Distributed Version Control

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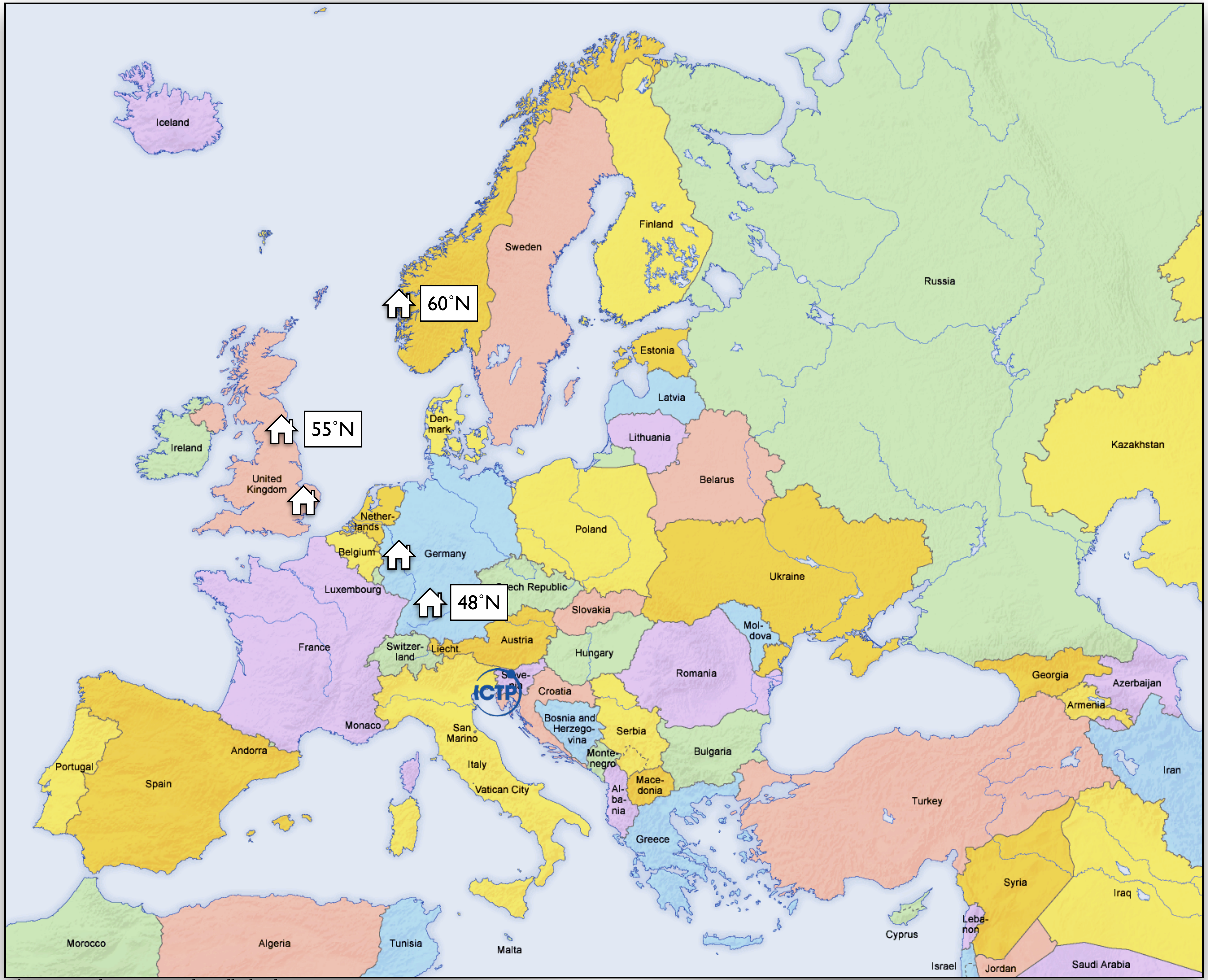
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Serbia
Monte-negro
Al-ba-nia
Mace-donia
Bulgaria
Greece
San Marino
Italy
Vatican City
Malta
Turkey
Georgia
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Algeria
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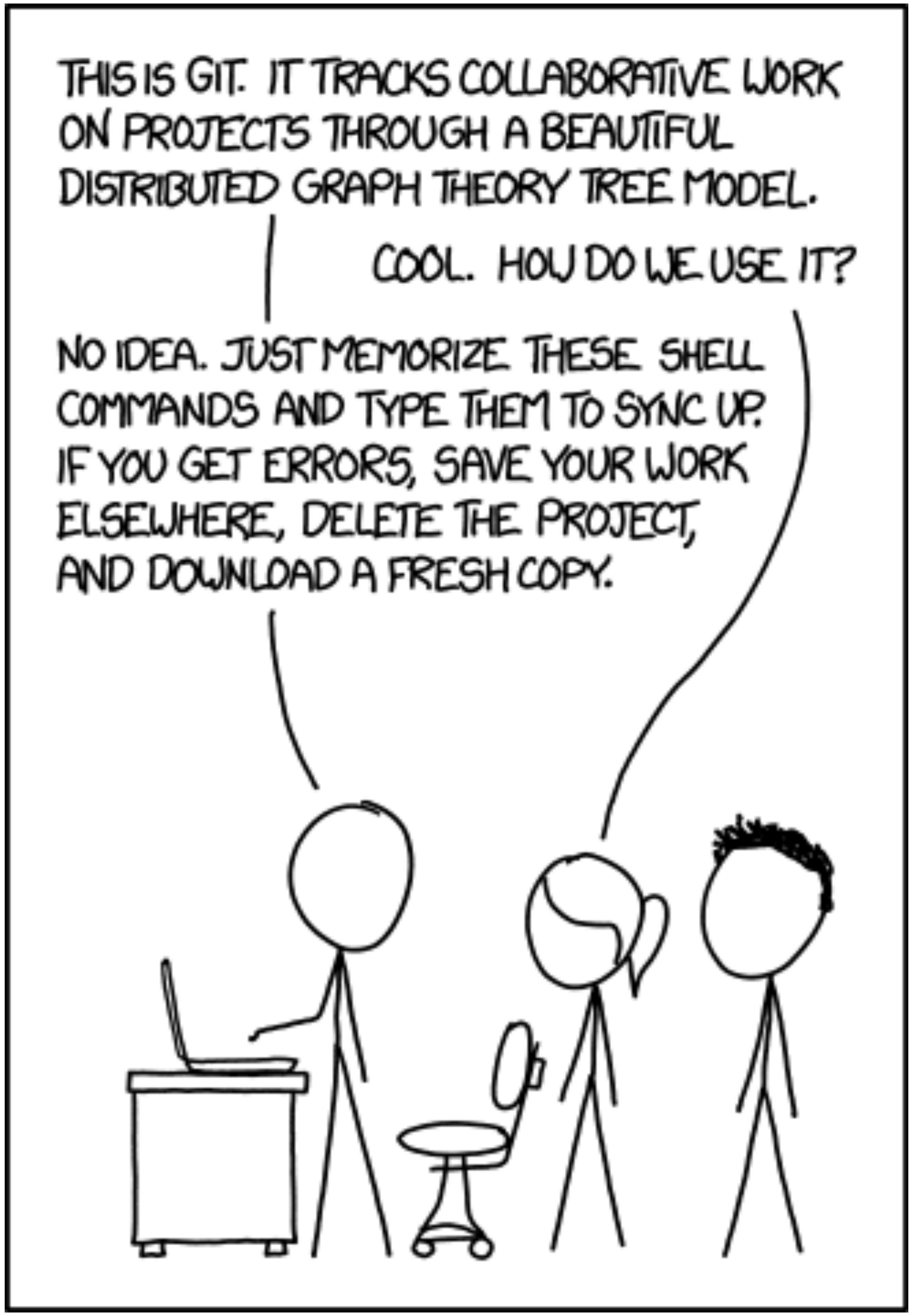

THIS IS GIT. IT TRACKS COLLABORATIVE WORK ON PROJECTS THROUGH A BEAUTIFUL DISTRIBUTED GRAPH THEORY TREE MODEL.
COOL. HOW DO WE USE IT?
NO IDEA. JUST MEMORIZE THESE SHELL COMMANDS AND TYPE THEM TO SYNC UP. IF YOU GET ERRORS, SAVE YOUR WORK ELSEWHERE, DELETE THE PROJECT, AND DOWNLOAD A FRESH COPY.

xkcd 1597

Version management

In any project, there are tedious bookkeeping tasks that need to be done:

* Backup of consistent project snapshots
* Documentation of changes
* Sharing of changes
* Distributed development by multiple people and/or in multiple locations
* Bug tracing through development history

Task automation

The bookkeeping can be done

- by hand: copy things into renamed files
- locally: keep versions in a DB of some form
- centrally: a server keeps the DB, clients do the work
- distributed: each client holds a full copy of the DB

Tool history

Only showing commonly used free/OSS tools:

- local:
  RCS (1982)
- central:
  CVS (1990), SVN (2000)
- distributed:
  Darcs (2002), Bazaar, Git, Mercurial (all 2005)

Frontends and visualization

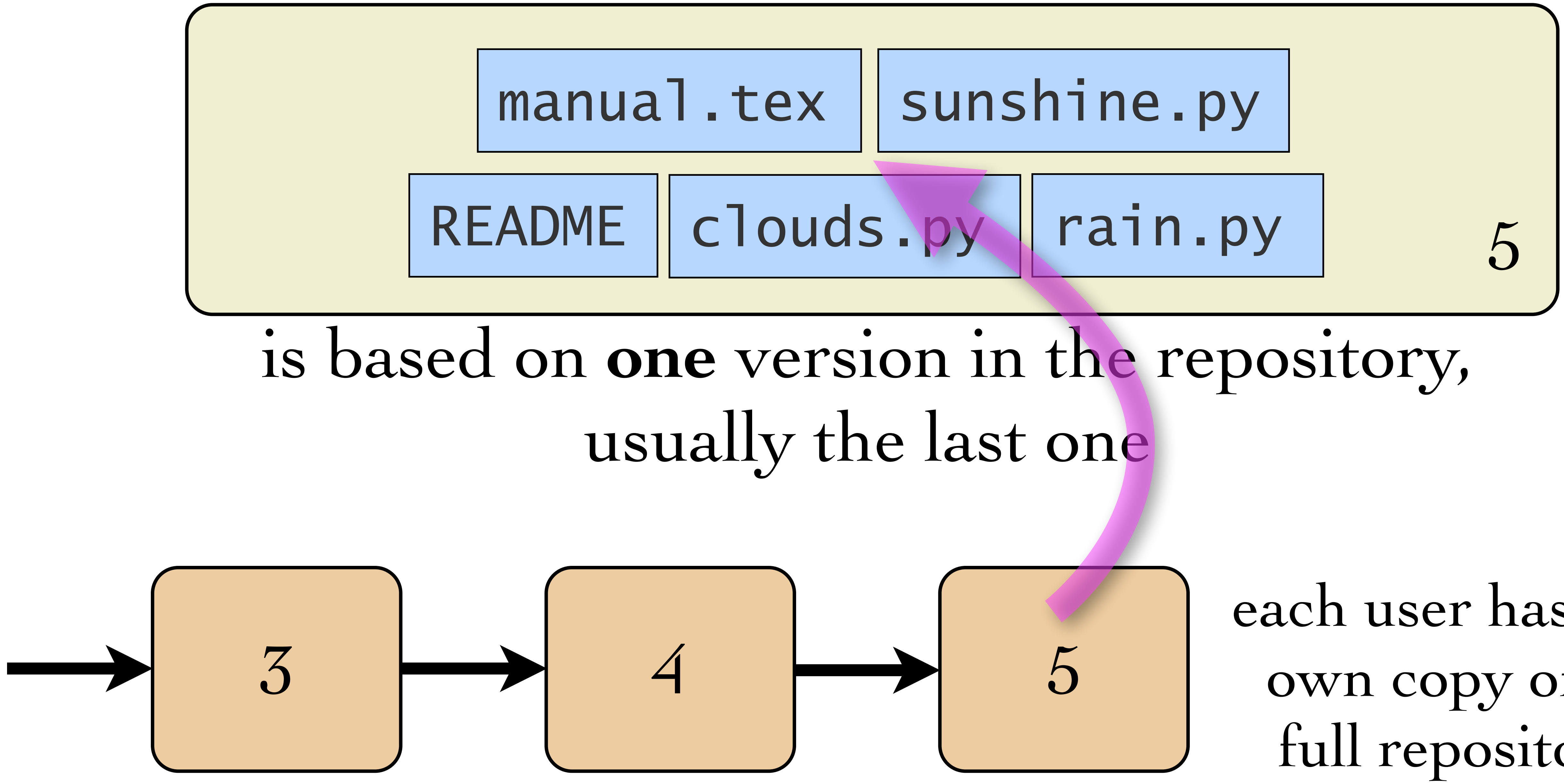
- Mercurial has built-in `hg serve`
- Many other GUI frontends available,
  try a few to find something you like
- Github / Bitbucket / Gitlab additionally give full project management tools, but keep a second repo elsewhere!

