CS 241: Systems Programming
Lecture 34. Advanced Git

Fall 2019

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Using "branches"

Development and release versions

Trying out new features

Focusing on fixing a bug

Simpler to do in Git than other VCS, consider using more frequently

Branches

Visualize a project’s development as a “linked list” of commits.

When a development track splits, a new branch is created.

In Git, branches are actually just a pointer to these commits

Git branching

List all branches in the project

- `git branch`

Create a new branch

- `git branch <branchname>`

Switch to a branch

- `git checkout <branchname>`

Create and immediately switch

- `git checkout –b <branchname>`

Delete a branch

- `git branch –d <branchname>`

Using branches

Create and switch to a branch

```
$ git branch working

$ git checkout working
M  README
Switched to branch 'working'

$ git branch
  master
* working
```

Stashing

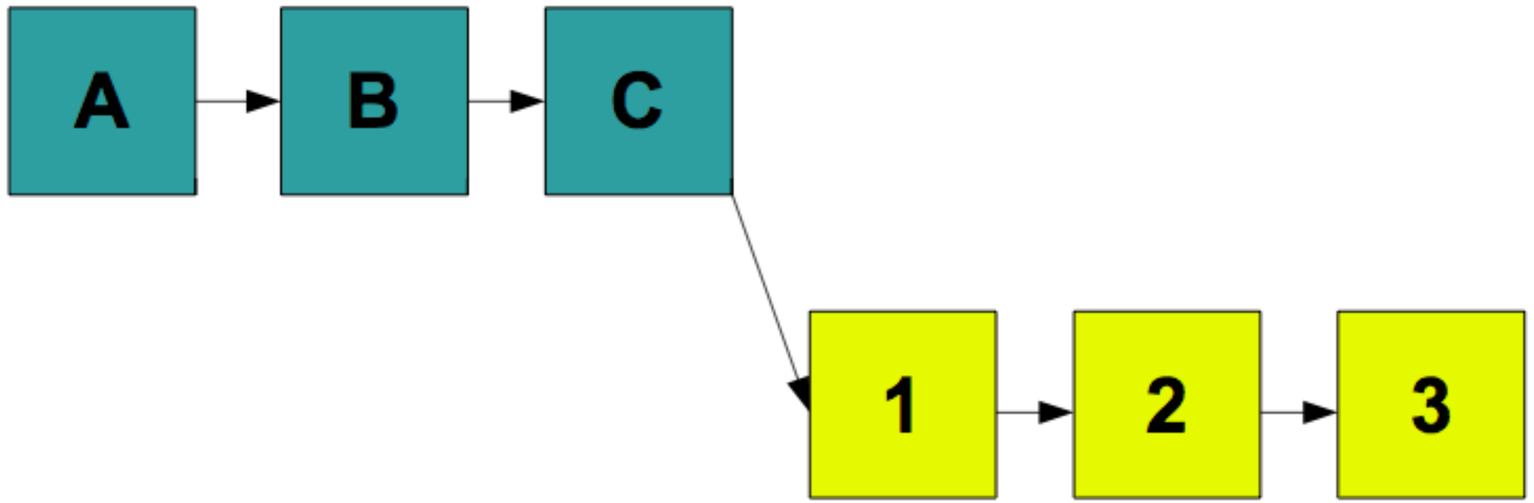
Working tree should be clean when switching branches

Save/hide changes you don't want to commit with `git stash`

- Pushes changes onto a stash stack

Recover changes lager with `git stash pop`

Using branches



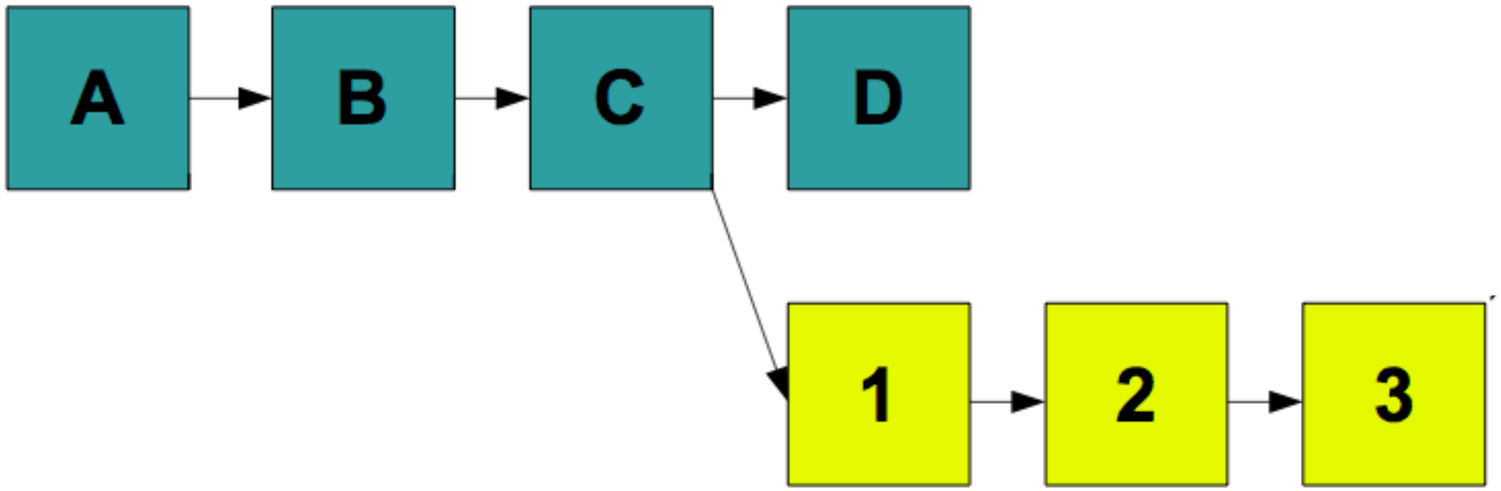
Using branches

Integrate changes back into **master**

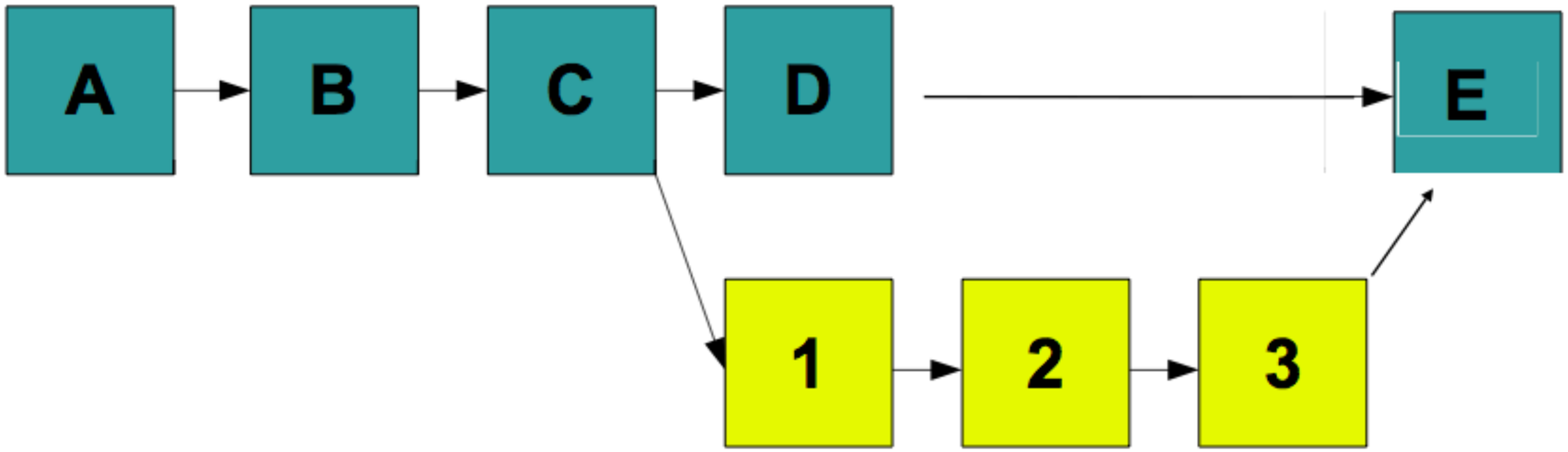
```
$ git checkout master
Switched to branch 'master'

$ git merge working
Merge made by the 'recursive' strategy.
 newfile.txt | 1 +
 1 file changed, 1 insertion(+)
 create mode 100644 newfile.txt
```

Before git merge



After git merge



Merged history

```
*   cdd07b2 - (HEAD, master) Merge branch
'working'
|\
| * 1ccf9e7 - (working) Added a new file
* | 3637a76 - Second change
* | cf98d00 - First change
|/
* cf31a23 - Updated README to 2.0
* 2a8fc15 - Initial commit
```

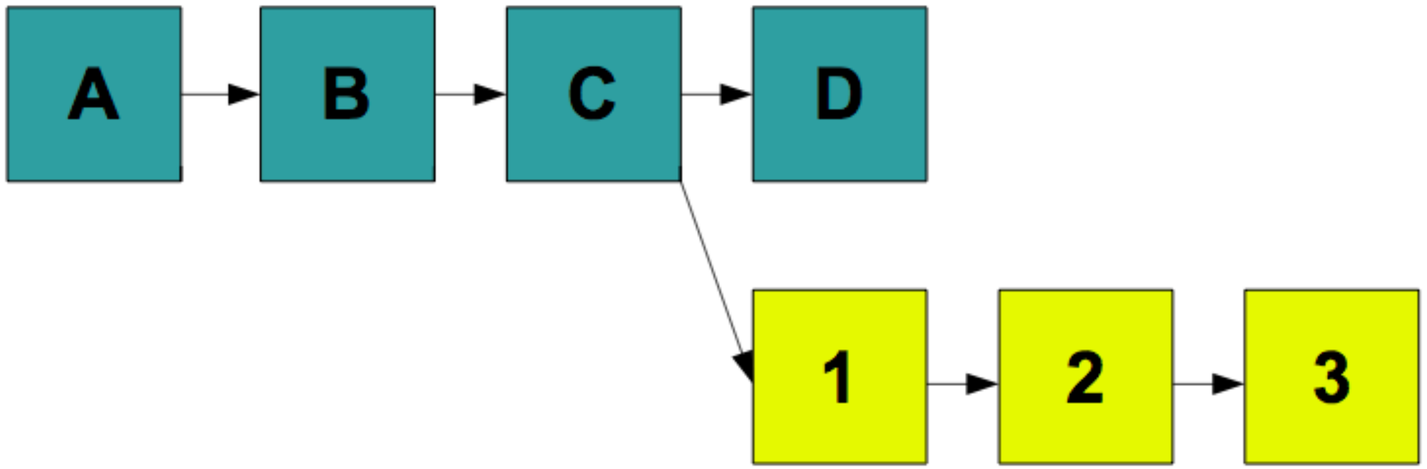
Rebasing

Like merging, rebasing transfers changes from one branch to another

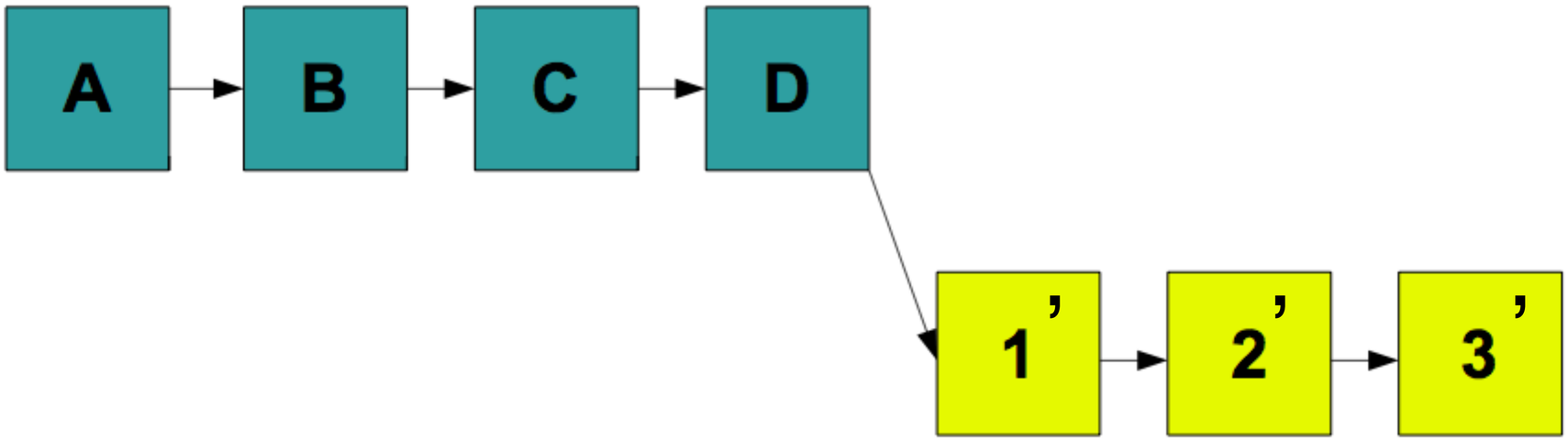
Does not create a new commit

Replays changes from current branch onto head of other branch

Before git rebase



After git rebase



git rebase

Powerful tool

Can change the commit order

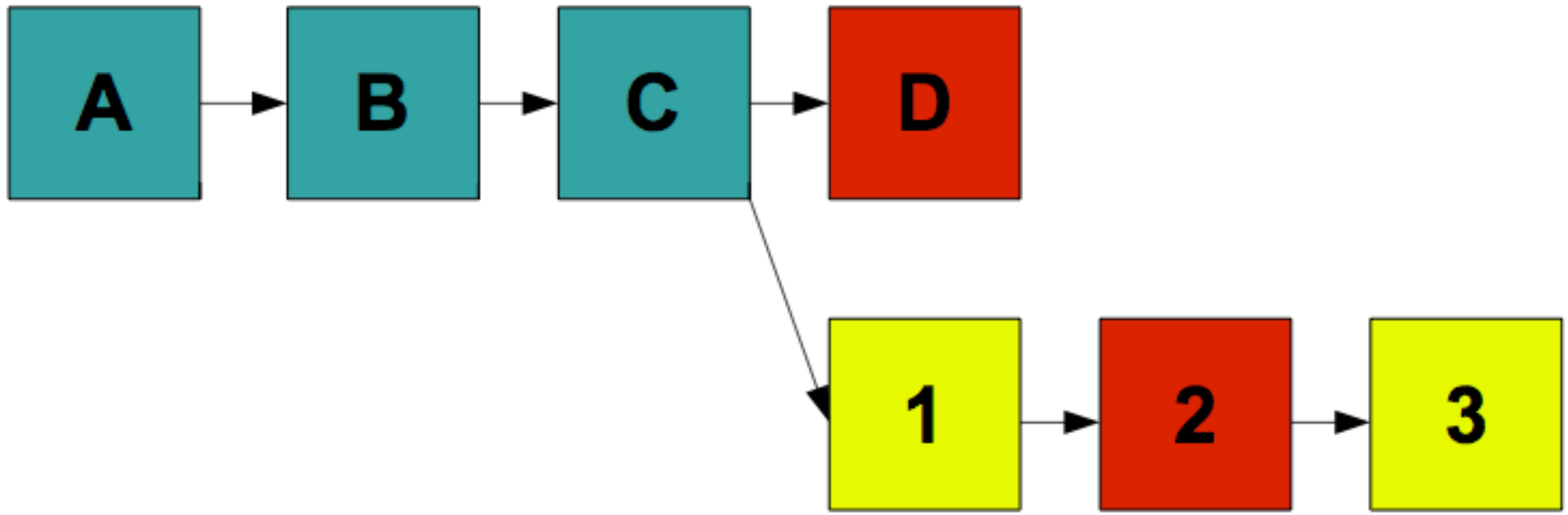
Merge/split commits

Make fixes in earlier commits

- DO NOT DO ON PUSHED CHANGES OR PUBLIC BRANCH

```
$ git rebase –i master
```

Conflicts



Git conflict markers

```
$ cat foo.c
<<<<<<< HEAD
current content
=======
branch content
>>>>>>> newbranch
$ vim foo.c
$ git add foo.c
$ git rebase --continue
```

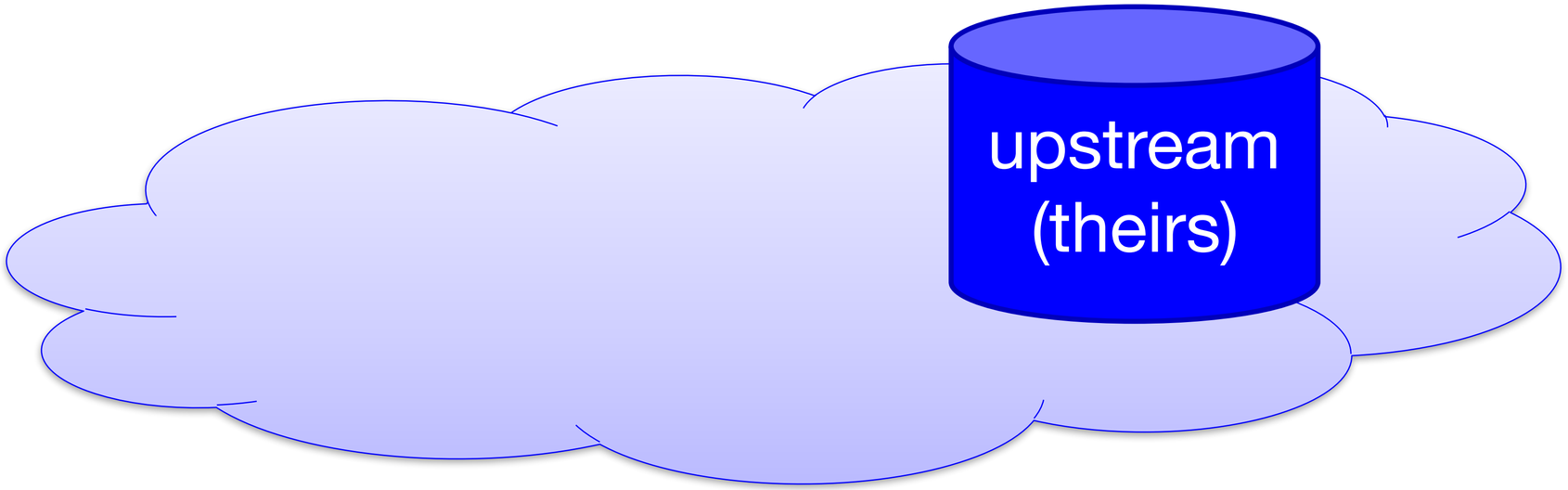
Pull requests with Github

Contributing changes to repositories on Github

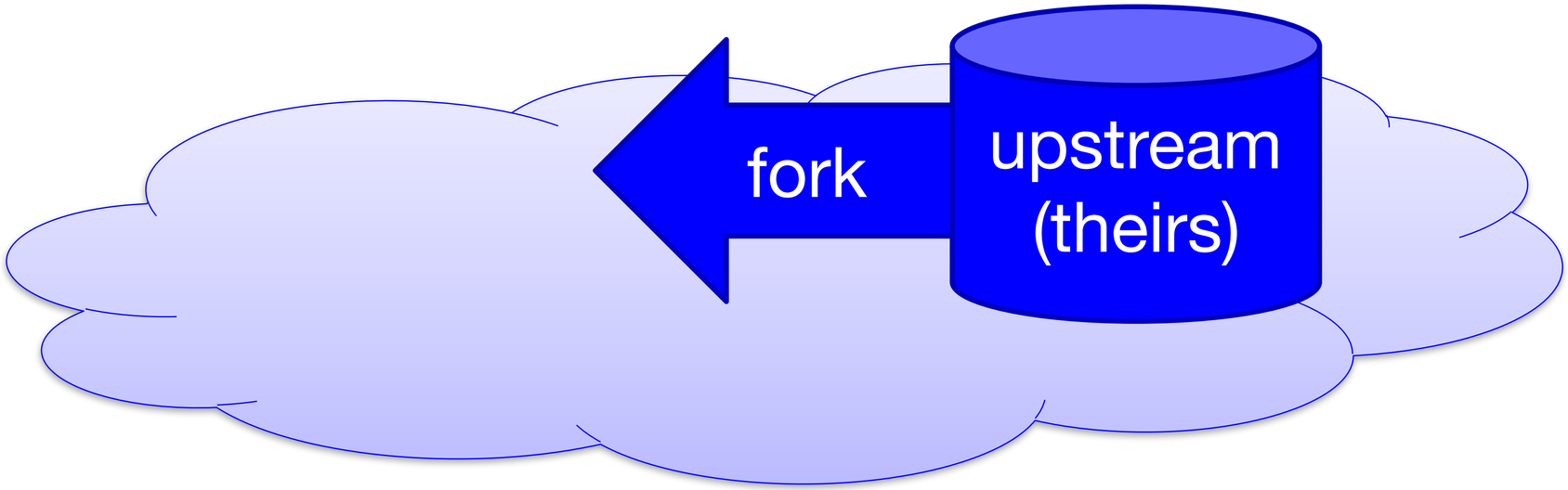
Requests the owner of the code integrate your changes

