WTF is GIT?

a humble talk by Sergey Arkhipov
in MERA on 15 Nov 2011

WTF is GIT?

Agenda

1. What is GIT?
2. GIT vs ClearCase
3. Fully distributed
4. GIT workflow
5. Musthave commands
6. Credits

What is GIT?

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Git is an open source, distributed version control system designed for speed and efficiency.

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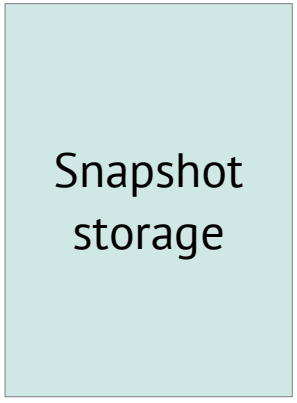
Snapshots, not patches!

What is GIT?

Snapshot, not patches!



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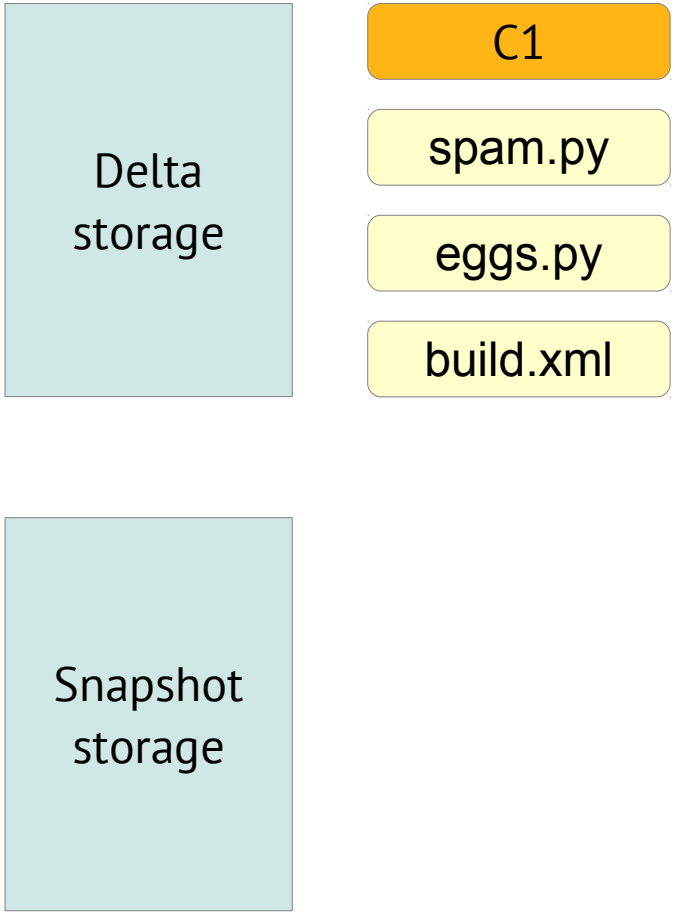

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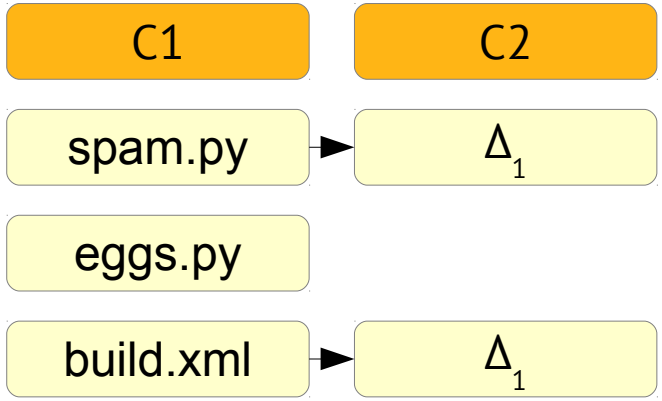
Delta storage



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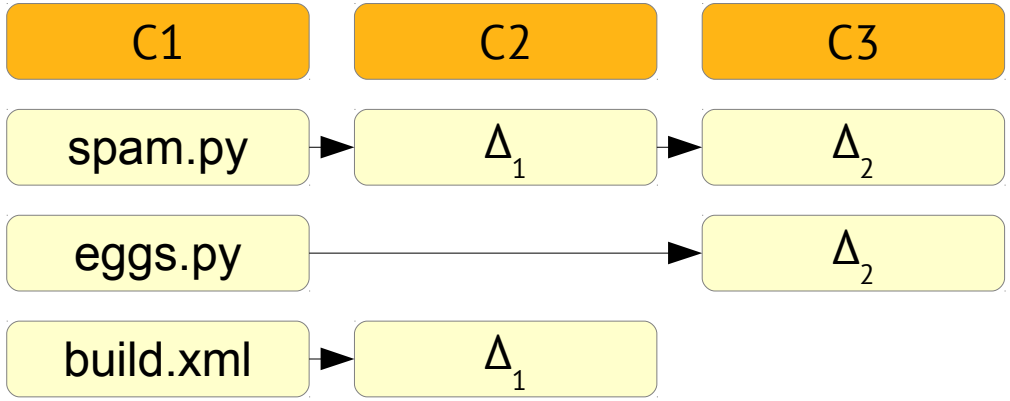

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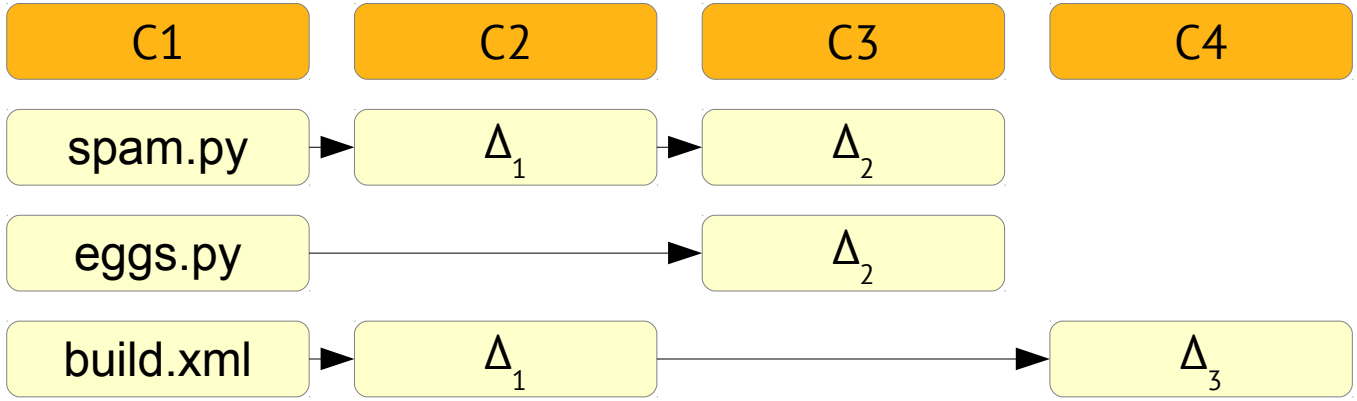

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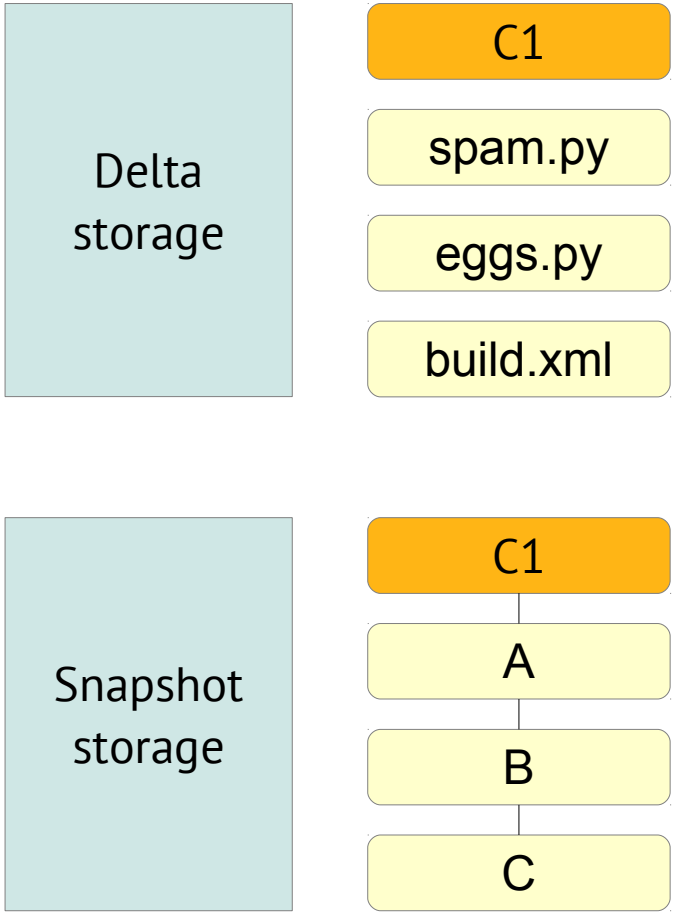

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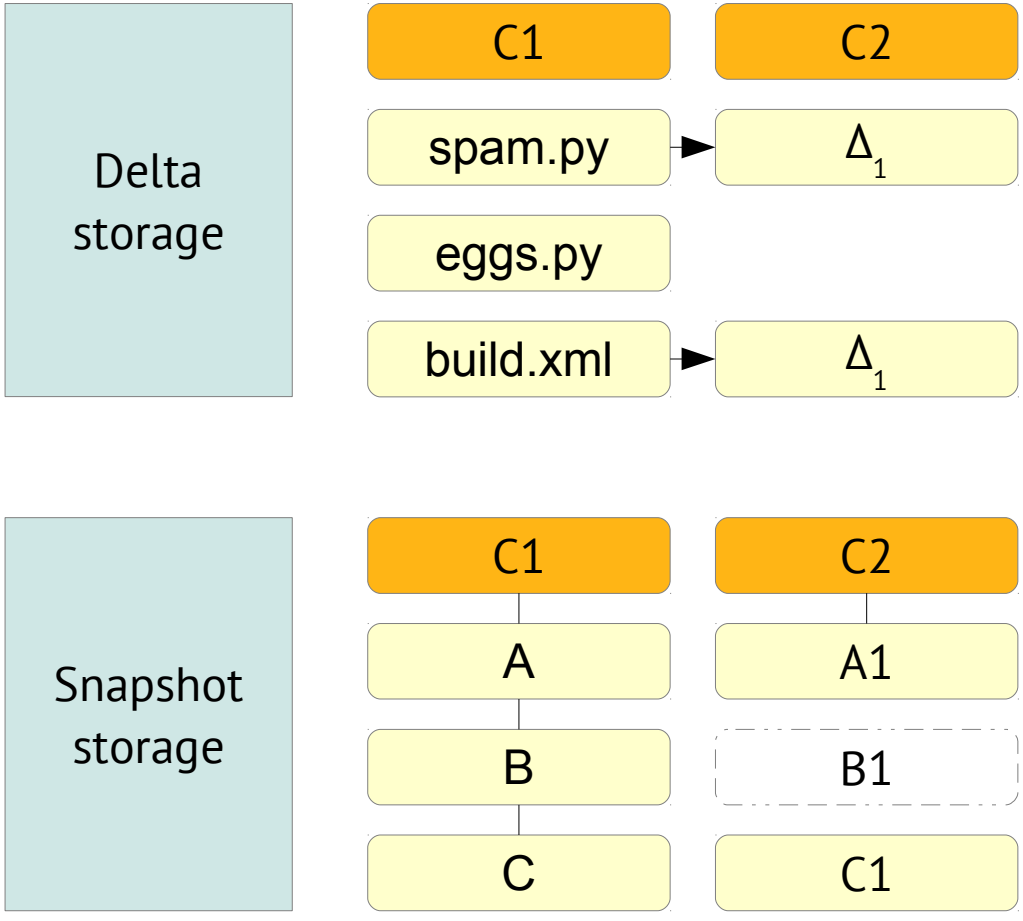

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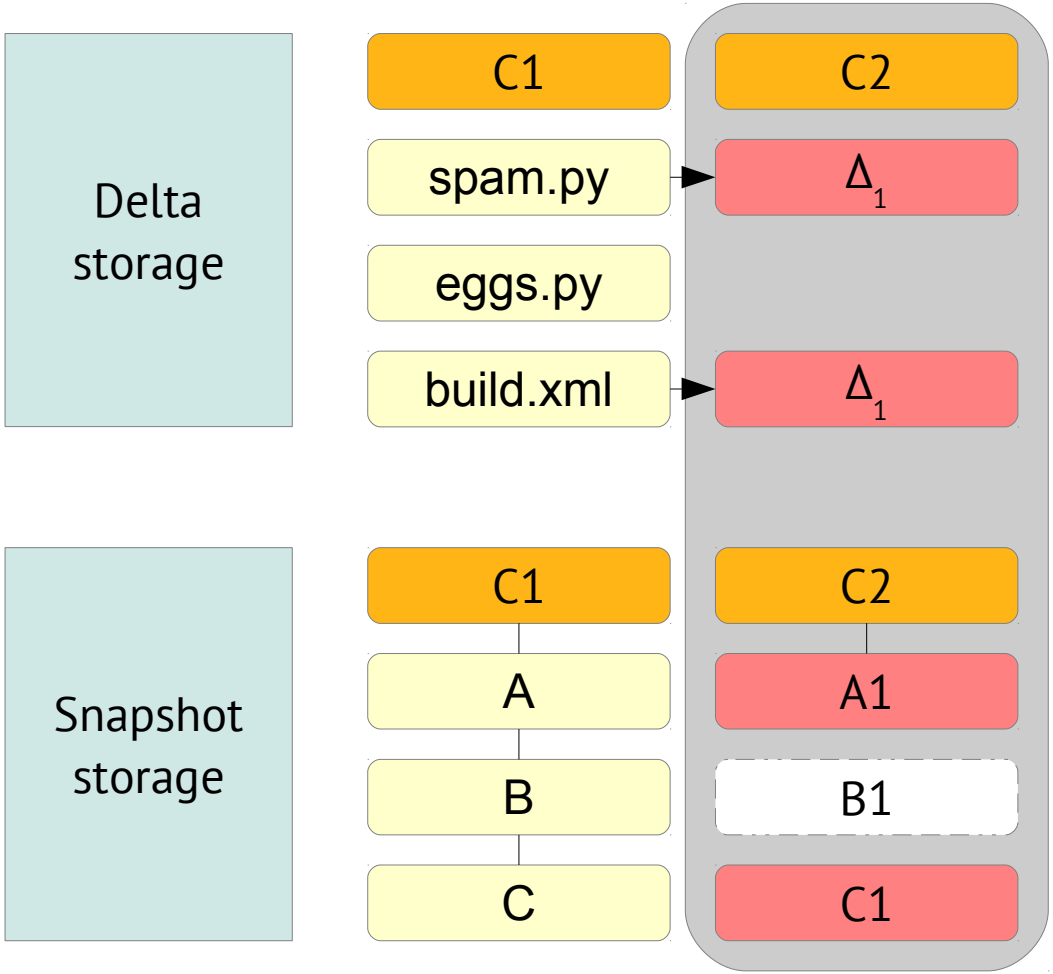

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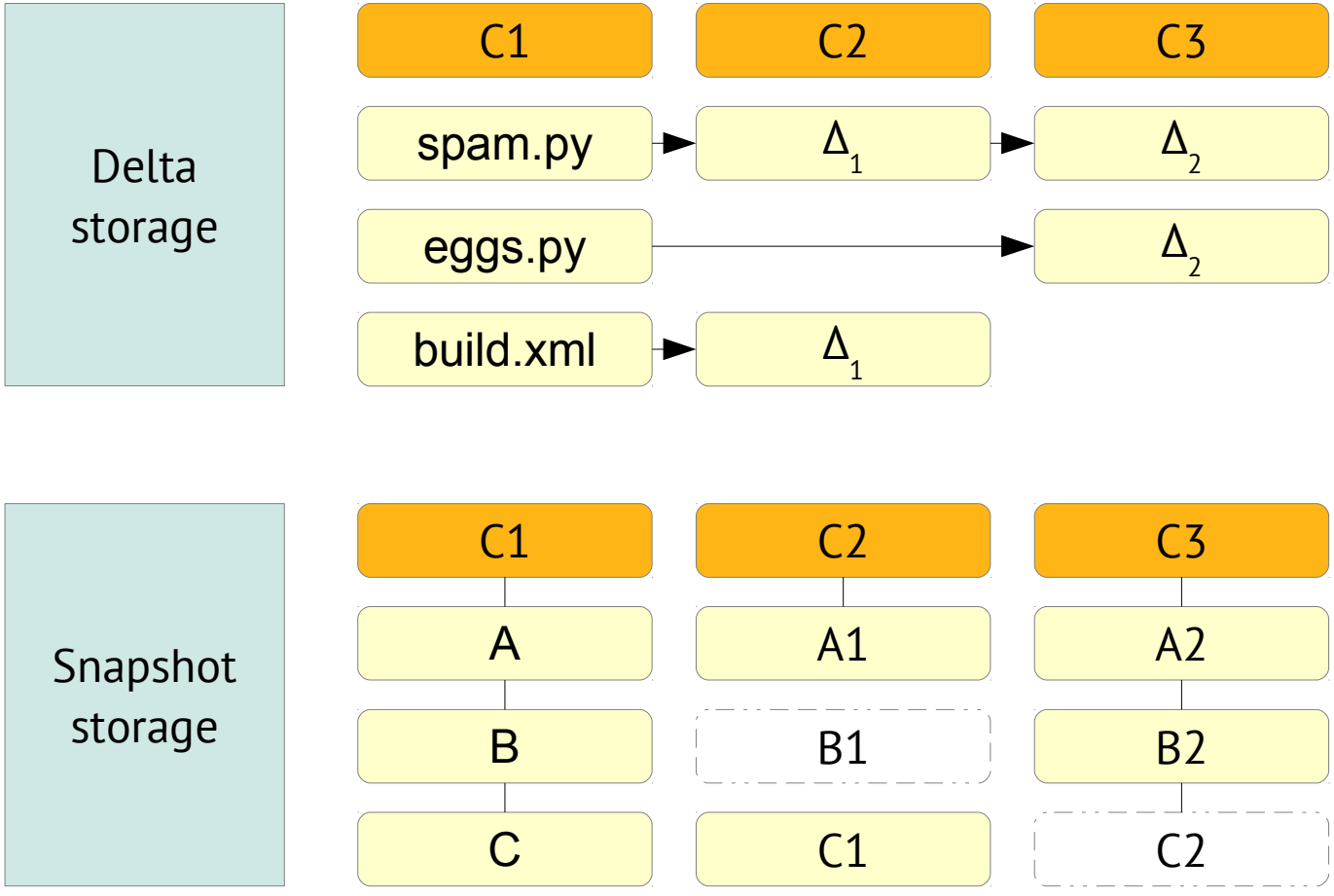

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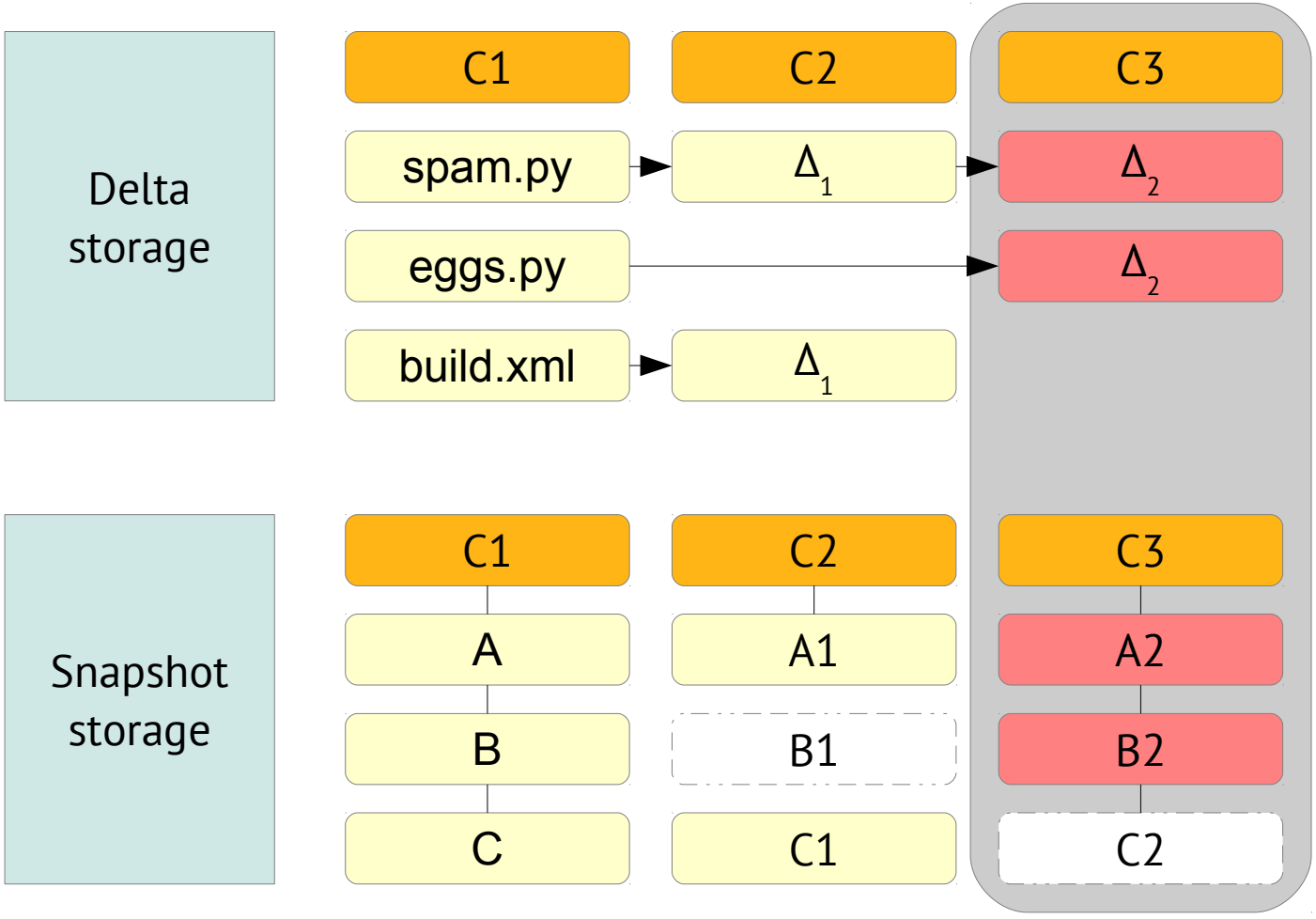

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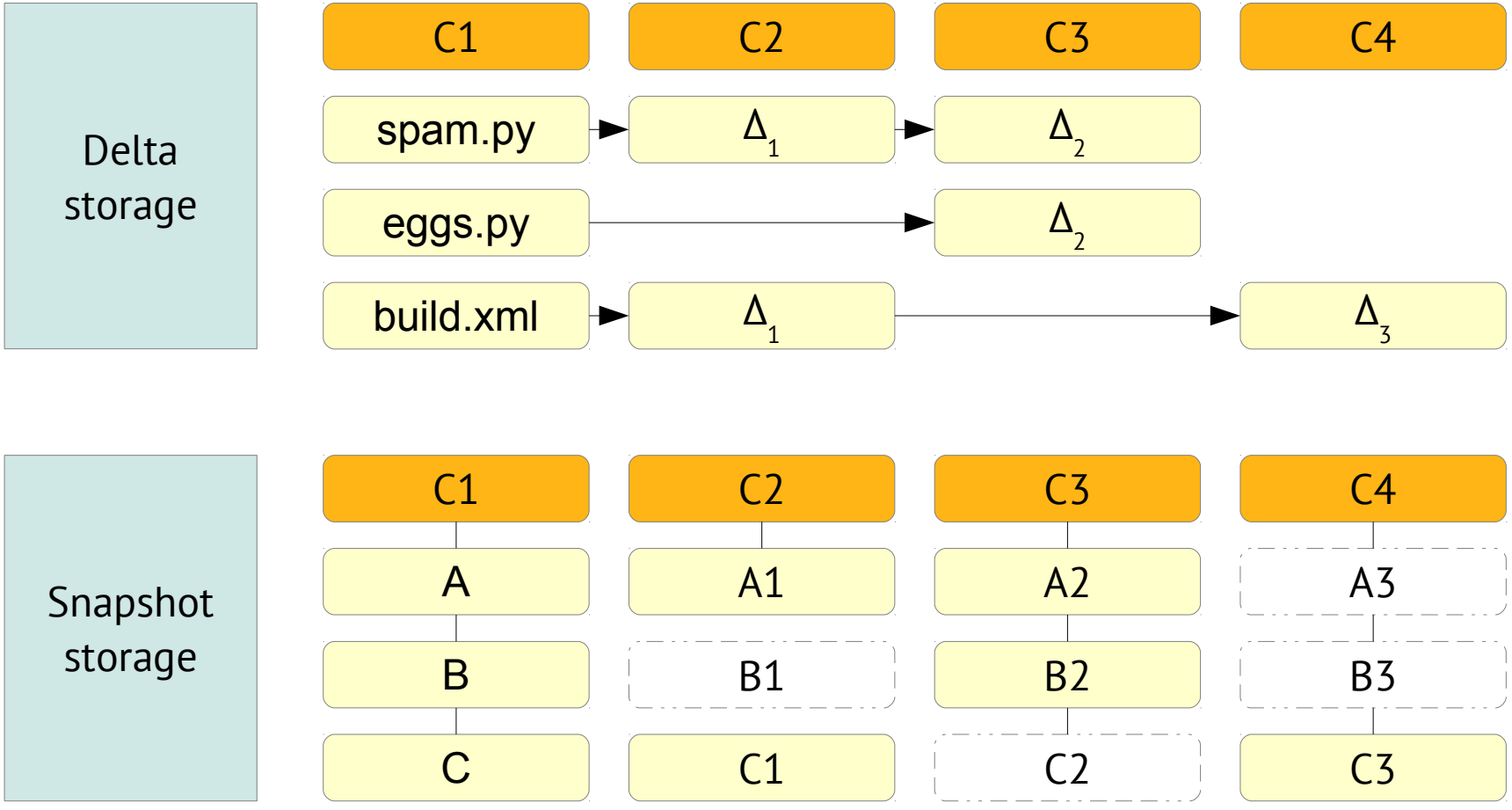

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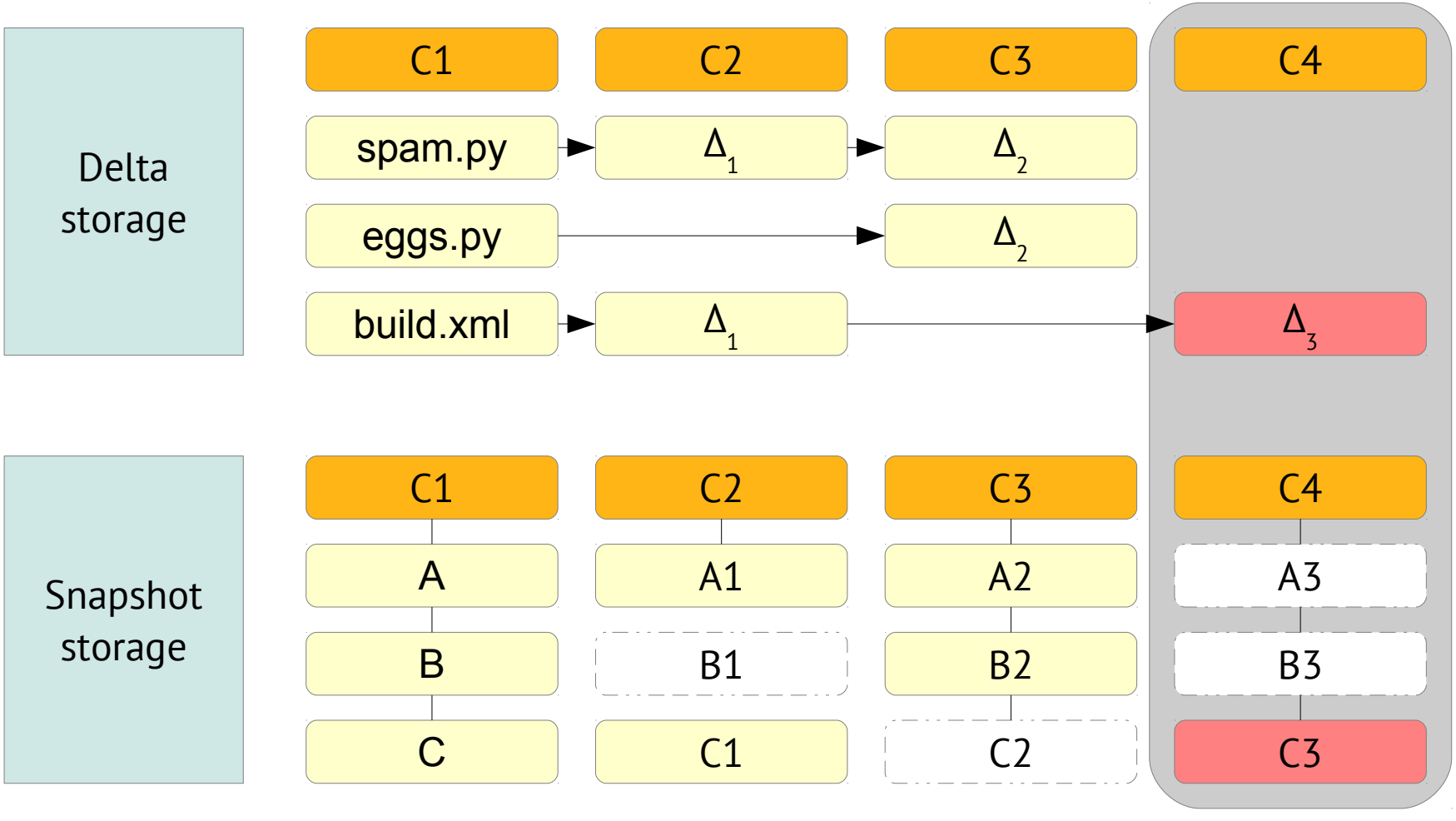

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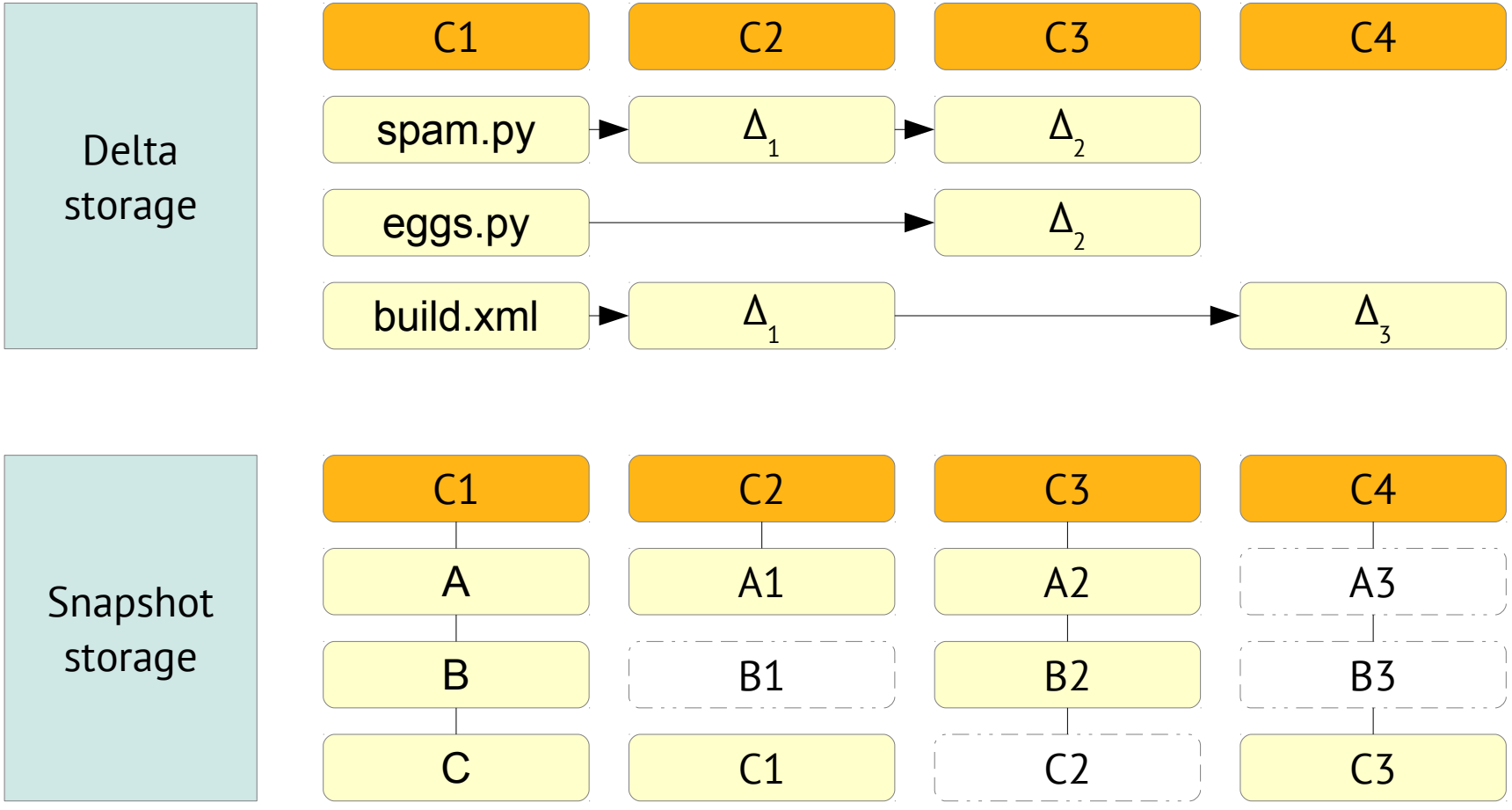

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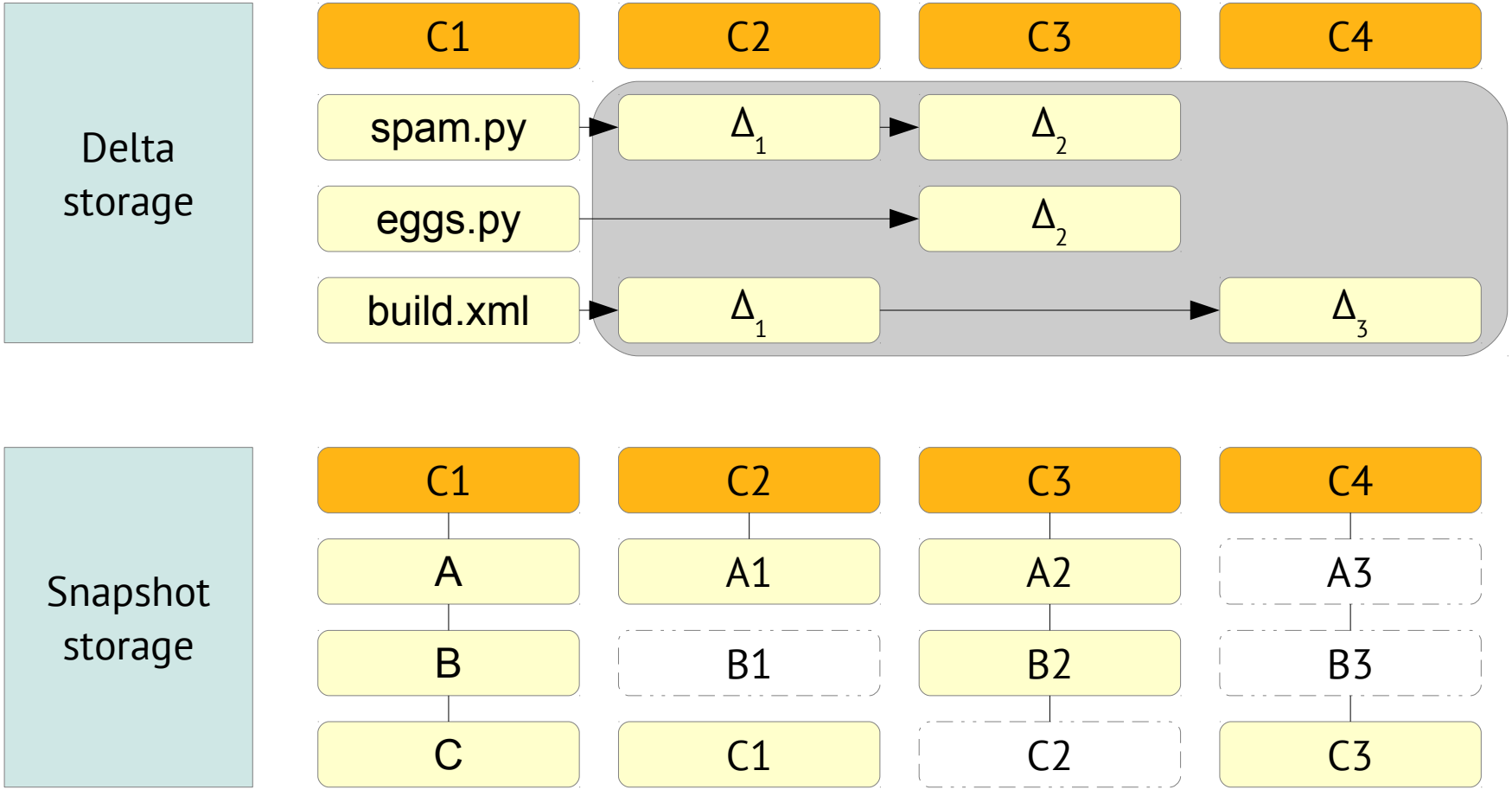

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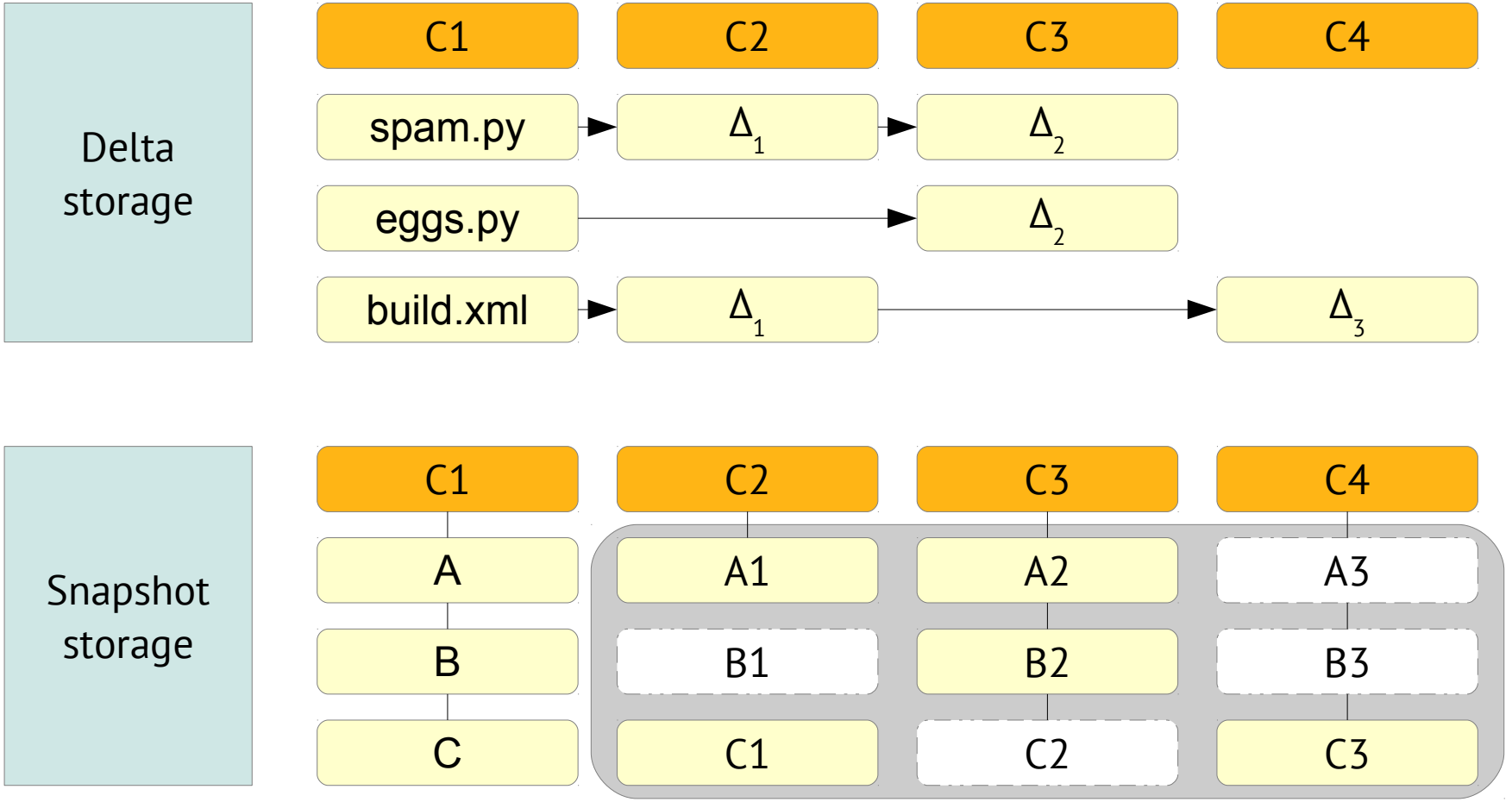
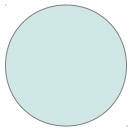


OK.
But how is this different to
our beloved ClearCase?

GIT vs ClearCase

GIT vs ClearCase



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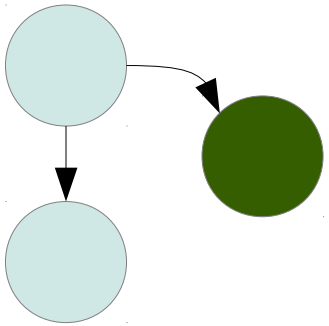

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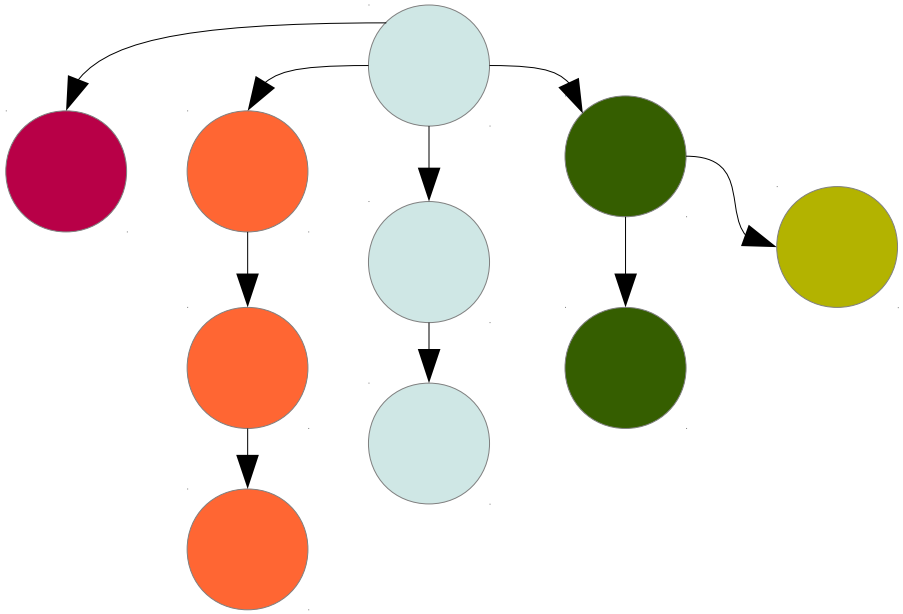

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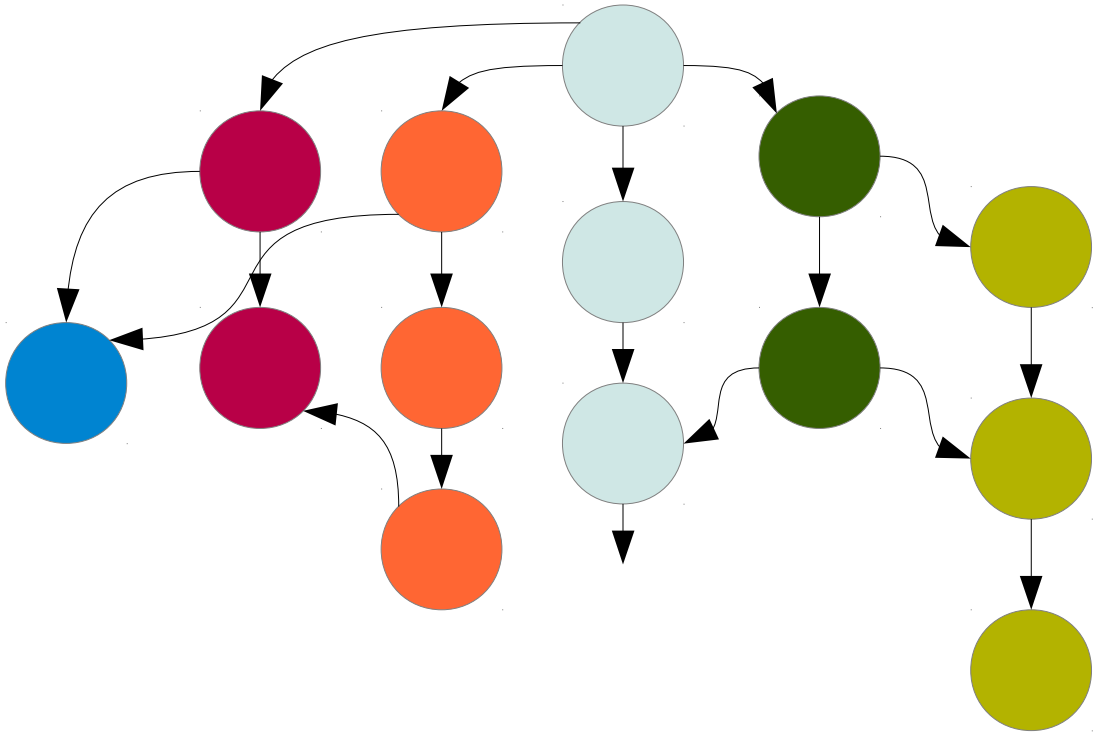

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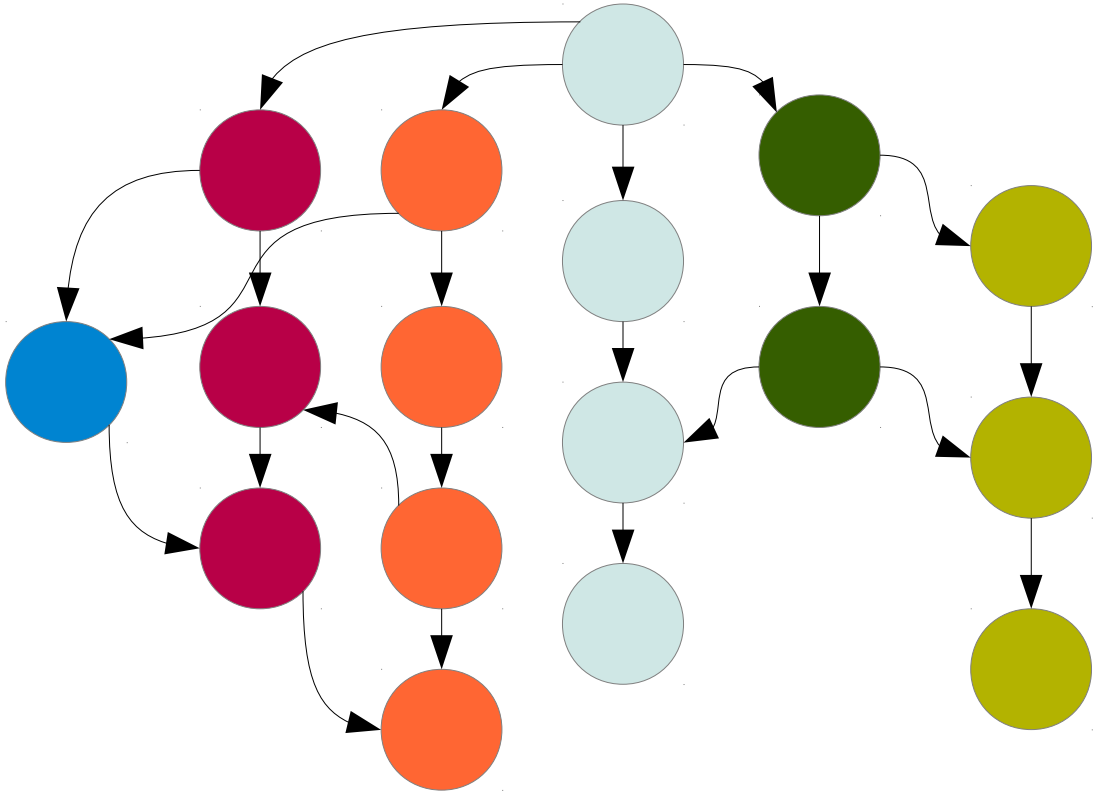

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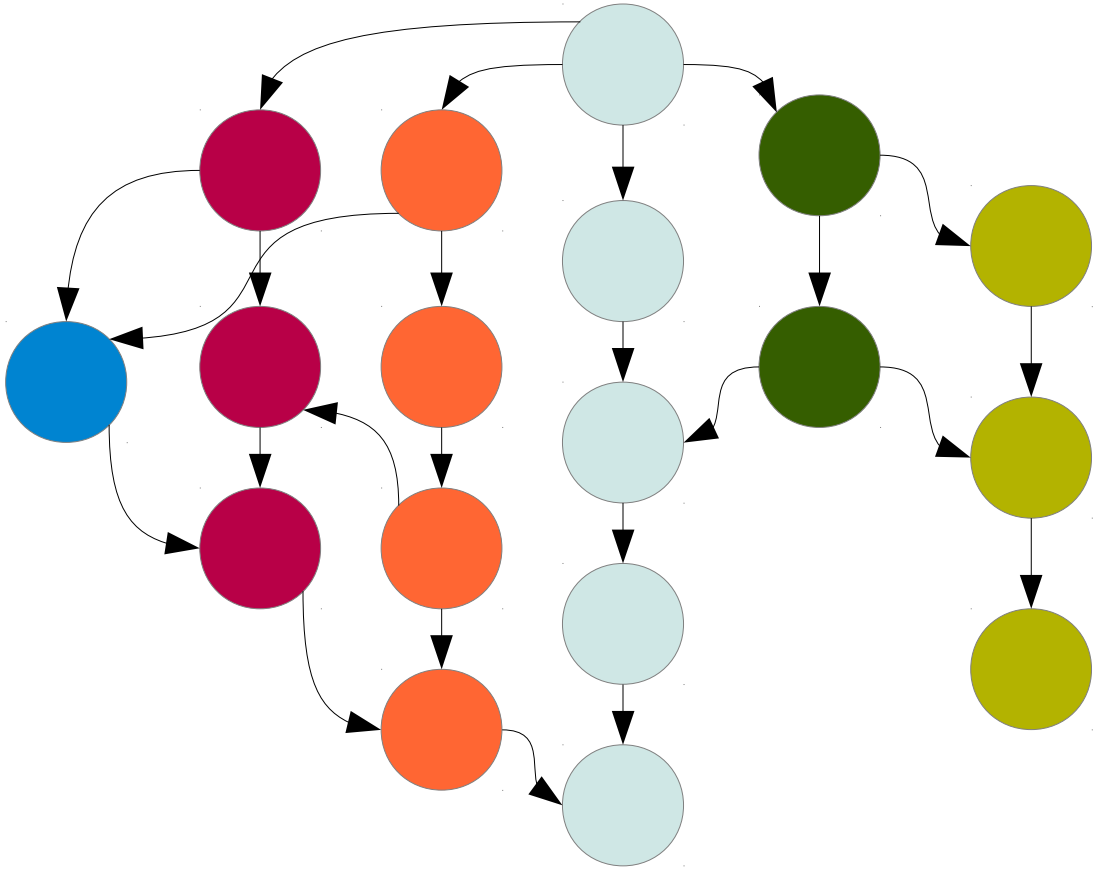

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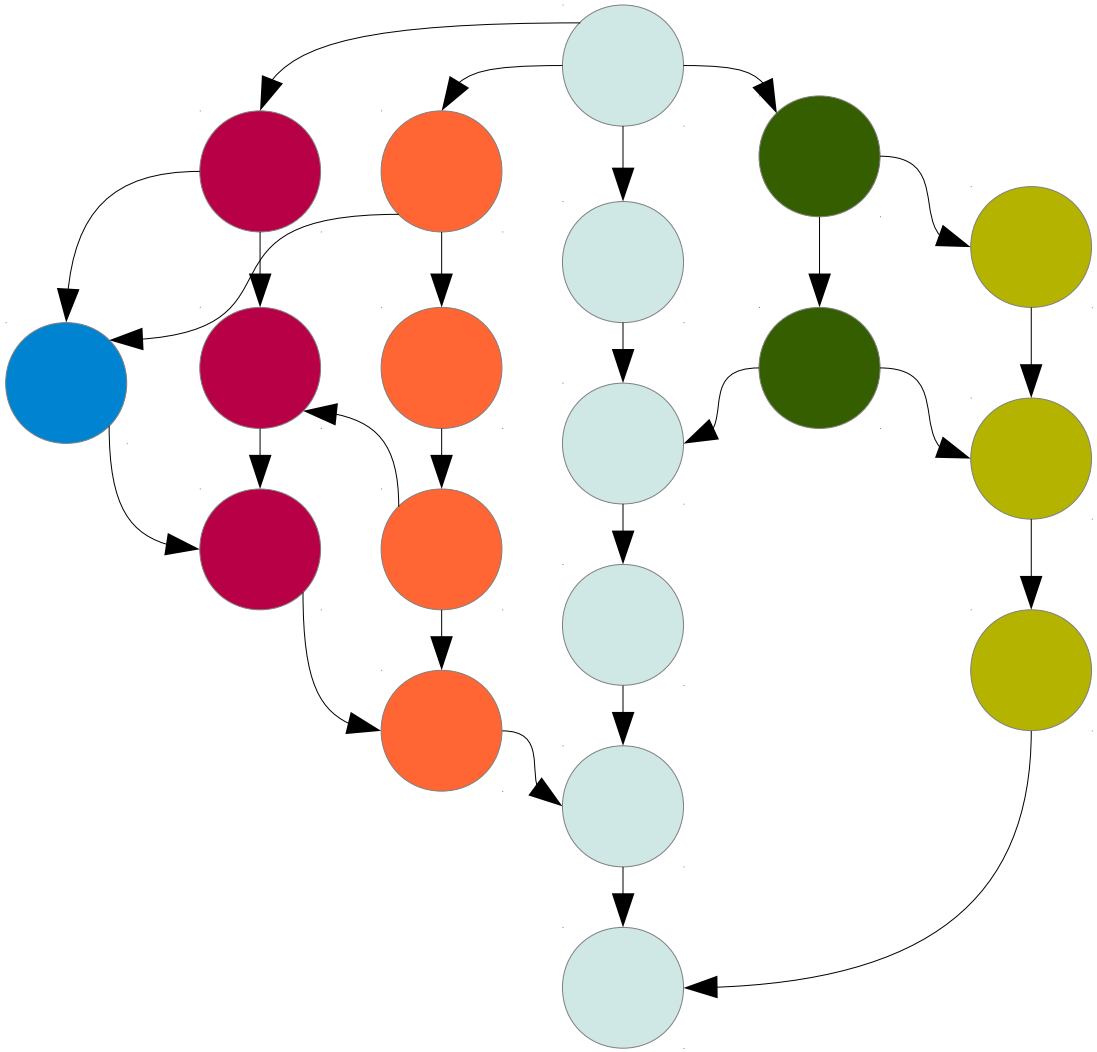
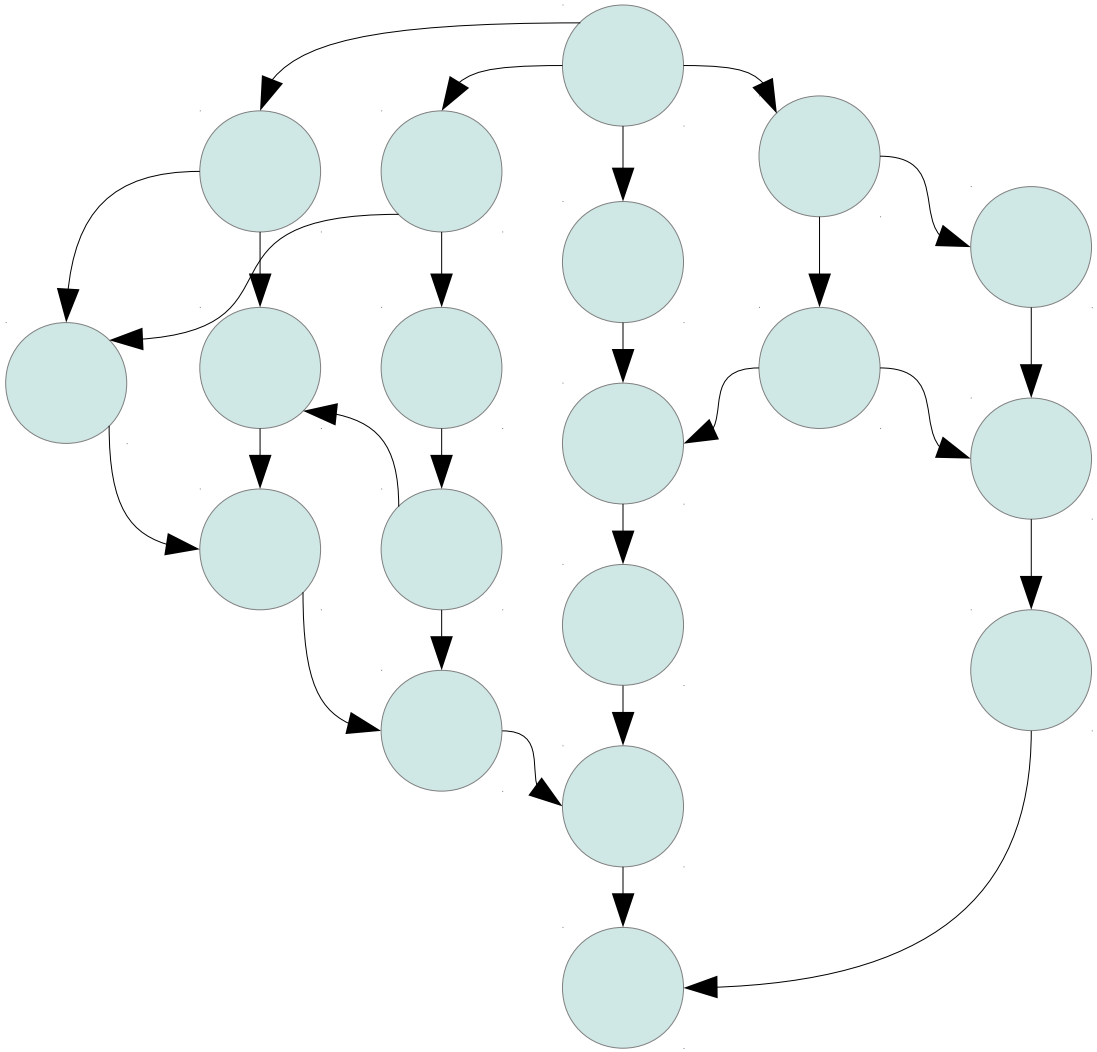


Everything looks great, but…

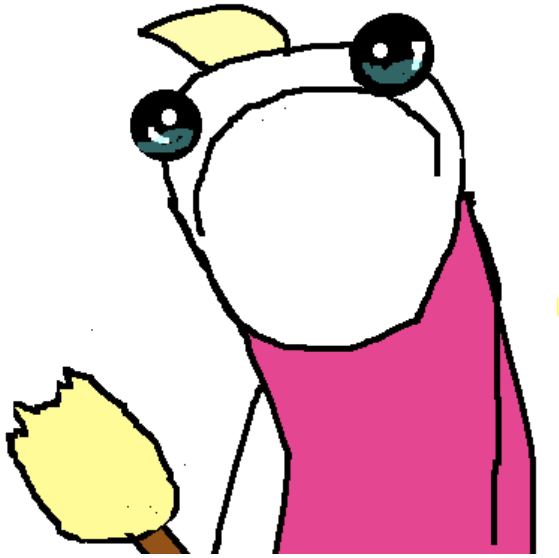
GIT vs ClearCase



After 1 year...

