GIT

version-control system

Outline for today

- The tutorial is for people who have never seen GIT before
  - We won’t be typing in any commands
- Explain the GIT workflow and basic operations visually
- Something for everyone
- Video lectures to learn in more depth!

What is GIT

- Version control
  - Thesis_v1.doc
  - Thesis_v2.doc
  - Thesis_v217.doc
- Keeps track of changes
  - Text changes
  - Most often to manage source code
- Move back and forth between versions
- Compare and see what changed between versions
- Team development and distributing code
- Industry standard

Change Sets (/Snapshots/commits)

- Git stores "change sets"
  - incremental changes applied
  - multiple files
- We'll explore how GIT tracks and merges "change sets"
- Small and simple is usually better
  - Want changes to be focused and independent of each other
  - If 2 change sets make conflicting edits, more difficult to merge
- Usually (but not always) good to have change sets that leave code in a working condition.

The Basics

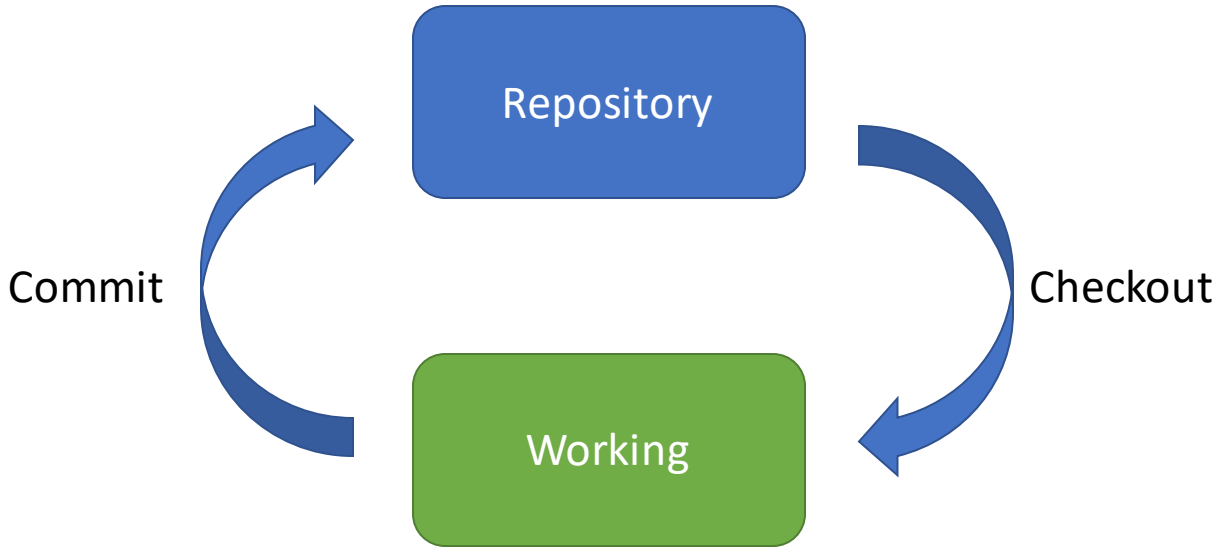
- Create a new folder and navigate into it
- git init command
  - Make this a git repository
  - Track all the files that come and go, changes that are made, and do it for all subfolders too
- .git folder is where it does all storing a tracking
  - This is GIT's workspace, GIT will manage these files
  - No need to mess around unless you know what you're doing

The Basics

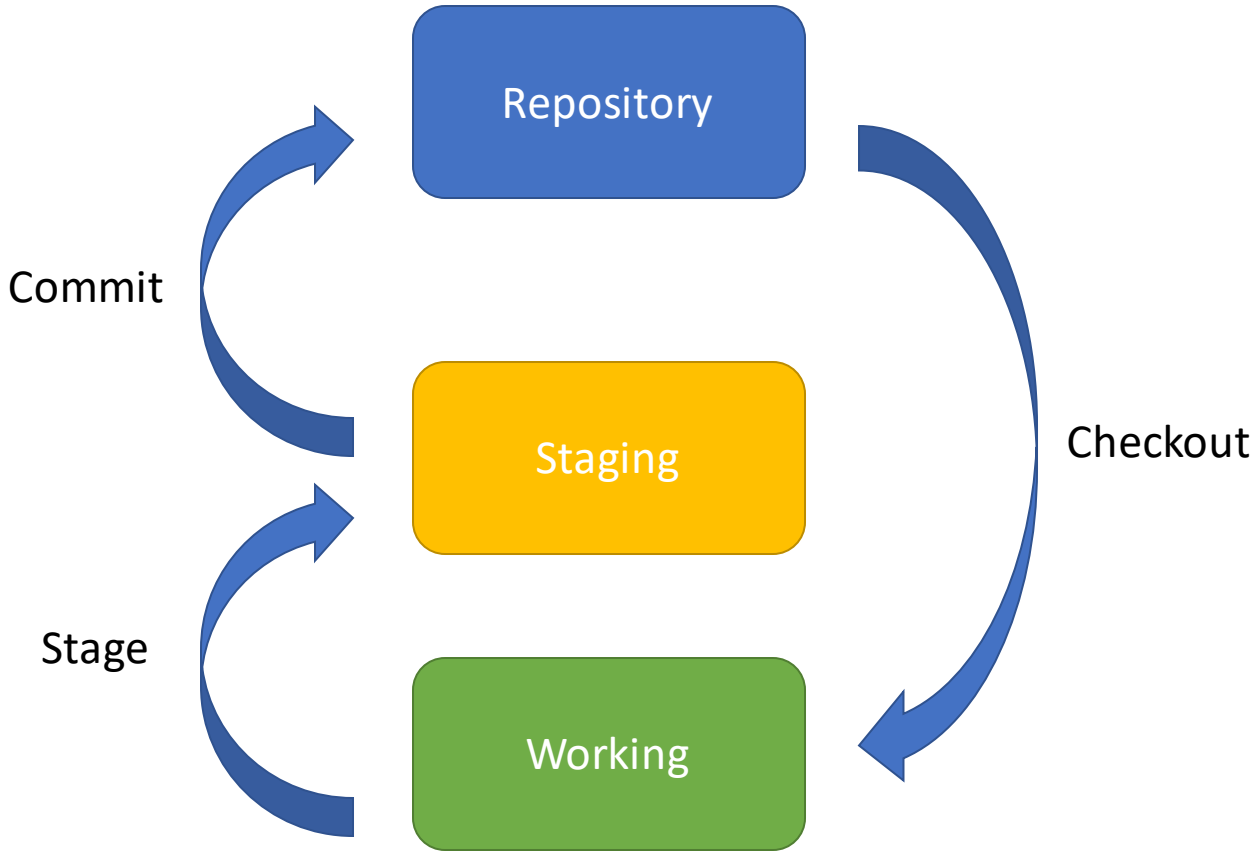
- The basic flow
  - Make changes in **working directory**
  - **Add** change set to **staging directory**
  - **Commit** change set to **repository directory**

3 Tree Architecture

3 Tree Architecture



3 Tree Architecture



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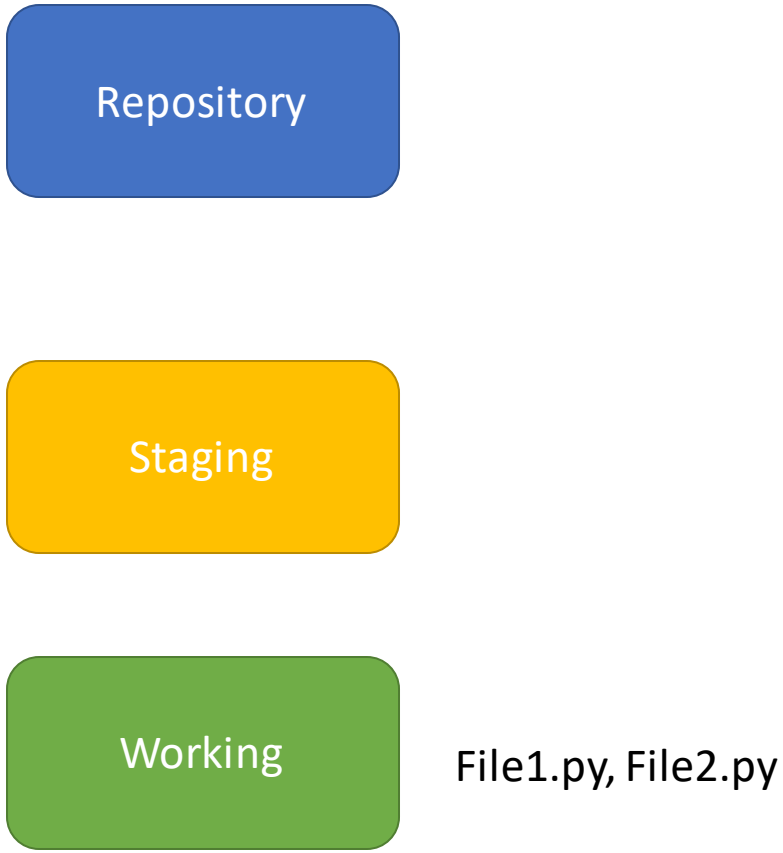

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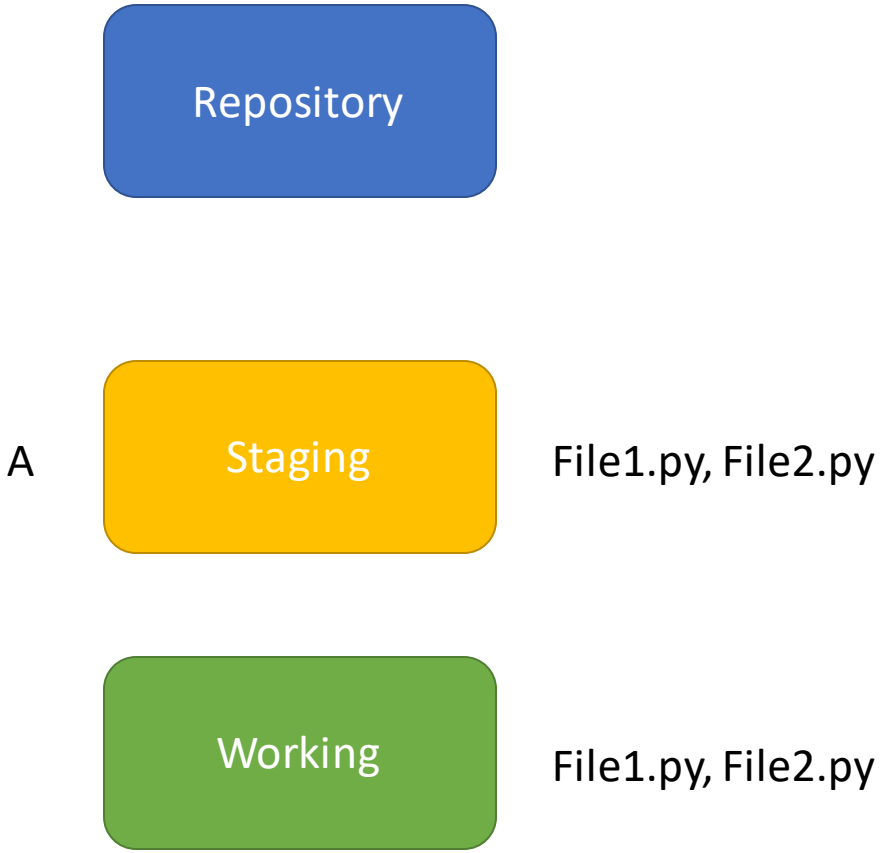