Setup

Setup



Setup



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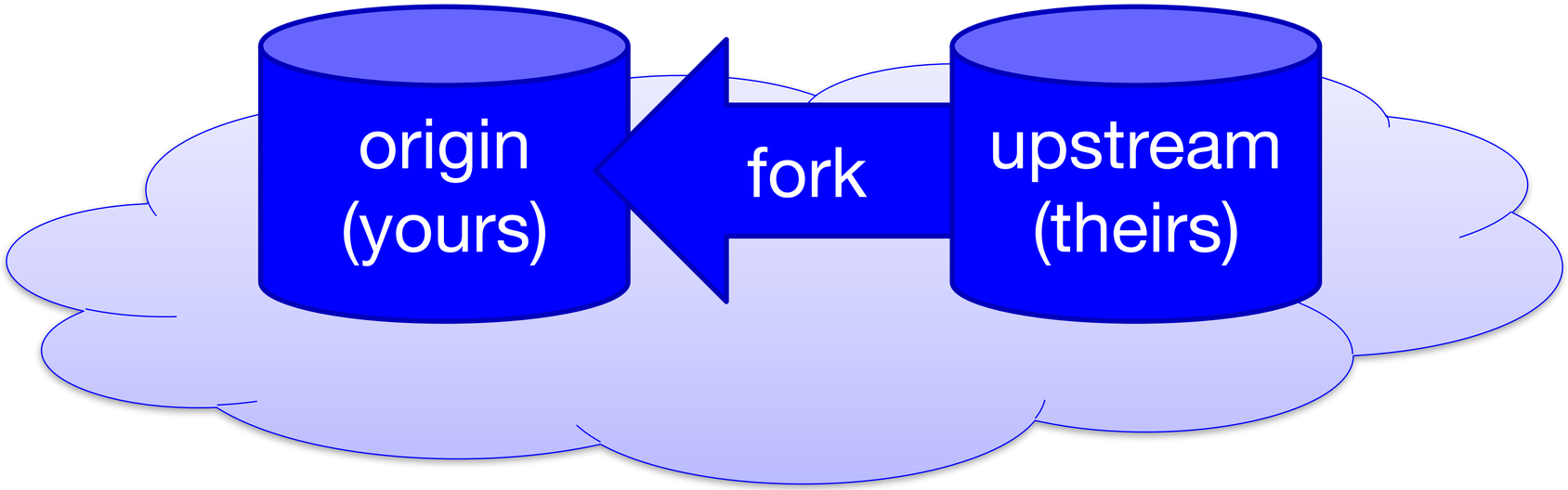
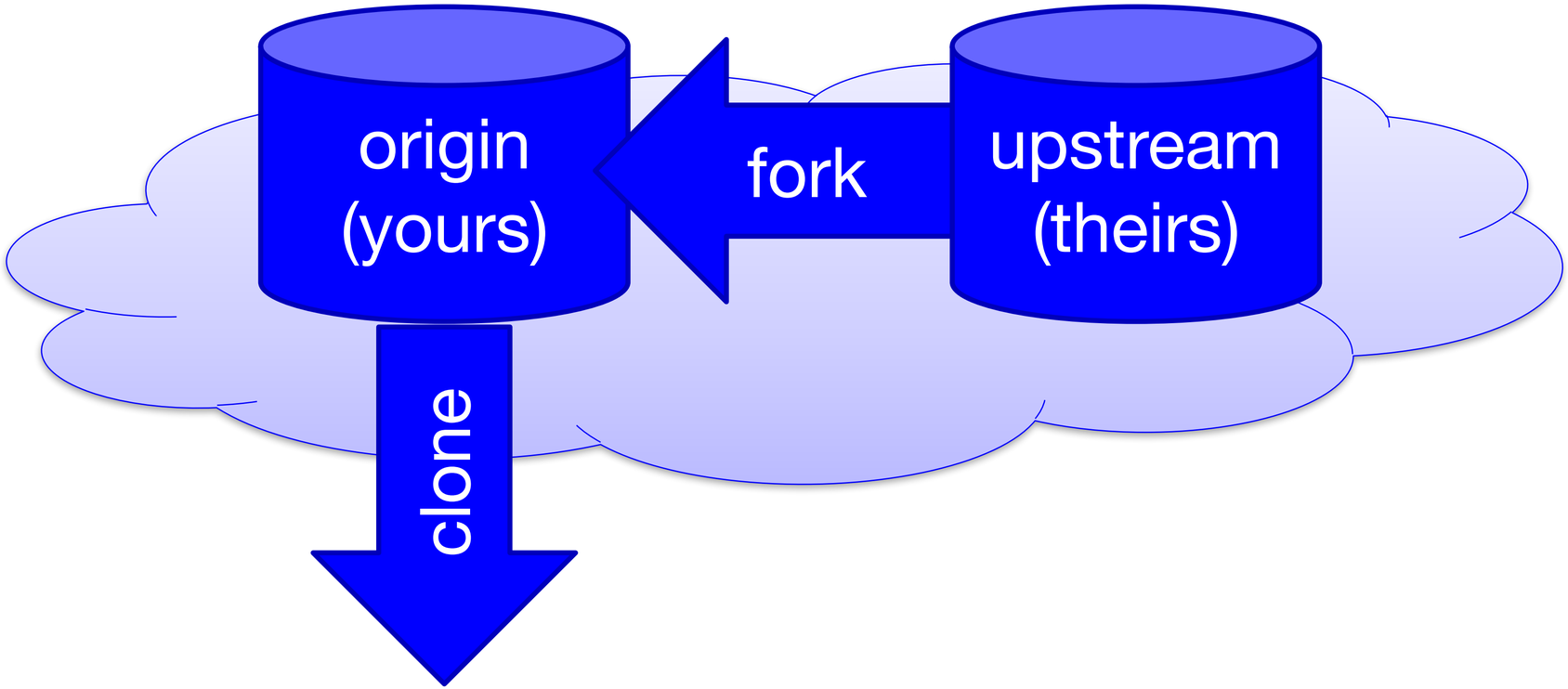
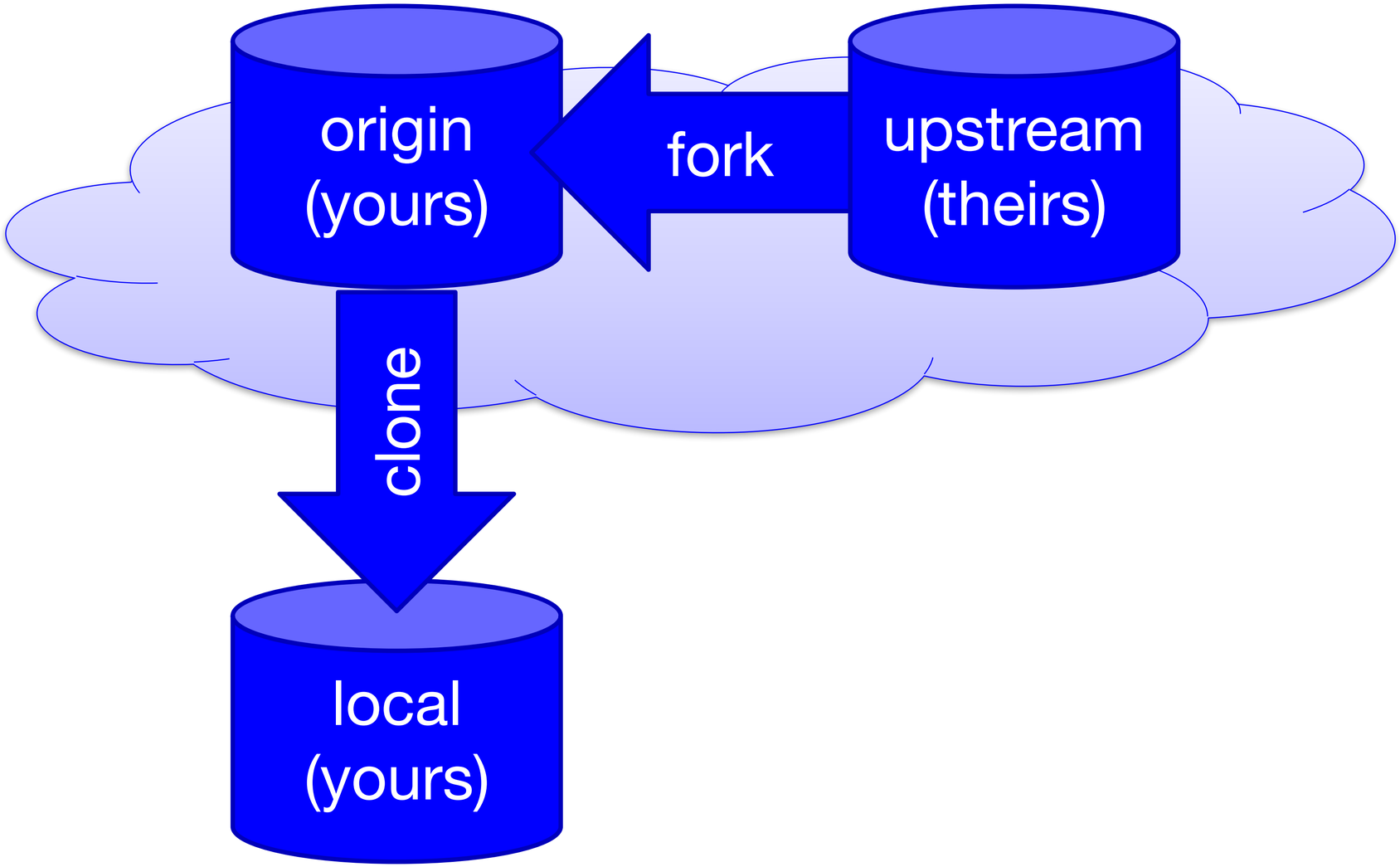


