

Git:

Distributed Version Control

Computer Science and Engineering ■ College of Engineering ■ The Ohio State University

Lecture 3

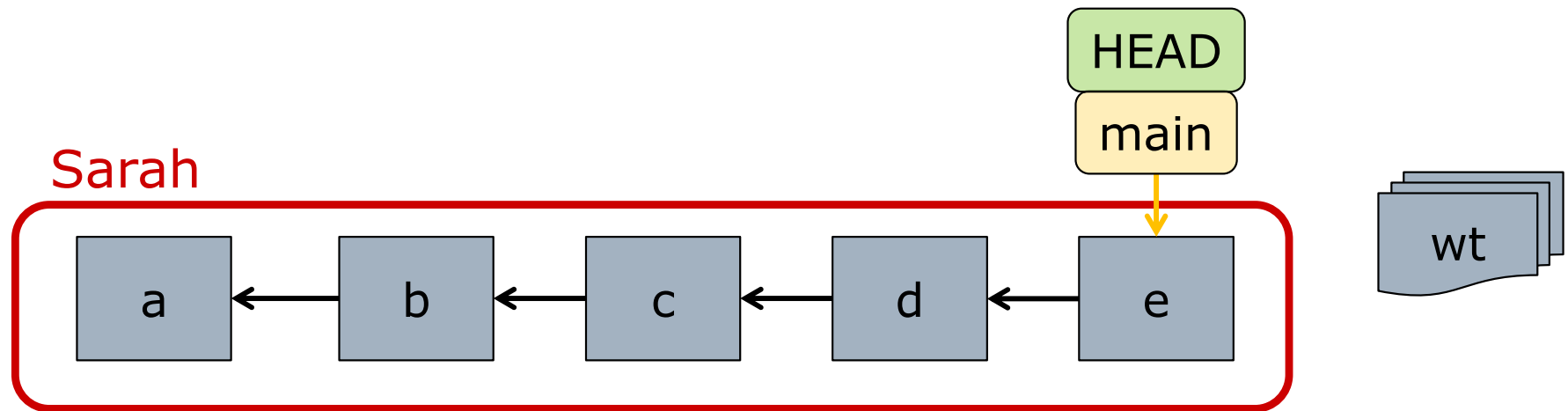
Demo

- Prep: Empty (but initialized) repo
- Linear development:
 - Create, edit, rename, ls -la files
 - Git: add, status, commit, log
- Checkout (time travel, detach HEAD)
- Branch (re-attach HEAD)
- More commits, see split in history
- Merge
 - No conflict
 - Fast-forward
- Play: git-school.github.io/visualizing-git

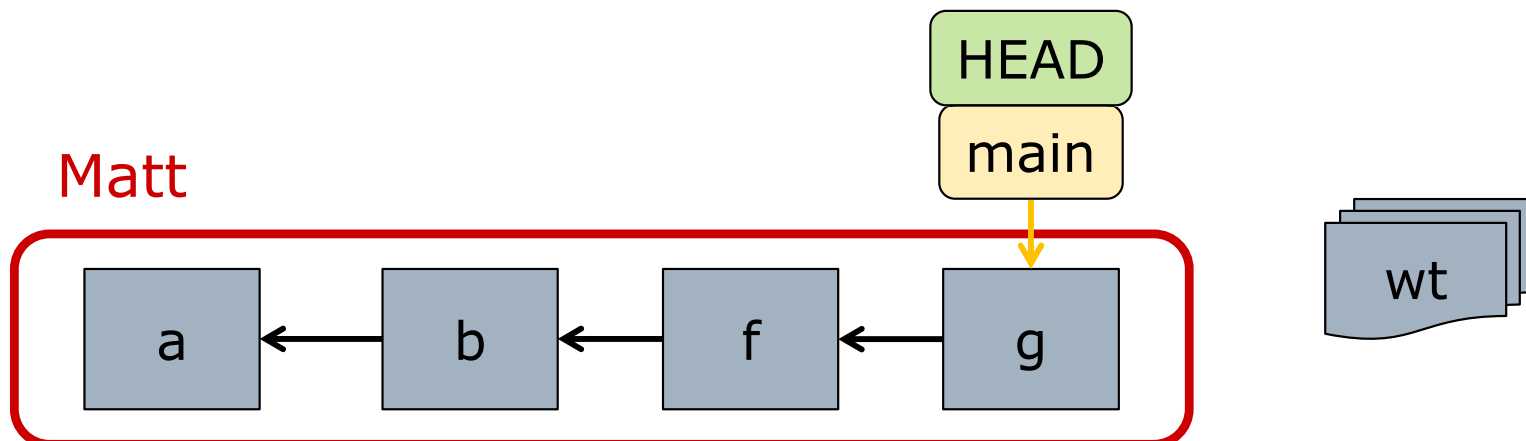
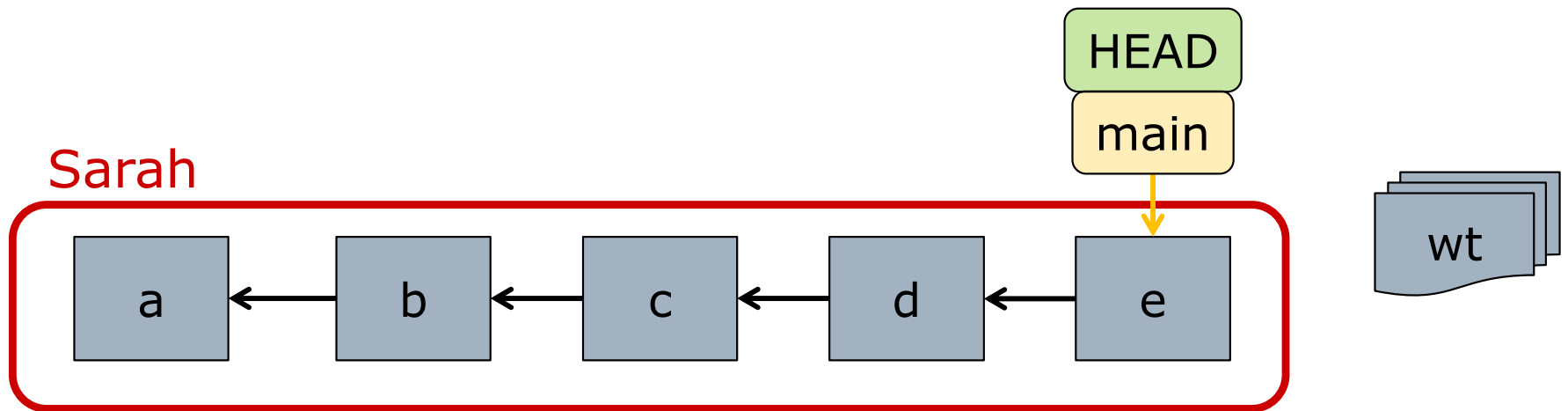
What Does "D" Stand For?