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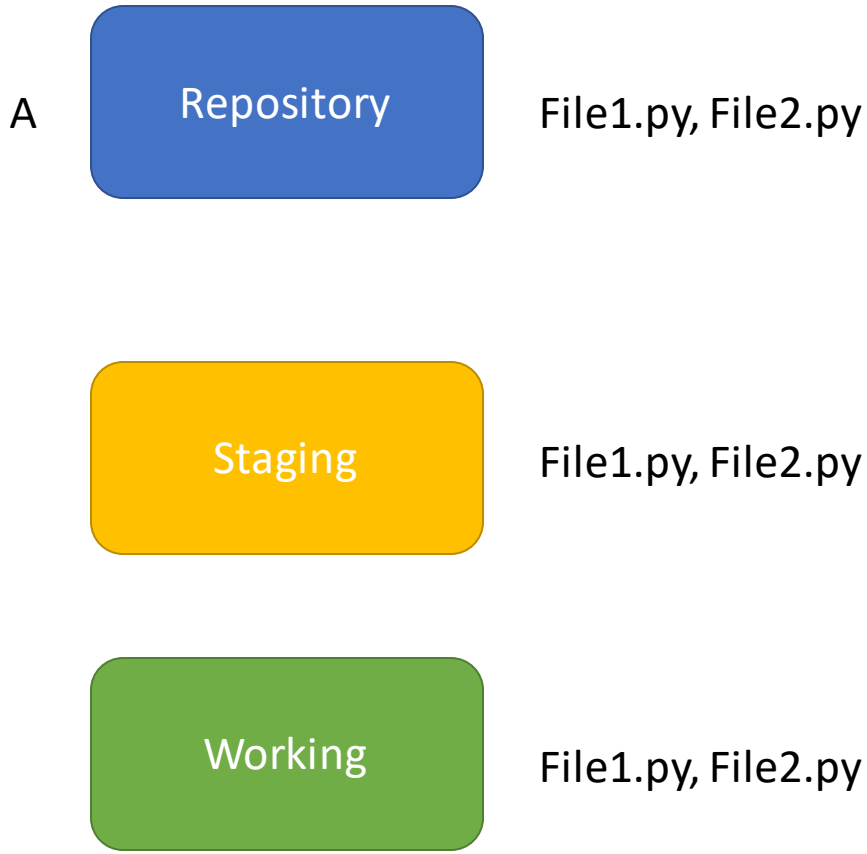

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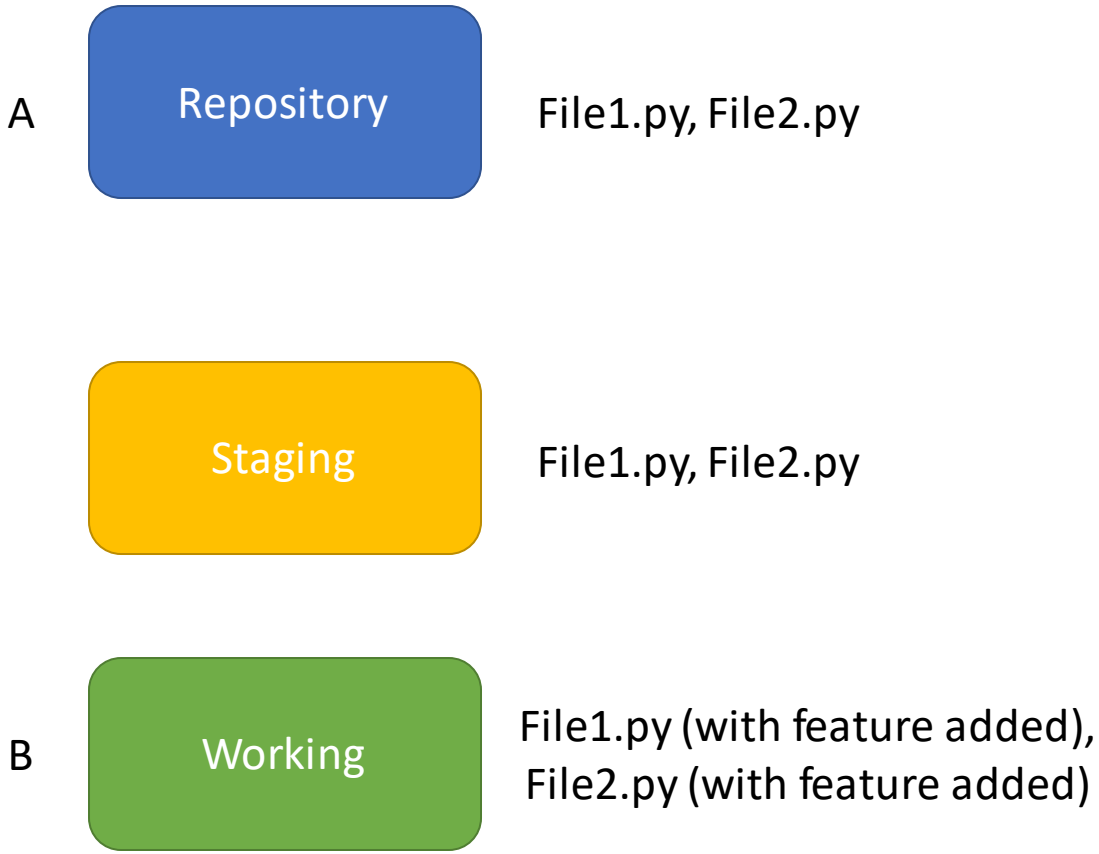

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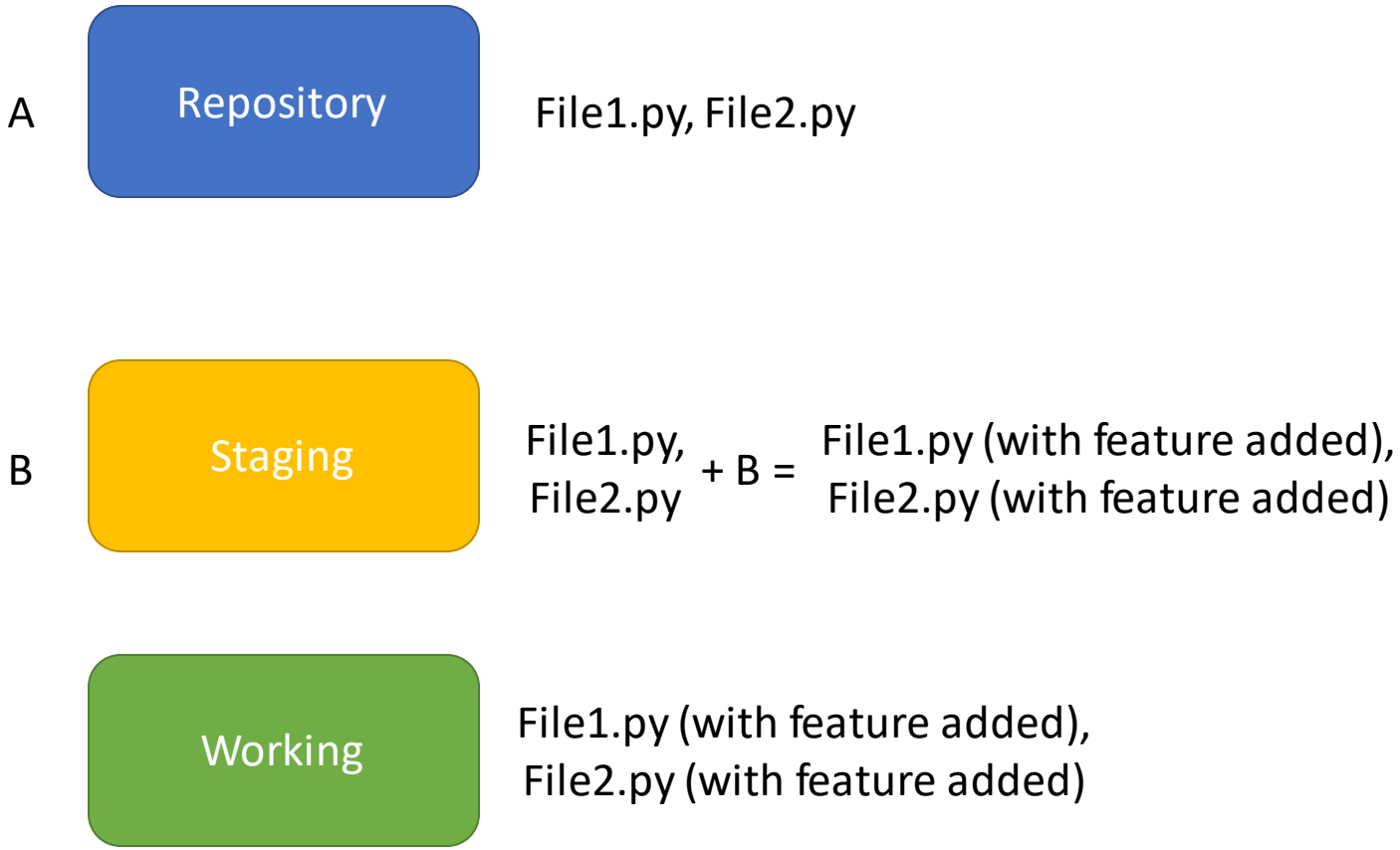