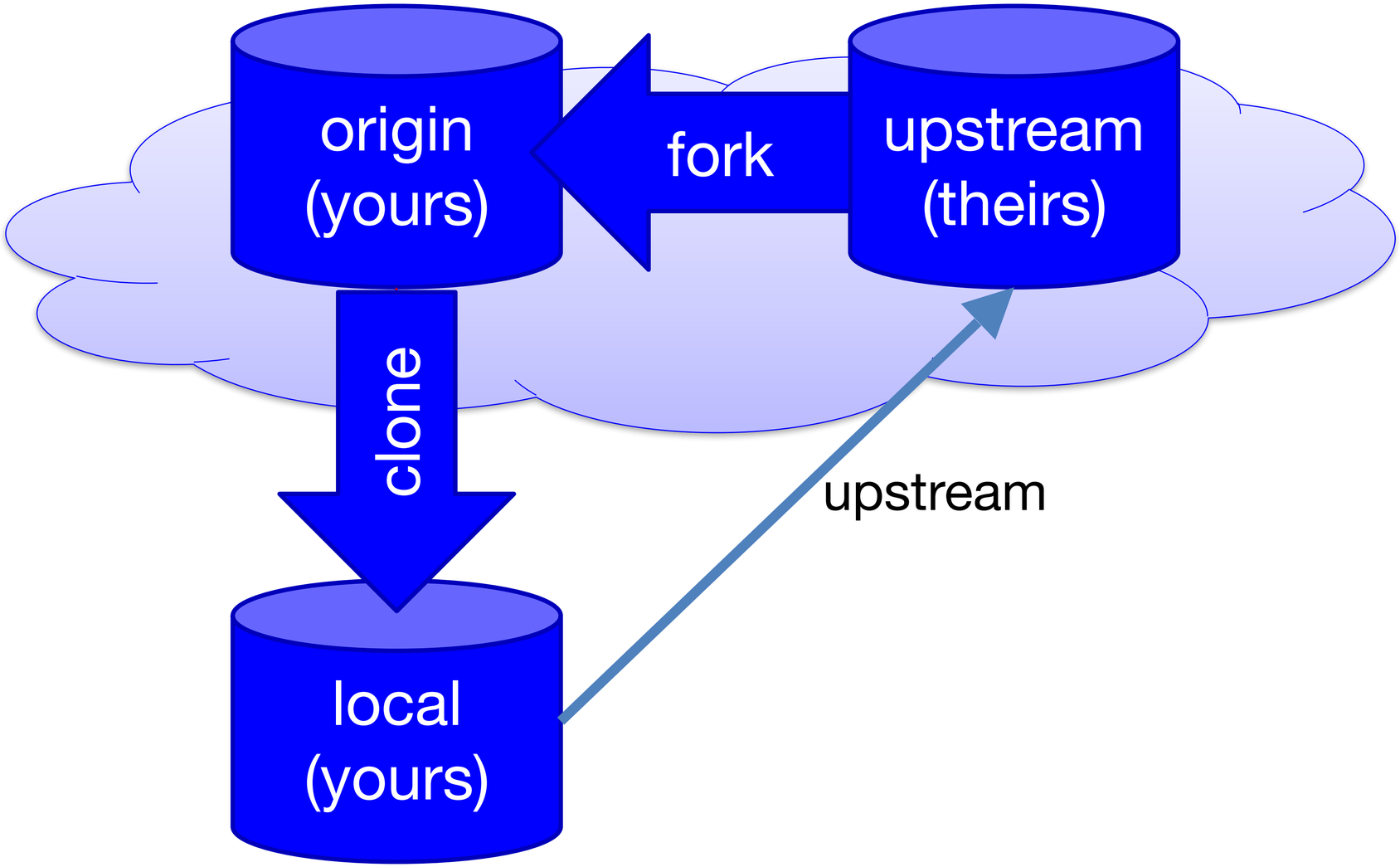
Setup



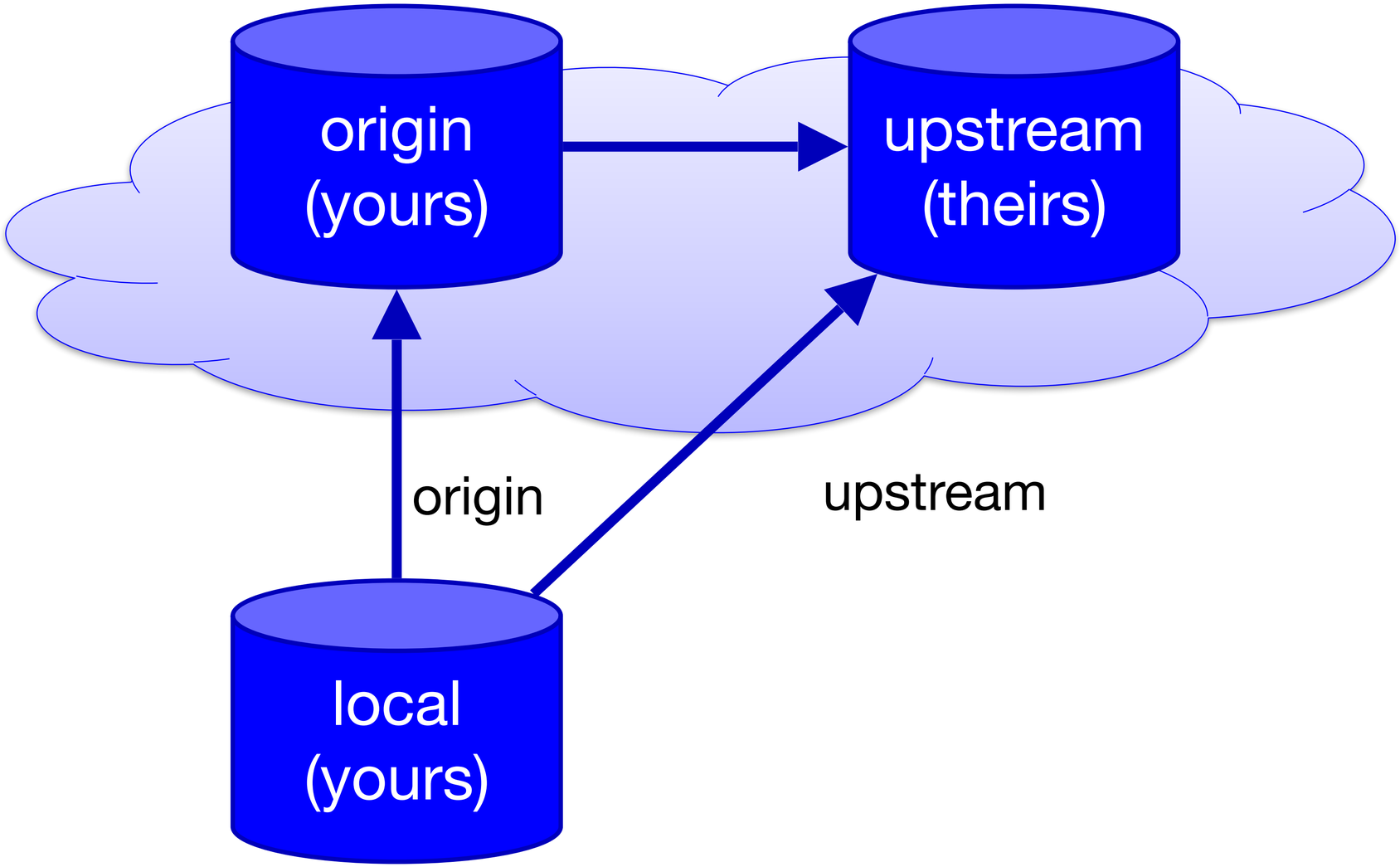
Setup



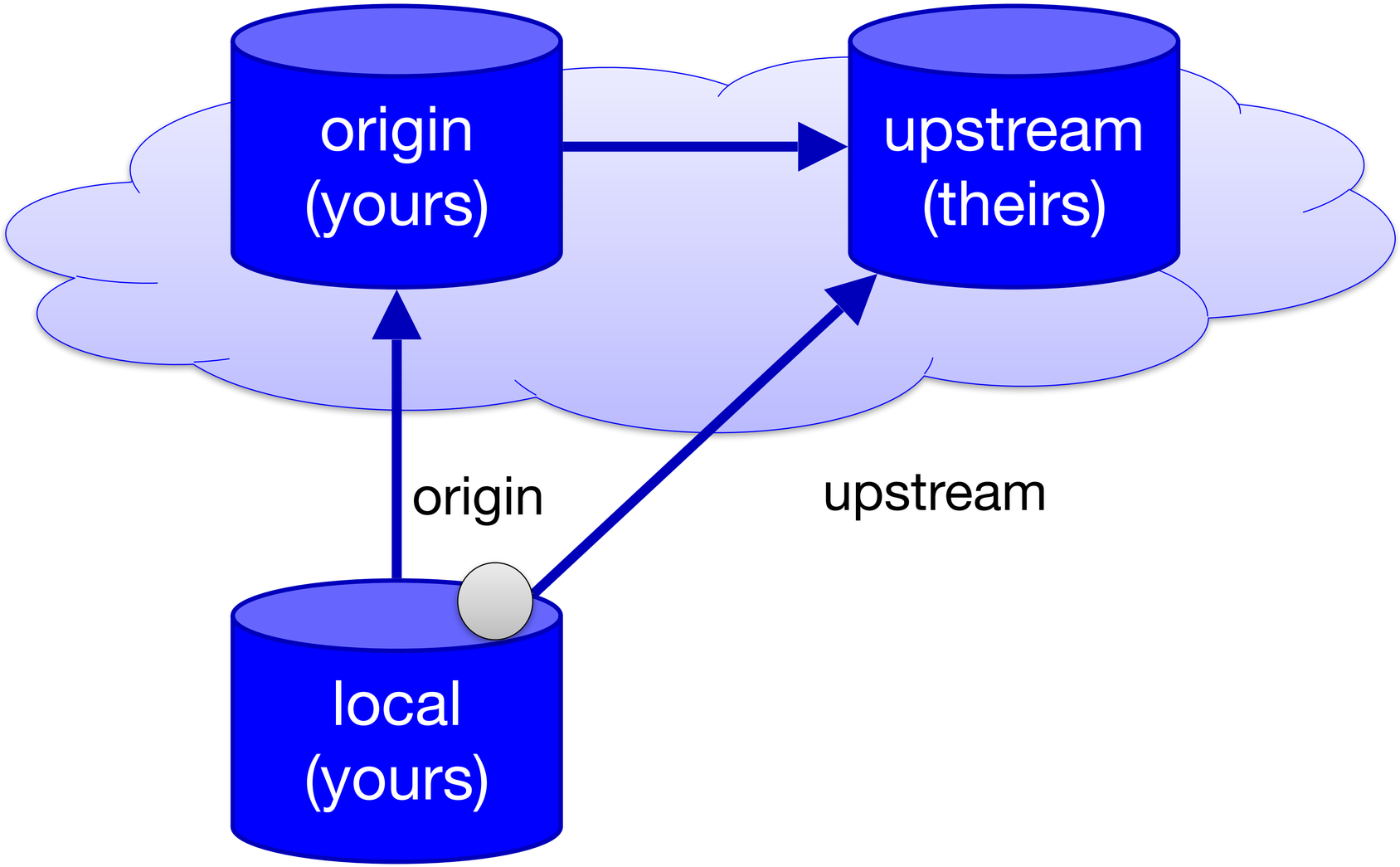
Setup


origin
(yours)
fork
upstream
(theirs)
clone
upstream
local
(yours)