Terminology

* Working copy
* Repository (local, remote)
* checkout, checkin — update, commit
* pull, push
* branch, merge

Working directory

one version of the project, visible to be edited

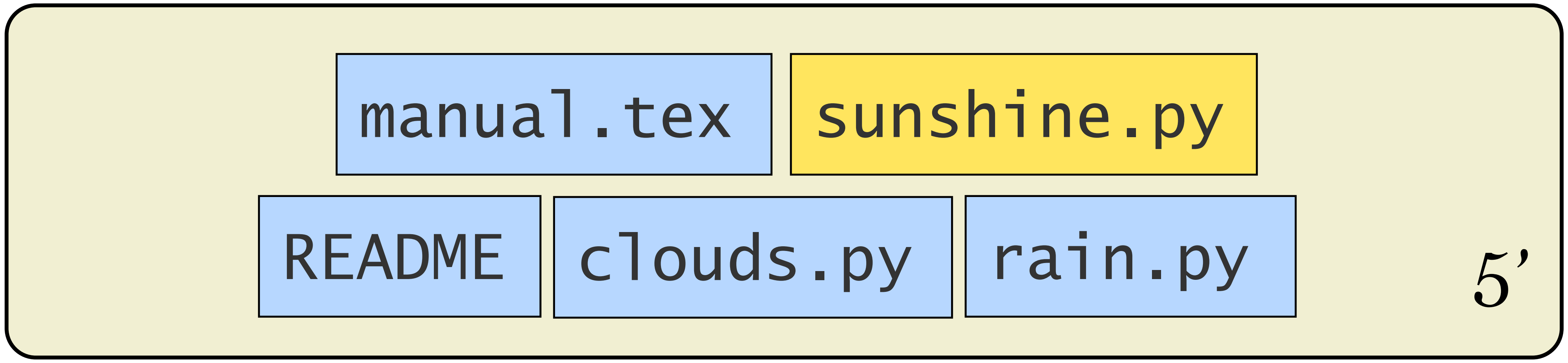


is based on **one** version in the repository, usually the last one

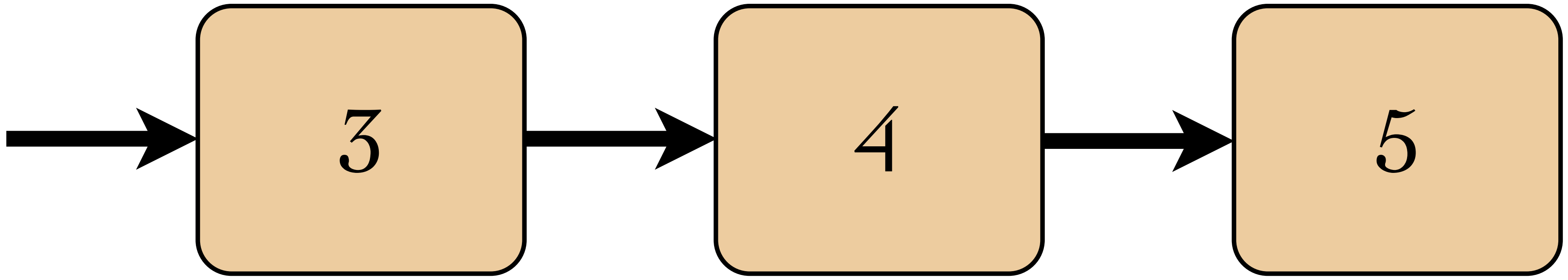
each user has their own copy of the full repository!

Changes

working copy can be changed as usual



changes are then checked in / committed as a new version



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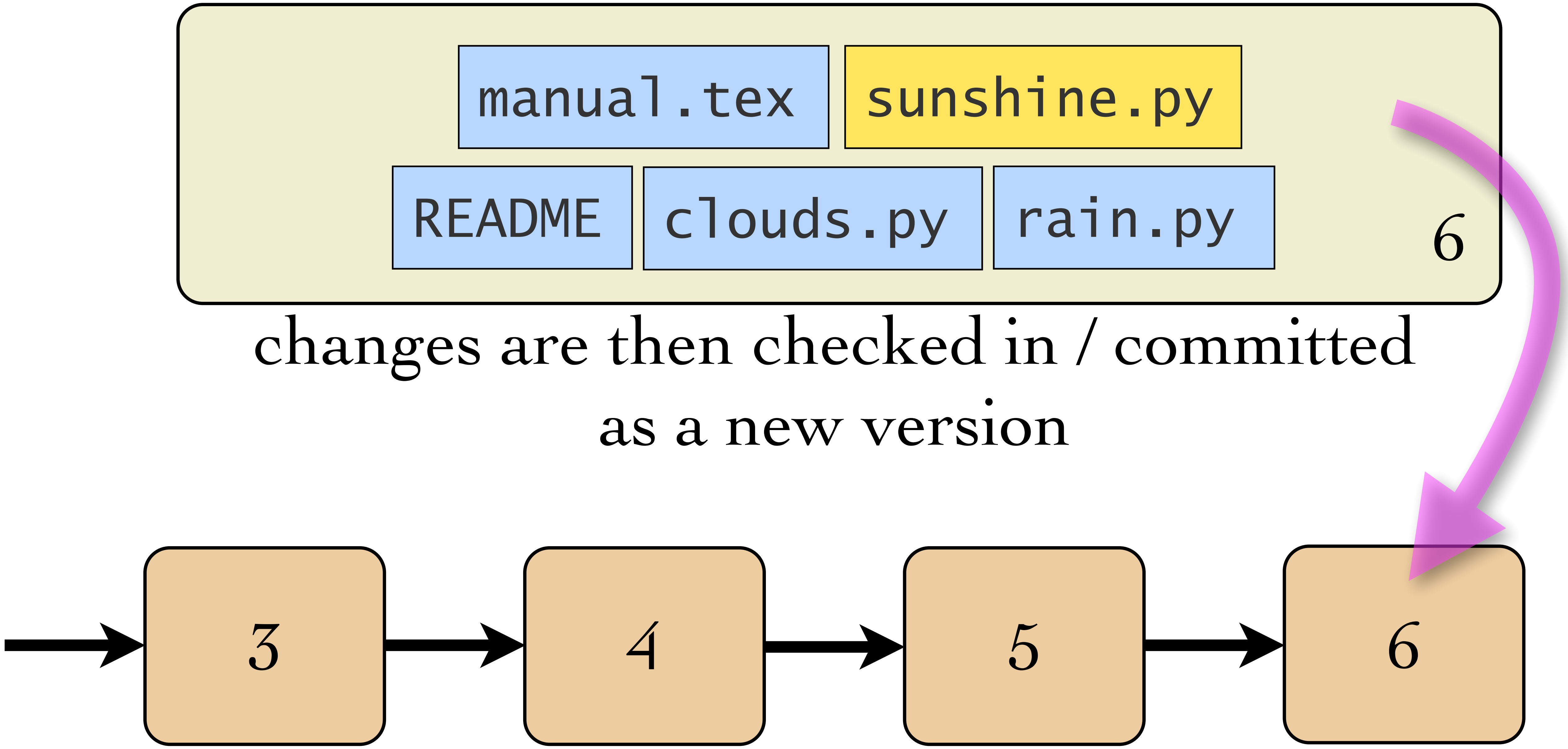

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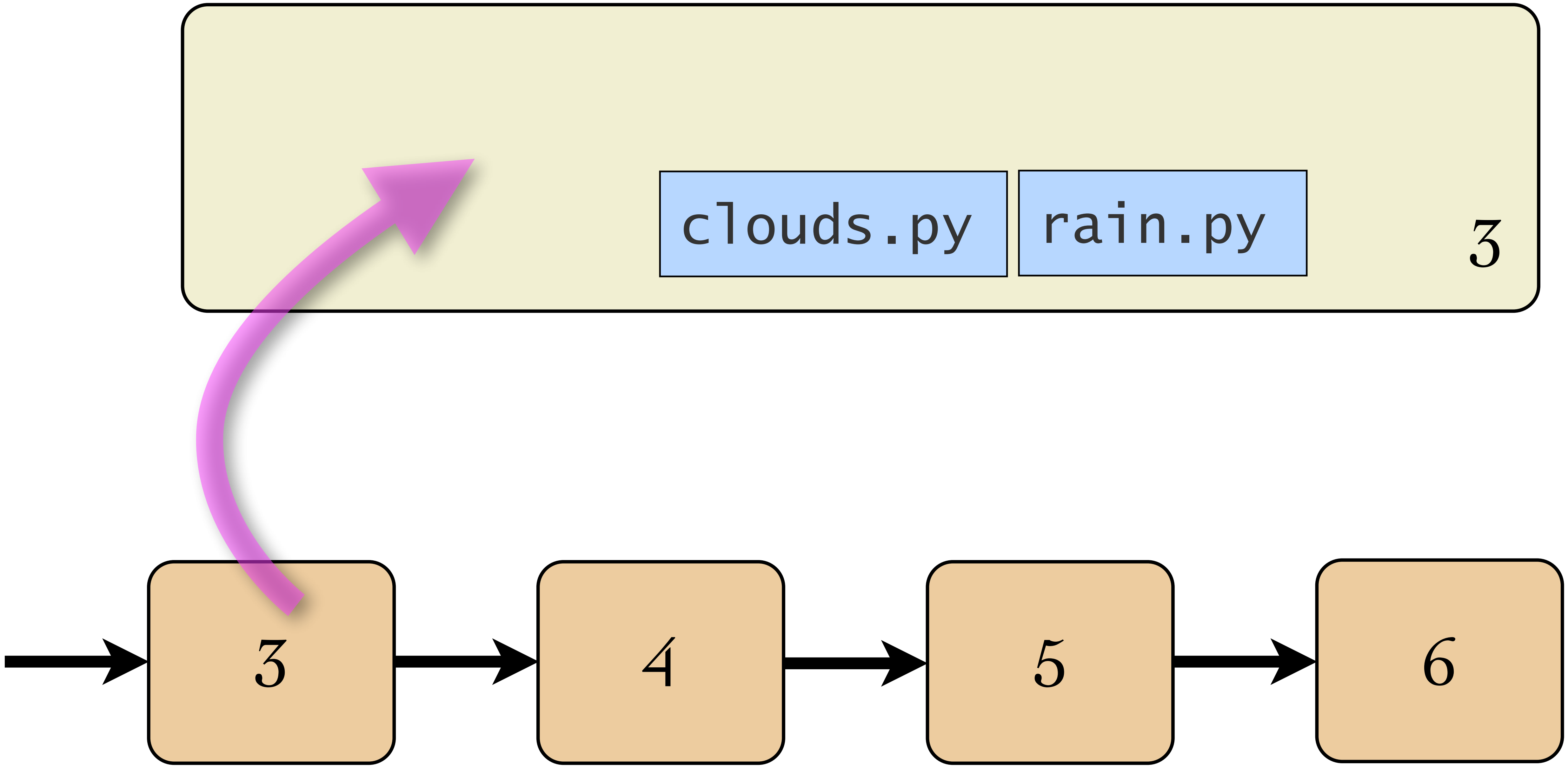
changeset