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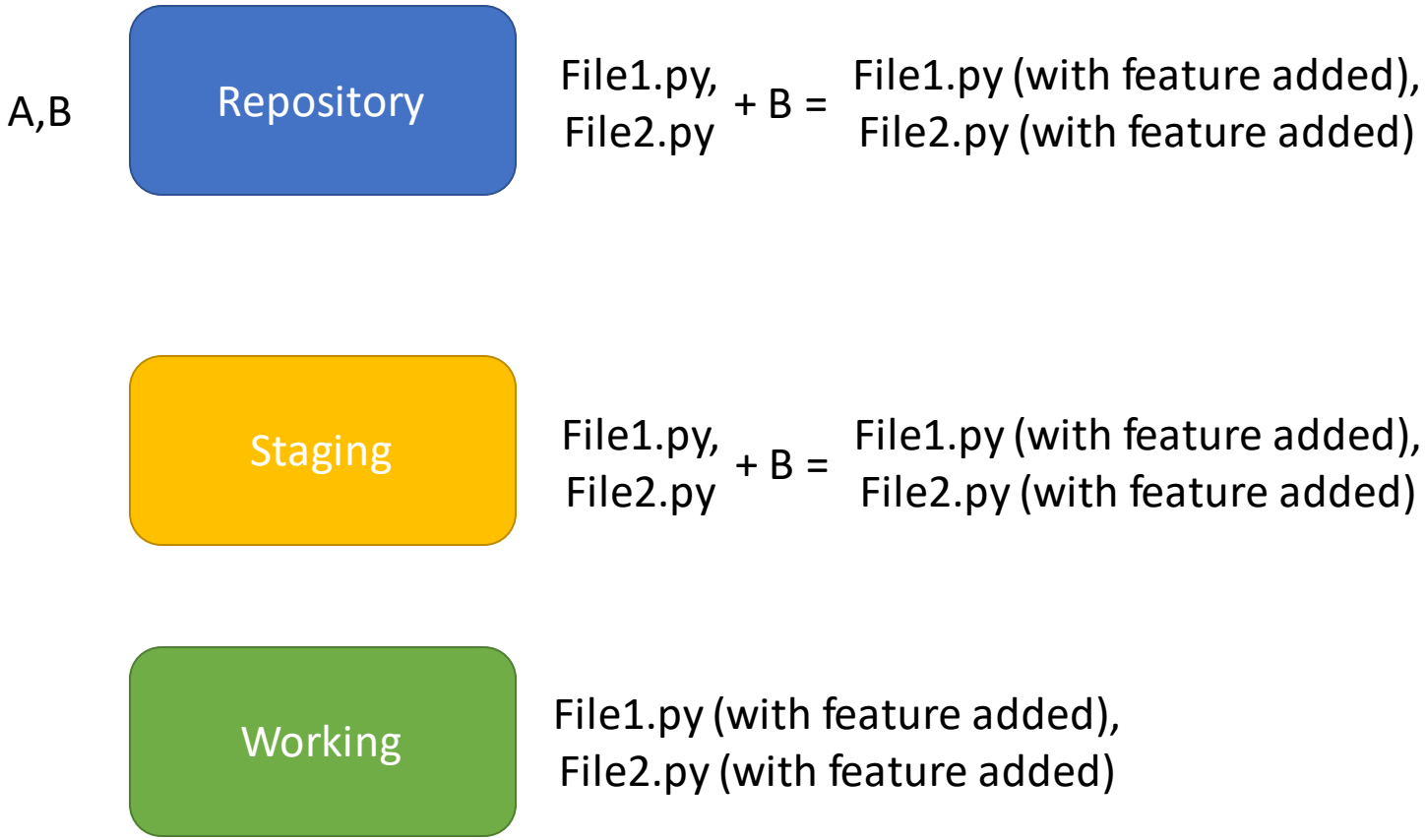

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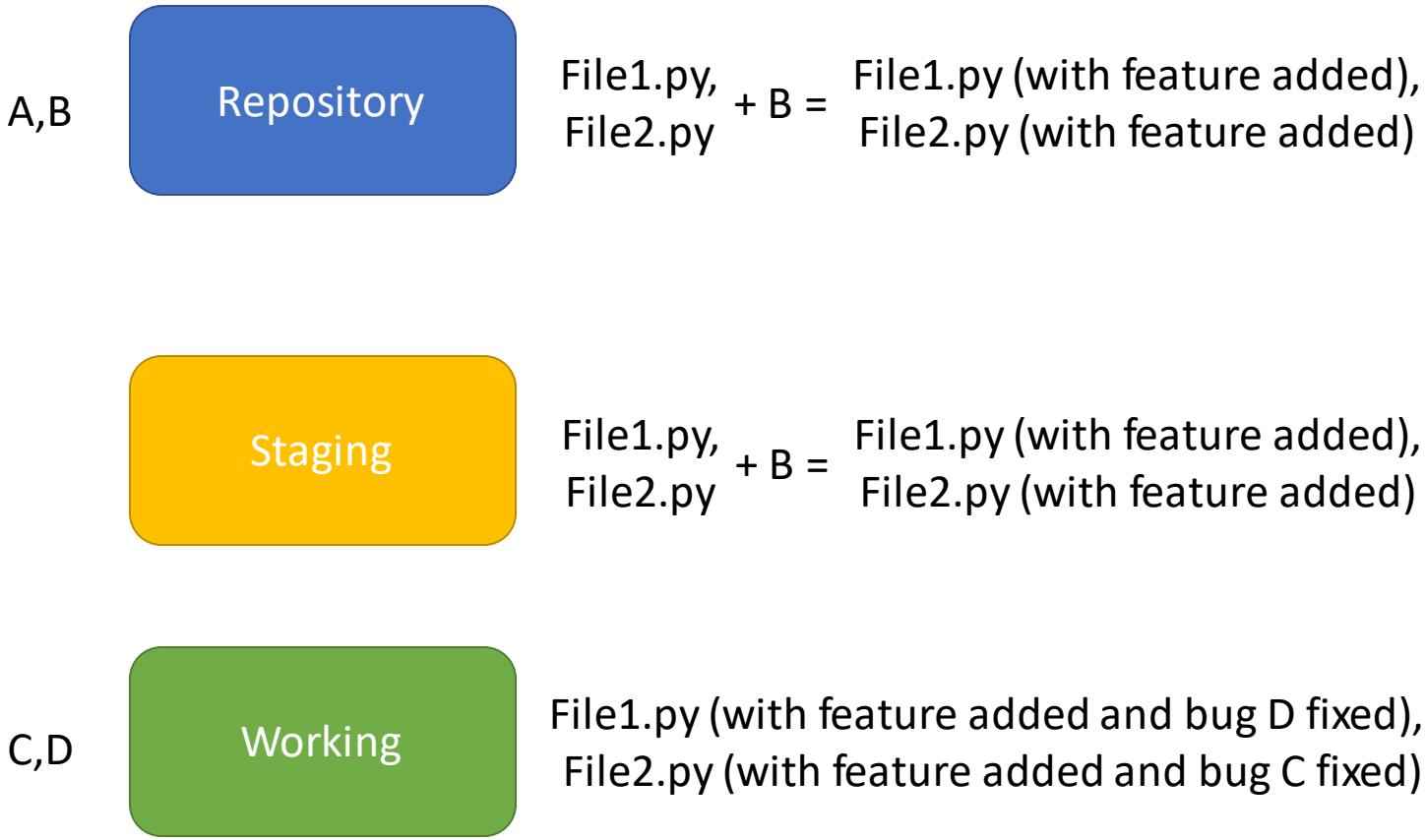

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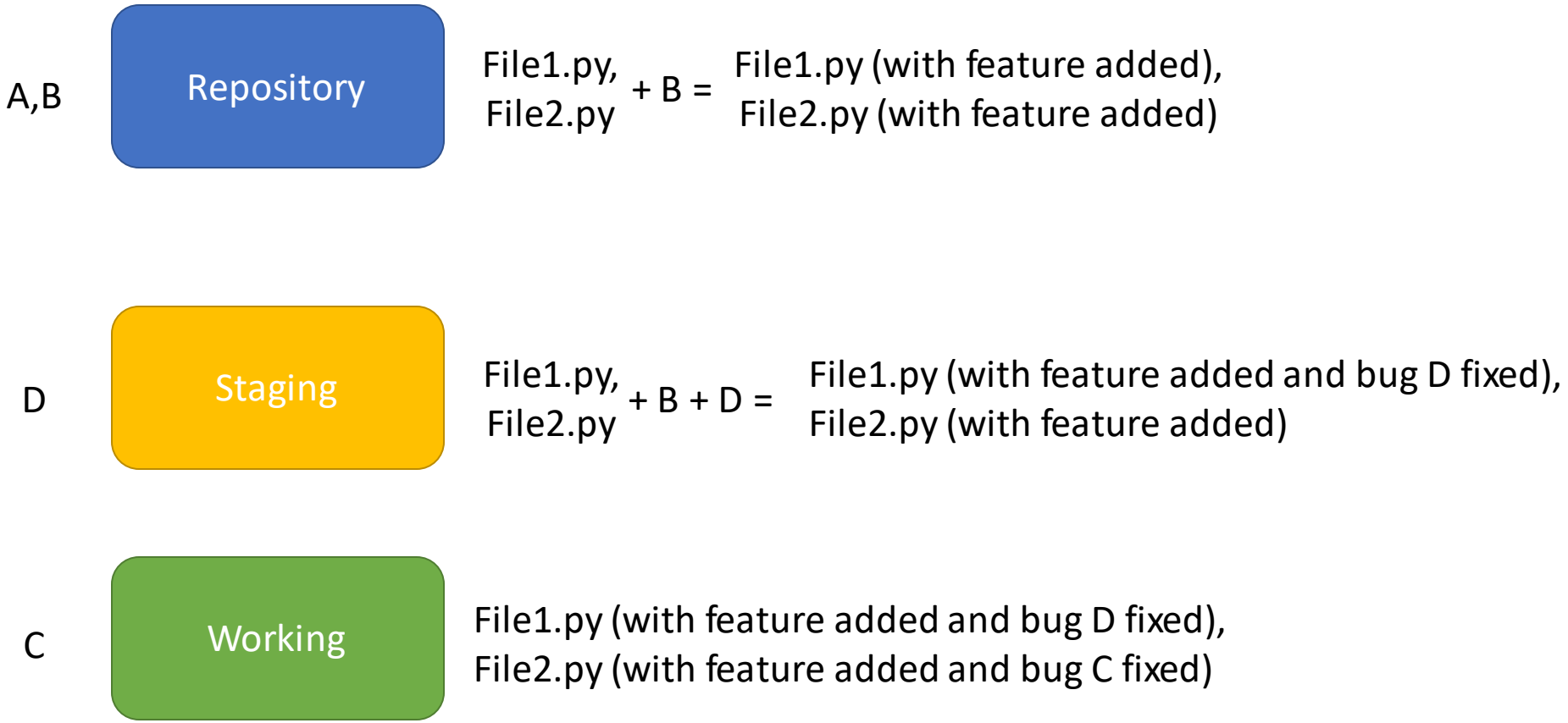

