Using Git on OS X

Munich CocoaHeads
2009-11-12
2009-12-10

Coming up

Basic Concepts

Daily Git

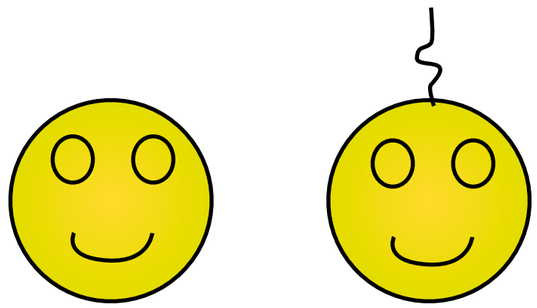
Git with XCode

Non-Obvious Git

Source Configuration Management

Source Configuration Management

Source Configuration Management



Source Configuration Management

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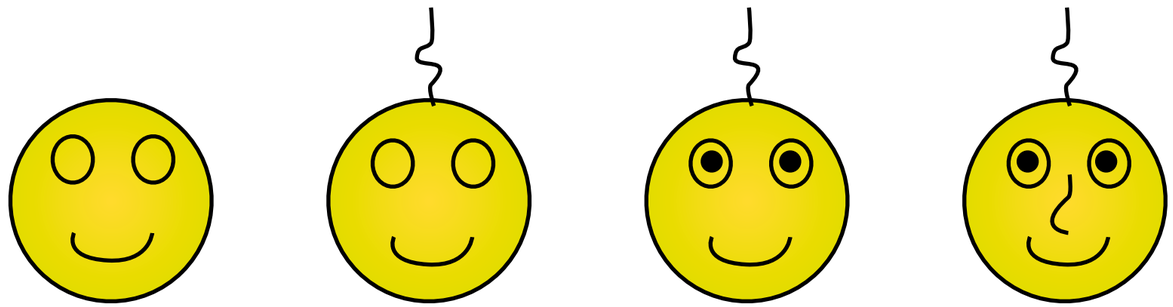

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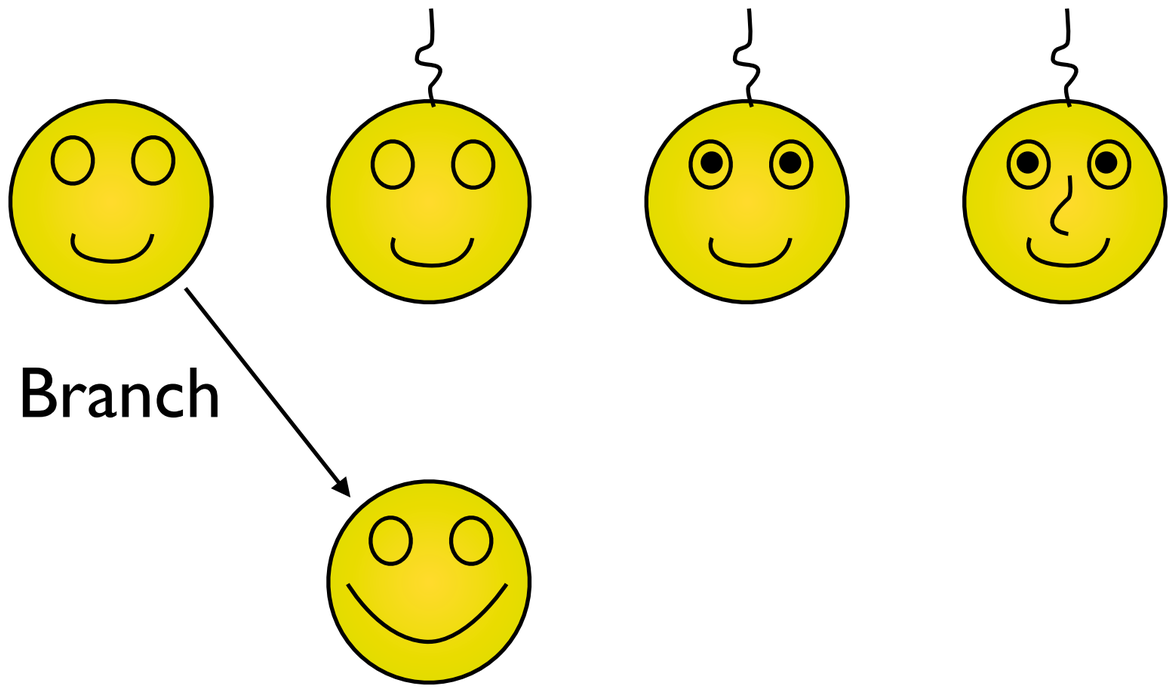
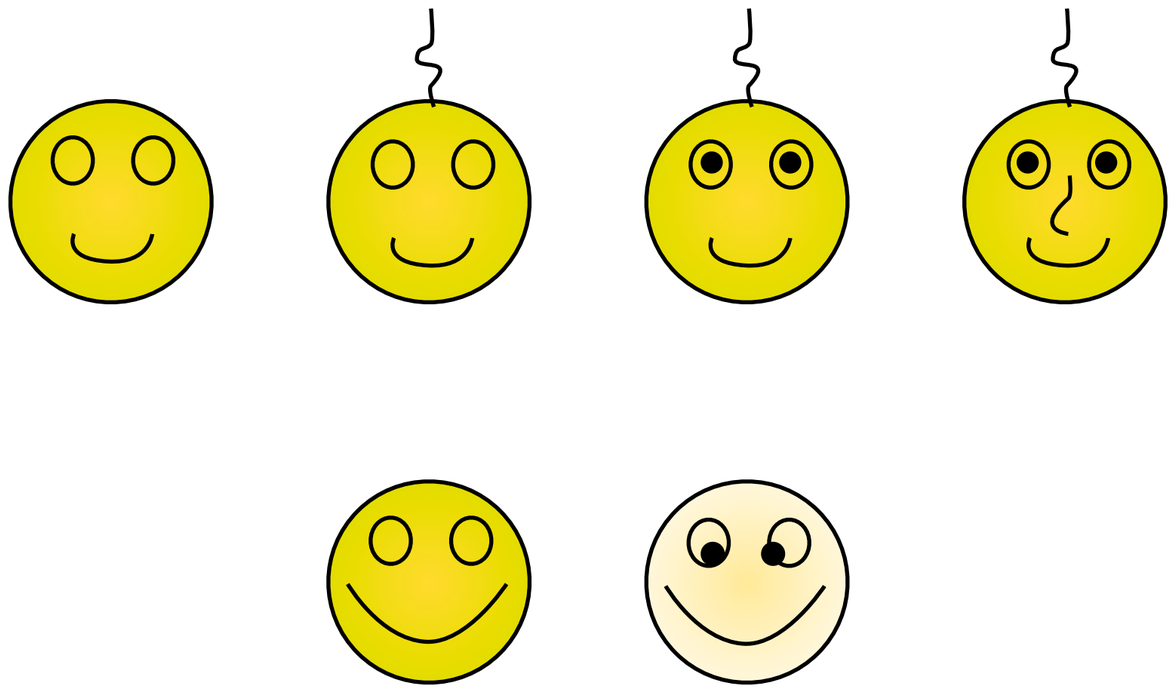


Source Configuration Management



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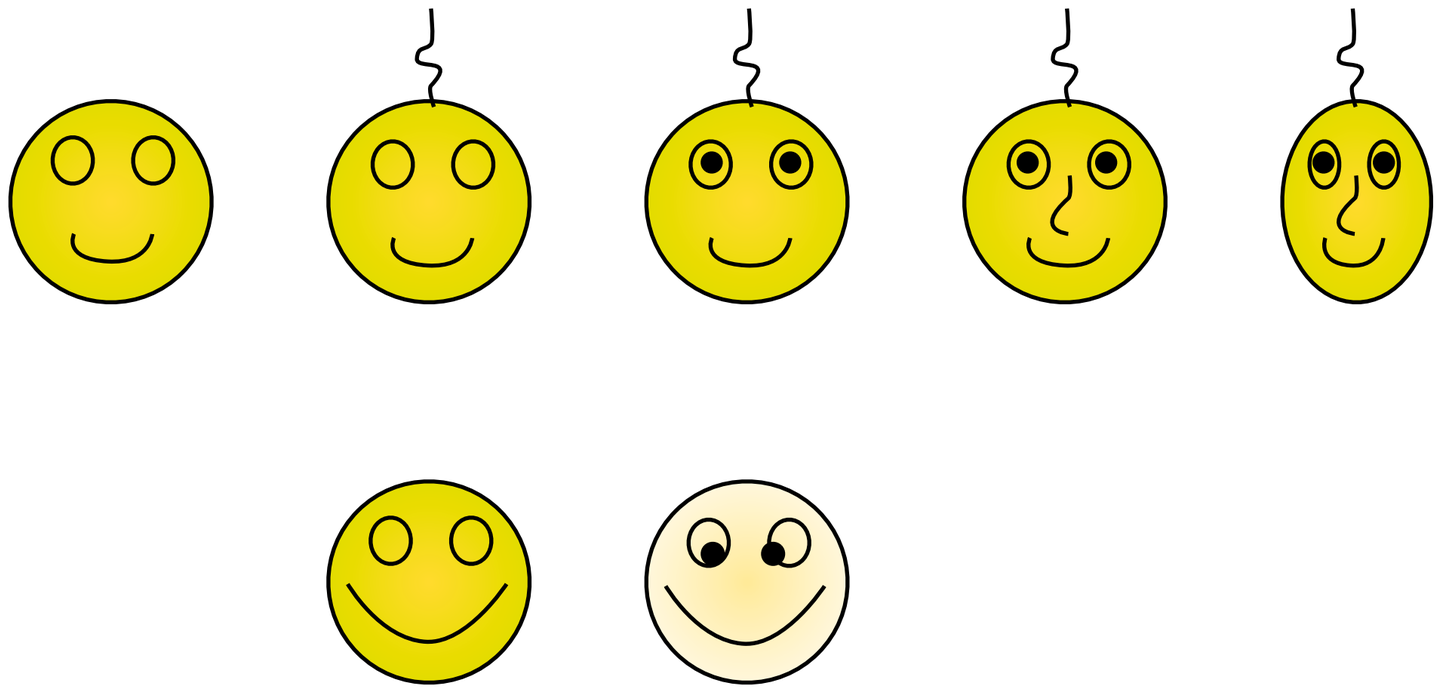

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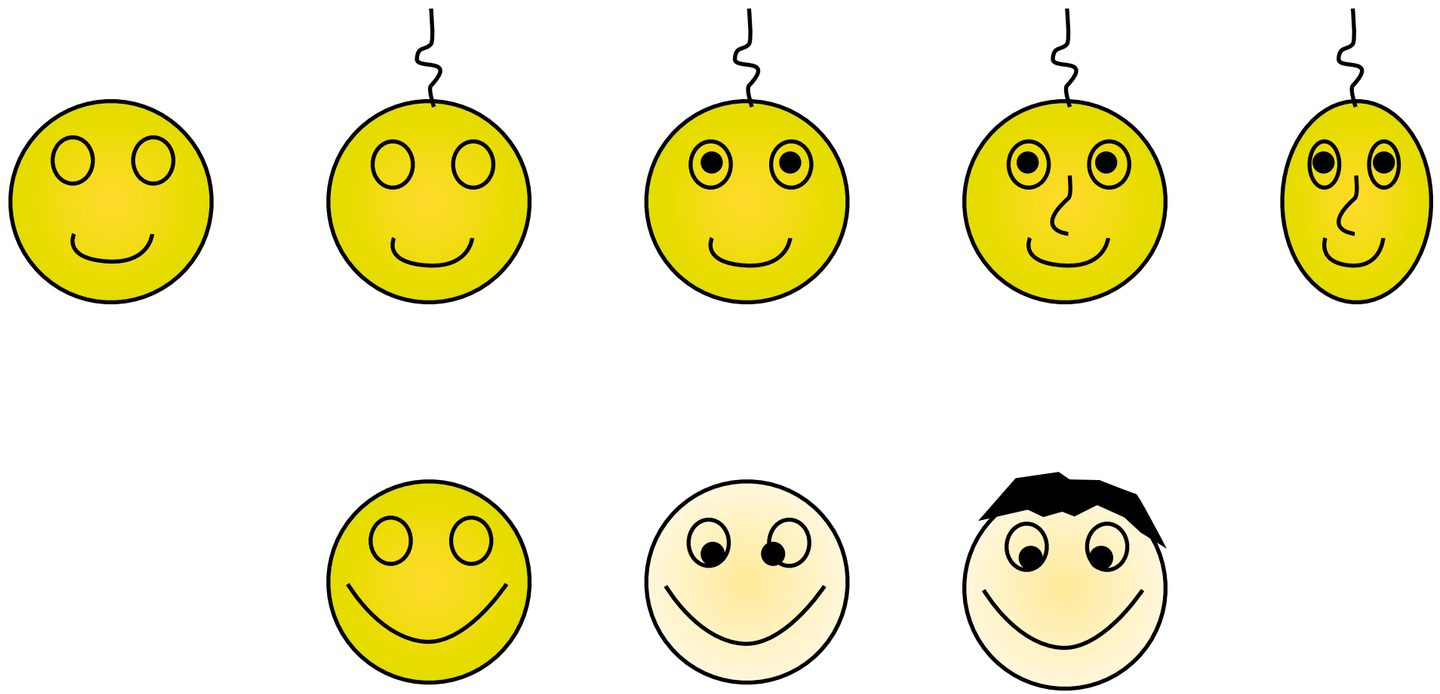

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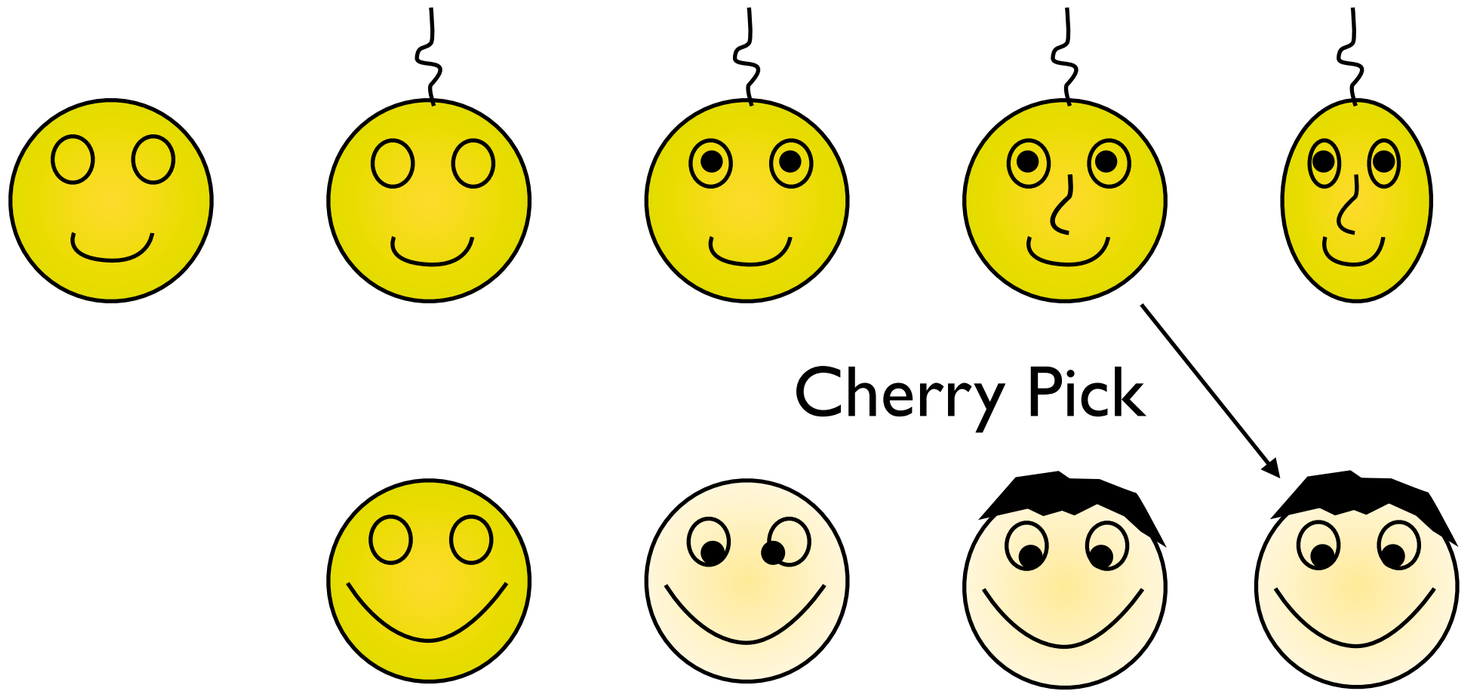

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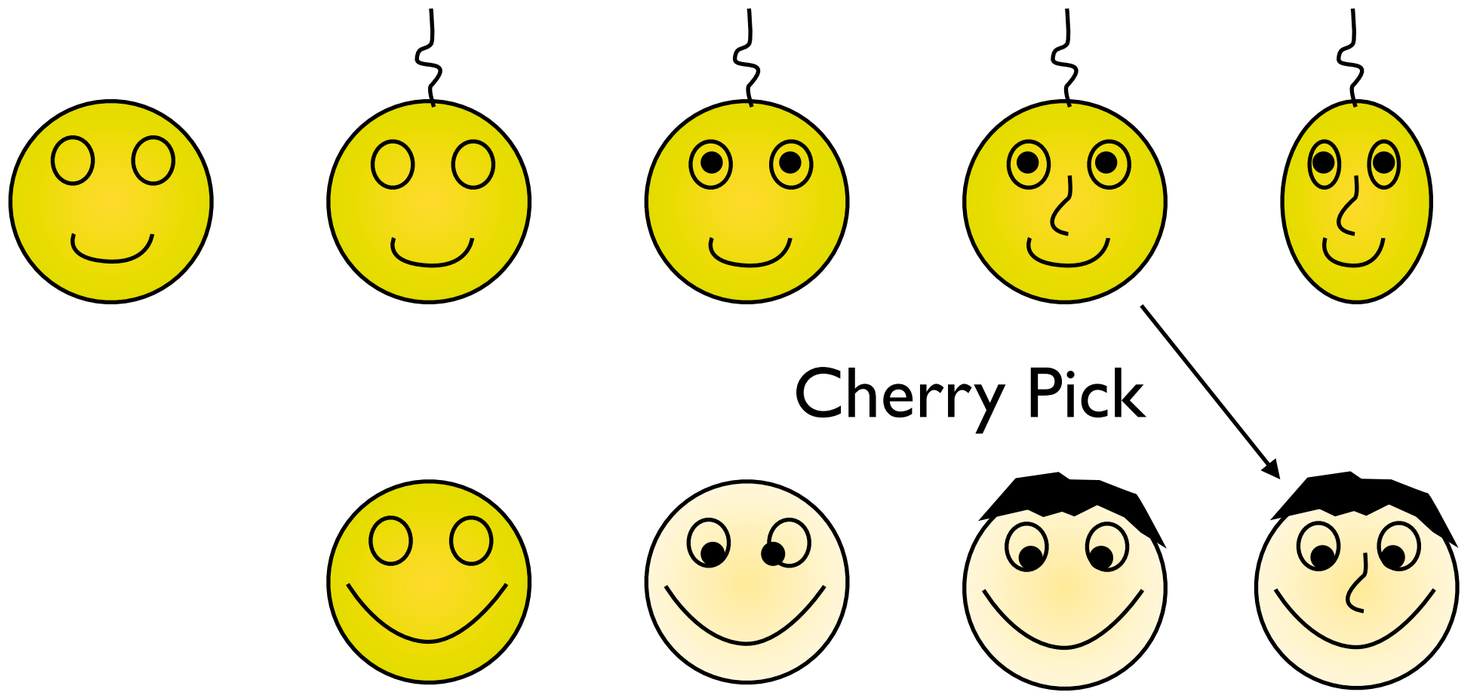

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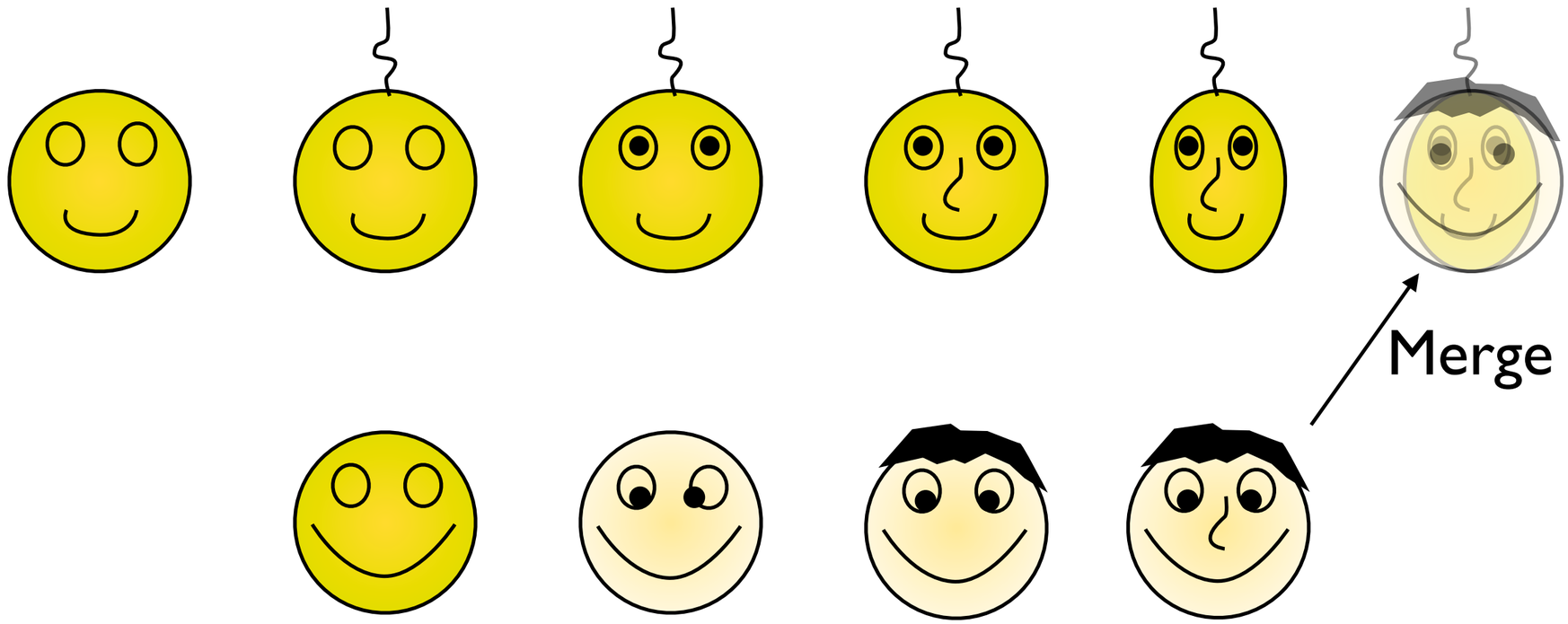

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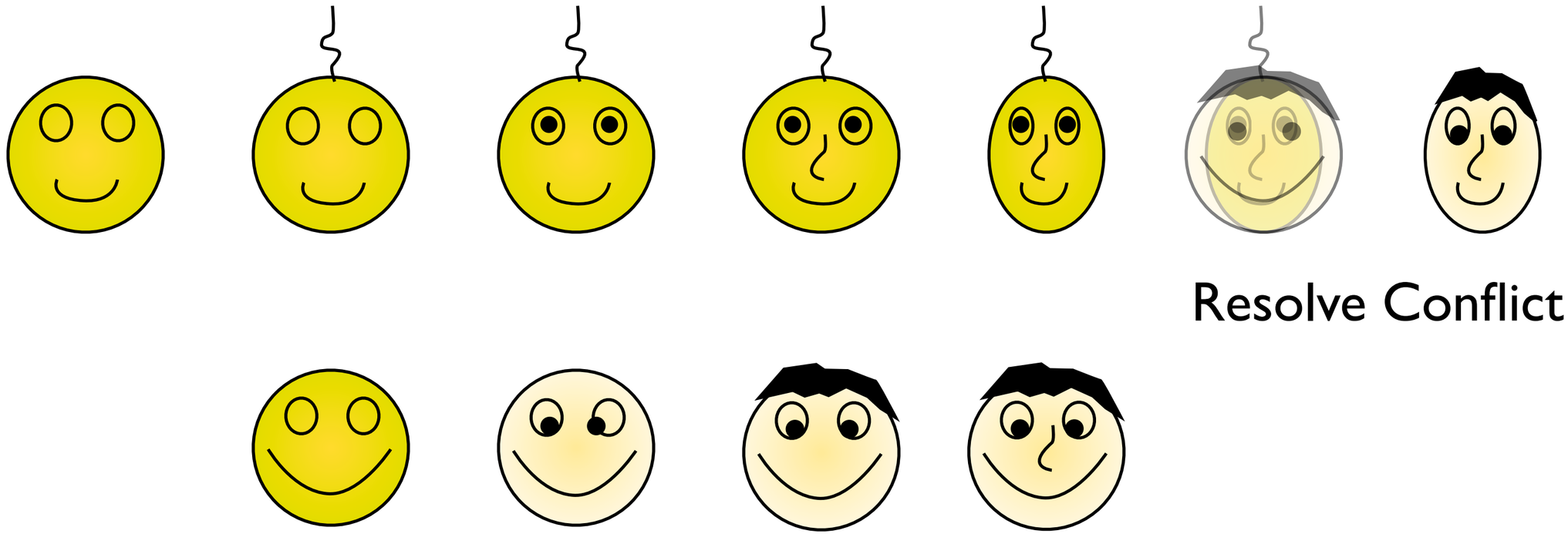

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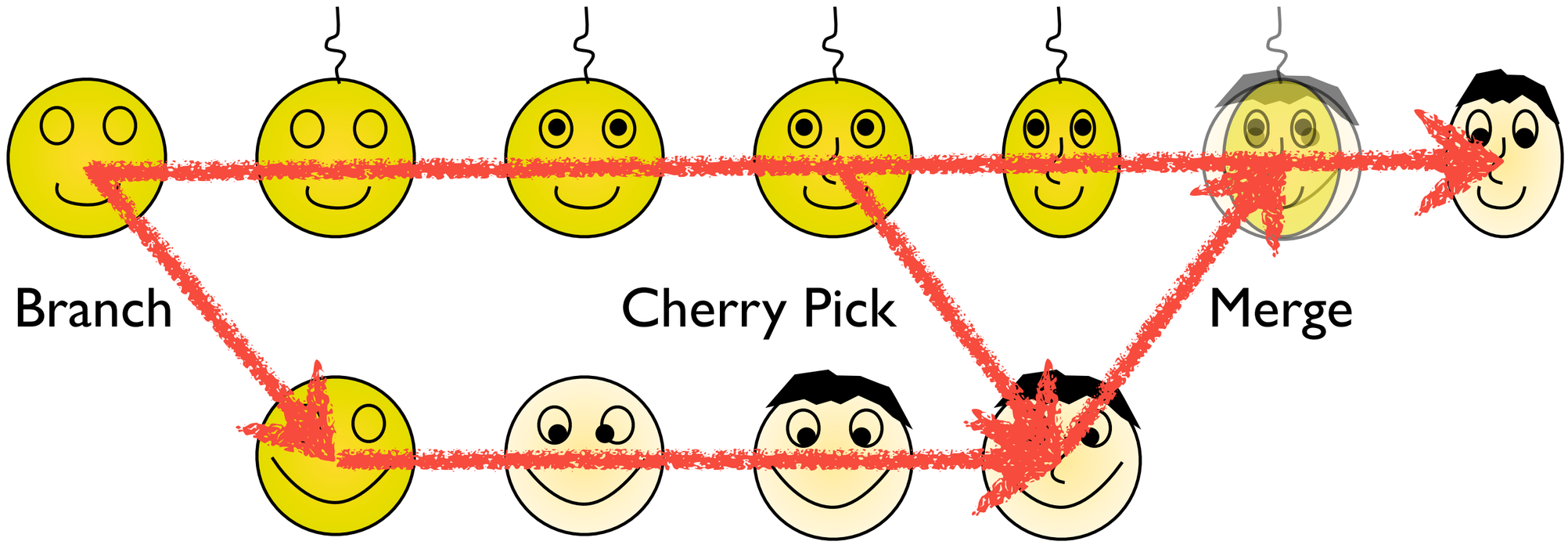

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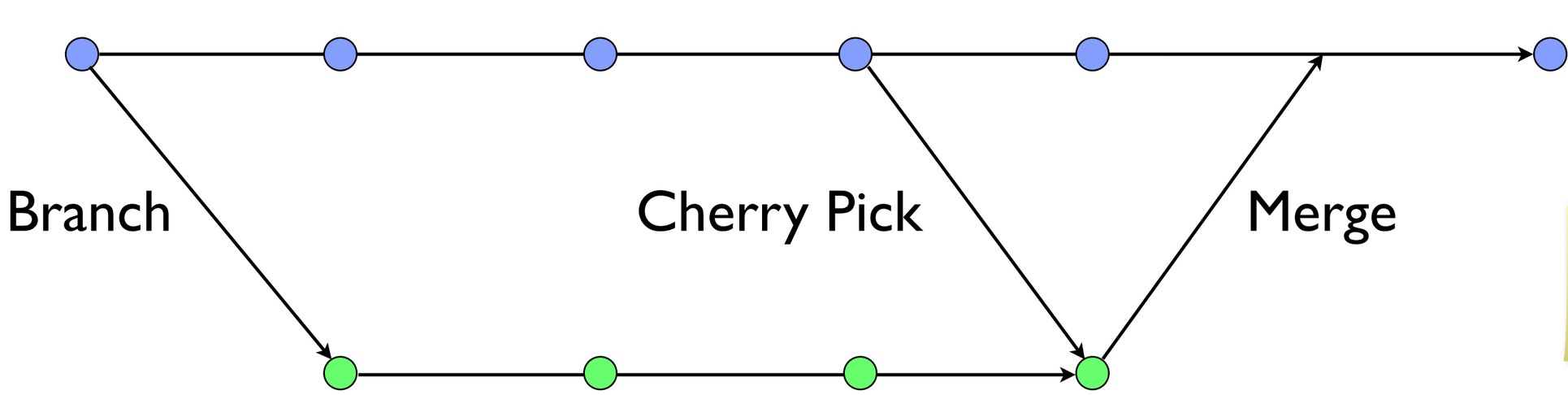
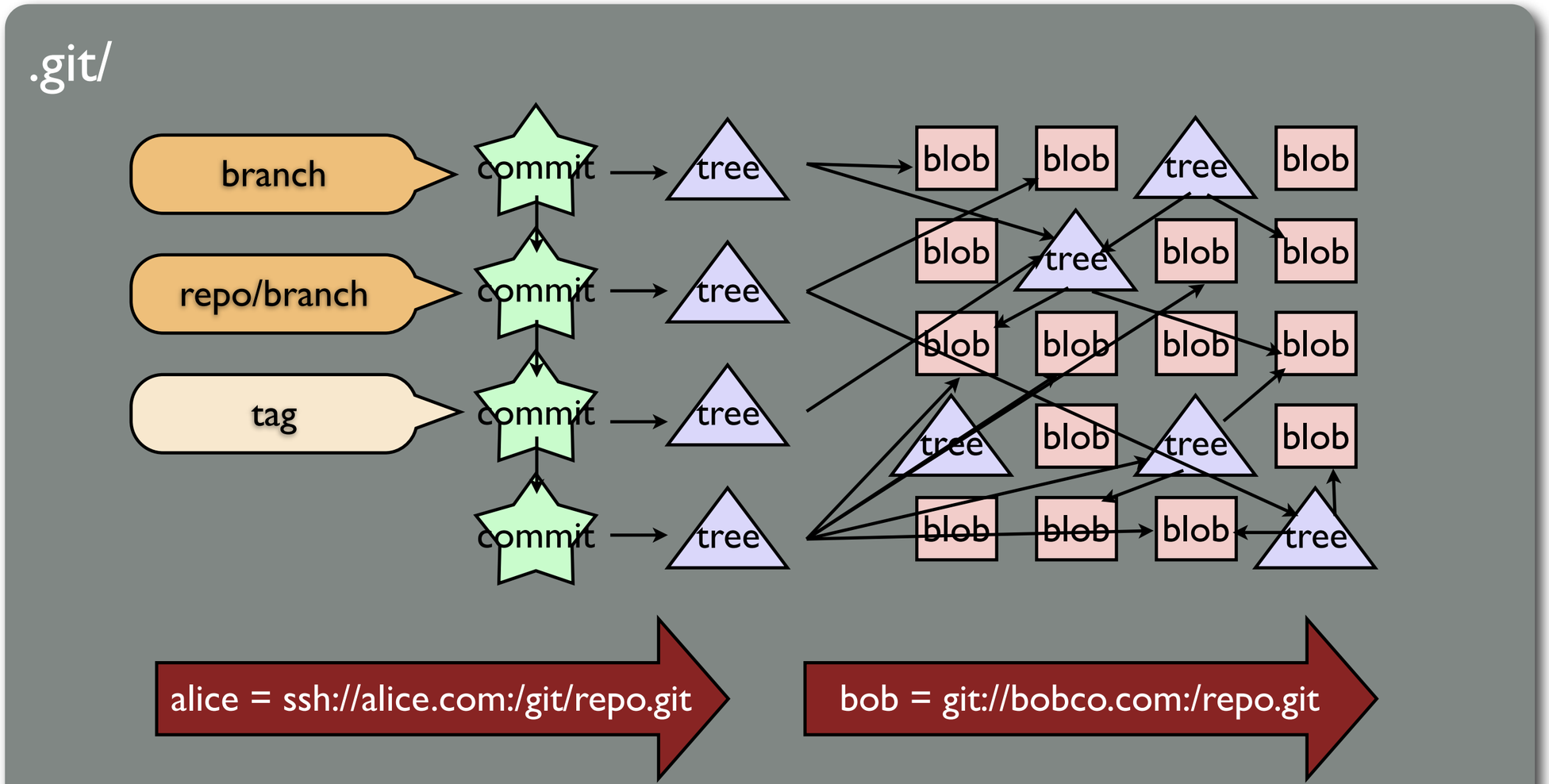


unresolved conflicts are not committed to the repository!

Git is SCM in a Directory

Inside Git



Git's Bits

Blobs

blob	size

`// Blah.m`
`// This class does`
 	
`@implementation Bla`
 	
`@synthesize a;`	

Trees

tree		size	
rw-rw-rw-	blob	5b1d3…	ReadMe
rwxrwxrwx	tree	03e78…	Classes
rwxrwxrwx	tree	cdc8b…	Resources
rw-rw-rw-	blob	cba0a…	Info.plist
rwxrwxrwx	blob	911e7…	distrib.pl

Commits

commit	size
tree	c4ec5…
previous commit	a149e…
author	Scott
commiter	Scott
date	2009-11-10 21:15
commit message	

Tags

tag	size
commit	ae668…
type	commit
tagger	Scott
tag message	

Blobs

blob	size

`// Blah.m`
`// This class does`
 	
`@implementation Bla`
 	
`@synthesize a;`	

Blobs

SHA-1

blob	size

```
// Blah.m
// This class does

@implementation Bla

@synthesize a;
```

Blobs

56906c1725109d441fe846300fd4e57063cc6d6b

blob	size

```
// Blah.m
// This class does

@implementation Bla

@synthesize a;
```

Blobs

56906c1...

blob	size

```
// Blah.m
// This class does

@implementation Bla

@synthesize a;
```

Trees

tree		size	
rw-rw-rw-	blob	5b1d3…	ReadMe
rwxrwxrwx	tree	03e78…	Classes
rwxrwxrwx	tree	cdc8b…	Resources
rw-rw-rw-	blob	cba0a…	Info.plist
rwxrwxrwx	blob	911e7…	distrib.pl

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56906c1...

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rw-rw-rw-	blob	5b1d3...	ReadMe
rwxrwxrwx	tree	03e78...	Classes
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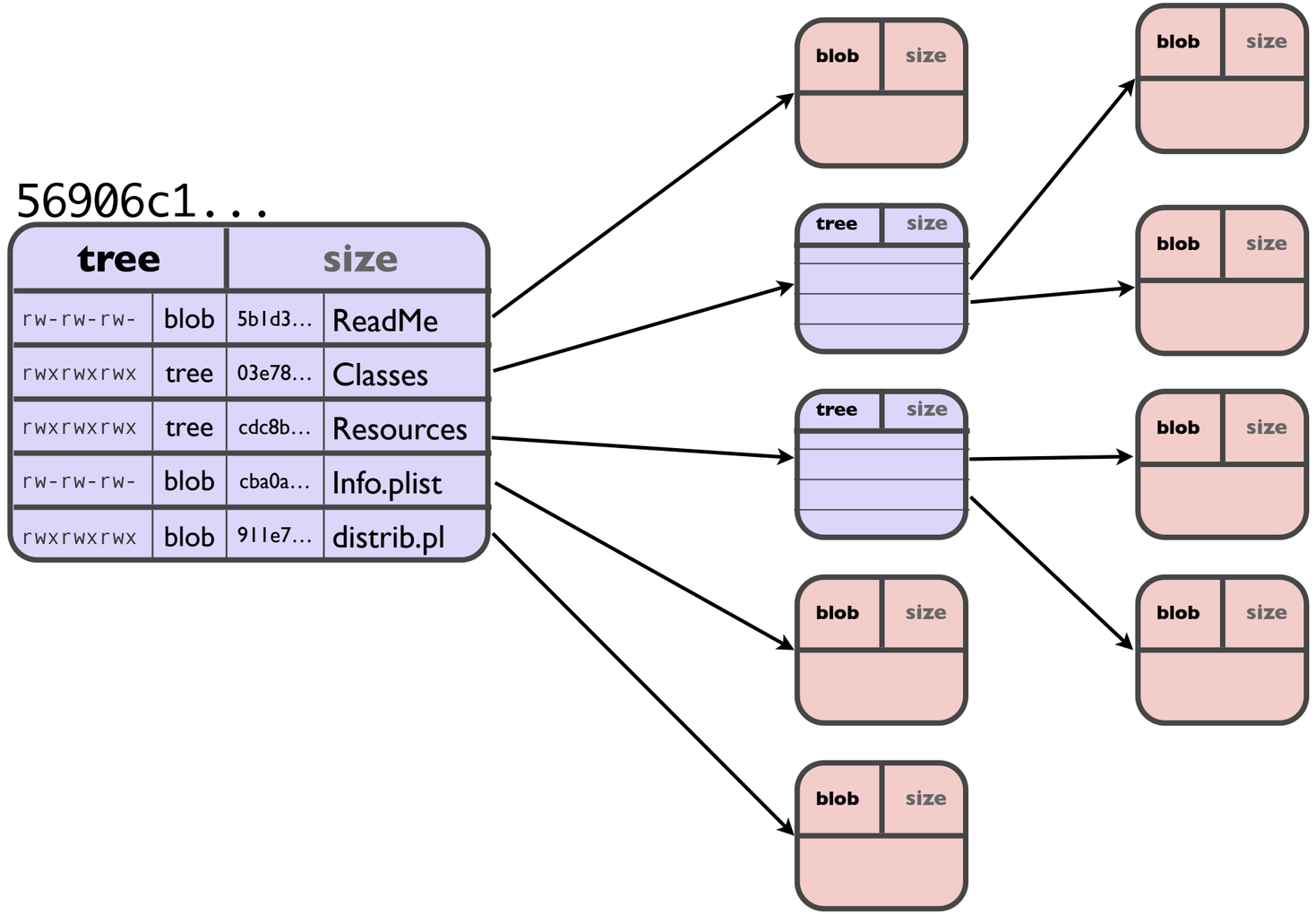
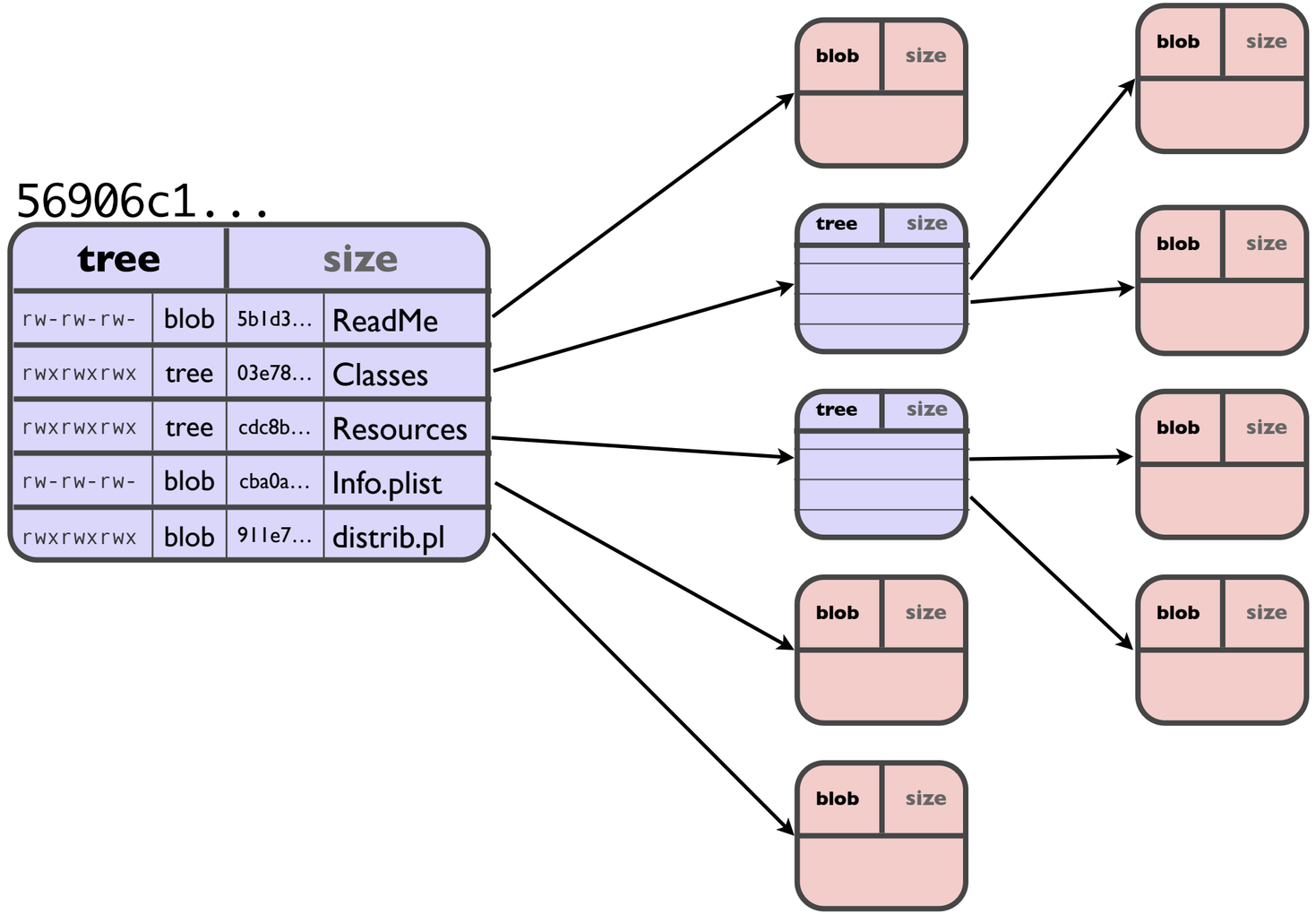
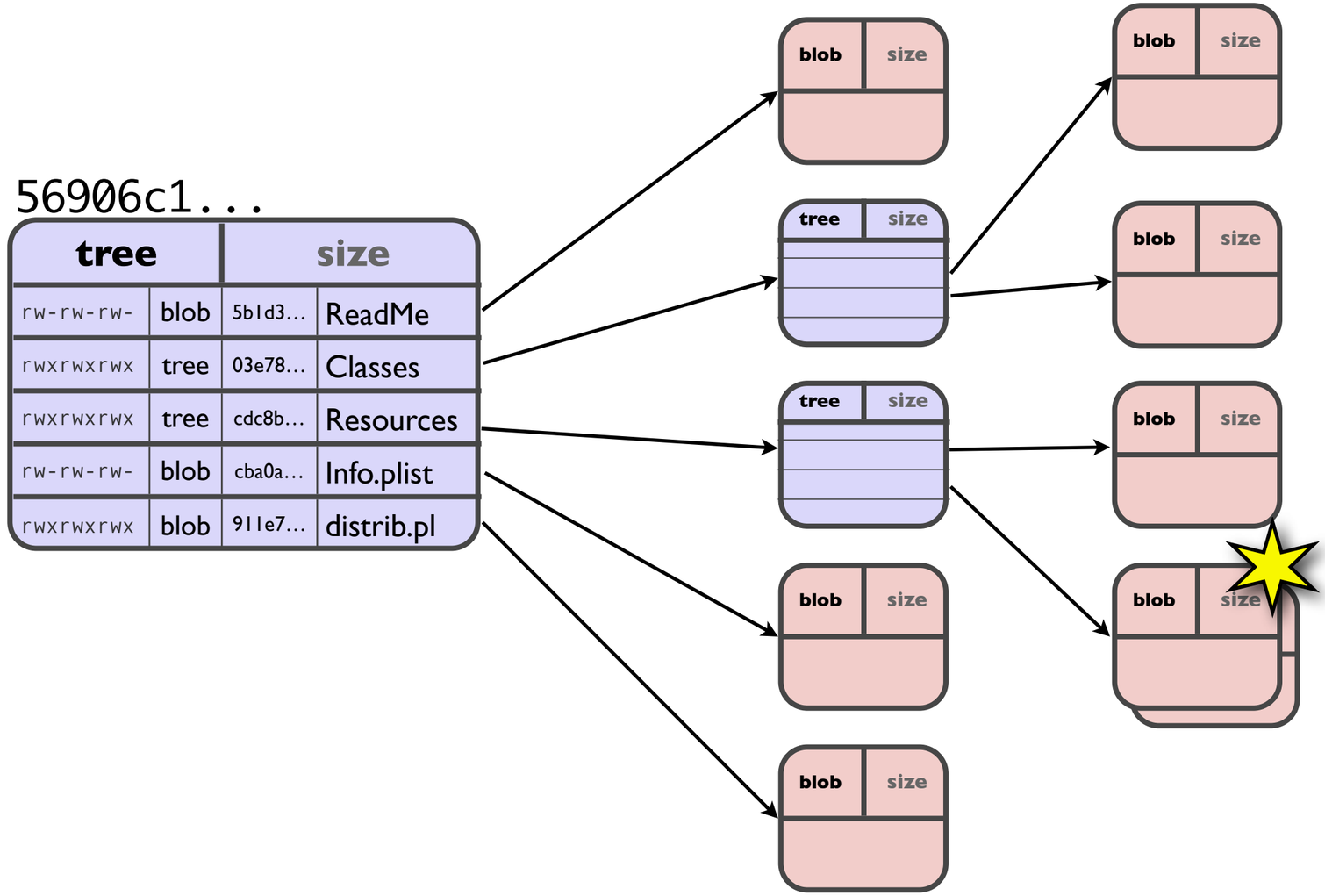
Trees