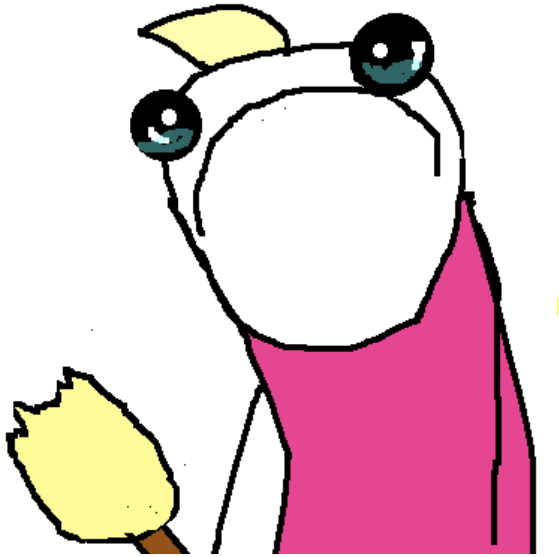
GIT vs ClearCase

Where did Ivan introduce his correction?



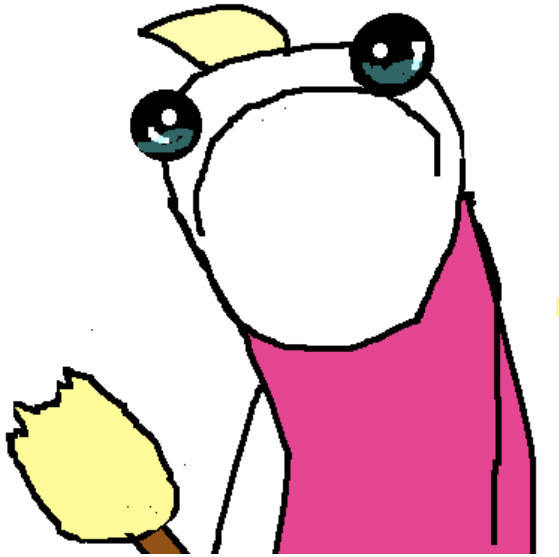
GIT vs ClearCase

How could I give my beautiful patch to Nikolay?



GIT vs ClearCase

How should I
manage this tree?



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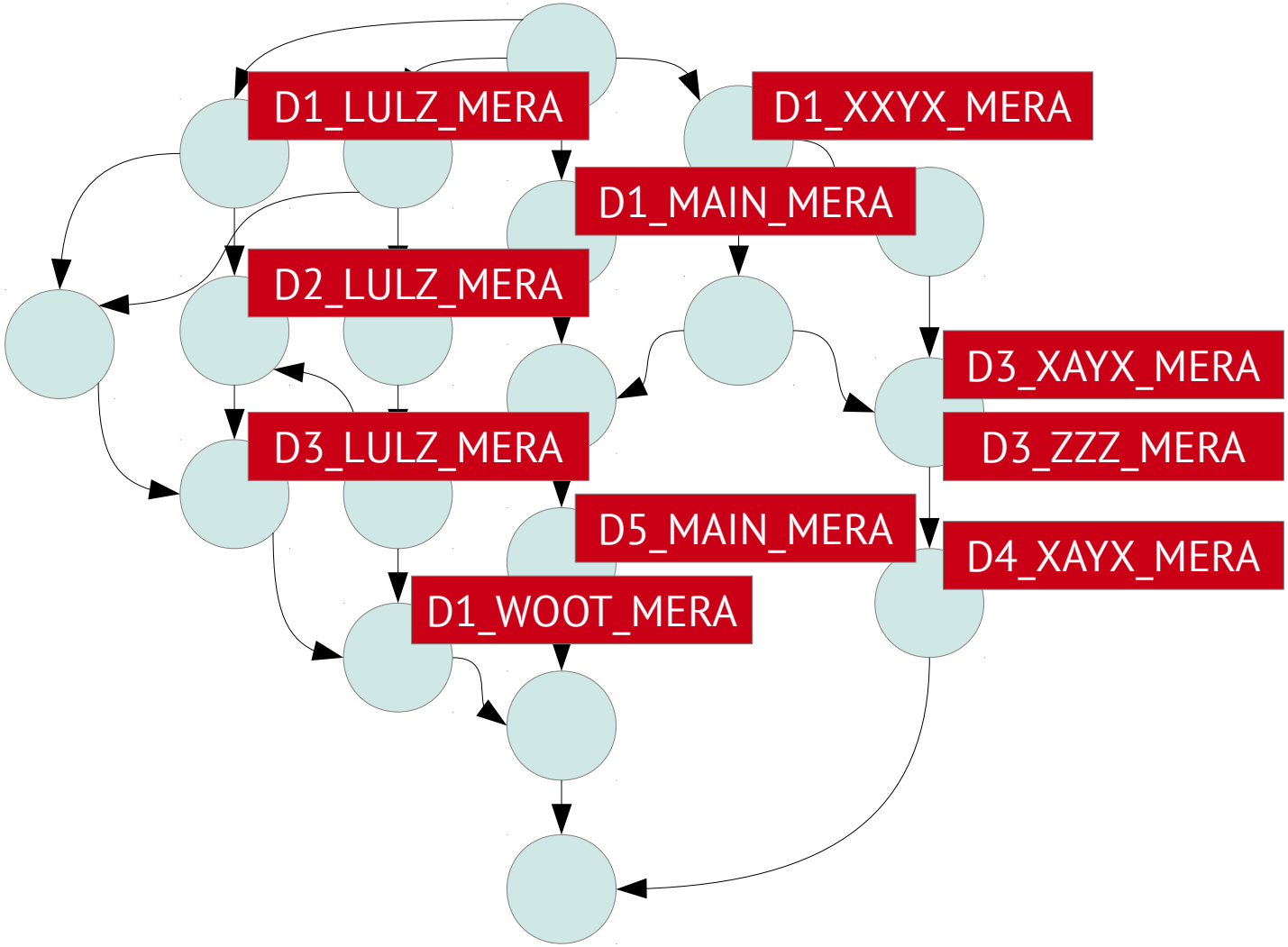

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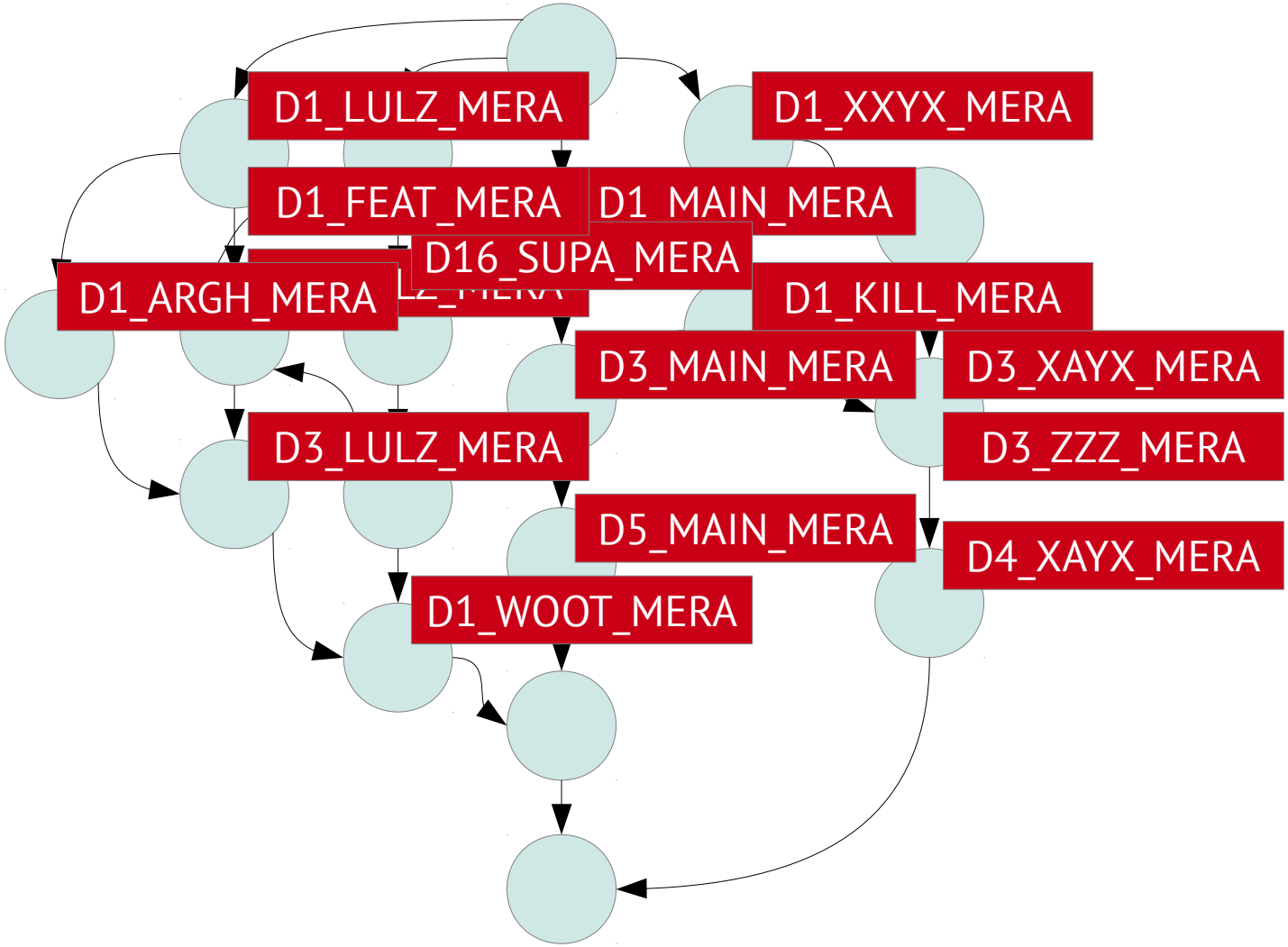

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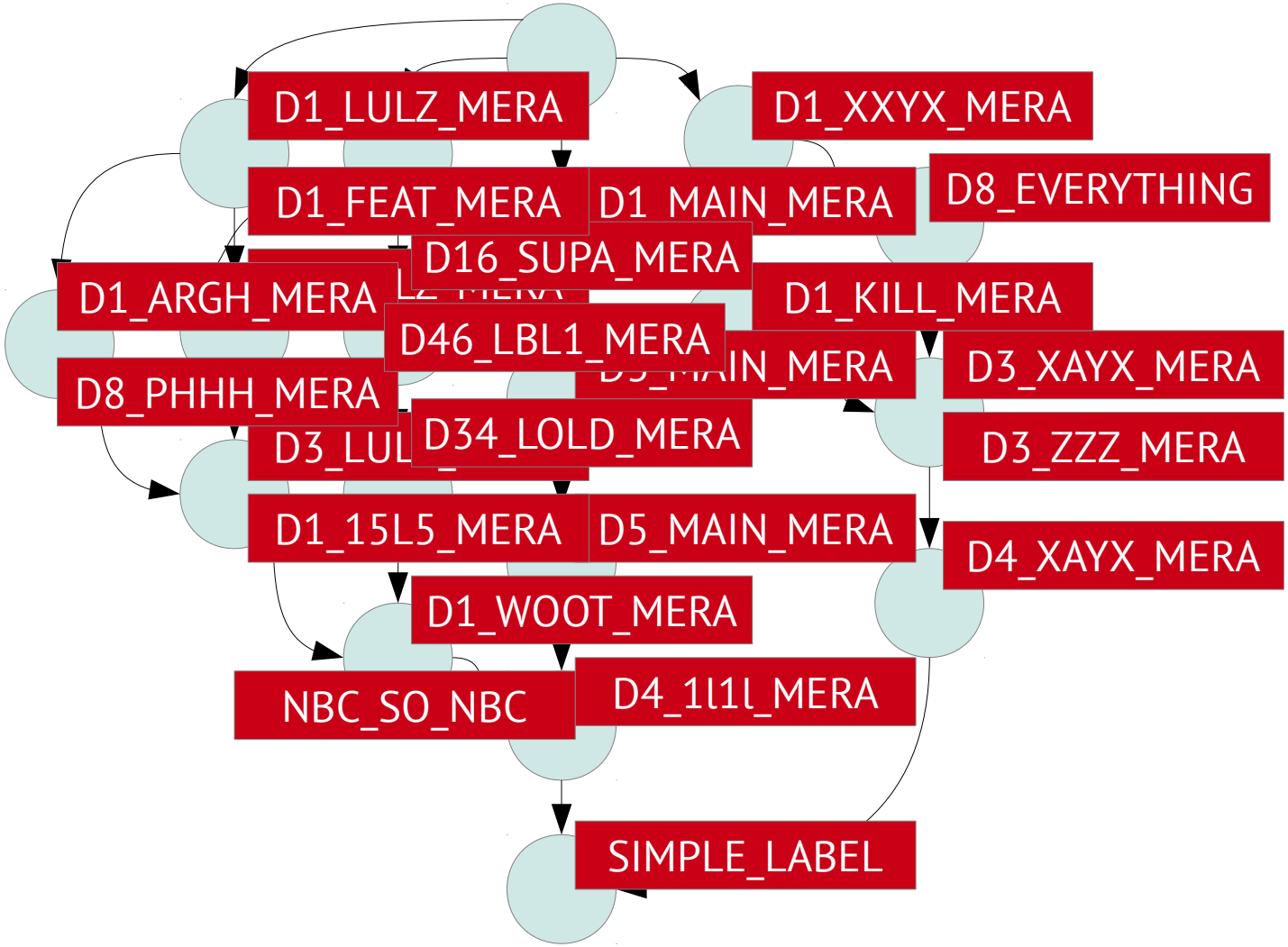

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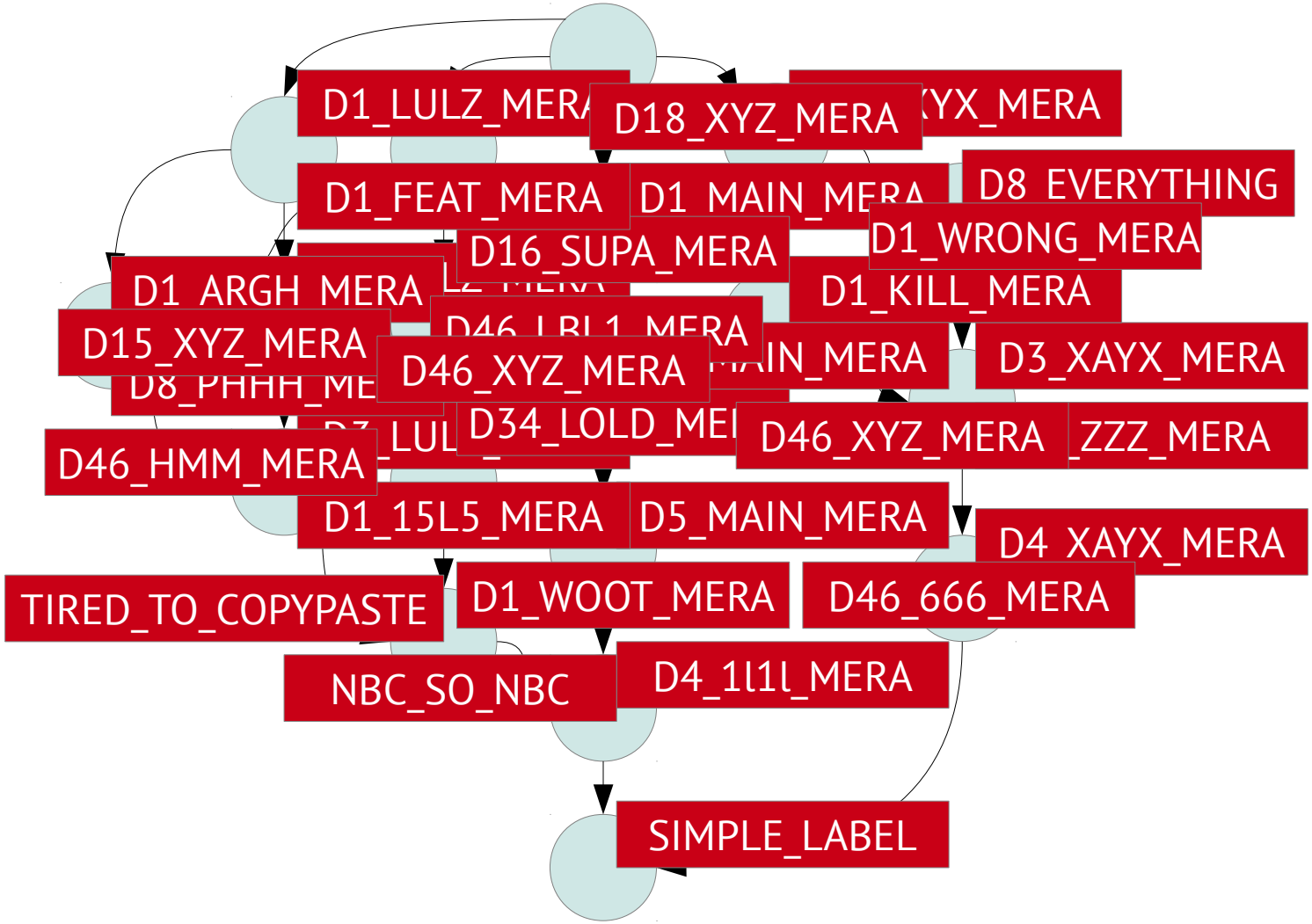

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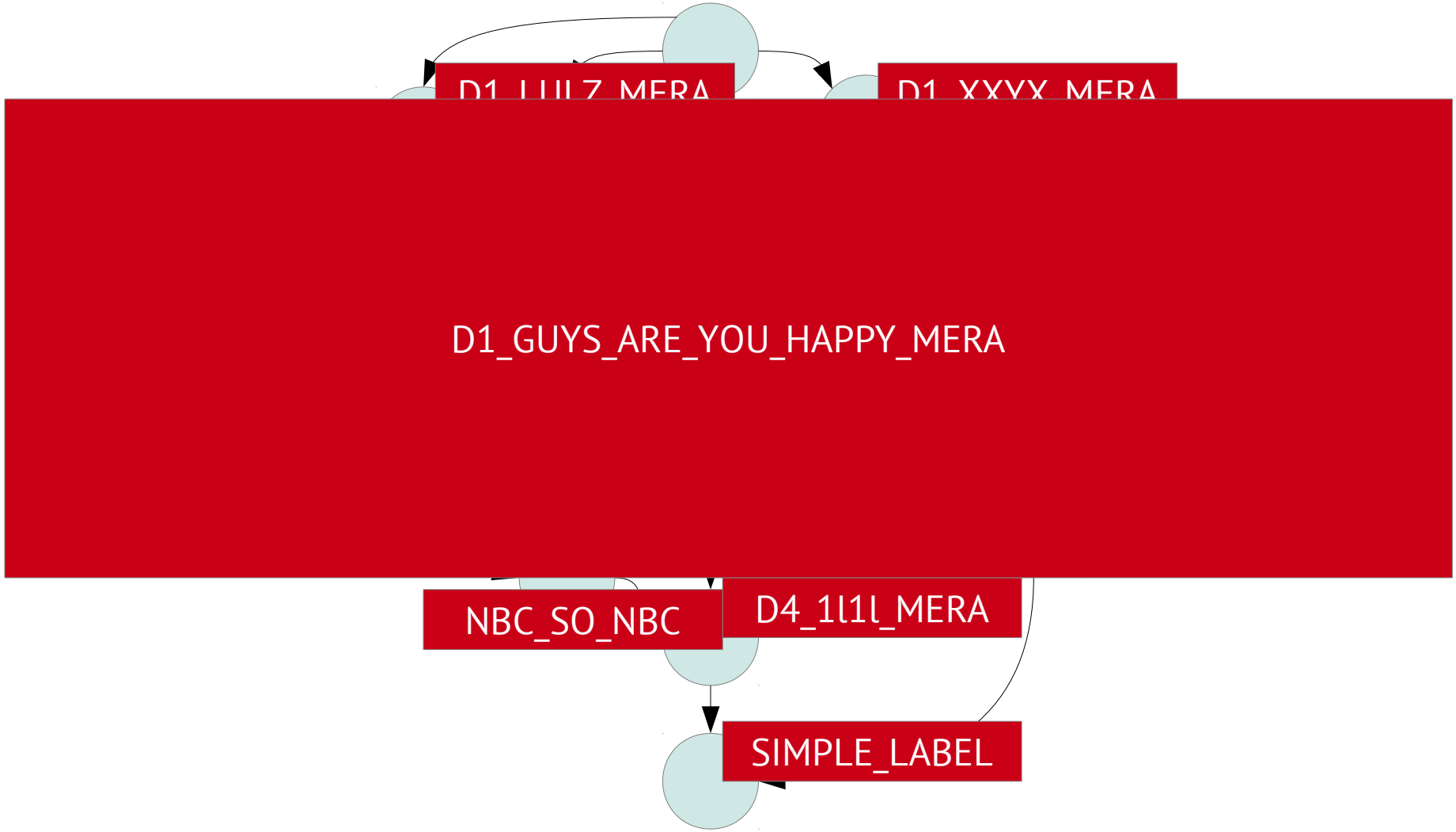


Are you really happy?

GIT vs ClearCase

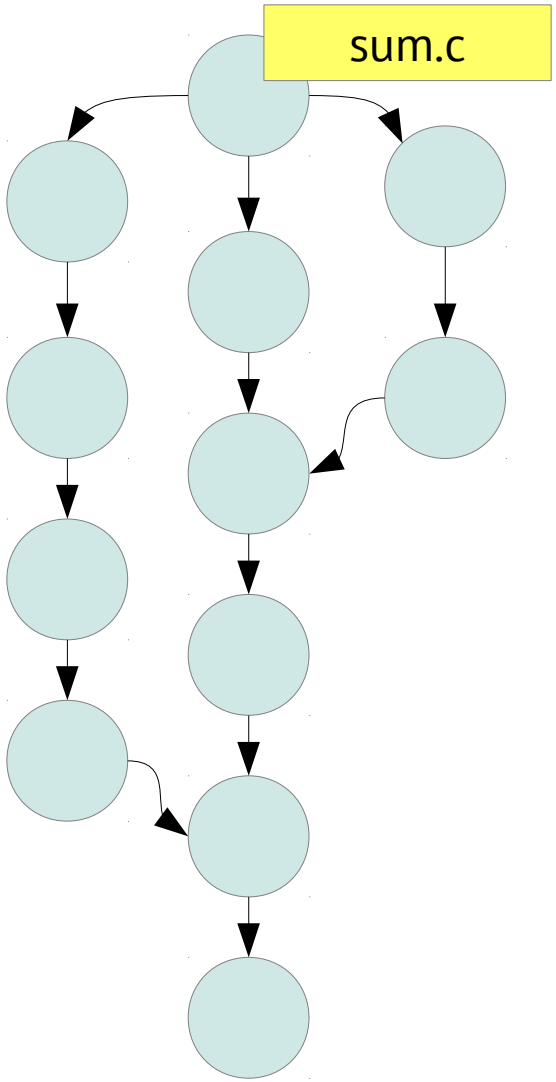
Ordinary ClearCase user

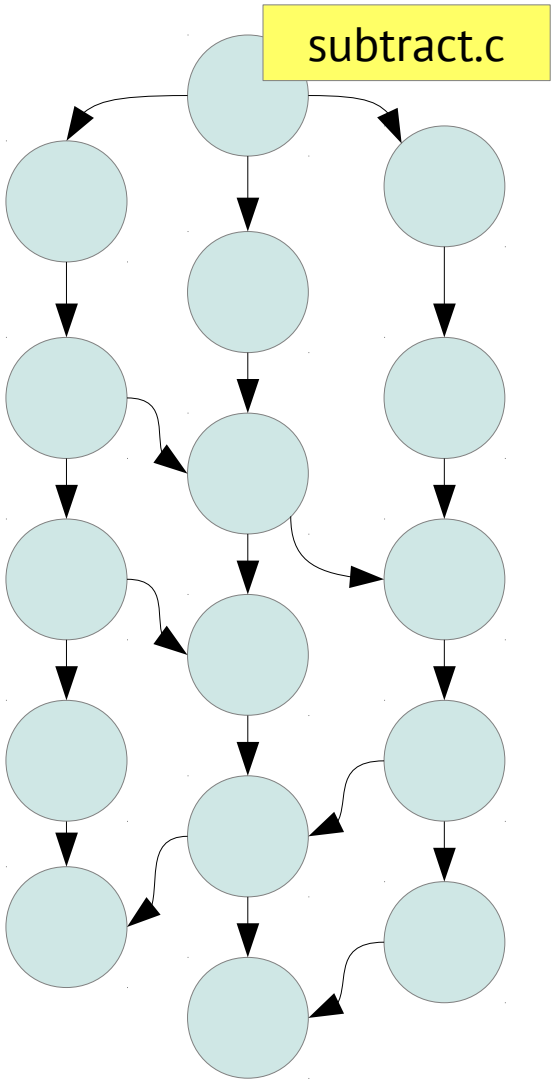
GIT vs ClearCase

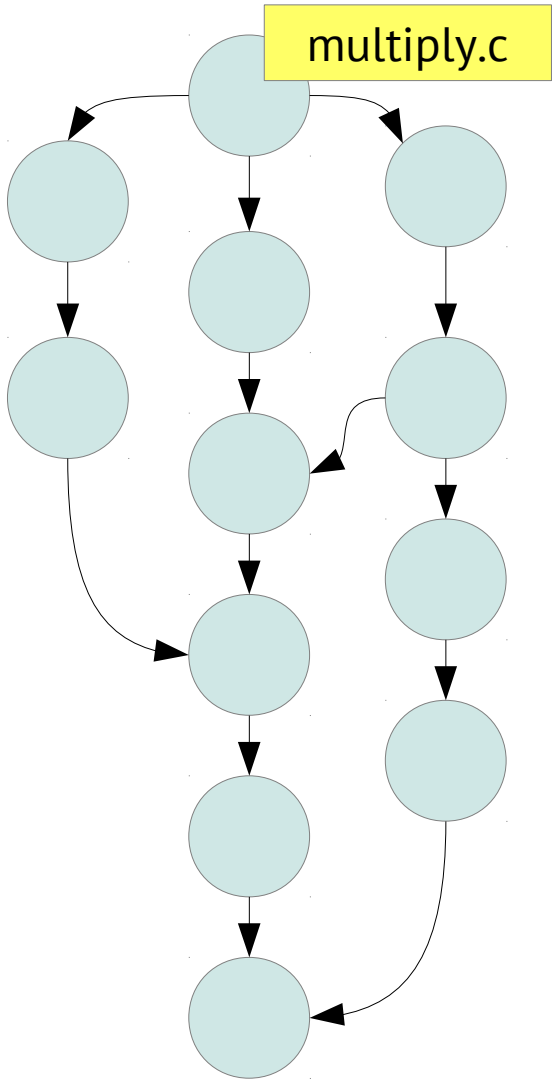
Ordinary GIT user

Have you ever realized
what your ClearCase view
really is?

GIT vs ClearCase







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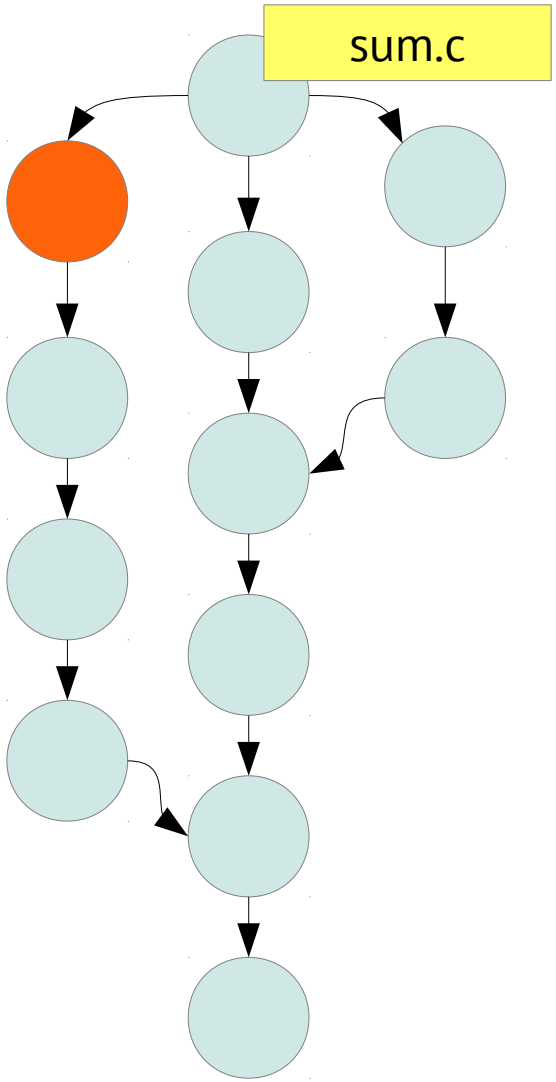

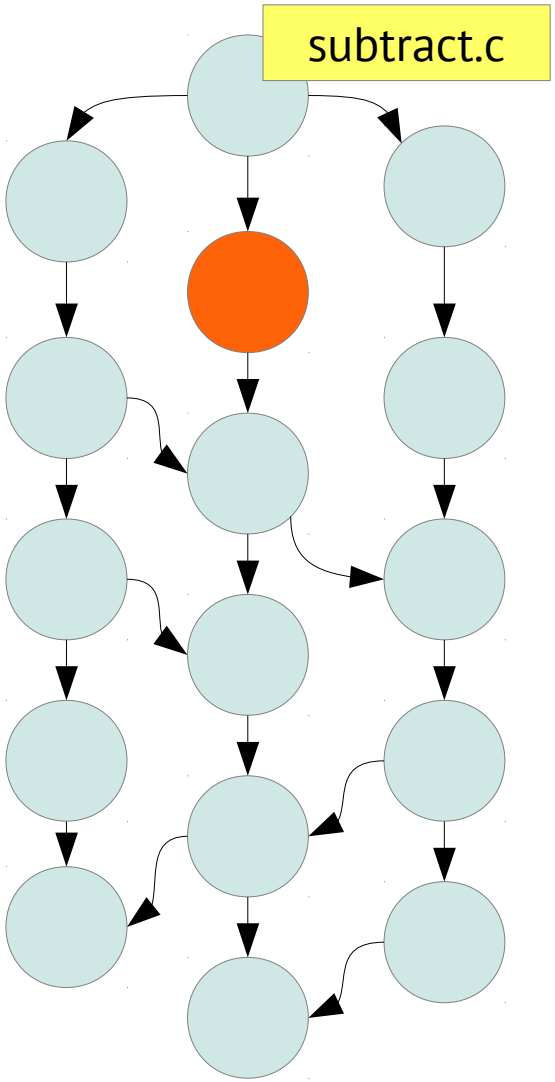

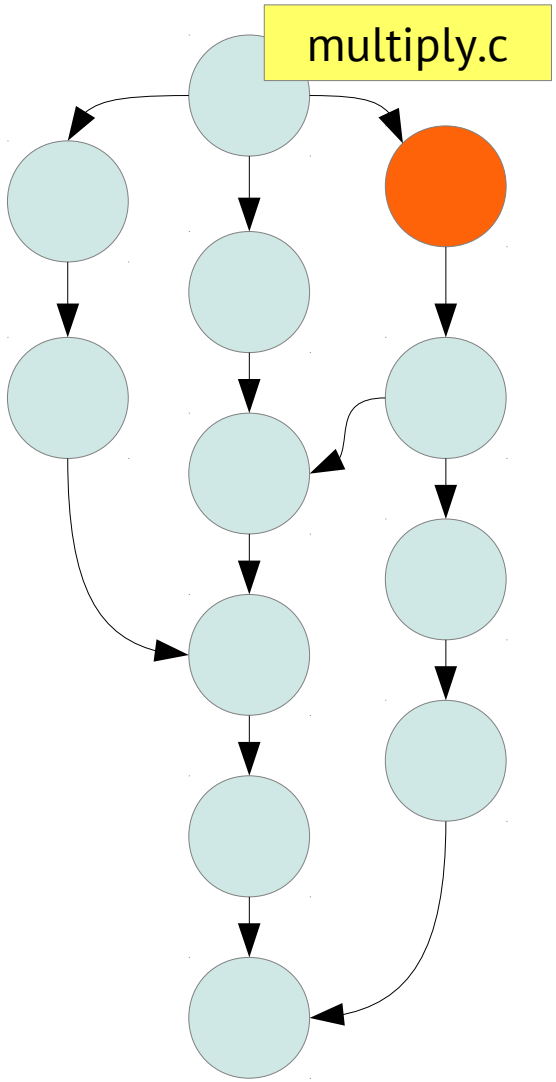

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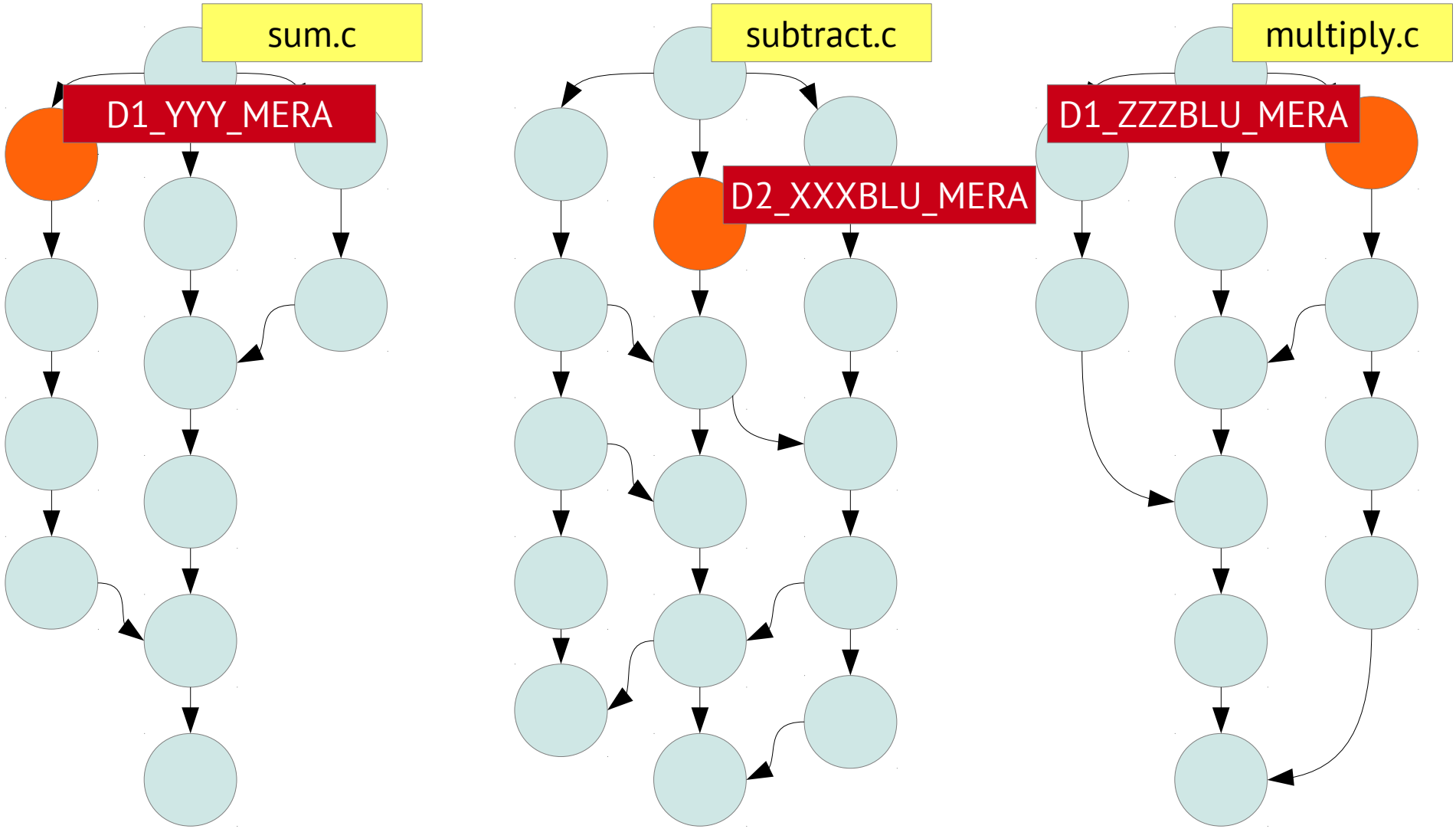

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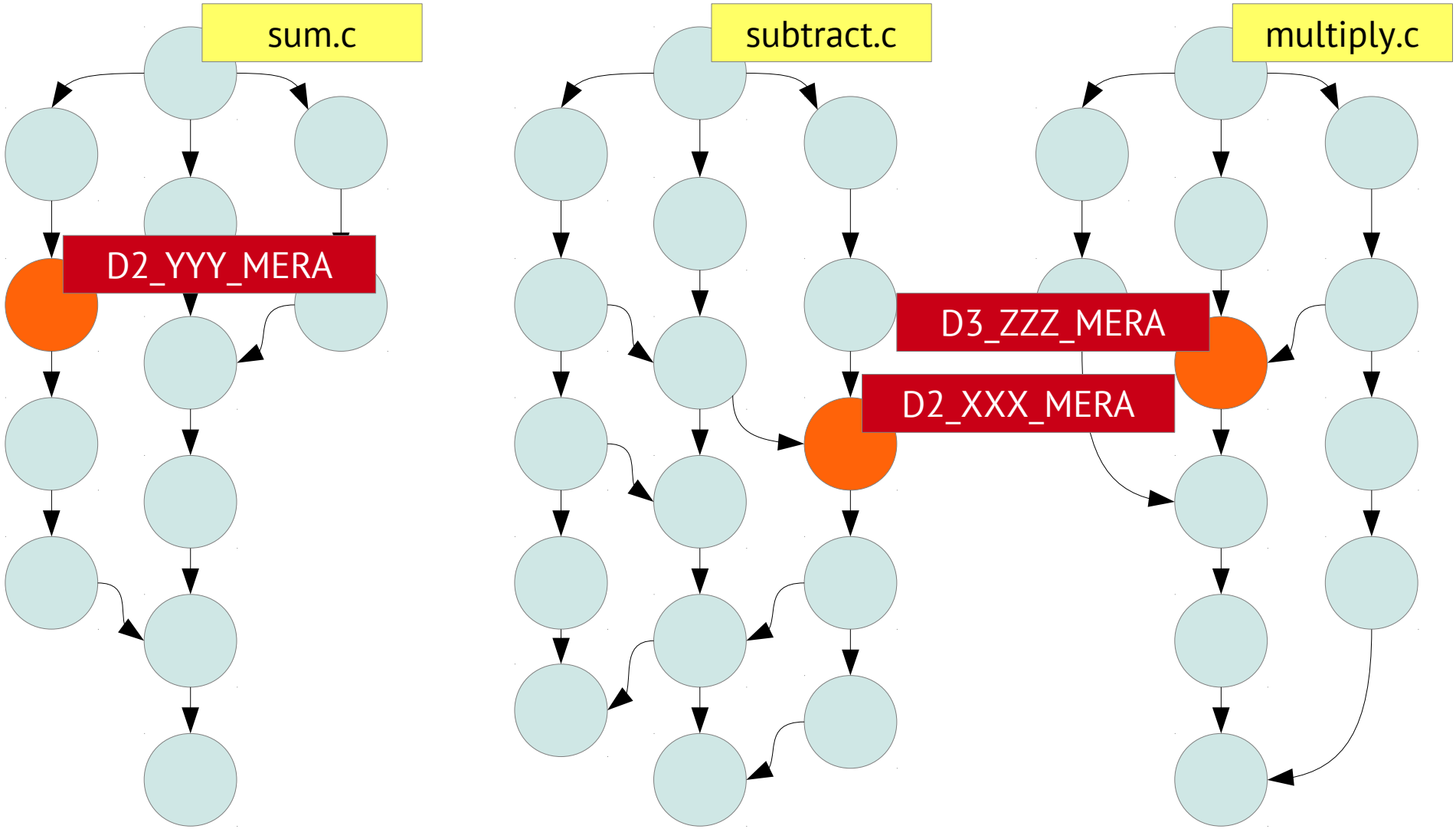

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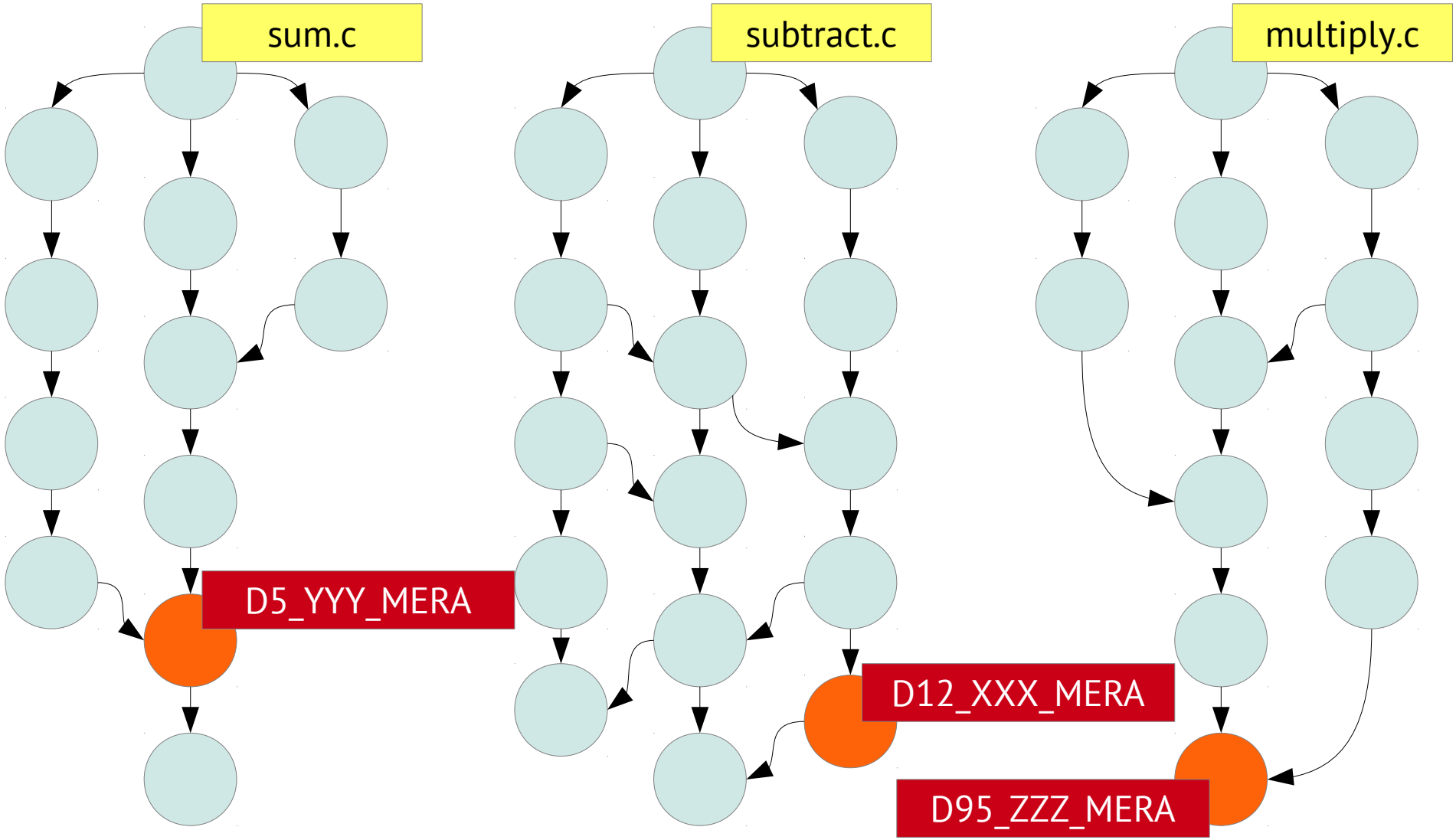
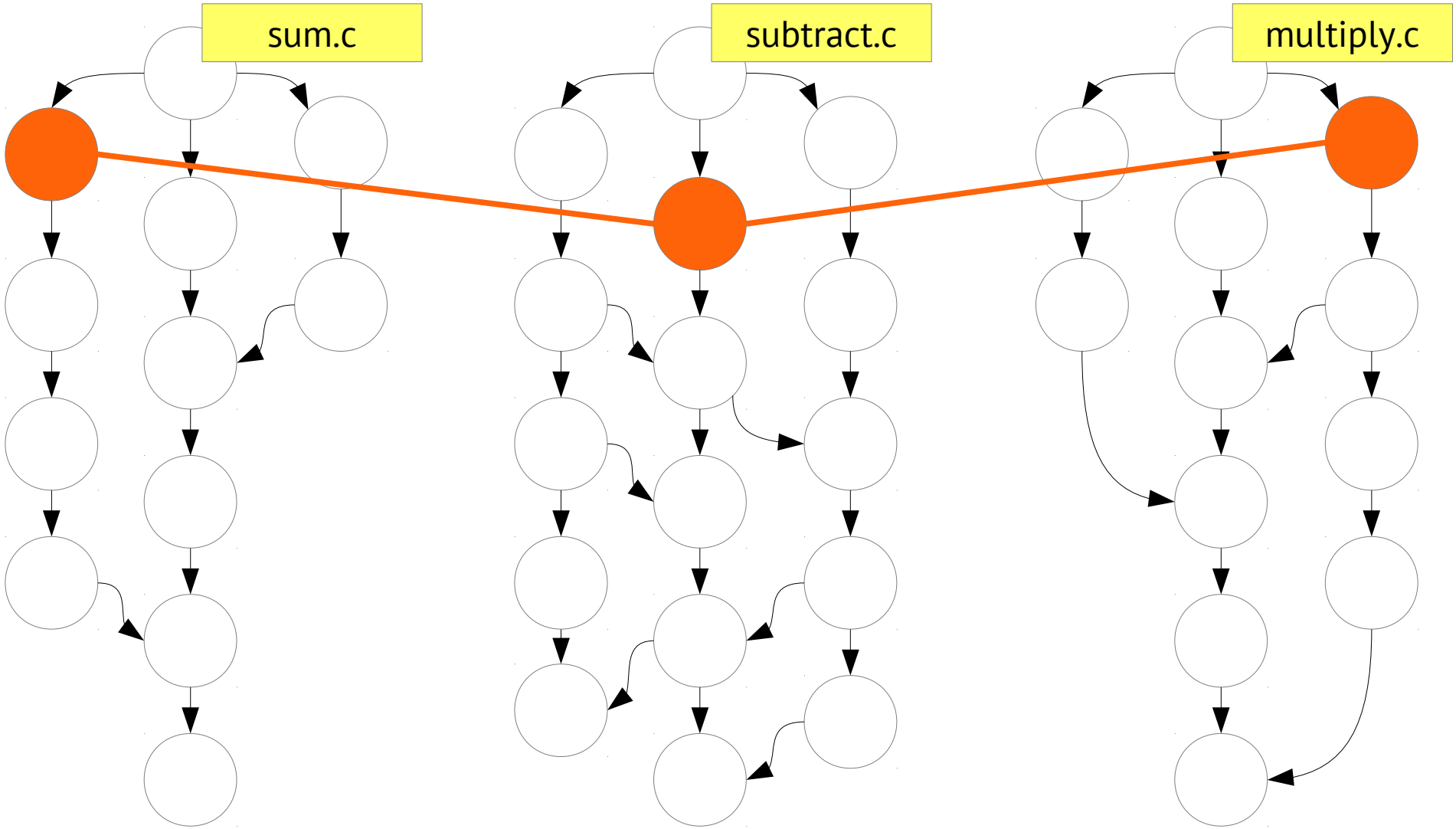


Any ideas about evolution of your view?

GIT vs ClearCase



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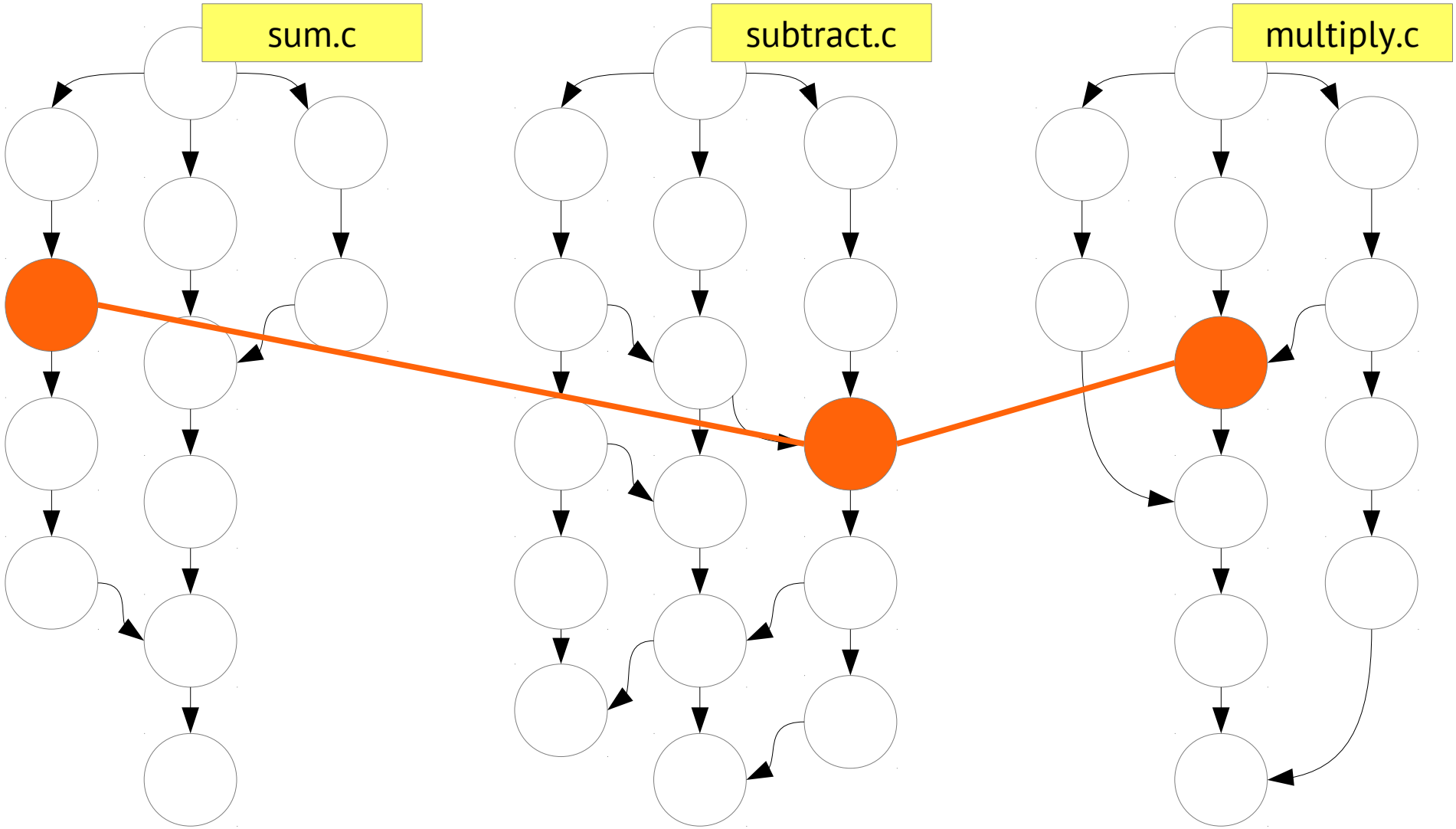

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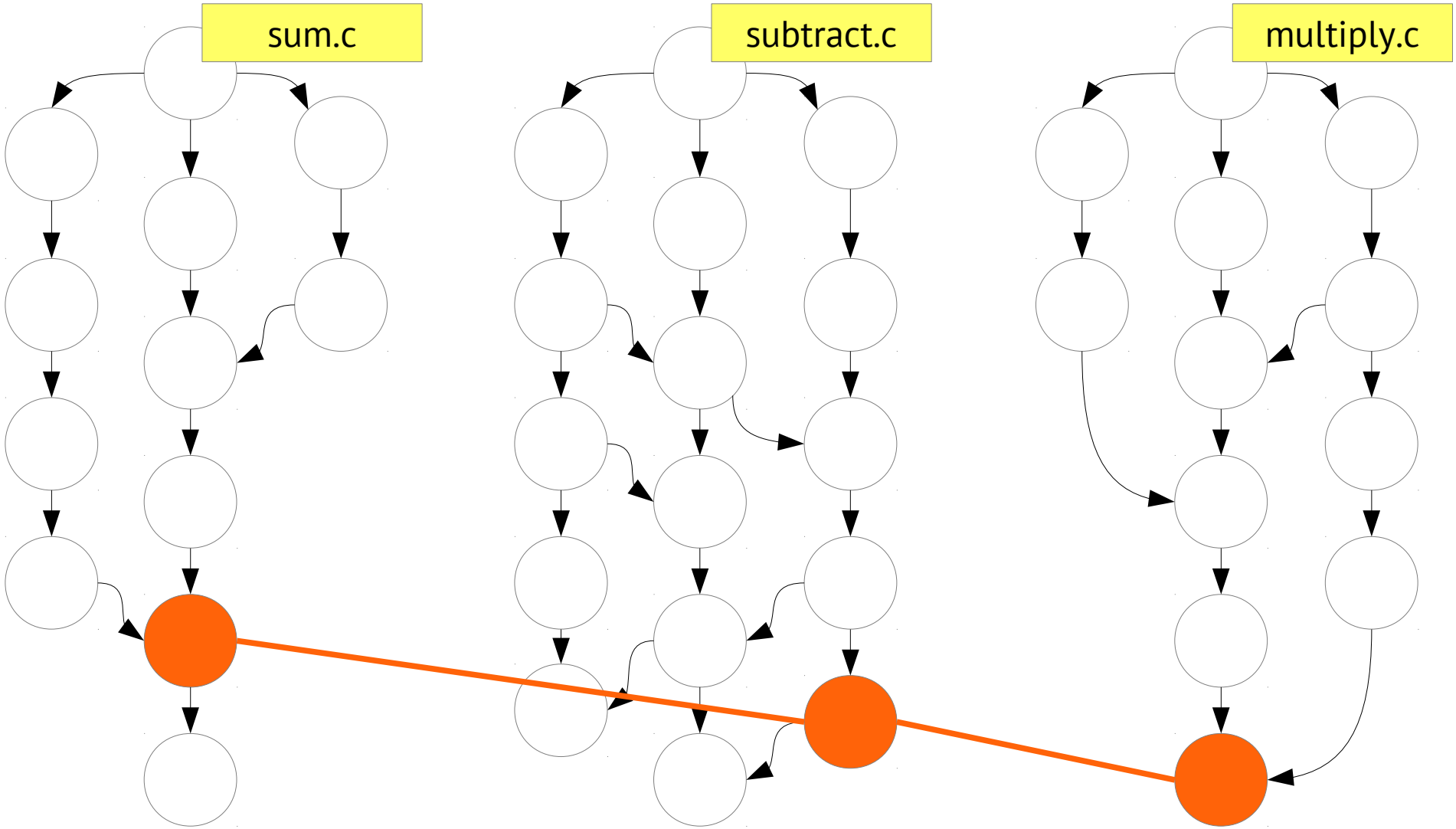

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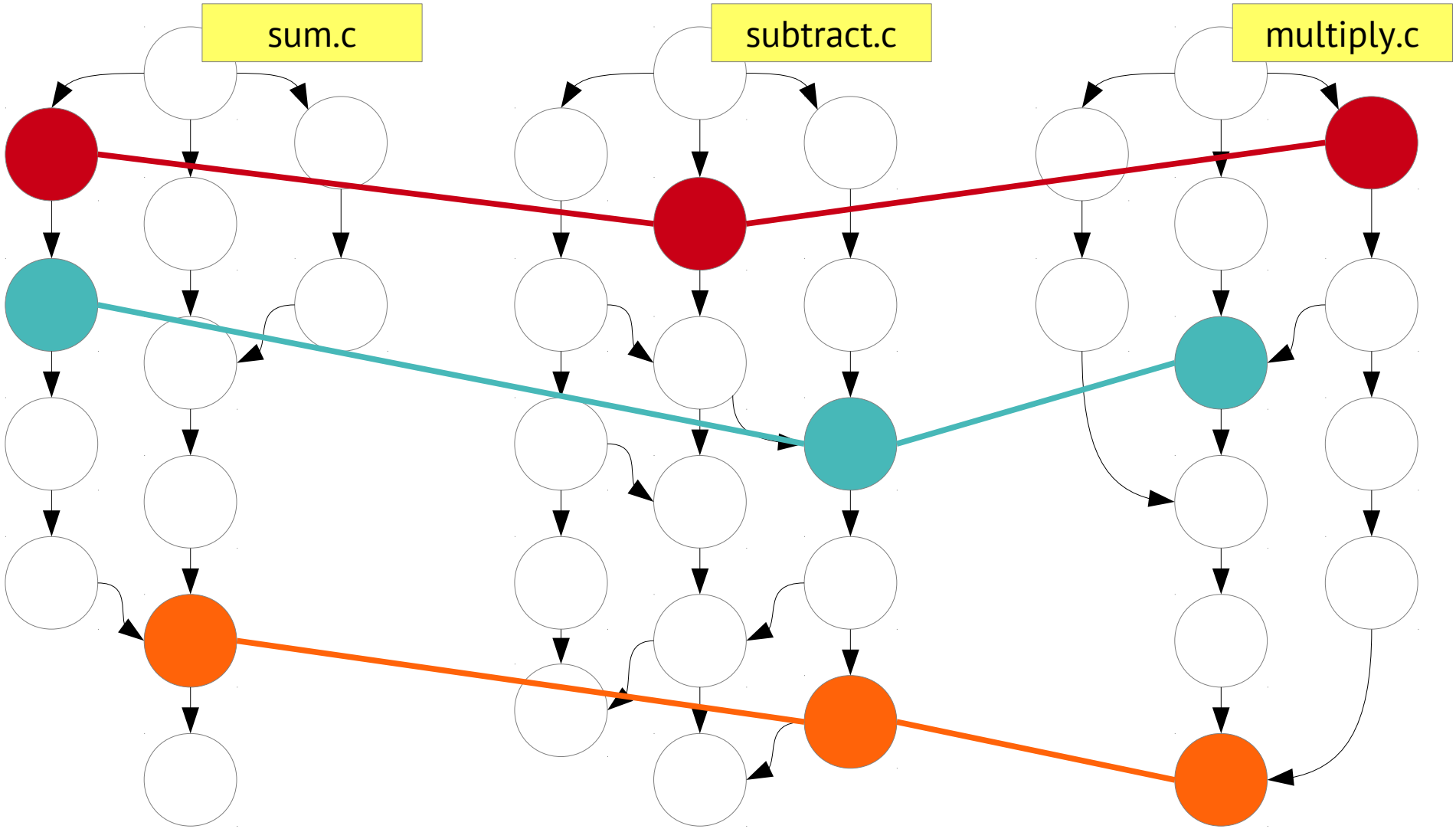

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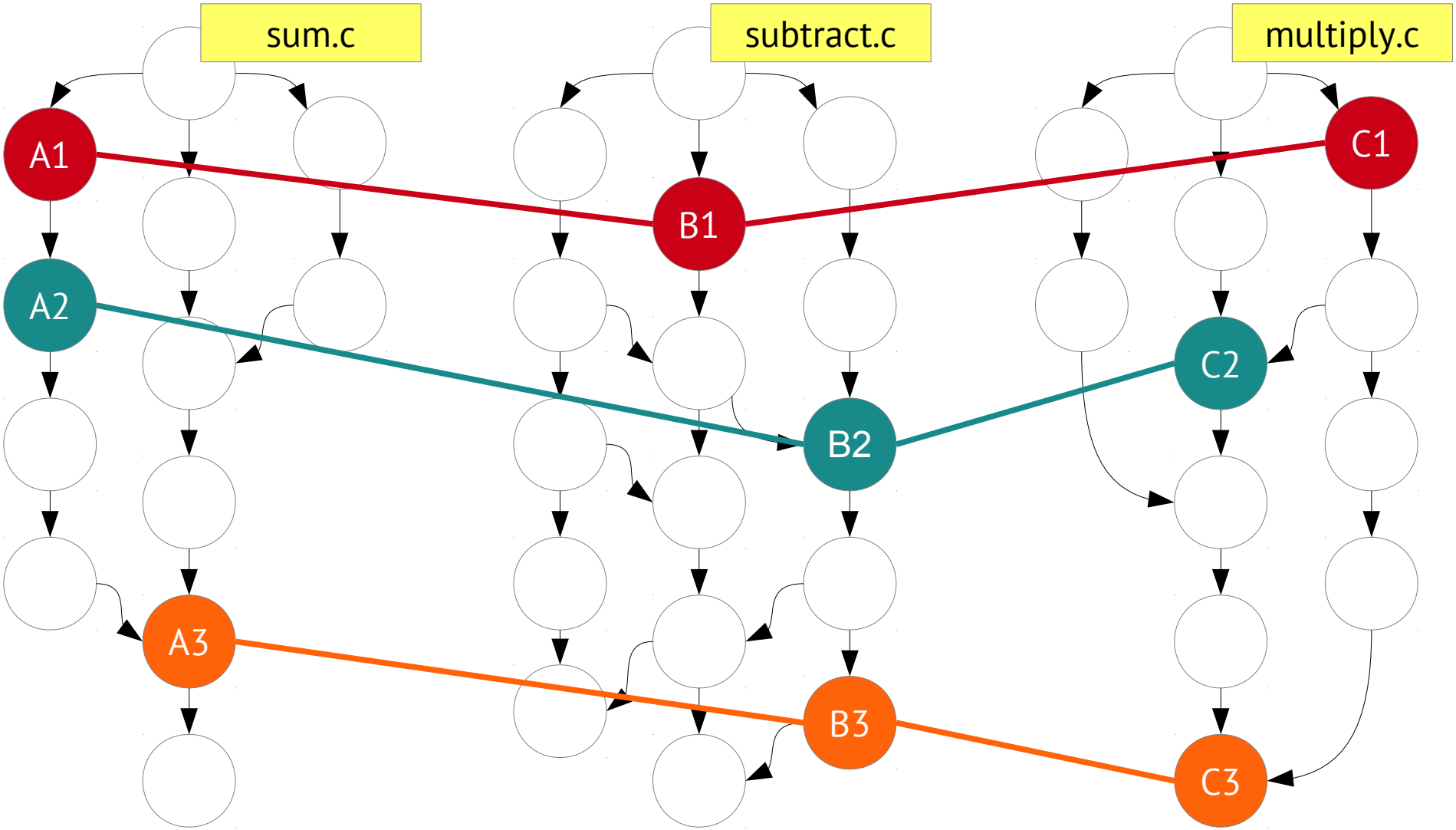

