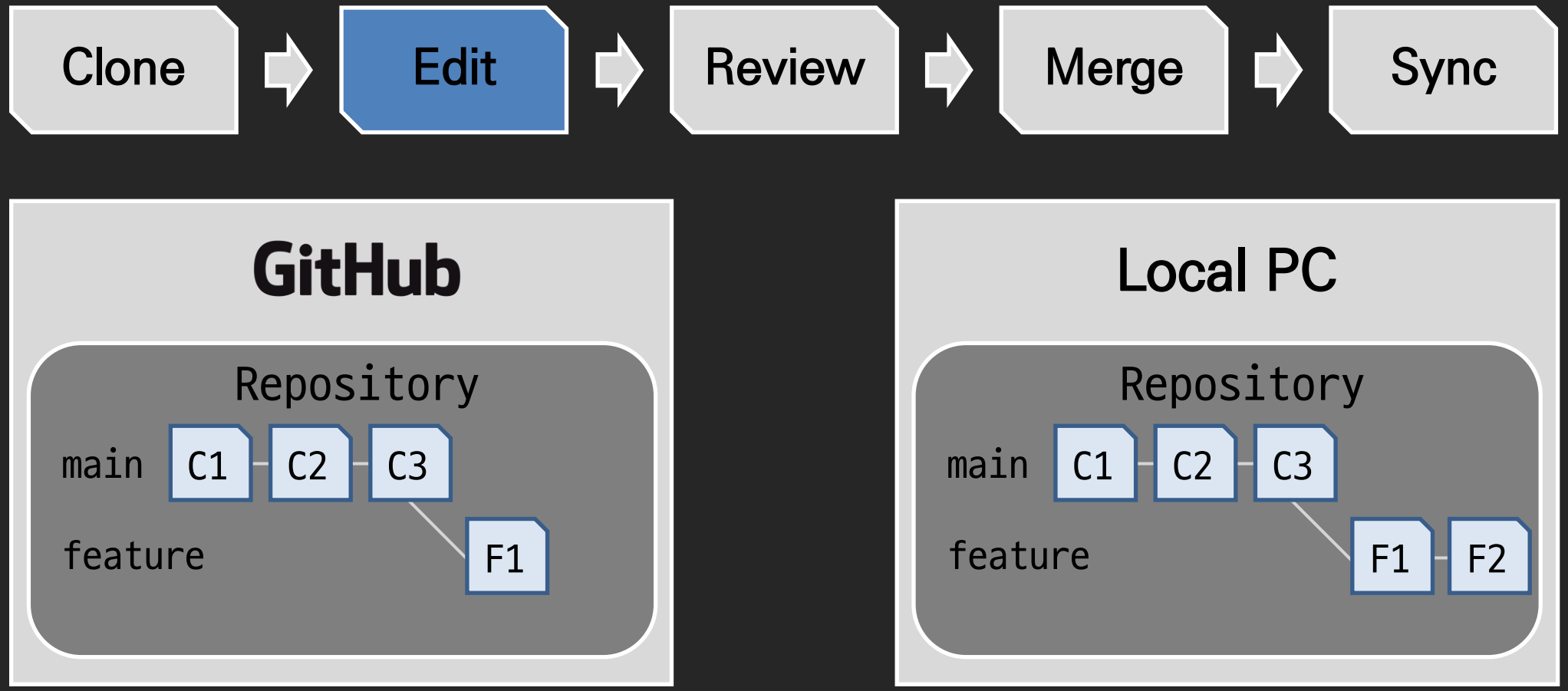

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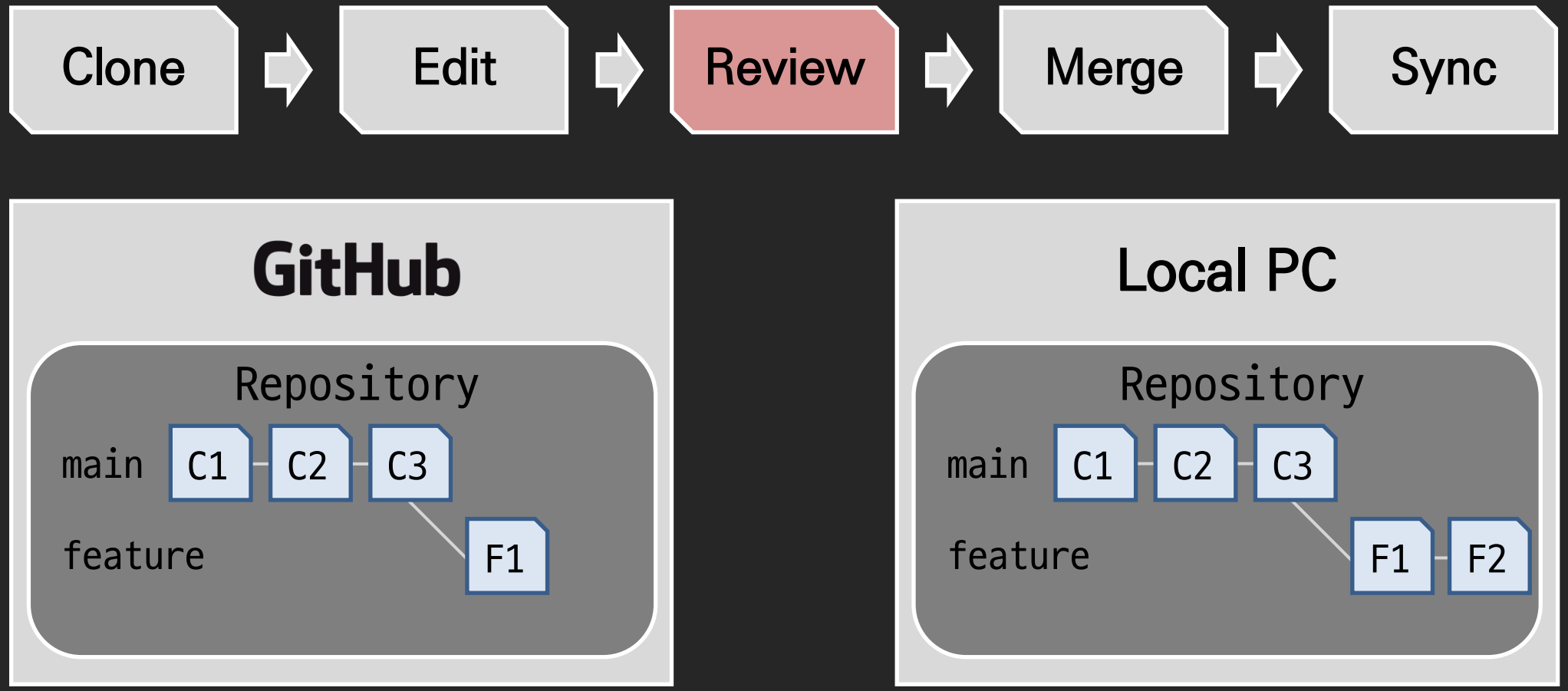

