[320] Version Control (git)

Tyler Caraza-Harter

Review

A running program is called a _____

fruits is a large list. Which will be faster?

1. fruits.insert(0, "pineapple") # adds to beginning of list
2. fruits.pop(-1) # removes from end of list

What is an example of resource that an operating system might allocate to a process?

what does a Python code usually need to worry more about matching?

1. hardware (especially CPU's instruction set)
2. operating system

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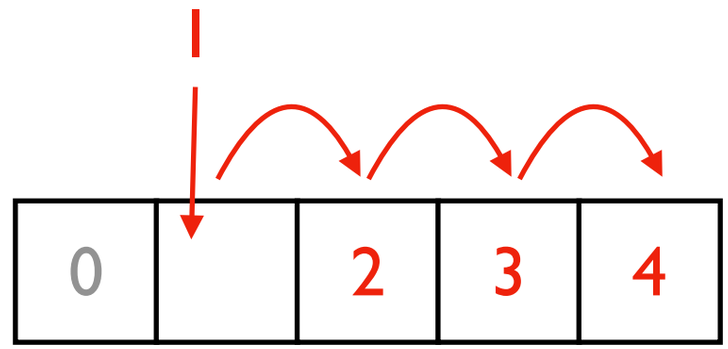

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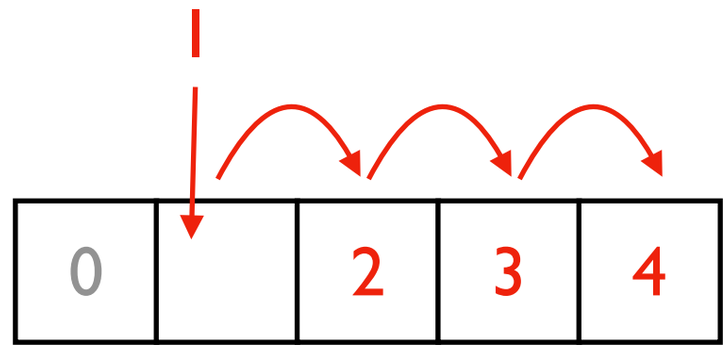

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time on CPU, space in memory, space in files, network bandwidth

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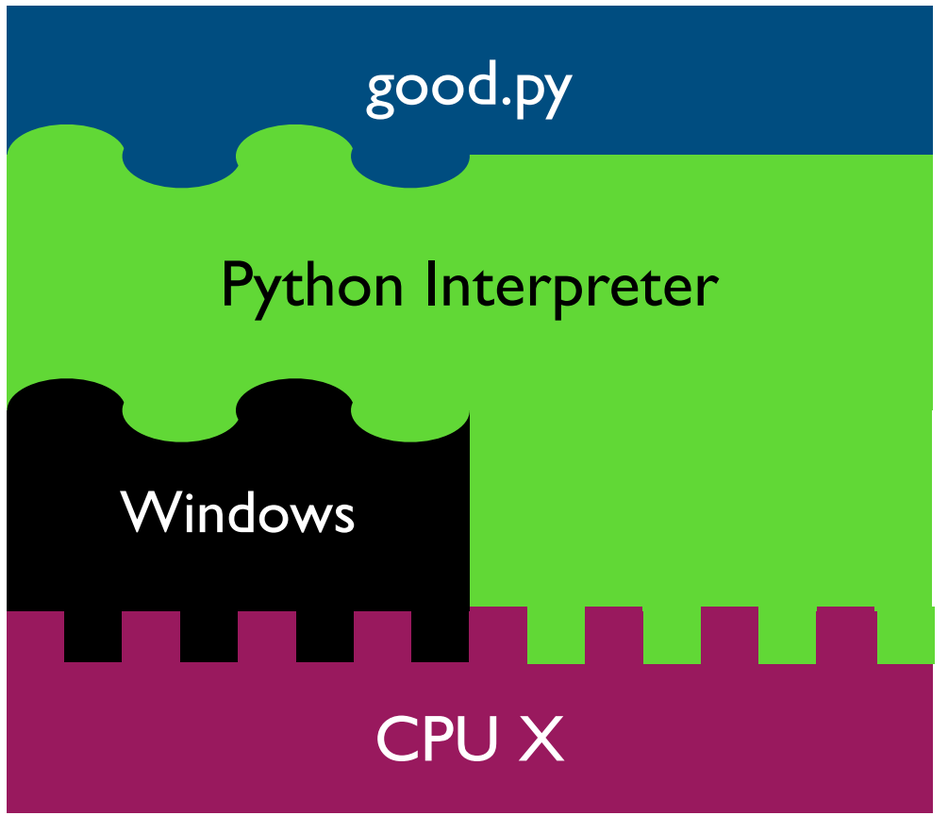

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1. hardware (especially CPU's instruction set)
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Reproducibility

Big question: *will my program run on someone else's computer?*

Things to match:

1. Hardware ← a program must fit the CPU; `python.exe` will do this, so `program.py` won't have to
2. Operating System ← we'll use Ubuntu Linux on virtual machines in the cloud
3. Dependencies ← today: versioning

Dependency Versions

this program "depends" on pandas

program.py

```
import os, sys, json
import pandas

import pandas

print("Pandas Version:", pandas.__version__)

# code that uses pandas
```

you can check a module version

behavior depends on which release was installed

```
pip install pandas
```

or

```
pip install pandas==0.25.1
```

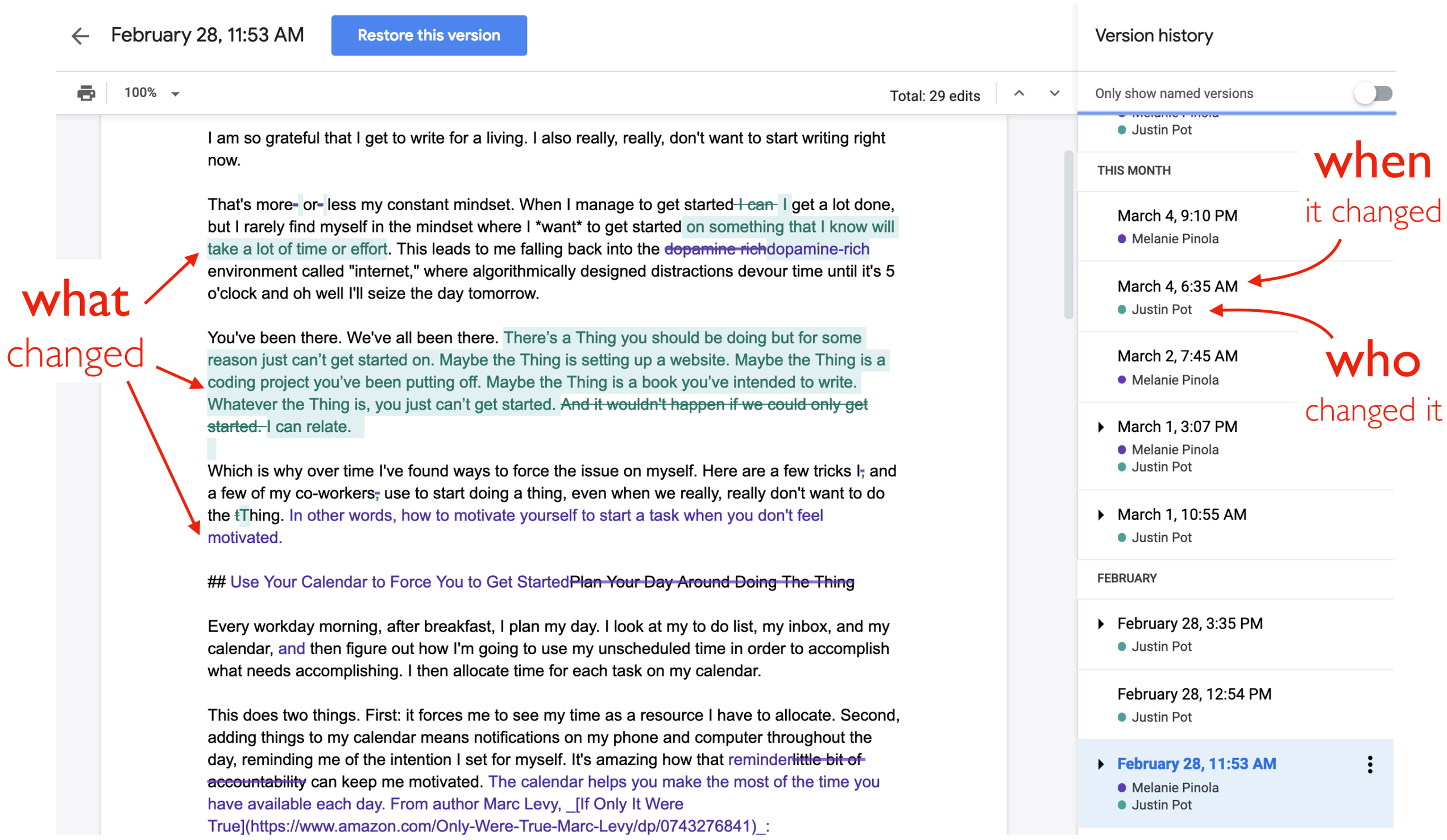
or

```
pip install pandas==0.24.0
```

or...