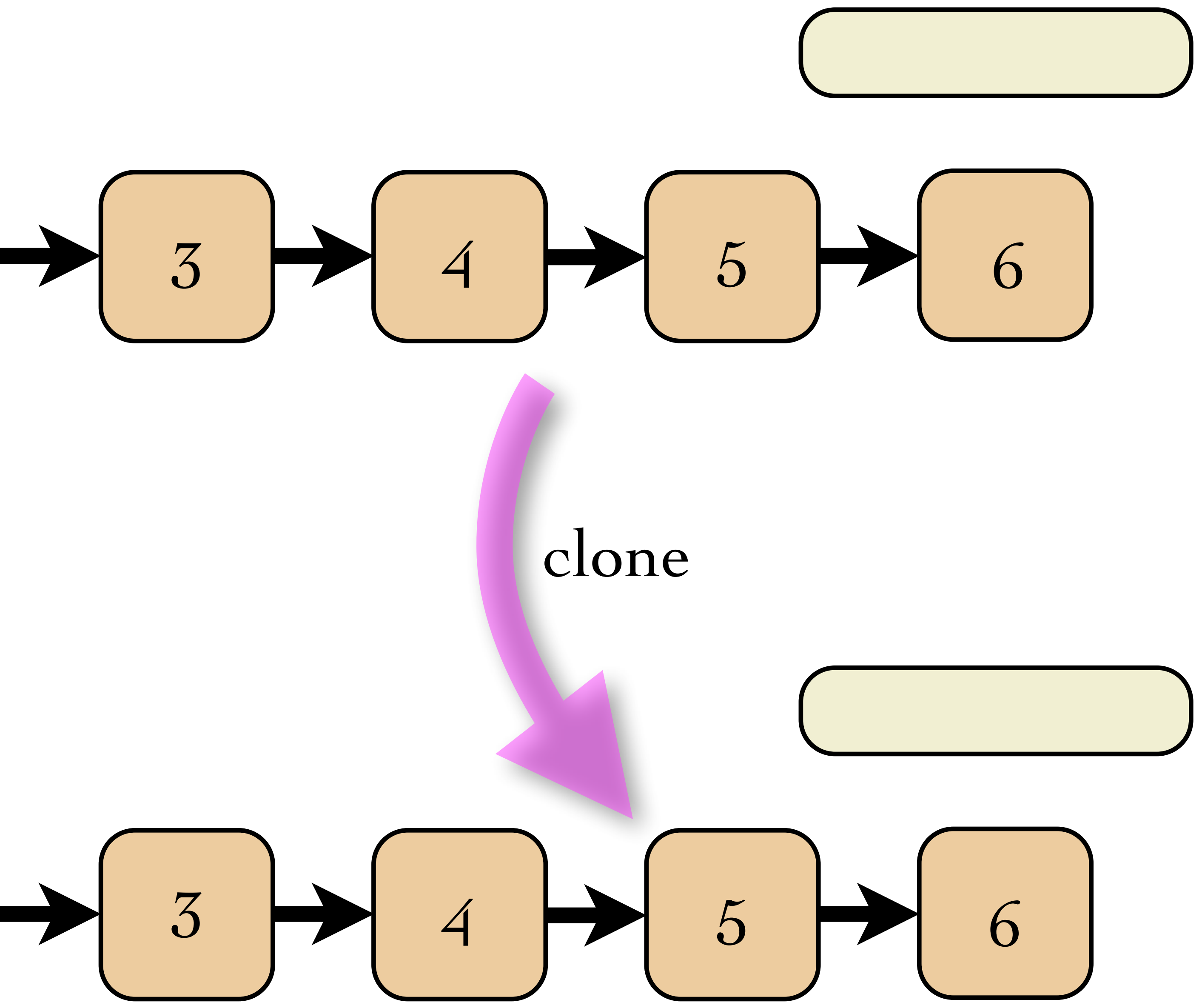
Backtracking

older versions can be looked at at any time



Remote work

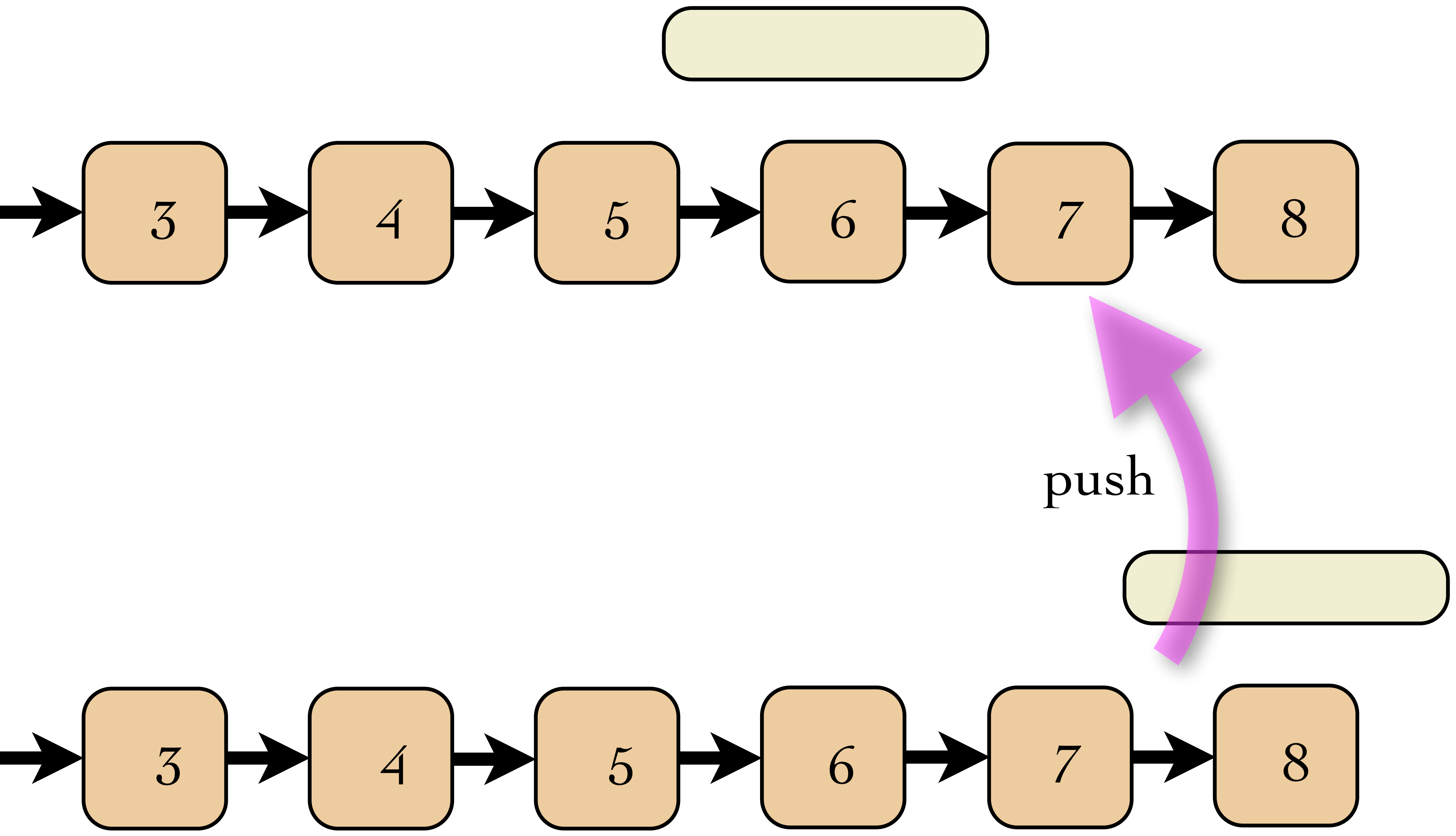
clone repositories to other locations / devices / people



each clone has all features,
not distinguishable

Remote work

development can happen anywhere



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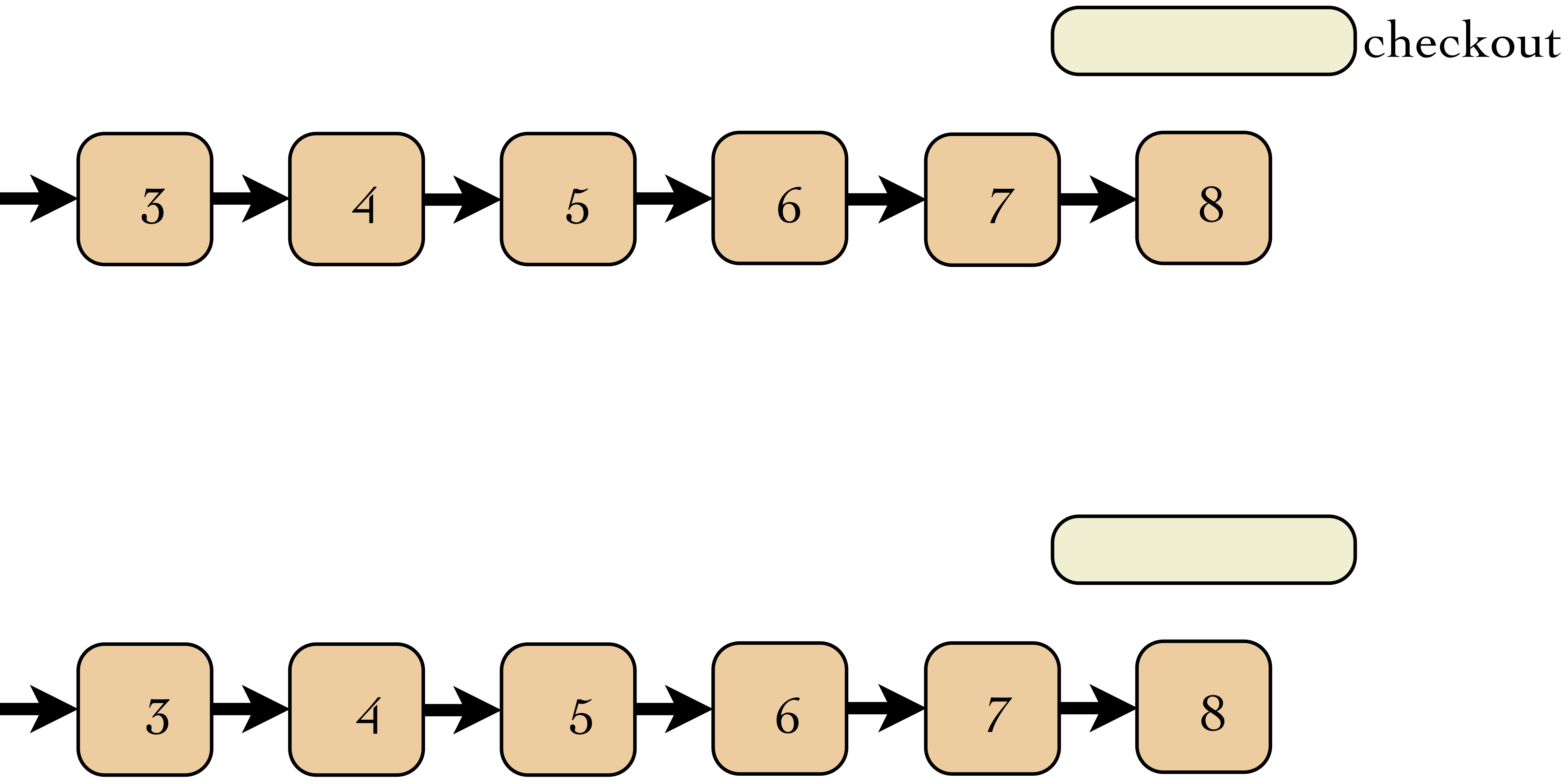
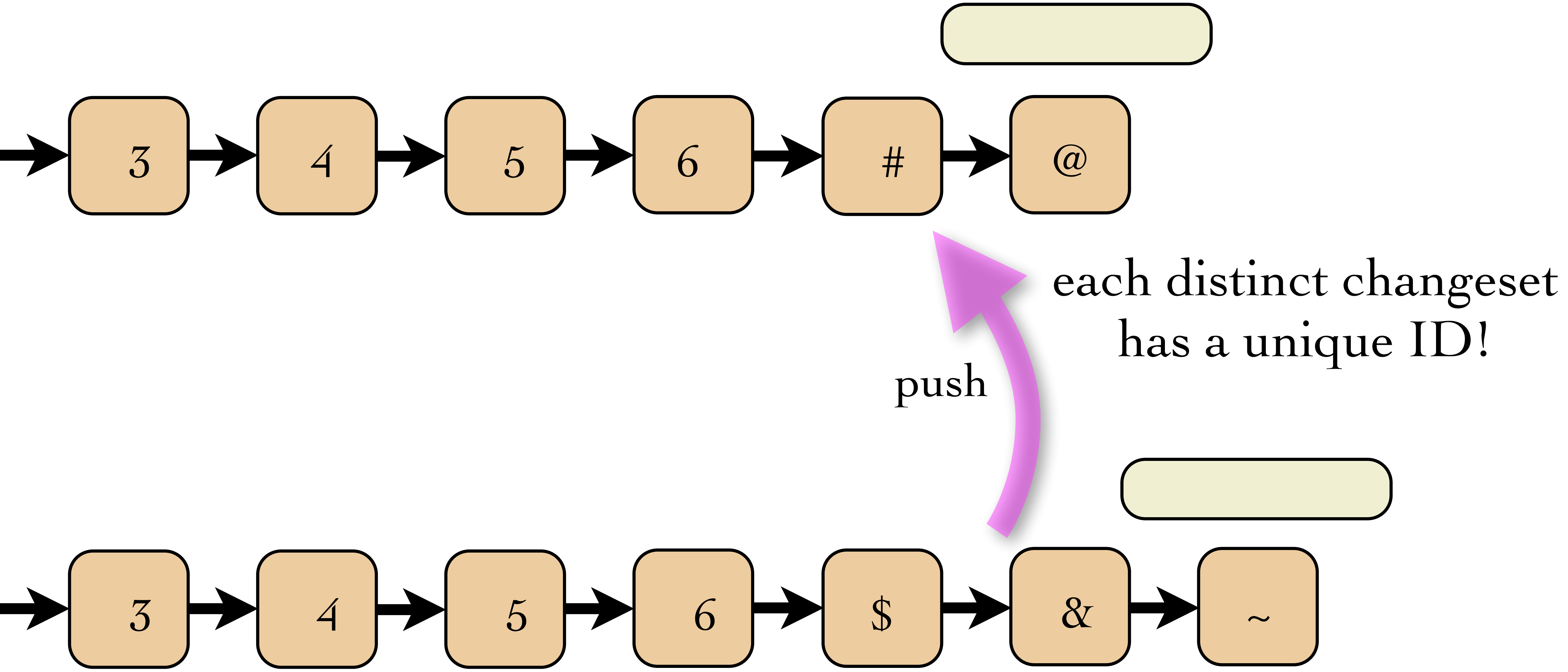