- *Distributed* version control
 - Multiple people, distributed across network
- Each person has their own repository!
 - Everyone has their own store (history)!
 - Big difference with older VCS (eg SVN)
- Units of data movement: changeset
 - Communication between teammates is to bring *stores* in sync
 - Basic operators: fetch and push

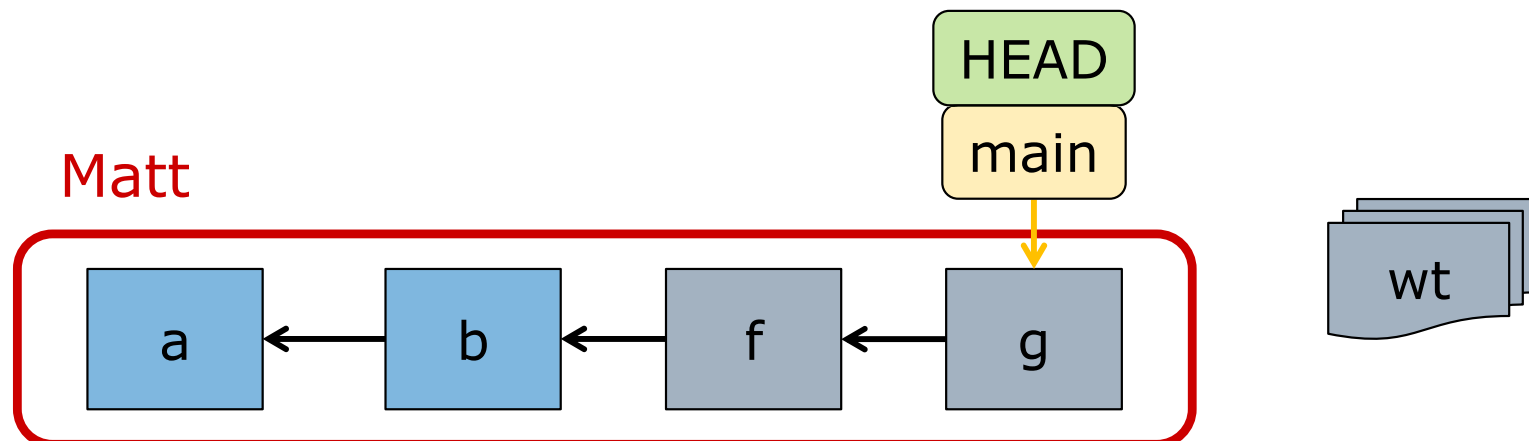
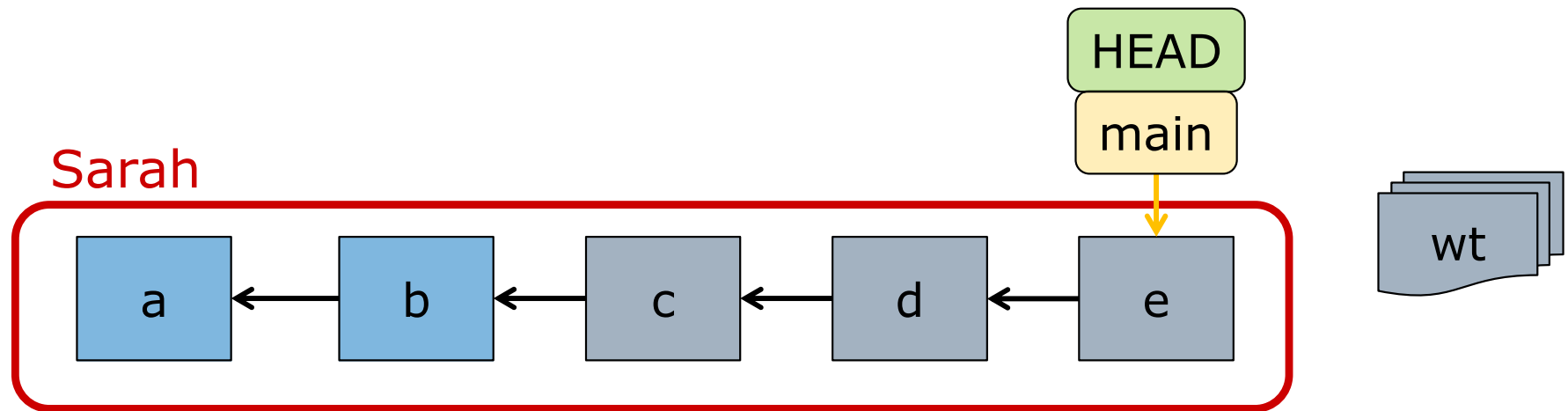
Sarah's Repository