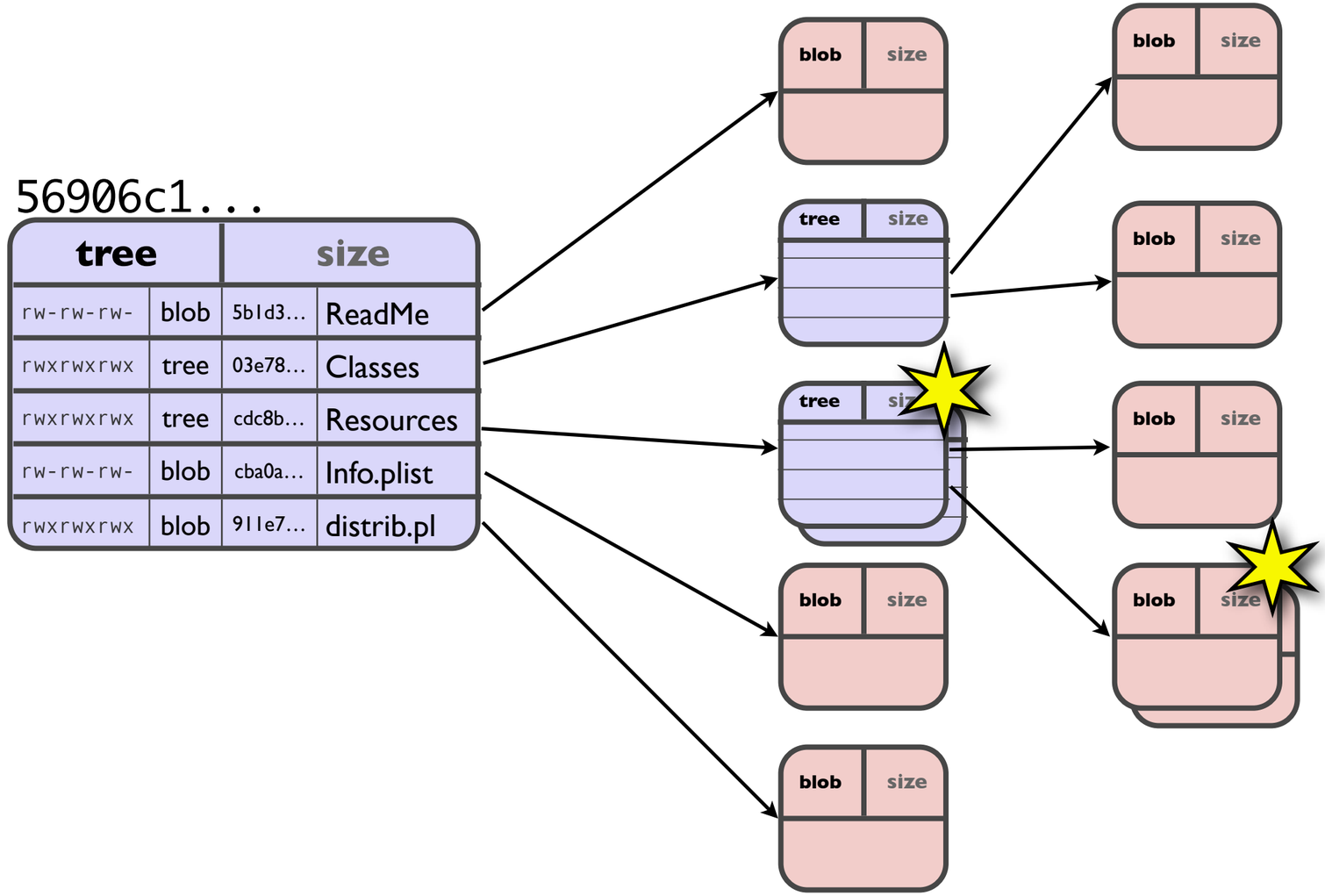
Changes



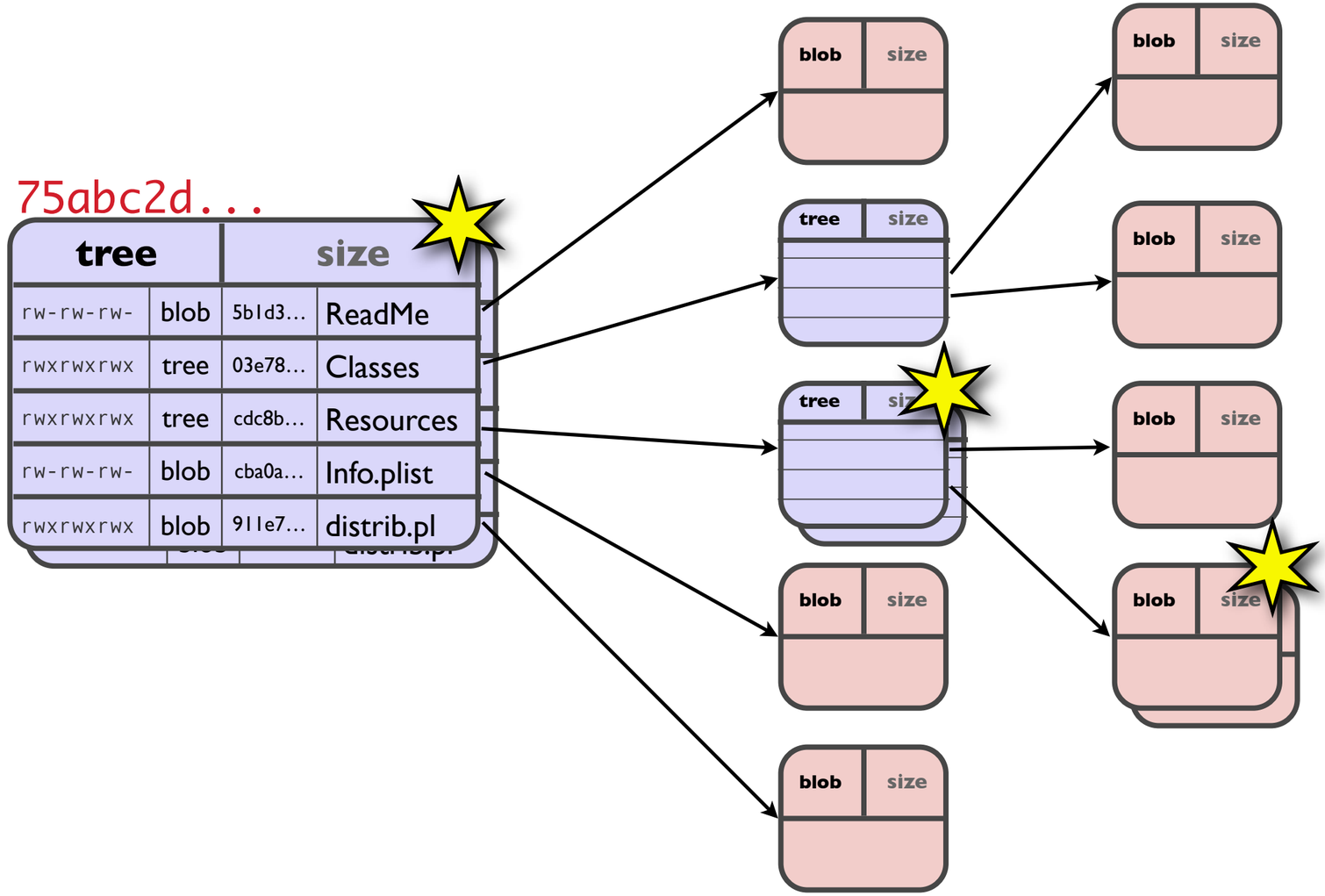
Changes



Changes



Changes



Commits

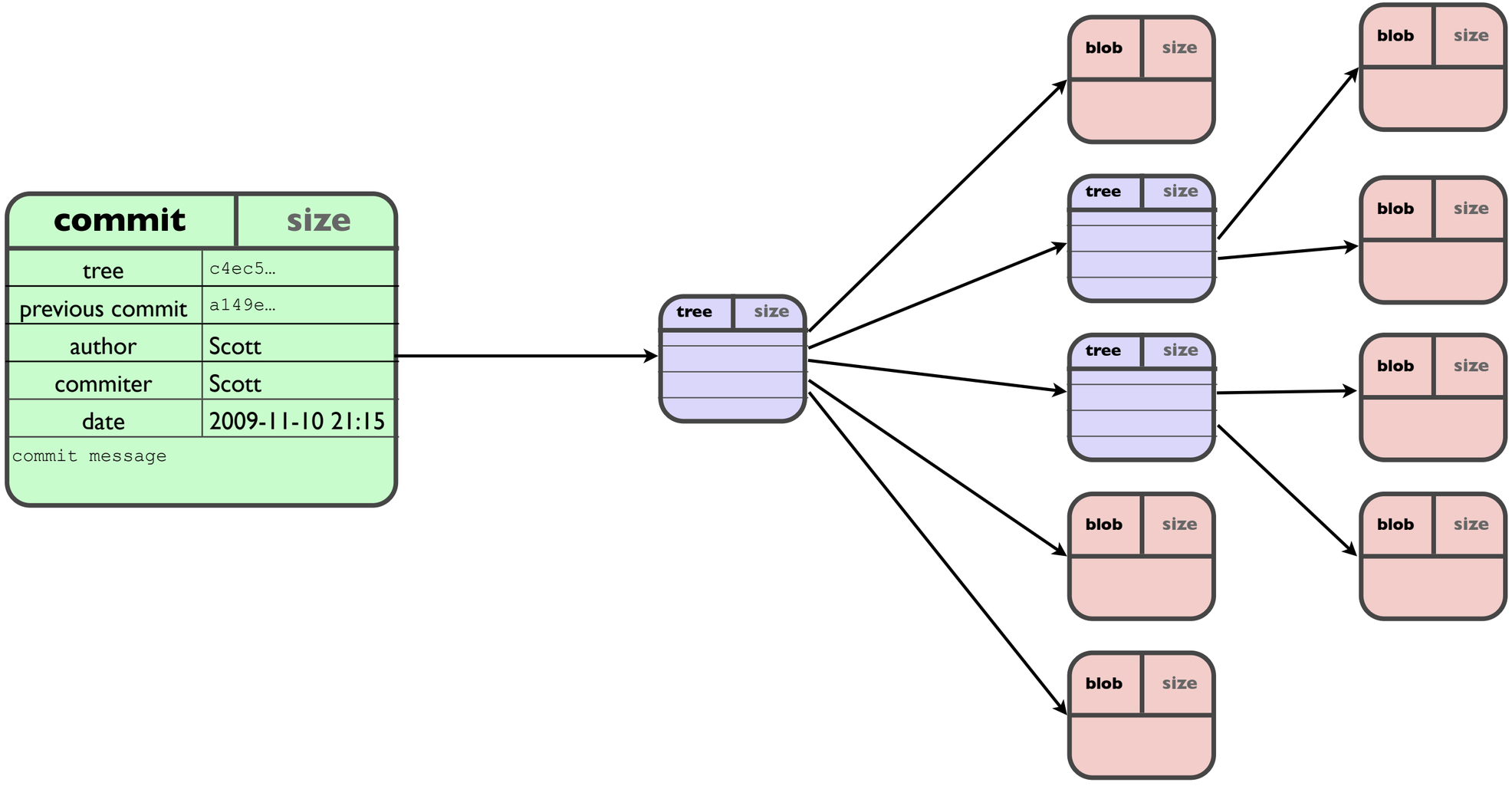
commit	size
tree	`c4ec5...`
previous commit	`a149e...`
author	Scott
commiter	Scott
date	2009-11-10 21:15
`commit message`	

Commits

56906c1...

commit	size
tree	c4ec5...
previous commit	a149e...
author	Scott
commiter	Scott
date	2009-11-10 21:15
commit message	

Commits



Tags

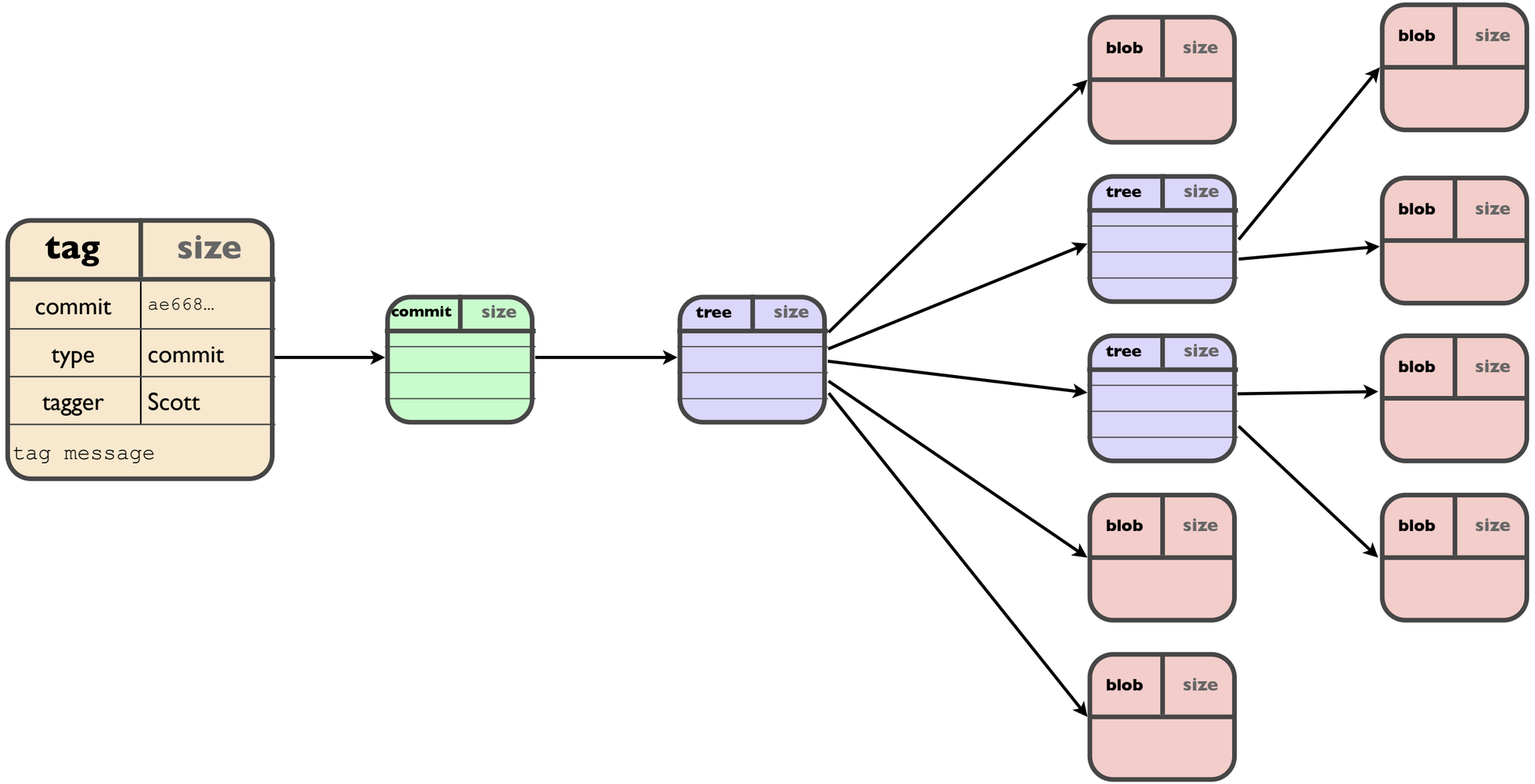
tag	size
commit	ae668...
type	commit
tagger	Scott
tag message	

Tags

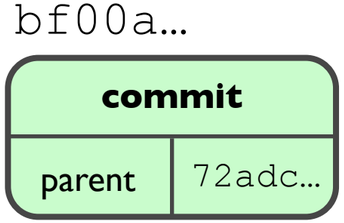
56906c1...

tag	size
commit	ae668...
type	commit
tagger	Scott
tag message	

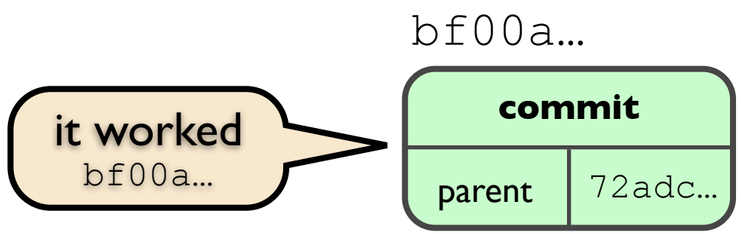
Tags



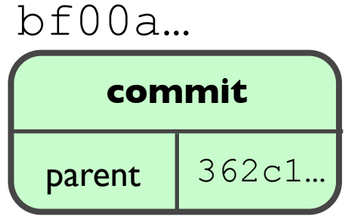
Light-weight tags



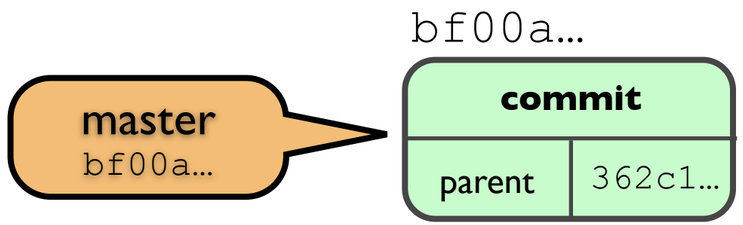
Light-weight tags



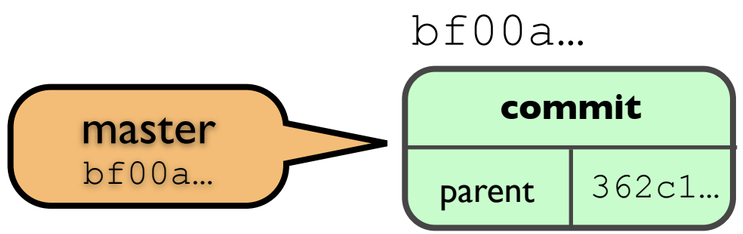
Branches



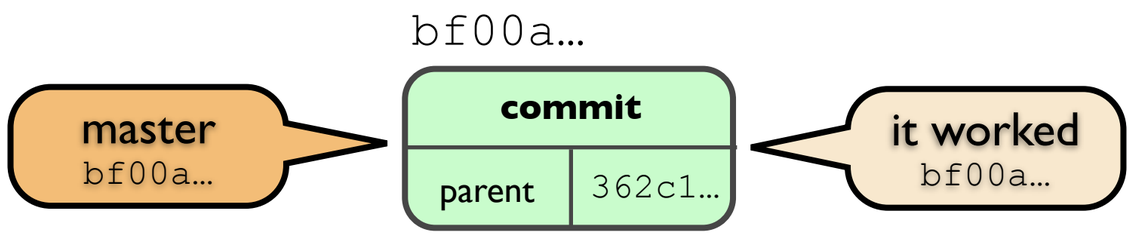
Branches



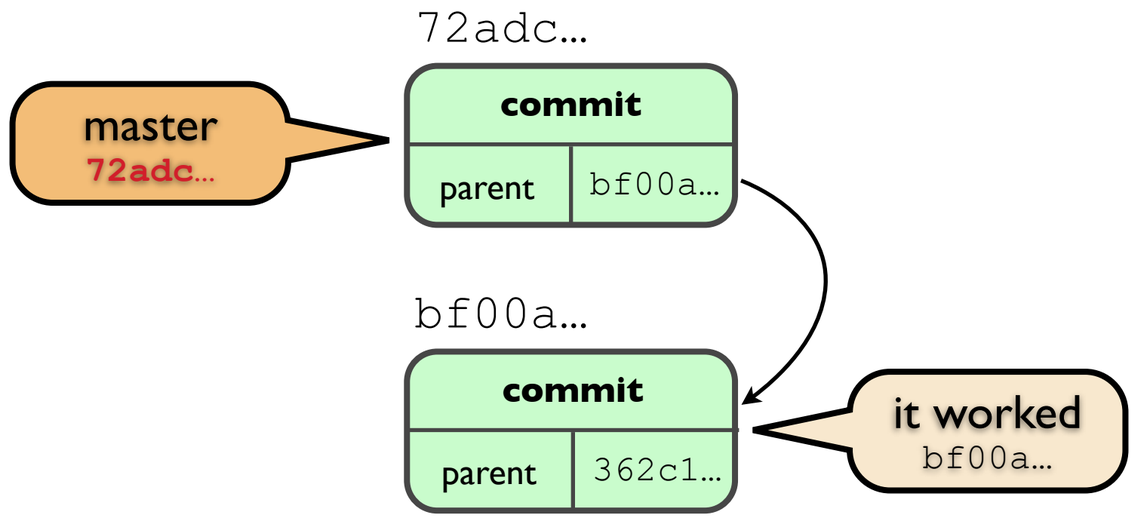
Branches ‘v’ Tags



Branches ‘v’ Tags

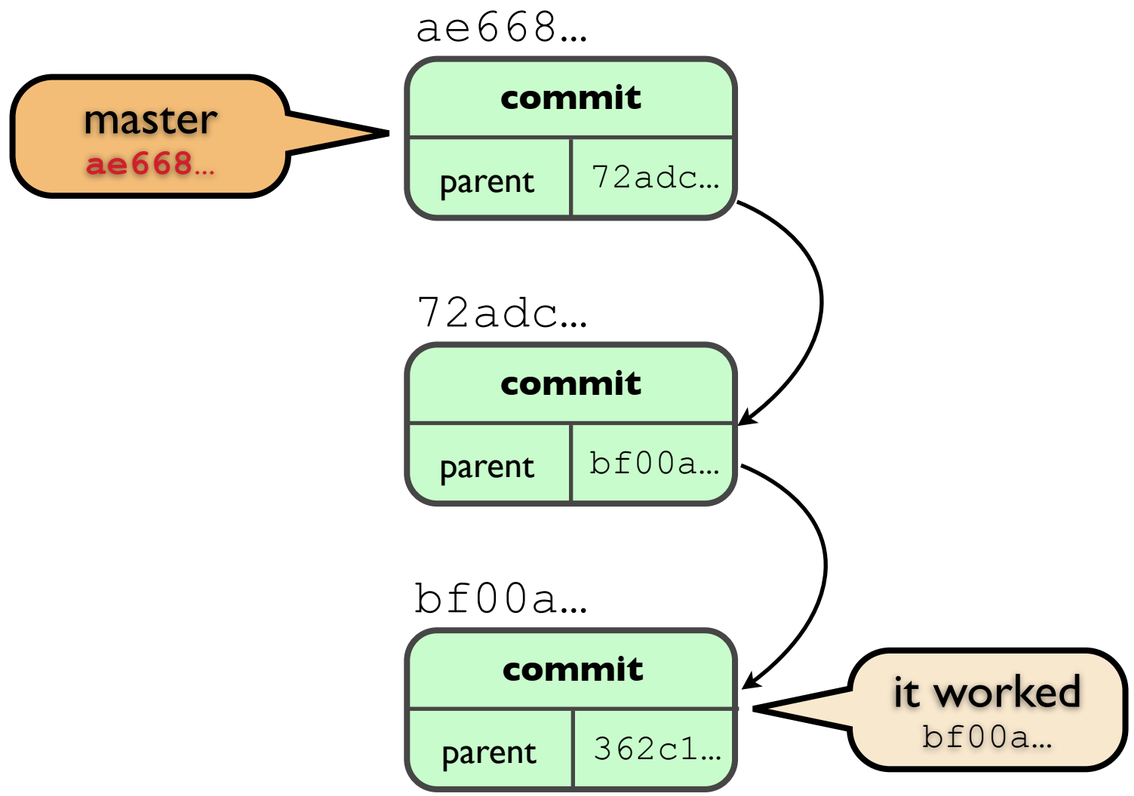


Branches ‘v’ Tags



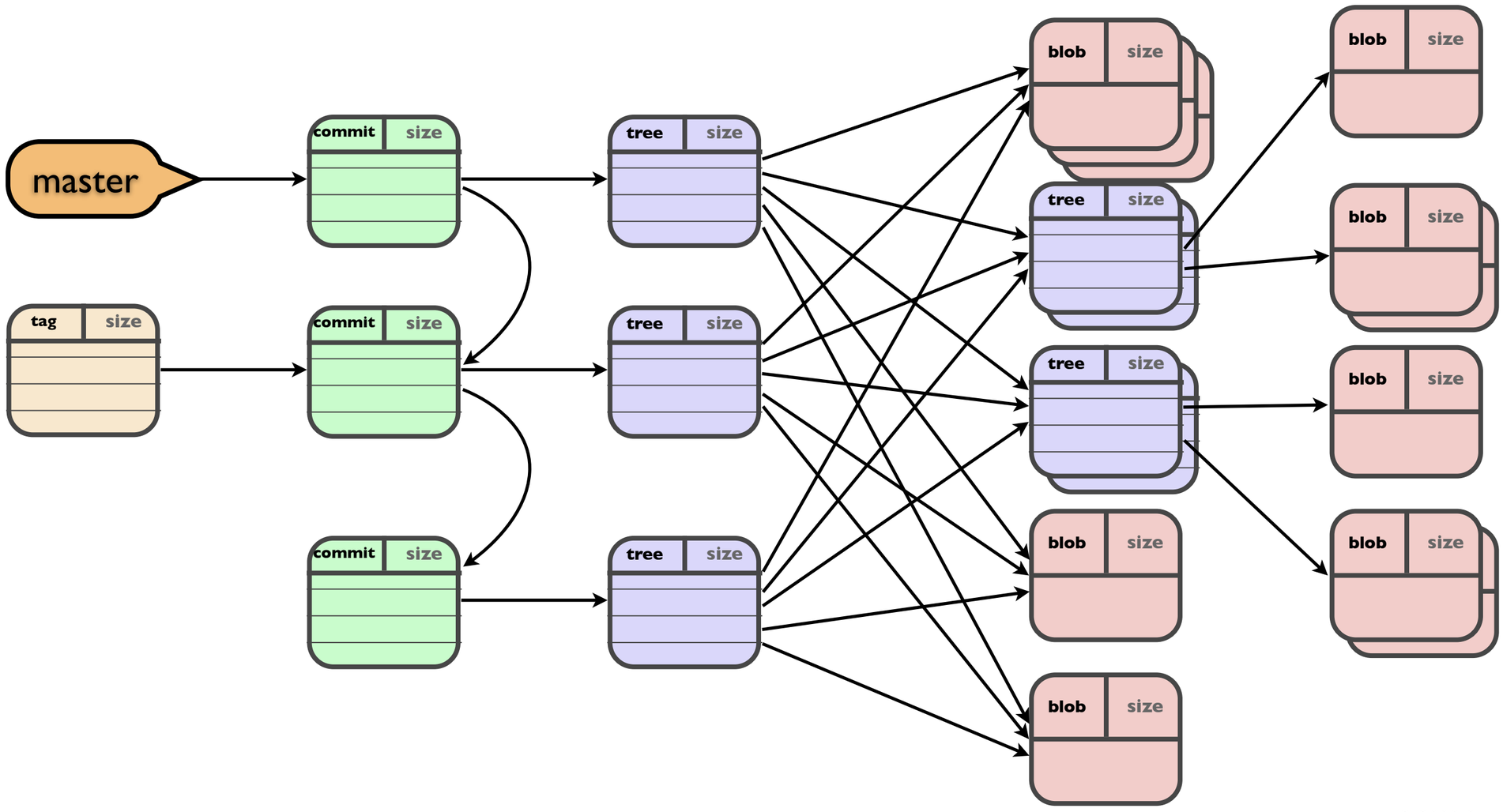
Branches ‘v’ Tags

HEAD and your current branch are automatically updated when you commit a change.