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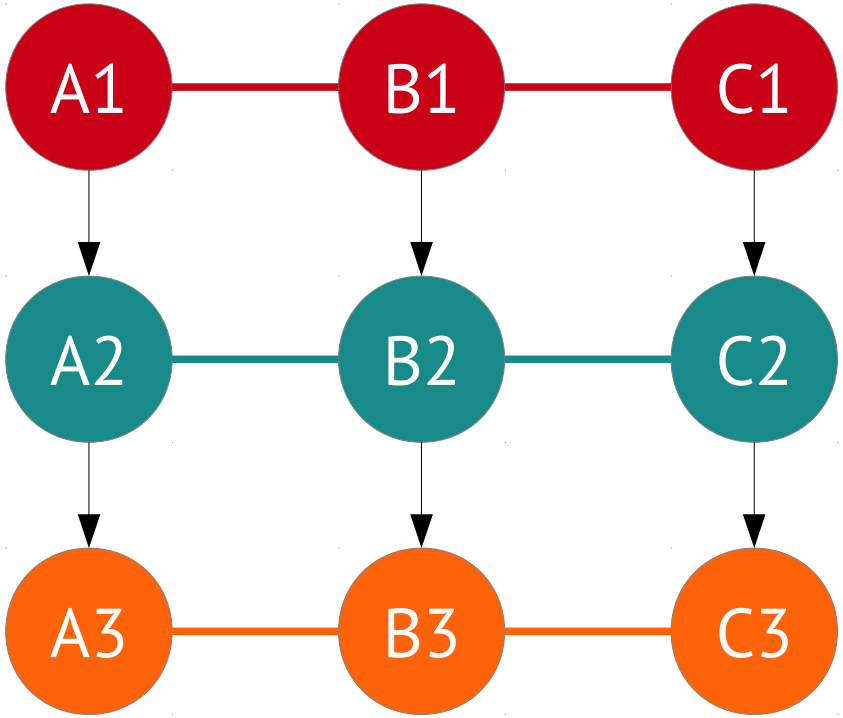

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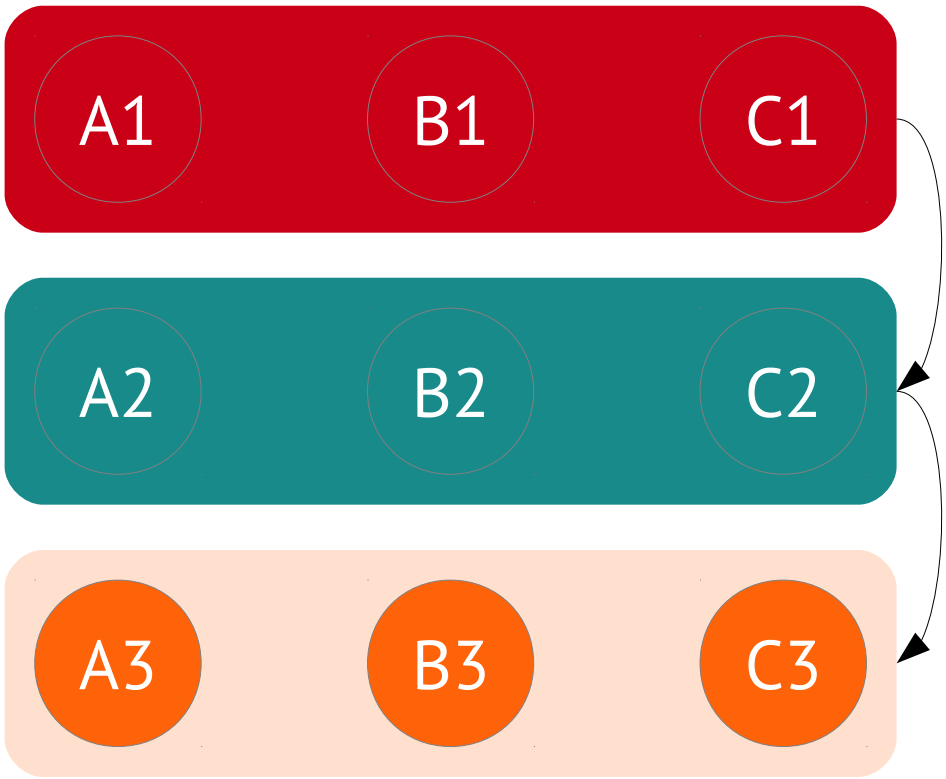

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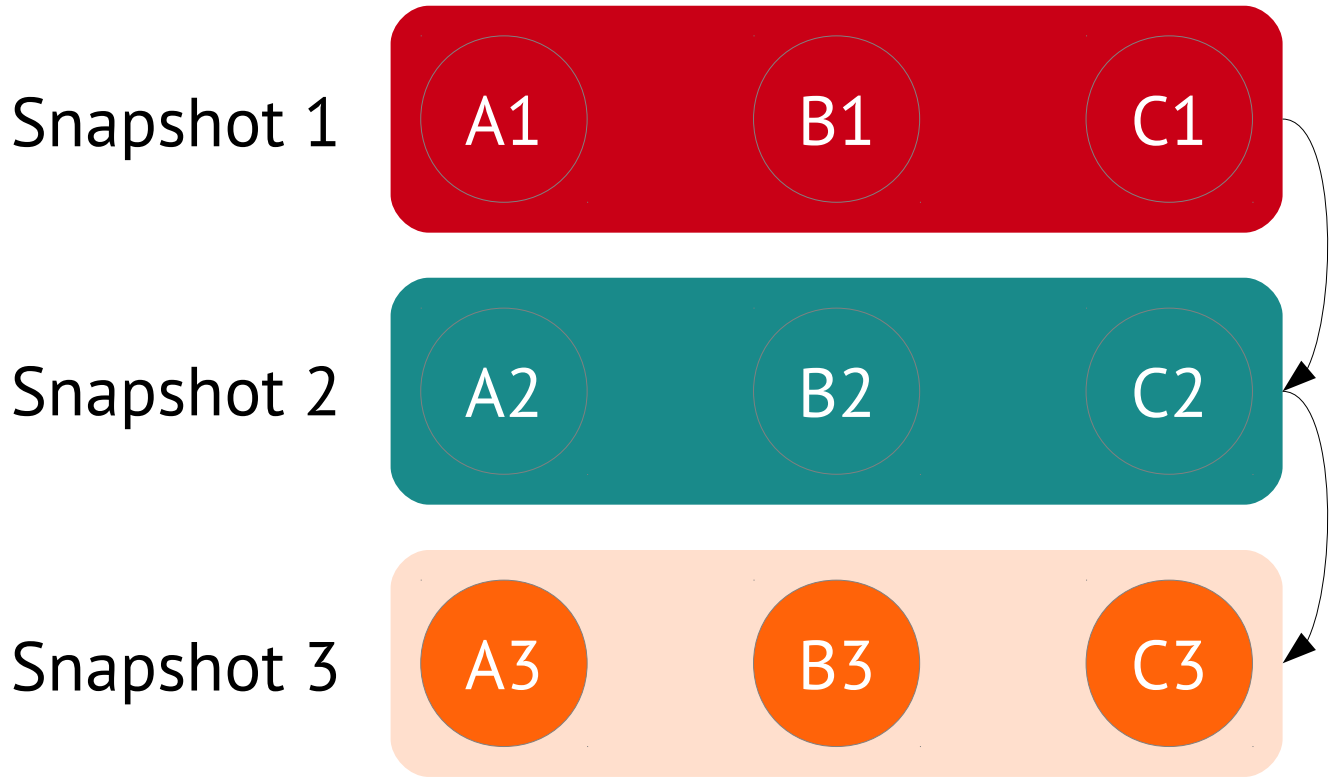

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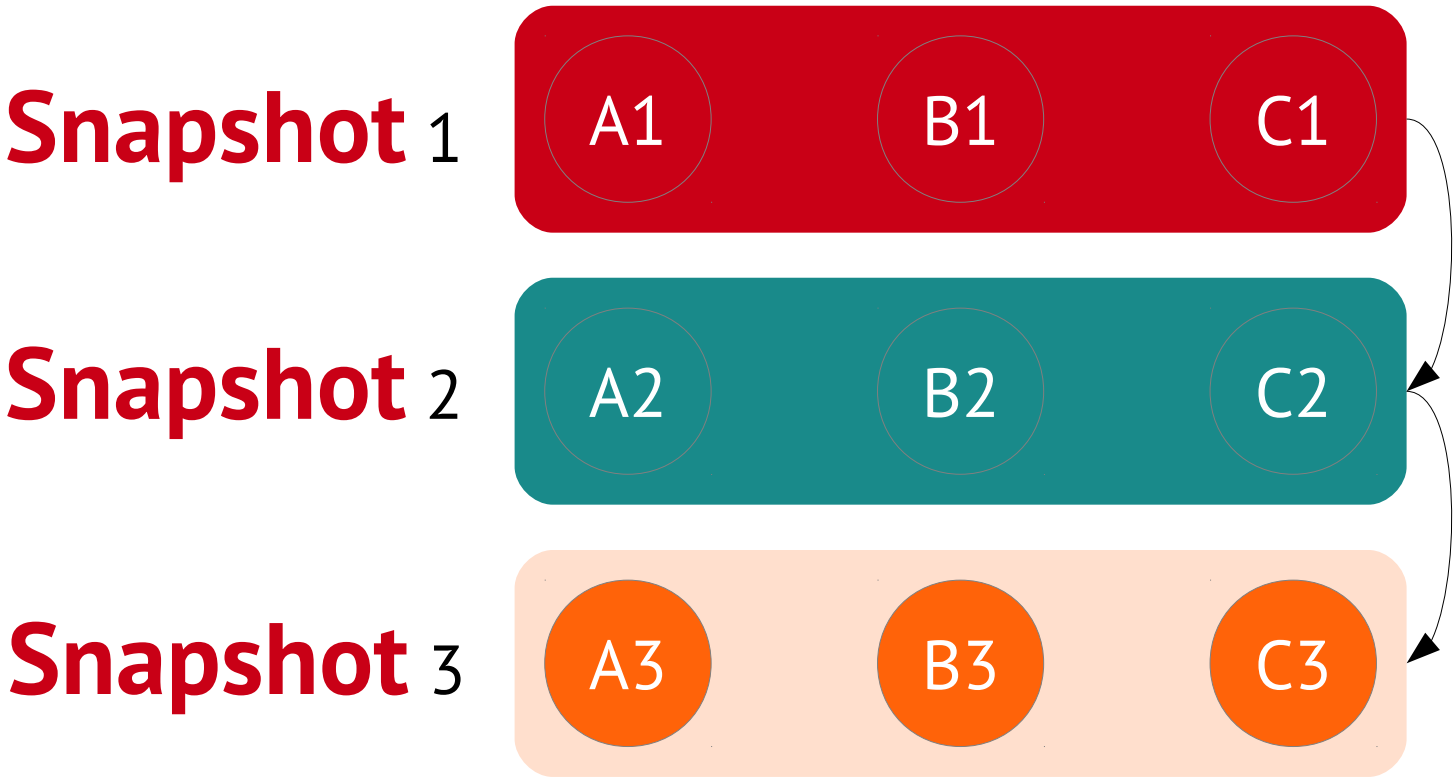


Do not lie yourself.
You do not deal with labels.
You deal with snapshots.

GIT vs ClearCase

- 'Baseline' means 'snapshot' in GIT terms.
- But to deliver you correct snapshots there is the team of masterminds who supports label system and makes centralized system redundant.
- Each config spec includes over 9000 different labels to create 1 snapshot.

Over 9000 labels
to create 1 snapshot

GIT vs ClearCase

- And if you want to extend your snapshot, you need to add much more additional rules.
- Each rule defines how your local copy of ClearCase will have to request information about certain file or diff by network.
- Each operation is performed over the network which causes mortal delays. Everything is very slow.
- Without network you cannot even open file or build something.
- You need to explain your ClearCase by unreadable labels and awkward rules time after time which snapshot you need instead of straight using it.

GIT vs ClearCase

GIT have no such restrictions by design

- GIT initialy operates snapshots, there is no need in any explicit determining which set of labels you need.
- Everything is local. You may pull changes from master repository and continue your work even in aircraft, with branches and whole development story. You may check earliest version even you lost in Tundra without any internet signs.
- Your repository is your own game. You can develop in any way you want. Just send your changes into central repository at time.
- Operations are really rapid and easy. If you want to select LSV or branch, you do not need to ask central repository for proper set of rules. Just use it!

Examples

GIT vs ClearCase

Choosing baseline

ClearCase way

`$ select_config CPP_DESIGN`

waiting for 2 minutes

selecting latest baseline

having a cup of tea

excluding components

Pushing 'Set' button

waiting for 2 minutes

closing application

waiting for 1 minute

working

Git way

`$ git checkout BASELINE`

working

GIT vs ClearCase

Branching

ClearCase way

`$ ct mkbrtype hardcore_branch`

`$ ctedcs`

Typing something like

```
element * CHECKEDOUT

element <path> …/hardcore_branch/LATEST

element <path> /main/cppdev/LATEST
-mkbranch hardcore_branch
```

`$ ct co -nc <path>/<file>`

Working if noone checkedout a file

Git way

`$ git checkout -b hardcore_branch`

working

GIT vs ClearCase

Building your software

ClearCase

$ cat ./cc_build.sh

```
ct_set_needed_cs -version
<LSV> -baseline <BASELINE>

cd <path to one our famed
component>

<build command>
```

GIT

$ cat ./git_build.sh

```
git checkout BASELINE

cd <path to one our famed
component>

<build command>
```

GIT vs ClearCase

Building your software

ClearCase

```
$ time -p ./cc_build.sh > /dev/null
real 1053
user 266
sys  78.72
```

GIT

```
$ time -p ./git_build.sh > /dev/null
real 58.28
user 21.20
sys 35.14
```

GIT vs ClearCase

Building your software

ClearCase

```
$ /usr/bin/time -p
  ./cc_build.sh > /dev/null
real 1053
user 266
sys  78.72
```

GIT

```
$ /usr/bin/time -p
  ./git_build.sh > /dev/null
real 58.28
user 21.20
sys 35.14
```

17.5 minutes vs 1 minute!

Do you really like ClearCase?

Or you just have not used something completely different before?

GIT vs ClearCase

- GIT support your **actual way** of developing software **by design**. You do not need to juggle tons of labels being in a jail of ClearCase ancient restrictions.
- ClearCase does not allow to use modern convenient ways of developing 'out of box'. It provides you with hardcore methods for hacking it only.
- Everytime you need something from ClearCase, you need to modify your config spec which already contains text with size around a two volumes of 'War and Peace' book instead of telling it what you really want to get.

You do not use ClearCase to simplify your job, everytime you appeal to it to get anything.

Fully distrubuted

What is GIT?

Git is an open source, **distributed** version control system designed for speed and efficiency.

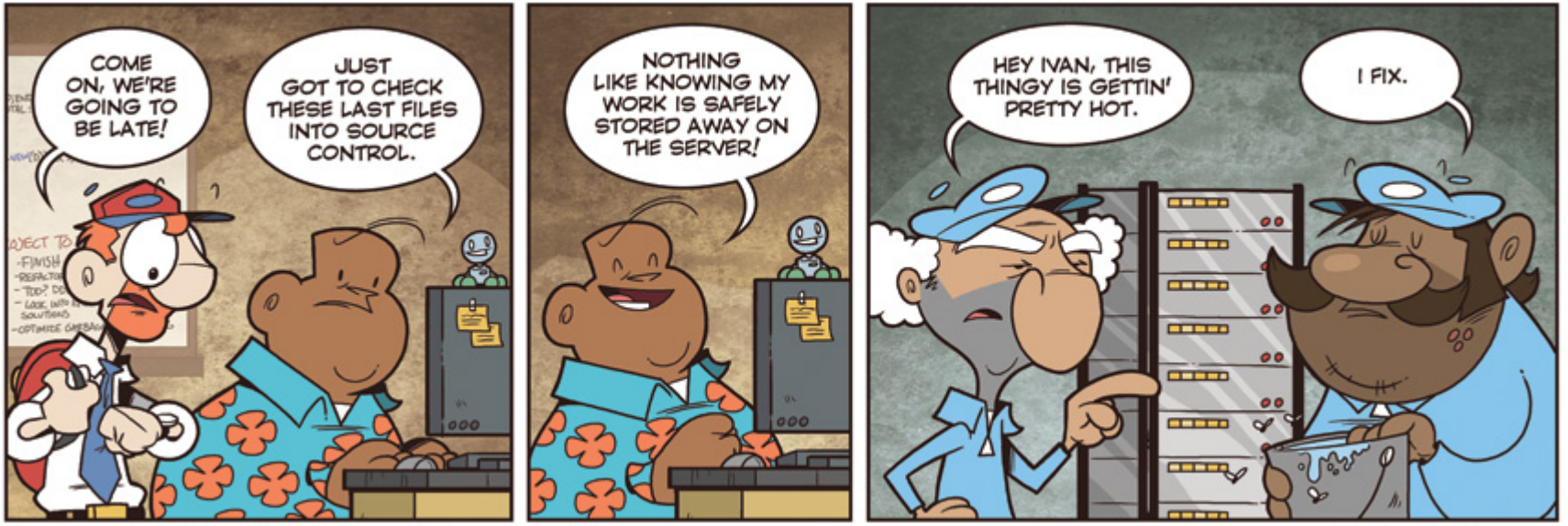
Fully distributed

(almost) everything is local

which means

- everything is fast;
- every clone is backup;
- work offline;
- every known remote repo is branch;

Fully distributed



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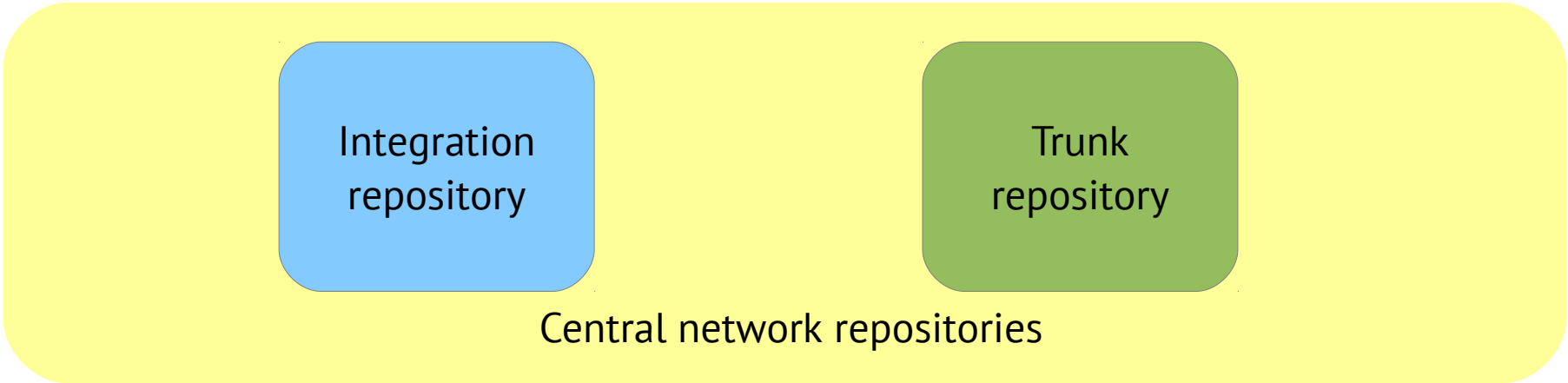

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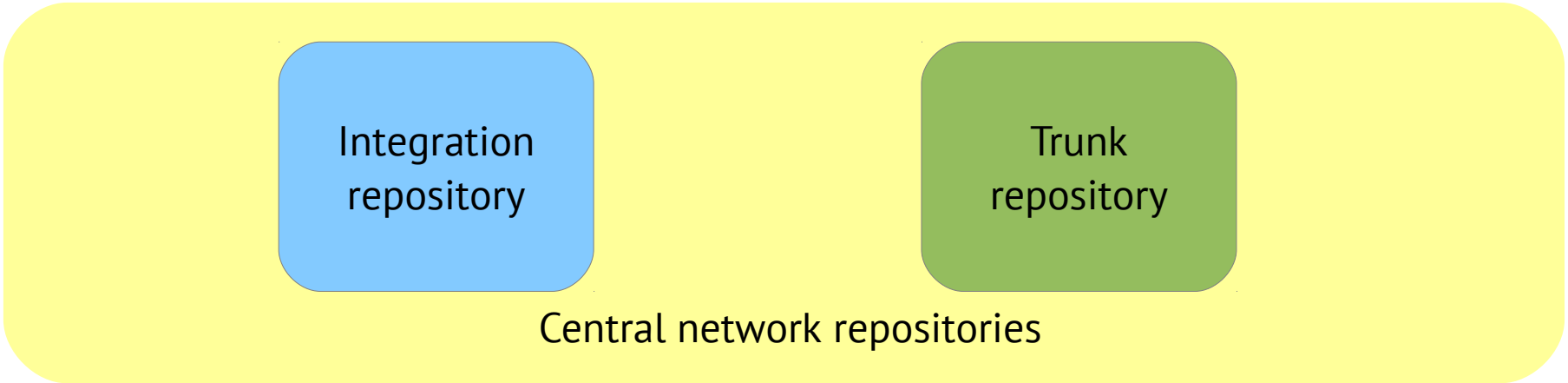

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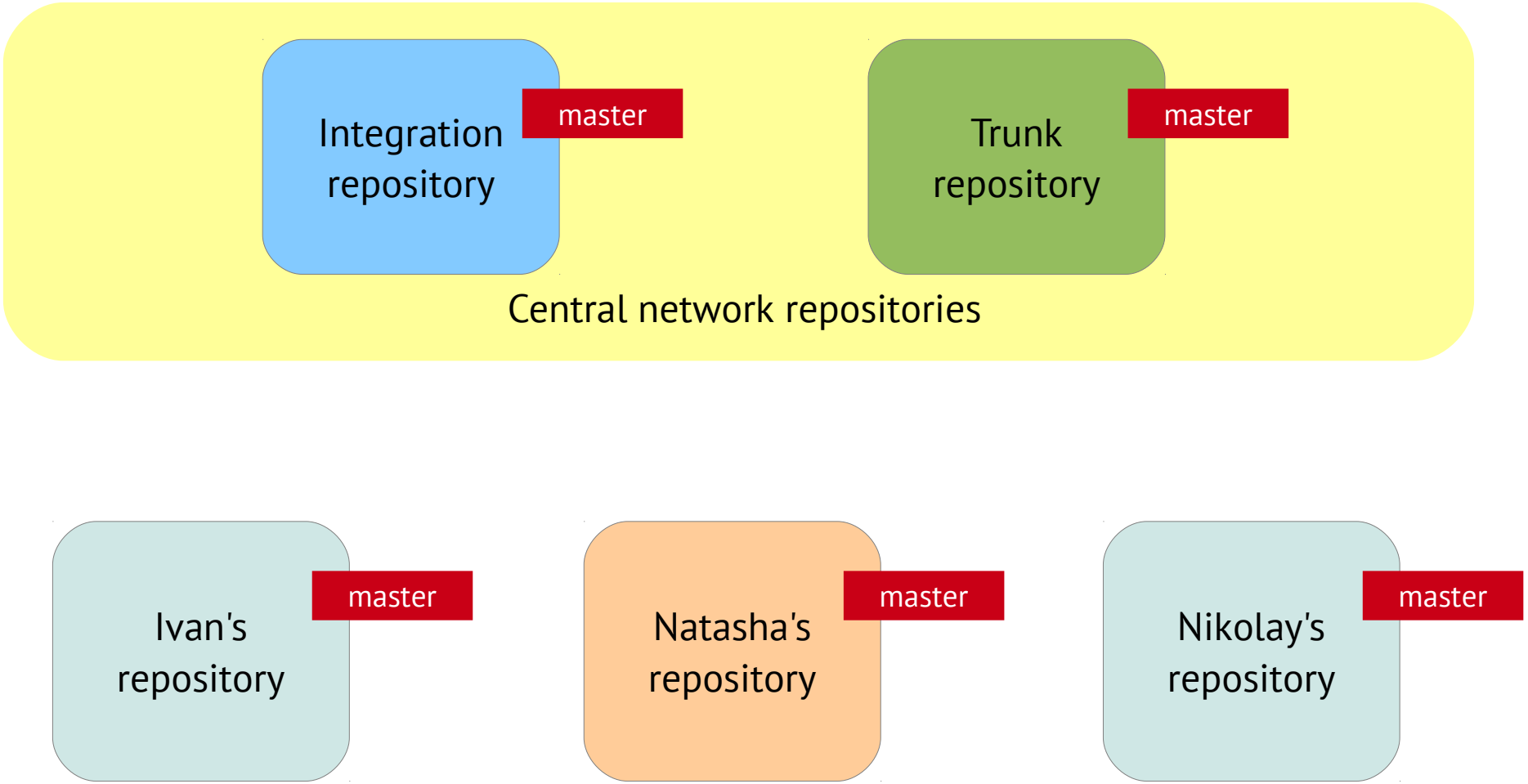

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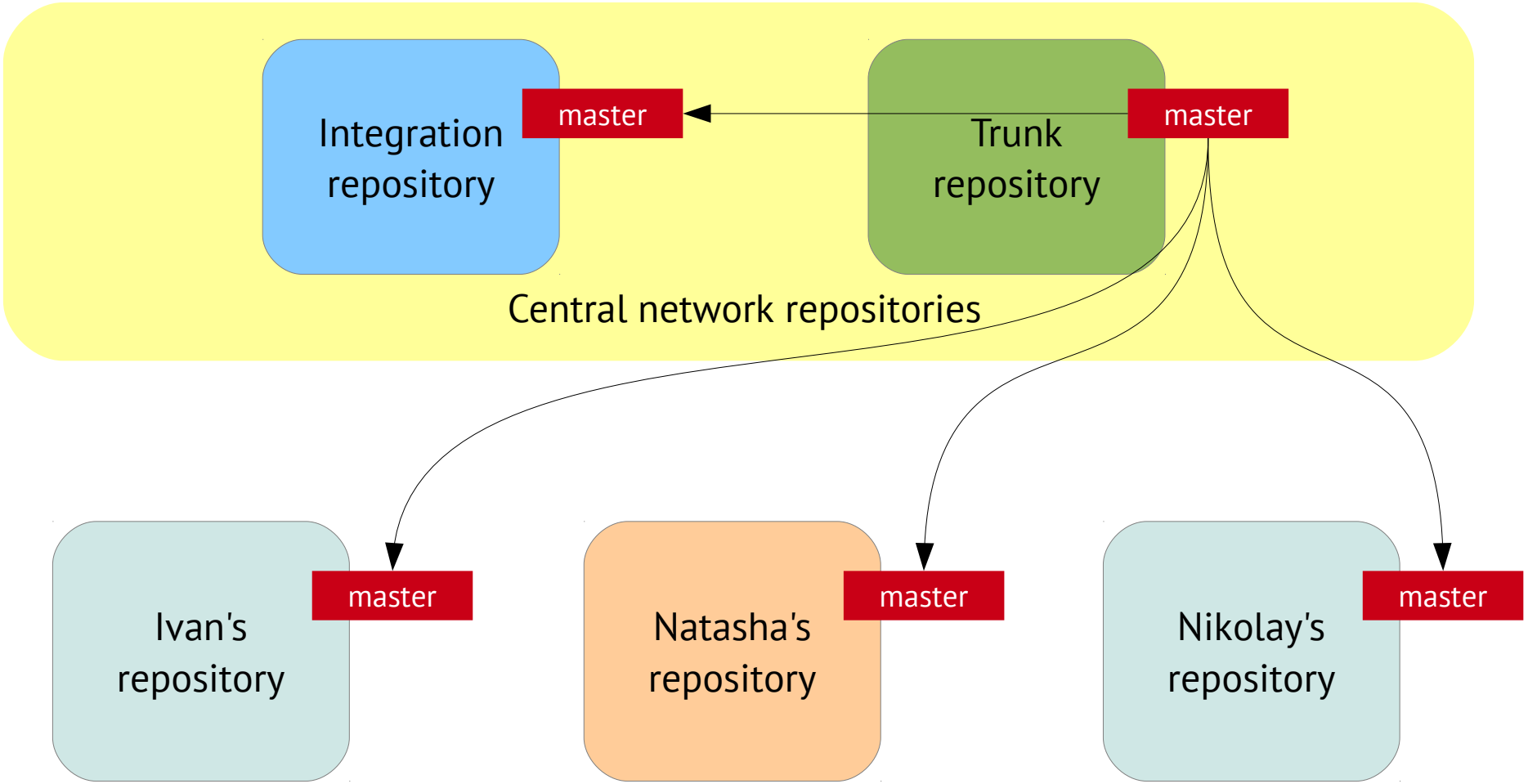

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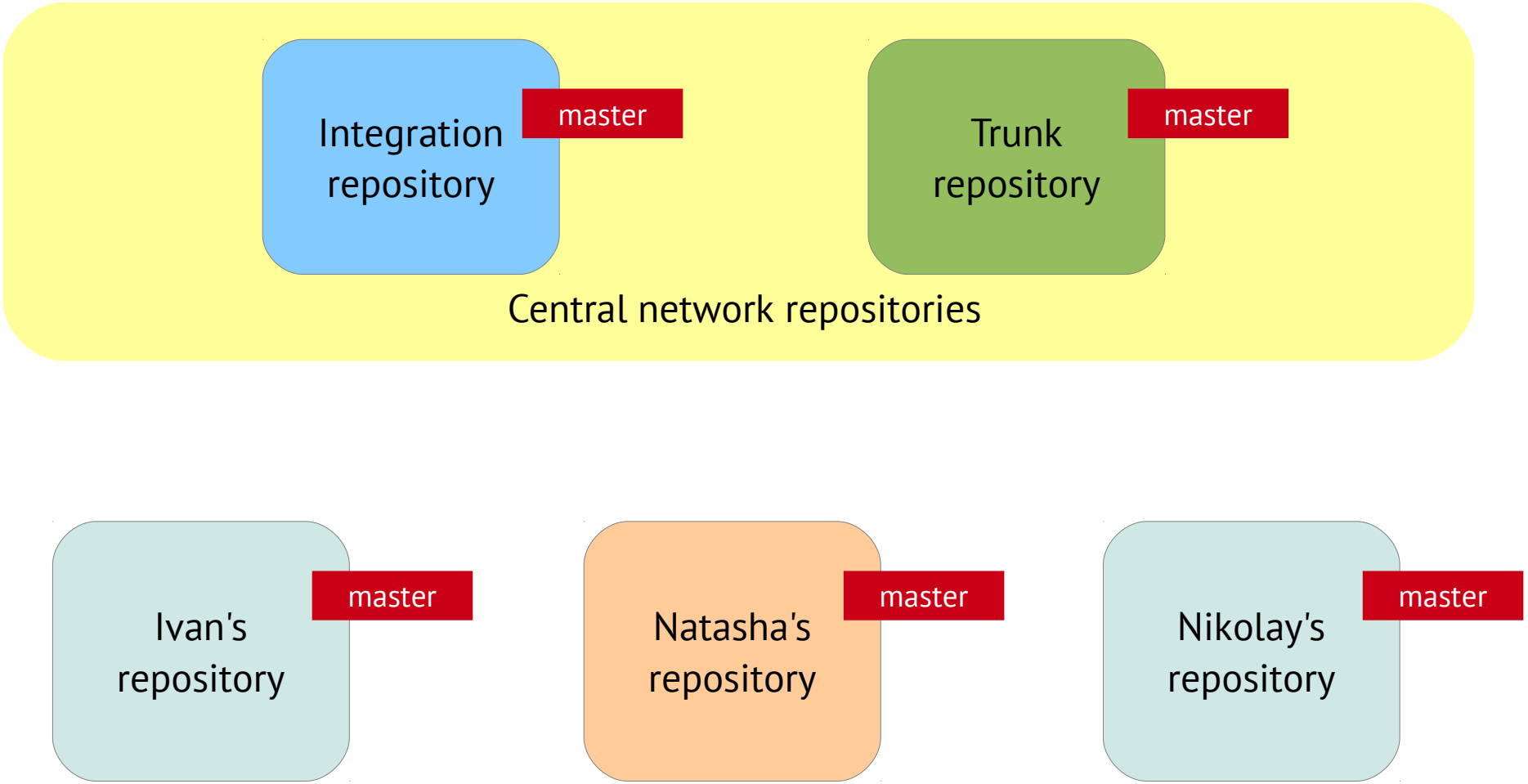

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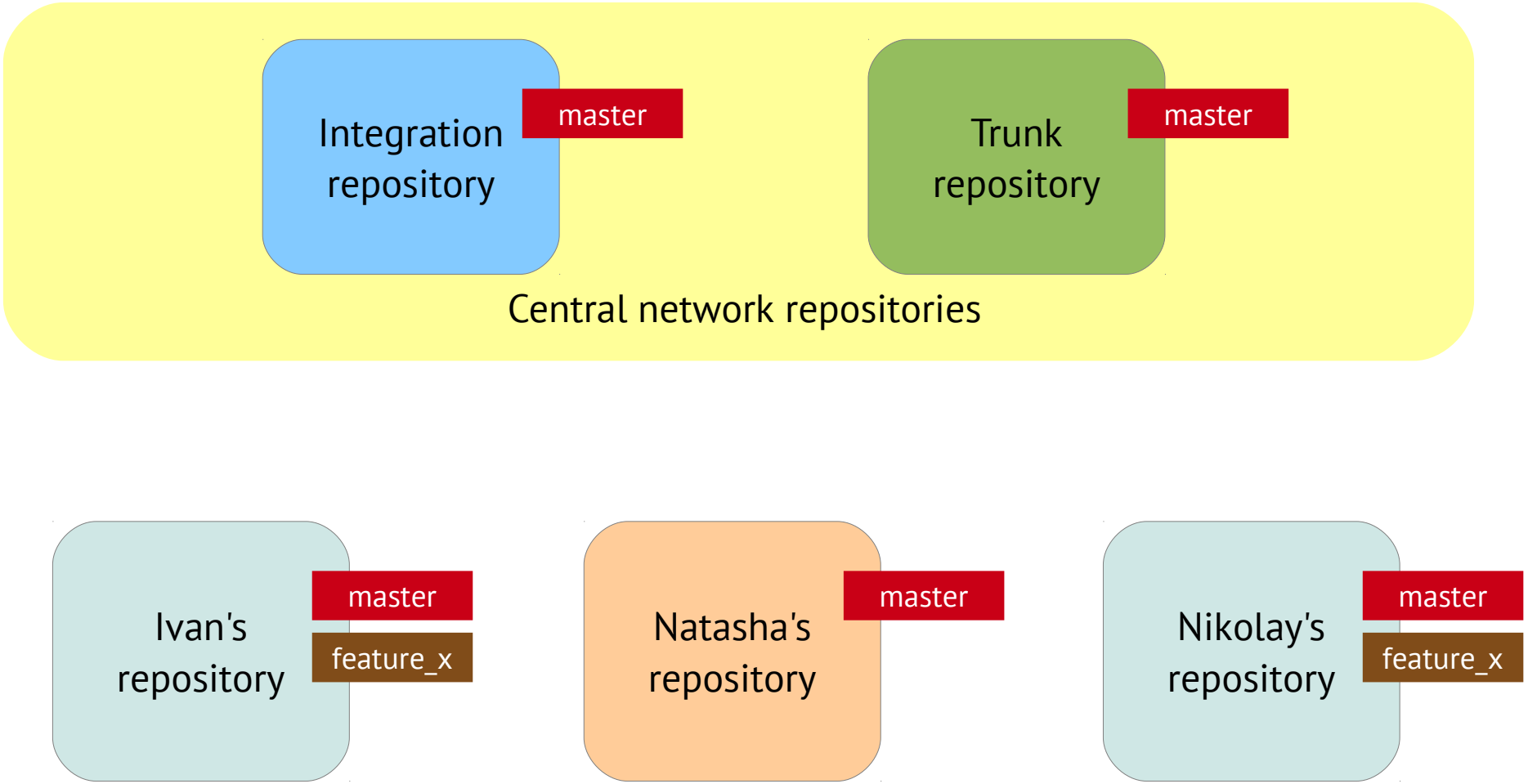

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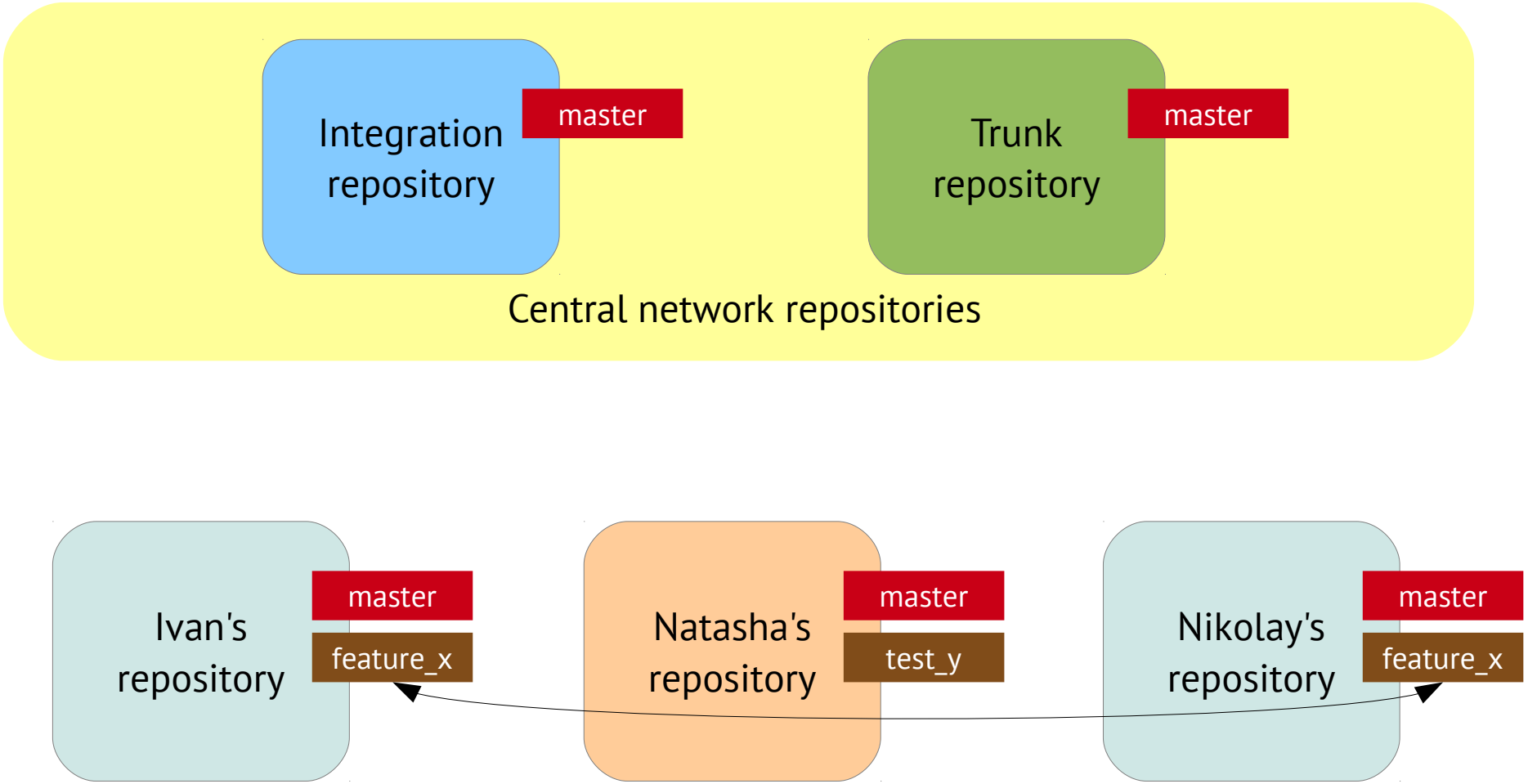

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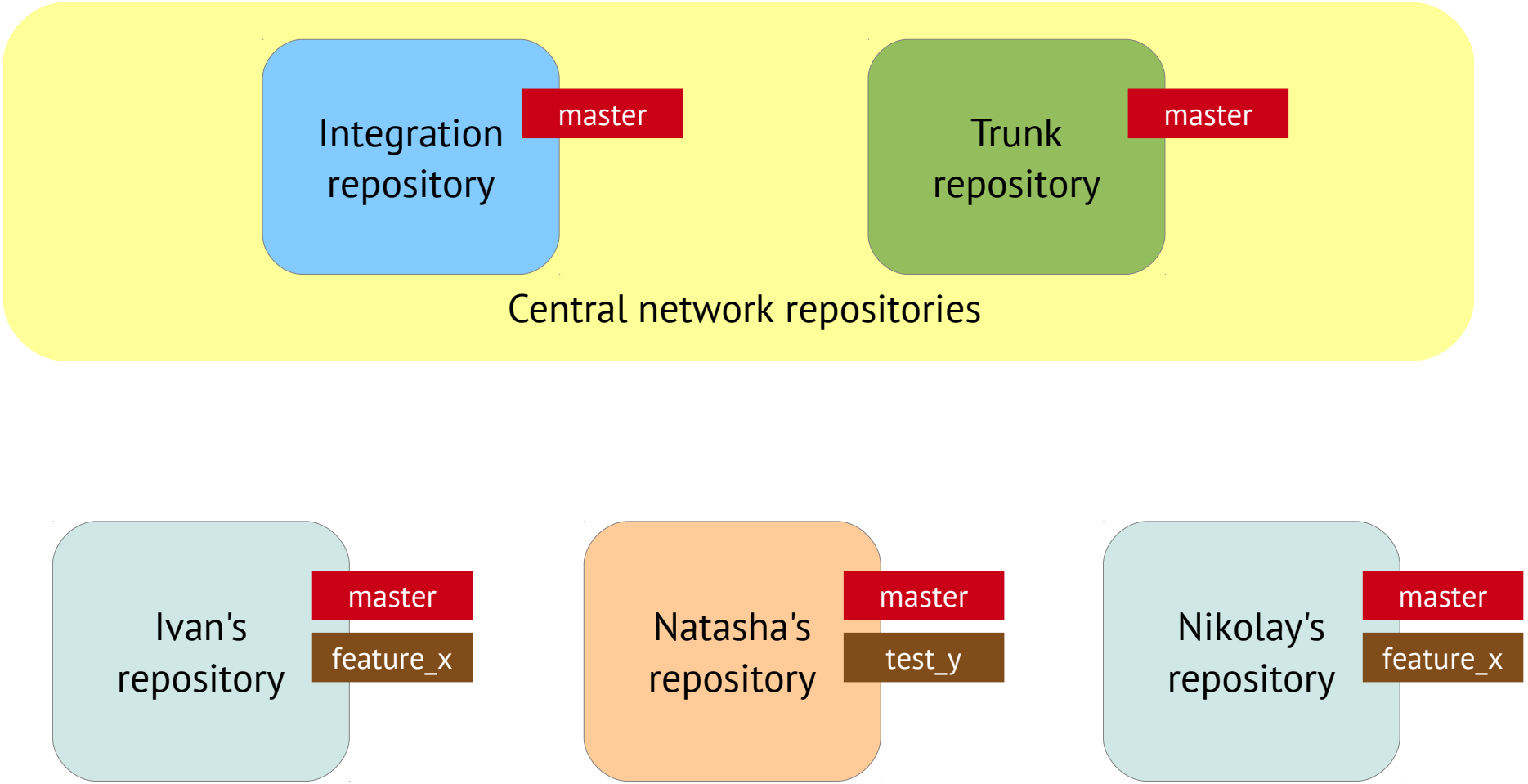

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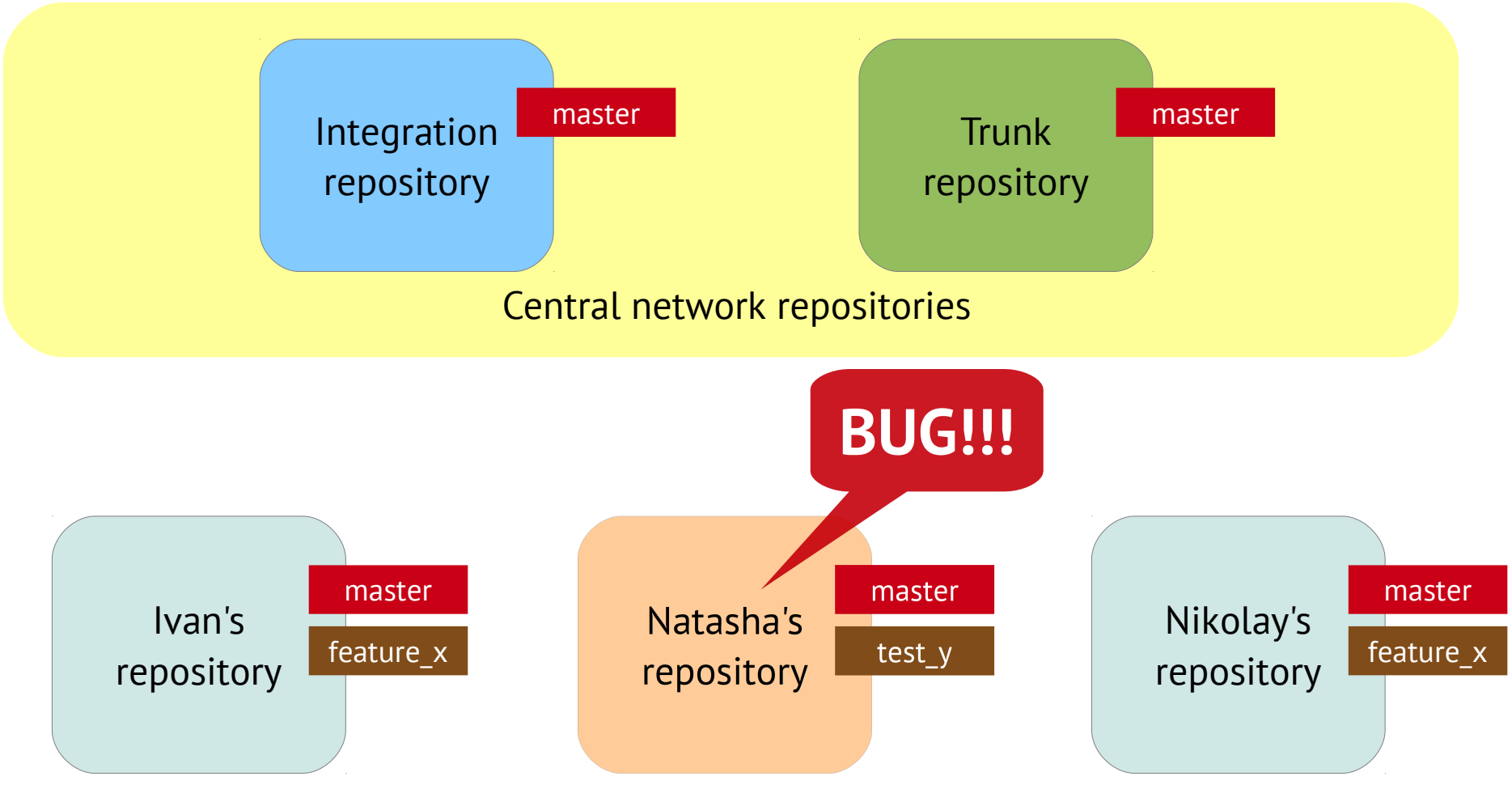

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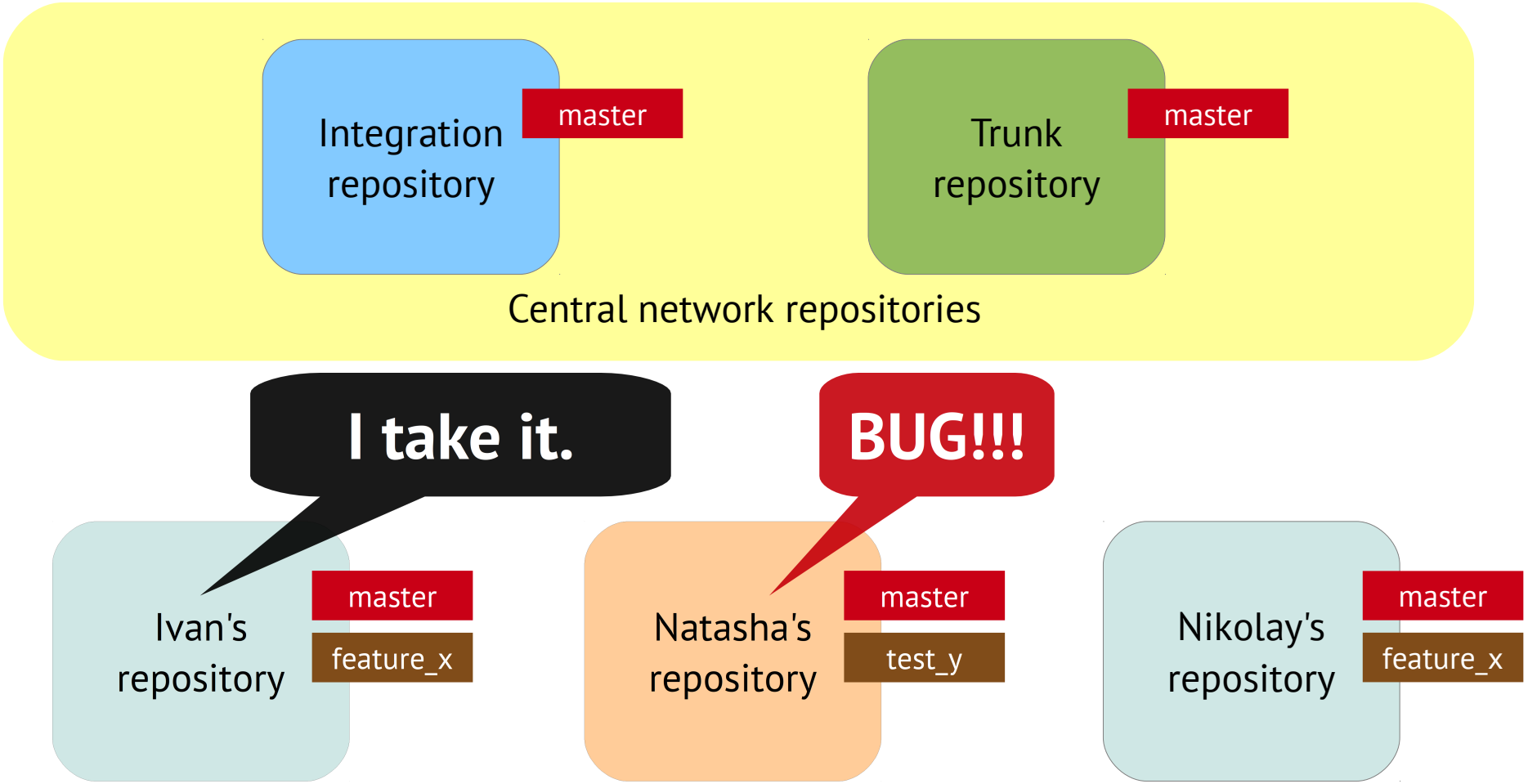

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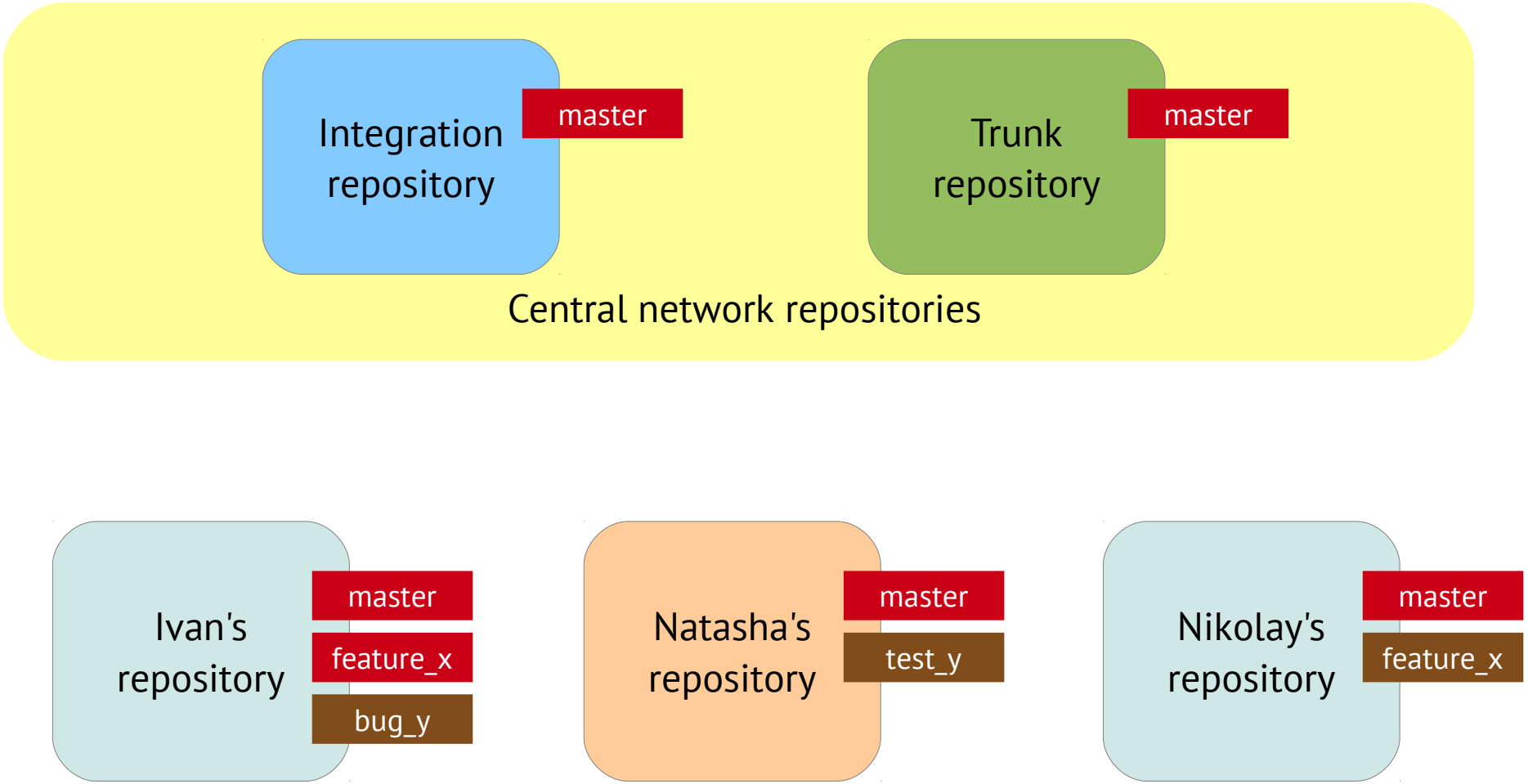

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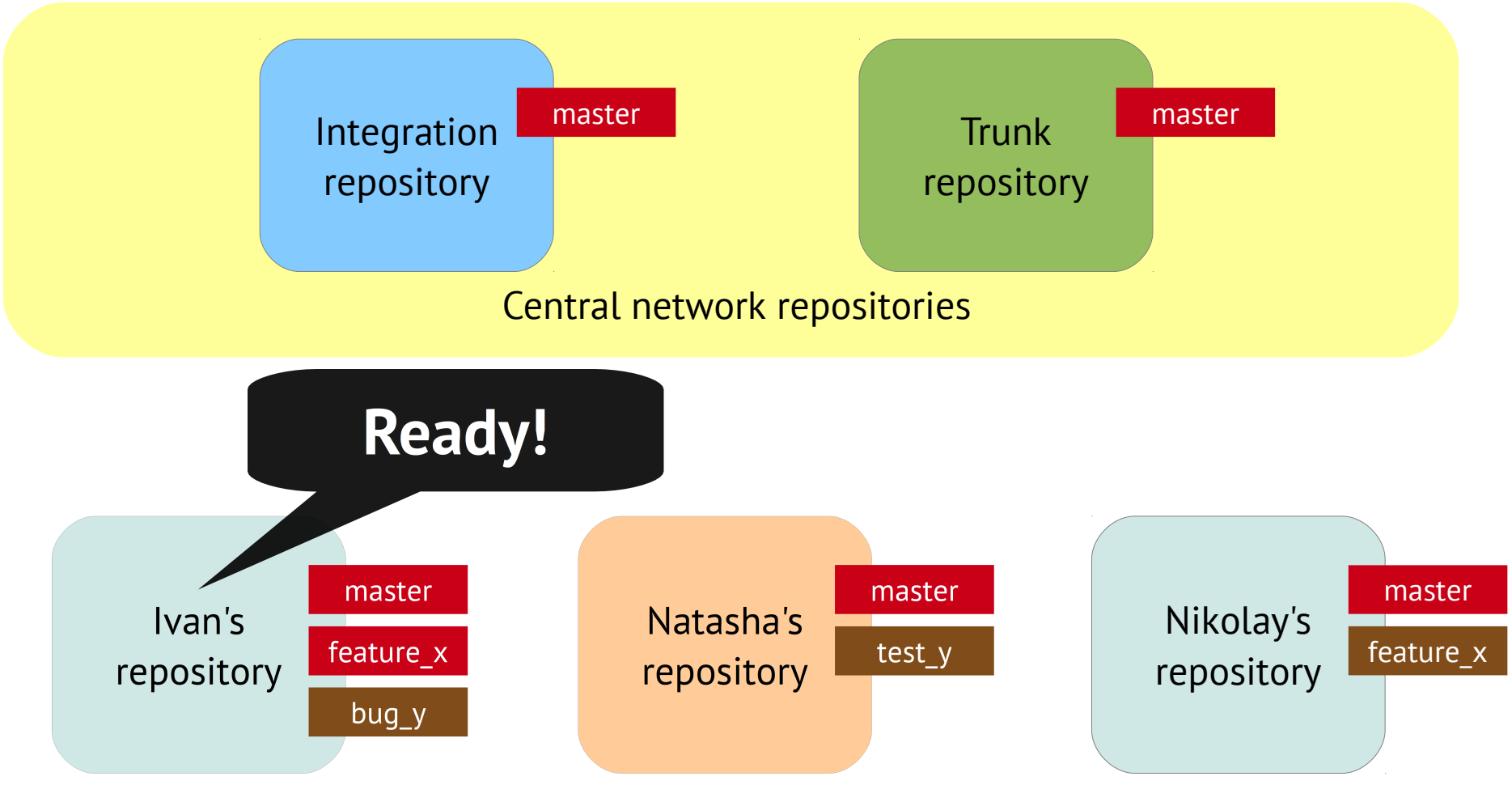