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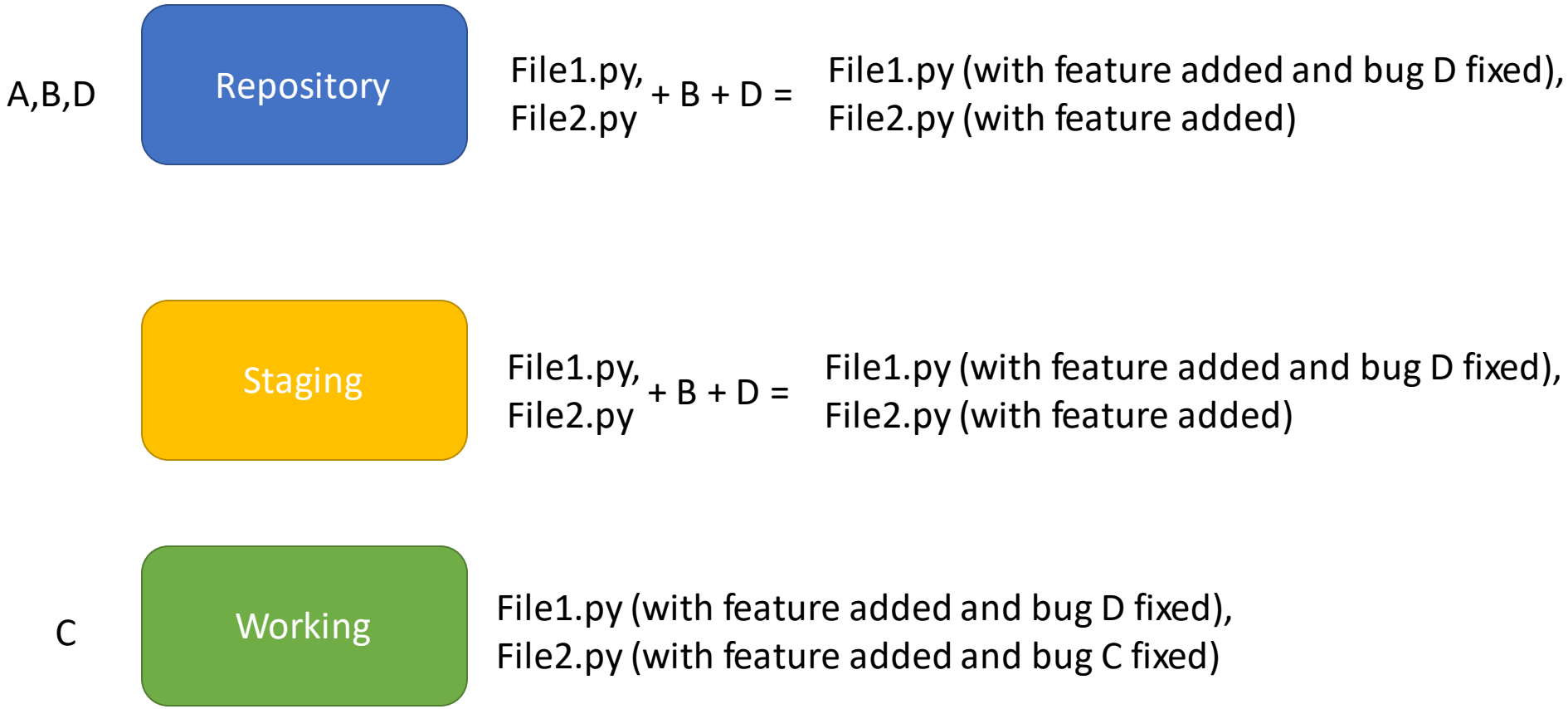

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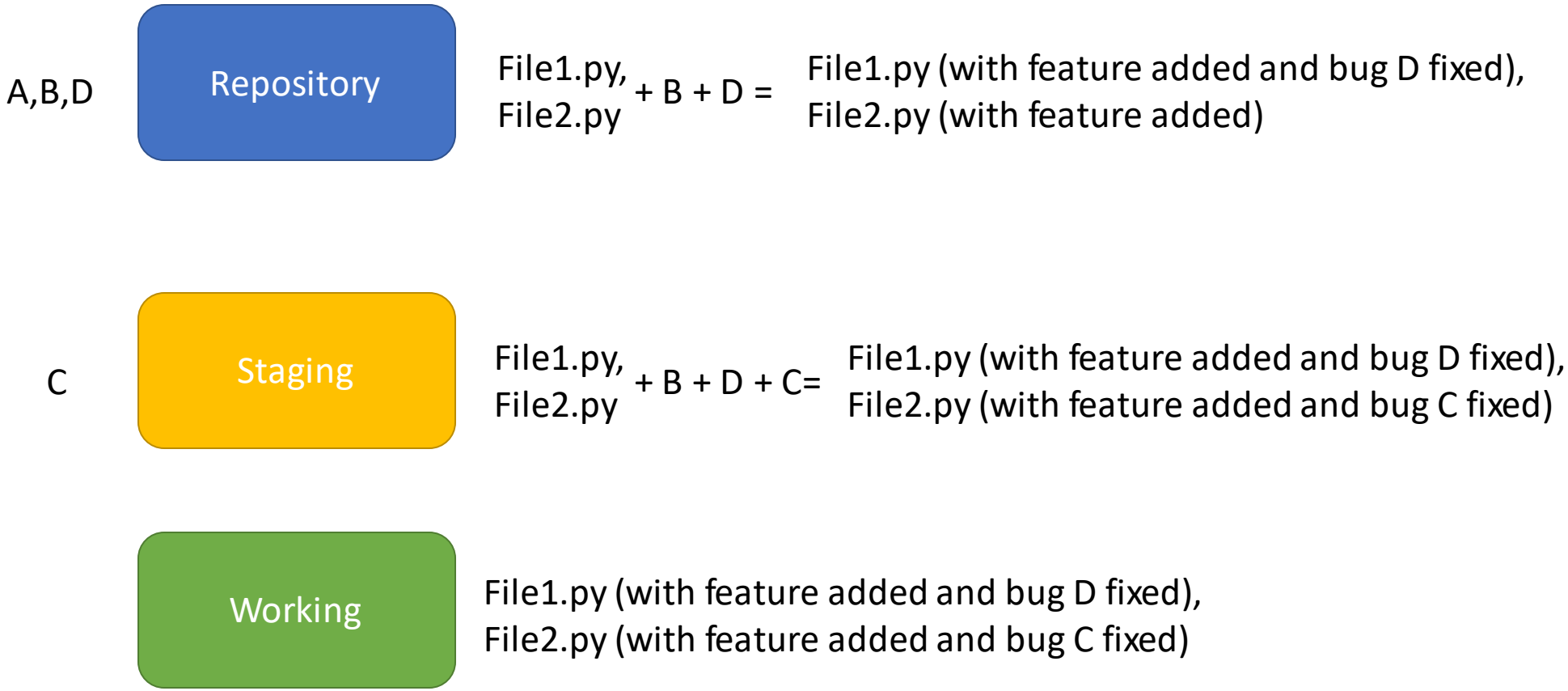

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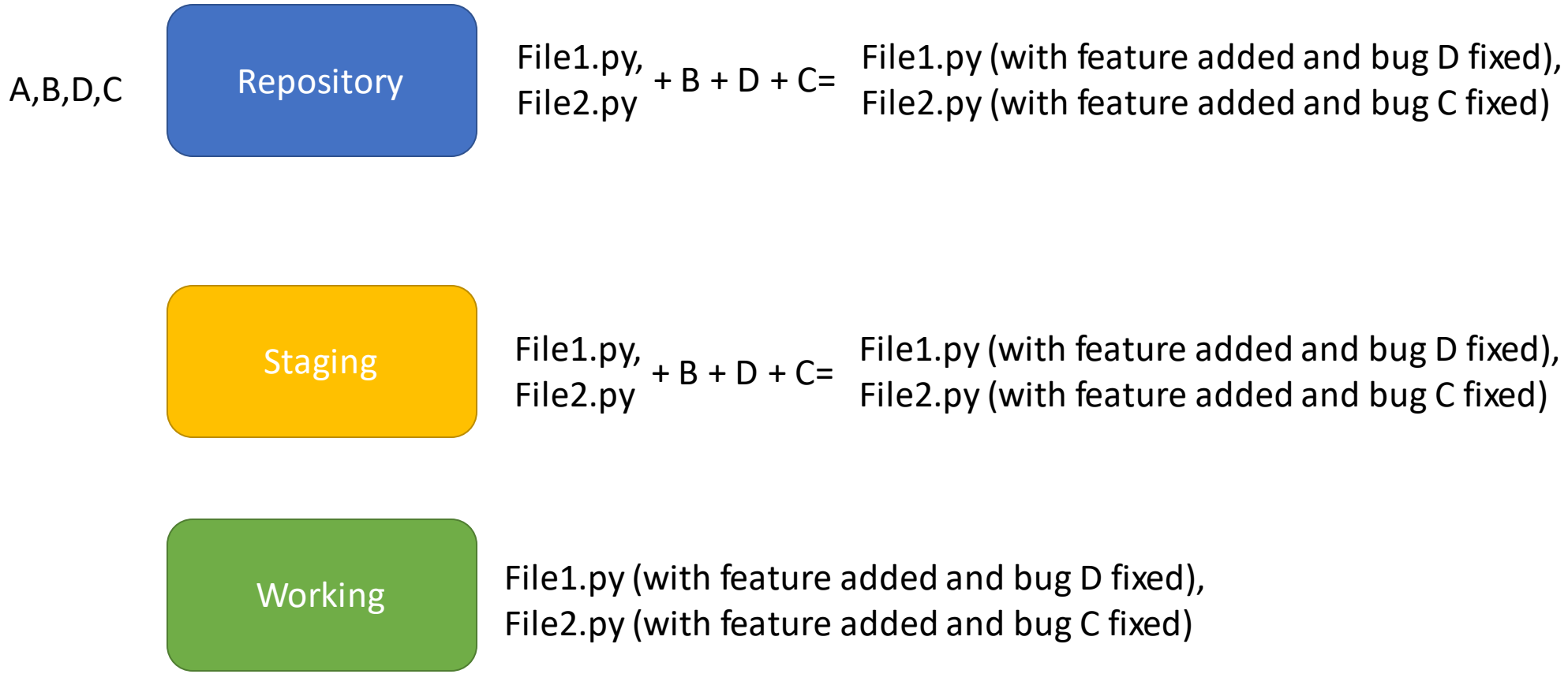