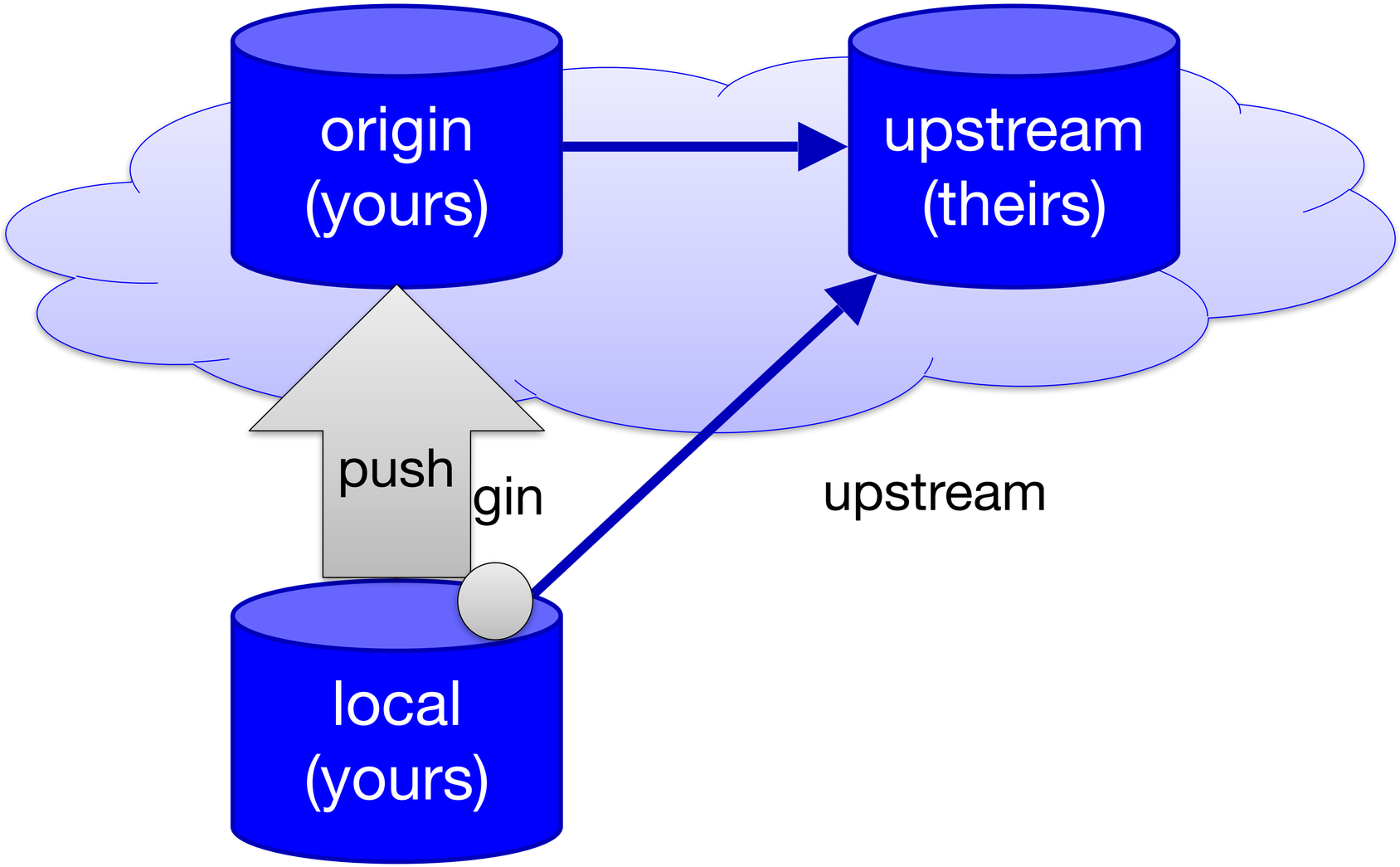
Setup



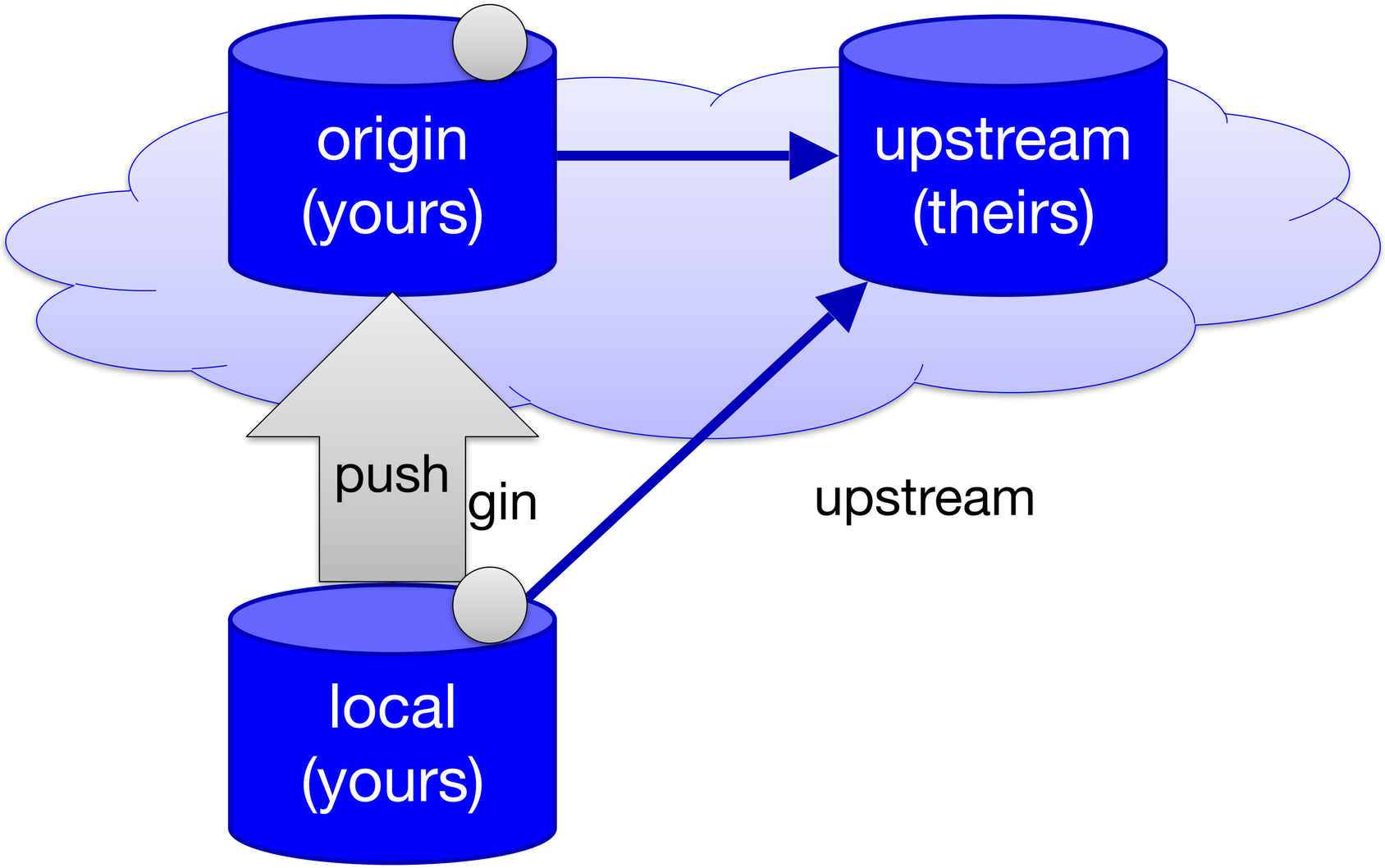
Contribute Changes



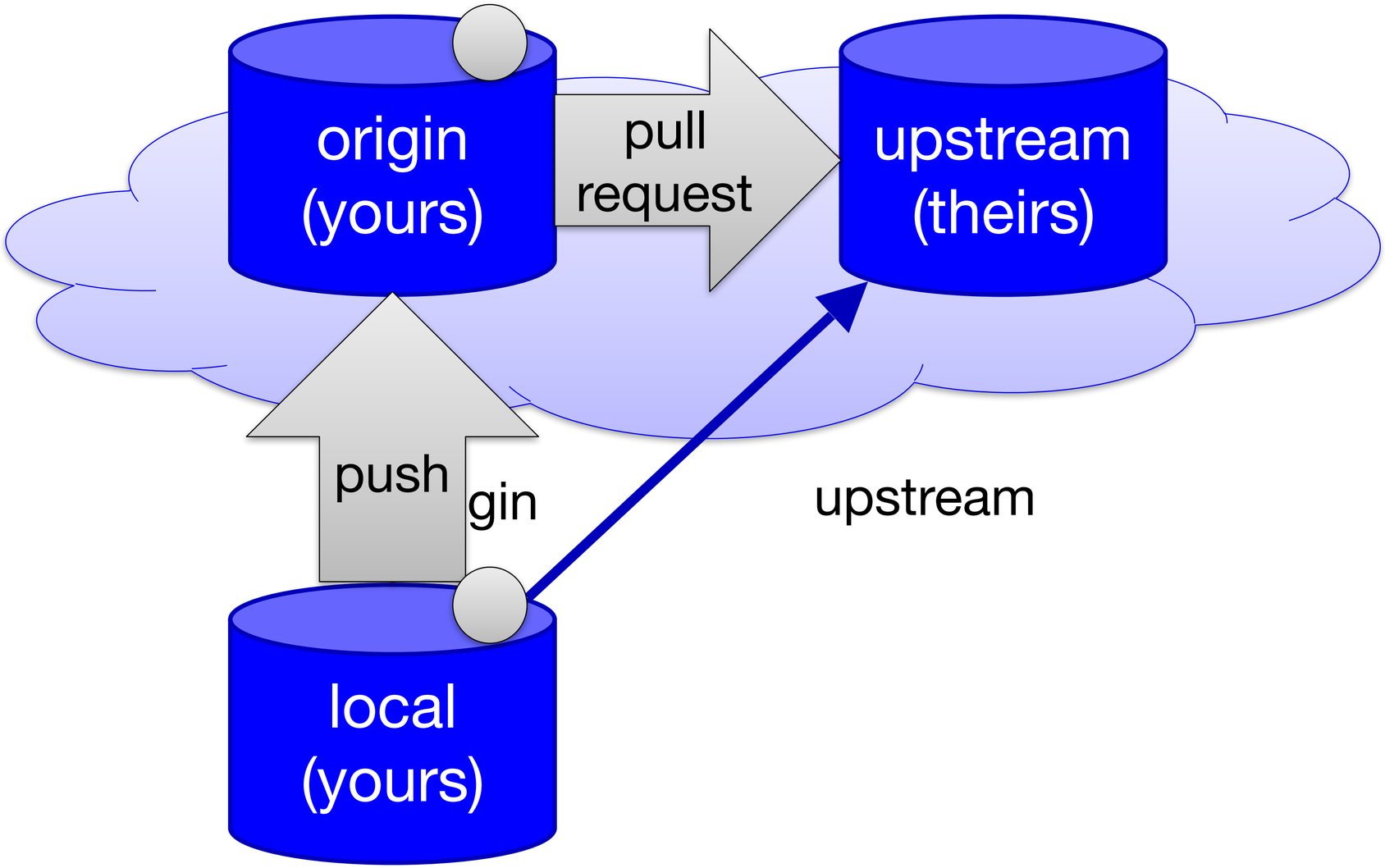
Contribute Changes



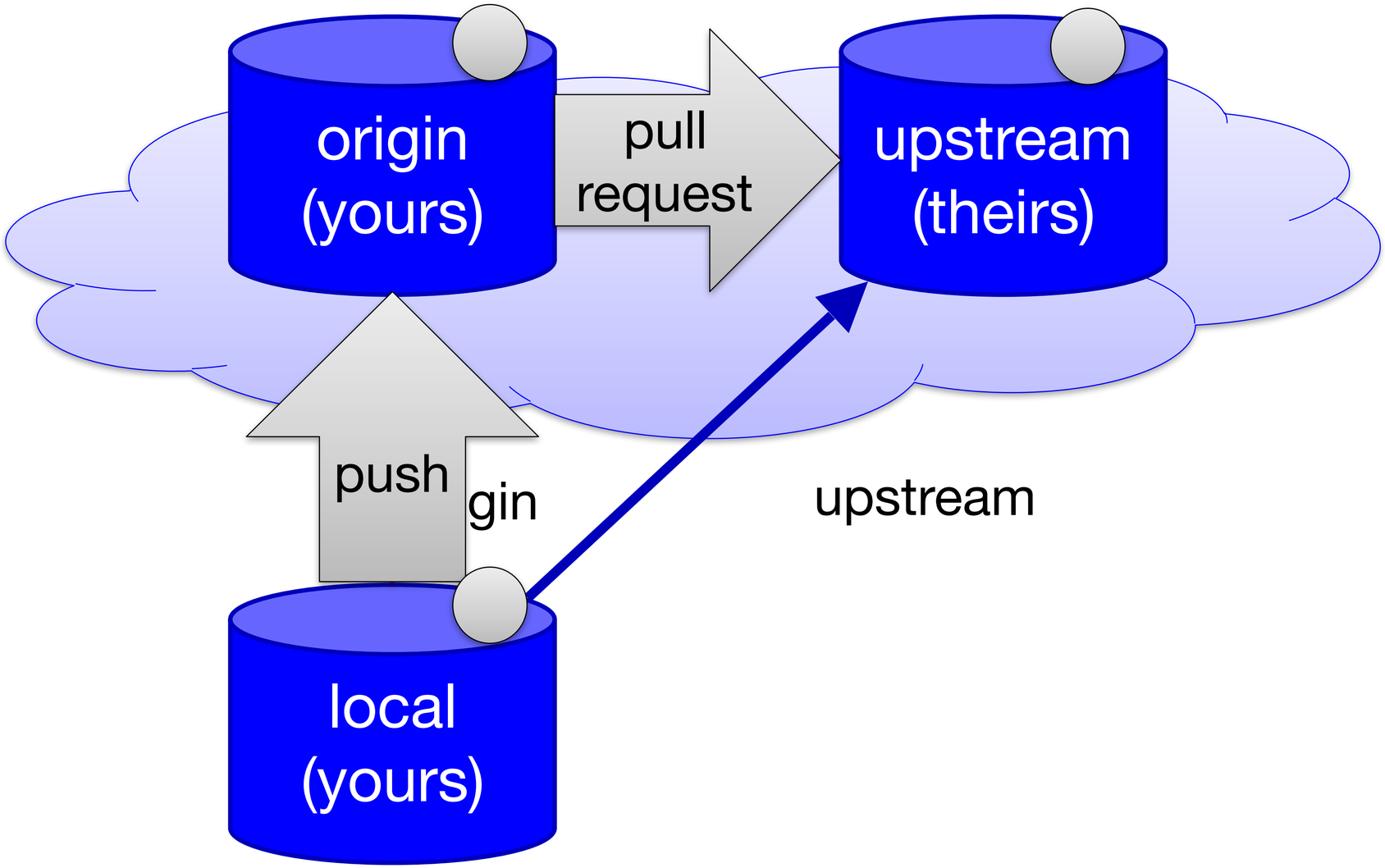
Contribute Changes



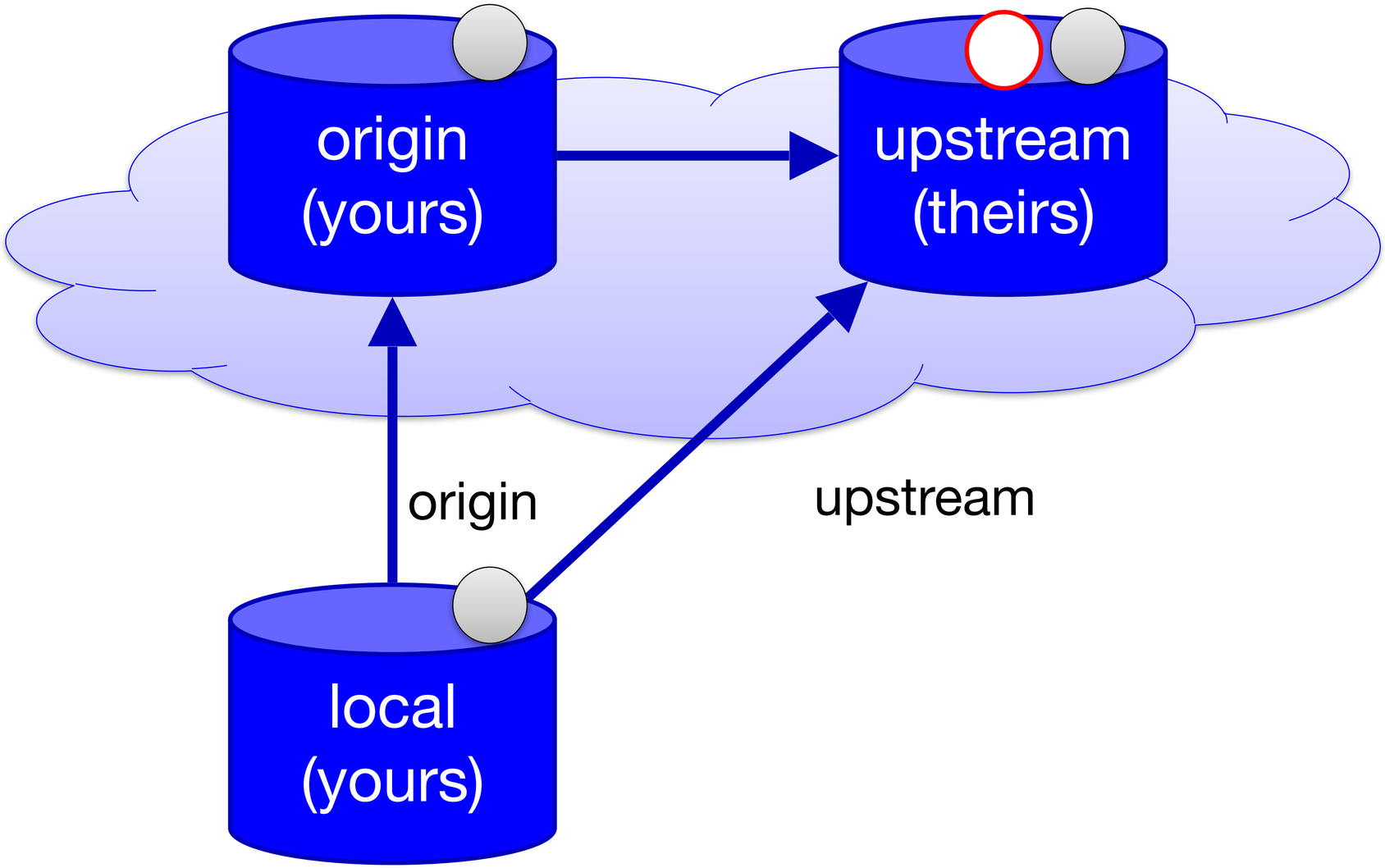
Contribute Changes



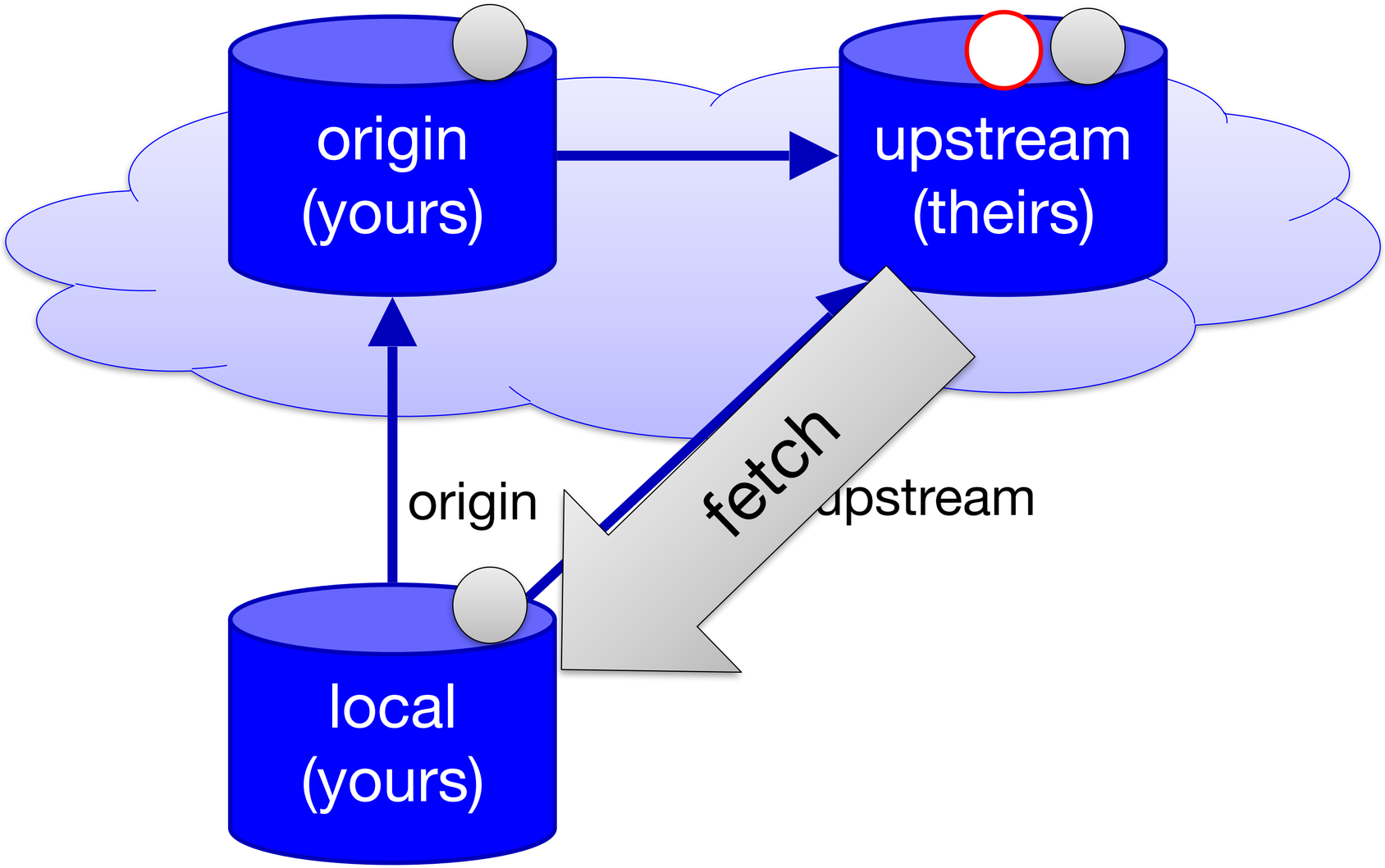
Contribute Changes



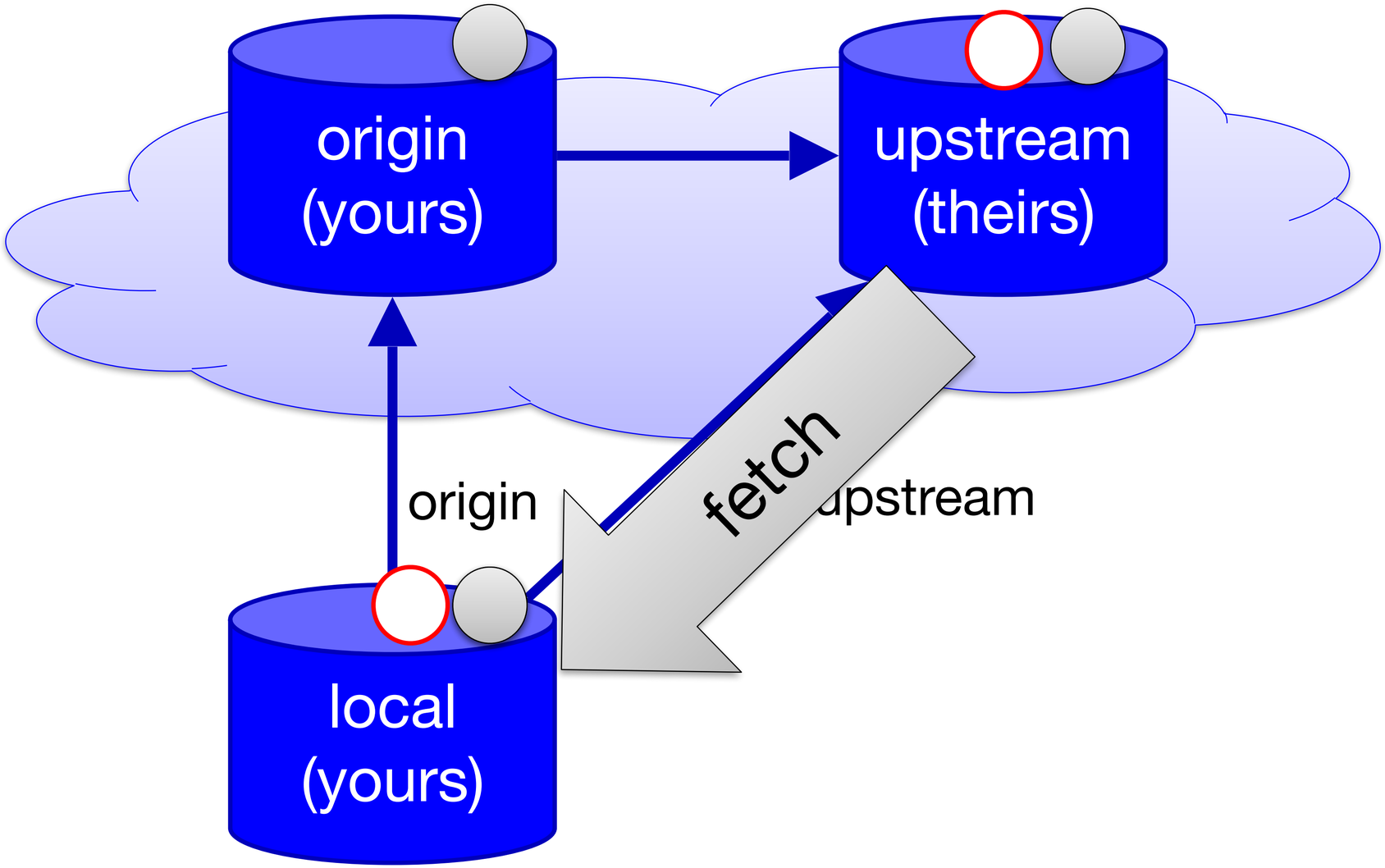
Integrate Changes



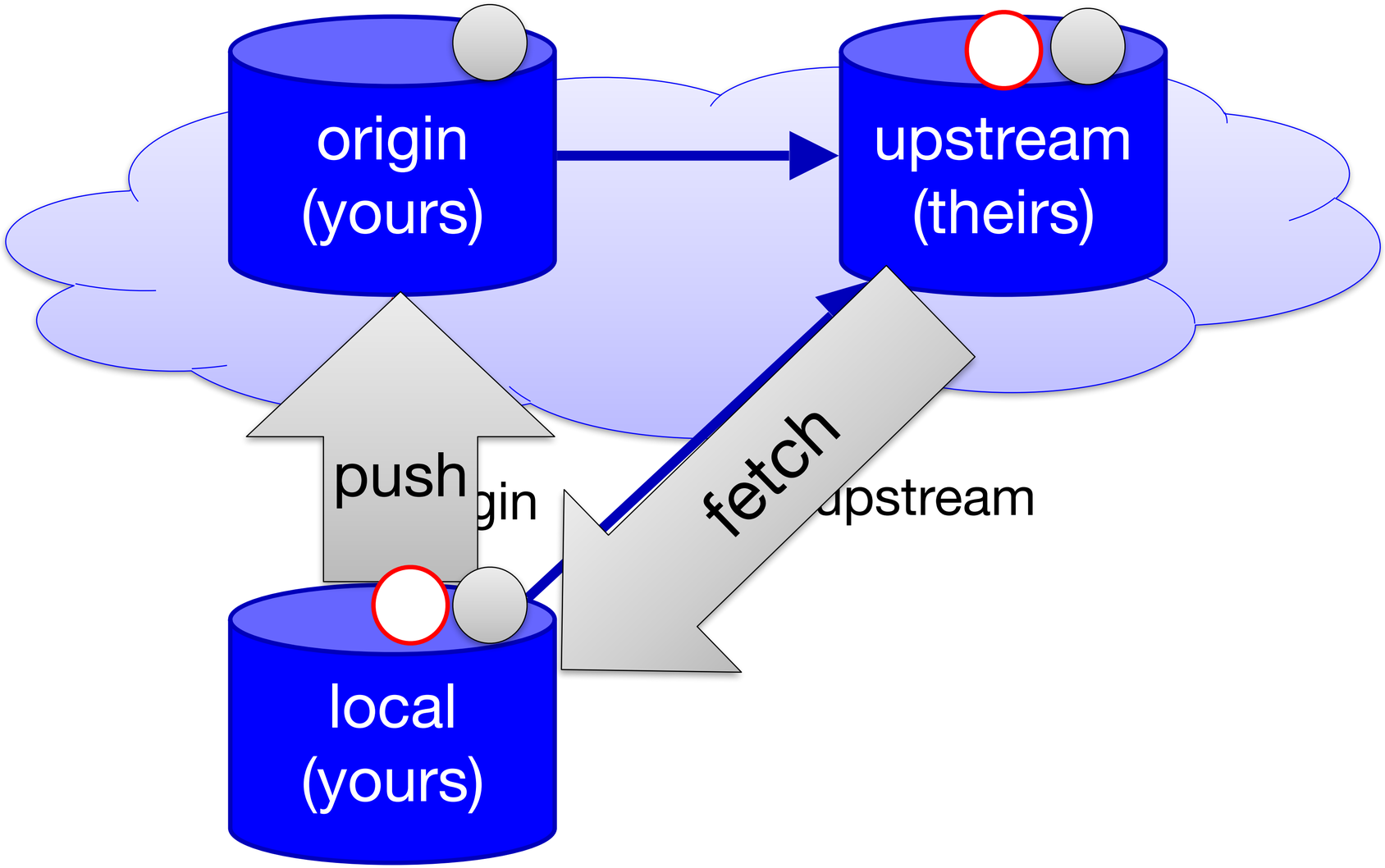
Integrate Changes



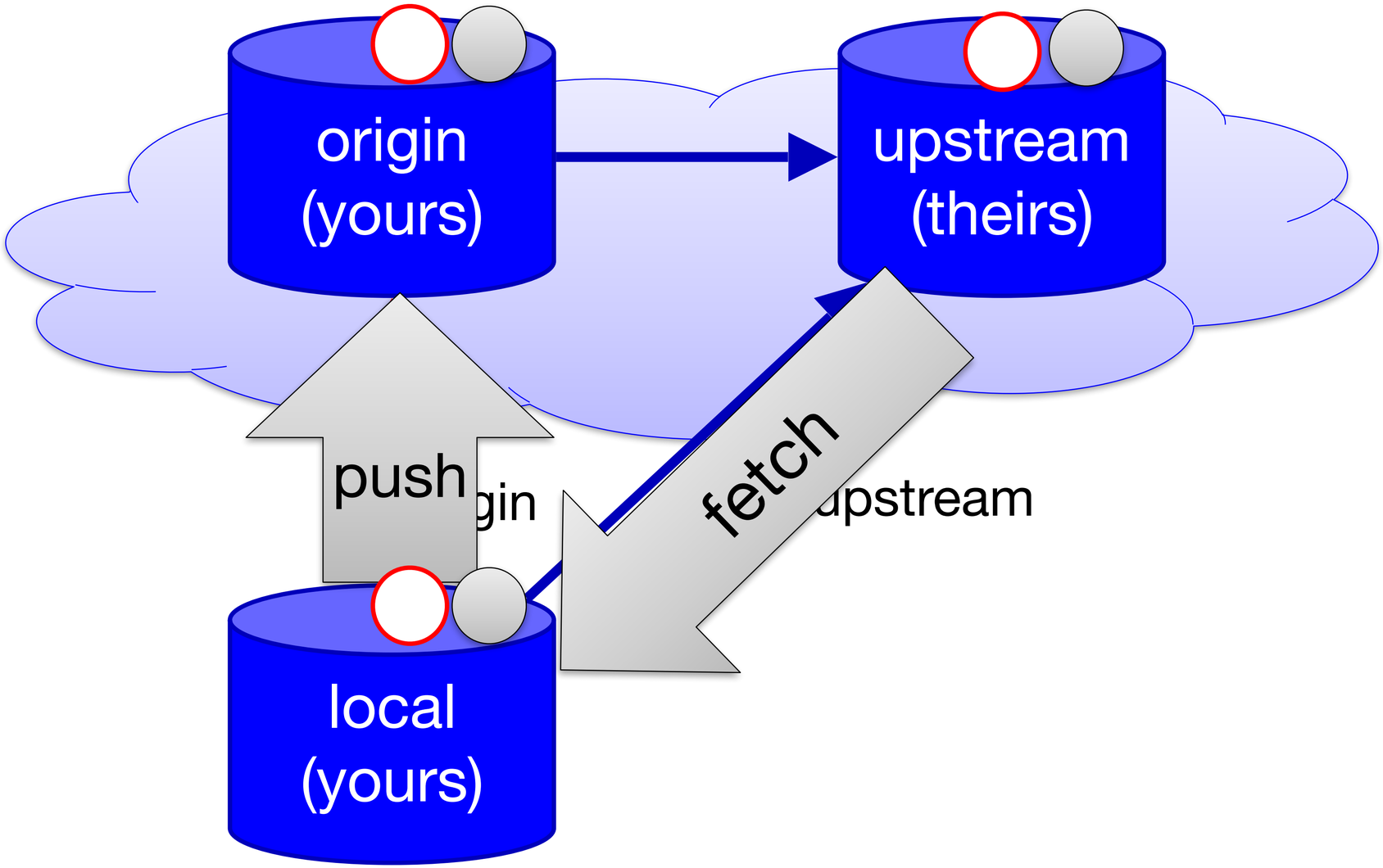
Integrate Changes



Integrate Changes



Integrate Changes



You want to contribute code to the Github project `fancy/project` (`fancy` is the name of the owner, `project` is the name of the repo). You fork the repo (producing `student/project`), commit your changes, and push to `student/project`. Next, you make a pull request for `fancy/project`.

Which statement is true?