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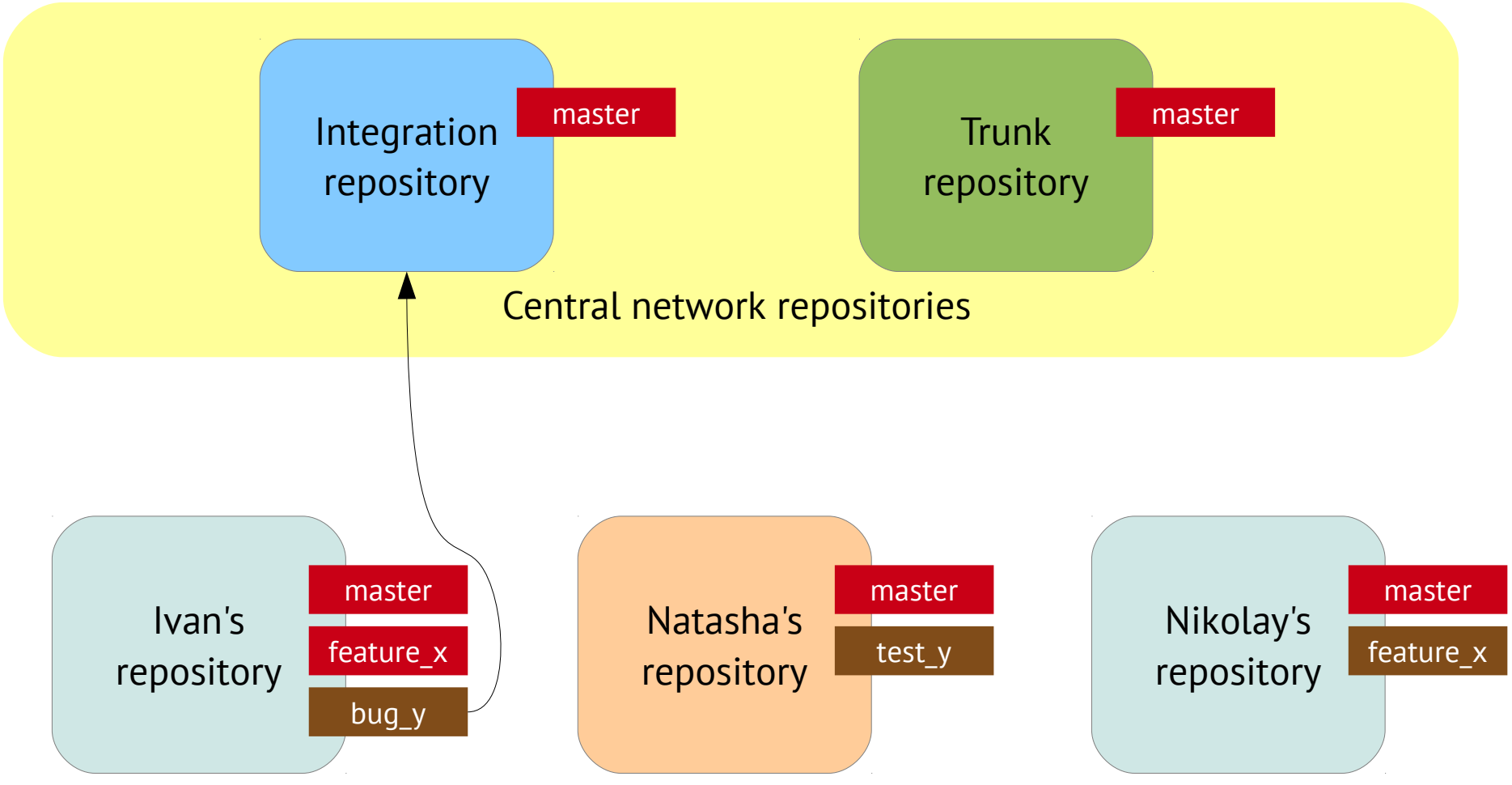

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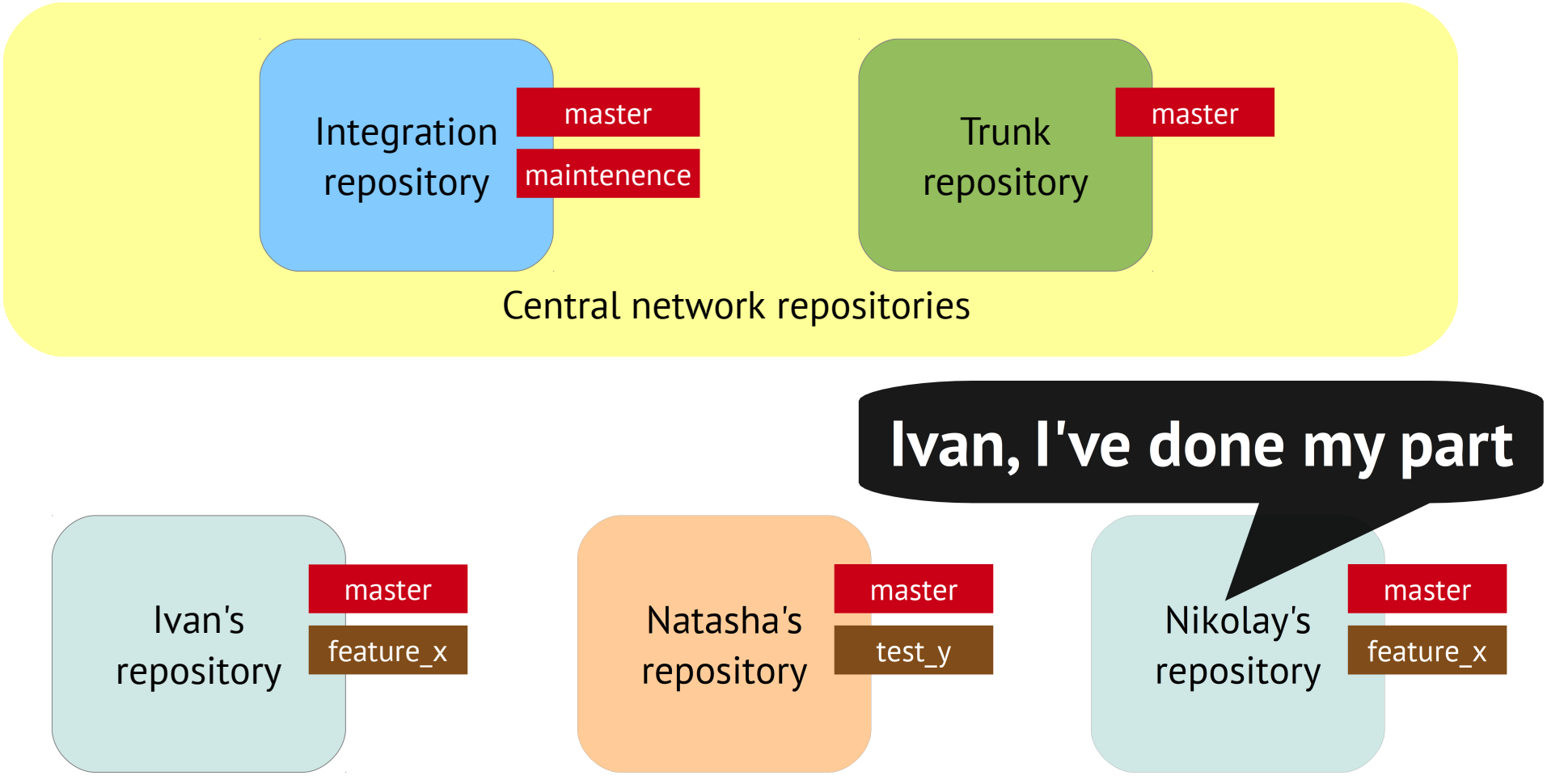

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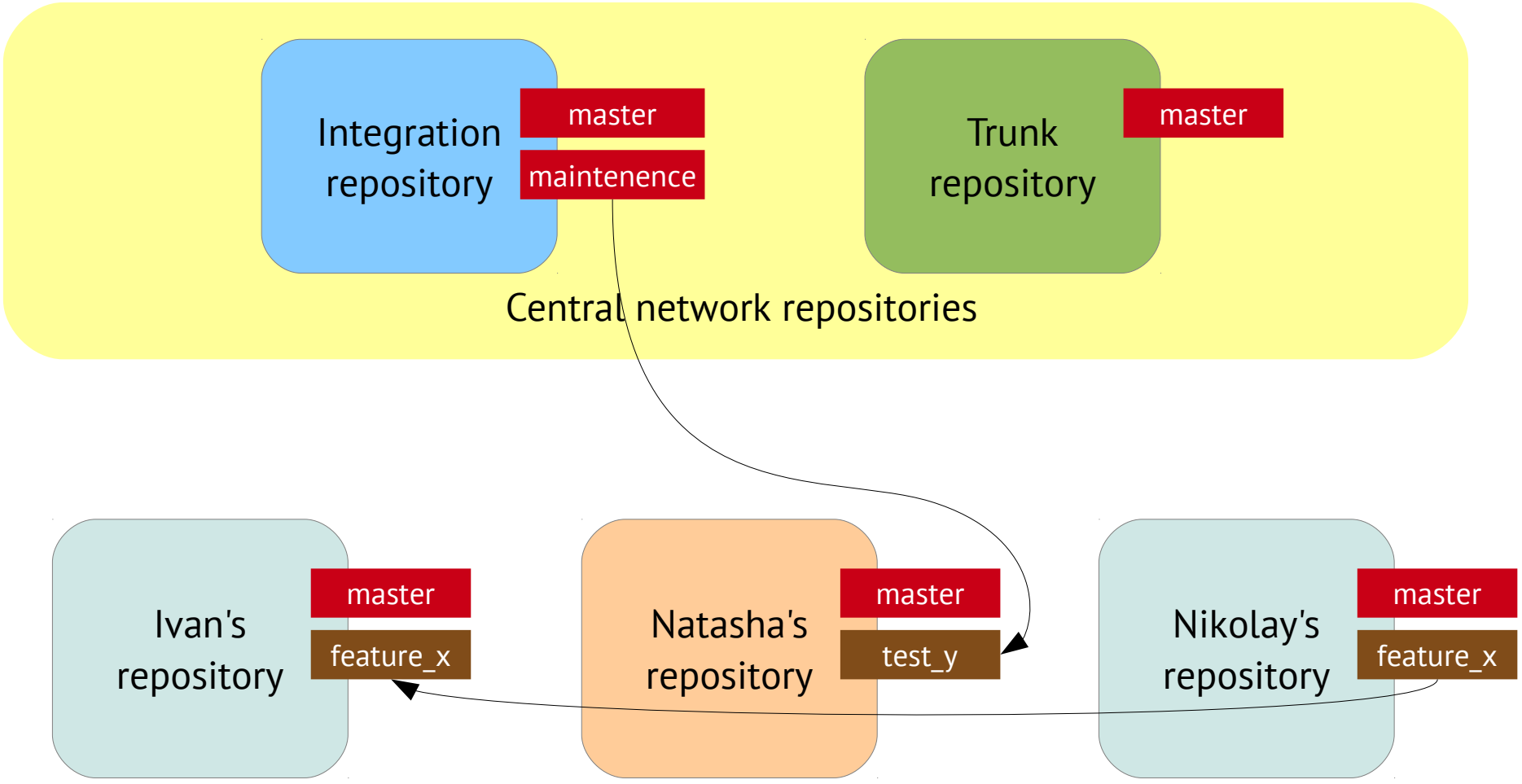

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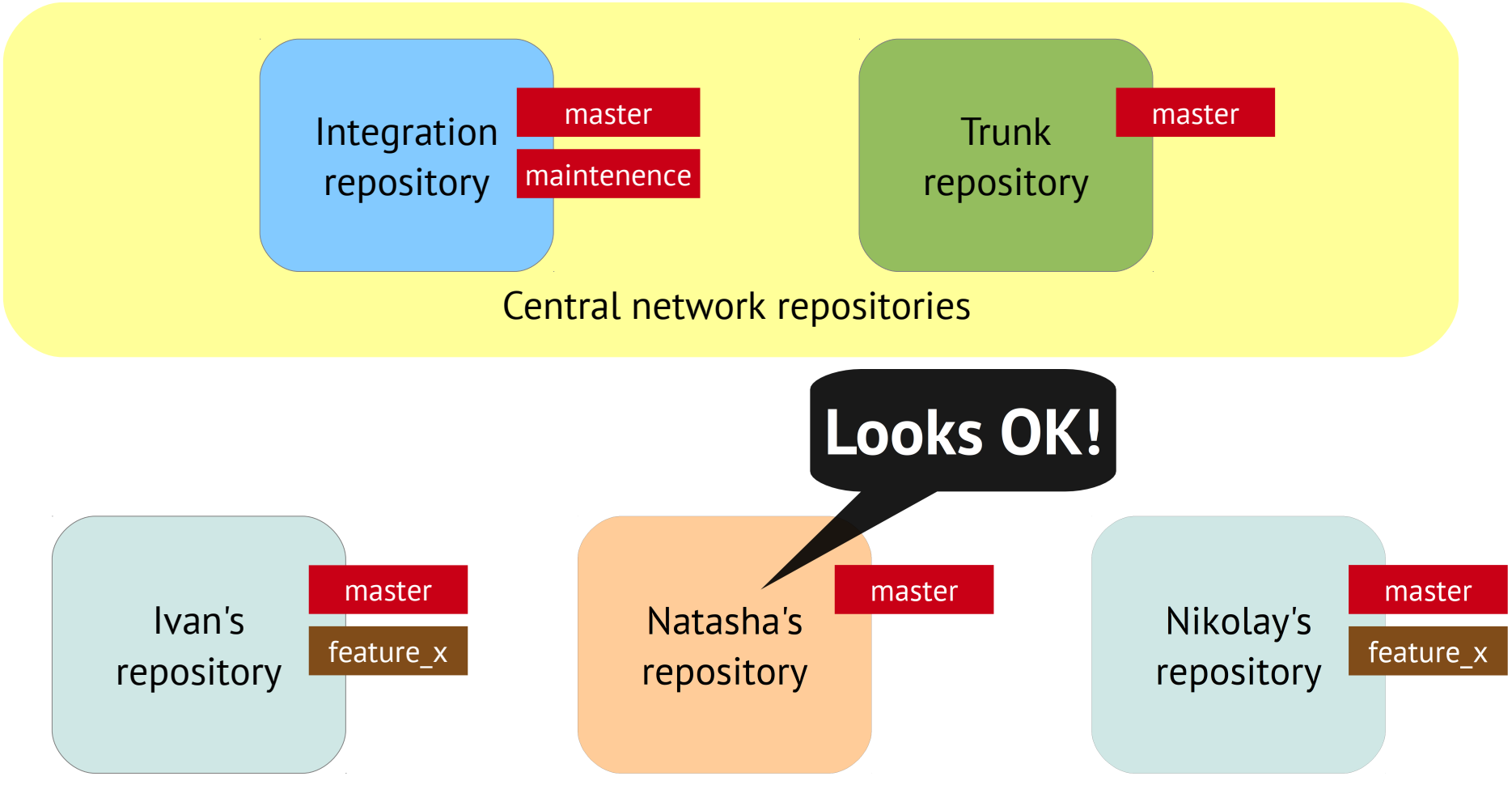

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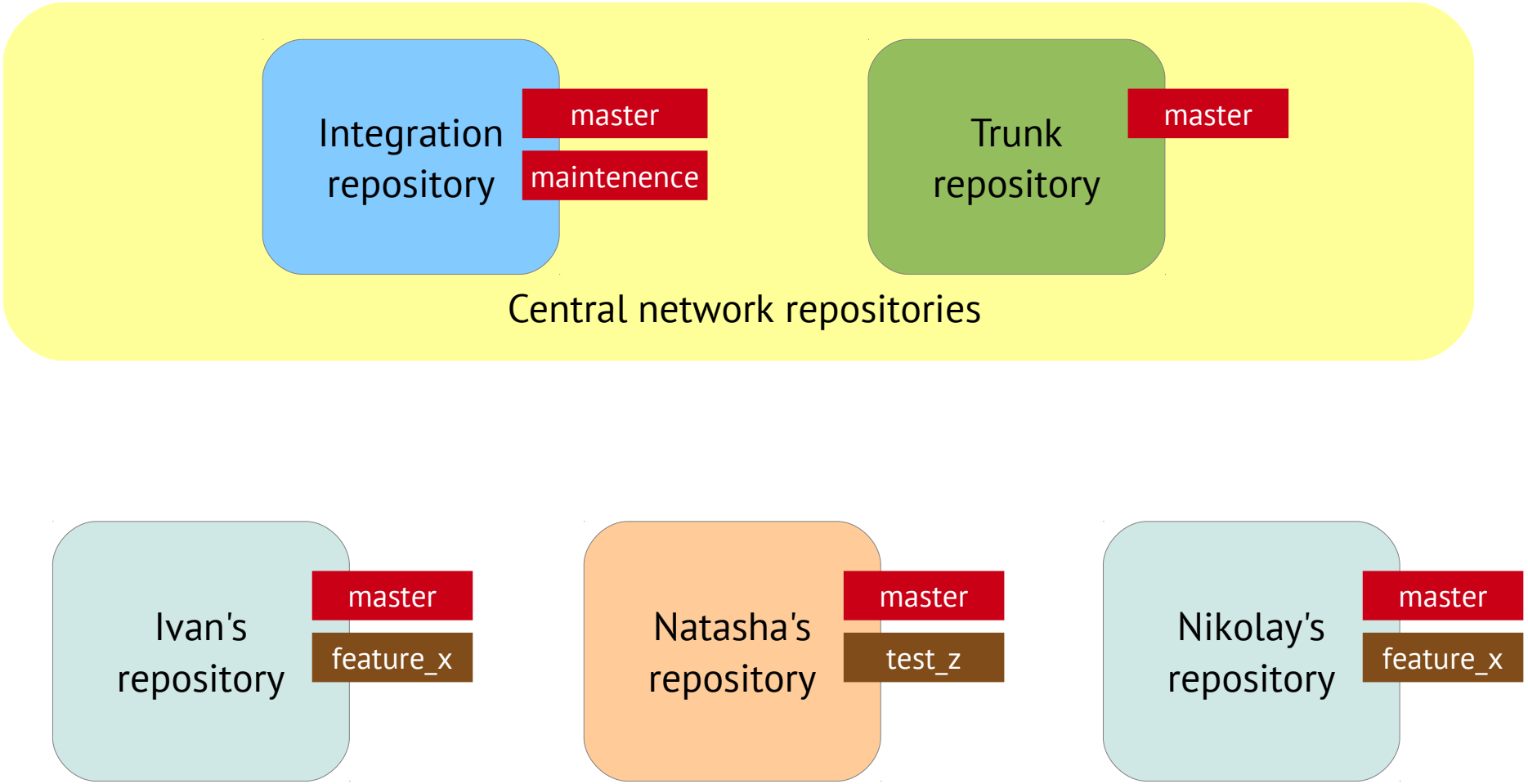

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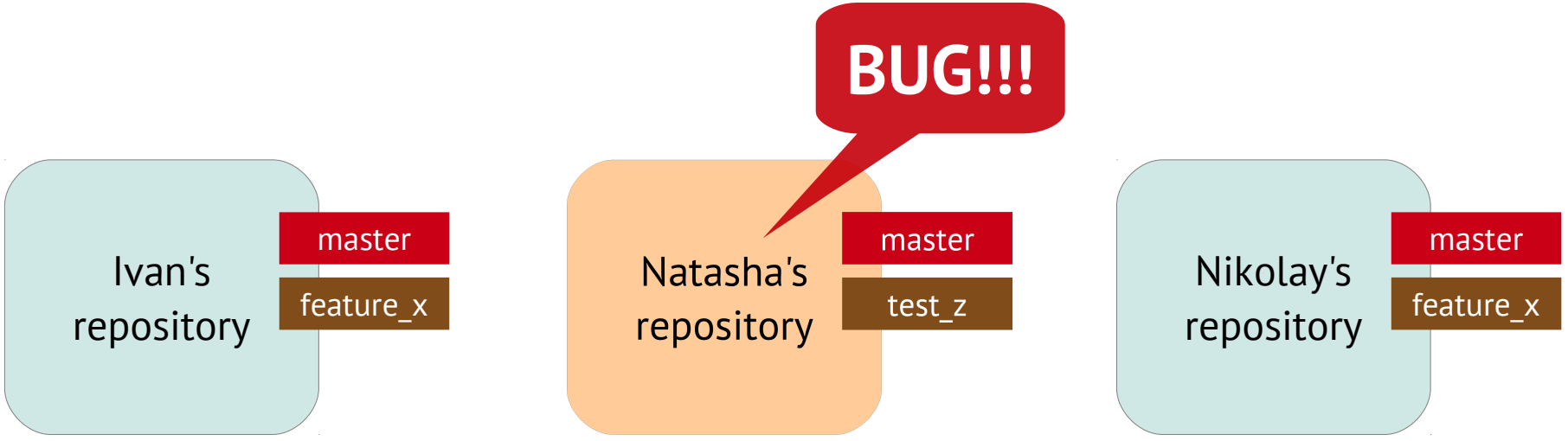

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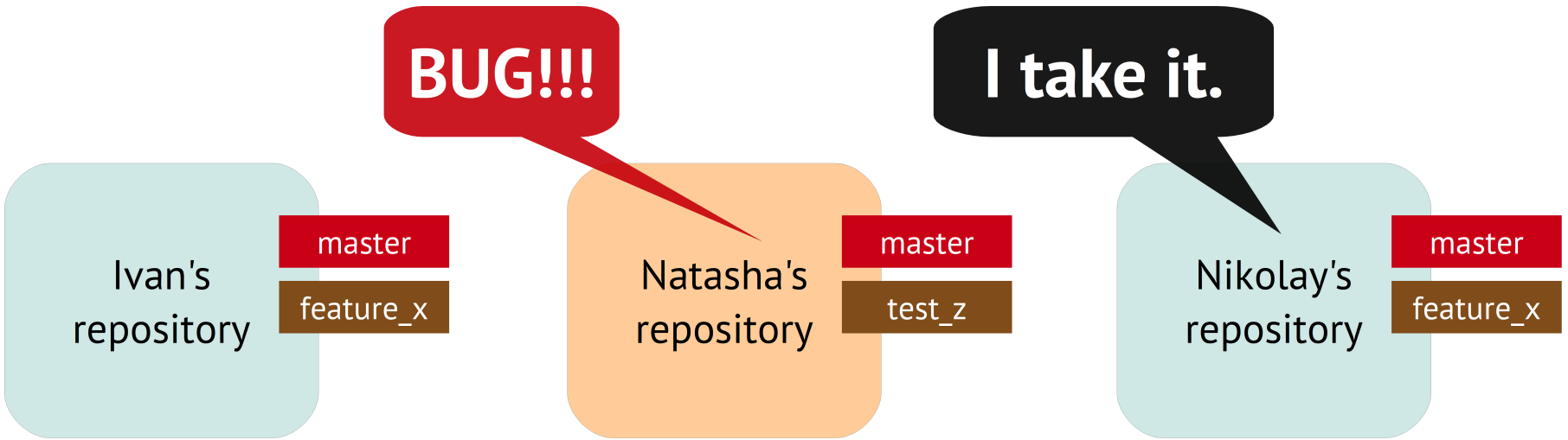

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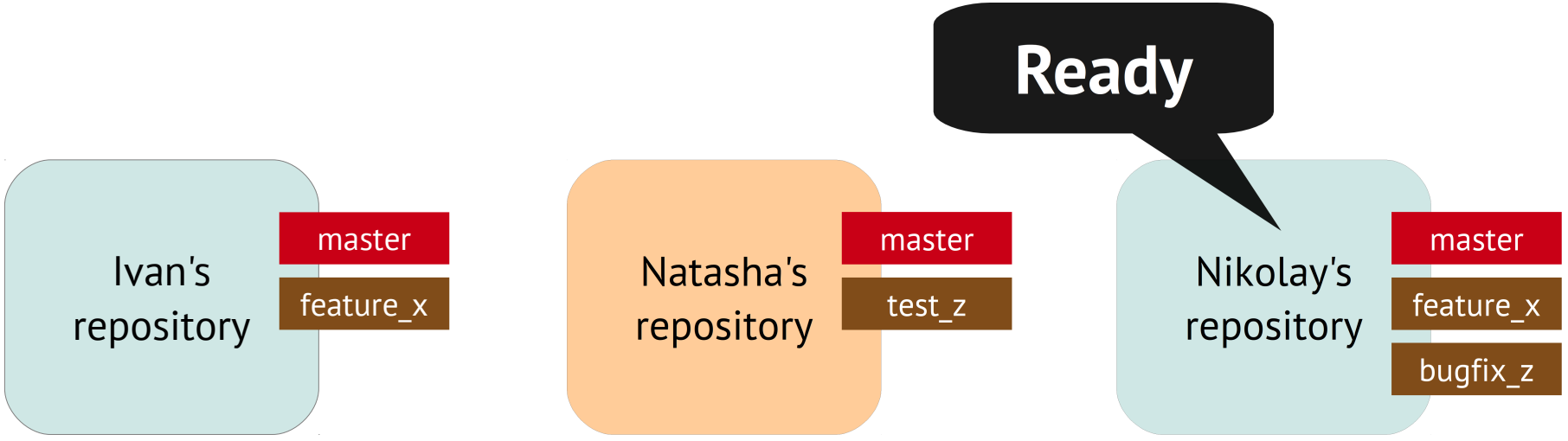
Network down

Fully distributed

Network down



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Network down

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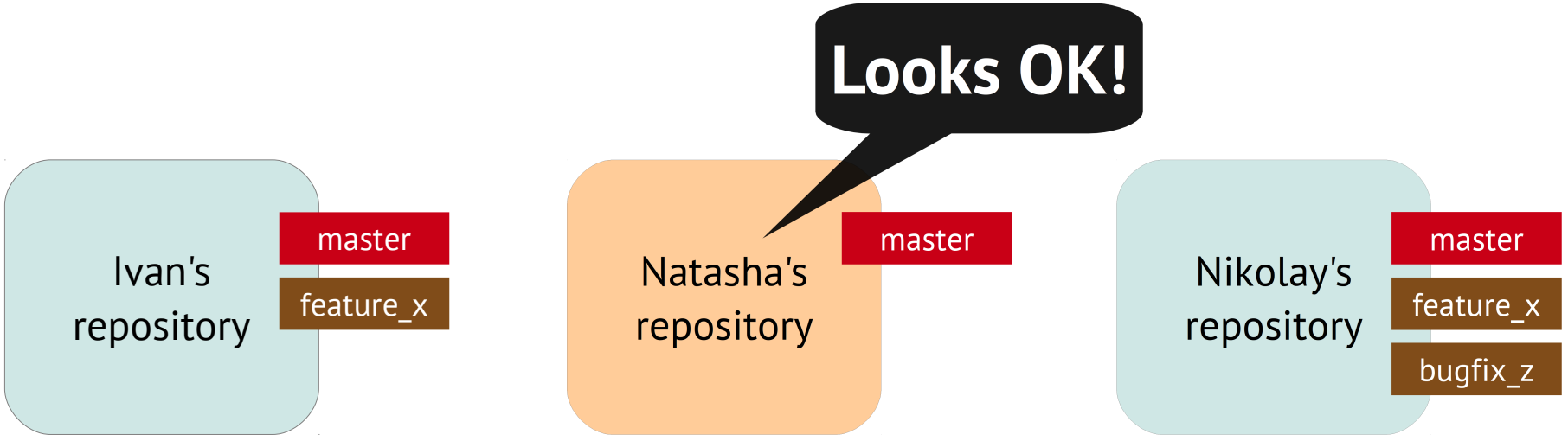

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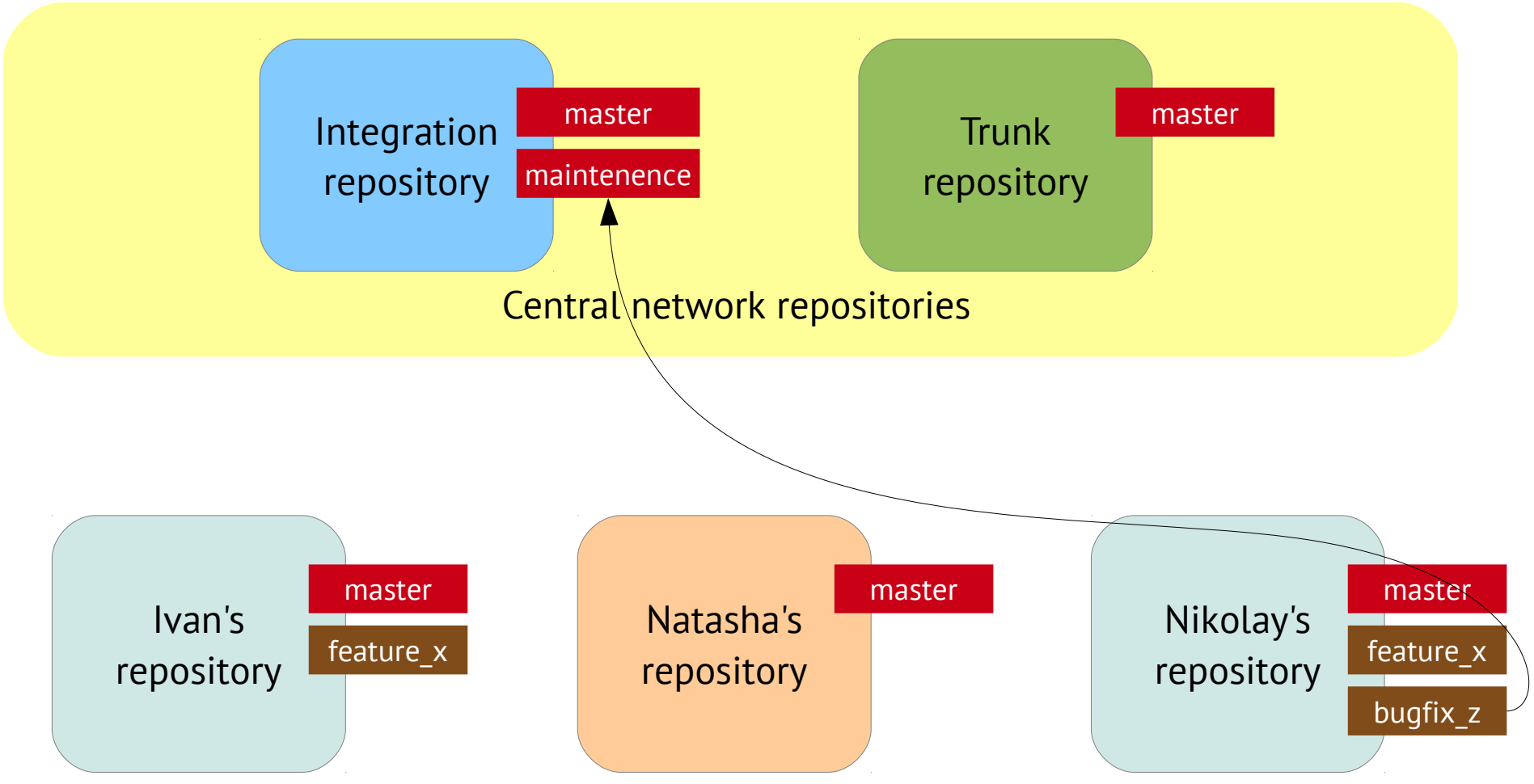

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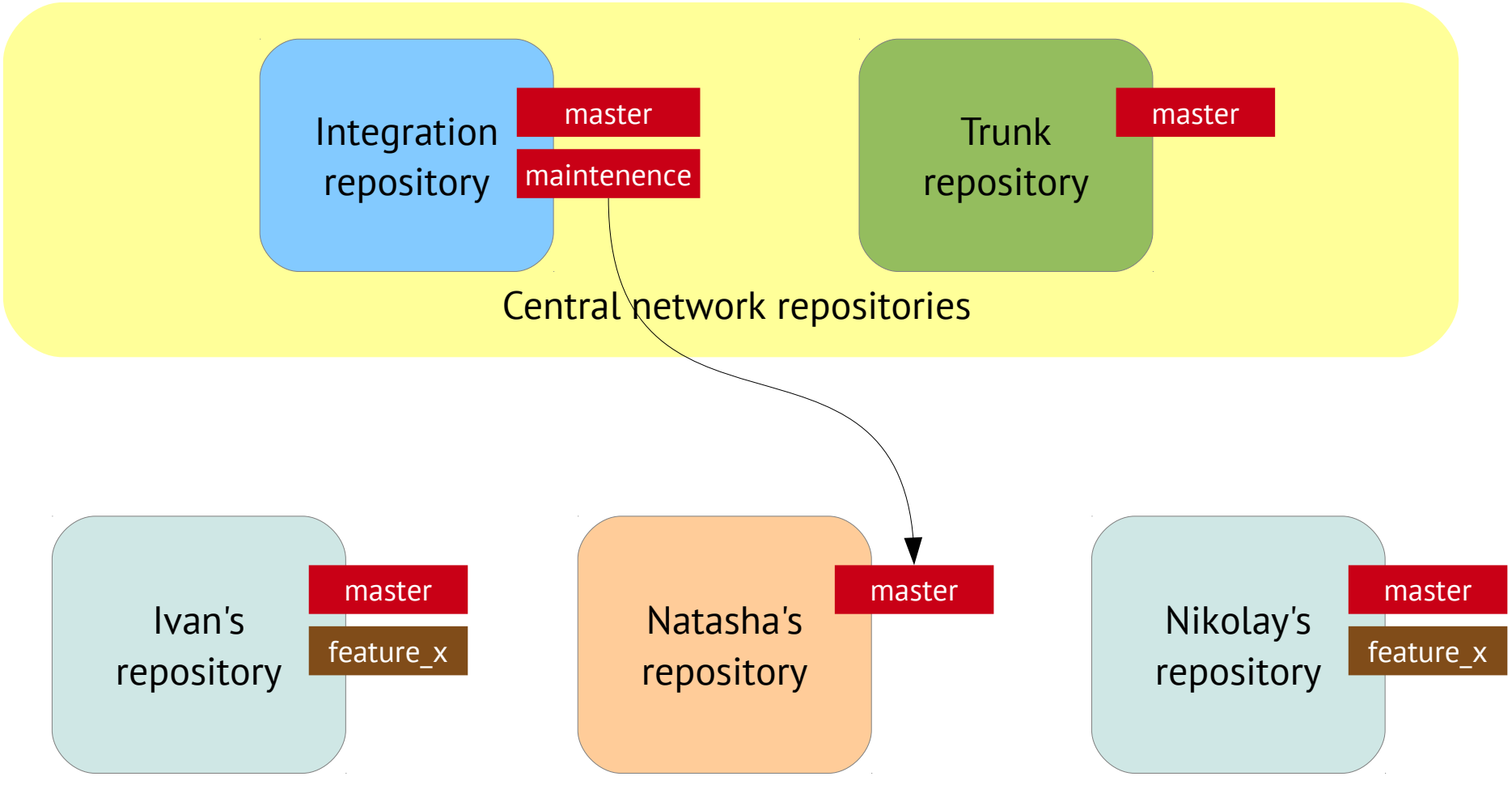

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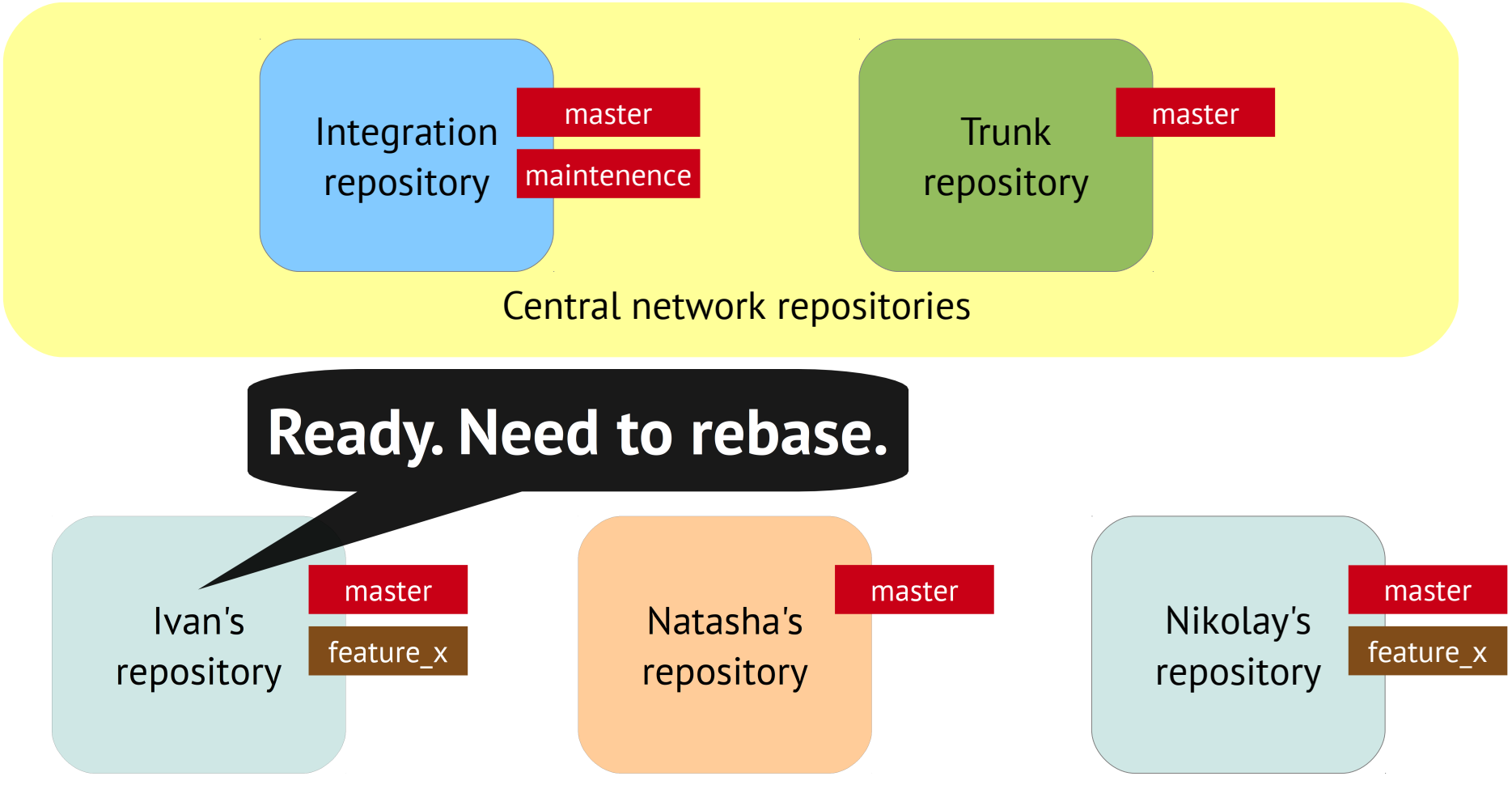

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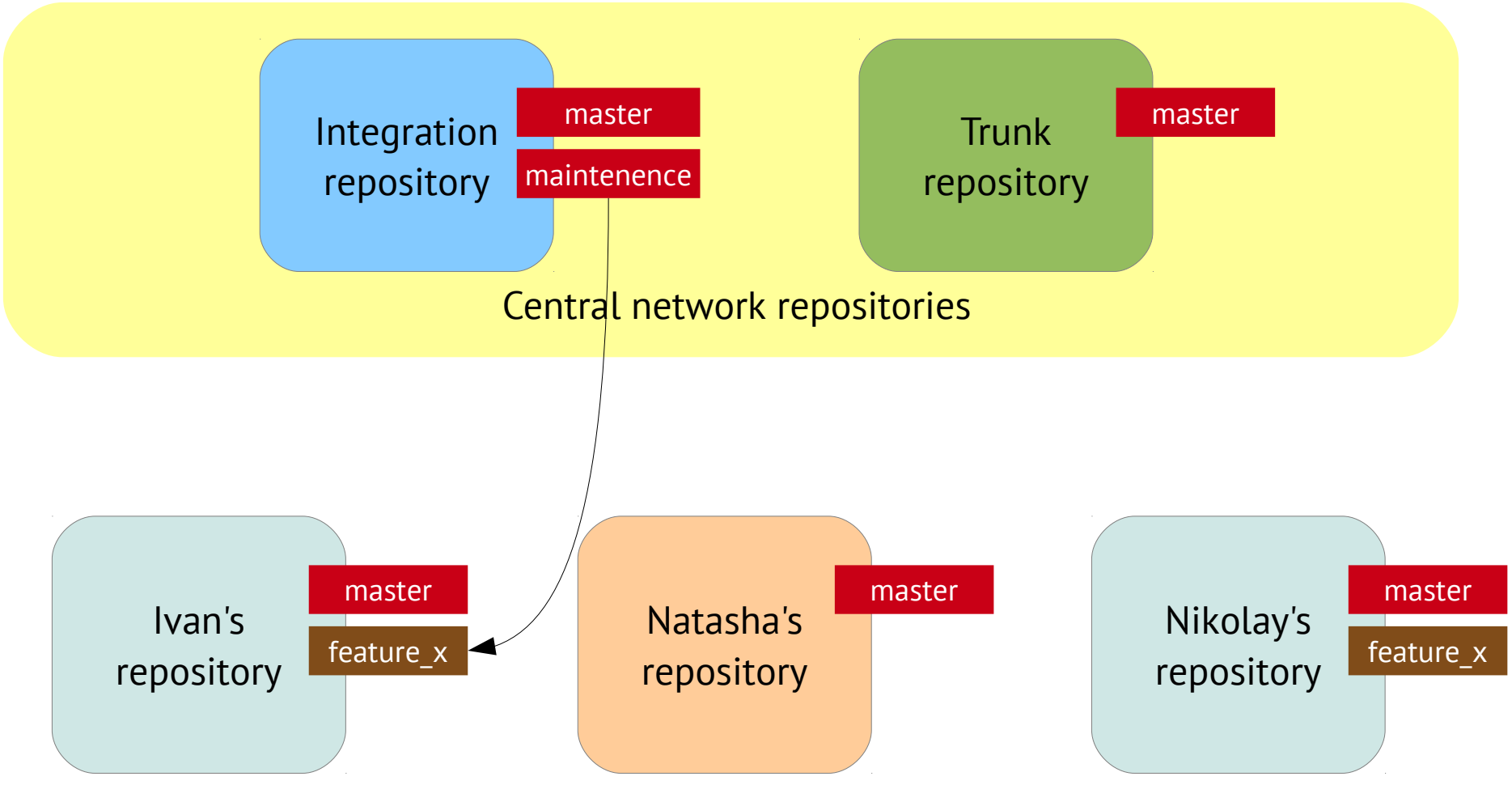

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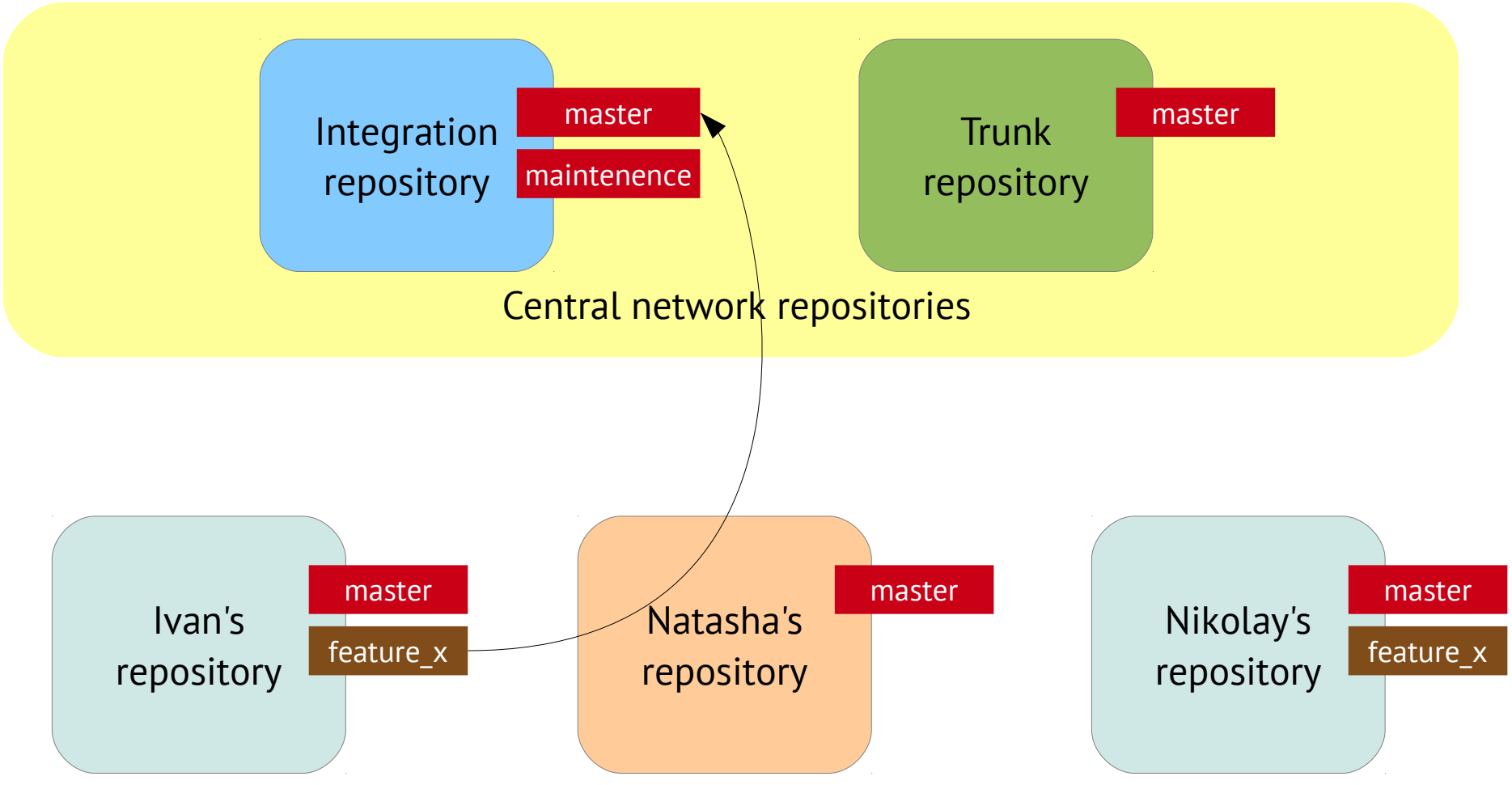

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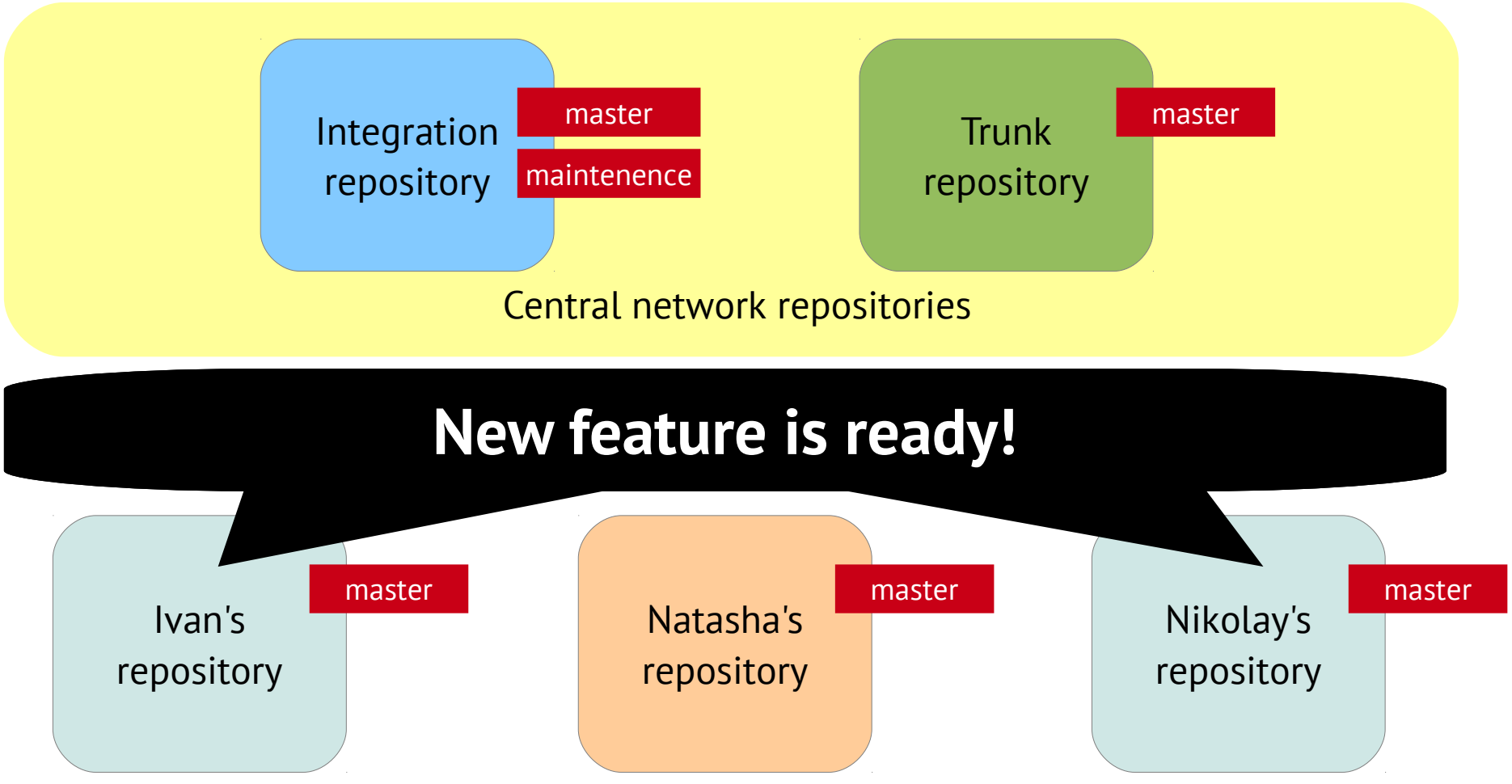

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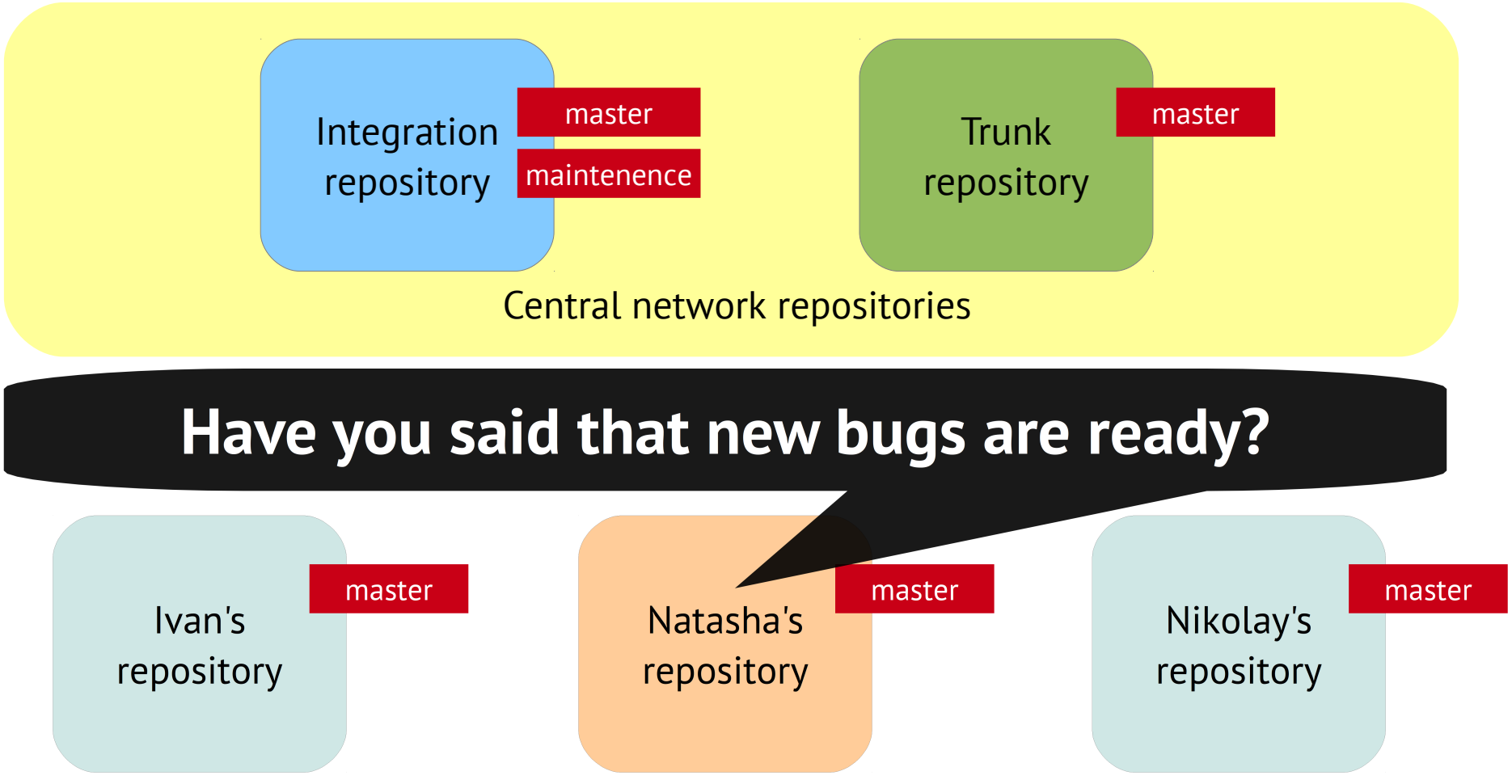

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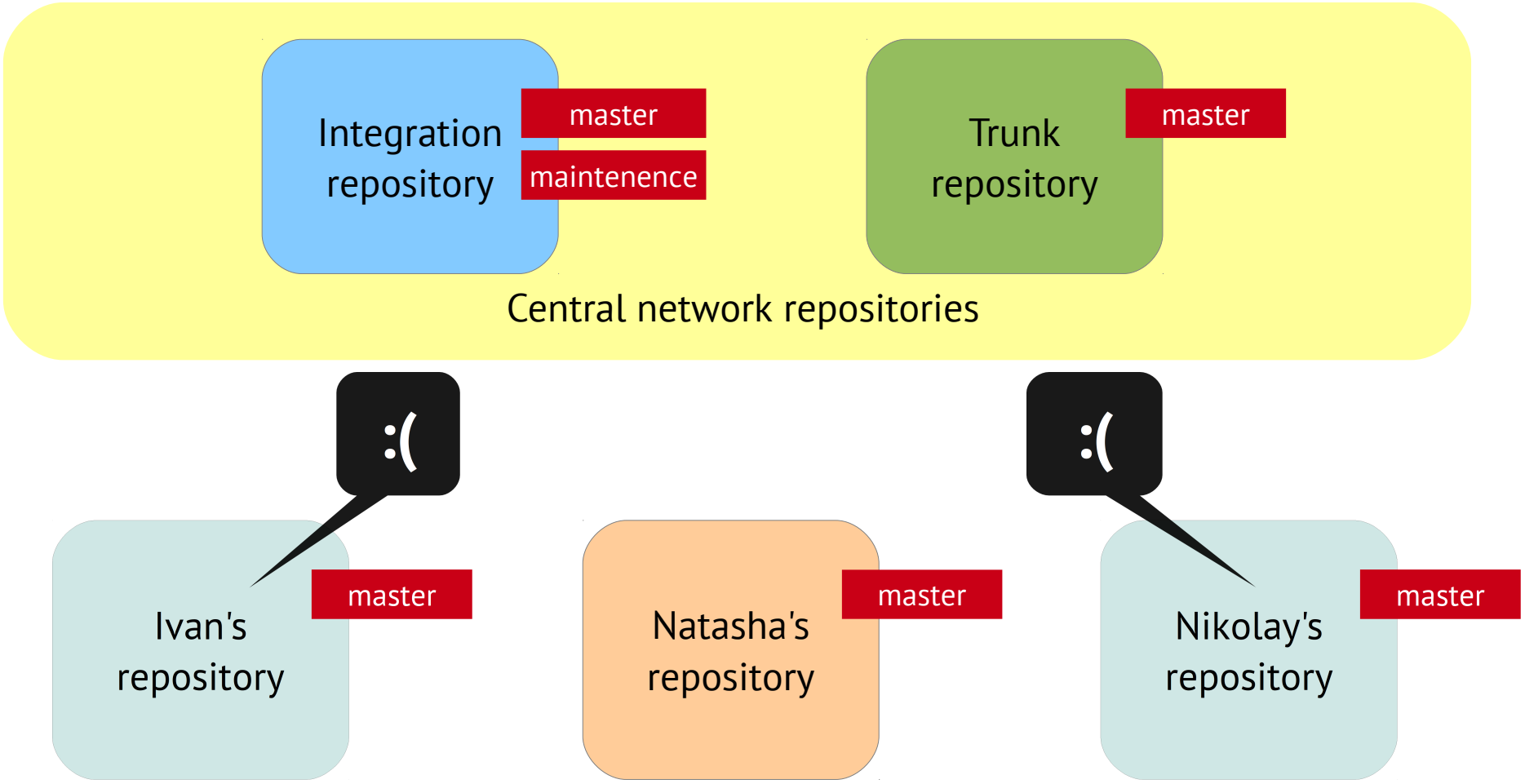

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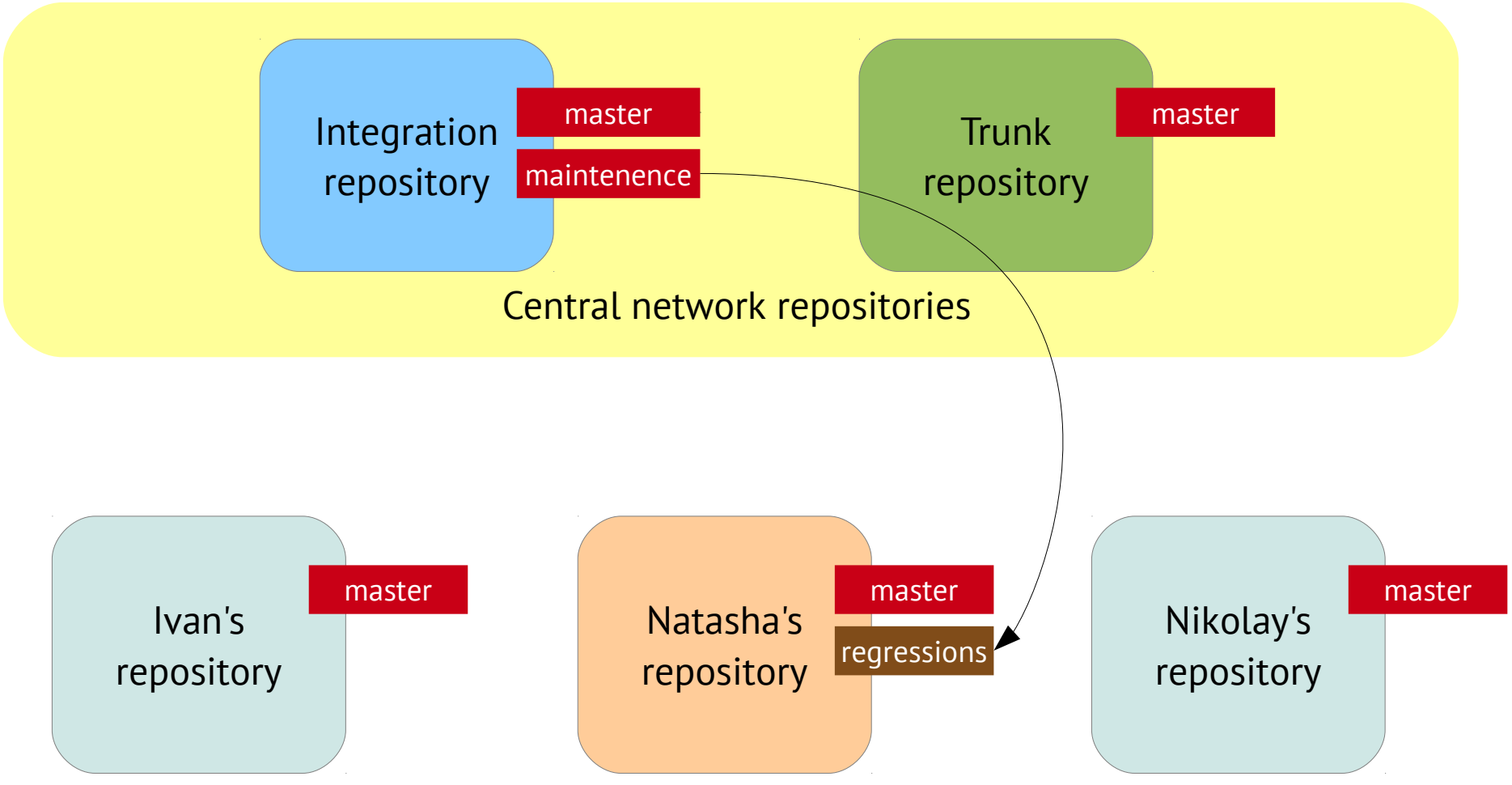