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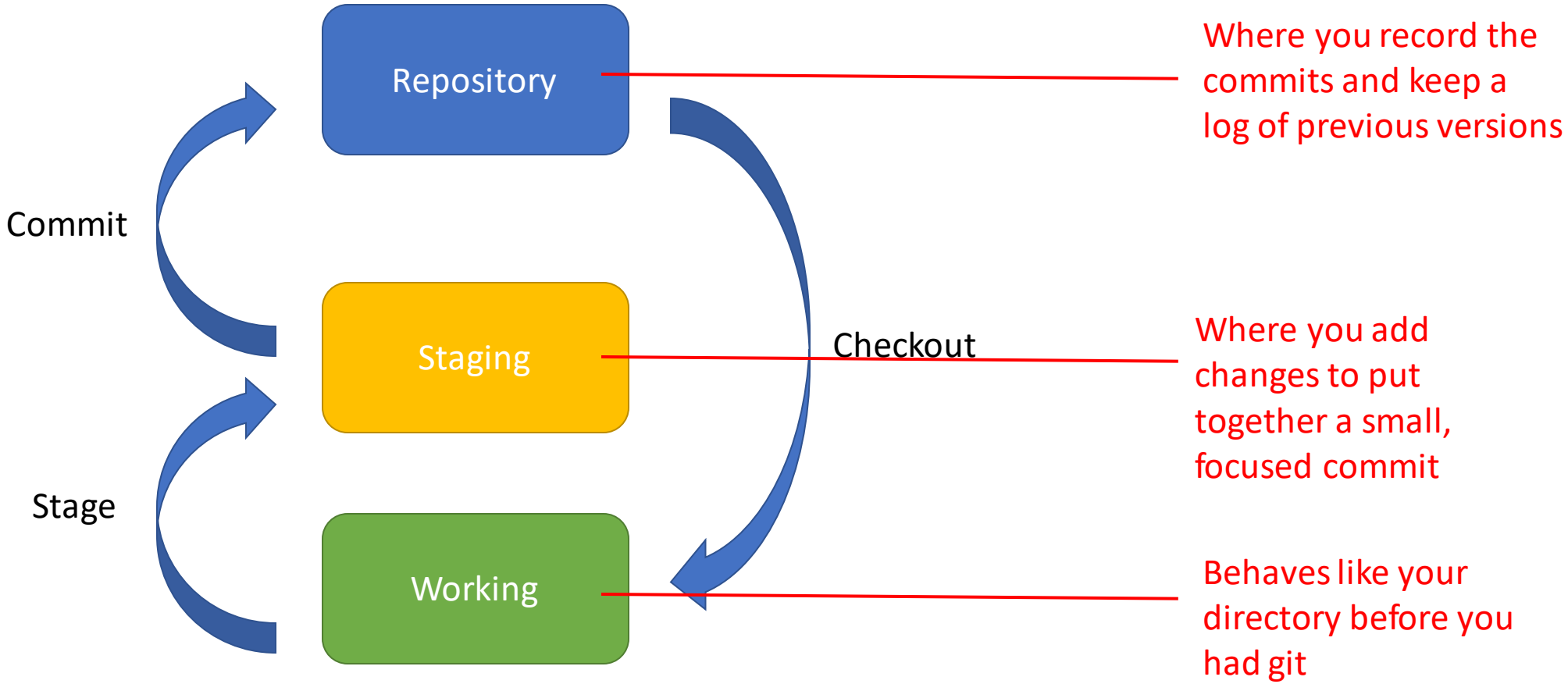


Commit messages

- Commit message should describe changes you are making in that change set
- You'll need to come back and look at change sets later
  - Want to just look at the commit message and know what's inside
- Short single-line summary (less than 50 characters)
- Optionally followed by a blank line and a more complete description

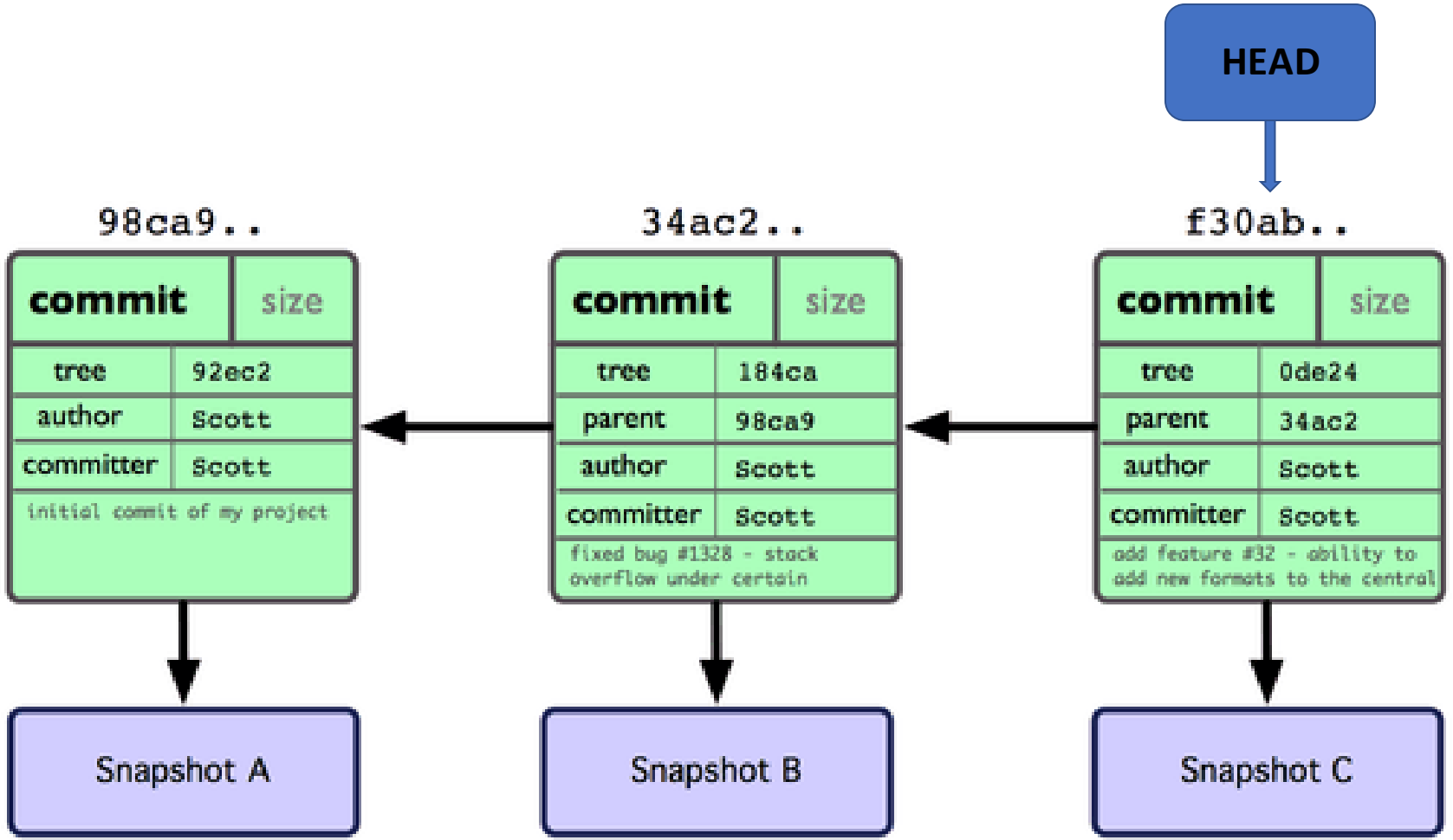
- Bad: "Fix typo"
  Good: "Adds missing semicolon to line 3"
- Bad: "updates nipype version, we should discuss if we want to keep using this version next week"

Some tools

- git status
  - Report back the difference between the work directory, staging index, and the repository
  - Untracked files
    - I can see your working directory has new things that I'm not currently tracking.
    - If you make text edits to these files, I won't be able to tell you what changed because I'm not tracking these.
- git log
- git diff
  - Compare working directory to repository

