Azrieli
College of Engineering
Jerusalem

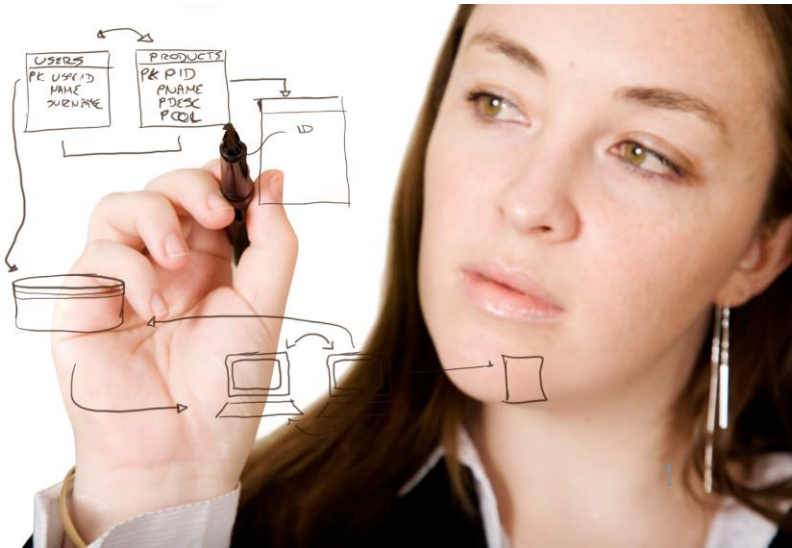
עזריאלי
מכללה אקדמית להנדסה
ירושלים

מודלים לפיתוח מערכות תוכנה
Software Systems Modeling

קורס 12003

סמסטר ב' תשע"ו

2. מודל קונספטואלי לבקרת קוד מבוזרת



ד"ר ראובן יגל
robi@post.jce.ac.il

הפעם

- מבוא לבקרת תצורה
- משל גיט
- מידול גיט

- המשך תרגיל 1

מקורות

- Git usage
  - www…
- Git Modeling
  - The Architecture of Open Source Applications, Vol. II, Chap. 6. http://www.aosabook.org/en/git.html, 2012
  - “What’s Wrong with Git? A Conceptual Design Analysis” (MIT paper, 2013) => gitless
  - www…

בקרת תצורה (SCM)

- לפרויקט תוכנה תוצרים שונים:
- מסמכי דרישות ותיכון, קוד, executables, מדריכי שימוש, בדיקות,...
- פרויקט תוכנה משתמש בכלים שונים:
- מהדרים, עורכים, צד ג', שת"פ, (מ"ה), ...

בקרת תצורה

- מבחינת תהליך זה אלו נקראים CI – Configuration Items
- לכל אחד יכולים להיות גרסאות ועותקים שונים
- אנו צריכים יכולת לזהות, לעקוב ולאחסן אותם
- נתמקד בנושא של גרסאות

בקרת גרסאות – Version Control

- איך (האם?) אתם שומרים את תוצרי העבודה שלכם?
- האם אפשר לשפר?
- האם יש הבדל בין מפתח בודד לחברה גדולה?
- שמות שונים:
  - בקרת תצורה
  - Revision Control
  - Software Configuration Management
  - Source-Code/Version Control System

בקרת גרסאות – בשביל מה? יעדים

- אחסון (גיבוי והצלה)
- איסוף כל הגרסאות ומעקב אחרי שינויים
  - חזרה לגרסה מסוימת, השוואה
  - מאפשר מחיקת קוד
- ניהול מספר גרסאות במקביל
- שיתוף מספר מפתחים (מרוחקים) בו זמנית
  - טיפול בסתירות
- מאגר מעודכן של תוצרי הפרויקט
  - במיוחד עם daily build\

בפרויקט תדרשו להדגים את בקרת התצורה שלכם

פעולות נדרשות

- בקרת שינויים
  - זיהוי ותיעוד (למשל מי משנה, הסיבה, זמן וכדו')
  - ניתוח והערכה (של שינוי)
  - אישור \ דחיה
  - אימות, מימש ושחרור
- בקרת גרסאות
  - מאגר
  - הכנסה והוצאה
  - ענפים ומיזוגים
  - תיוג

כלים: היסטוריה (השוואה)

Generation	Networking	Operations	Concurrency	Examples
1	None	One file at a time	Locks	RCS, SCCS
2	Centralized	Multi-file	Merge before commit	CVS, SourceSafe, Subversion, Team Foundation Server, IBM Rational ClearCase
3	Distributed	Changesets	Commit before merge	Bazaar, Git, Mercurial

40 Years of Version Control

SCCS & RCS (1970s)

CVS (1986)

Subversion (2001)

Git (2005)

Image © TheSun.au

Git Intro

- Distributed Version Control System
- Linux
  - Many contributors
  - Using “tarballs” / patches
  - BitKeeper & CVS
  - Linus develop alt. scripts, Goals:
    - Distributed workflows
    - Guard against content corruption
    - Performance

Distributed VCS

- Providing the ability for collaborators to work offline and commit incrementally
- Allowing a collaborator to determine when his/her work is ready to share
- Offering the collaborator access to the repository history when offline
- Allowing the managed work to be published to multiple repositories, potentially with different branches or granularity of changes visible
- Other: Bazaar, Darcs, Fossil, Mercurial, Veracity

Git

- Successful open source project
  https://git.wiki.kernel.org/index.php/GitProjects
  https://github.com/google, microsoft, facebook, twitter…
  http://stackoverflow.com/research/developer-survey-2015#tech-sourcecontrol
- Problems / Issues:
  - Usability!
  - Mainly a scripted / toolset (by now IDE integration and GUIs)
  - Binary/big file (also taken care)
  - Enterprise (e.g. locking)

משל גיט

- Tom Preston-Werner http://tom.preston-werner.com/2009/05/19/the-git-parable.html
- Herland, http://www.infoq.com/presentations/git-details, slides: https://github.com/jherland/git_parable

The Git Parable

Johan Herland

johan@herland.net

The Git Parable

- Shamelessly stolen from Tom Preston-Werner
  http://tom.preston-werner.com/2009/05/19/the-git-parable.html
- I'm lazy...
- Also: Best introduction to Git I've found so far

The Git Parable

- Git - simple & powerful

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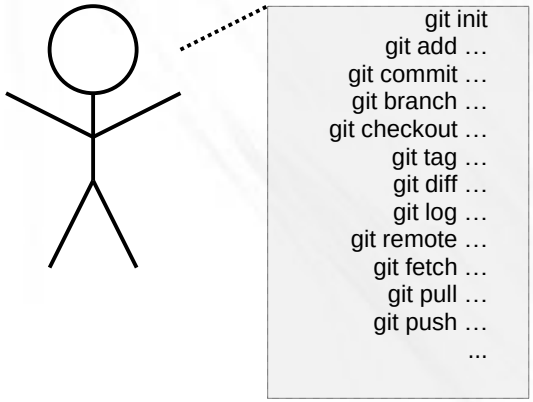

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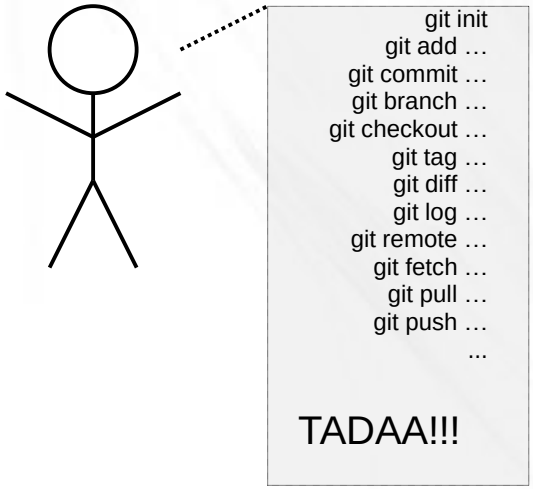

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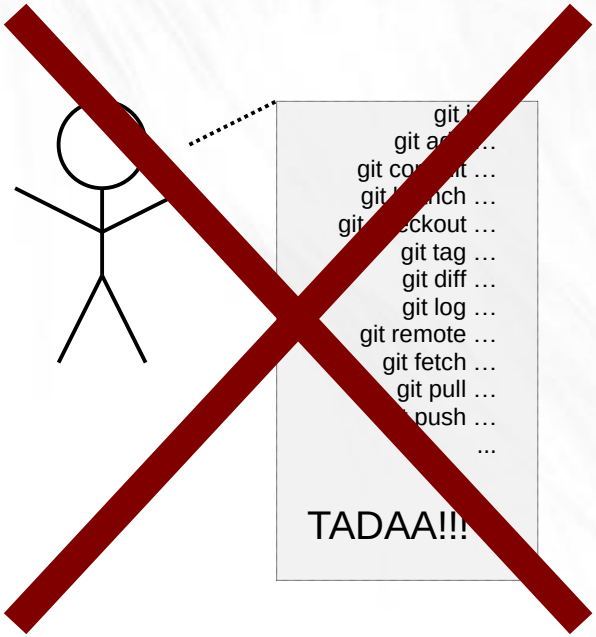

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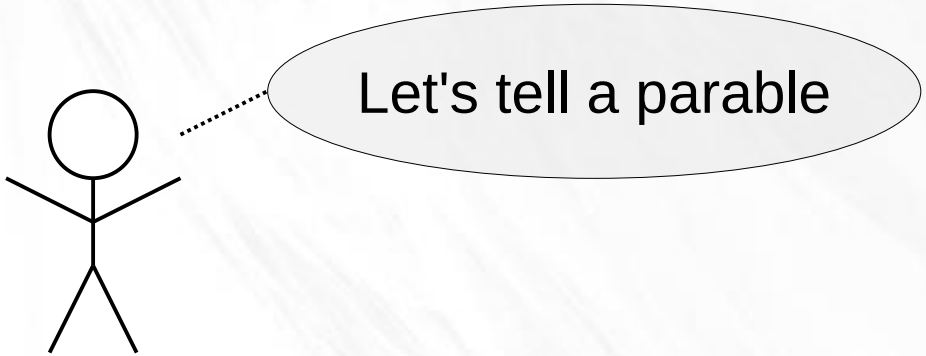

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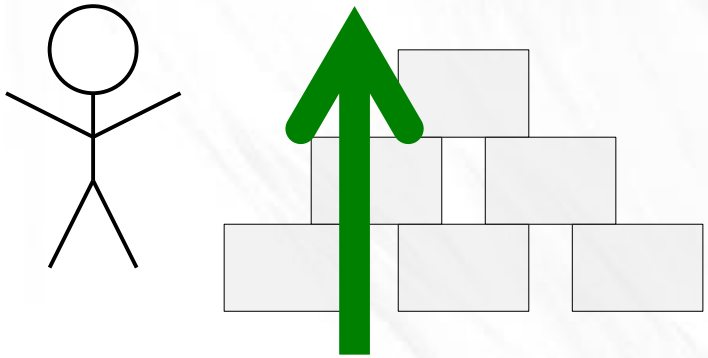

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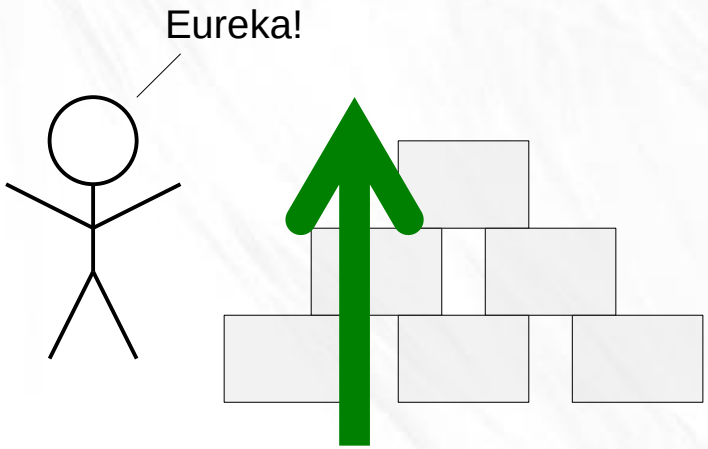
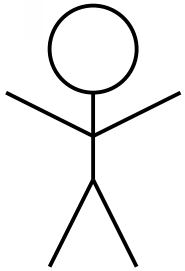


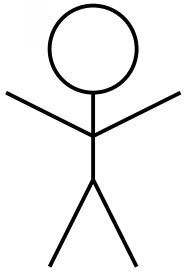
The Parable

- A simple computer
  - A text editor
  - A few filesystem commands



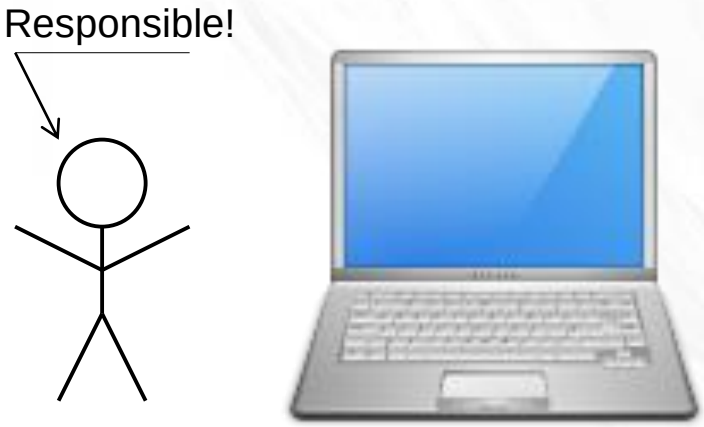
The Parable

- Write a large software program



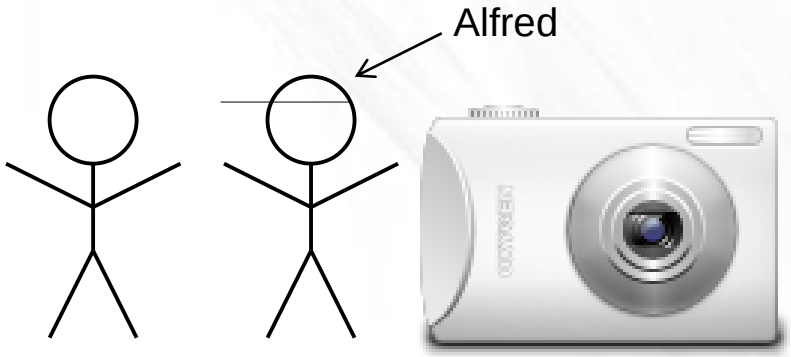
The Parable

- Write a large software program
- Invent some method to keep track of versions
  - retrieve code that you changed/deleted



Snapshots

- Alfred, the photographer



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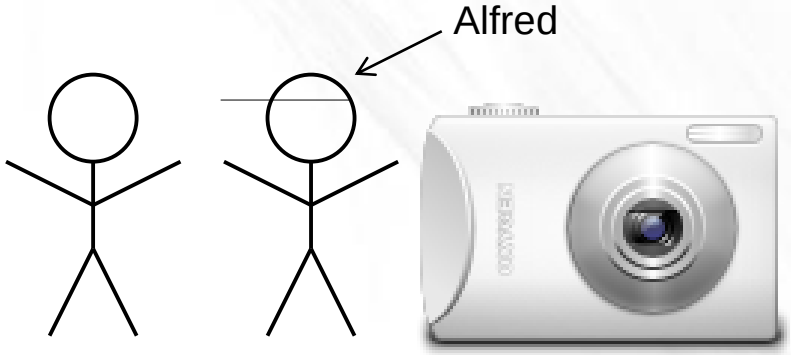
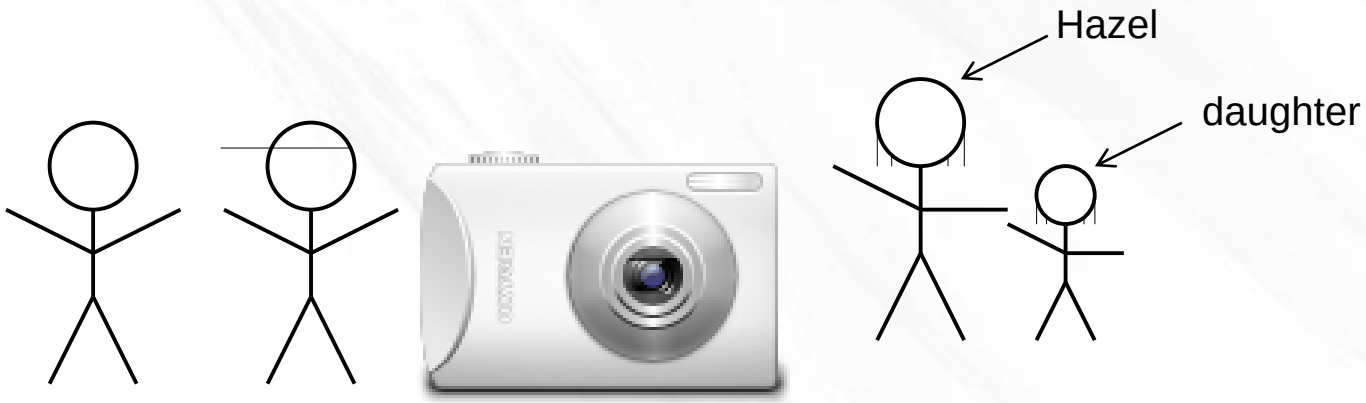


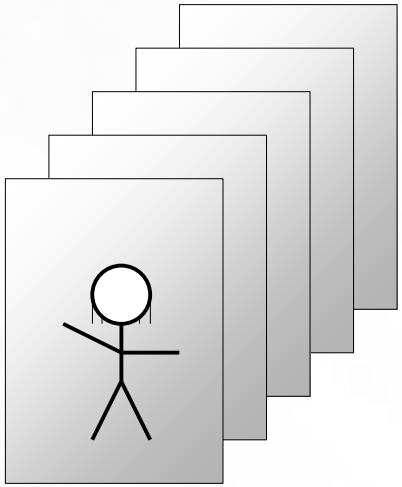
Snapshots

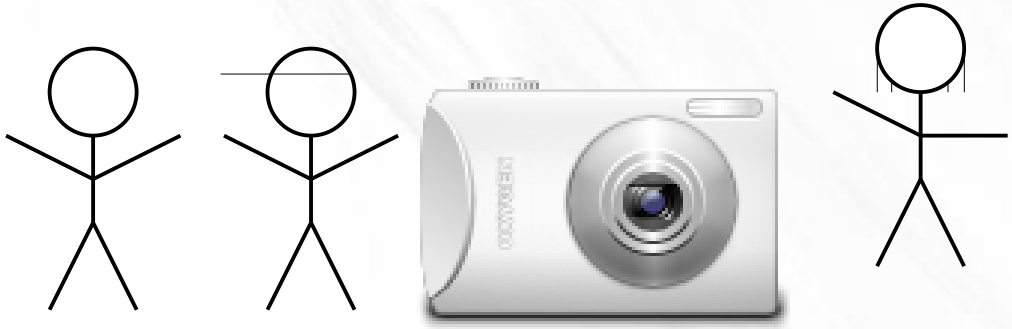
- Alfred, the photographer
- Hazel and her daughter



Snapshots

- Alfred, the photographer
- Hazel and her daughter
  - Remember what the daughter was like at each different stage





Snapshots

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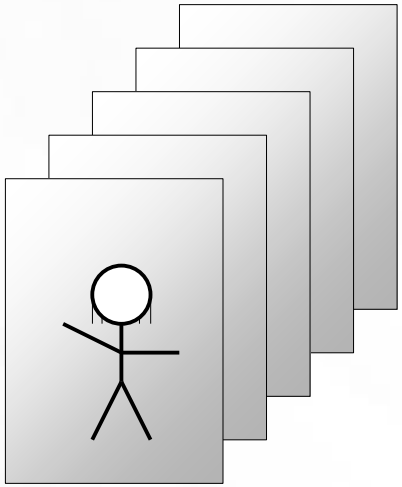
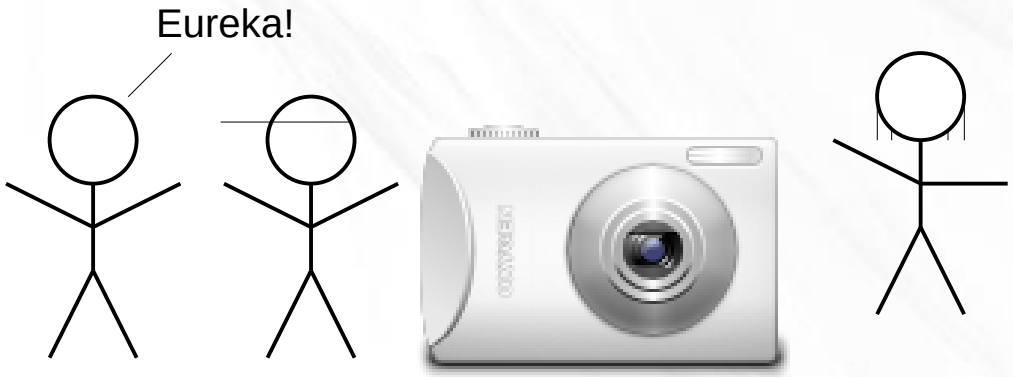
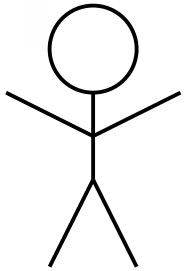


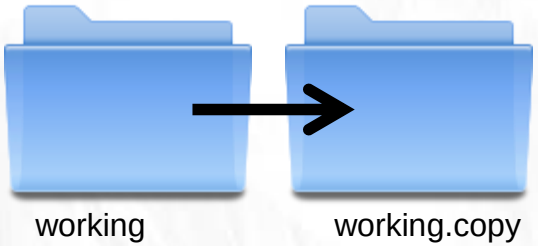


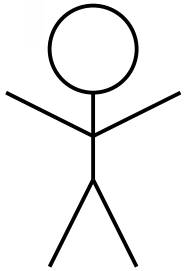
Snapshots

working

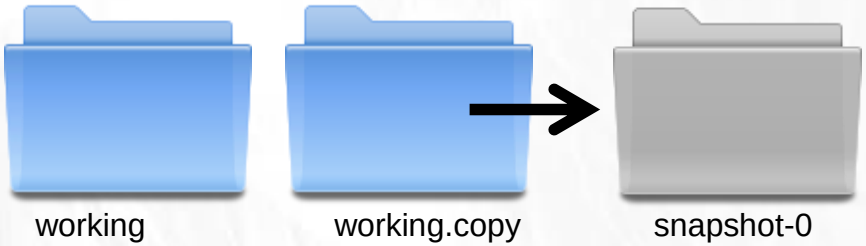


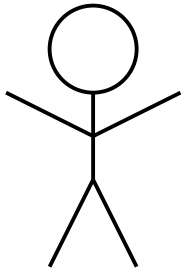
Snapshots





Snapshots





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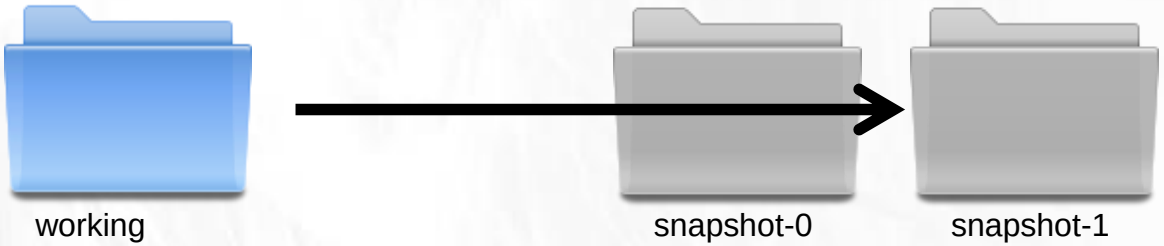
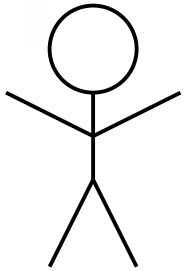
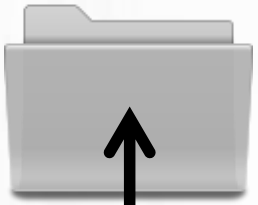




Snapshots

working

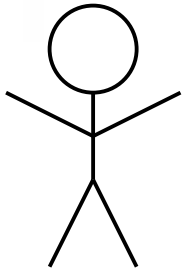
snapshot-0



snapshot-1

message

message



2009-05-20 12:34:56

Initial version

2009-05-21 23:45:01

Introduced a new foo, and reset the bar to xyzzy.

Branches

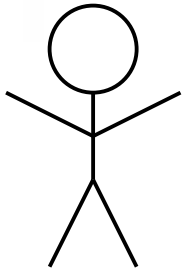
working

snapshot-0

snapshot-1

. . .

snapshot-99



Branches

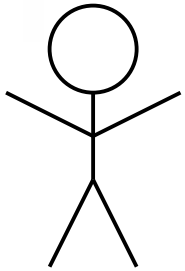
working

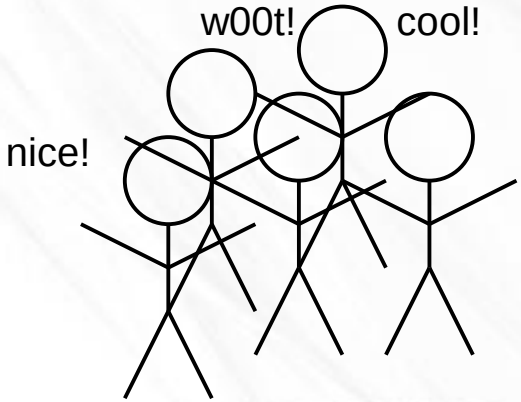
snapshot-0

snapshot-1

. . .

snapshot-99





Branches

working

snapshot-0

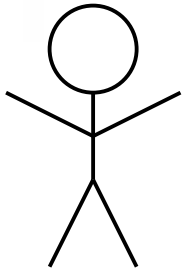
snapshot-1

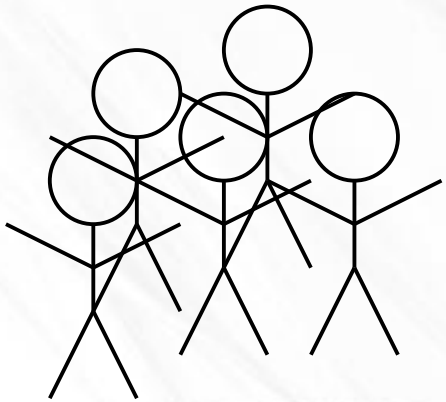
. . .

snapshot-99

. . .

snapshot-109





Branches

working

snapshot-0

snapshot-1

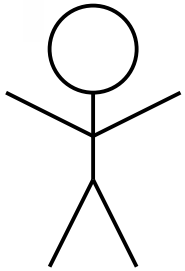
. . .

snapshot-99

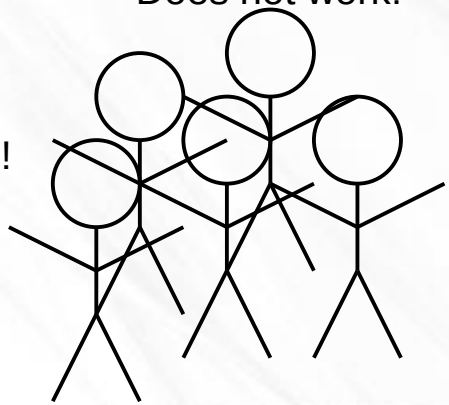
. . .

snapshot-109

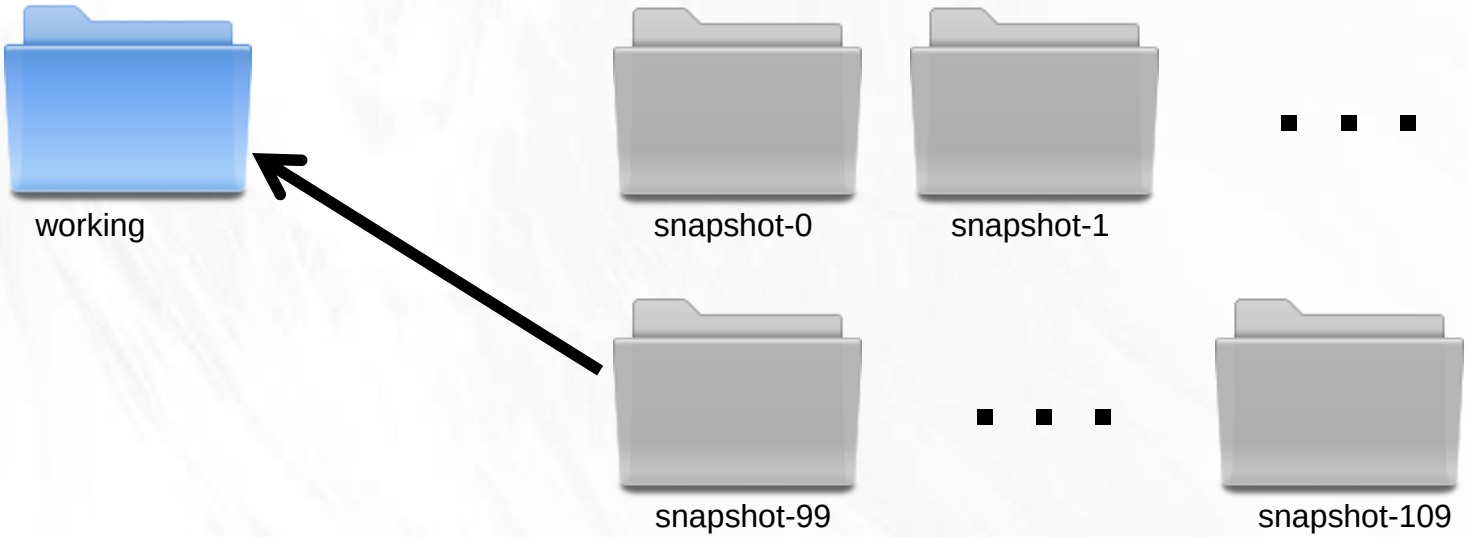
Does not work!

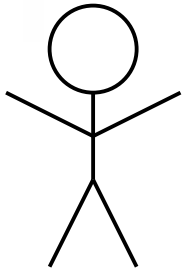


Boo!



Branches





Branches

working

snapshot-0

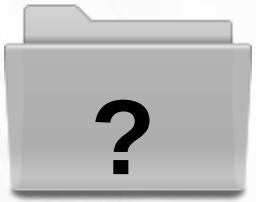
snapshot-1

. . .

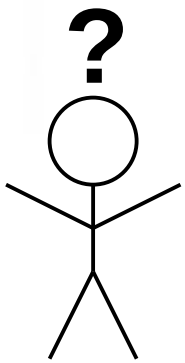
snapshot-99

. . .

snapshot-109

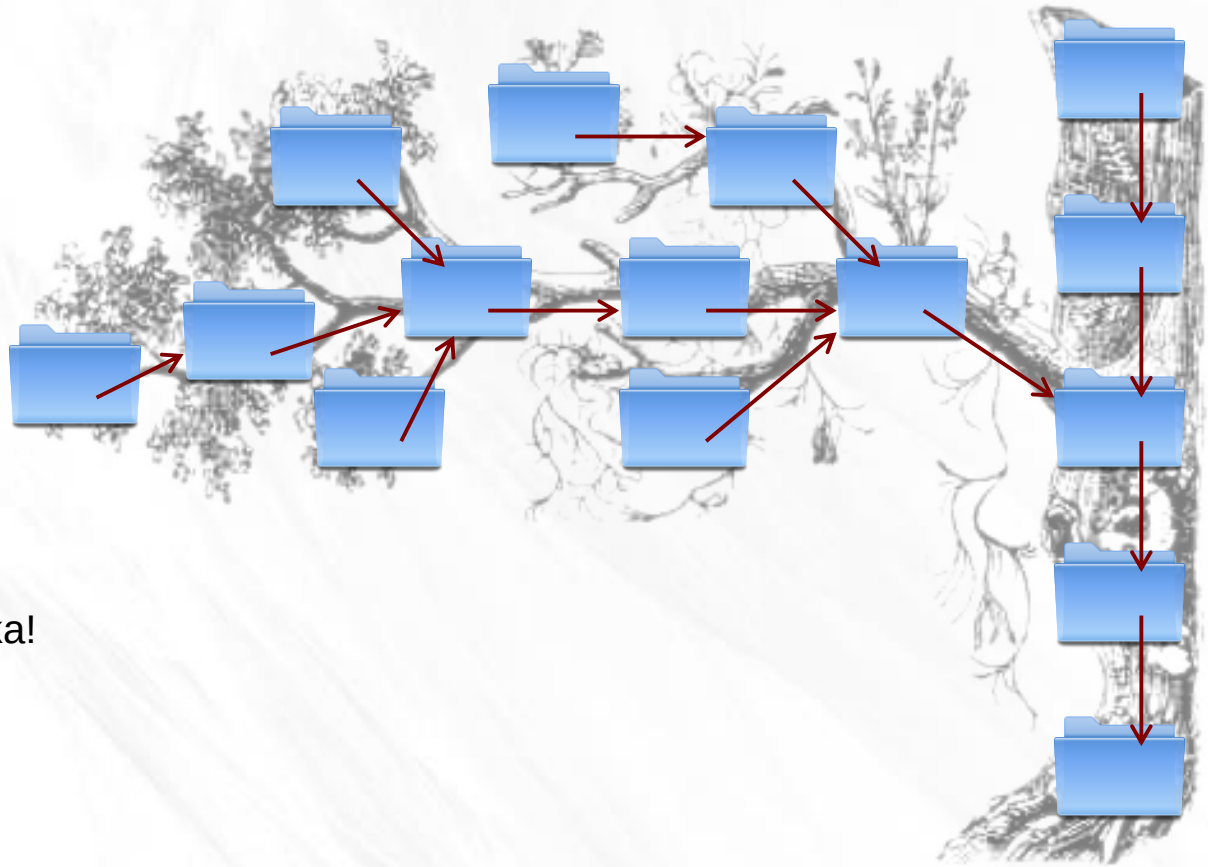


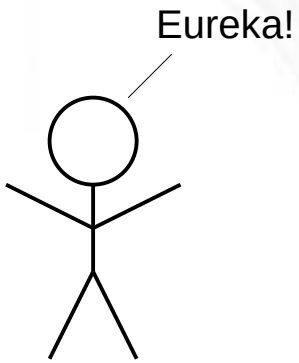
snapshot-110



Branches

Branches





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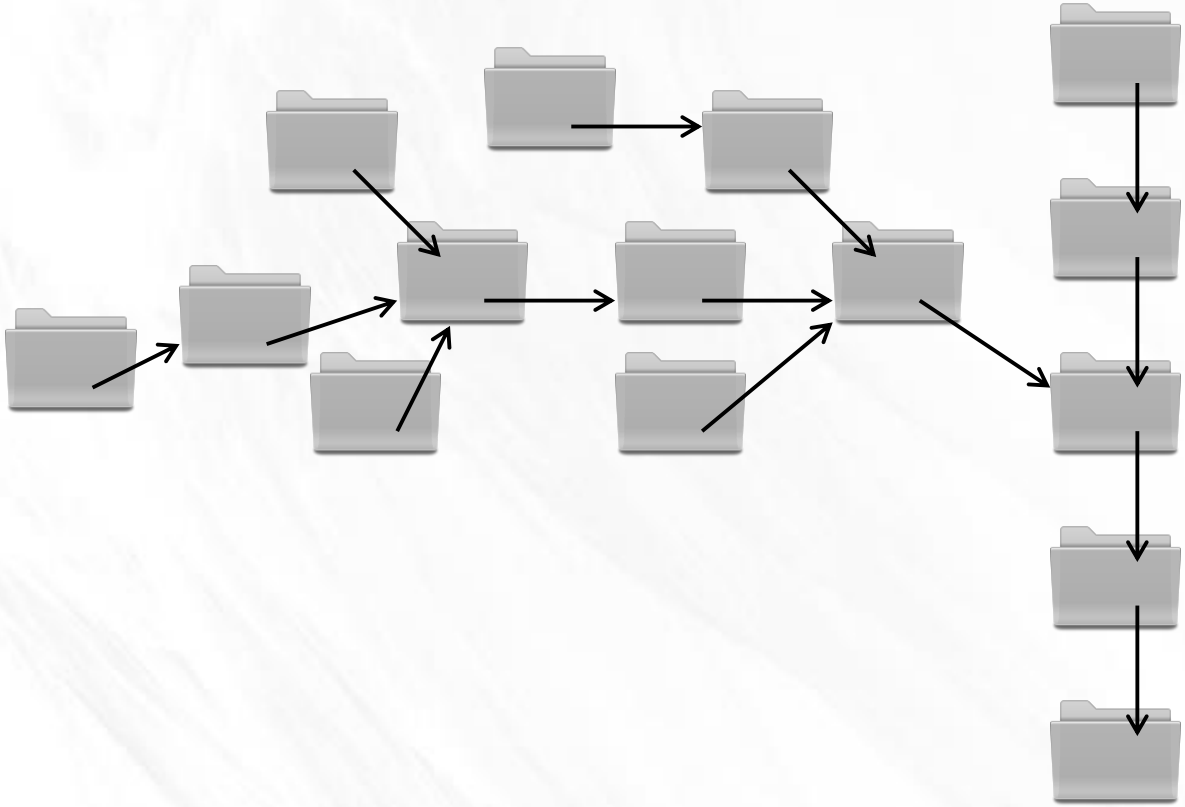
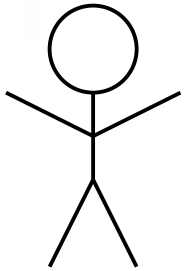
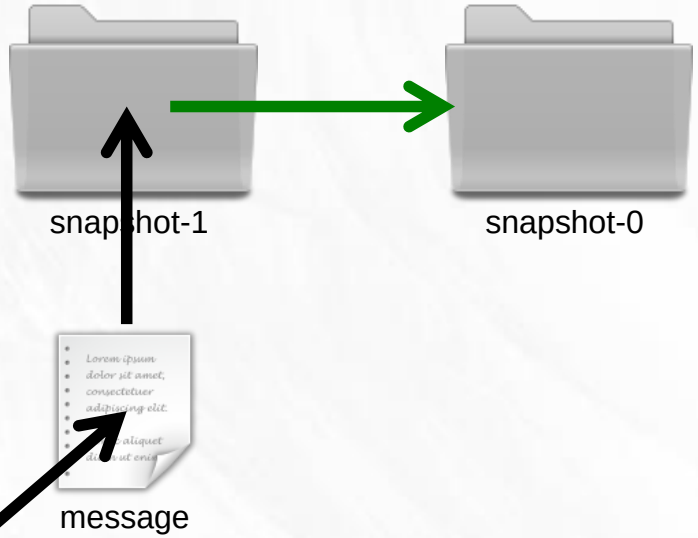
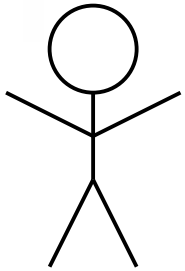




Branches



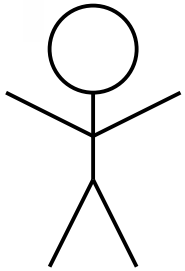


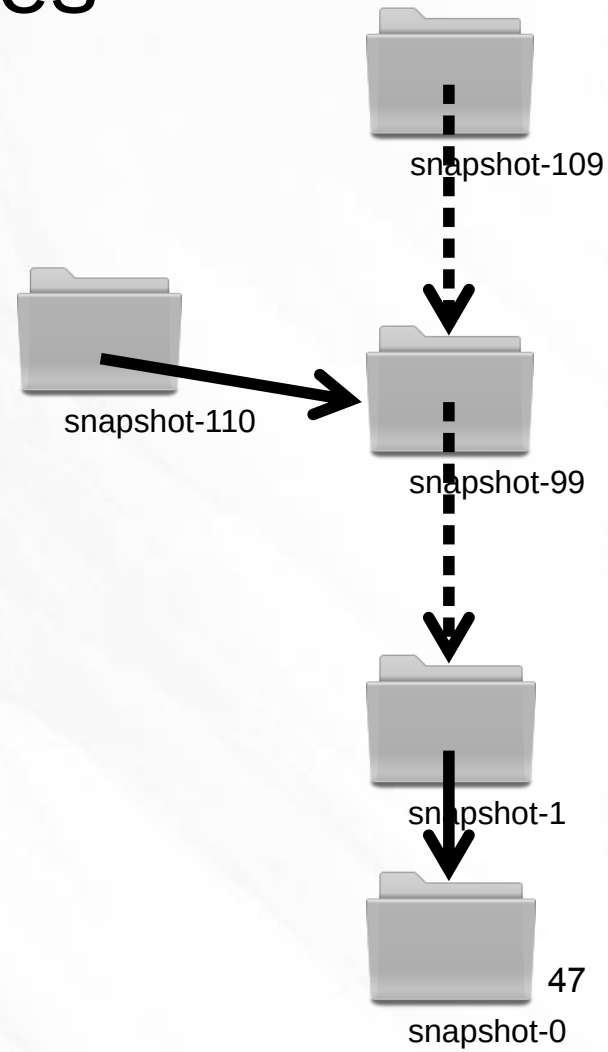
2009-05-21 23:45:01
parent: snapshot-0

Introduced a new foo, and reset the bar to xyzzy.