And Matt's Repository



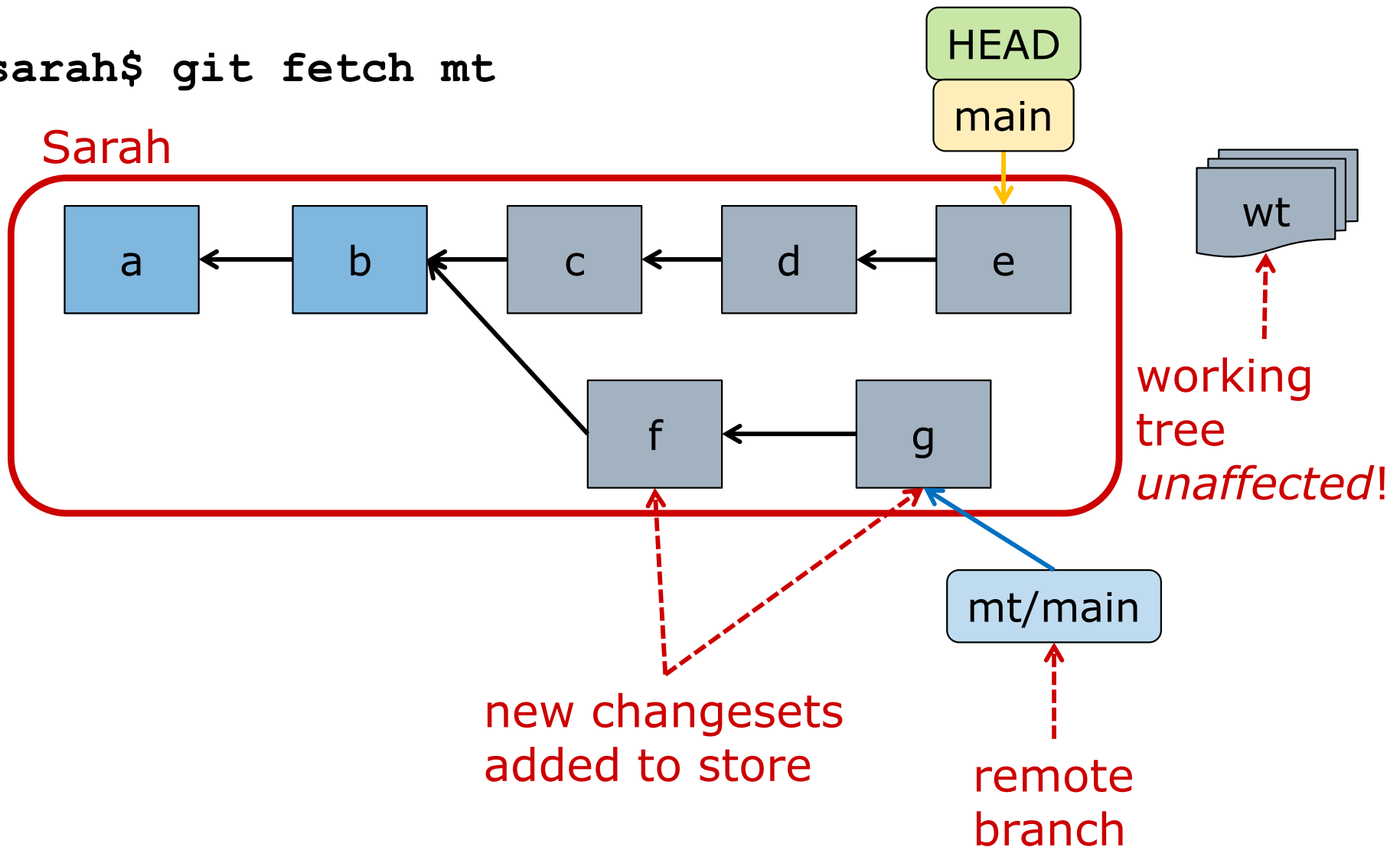
Some Shared History



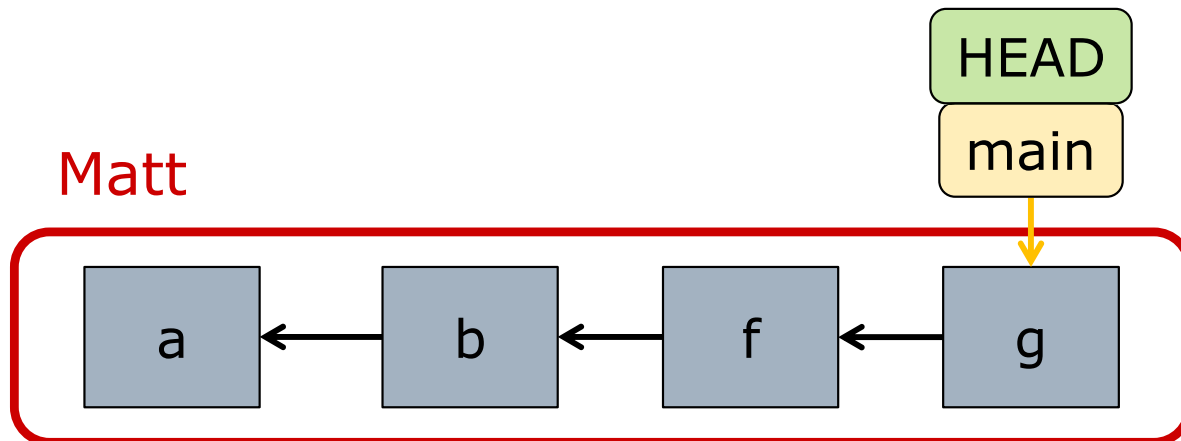
Fetch: Remote Store → Local

```
sarah$ git fetch mt
```