tags are immutable and reliably point to a known state of the entire repository

The Whole Lot



Sharing

/project_dir/repo.git

my repository

Alice' repository

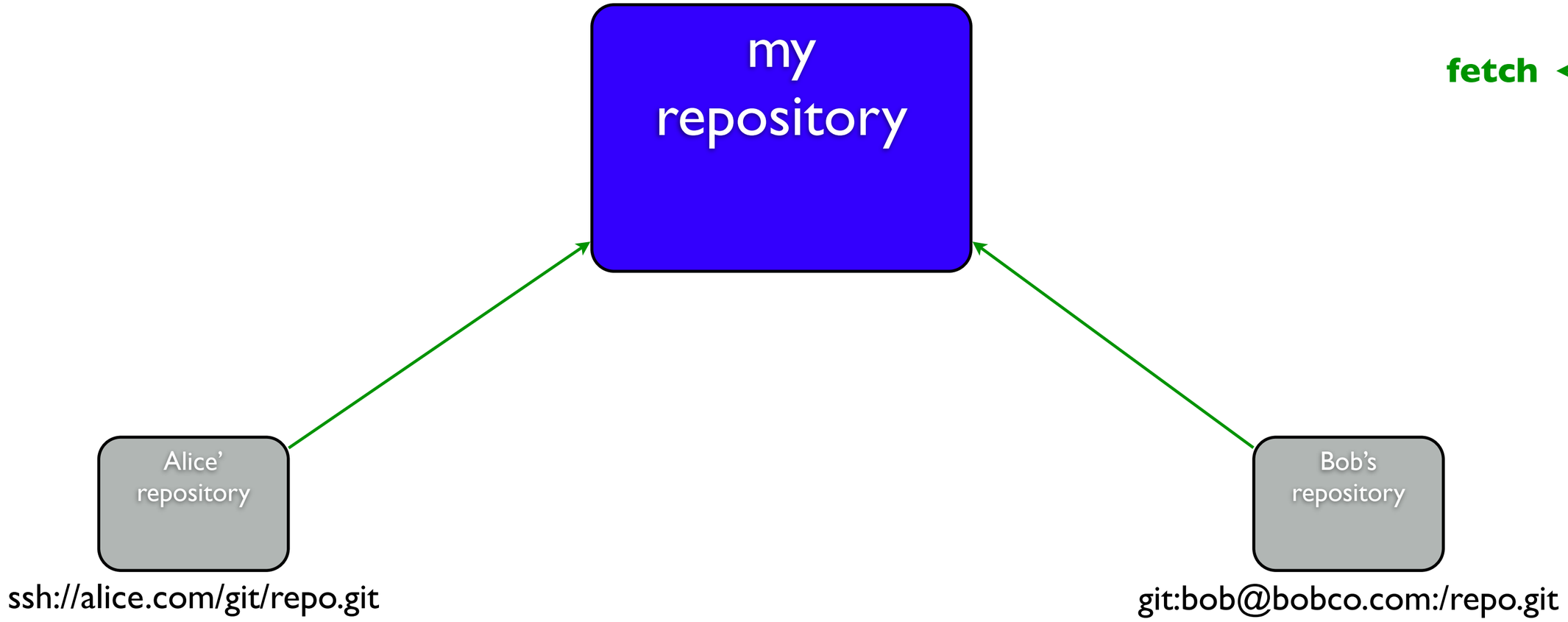
ssh://alice.com/git/repo.git

Bob's repository

git:bob@bobco.com:/repo.git

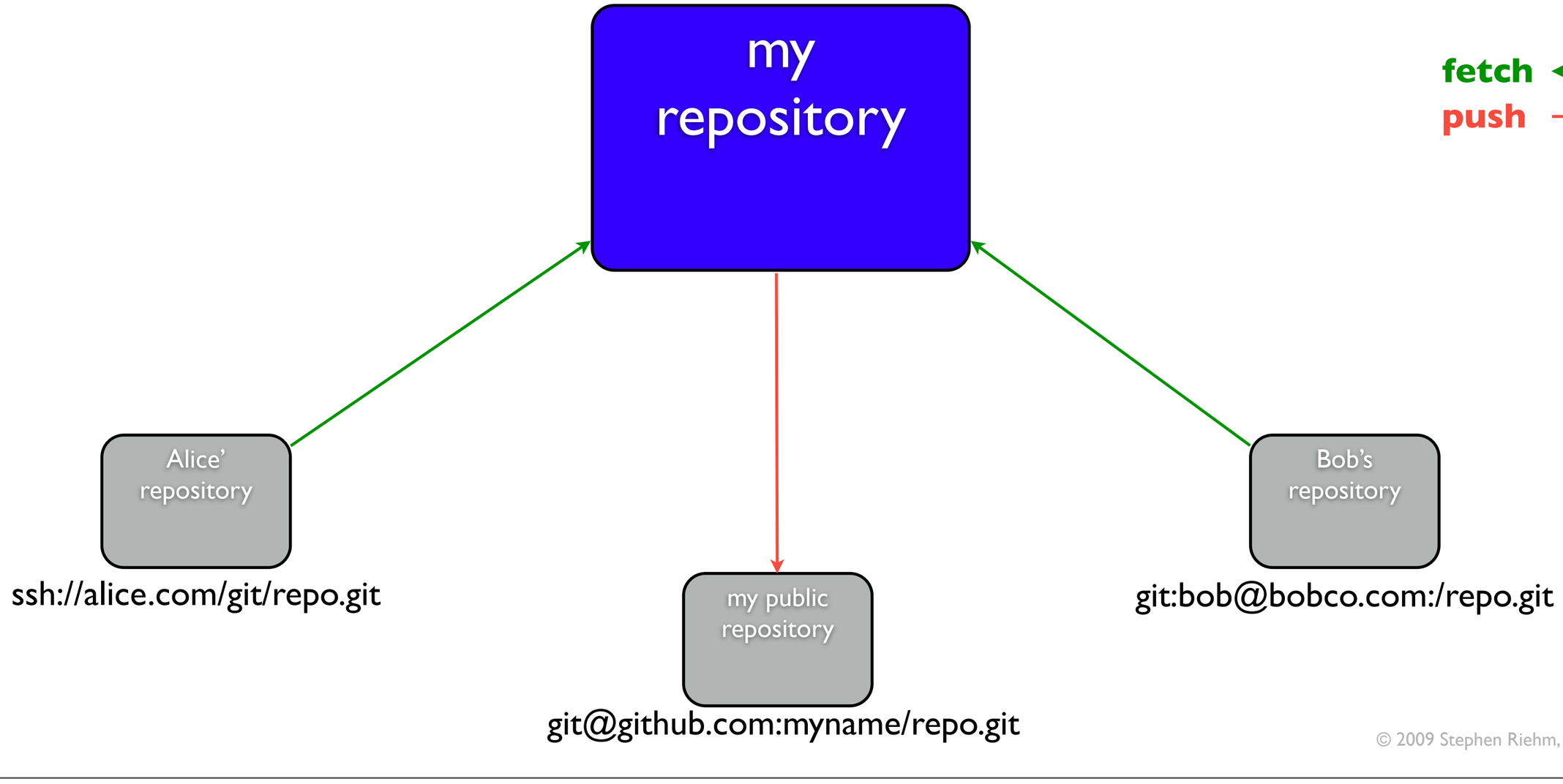
Sharing

/project_dir/repo.git

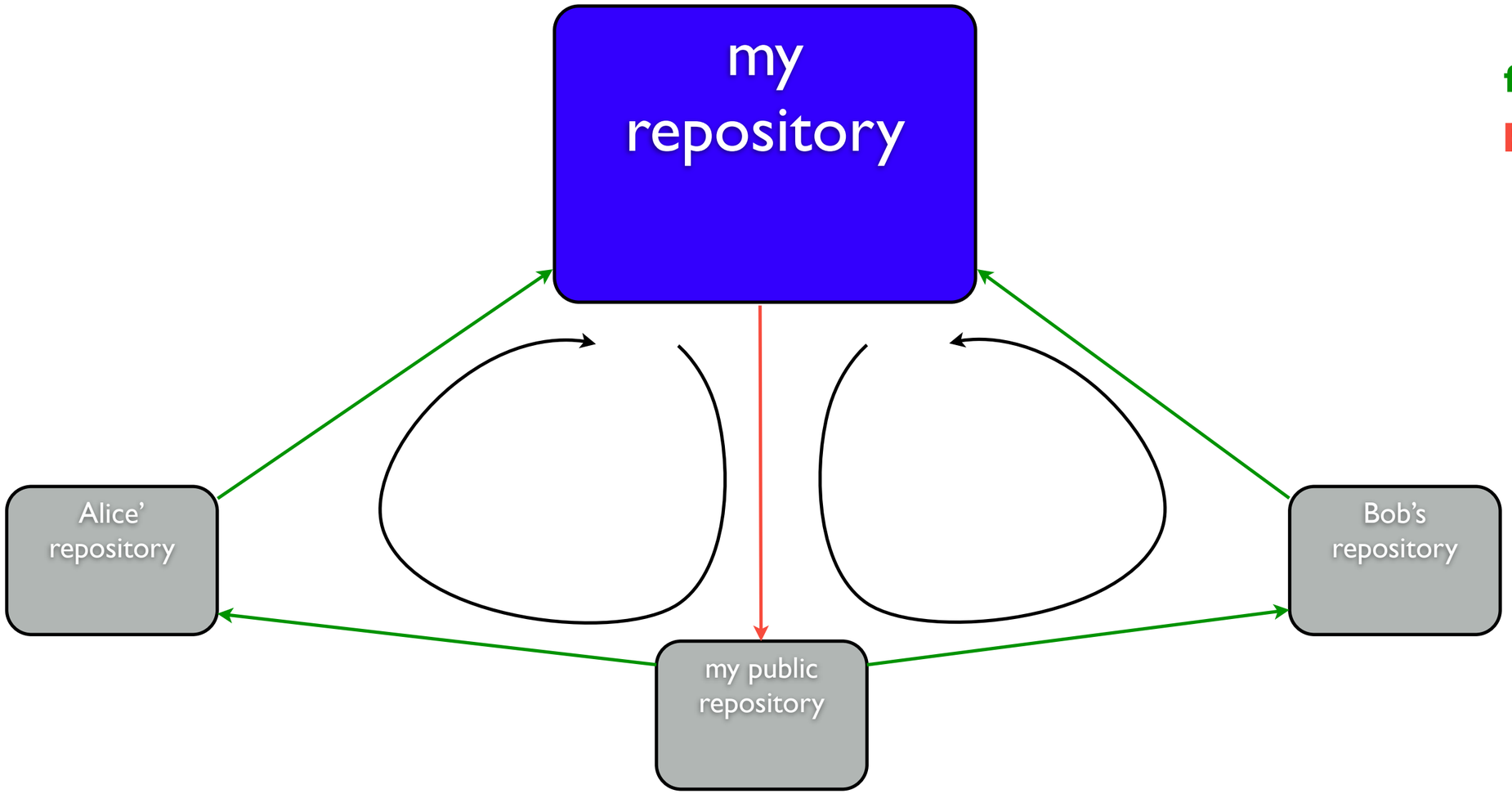


Sharing

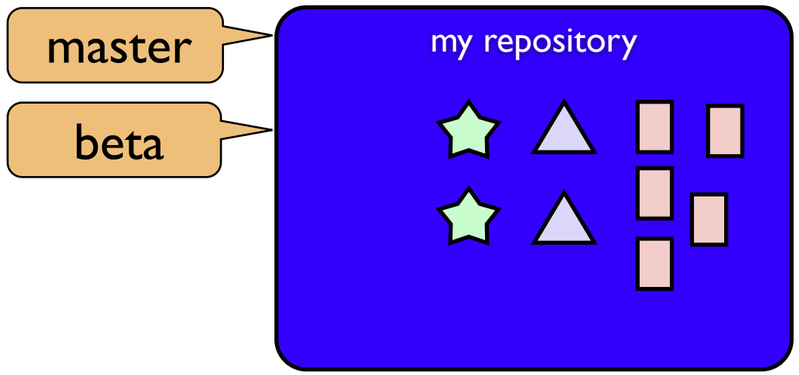
/project_dir/repo.git

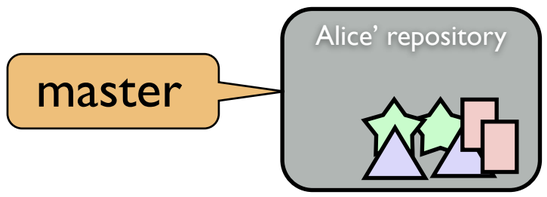


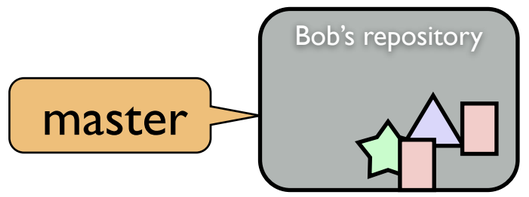
Sharing



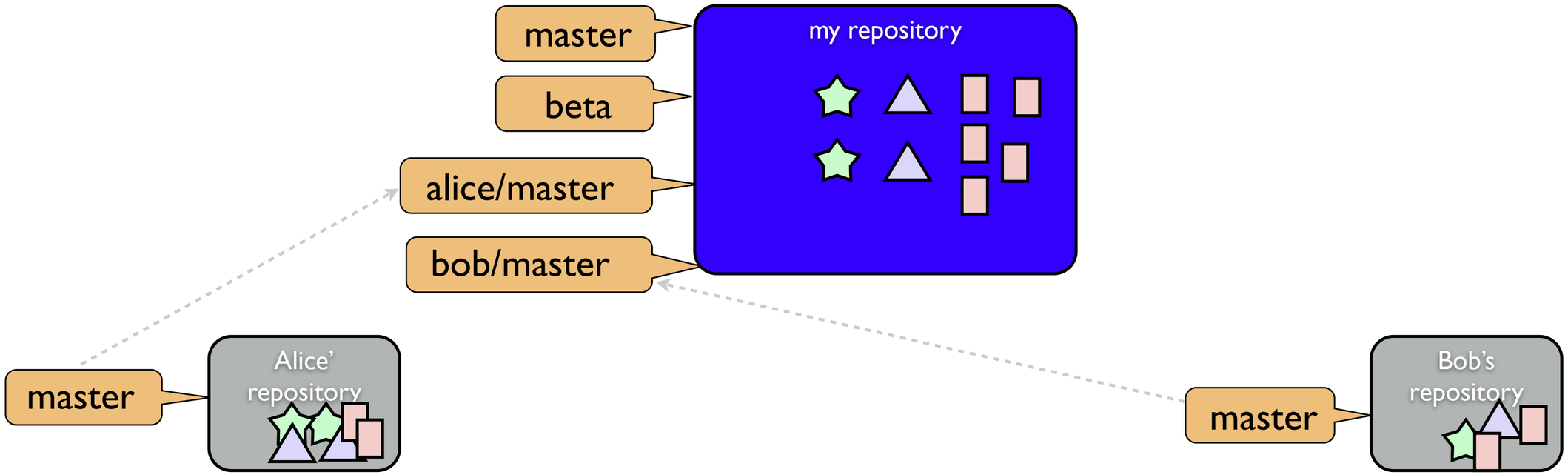
Namespaces







Namespaces

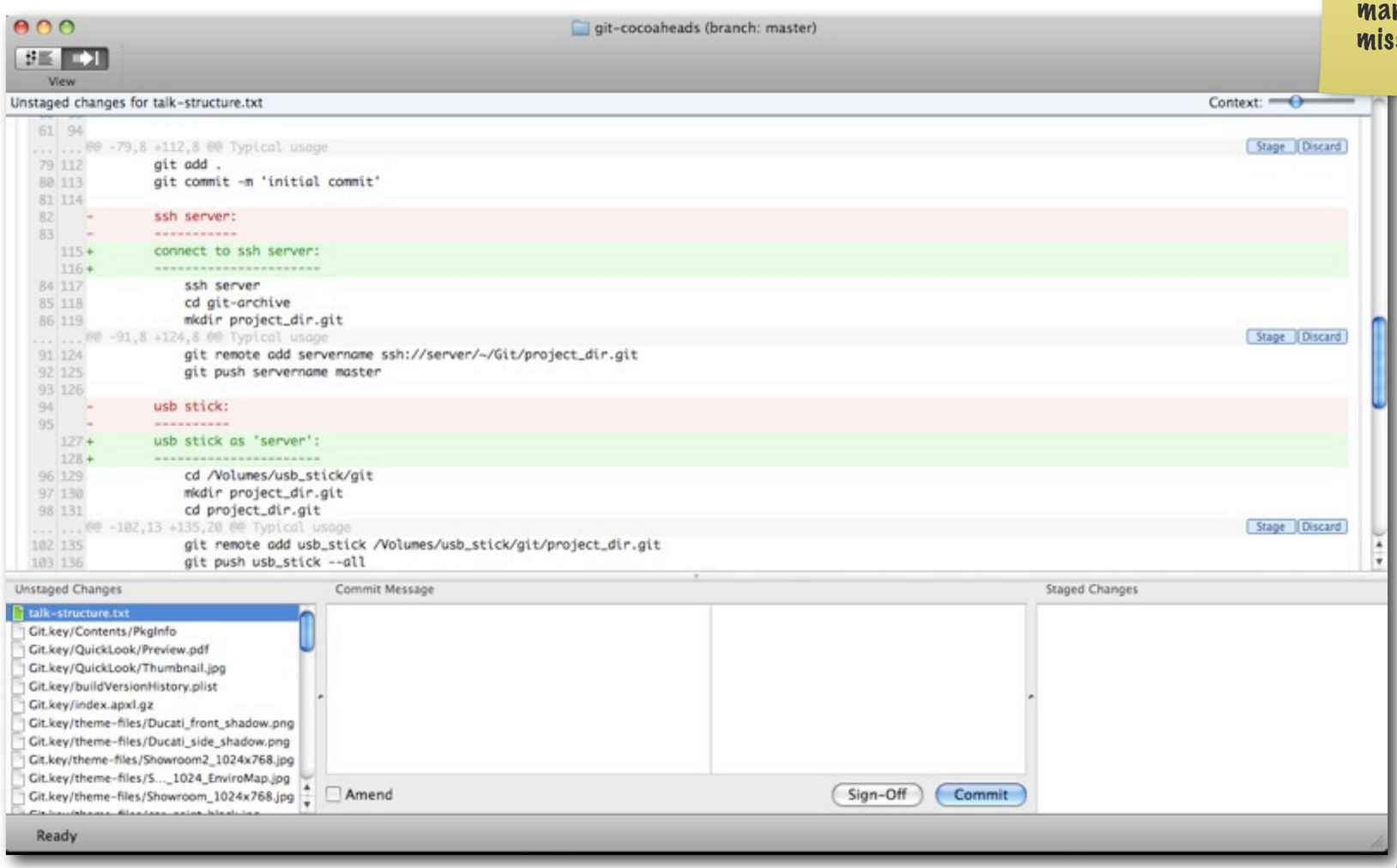


Git On OS X

gitx

actually, gitx is very good at what it does:
- switching branches
- displaying diffs
- staging
- committing

Features such as branch management are sadly missing.



gitx

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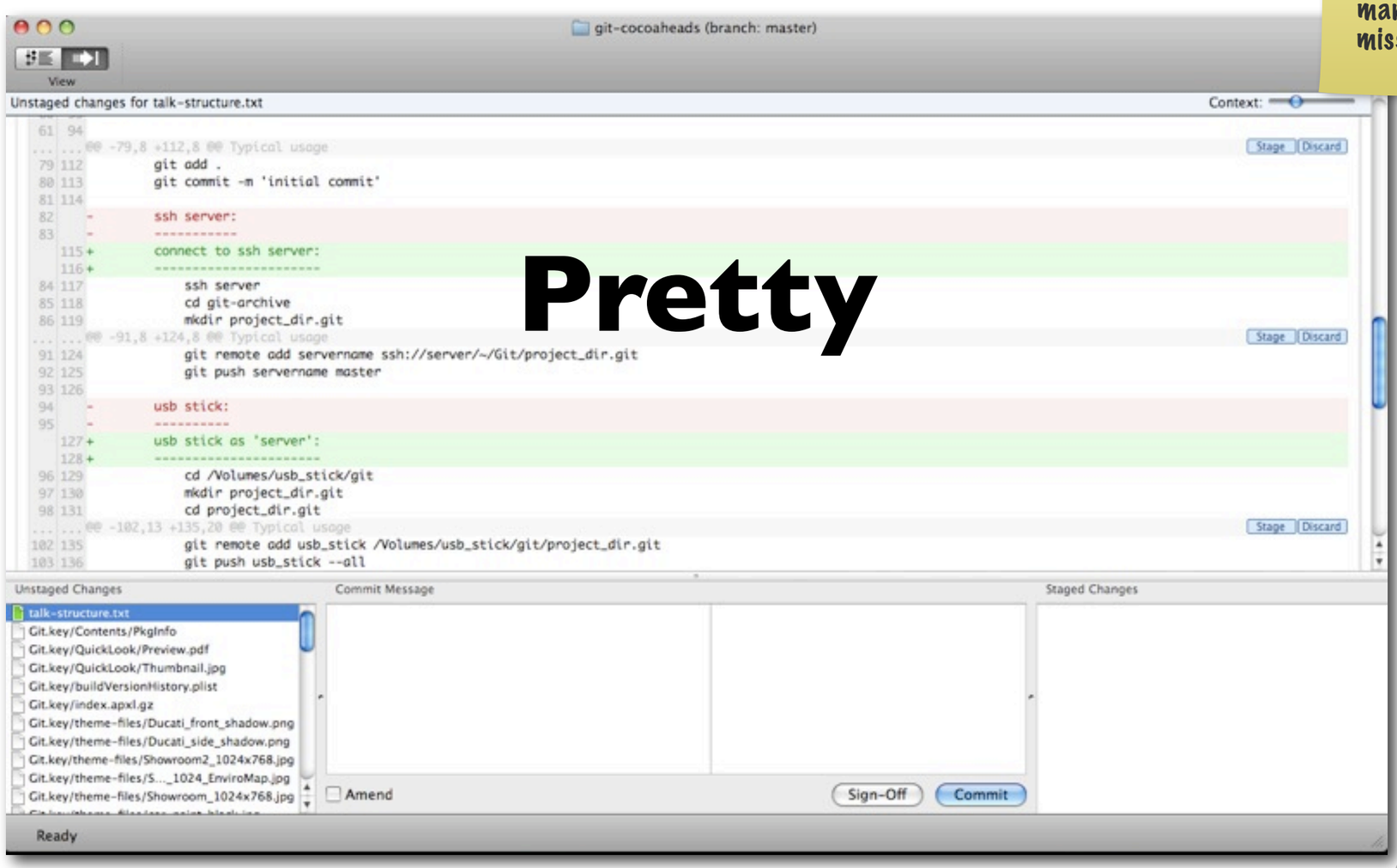

Pretty

gitx

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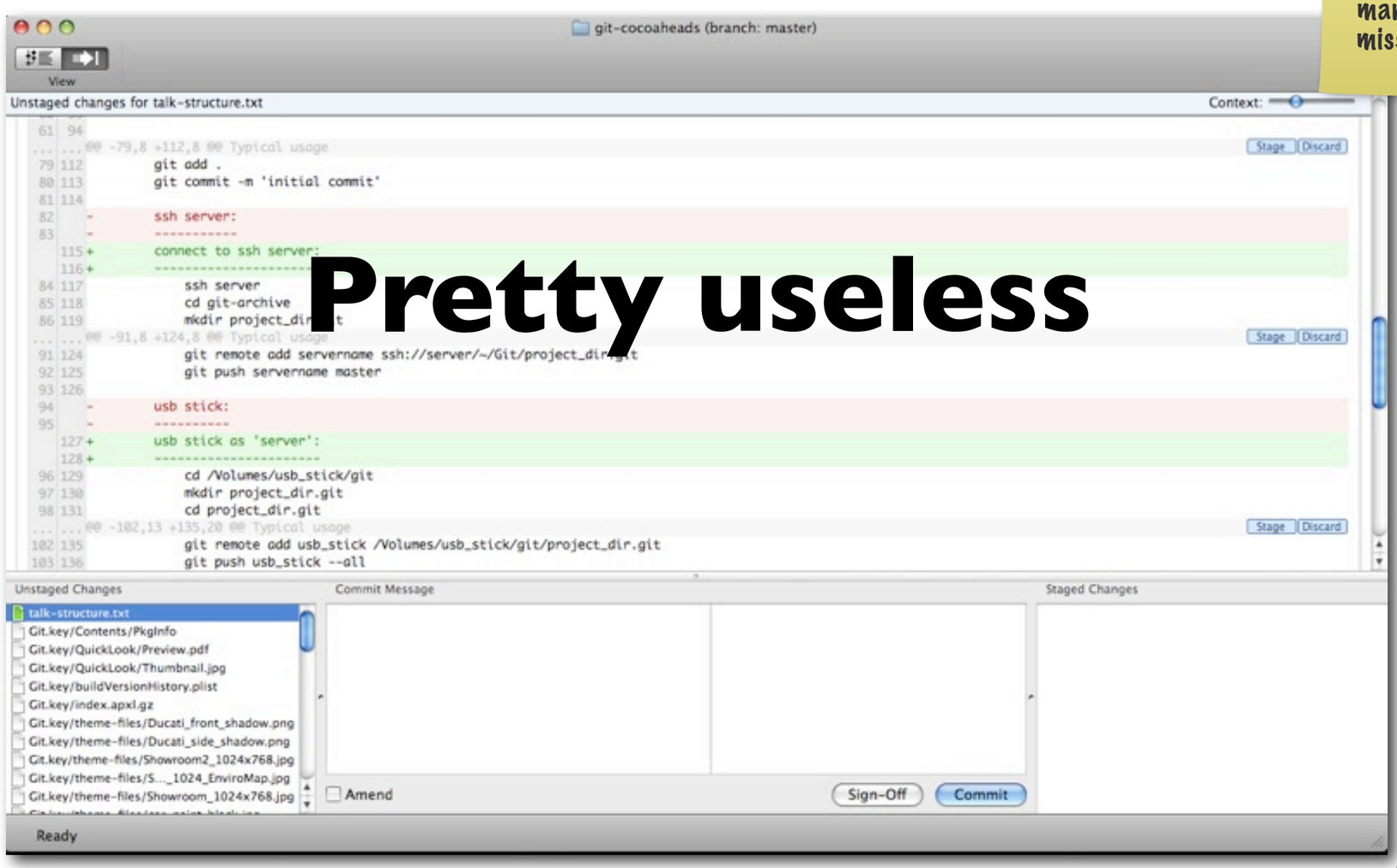
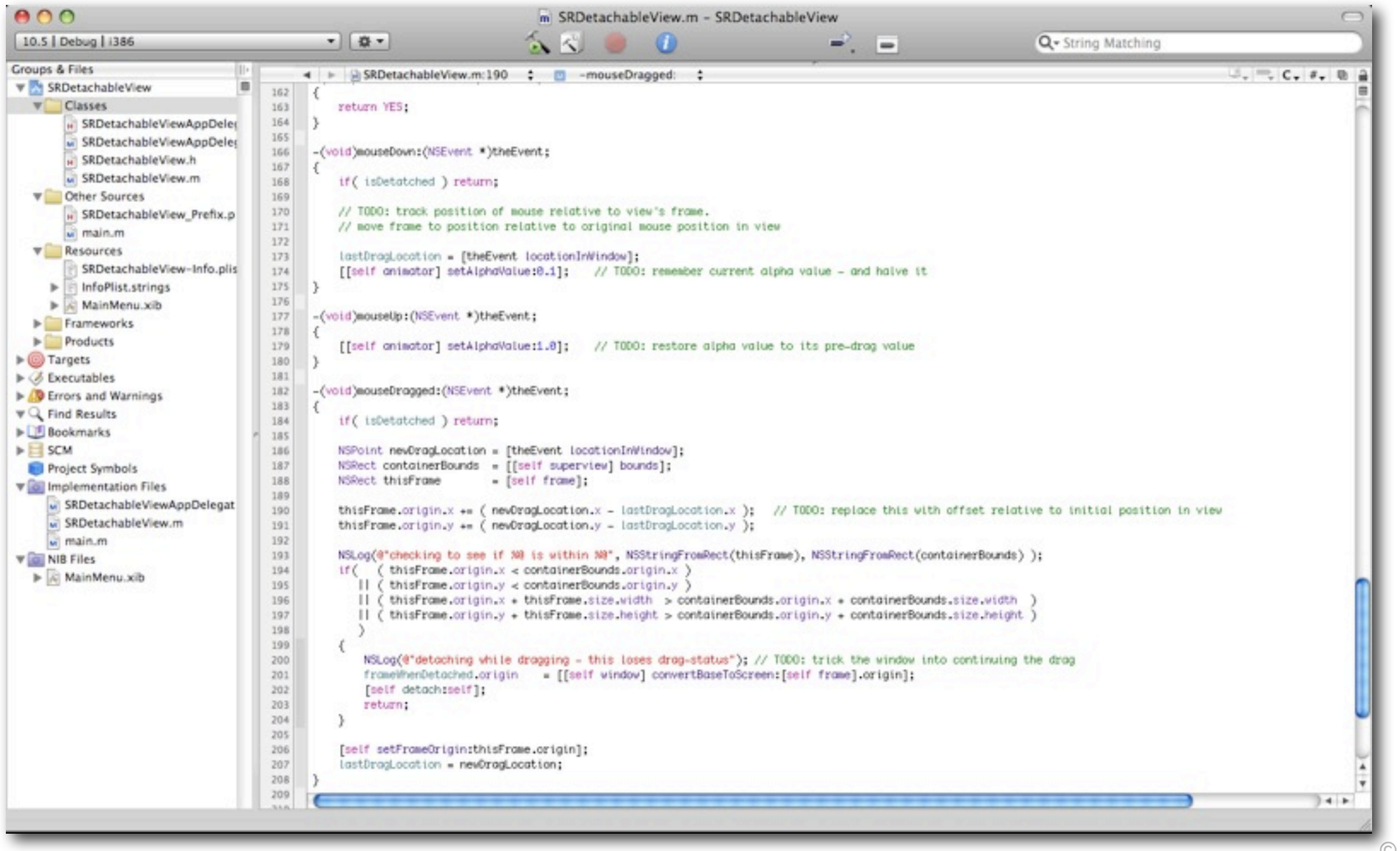
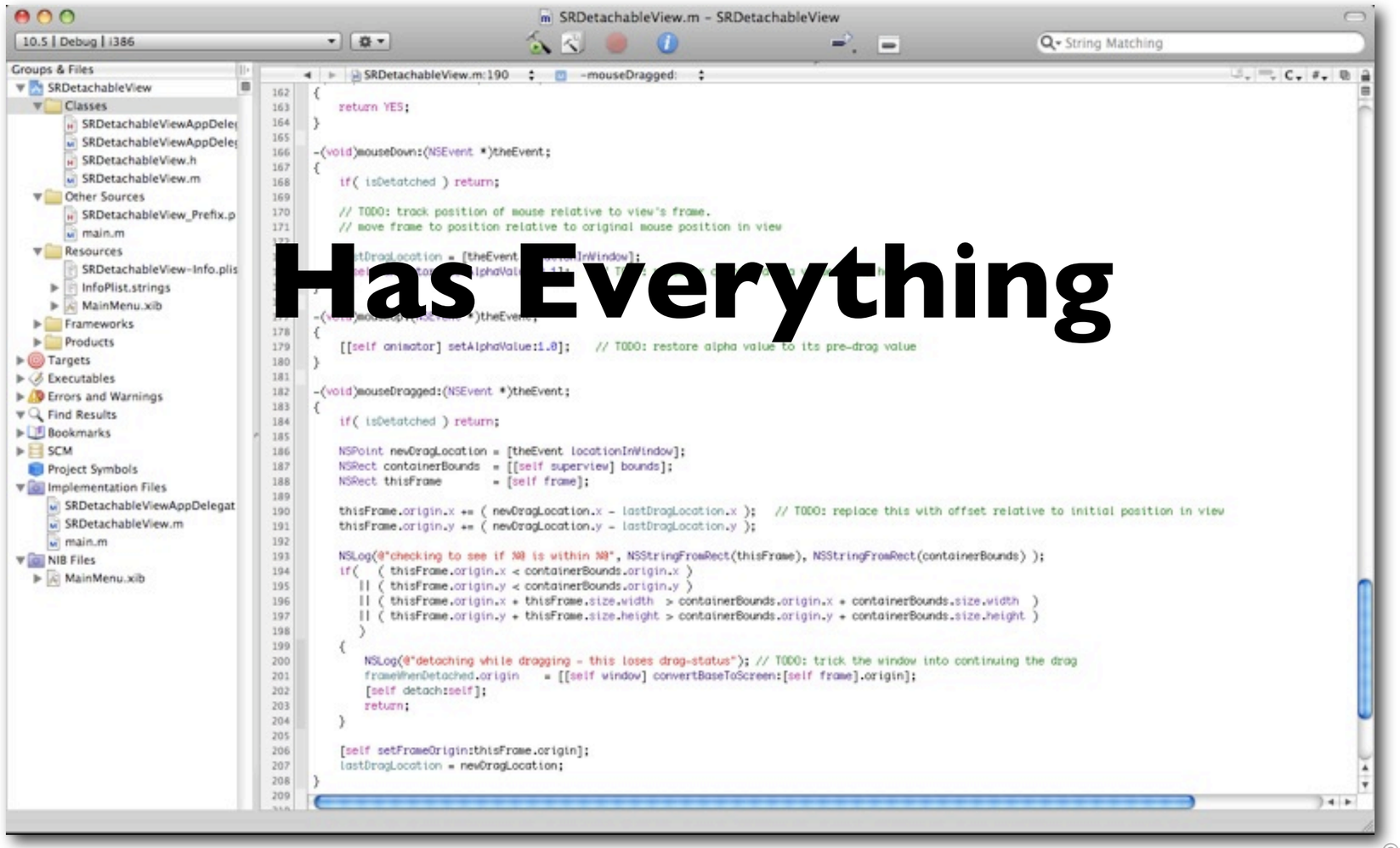


Pretty useless

XCode



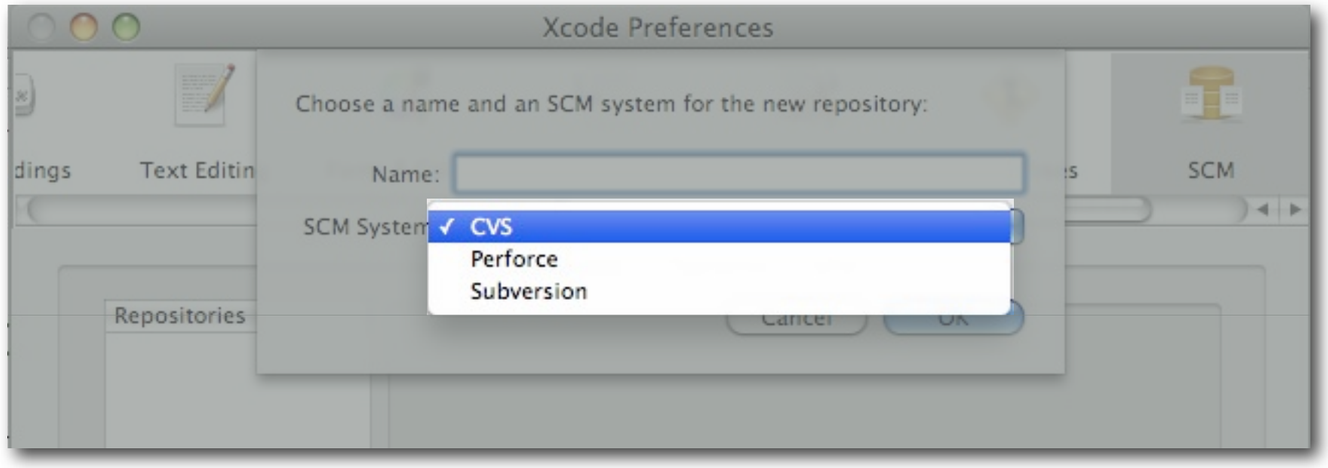
XCode



Has Everything

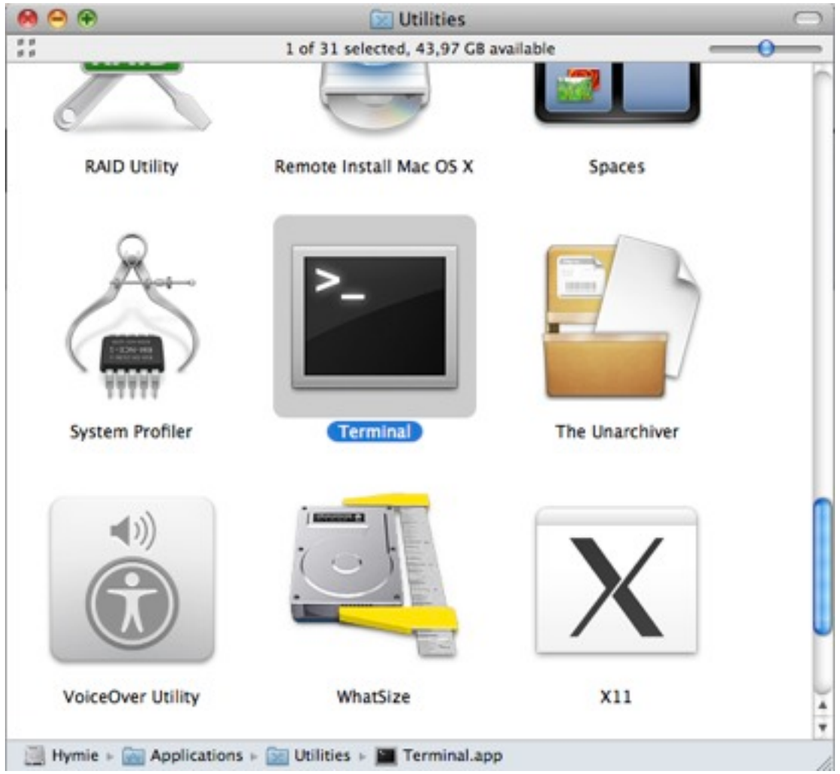
XCode

Has Everything



except git support

Git your hands dirty



Git your hands dirty

```
~/ > echo "you're going to need the command line :-)"
```

First Steps

Global Configuration

```
~/ > $EDITOR ~/.gitconfig

[core]
    pager = more
    excludesfile = /Users/me/.gitignore
[user]
    name = My Full Public Identity
    email = h4x0r@example.com
[format]
    pretty = format:%h %ci [%aN] %s
```

pager stops long lists from flying past your nose uncontrollably

excludesfile specifies files should never be checked into a git repository

format:
- %h = hash id
- %ci = commit date, iso 8601 format
- %aN = author name
- %s = summary

more info: `git log --help`

Global Configuration

```
~/ > $EDITOR ~/.gitignore

# apple typical files
.DS_Store
.Spotlight-V100
.com.apple.timemachine.supported
.fseventsdbuild

# XCode user state files
*.mode1v3
*.pbxuser
*.objc_sync

# other SCM systems
.svn

# editor temporary files
*~
*.swp

# files you generate while building
build/
version.txt
CHANGELOG
```

Things which git should probably ignore (for commands like `git add .` which just grab everything)

Where to look for Help

make sure you install git's man-pages.

Use the `man` branch of the git repository

```
~/ > git help <cmd>
```

```
~/ > git <cmd> --help
```

Where to look for Help

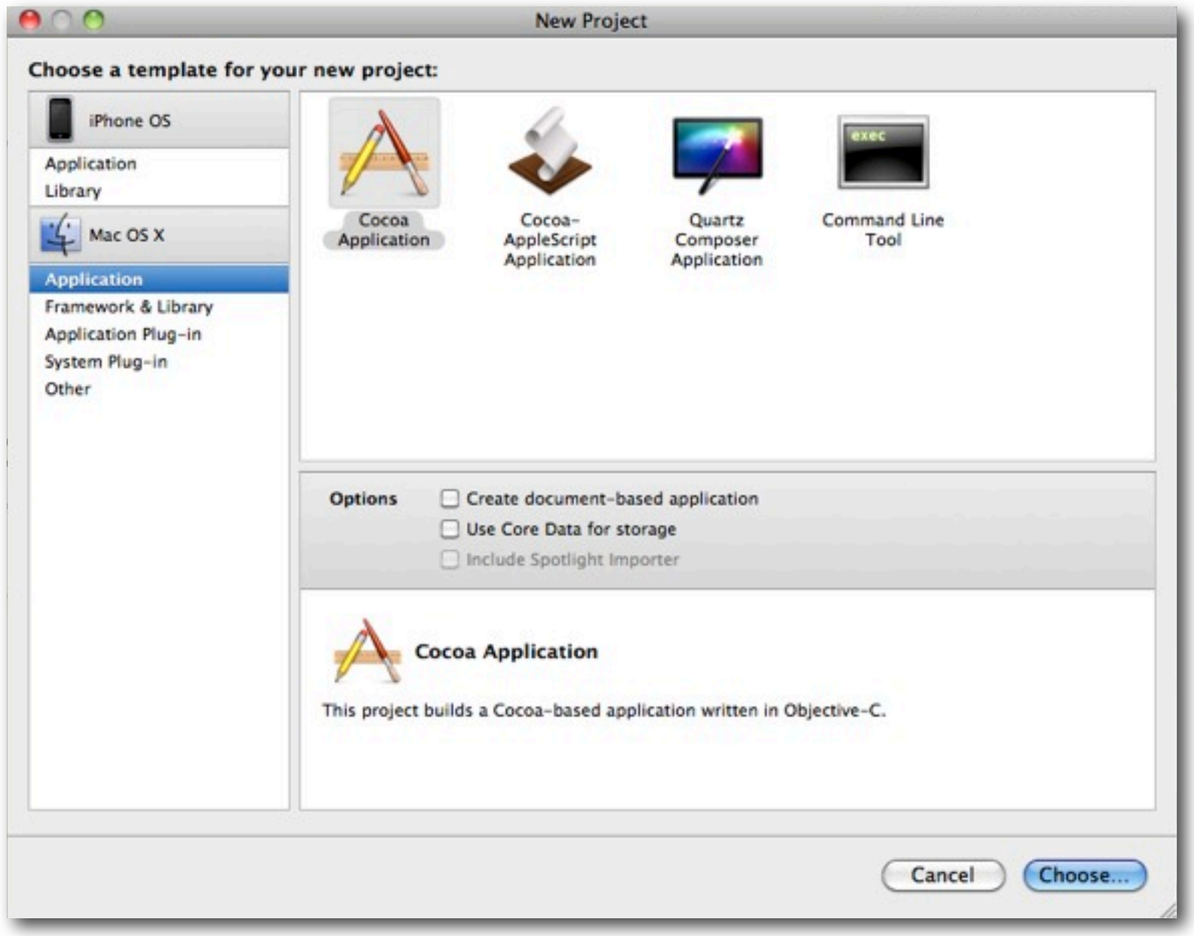
http://git-scm.com

http://github.com

http://gitready.com

http://google.com

A new Project



New Project in Git

```
~/>              cd project



~/project/ >  git init
Initialized empty Git repository in project_dir/.git/



~/project/ >  git add .



~/project/ >  git commit -m 'initial commit'
[master (root-commit) 64fb323] initial commit
 1 files changed, 1 insertions(+), 0 deletions(-)
 create mode 100644 hello.txt
```

In english:
- create your project in XCode
- create a new git repository
- add your files & directories to git
- commit your changes

Git Configuration for Xcode

```
~/project/ >  $EDITOR .gitattributes


*.pbxproj -crlf -diff -merge
*.nib     -crlf -diff -merge
*.xib     -crlf -diff -merge
*.graffle -crlf -diff -merge


~/project/ >  git add .gitattributes


~/project/ >  git commit -m 'add .gitattributes - prevent accidental merging of special XCode files'
[master (root-commit) 64fb323] initial commit
 1 files changed, 1 insertions(+), 0 deletions(-)
 create mode 100644 .gitattributes
```

Tell git to treat these files as if they were binaries.

XML files are notorious for being text, but "unmergable".

`.gitattributes` is project-specific
- must be checked into each project seperately
- will automatically be used by all project members

Joining An Existing Project

```
~/ > git clone -o cloned_repo URL/project.git
```

```
~/ > cd project
```

```
~/project/ > git checkout -b my_stuff cloned_repo/master
```

cloning a repository automatically sets up a remote repository called `origin`.

You can specify a different name for the remote repository with `-o name`

Clone a local repository

cloning a repository automatically sets up a remote repository called `origin`.

You can specify a different name for the remote repository with `-o name`

```
~/ > git clone ~/old_project_dir ~/new_project_dir
```

Git with XCode

Git with XCode

I warned you!
Grab your favourite terminal window and start typing...

```
~/project/ > open *.xcode*
```

Git with XCode

I warned you!
Grab your favourite terminal window and start typing...

```
~/project/ > open *.xcode*
```

Git with XCode

A typical sequence of commands

```
~/project/ > git status

~/project/ > git diff

~/project/ > git checkout -b fix

work work work…

~/project/ > git commit -am '…'

~/project/ > git checkout master

~/project/ > git merge fix

~/project/ > git push public
```

if this happens…

`git checkout`

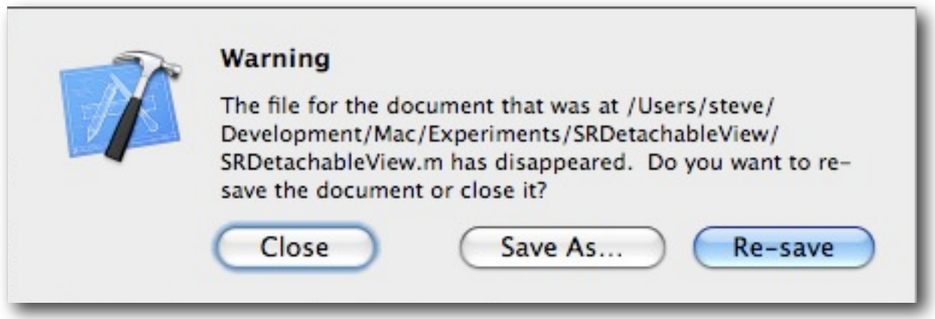
everything's OK, XCode just doesn't want to lose your work…

if this happens…

`git checkout`

"**Read from Disk**" will bring XCode up-to-date with your git repository

However…



If you get this message, you should:

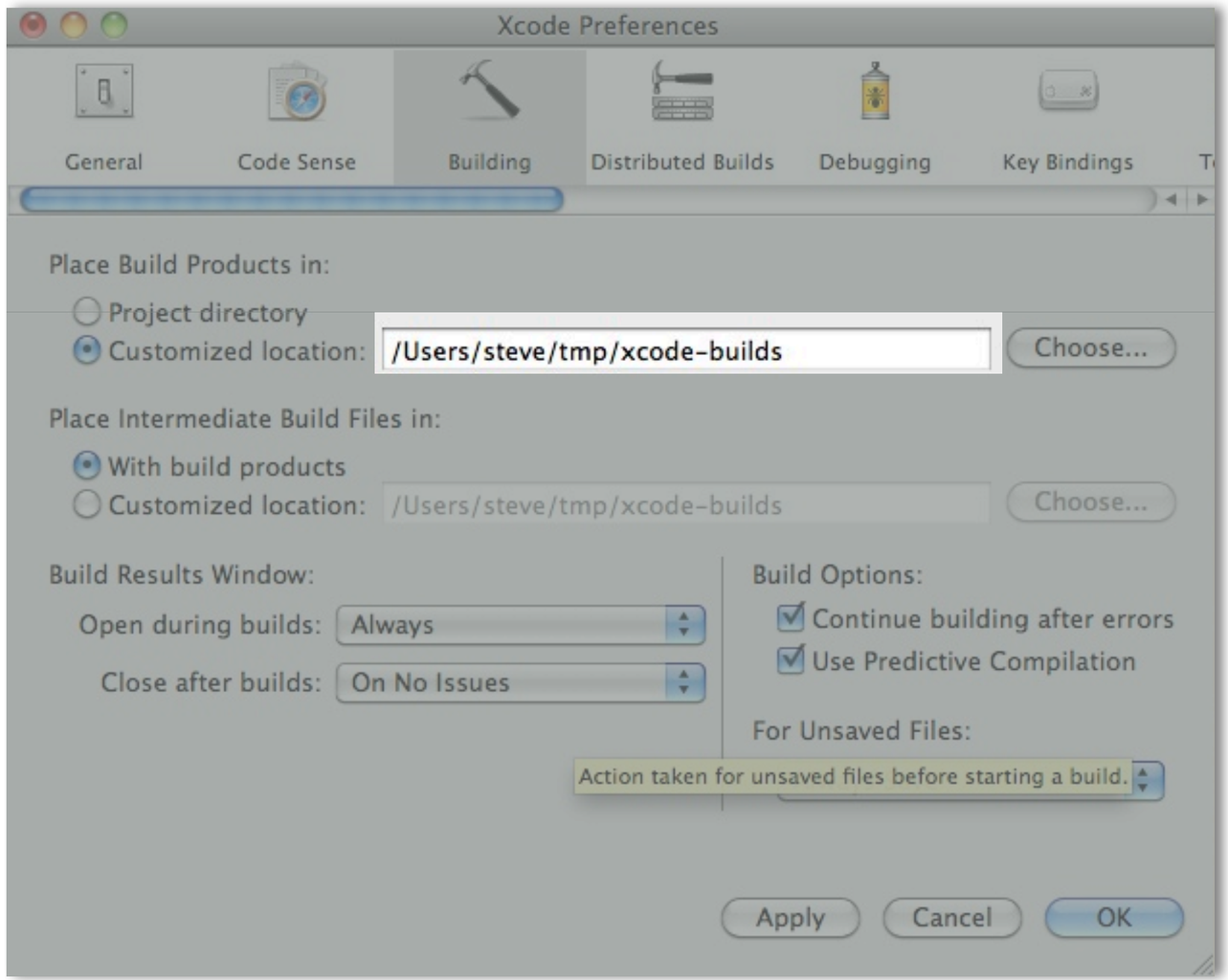
Save your work (possibly in a temporary directory)

Close XCode

Manually up your working directory (command line)

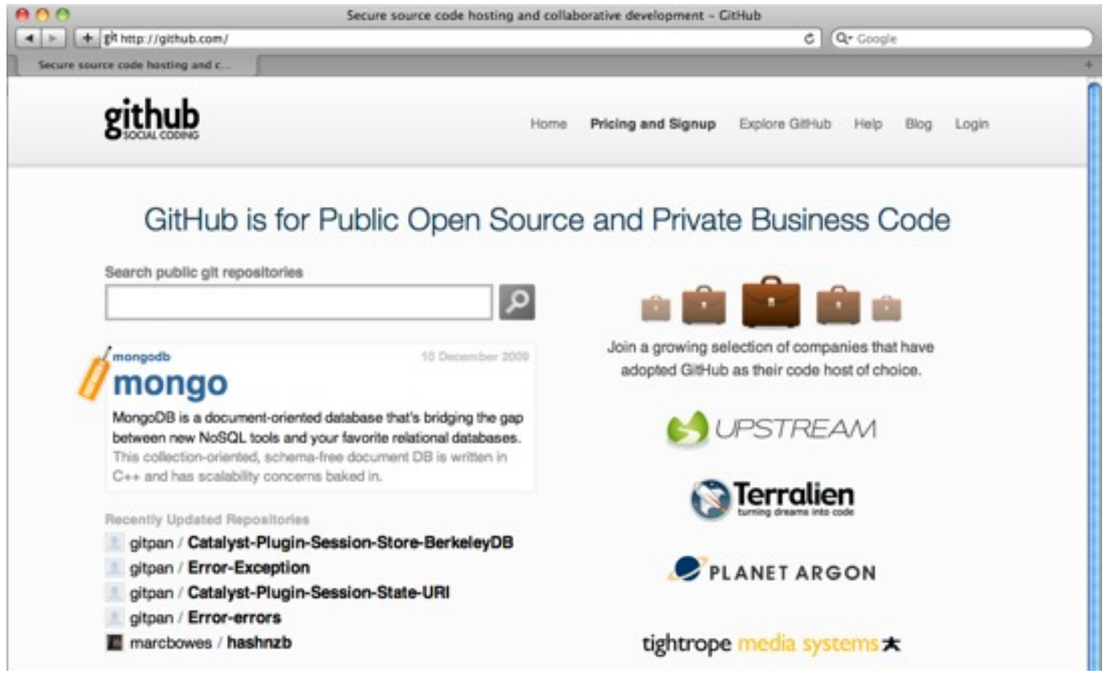
Open XCode again

XCode - Tips



Github

Github



Github

Free Public Git Repositories

~~Free~~ Private Git Repositories

Simple Issue Tracking

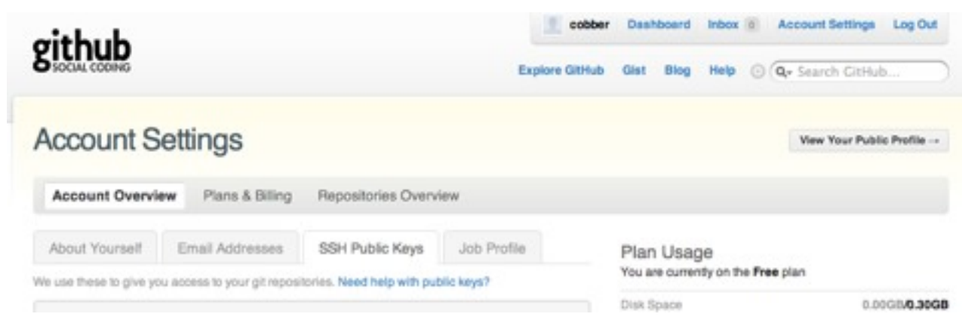
Community

SSH Key For Github

Copy and paste your public key into the SSH Public Keys tab of your github account settings.

```
~/.ssh/ > ssh-keygen -t rsa -f github

Generating public/private rsa key pair.
Enter passphrase (empty for no passphrase): password or just hit return
Enter same passphrase again: password or just hit return

~/.ssh/ > ls

github
github.pub

~/.ssh/ > pbcopy < github.pub
```

paste



Daily Work

Add & Commit

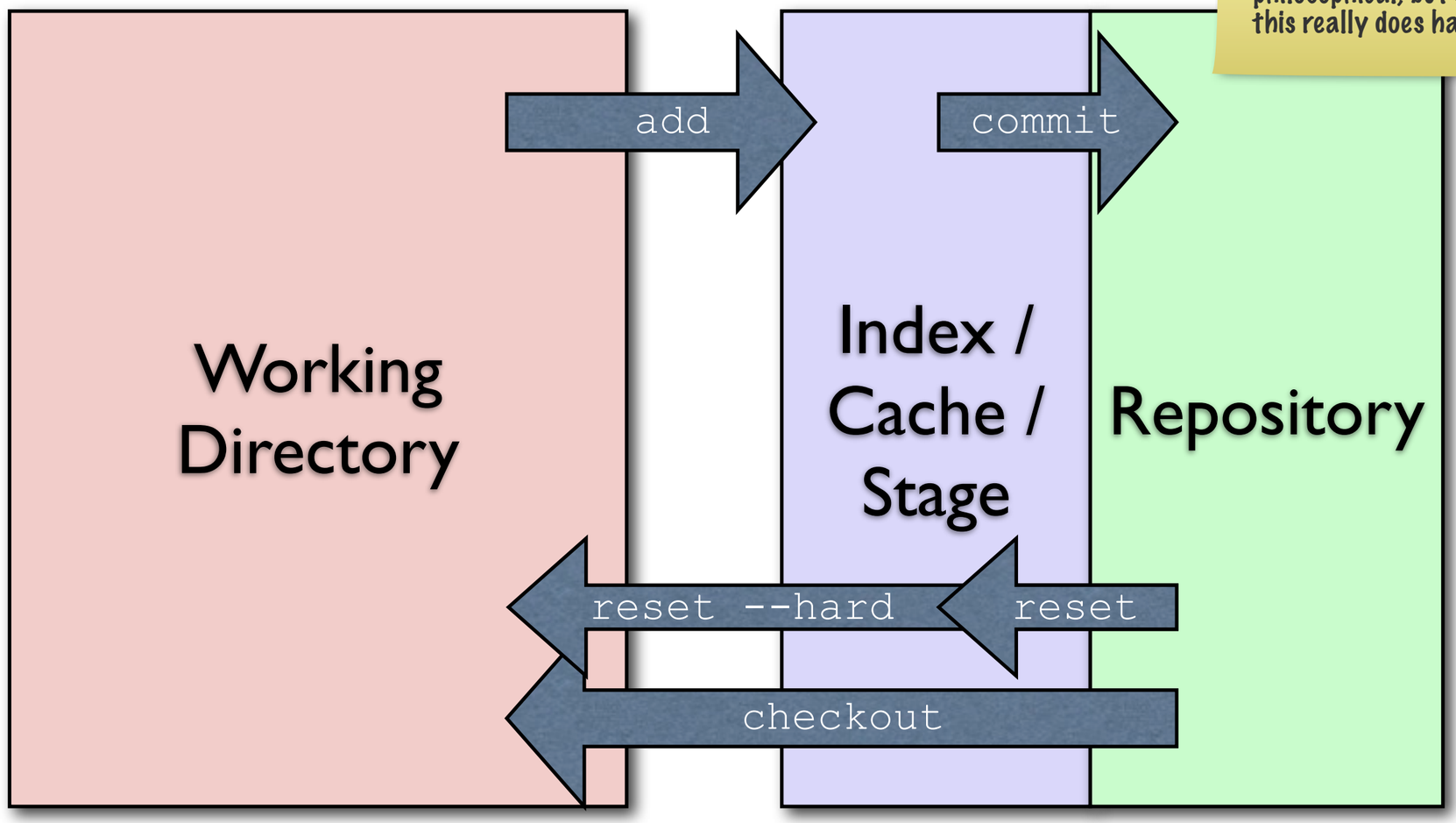
work work work…

```
~/project/ > git status

~/project/ > git add file file file directory… or git add -A  or git add -u

~/project/ > git status

~/project/ > git commit -m 'what I just did'

~/project/ > git commit -a -m 'what I just did'
```

```
git add -A
   new files
   changed files
   removed files

git add -u
   changed files
   removed files

git commit -a
same as
git add -u; git commit
```

Why Add & Commit?