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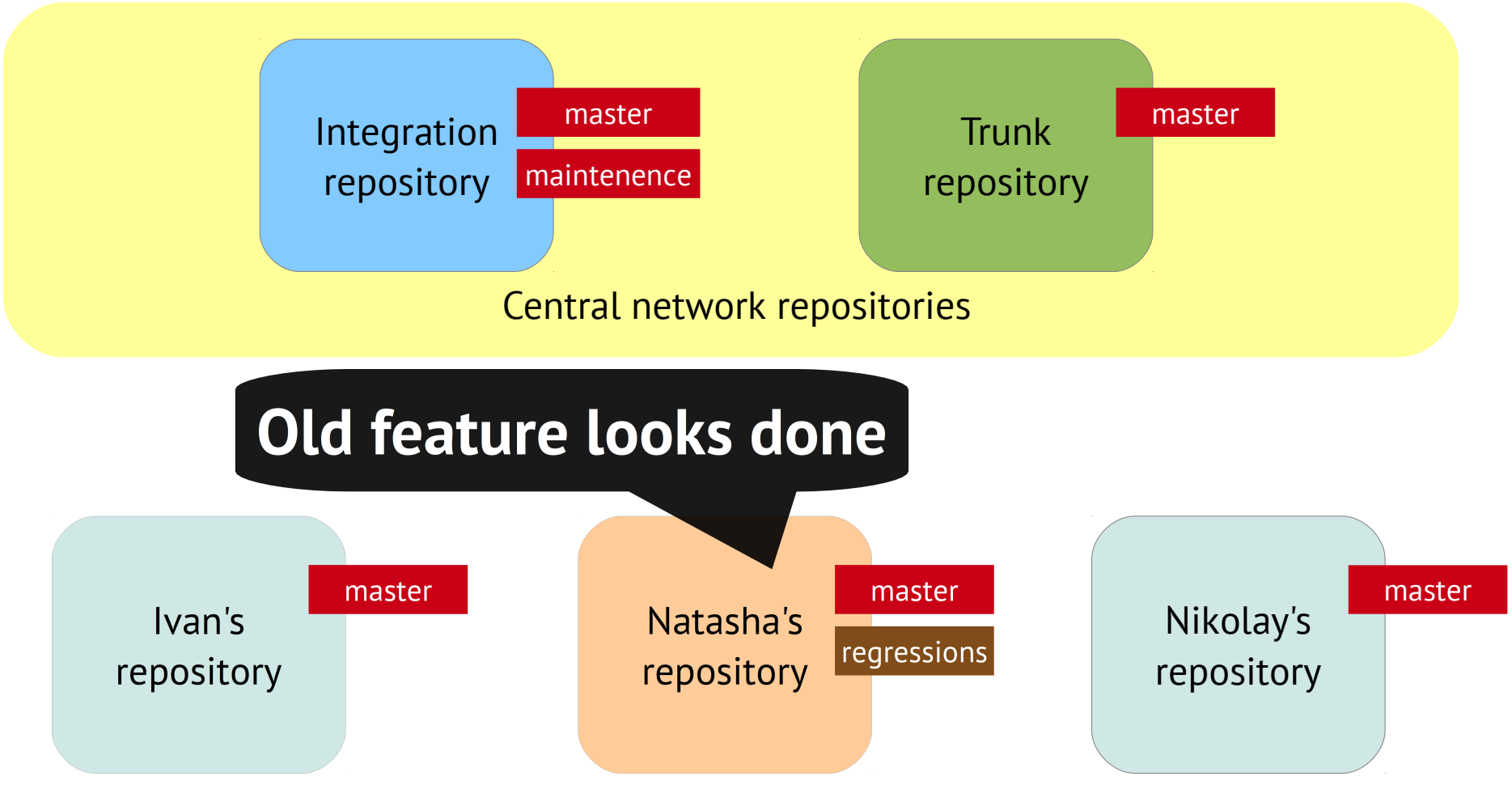

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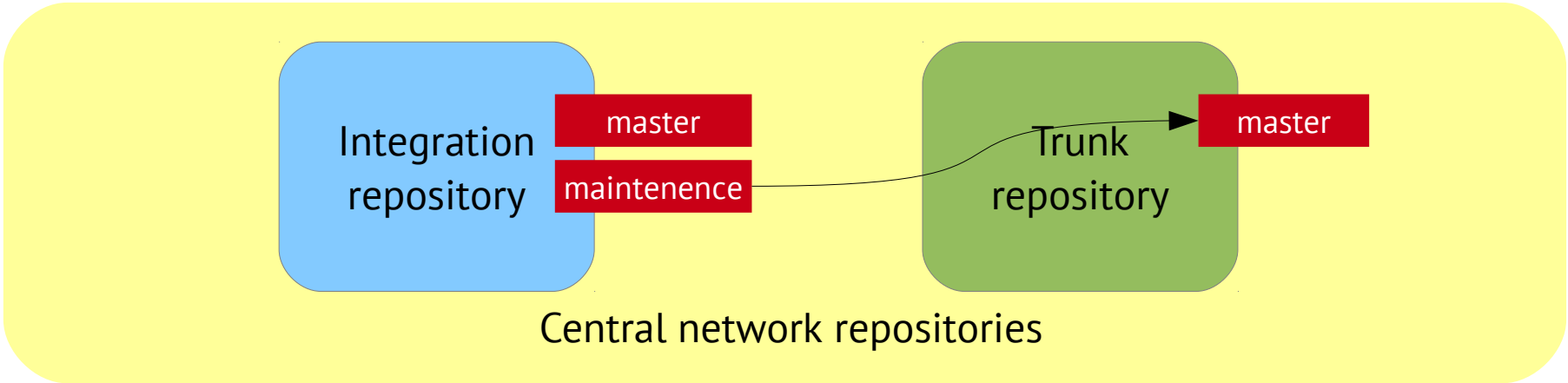

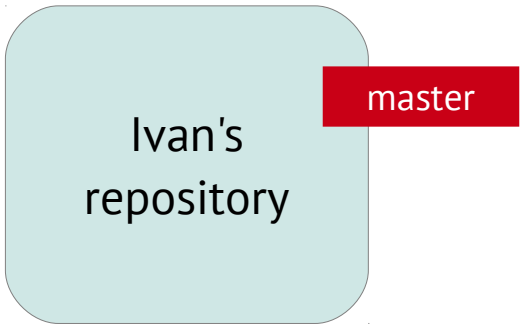

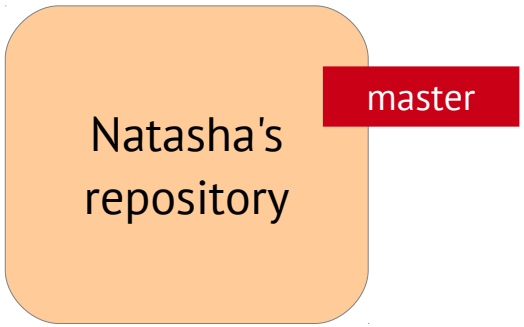

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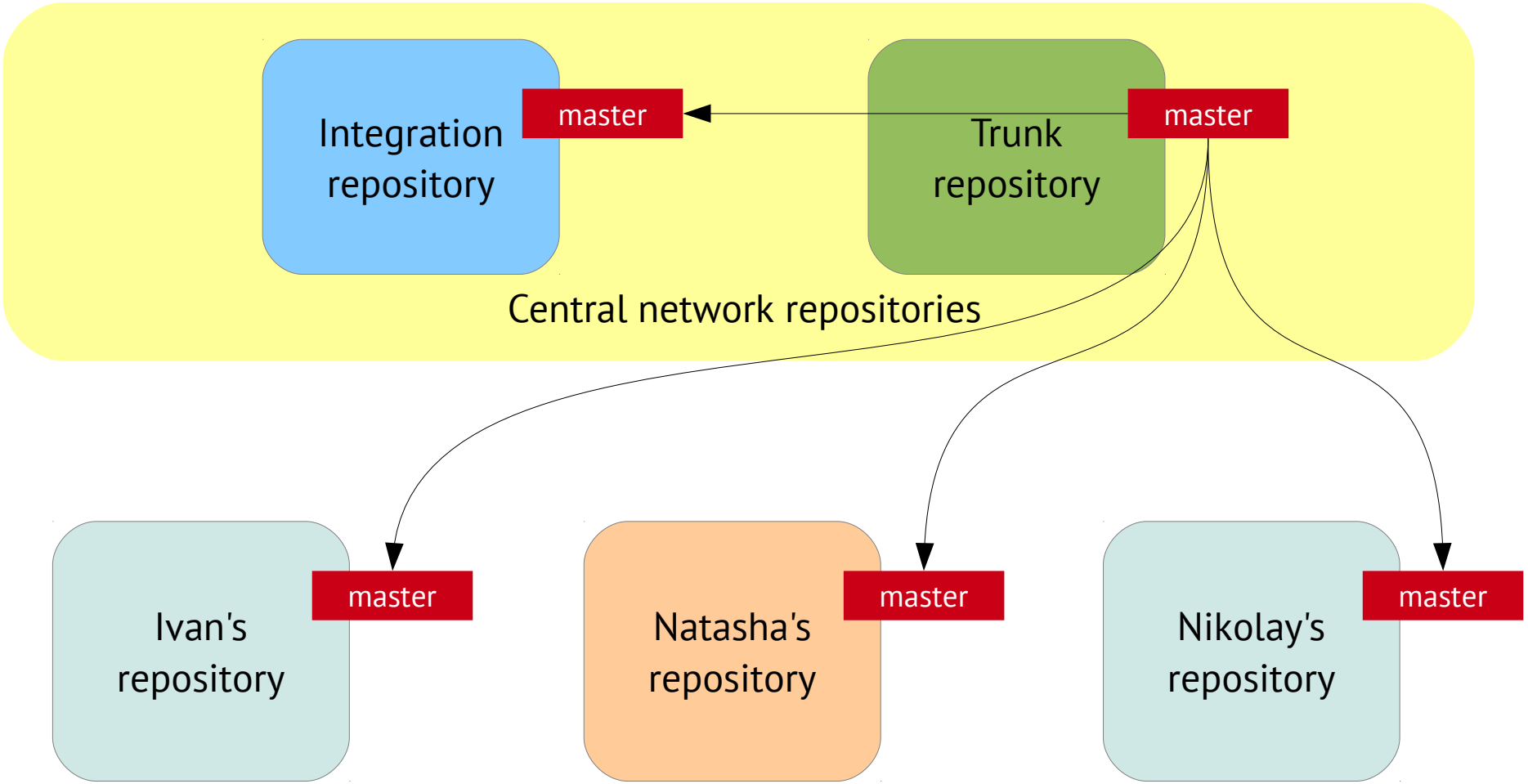


GIT workflow

GIT workflow

- **Create your branch**
- Edit files
- Stage your changes
- Commit the changes
- Rebase your branch from master
- Merge to master
- Push to central repository

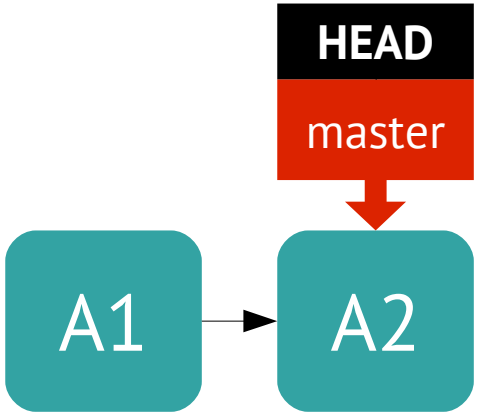
Branches

GIT workflow

Branching in details

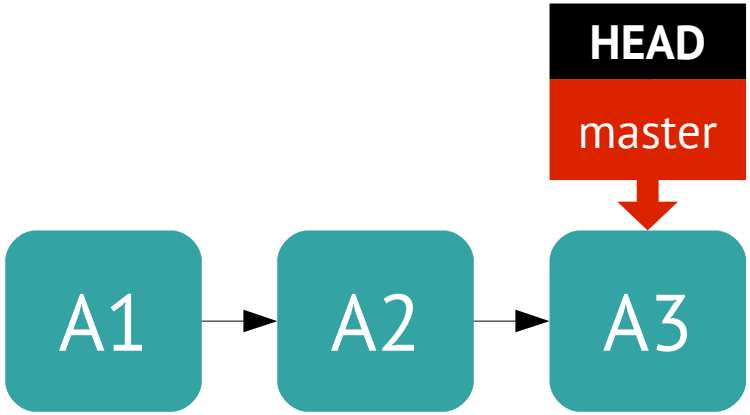
GIT workflow

Branching in details



GIT workflow

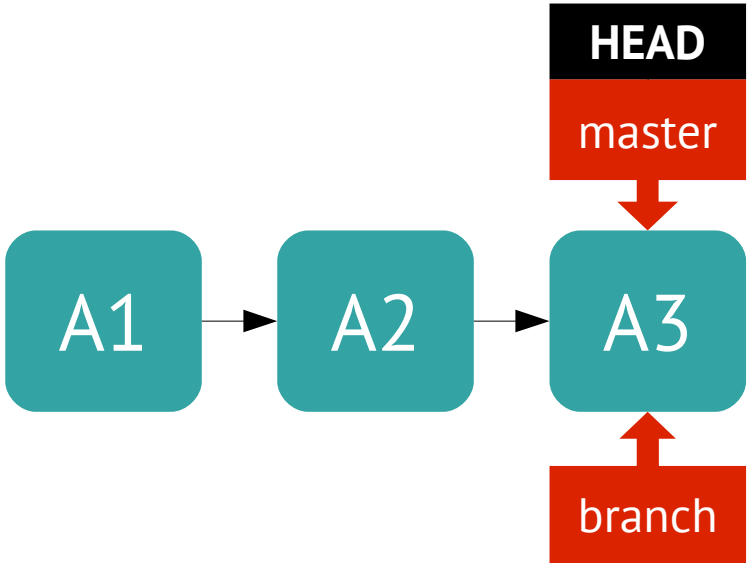
Branching in details




```
git branch branch
```

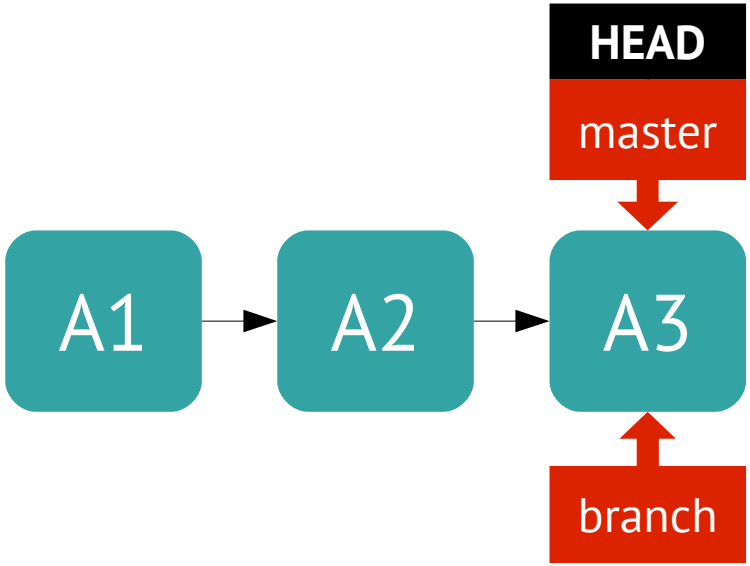
GIT workflow

Branching in details



GIT workflow

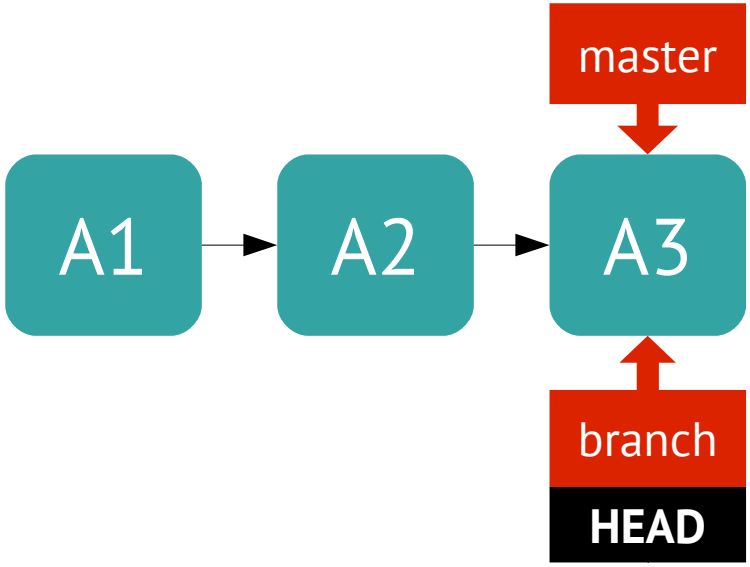
Branching in details




```
git checkout branch
```

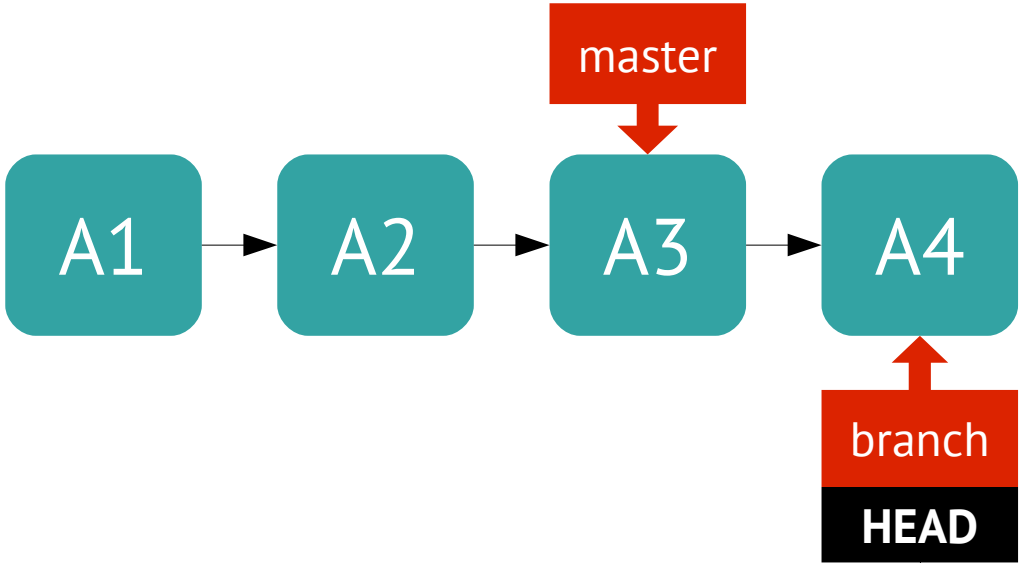
GIT workflow

Branching in details



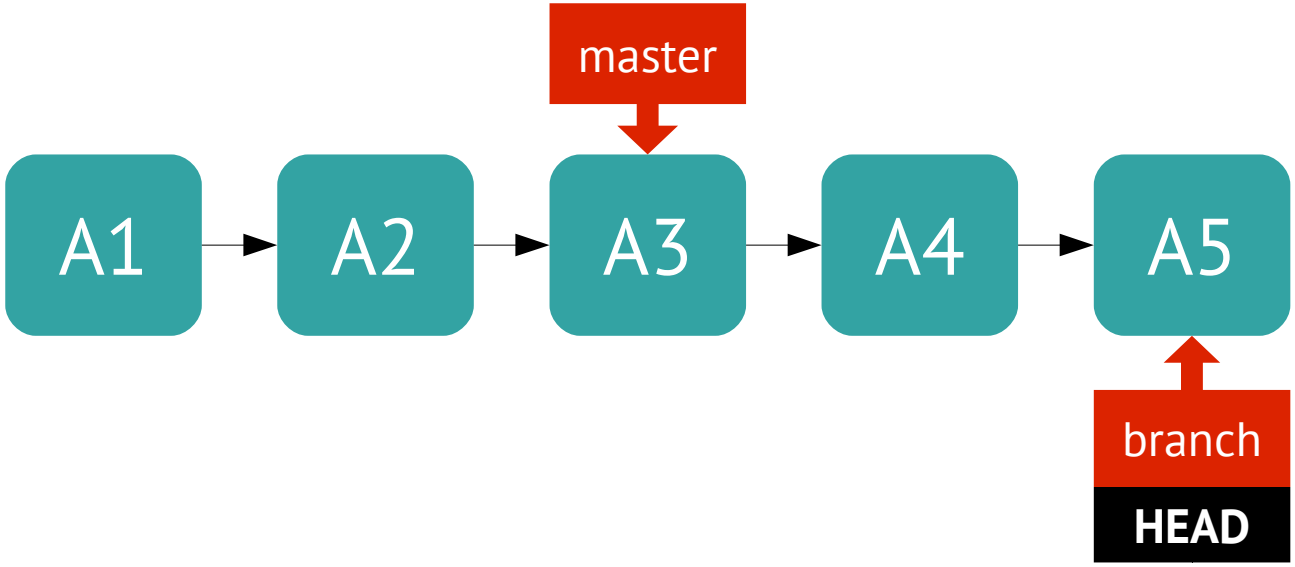
GIT workflow

Branching in details



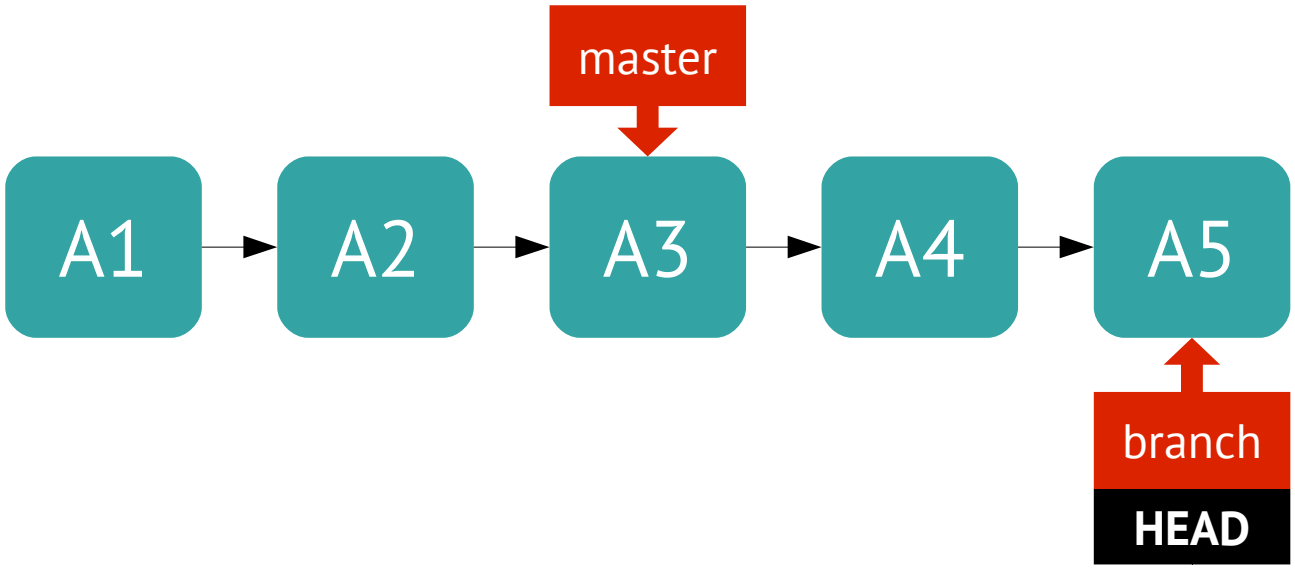
GIT workflow

Branching in details



GIT workflow

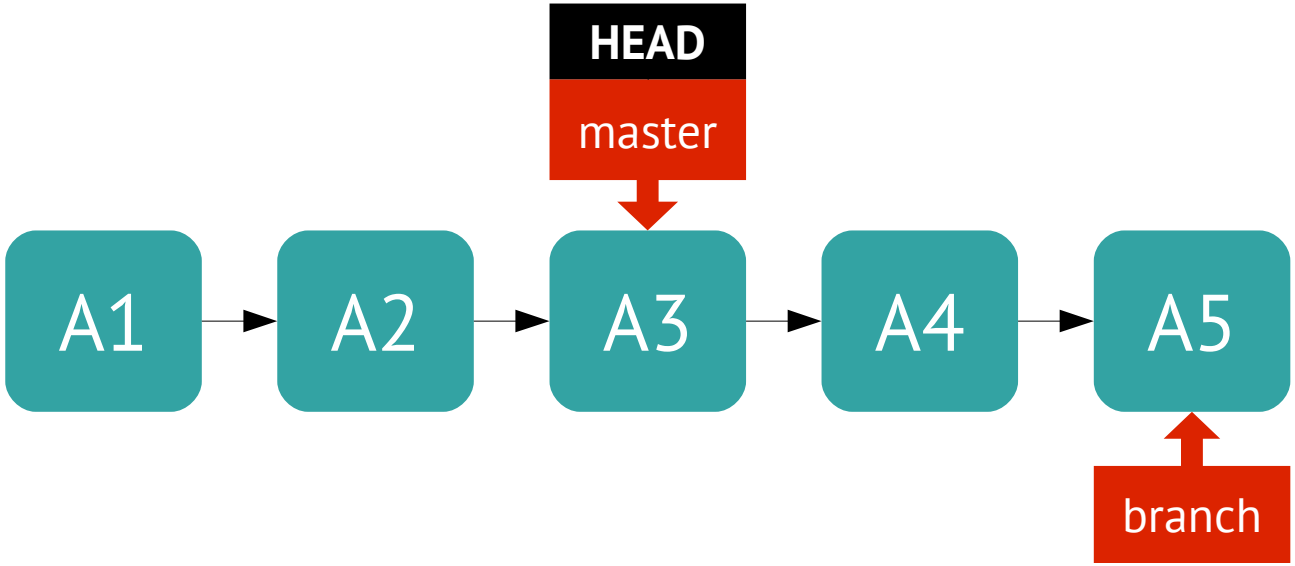
Branching in details




```
git checkout master
```

GIT workflow

Branching in details



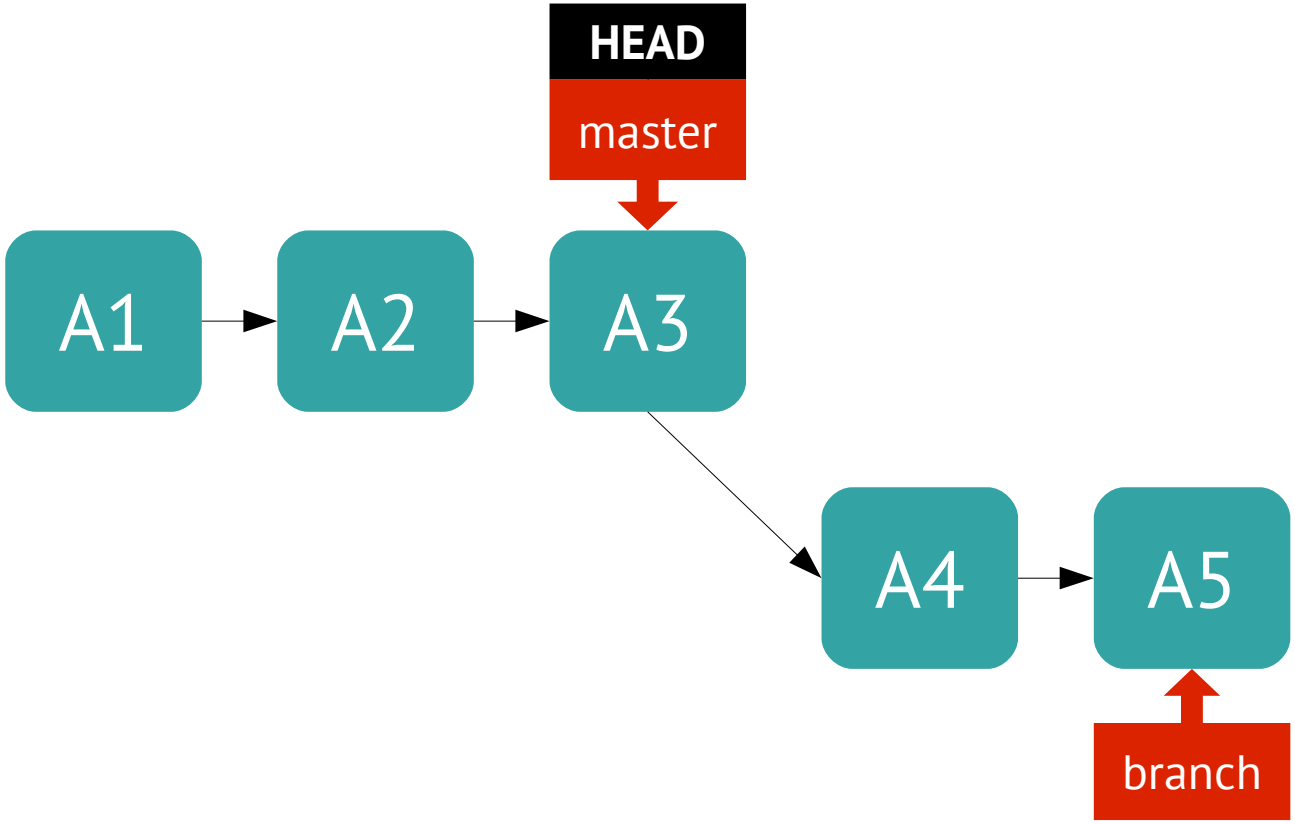
What's up, folks?

This presentation contains 256 slides and looks like that you have reached midway.

Congrats!

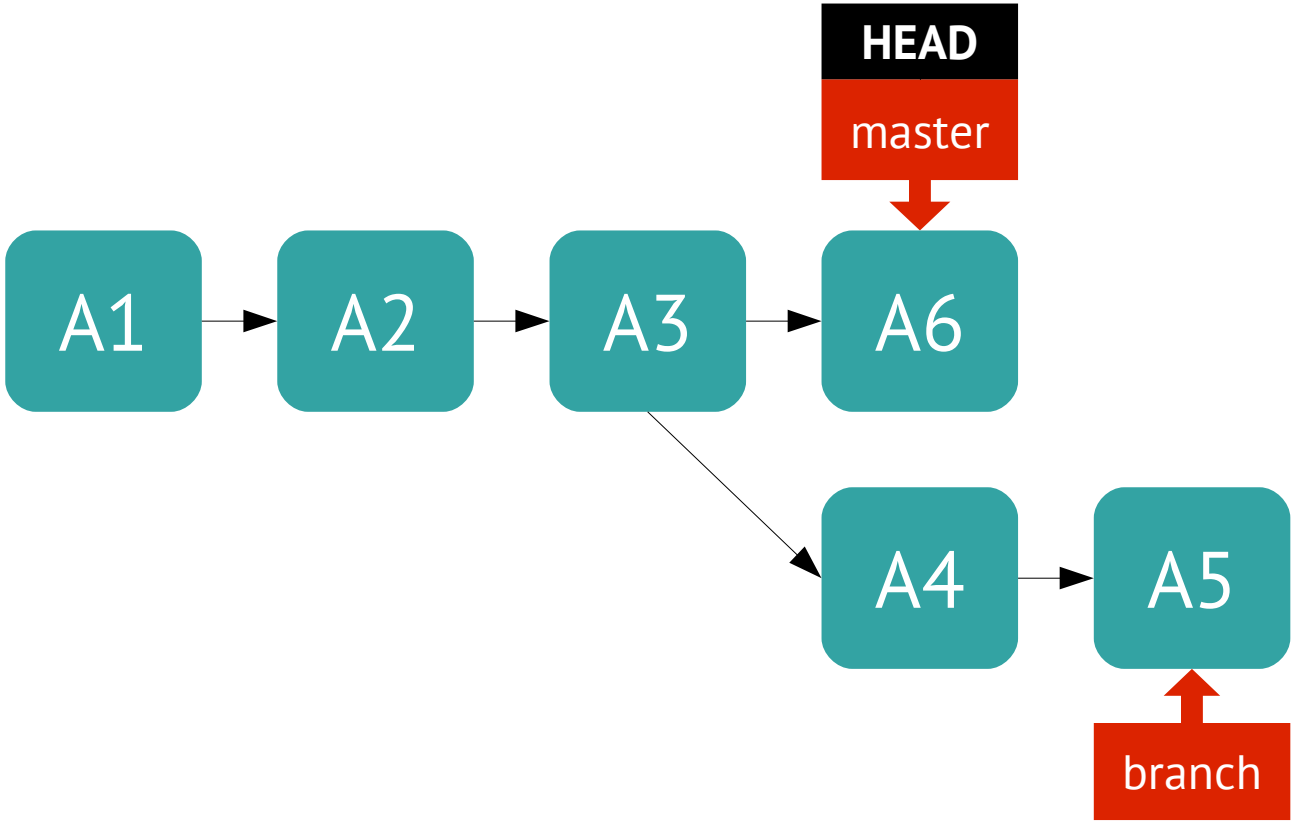
GIT workflow

Branching in details



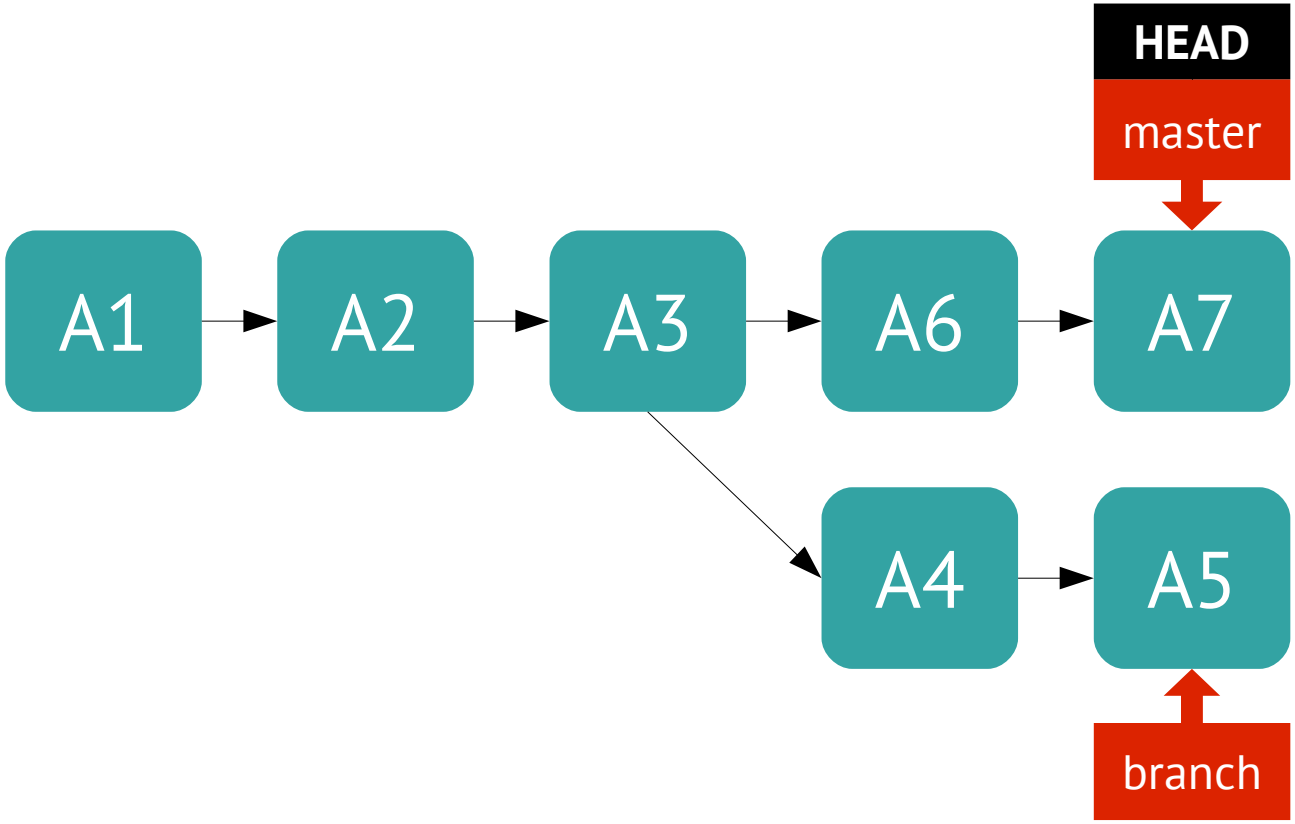
GIT workflow

Branching in details



GIT workflow

Branching in details



GIT workflow

Branching in details

- Branch pointer always points on the head of a branch;
- Creating branch = creating pointer to commit. 41 bytes on your disk;
- Removing branch is removing pointer.
- Obsolete commits is removed by GIT's GC;
- `HEAD` meta-tag points to a current active branch;
- One task = one branch.

GIT workflow

Branching in details

- Branch pointer always points on the head of a branch;
- Creating branch = creating pointer to commit. 41 bytes on your disk;
- Removing branch is removing pointer.
- Obsolete commits is removed by GIT's GC;
- HEAD meta-tag points to a current active branch;
- **One task = one branch**.

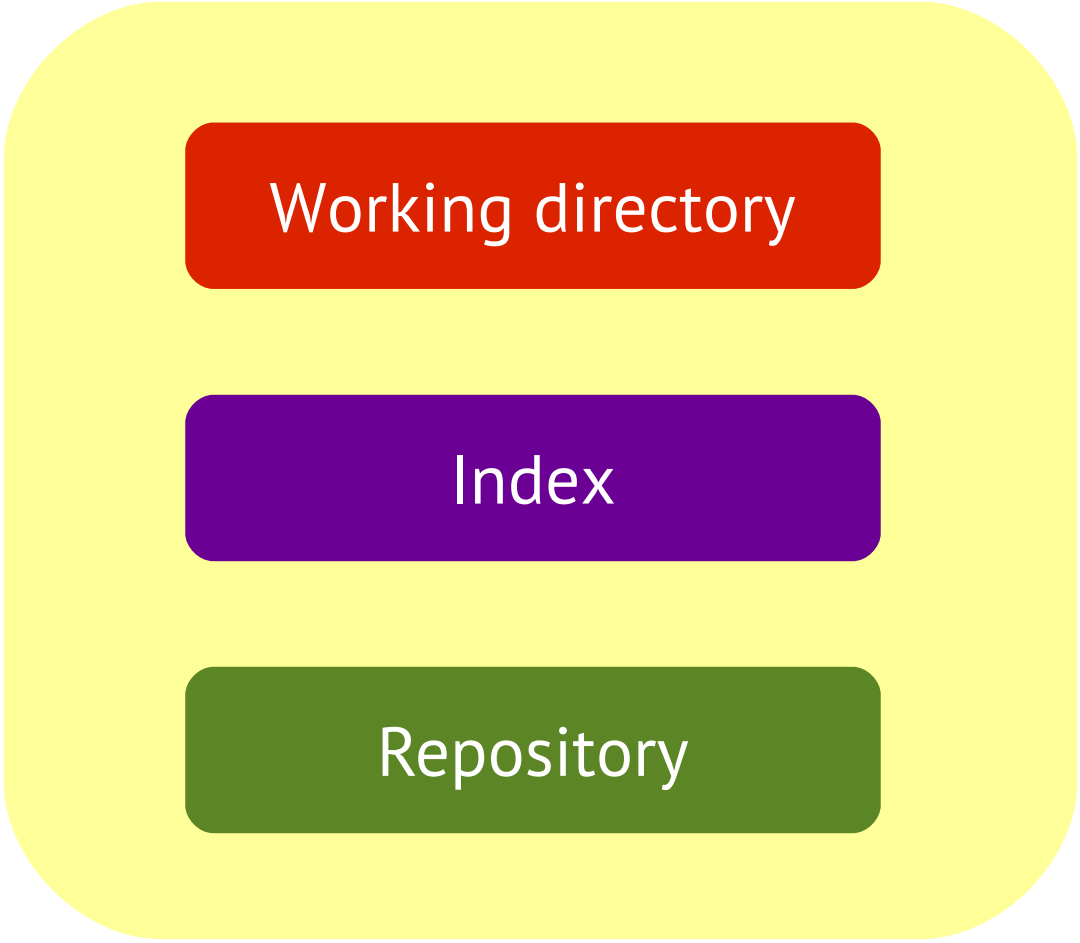
GIT workflow

- ~~Create your branch~~
- **Edit files**
- **Stage your changes**
- **Commit the changes**
- Rebase your branch from master
- Merge to master
- Push to central repository

Staging and commiting

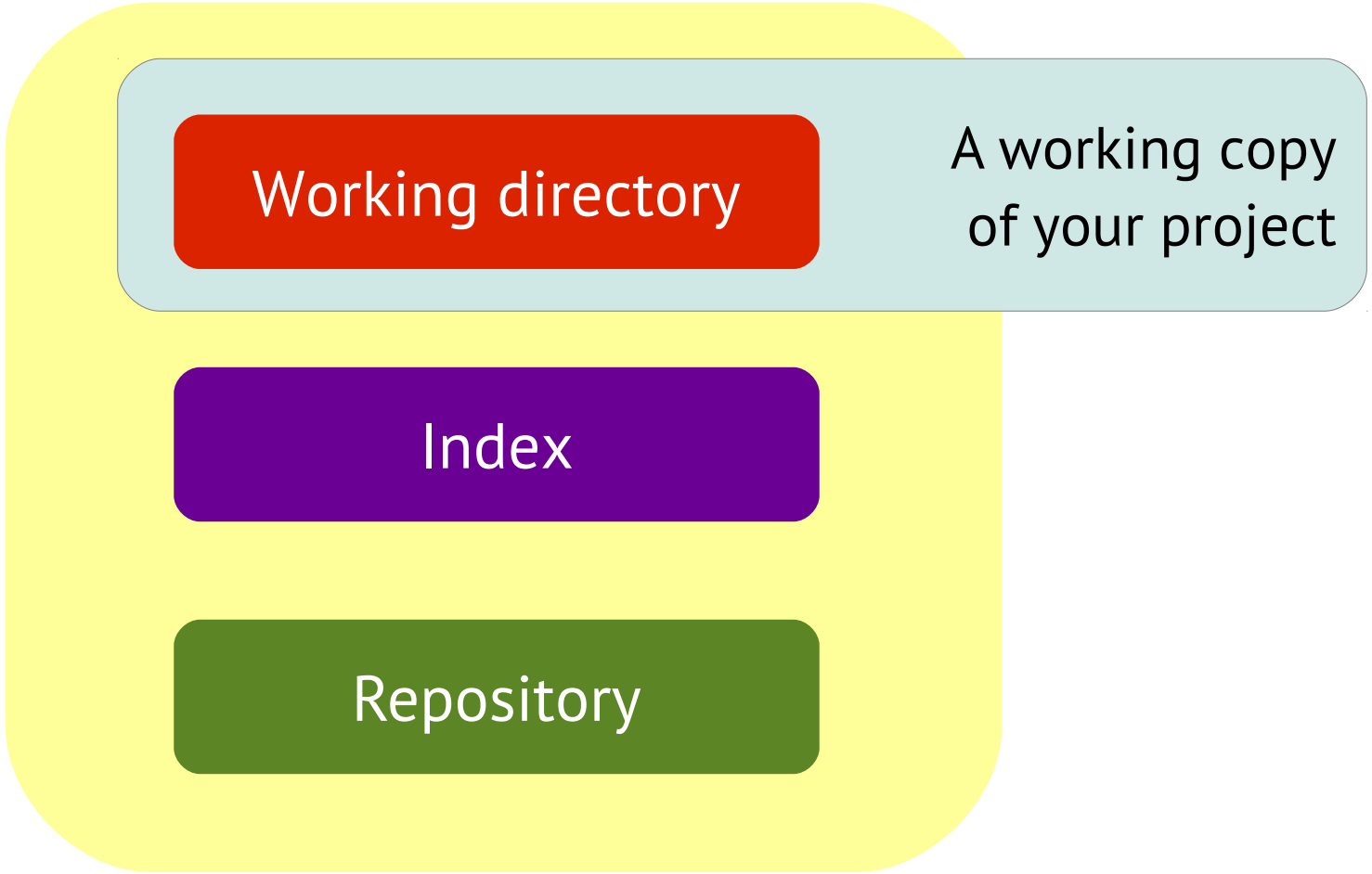
GIT workflow

Staging and commiting



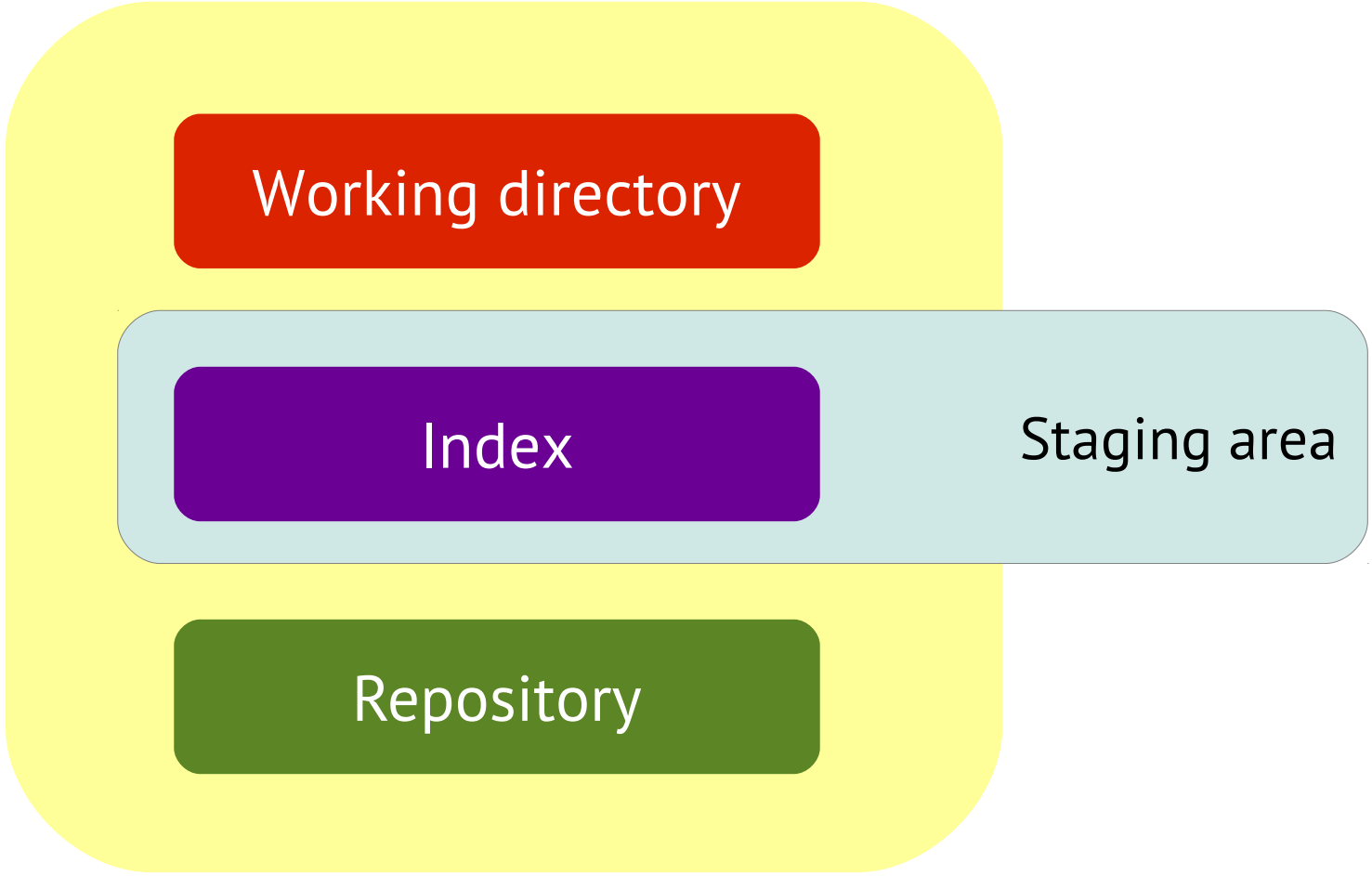
GIT workflow

Staging and commiting



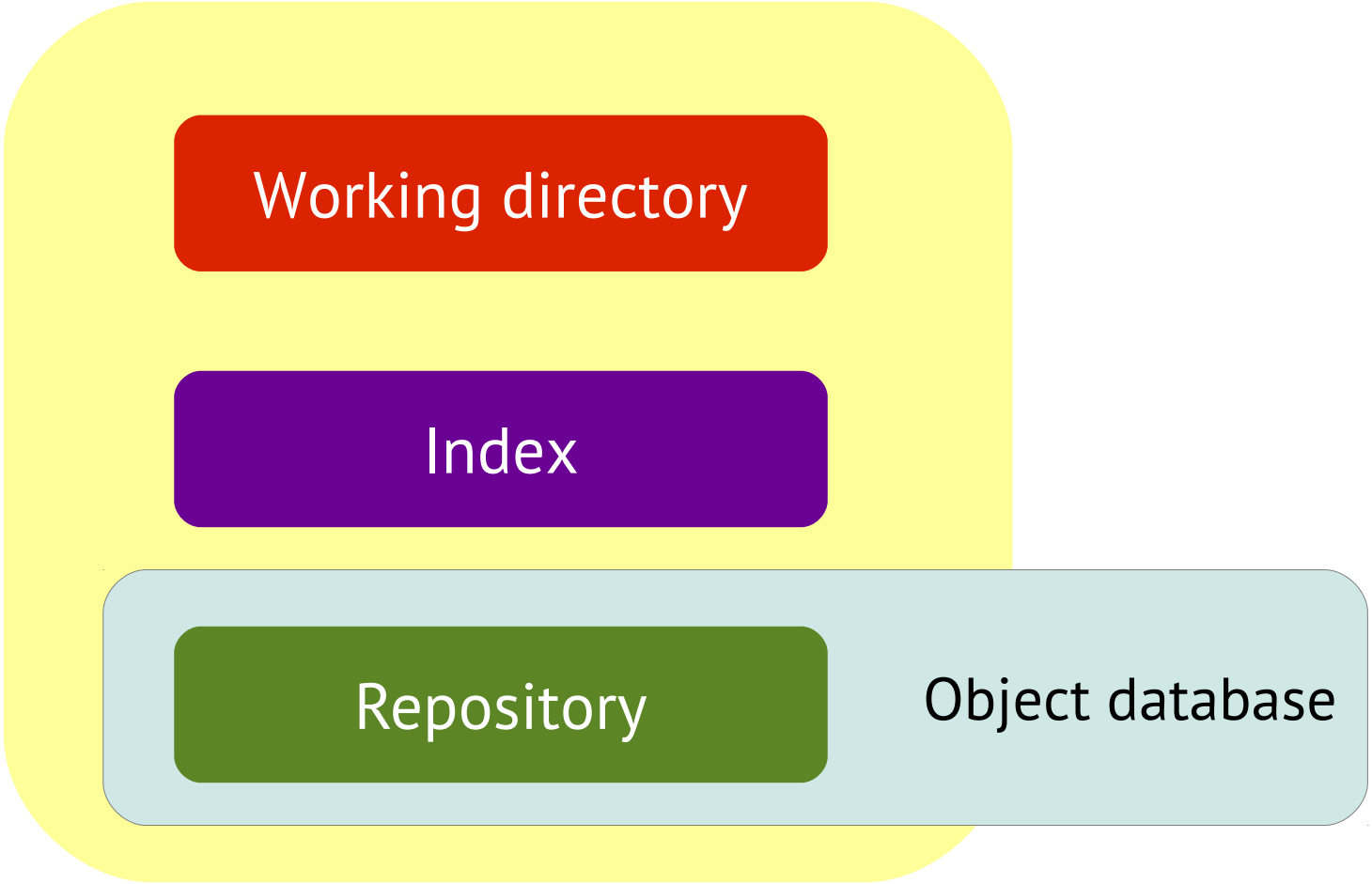
GIT workflow

Staging and commiting



GIT workflow

Staging and commiting



GIT workflow

Staging and commiting

```
$ git status
# On branch master
#
# Initial commit
#
nothing to commit (create/copy files and use "git add" to
track)
```

GIT workflow

Staging and commiting

```
$ git status
# On branch master
#
# Initial commit
#
nothing to commit (create/copy files and use "git add" to
track)
```

GIT workflow

Staging and commiting

```
$ emacs helloworld.c
$ cat helloworld.c
/* This is a classic 'hello world' app */

int
main (int argc, char** argv) {
    puts("Hello, brave new world!");
    return 0;
}
```

GIT workflow

Staging and commiting

```
$ git status
# On branch master
#
# Initial commit
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#  helloworld.c
nothing added to commit but untracked files present (use "git add"
to track)
```

GIT workflow

Staging and commiting

```
$ git status
# On branch master
#
# Initial commit
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#  helloworld.c
nothing added to commit but untracked files present (use "git add"
to track)
```

GIT workflow

Staging and commiting

```
$ git add helloworld.c
$ git status
# On branch master
#
# Initial commit
#
# Changes to be committed:
#   (use "git rm --cached <file>..." to unstage)
#
#   new file:   helloworld.c
#
```

GIT workflow

Staging and commiting

```
$ git add helloworld.c
$ git status
# On branch master
#
# Initial commit
#
# Changes to be committed:
#   (use "git rm --cached <file>..." to unstage)
#
#   new file:   helloworld.c
#
```

GIT workflow

Staging and commiting

```
$ git commit -m "Useful comment"
[master (root-commit) 23409d6] Useful comment
 1 files changed, 7 insertions(+), 0 deletions(-)
 create mode 100644 helloworld.c
```

GIT workflow

Staging and commiting

$ emacs helloworld.c

$ cat helloworld.c

```
/* This is a classic 'hello world' app */

#include <stdio.h>

int
main (int argc, char** argv) {
    puts("Hello, brave new world!");
    return 0;
}
```

GIT workflow

Staging and commiting

$ git status

```
# On branch master

# Changes not staged for commit:

#   (use "git add <file>..." to update what will be committed)

#   (use "git checkout -- <file>..." to discard changes in working
directory)

#

#   modified:   helloworld.c

#

no changes added to commit (use "git add" and/or "git commit -a")
```

GIT workflow

Staging and commiting

$ git status

```
# On branch master
# Changes not staged for commit:
#   (use "git add <file>..." to update what will be committed)
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directory)
#
#   modified:   helloworld.c
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GIT workflow

Staging and commiting

$ git status

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# On branch master
# Changes not staged for commit:
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directory)
#
#   modified:   helloworld.c
#
no changes added to commit (use "git add" and/or "git commit -a")
```

GIT workflow

Staging and commiting

$ git diff

```
--- a/helloworld.c
+++ b/helloworld.c
@@ -1,5 +1,7 @@
 /* This is a classic 'hello world' app */

+#include <stdio.h>
+
 int
 main (int argc, char** argv) {
     puts("Hello, brave new world!");
```

GIT workflow

Staging and commiting

$ git diff

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 int
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GIT workflow

Staging and commiting

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```

GIT workflow

Staging and commiting

```
$ git add helloworld.c
$ git status
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#   modified:   helloworld.c
#
```

GIT workflow

Staging and commiting

$ emacs helloworld.c

$ cat helloworld.c

```
/* This is a classic 'hello world' app */

#include <stdio.h>

int
main (int argc, char** argv) {
    printf("Hello, brave new world!\n");
    return 0;
}
```

GIT workflow

Staging and commiting

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#
#   modified:   helloworld.c
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```

GIT workflow

Staging and commiting

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#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#   modified:   helloworld.c
#
```

GIT workflow

Staging and commiting

$ git diff

```
--- a/helloworld.c
+++ b/helloworld.c
@@ -4,6 +4,6 @@

 int
 main (int argc, char** argv) {
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     return 0;
 }
```

GIT workflow

Staging and commiting

$ git diff

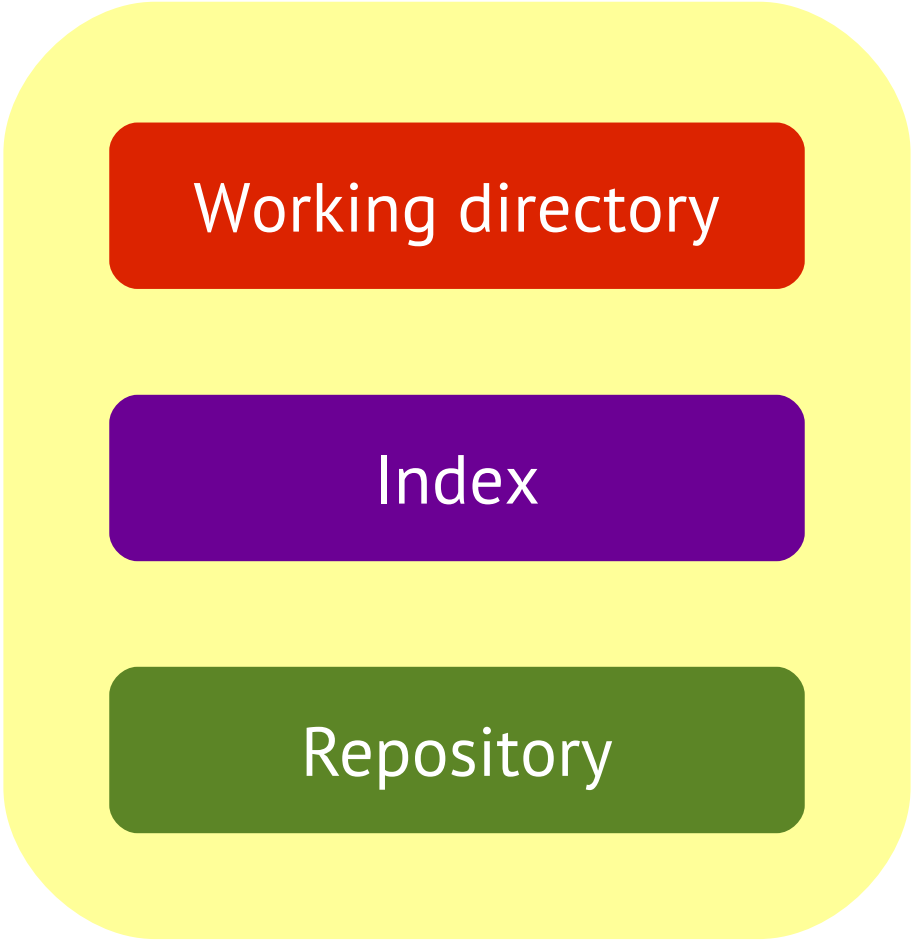
```
--- a/helloworld.c
+++ b/helloworld.c
@@ -4,6 +4,6 @@

 int
 main (int argc, char** argv) {
-    puts("Hello, brave new world!");
+    printf("Hello, brave new world!\n");
     return 0;
 }
```

WTF?

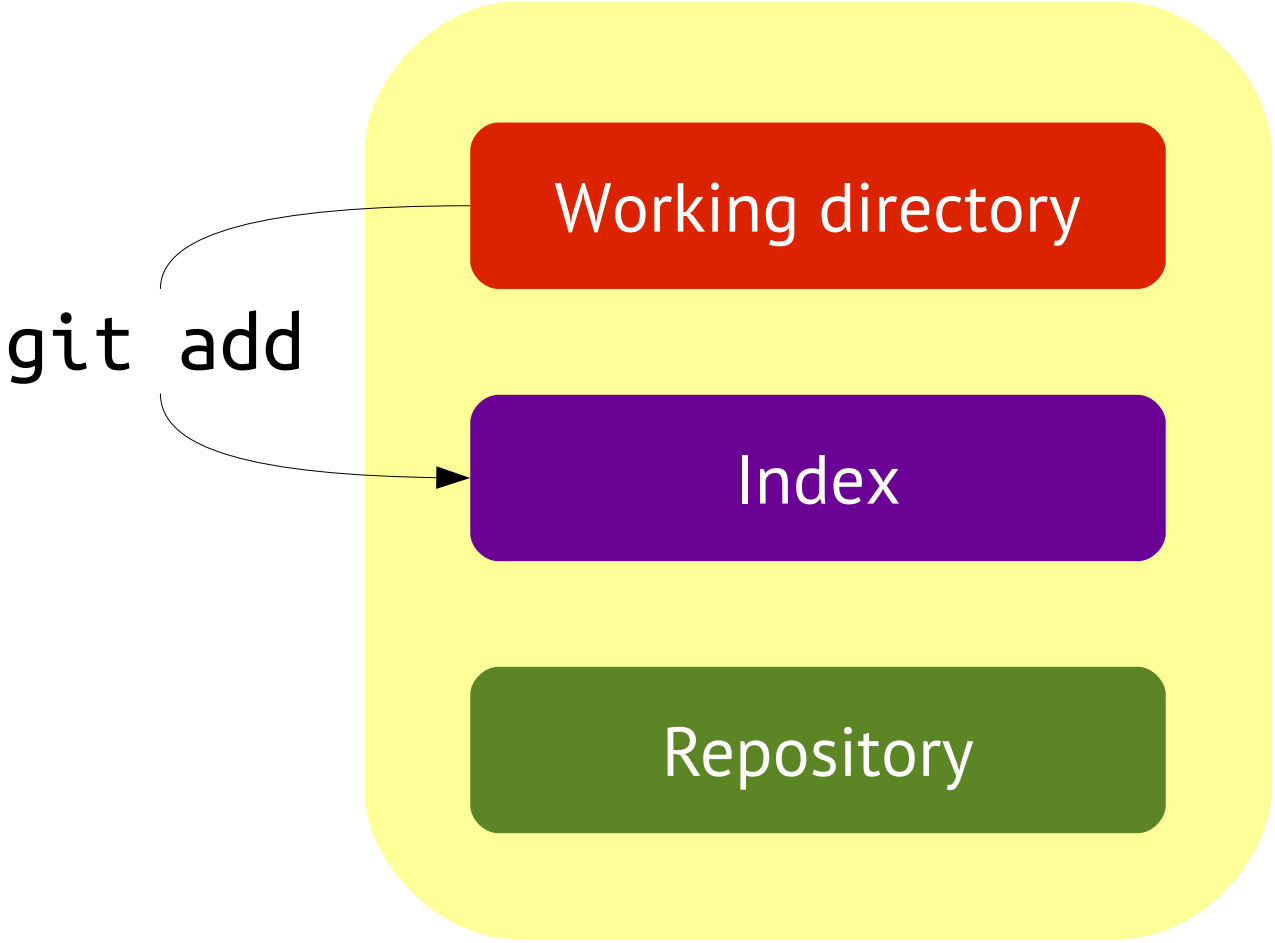
GIT workflow

Staging and commiting



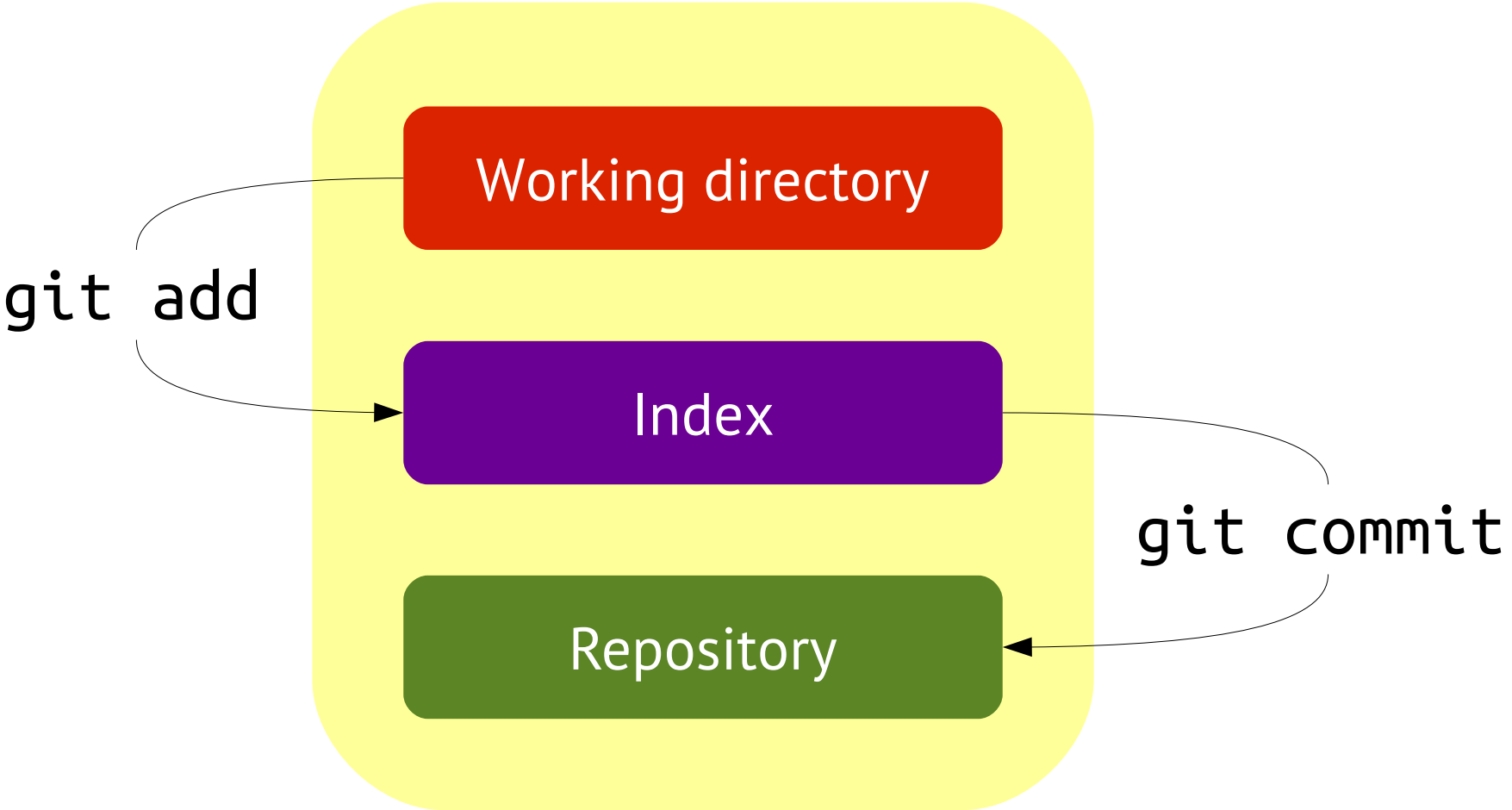
GIT workflow

Staging and commiting



GIT workflow

Staging and commiting



GIT workflow

Staging and commiting

$ git status