Branches

unlike in SVN, branches are a natural feature



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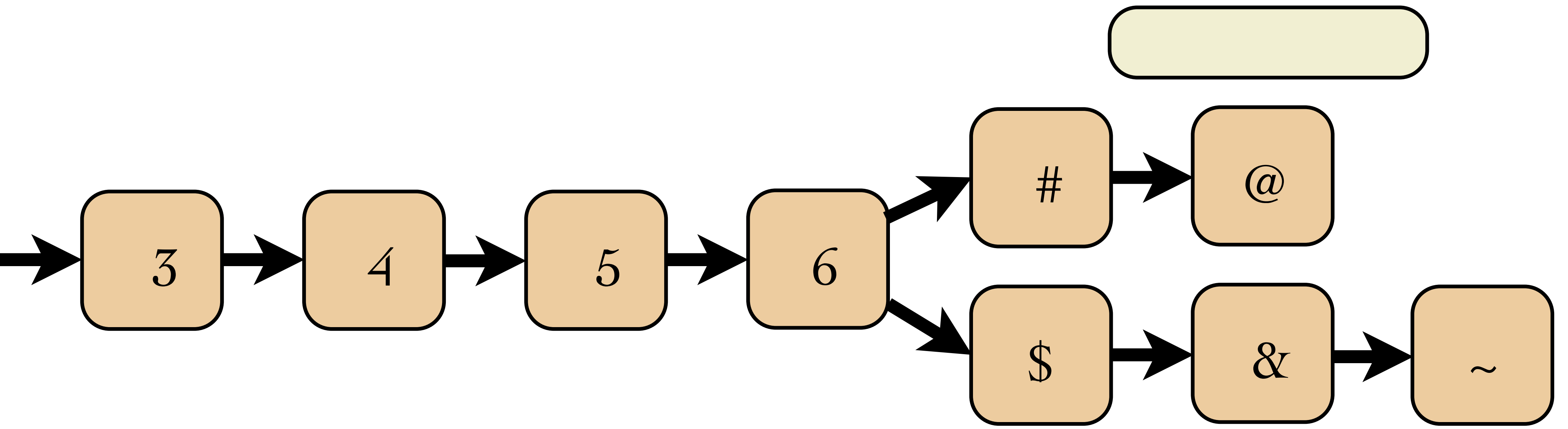
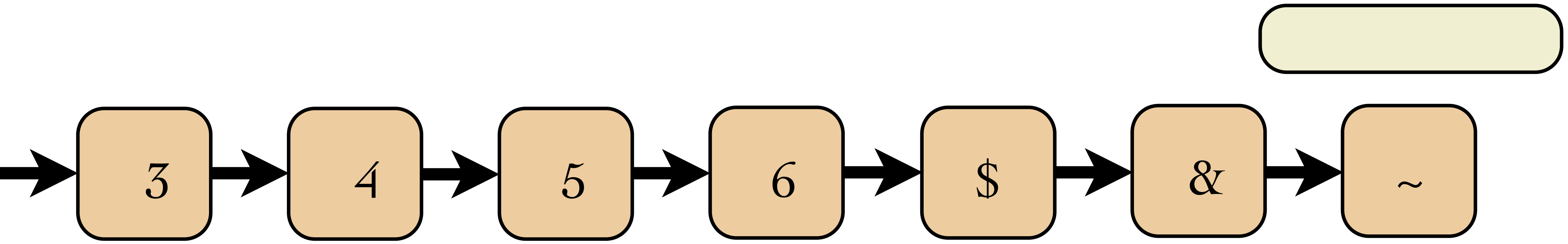
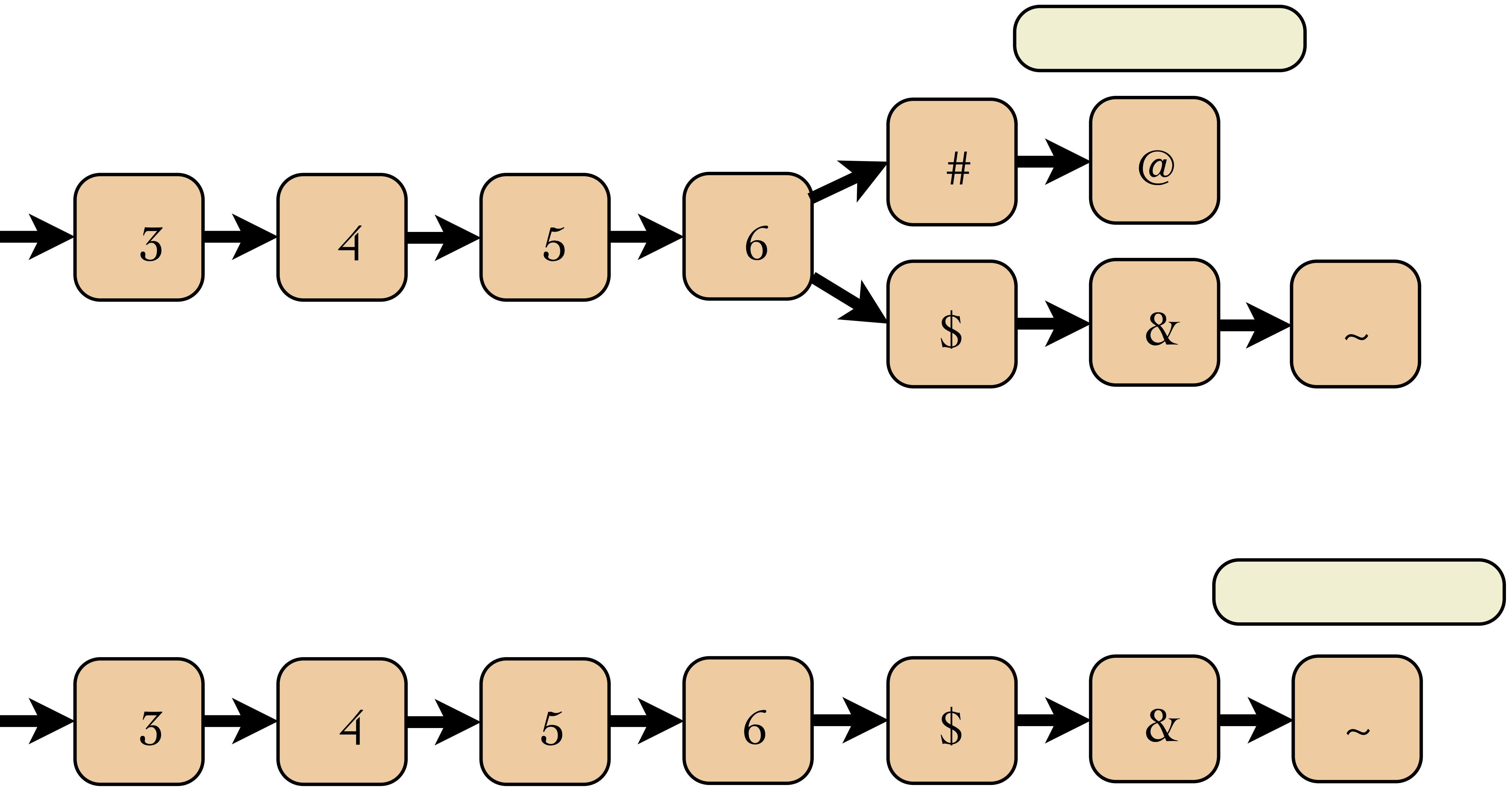