Undoing Changes

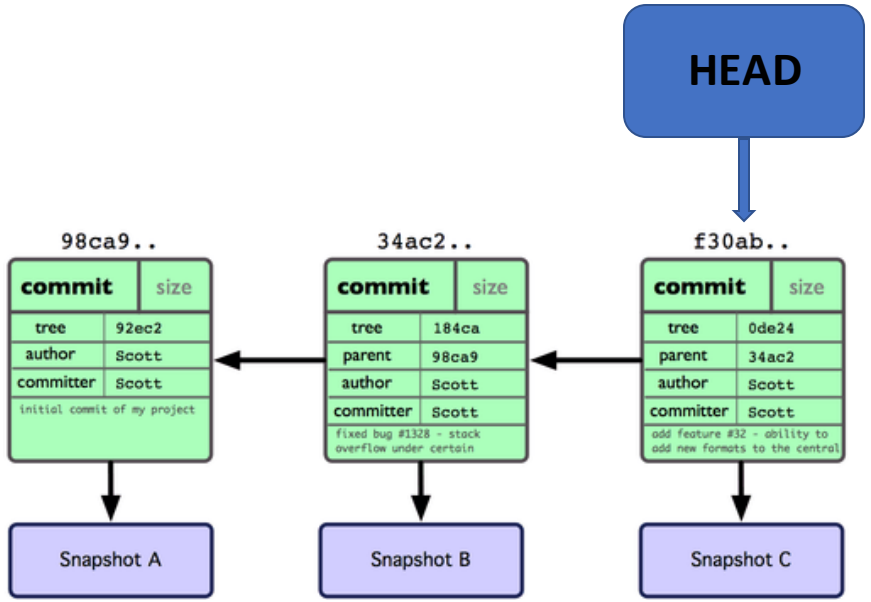
Repository record



Commands for undoing changes

- git checkout
  - Checkout file from repository and overwrite working directory

Checkout



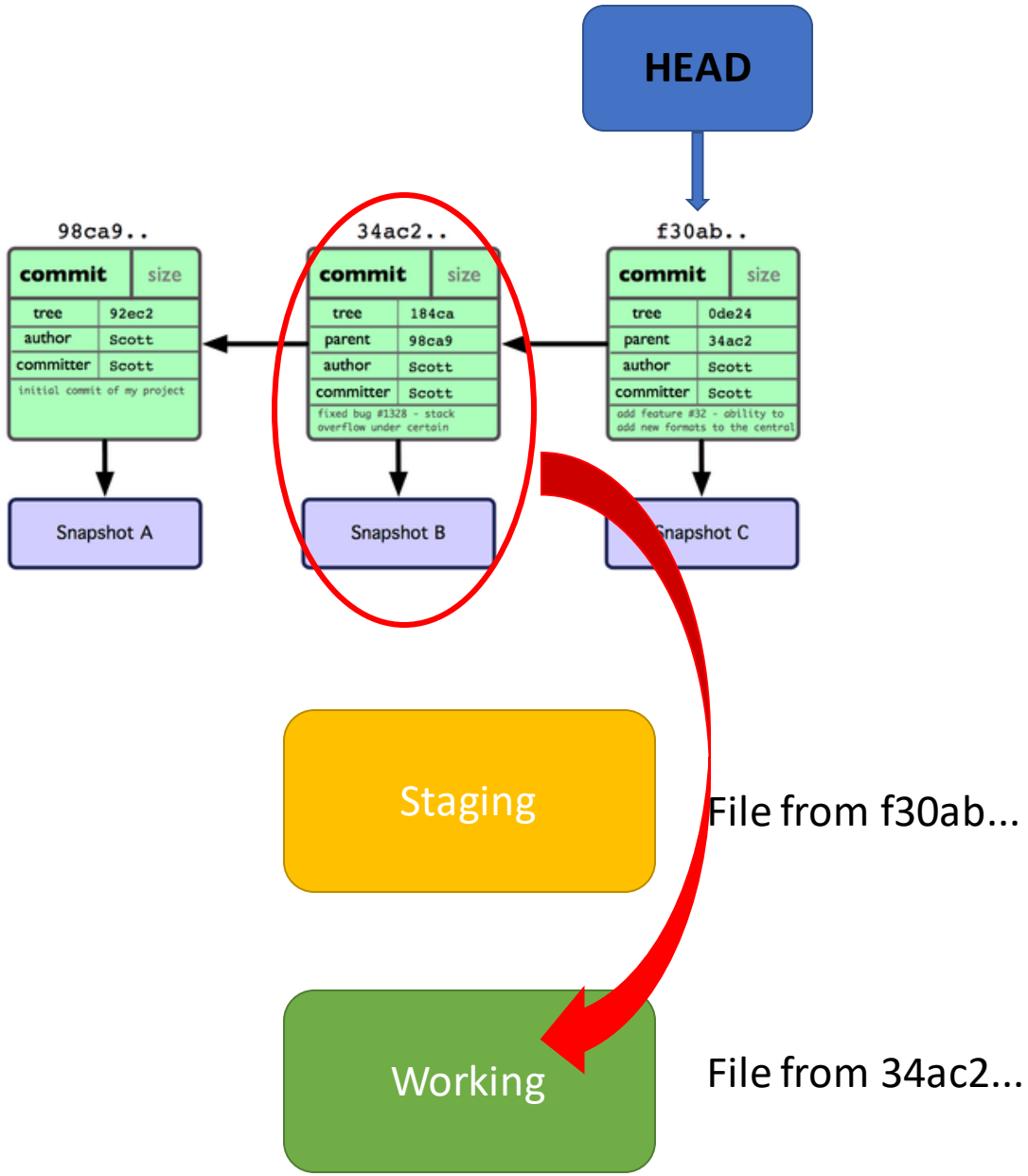
Staging

File from f30ab...

Working

File from f30ab...

Checkout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Snapshot A
Snapshot B
Snapshot C
Staging
File from f30ab...
Working
File from 34ac2...

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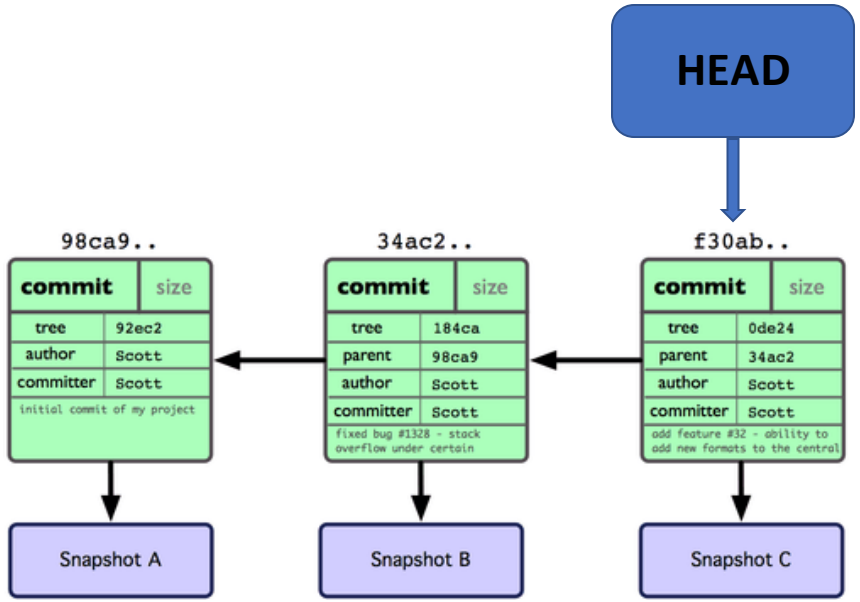


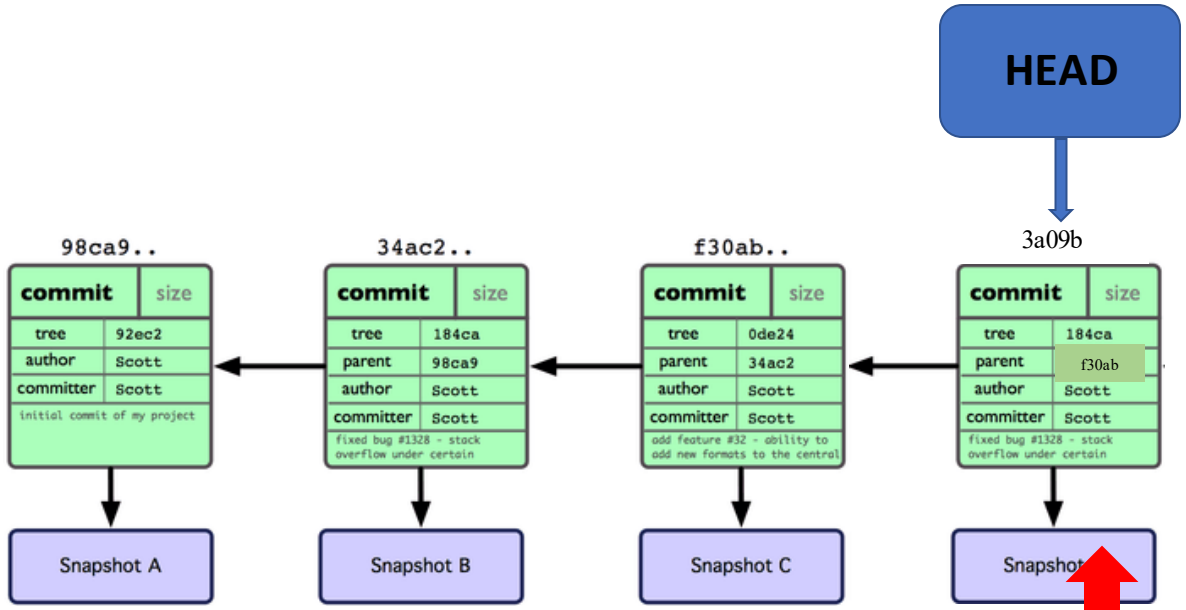
Staging

File from f30ab... + change set = File from 34ac2...

Working

File from 34ac2...

Checkout



Staging

File from f30ab... + change set = File from 34ac2...

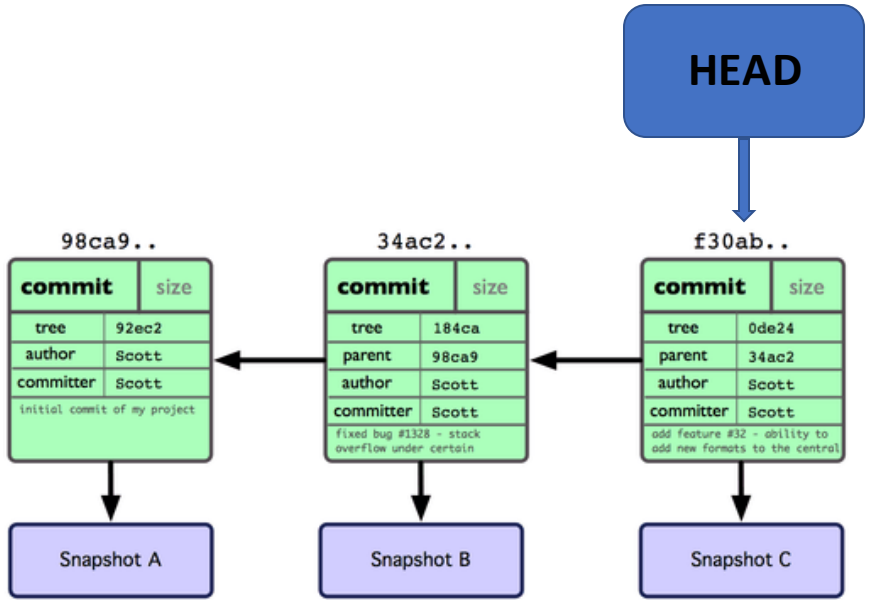
Working

File from 34ac2...