```
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#   modified:   helloworld.c
#
# Changes not staged for commit:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#   modified:   helloworld.c
#
```

GIT workflow

Staging and commiting

$ git status

```
# On branch master
# Changes that are staged:
#   (use "git reset HEAD <file>..." to unstage)
#
#   modified:   helloworld.c
#
# Changes that are not staged:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#   modified:   helloworld.c
#
```

GIT workflow

Staging and commiting

$ git status

```
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#   modified:   helloworld.c
#
# Changes not staged for commit:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#   modified:   helloworld.c
#
```

Staged

GIT workflow

Staging and commiting

$ git status

```
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#   modified:   helloworld.c
#
# Changes not staged for commit:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#   modified:   helloworld.c
#
```

Not staged

GIT workflow

Staging and commiting

You have to stage a file after you edit it

GIT workflow

Staging and commiting

You have to stage a file
after you edit it

GIT workflow

Staging and commiting

You have to stage a file

after you edit it

GIT workflow

Staging and commiting

$ git commit -a

```
Hello world of a new generation.
# Please enter the commit message for your changes. Lines starting
# with '#' will be ignored, and an empty message aborts the commit.
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       modified:   helloworld.c
#
```

GIT workflow

Staging and commiting

```
[master 4bbbef9] Hello world of a new generation.
 1 files changed, 3 insertions(+), 1 deletions(-)
```

GIT workflow

Staging and commiting

```
[master 4bbbef9] Hello world of a new generation.
 1 files changed, 3 insertions(+), 1 deletions(-)
```

GIT workflow

Staging and commiting

4bbbef9

GIT workflow

Staging and commiting

4bbbef94bbbef9b703c8197ec34cb90382c7b8fd5046a9a

GIT workflow

Staging and commiting

$ tree -a

```
.
├── .git
│   ├── branches
│   ├── COMMIT_EDITMSG
│   ├── config
│   ├── description
│   ├── HEAD
│   ├── hooks
│   │   ├── applypatch-msg.sample
│   │   ├── ...
│   ├── index
│   ├── info
│   │   └── exclude
│   ├── logs
│   │   ├── HEAD
│   │   └── refs
│   │       └── heads
│   │           └── master
│   ├── objects
│   │   ├── 23
│   │   │   └── 409d6895e7cb65306d4ed7d0c558ced6c82753
│   │   ├── ...
│   │   ├── info
│   │   └── pack
│   └── refs
│       ├── heads
│       │   └── master
│       └── tags
└── helloworld.c
```

GIT workflow

Staging and commiting

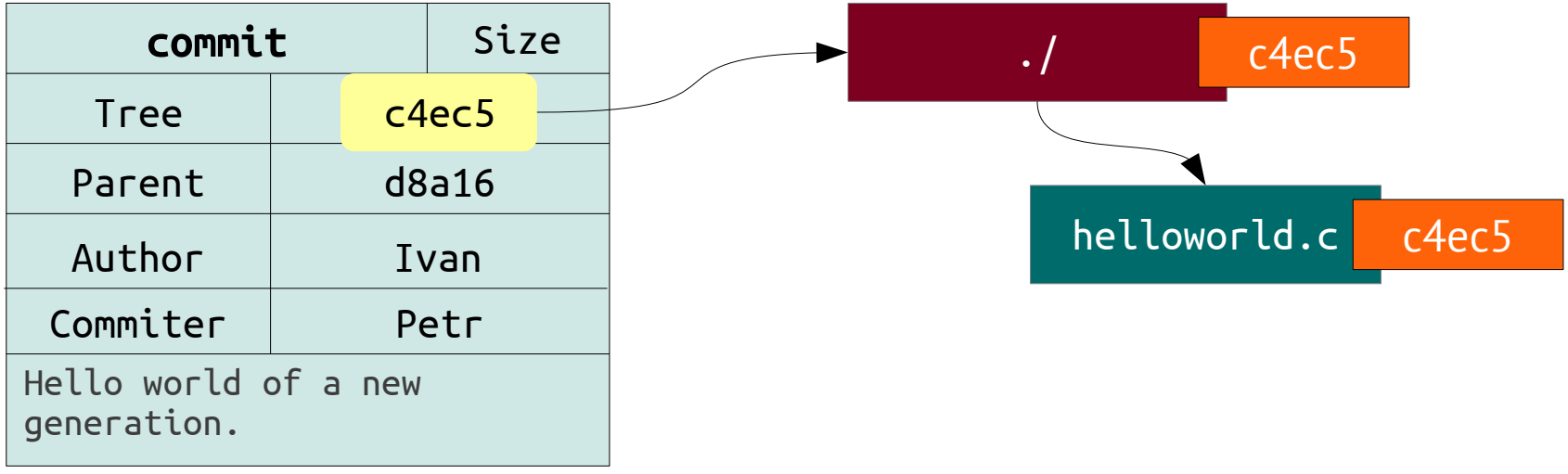
4bbbef94bbbef9b703c8197ec34cb90382c7b8fd5046a9a

commit	Size
Tree	c4ec5
Parent	d8a16
Author	Ivan
Commiter	Petr
Hello world of a new generation.	

GIT workflow

Staging and commiting

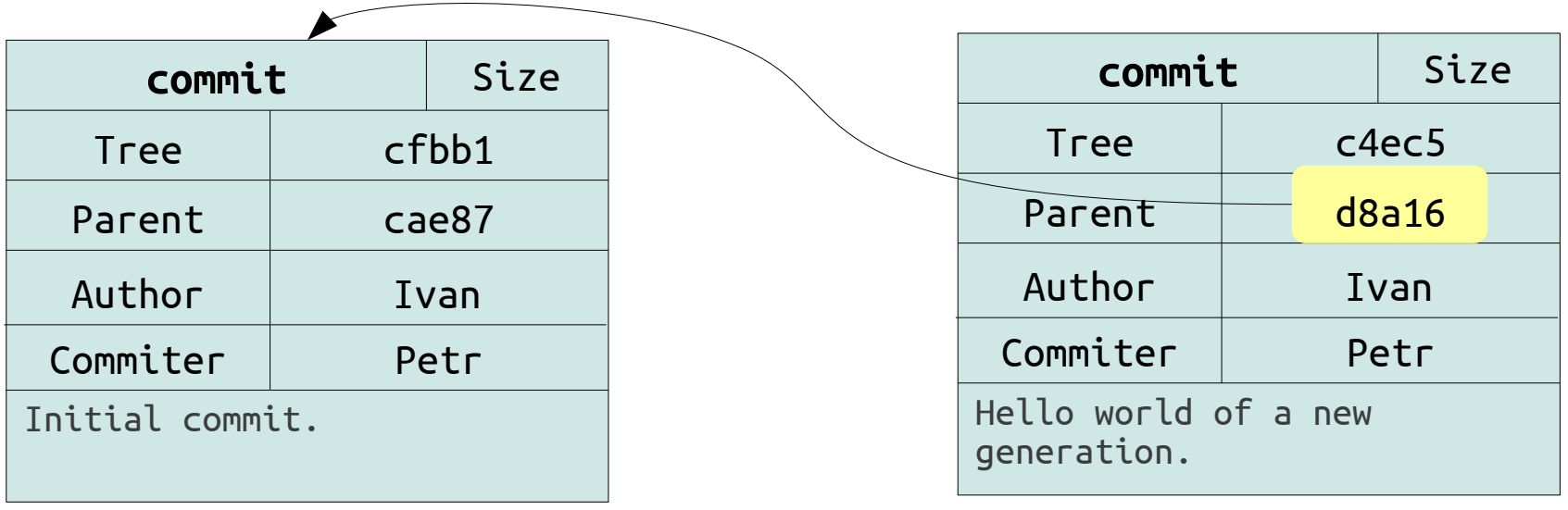
4bbbef94bbbef9b703c8197ec34cb90382c7b8fd5046a9a



GIT workflow

Staging and commiting

4bbbef94bbbef9b703c8197ec34cb90382c7b8fd5046a9a



GIT workflow

Staging and commiting

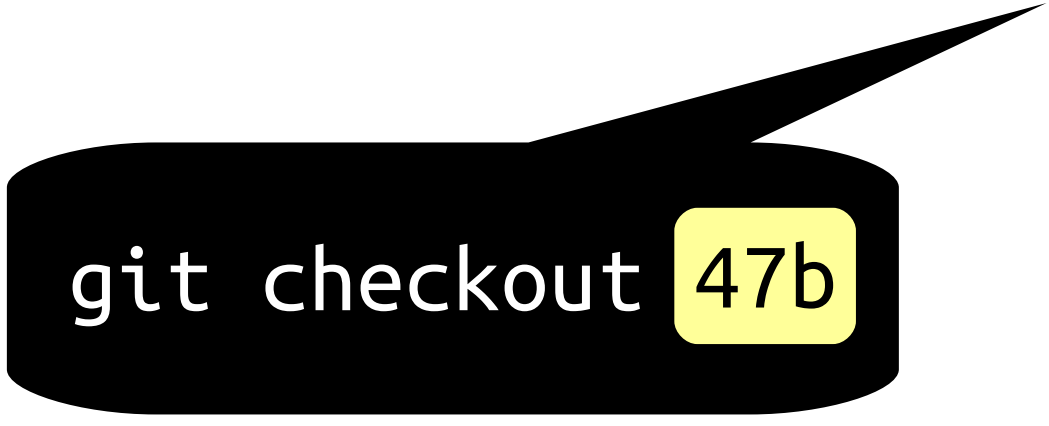
GIT workflow

Staging and commiting

Repository

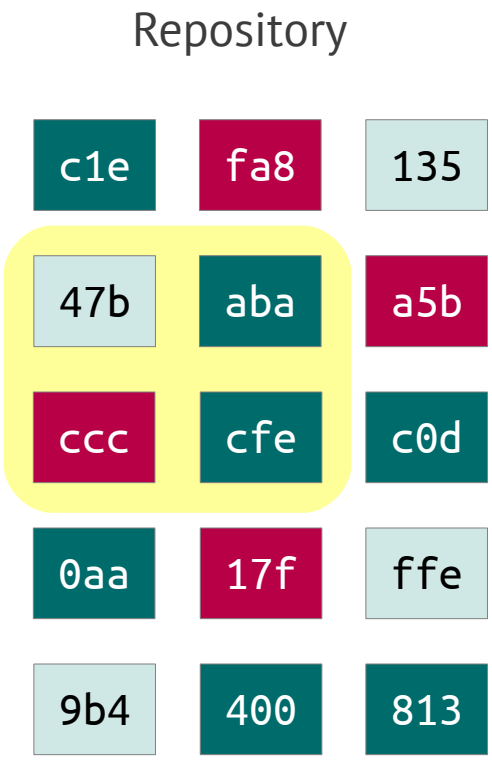
GIT workflow

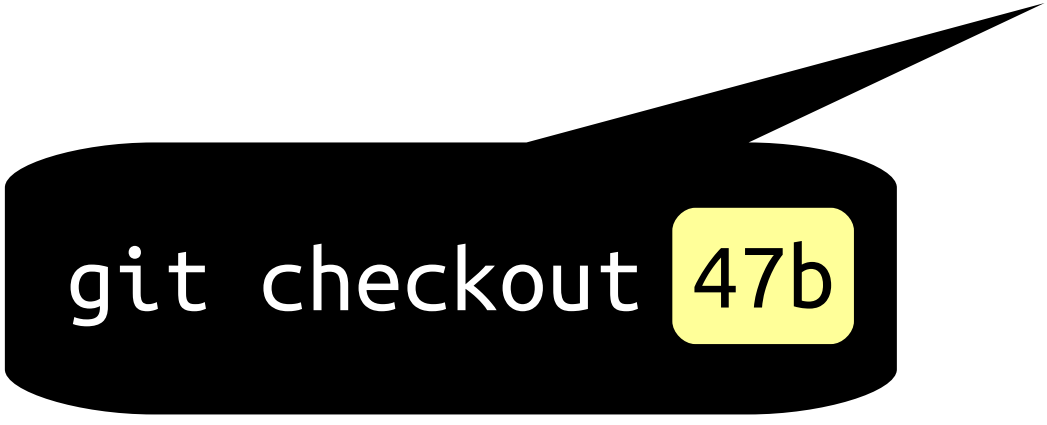
Staging and commiting



GIT workflow

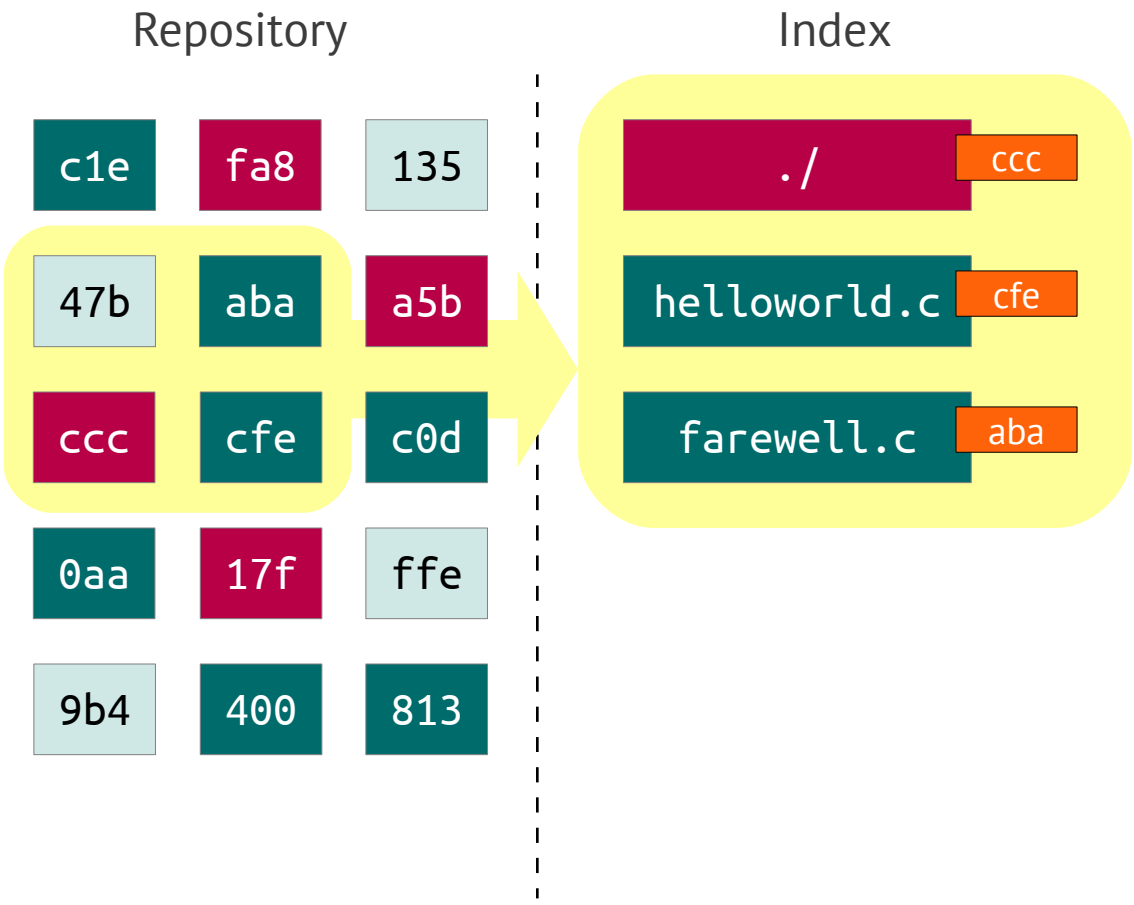
Staging and commiting





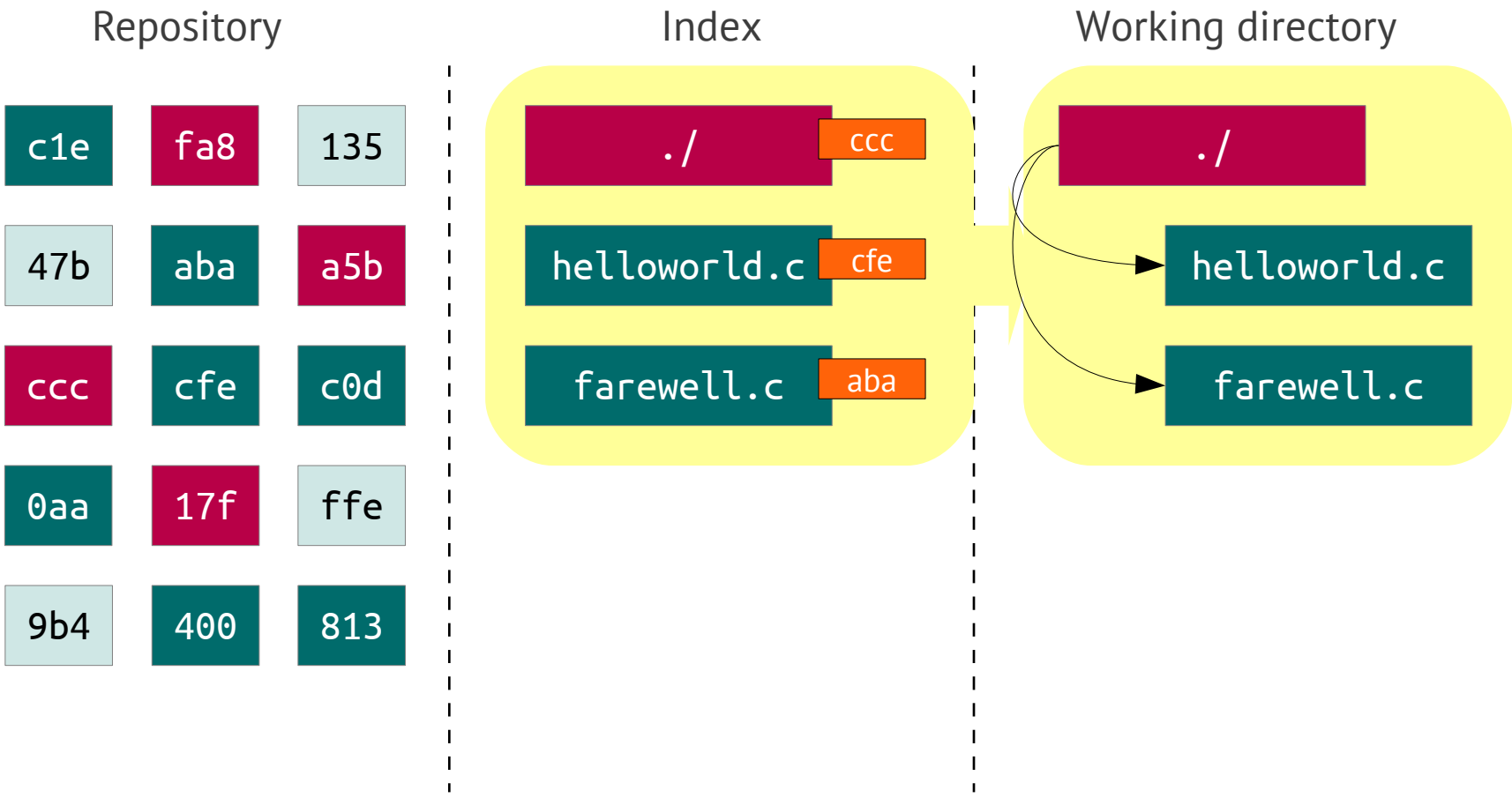
GIT workflow

Staging and commiting



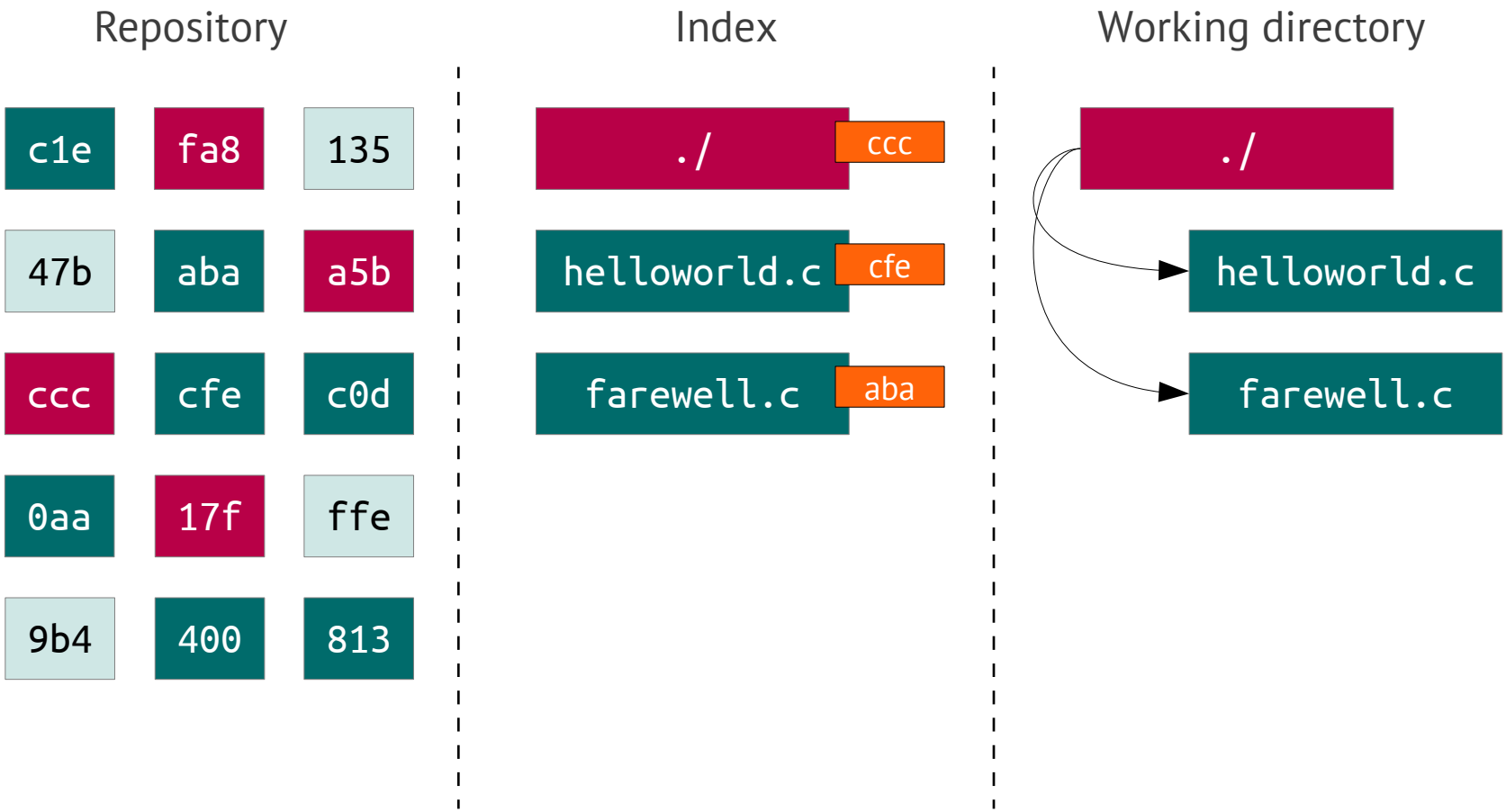
GIT workflow

Staging and commiting



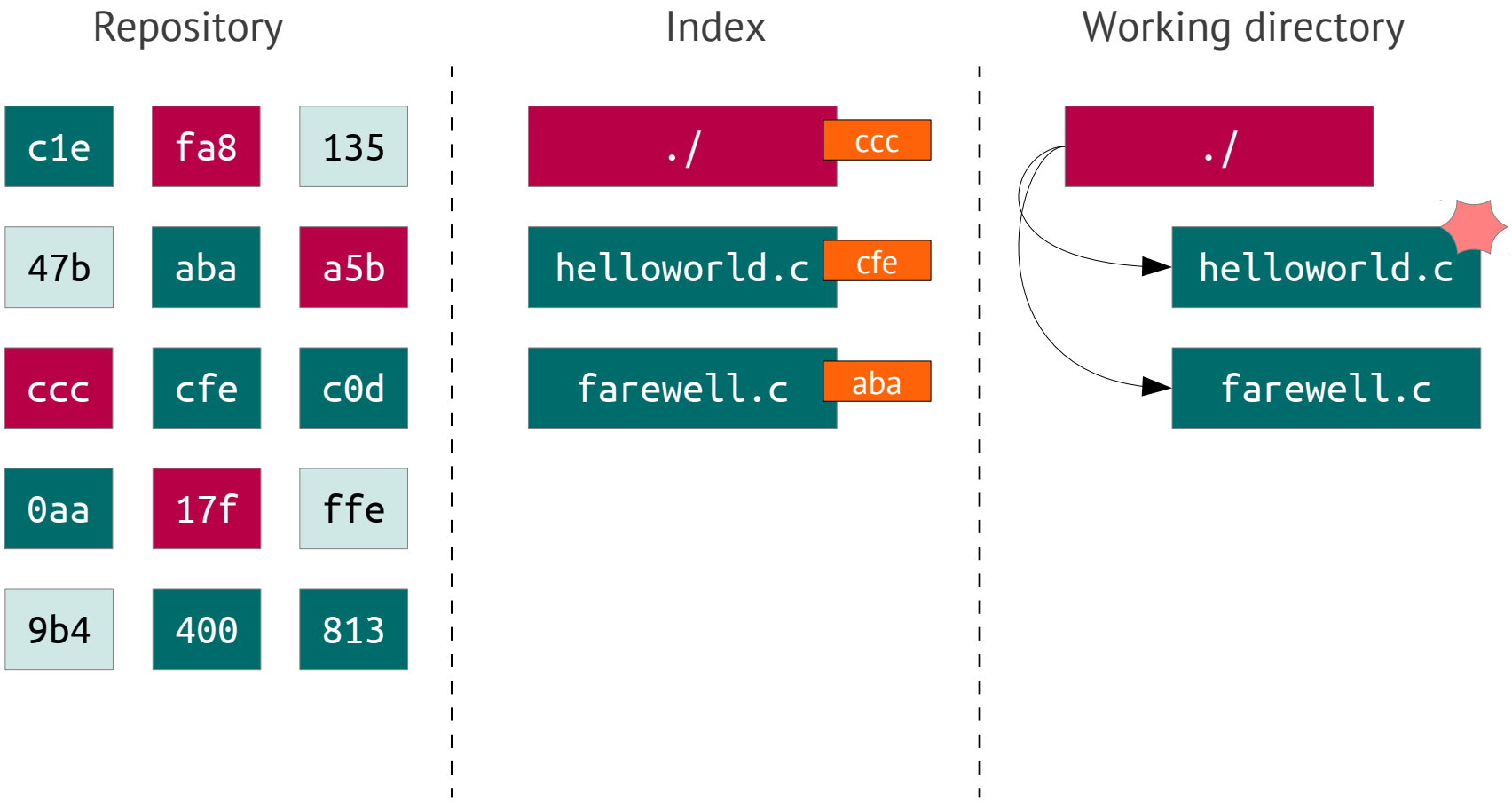
GIT workflow

Staging and commiting



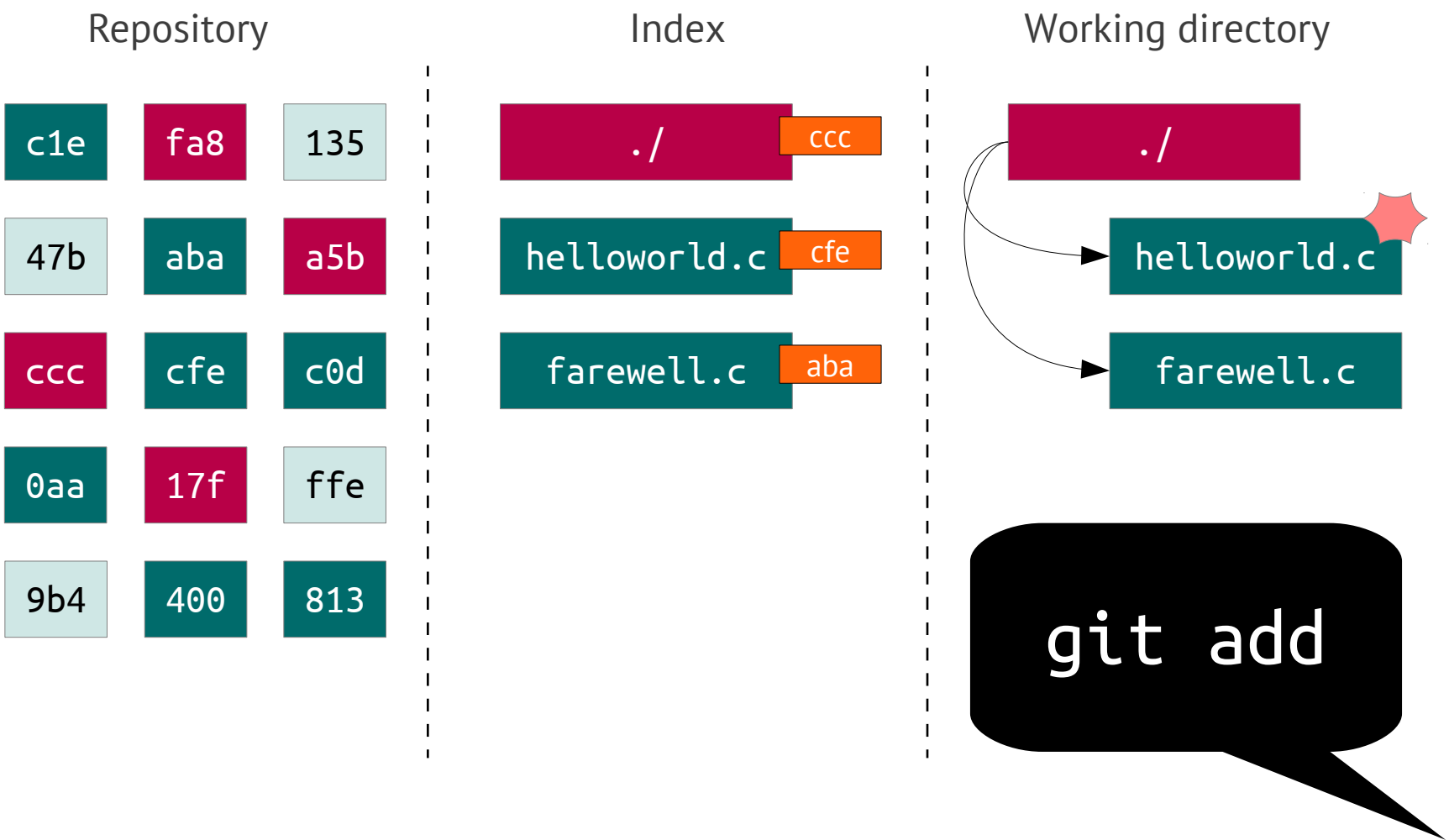
GIT workflow

Staging and commiting



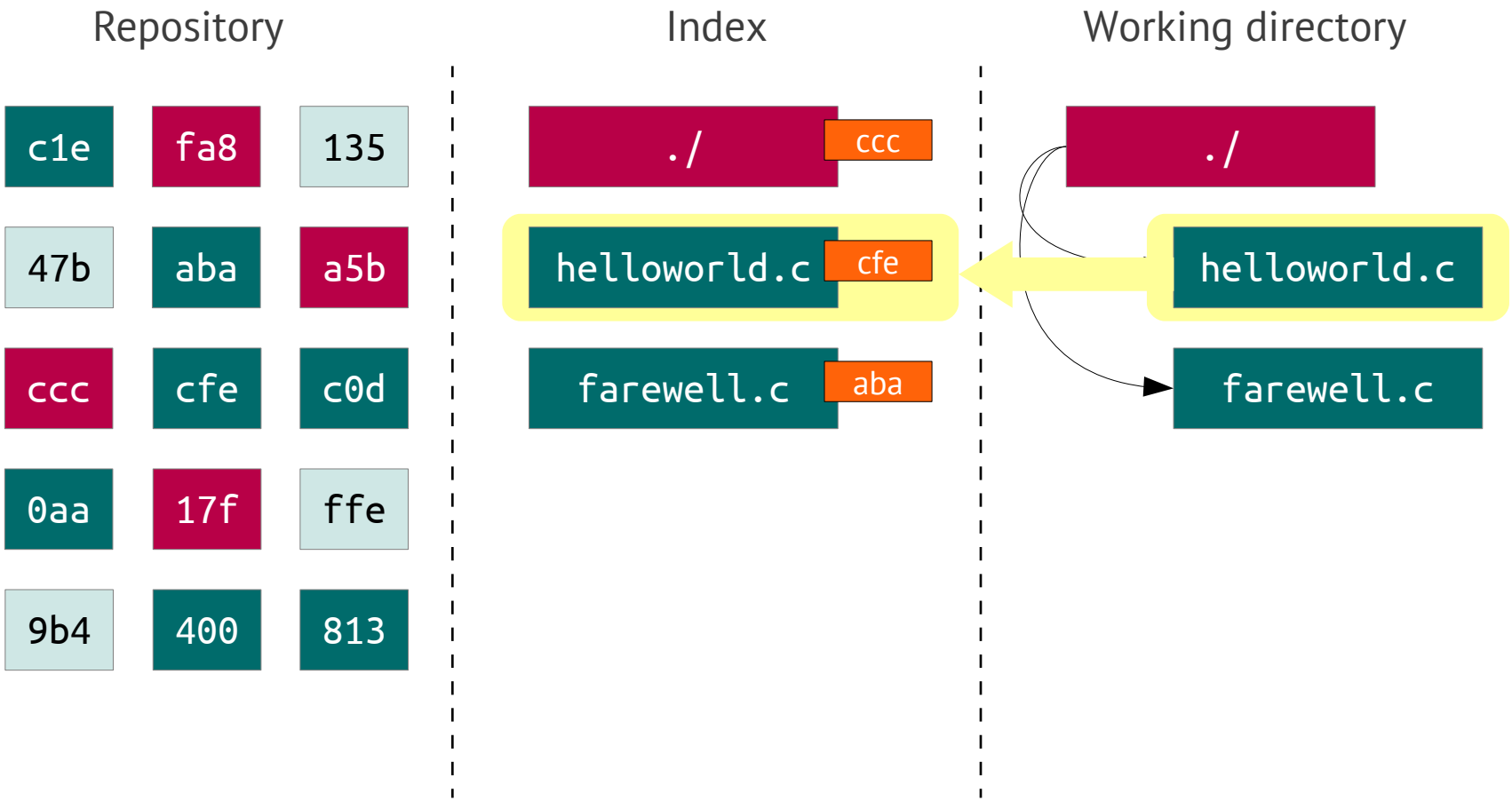
GIT workflow

Staging and commiting



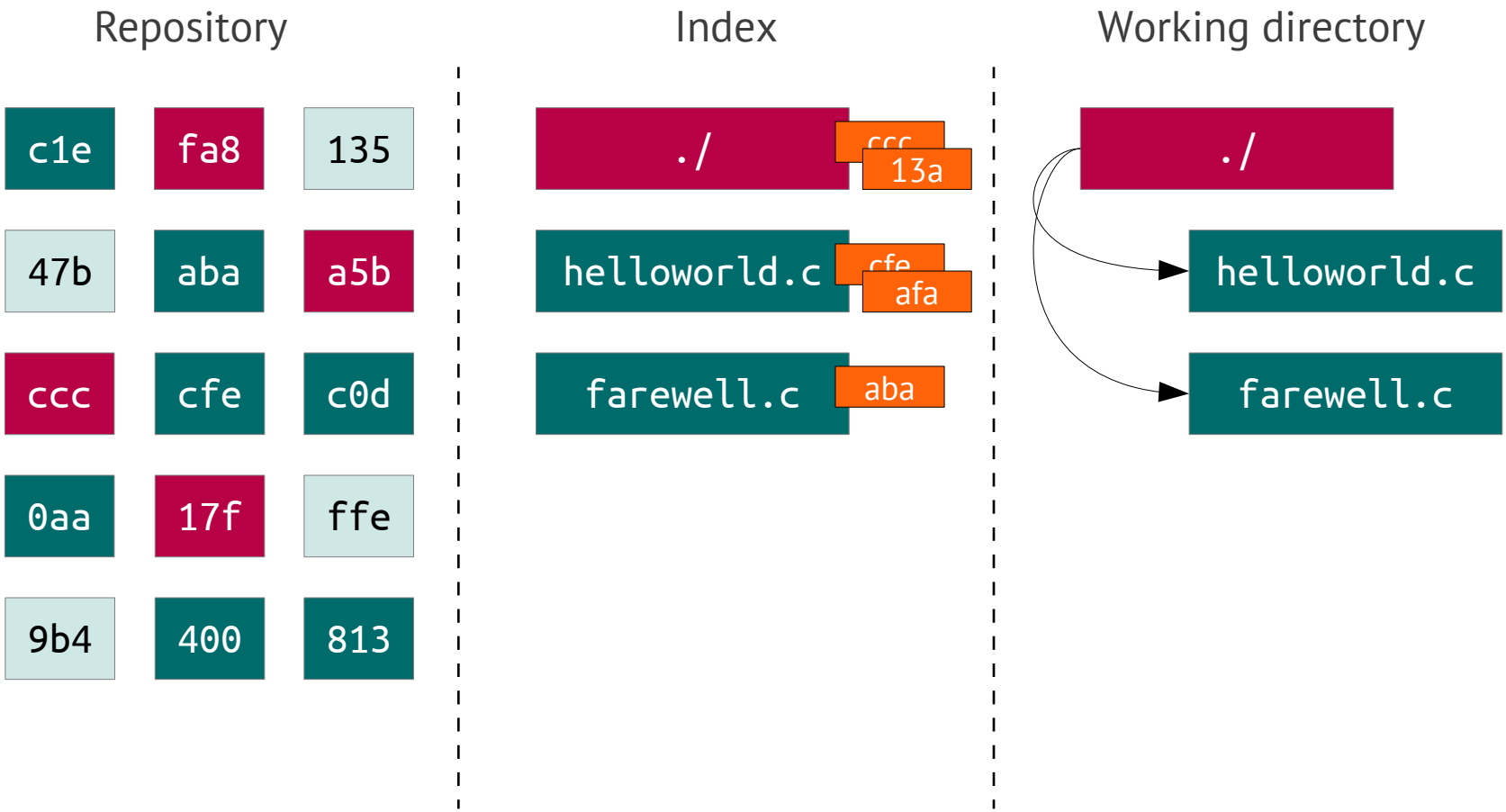
GIT workflow

Staging and commiting



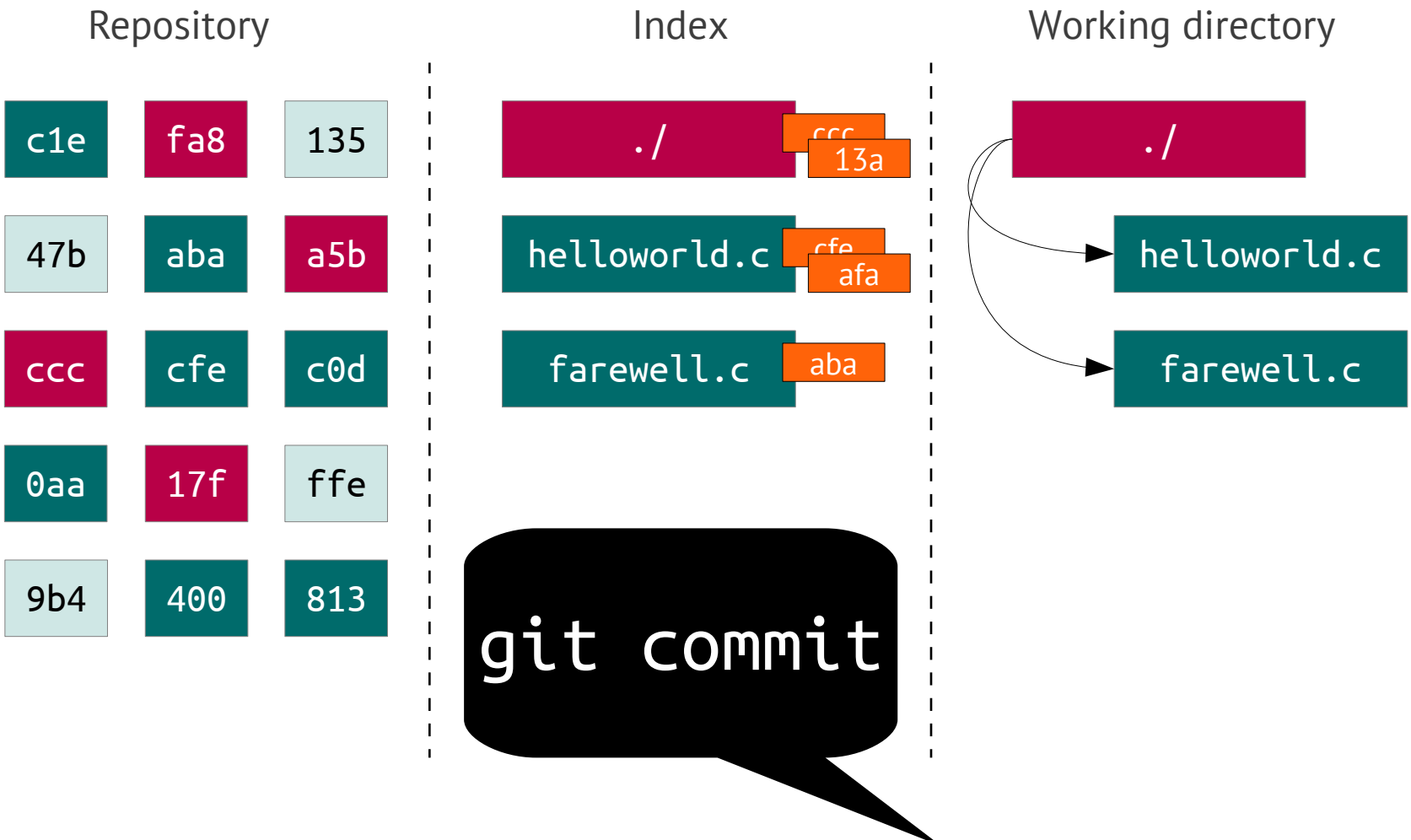
GIT workflow

Staging and commiting



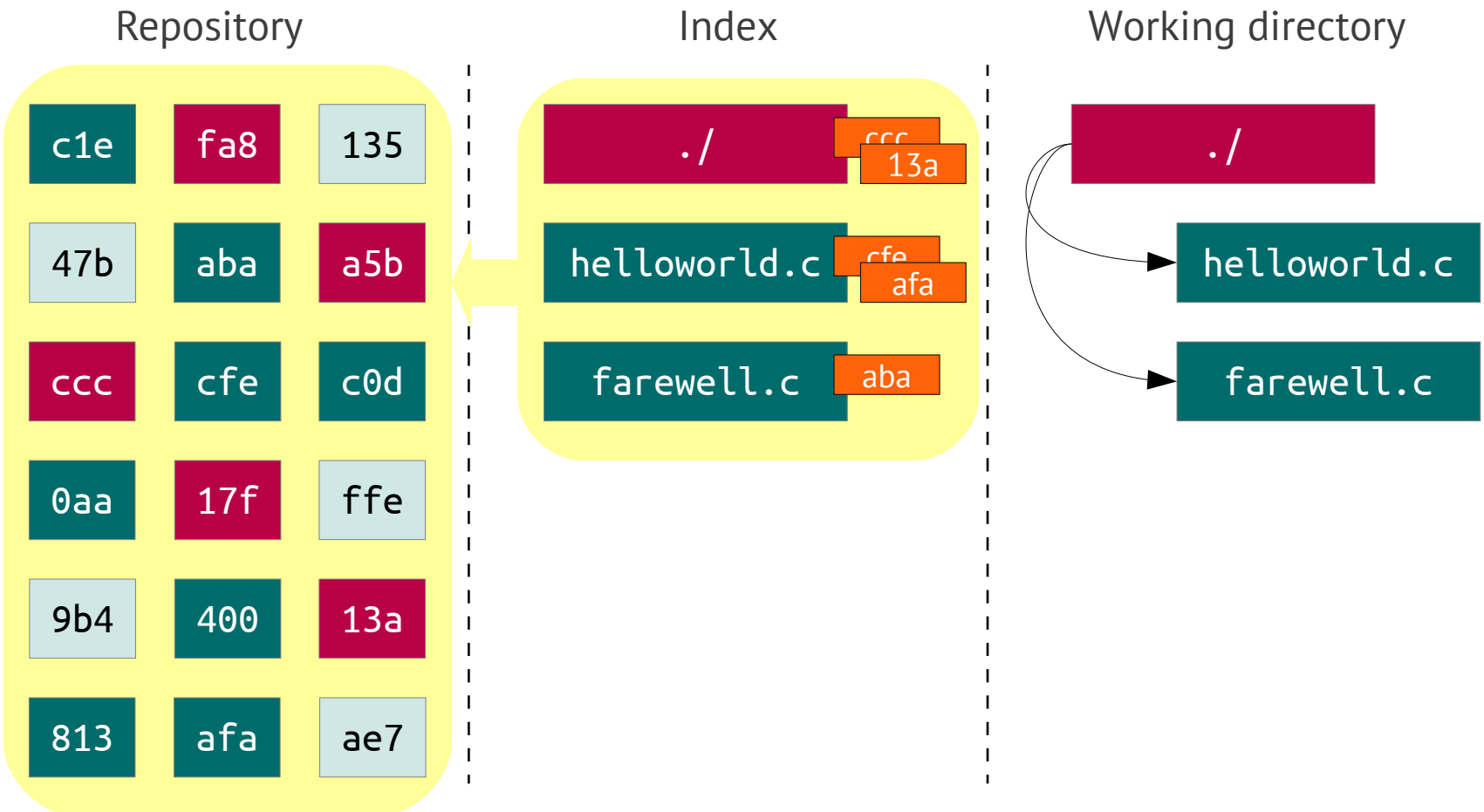
GIT workflow

Staging and commiting



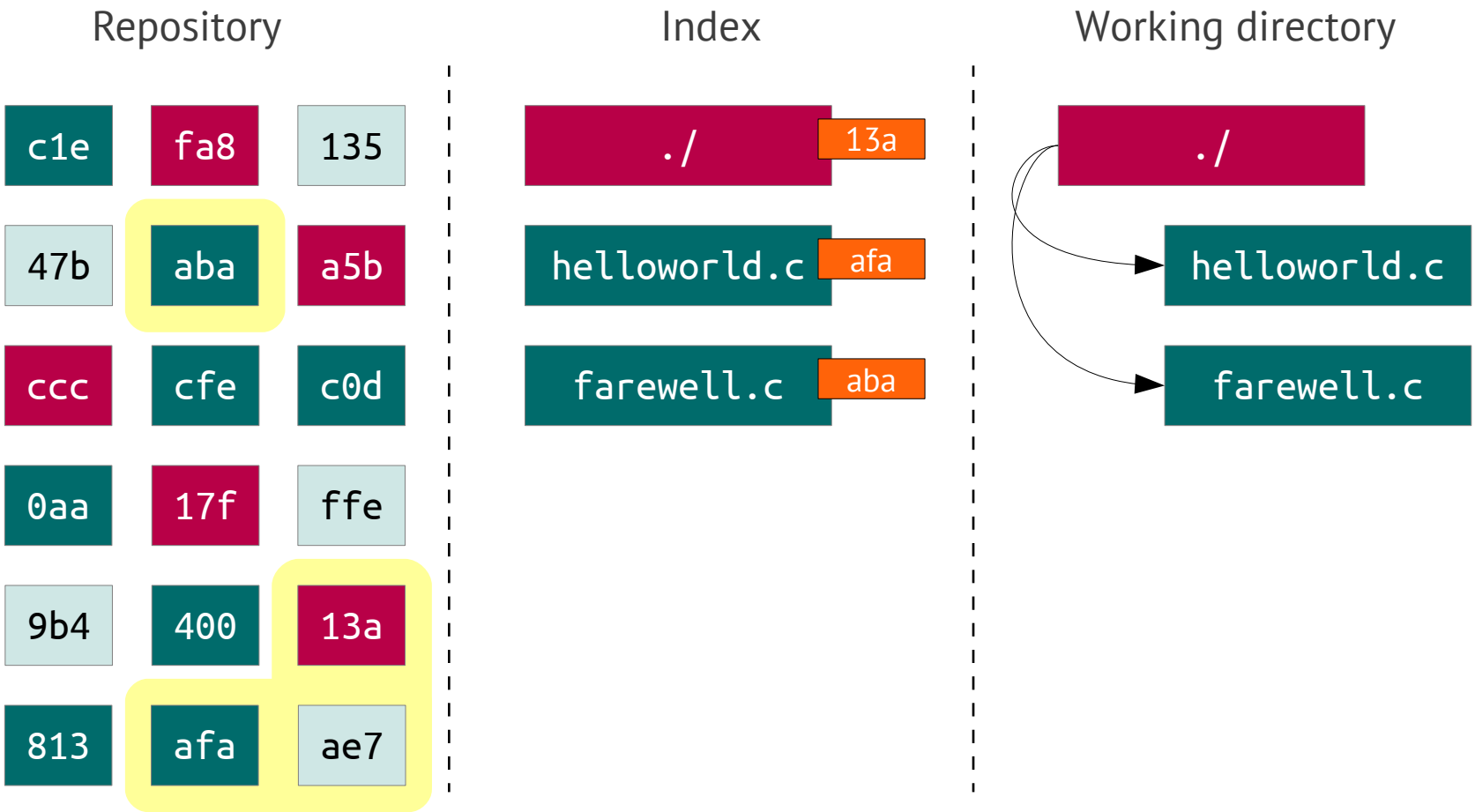
GIT workflow

Staging and commiting



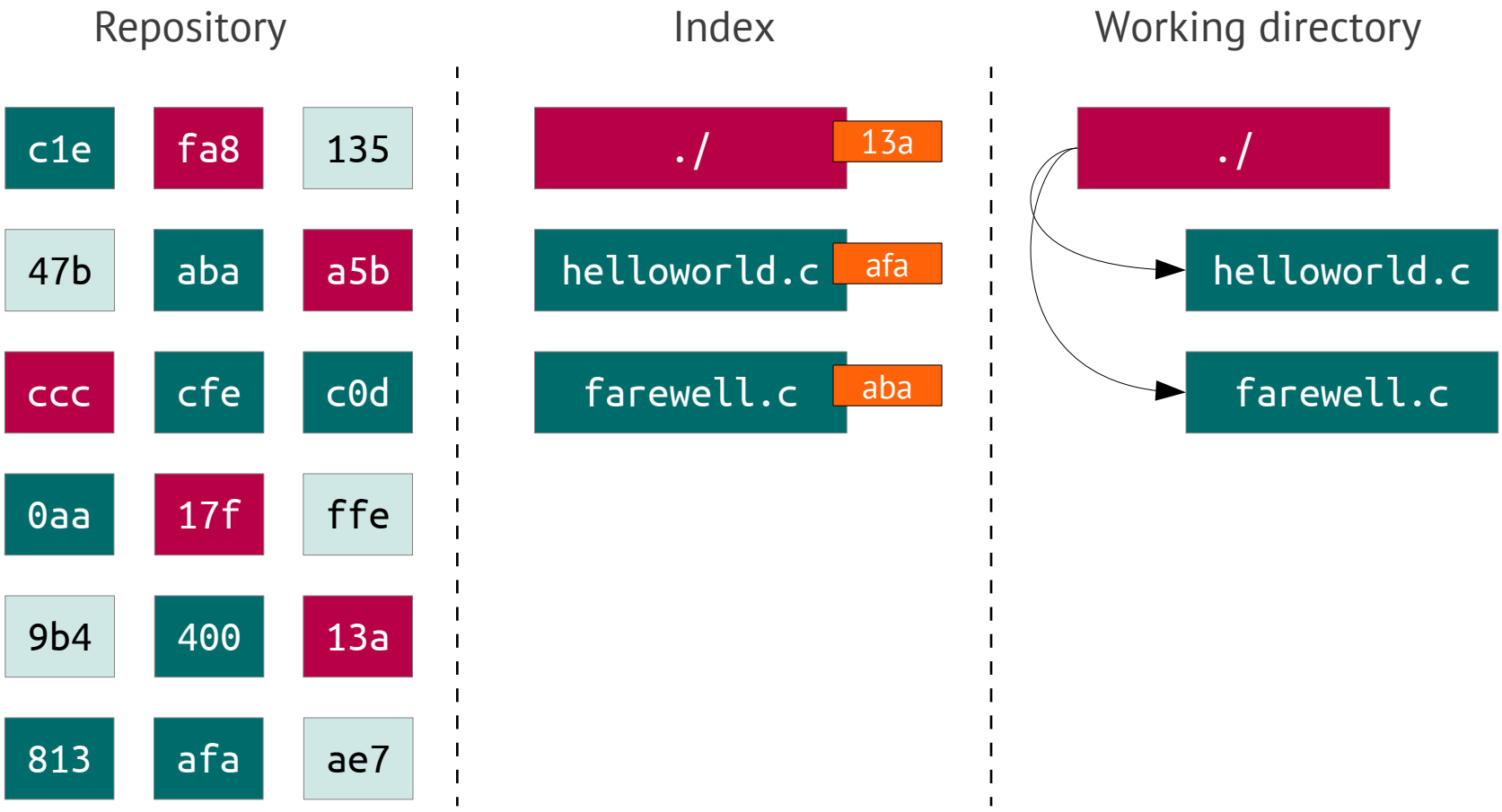
GIT workflow

Staging and commiting



GIT workflow

Staging and commiting



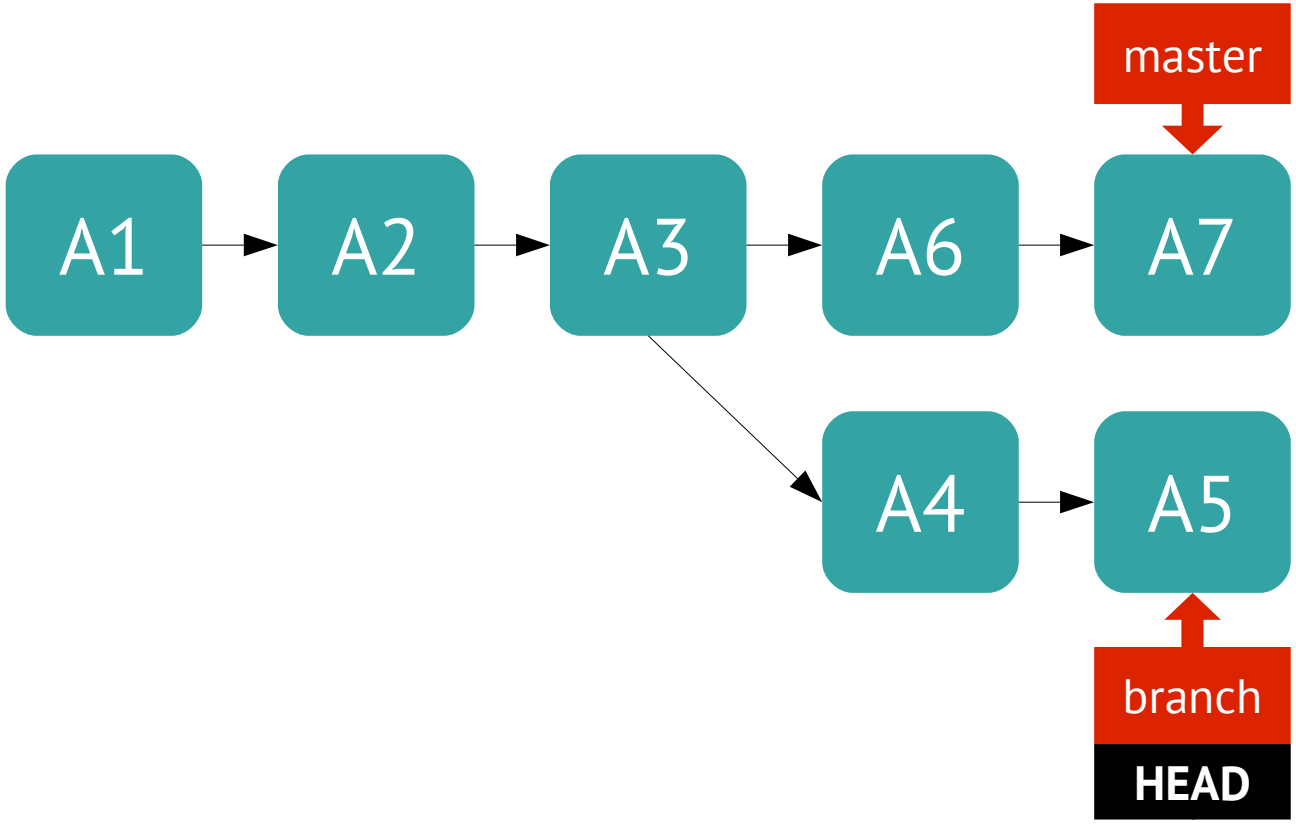
GIT workflow

- ~~Create your branch~~
- ~~Edit files~~
- ~~Stage your changes~~
- ~~Commit the changes~~
- **Rebase your branch from master**
- Merge to master
- Push to central repository

Rebasing

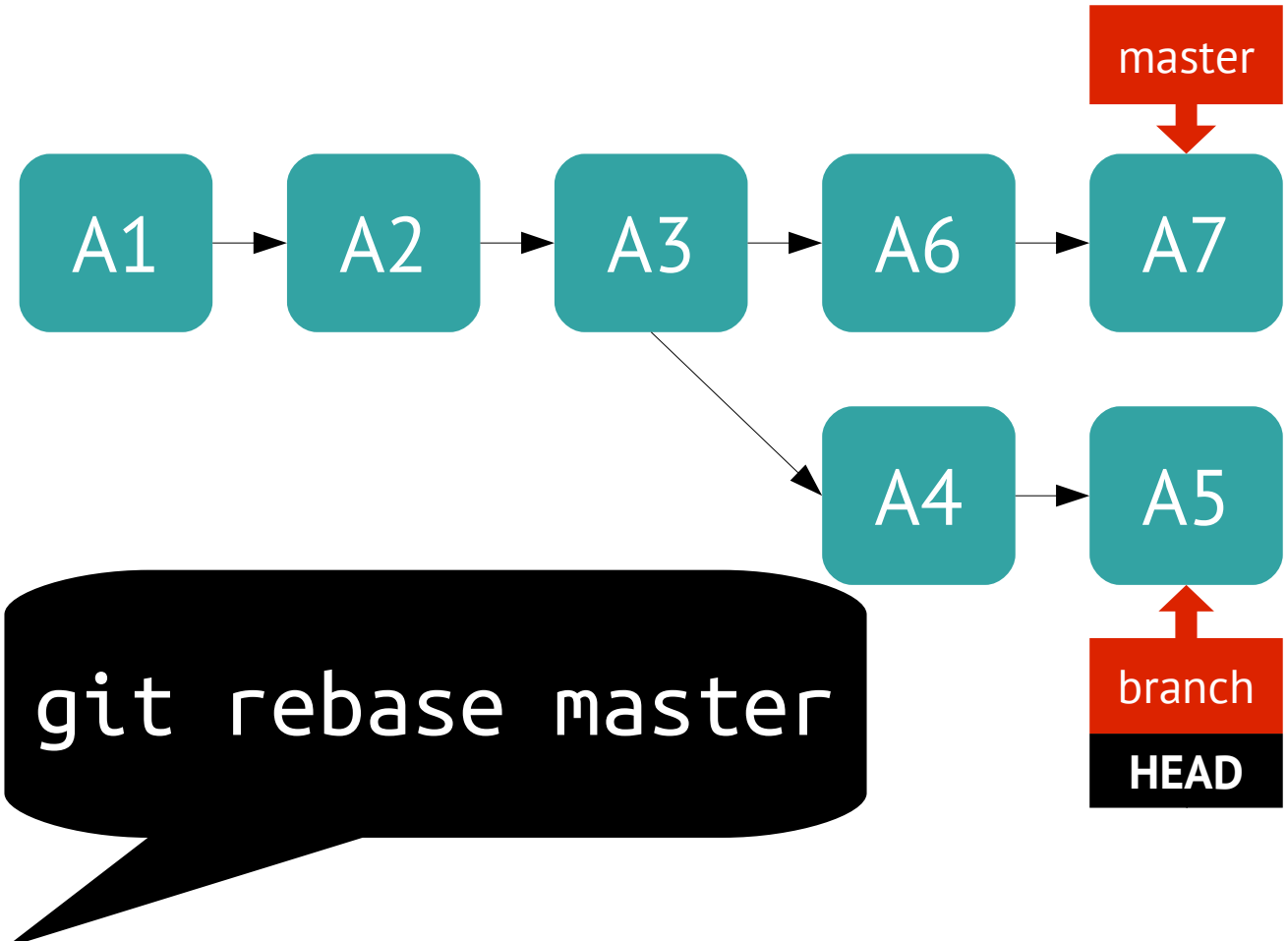
GIT workflow

Rebasing



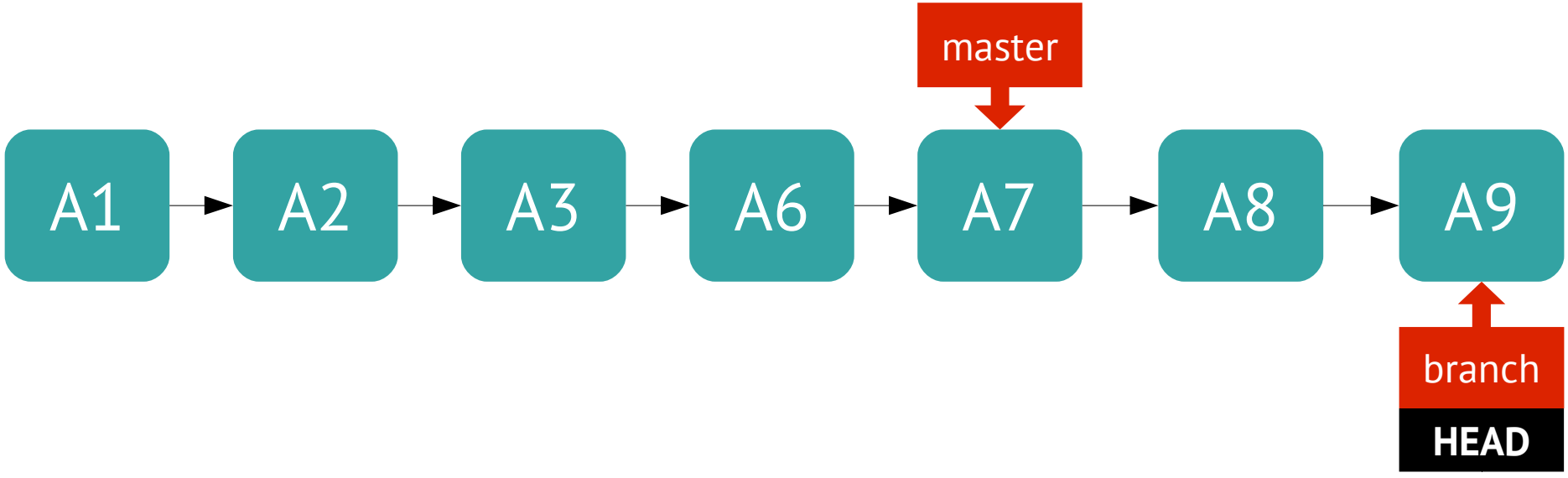
GIT workflow

Rebasing



GIT workflow

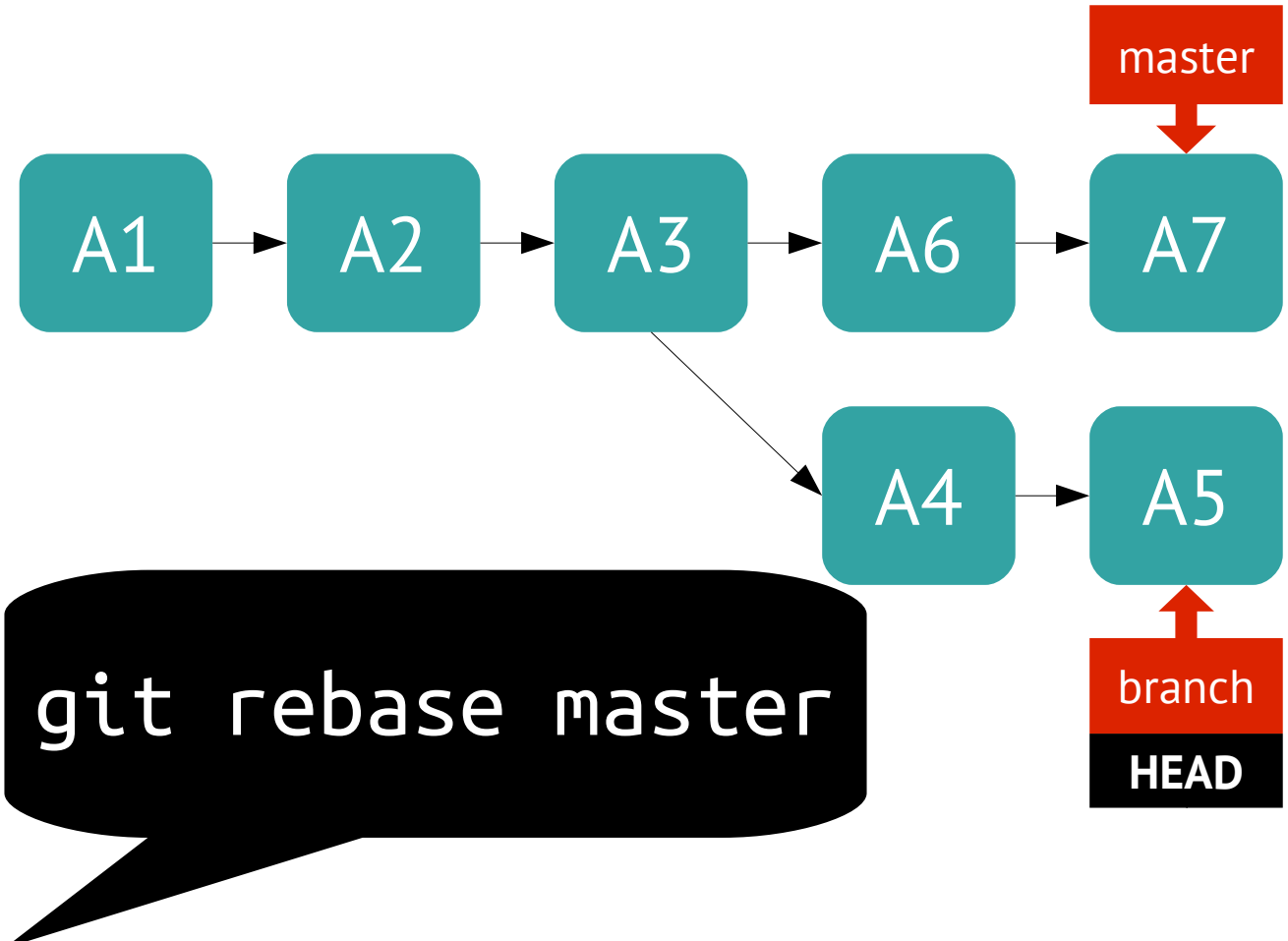
Rebasing



Huh?
Where is my A4 and A5?
What is happening?

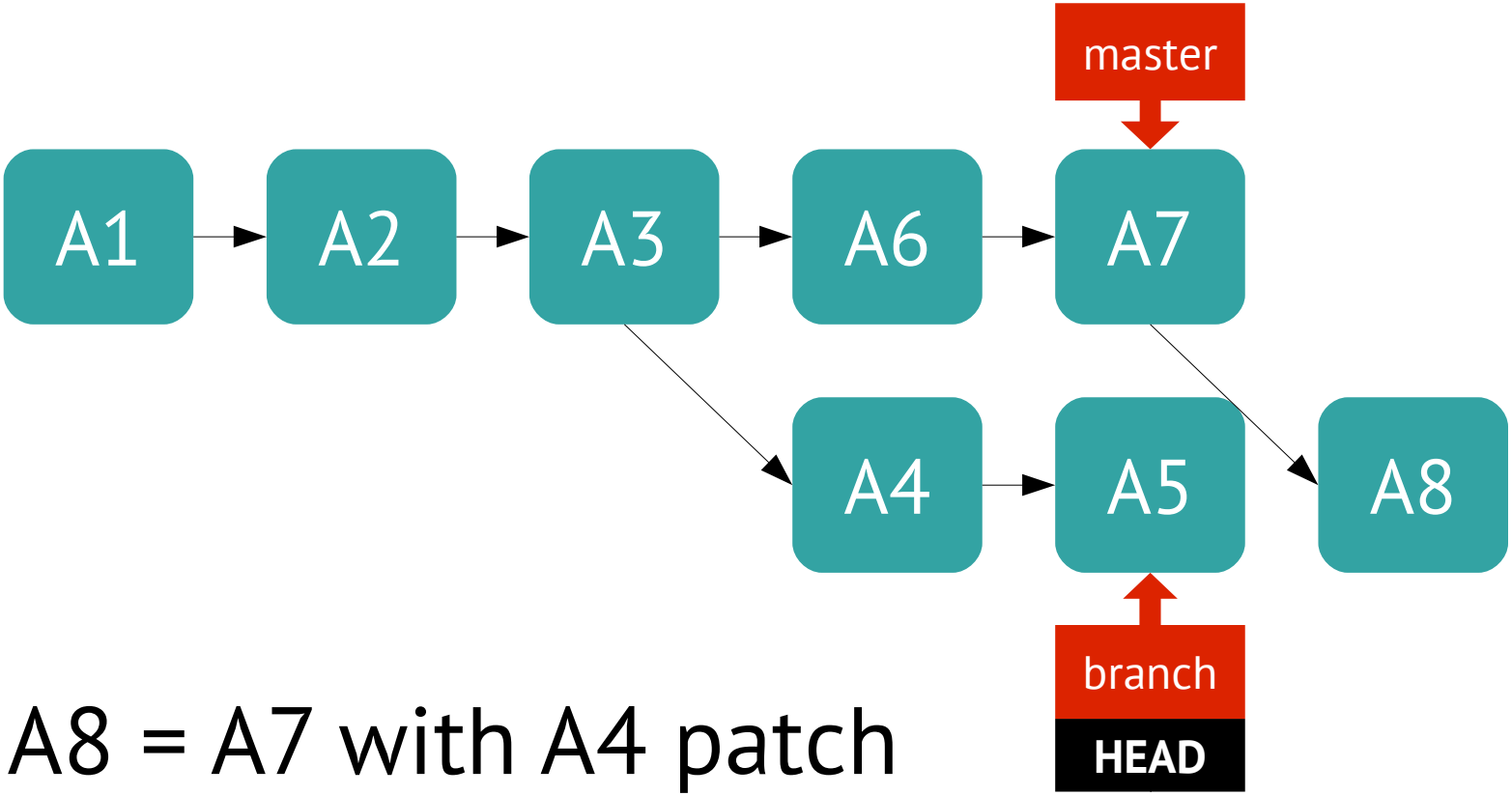
GIT workflow

Rebasing



GIT workflow

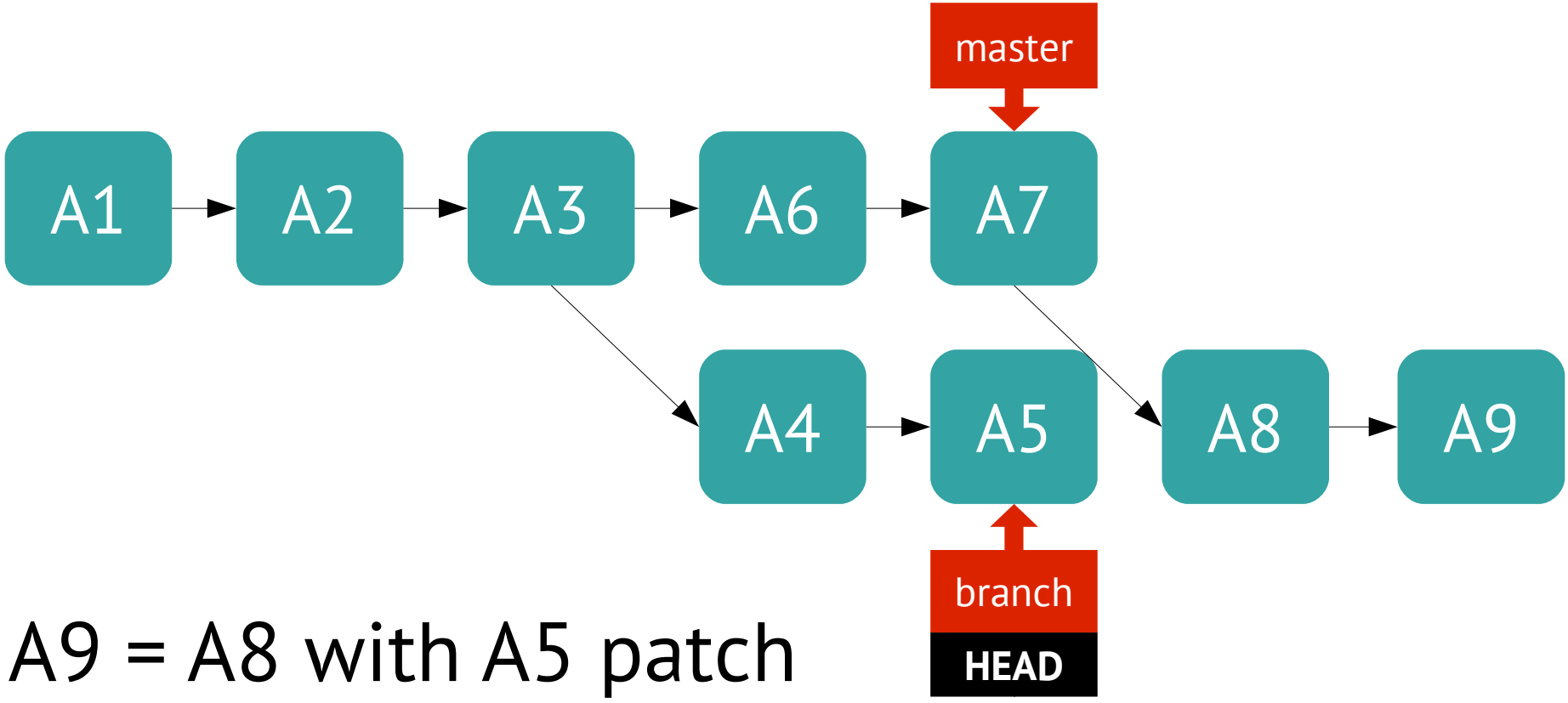
Rebasing



A8 = A7 with A4 patch

GIT workflow

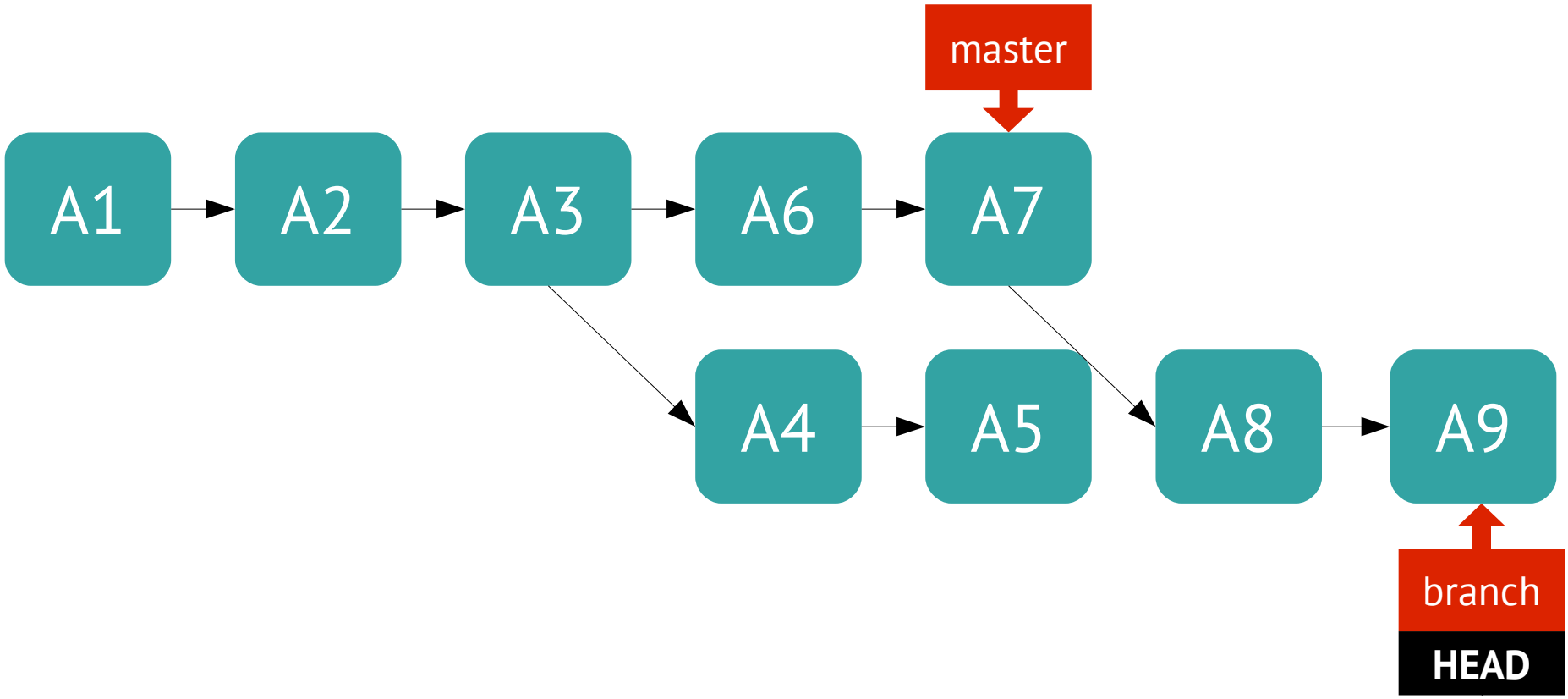
Rebasing



A9 = A8 with A5 patch

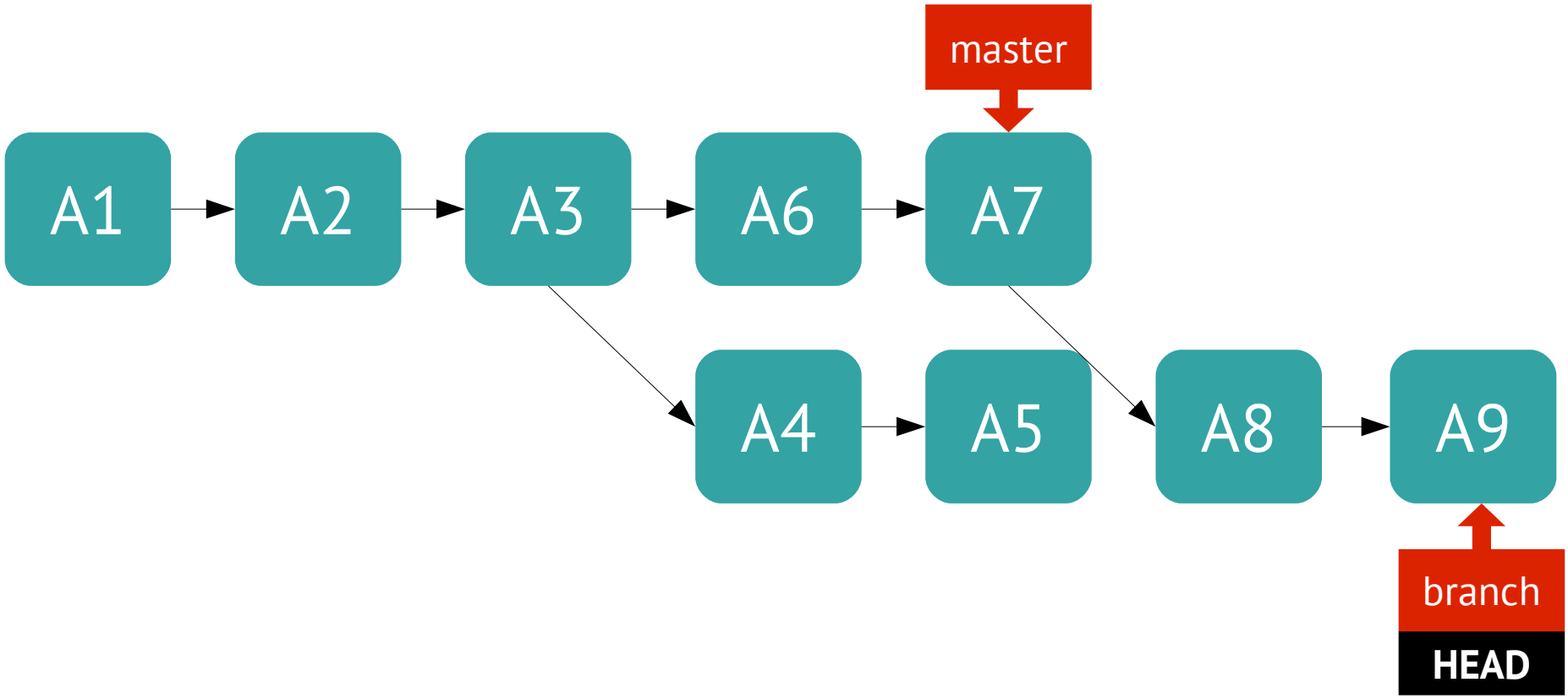
GIT workflow

Rebasing



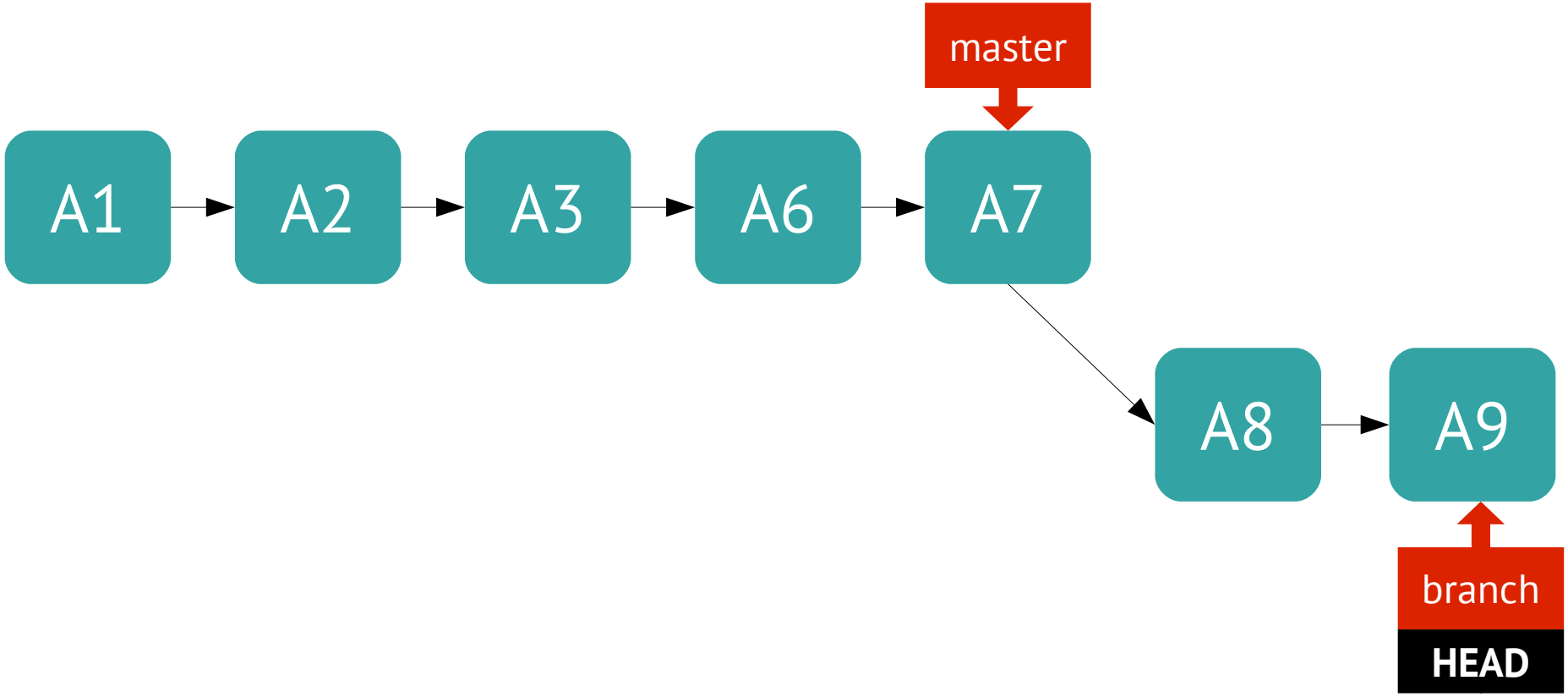
GIT workflow

Rebasing



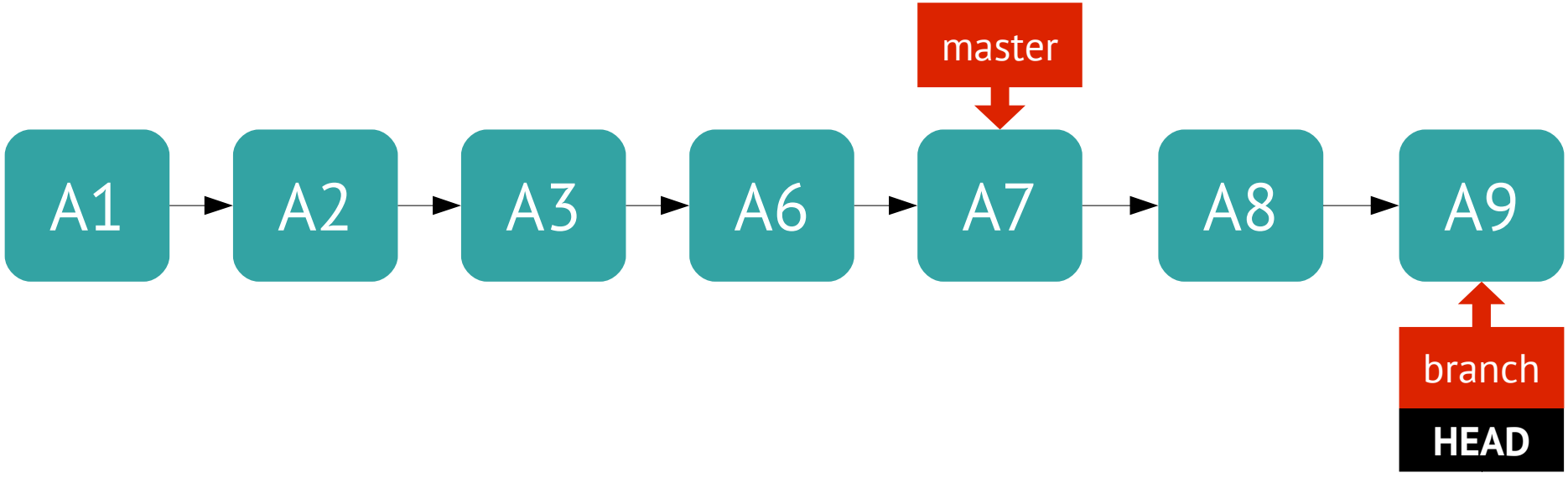
GIT workflow

Rebasing



GIT workflow

Rebasing



GIT workflow

Rebasing

Never rebase when you are on a shared branch

GIT workflow

Rebasing

Never rebase when you are on **a shared branch**

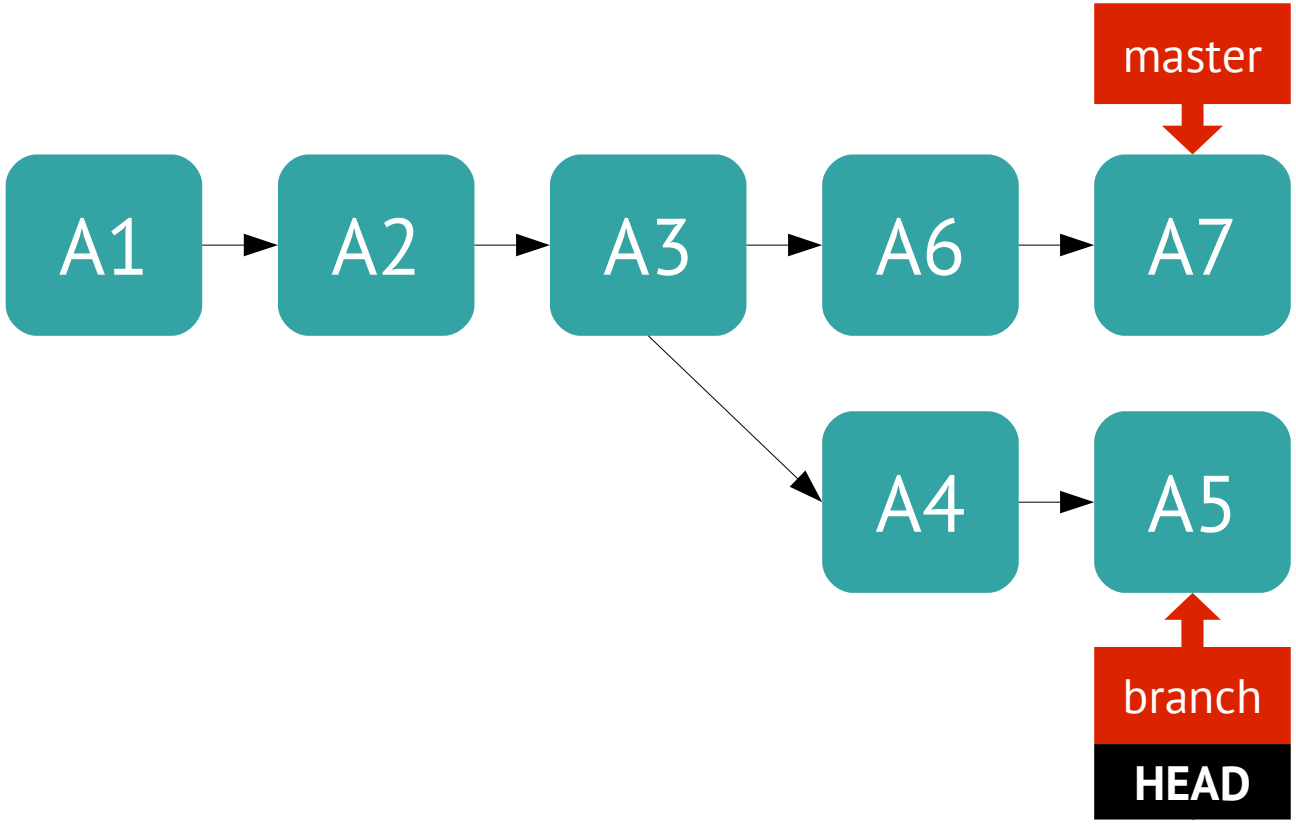
GIT workflow

Rebasing

Never rebase a shared branch

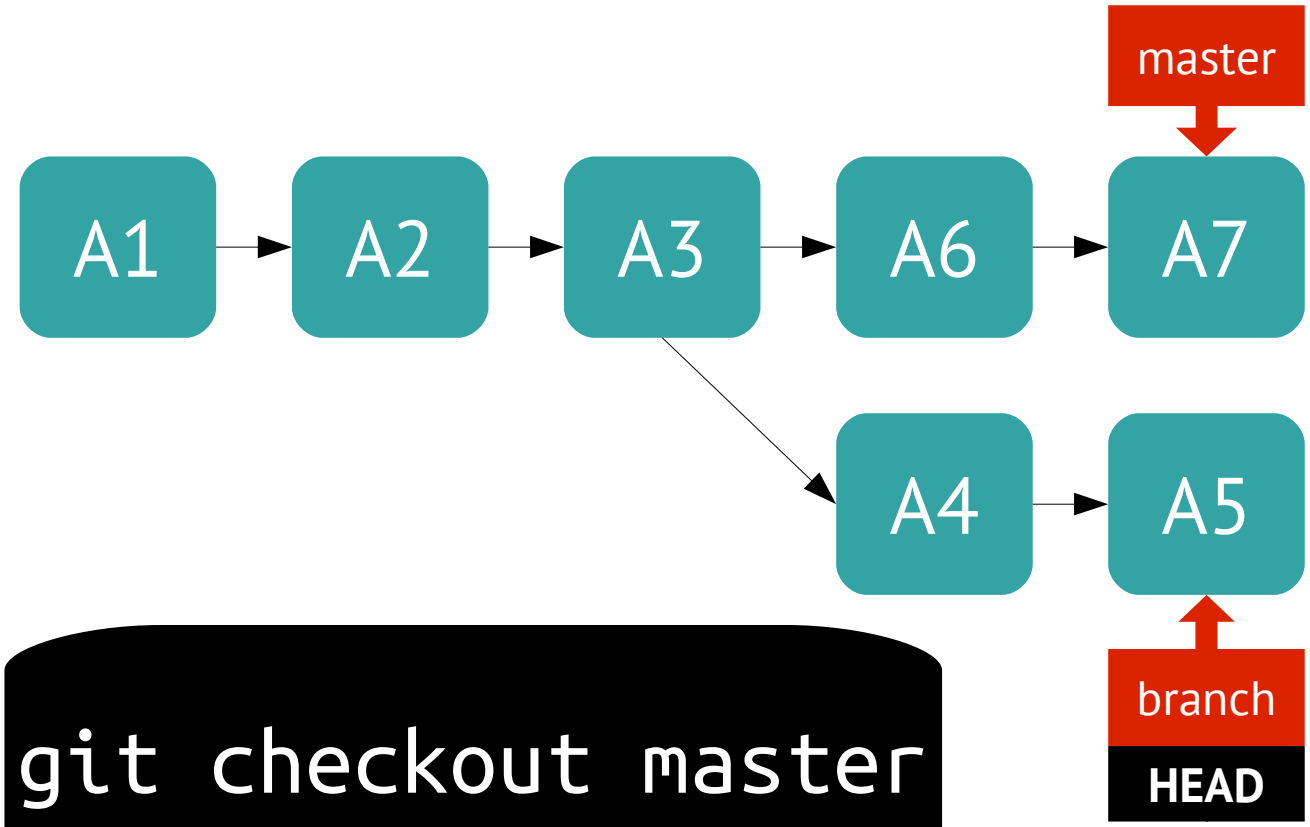
GIT workflow

Rebasing



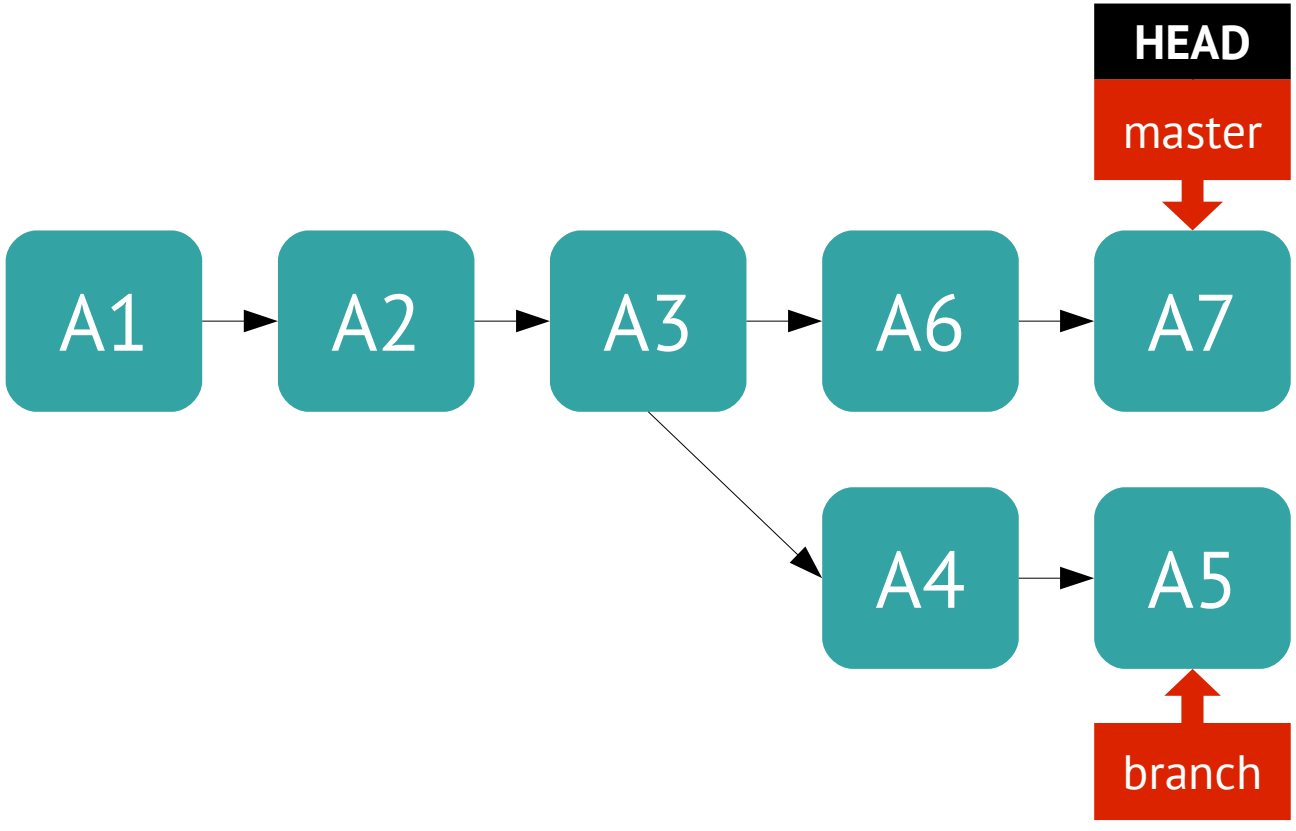
GIT workflow

Rebasing



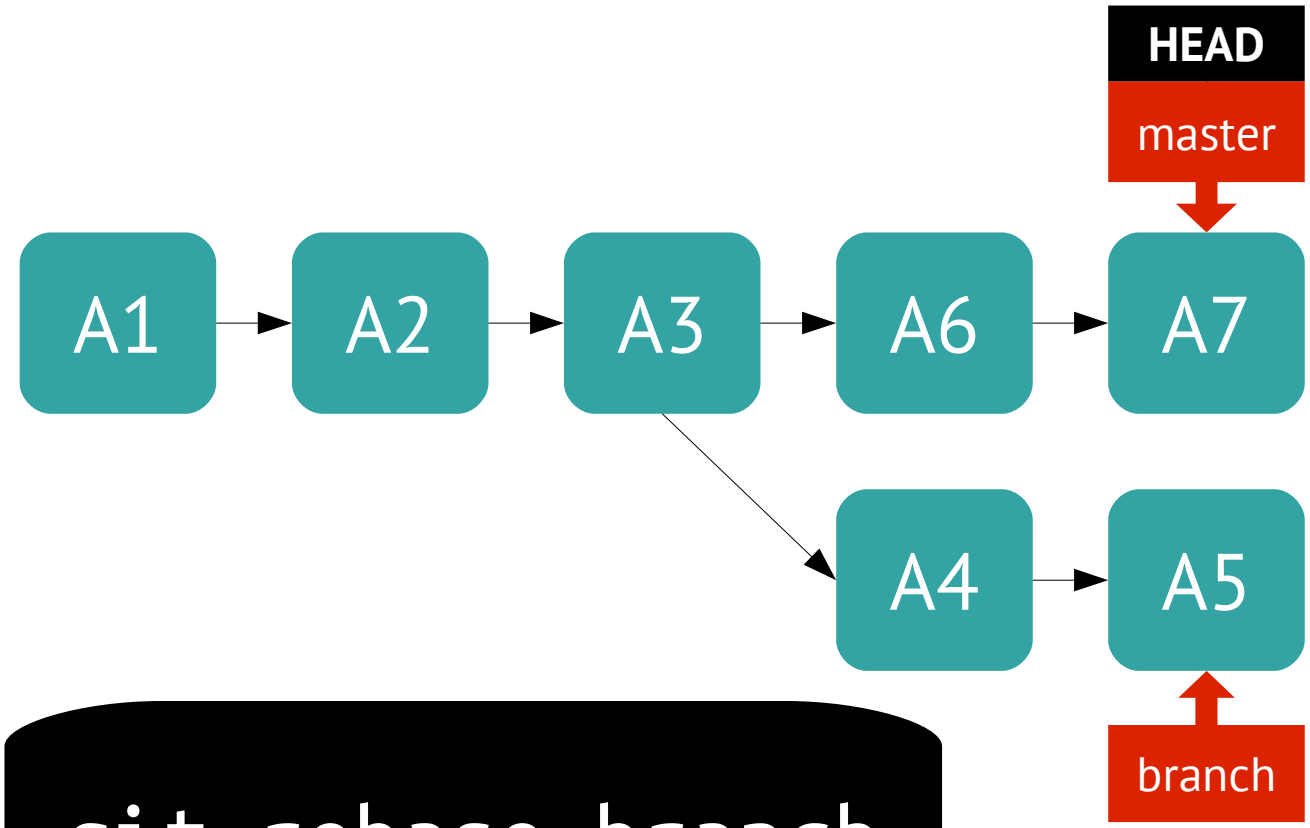
GIT workflow

Rebasing



GIT workflow

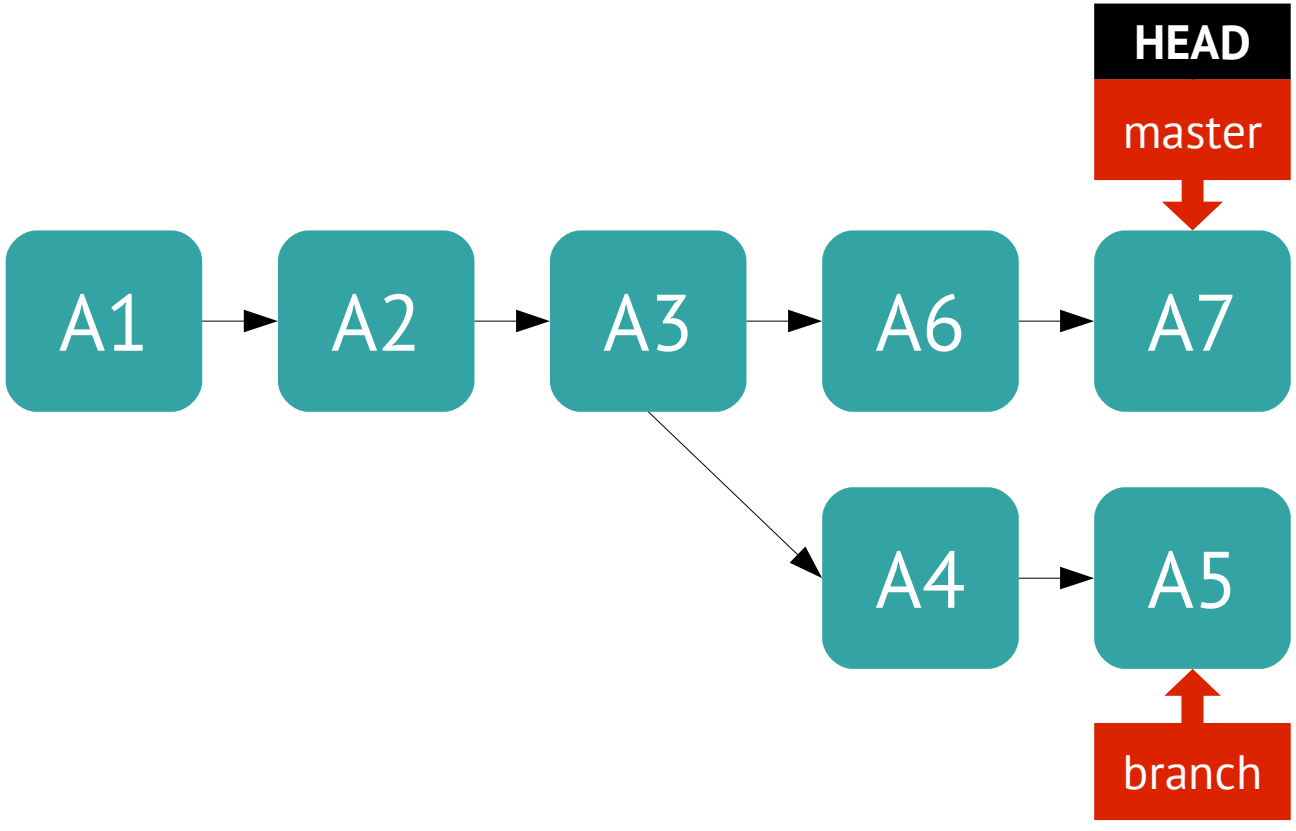
Rebasing