Merging

merging is automatic as far as possible



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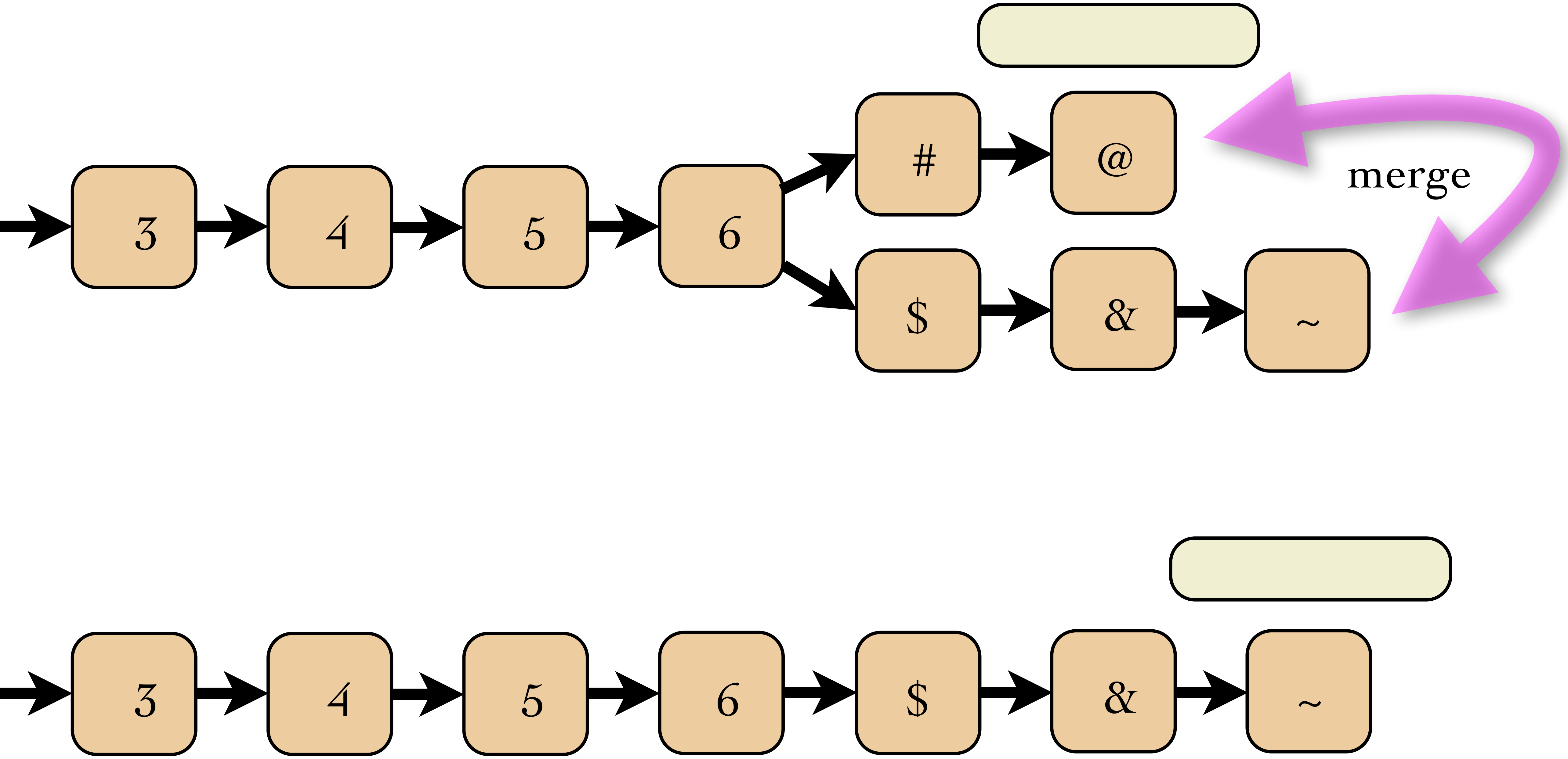
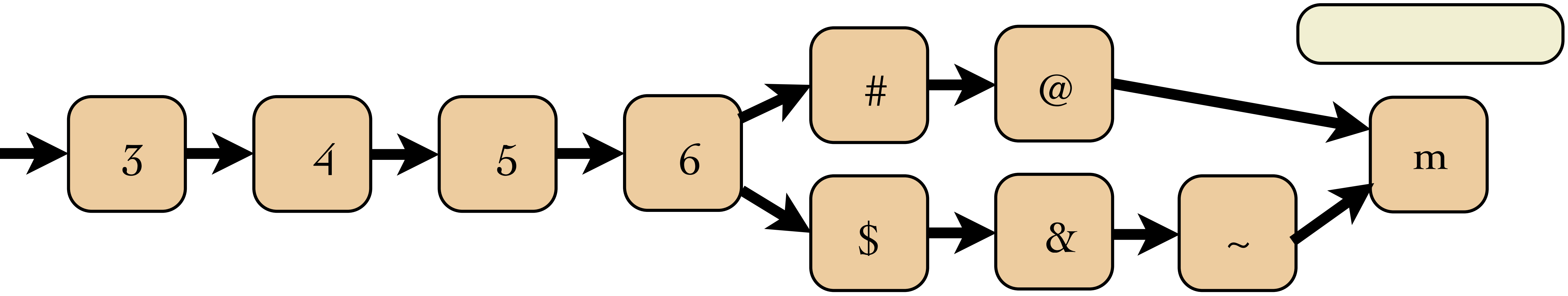
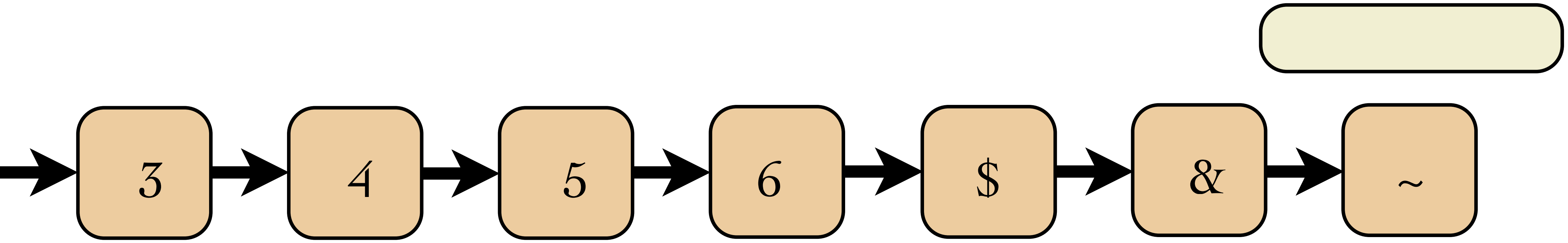


Merging

only need to fix some conflicts by hand





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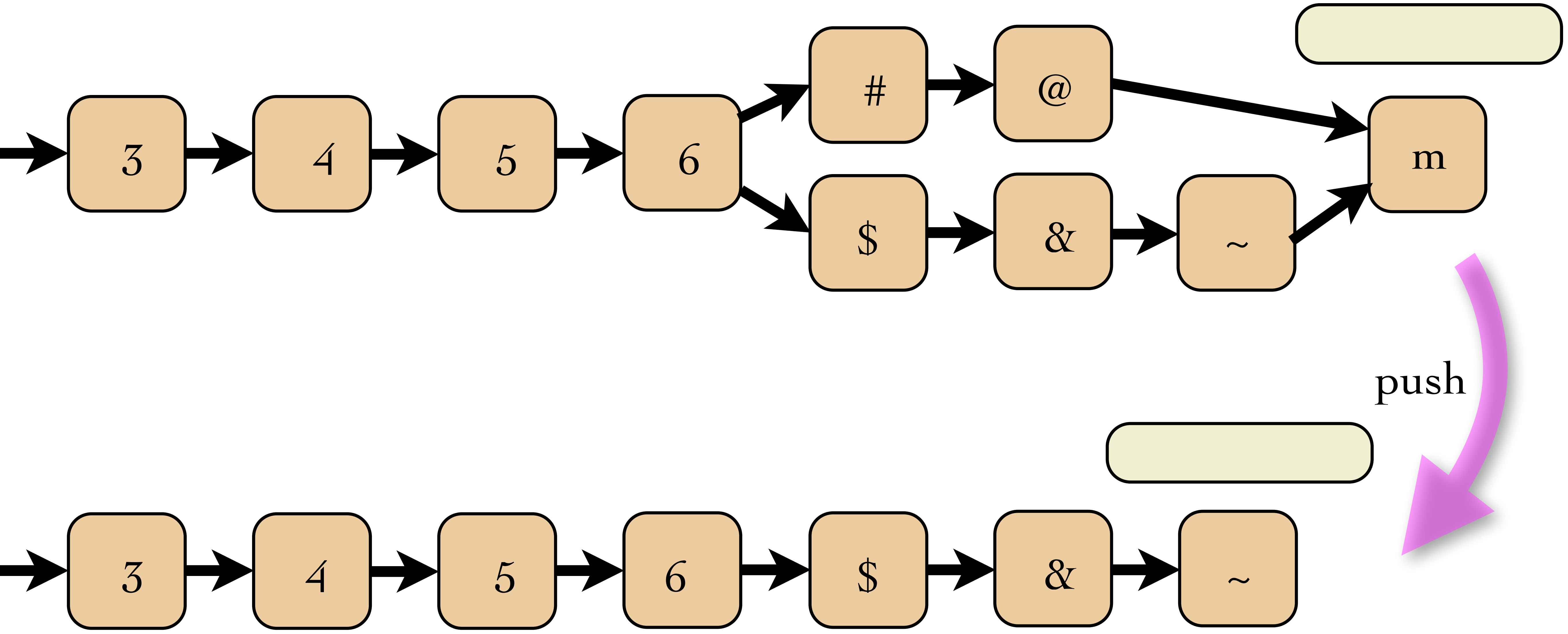
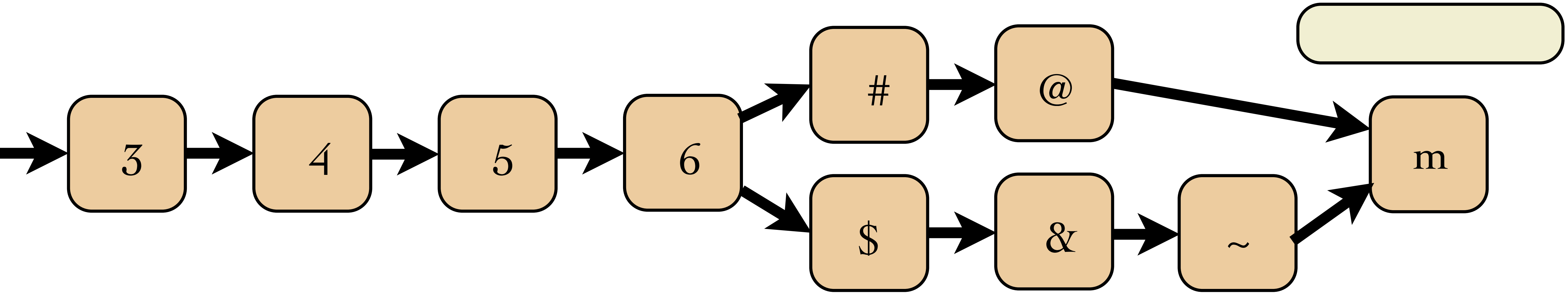
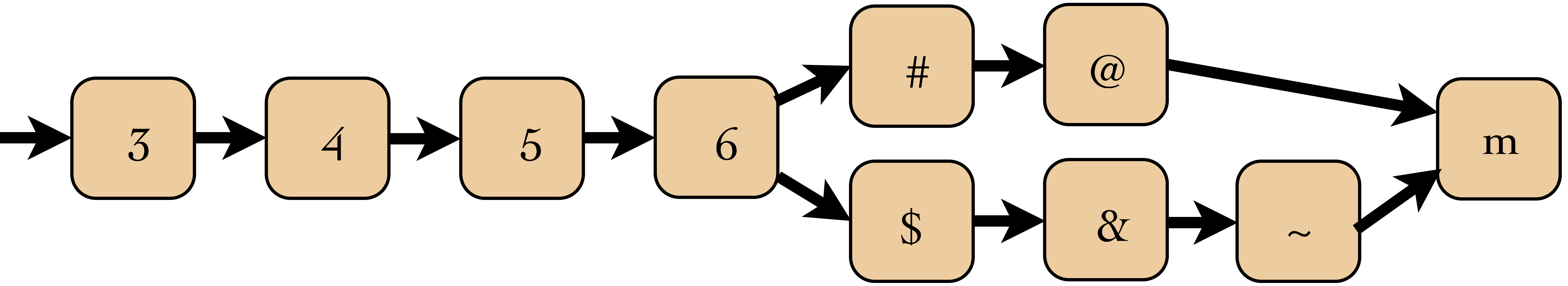