OK, so this is more the "how" than "why". Asking "why" very quickly gets philosophical, but splitting things up like this really does have its uses.



Branching

```
~/project/ > git checkout -b new_branch
```

TIP: you can create a new branch AFTER you have already made changes.

Just `checout -b new_branch` before you `git add`

```
~/project/ > git branch -a
```

```
~/project/ > git branch -d old_branch
```

Delete a branch which has become part of another branch (nothing will be lost)

```
~/project/ > git branch -D old_branch
```

Delete a branch that cannot be re-constructed without knowing the commit ID (if you didn't write it down, it's gone!)

Differences?

```
~/project/ > git diff

~/project/ > git diff --cached

~/project/ > git diff HEAD

~/project/ > git diff other_branch
```

Merging

```
~/project/ > git merge other_branch
```

fix conflicts…

```
~/project/ > git add -A
```

```
~/project/ > git commit -m 'merge changes from other_branch'
```

git always merges into the working directory

merged files are added automatically

conflicts are not added - you need to resolve them first

Throwing Things Away

```
~/project/ > git reset commit
```

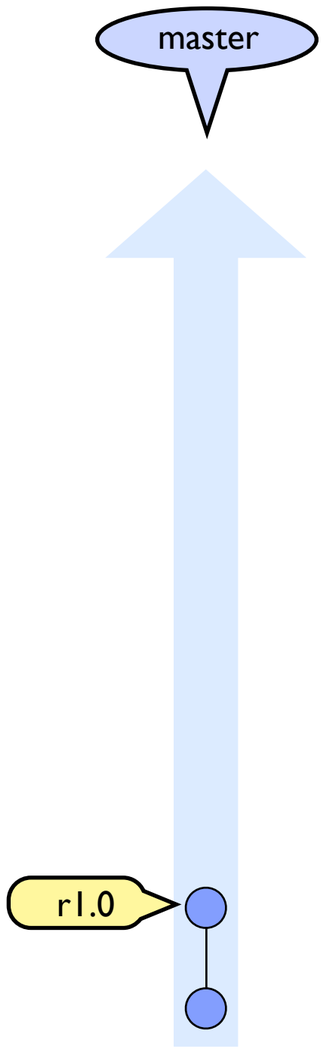
`git reset` updates the cache to reflect the named commit. No changes are made to your working tree. (usefull if you want to un-add something)

```
~/project/ > git reset --hard commit
```

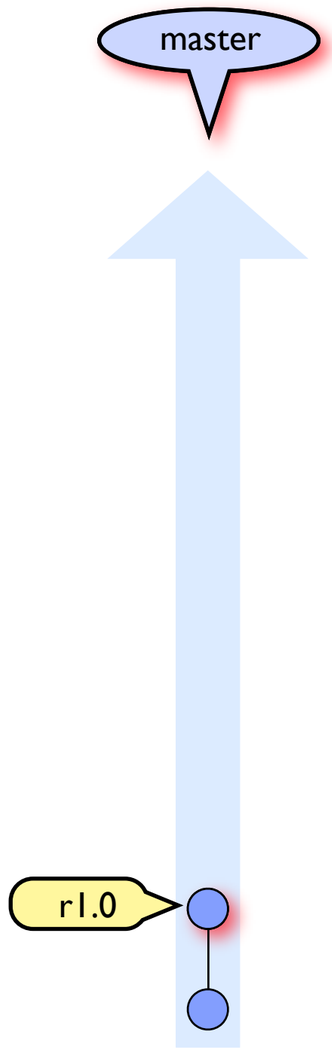
`git reset --hard` updates the cache and the working tree to match the named branch (by default `HEAD`).
This will kill any uncommitted changes!

Multiple Branches

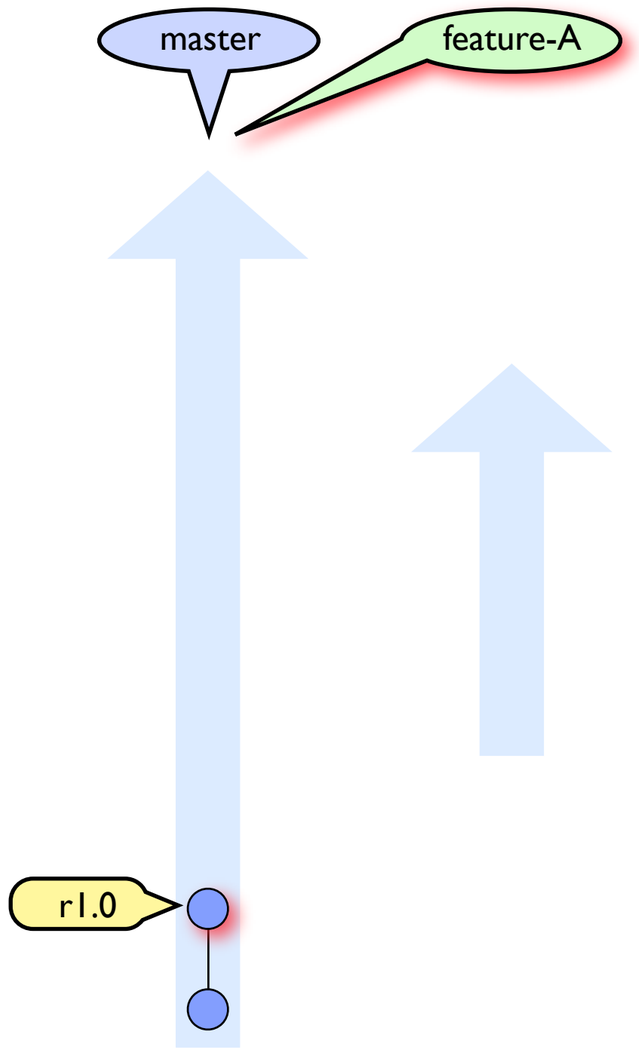
Step By Step…



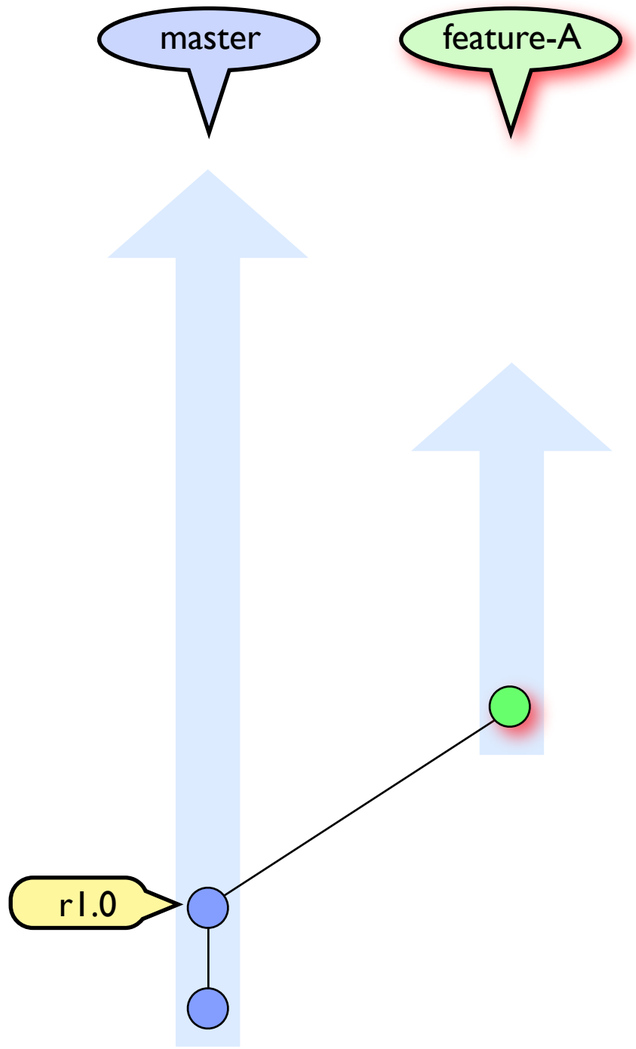
```
git checkout master
```



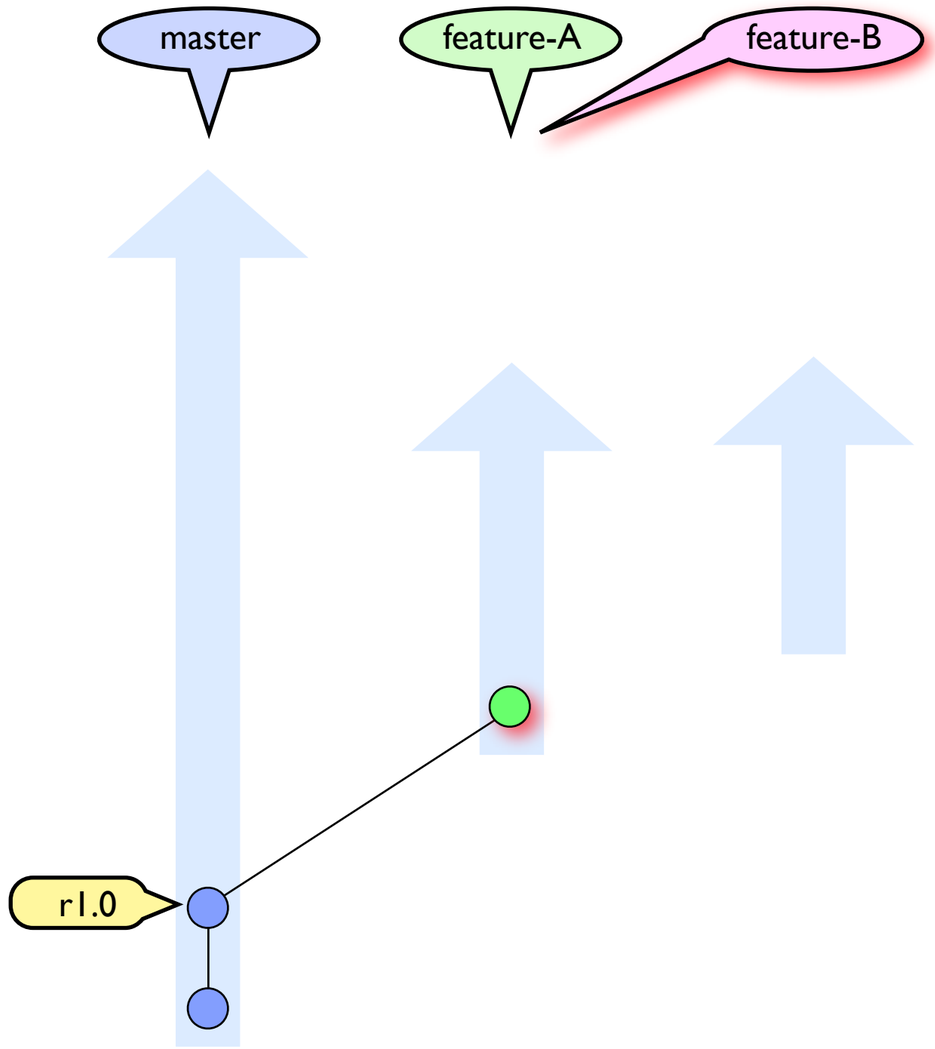
```
git checkout master
git checkout -b feature-A
```



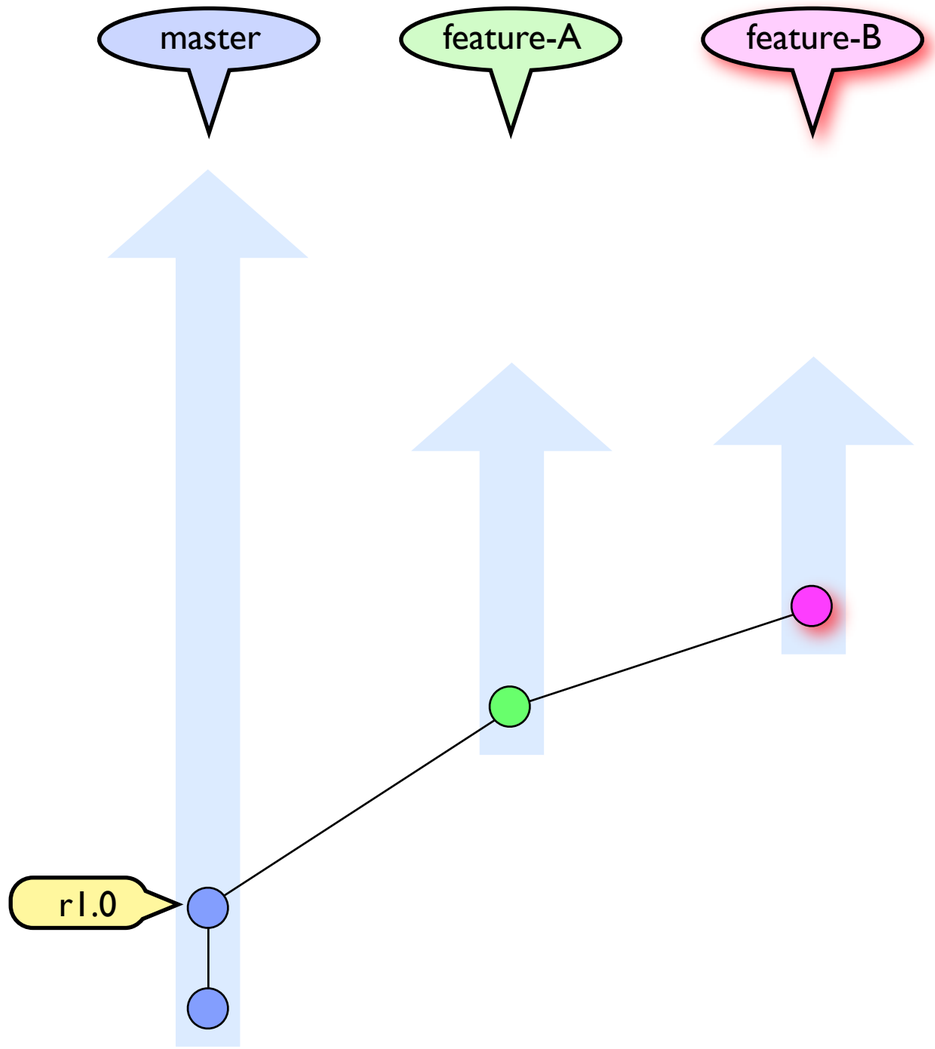
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
```



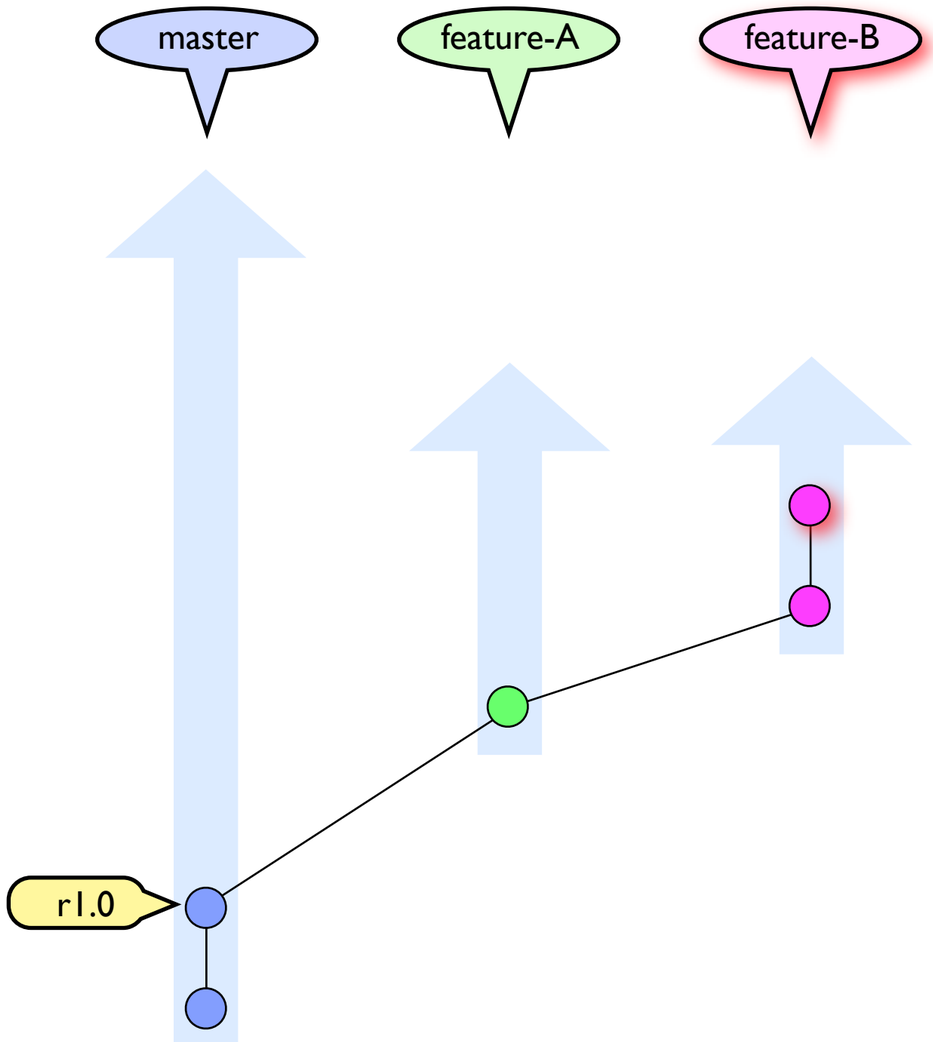
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
```



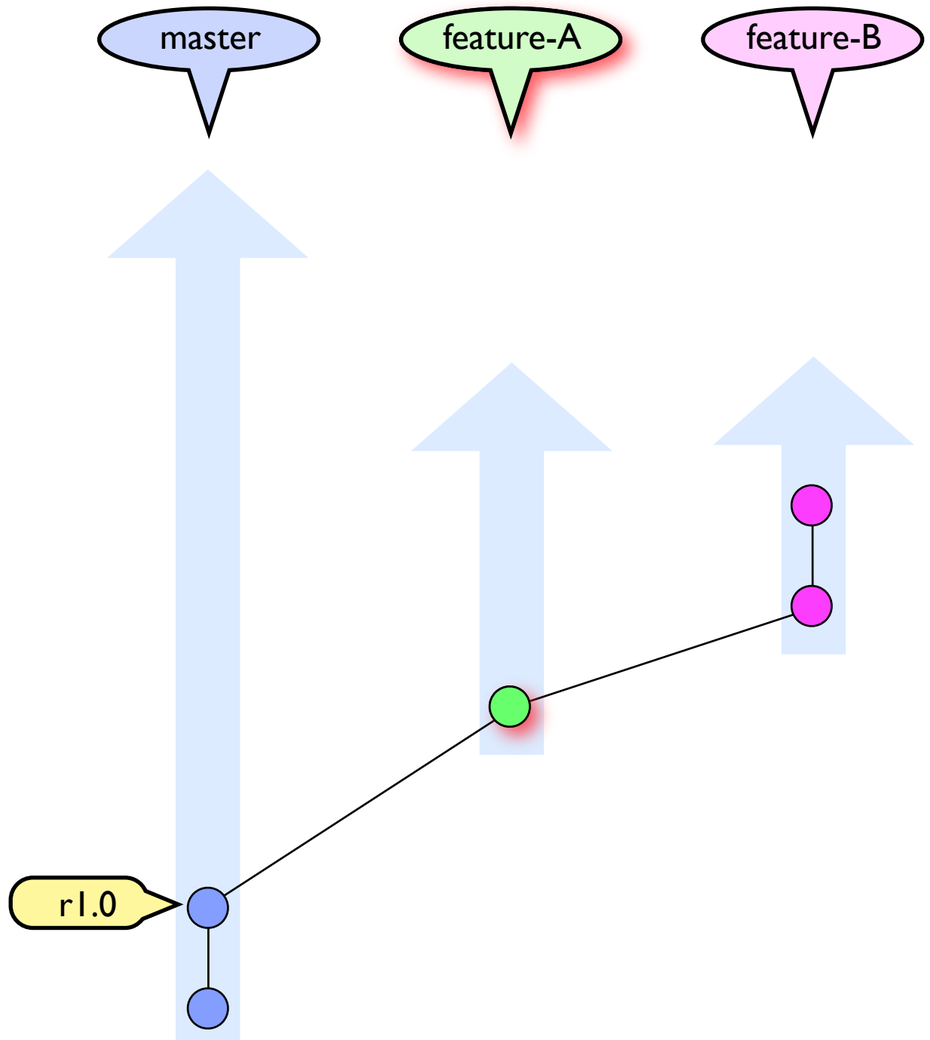
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
```



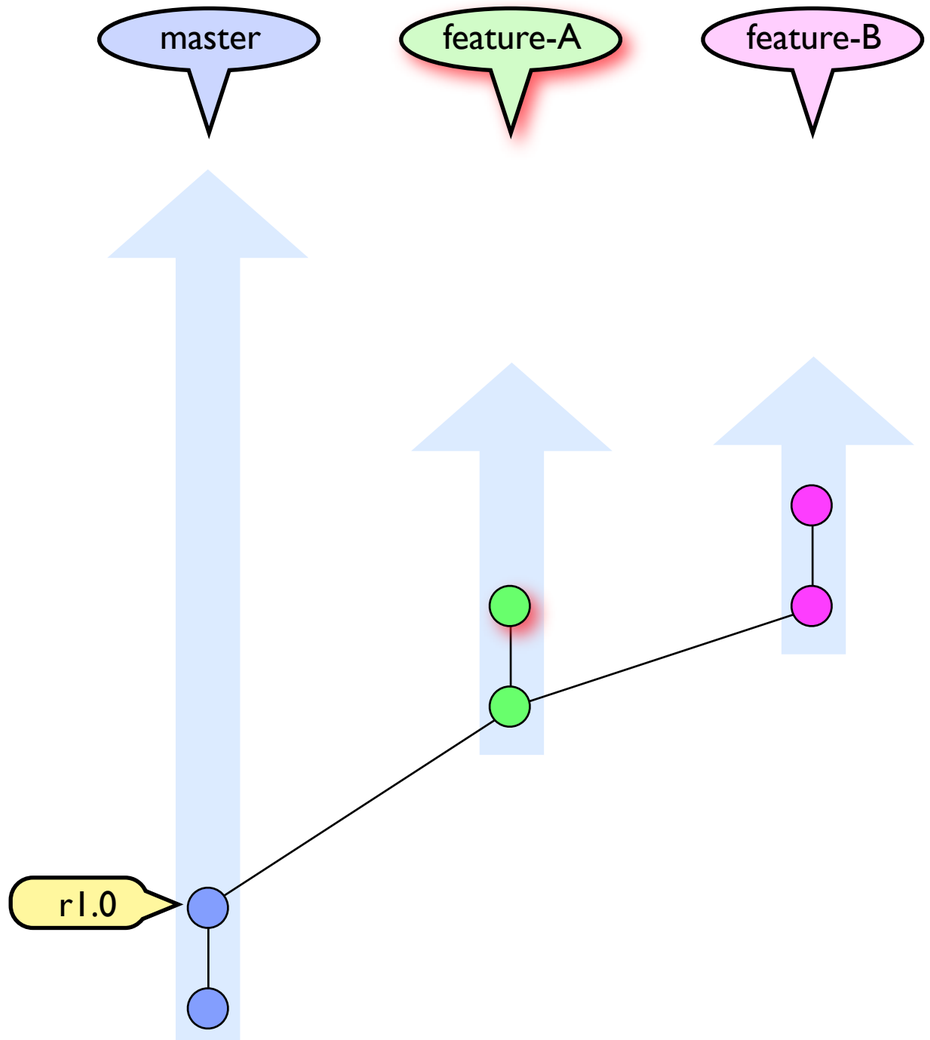
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
```



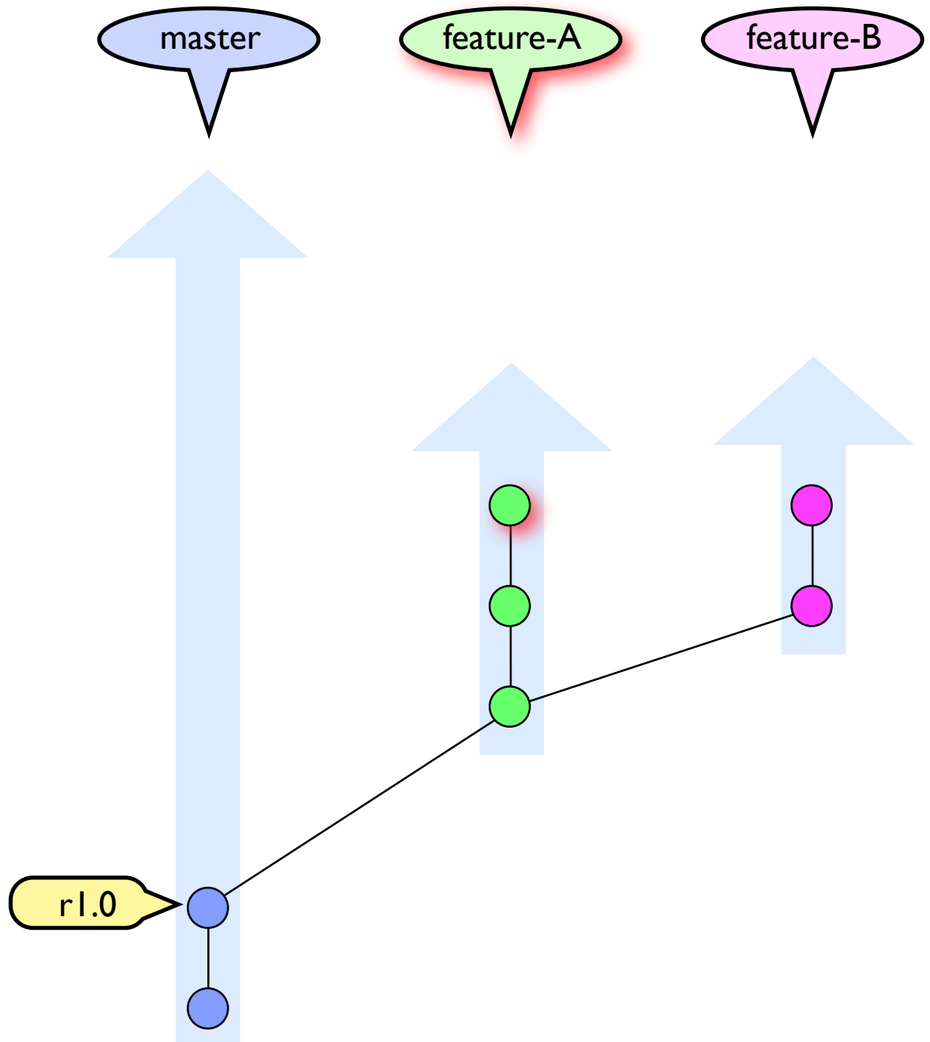
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
```



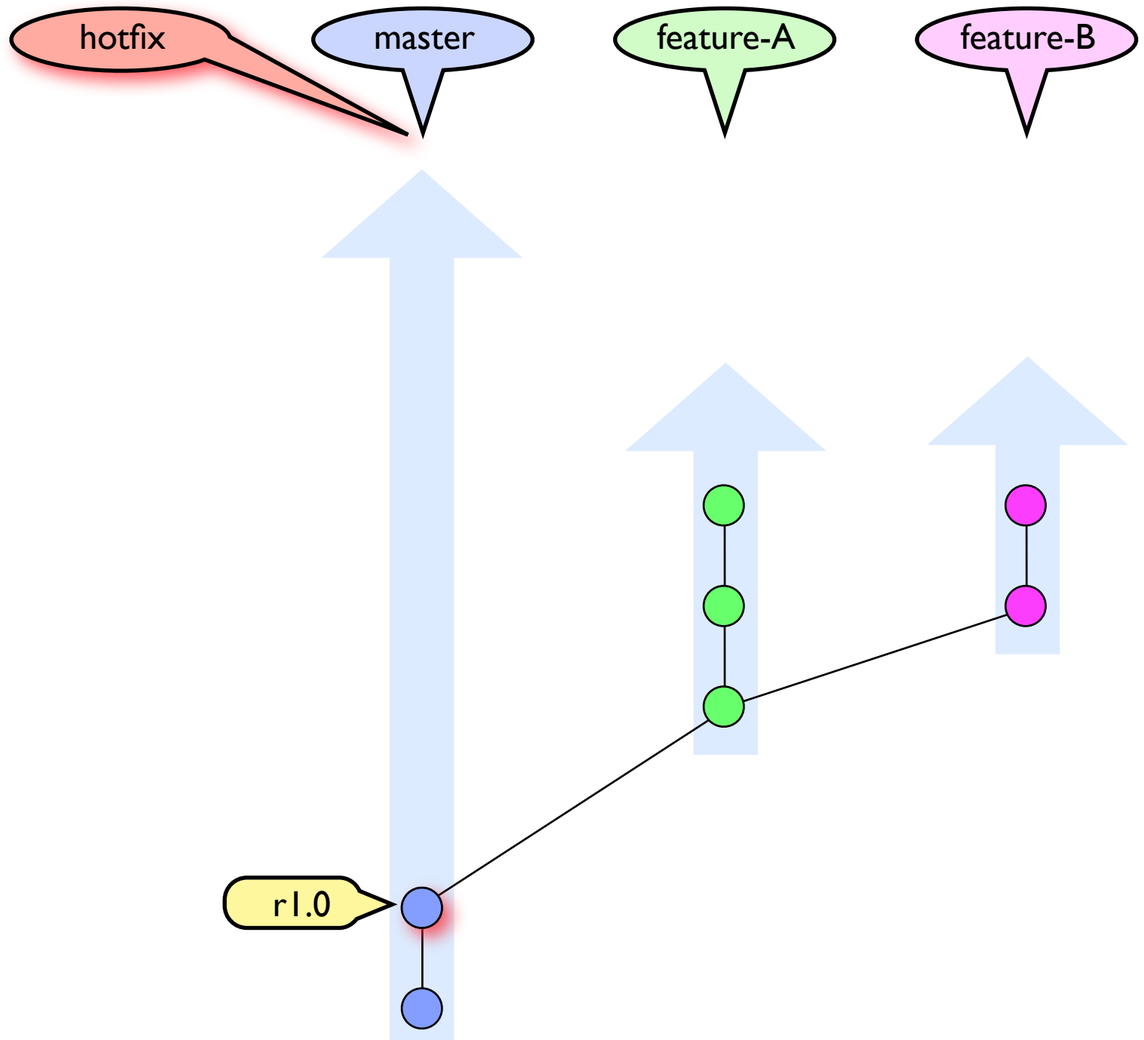
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
```



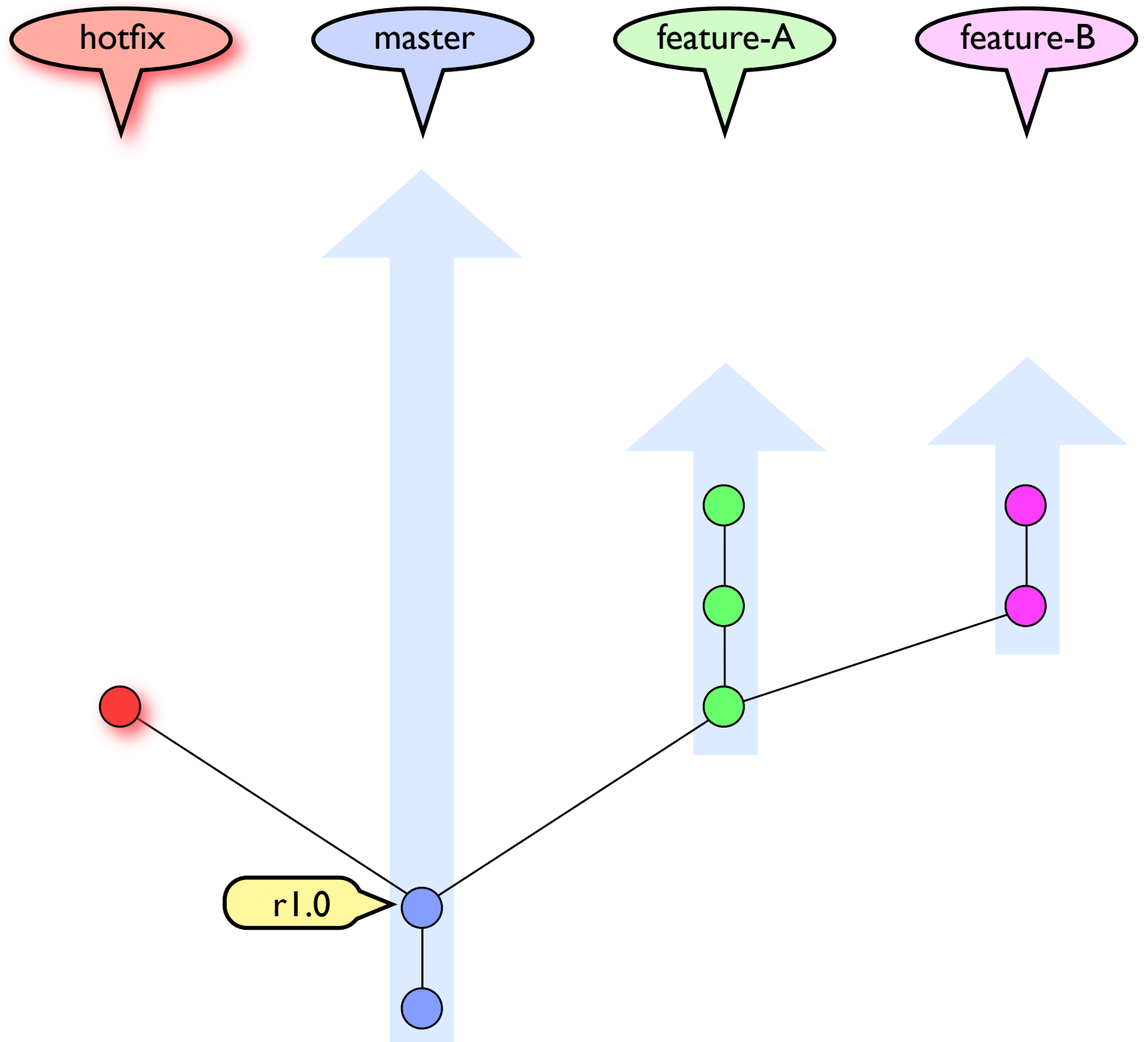
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
```



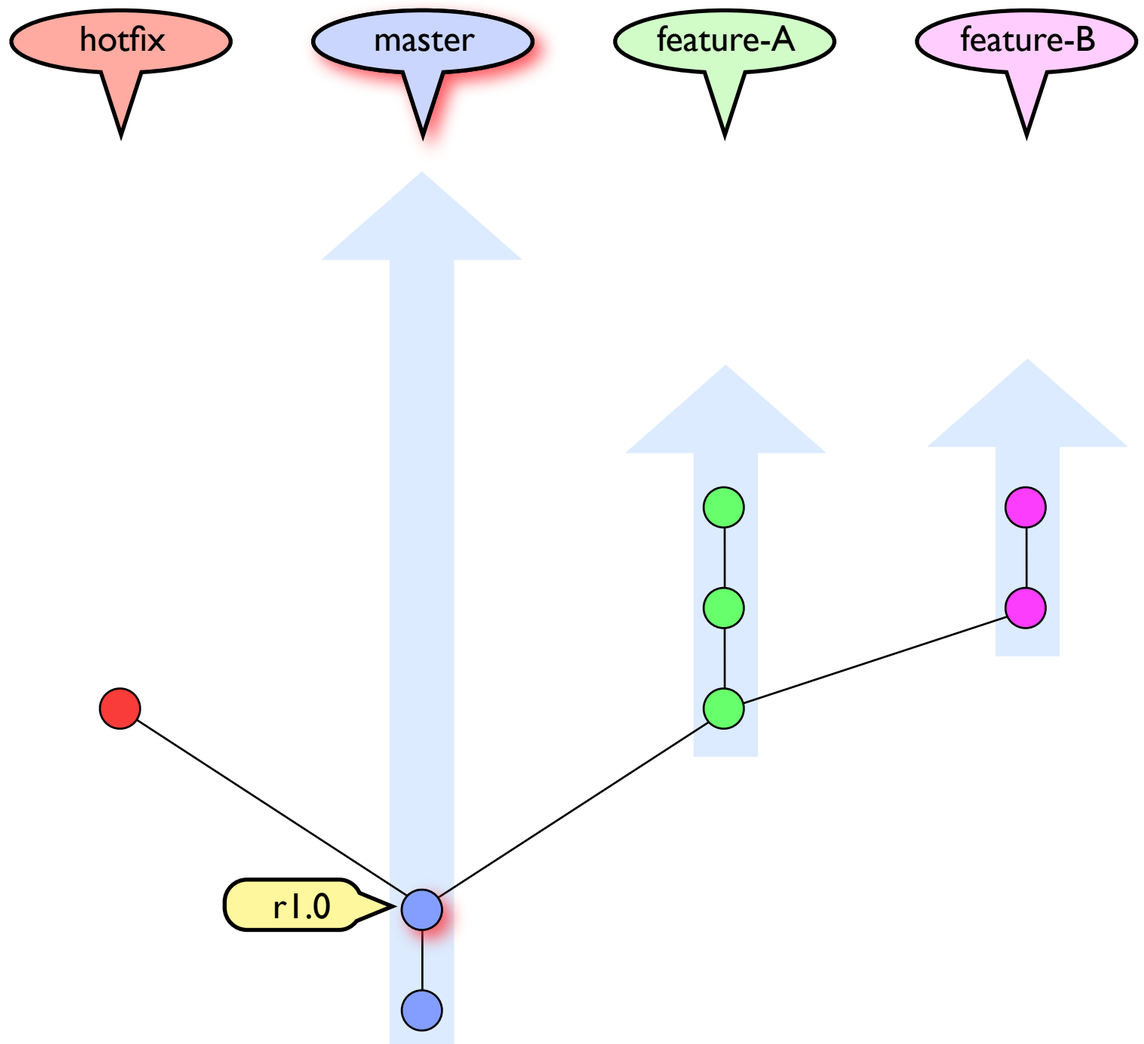
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
```