Sarah



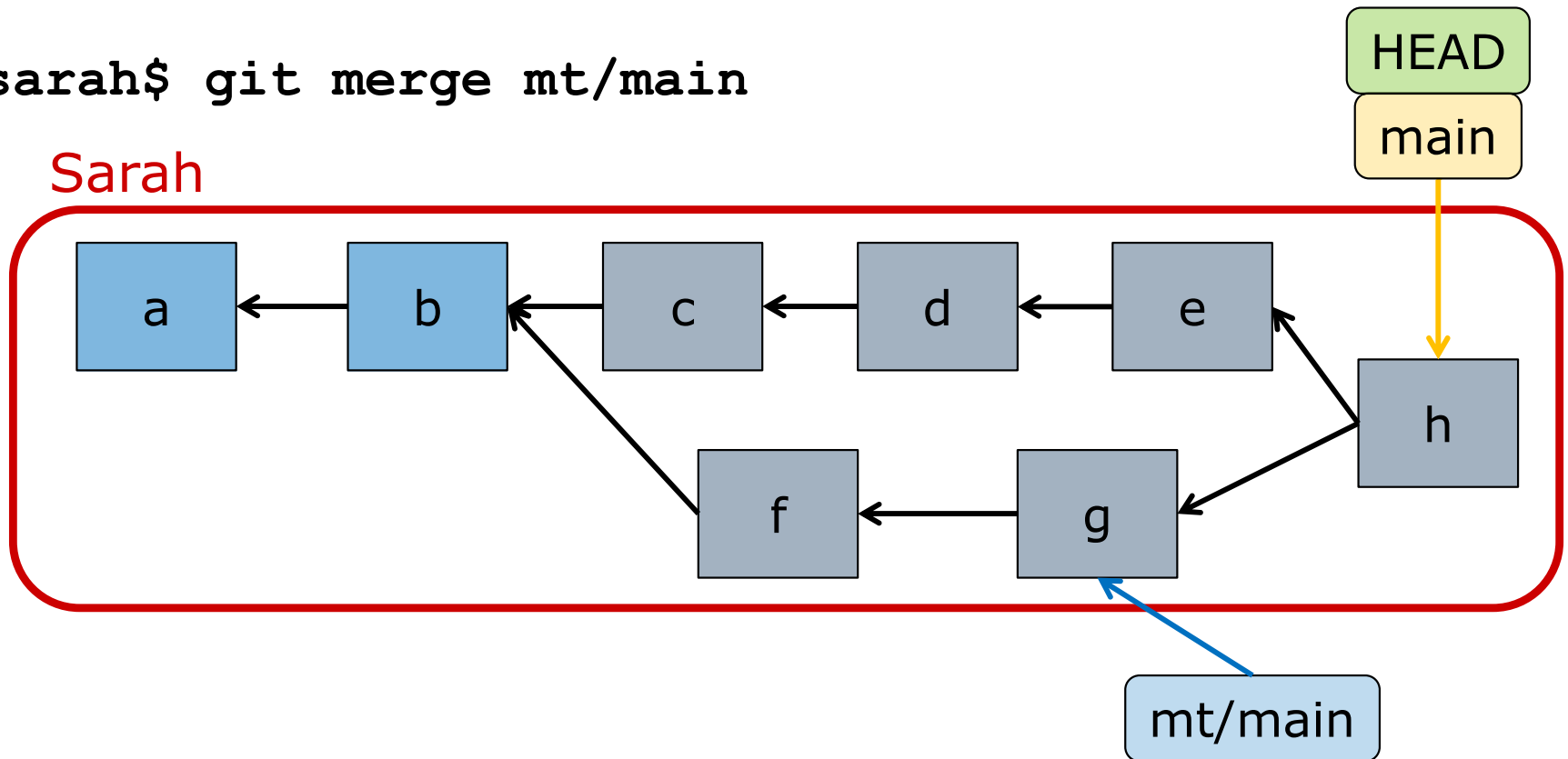
Remote Repository Unchanged



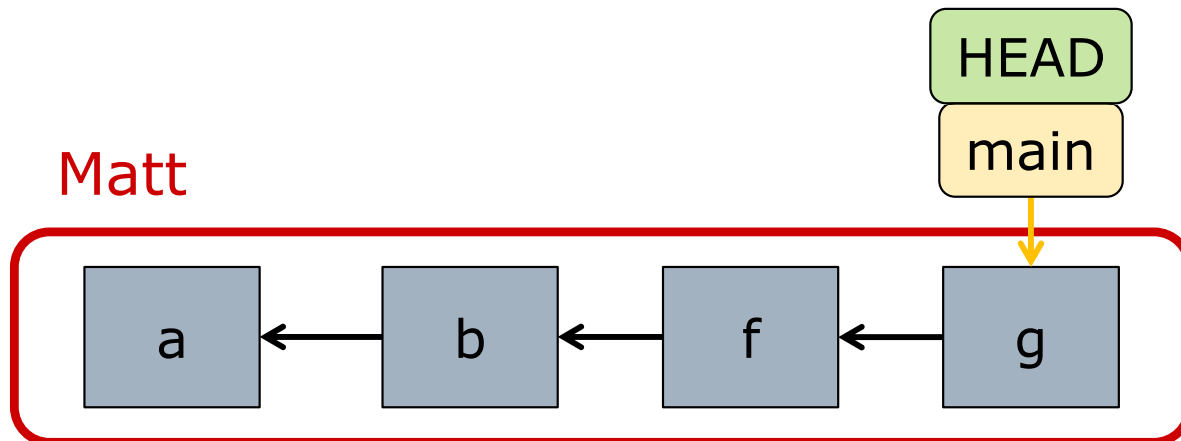
Workflow: Merge After Fetch

```
sarah$ git merge mt/main
```

Sarah



Remote Repository Unchanged



View of DAG with All Branches

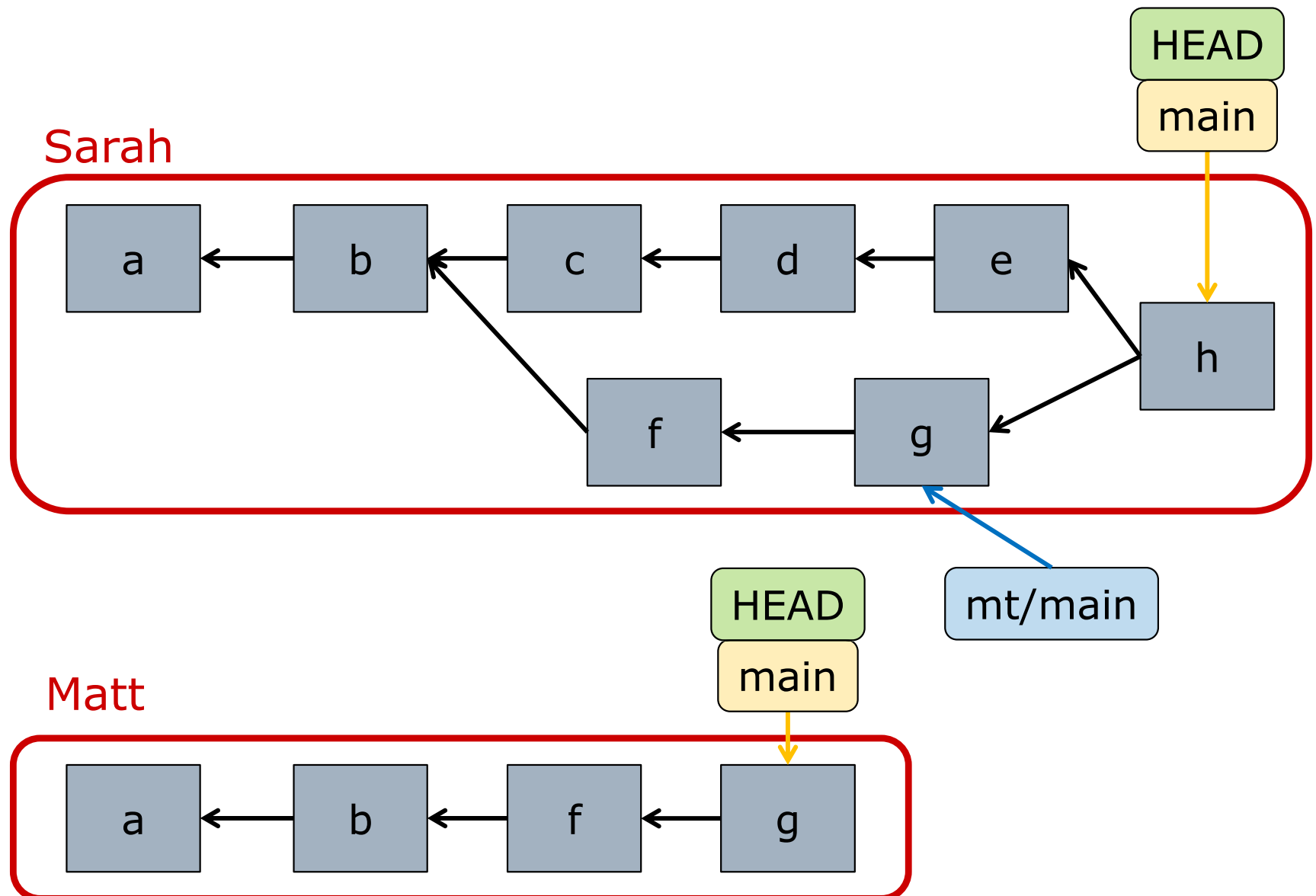
```
$ git log --oneline --graph # shows local & remote

* 1618849 (HEAD -> main, origin/main) clean up css
* d579fa2 (alert) merge in improvements from master
|\
| * 0f10869 replace image-url helper in css
* | b595b10 (origin/alert) add buckeye alert notes
* | a6e8eb3 add raw buckeye alert download
|/
* b4e201c wrap osu layout around content
* e9d3686 add Rakefile and refactor schedule loop
* 515aaa3 create README.md
* eb26605 initial commit
```