Versioning: motivation and basic concepts

Many tools auto-track history (e.g., Google Docs)



https://zapier.com/apps/google-docs/tutorials/google-docs-revision-history

Version Control Systems (VCS)

Useful for many kinds of projects

- code, papers, websites, etc
- manages all files for same project (maybe thousands) in a repository

Explicit snapshots/checkpoints, called *commits*

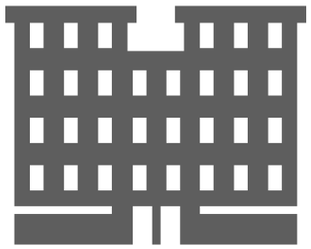
- users **manually** run commands to preserve good versions

Explicit **commit messages**

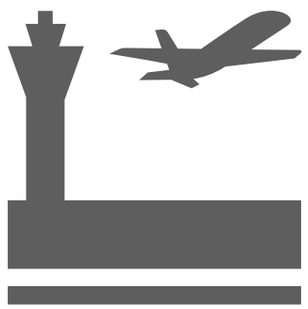
- who, what, when, **why**

Work can *branch* out and be *merged* back

- people can work offline
- can get feedback before merging
- humans need to resolve ***conflicts*** when versions being merged are too different



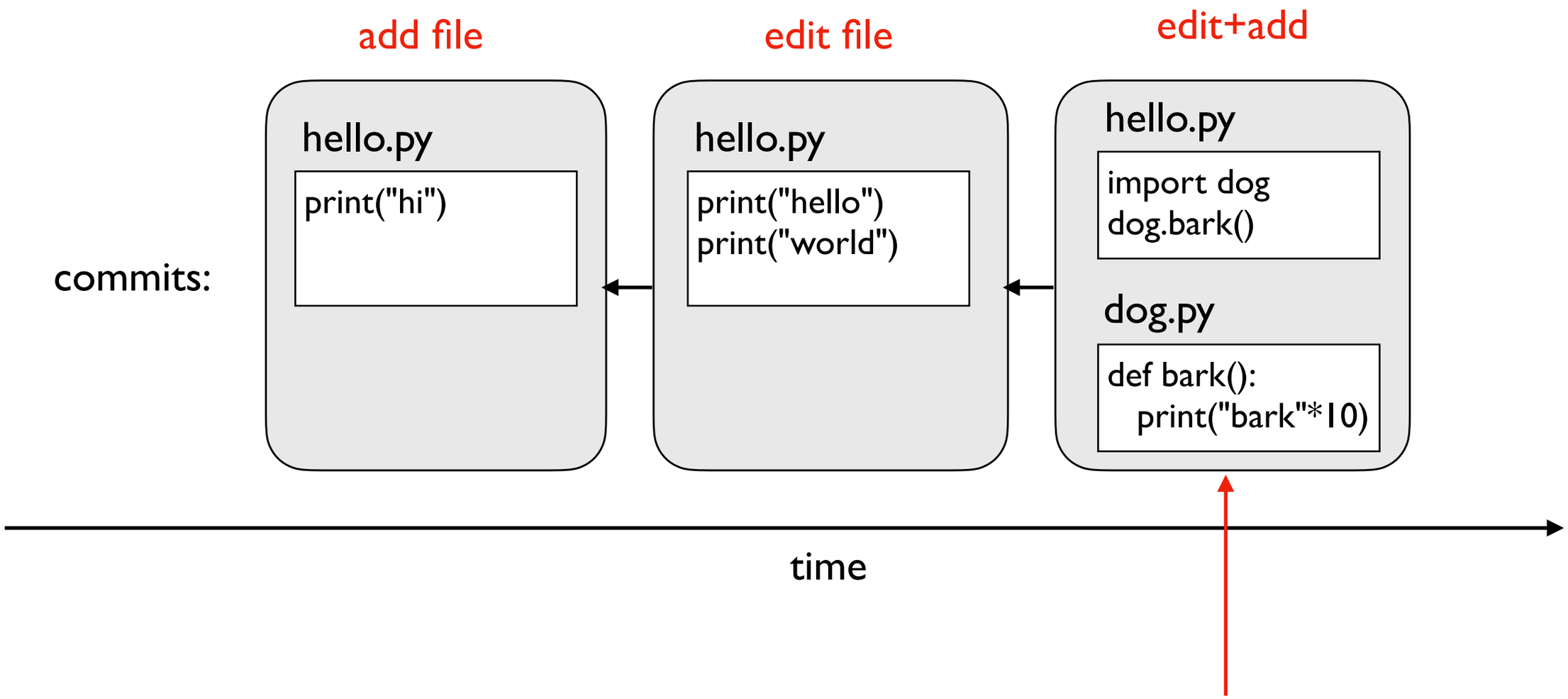
partner A working on `hw.py` at school



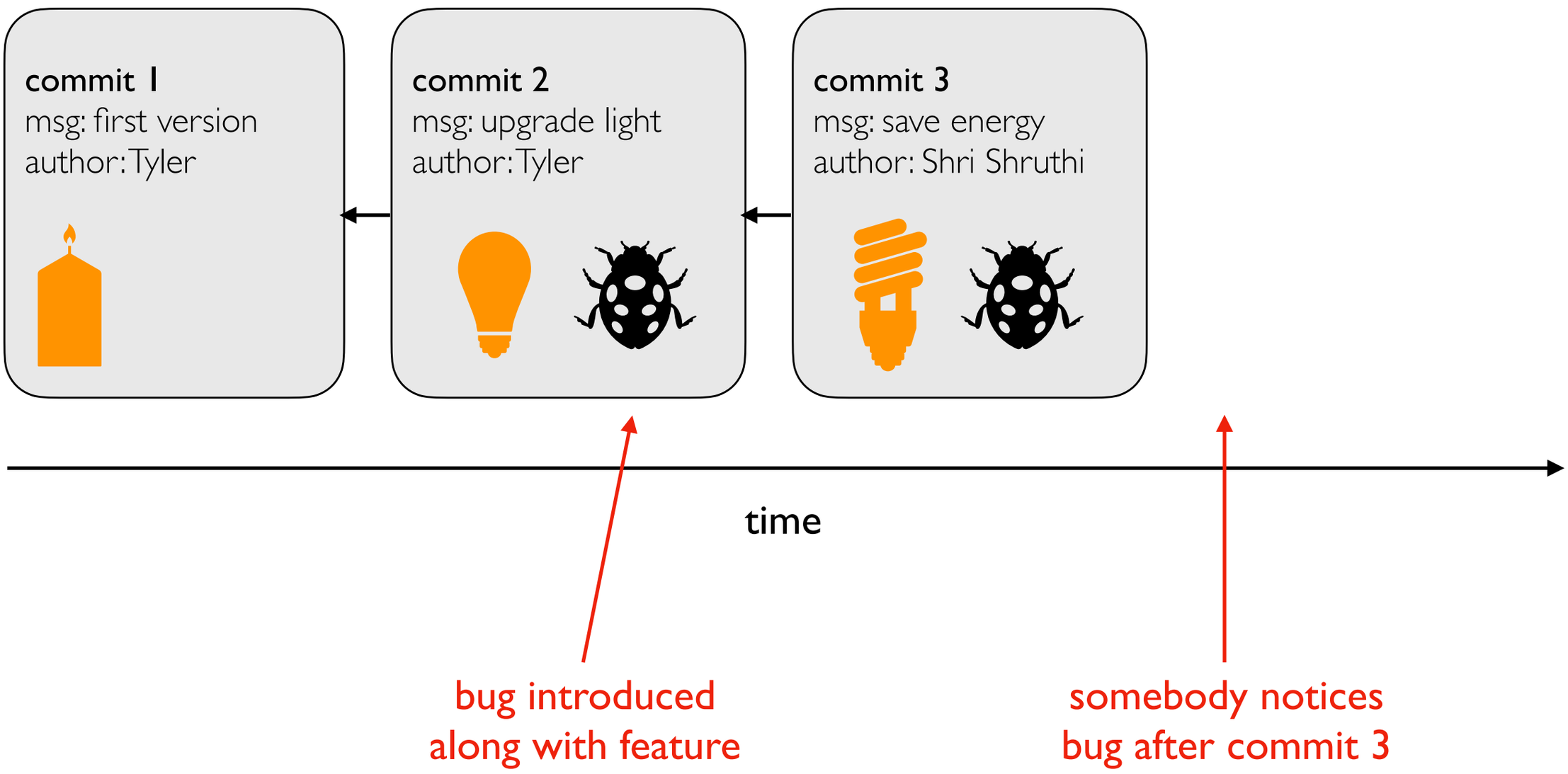
partner B also working on `hw.py`, without wifi

what happens when the plane lands?