Merging

consistent state after push





Merging

consistent state after push

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3 \arrow[r] & 4 \arrow[r] & 5 \arrow[r] & 6 \arrow[ur] \arrow[dr] & & & & m \\
 & & & & \$ \arrow[r] & \& \arrow[r] & \sim \arrow[ur] &
\end{tikzcd}$$

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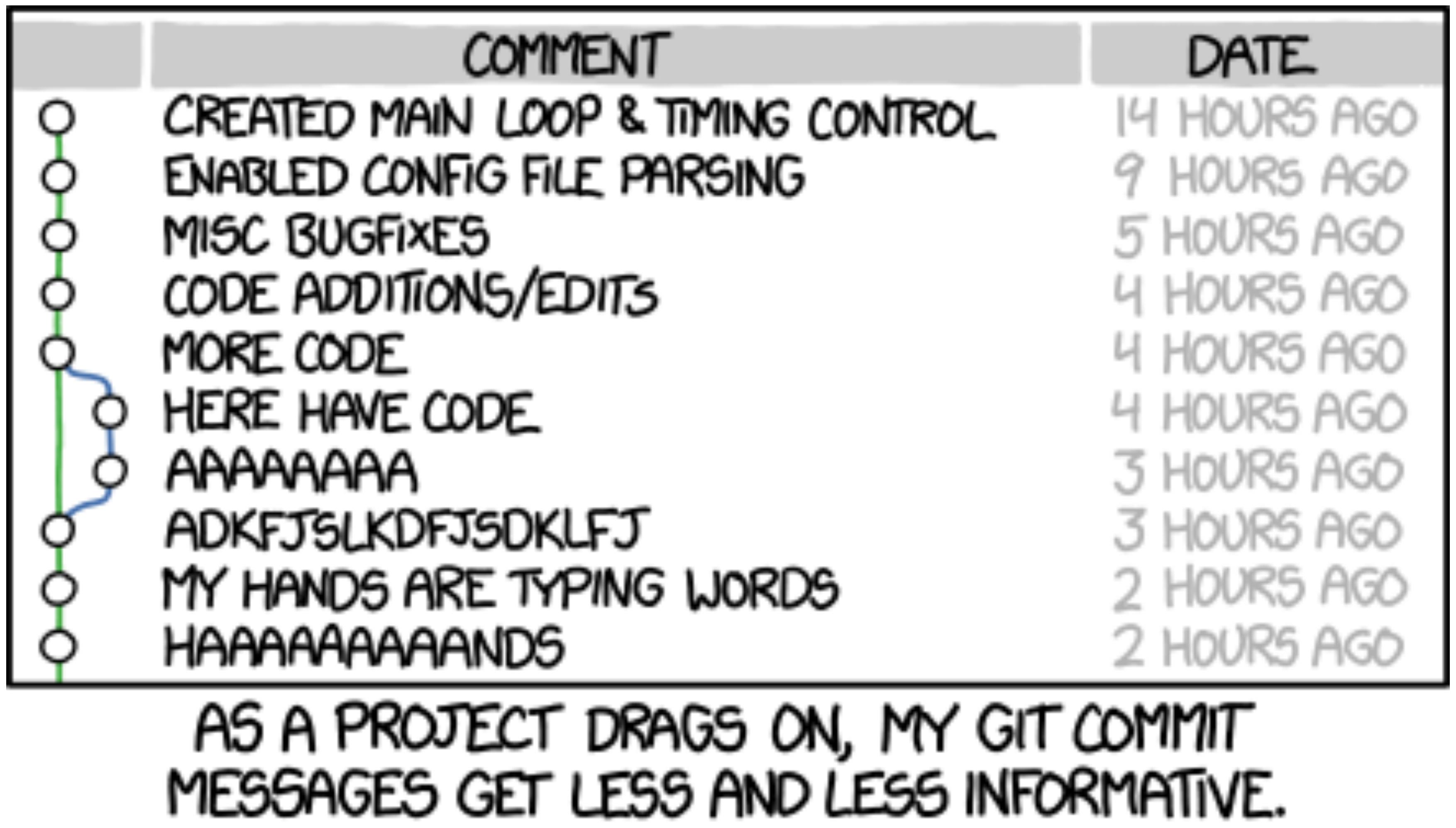


	COMMENT	DATE
○	CREATED MAIN LOOP & TIMING CONTROL	14 HOURS AGO
○	ENABLED CONFIG FILE PARSING	9 HOURS AGO
○	MISC BUGFIXES	5 HOURS AGO
○	CODE ADDITIONS/EDITS	4 HOURS AGO
○	MORE CODE	4 HOURS AGO
○	HERE HAVE CODE	4 HOURS AGO
○	AAAAAAAA	3 HOURS AGO
○	ADKFJSLKDFJSDKLFJ	3 HOURS AGO
○	MY HANDS ARE TYPING WORDS	2 HOURS AGO
○	HAAAAAAAANDS	2 HOURS AGO

AS A PROJECT DRAGS ON, MY GIT COMMIT MESSAGES GET LESS AND LESS INFORMATIVE.

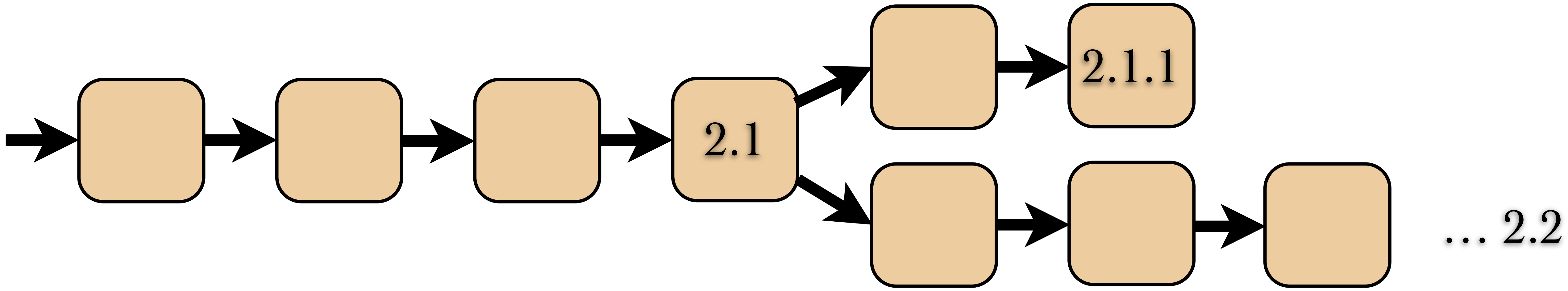
xkcd 1296

Typical usage patterns

- Technically, every repo is the same
- By agreement, designate one repo as “central”
- Tarballs or other distributions are built *only* from there
- Interaction with central repo: only `push/pull` from developers, no direct commits
- Can pipeline even more: put code-review, tester, build manager repos in between

Typical usage patterns

* Think about release lifetime
* Typically, separate release and feature branches
* Carefully put checkins in the right place!



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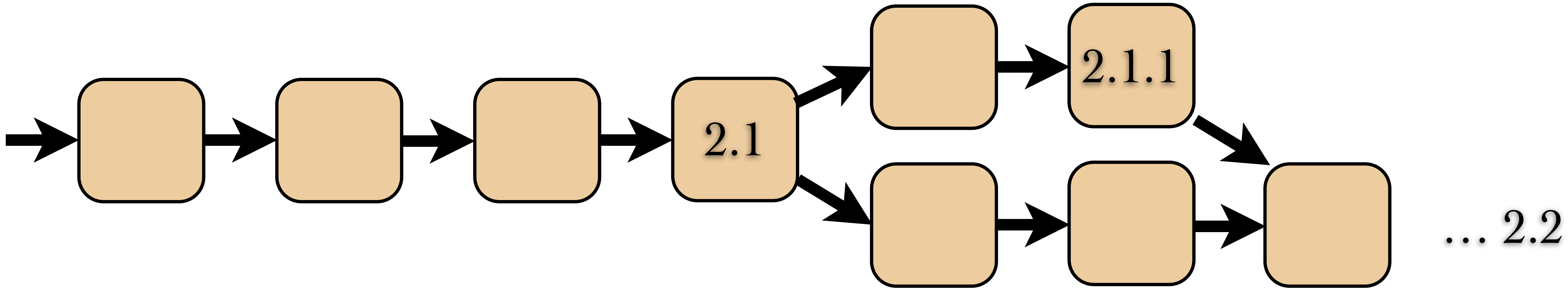
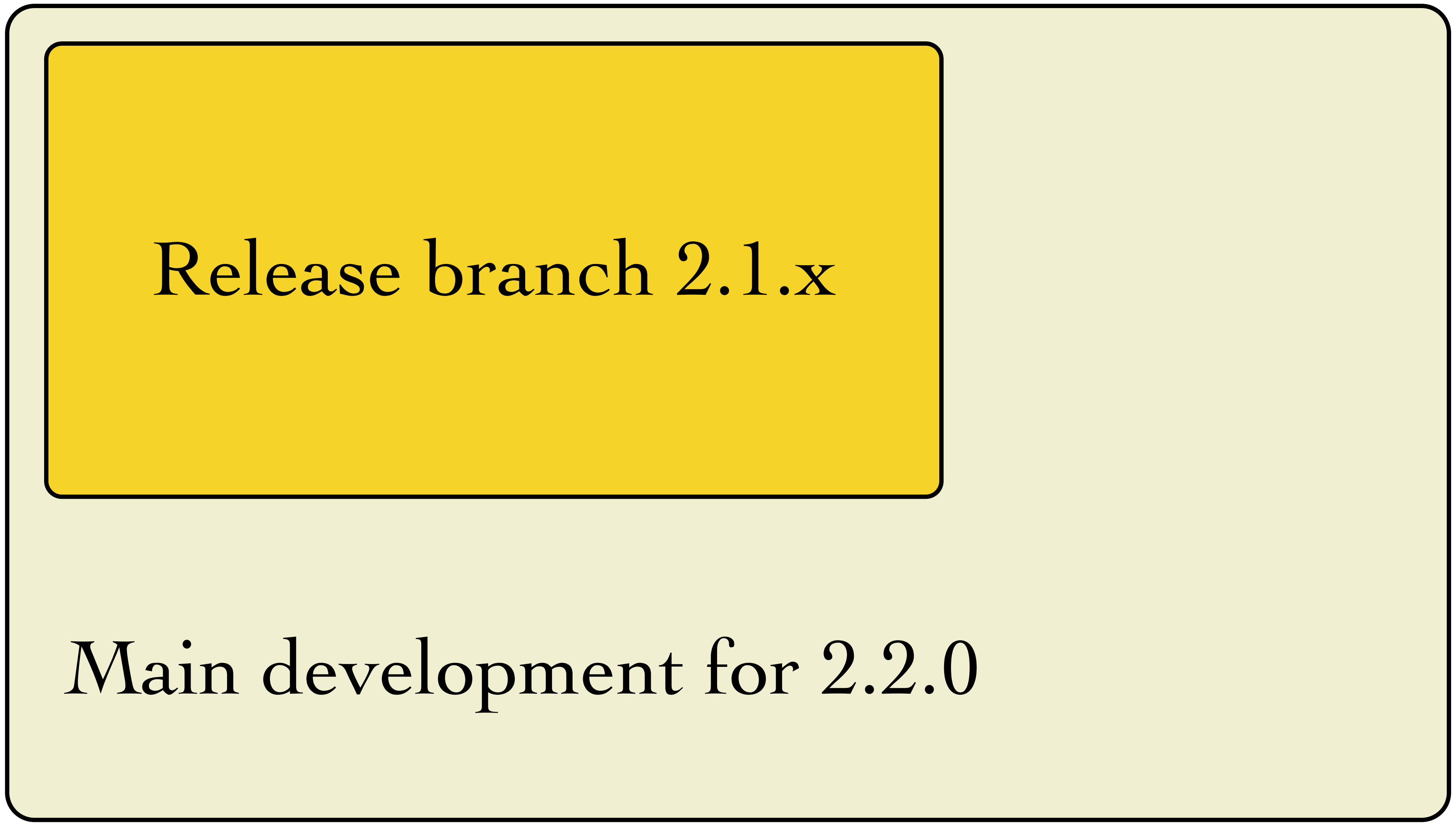


Which branch for which checkin?