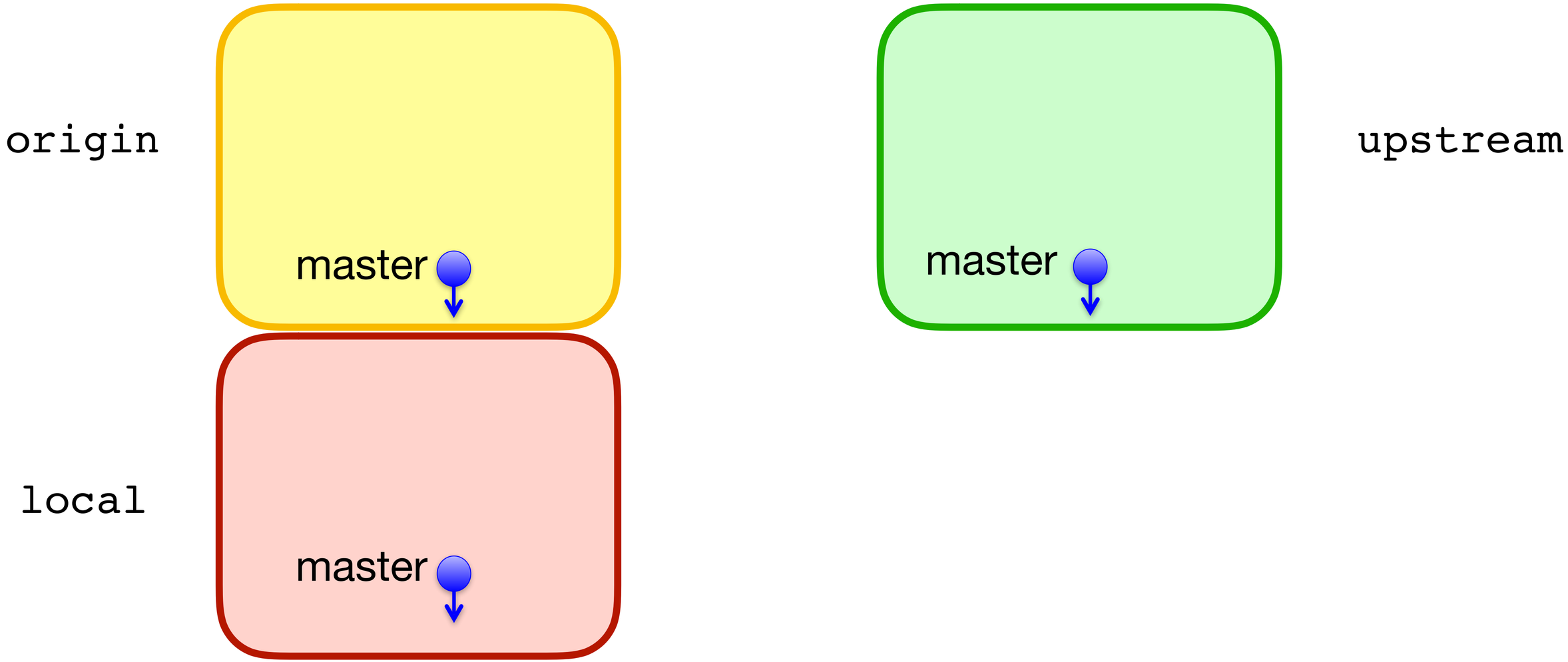
A. Your code is now integrated into `fancy/project` via merging

B. Your code is now integrated into `fancy/project` via rebasing

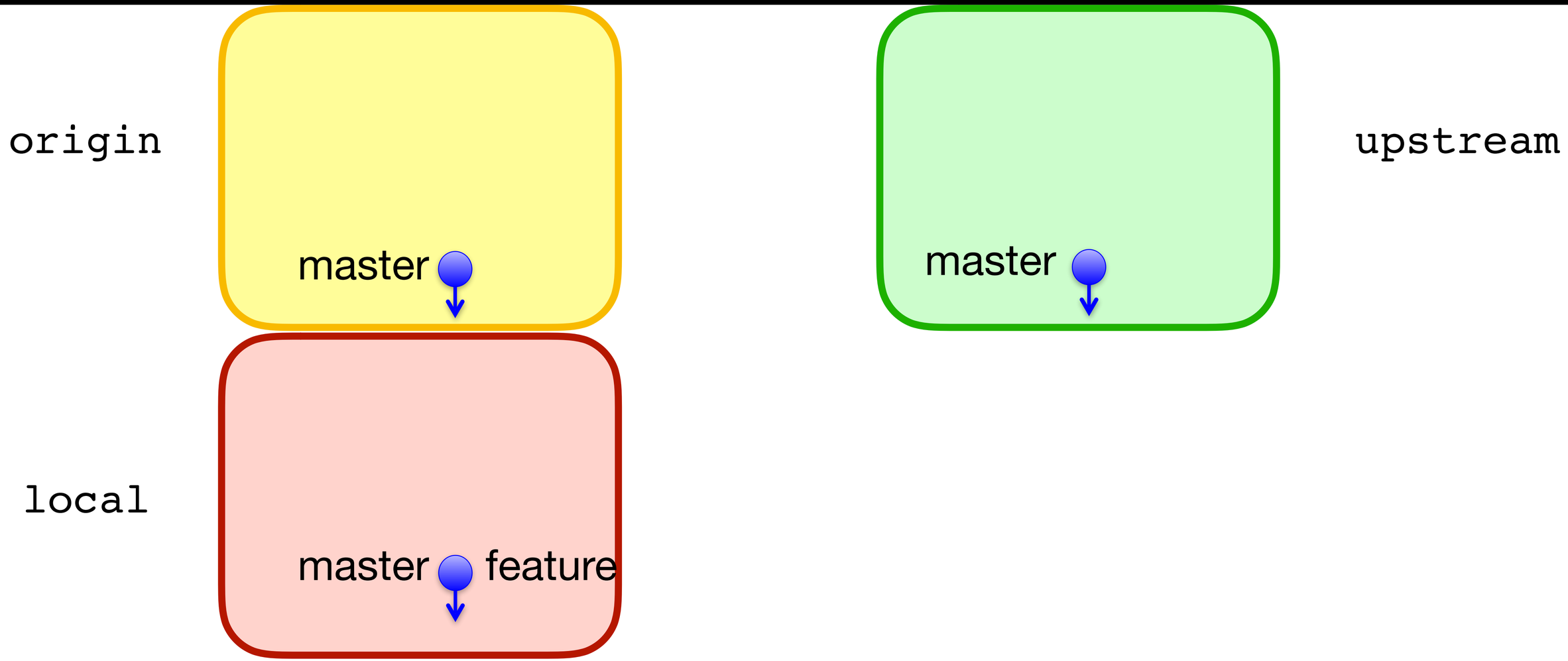
C. You have requested that your code be integrated into `fancy/project`, but no changes have been made