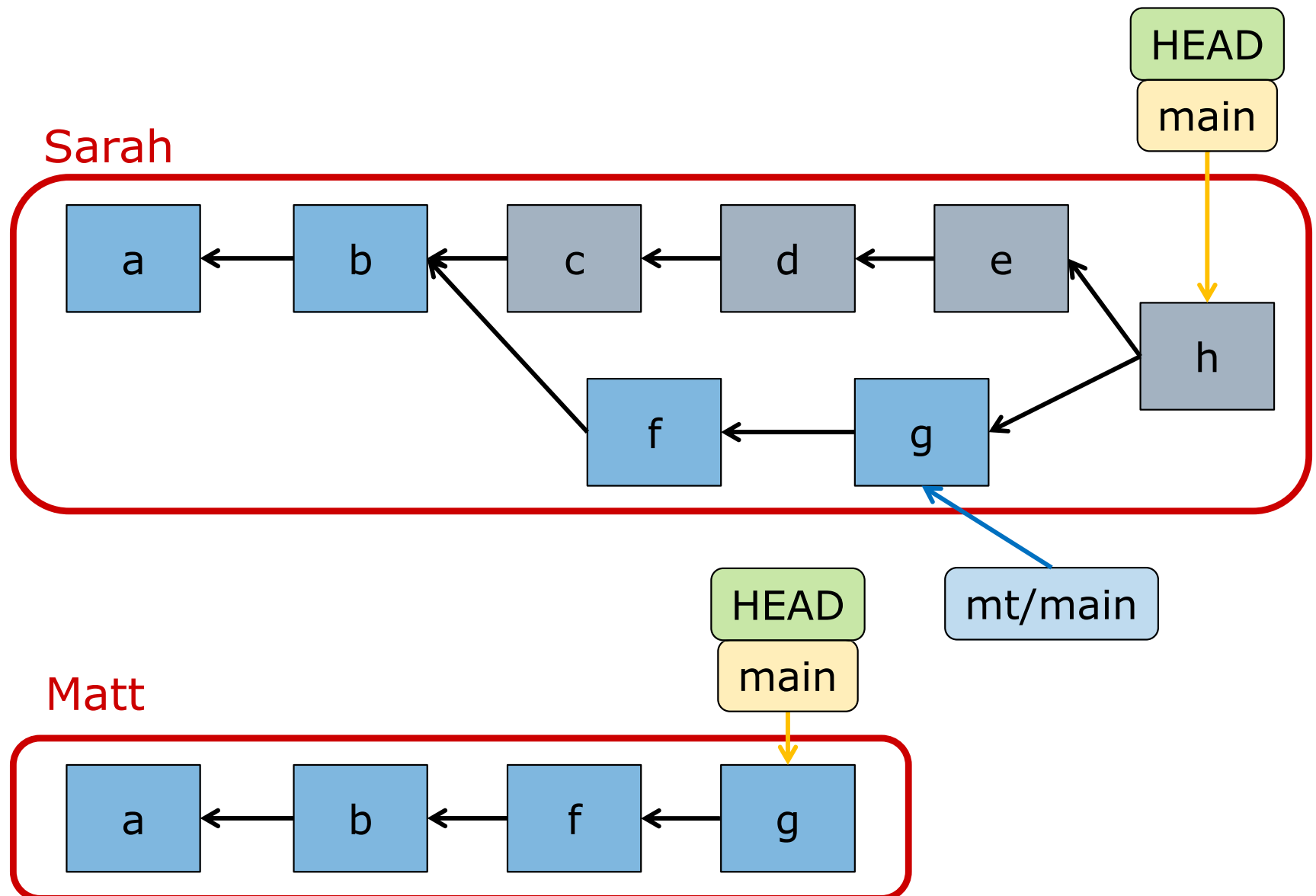
Your Turn

- Show the state of Matt's repository after each of the following steps
 - Fetch (from Sarah)
 - Merge

Sarah and Matt's Repositories



Some Shared History



Your Turn: Fetch

```
matt$ git fetch sr
```

Your Turn: Merge

```
matt$ git merge sr/main
```


Demo

- <https://git-school.github.io/visualizing-git/#upstream-changes>
- Try:
 - `git commit`
 - `git fetch origin # see origin/feature`
 - `git merge origin/feature # see feature`

Pull: Fetch then Merge

- A *pull* combines both fetch & merge

```
matt$ git pull sr
```

- Advice: Prefer explicit fetch, merge

- After fetch, examine new work

```
$ git log          # see commit messages
```

```
$ git checkout # see work
```

```
$ git diff        # compare
```