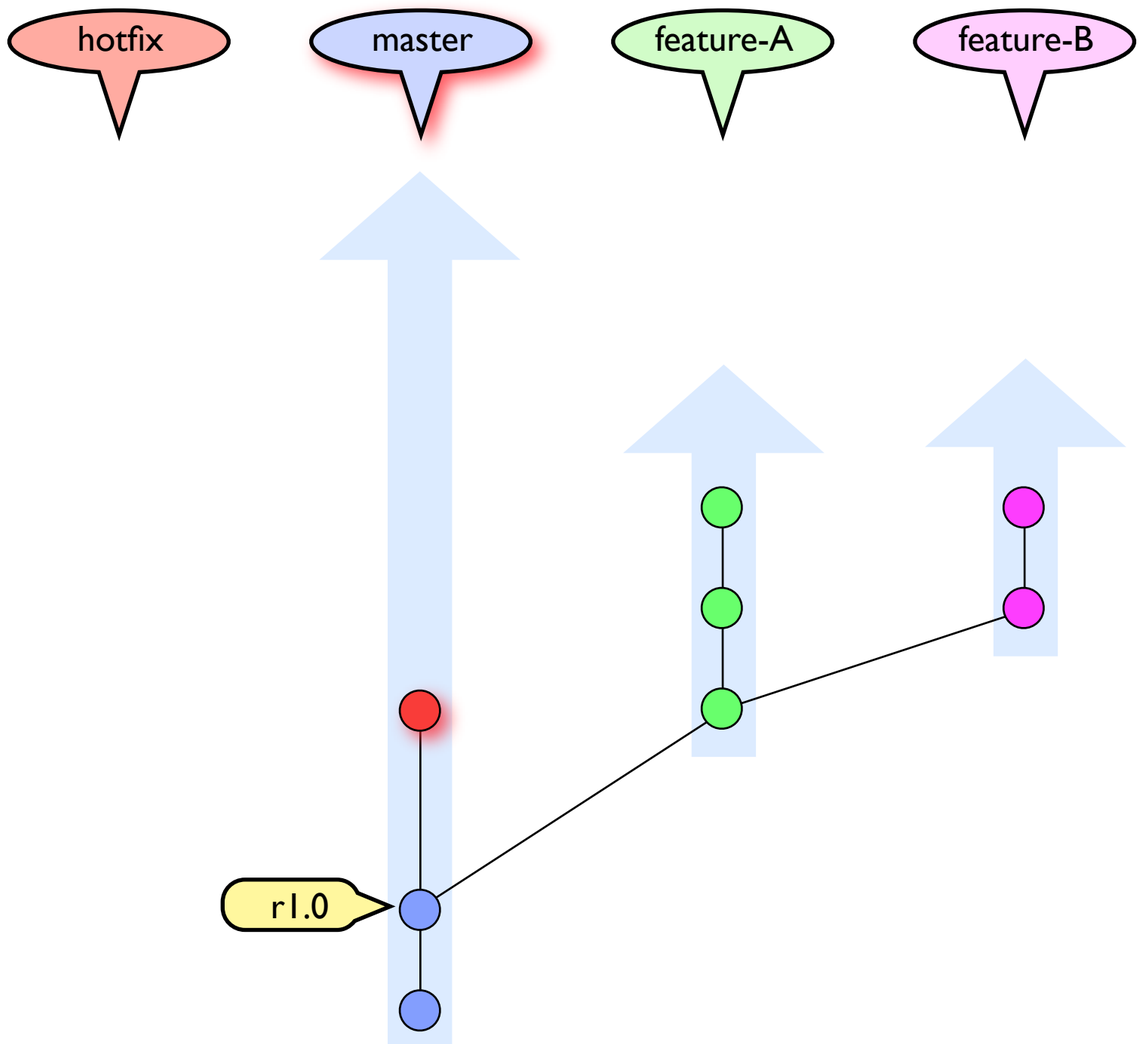
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
```



```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
```

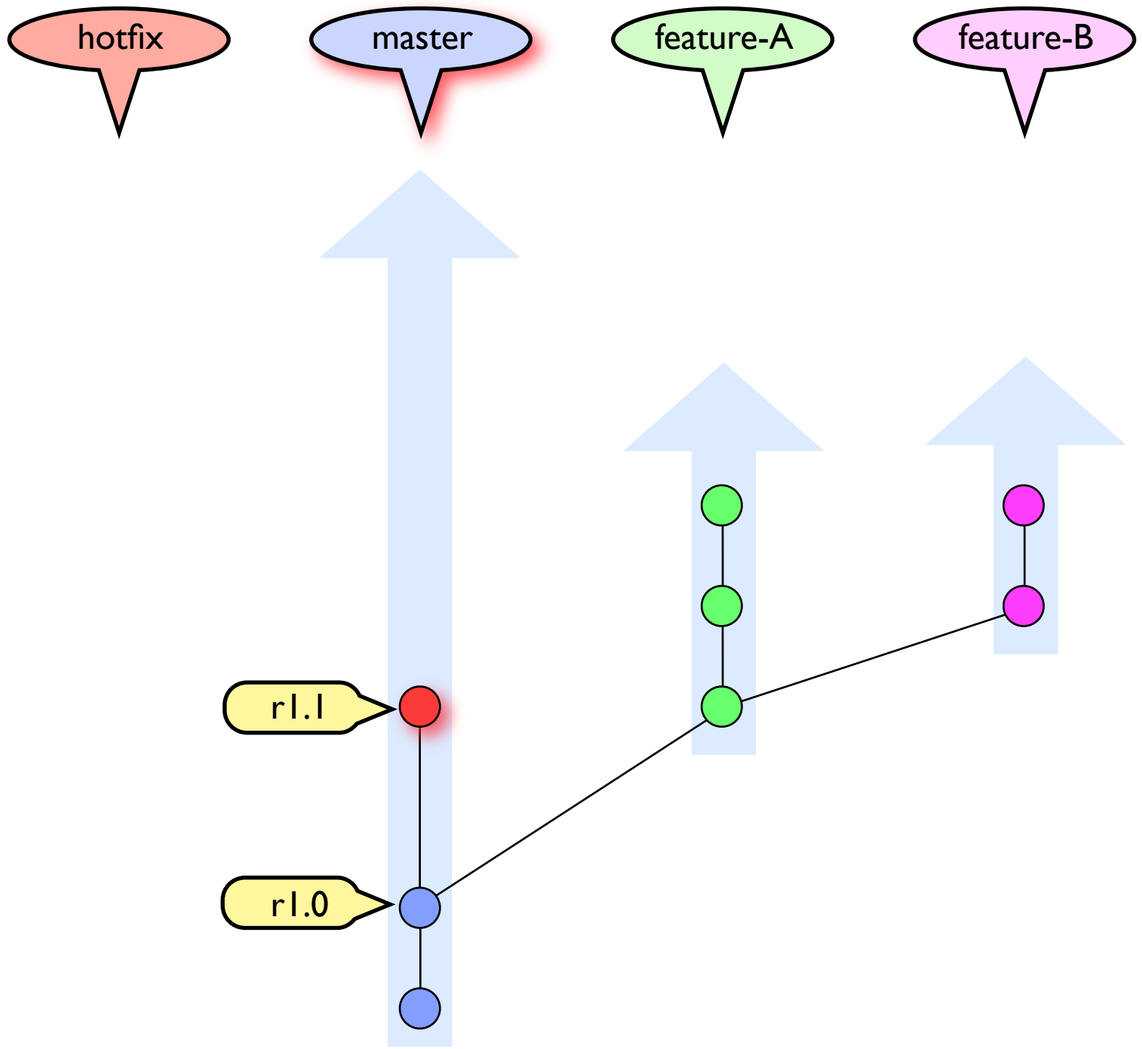


```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
```

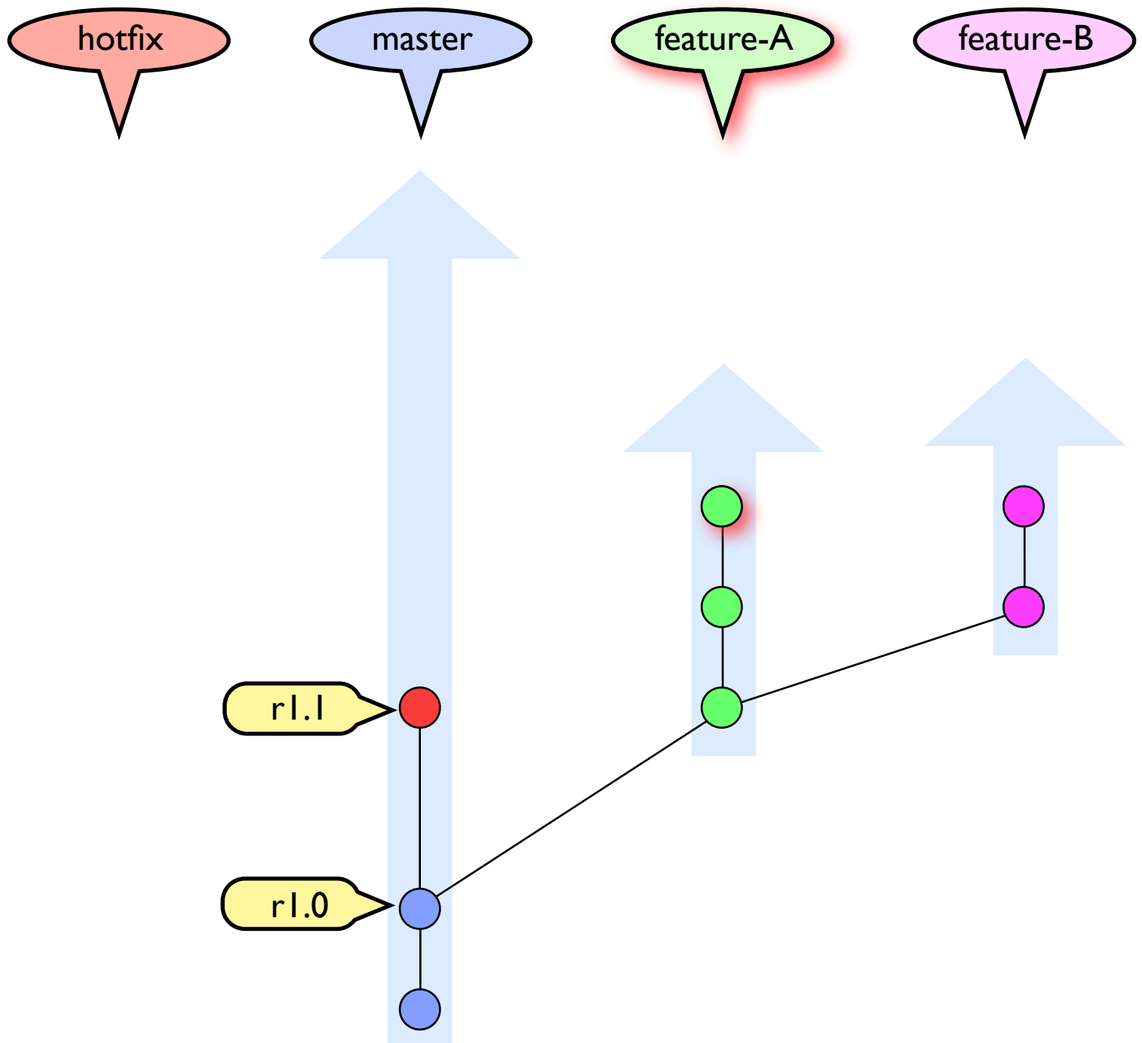


This is a "fast forward" merge.
No *merging* actually takes place.
Instead, the current branch is simply updated to the head of the branch being merged.

```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
```



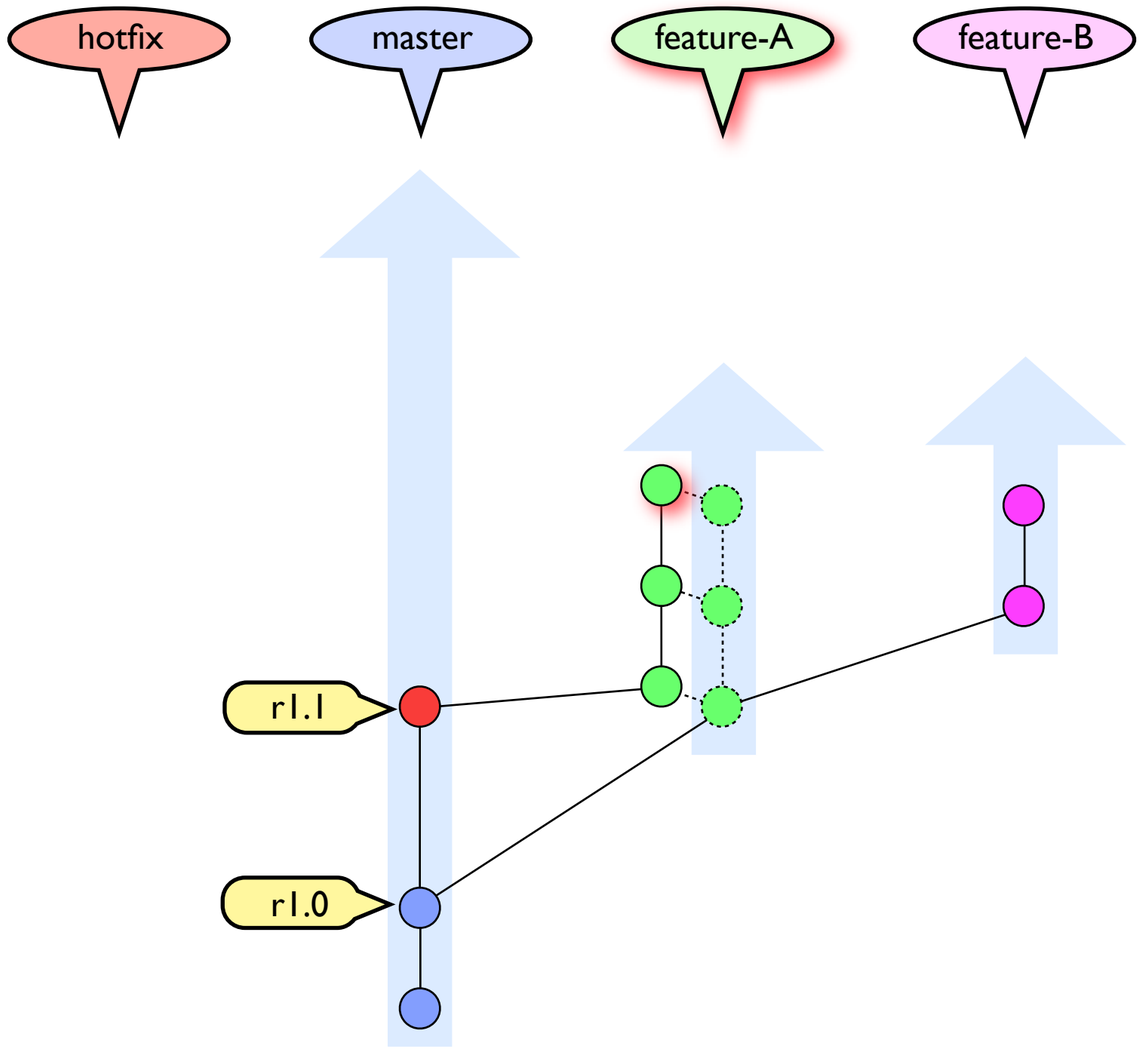
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
```



```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
```

…resolve conflicts…

```
git rebase --continue
```

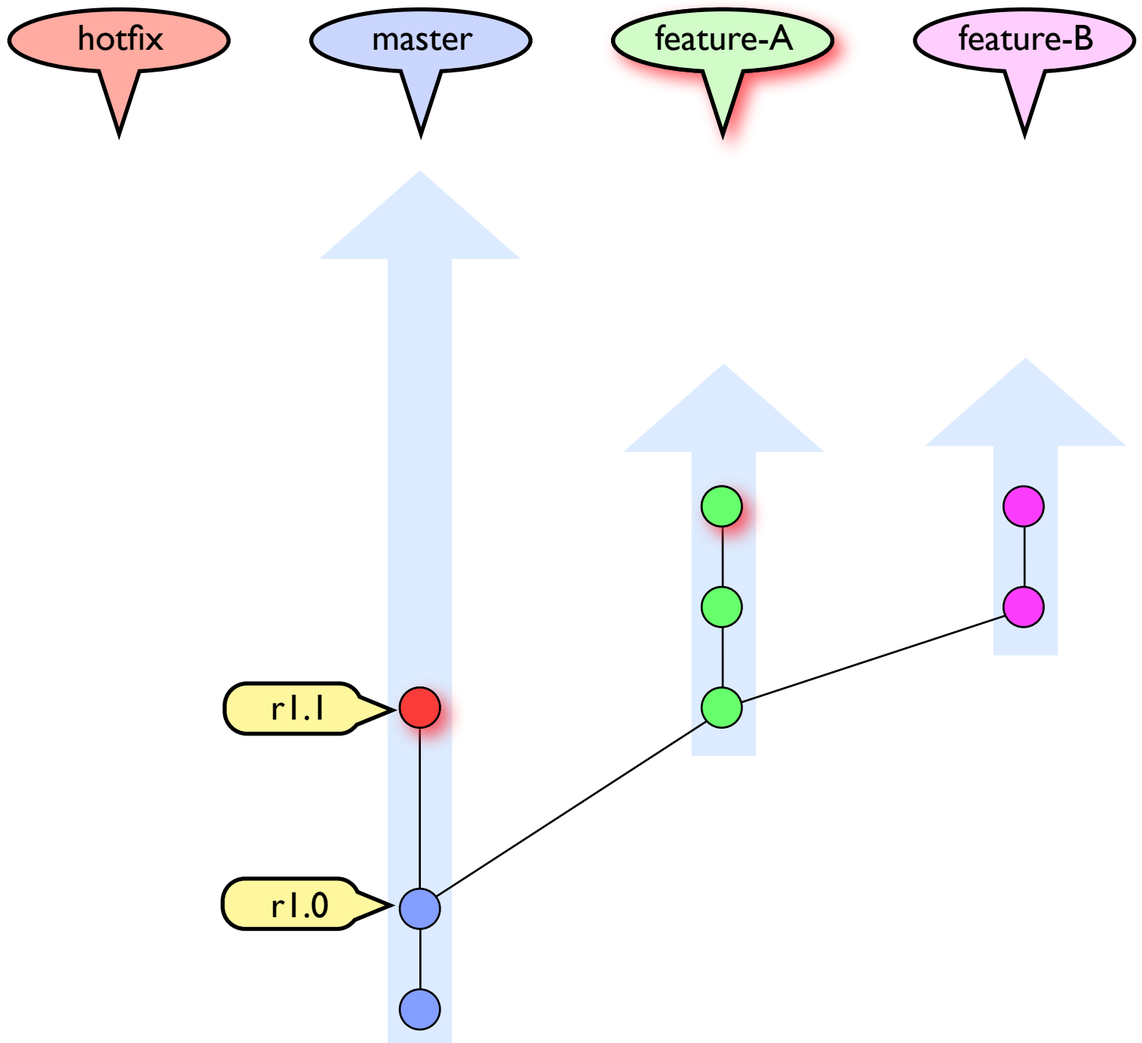


rebasing creates new copies of ***every*** commit between the base and the head!

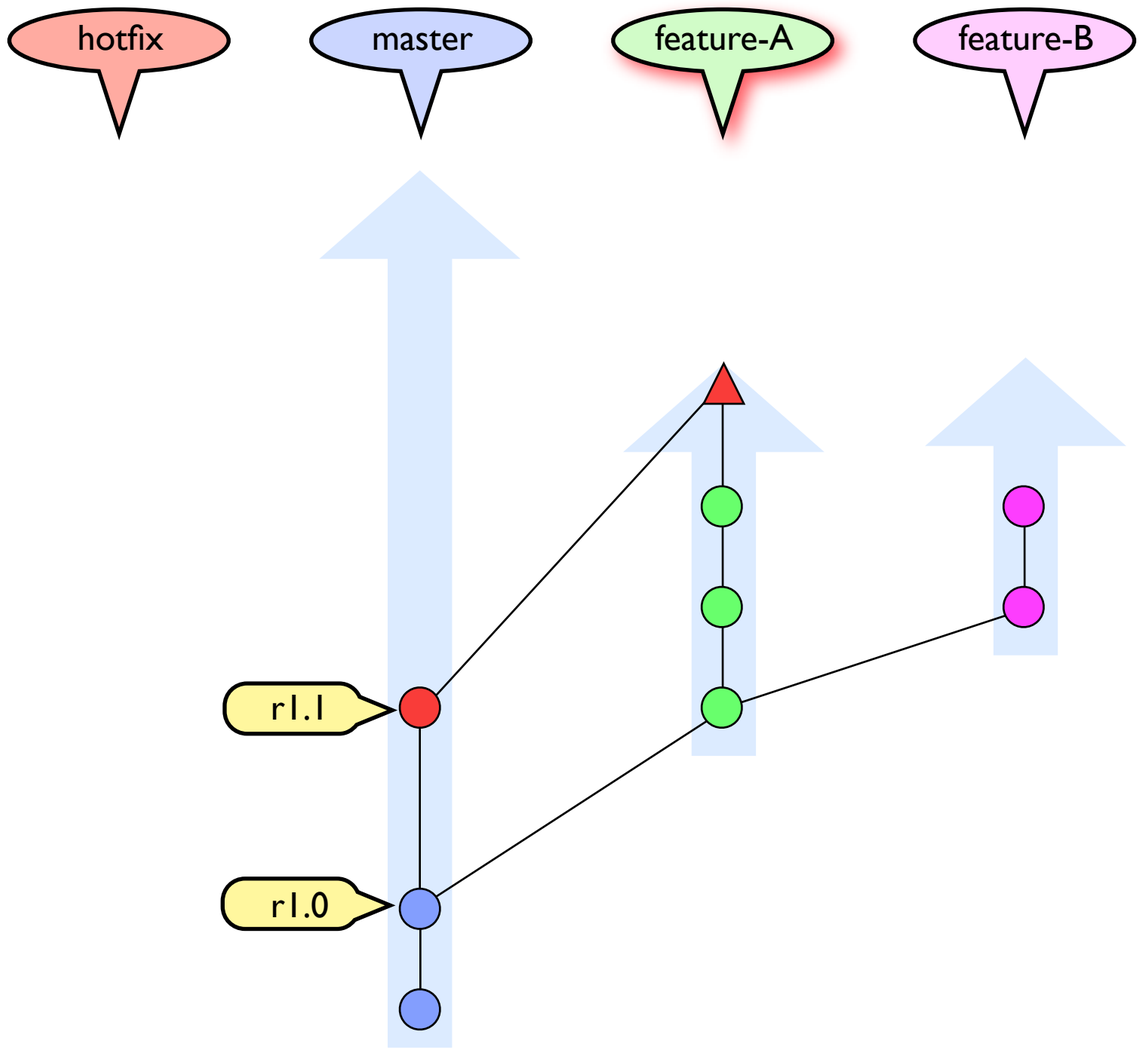
DO use rebase if you are about to synchronise your work with a public repository.

DO NOT use rebase if the effected commits have already been published!

```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
```

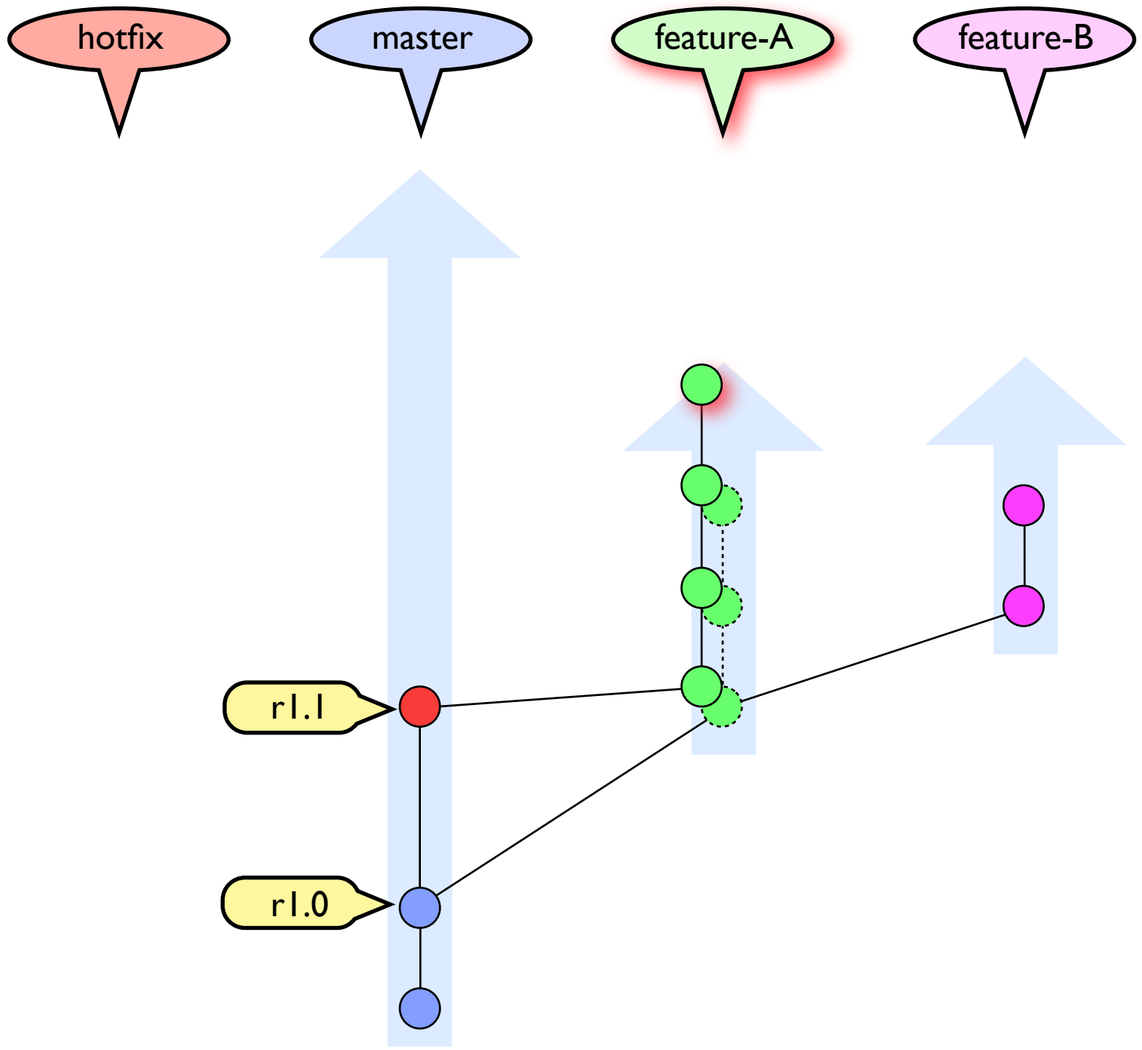


```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git merge master
…resolve conflicts…
git commit -m 'merge from r1.1'
```



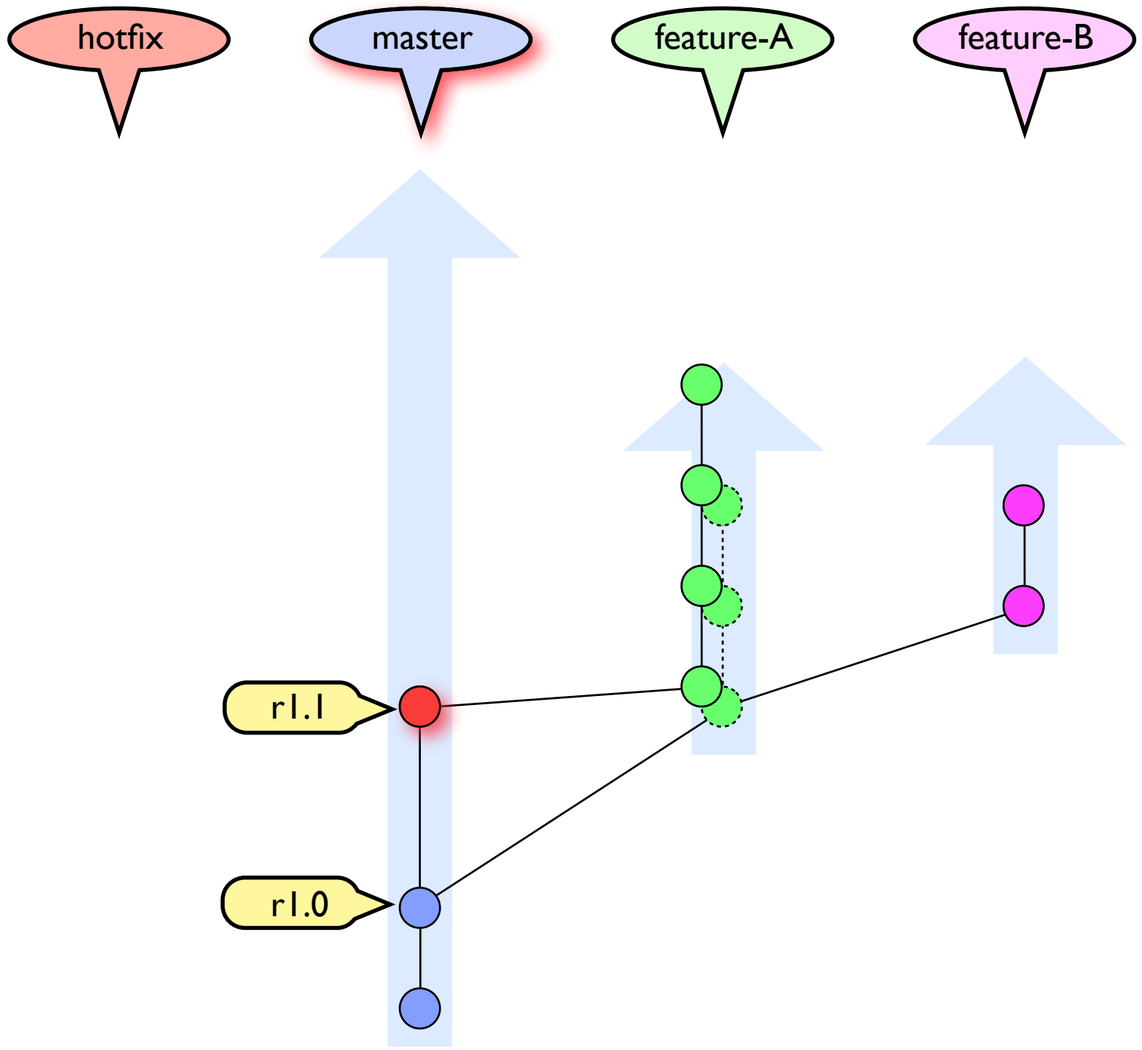
merging applies the changes from the source branch onto the head of the target branch.
Existing commits remain effective, the merged commits are duplicated.
DO use merge if your commits have been published!

```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
…resolve conflicts…
git rebase --continue
git commit -a -m 'polish feature A'
```

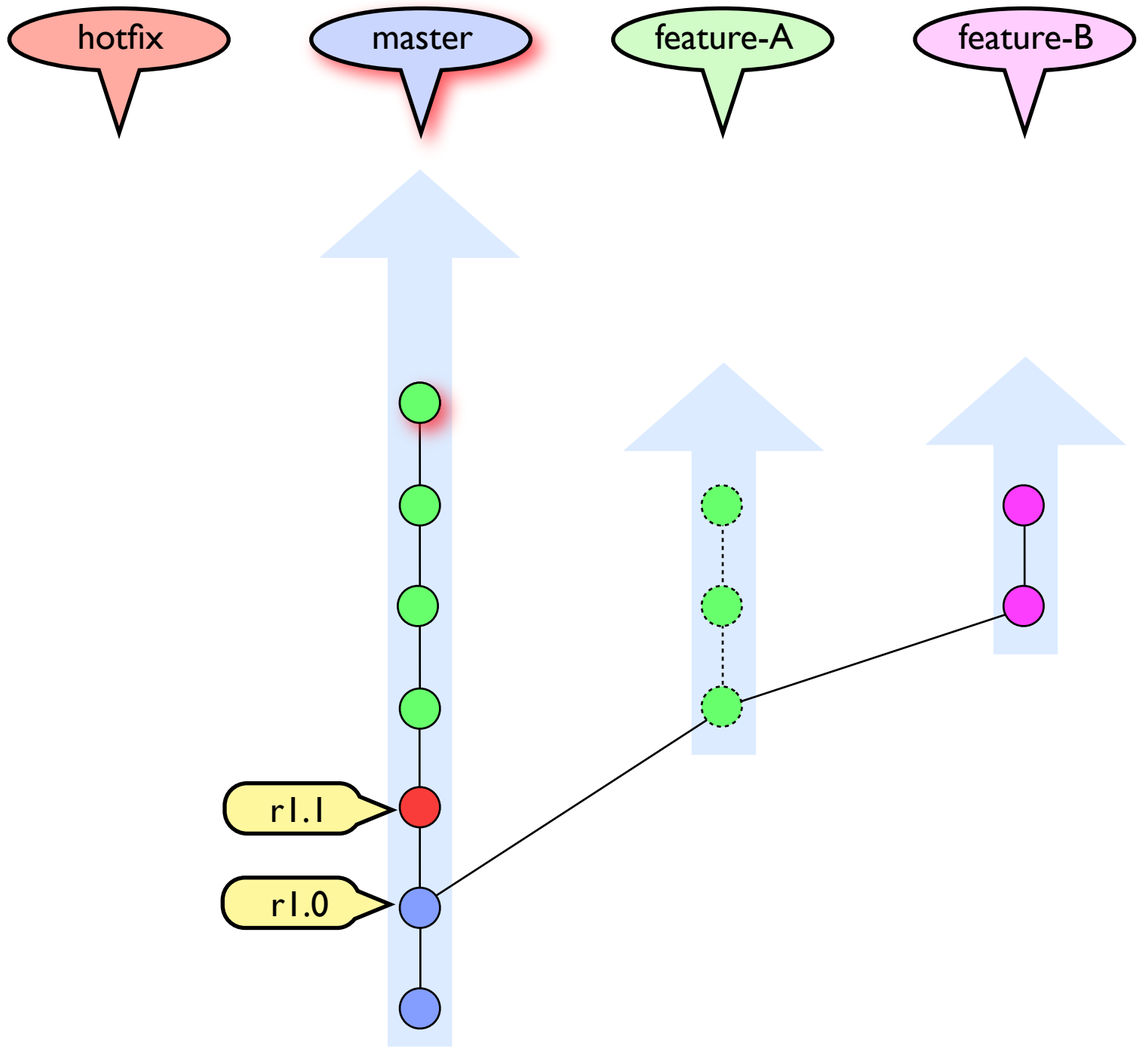


The original commits are no longer accessible via the branch.
Branches stemming from an original commit still reference it!

```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
…resolve conflicts…
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
```

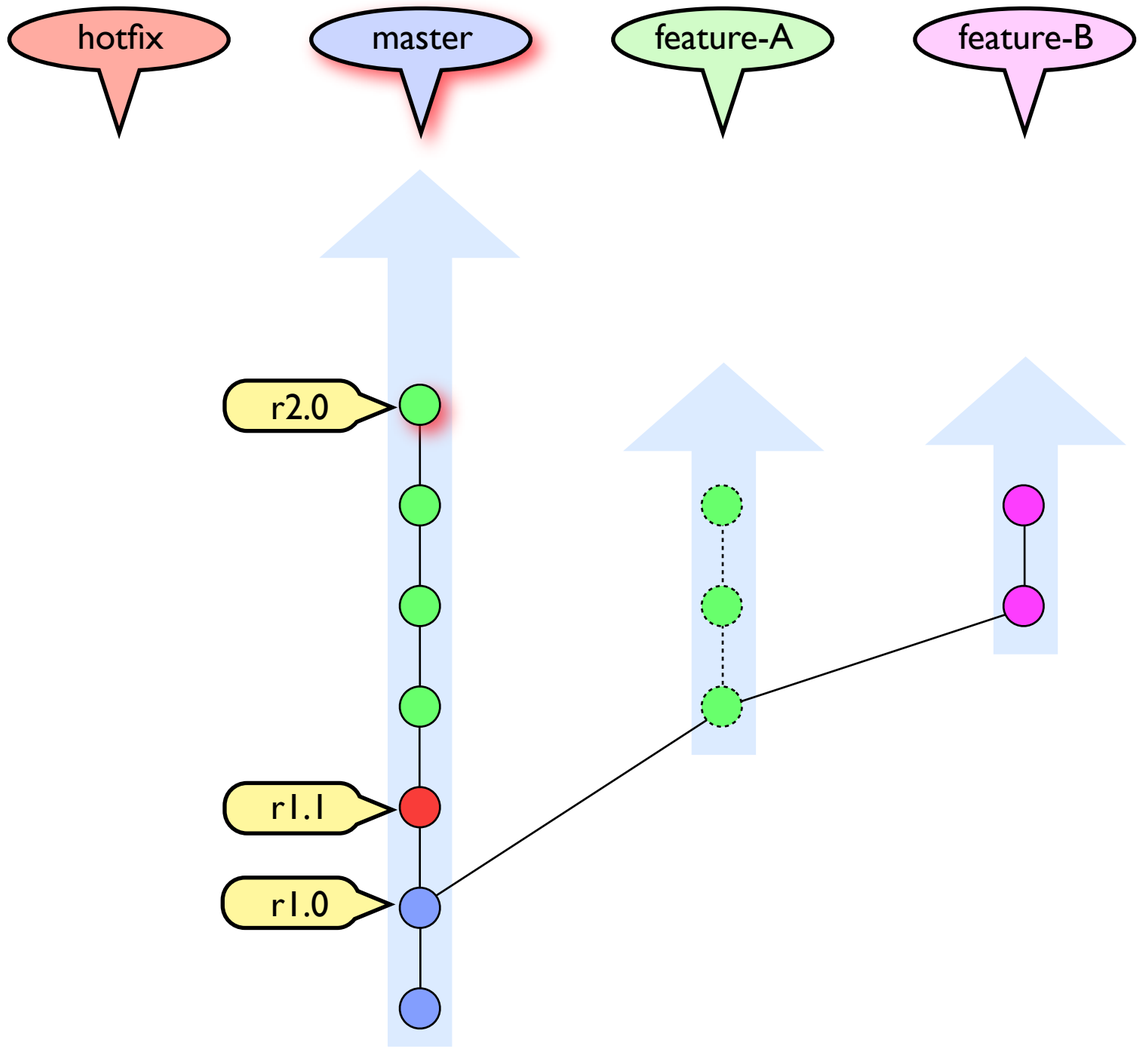


```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
…resolve conflicts…
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
```



fast forward merge again

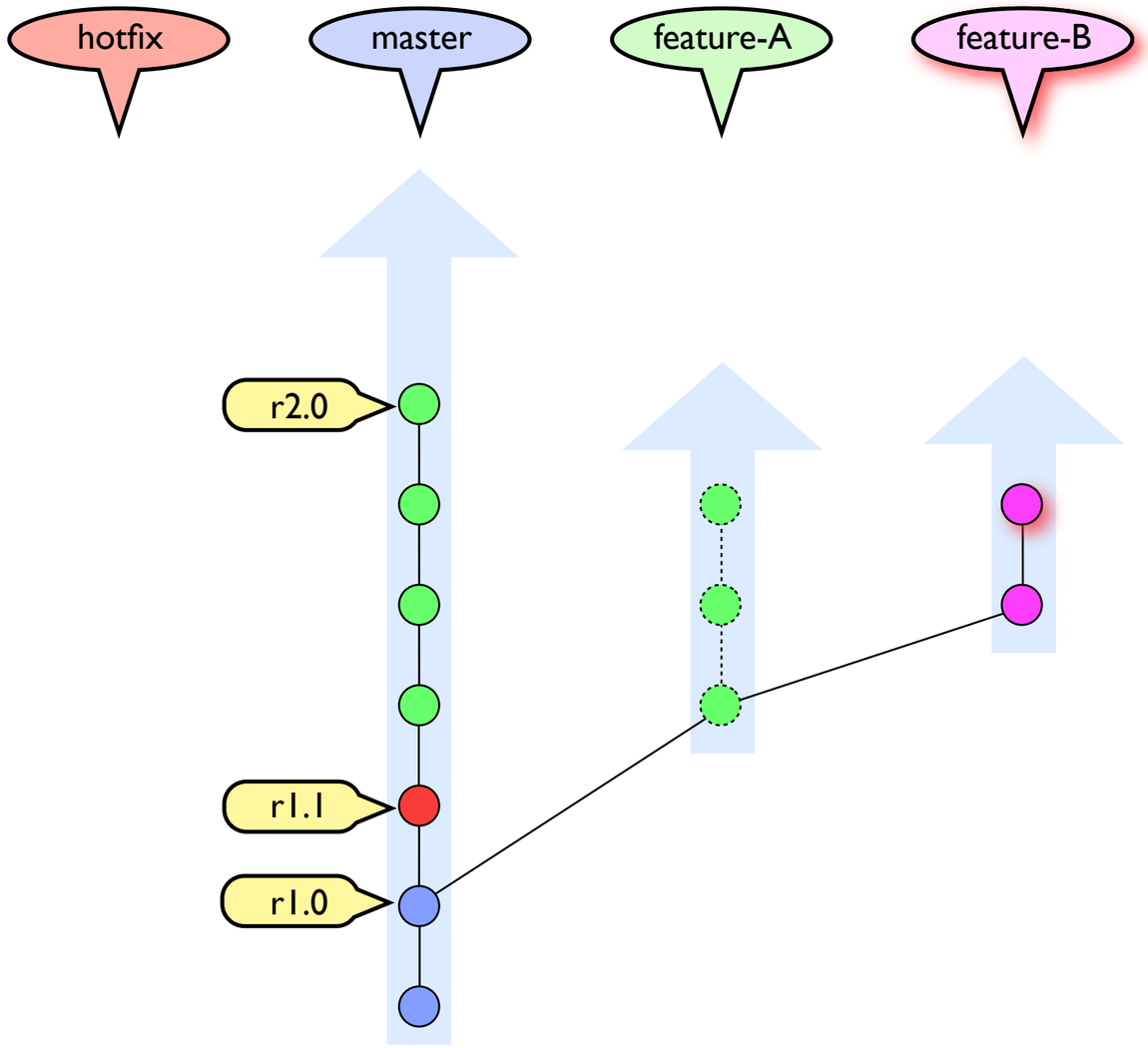
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
…resolve conflicts…
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
```