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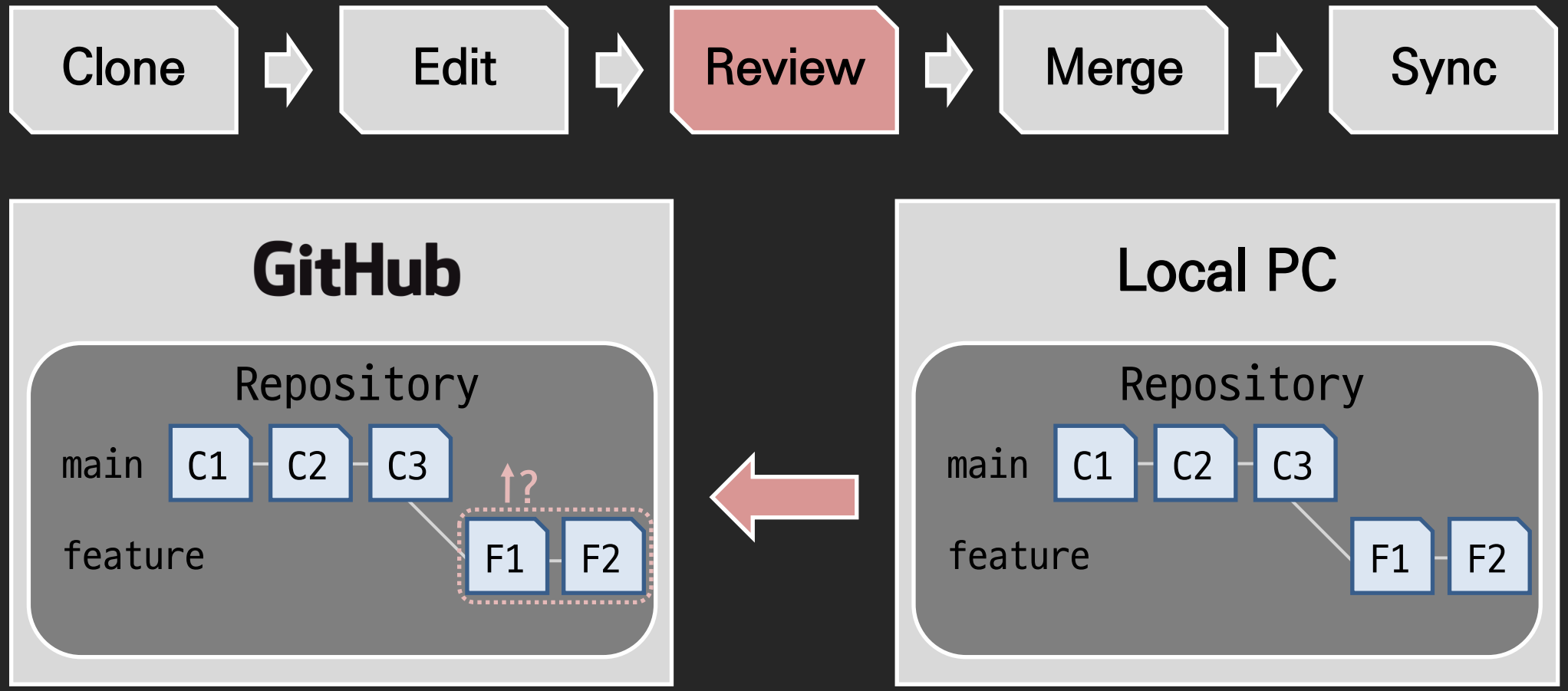

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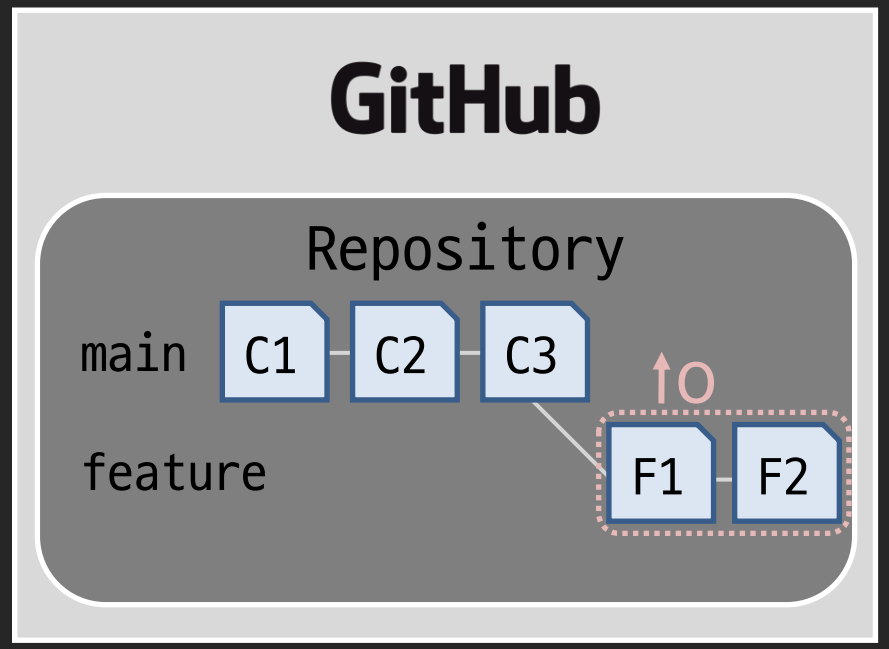