Branch Names

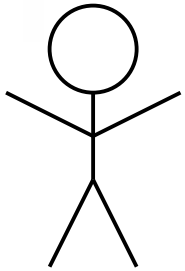
working

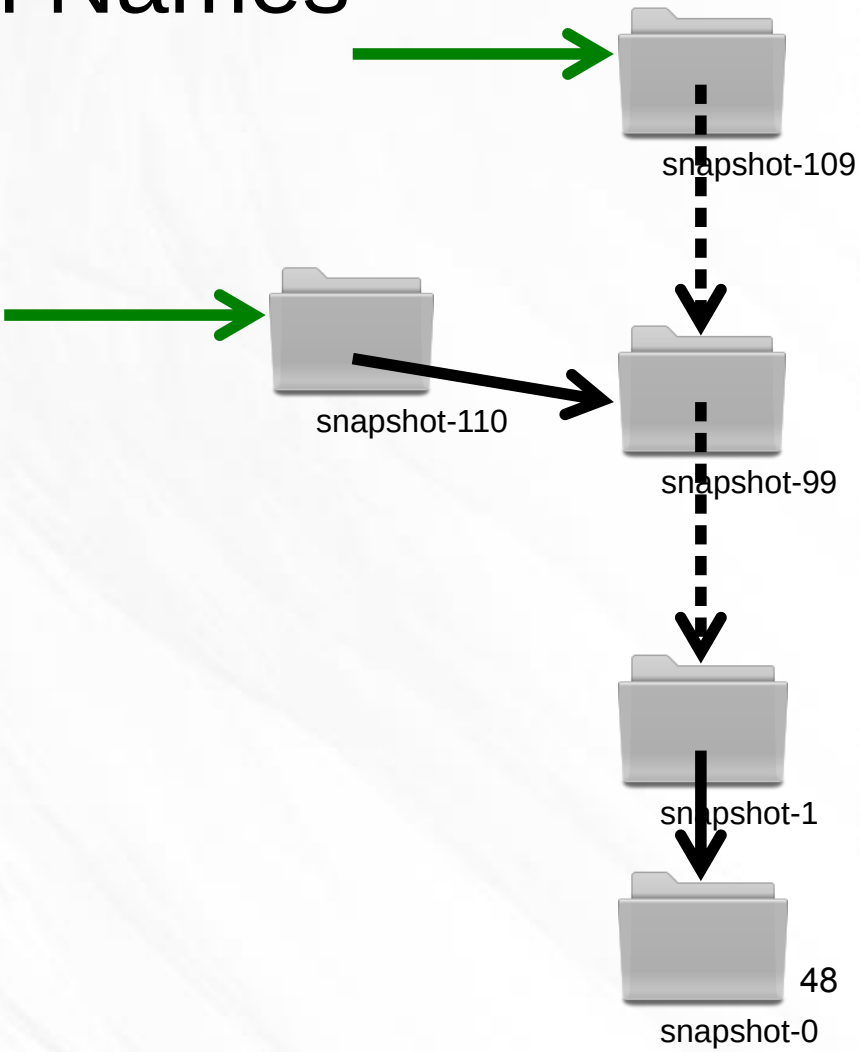




Branch Names

working





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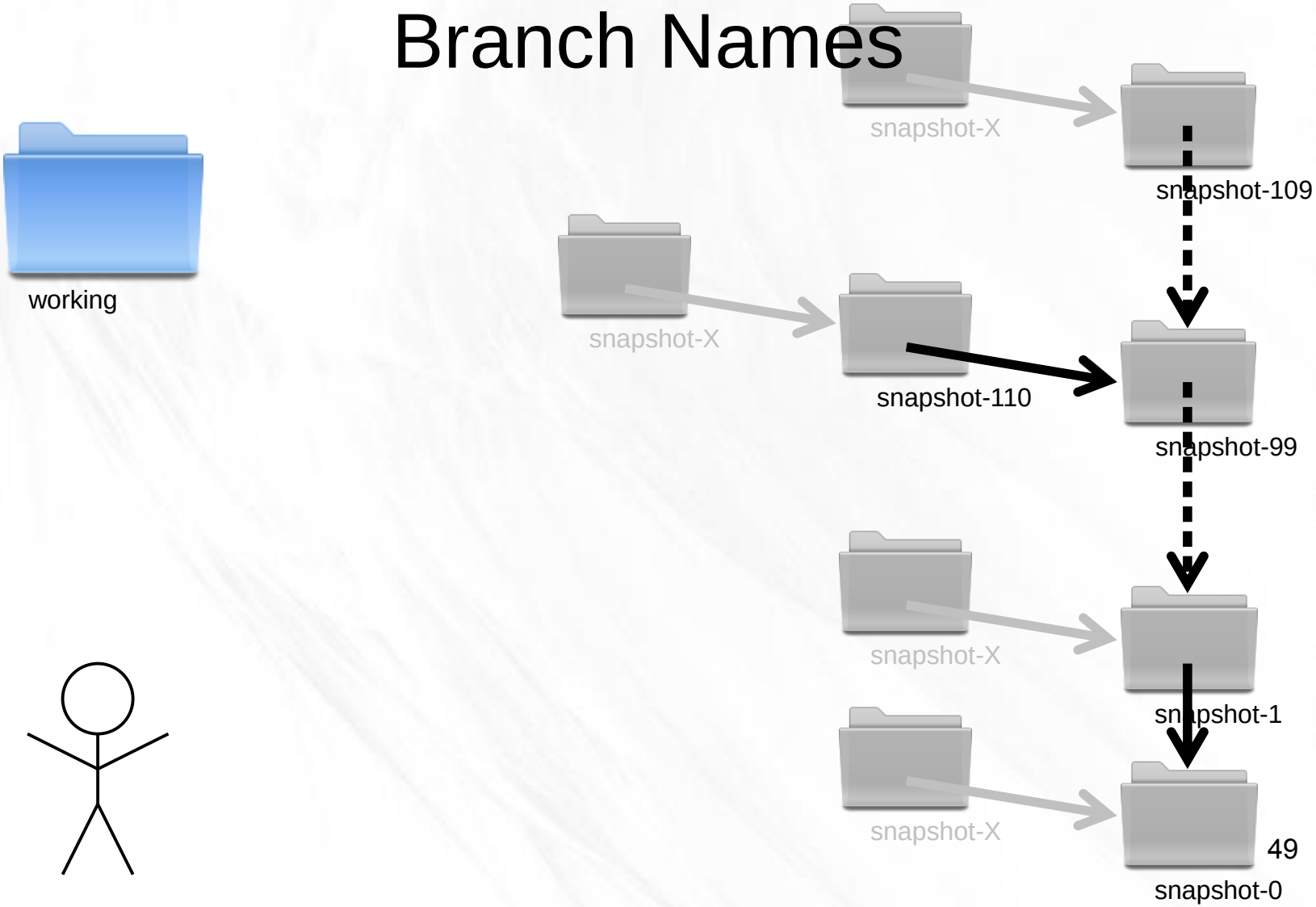

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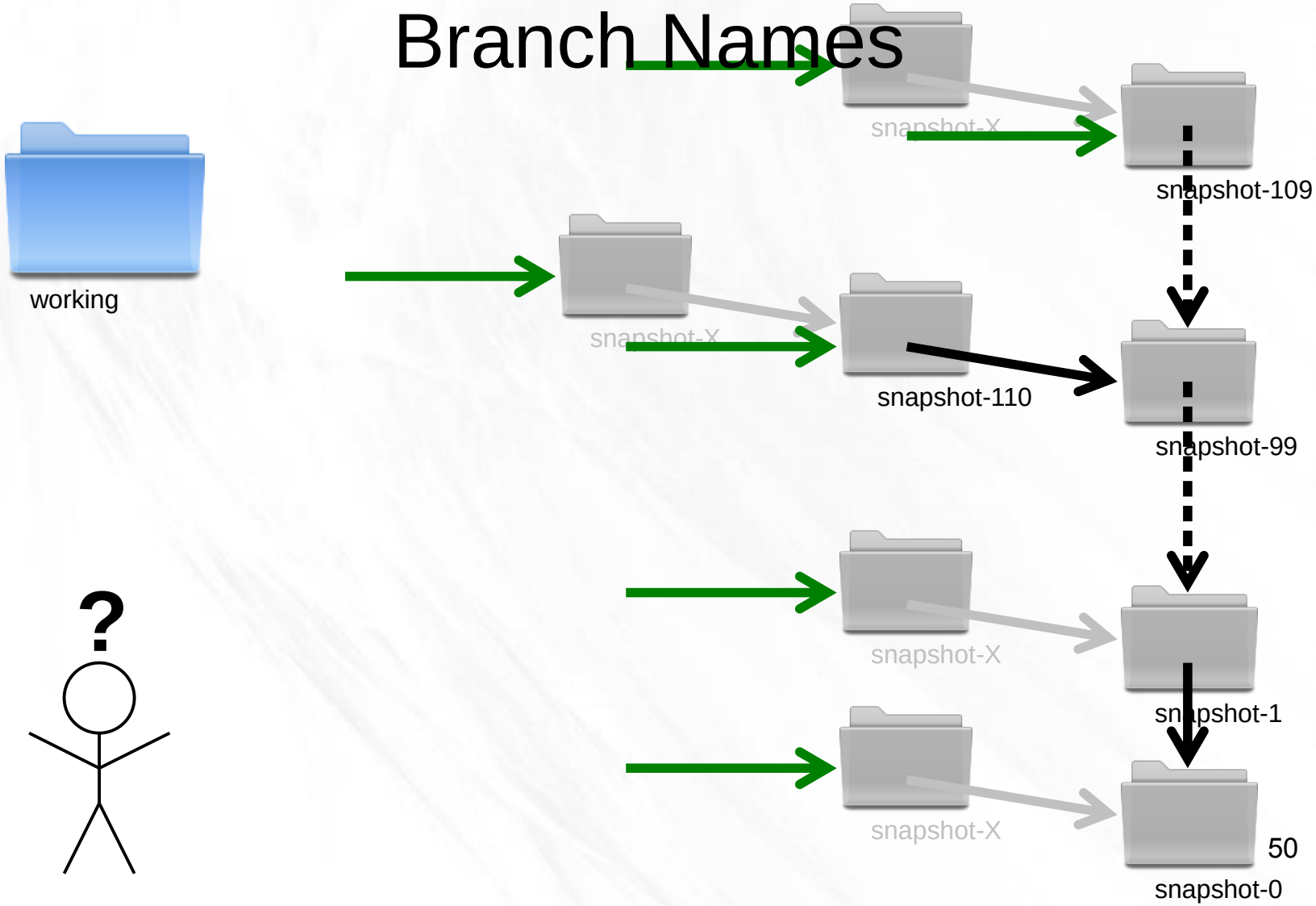

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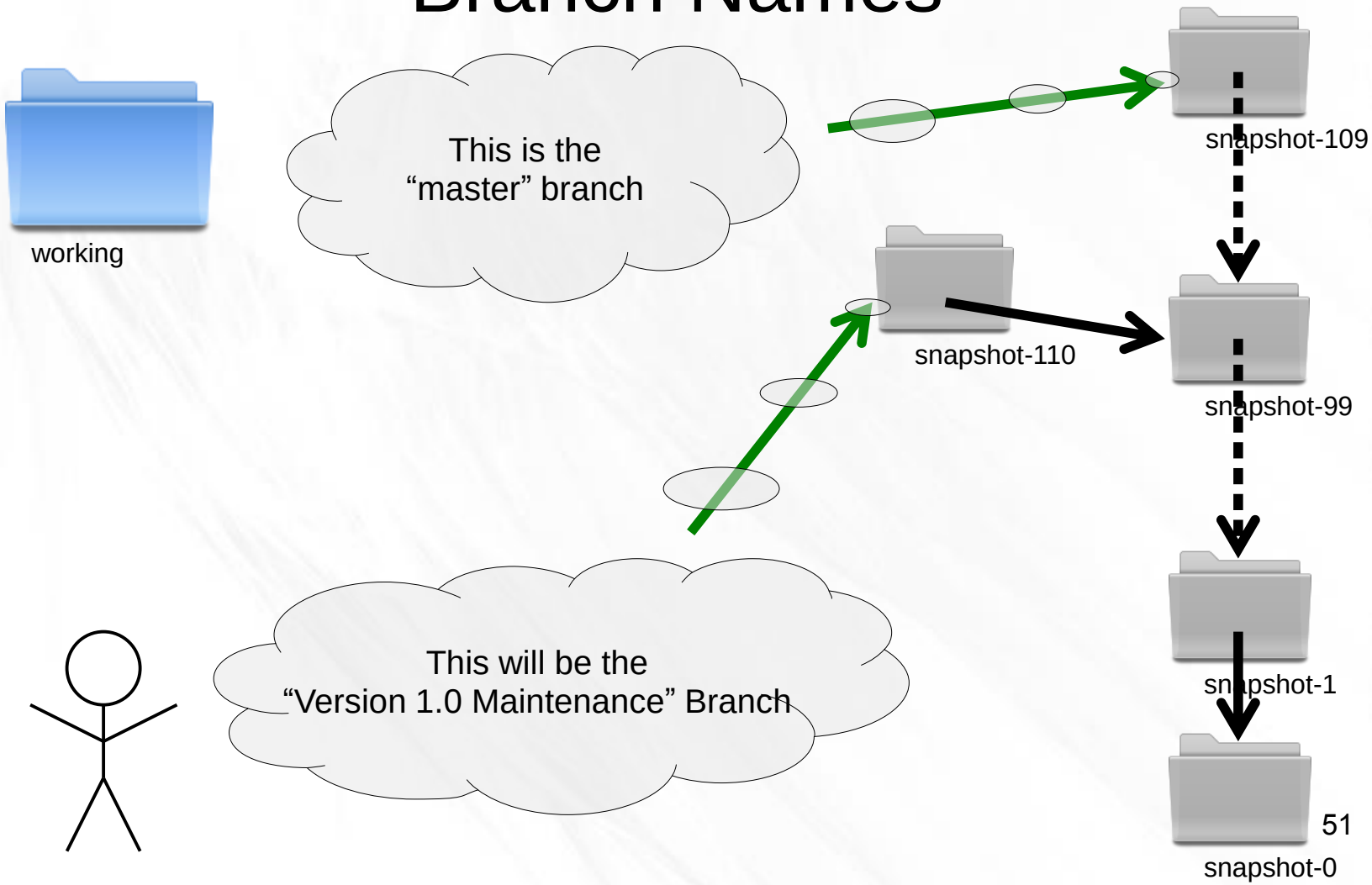

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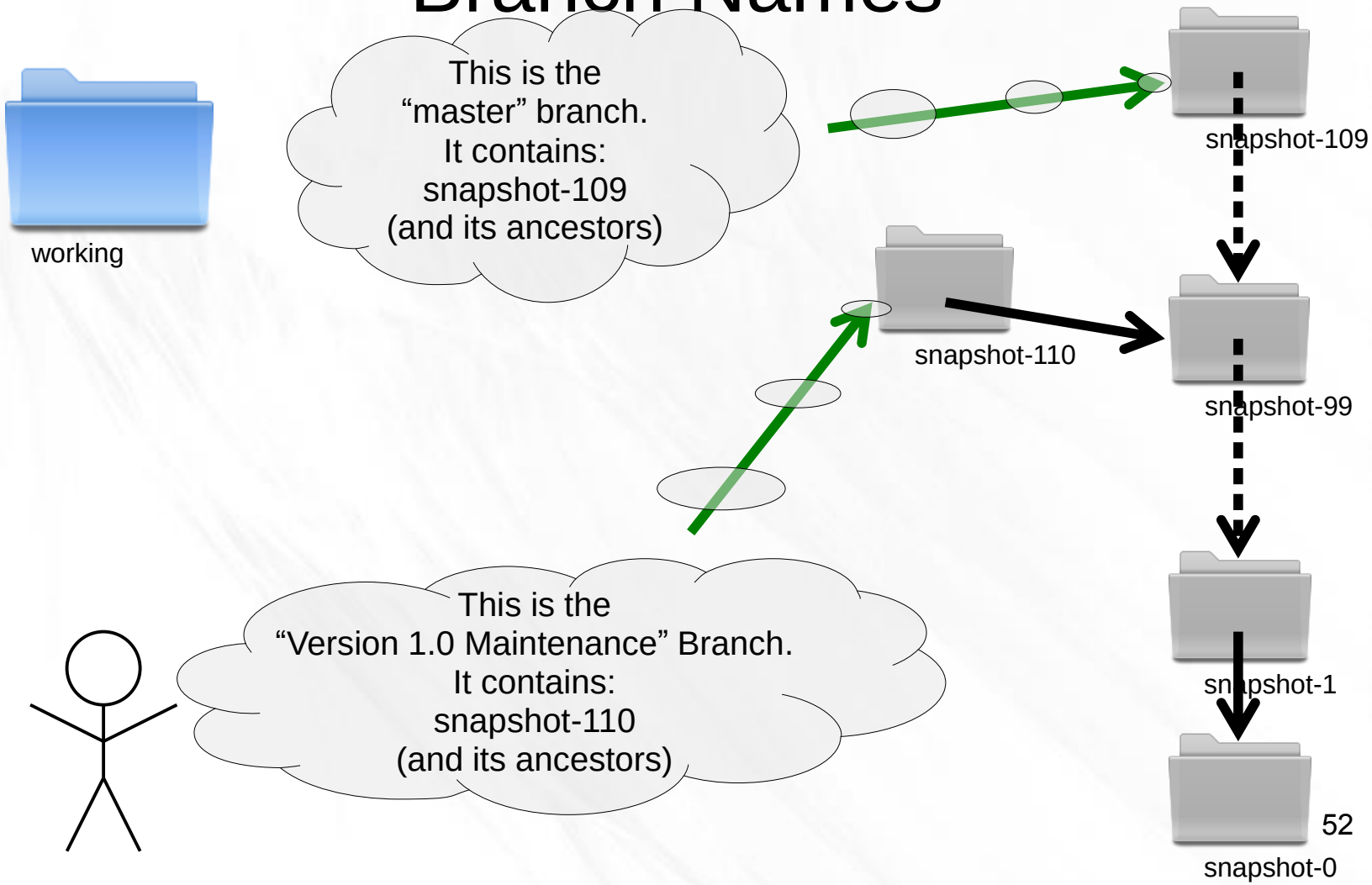

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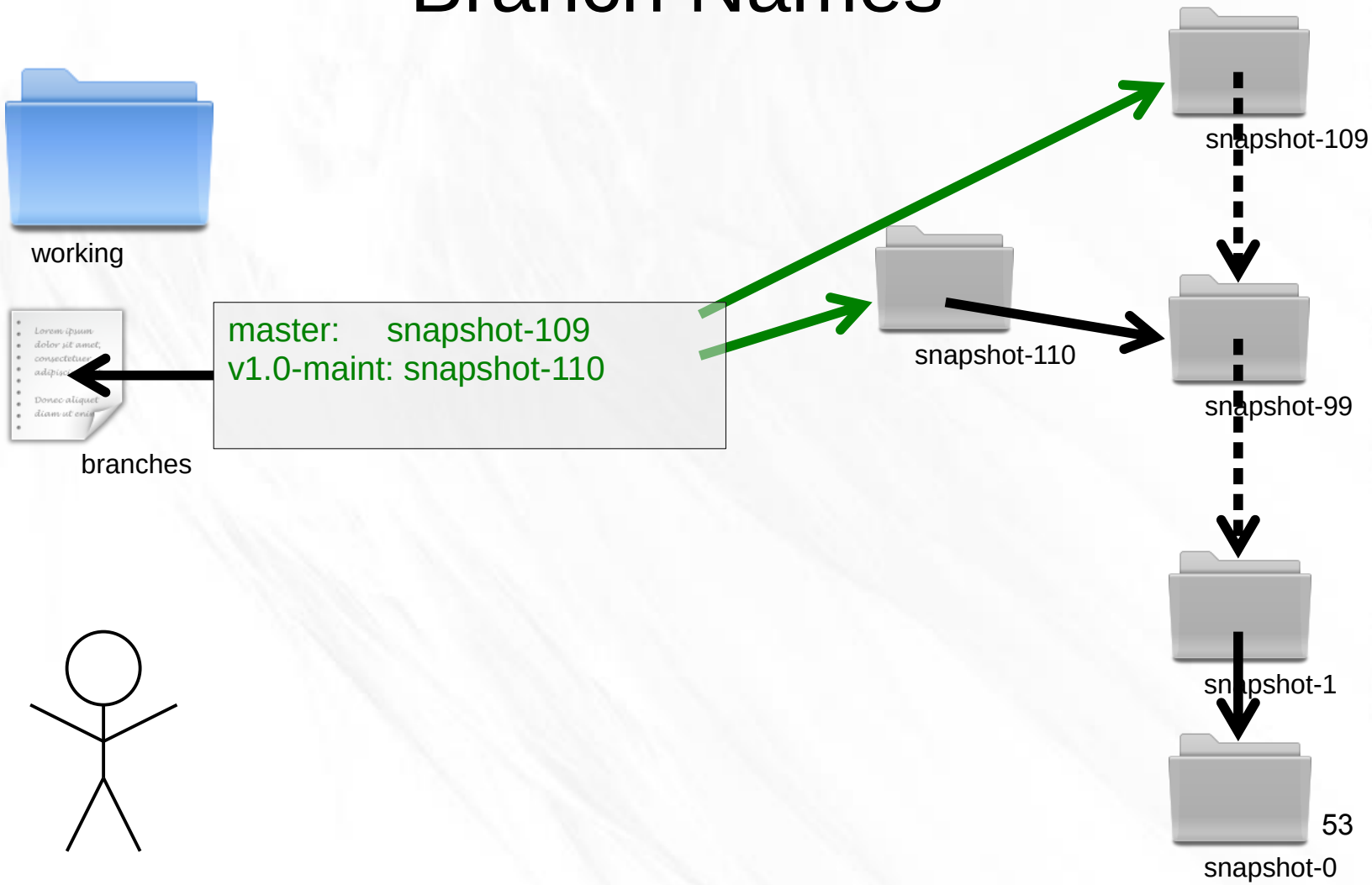

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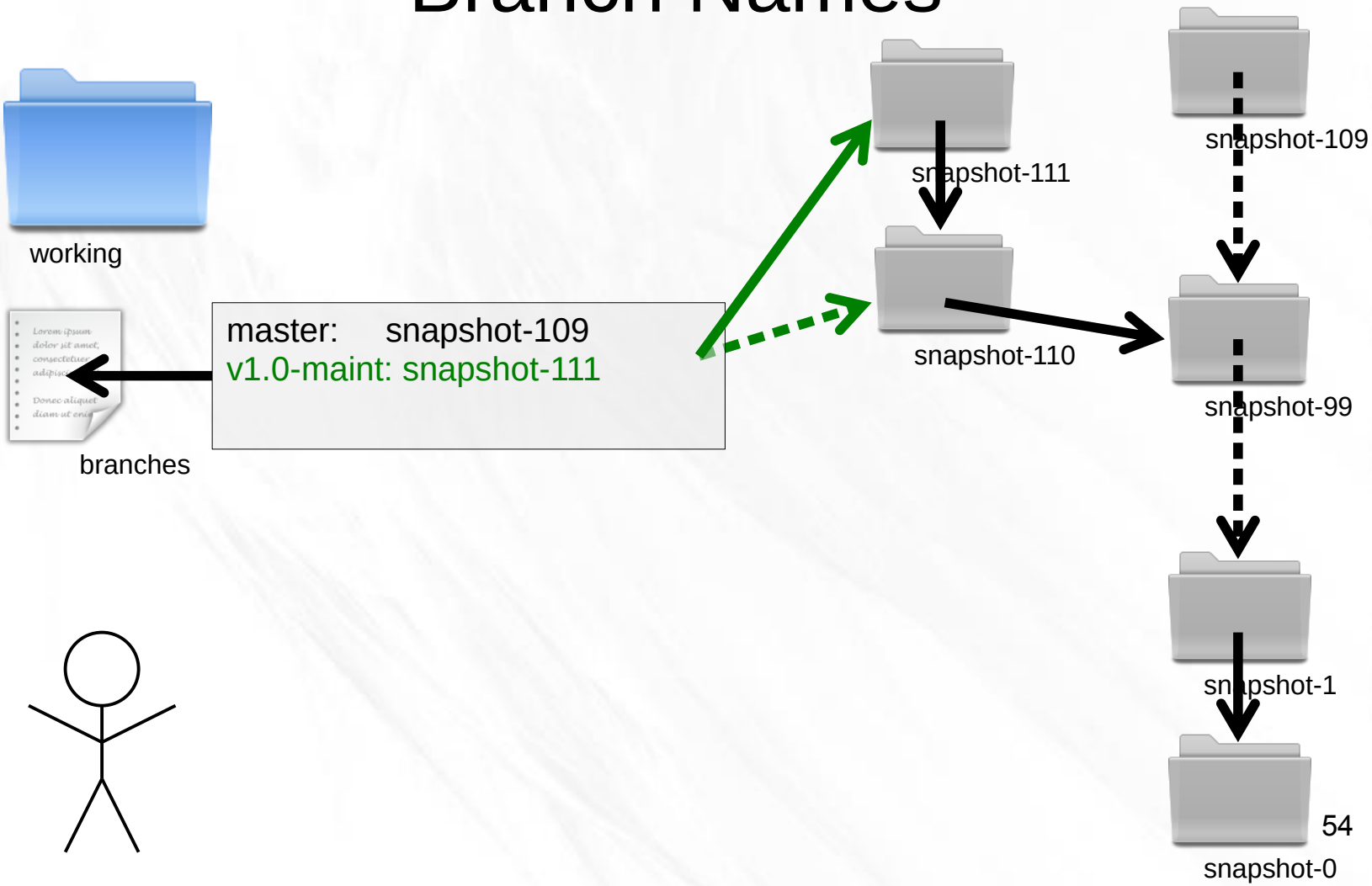

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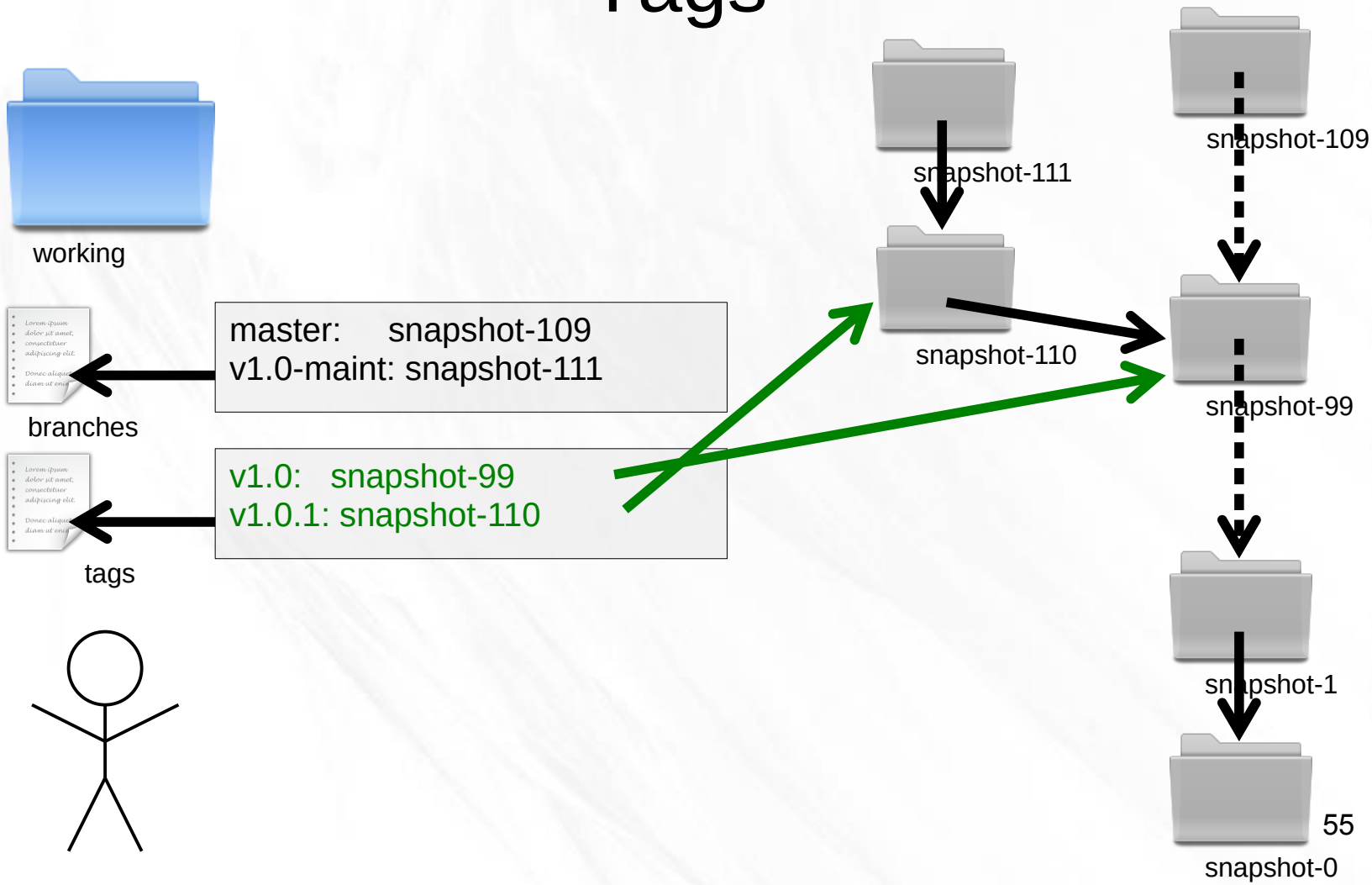
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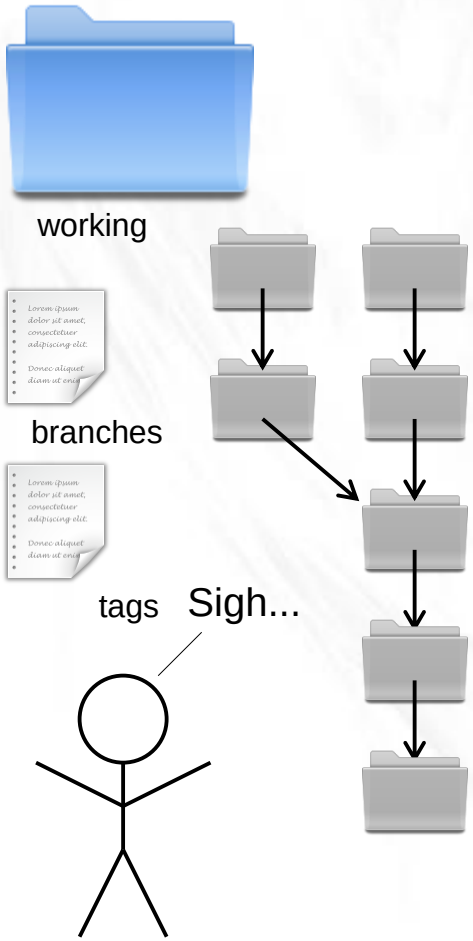

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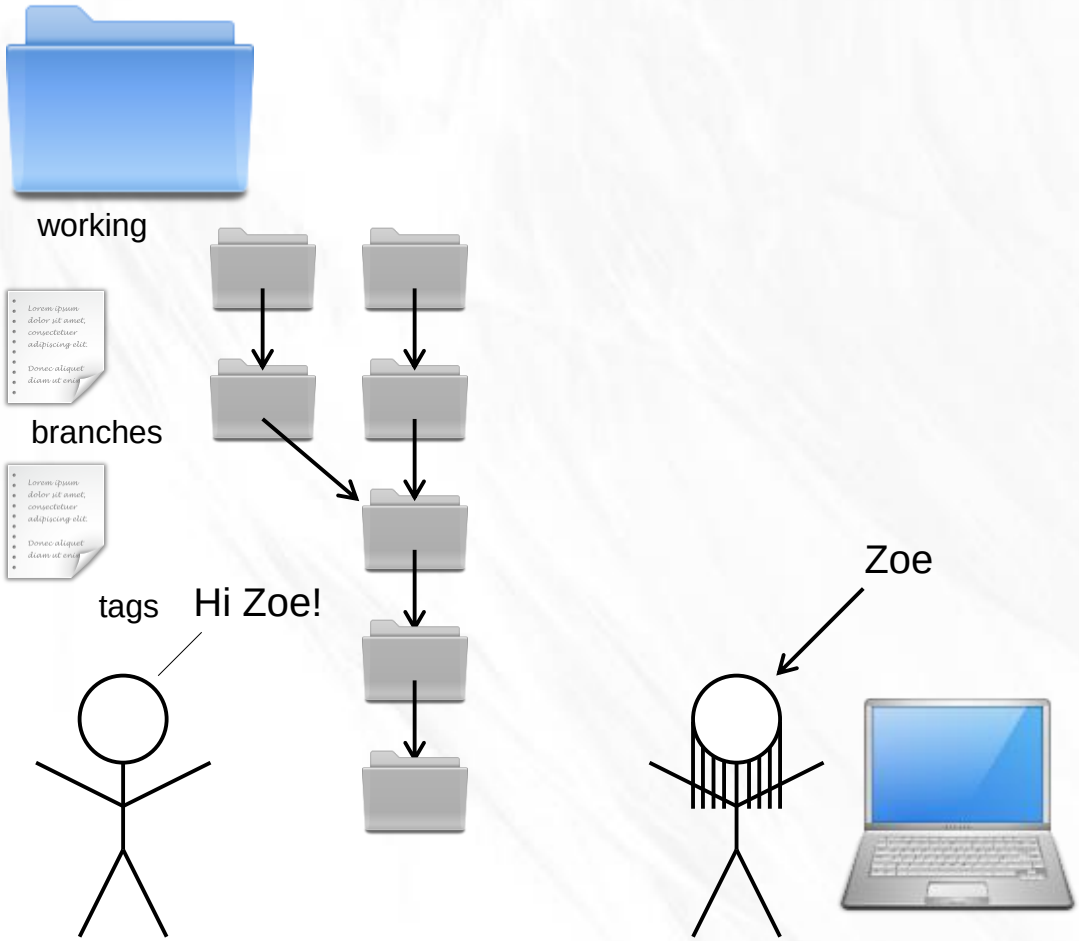