```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
```

…resolve conflicts…

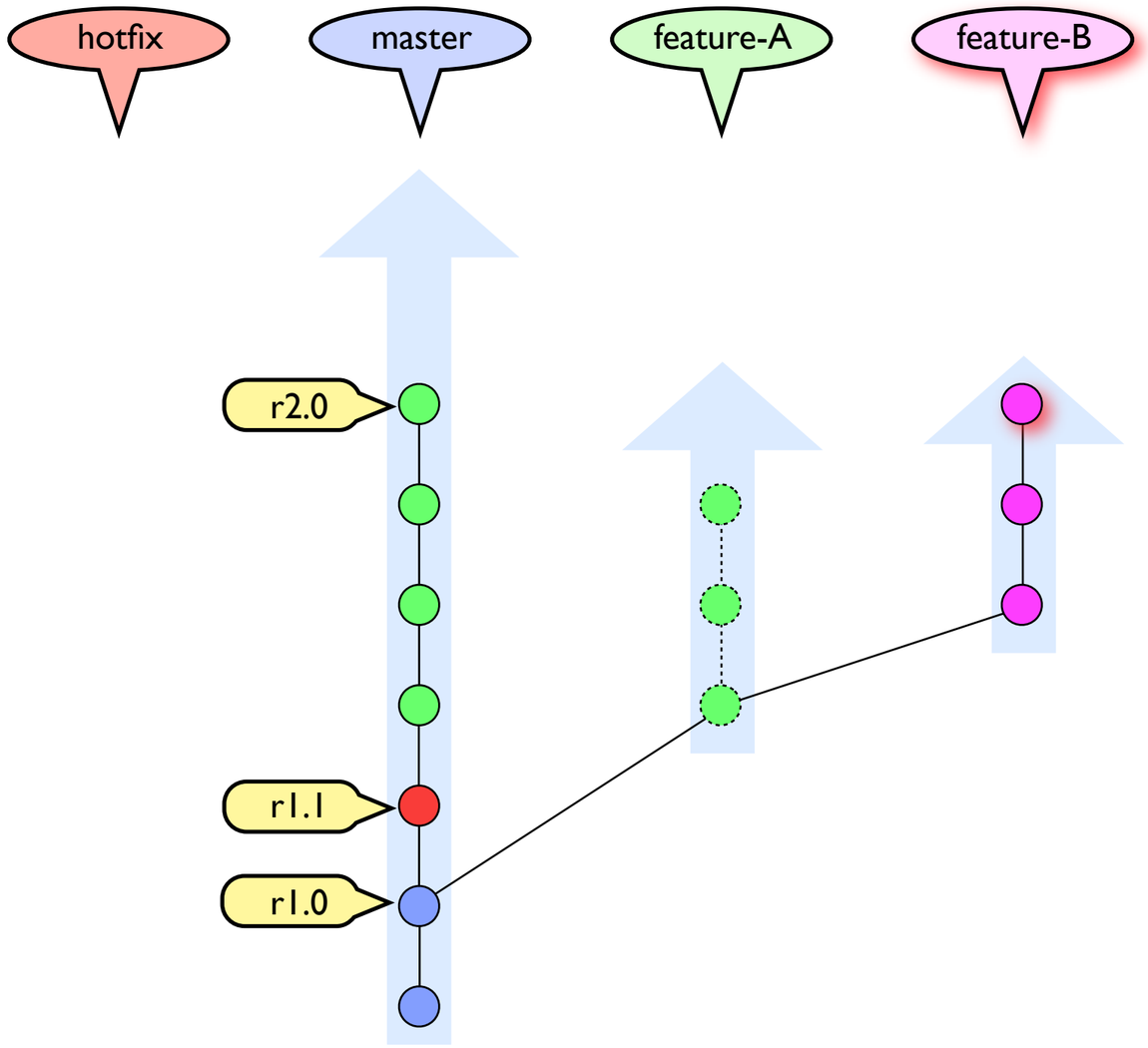
```
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
```



```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
```

…resolve conflicts…

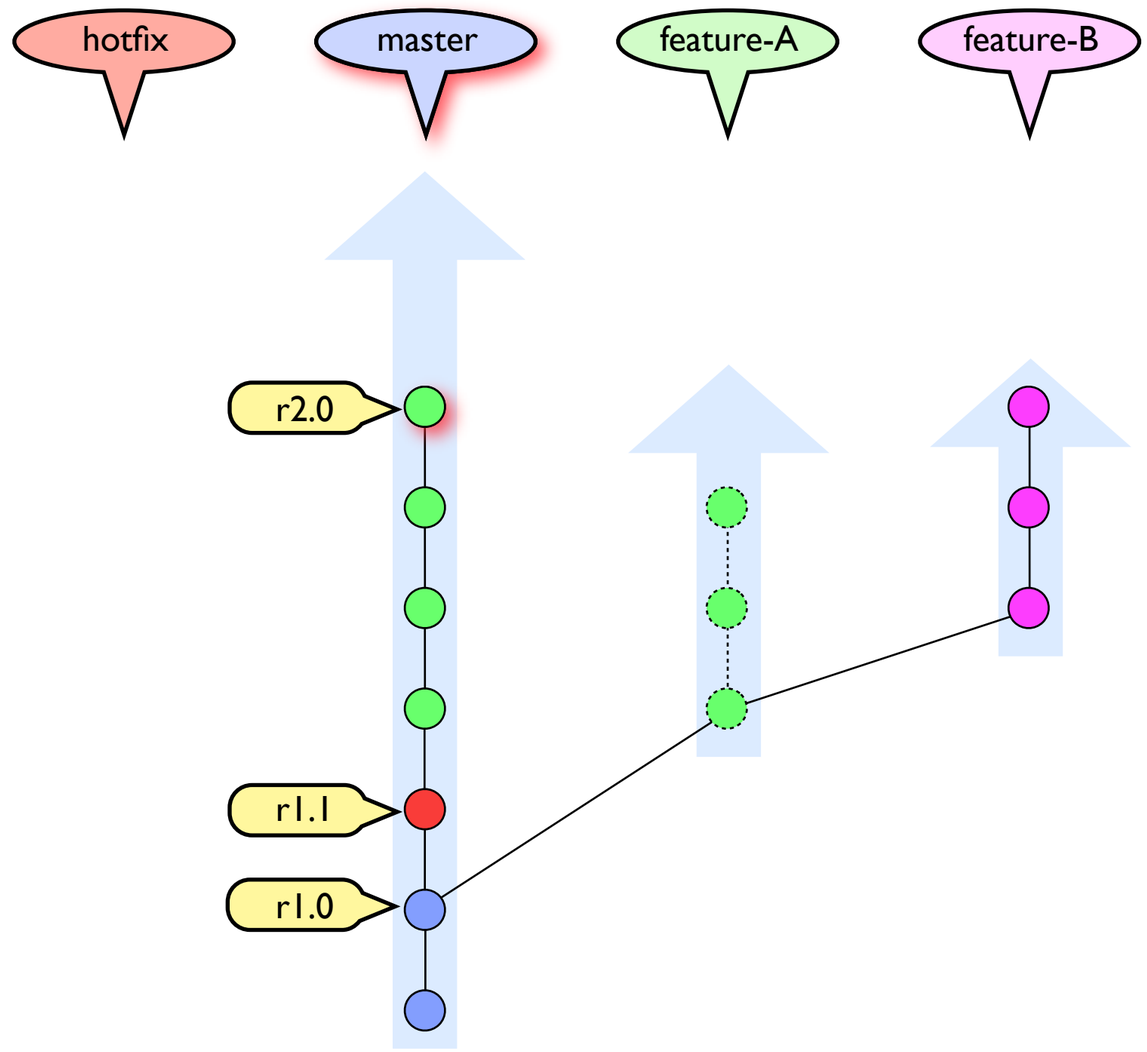
```
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
```



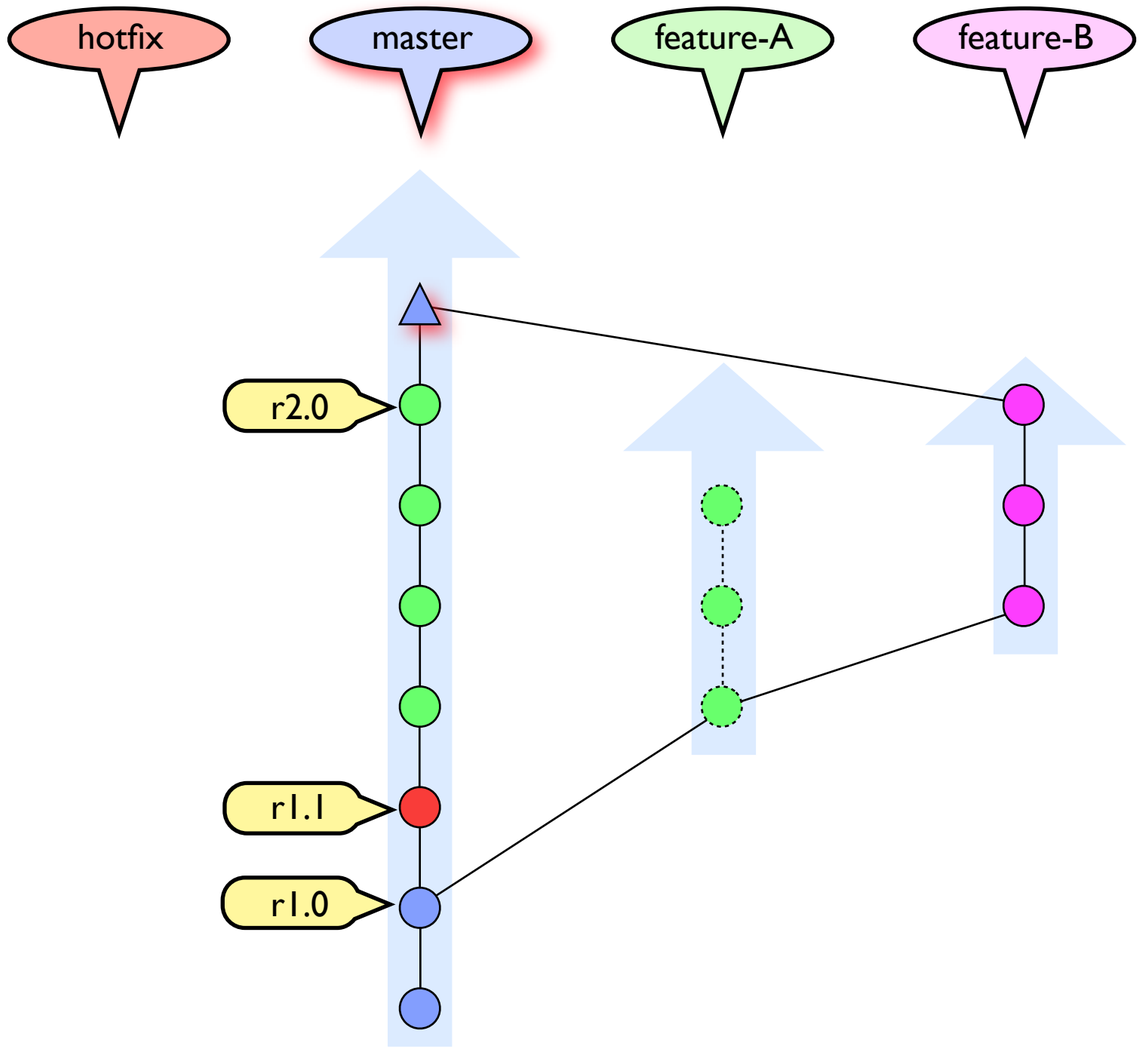
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
```

…resolve conflicts…

```
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
git checkout master
```

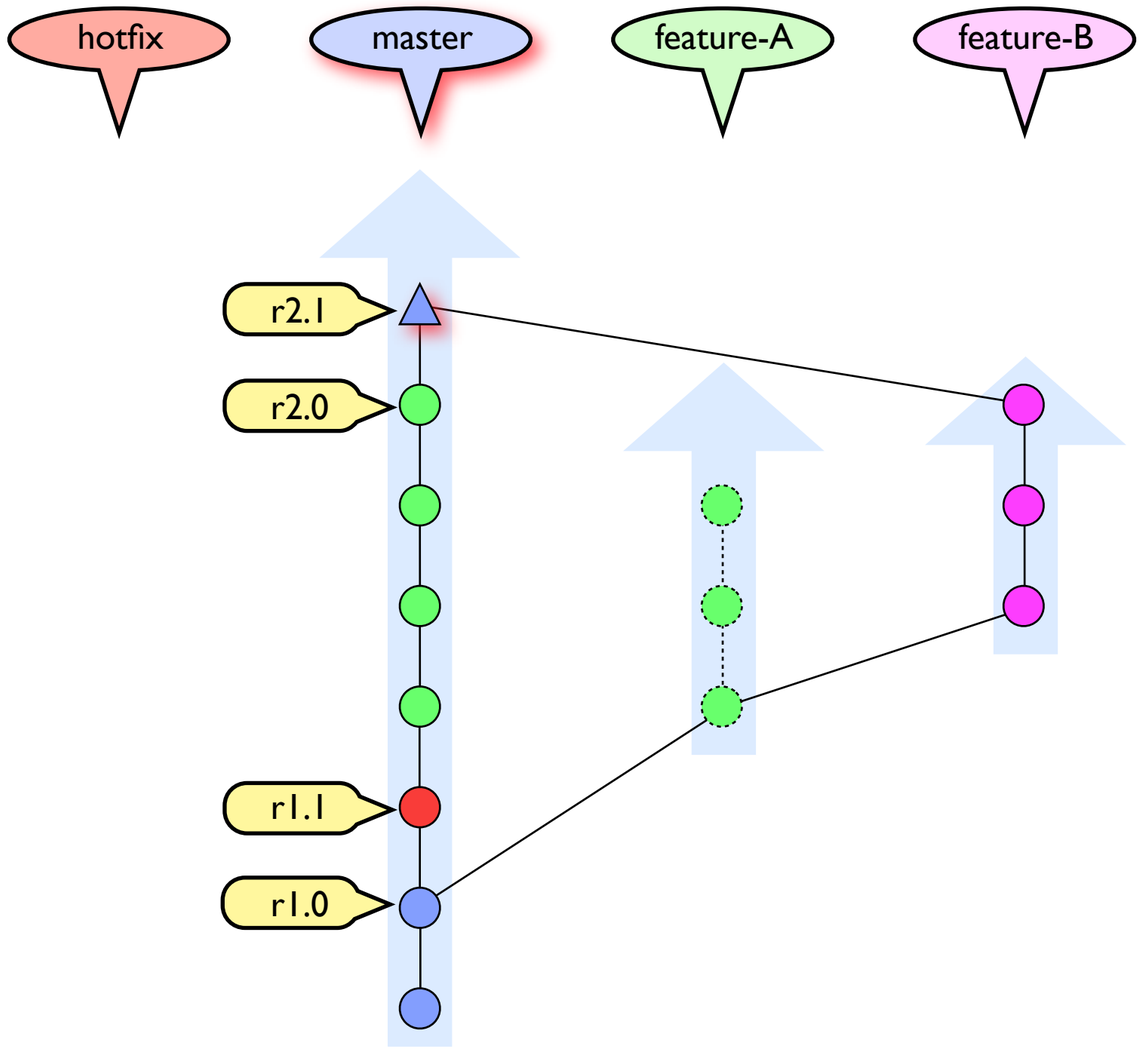


```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
…resolve conflicts…
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
git checkout master
git merge feature-B
…resolve conflicts…
git commit -a -m 'merge feature-B into master'
```

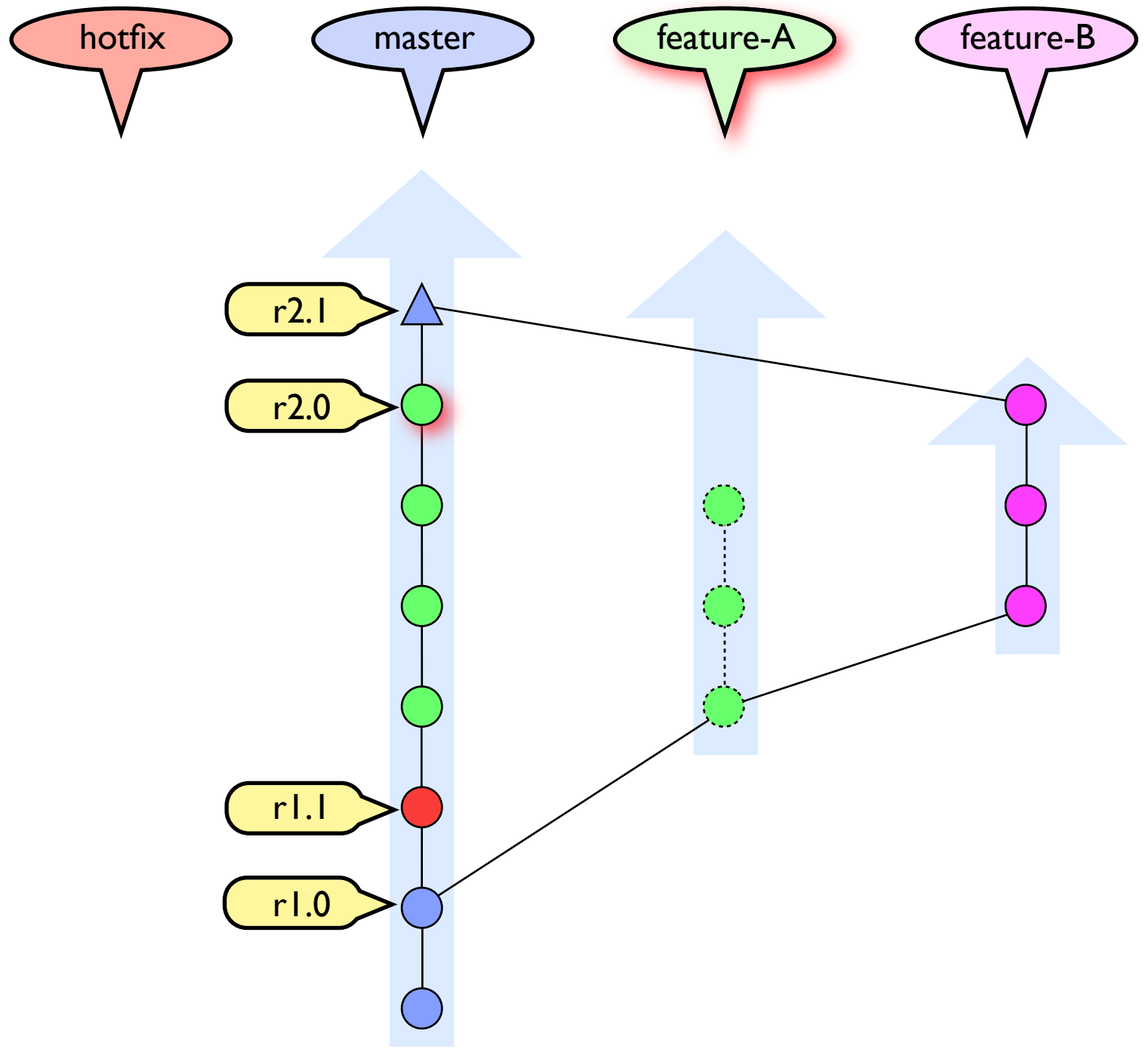


divergent branches require a new commit with 2 parents.
The new commit tracks conflict resolutions.
`git merge` automatically detects if a fast forward merge is possible or not.

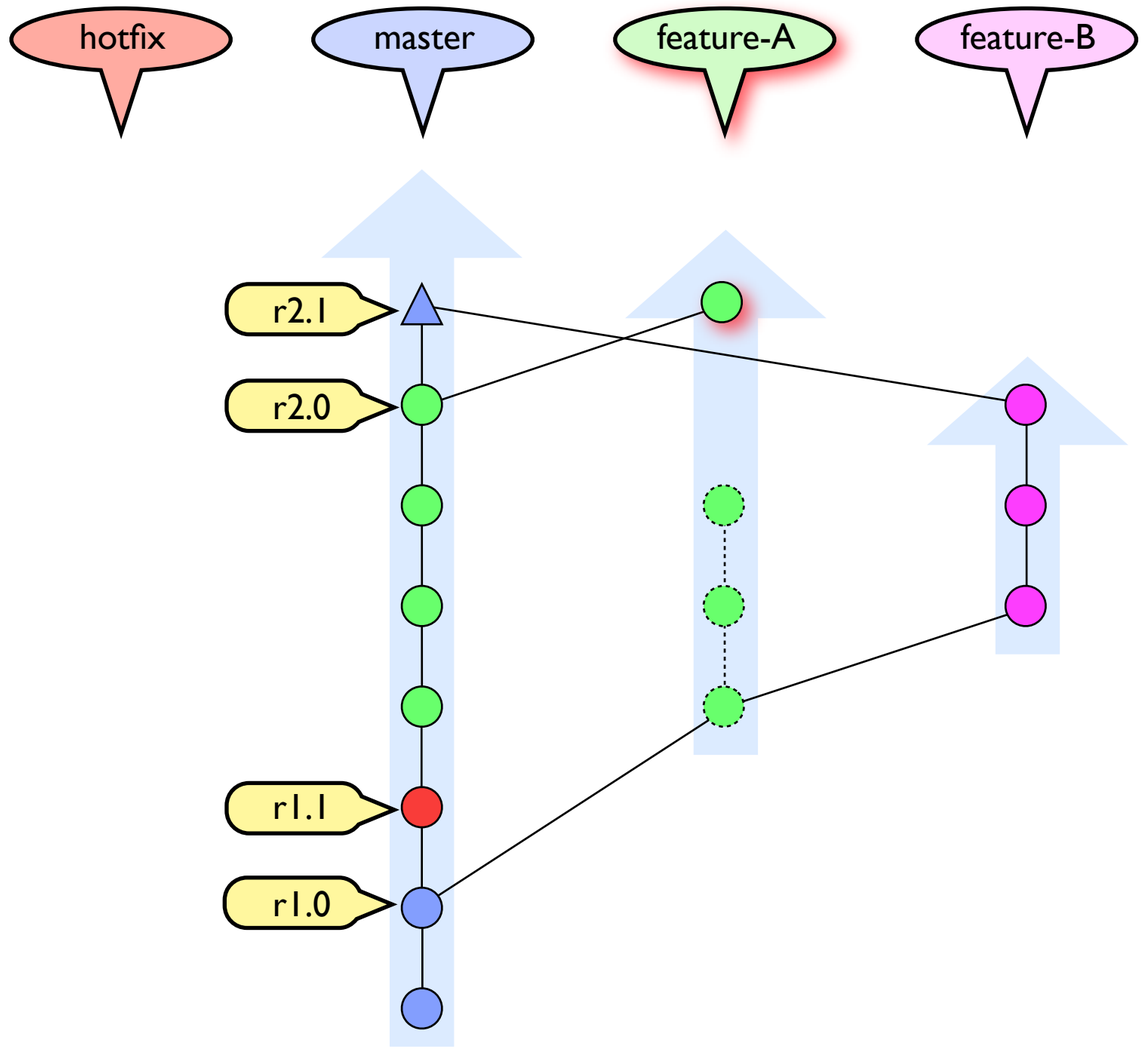
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
…resolve conflicts…
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
git checkout master
git merge feature-B
…resolve conflicts…
git commit -a -m 'merge feature-B into master'
git tag -a r2.1 -m 'wow release'
```



```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
…resolve conflicts…
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
git checkout master
git merge feature-B
…resolve conflicts…
git commit -a -m 'merge feature-B into master'
git tag -a r2.1 -m 'wow release'
git checkout feature-A
```



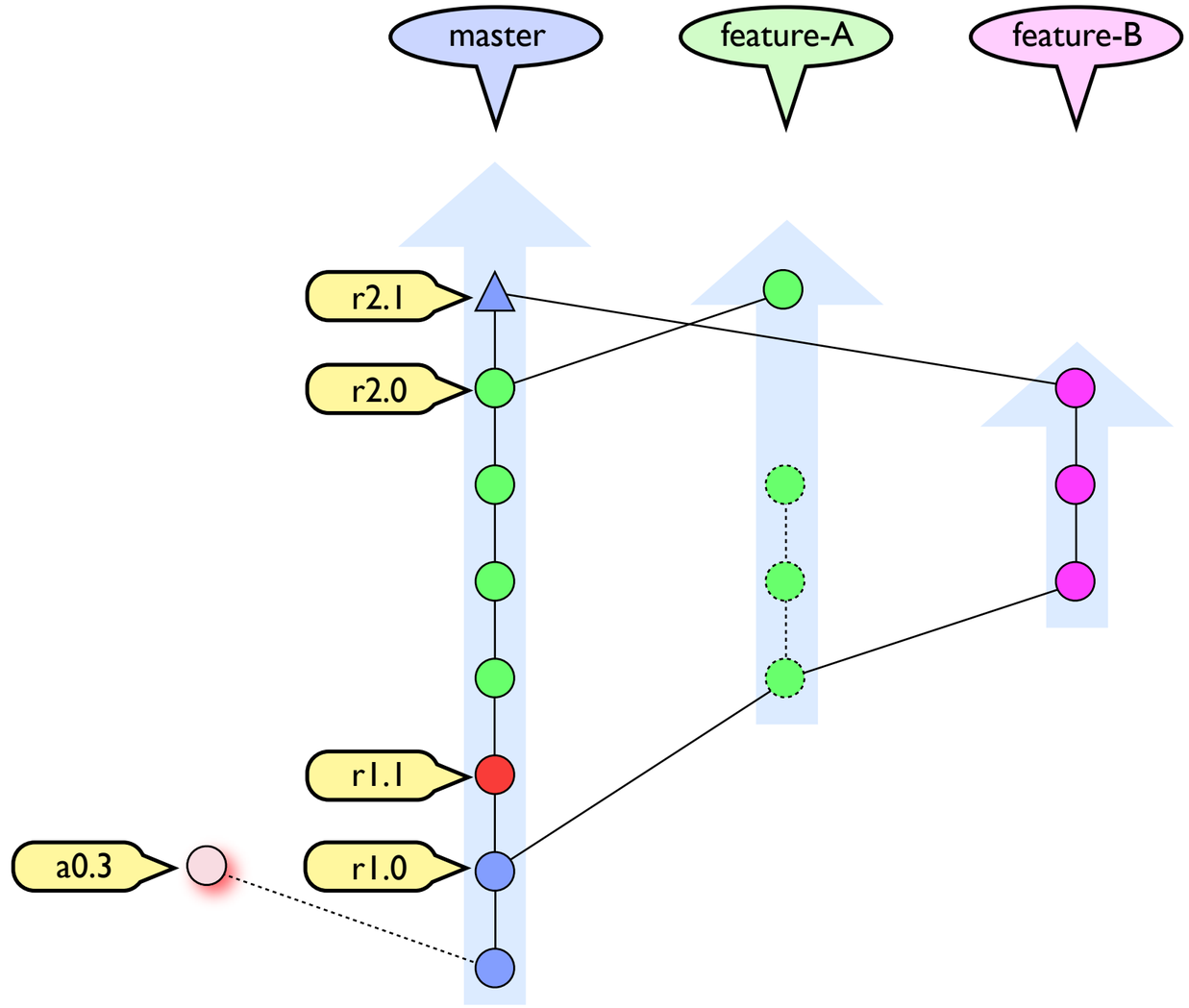
```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
…resolve conflicts…
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
git checkout master
git merge feature-B
…resolve conflicts…
git commit -a -m 'merge feature-B into master'
git tag -a r2.1 -m 'wow release'
git checkout feature-A
git commit -a -m 'feature-A extension'
```



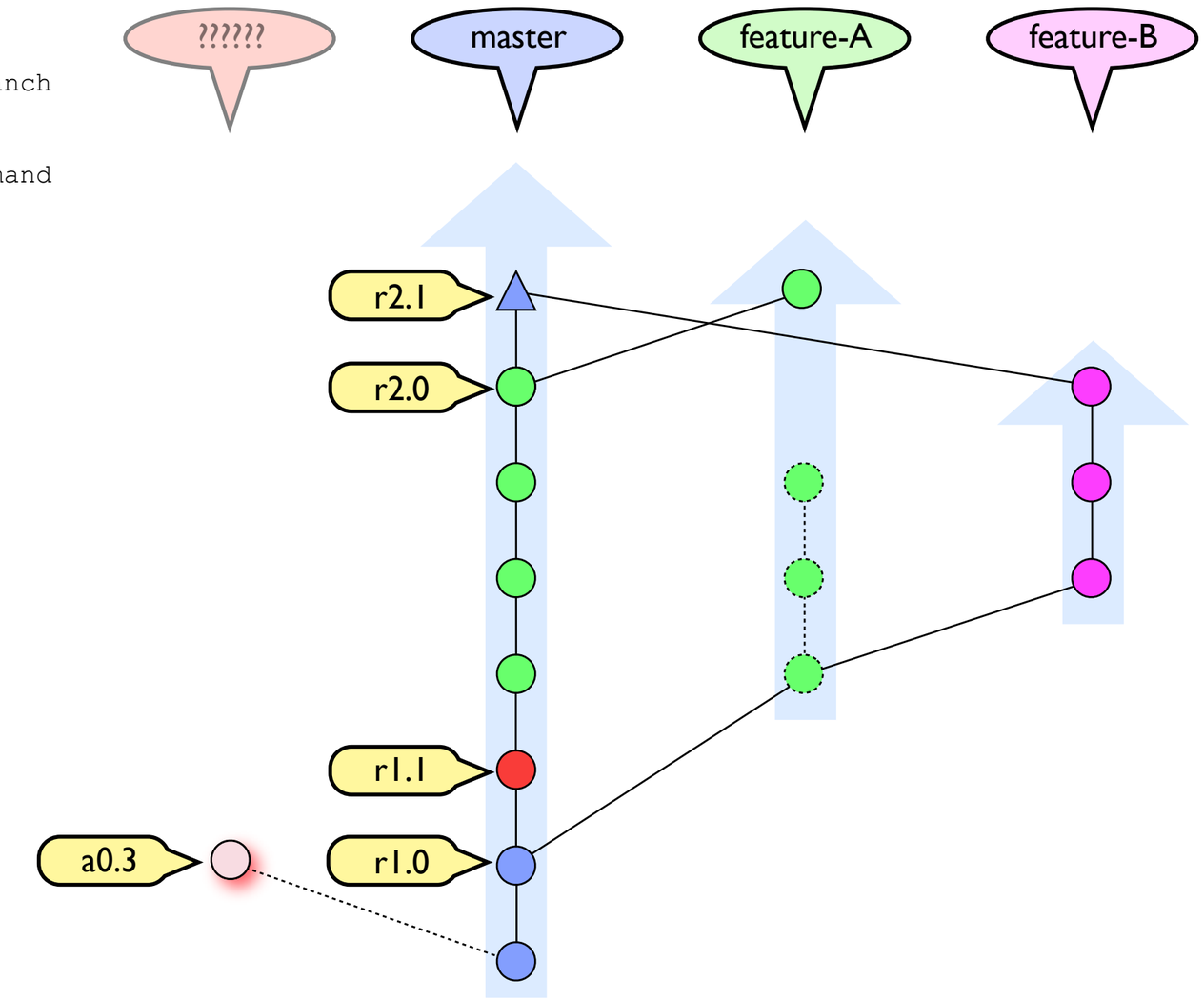
Lost Your Head?

Common point of confusion when git reports a "*detached head*"

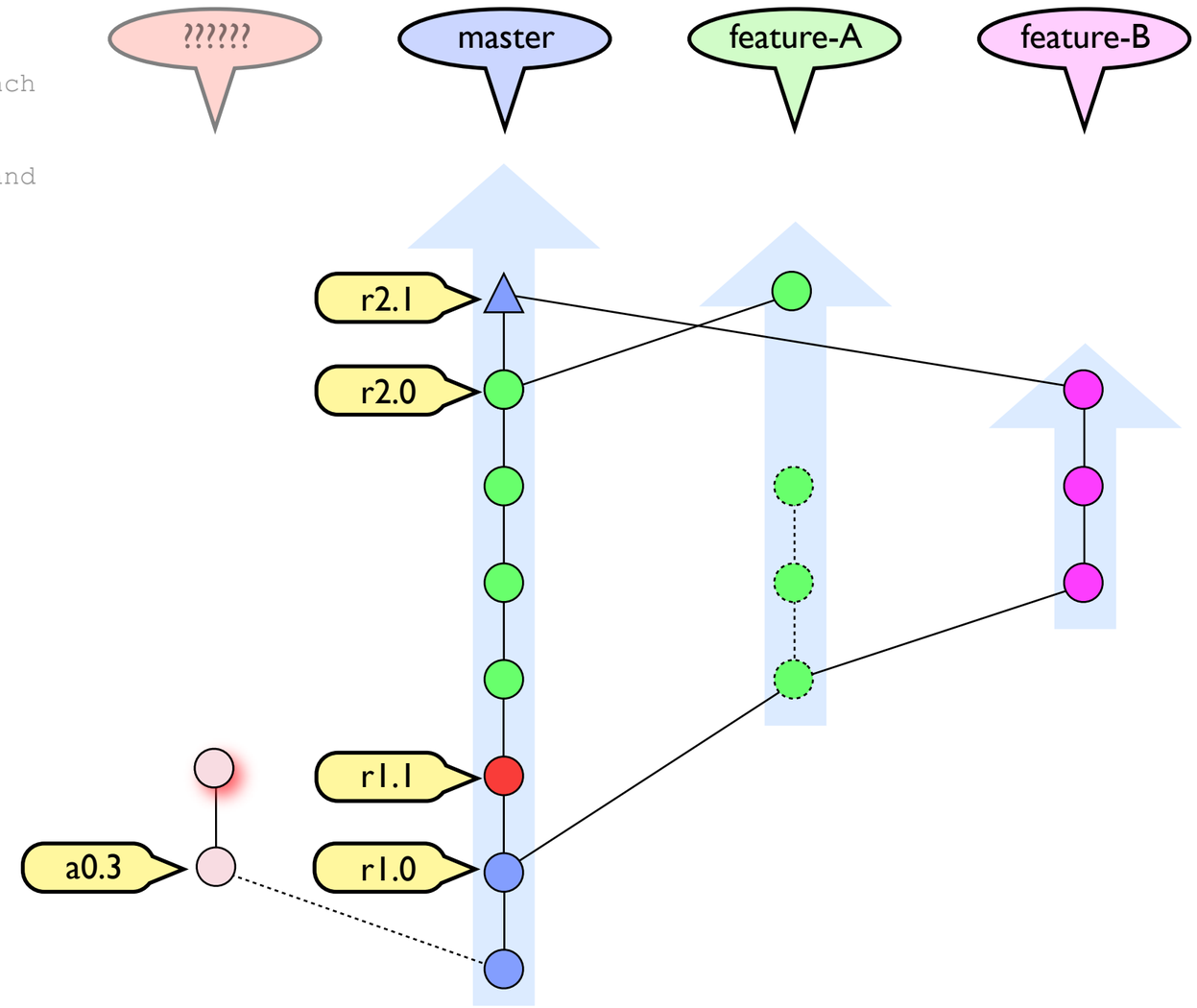
```
git checkout a0.3
```



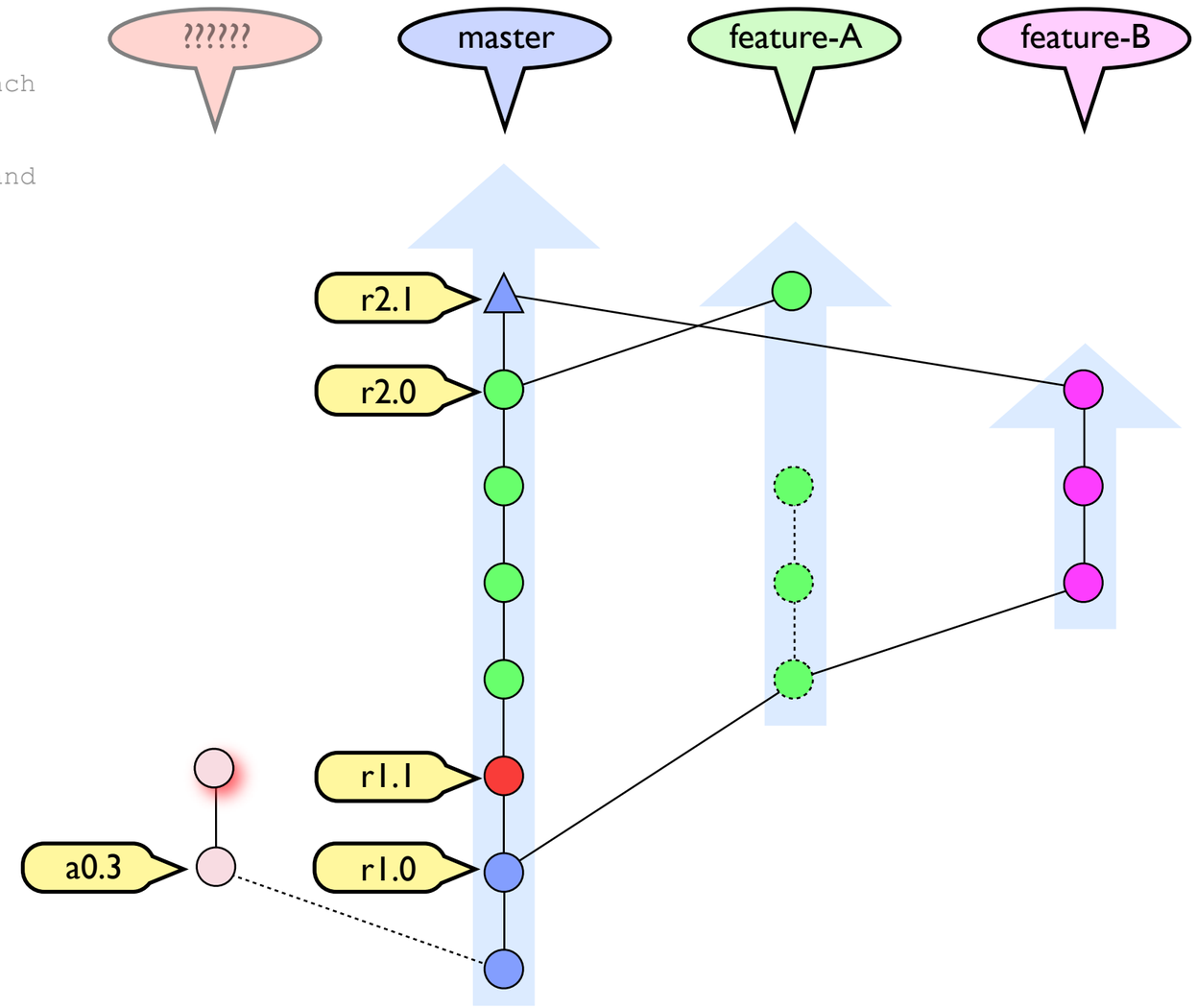
```
git checkout a0.3
Note: moving to 'a67061d' which isn't a local branch
If you want to create a new branch from this
checkout, you may do so
(now or later) by using -b with the checkout command
again. Example:
  git checkout -b <new_branch_name>
HEAD is now at a67061d...
```



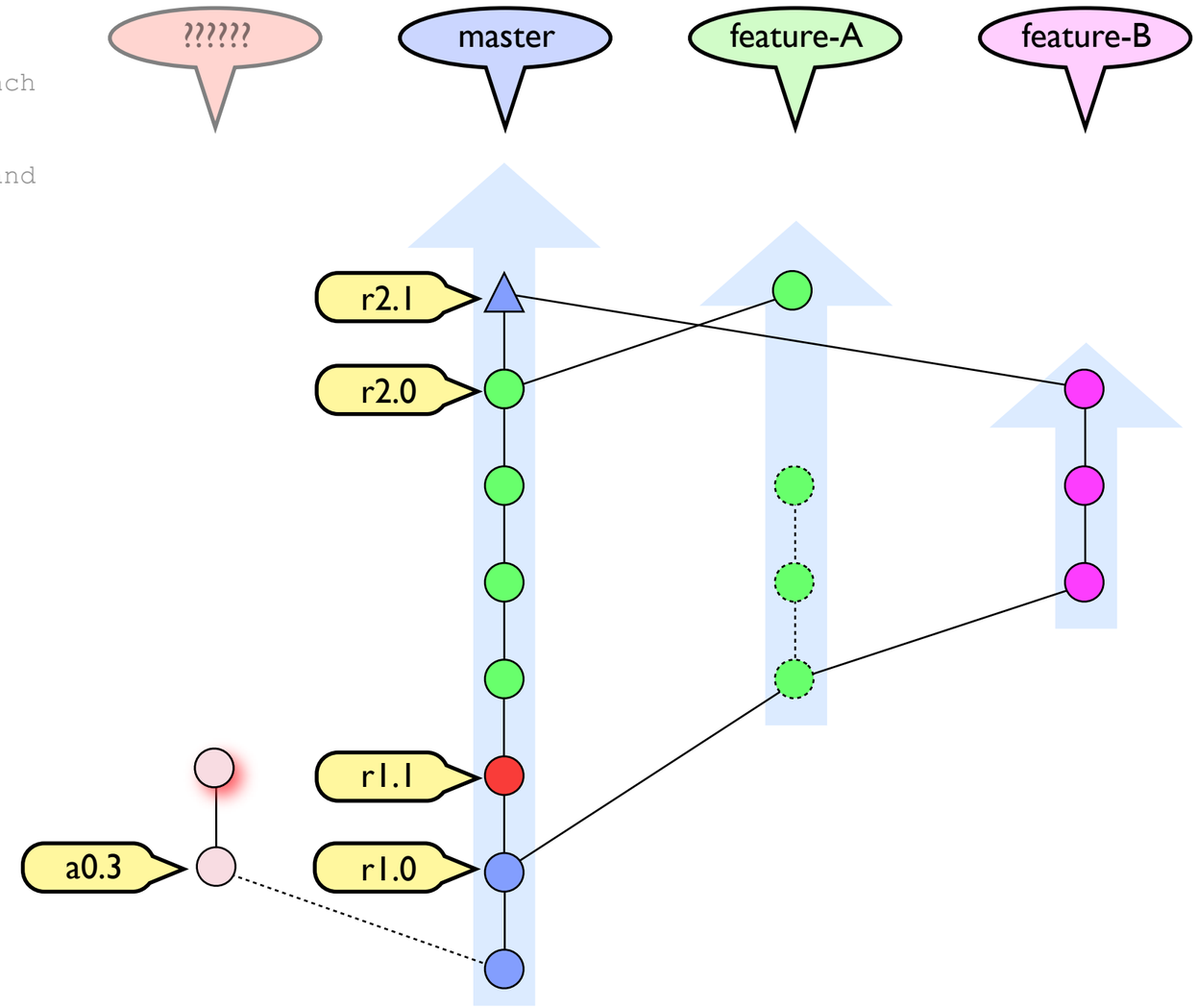
```
git checkout a0.3
Note: moving to 'a67061d' which isn't a local branch
If you want to create a new branch from this
checkout, you may do so
(now or later) by using -b with the checkout command
again. Example:
  git checkout -b <new_branch_name>
HEAD is now at a67061d...
```
...work work work...
```
git commit -a -m 'this is cool'
[detached HEAD a67061d] add foo.txt
```



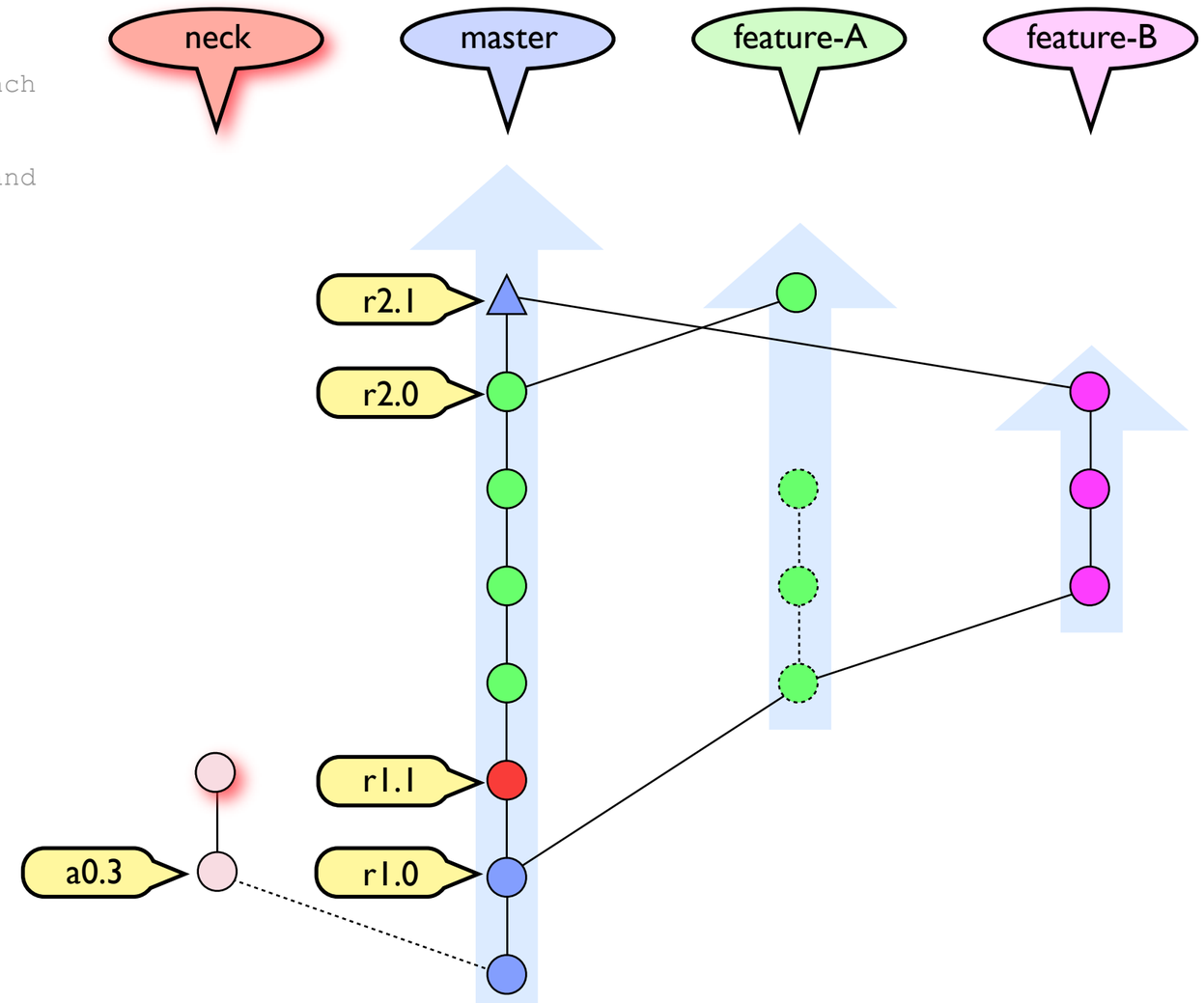
```
git checkout a0.3
Note: moving to 'a67061d' which isn't a local branch
If you want to create a new branch from this
checkout, you may do so
(now or later) by using -b with the checkout command
again. Example:
  git checkout -b <new_branch_name>
HEAD is now at a67061d...
```
...work work work...
```
git commit -a -m 'this is cool'
[detached HEAD a67061d] add foo.txt
git status
# Not currently on any branch.
nothing to commit (working directory clean)
```



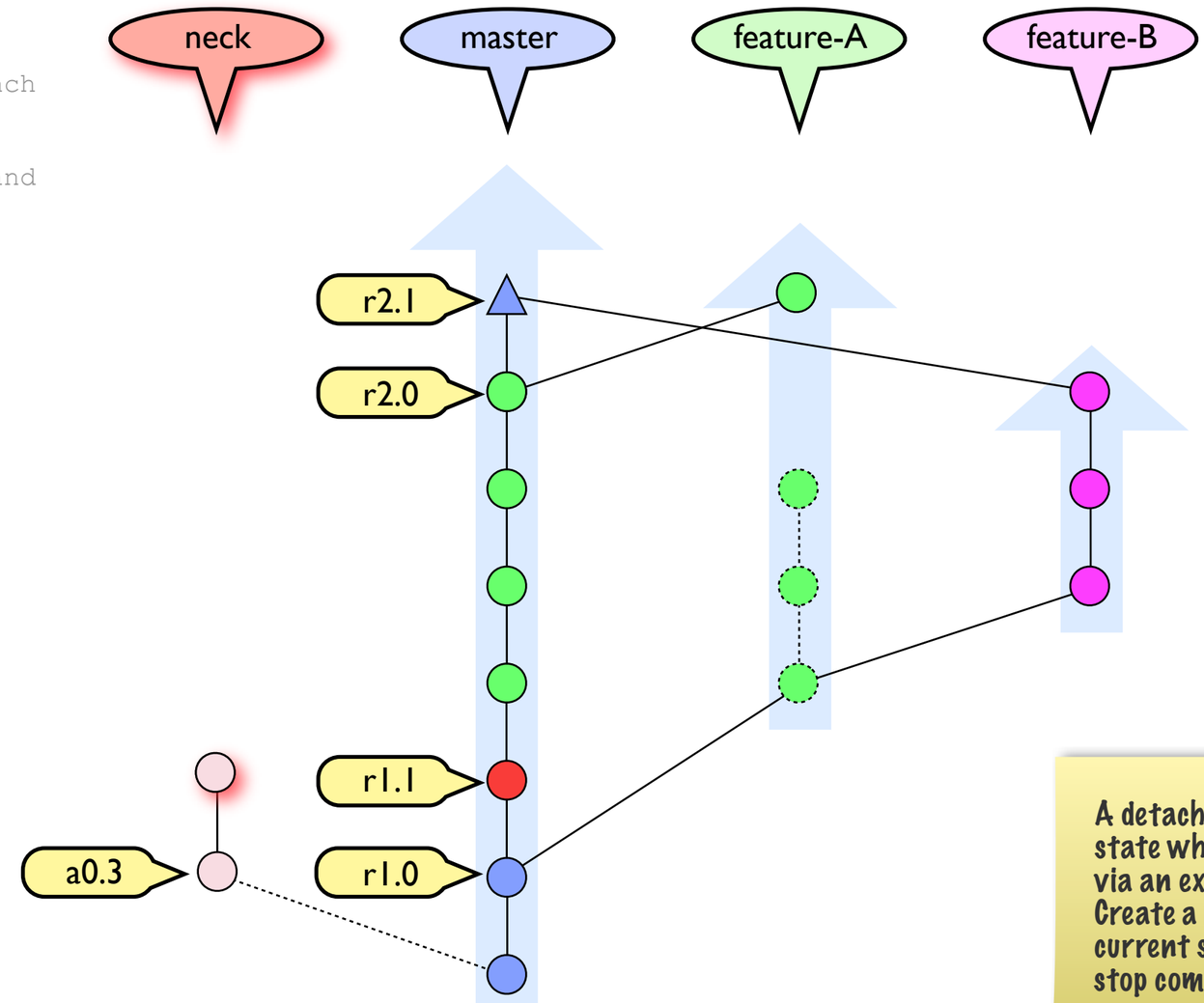
```
git checkout a0.3
Note: moving to 'a67061d' which isn't a local branch
If you want to create a new branch from this
checkout, you may do so
(now or later) by using -b with the checkout command
again. Example:
  git checkout -b <new_branch_name>
HEAD is now at a67061d...
```
...work work work...
```
git commit -a -m 'this is cool'
[detached HEAD a67061d] add foo.txt
git status
# Not currently on any branch.
nothing to commit (working directory clean)
git checkout -b neck
```