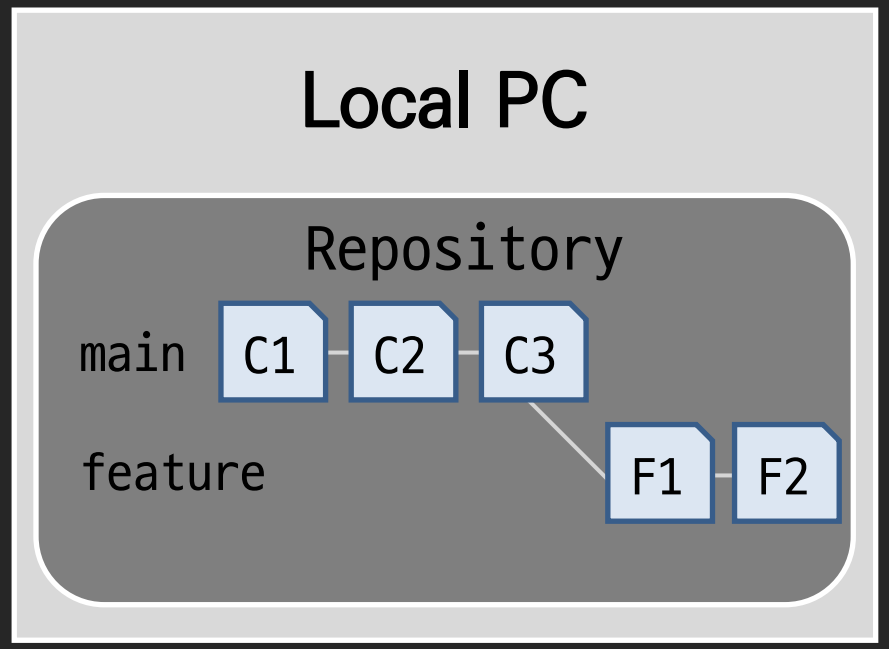
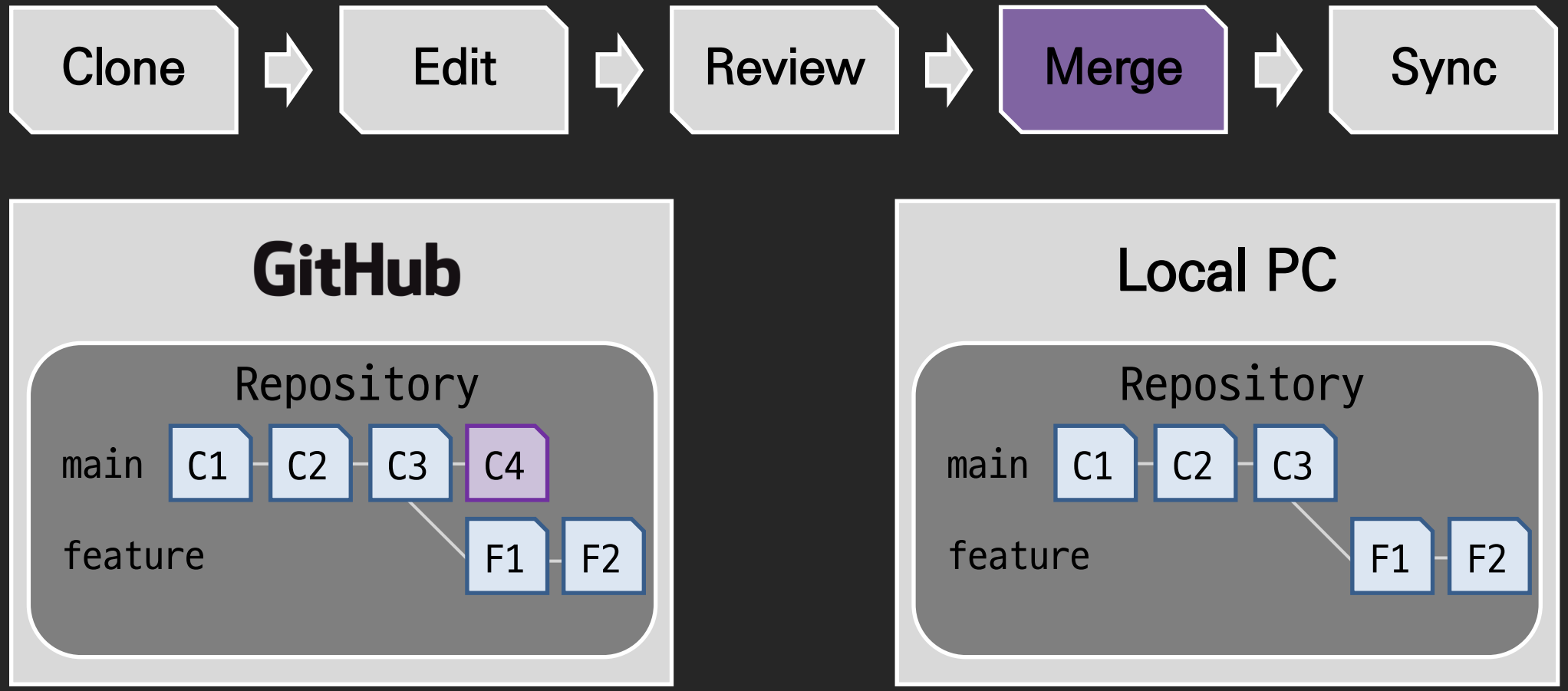




Collaborative Development Steps