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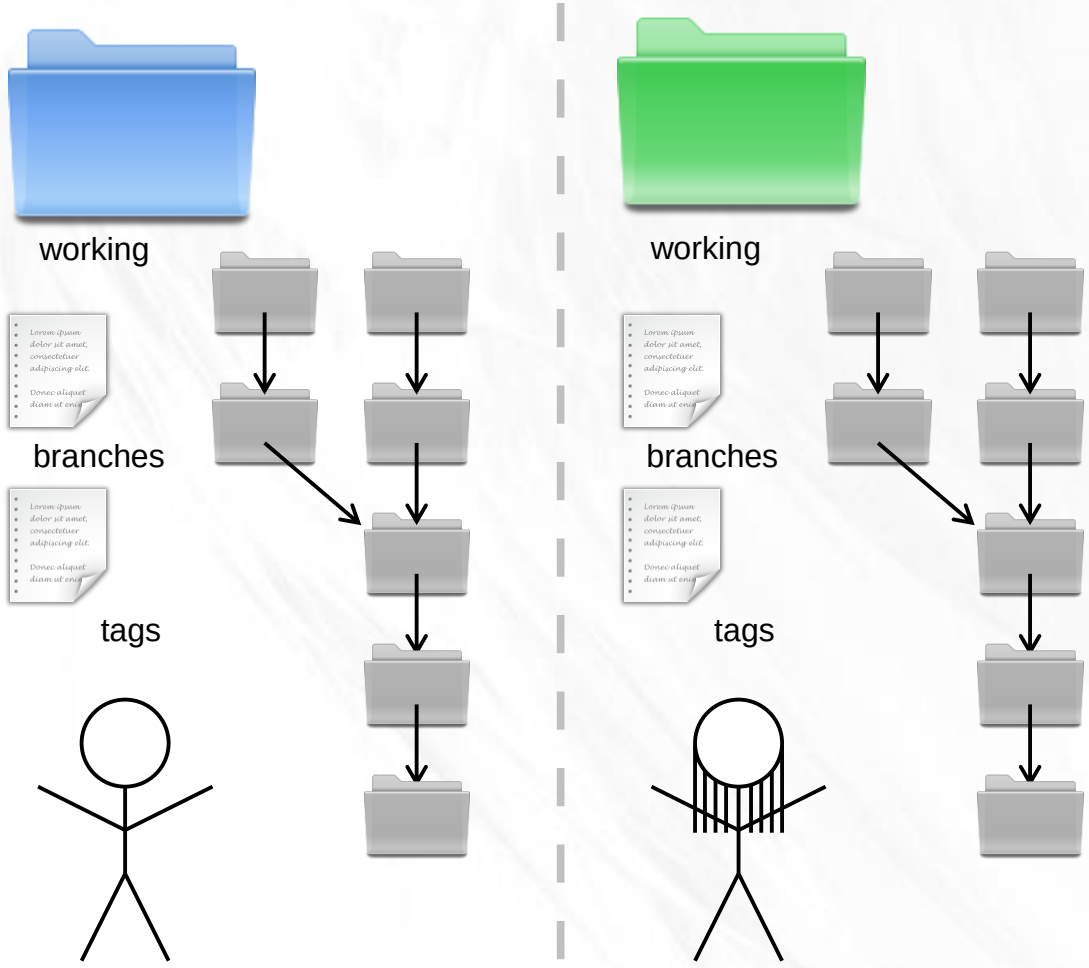

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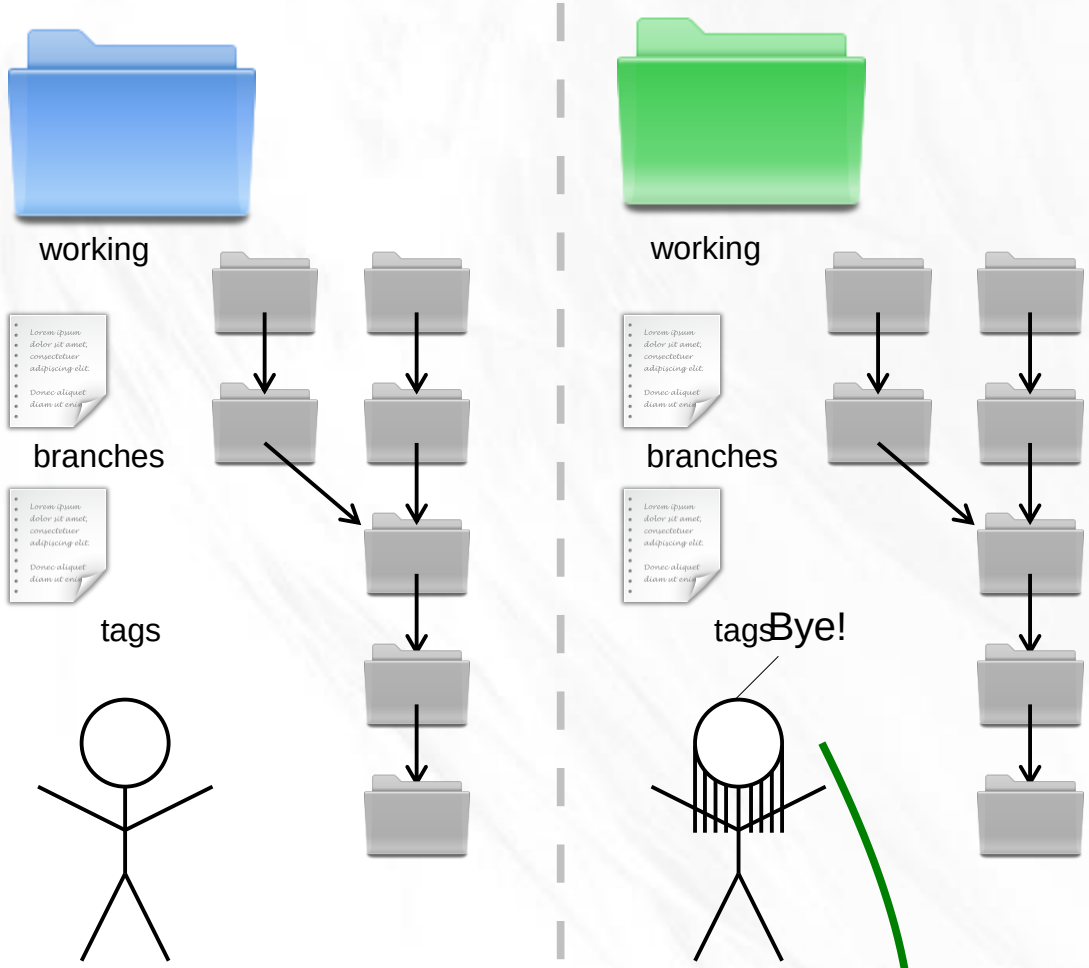

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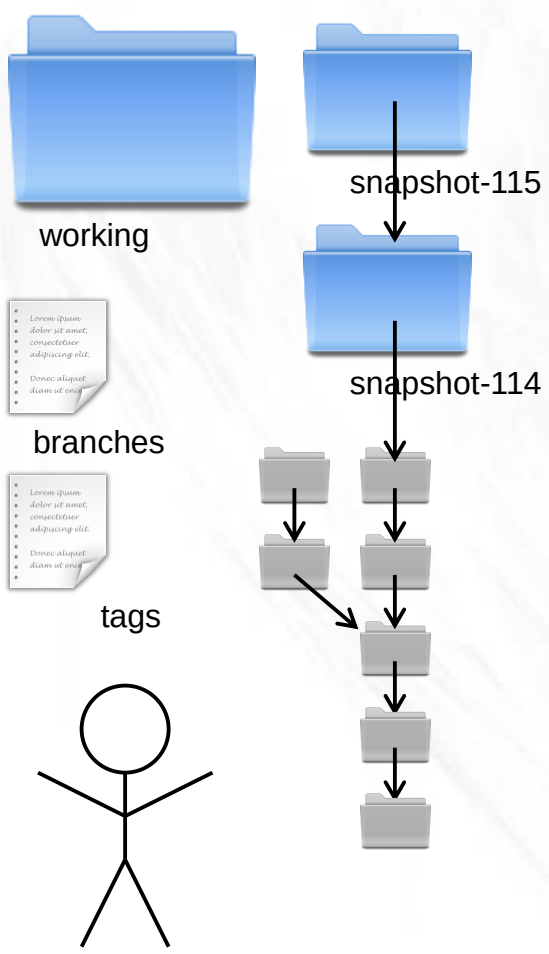
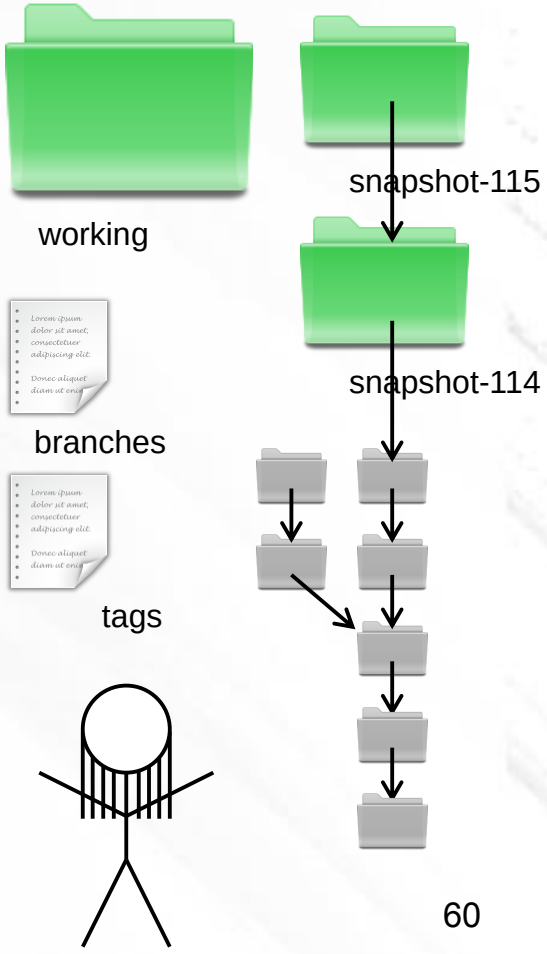




Distributed

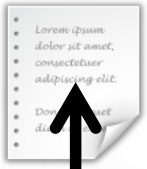
snapshot-114

message

2009-05-22 12:12:12
parent: snapshot-113
author: Me <me@me.me>

Blarfle, a cool new feature; extends the existing blorg.

snapshot-114



message

2009-05-21 23:45:01
parent: snapshot-113
author: Zoe <zoe@z.oe>

Introduced a new foo, and reset the bar to xyzzy.

Distributed

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SHA1

message

2009-05-22 12:12:12
parent: snapshot-113
author: Me <me@me.me>

Blarfle, a cool new feature; extends the existing blorg.

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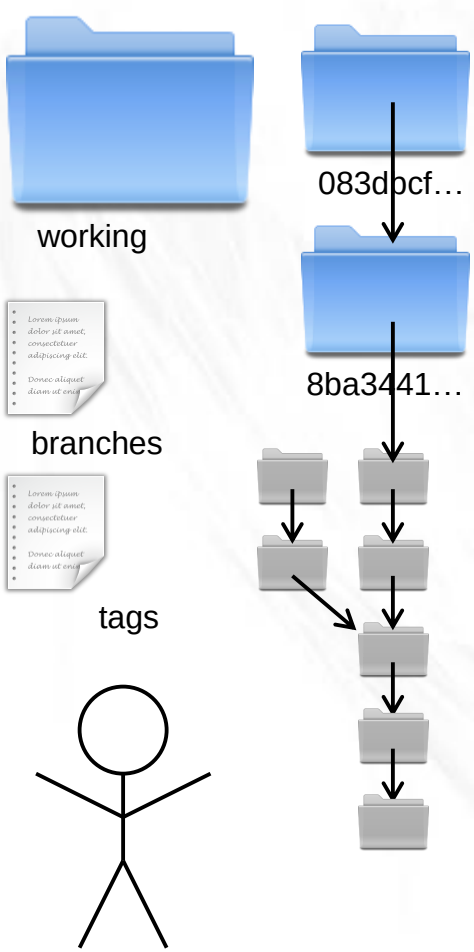
SHA1

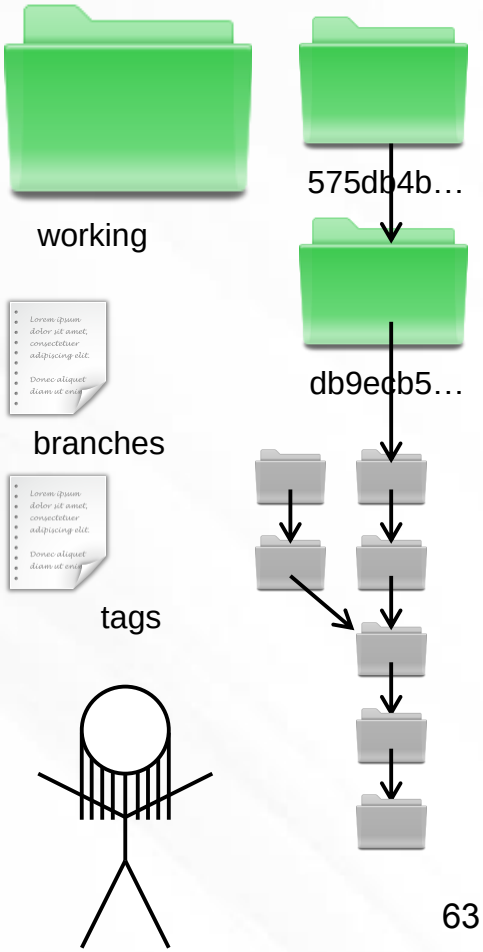
message

2009-05-21 23:45:01
parent: snapshot-113
author: Zoe <zoe@z.oe>

Introduced a new foo, and reset the bar to xyzzy.

Distributed





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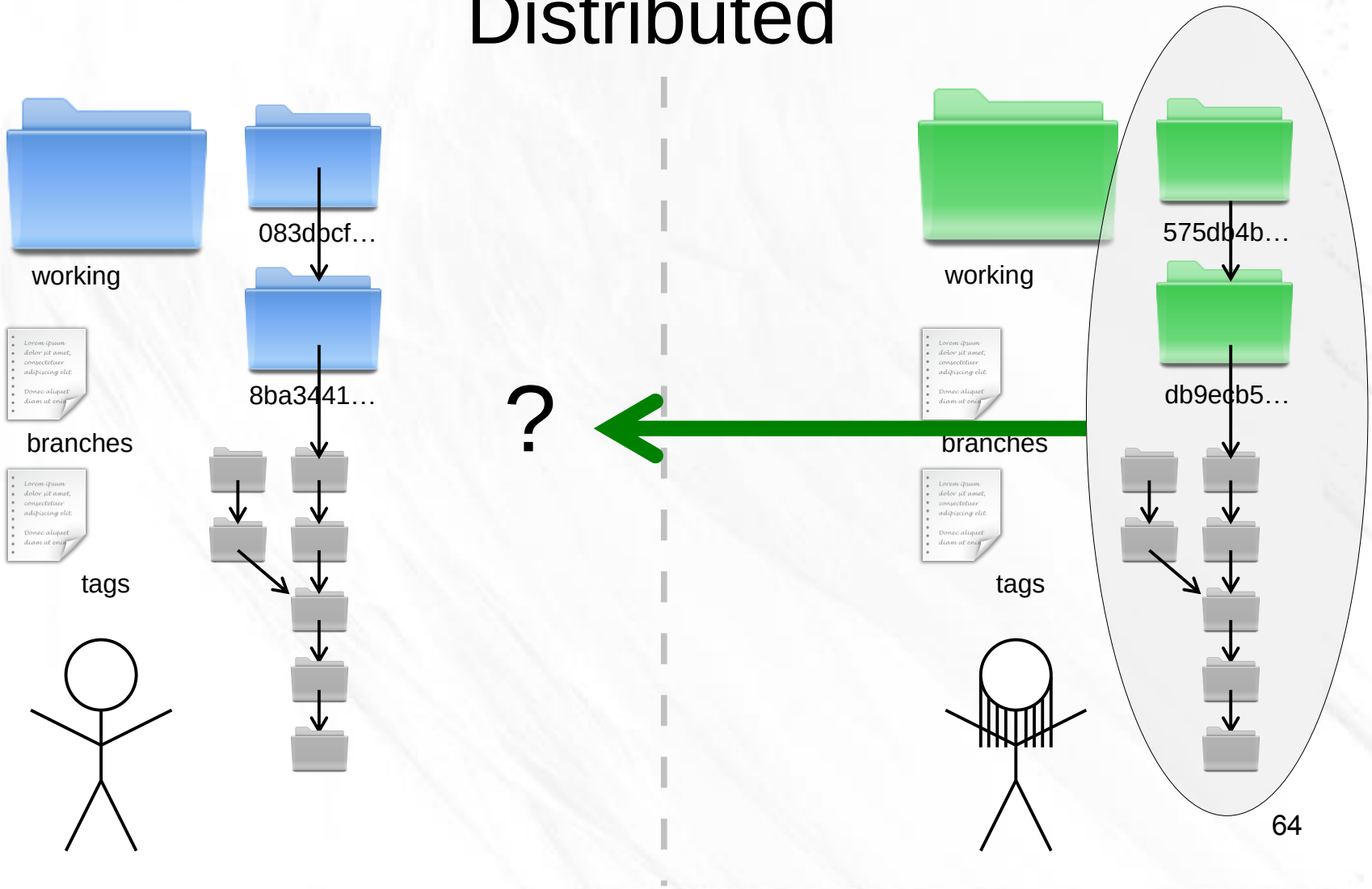

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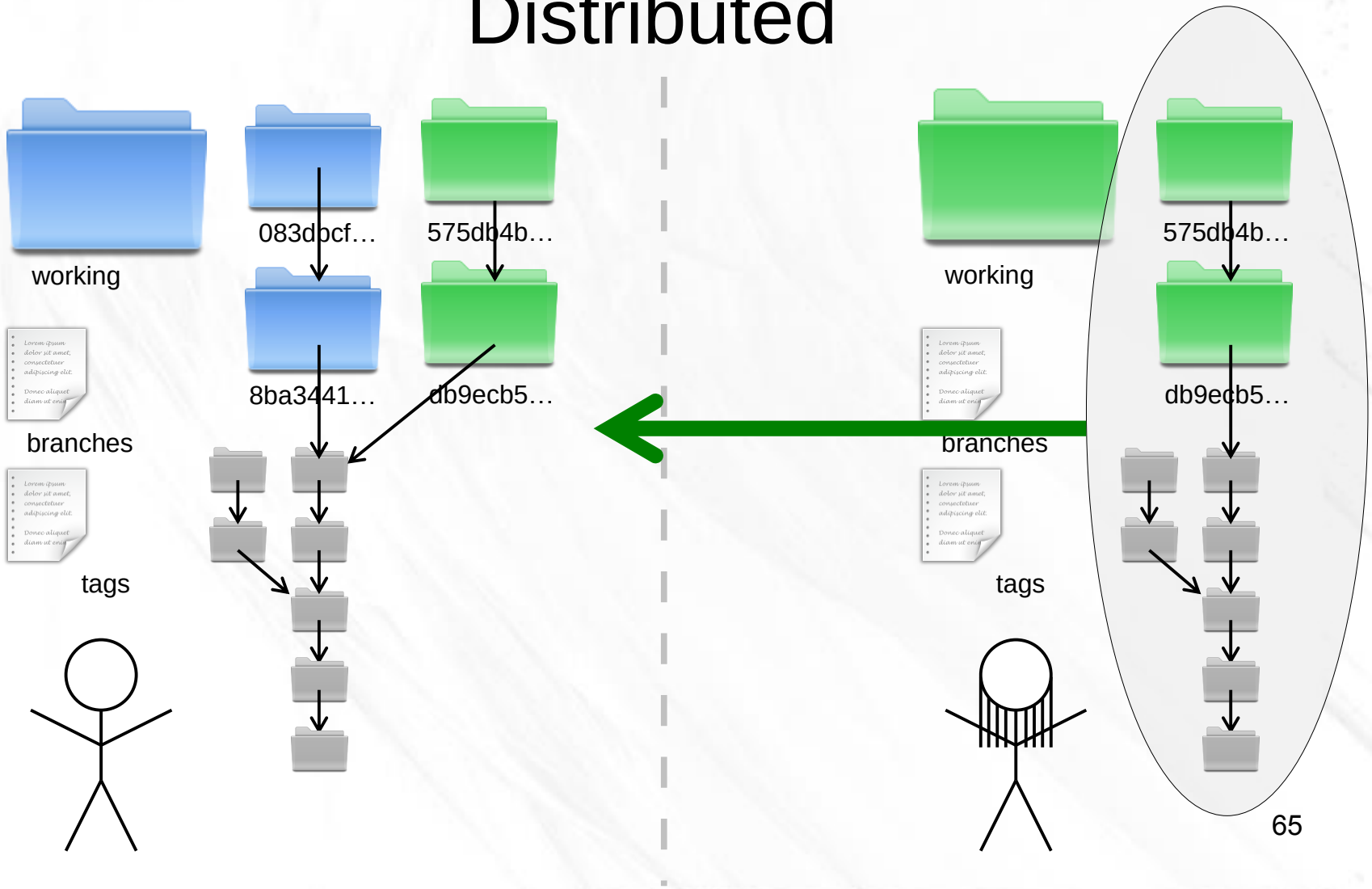

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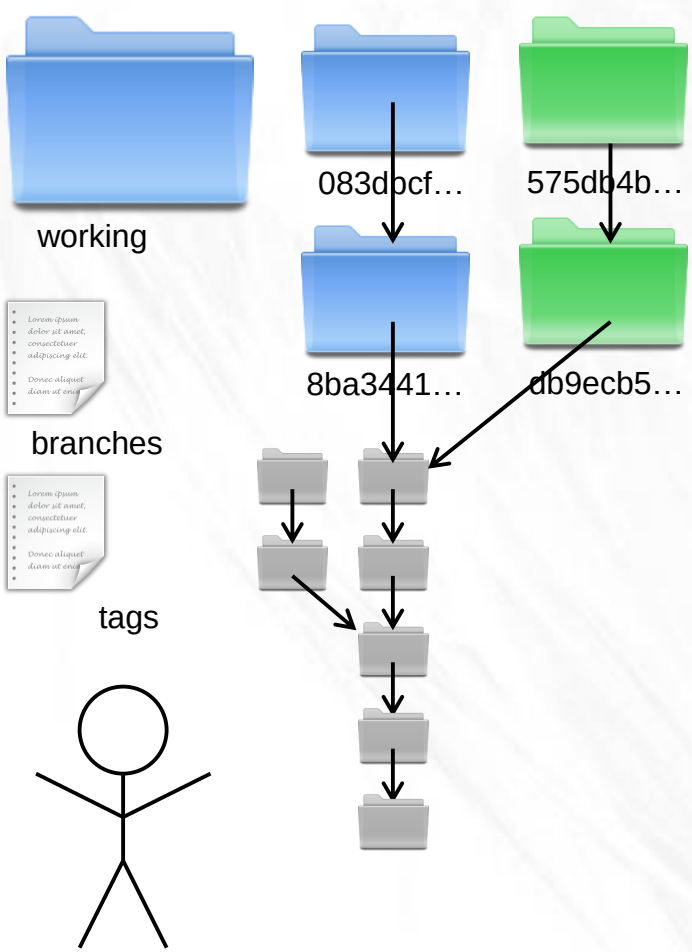

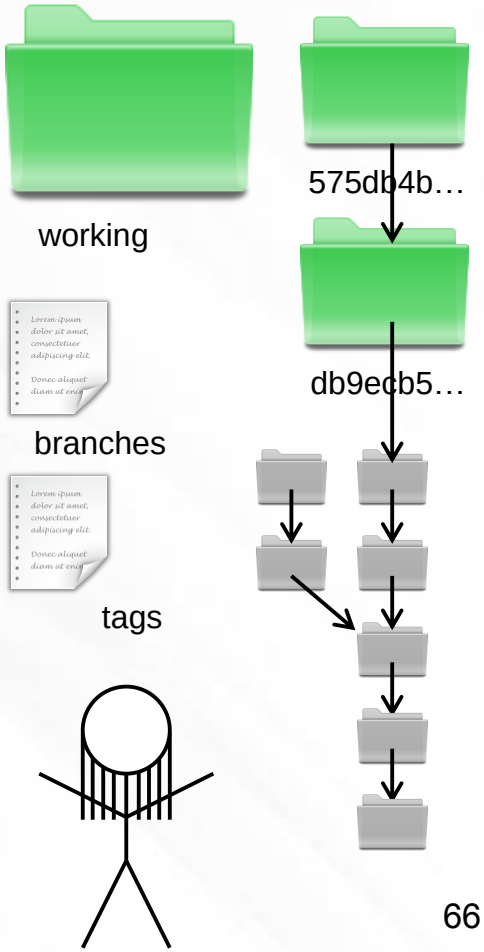

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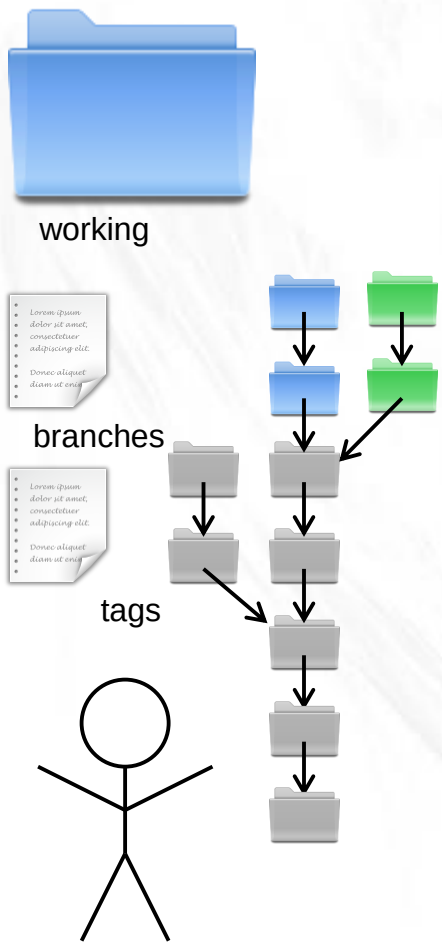

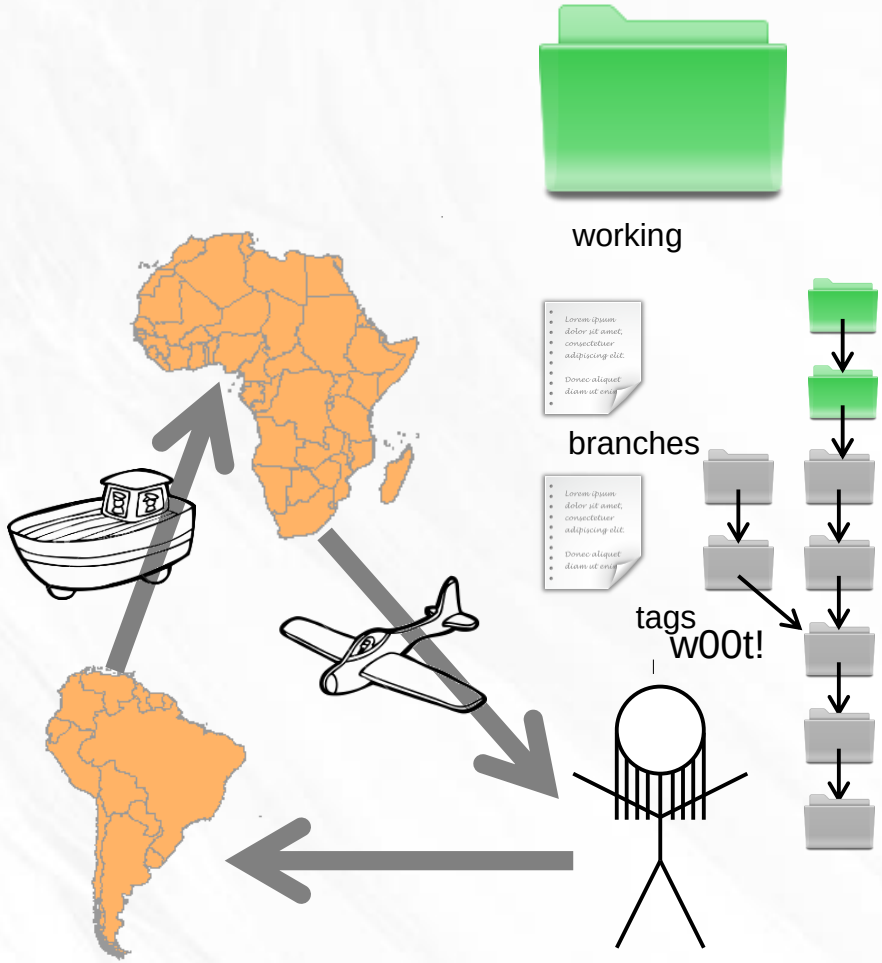

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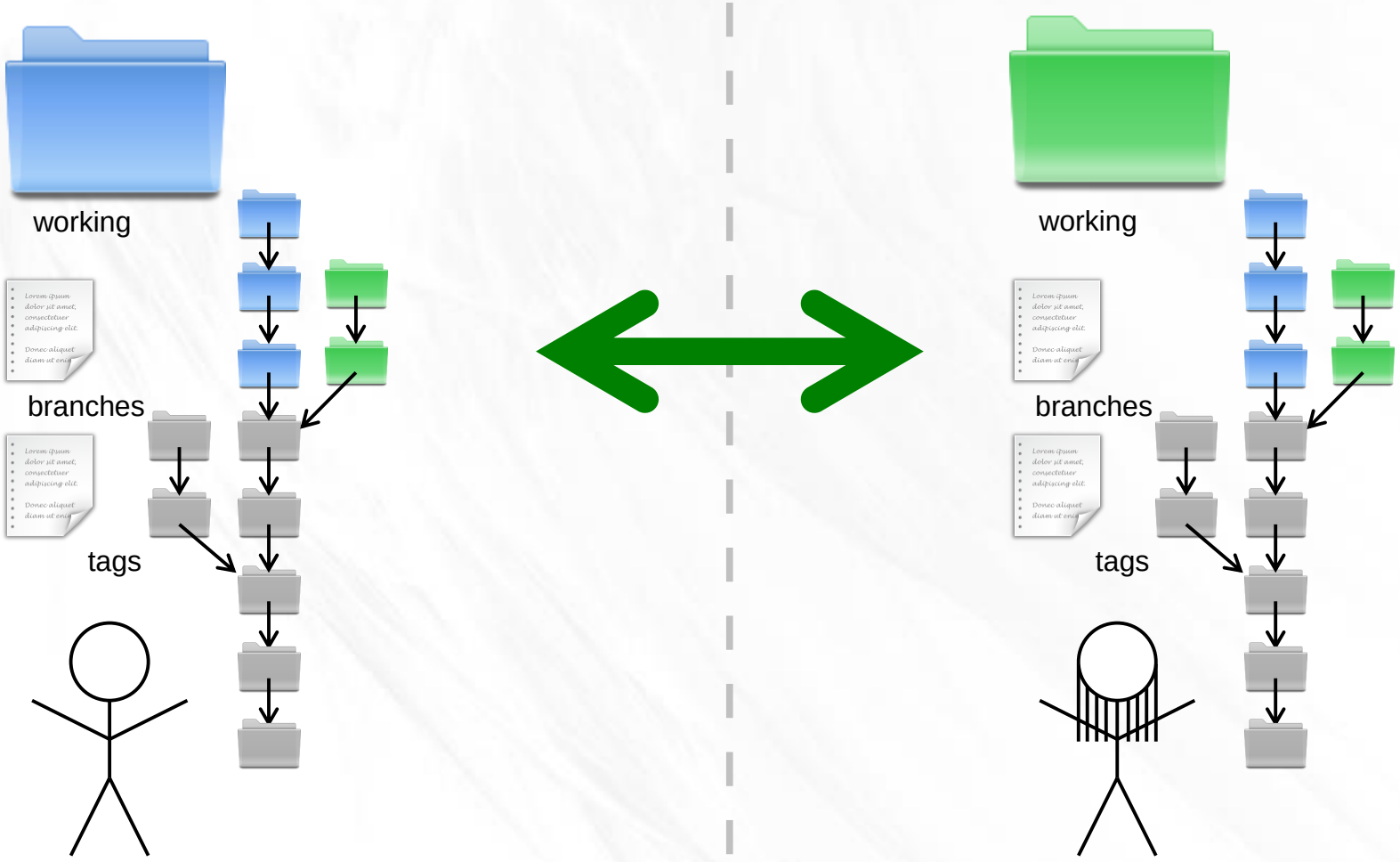
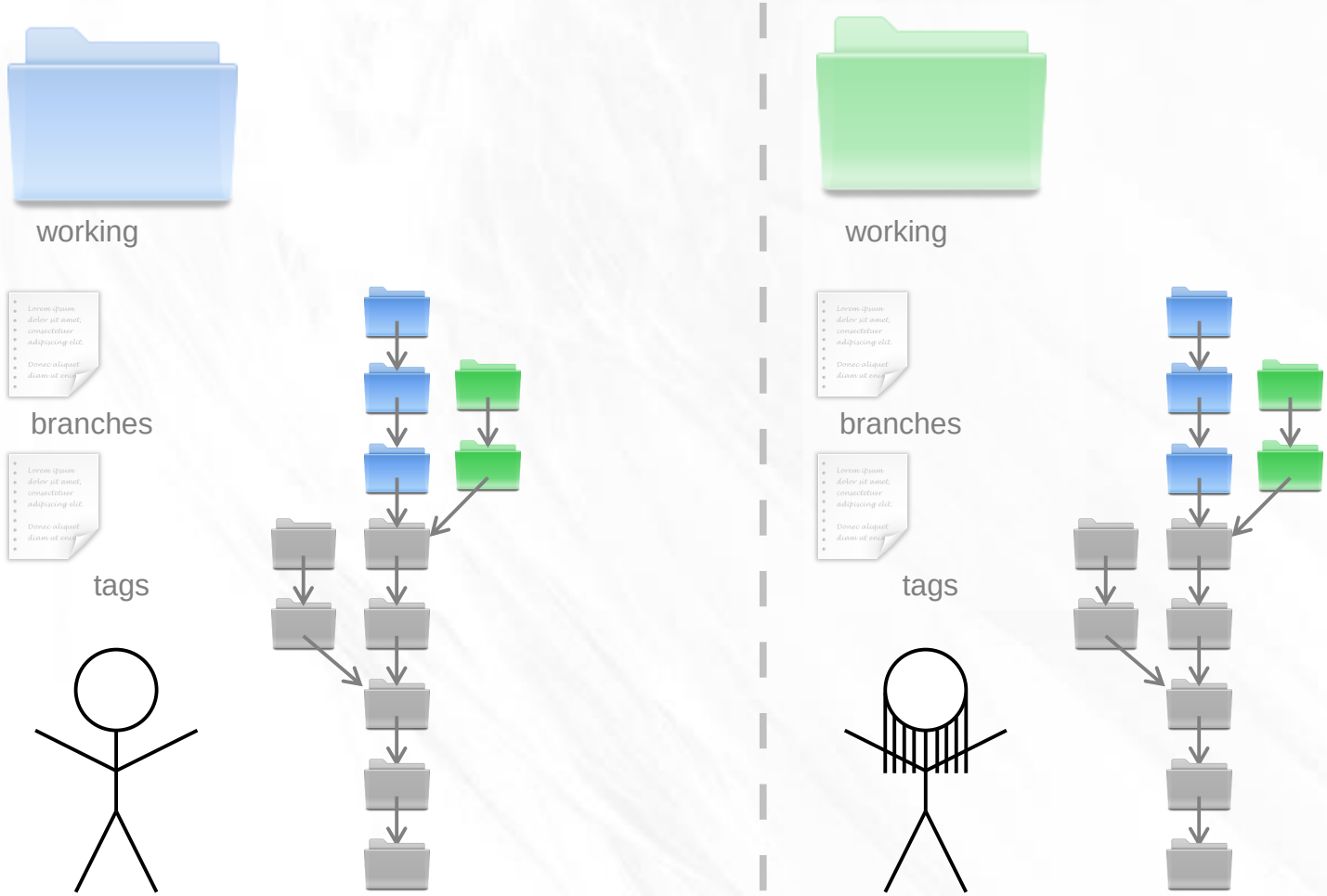


(simpler drawings)



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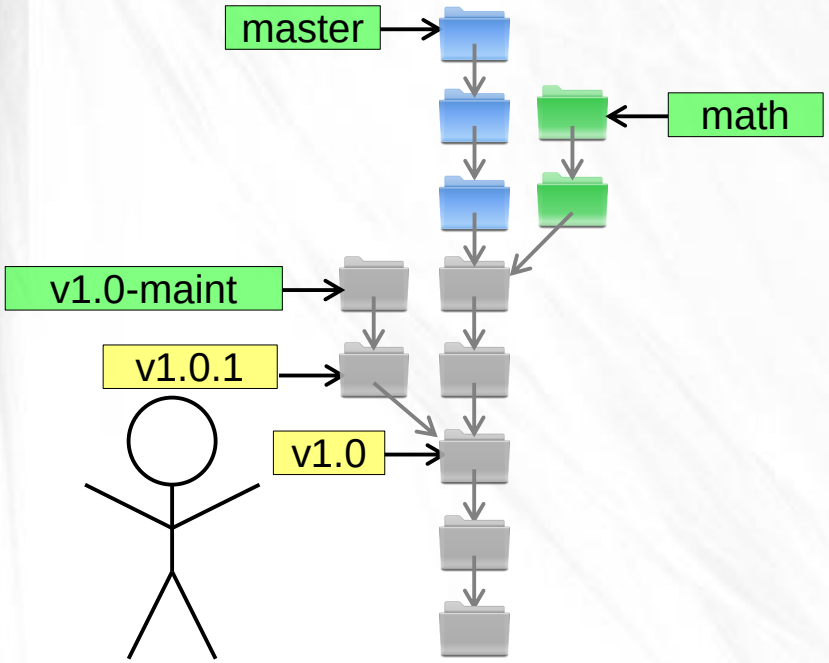