D. You cannot make any additional commits until the pull request has been accepted

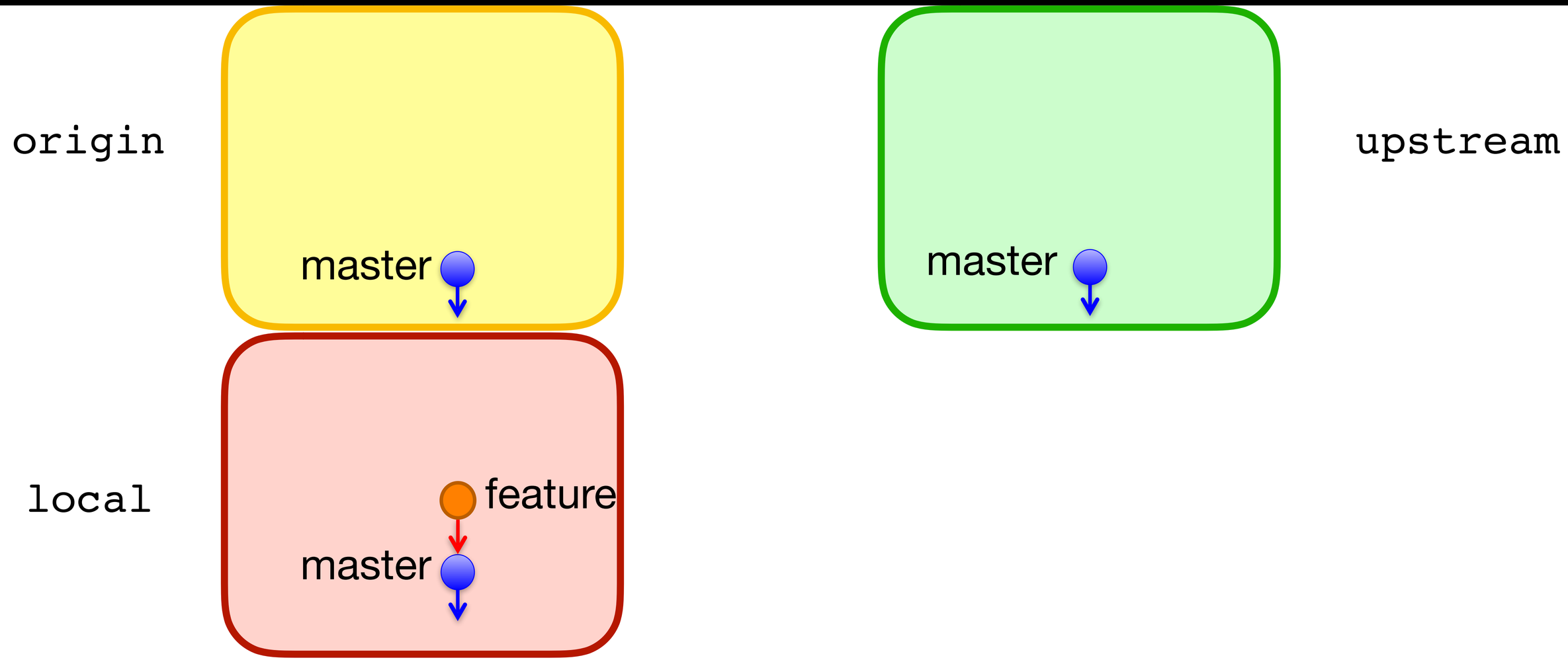
Branches



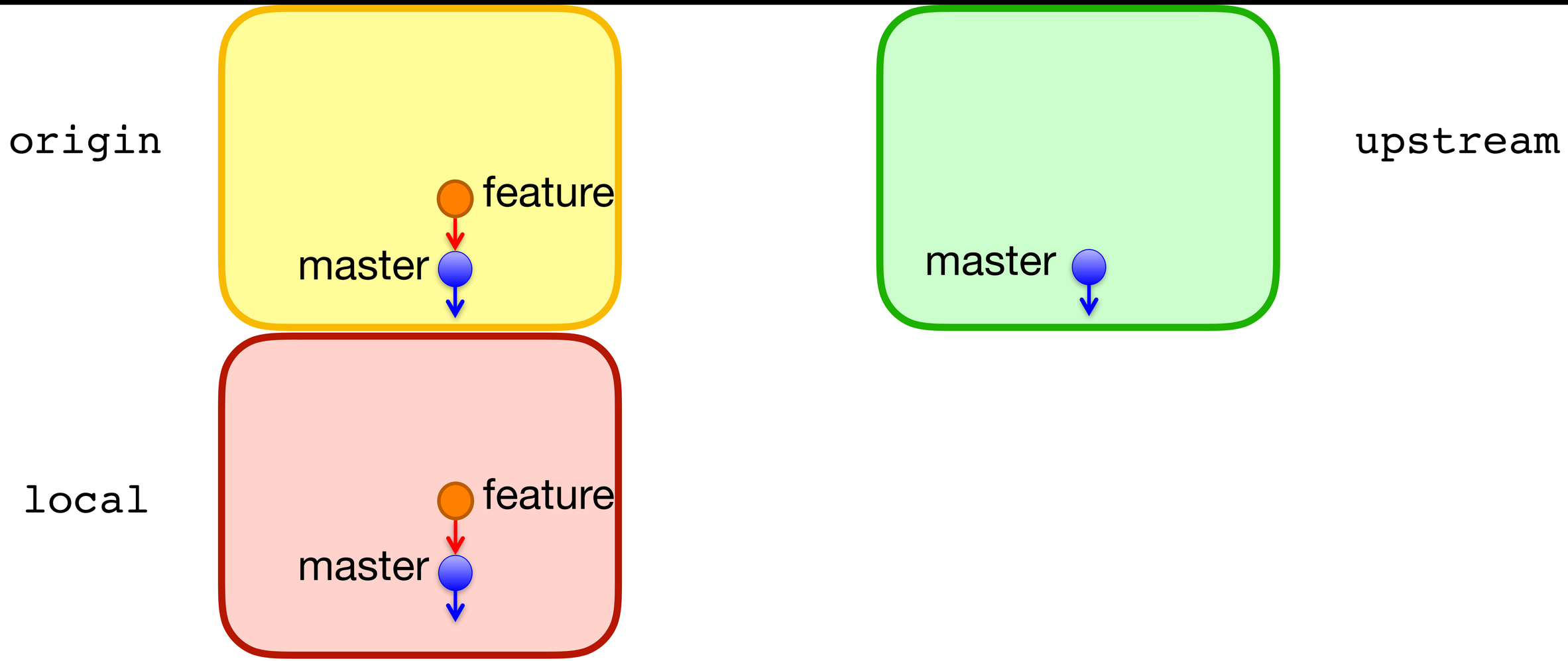
$ git checkout -b feature

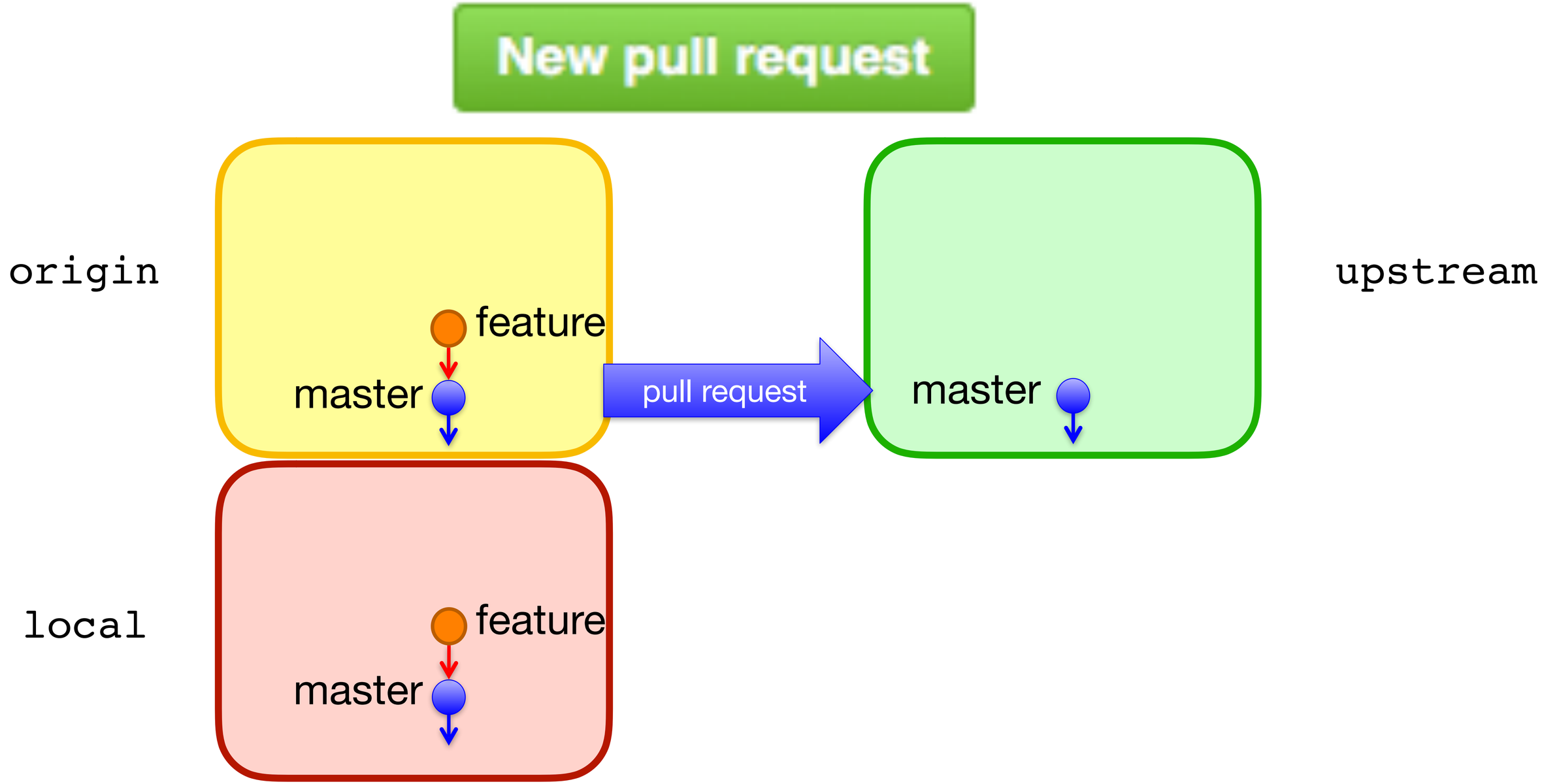


$ git commit

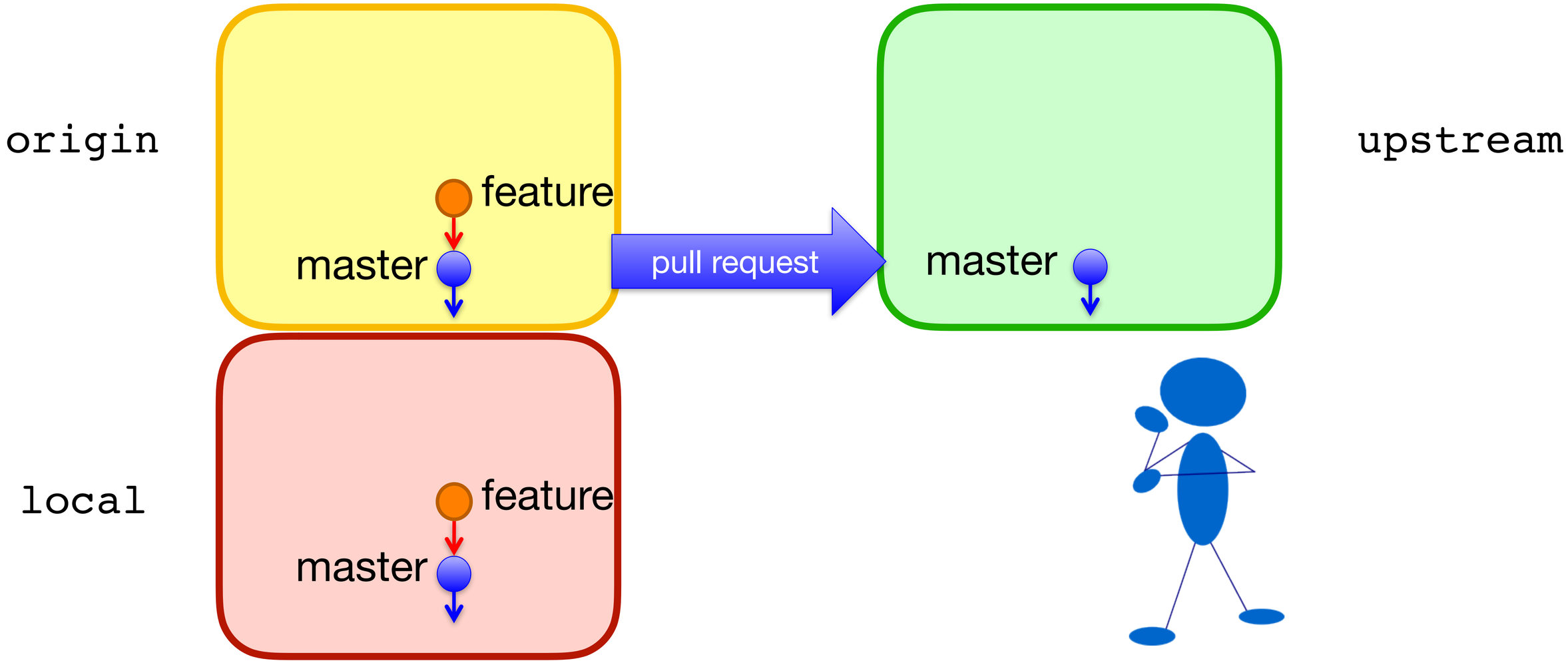


$ git push -u origin feature

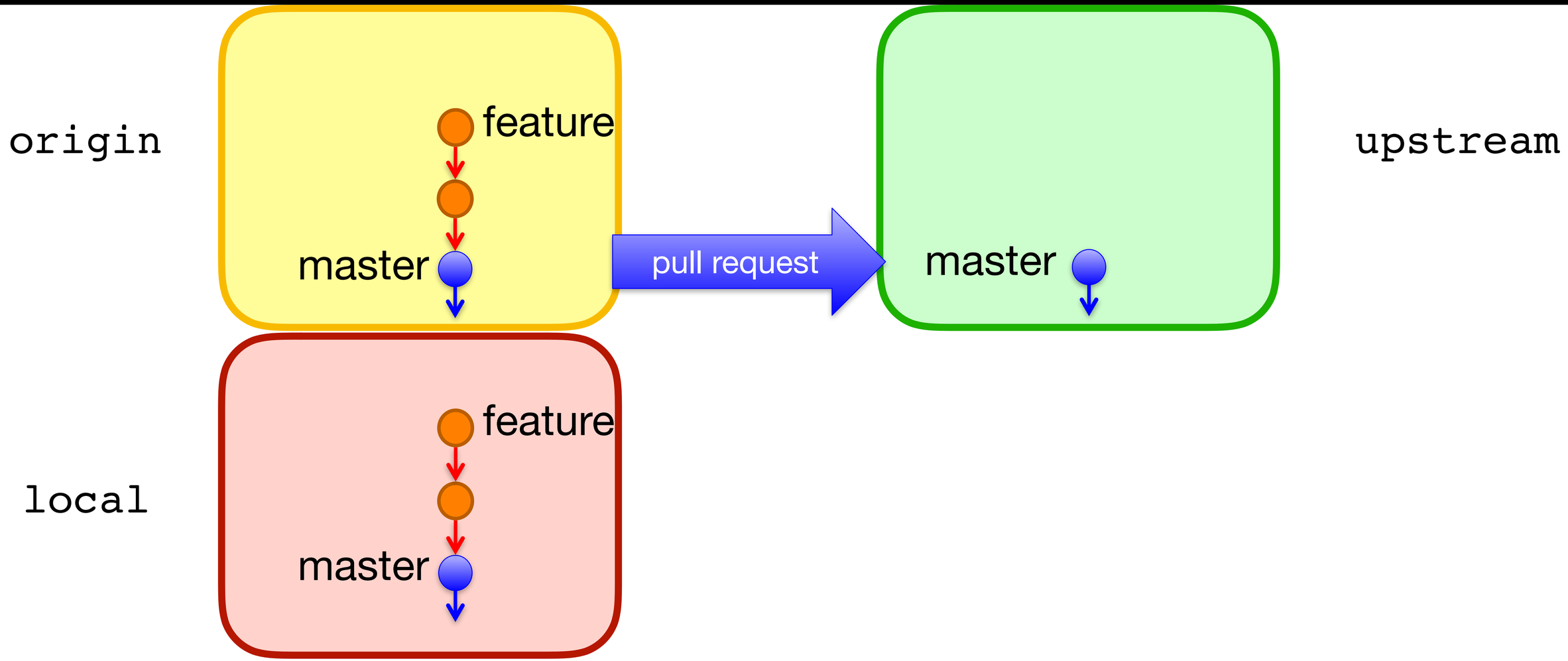



New pull request
origin
upstream
feature
master
pull request
master
local
feature
master

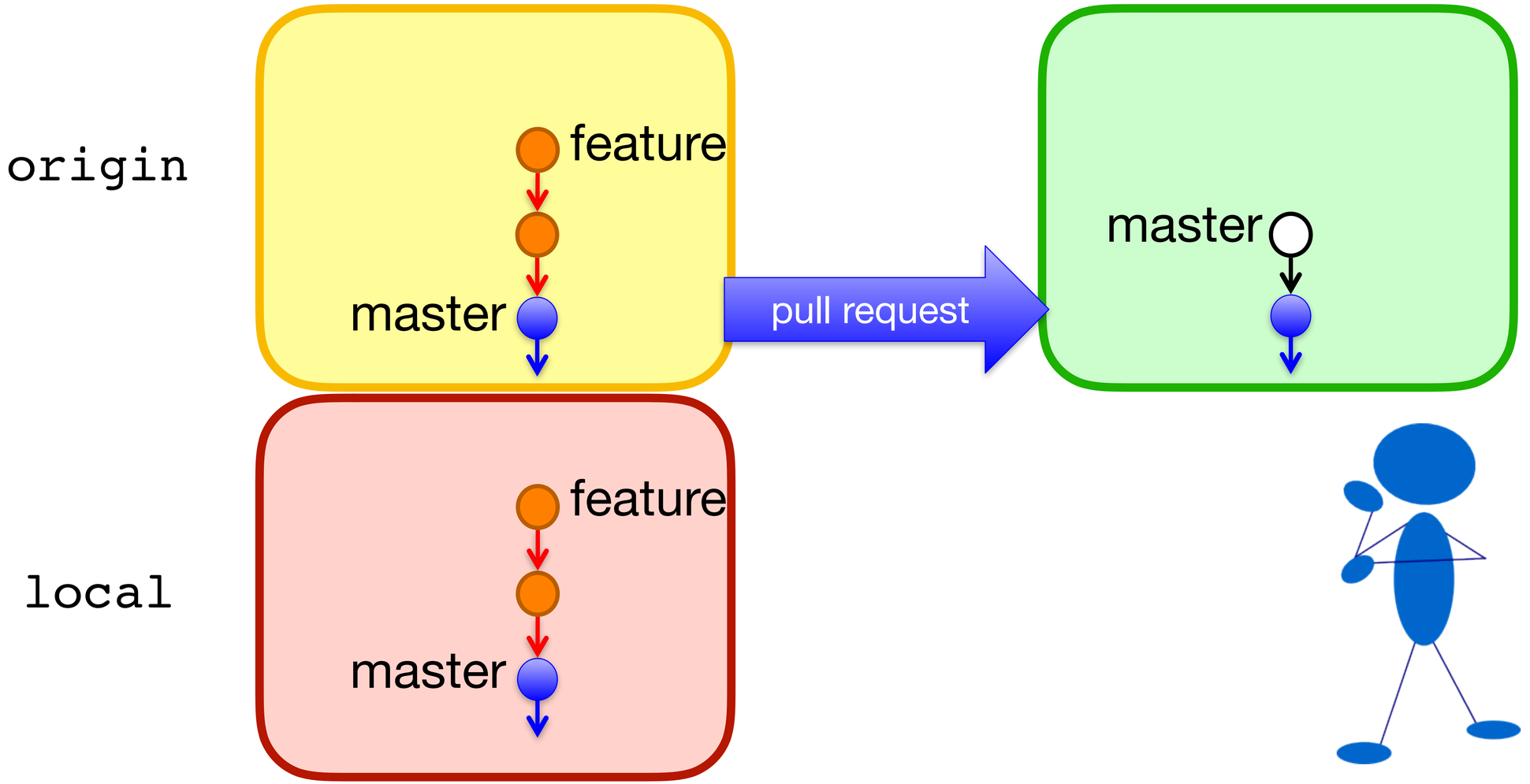
Great idea, now can you do it more like this?



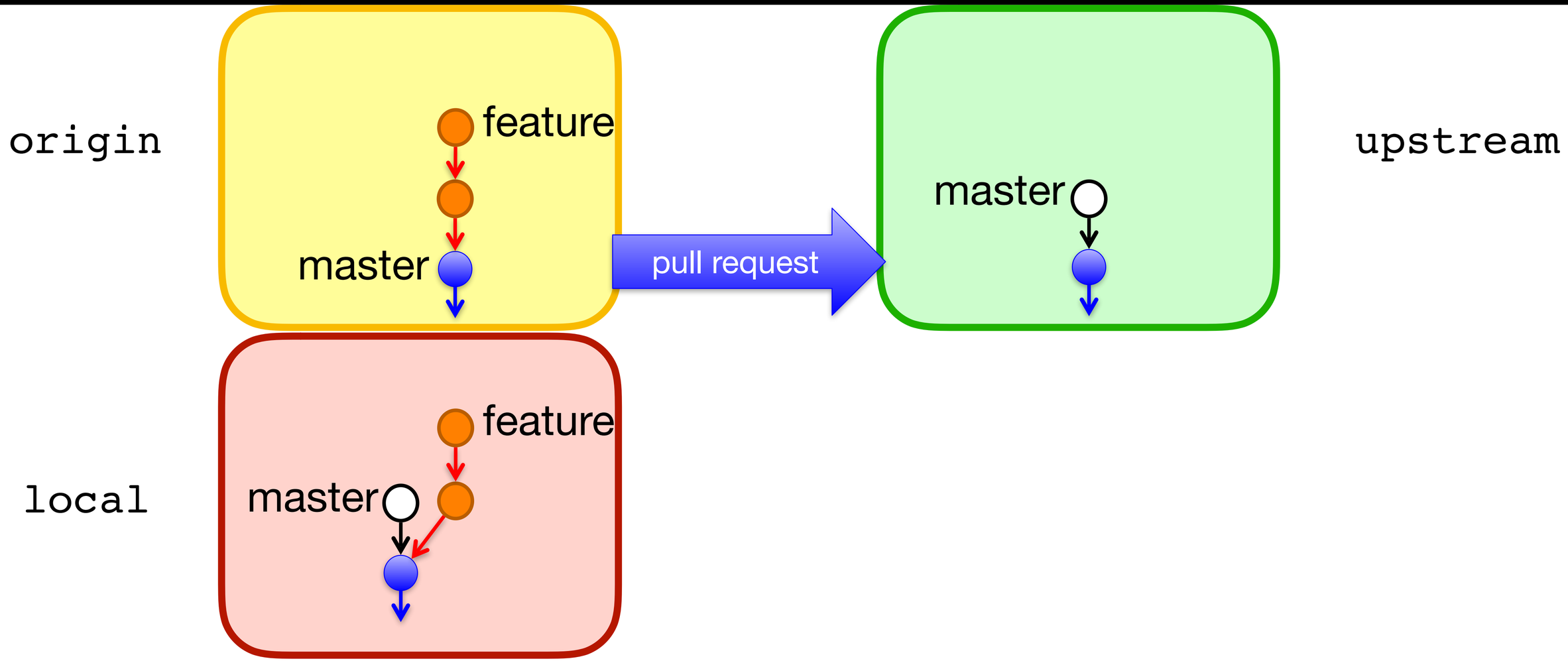
$ git commit
$ git push



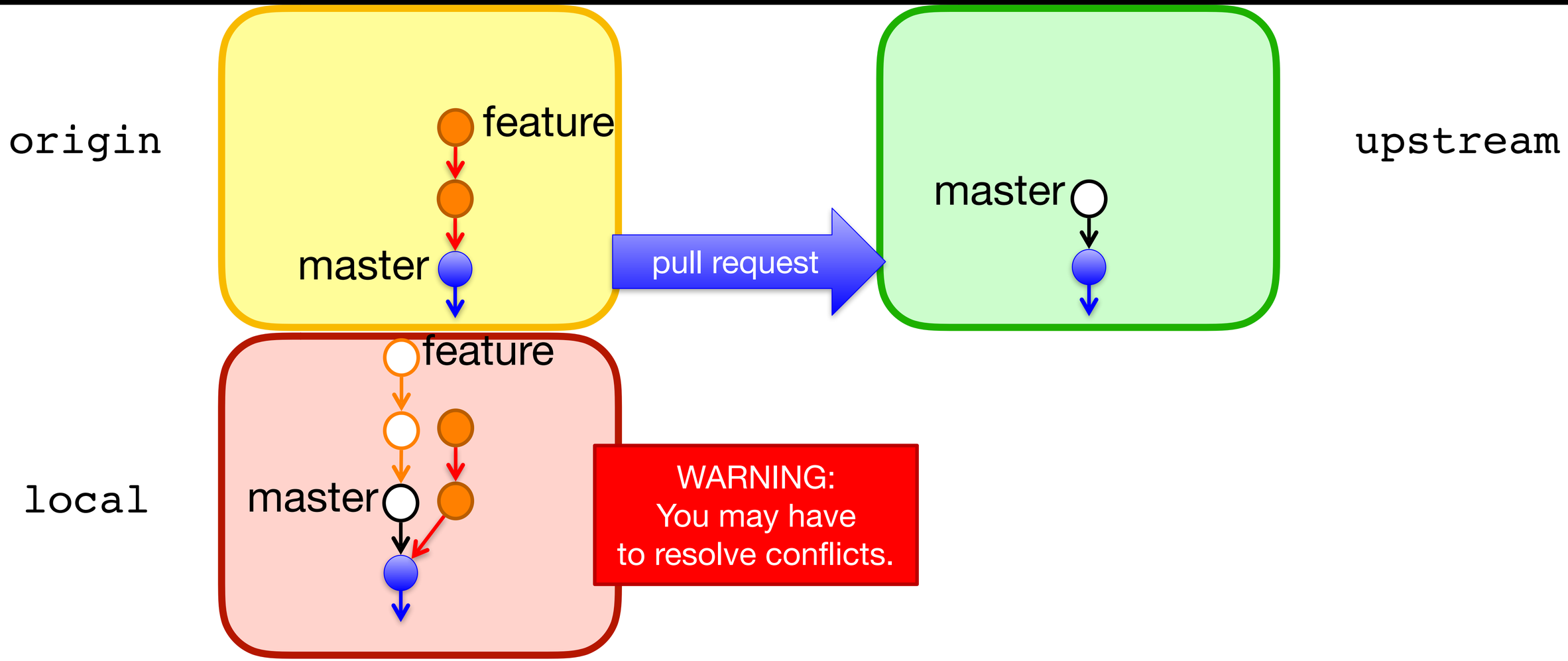
Awesome, but please update with new changes in master



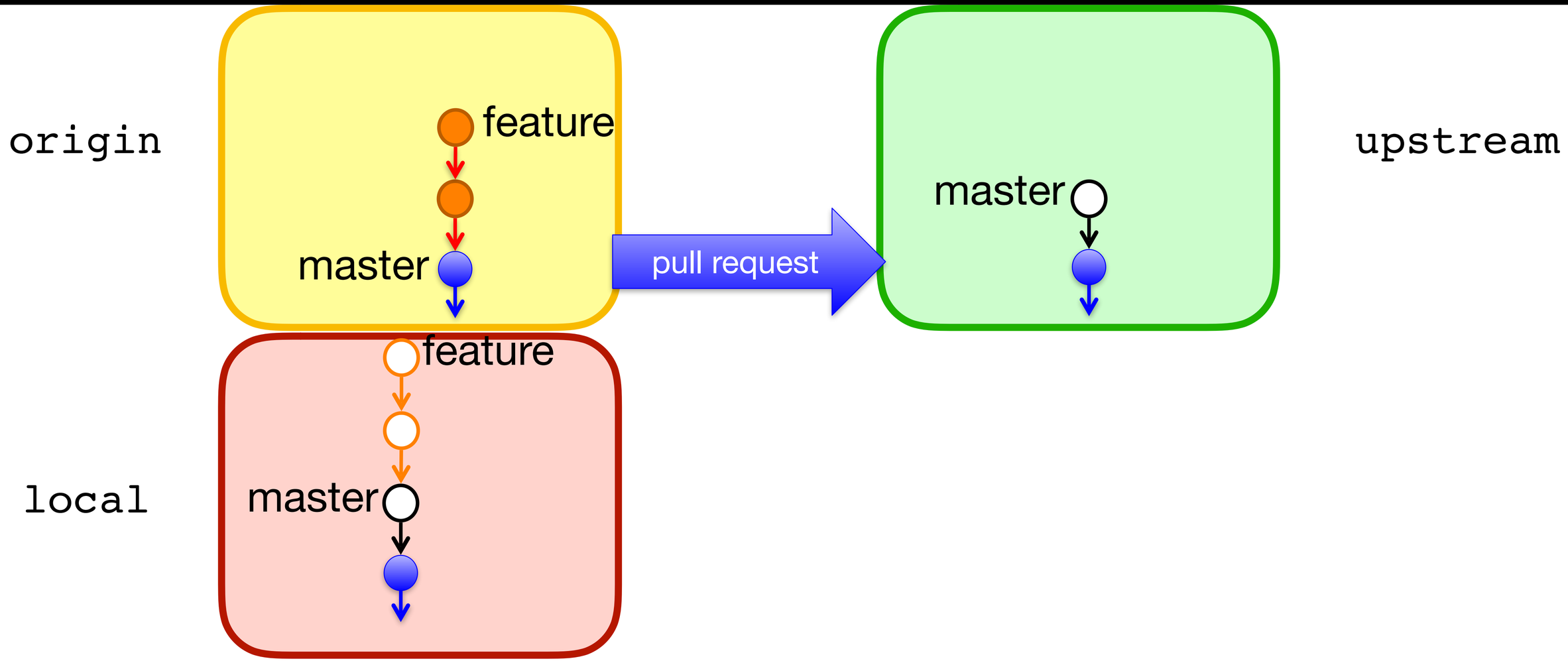
```
$ git remote add upstream https://github.com/…
$ git fetch upstream master:master
```