Example

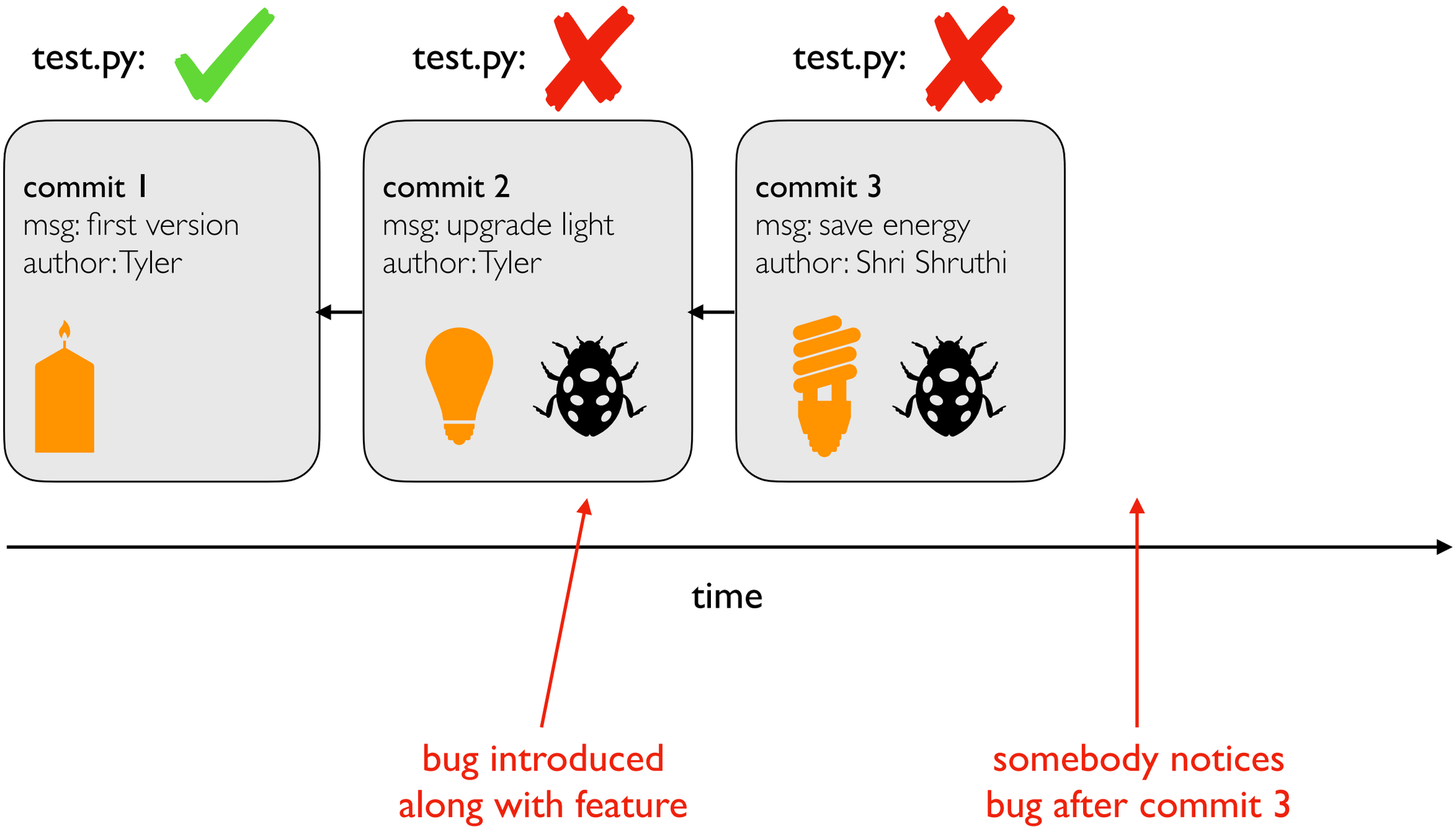

add file
edit file
edit+add
commits:
hello.py
print("hi")
hello.py
print("hello")
print("world")
hello.py
import dog
dog.bark()
dog.py
def bark():
print("bark"*10)
time
at any point in time,
you just see one version
of the files on your computer

Use case 1: troubleshooting discovered bug



who will get blamed?

Use case 1: troubleshooting discovered bug



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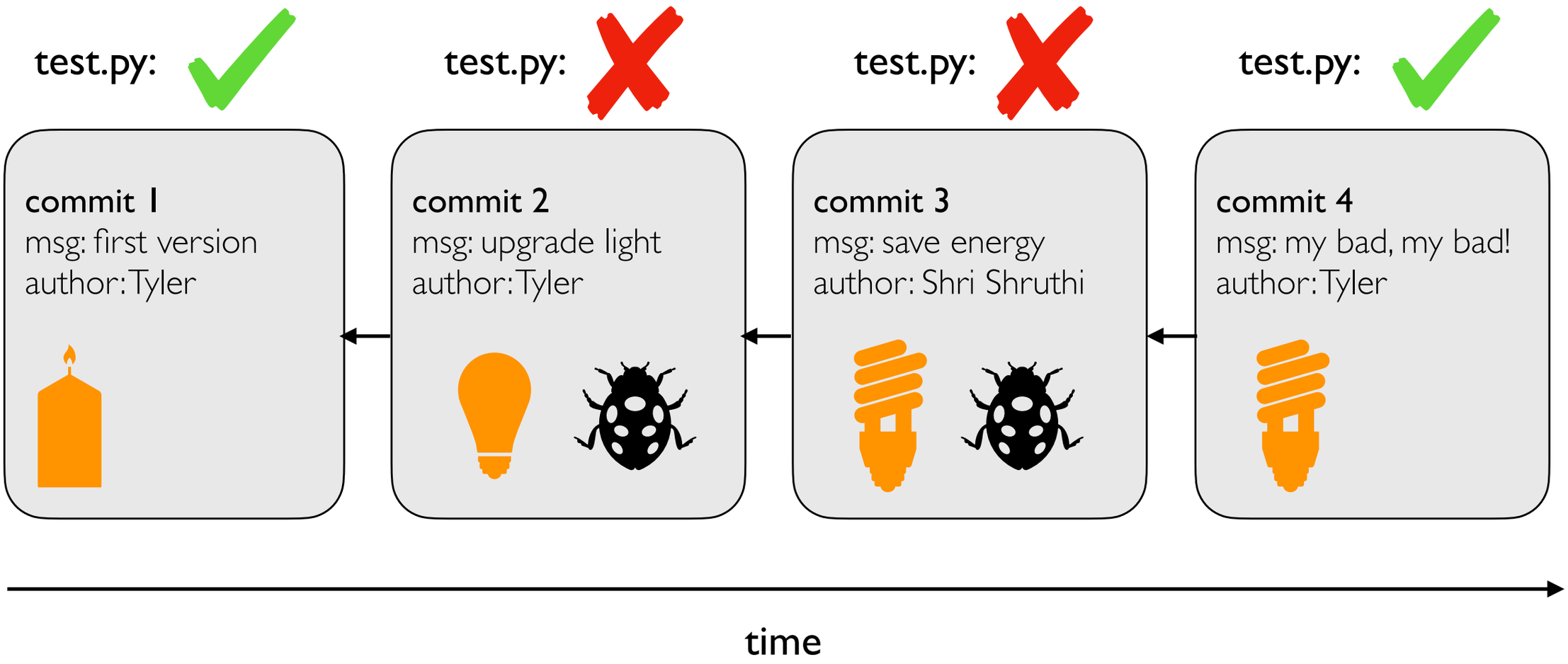
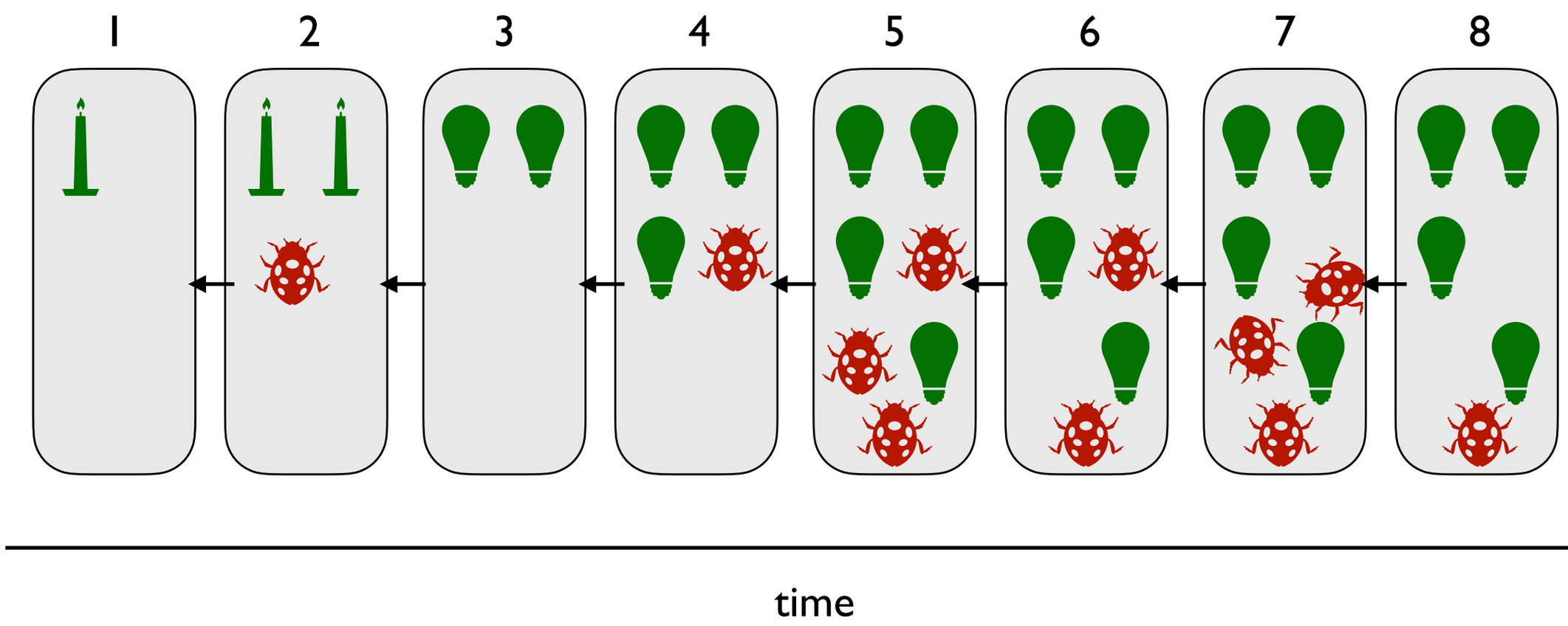
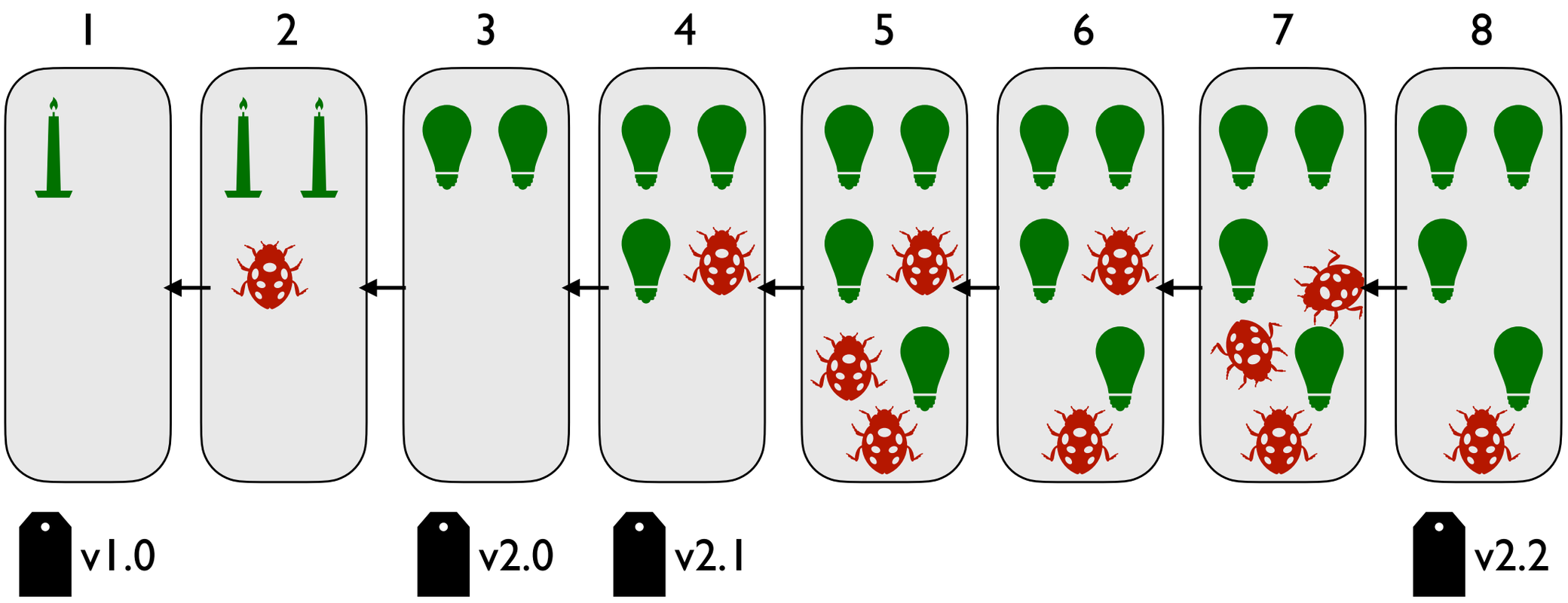