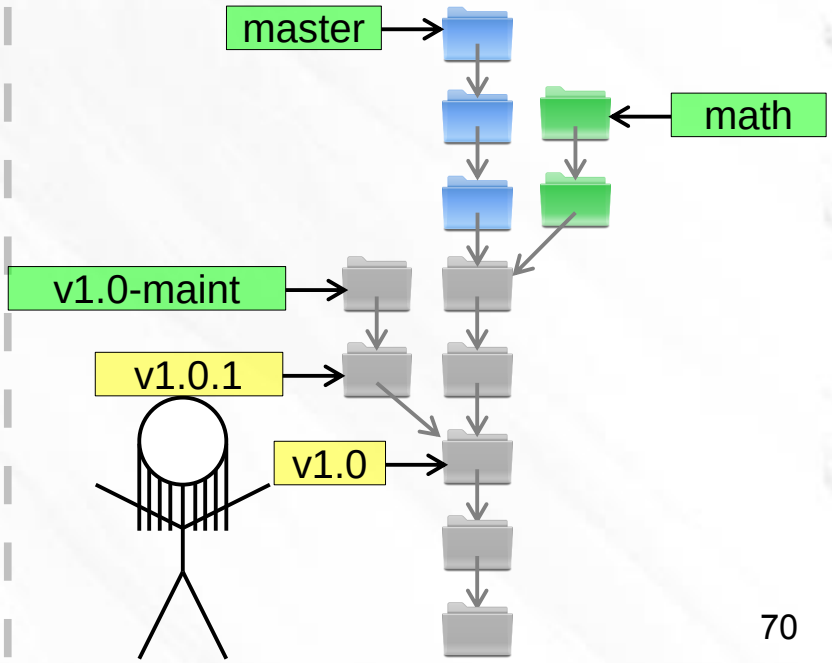

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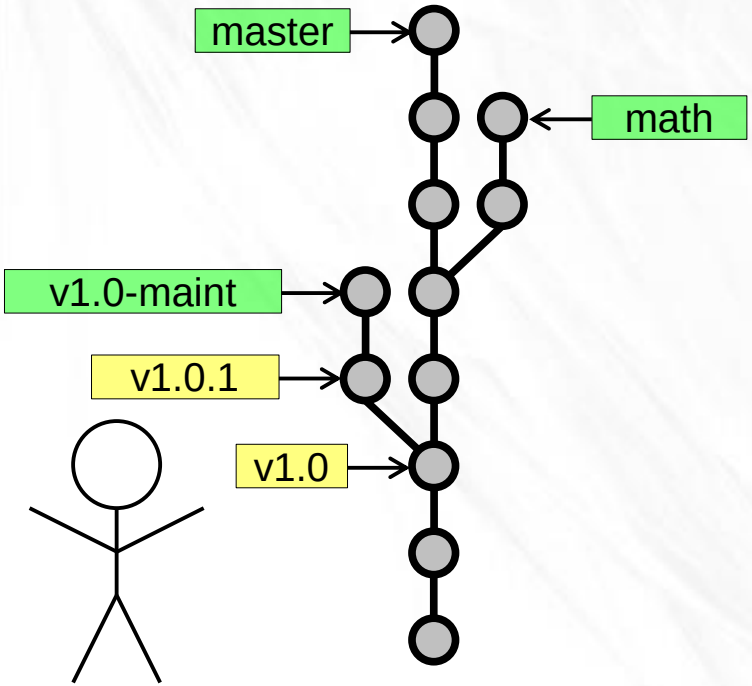
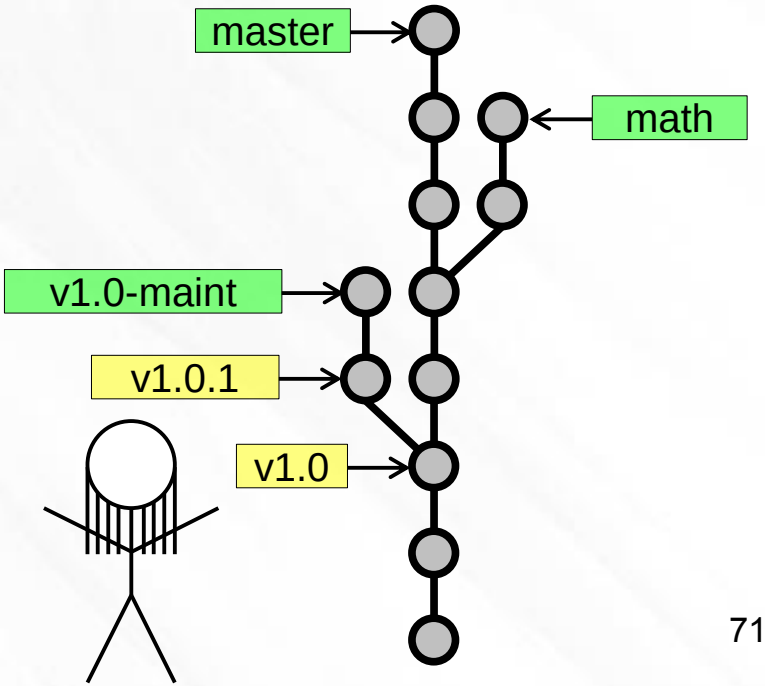
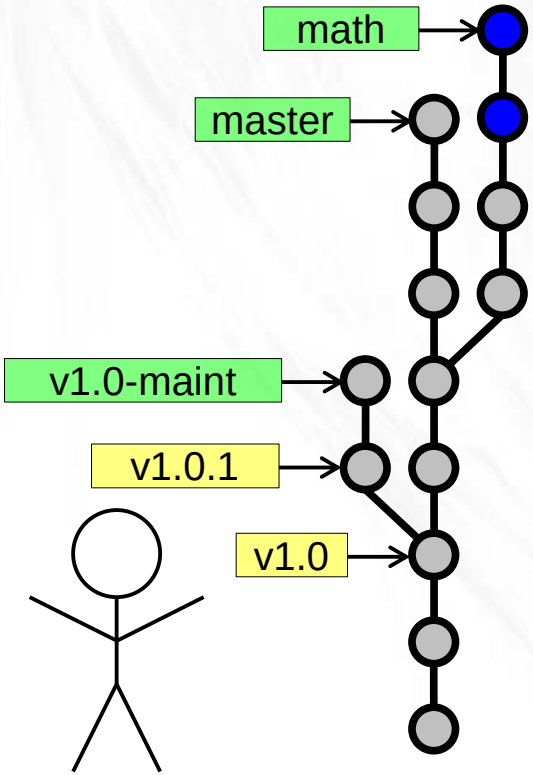




Merges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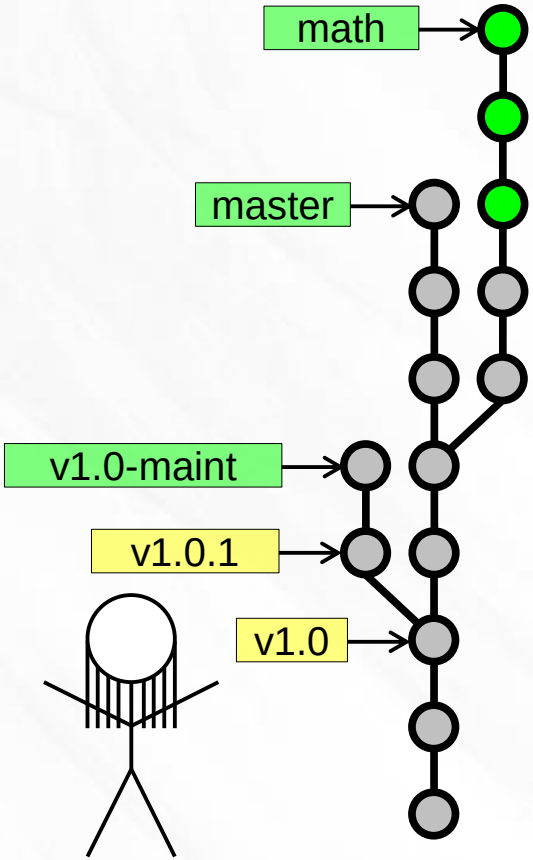
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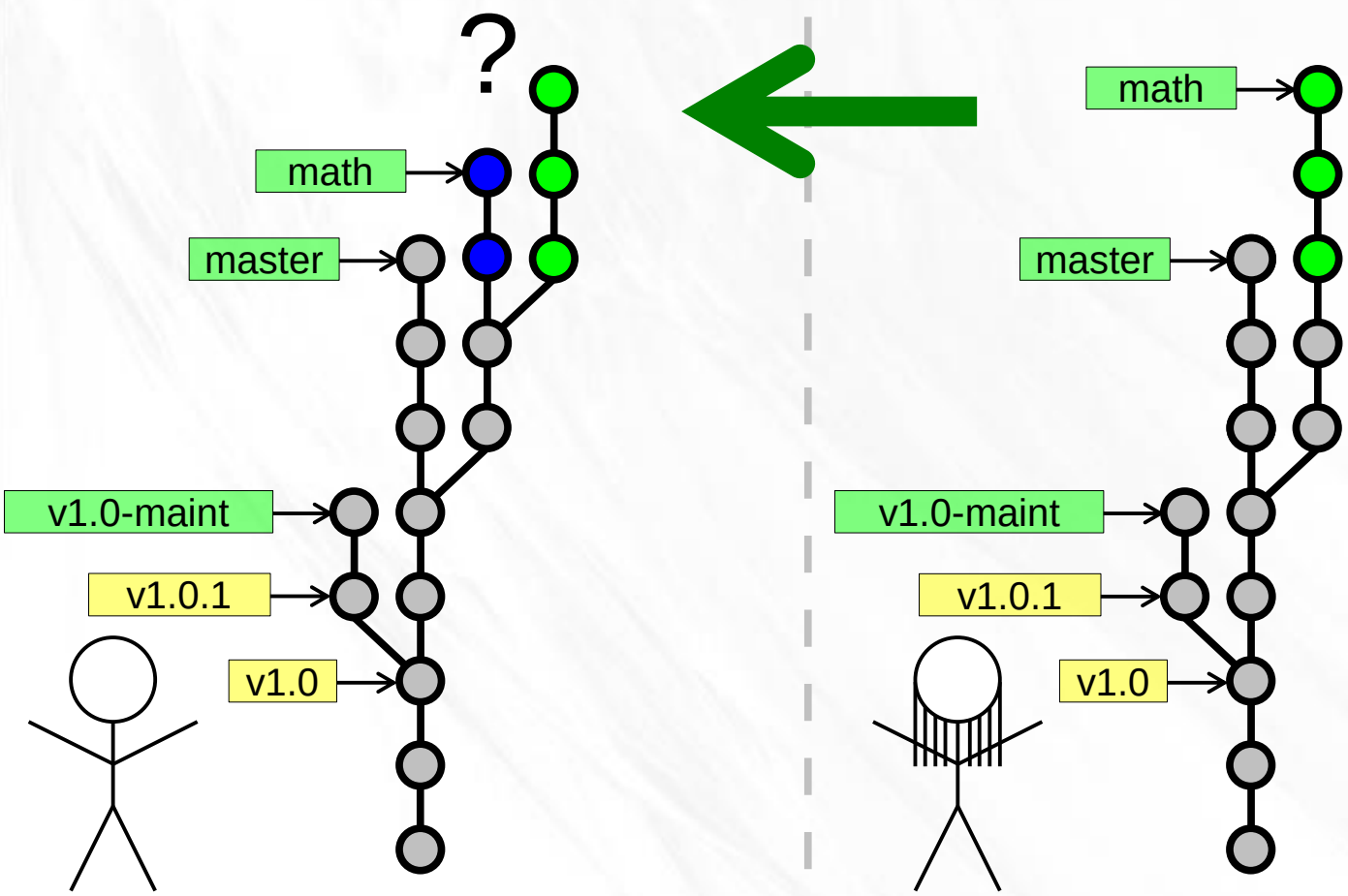
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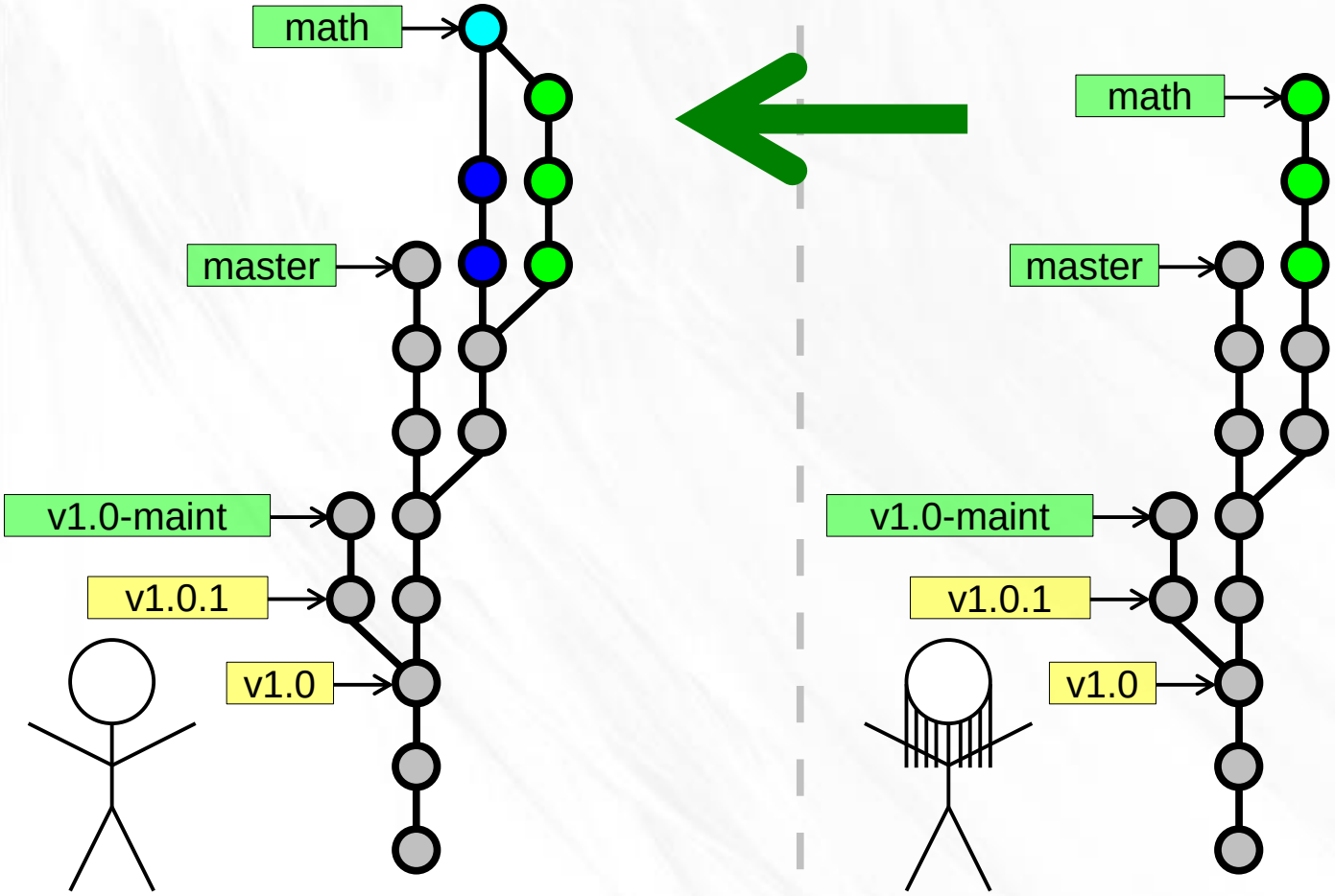
Merges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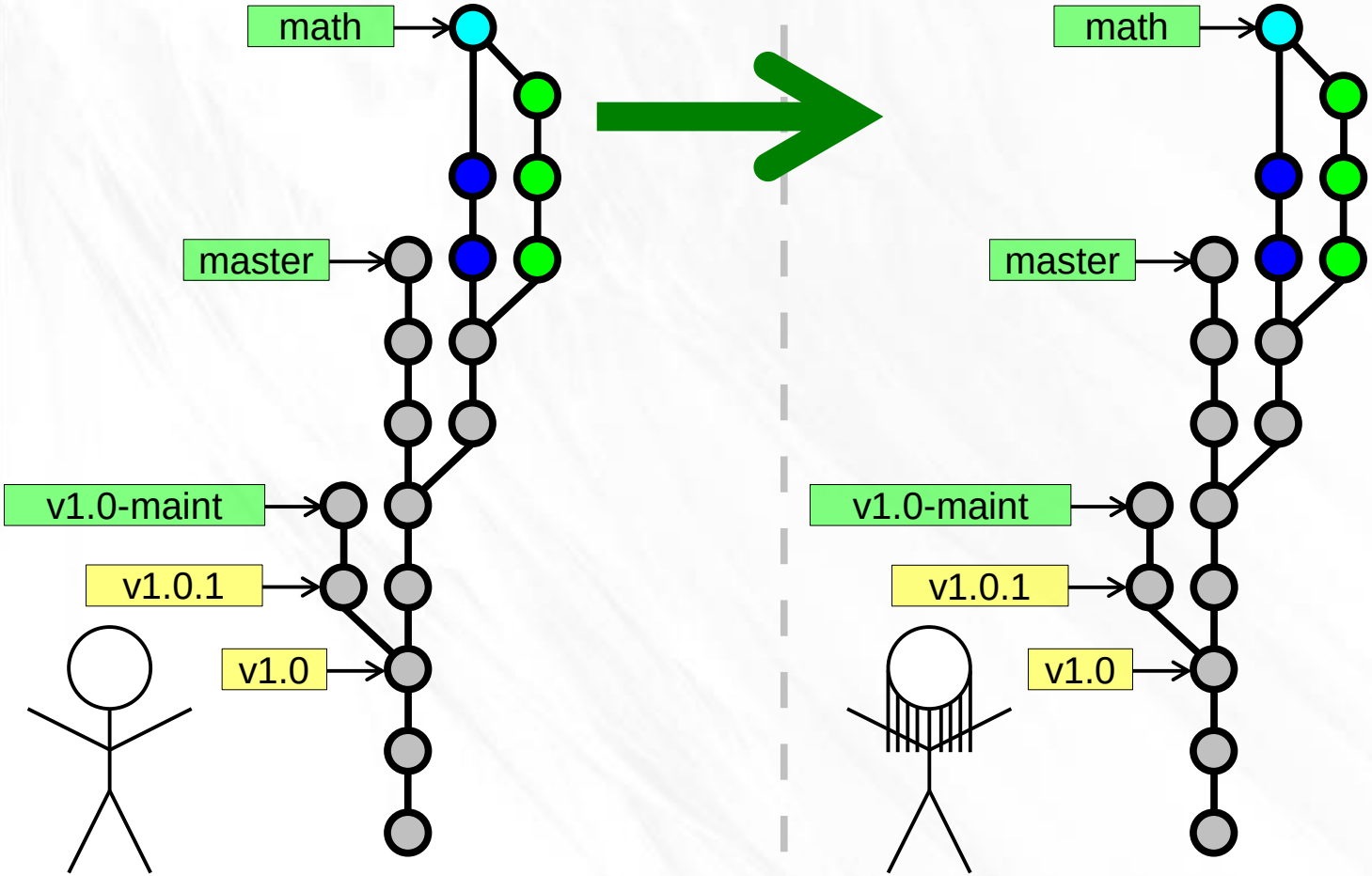
Merges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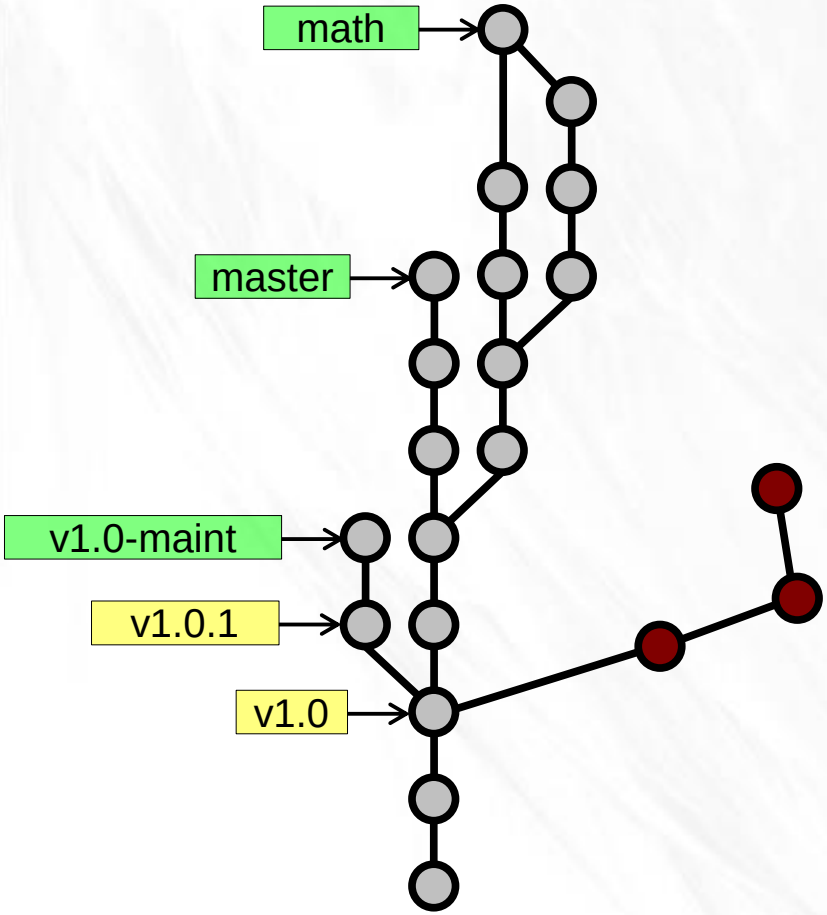
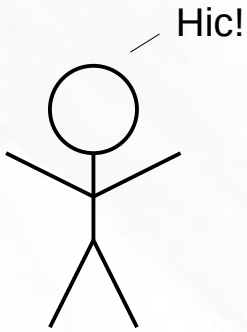
Rewriting History





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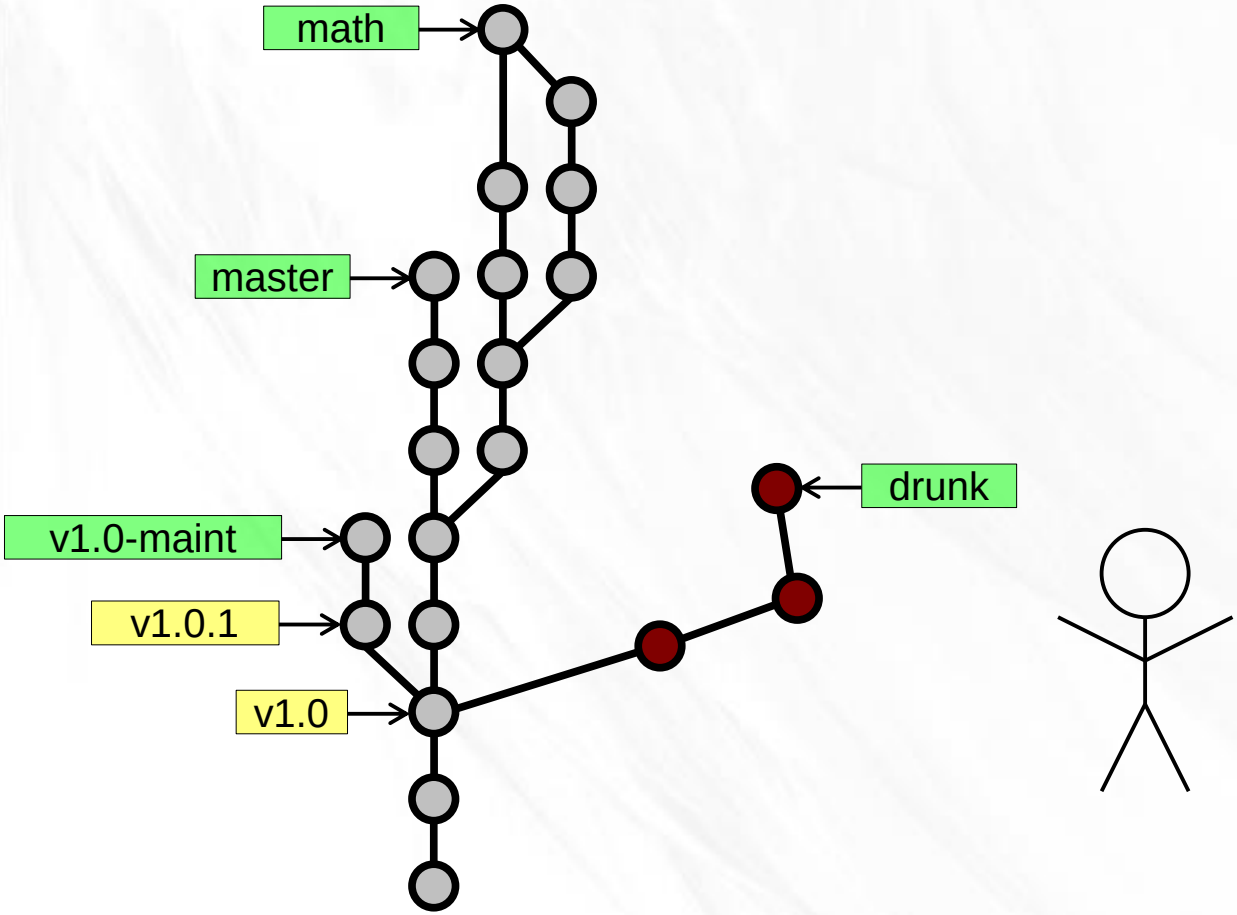

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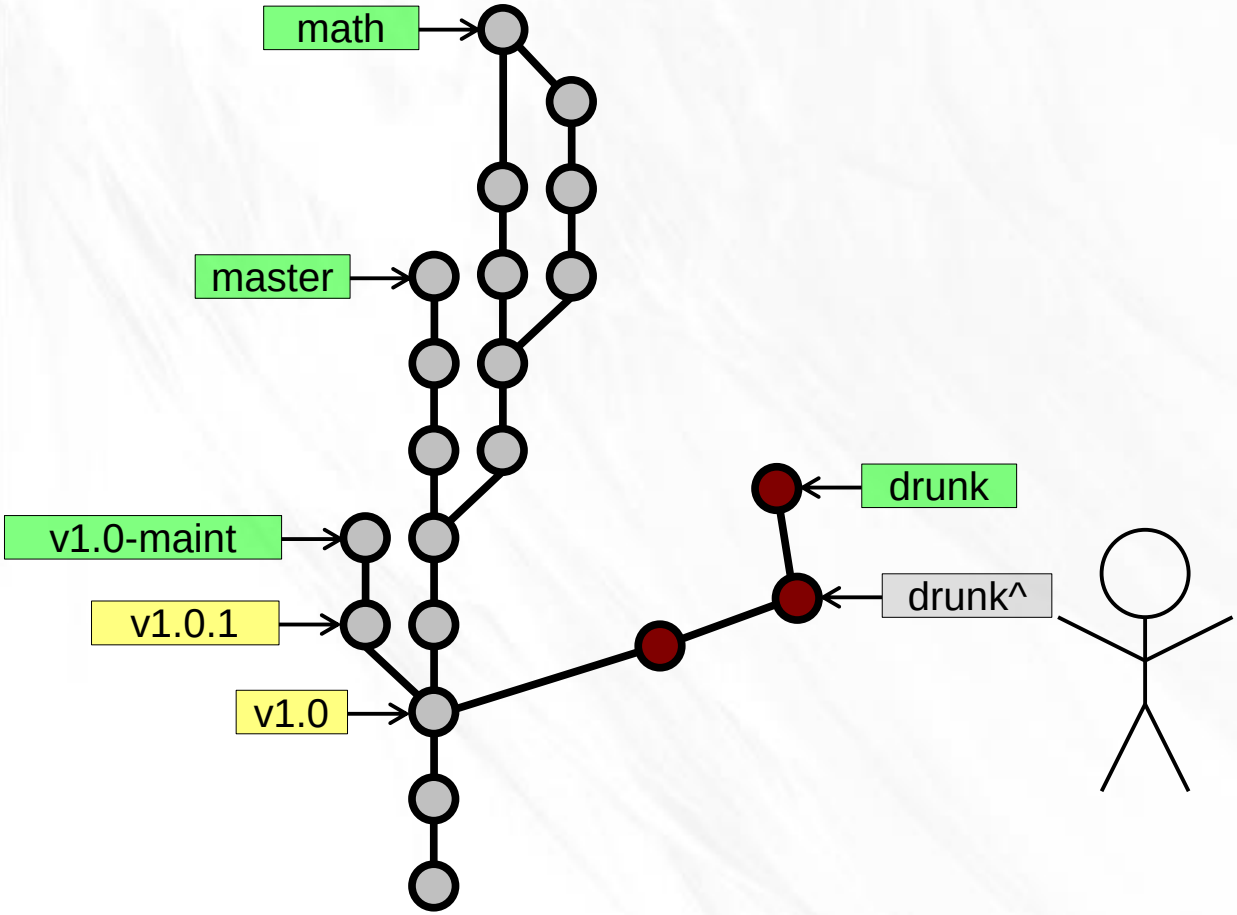

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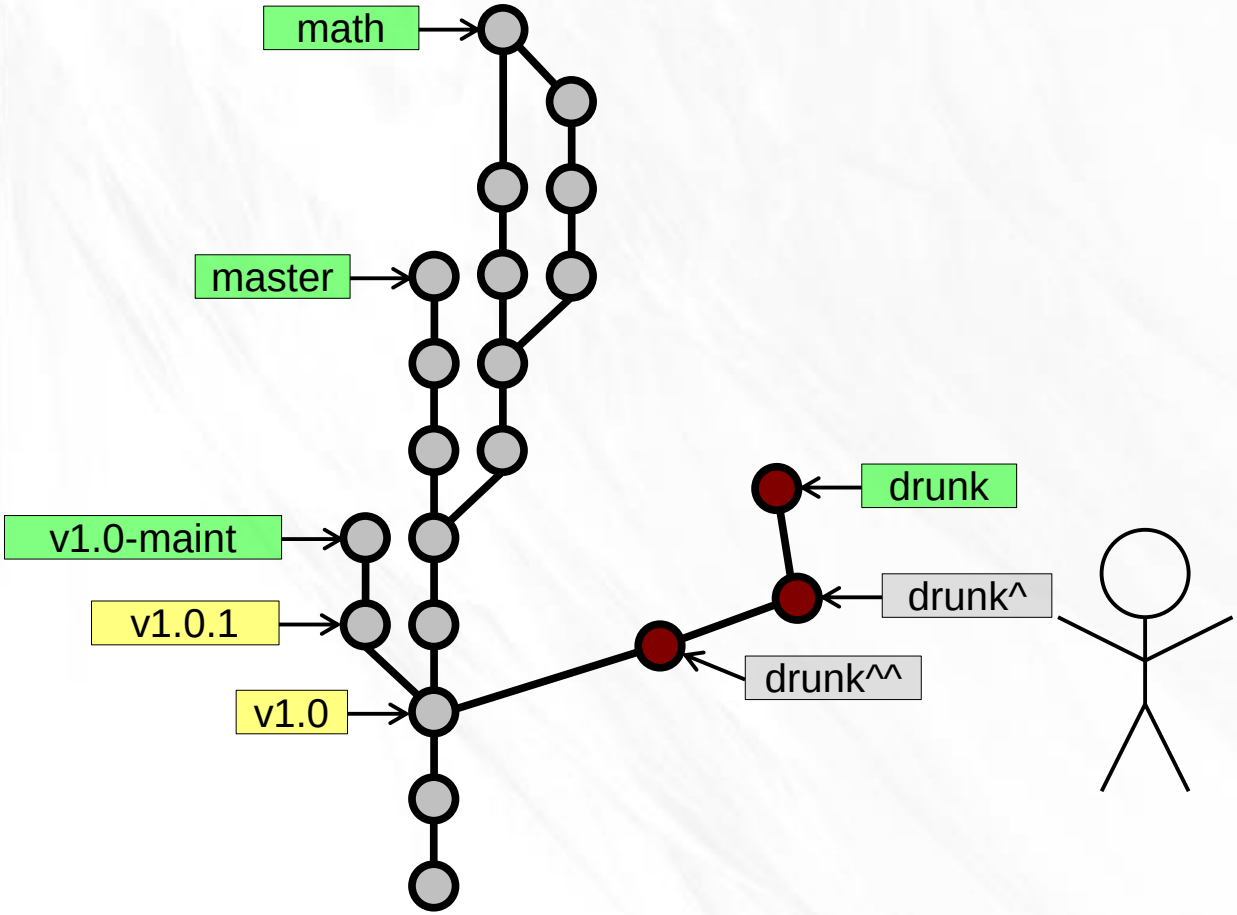

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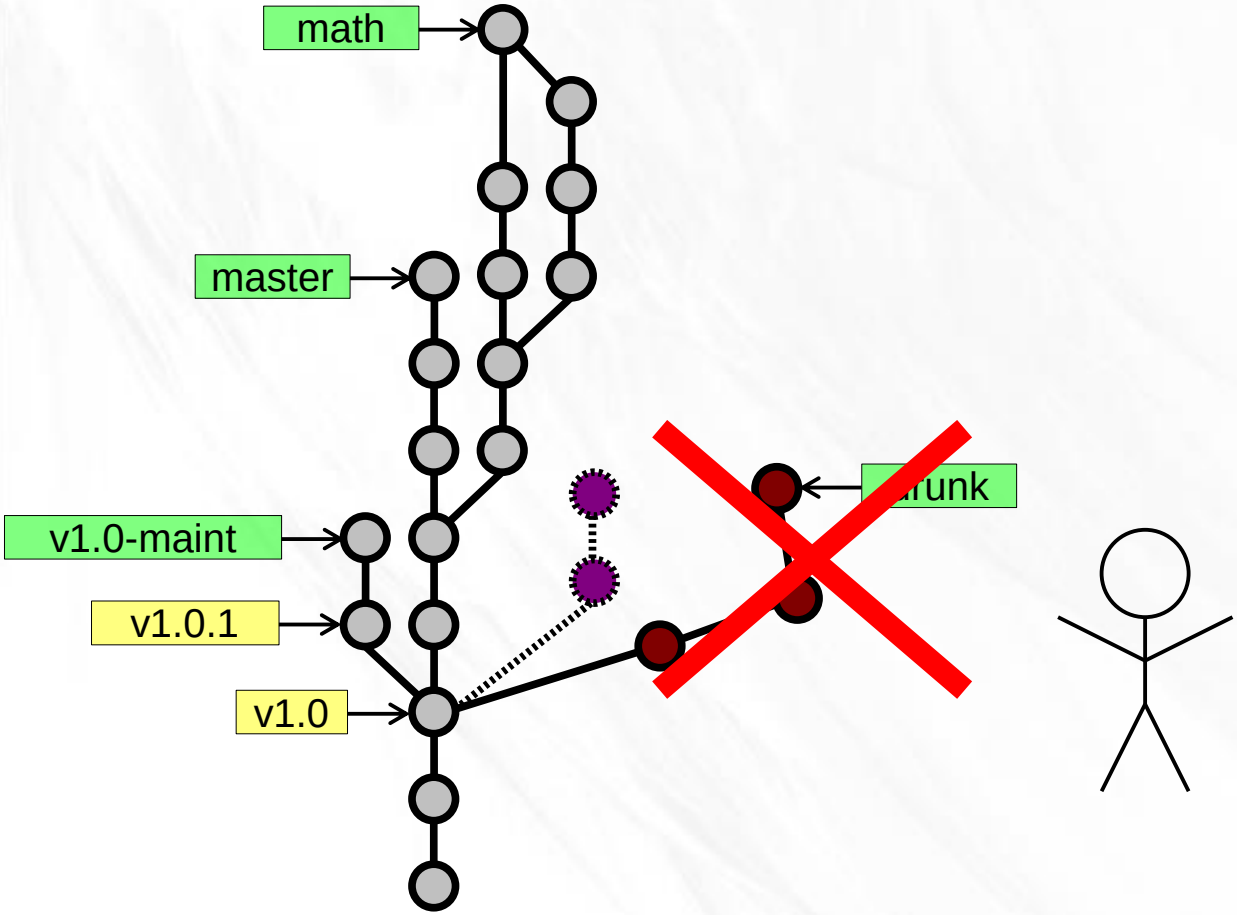

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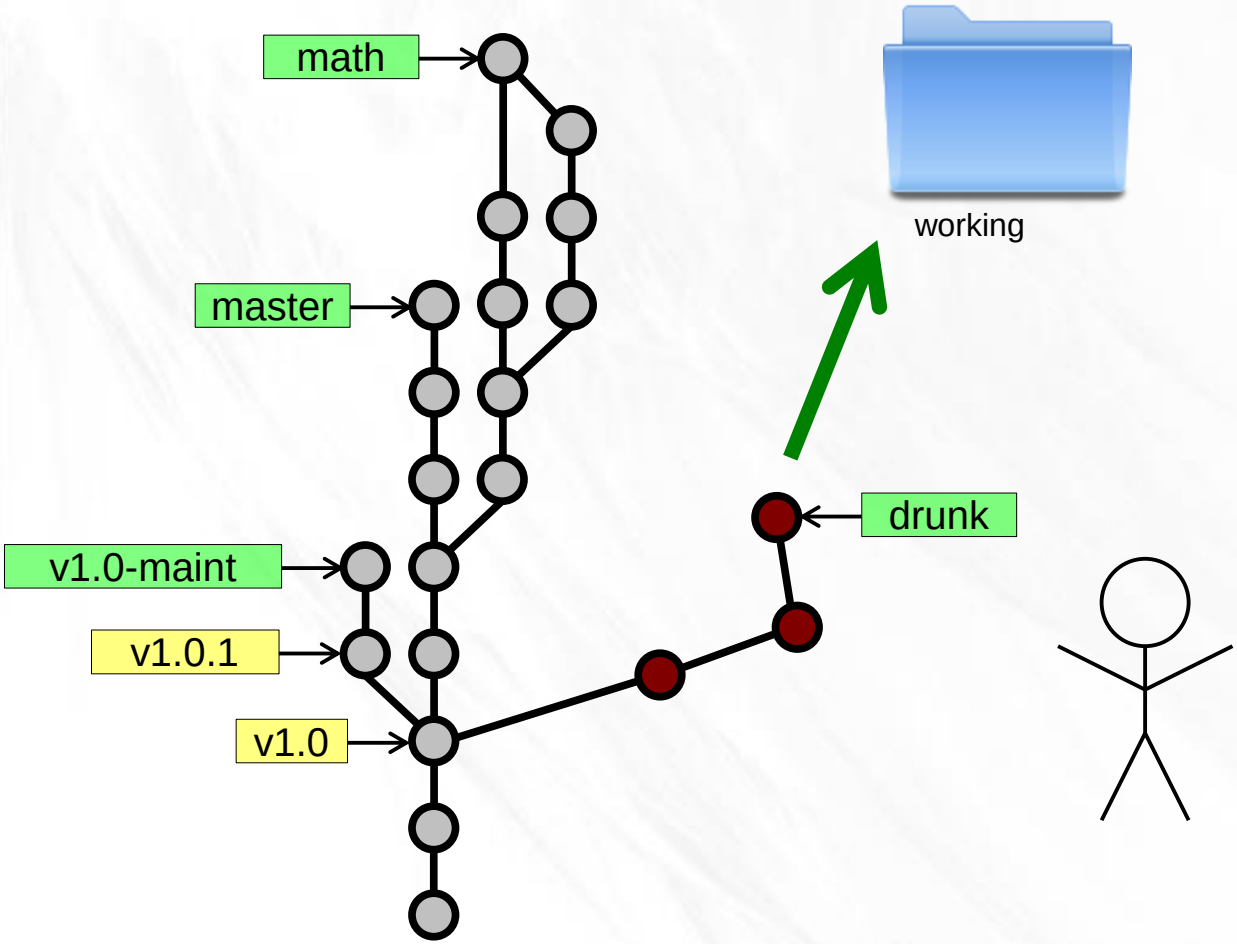