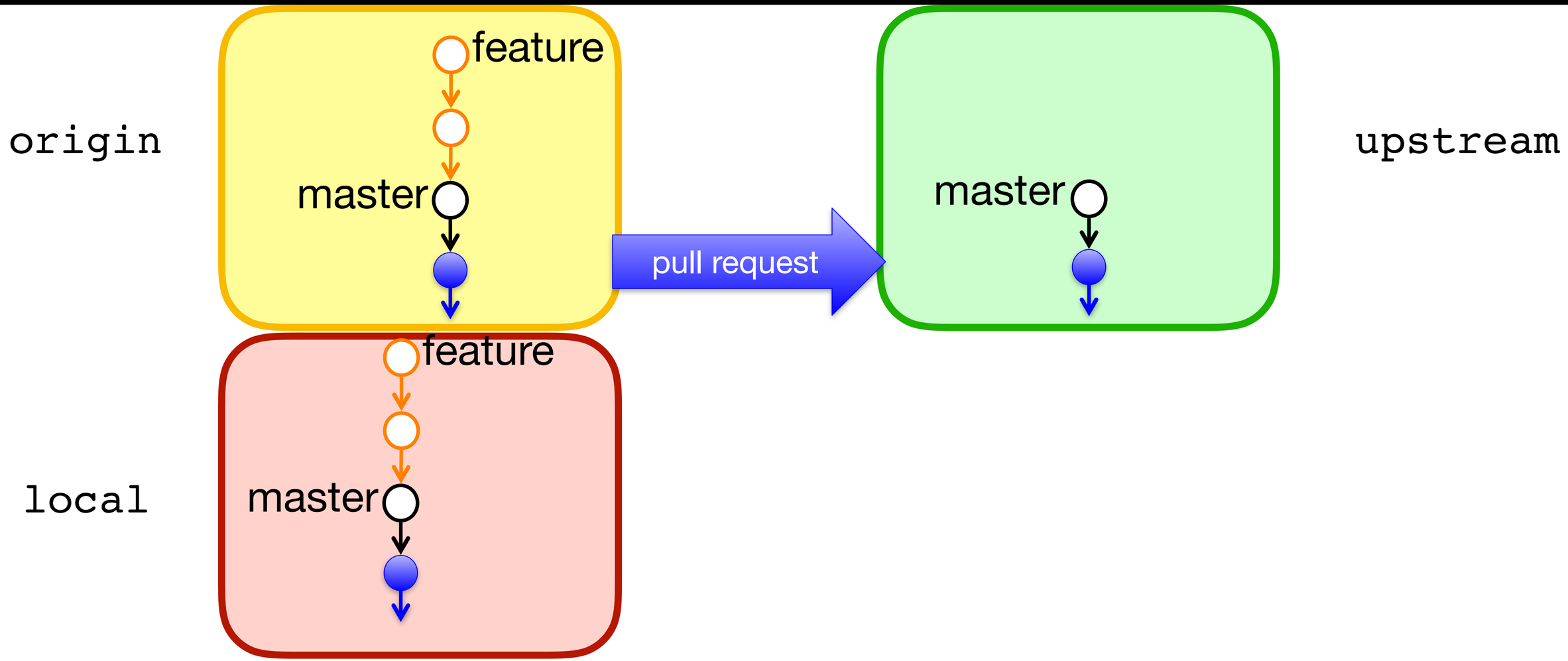
$ git rebase master



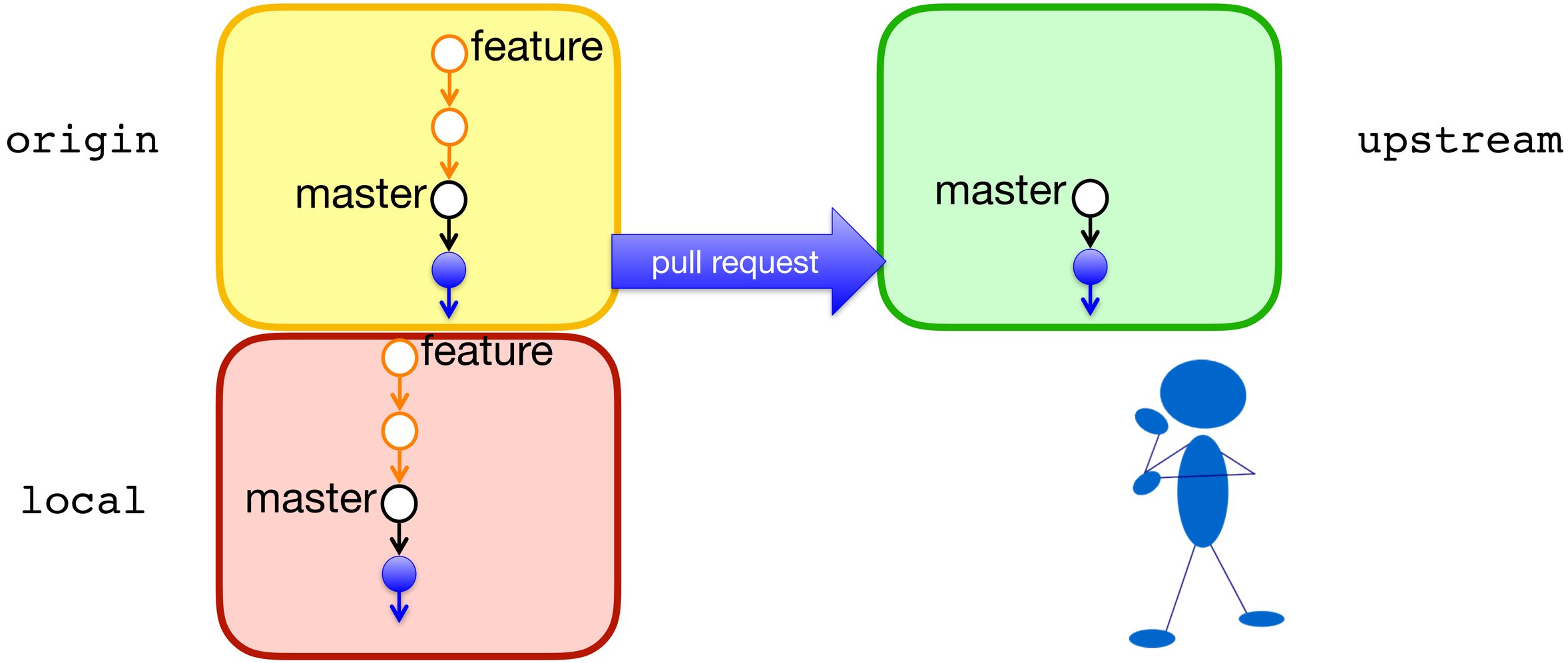
$ git rebase master



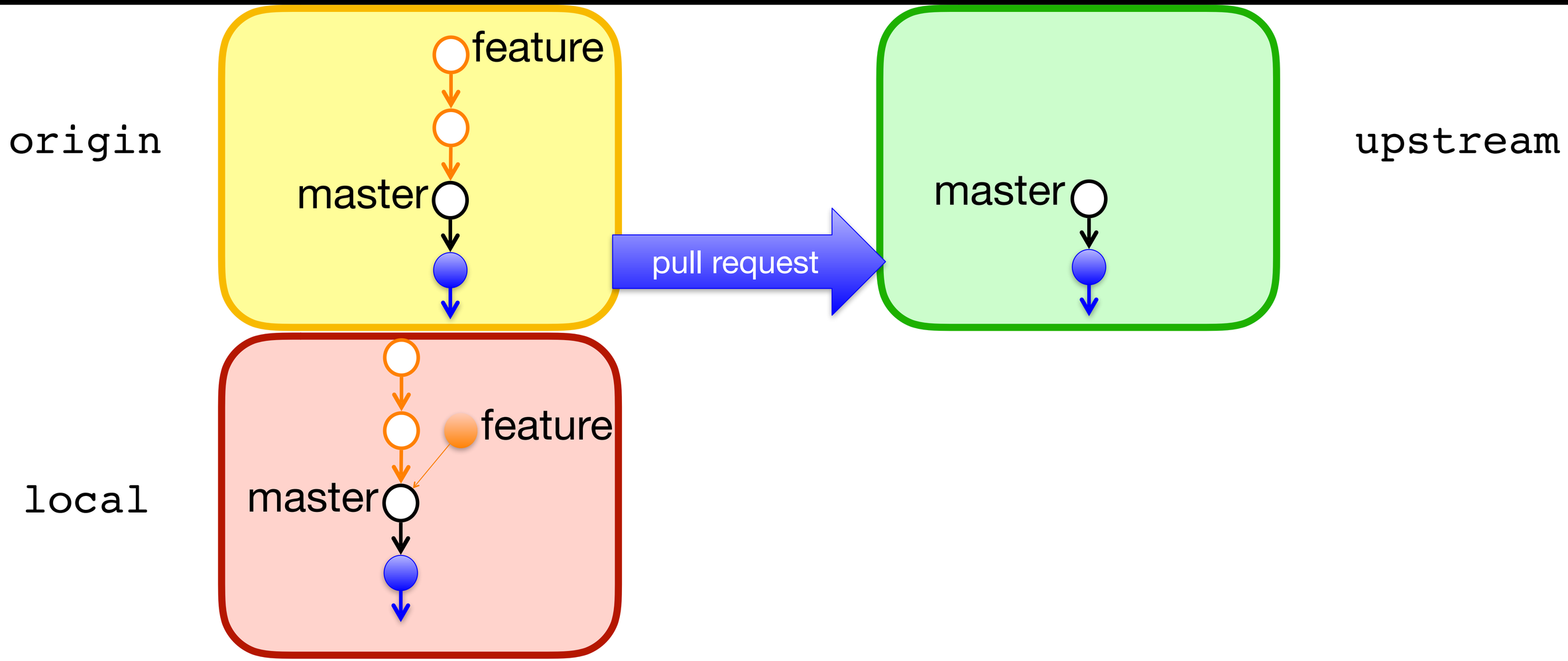
$ git push -f origin master feature



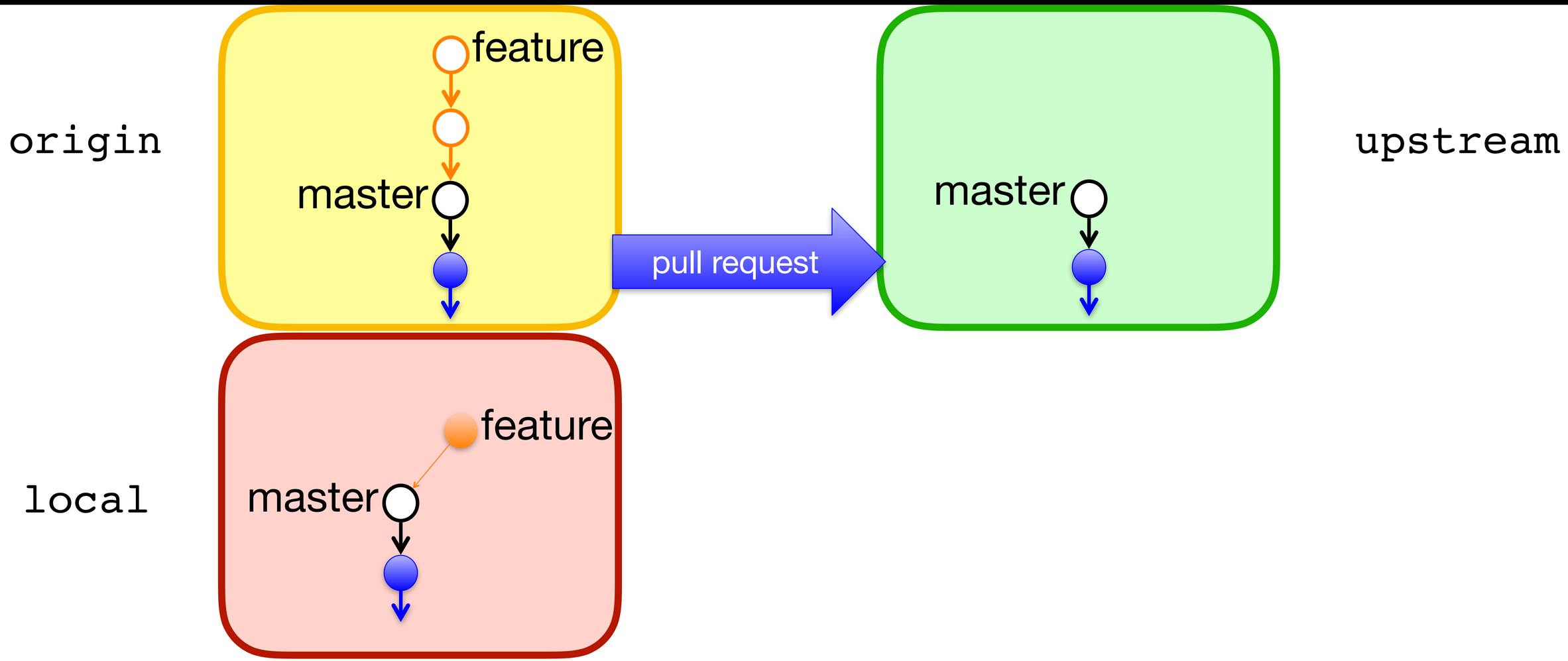
Great. Please squash your commits.