```
git rebase branch
```

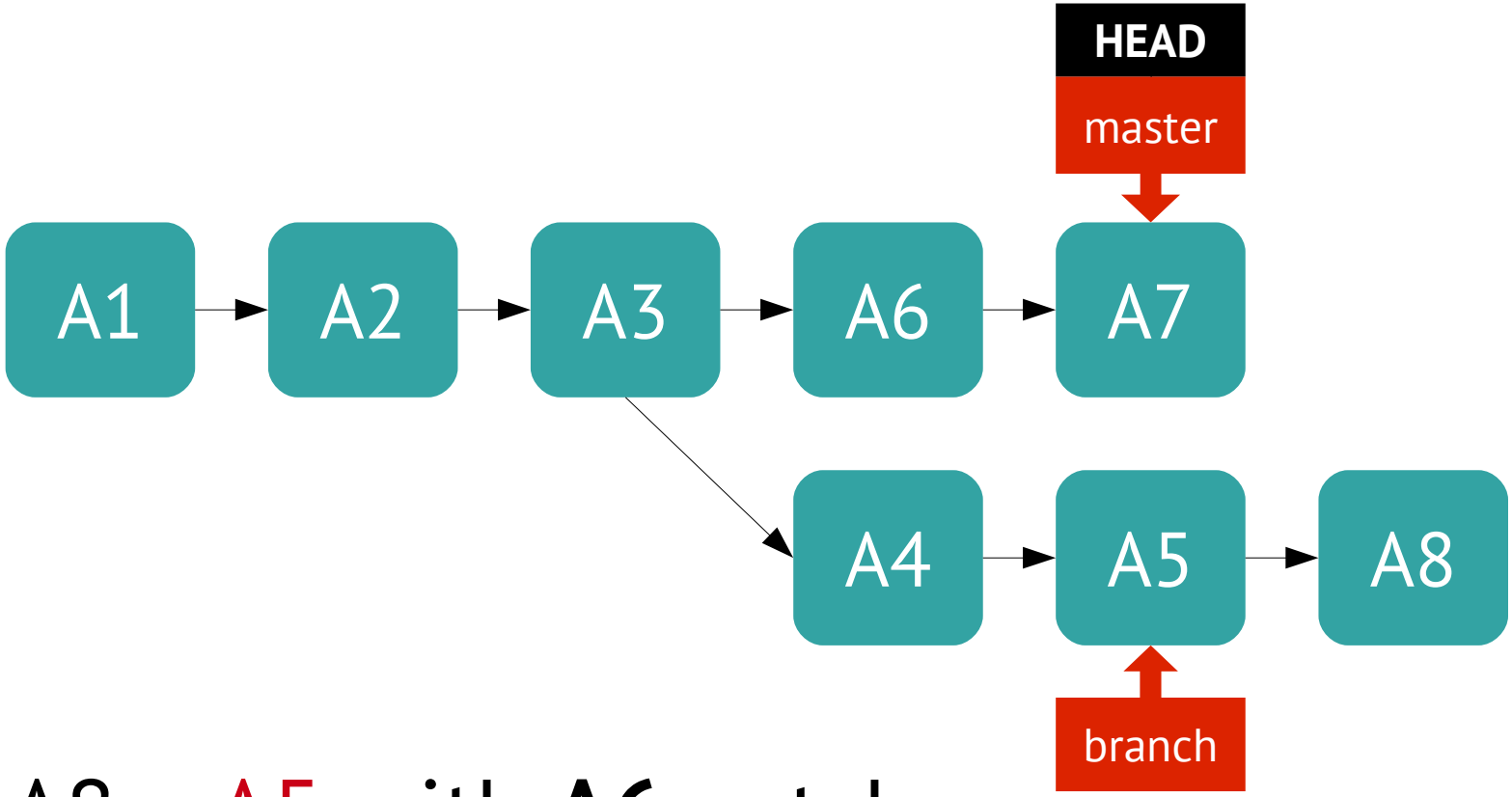
GIT workflow

Rebasing



GIT workflow

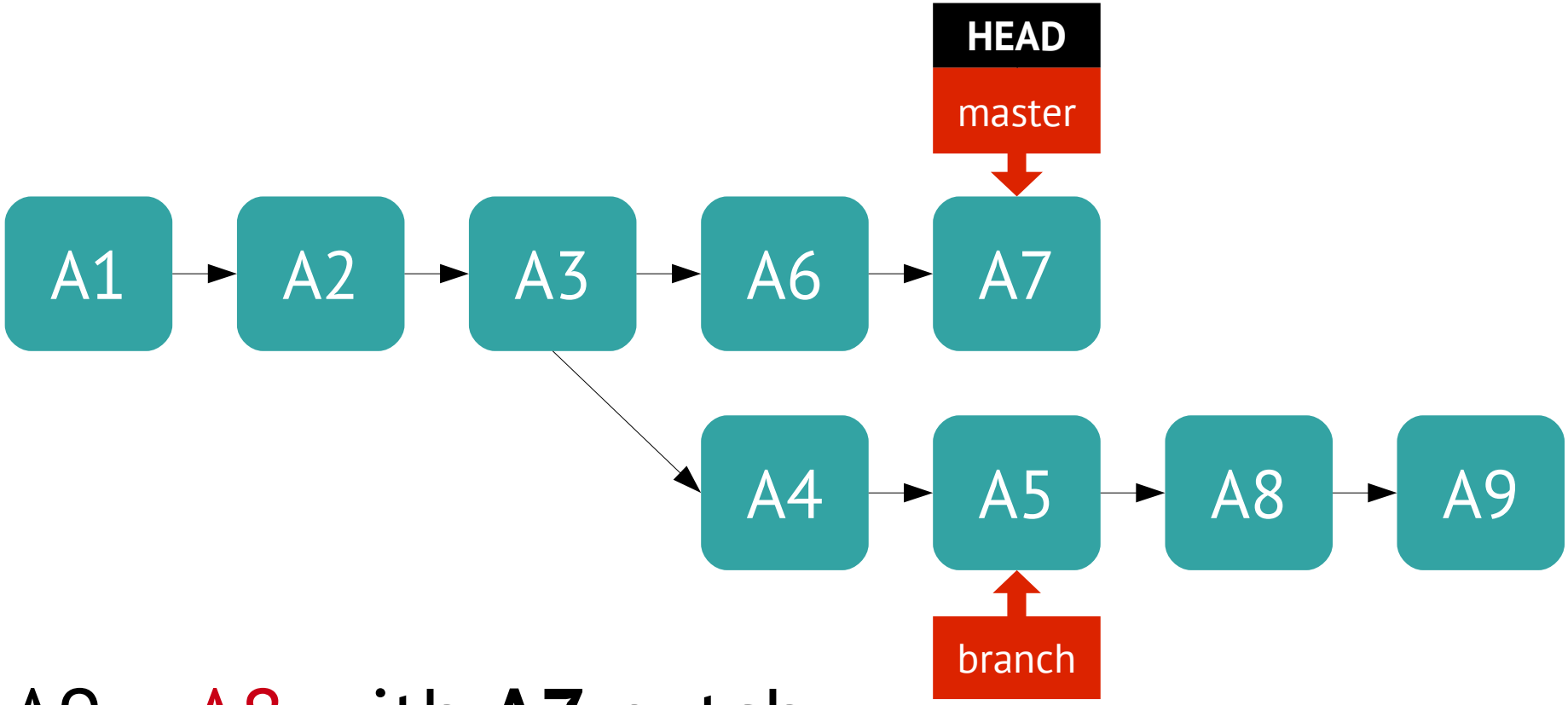
Rebasing



A8 = A5 with **A6** patch

GIT workflow

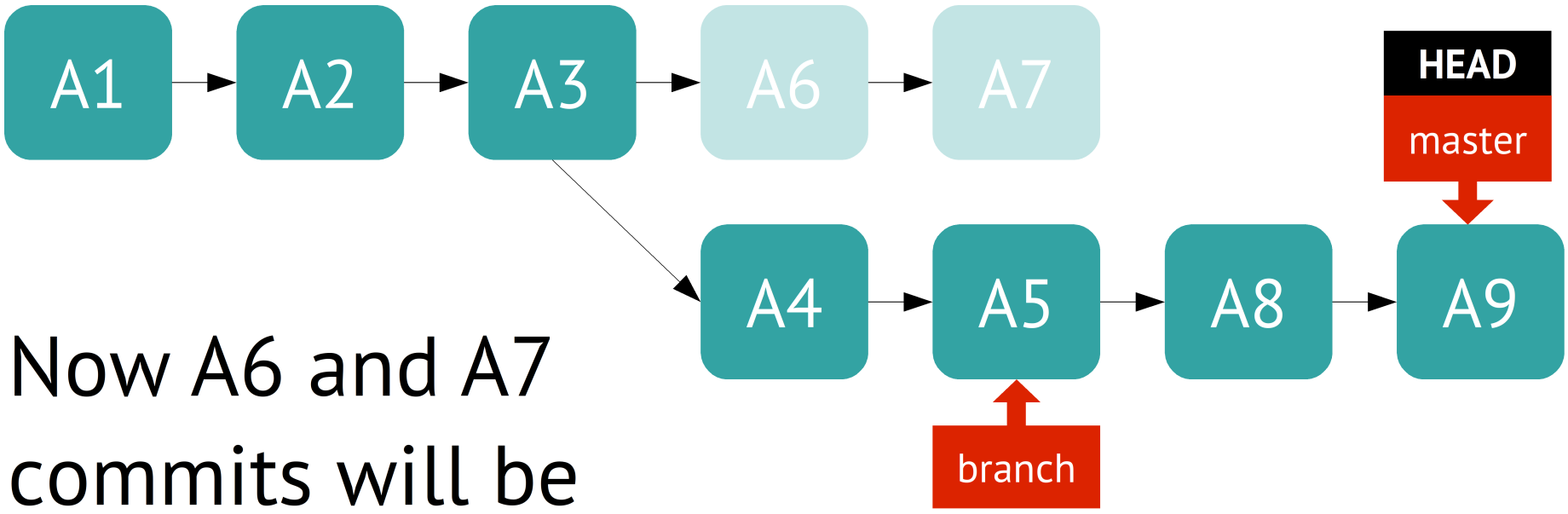
Rebasing



A9 = A8 with **A7** patch

GIT workflow

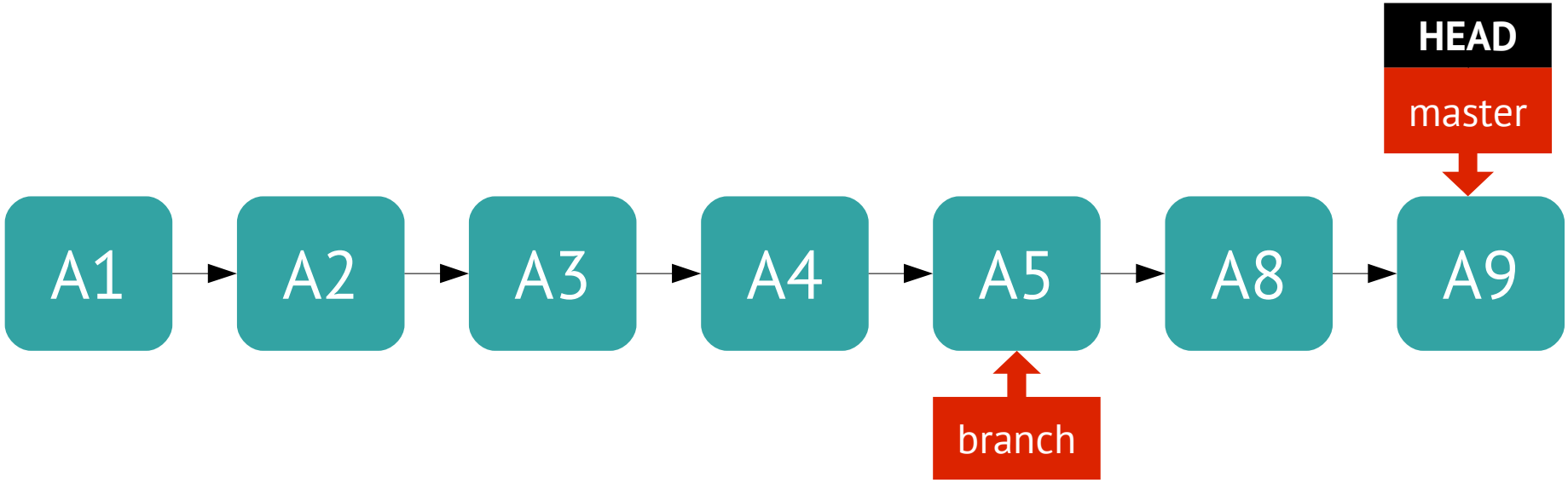
Rebasing



Now A6 and A7 commits will be deleted. Forever.

GIT workflow

Rebasing



You have broken common branch. If you push it somewhere, it will break other's ones.

GIT workflow

Rebasing

Never rebase a shared branch, you idiot!

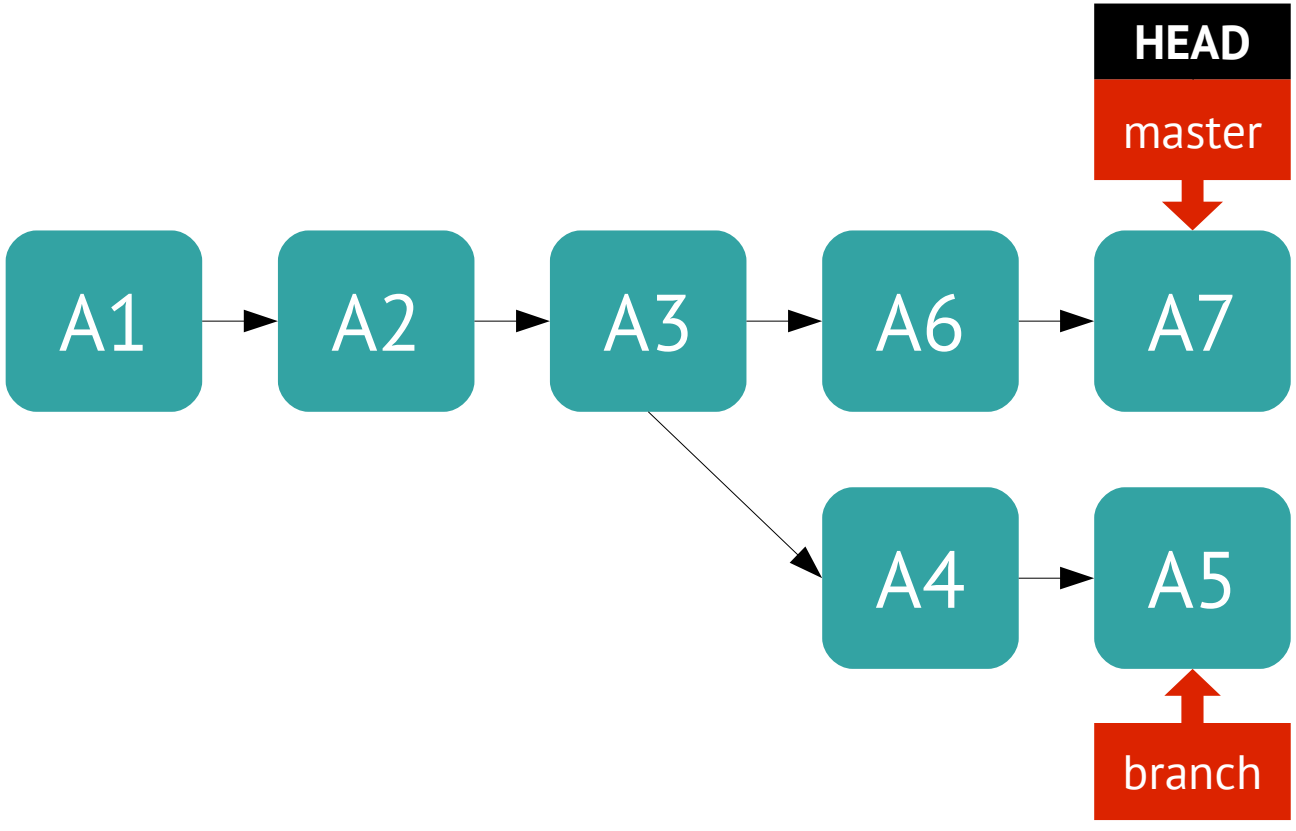
GIT workflow

- ~~Create your branch~~
- ~~Edit files~~
- ~~Stage your changes~~
- ~~Commit the changes~~
- ~~Rebase your branch from master~~
- **Merge to master**
- Push to central repository

Merges

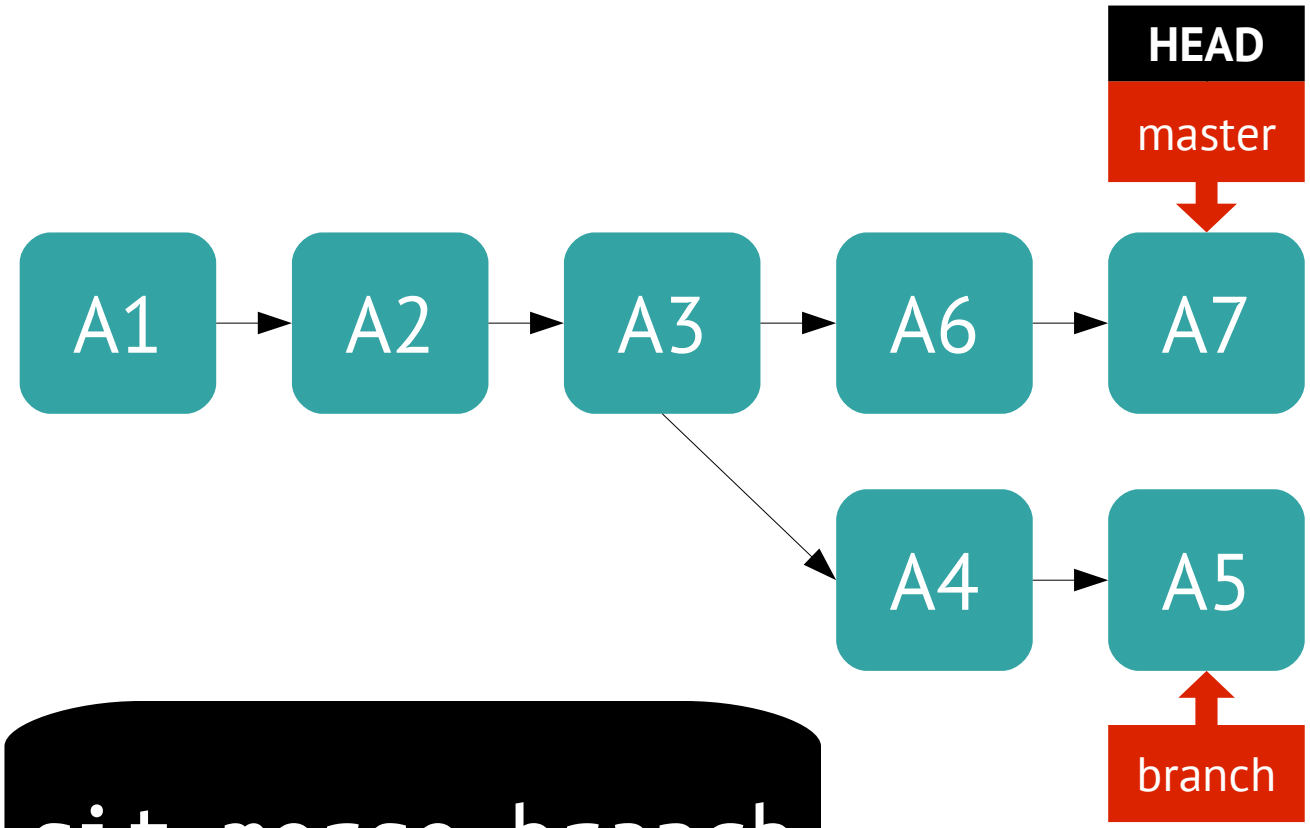
GIT workflow

Merges



GIT workflow

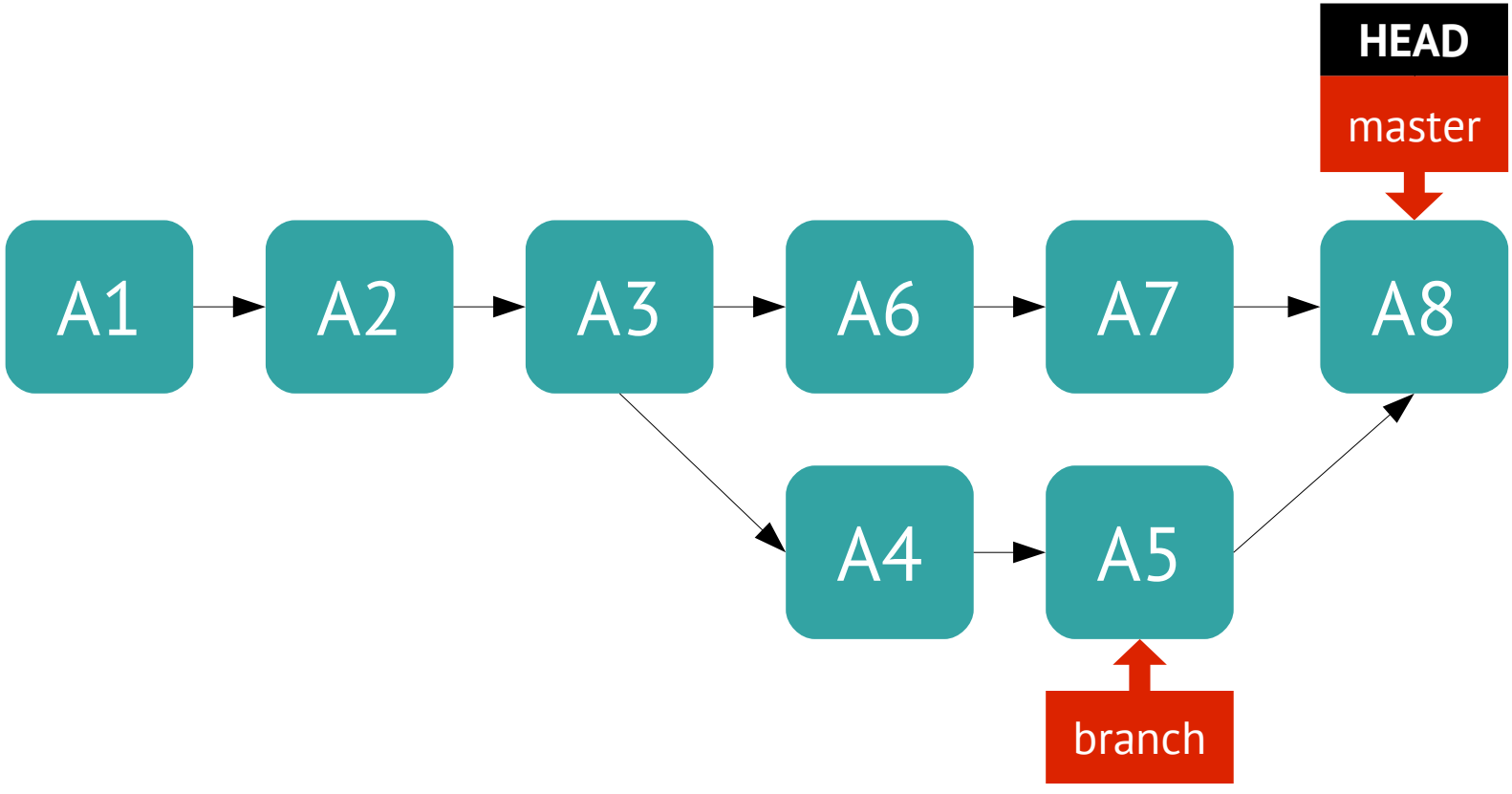
Merges