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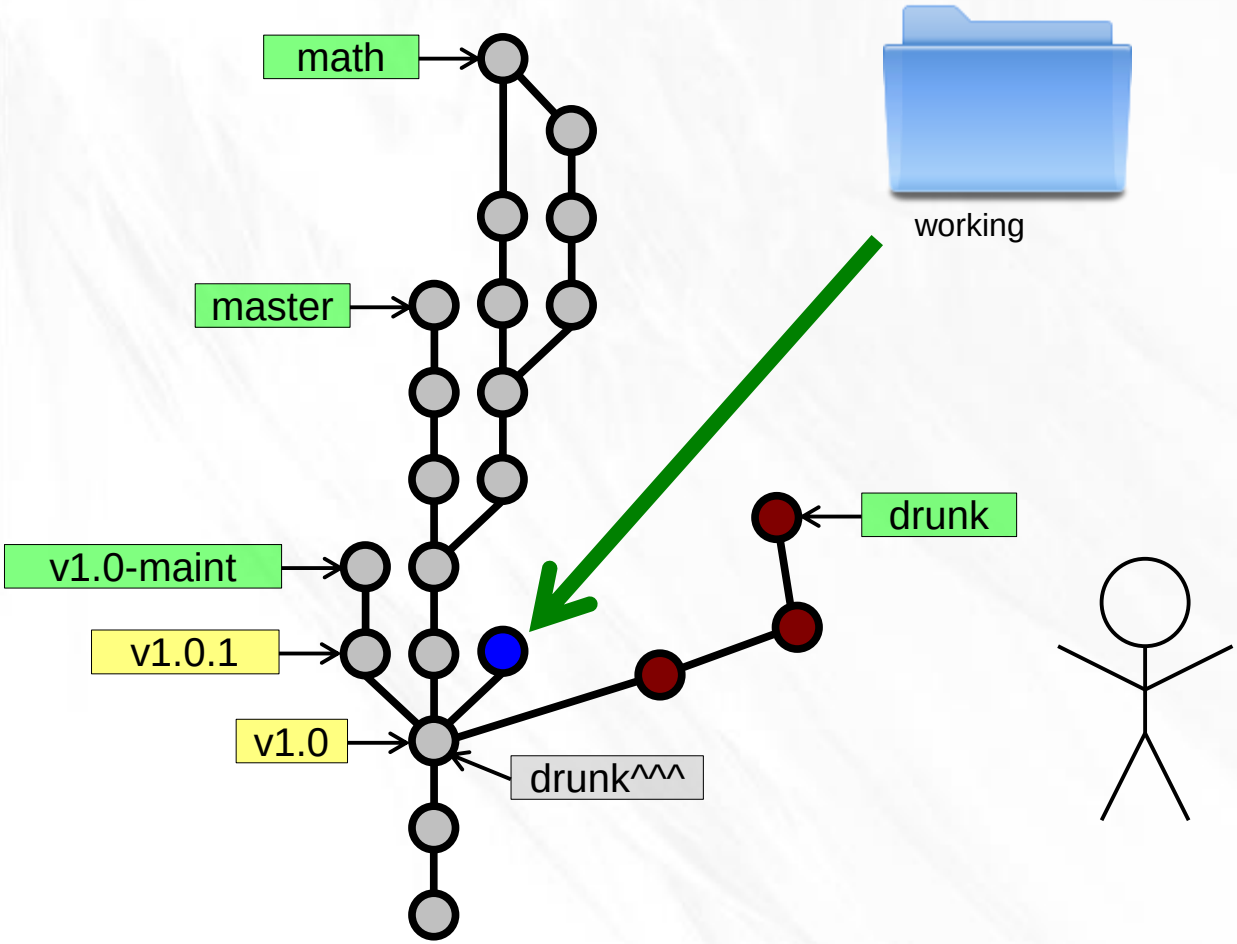

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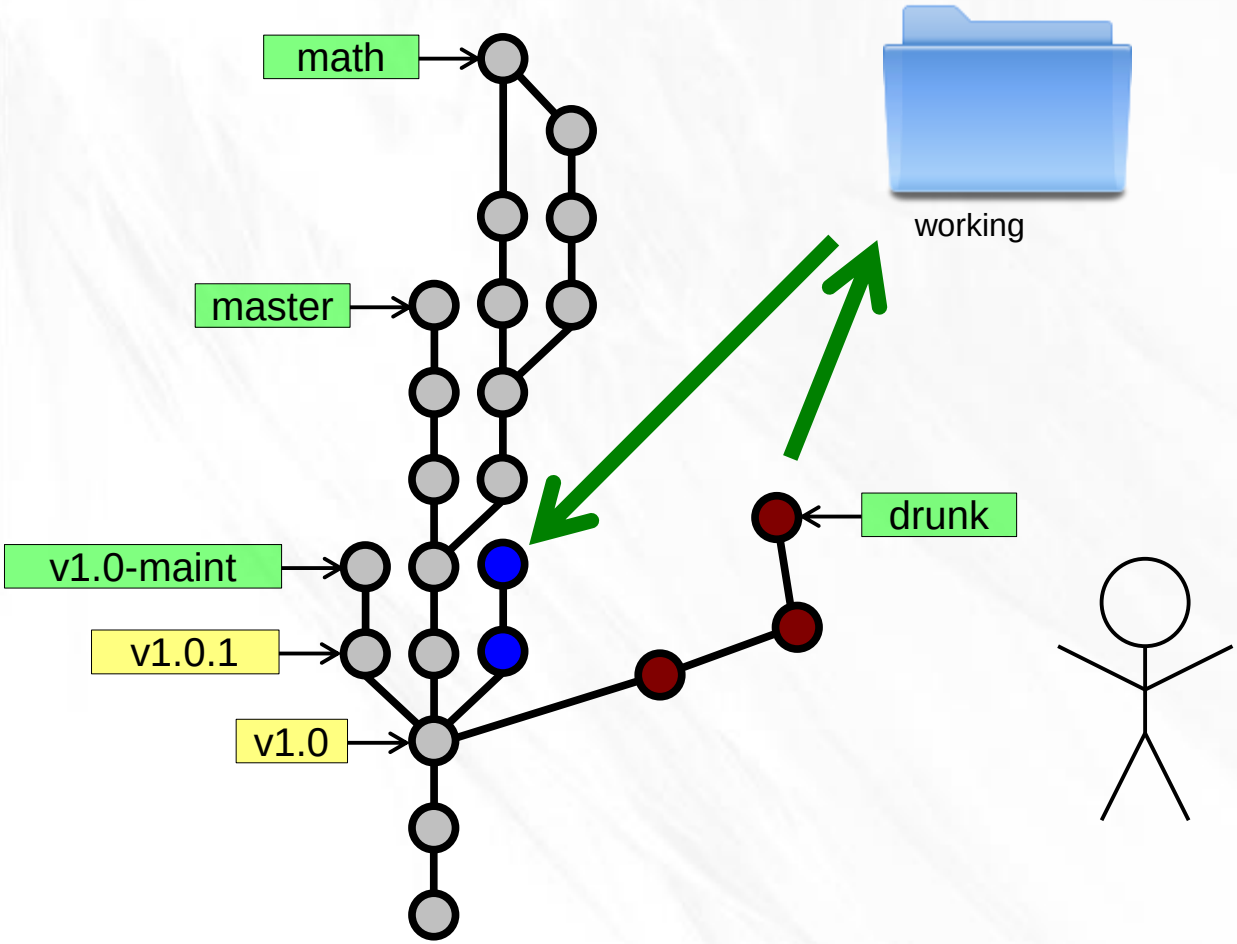

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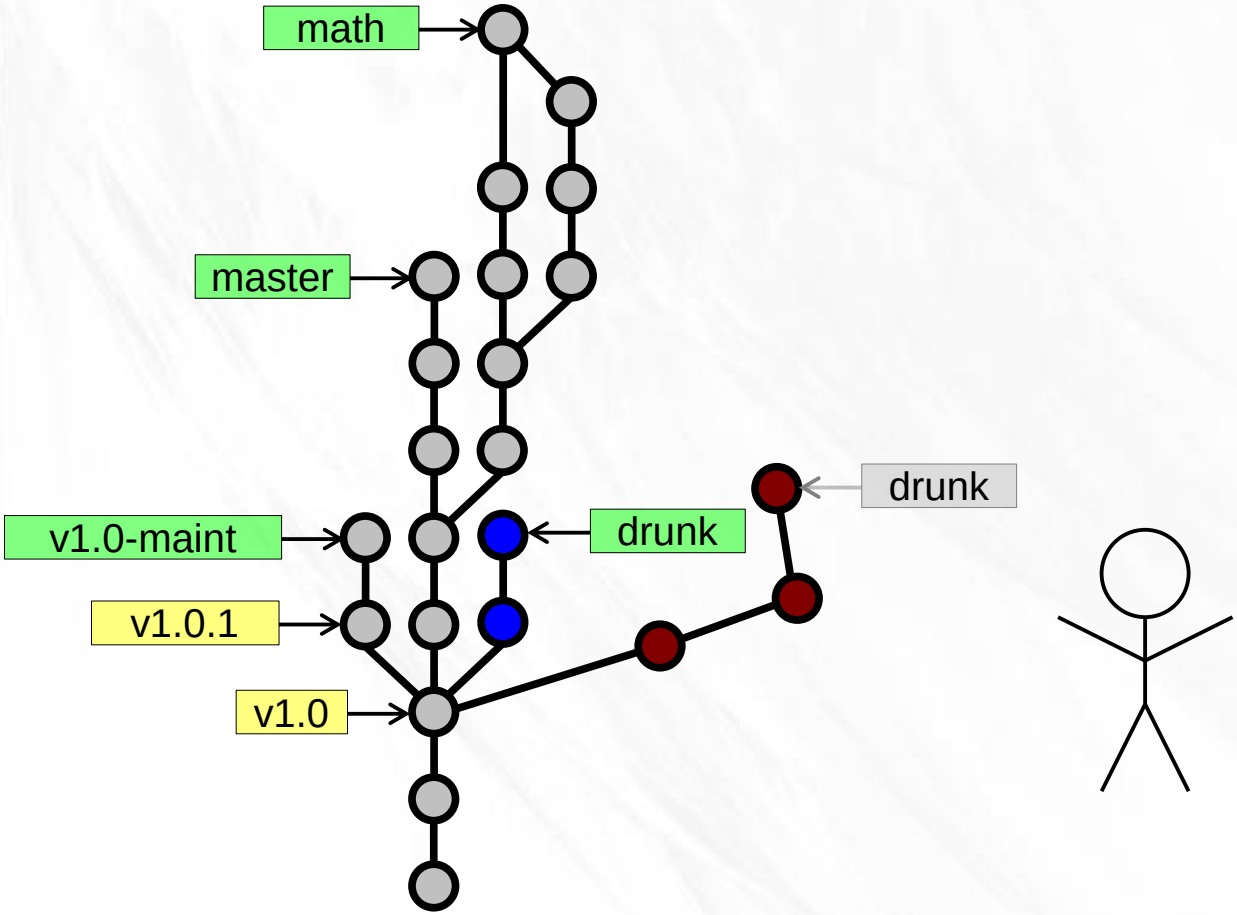

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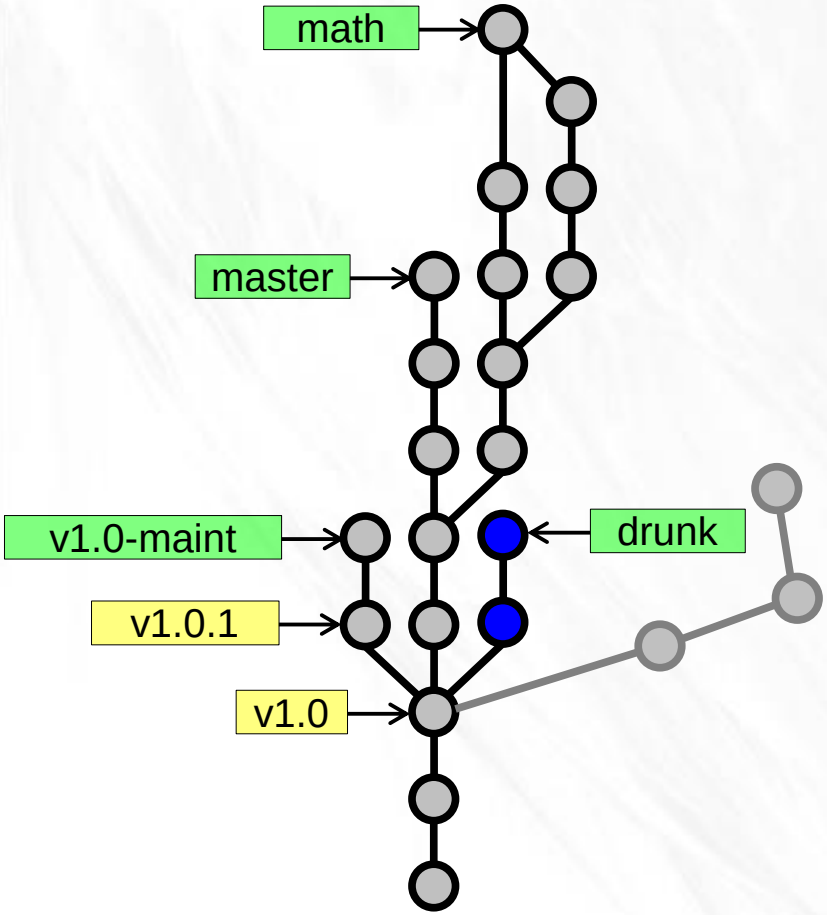

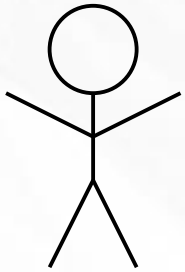

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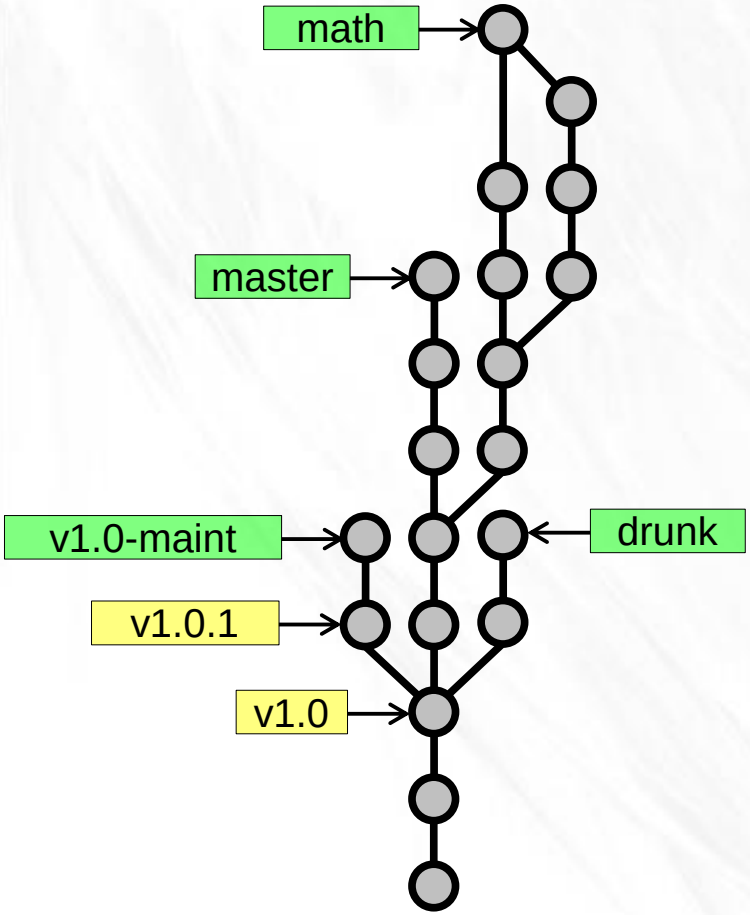

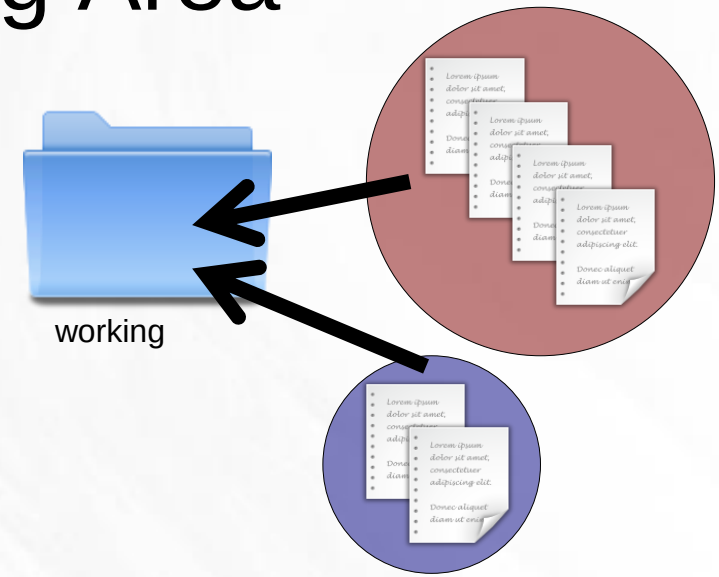

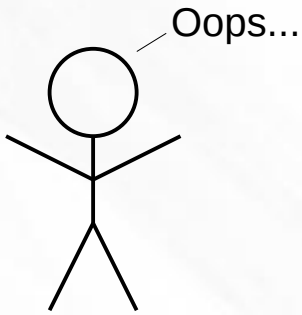

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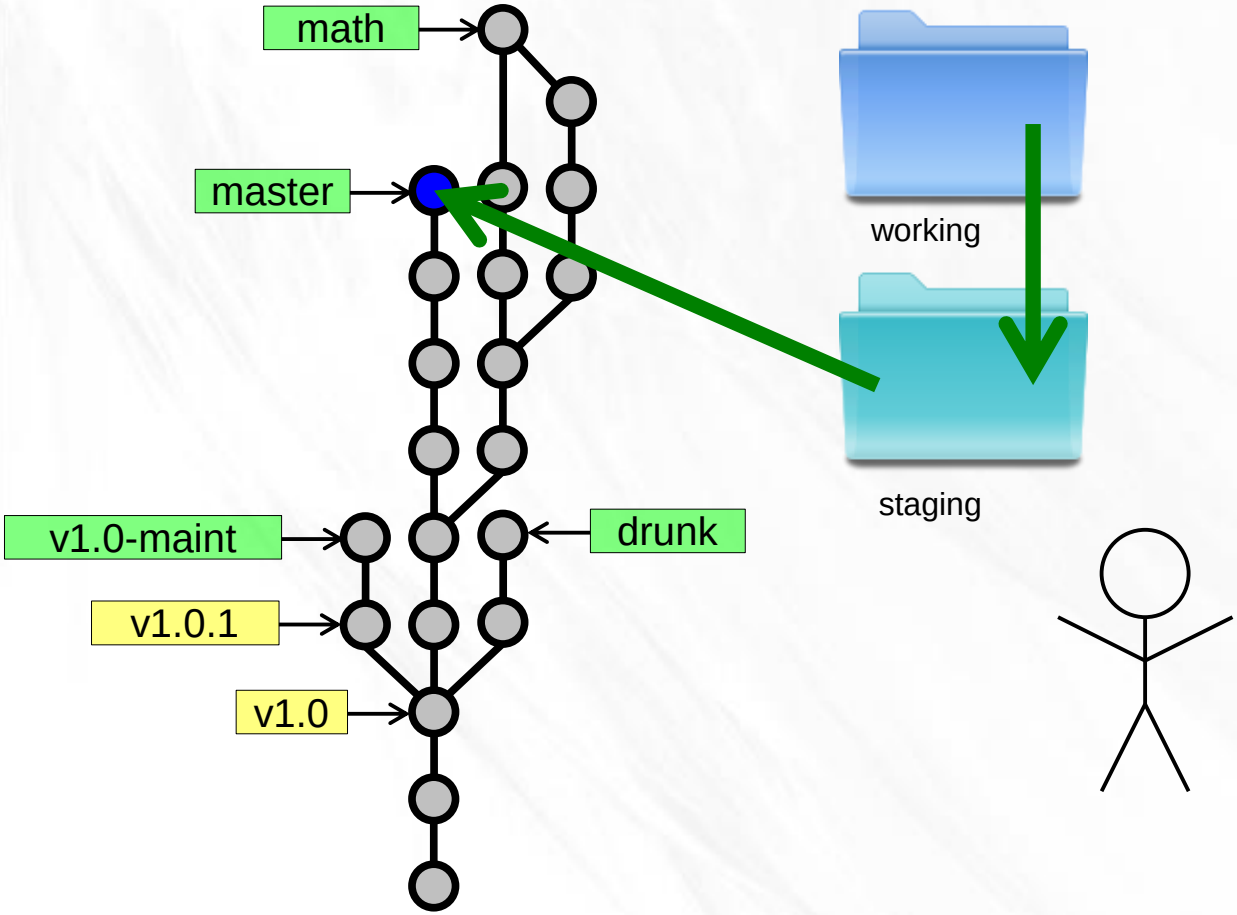

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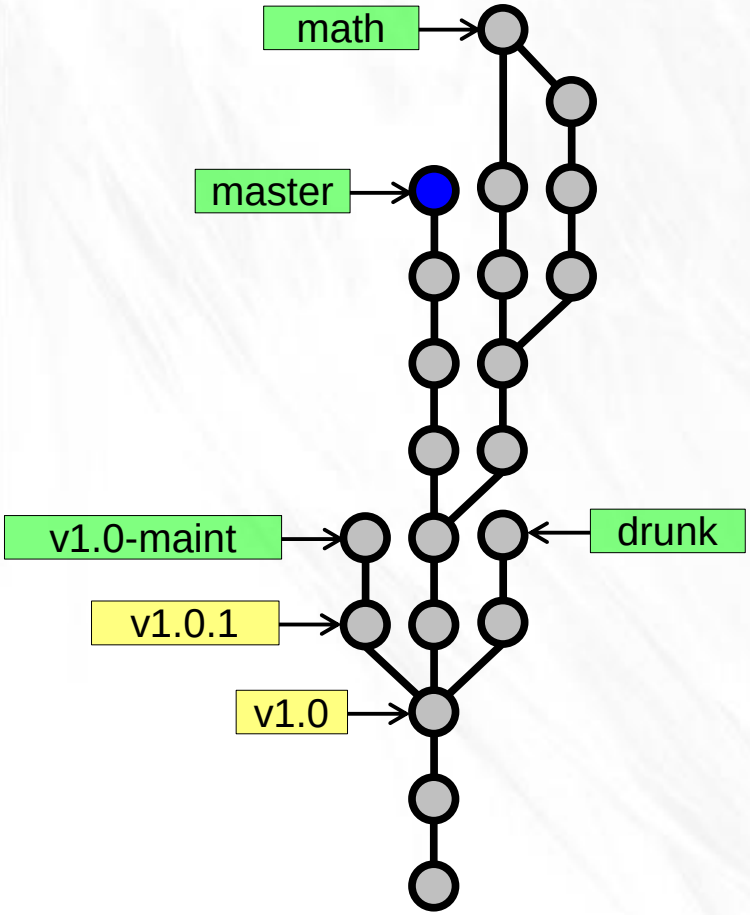
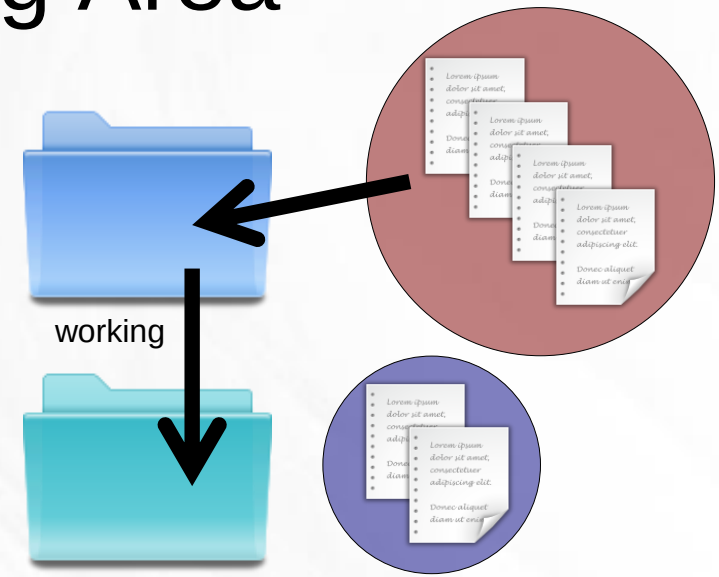
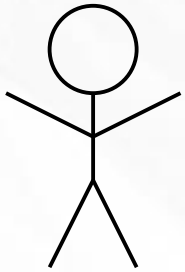
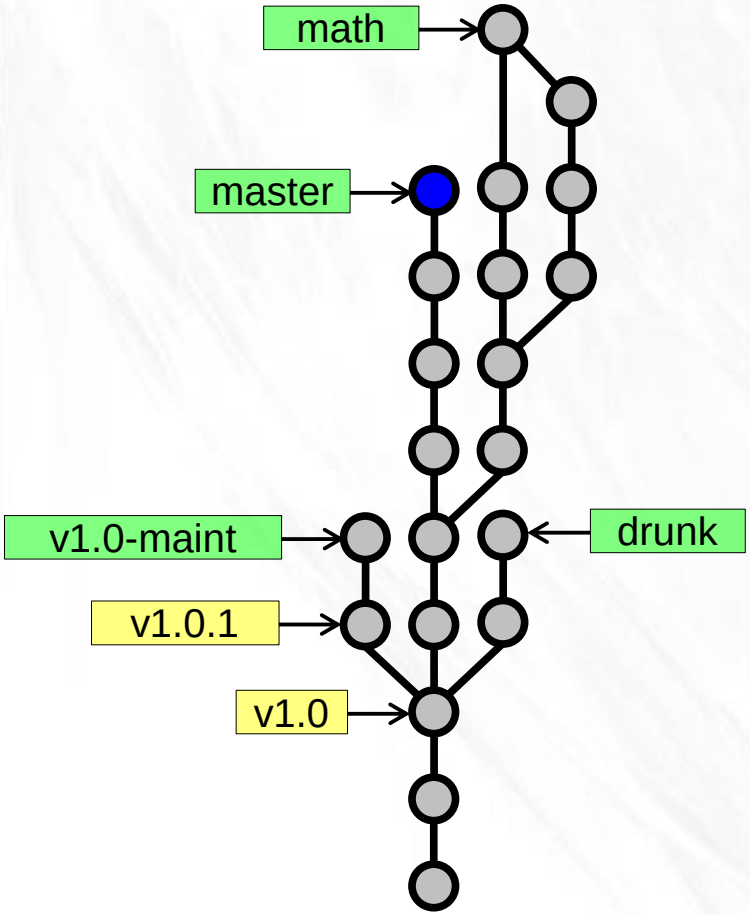
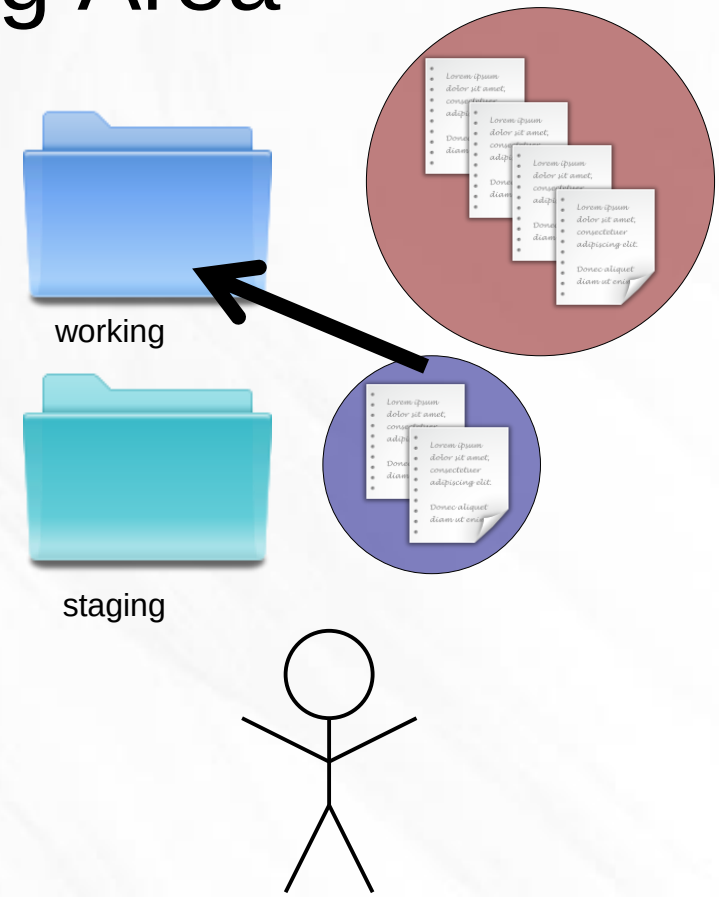




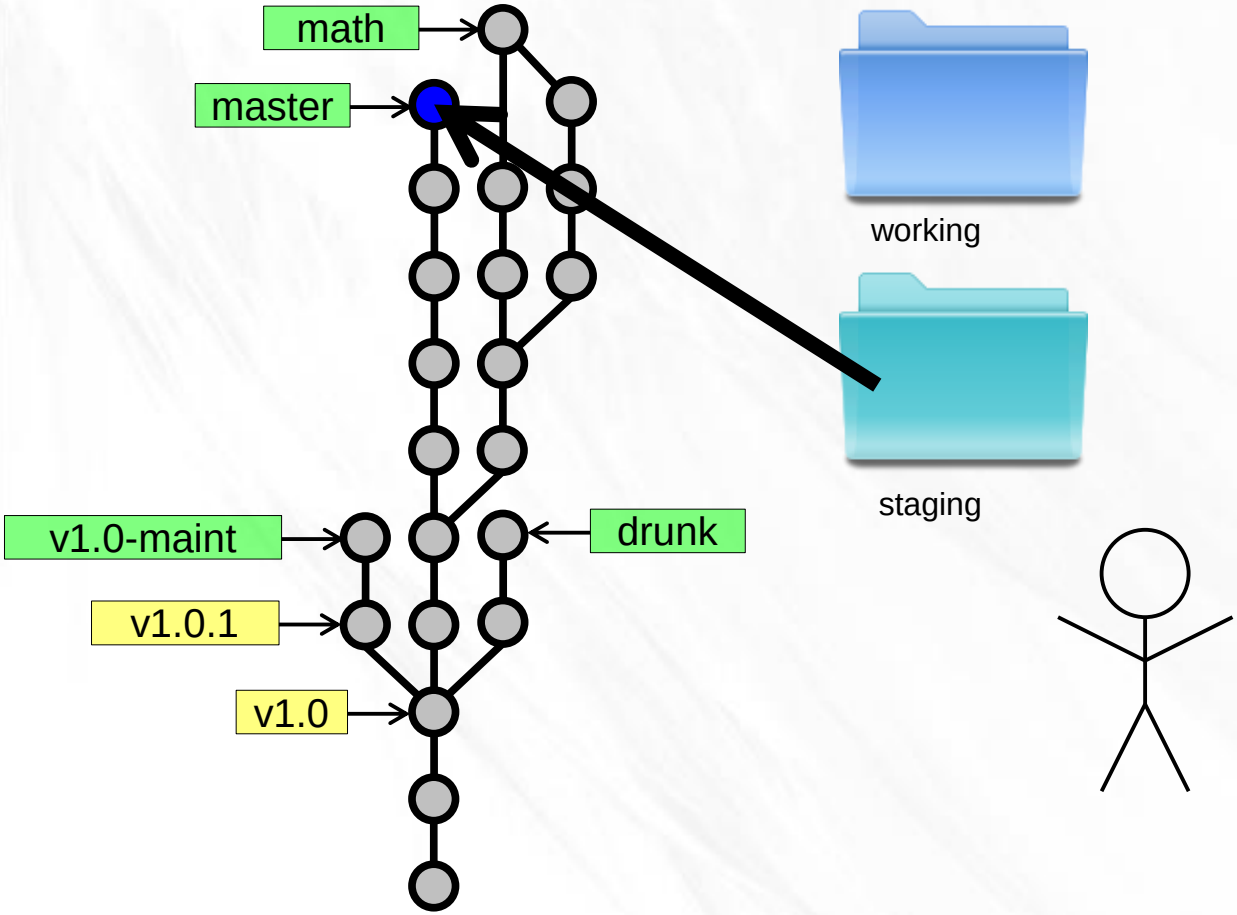


Staging Area

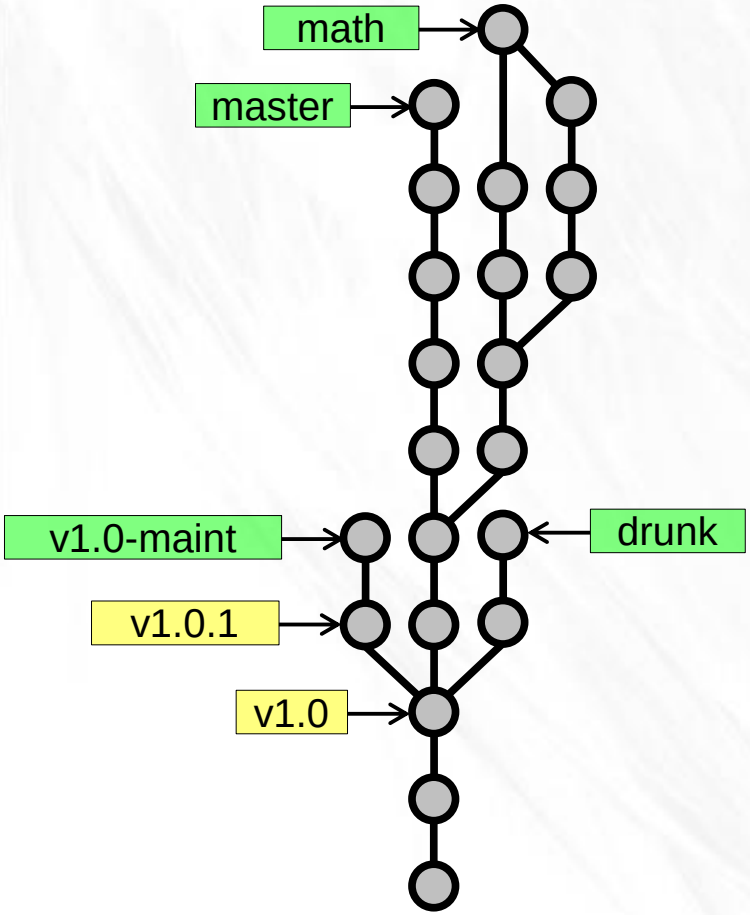


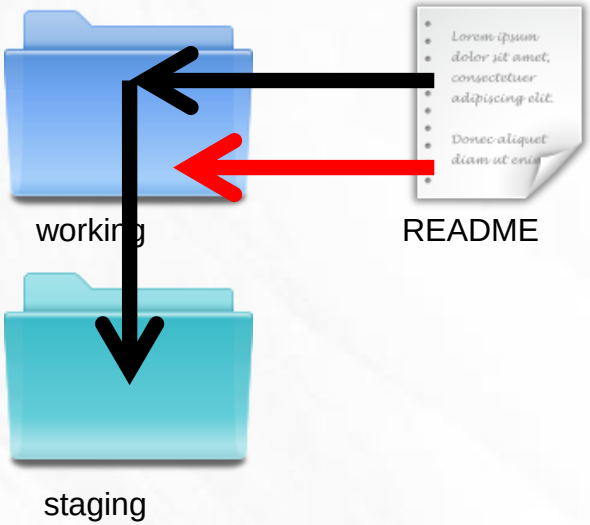


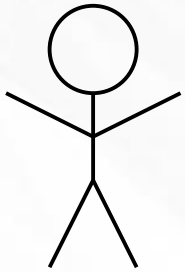
Staging Area



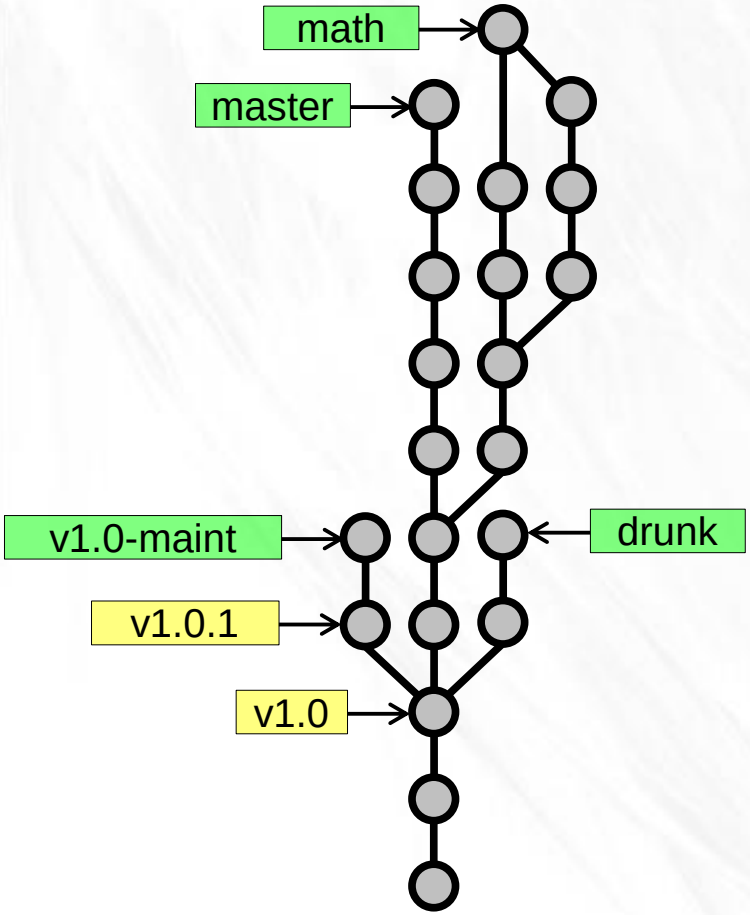
Staging Area

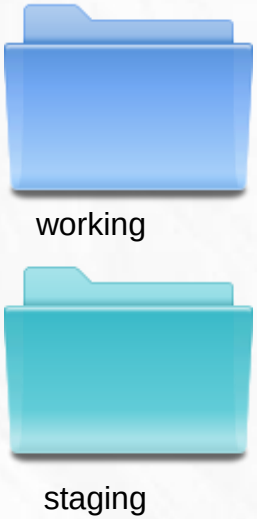




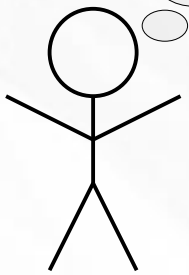


Diffs

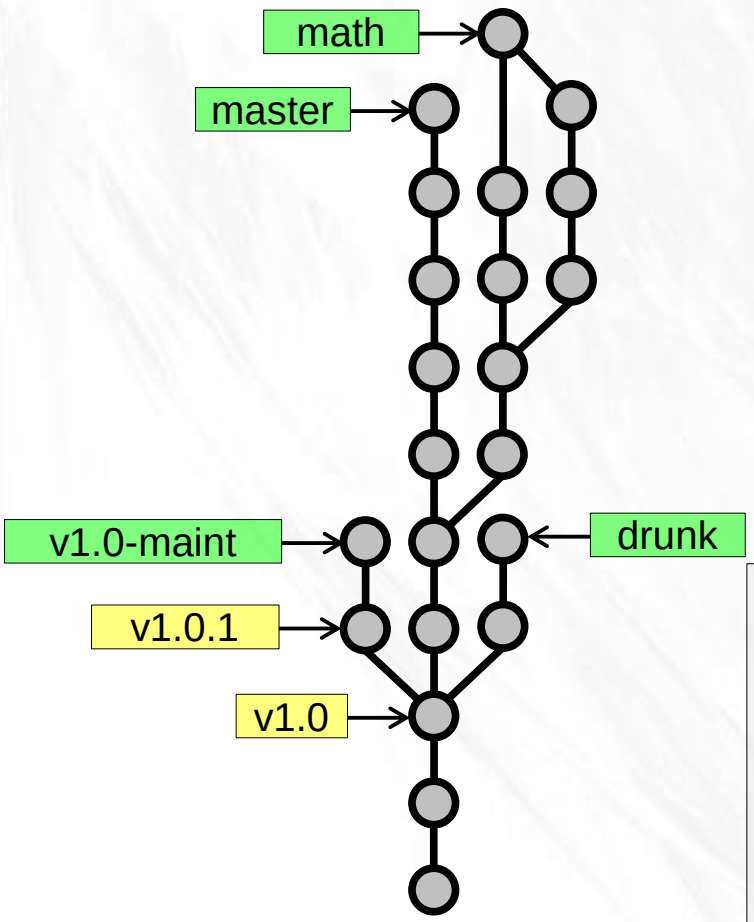


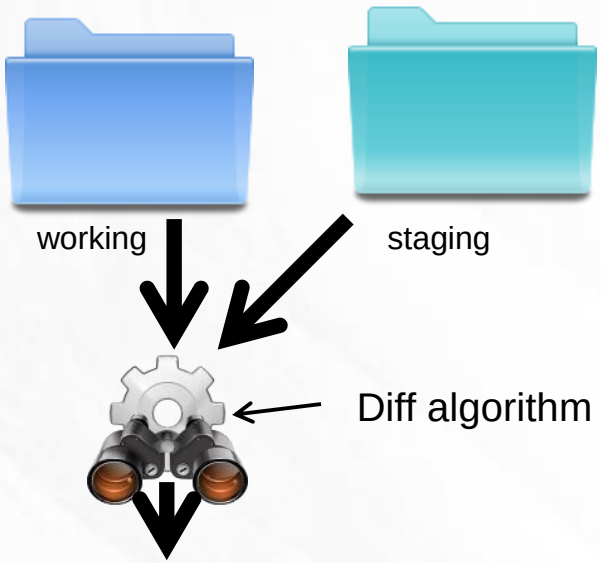


What are the changes?
- working vs. staging
- working vs. snapshot X
- staging vs. snapshot X
- snapshot X vs. snapshot Y