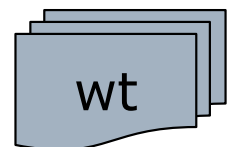
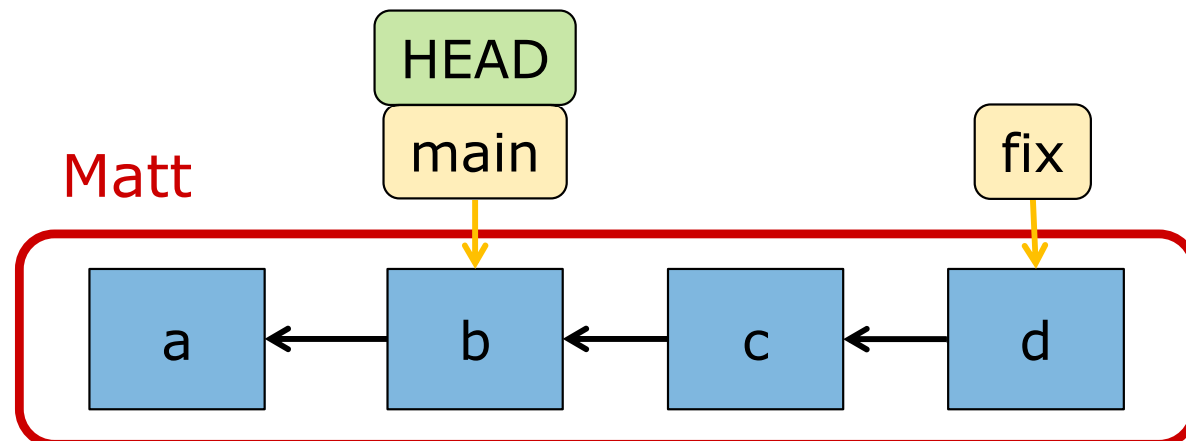
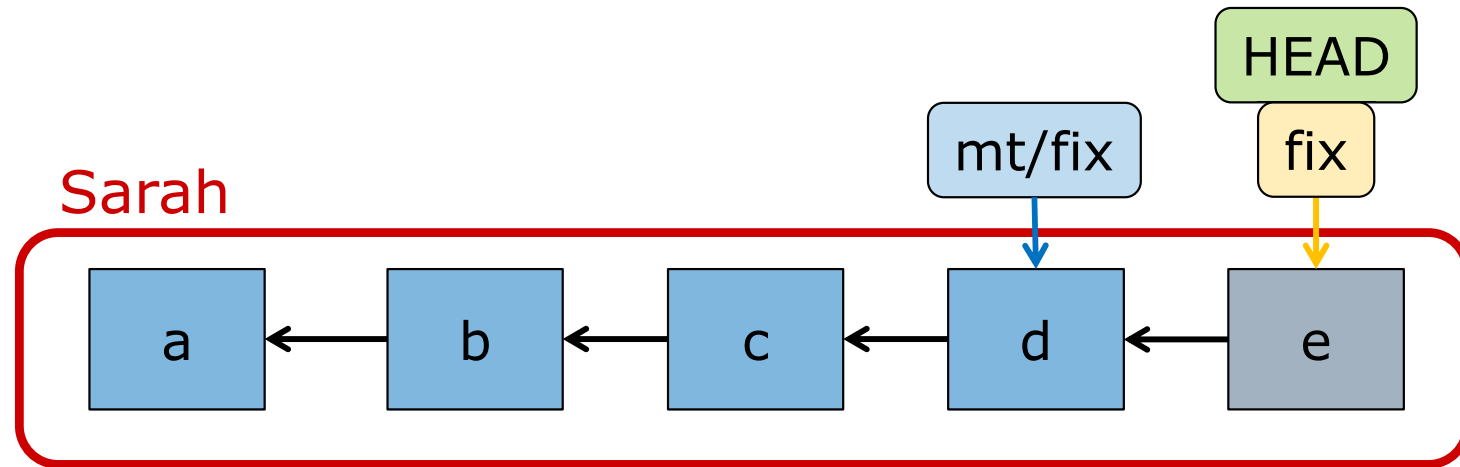
- Then merge

- Easier to adopt more complex workflows
(e.g., rebasing instead of merging)

Push: Local Store → Remote

- Push sends local commits to remote store
- Usually push one branch (at a time)
 - `sarah$ git push mt fix`
 - Advances Matt's fix branch
 - Advances Sarah's mt/fix remote branch
- Requires:
 1. Matt's fix branch *must not* be his HEAD
 2. Matt's fix branch *must be* ancestor of Sarah's
- Common practices:
 1. Only push to *bare* repositories (bare means no working tree, ie no HEAD)
 2. Get remote store's branch into local DAG (ie fetch, merge, commit) *before* pushing

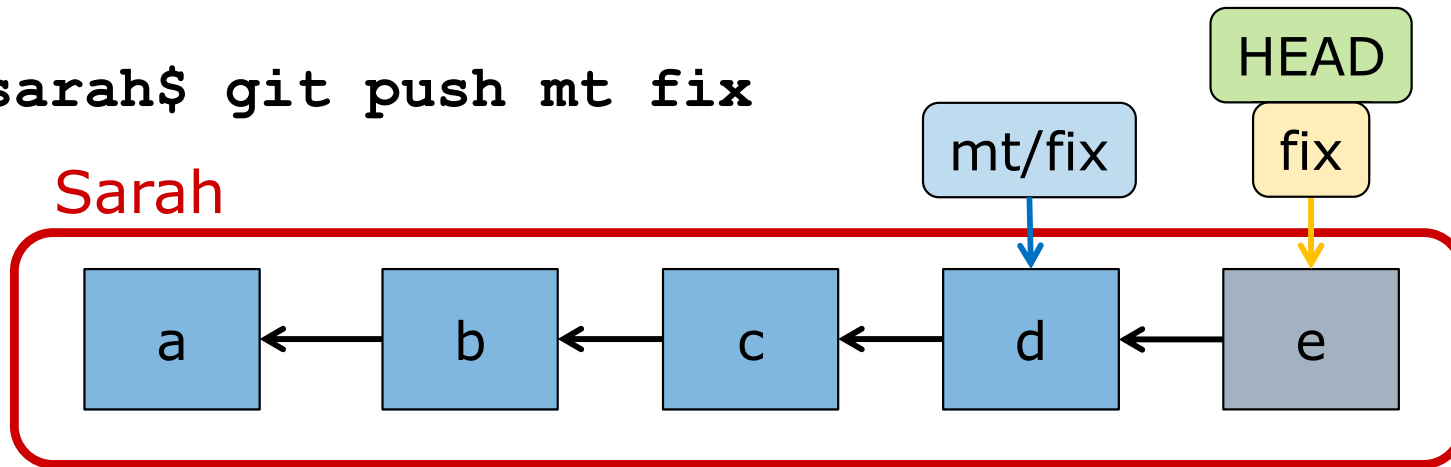
Remote's Branch is Ancestor



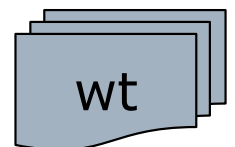
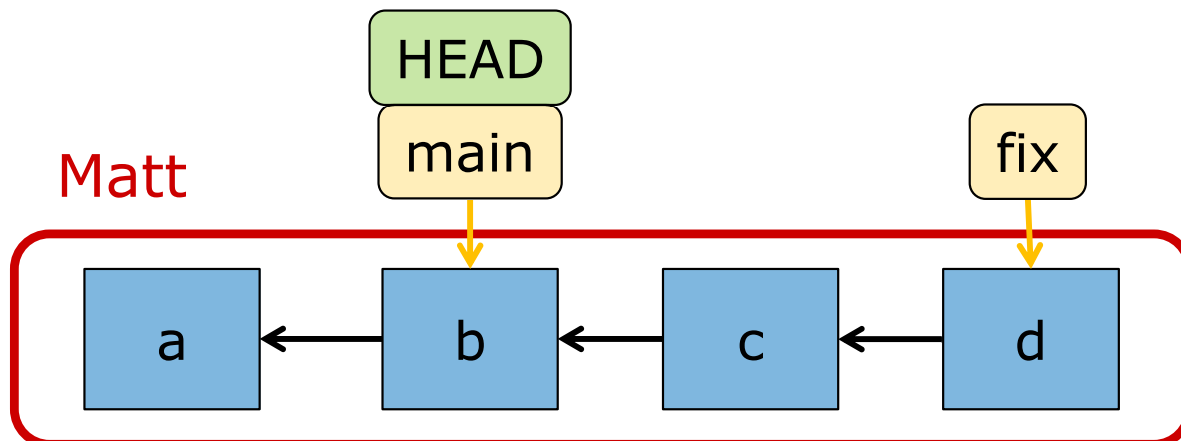
Push: Local Store → Remote

```
sarah$ git push mt fix
```