```
git checkout a0.3
Note: moving to 'a67061d' which isn't a local branch
If you want to create a new branch from this
checkout, you may do so
(now or later) by using -b with the checkout command
again. Example:
  git checkout -b <new_branch_name>
HEAD is now at a67061d...
...work work work...
git commit -a -m 'this is cool'
[detached HEAD a67061d] add foo.txt
git status
# Not currently on any branch.
nothing to commit (working directory clean)
git checkout -b neck
Switched to a new branch 'neck'
```



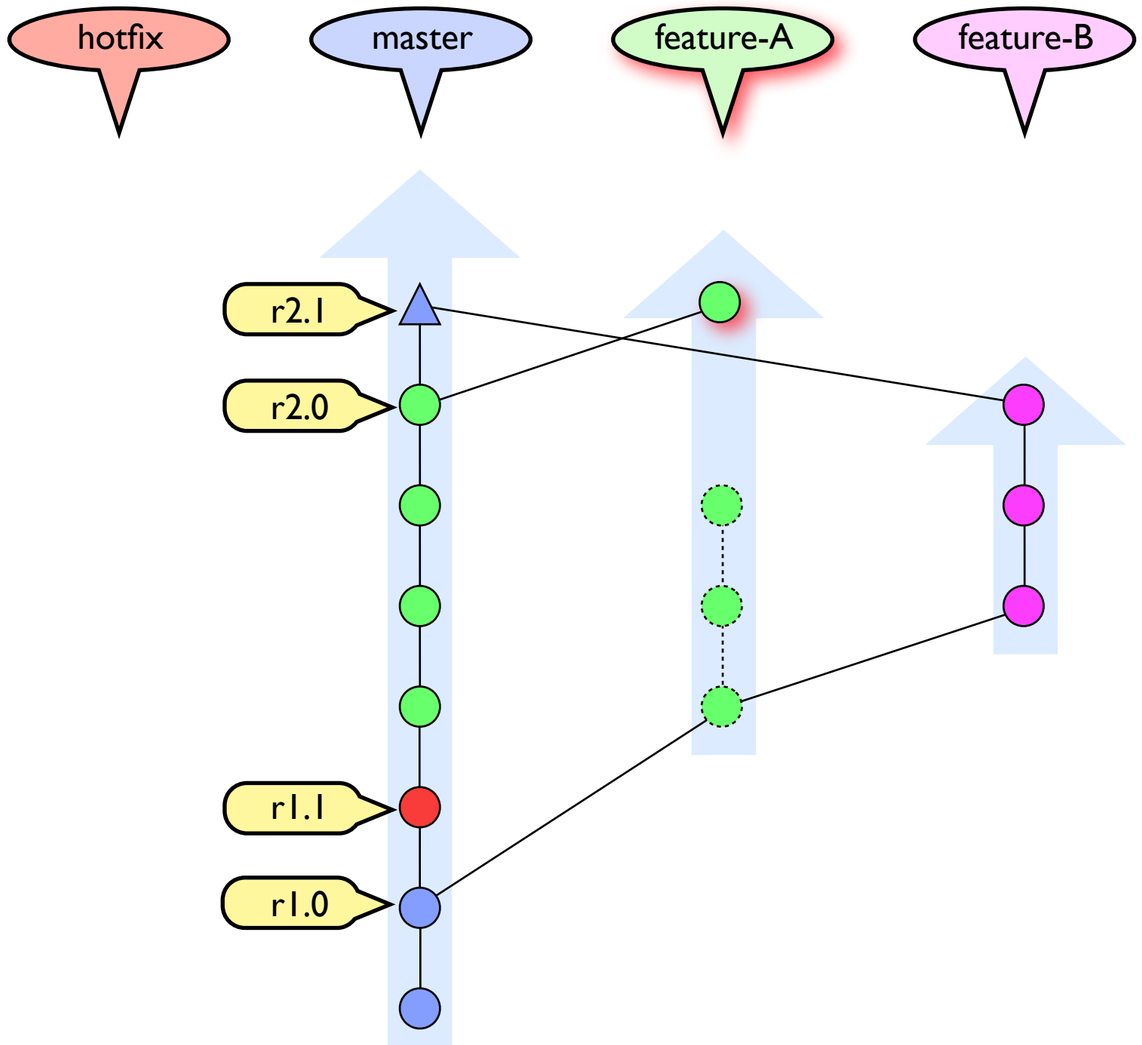
```
git checkout a0.3
Note: moving to 'a67061d' which isn't a local branch
If you want to create a new branch from this
checkout, you may do so
(now or later) by using -b with the checkout command
again. Example:
  git checkout -b <new_branch_name>
HEAD is now at a67061d...
...work work work...
git commit -a -m 'this is cool'
[detached HEAD a67061d] add foo.txt
git status
# Not currently on any branch.
nothing to commit (working directory clean)
git checkout -b neck
Switched to a new branch 'neck'
git status
# On branch neck
nothing to commit (working directory clean)
```



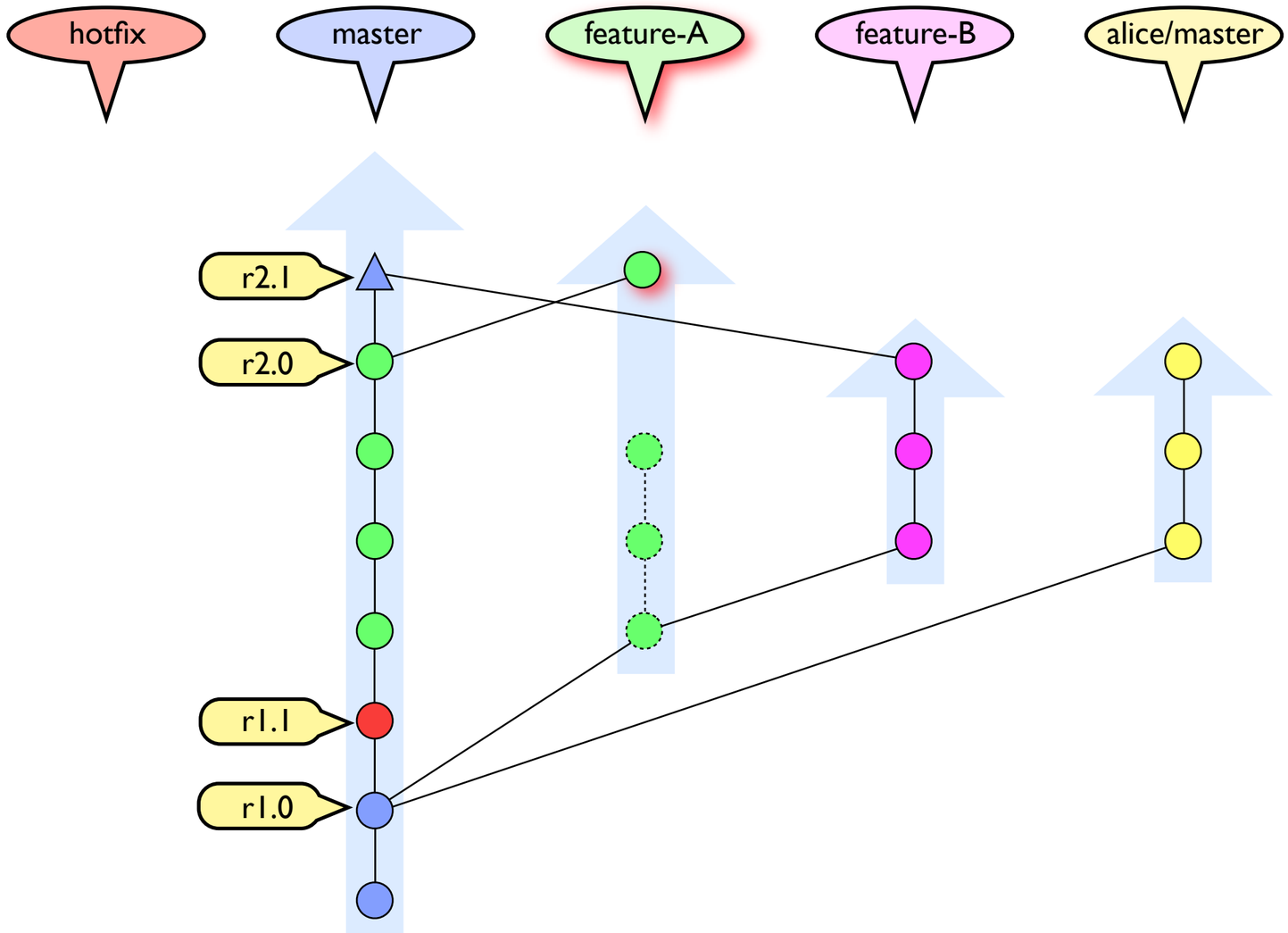
A detached head is just a state which cannot reached via an existing branch. Create a new branch for the current state and git will stop complaining

Multiple Repositories

```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
…resolve conflicts…
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
git checkout master
git merge feature-B
…resolve conflicts…
git commit -a -m 'merge feature-B into master'
git tag -a r2.1 -m 'wow release'
git checkout feature-A
git commit -a -m 'feature-A extension'
```

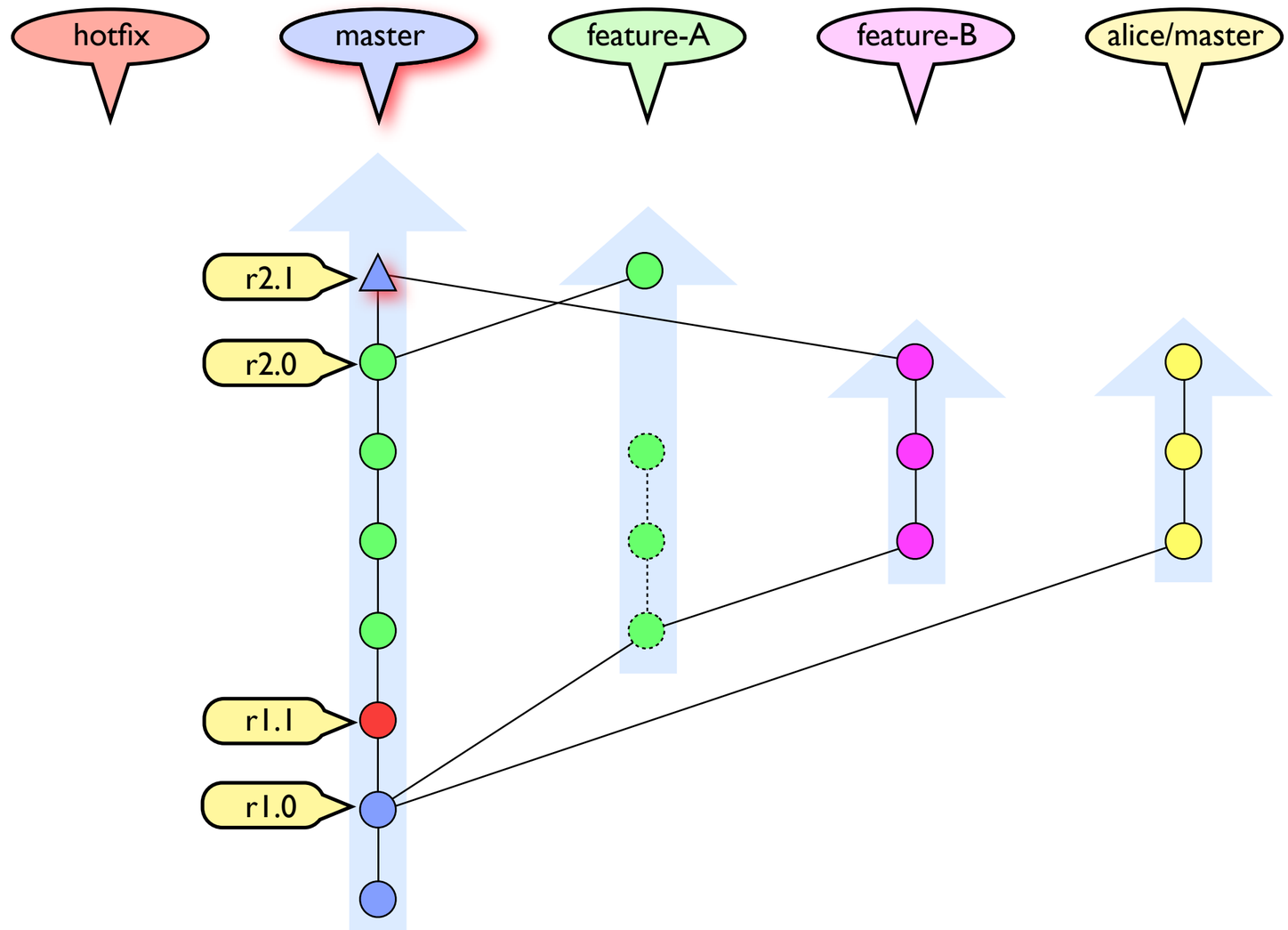


```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
…resolve conflicts…
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
git checkout master
git merge feature-B
…resolve conflicts…
git commit -a -m 'merge feature-B into master'
git tag -a r2.1 -m 'wow release'
git checkout feature-A
git commit -a -m 'feature-A extension'
git fetch alice
```

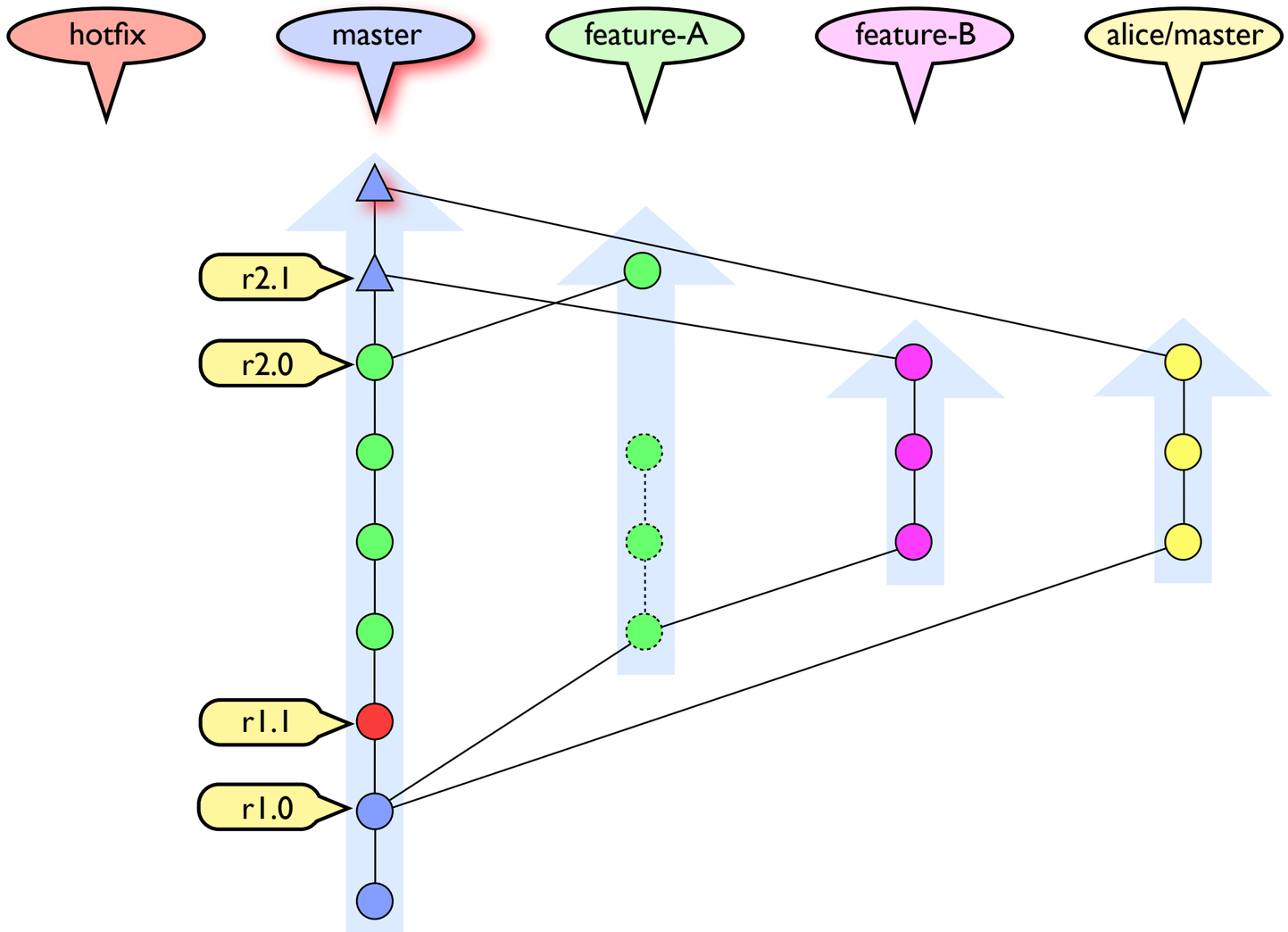


Fetching from a remote repository doesn't change your commit tree!

```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
```
…resolve conflicts…
```
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
git checkout master
git merge feature-B
```
…resolve conflicts…
```
git commit -a -m 'merge feature-B into master'
git tag -a r2.1 -m 'wow release'
git checkout feature-A
git commit -a -m 'feature-A extension'
git fetch alice
git checkout master
```

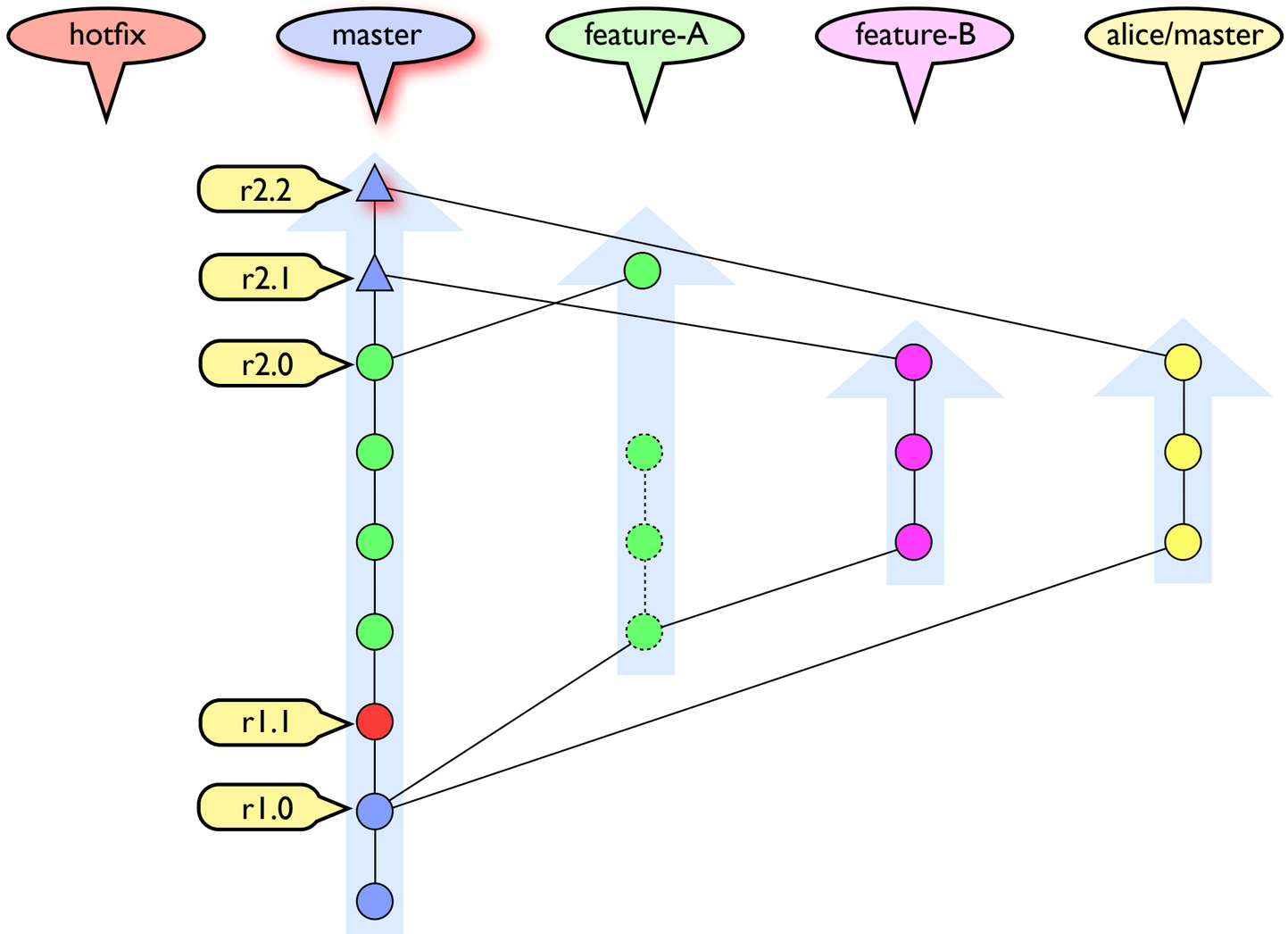


```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
```
…resolve conflicts…
```
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
git checkout master
git merge feature-B
```
…resolve conflicts…
```
git commit -a -m 'merge feature-B into master'
git tag -a r2.1 -m 'wow release'
git checkout feature-A
git commit -a -m 'feature-A extension'
git fetch alice
git checkout master
git merge alice/master
```
…resolve conflicts…
```
git commit -a -m 'merge alice/master into master'
```



`git pull` **combines fetch and merge!**

```
git checkout master
git checkout -b feature-A
git commit -a -m 'basic feature A structure'
git checkout -b feature-B
git commit -a -m 'basic feature B structure'
git commit -a -m 'debug feature B'
git checkout feature-A
git commit -a -m 'finish feature A'
git commit -a -m 'debug feature A'
git checkout -b hotfix r1.0
git commit -a -m 'keep customer happy'
git checkout master
git merge hotfix
git tag -a r1.1 -m 'security update'
git checkout feature-A
git rebase master
```
…resolve conflicts…
```
git rebase --continue
git commit -a -m 'polish feature A'
git checkout master
git merge feature-A
git tag -a 2.0 -m 'new and improved release'
git checkout feature-B
git commit -a -m 'polish feature-B'
git checkout master
git merge feature-B
```
…resolve conflicts…
```
git commit -a -m 'merge feature-B into master'
git tag -a r2.1 -m 'wow release'
git checkout feature-A
git commit -a -m 'feature-A extension'
git checkout master
git fetch alice
git merge alice/master
```
…resolve conflicts…
```
git commit -a -m 'merge alice/master into master'
git tag -a r2.2 -m 'insecurity update'
```



Publishing Your Repository

```
local ~/project/ >          ssh me@remote.com

remote ~/ >                 mkdir project.git

remote ~/project.git/ >     cd project.git

remote ~/project.git/ >     git init --bare

remote ~/project.git/ >     logout

local ~/project/ >          git remote add public_repo ssh://me@remote.com/~/project.git

local ~/project/ >          git push public_repo release_branch
```

you should NOT publish your private directories (basic security)

create a `bare repository` on a public server

push only the branches your wish to publish

USB-Stick

```
~/project/ > git clone --bare . /Volumes/usb_stick/project.git
```

```
~/project/ > git remote add usb_stick /Volumes/usb_stick/project.git
```

```
~/project/ > git push usb_stick
```

USB stick, external disk

great for ad-hoc sharing

great for backup

treat like a public repository

Which Repos Am I Connected To?

```
~/project_dir/ > git remote -v

public_repo    ssh://me@remote.com/~/project.git (fetch)
public_repo    ssh://me@remote.com/~/project.git (push)
usb_stick      /Volumes/usb_stick/project.git (fetch)
usb_stick      /Volumes/usb_stick/project.git (push)
```

Updates From Multiple Repos

```
~/project/ > $EDITOR .git/config

...
[remote "steve"]
        url = ssh://steveserve.com/~/Git/project.git
        fetch = +refs/heads/*:refs/remotes/steve/*
[remote "mac"]
        url = git@github.com:mac/project.git
        fetch = +refs/heads/*:refs/remotes/mac/*
[remotes]
        buddies = steve mac
...

~/project/ > git remote update buddies
Updating steve
...
Updating mac
...
```

Working With Others

Publish your changes via a bare repository

Never push to someone else's repository

Use `git remote update` to track multiple repositories

Use `git show-branch` or `git whatchanged` to see what's new

Rewriting History

What if you want to…

…find the commit that introduced a problem…

…remove some commits from the history…

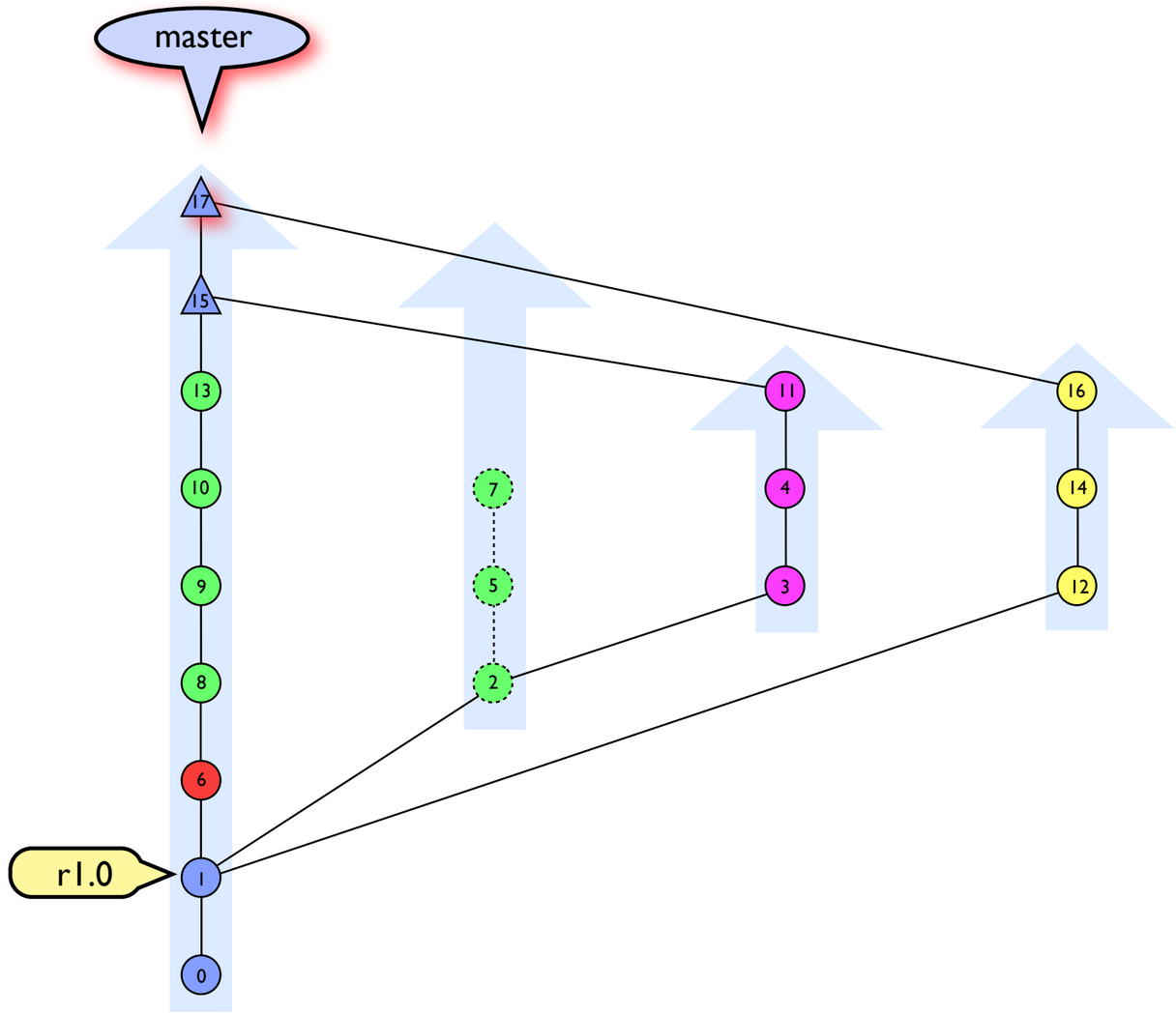
…add one or more commits from one branch to another…

…work on a branch for a long time…

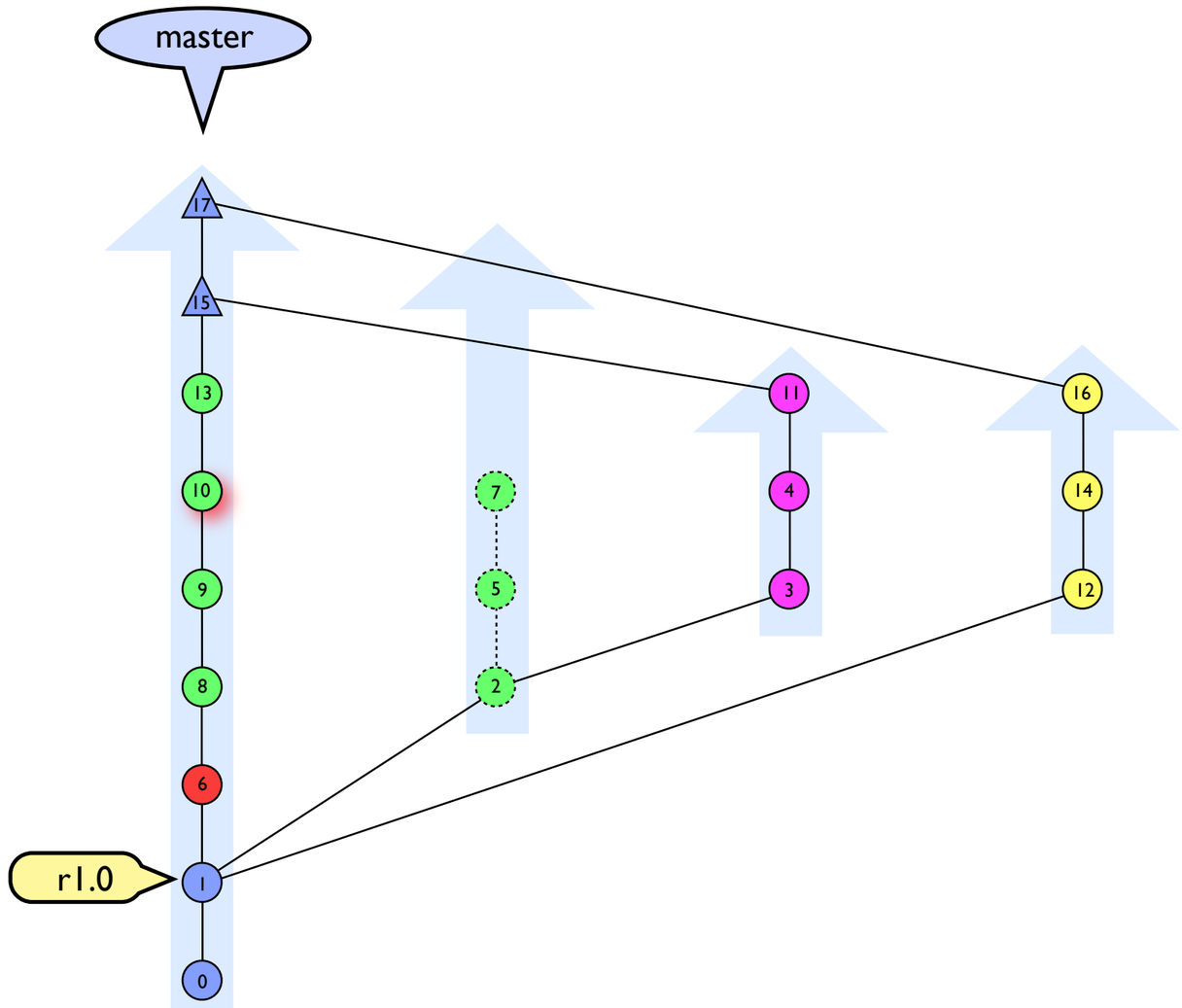
Finding Bad Commits

Git Bisect

```
git checkout master
```

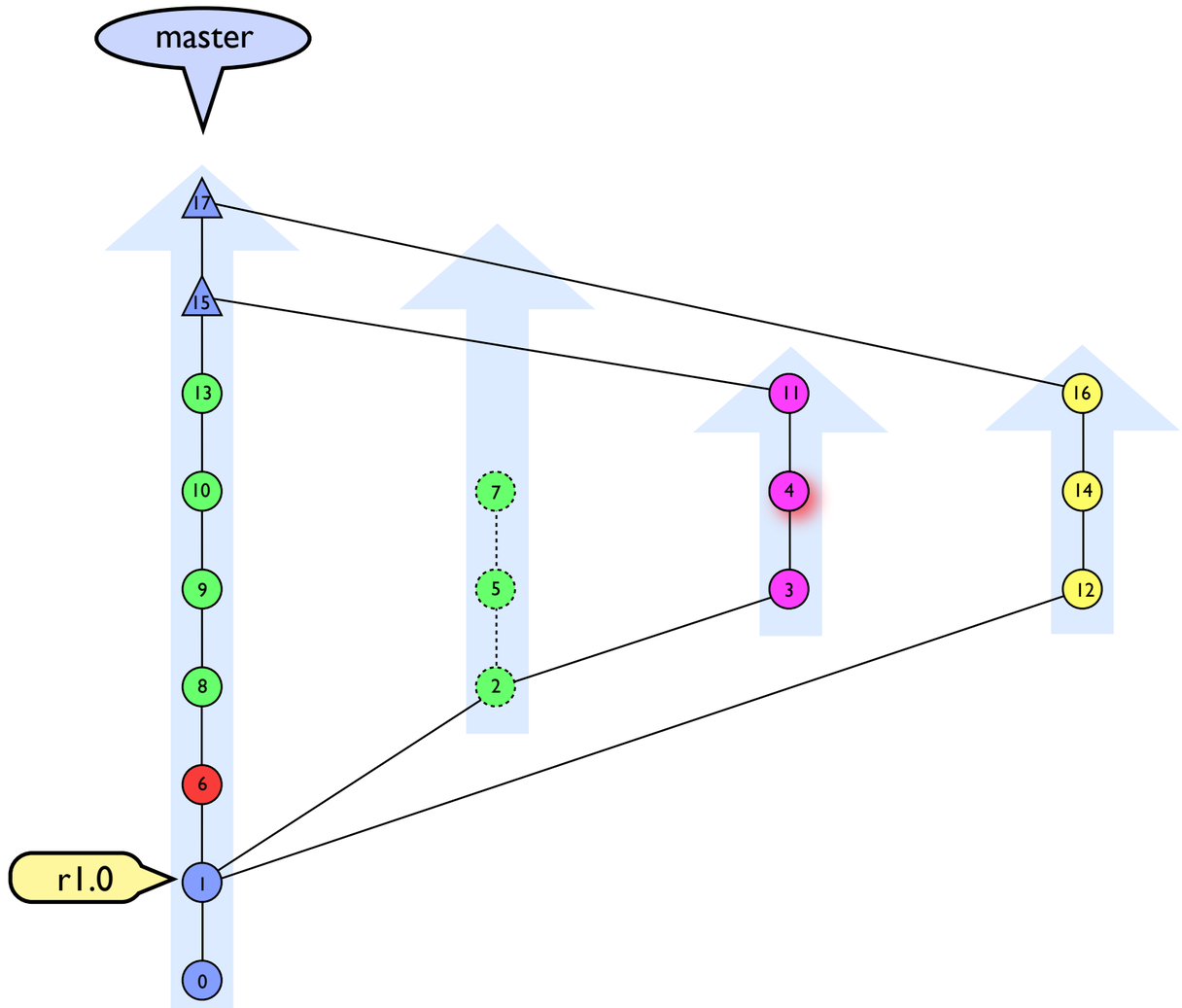


```
git checkout master
git bisect start
git bisect bad master
git bisect good r1.0