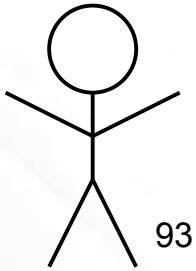


Diffs

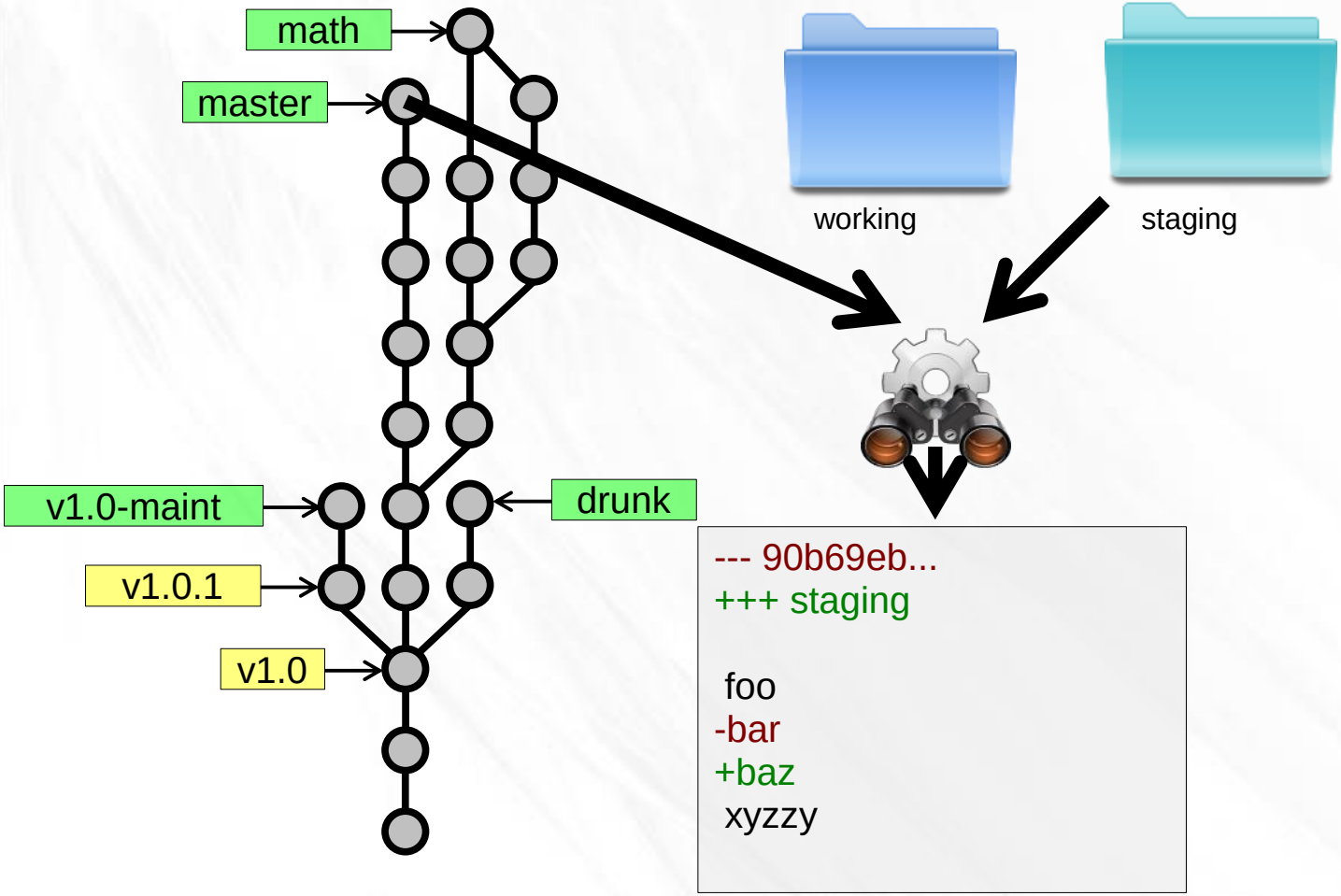




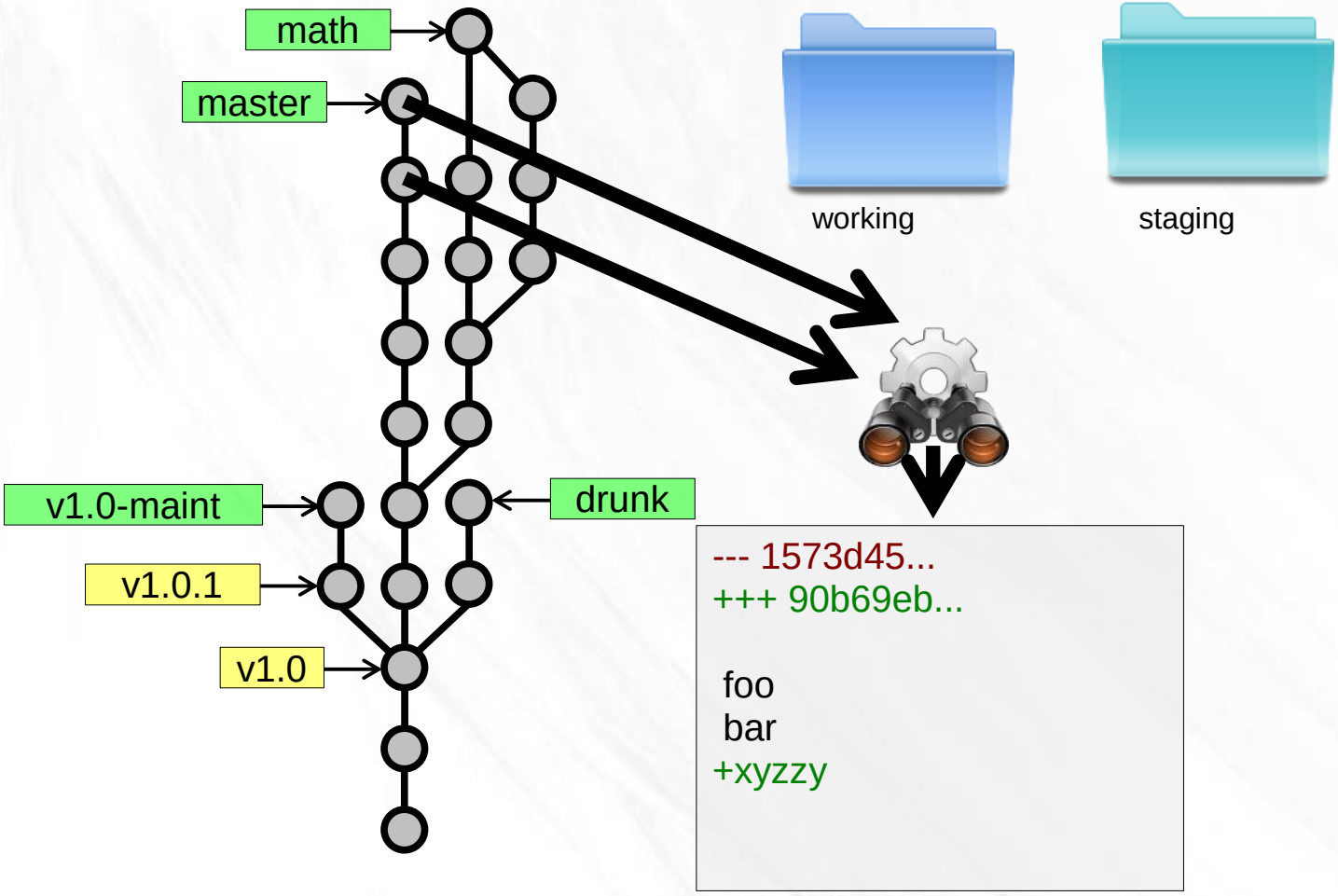

```
--- staging
+++ working

 foo
-baz
+bazzle
 xyzzy
```

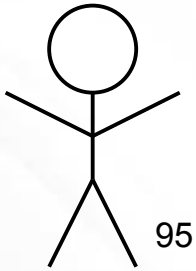


Diffs

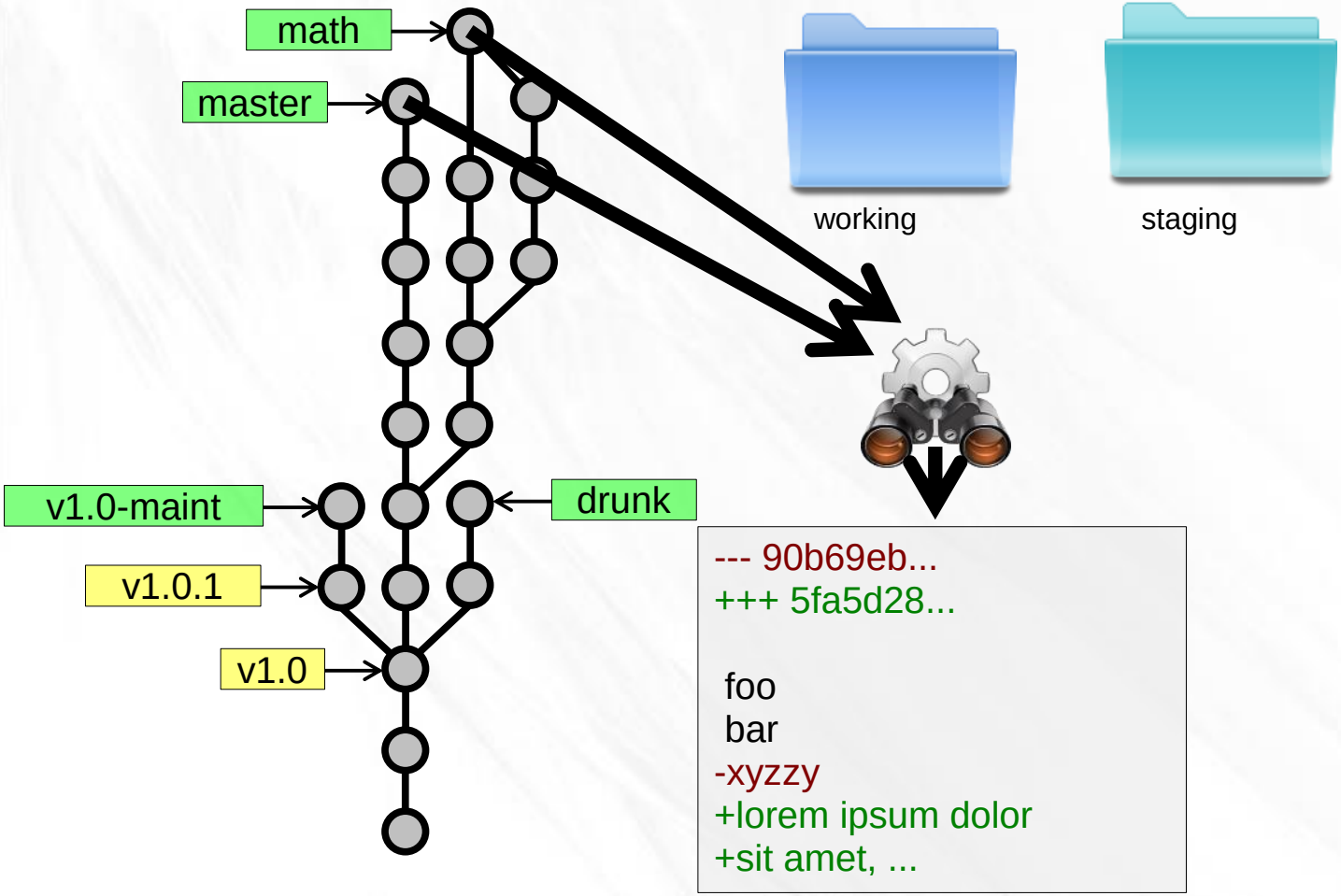

math
master
v1.0-maint
drunk
v1.0.1
v1.0
working
staging
--- 90b69eb...
+++ staging
foo
-bar
+baz
xyzzy

Diffs

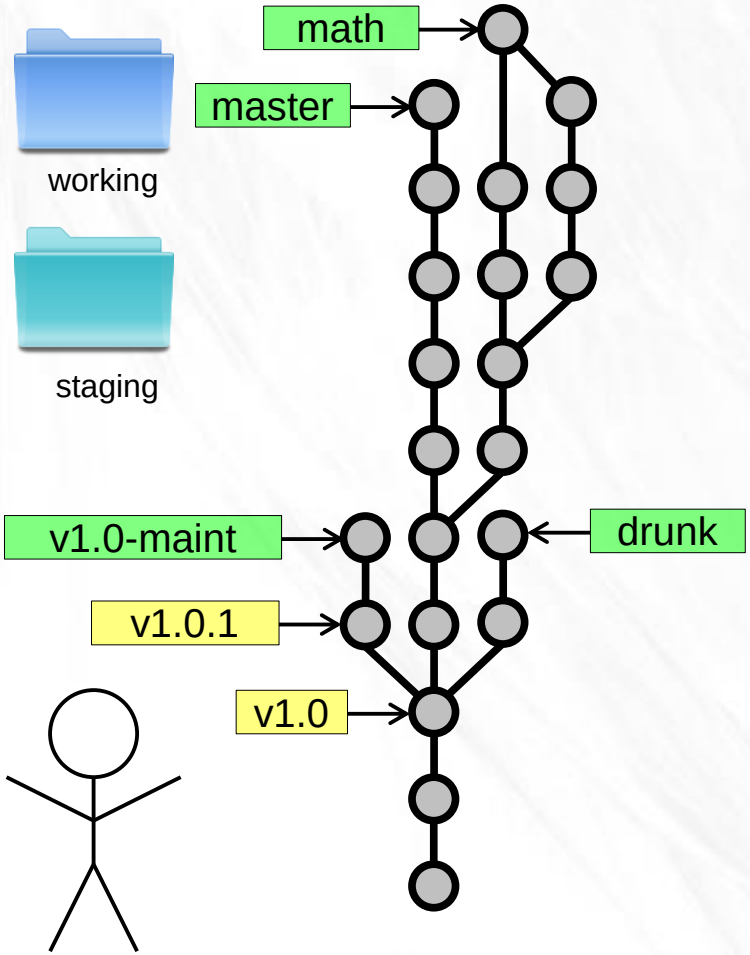

math
master
v1.0-maint
drunk
v1.0.1
v1.0
working
staging
--- 1573d45...
+++ 90b69eb...
foo
bar
+xyzzy

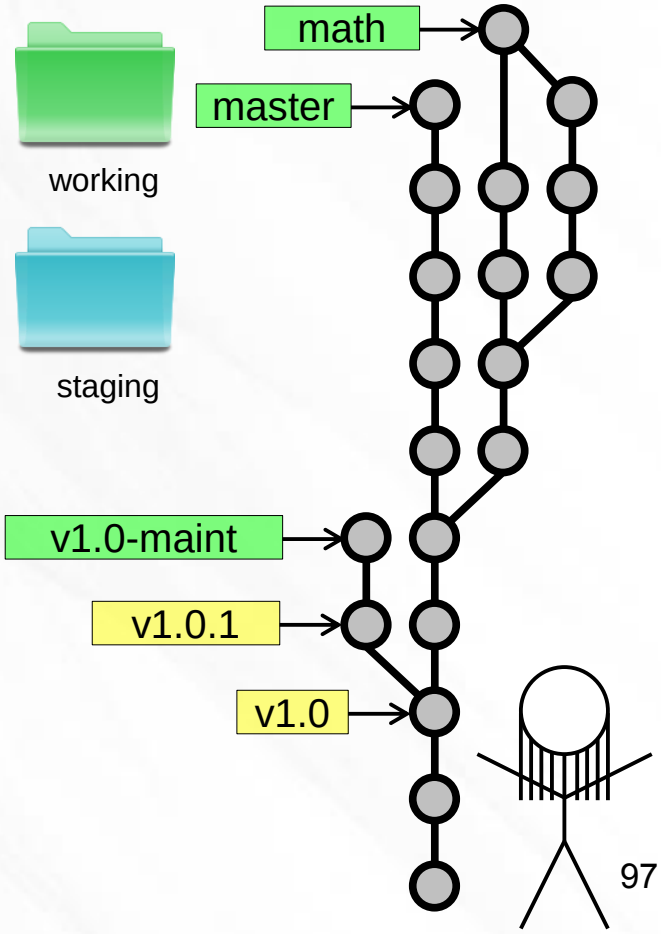


Diffs

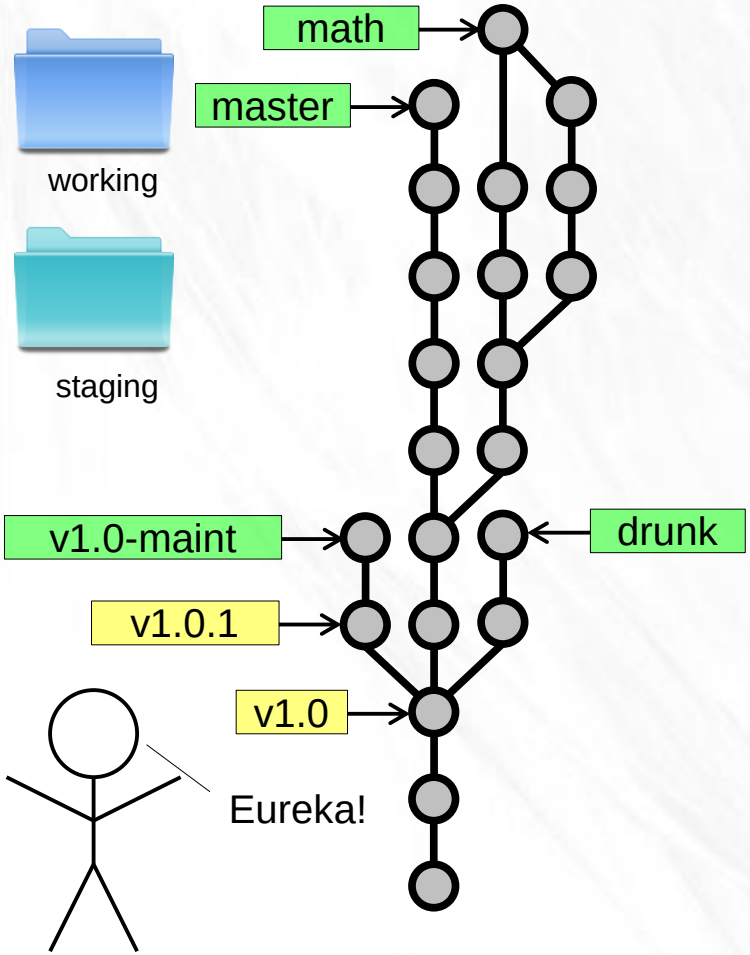

math
master
v1.0-maint
drunk
v1.0.1
v1.0
working
staging
--- 90b69eb...
+++ 5fa5d28...
foo
bar
-xyzzy
+lorem ipsum dolor
+sit amet, ...

Eliminating Duplication





Eliminating Duplication

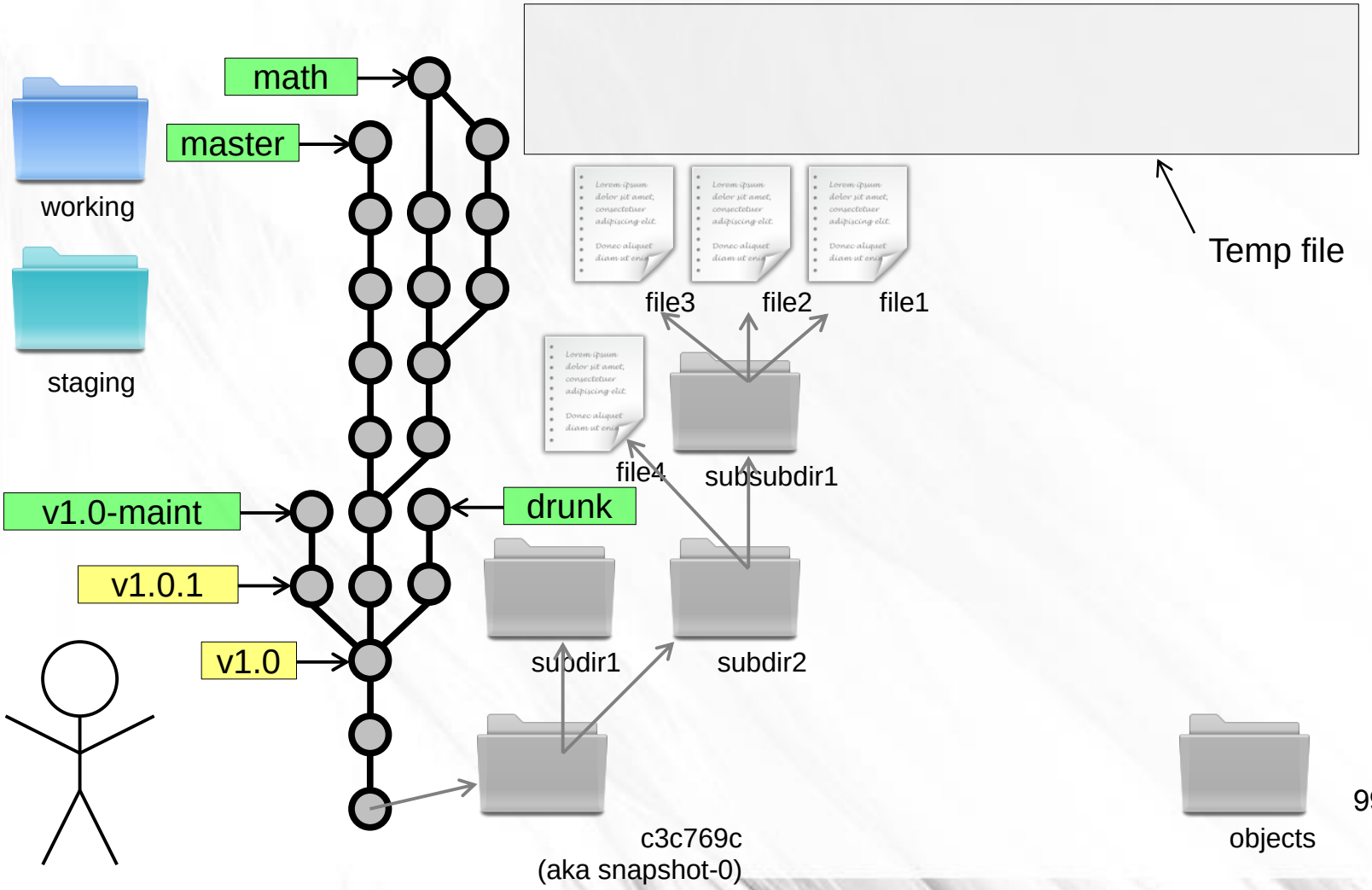


SHA1

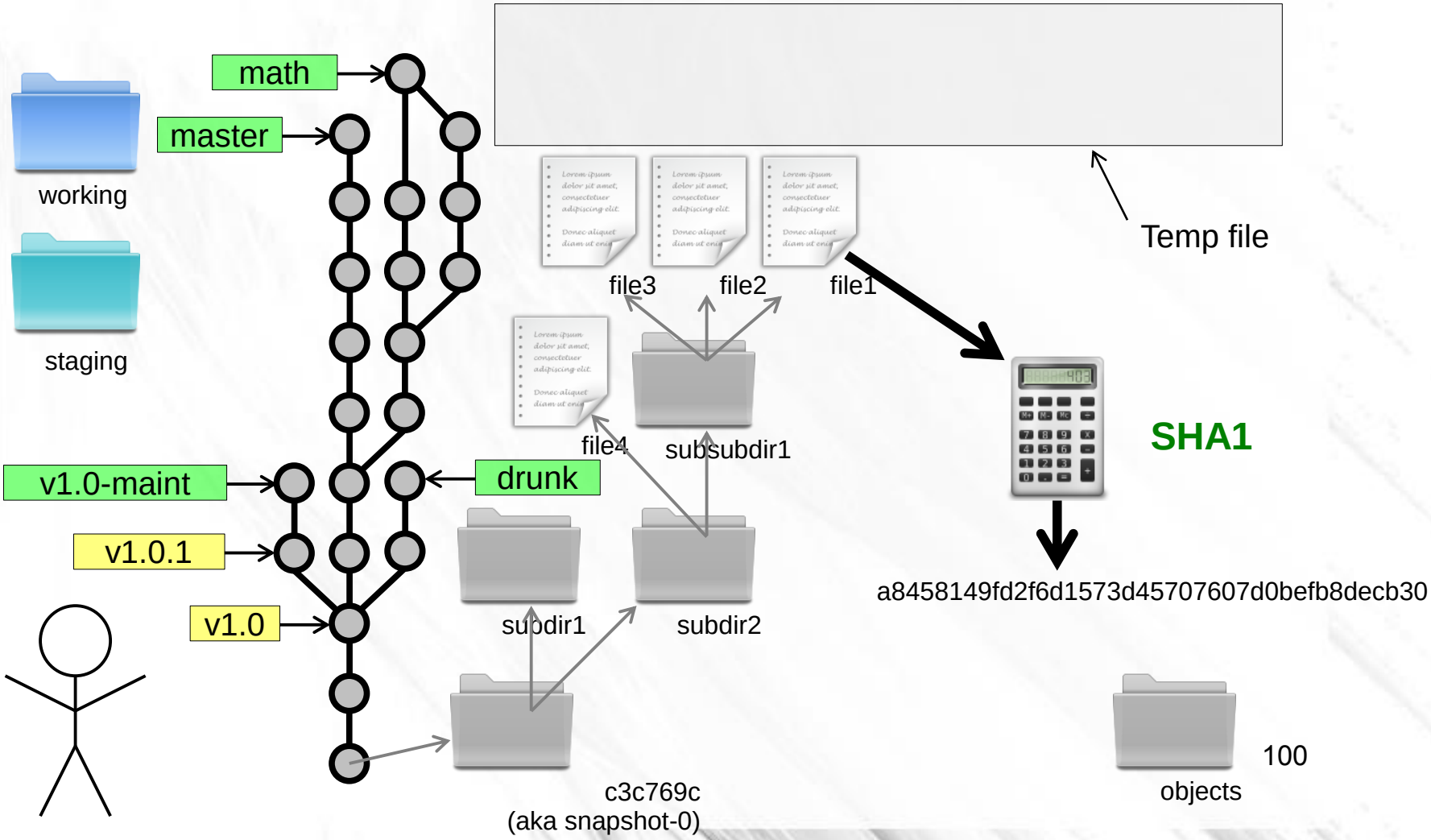
2804133755c3ed396d162028c7b30a1cbcfecded