Sarah



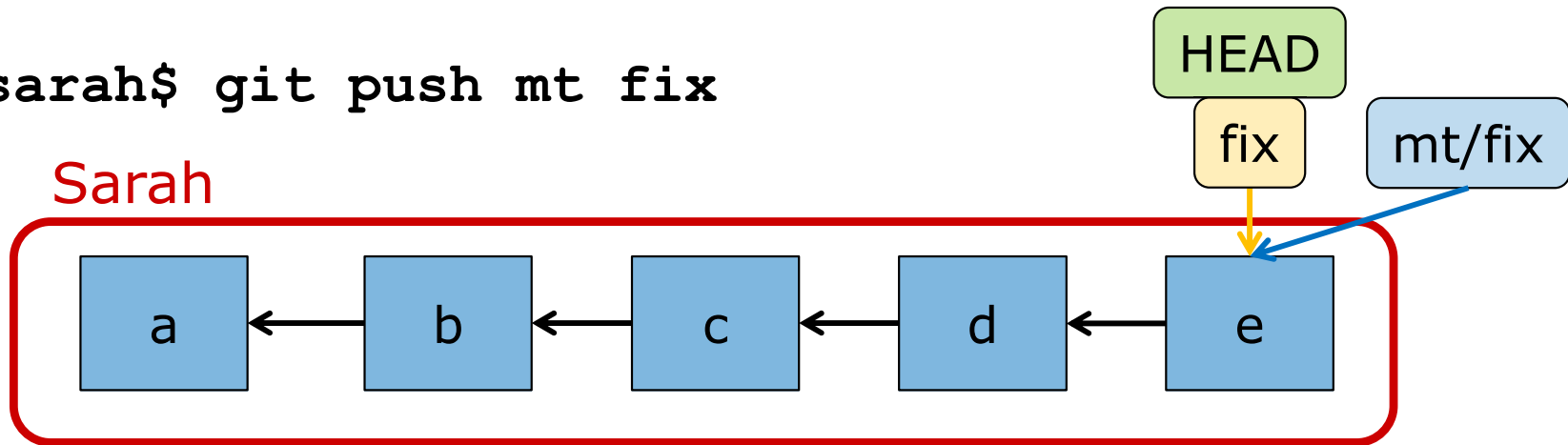
Matt



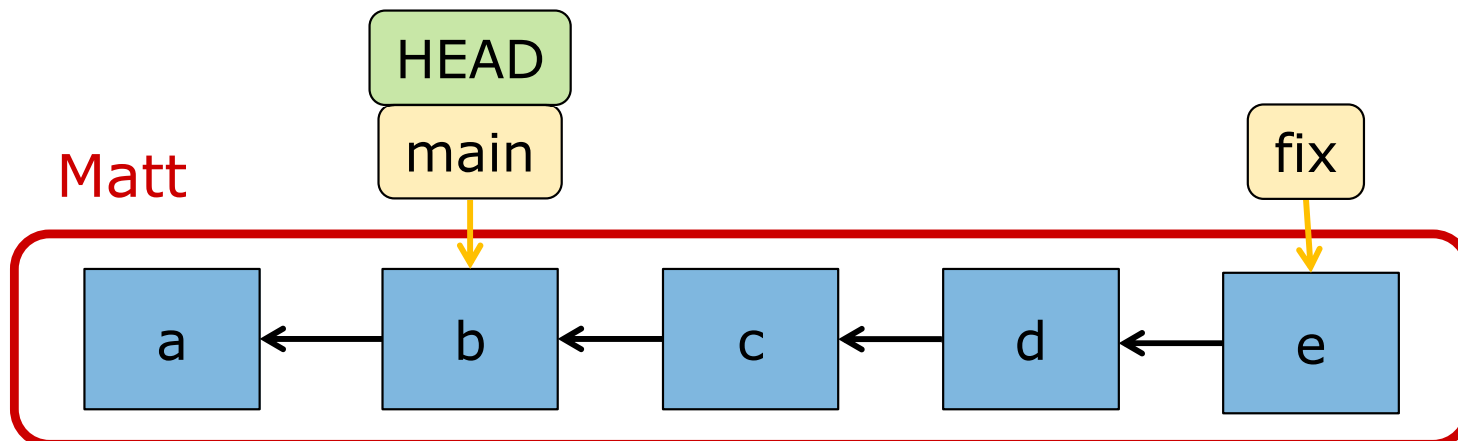
Push: After

```
sarah$ git push mt fix
```