Clone → Edit → Review → **Merge** → Sync

Collaborative Development Steps



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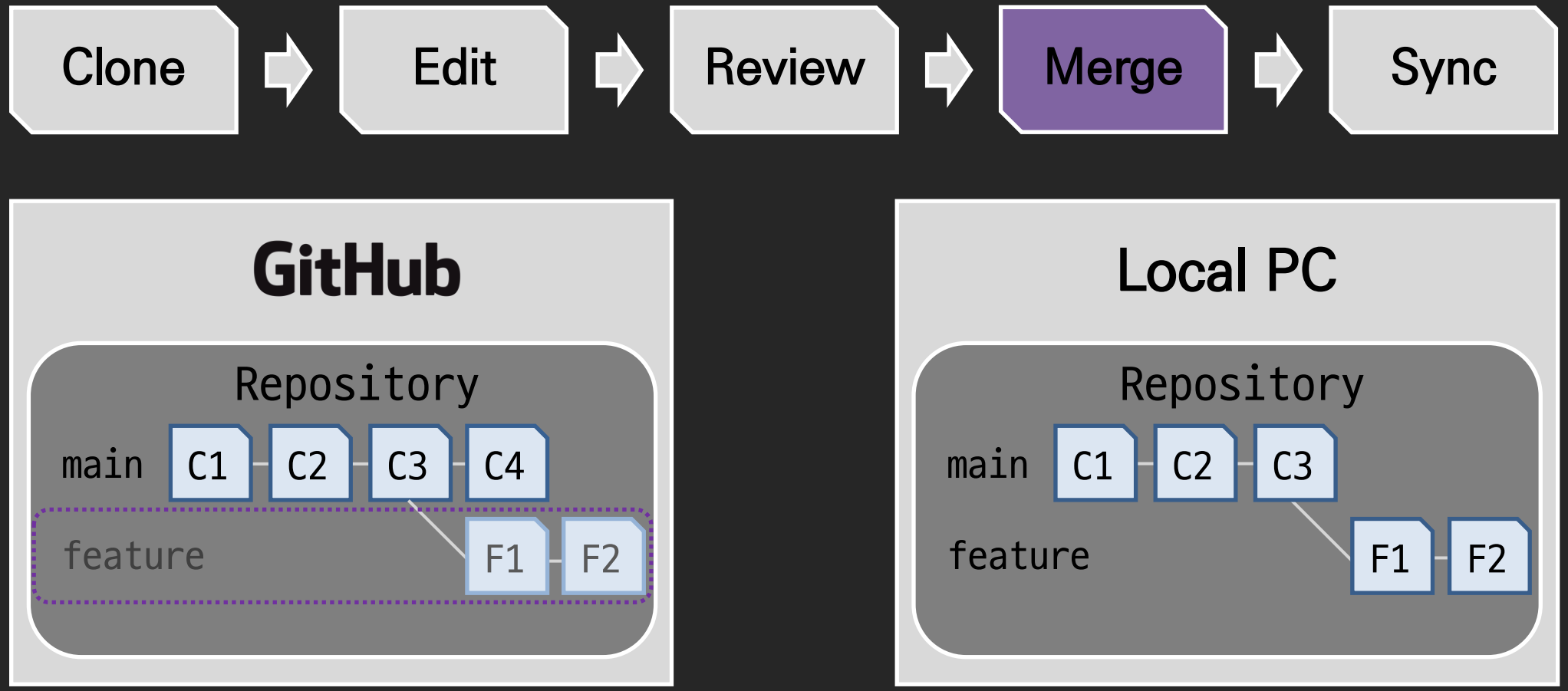