Use case 2: versioned releases



which version would you use?

Use case 2: versioned releases

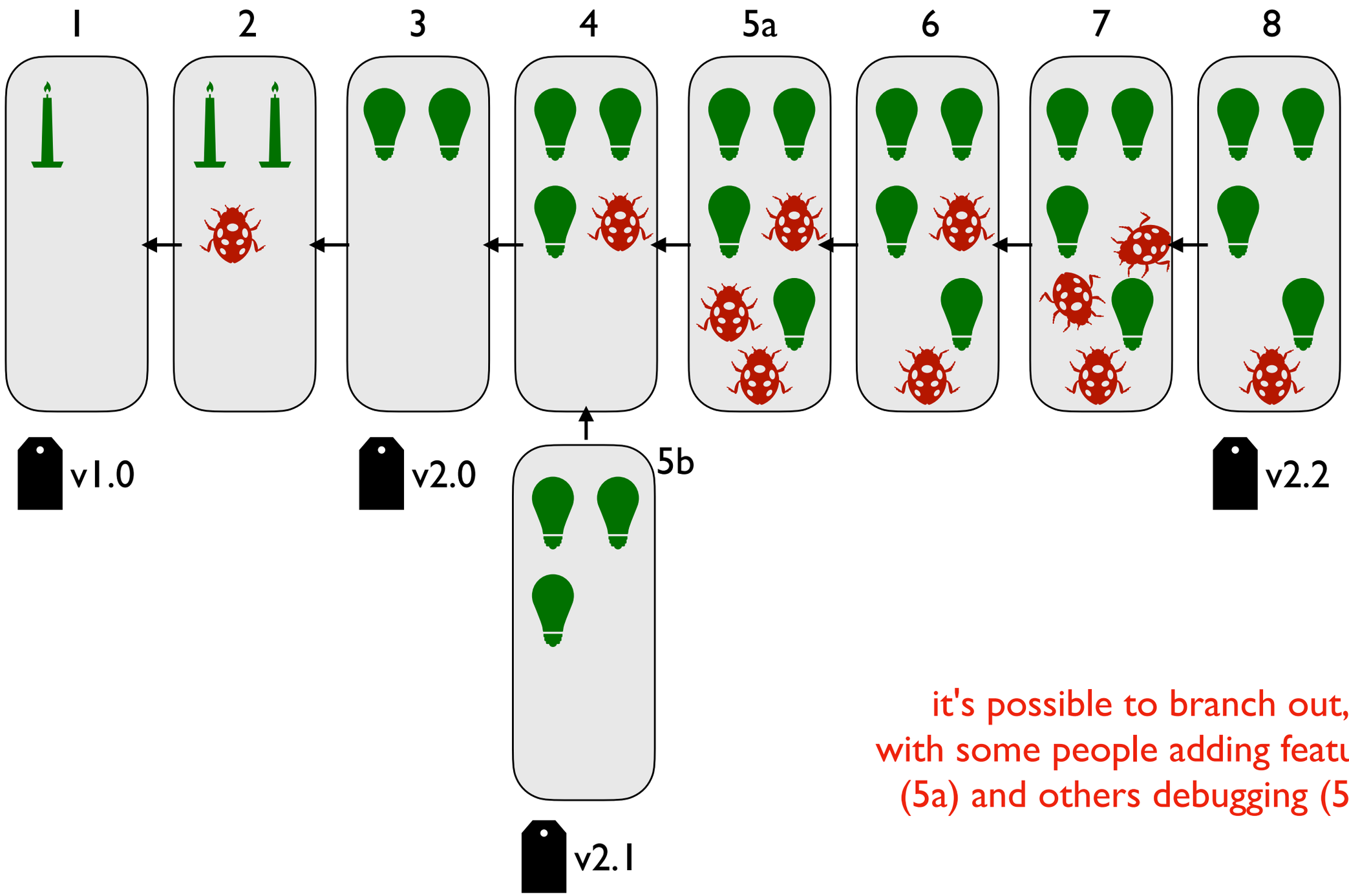


tag "good" commits to create releases

https://pypi.org/project/pandas/#history

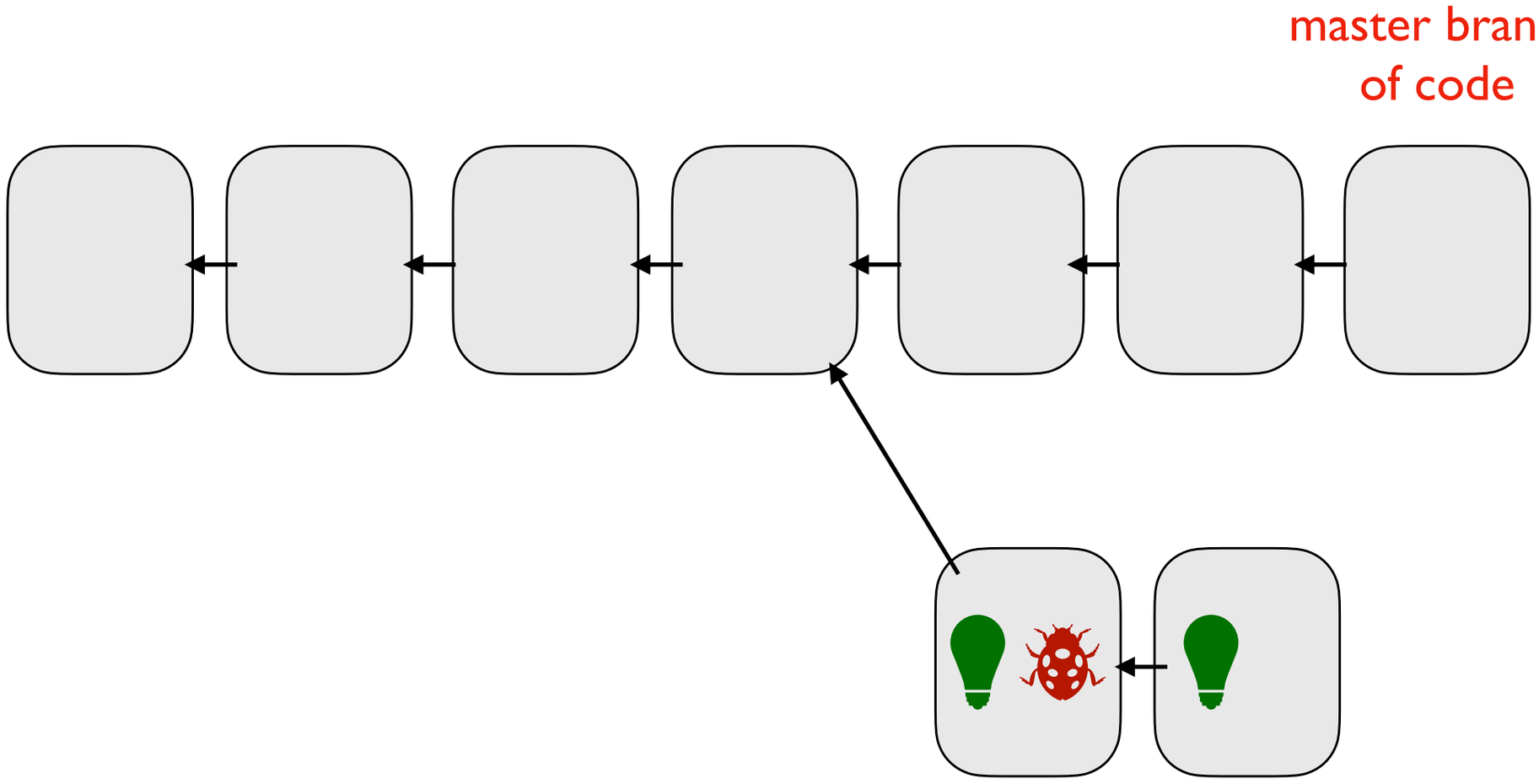
https://github.com/pandas-dev/pandas/releases

Use case 2: versioned releases



it's possible to branch out,
with some people adding features
(5a) and others debugging (5b)

Use case 3: feedback



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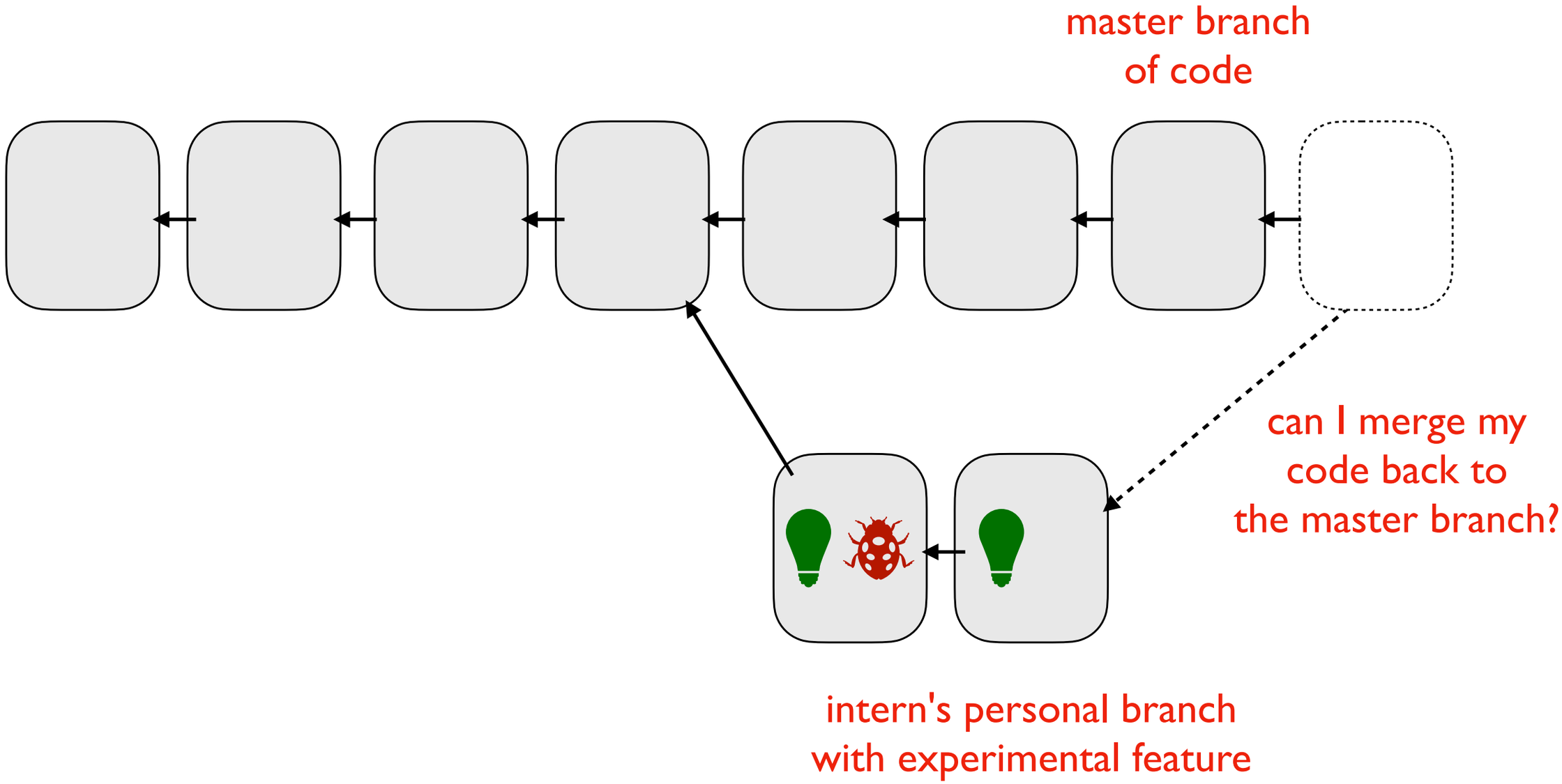


git

Version Control System Tools

tools

svn

git

Mercurial

TeamFoundation

git providers

GitLab

BitBucket

GitHub: signup for a free account for next weeks lab

- **do** choose a name that won't embarrass you on a resume
- **do not** post course work