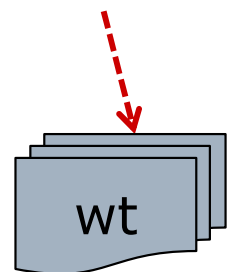
Sarah



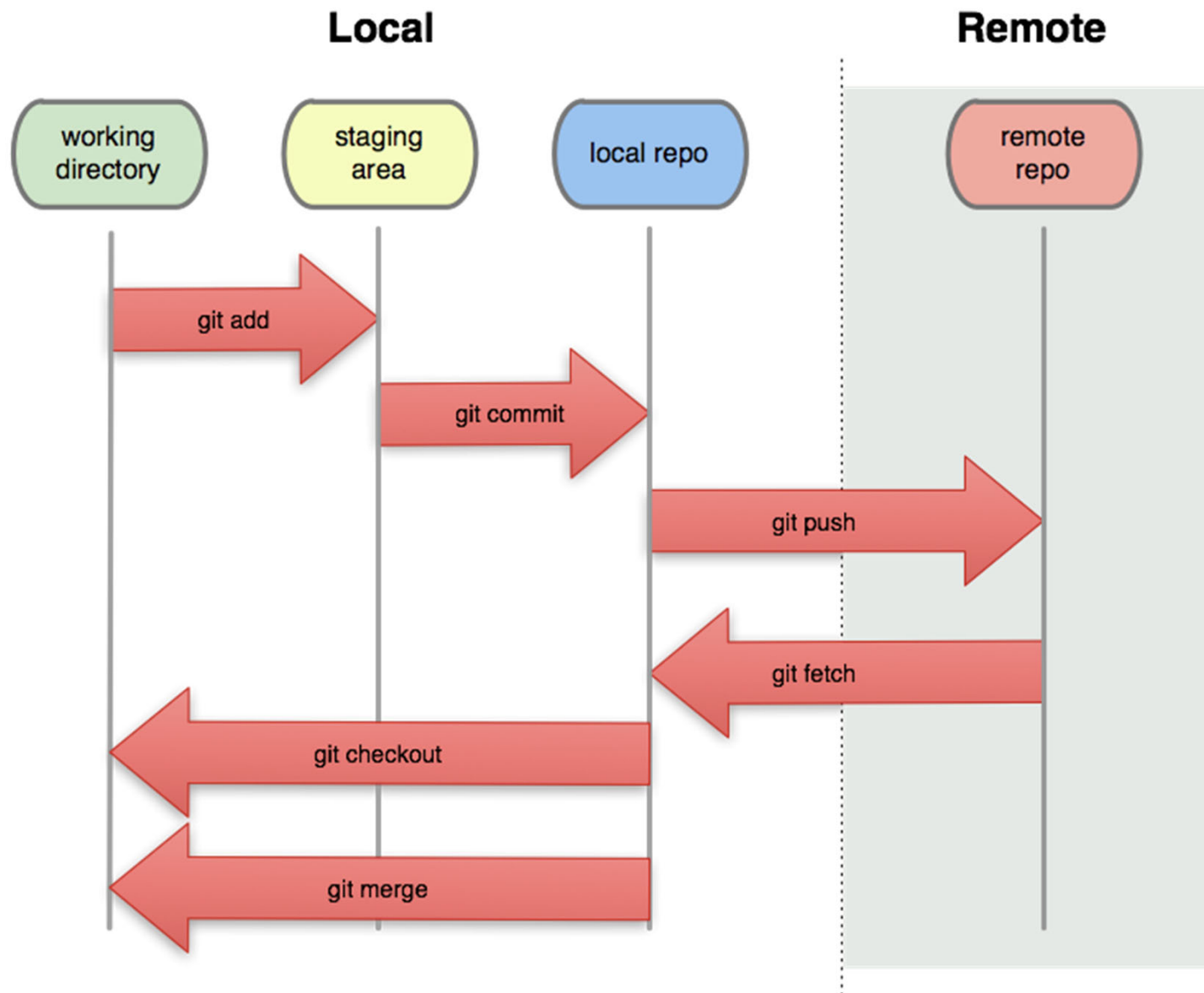
Matt



working
tree
unaffected!



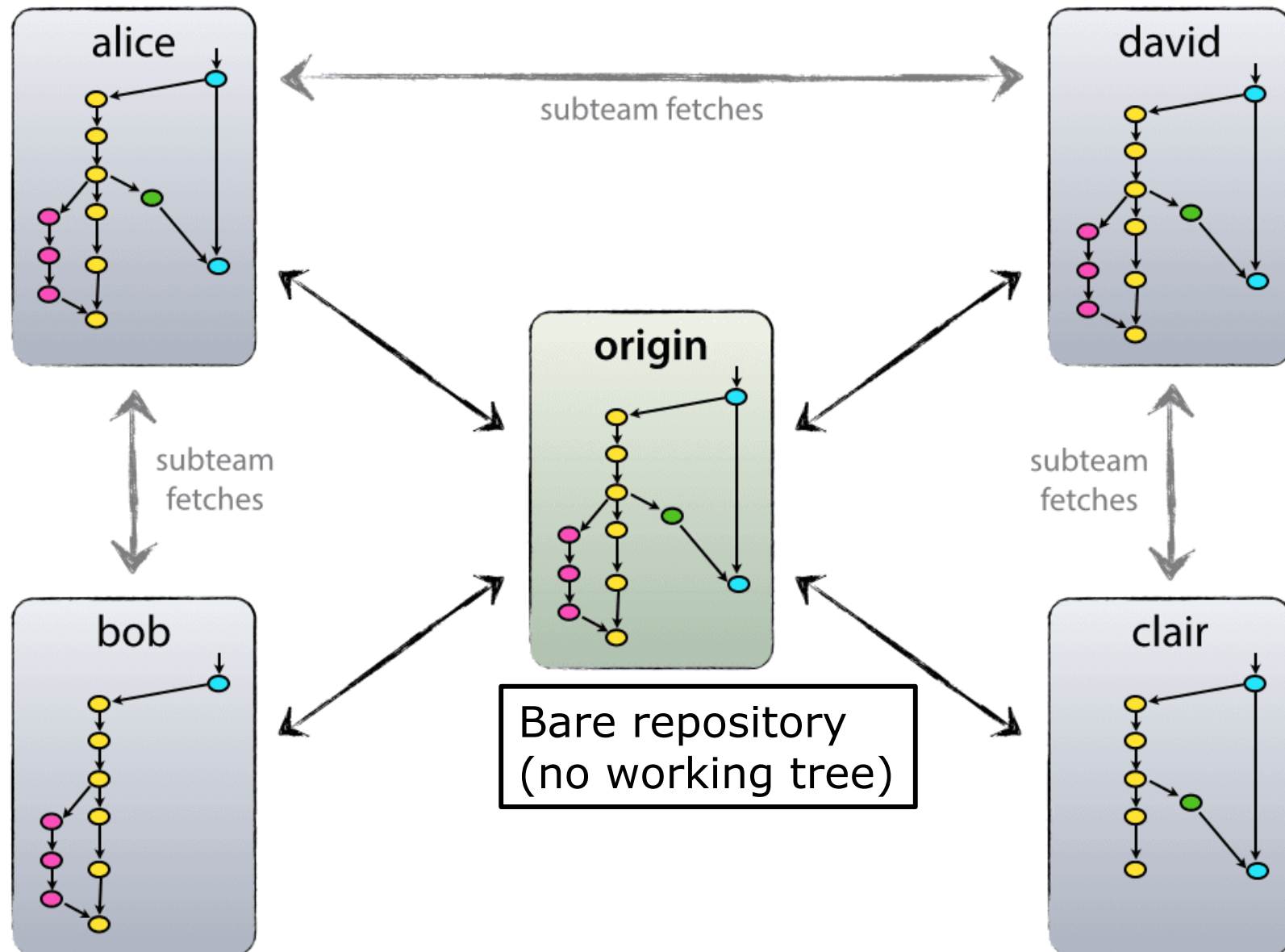
Commit/Checkout vs Push/Fetch



Common Topology: Star

- n -person team has $n+1$ repositories
 - 1 shared central repository (bare!)
 - 1 local repository / developer
- Each developer *clones* central repository
 - Creates (local) copy of (entire) central repo
 - Local repo has a remote called “origin”
 - Default source/destination for fetch/push
- Variations for central repository:
 - Everyone can read and write (ie push)
 - Everyone can read, but only 1 person can write (responsible for pulling and merging)

Common Topology: Star



Summary

- Push/fetch to share your store with remote repositories
 - Neither working tree is affected
- Branches in history are easy to form
 - Committing when HEAD is not a leaf
 - Fetching work based on earlier commit
- Team coordination
 - One single, central repo
 - Every developer pushes/fetches from their (local) repo to this central (remote) repo