```
git merge branch
```

GIT workflow

Merges



Have you really thought
that GIT have
complicated merges?

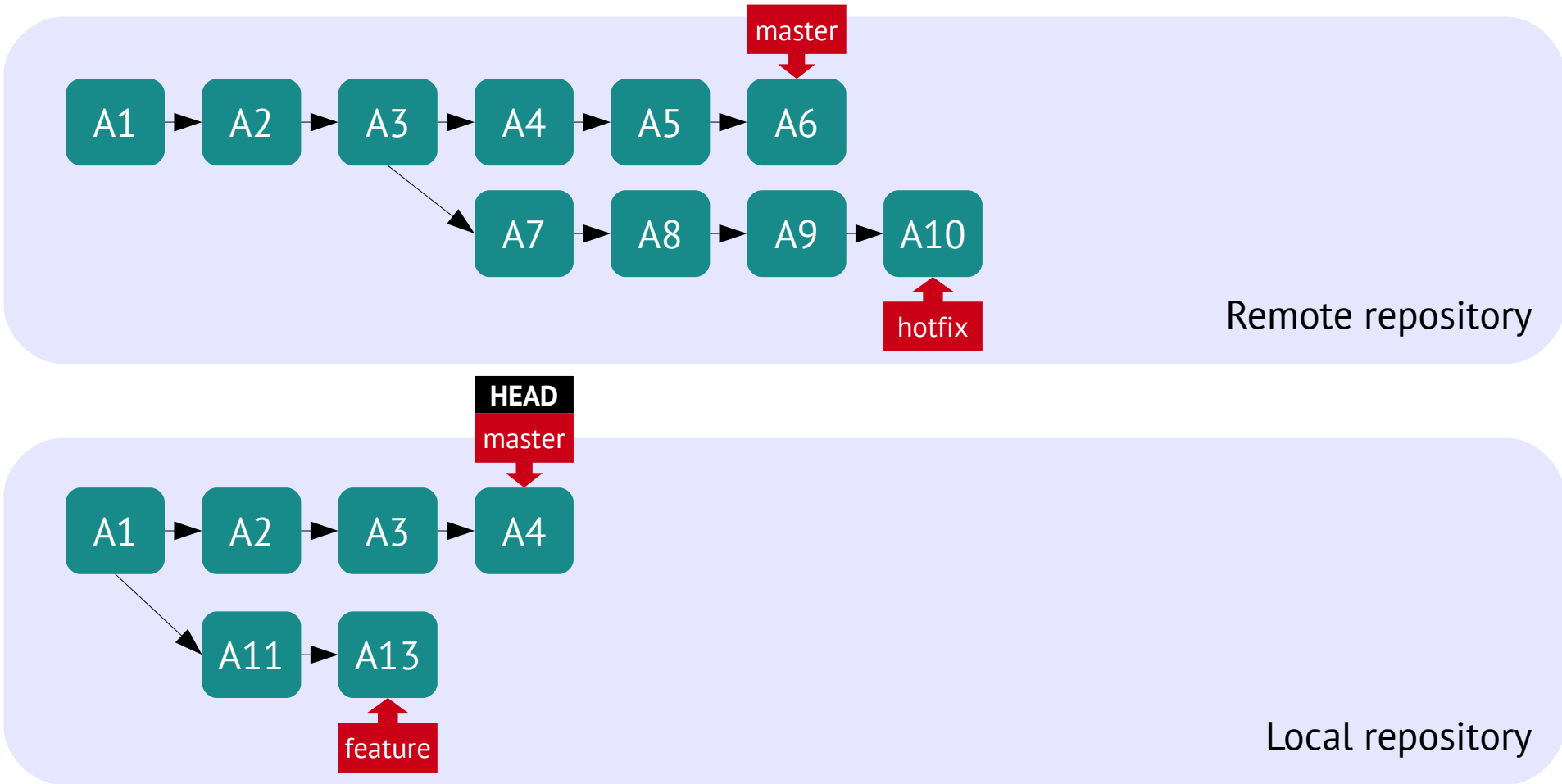
GIT workflow

- ~~Create your branch~~
- ~~Edit files~~
- ~~Stage your changes~~
- ~~Commit the changes~~
- ~~Rebase your branch from master~~
- ~~Merge to master~~
- **Push to central repository**

Push and pull

GIT workflow

Push and pull



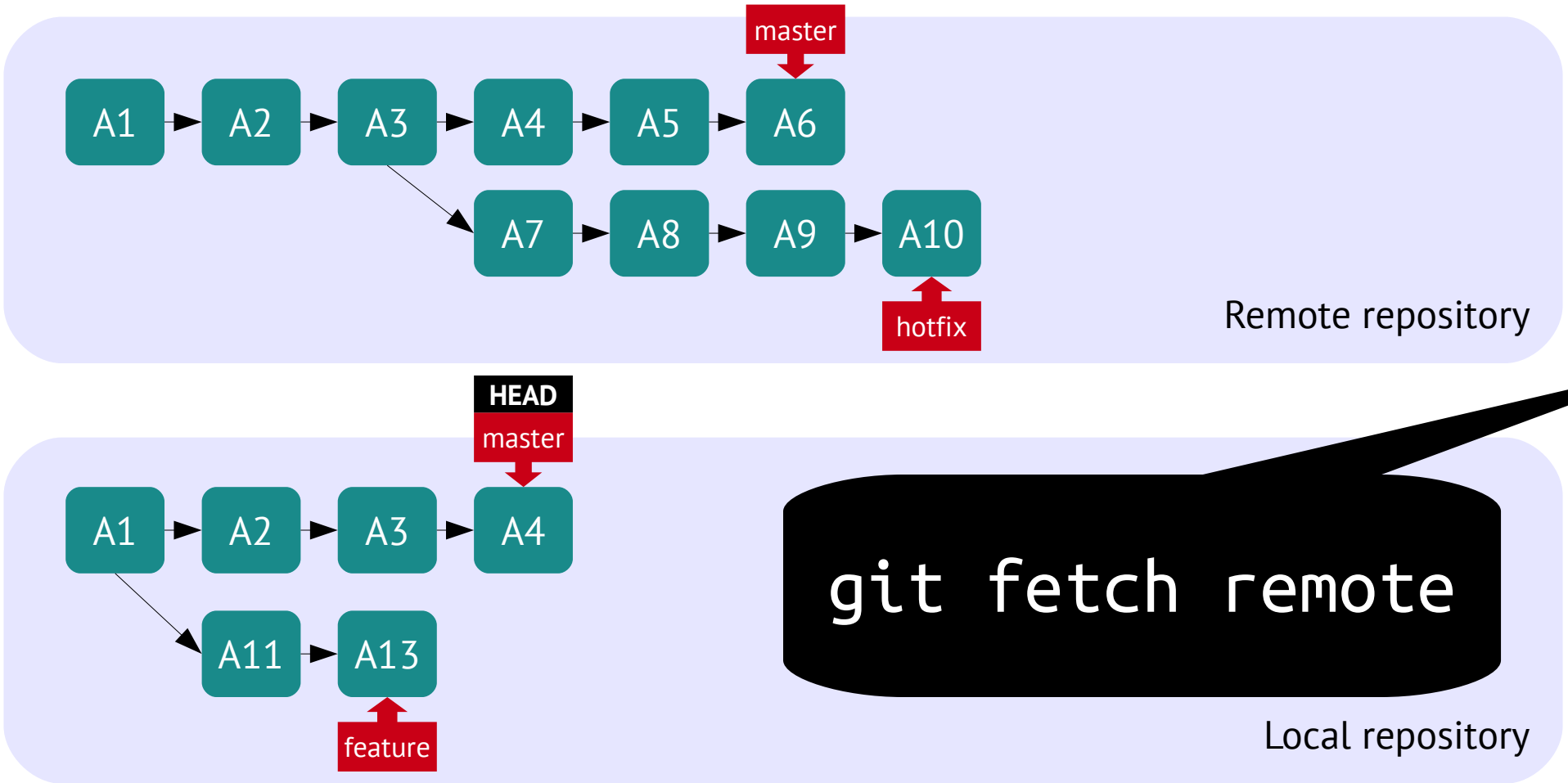
GIT workflow

Push and pull

```
git fetch
```

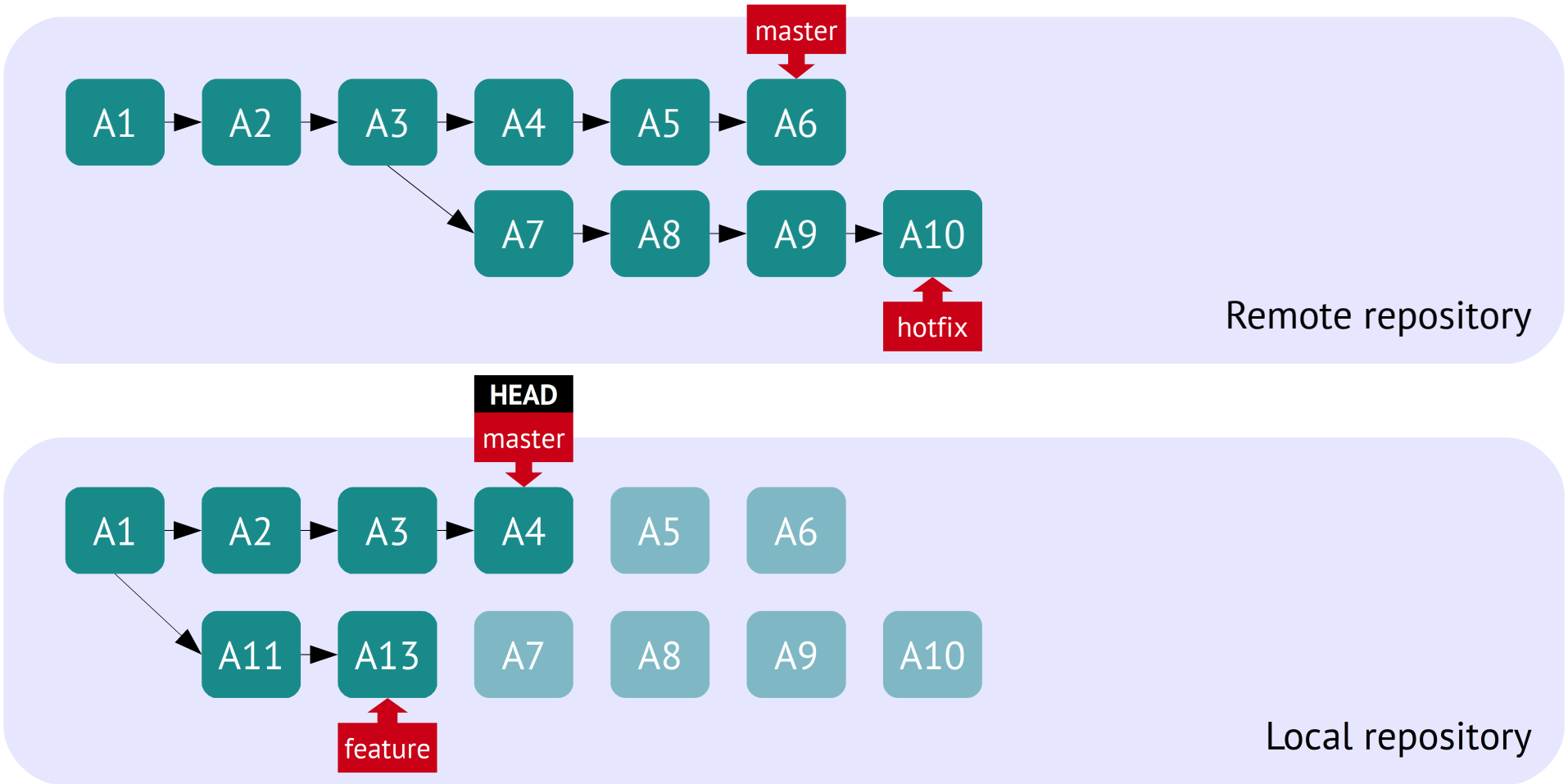
GIT workflow

Push and pull



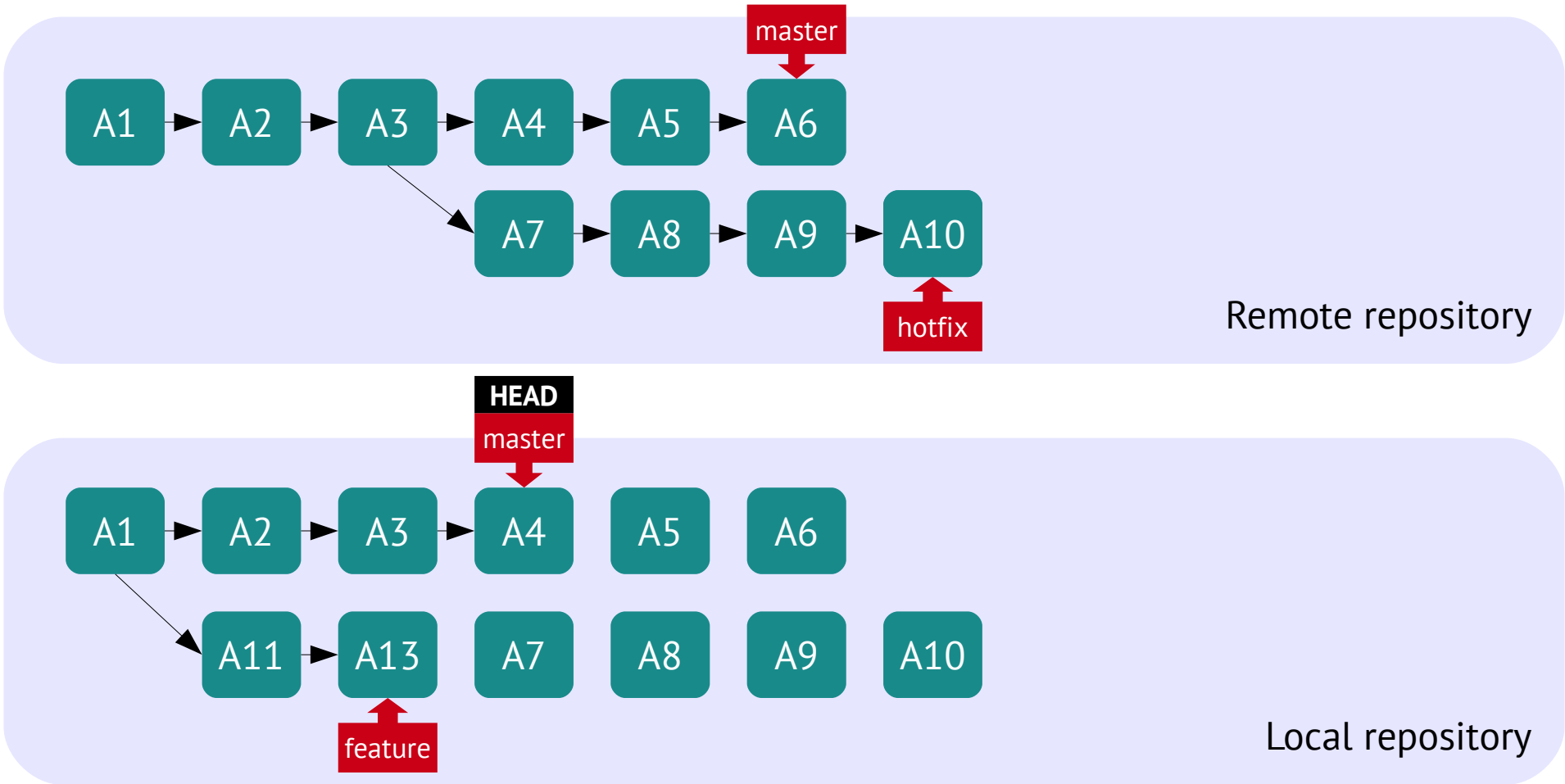
GIT workflow

Push and pull



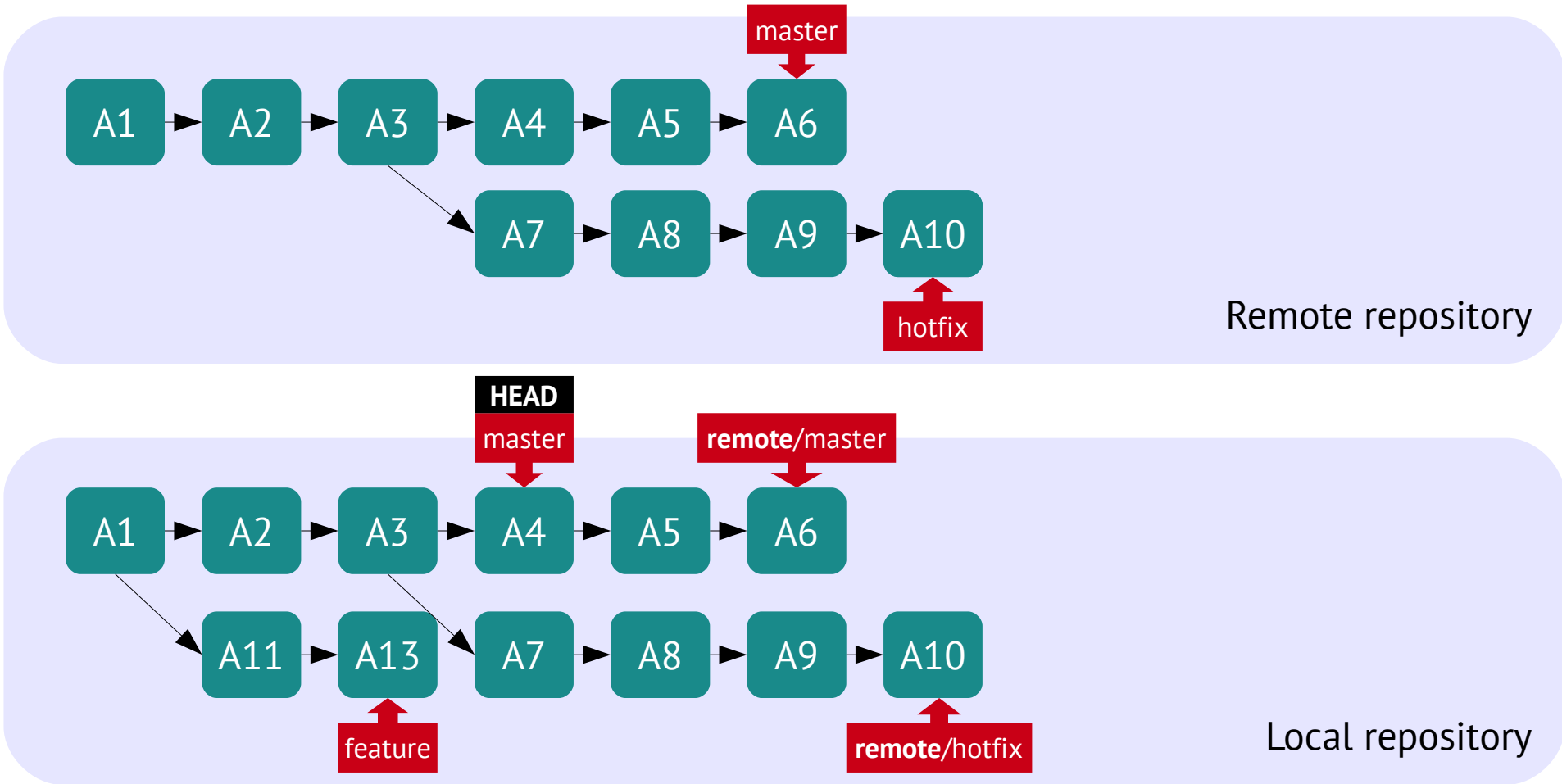
GIT workflow

Push and pull



GIT workflow

Push and pull



GIT workflow

Push and pull

```
git pull
```

GIT workflow

Push and pull

pull = fetch + merge

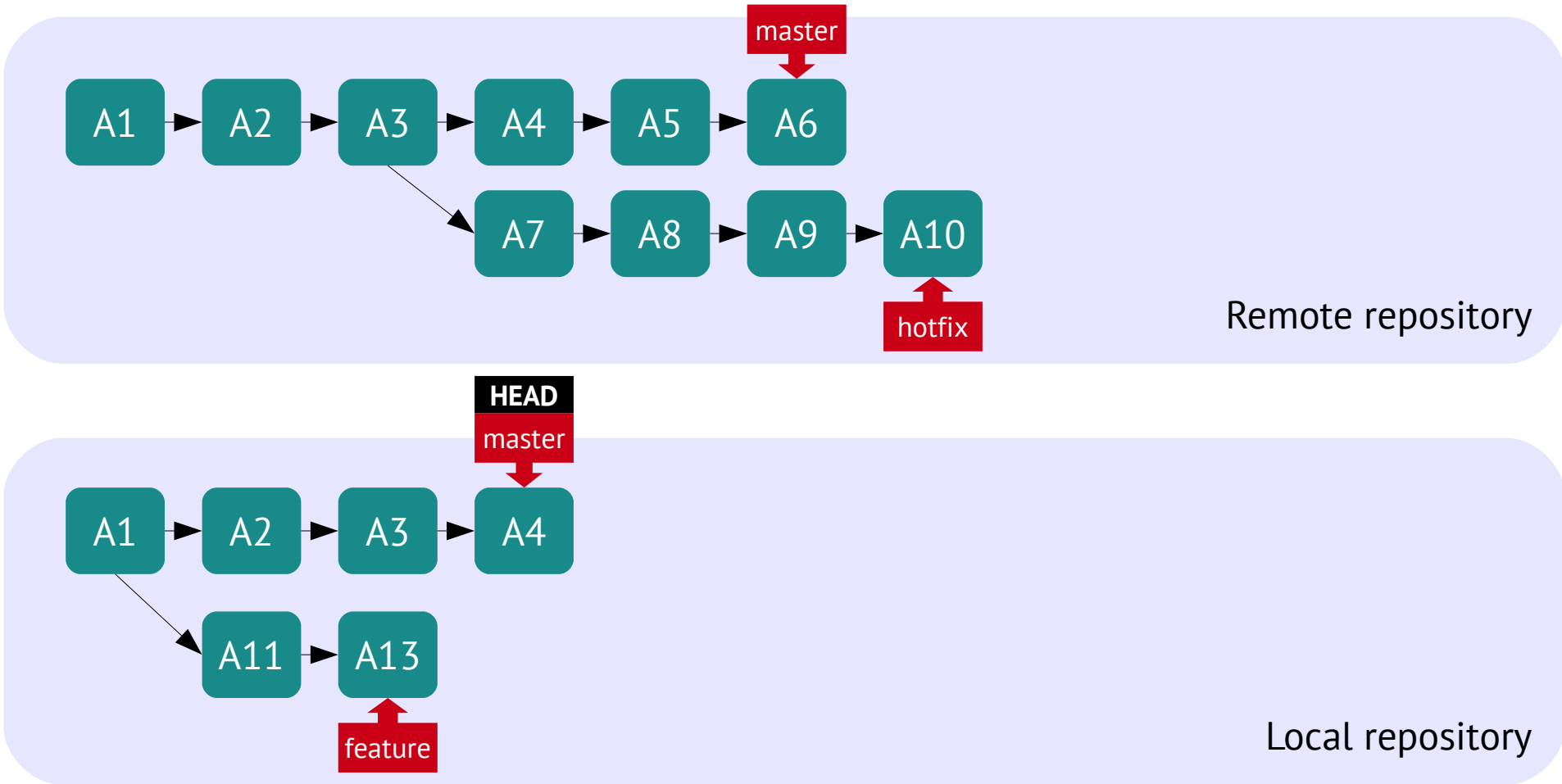
GIT workflow

Push and pull

```
git push
```

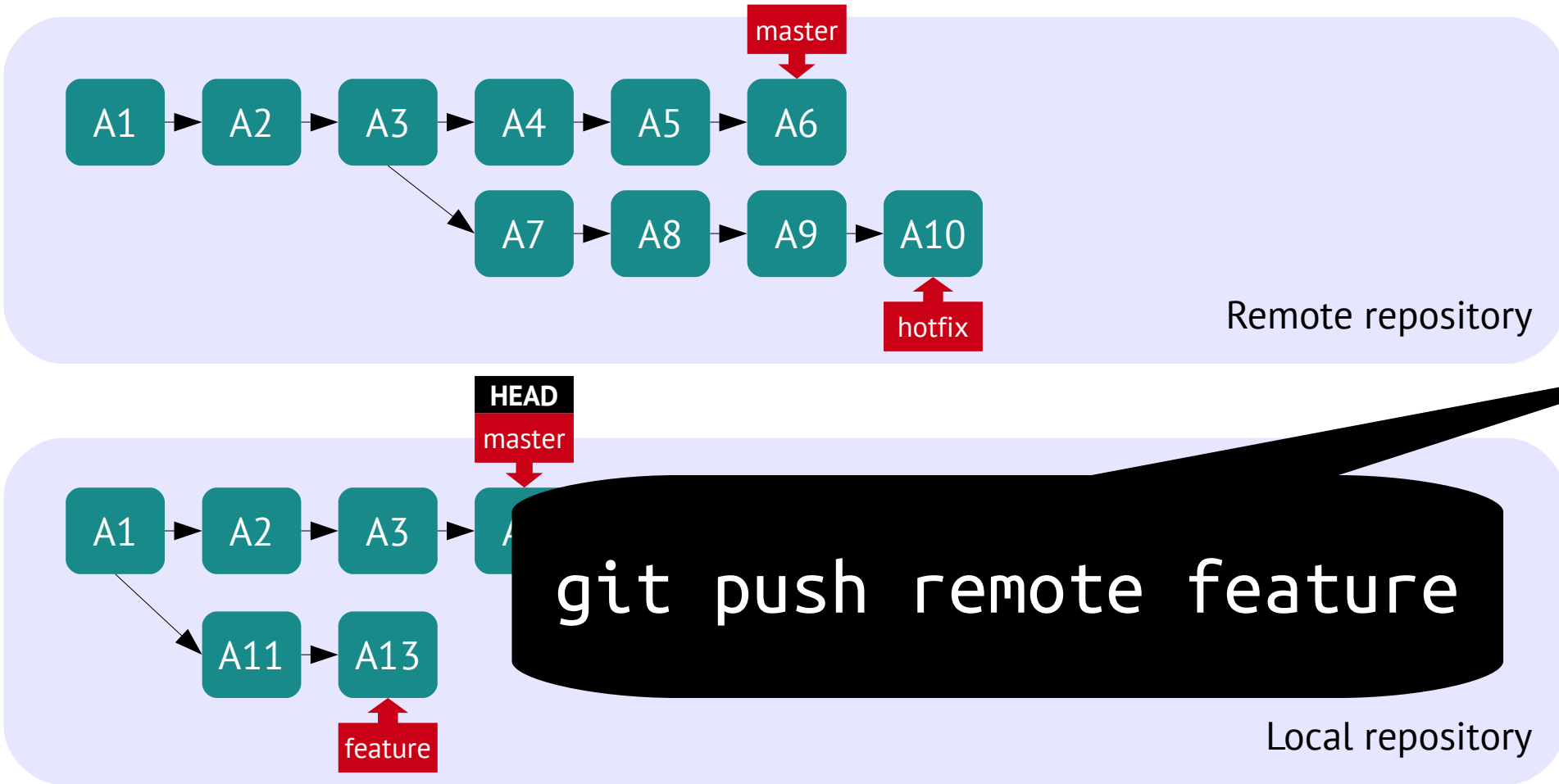
GIT workflow

Push and pull



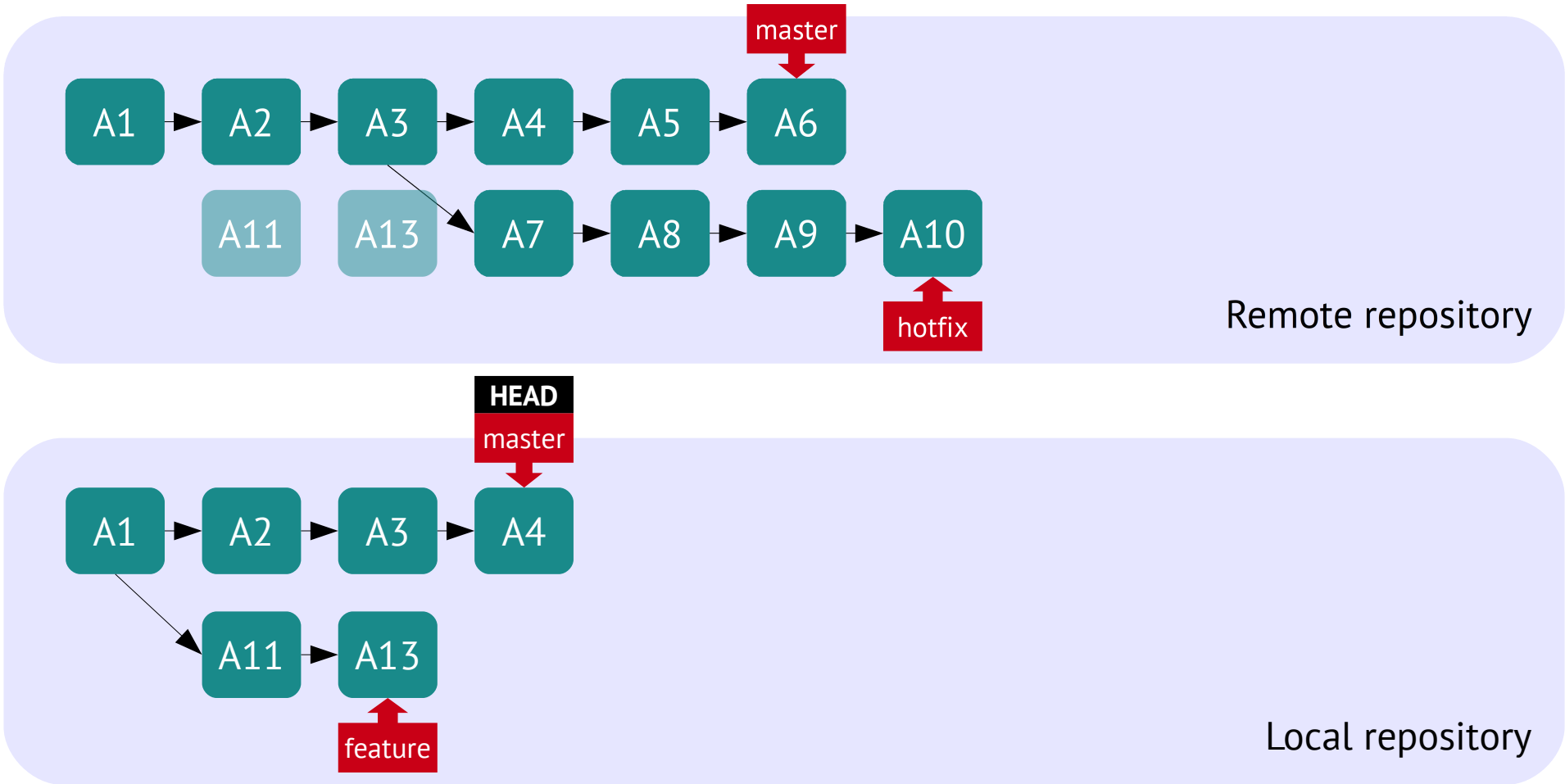
GIT workflow

Push and pull



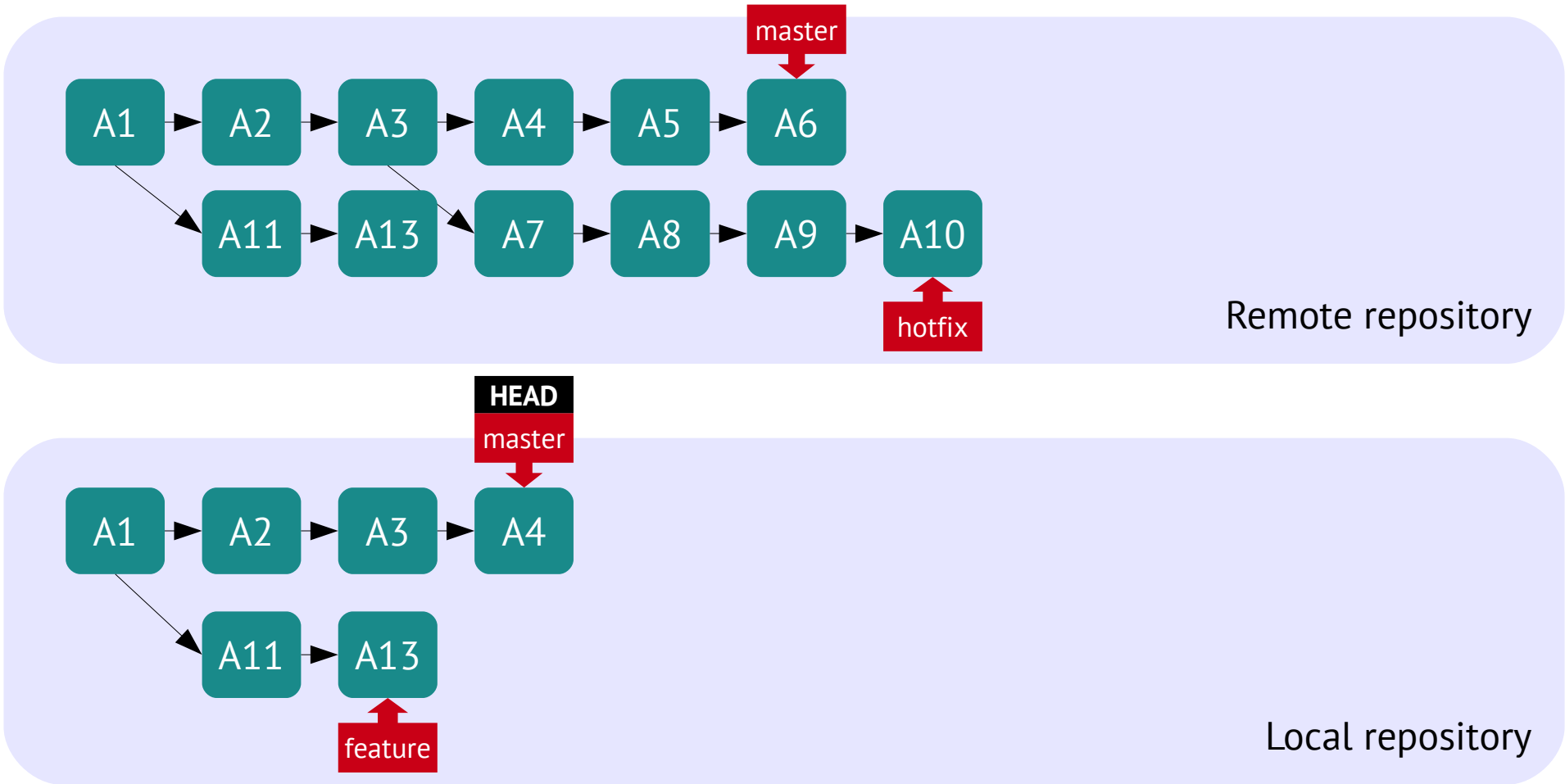
GIT workflow

Push and pull



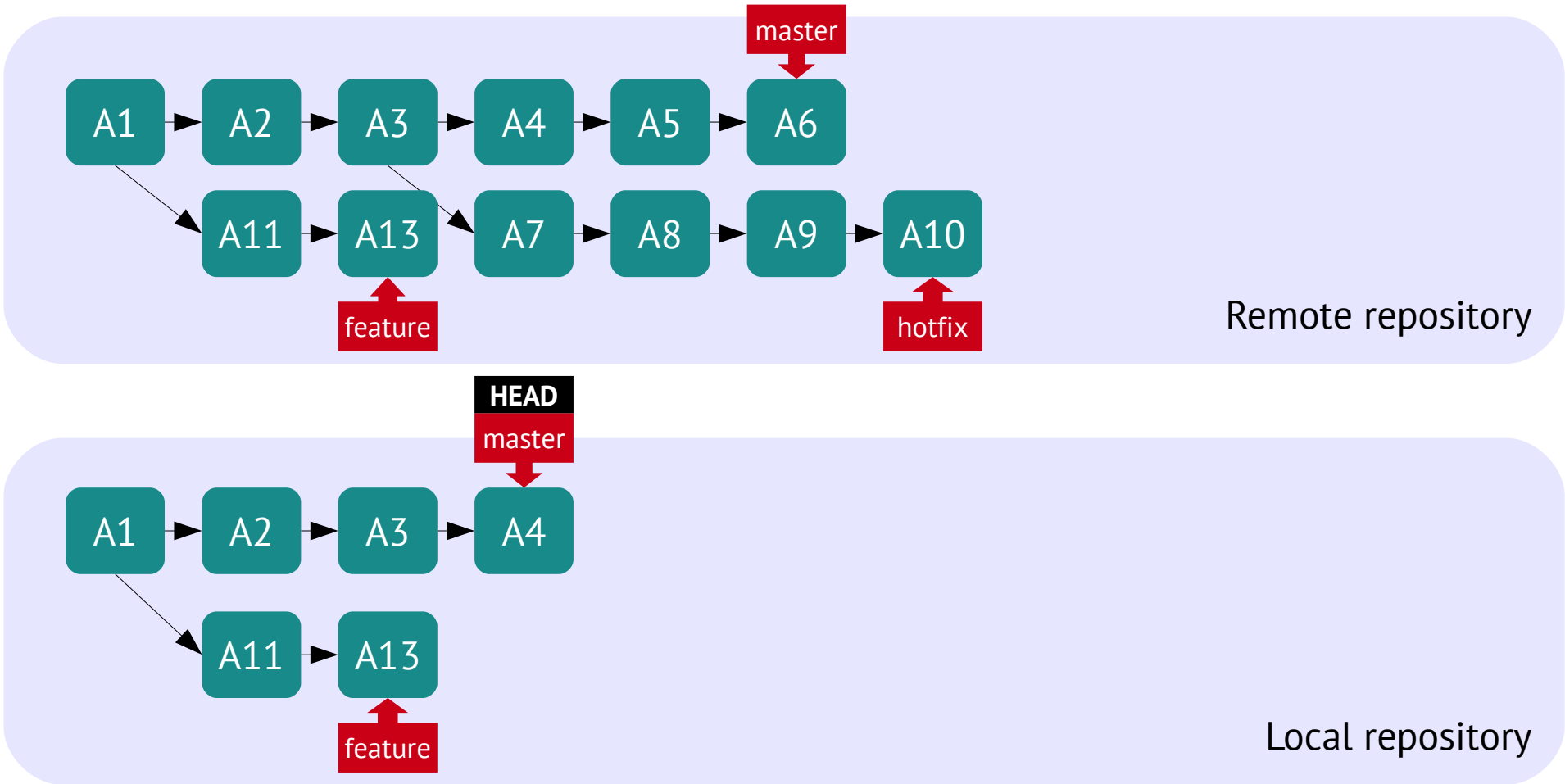
GIT workflow

Push and pull



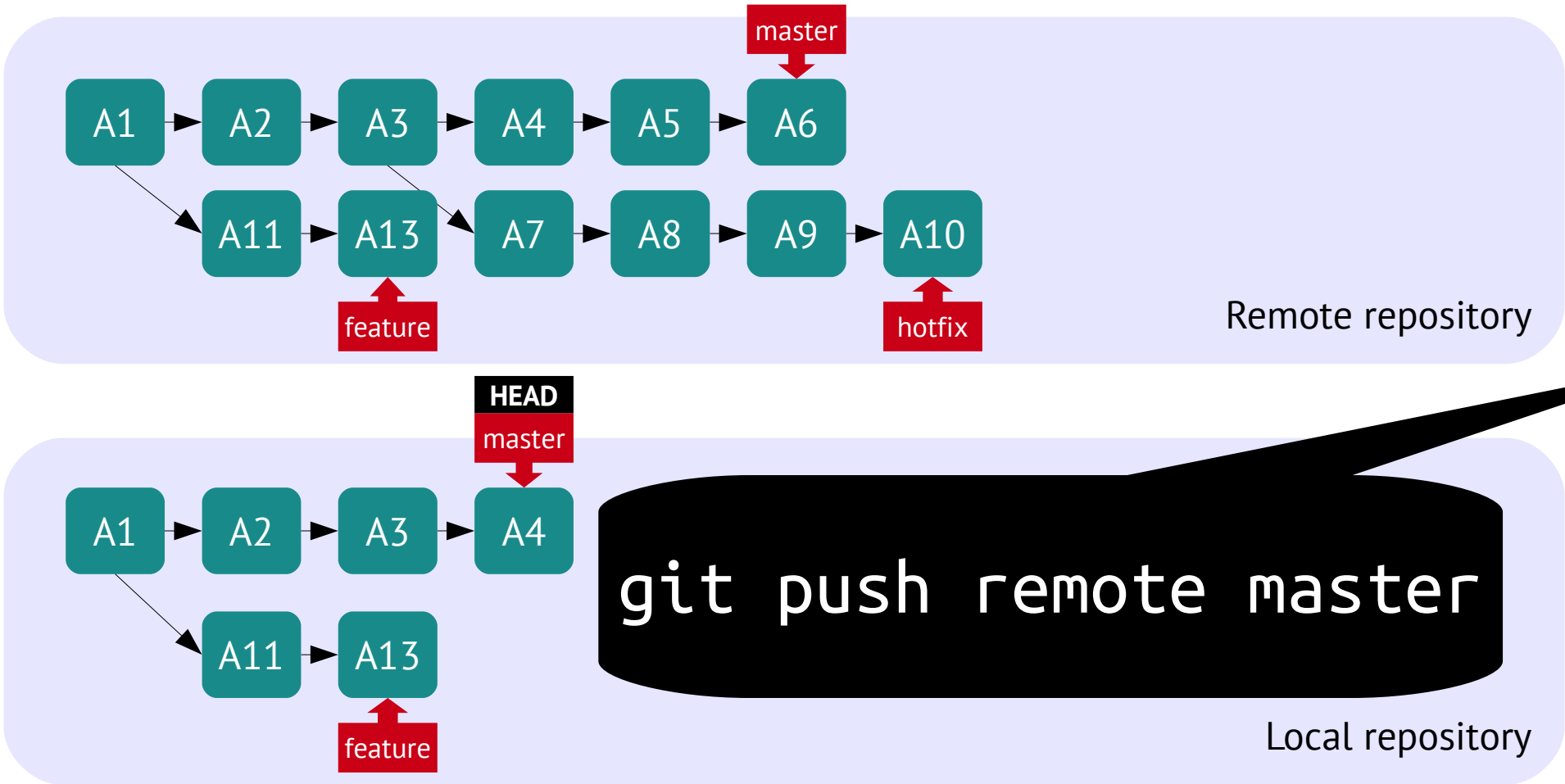
GIT workflow

Push and pull



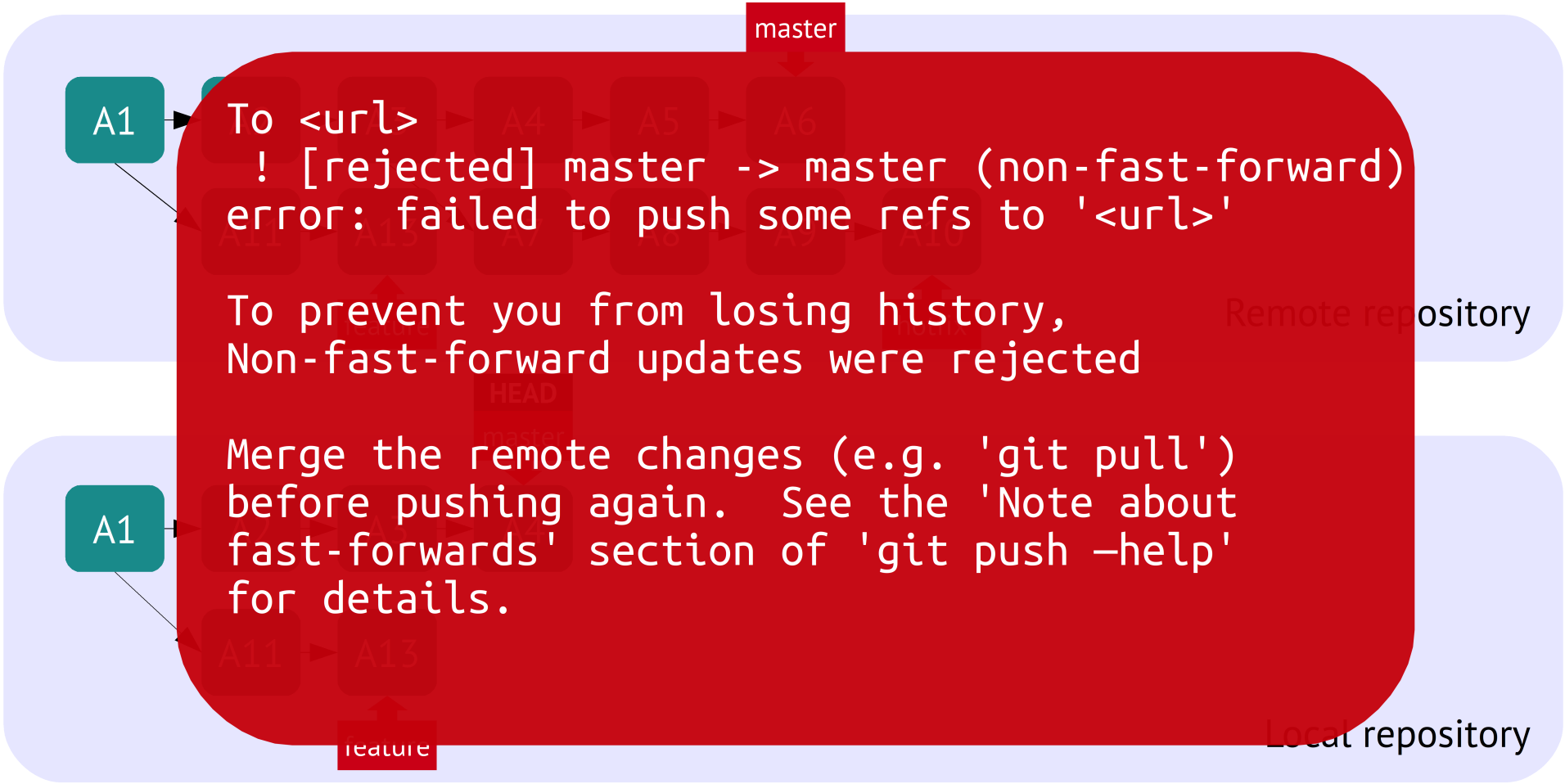
GIT workflow

Push and pull



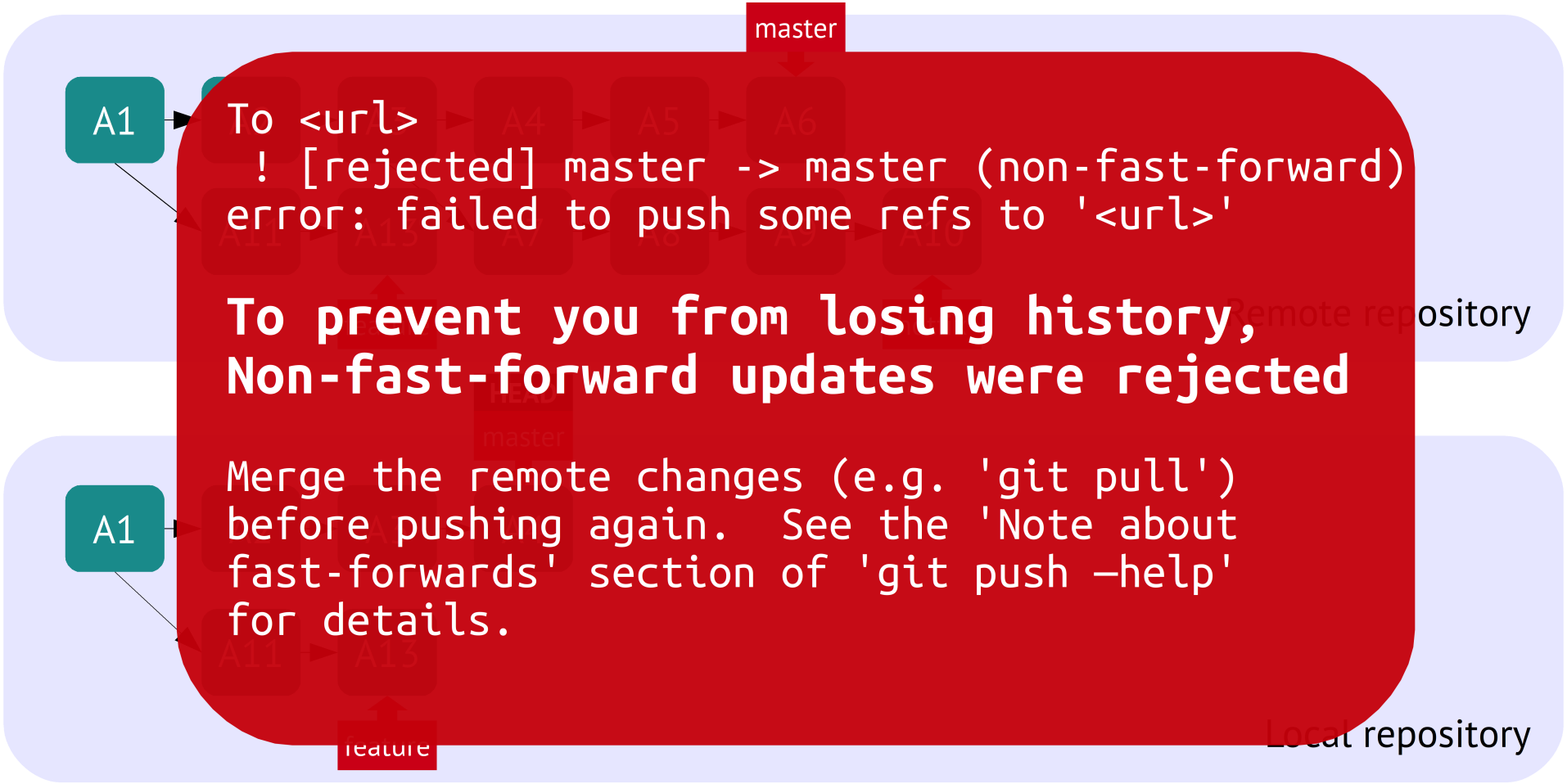
GIT workflow

Push and pull



GIT workflow

Push and pull



GIT workflow

Push and pull

`git push` is about fast-forward merges

GIT workflow

Push and pull

Always `pull` before `push`!

GIT workflow

Push and pull

Always **`pull before push`**!

GIT workflow

- ~~Create your branch~~
- ~~Edit files~~
- ~~Stage your changes~~
- ~~Commit the changes~~
- ~~Rebase your branch from master~~
- ~~Merge to master~~
- ~~Push to central repository~~

There is only 5 slides left.
Cheer up!

Must-have commands

Must-have commands

```
git diff
git clone
git add
git commit
git branch
git commit
```

```
git remote
git merge
git log
git push
git pull
git fetch
```

12

commands

Credits

Credits

- Git Community Book
- ProGit
- Help on GitHub
- Linus Torvalds on GIT
- StackOverflow GIT tag
- GIT Magic
- GIT Immersion
- GITCasts
- GIT Wizardry
- GIT Manual
- GIT official site
- GIT Reference

that's it!