Commands for undoing changes

- git checkout
  - Checkout file from repository and overwrite working directory
- git reset
  - Move the repository head pointer and start recording from new position

Reset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Snapshot B
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Staging


Working

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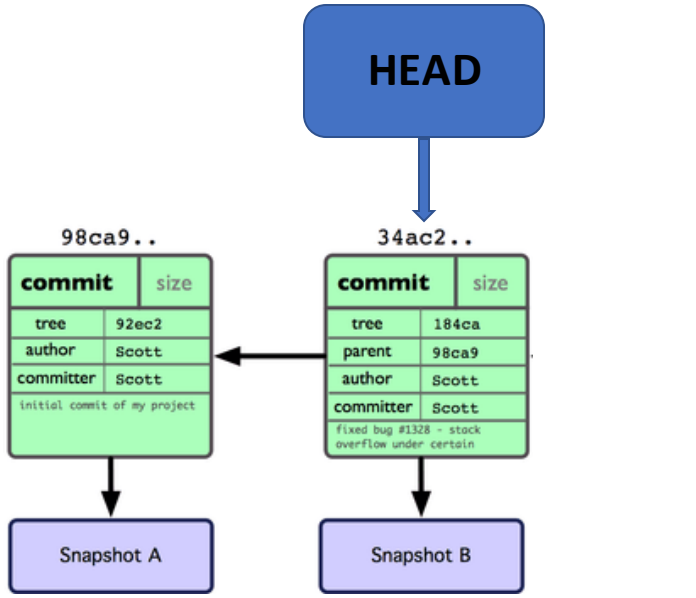
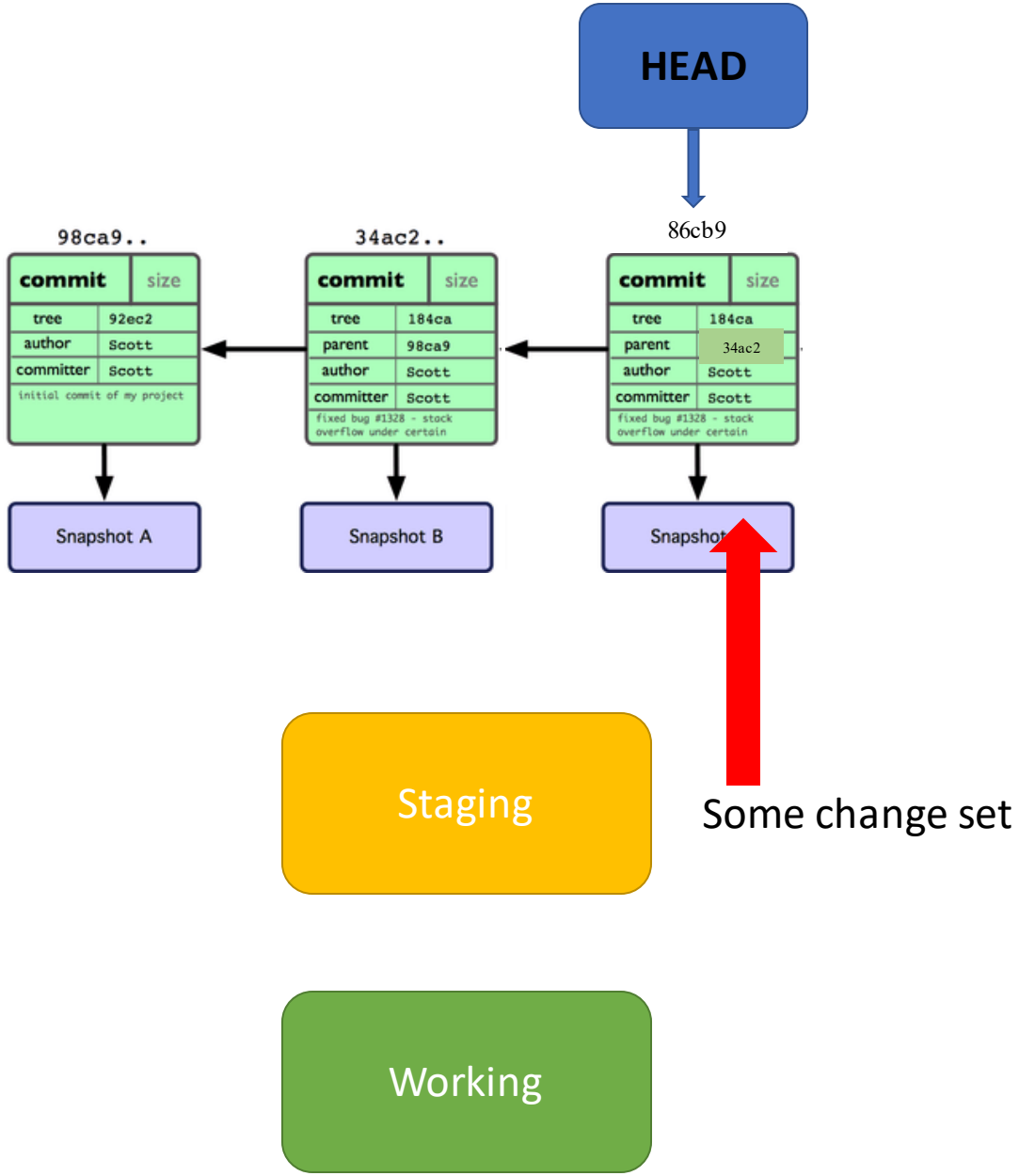


Staging

Working

Reset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34ac2
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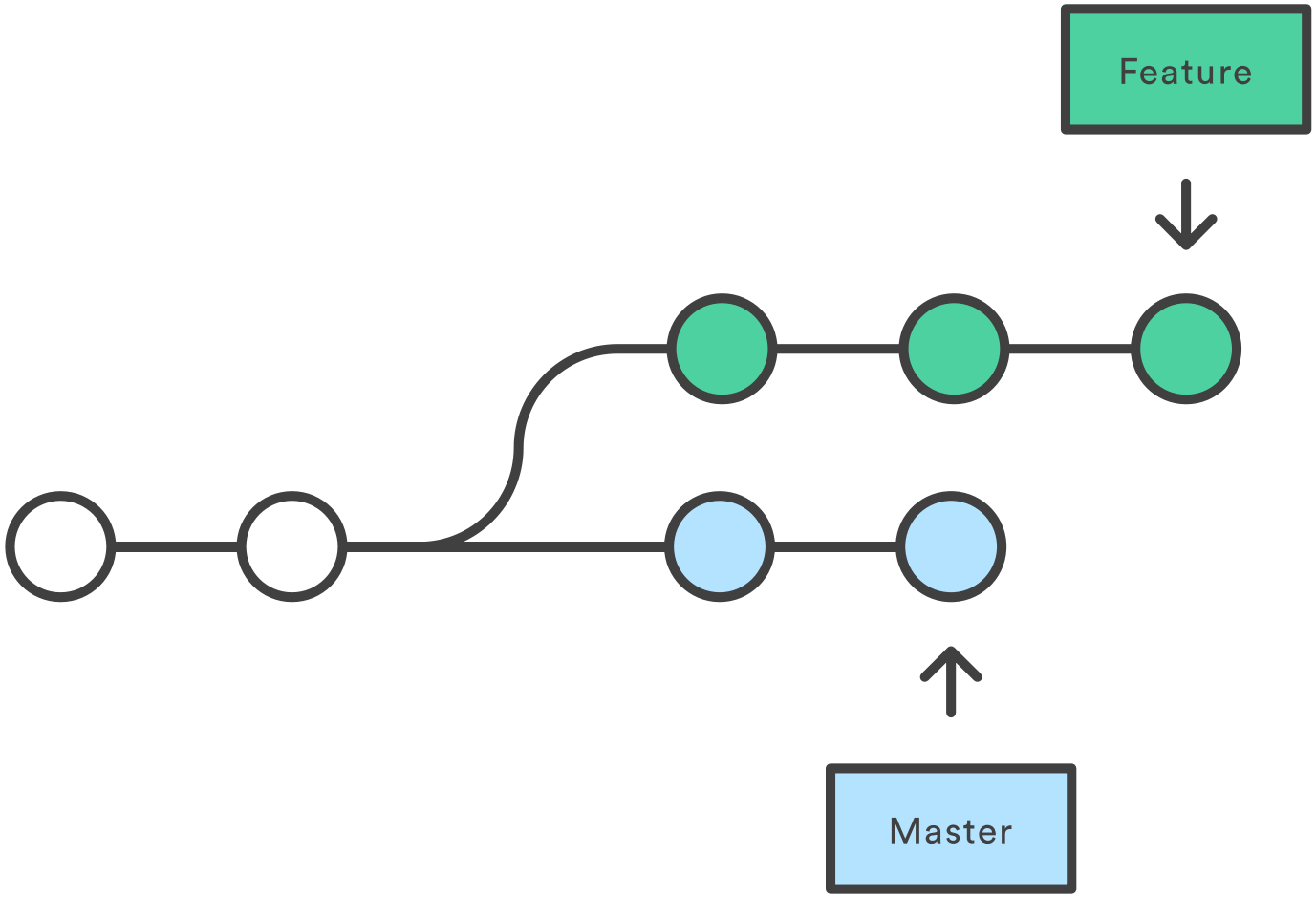
Snapshot A
Snapshot B
Staging
Some change set
Working

Commands for undoing changes

- git checkout
  - Checkout file from repository and overwrite working directory
- git reset
  - Move the repository head pointer and start recording from new position
- checkout vs reset
  - Committing after a checkout leaves the entire journey documented (documents that you tried something new and then reverted back to an older version)
  - Committing after a reset records over what you tried