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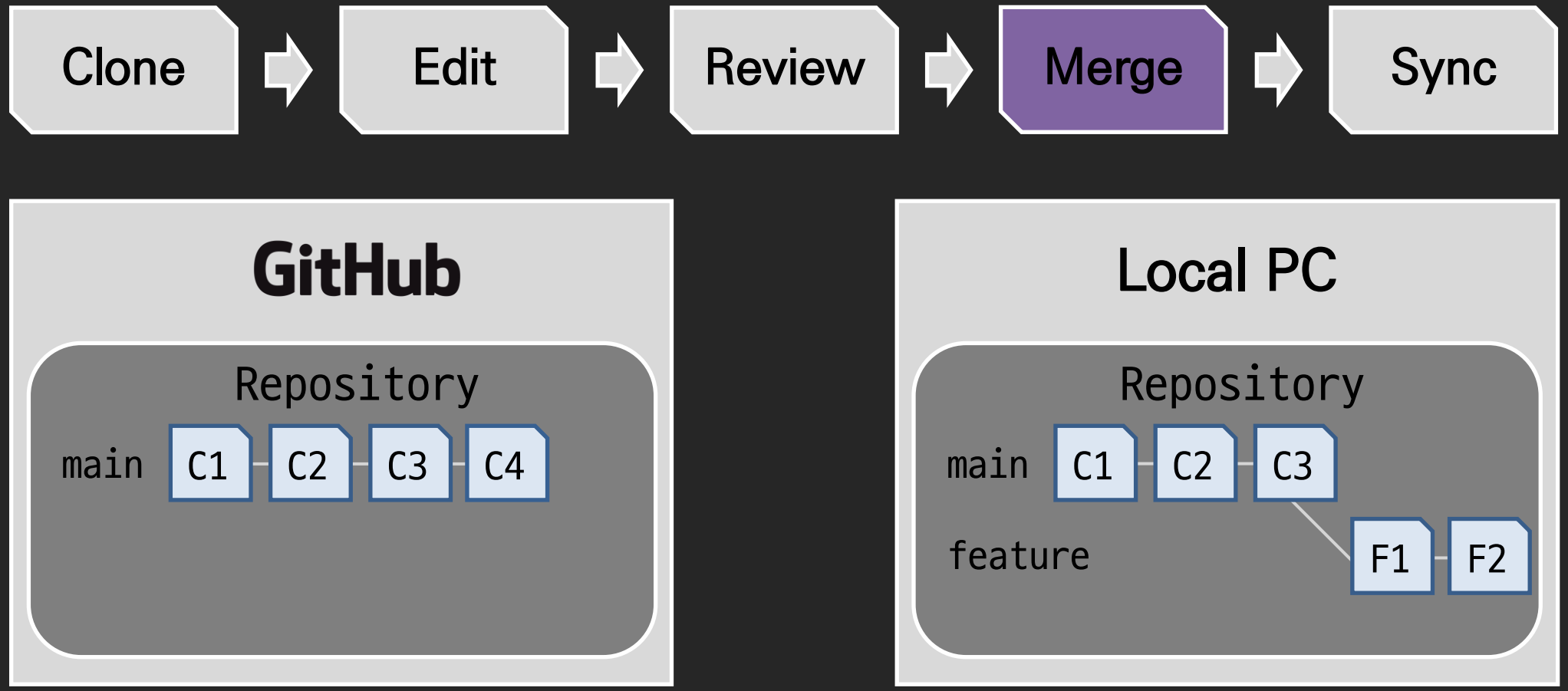

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