Linus Torvalds developed git to manage Linux as a BitKeeper replacement

https://www.linuxjournal.com/content/25-years-later-interview-linus-torvalds

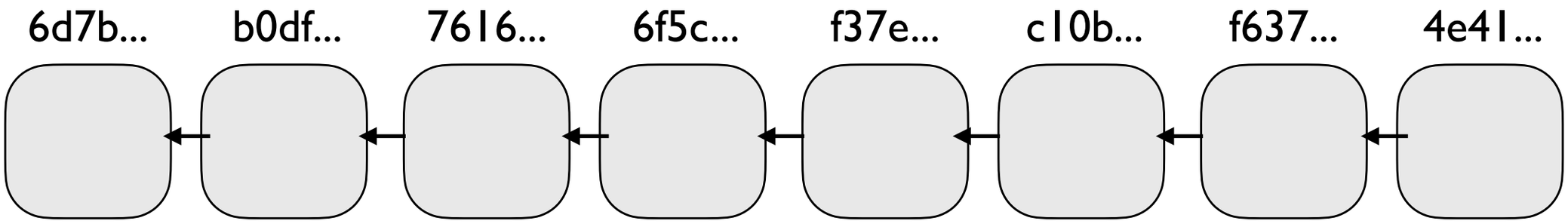
Viewing Commits

Download P1 repo (https://github.com/tylerharter/cs320-p1):

```
git clone https://github.com/tylerharter/cs320-p1.git
cd cs320-p1
```

View Commits (newest on top)

```
git log
git checkout ?????
```




```
commit 6d7beafb8e79b7a92fed8e67673a33bb7f607dbe
Author: Ada <ada@example.com>
Date:   Thu Jan 9 13:53:20 2020 -0600

    count a specific word
```

commit number in hexadecimal (hexsha)

commiter message

binary: 0,1
decimal: 0,1,2,3,4,5,6,7,8,9
hex: 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F

Creating Commits

Configure your name/email

```
git config --global user.name "Tyler"
git config --global user.name "tharter@wisc.edu"
```