Branch

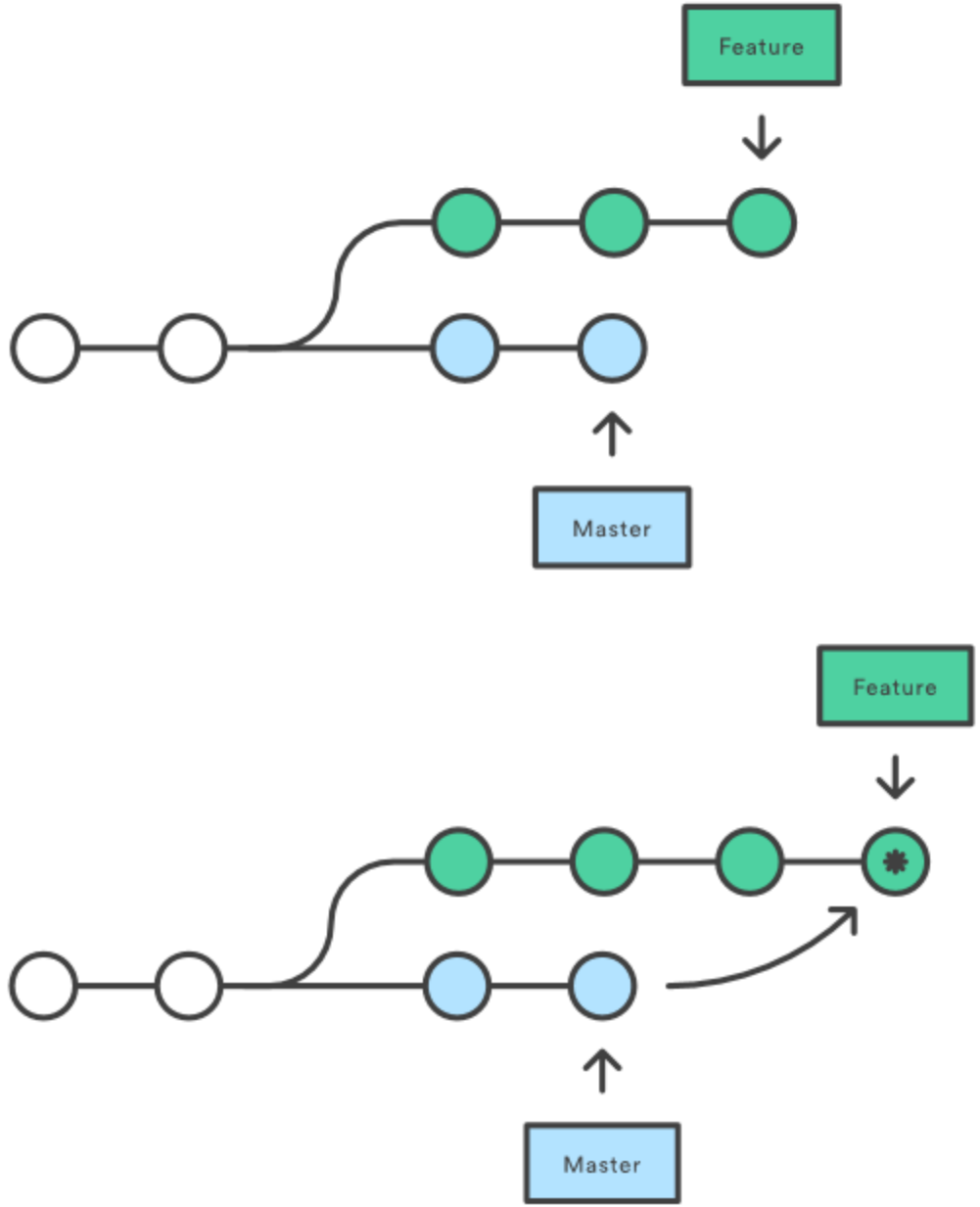
A forked commit history



When to branch off from the master branch?

- Branching from master
- Fix a bug
- Add a feature
- Try something new, development
- Refactor code

Merge

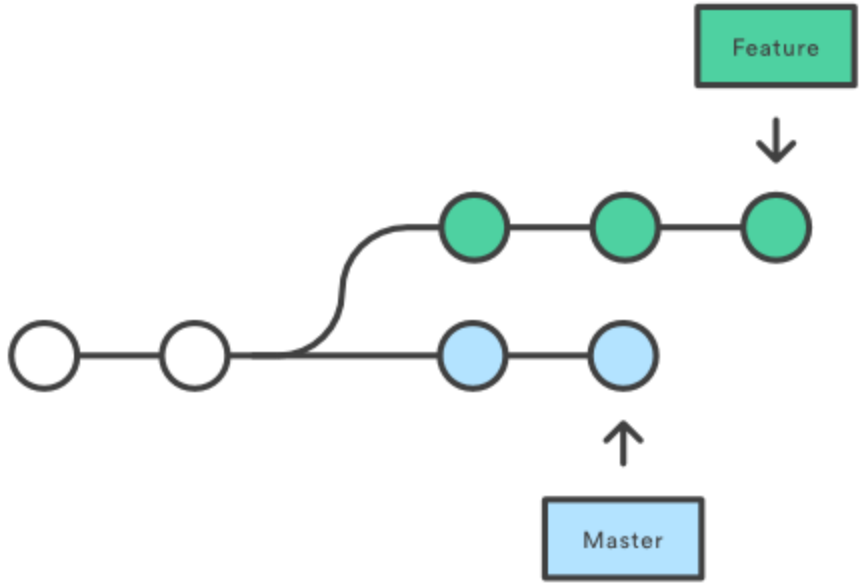

Feature
Master
Feature
Master
Merge Commit

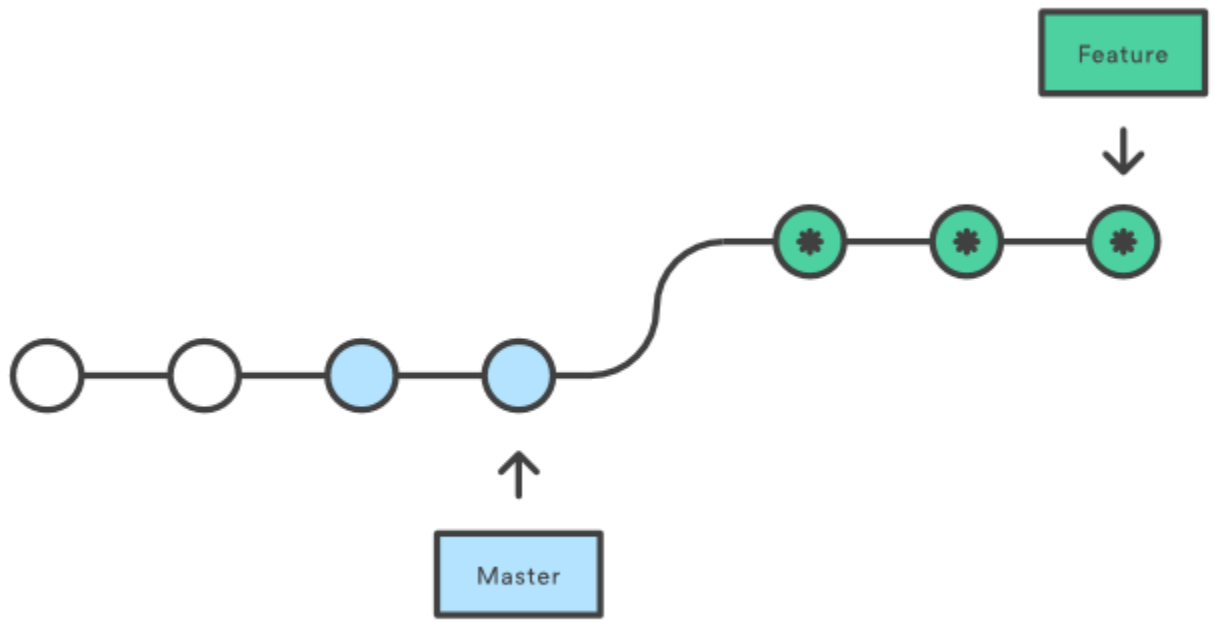
When to merge

- Update master branch with new functionality from a feature branch
- Feature branch track incremental changes in master branch

Conflicts!

Rebase



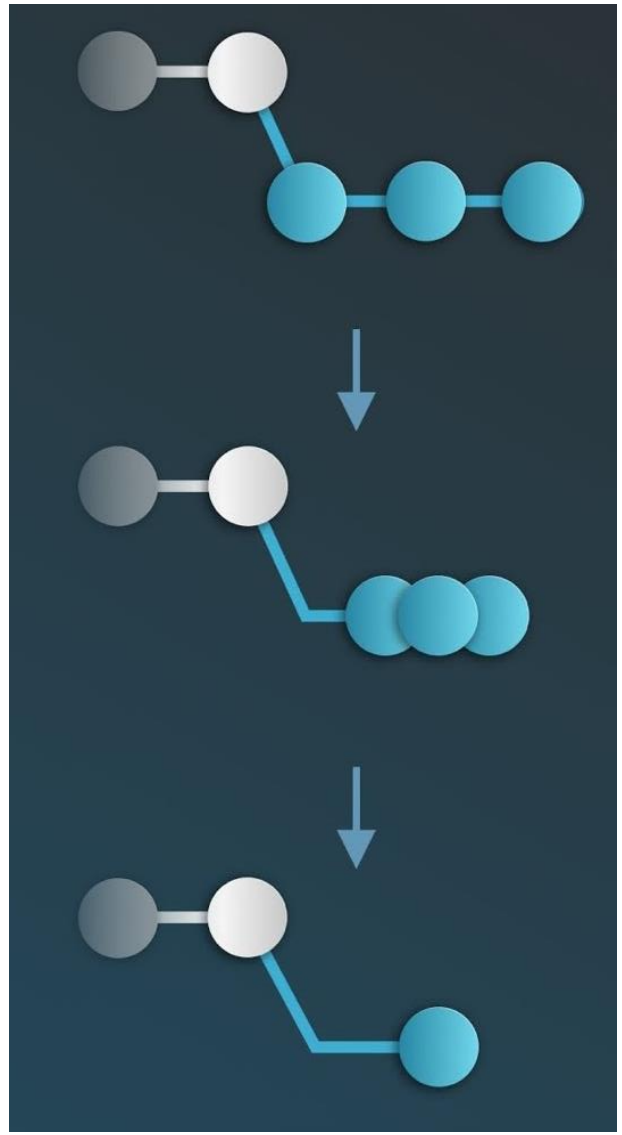


Brand New Commit

When to rebase

- Feature branch track incremental changes in master branch
- Want a clean logs and a linear history (different than merge)
- It's destructive, sha changes, commits are rewritten, tricky to undo

Squash



When to squash

- Fold two or more commits into one
- Prepare feature branch to be merged into master:
- Consolidate log
- Package up the commits so that code is in working condition.

Branching workflow

- Branch to try something new!
- Use rebase to incorporate any changes made in the master branch into your new feature branch
- When the feature branch is complete, clean up the history using squash (squash intermediate commits that are not in a working state, combine groups of commits)
- Merge the new feature into the master branch

Remotes and clone

Remotes and clone

- Remote: versions of your project hosted on the internet
  - Github
  - Gitlab
  - CFMM
- Clone: The command used to retrieve the repository

More resources

- Videos with tutorials and worked out examples
  - Linkedin learning: https://linkedinlearning.uwo.ca/
    Git essentials with Kevin Skoglund

- Git GUIs
  - Sourcetree
  - Smartgit

- Practice on fake files first!

- Come to Igor's tutorial on Friday

Interactive Staging

- Allows you to stage portions of files, interactively
- Even smaller, more focused commits
- Like a little program that lets you stage only the things you want
- Sometimes you fix multiple bugs at once, but you don't want those fixes to be grouped together in your log