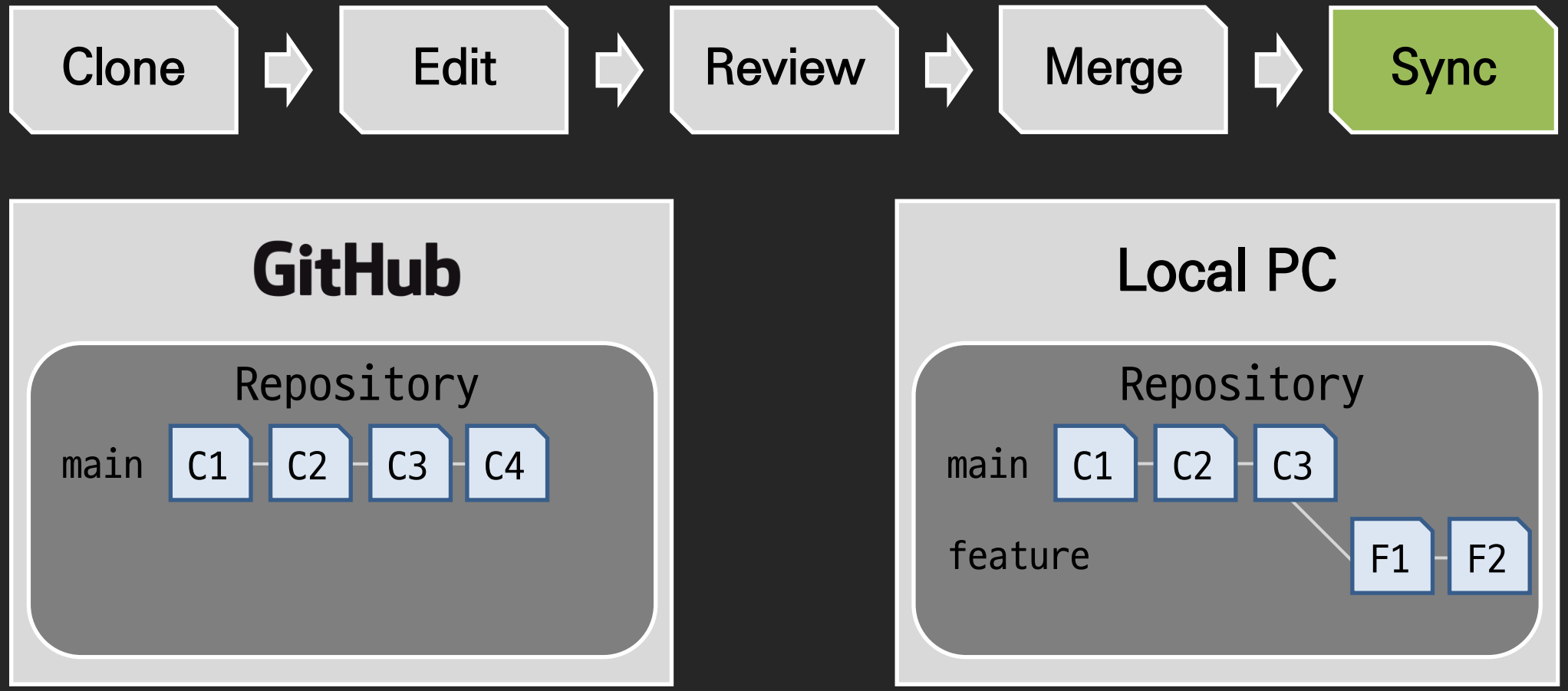

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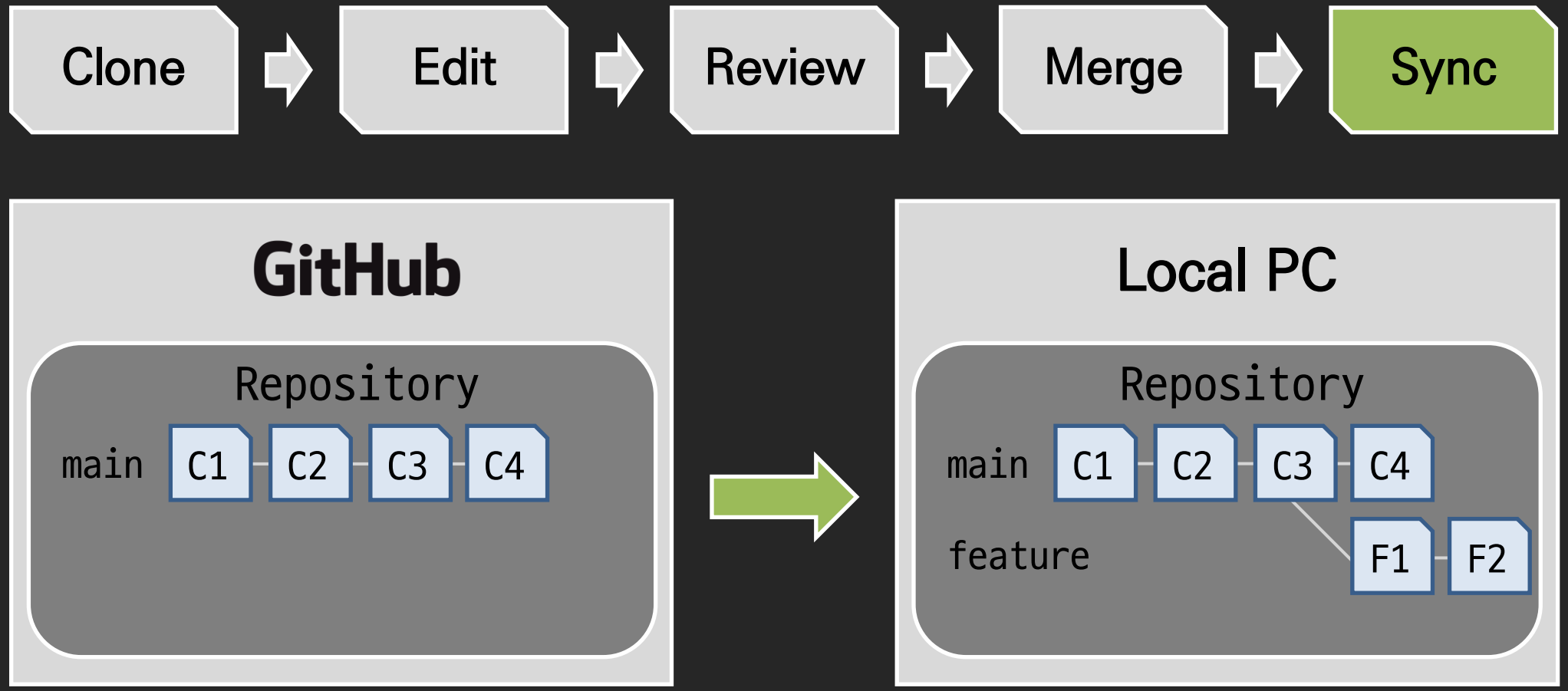

Other Useful Commands

- `git diff`
- `git blame`
- `git bisect`
- `git cherry-pick`
- Google the arguments and usages by yourself!

vscode and git

- vscode has integrated git interface
- Often-used commands are easily accessible
  - Integrated GUI
  - Command palette
- Extensions offer even more convenient features!