Bisecting: ## revisions left to test after this
[10] commit message
```



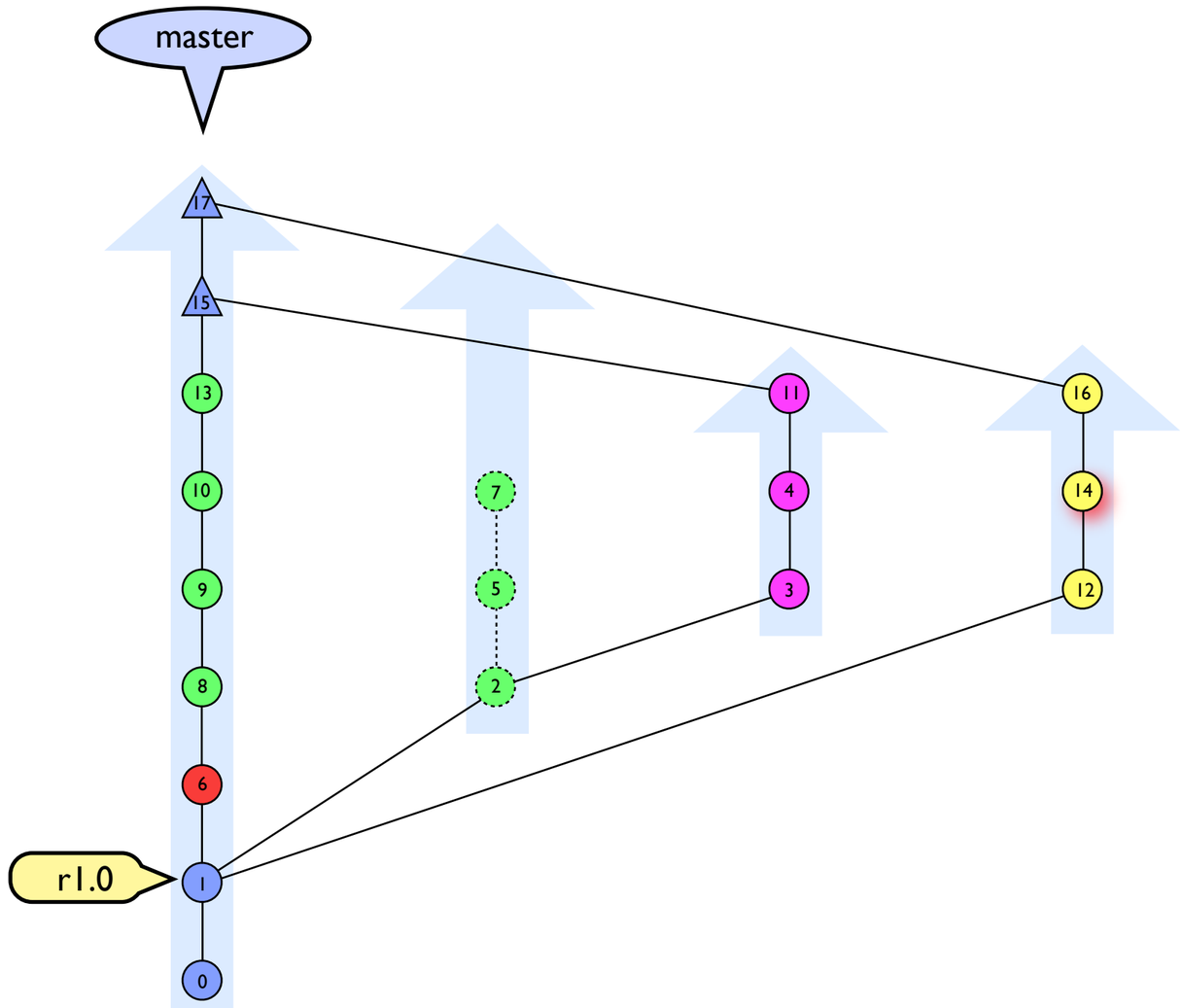
git has checked out a commit for you to test…
Is the problem currently checked out?
If not call `git bisect good`

```
git checkout master
git bisect start
git bisect bad master
git bisect good r1.0

Bisecting: ## revisions left to test after this
[10] commit message

git bisect good

Bisecting: ## revisions left to test after this
[4] commit message
```



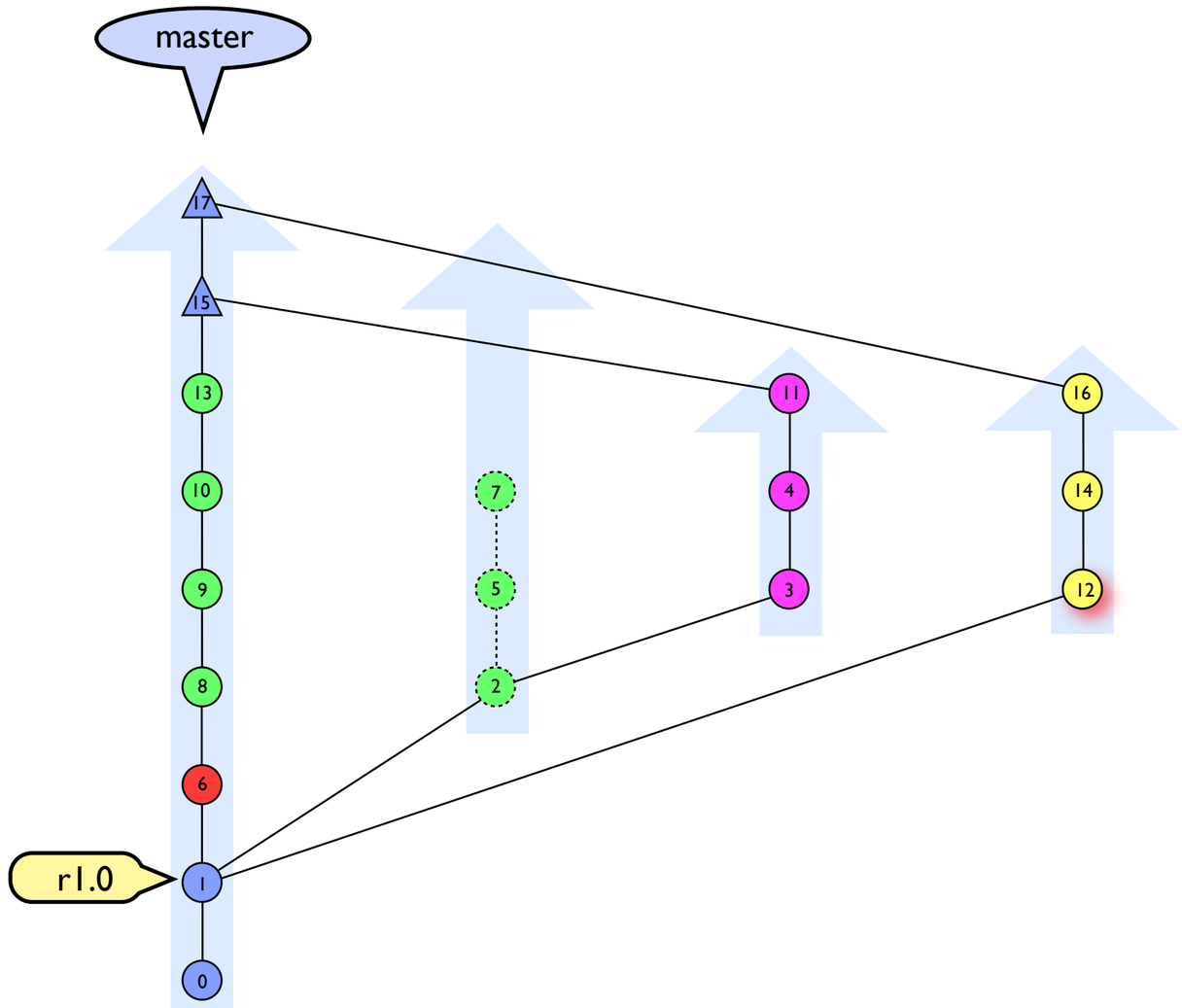
git has checked out another commit for you to test…
Can't test this version? (doesn't compile?)
If so call `git bisect skip`

```
git checkout master
git bisect start
git bisect bad master
git bisect good r1.0

Bisecting: ## revisions left to test after this
[10] commit message

git bisect good

Bisecting: ## revisions left to test after this
[4] commit message

git bisect skip

Bisecting: ## revisions left to test after this
[14] commit message
```



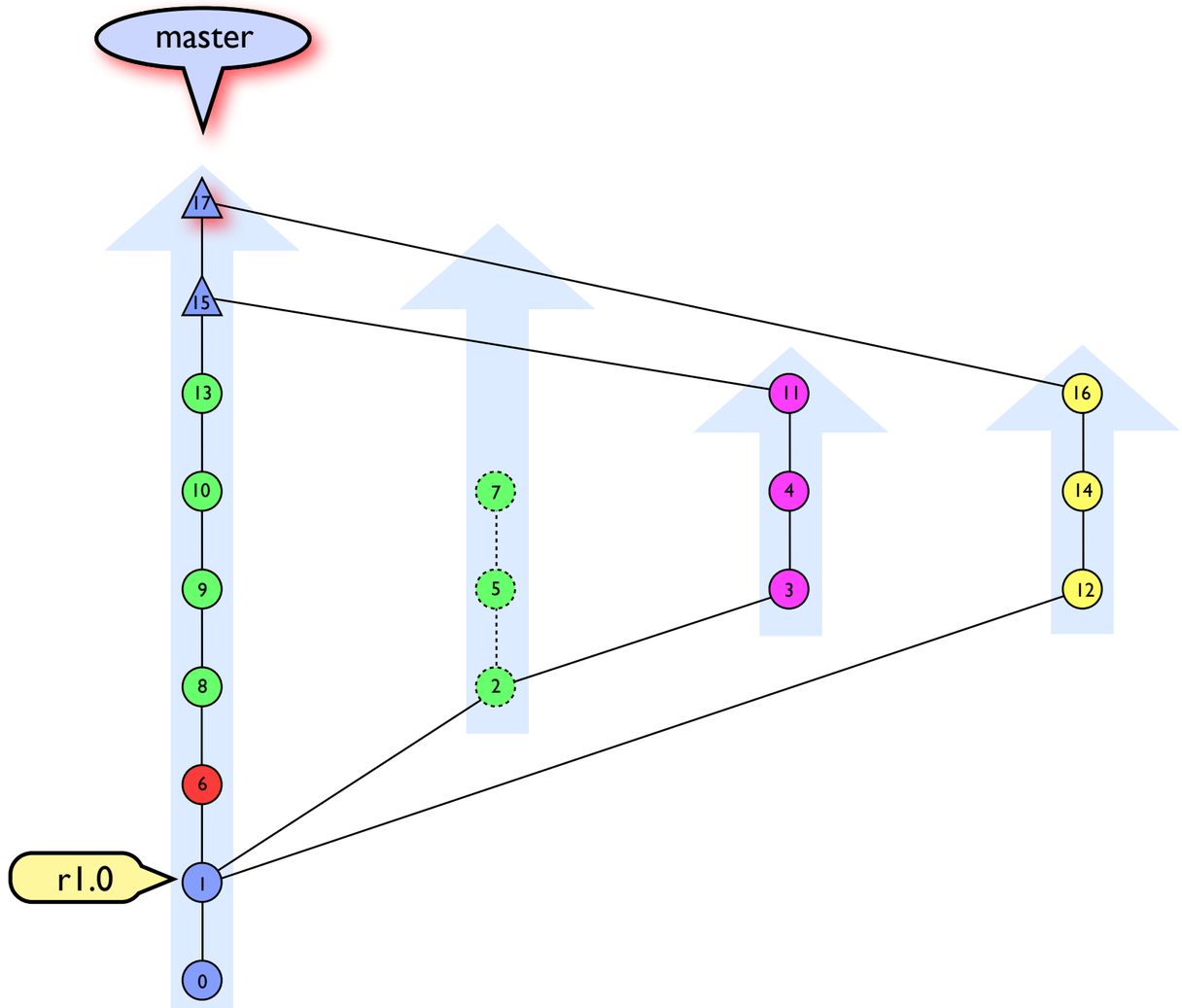
Another commit for you to test…
Is the problem currently checked out?
If so call `git bisect bad`

```
git checkout master
git bisect start
git bisect bad master
git bisect good r1.0

Bisecting: ## revisions left to test after this
[10] commit message

git bisect good

Bisecting: ## revisions left to test after this
[4] commit message

git bisect skip

Bisecting: ## revisions left to test after this
[14] commit message

git bisect bad

12 is the first bad commit
```



Now you know where the problem is.
Go back to your branch and fix it with a normal commit.

```
git checkout master
git bisect start
git bisect bad master
git bisect good r1.0

Bisecting: ## revisions left to test after this
[10] commit message

git bisect good

Bisecting: ## revisions left to test after this
[4] commit message

git bisect skip

Bisecting: ## revisions left to test after this
[14] commit message

git bisect bad

12 is the first bad commit

git bisect reset
```



Git Bisect Automation

git bisect start *bad_commit good_commit*

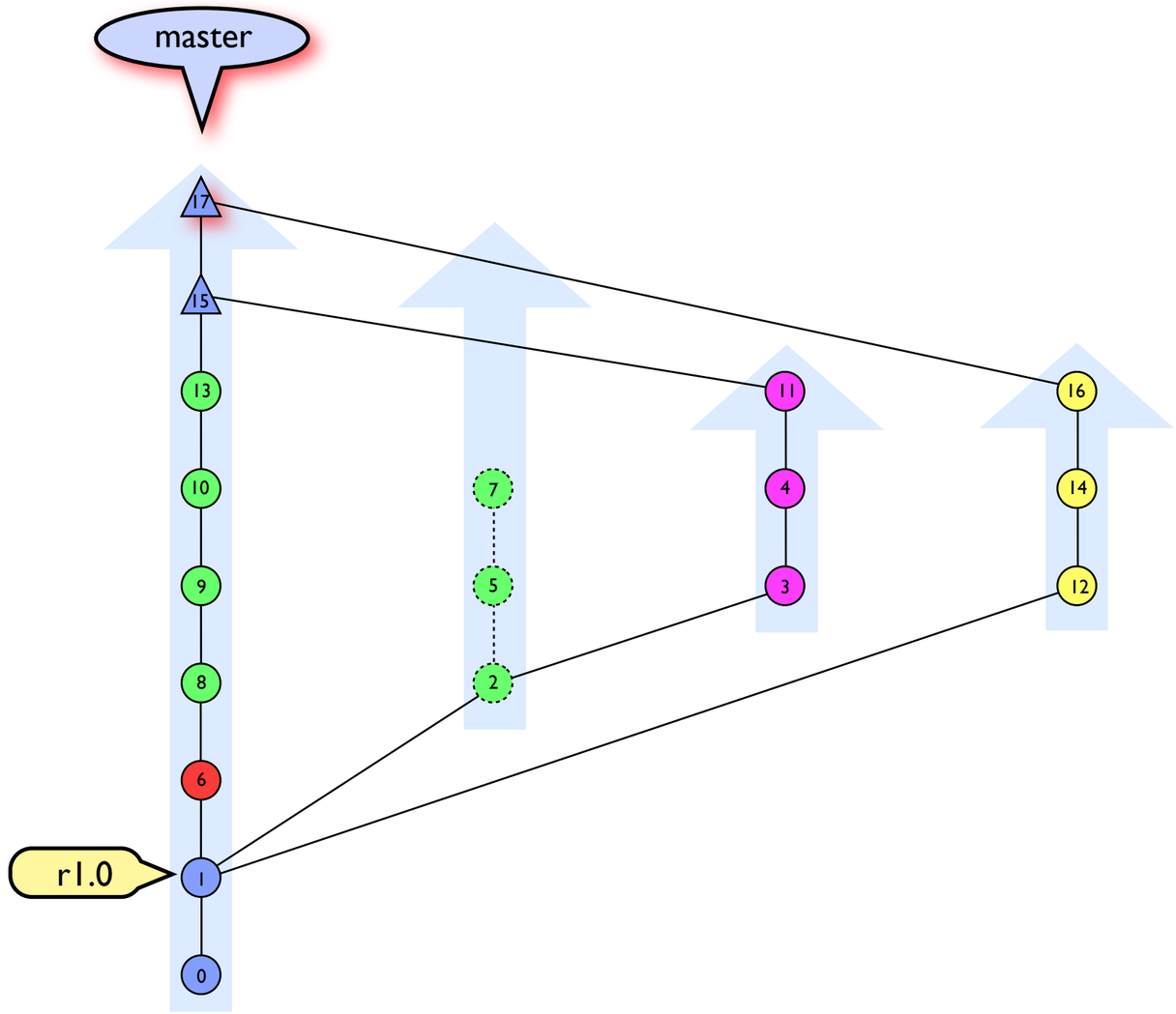
git bisect run *test_script options…*

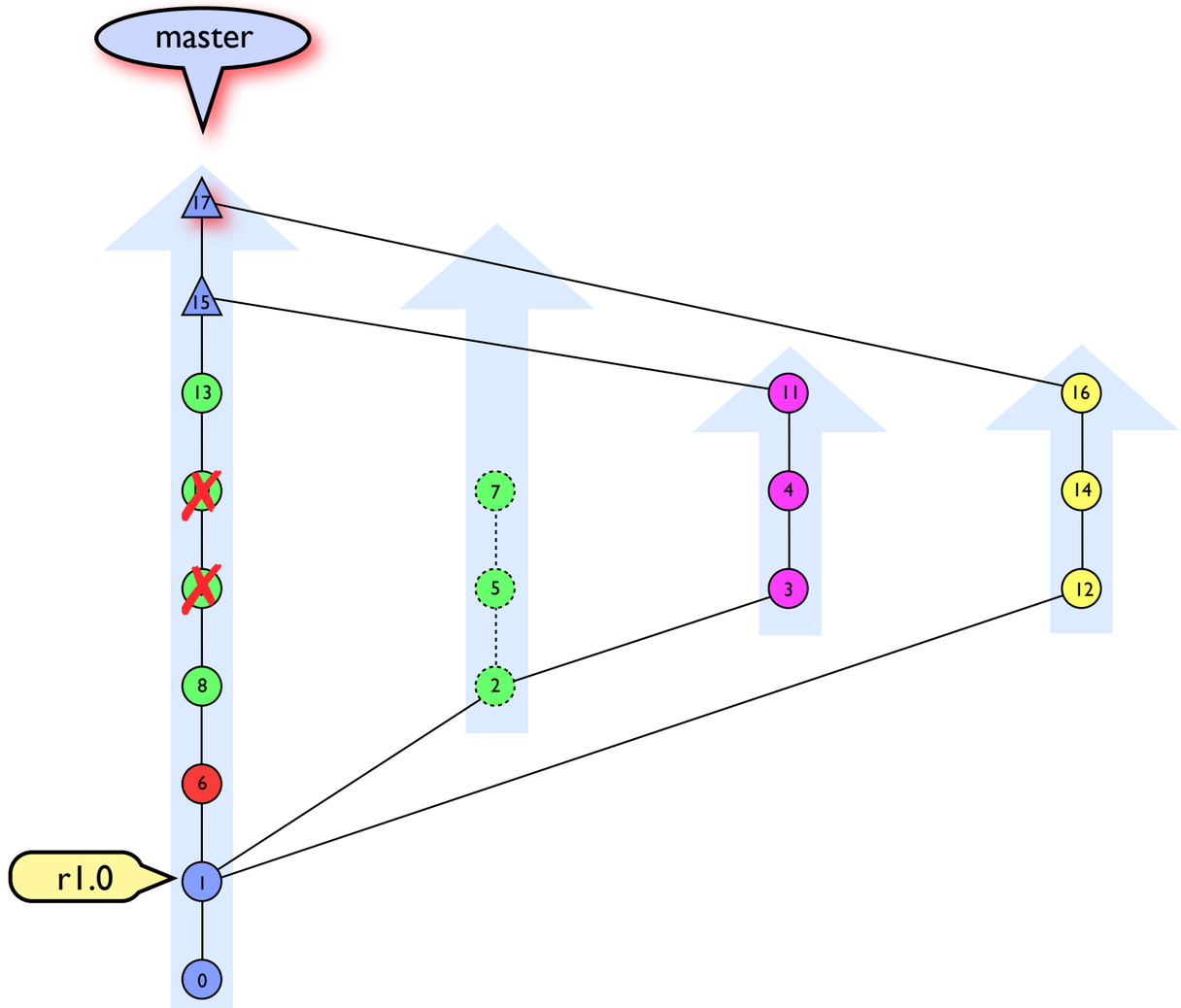
Test script exit codes:

```
exit 0          => good

exit 125        => skip

exit 1 .. 127 => bad
```

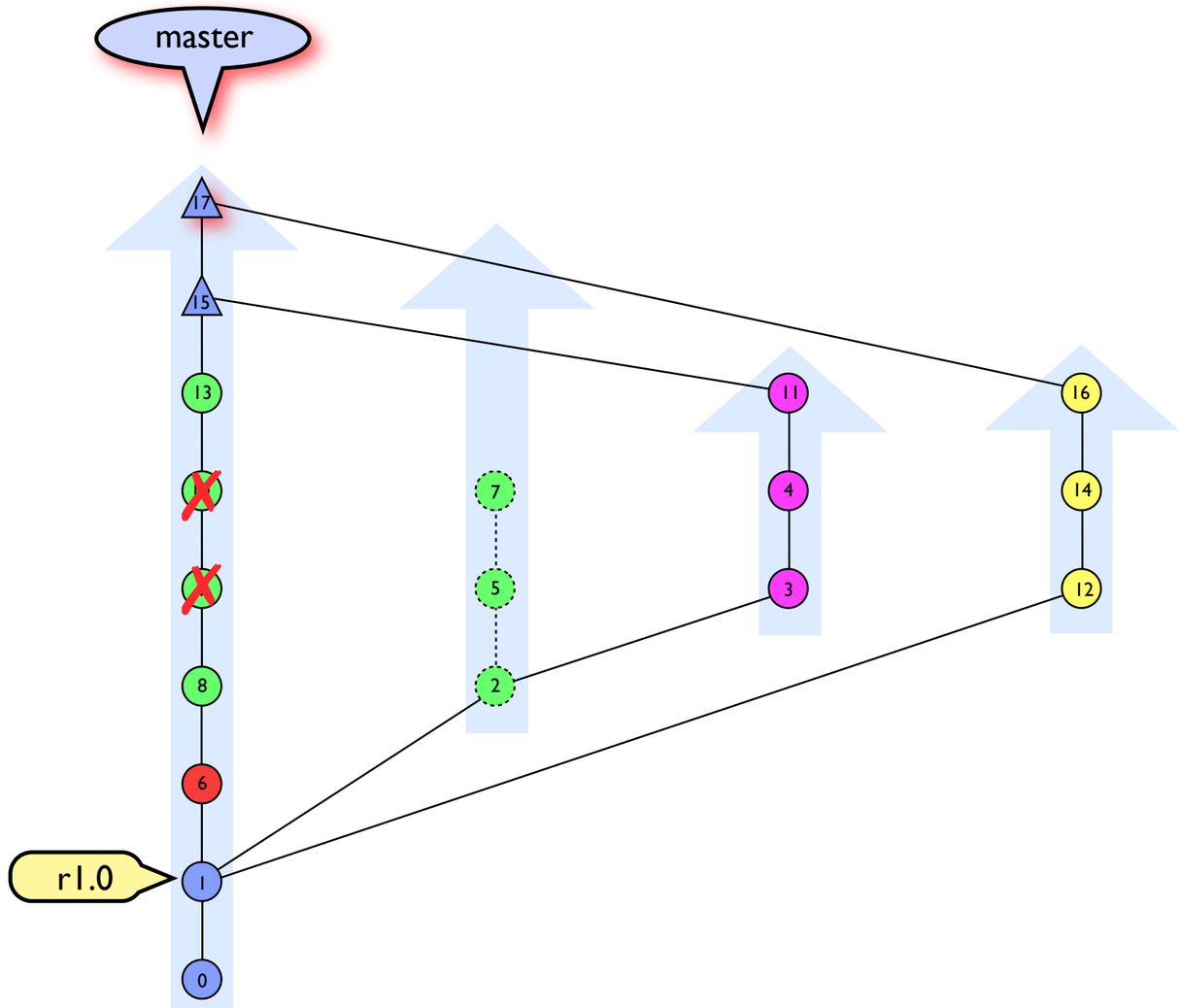
Removing Bad Commits

Interactive Rebasing

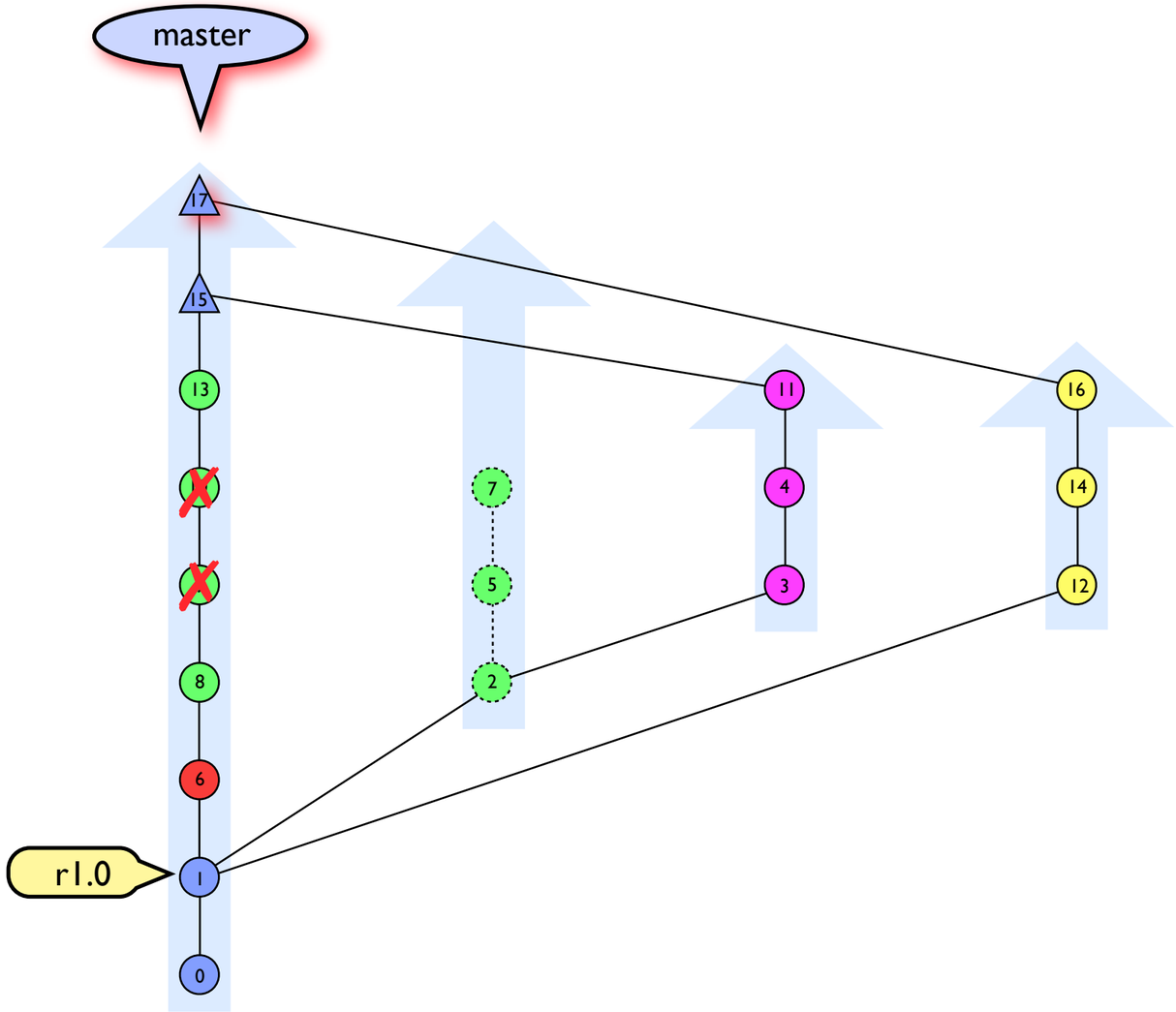




```
git checkout master
git rebase --interactive r1.0
```

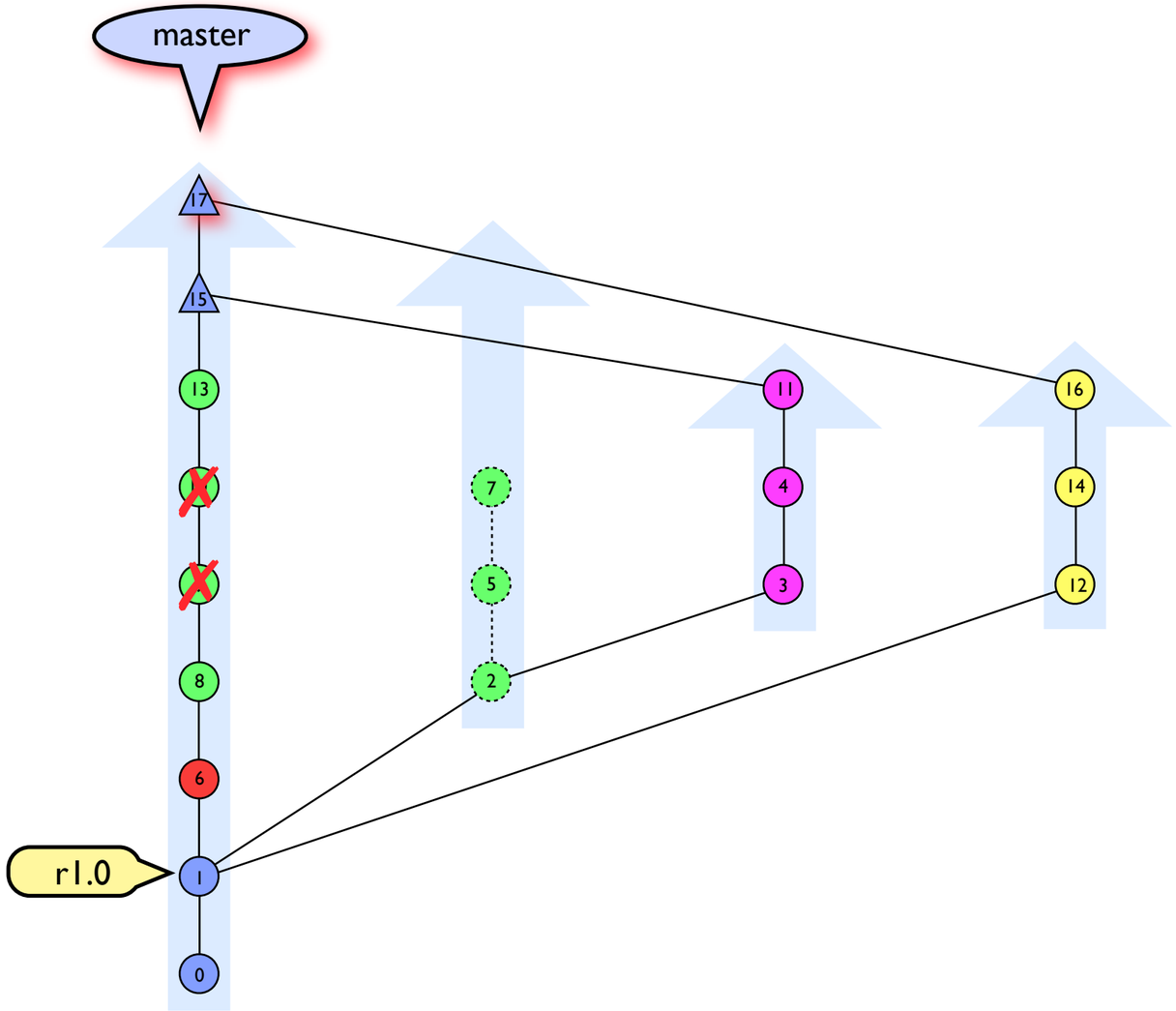


```
pick ca4f103  6 hotfix
pick 1f85820  8 feature_A - first try
pick 9b6e08e  9 feature_A - with signature
pick 7d86f88 10 feature_A with more detail
pick e29b897  2 feature_A - first try
pick 39f4215  3 first attempt at feature B
pick f4449ad  4 feature_B comments
pick 27c2b4c 11 feature_B fix wrong spellt world

# Rebase 2aa3032..5af9beb onto 2aa3032
#
# Commands:
#  p, pick = use commit
#  e, edit = use commit, but stop for amending
#  s, squash = use commit, but meld into previous commit
#
# If you remove a line here THAT COMMIT WILL BE LOST.
# However, if you remove everything, the rebase will be aborted.
#
```



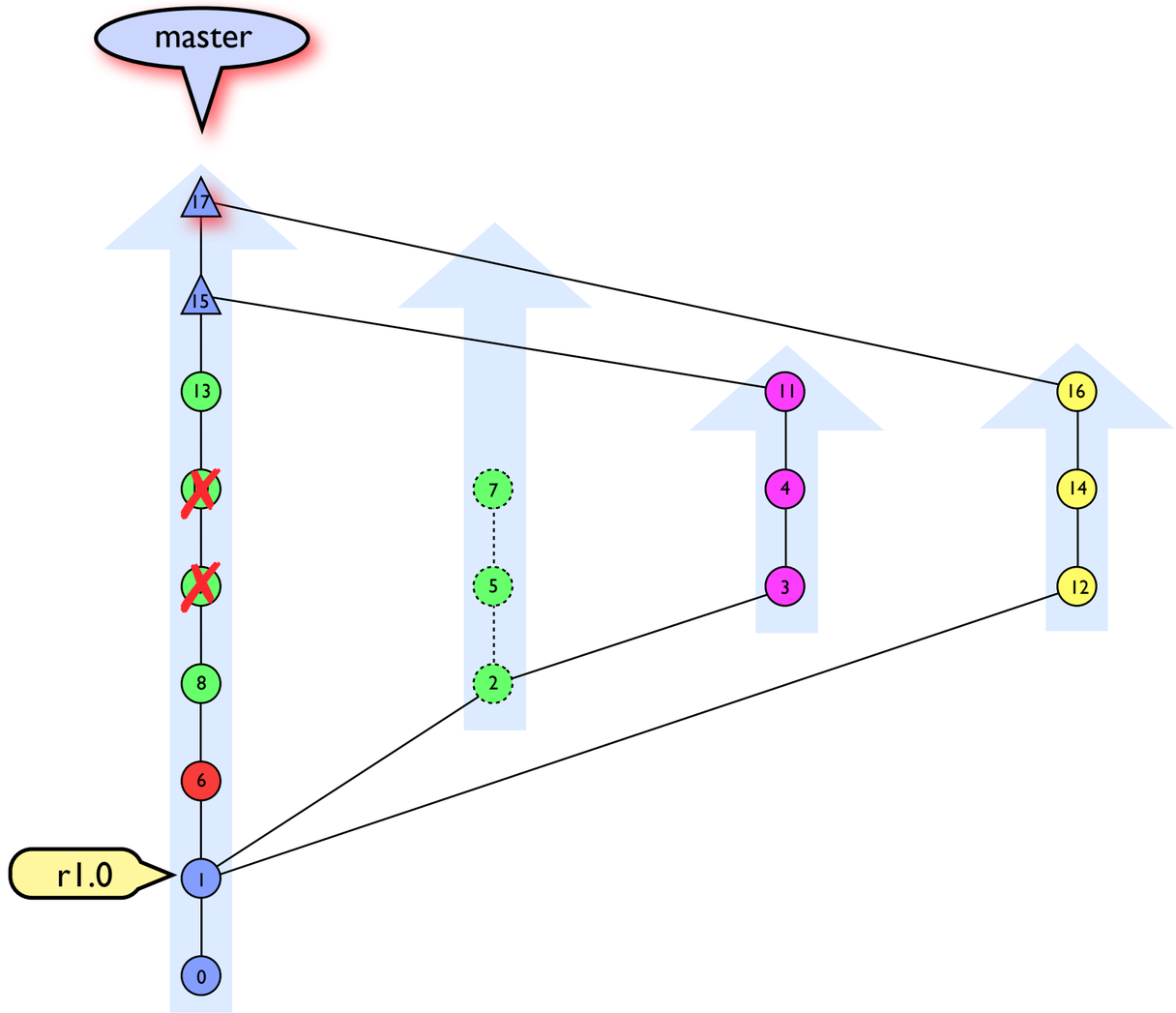
Warning!
Newest commits are at the bottom!
(git show-branch etc. put the newest commit at the top)

```
pick ca4f103  6 hotfix
pick 1f85820  8 feature_A - first try
pick 9b6e08e  9 feature_A - with signature
pick 7d86f88 10 feature_A with more detail
pick e29b897  2 feature_A - first try
pick 39f4215  3 first attempt at feature B
pick f4449ad  4 feature_B comments
pick 27c2b4c 11 feature_B fix wrong spellt world

# Rebase 2aa3032..5af9beb onto 2aa3032
#
# Commands:
#  p, pick = use commit
#  e, edit = use commit, but stop for amending
#  s, squash = use commit, but meld into previous commit
#
# If you remove a line here THAT COMMIT WILL BE LOST.
# However, if you remove everything, the rebase will be aborted.
#
```

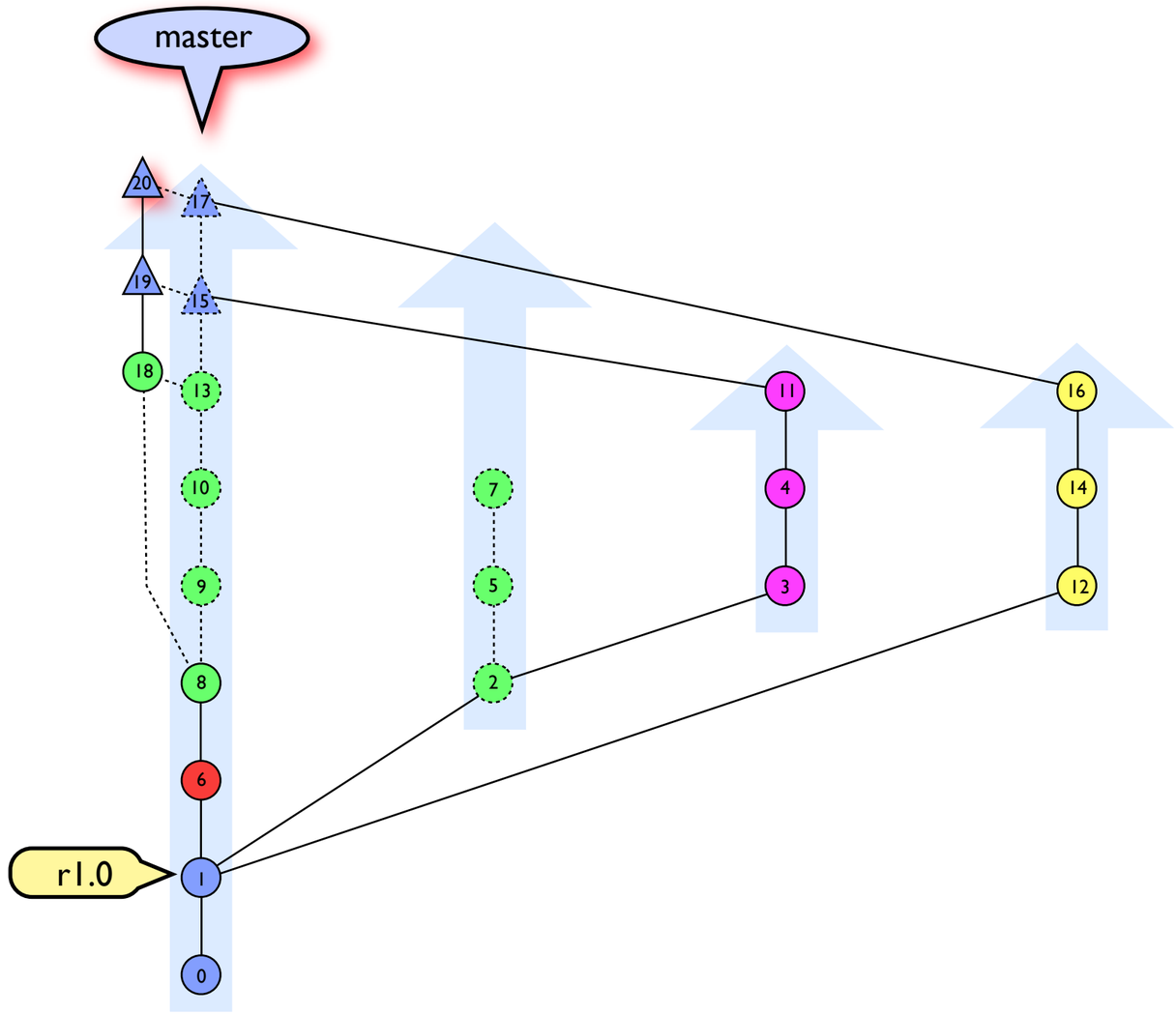


Delete the lines of commits you don't want.
Change `pick` to `squash` if you want merge commits,
or `edit` if you want to split a commit into smaller commits.

```
pick ca4f103  6 hotfix
pick 1f85820  8 feature_A - first try


pick e29b897  2 feature_A - first try
pick 39f4215  3 first attempt at feature B
pick f4449ad  4 feature_B comments
pick 27c2b4c 11 feature_B fix wrong spellt world

# Rebase 2aa3032..5af9beb onto 2aa3032
#
# Commands:
#  p, pick = use commit
#  e, edit = use commit, but stop for amending
#  s, squash = use commit, but meld into previous commit
#
# If you remove a line here THAT COMMIT WILL BE LOST.
# However, if you remove everything, the rebase will be aborted.
#
```



save the file and exit your editor…
git performs the rebase automatically



Adding Commits To Other Branches

Cherry Picking

Add just one commit to the current branch:

```
git cherry-pick sha1
```

Rebasing Onto Another Branch

Add a chain of commits, not the whole branch:

```
git rebase --onto target_commit first_commit last_commit
```

Many Thanks To:

Patrick Stein (Venue)

Matthias Carell (Estemed Critic)

CocoaHeads Munich (Avid Listeners)