View status of files

```
git status
```

Move file to staging

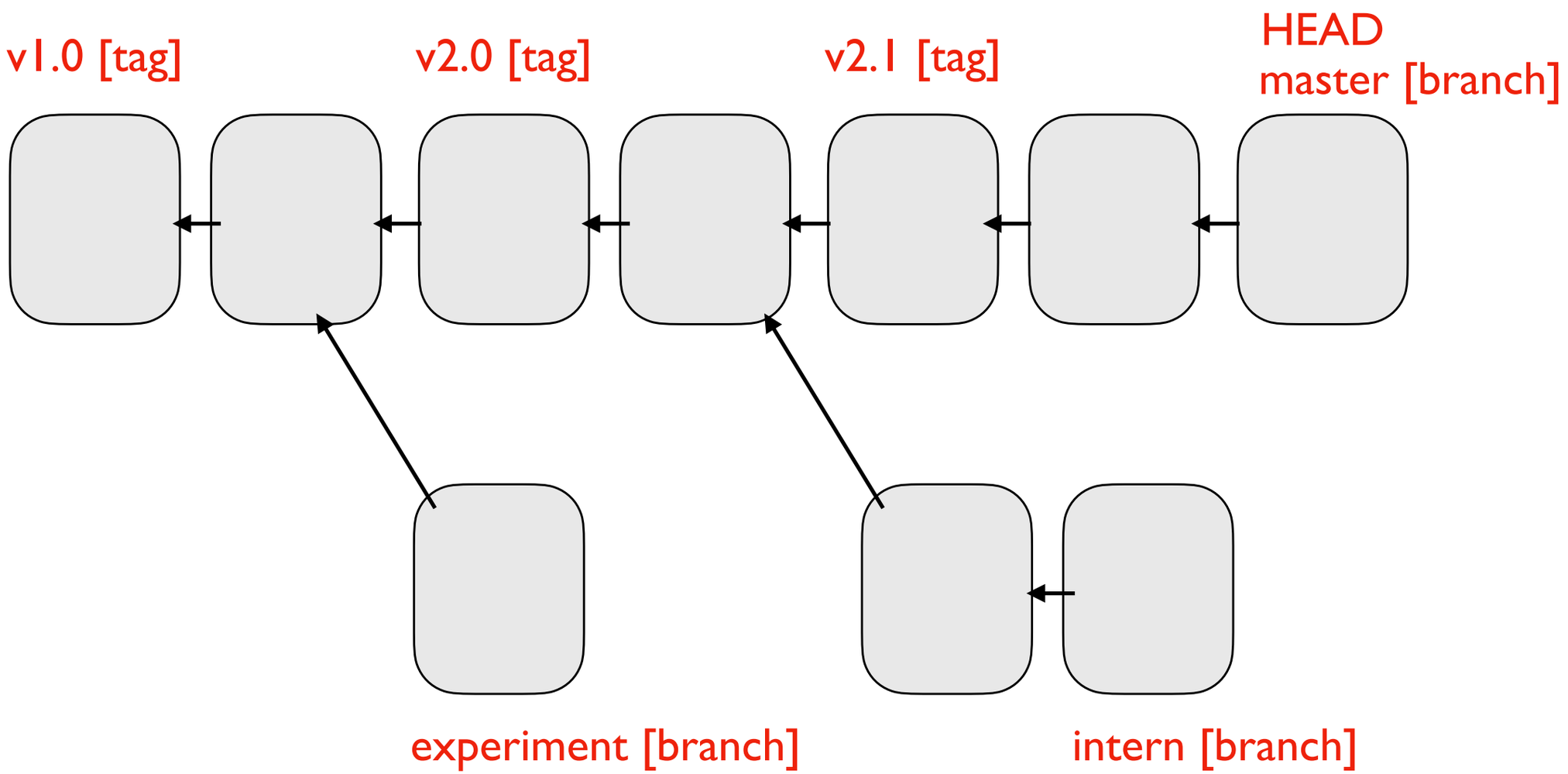
```
git add file.txt
```

Create a commit (take a snapshot of staged changes)

```
git commit -m "I made a change!"
```

HEAD, Branches, and Tags

Remembering commit numbers is a pain! Various kinds of labels can serve as easy-to-remember aliases



HEAD: wherever you currently are (only one of these)
tag: label tied to a specific commit number
branch: label tied to end of chain (moves upon new commits)

HEAD, Branches, and Tags

What branch are we on?

```
git branch
```

Create new branch

```
git branch branchname
```

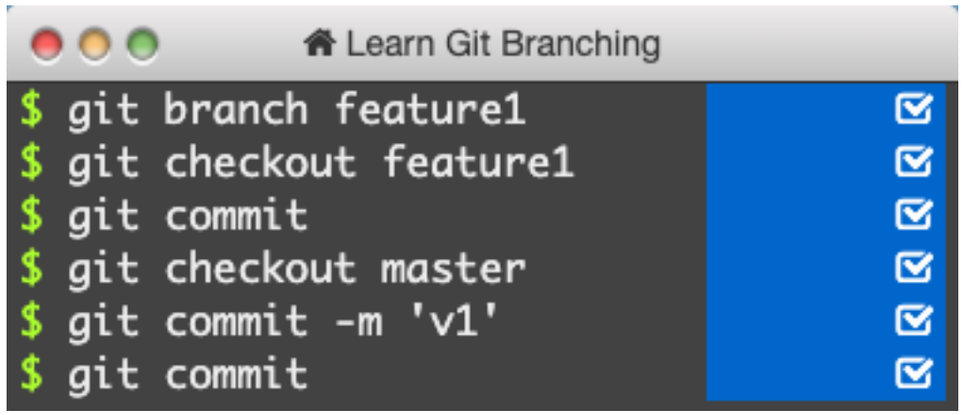
Switch branch

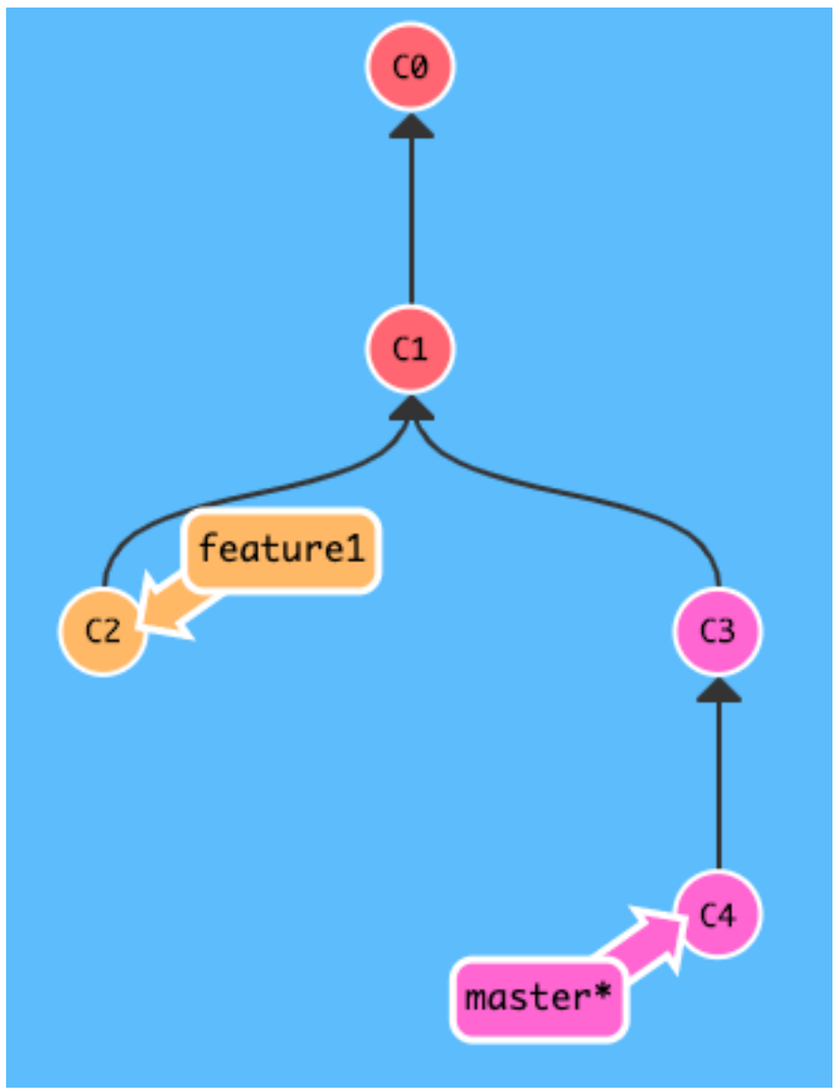
```
git checkout branchname
```

Practice Branching

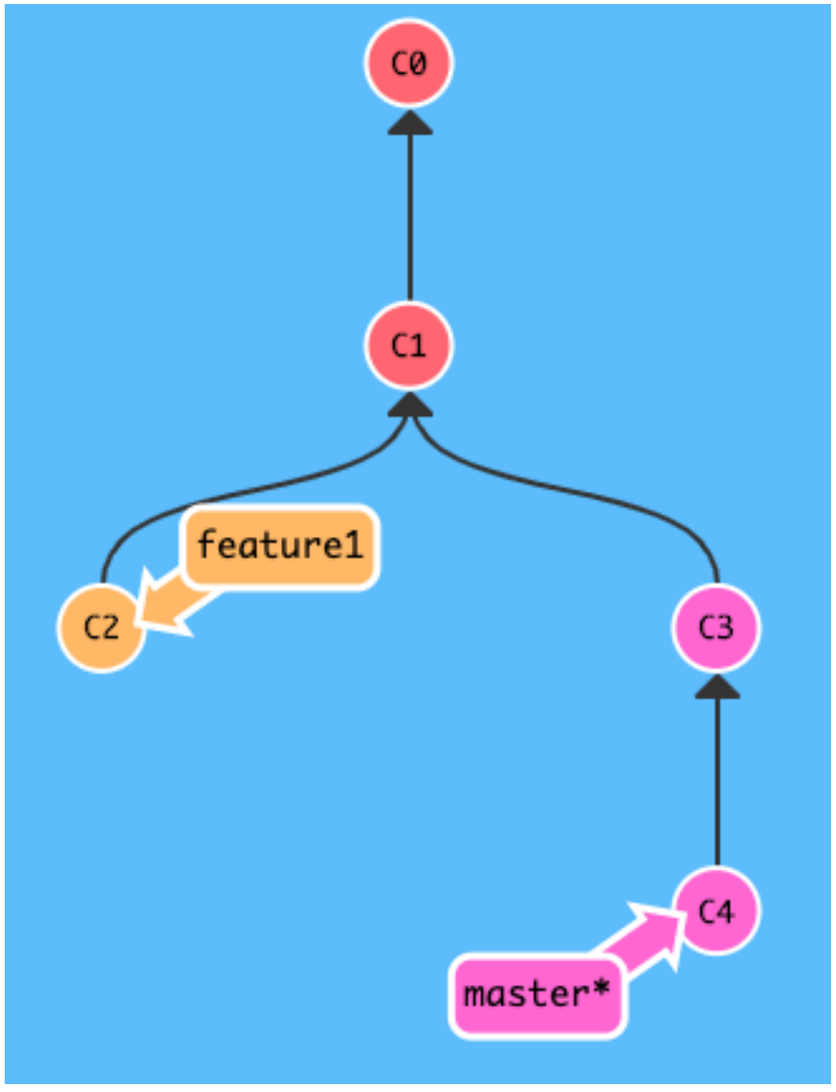
Git equivalent of PythonTutor:

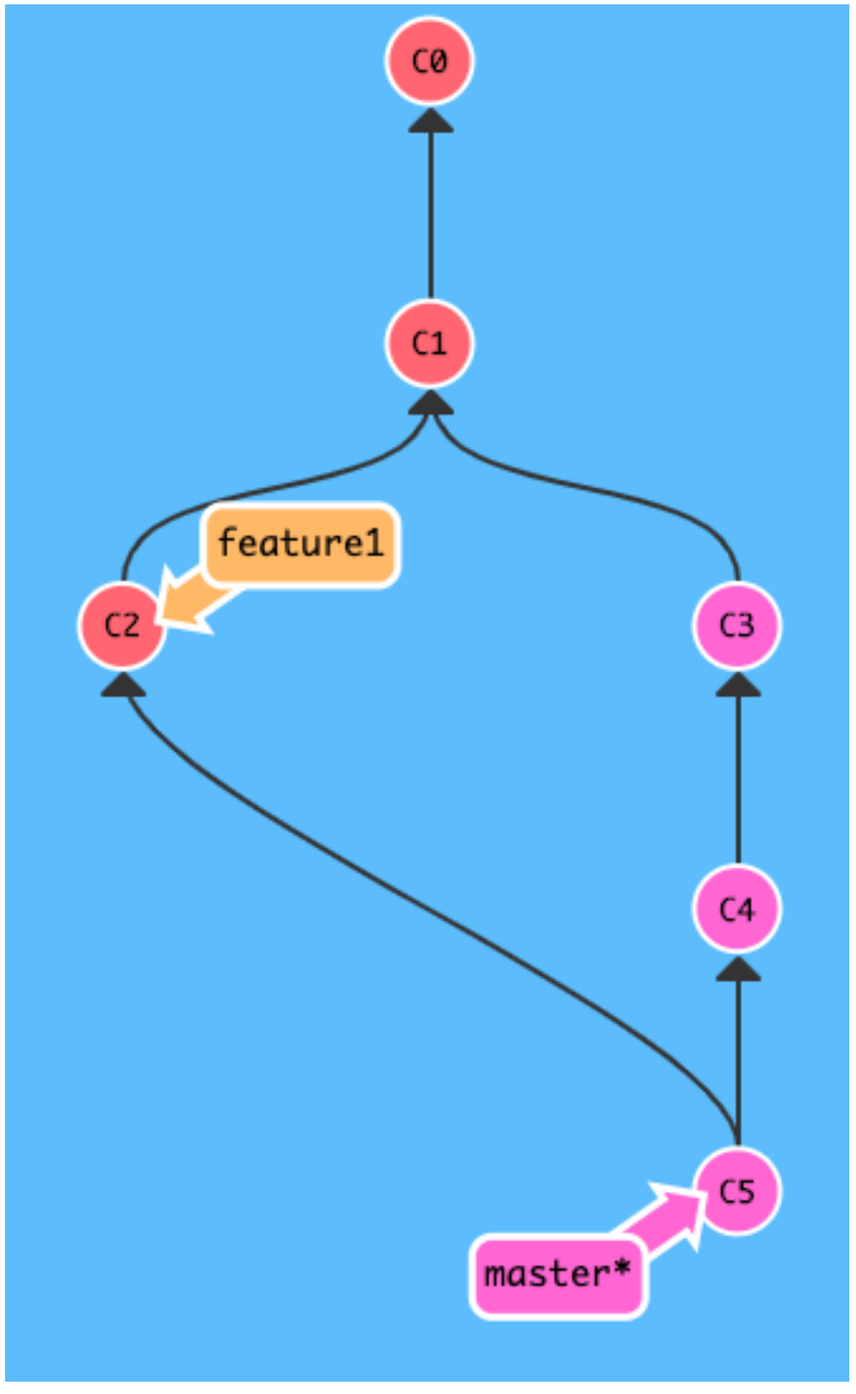
https://learngitbranching.js.org/?NODEMO





Merging without Conflicts





Switch branch

```
git merge frombranch
```

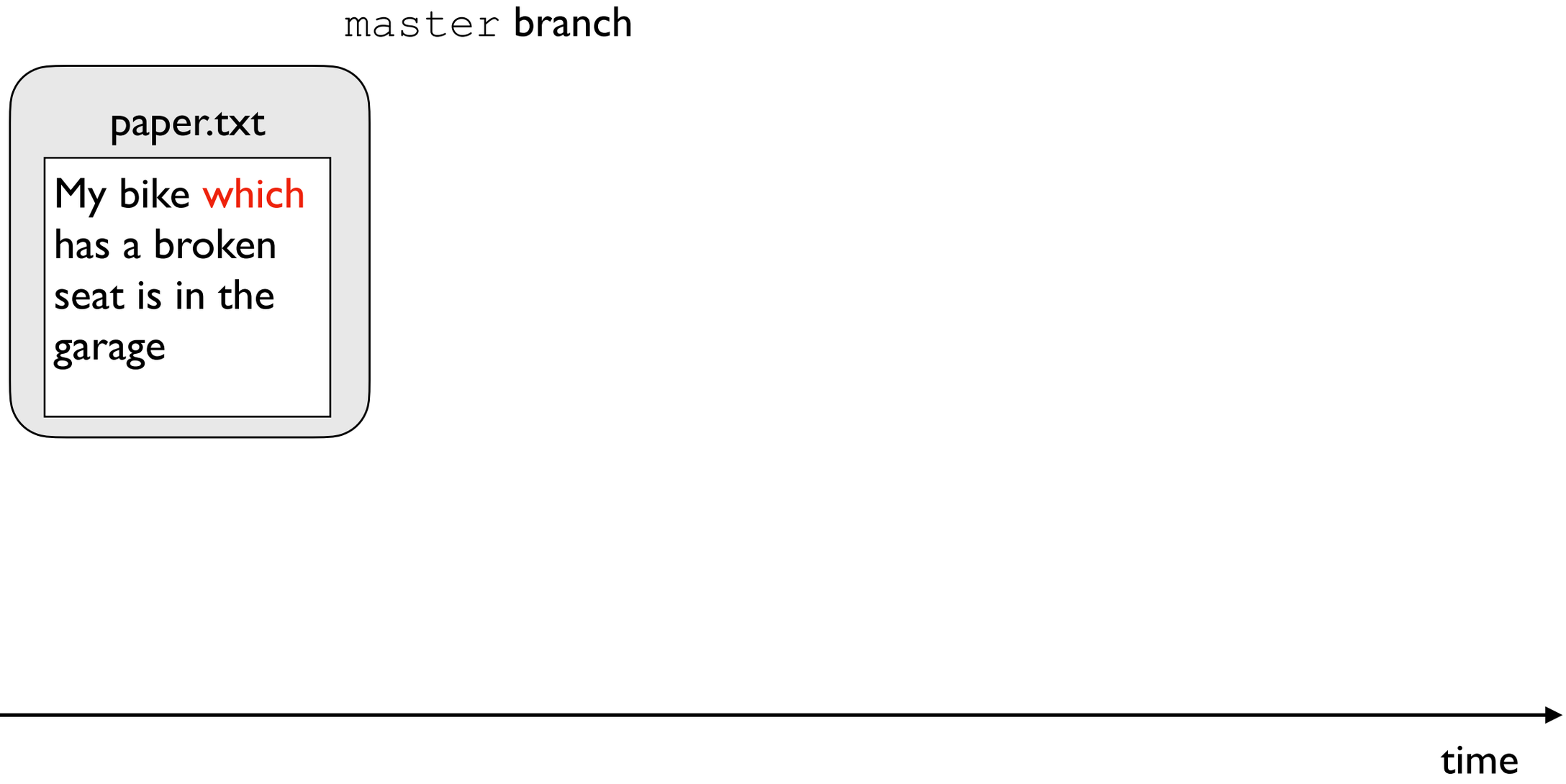
add whatever is there to the current branch

tip (or learn vim):

```
export EDITOR=nano
```

Merging with Conflicts

What happens when two people try to fix the same issue, in two different (incompatible) ways?