objects

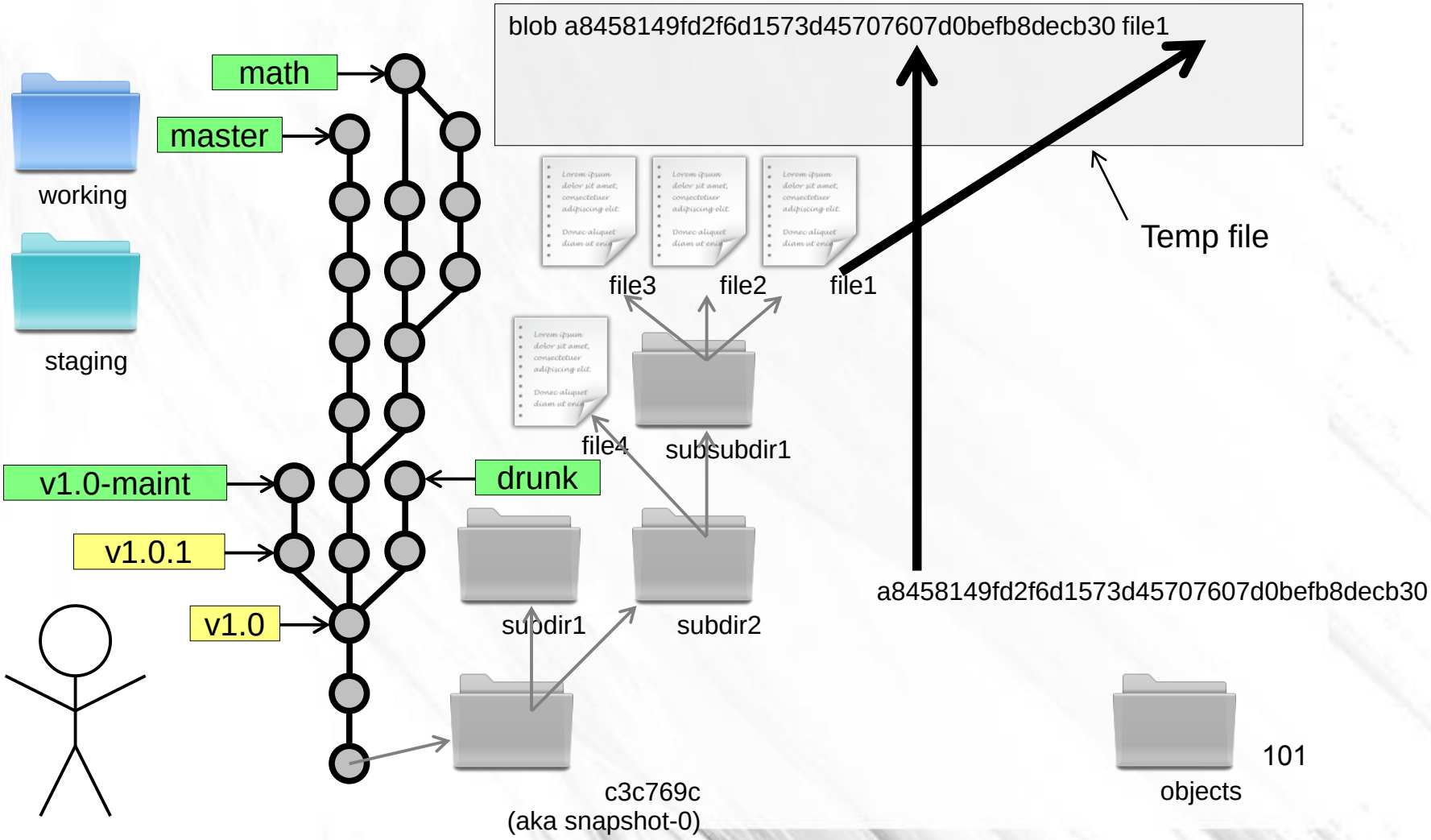
Eliminating Duplication



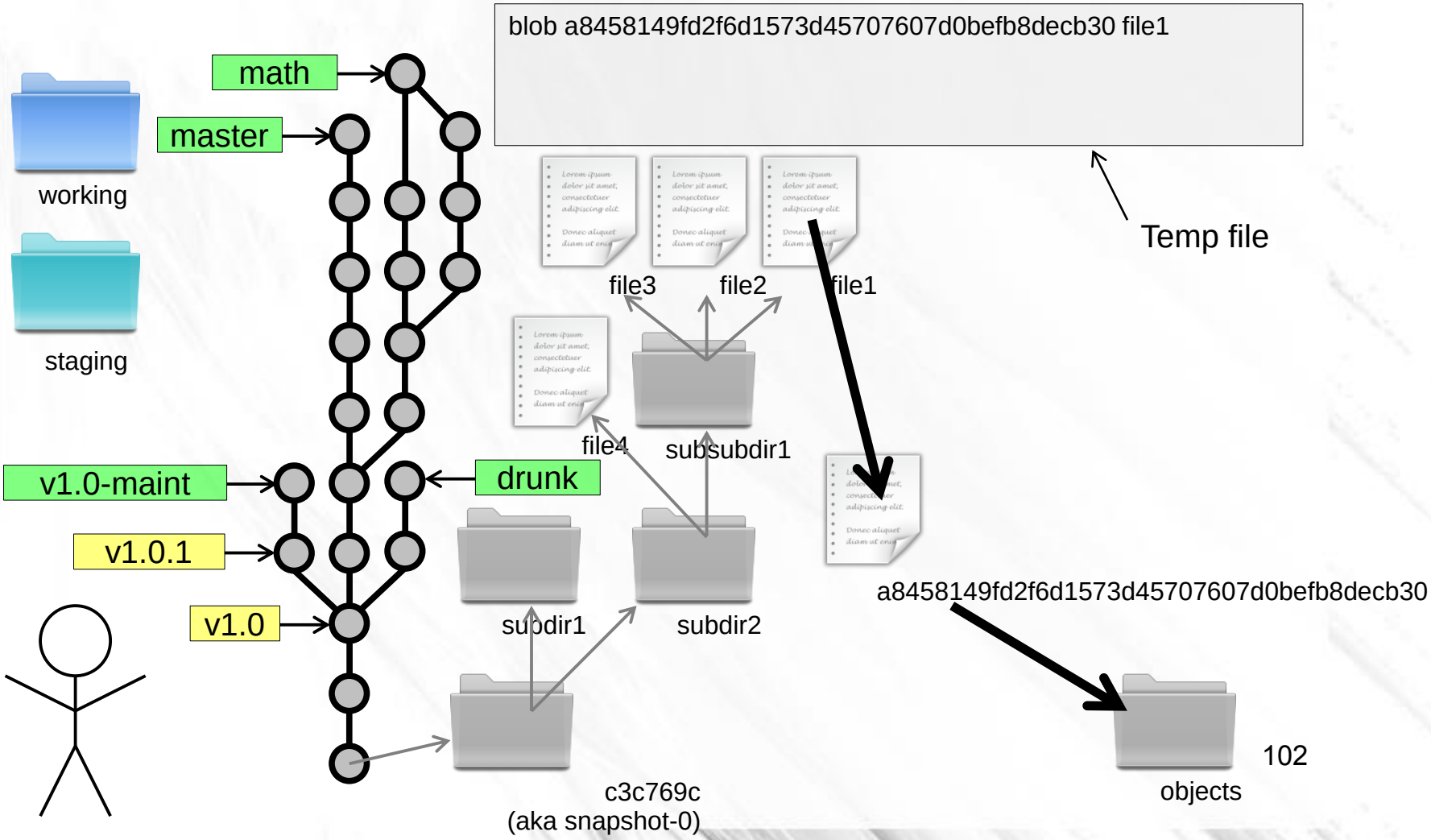
Eliminating Duplication



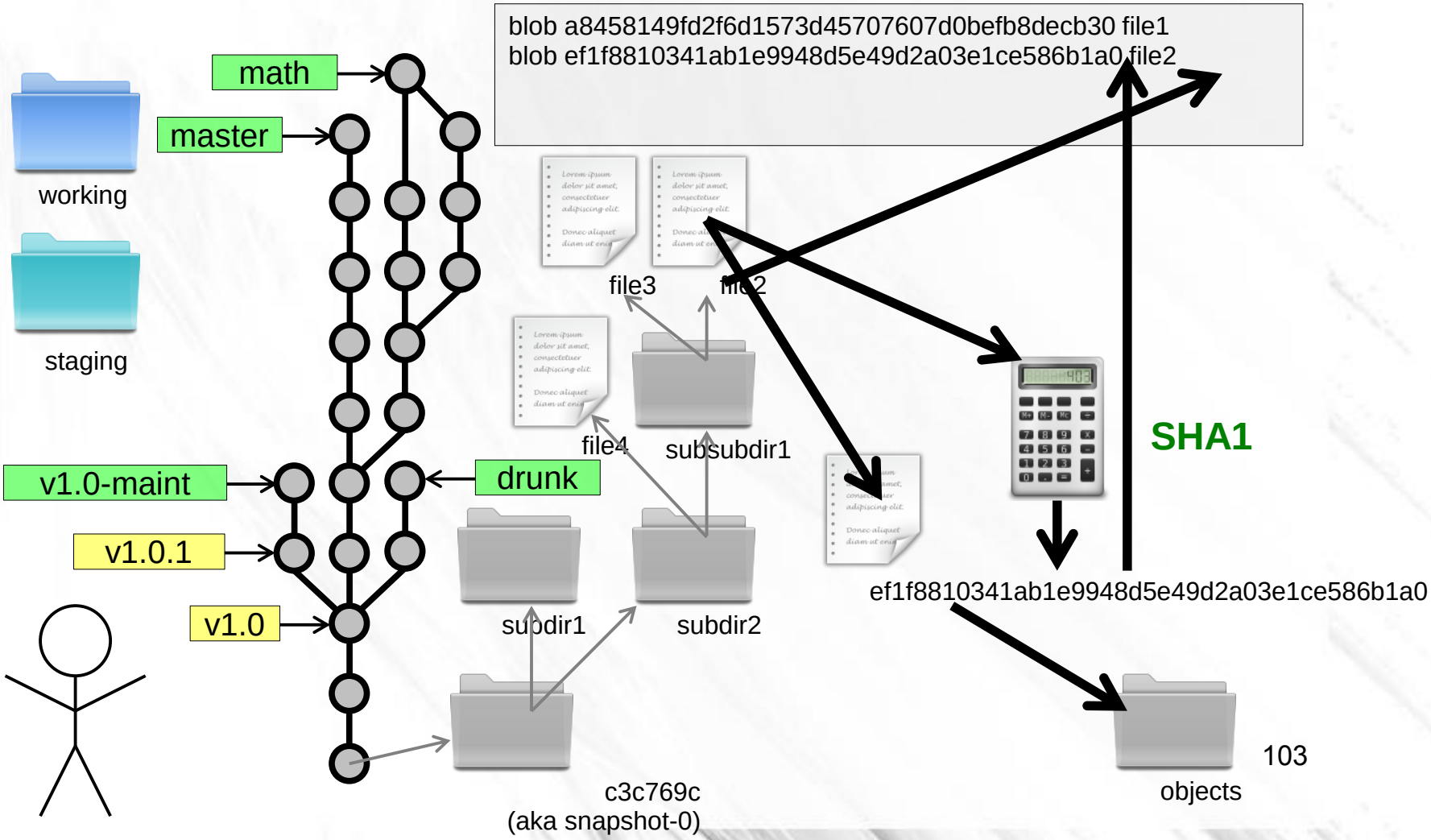
Eliminating Duplication



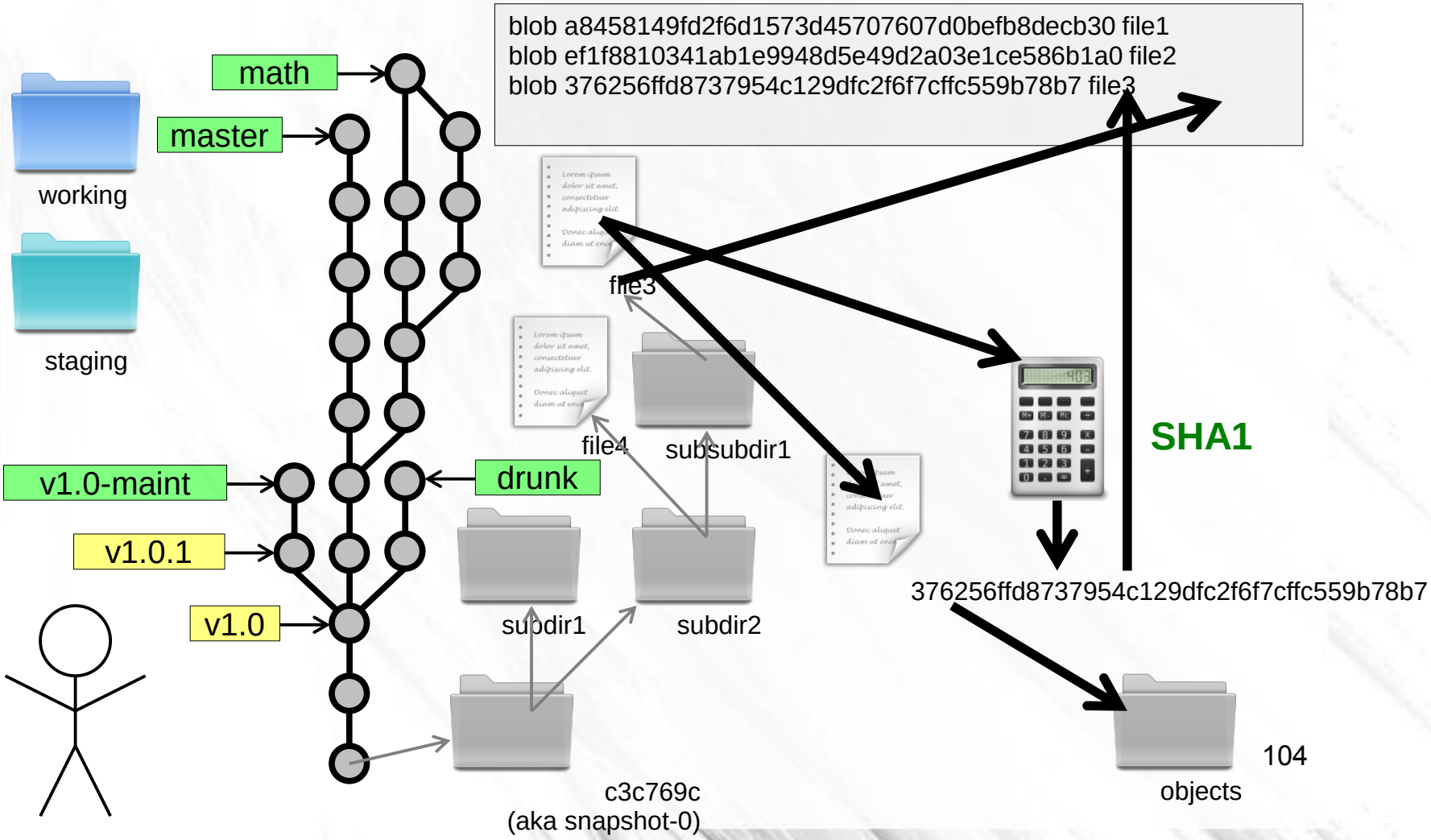
Eliminating Duplication



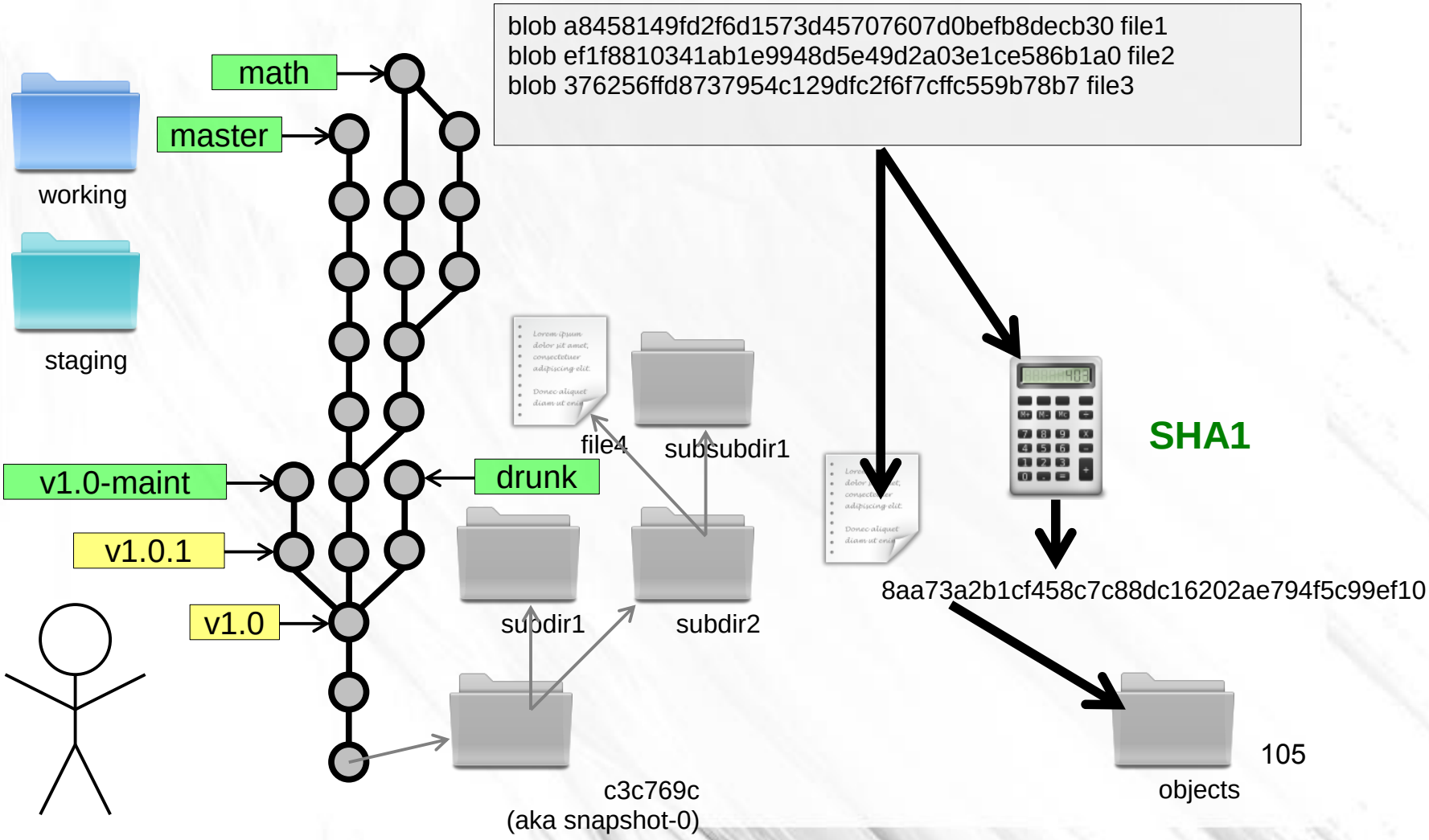
Eliminating Duplication



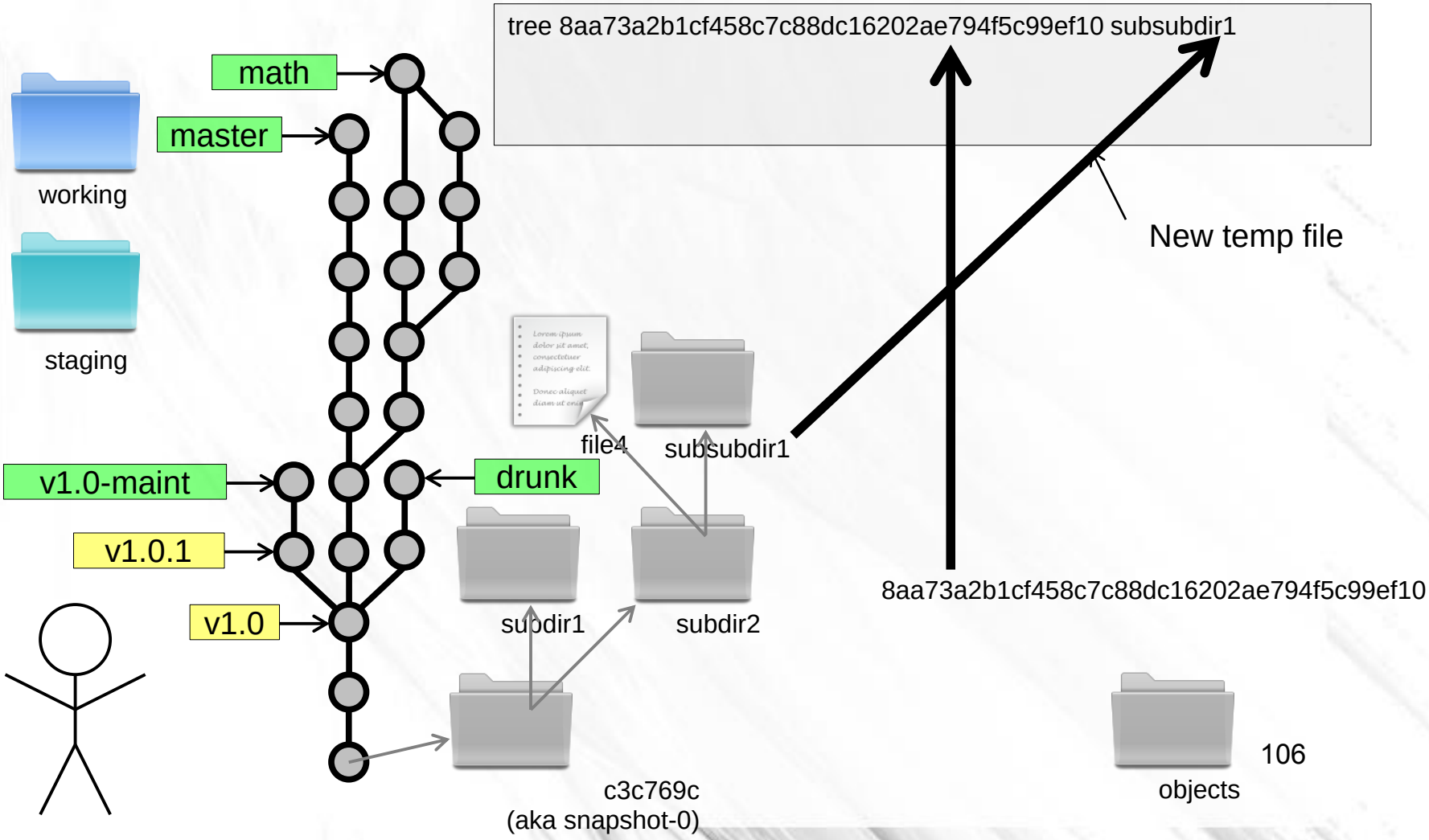
Eliminating Duplication



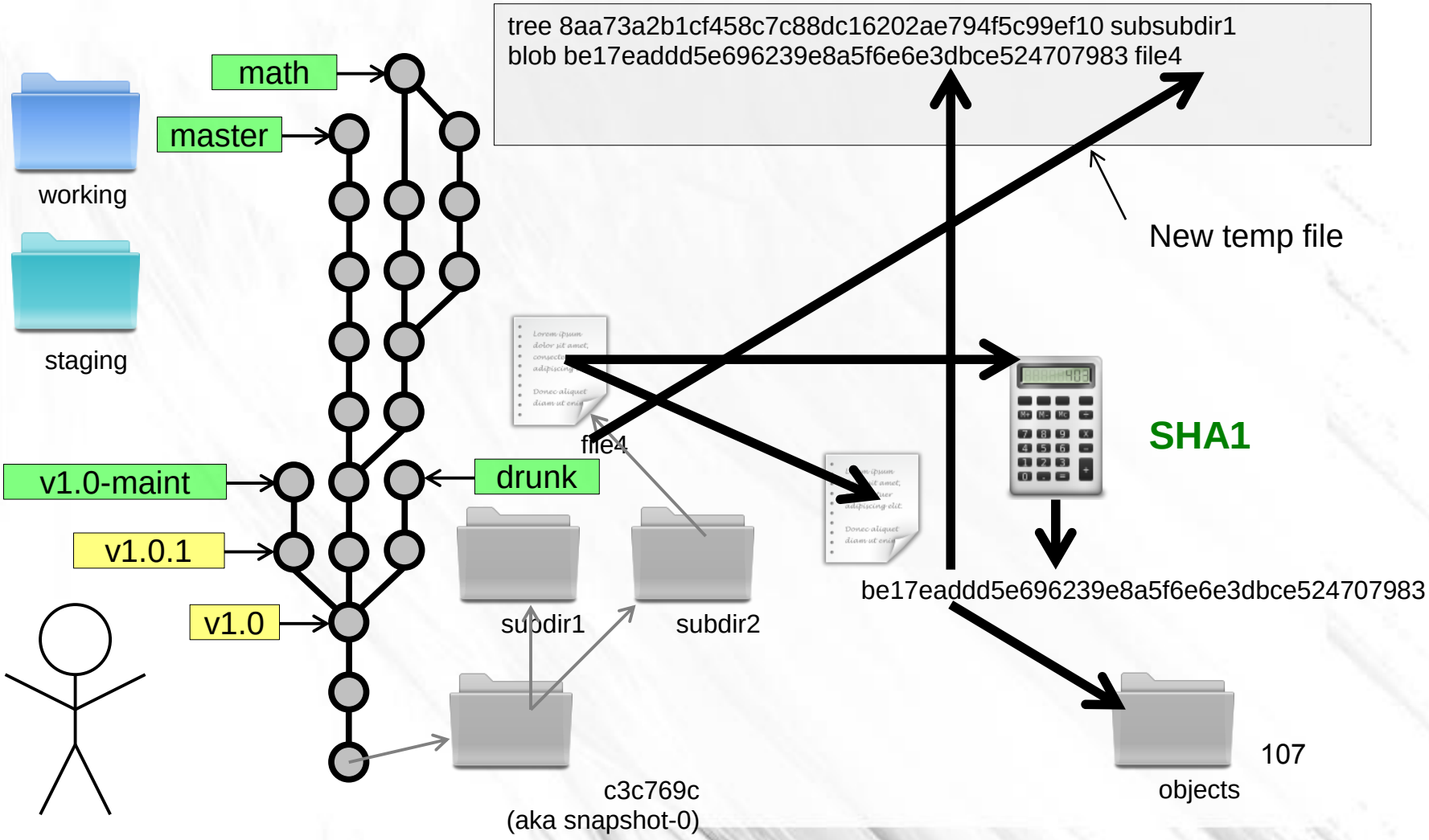
Eliminating Duplication



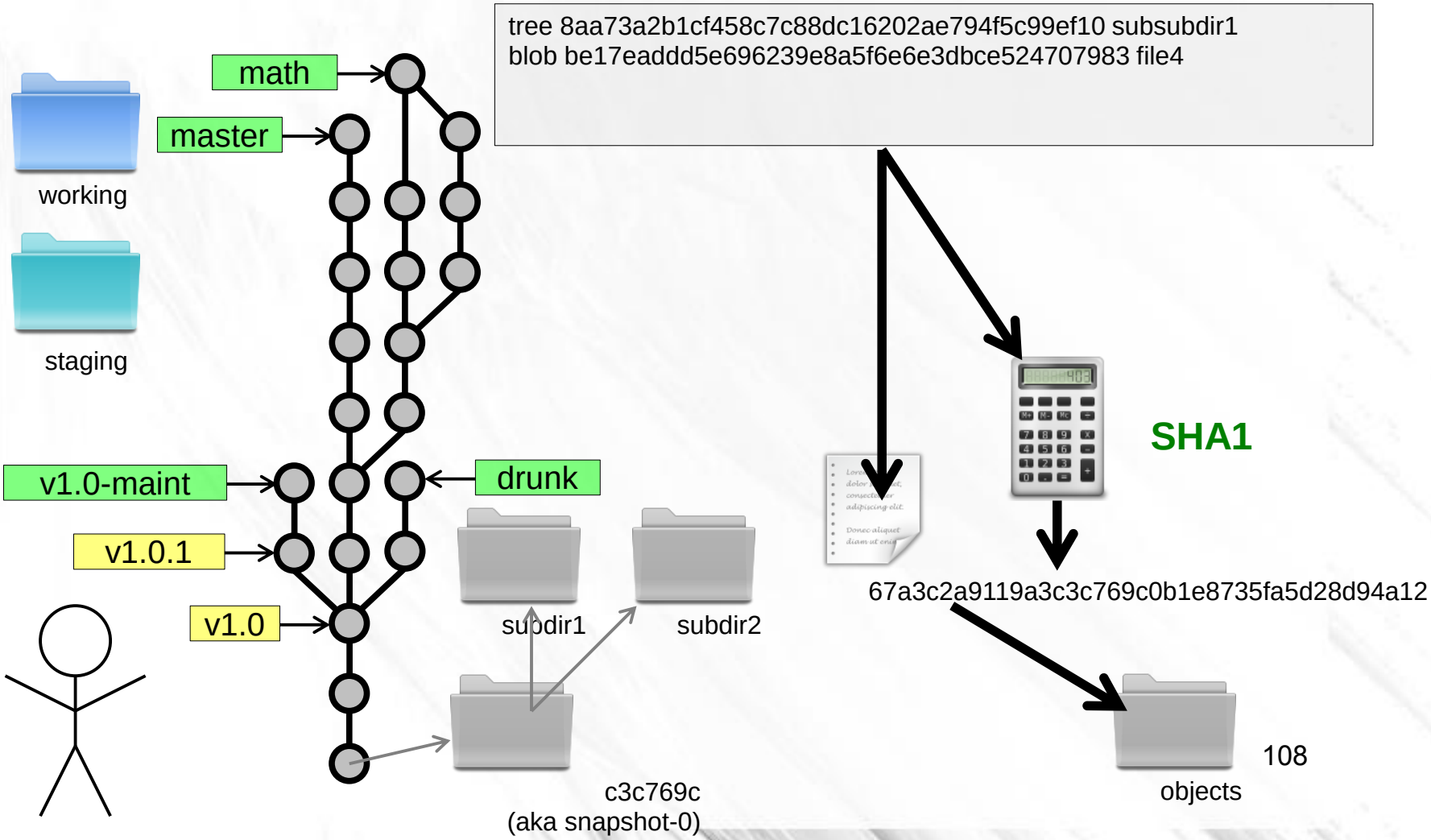
Eliminating Duplication



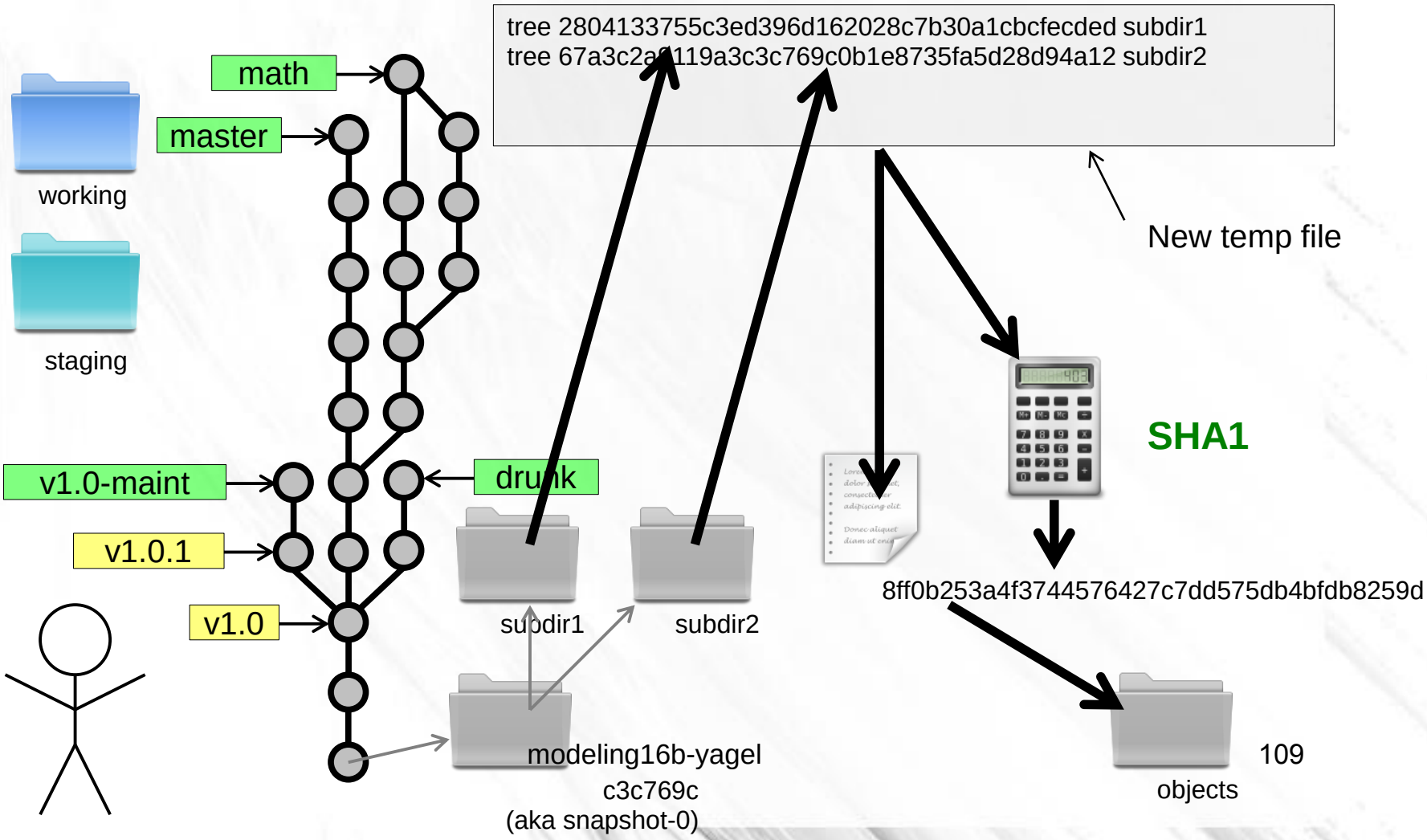
Eliminating Duplication



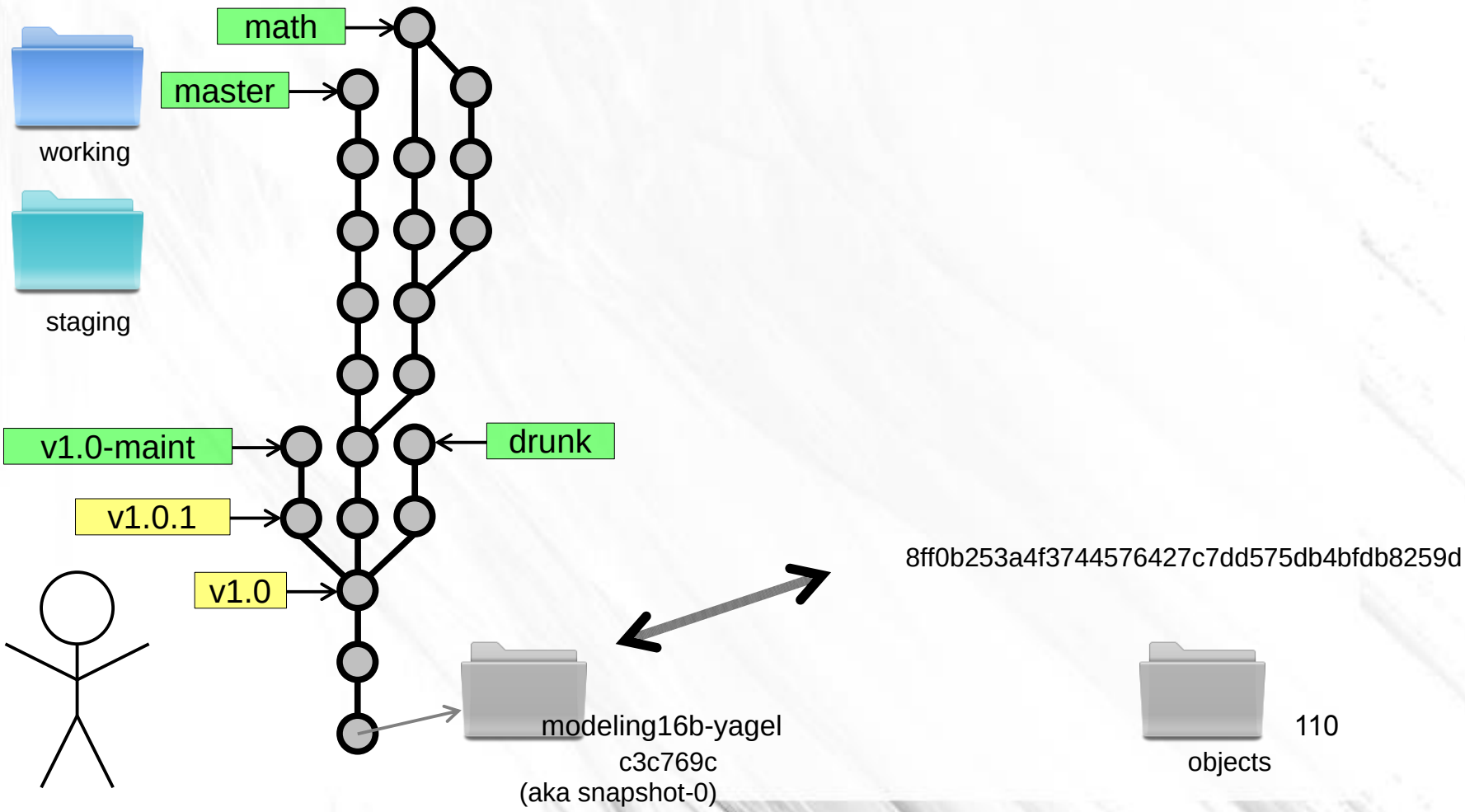
Eliminating Duplication



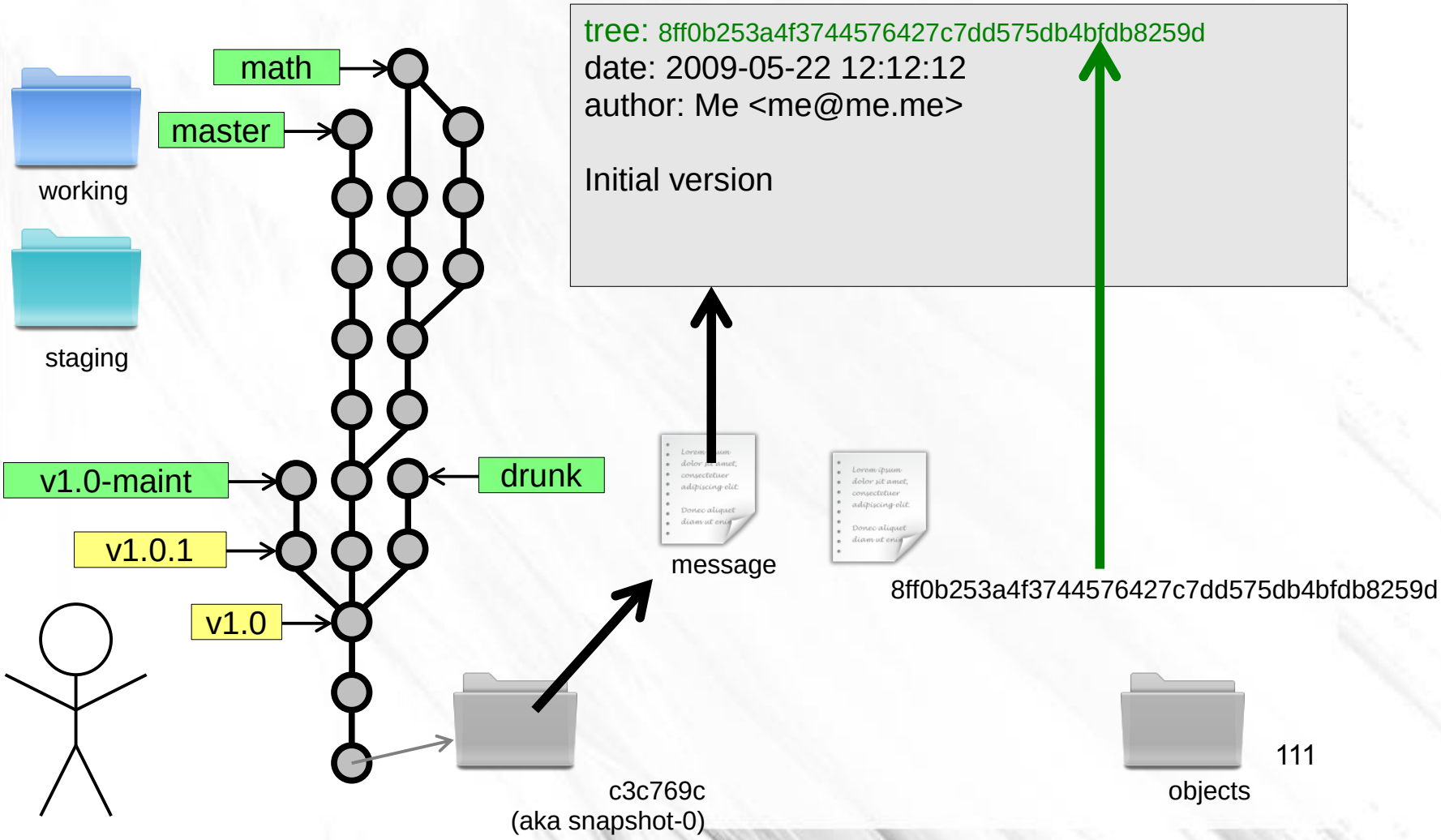
Eliminating Duplication



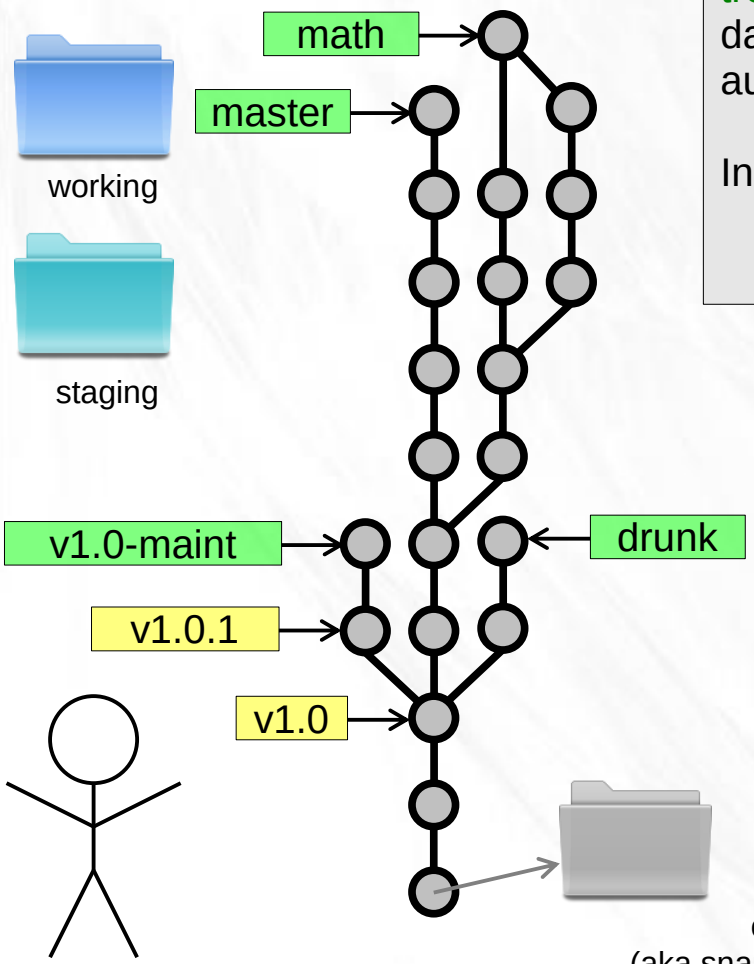
Eliminating Duplication



Eliminating Duplication

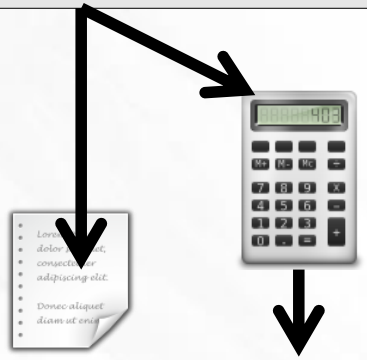


Eliminating Duplication



tree: 8ff0b253a4f3744576427c7dd575db4bfdb8259d
date: 2009-05-22 12:12:12
author: Me <me@me.me>