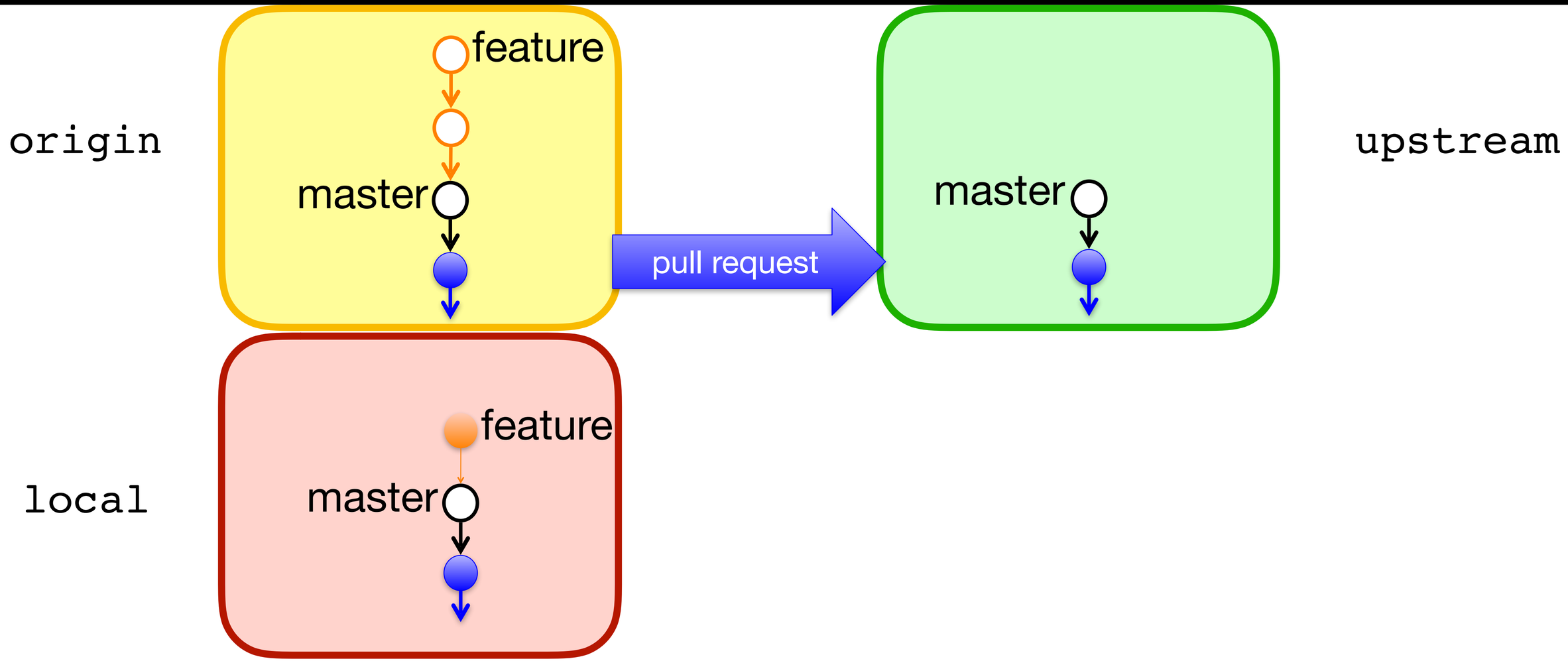
$ git rebase –i master



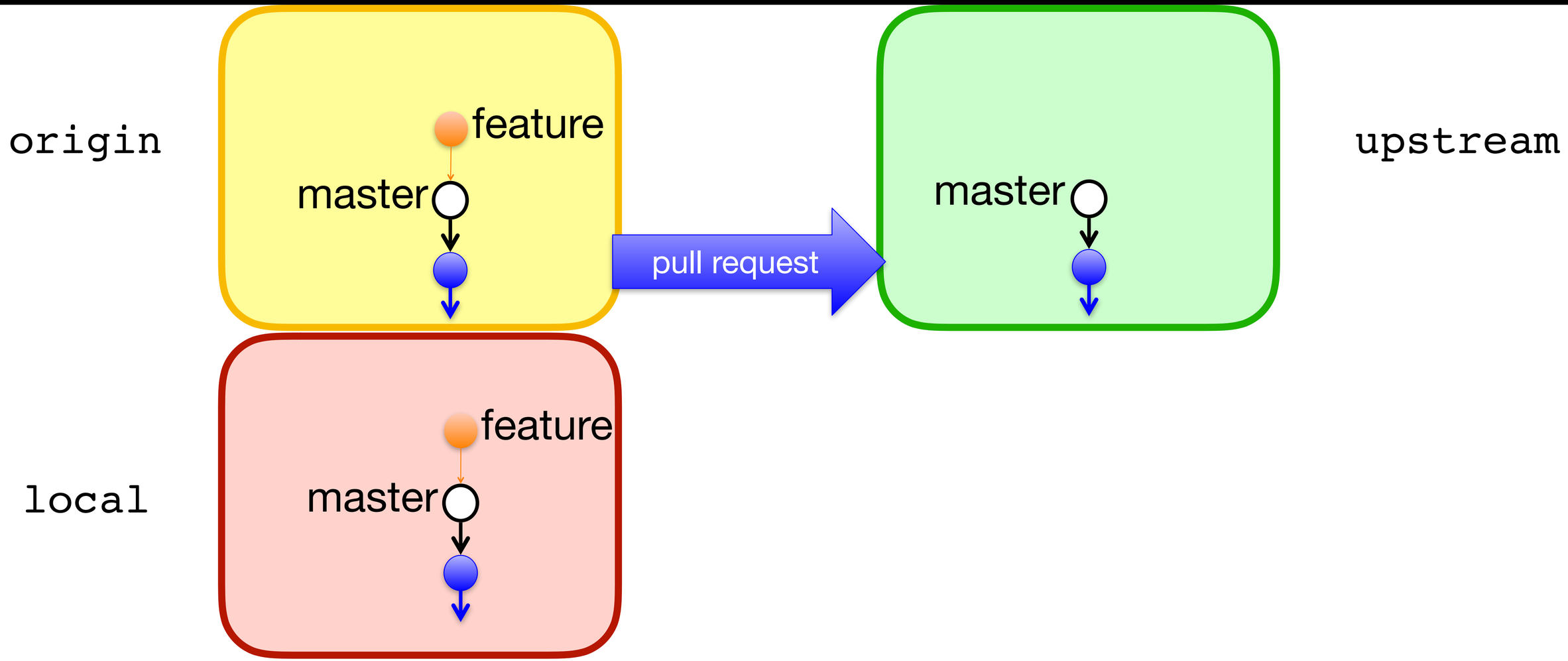
$ git rebase –i master



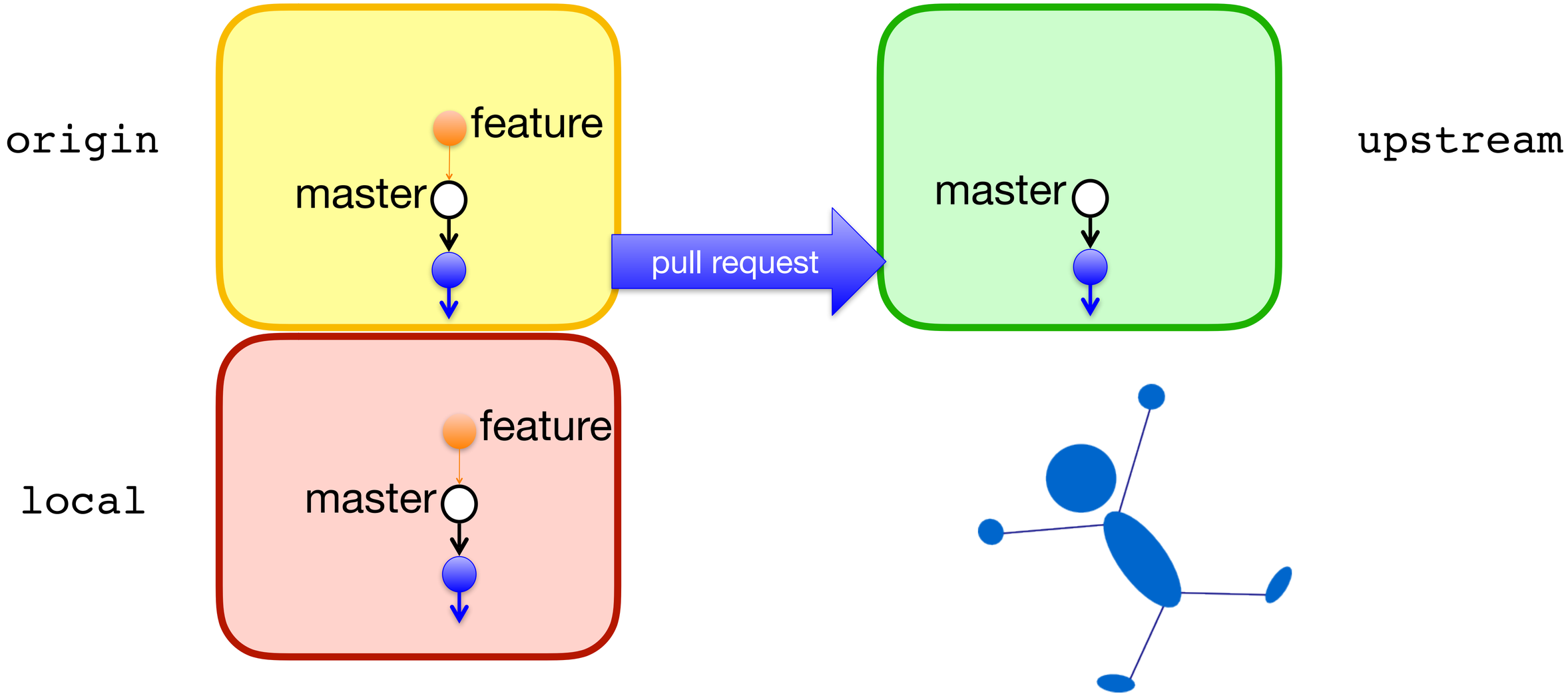
$ git rebase –i master



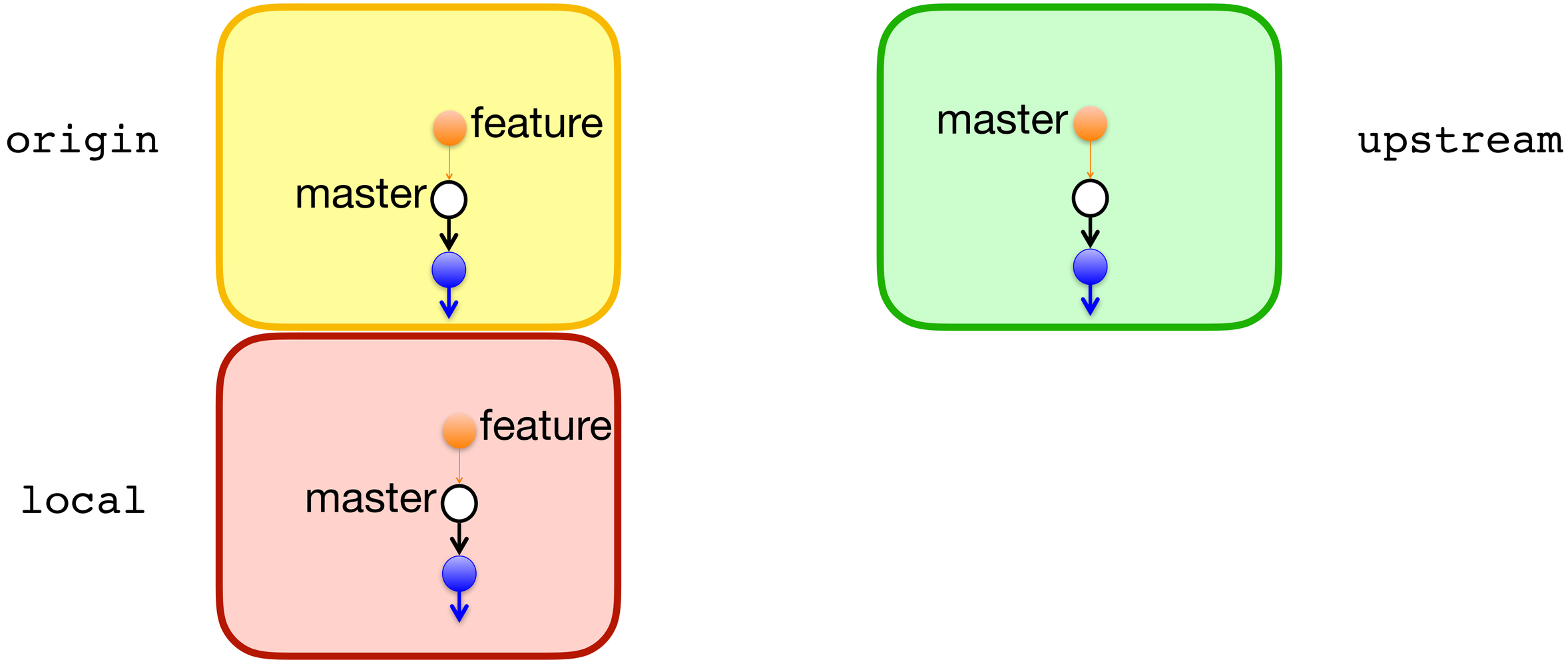
$ git push -f origin feature



Perfect, I accept!

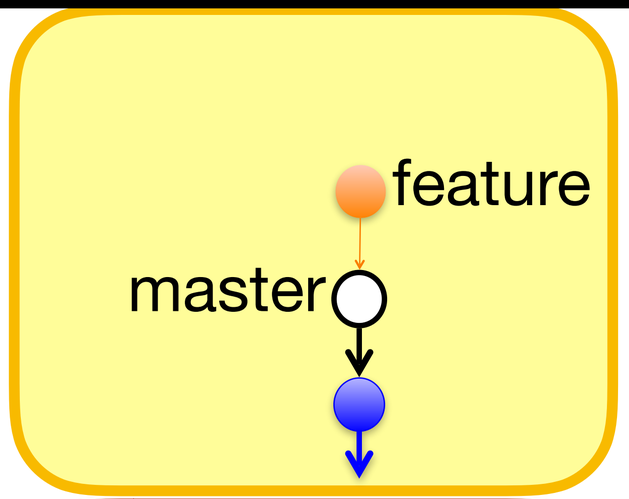


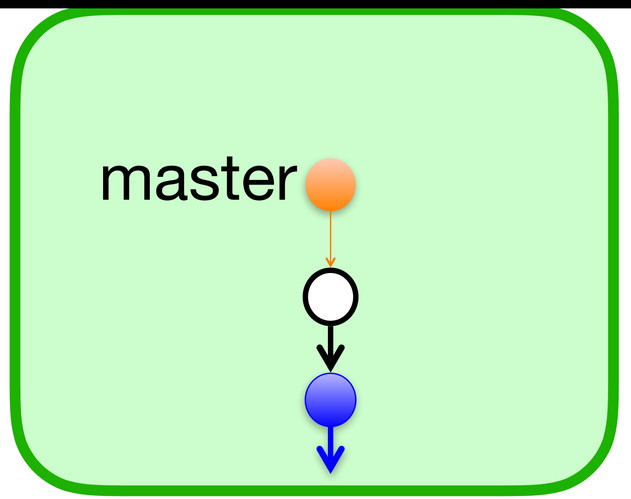
Time to Clean Up



$ git fetch upstream master:master

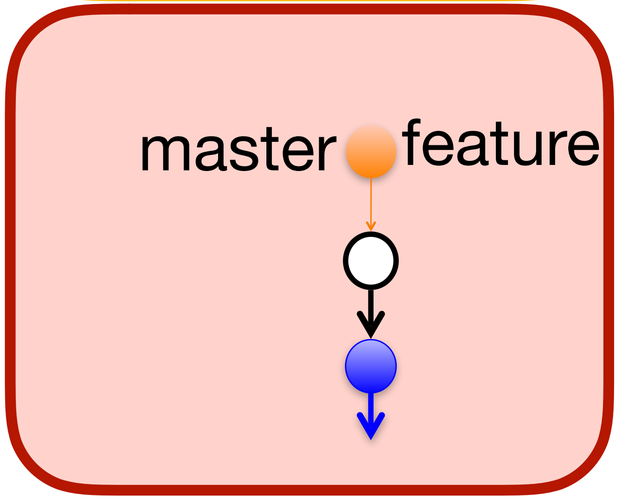
origin





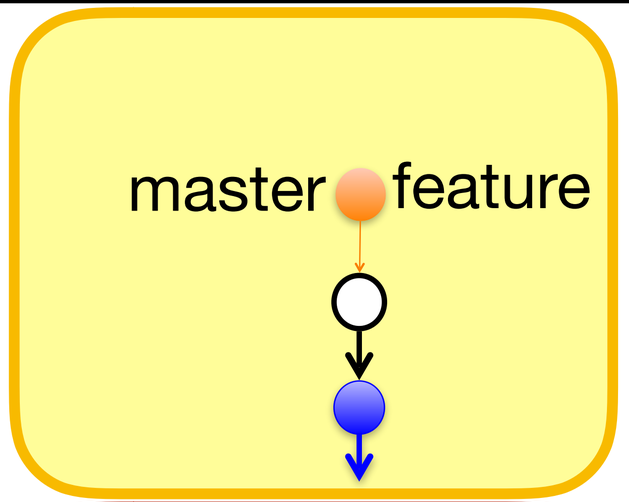
upstream

local

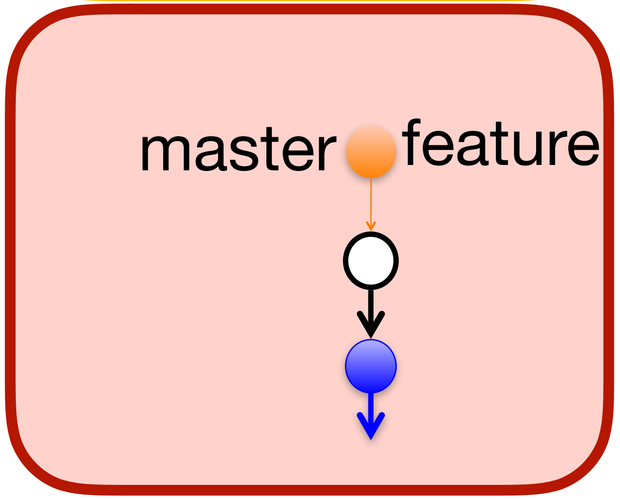


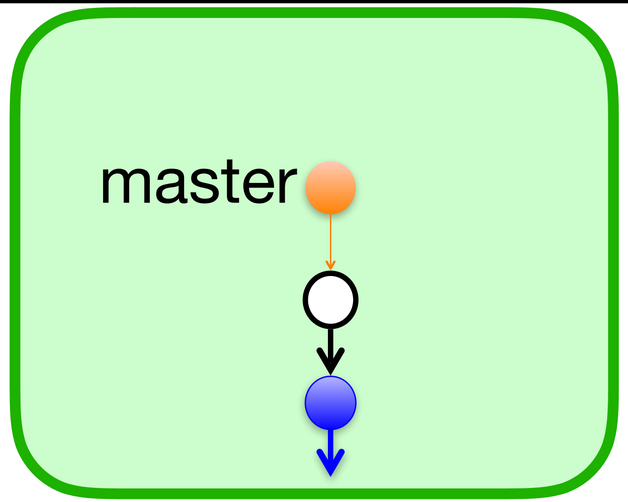
$ git push origin master

origin



local

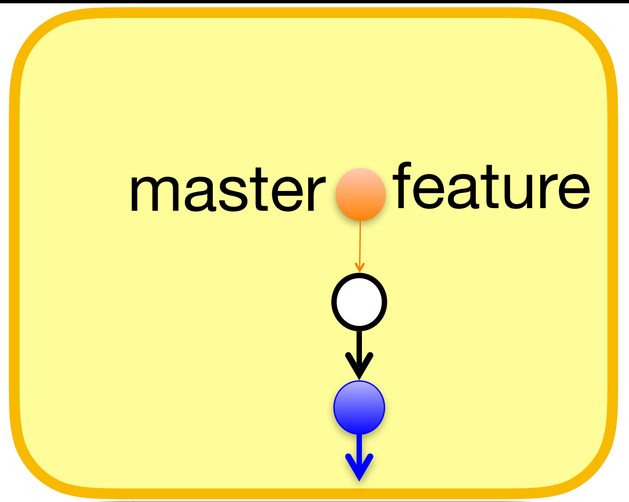




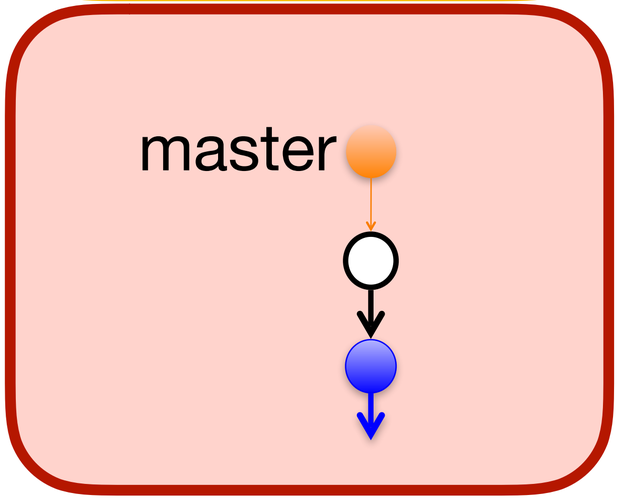
upstream

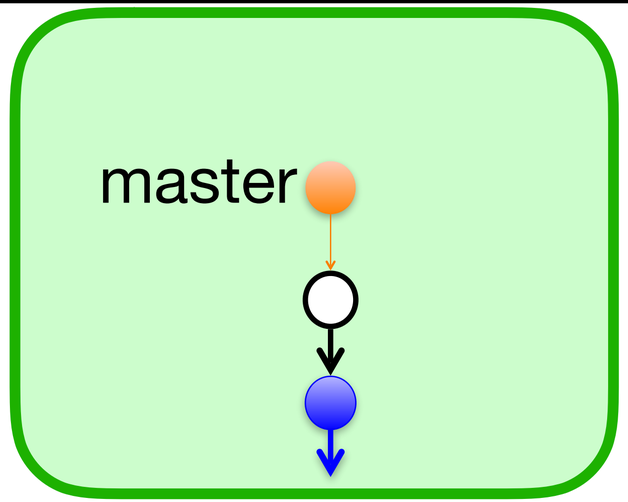
$ git checkout master
$ git branch -d feature

origin



local

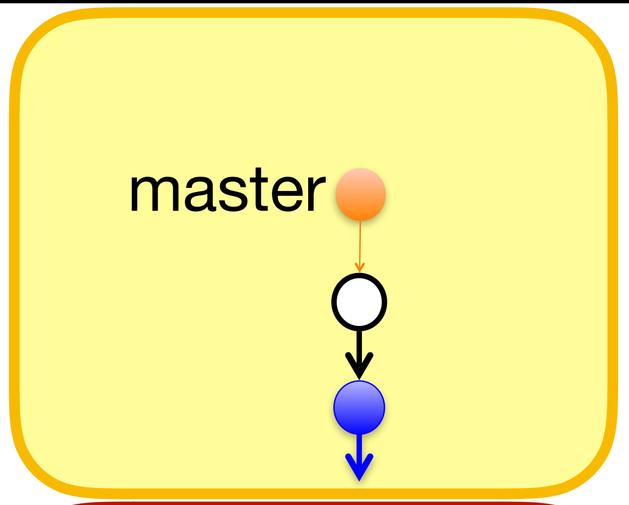




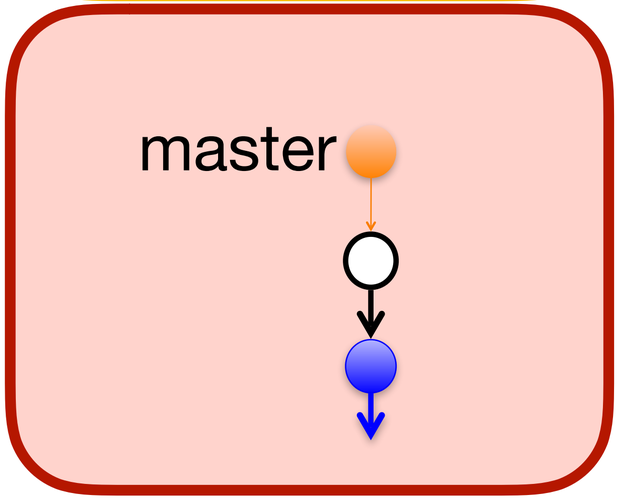
upstream

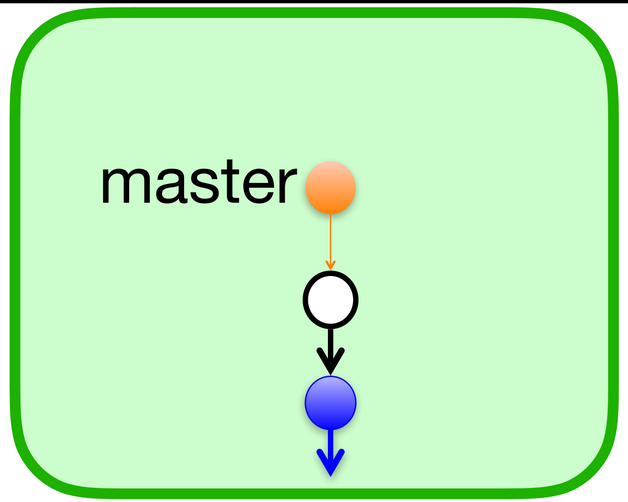
$ git push origin -d feature

origin



local





upstream

After a PR is accepted, Github will ask you if you want to delete your feature branch. If you say yes, which branches get deleted?

A. `feature` — the branch named feature in your local repo

B. `origin/feature` — the branch named feature in your remote repo

C. `upstream/feature` — the branch named feature in their remote repo

D. `feature` and `origin/feature`

E. `feature`, `origin/feature`, and `upstream/feature`

Now that `origin/feature` has been deleted, how do you delete `feature`?

A. $ git delete feature

B. $ git delete -b feature

C. $ git branch -d feature

D. $ git push origin -d feature

E. I would google "delete a git branch" and then click on https://stackoverflow.com/questions/2003505/how-do-i-delete-a-git-branch-locally-and-remotely like every other programmer

In-class exercise

https://checkoway.net/teaching/cs241/2019-fall/exercises/Lecture-34.html

Grab a laptop and a partner and try to get as much of that done as you can!