- Pick the innermost appropriate branch



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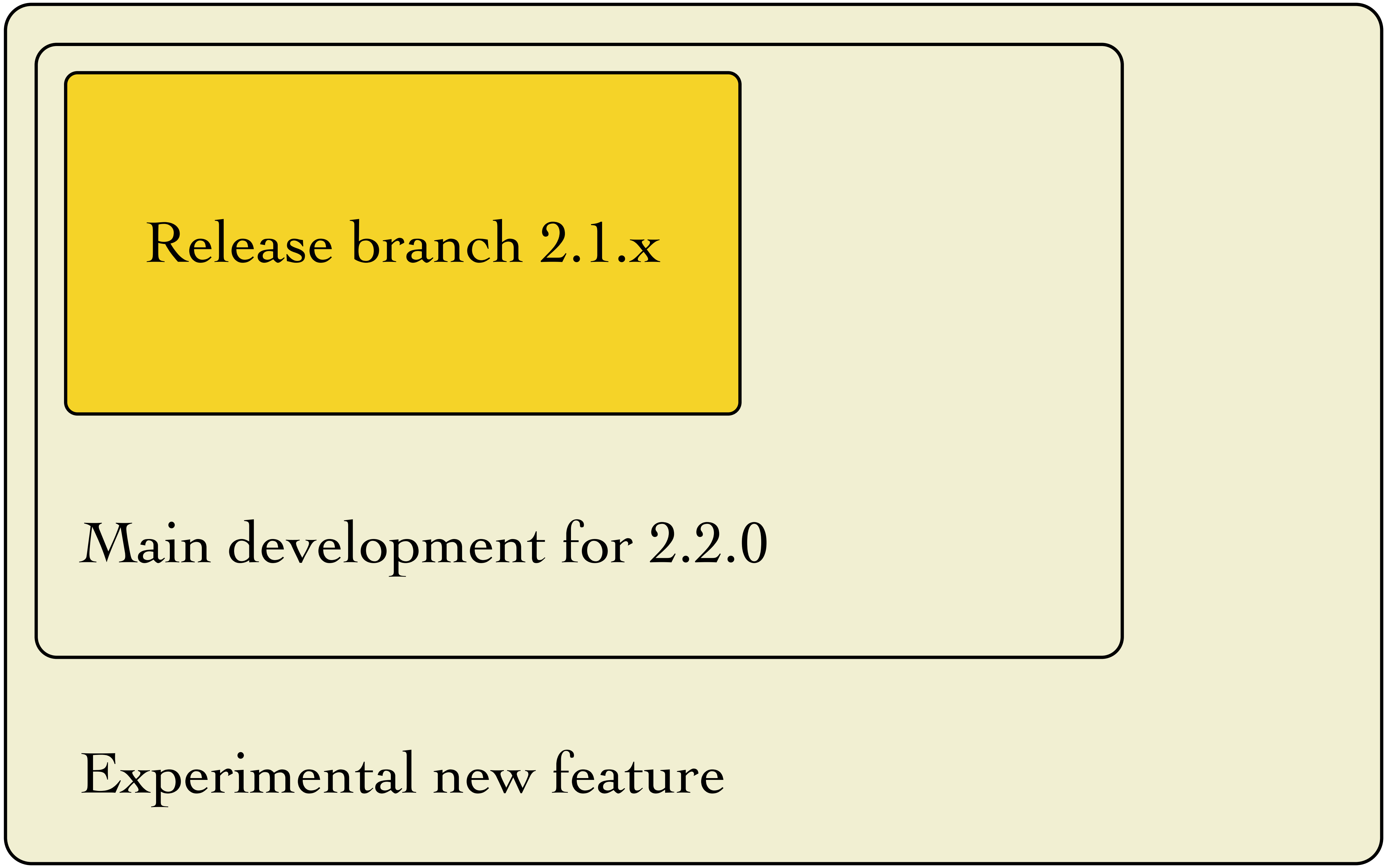

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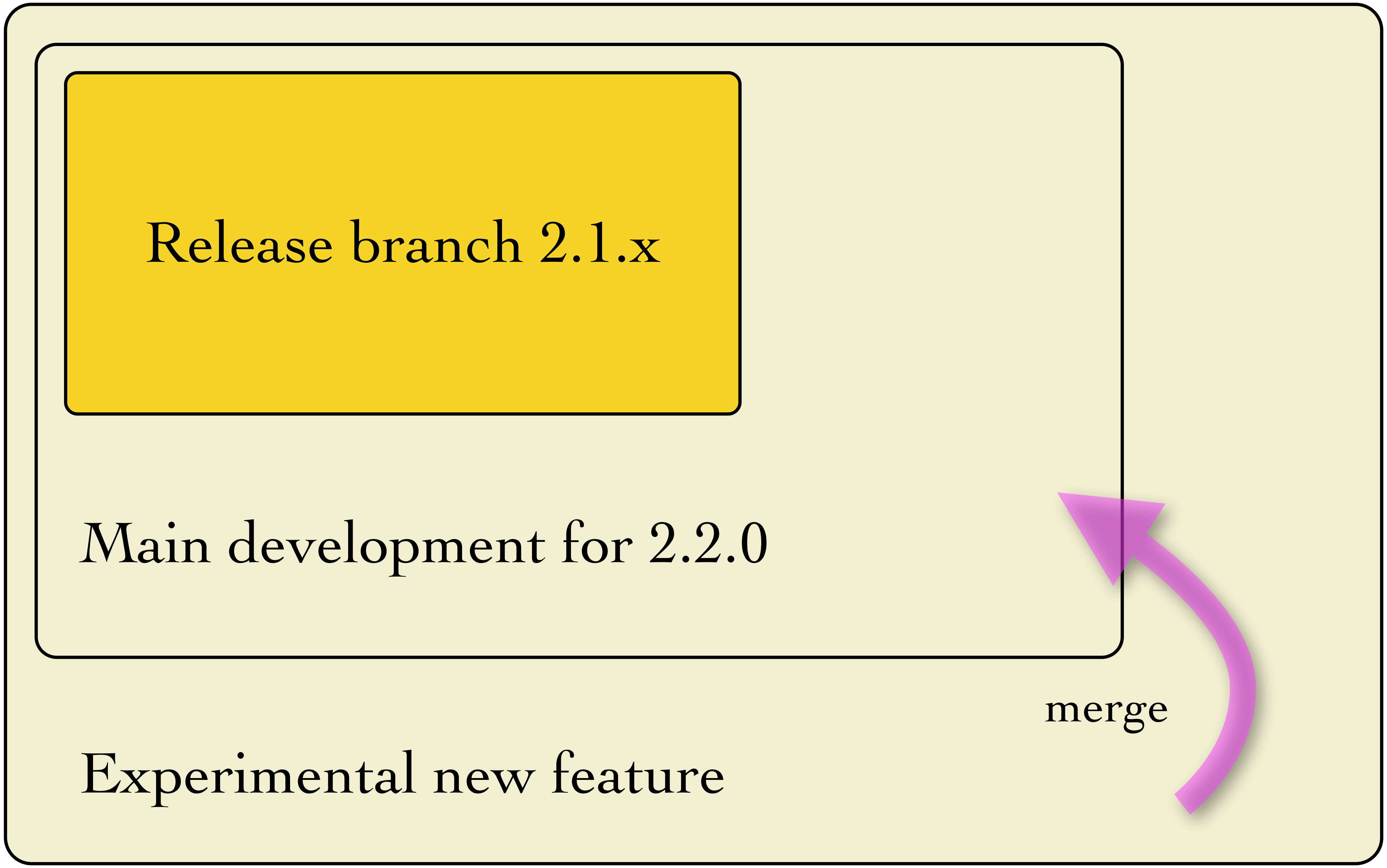

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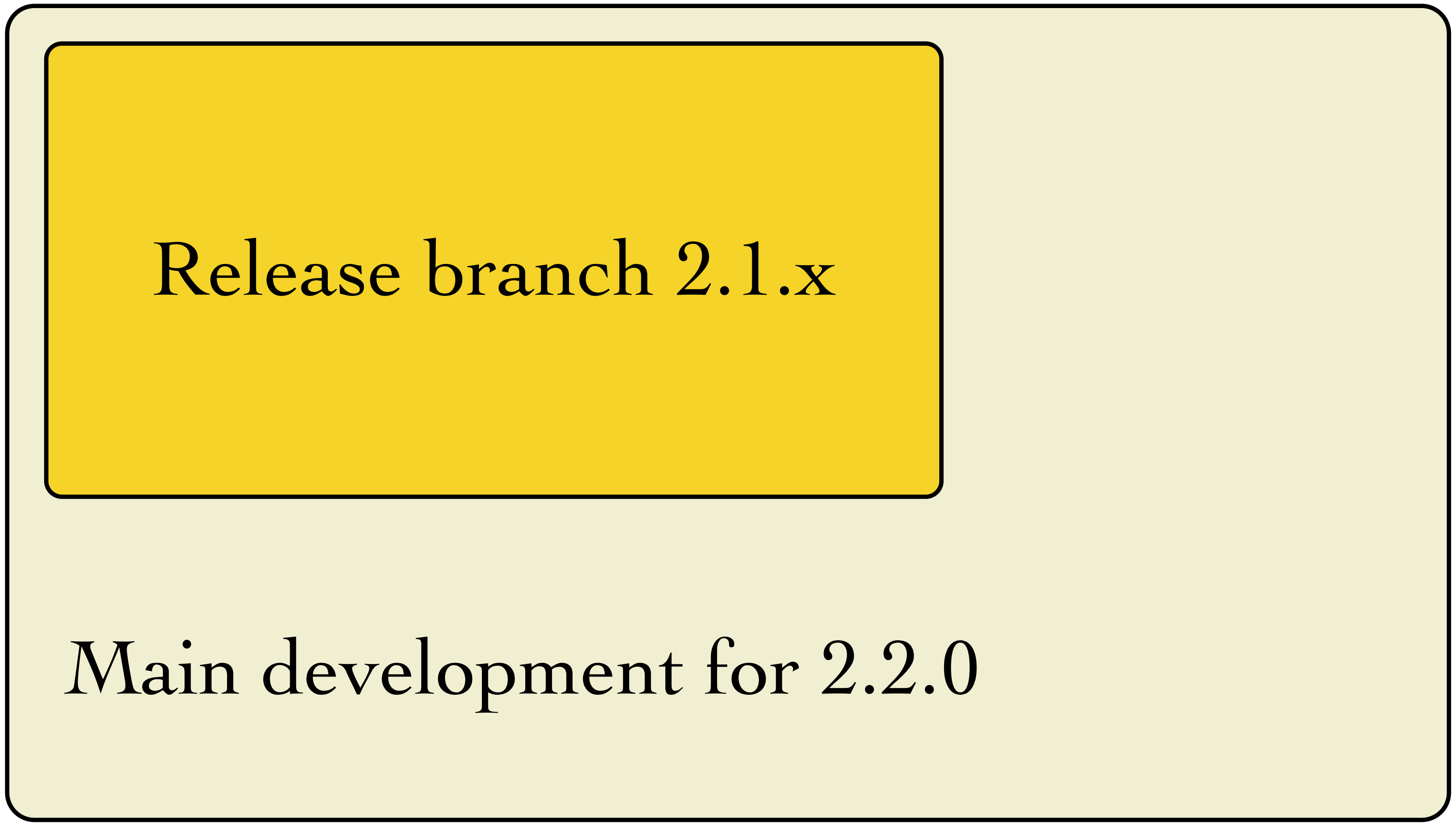
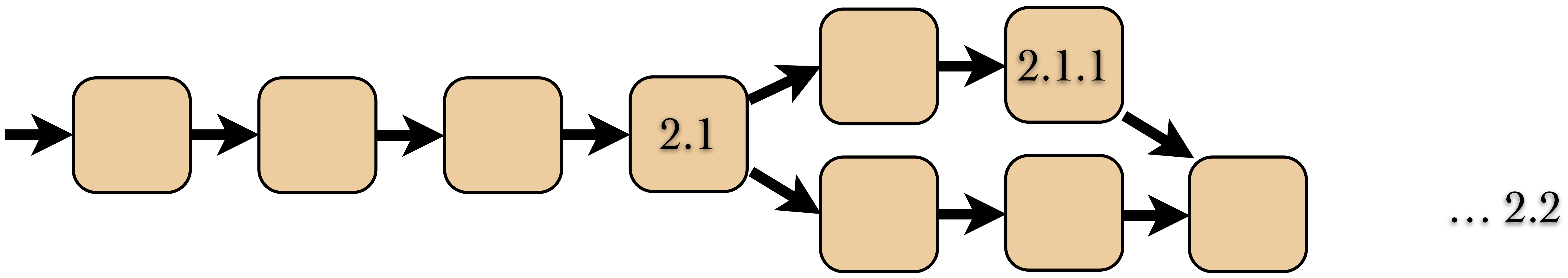