Initial version



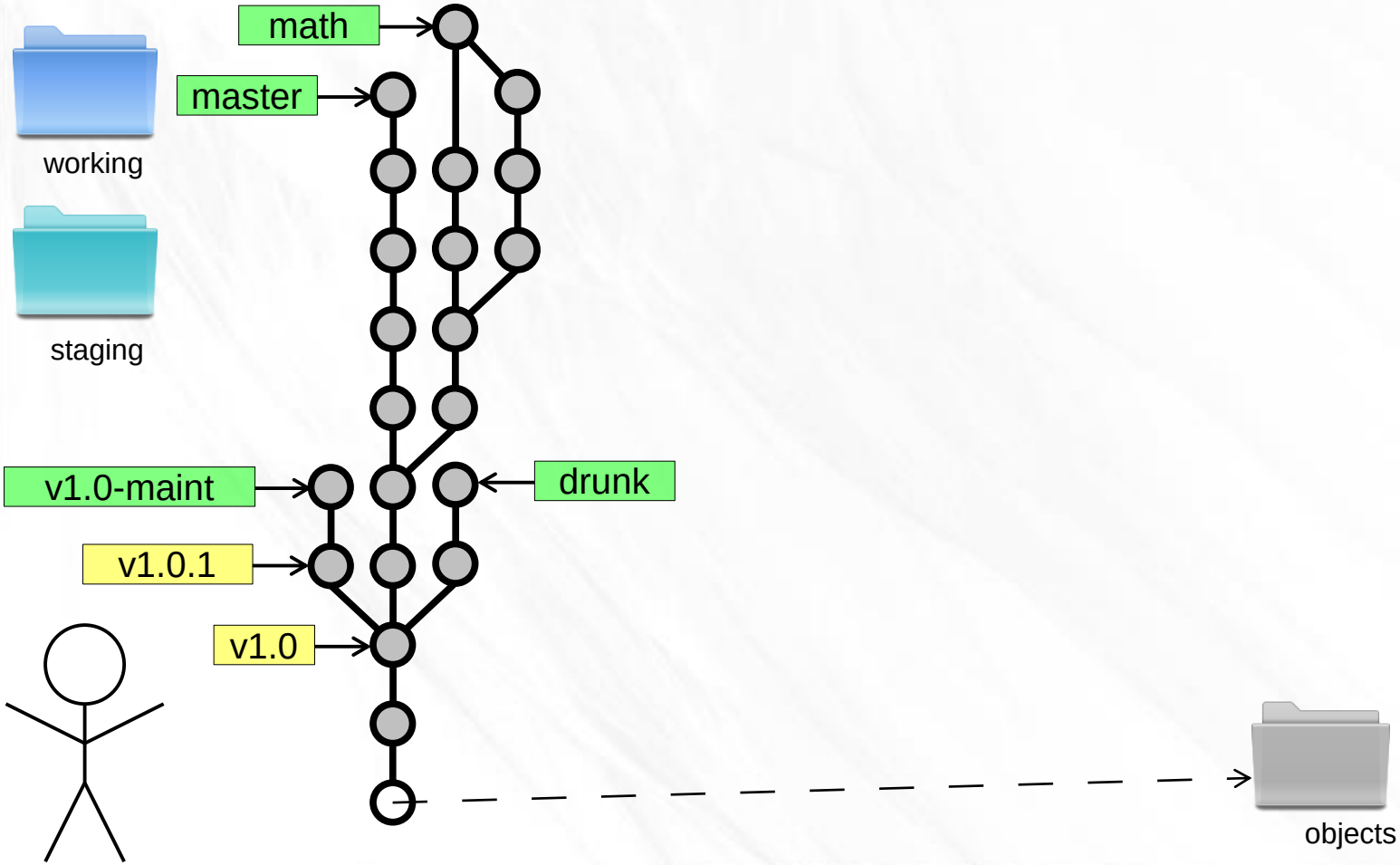
SHA1

5a2fa987819083dbcf44d36697b7ecbe3bfc9a3f

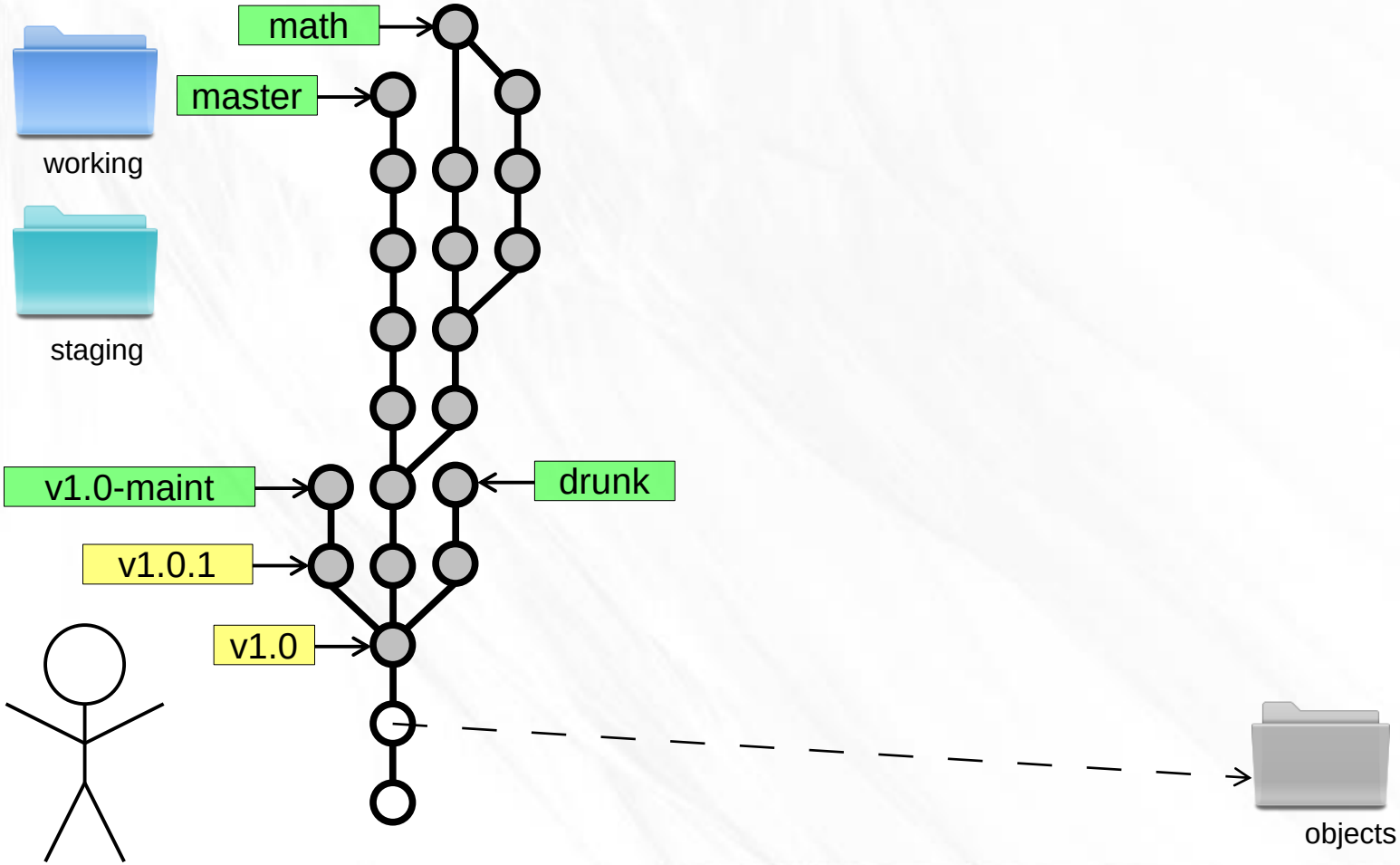
c3c769c
(aka snapshot-0)

objects

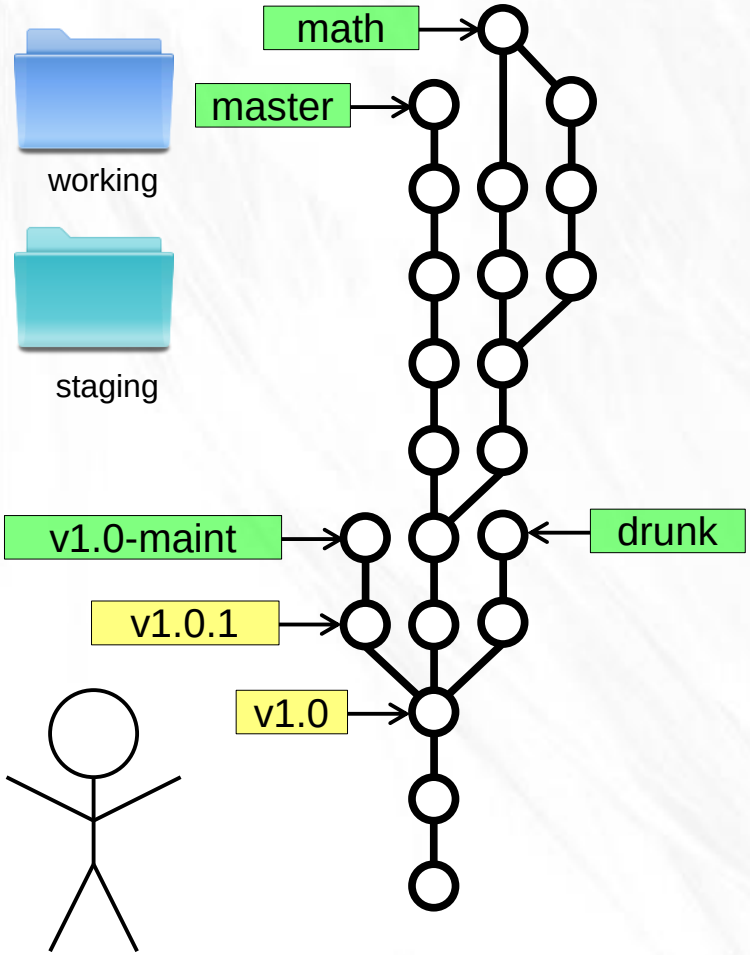
Eliminating Duplication



Eliminating Duplication

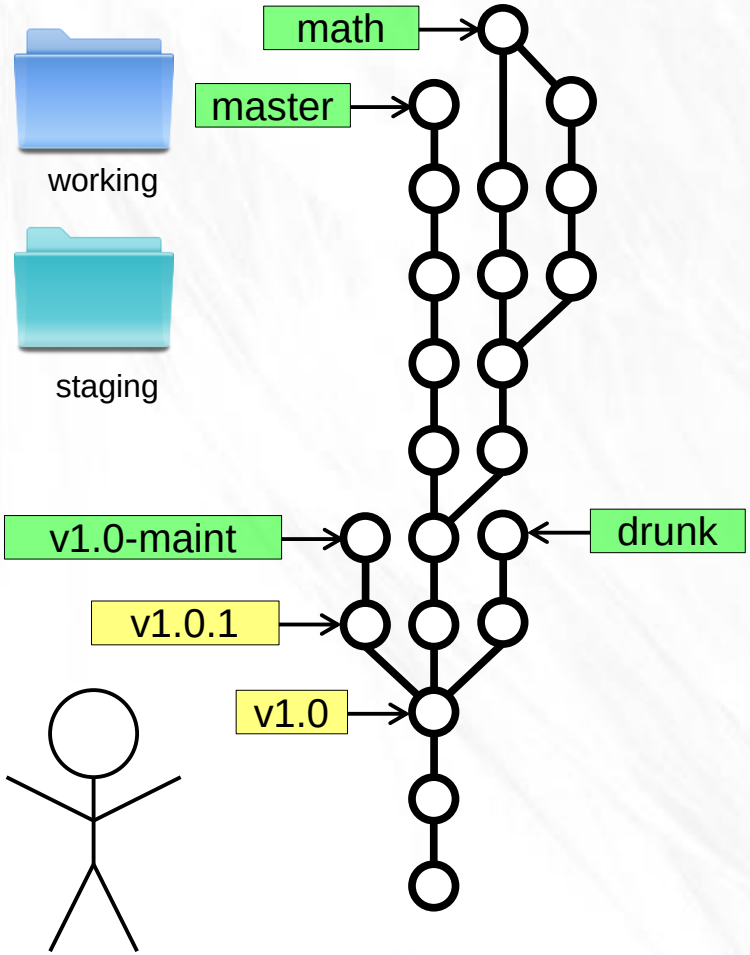


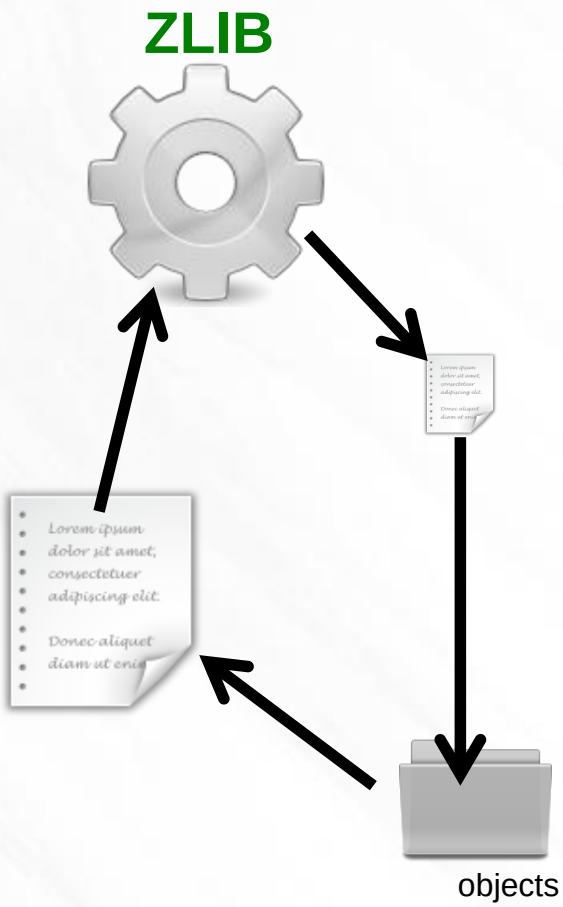
Eliminating Duplication



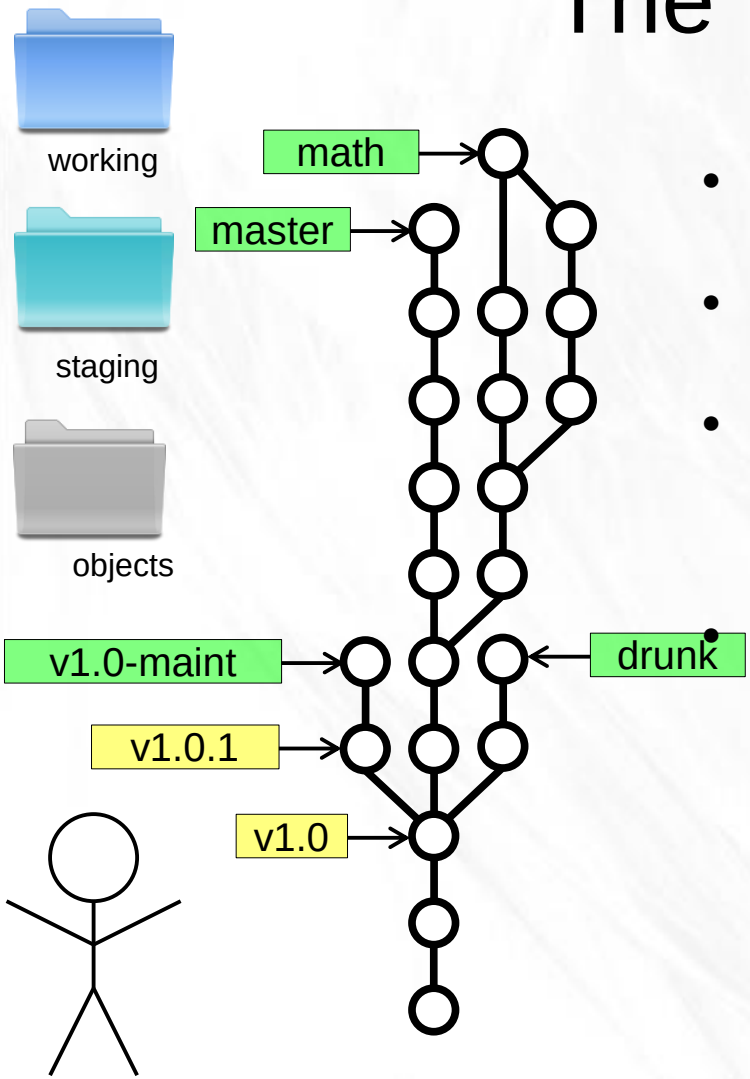

objects

Compressing Blobs





The True Git

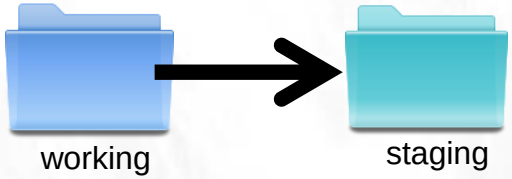


- TADAA!
- This is pretty much Git
- Nicer command line tools for all these operations
- Many, many other tools

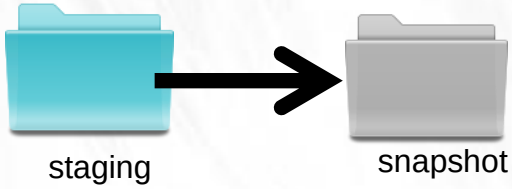
Commands: Getting Started

- First, tell Git who you are:
  - git config --global user.name “My Name”
  - git config --global user.email “my@email.address”
- Get help:
  - git <command> -h
  - git help <command>
- Start a new Git repository:
  - git init

Commands: Making snapshots



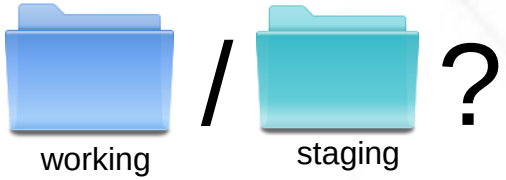
- git add



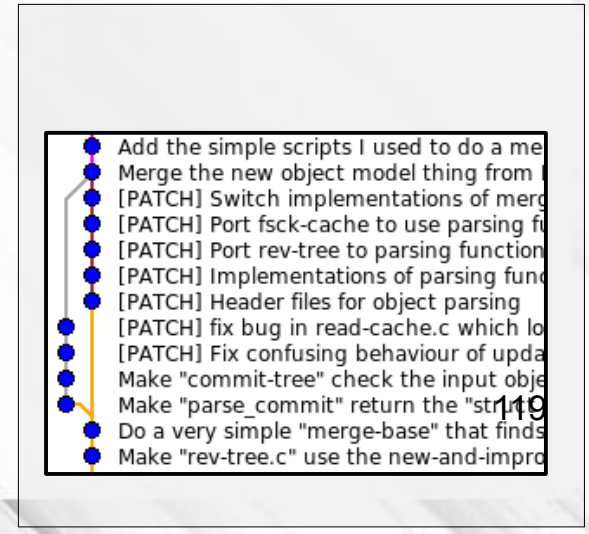
- git commit

git commit -a

- git log



- git status



gitk

Commands: Diffing


working

vs.


staging

- git diff


staging

vs.


snapshot

- git diff --staged


working

vs.


snapshot

- git diff HEAD


snapshot

vs.


snapshot

- git diff <from> <to>

Commands: Branches & Tags

- git branch
- git branch <branch>
- git checkout <branch>
- git tag -l
- git tag <tag>

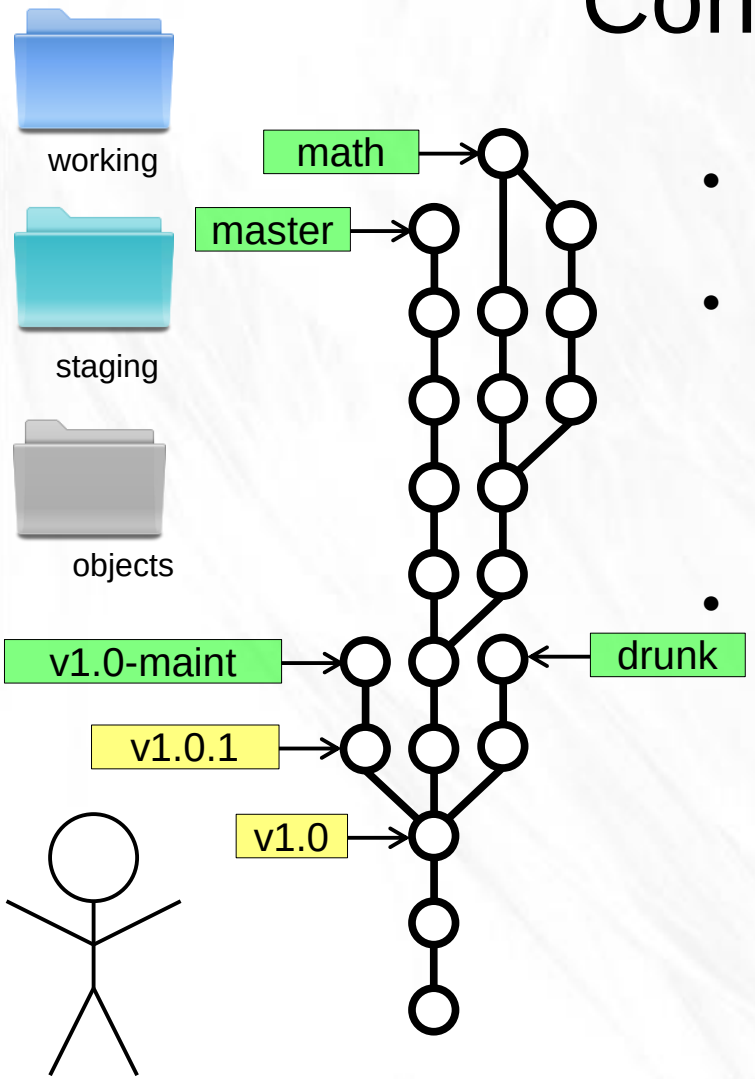
git checkout -b ...

Commands: Fetching & Merging

- git remote add <name> <URL>
- git fetch <name>
- git merge <name>/<branch>

git pull

Conclusion



- Keep this parable in mind
- Git is simple and powerful
- One more thing:

  git reflog

Where to go next?

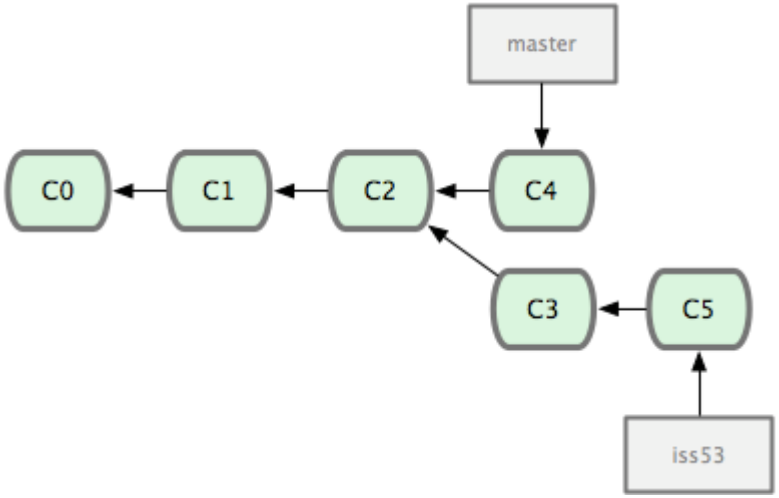
- Git homepage: http://git-scm.com
- Pro Git: http://git-scm.com/book
- Git Reference: http://gitref.org
- GitHub: http://github.com
- Gitorious: http://gitorious.org

Questions?

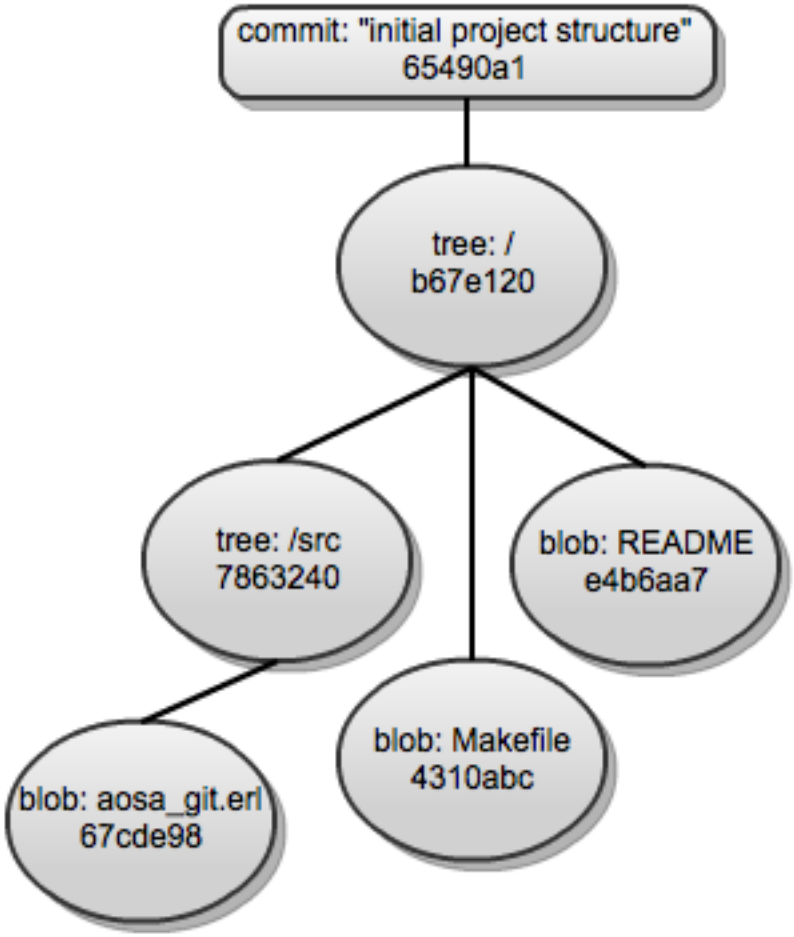
- Thanks for your attention!
- These slides are available at:
  https://github.com/jherland/git_parable
- Reach me at <johan@herland.net>

Content

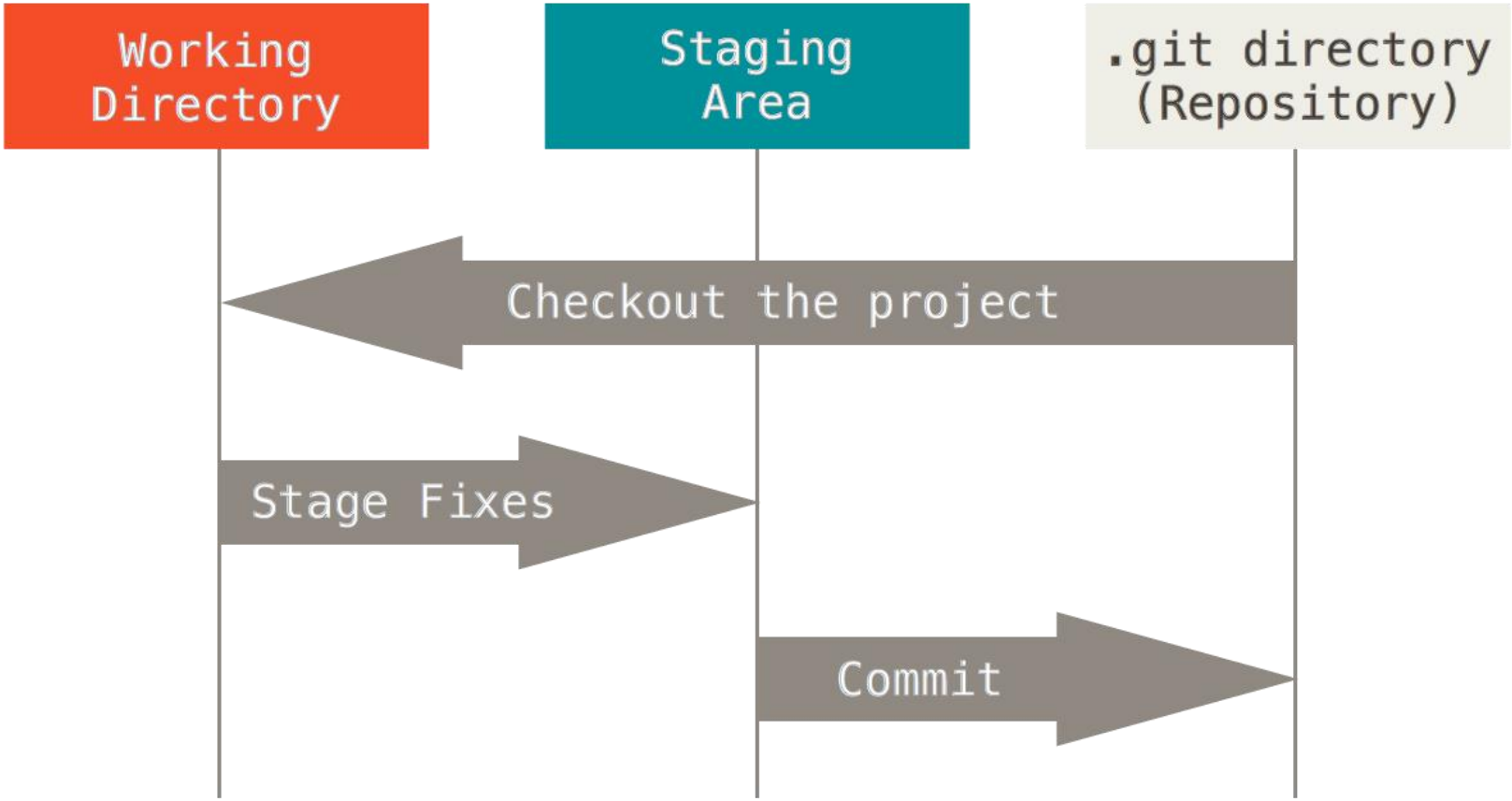
- DAG



Commit and Merge Histories



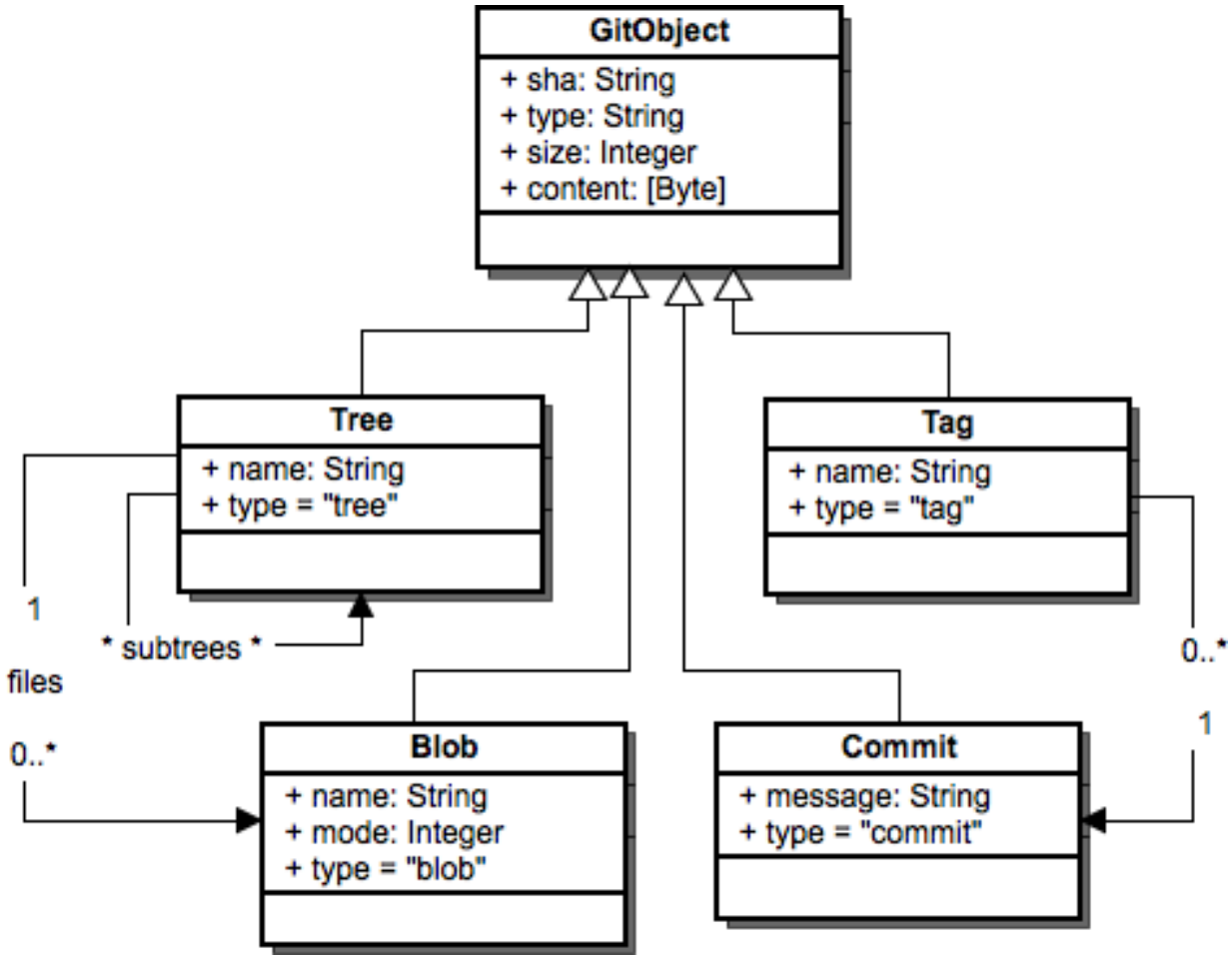
The 3 states


Working Directory
Staging Area
.git directory (Repository)
Checkout the project
Stage Fixes
Commit

Git Init

```
tree .git/
.git/
|-- HEAD
|-- config
|-- description
|-- hooks
|   |-- applypatch-msg.sample
|   |-- commit-msg.sample
|   |-- post-commit.sample
|   |-- post-receive.sample
|   |-- post-update.sample
|   |-- pre-applypatch.sample
|   |-- pre-commit.sample
|   |-- pre-rebase.sample
|   |-- prepare-commit-msg.sample
|   |-- update.sample
|-- info
|   |-- exclude
|-- objects
|   |-- info
|   |-- pack
|-- refs
    |-- heads
    |-- tags
```

Object Database



Cons

- IDE Integration (not anymore really)
- Script based (“), Toolkit
- => complexity / confusion for users

Before

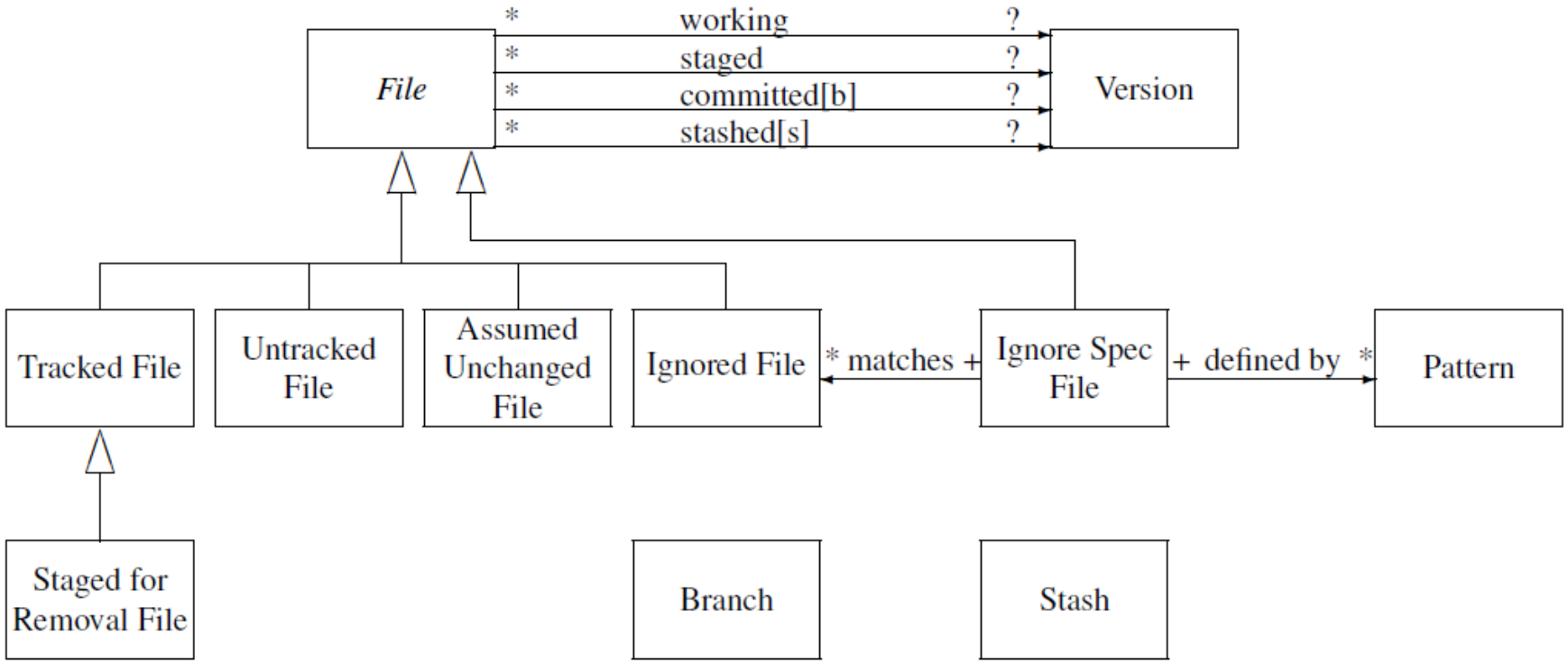


Figure 1. Graphical representation of Git's conceptual model.

Usability Issues Examples

- Let me just “checkin”
  git commit -a
- Add -> edit -> commit -> reset.
  What is the version now? (depends on reset params)
- Switching branches when there are edited new files existing in the other branch
  (git checkout help: “Local modifications to the files in the working tree are kept, so that they can be committed to the <branch>.”)

Code Review

After (Gitless)

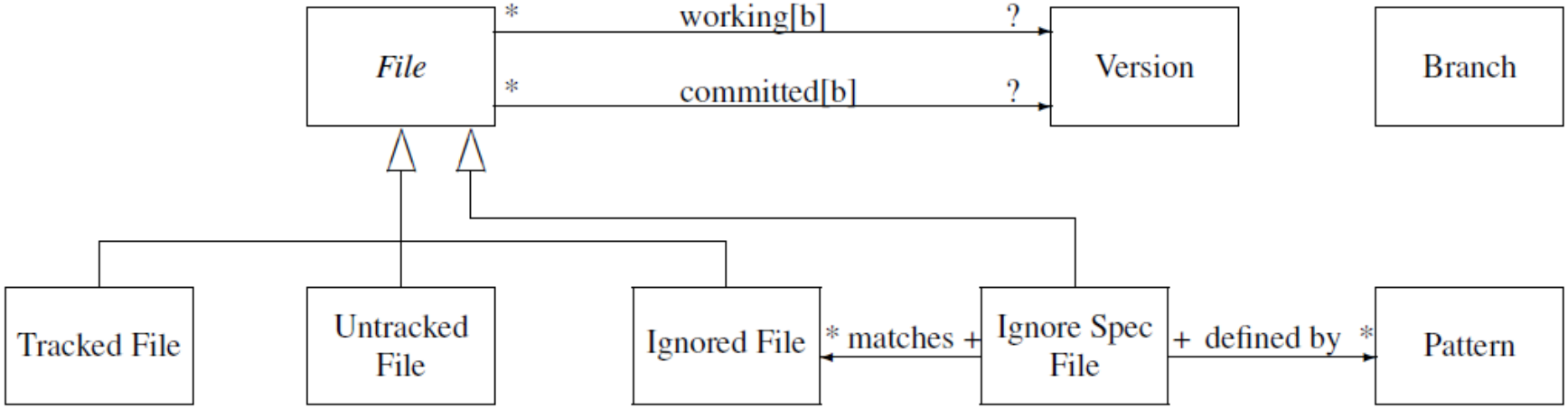


Figure 2. Graphical representation of Gitless's conceptual model.

לסיכום

- תהליך: בקרת תצורה וגרסאות
- כלים: git / github
- שיטות: למשל git flow
- עוד: Git For Ages 4 And Up

- פעם הבאה: מידול עם UML