https://www.grammarly.com/blog/which-vs-that/

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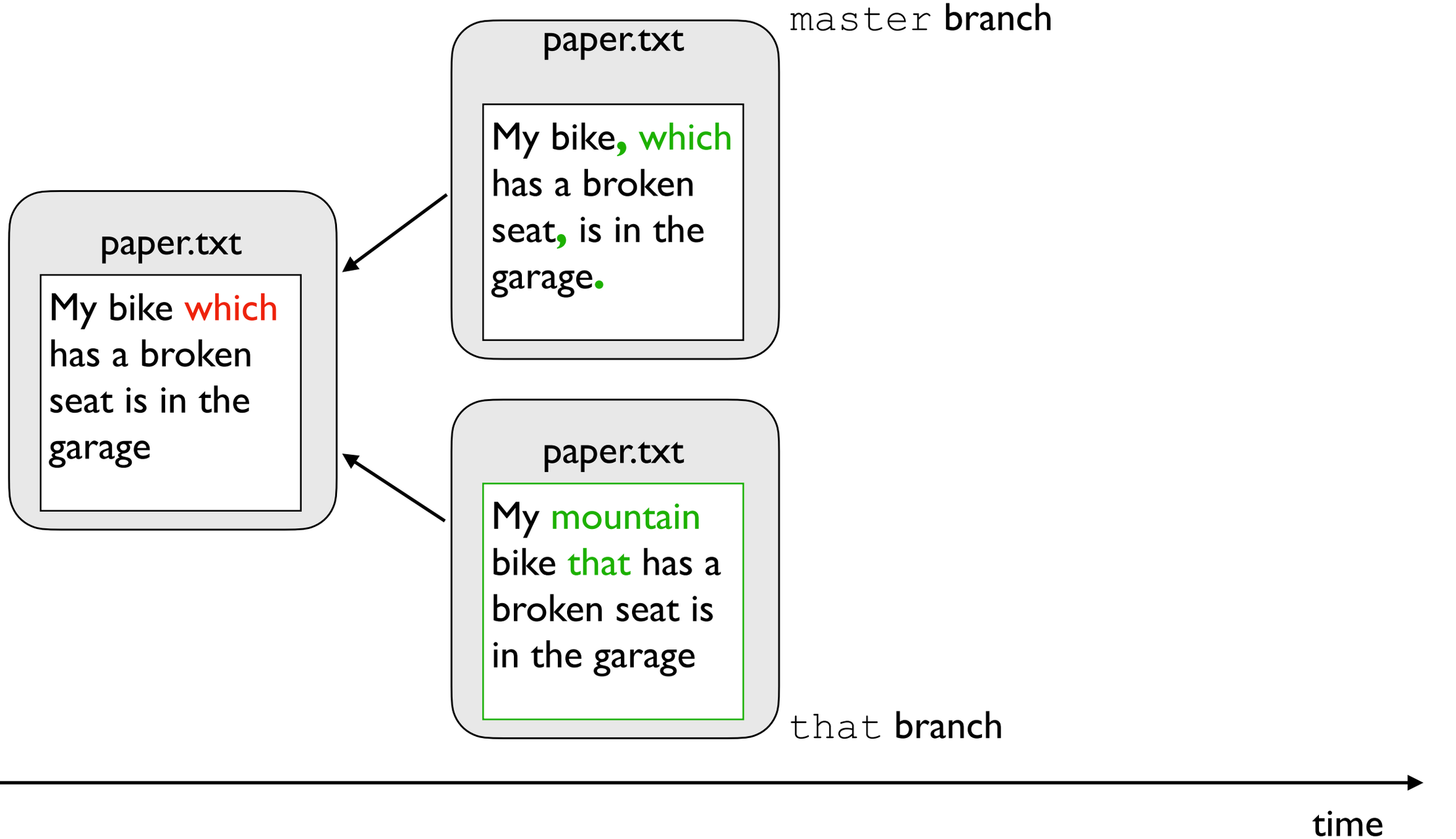

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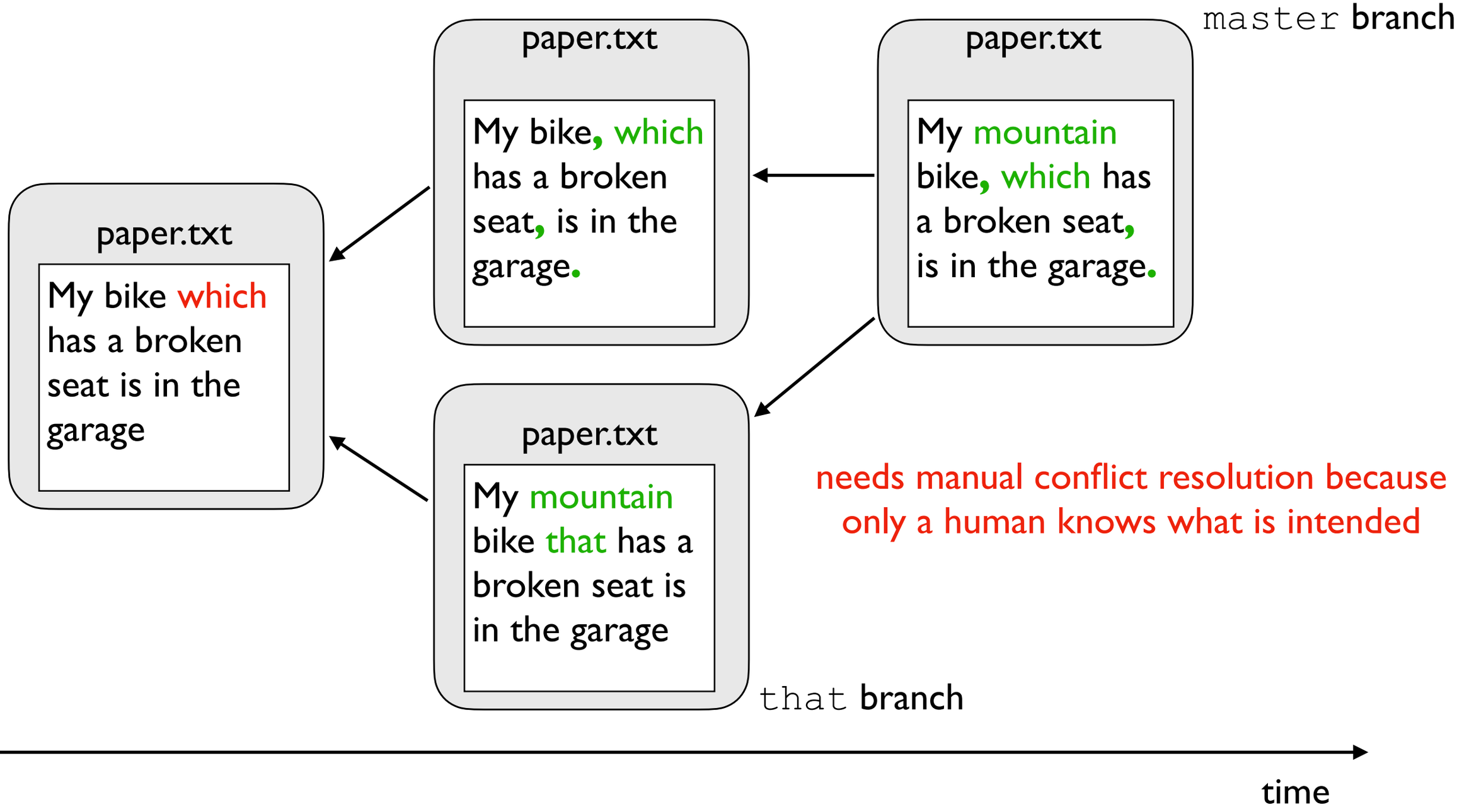

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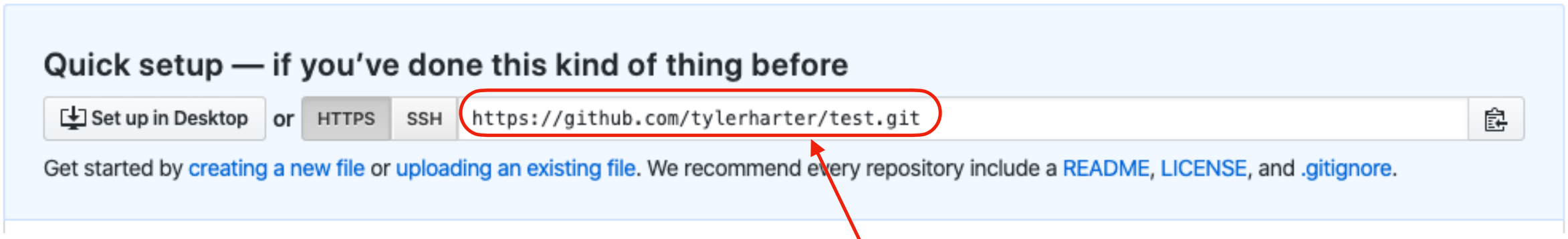
Remotes

We will often want to work on our laptops, but also have our repositories on GitHub (or similar)

Create GitHub account, go here: https://github.com/new



Pushing a branch to GitHub

```
git remote add github https://github.com/tylerharter/test.git

git push github master
```

remote name

branch name

see reading about naming in software

Summary of Terms

commit: a snapshot of files at a point in time

HEAD: a convenient label for the current commit

tag: a long-term label associated with a commit

branch: a label attached to a commit that re-attaches to new commits

merge: to combine changes on another branch into the current branch

conflict: differences that cannot automatically be merged

Challenges: https://learngitbranching.js.org/?NODEMO