Typical usage patterns

If a bugfix is localizable, fix it **there!**



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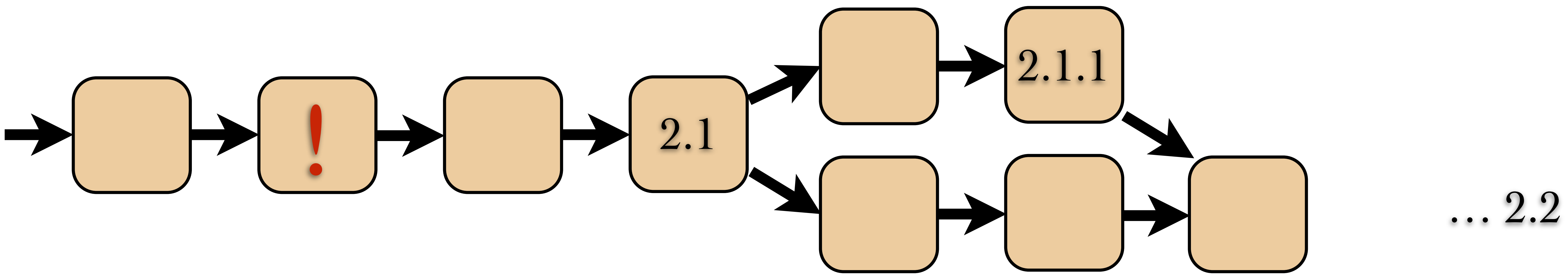

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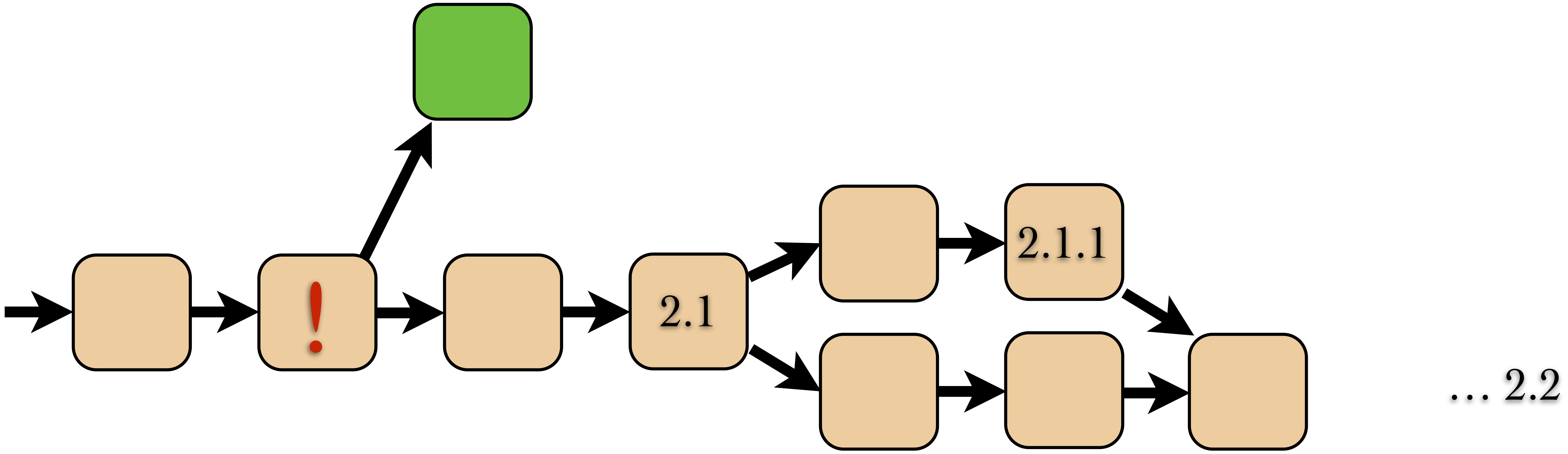

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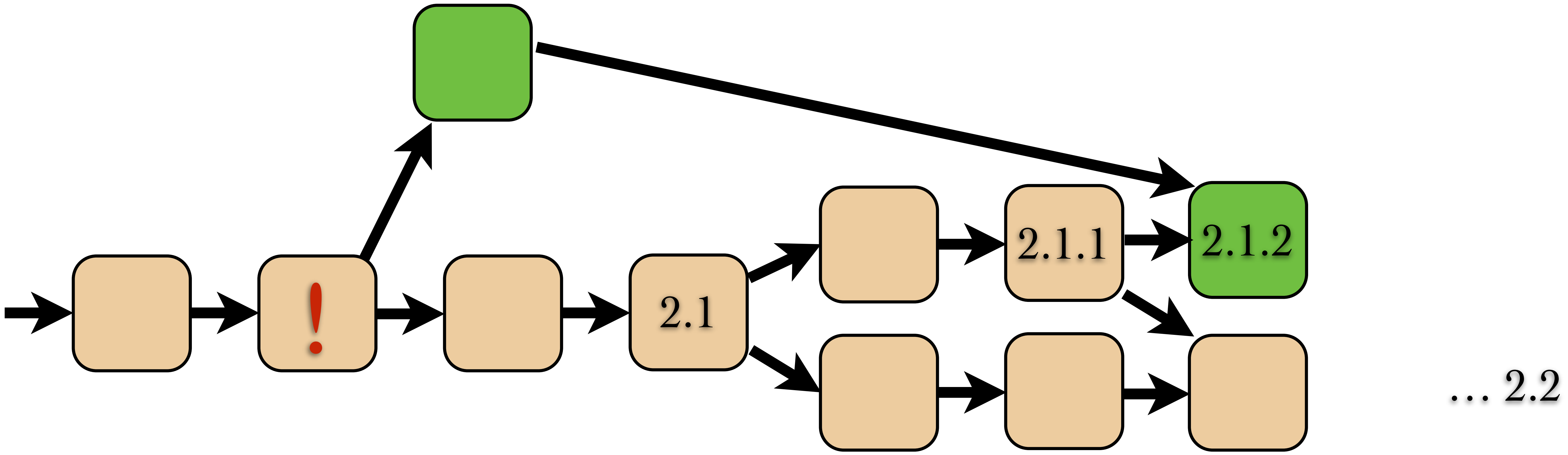

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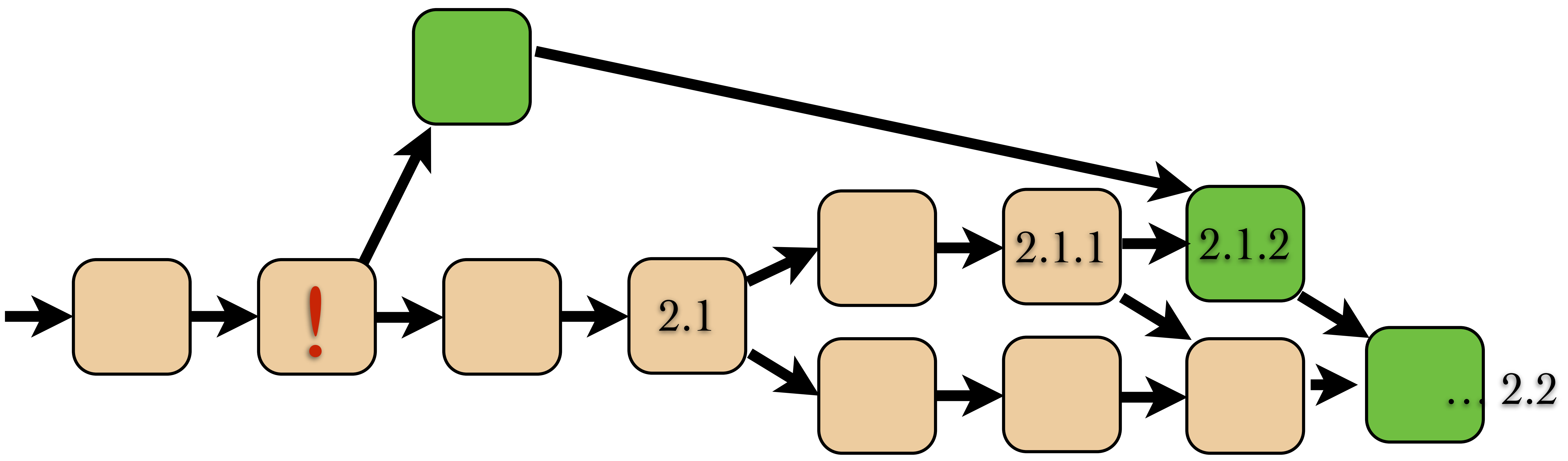

Summary

Distributed VCS are so easy to use that there's no reason not to do so!

Don't even think of writing outside version control!

- Configure your git settings:
    - $ git config --global user.name "[name]"
    - $ git config --global user.email "[email address]"
    - $ git config --global color.ui auto
- More options:
    - $ git config --global core.editor “editor name”
    - $ git config --global -e
    - $ git config -h
    - $ git config --help

- Initiate git in a directory:
    - $ git init
- Make some files:
    - $ git status
    - $ git add
- Committing to changes:
    - $ git commit
    - $ git commit -a

- Now make a change and go through the process again!

- Try:
  - `$ git status -s`
- Add a file to the staging environment
  - `$ git diff`
- Try:
    - `$ git diff -h`
    - `$ git diff --stat`

- Looking at the changes
  - $ git log
  - $ git log -3
  - $ git log -p
  - $ git log --stat --summary
  - $ git log --follow [file]
  - $ git log --oneline
  - $ git log --after 2017-07-04
  - $ git log —author=“ali”
  - $ git log —grep=" word of phrase to search”

- $ git show 1b2e1d63ff (some identifier)
- $ git show HEAD
- $ git show HEAD~1
- $ git show HEAD~2:file1.txt

- $ rm file2.txt
- $ git add file2.txt

$ git rm file2.txt

$ git commit -m “”

- Rename files
  - $ mv file3.txt main.cpp
  - $ git add file3.txt
  - $ git add main.cpp

$ git mv file3.txt main.cpp

- Made changes to file1.txt
  - $ git restore file1.txt
- Added changes to file1.txt to the staging area
  - $ git restore --staged file1.txt
  - $ git restore file1.txt
- Restoring deleted files
  - $git rm file1.cpp; $ git commit
  - $ git restore --source=HEAD~1 file1.cpp
  - [more options] $ git restore -h