寫給大家的 *Git* 教學

Littlebtc (Hsiao-Ting Yu)

What is Version Control?

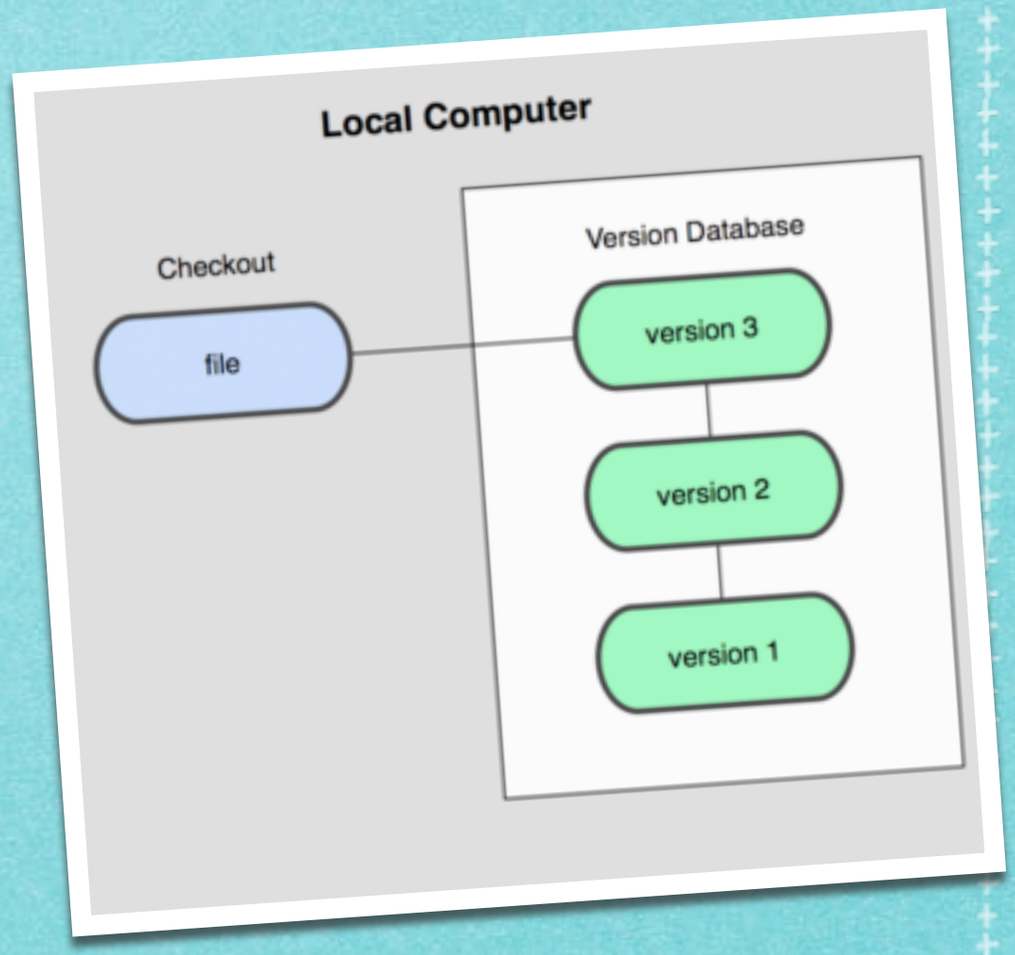
What is Git?

為什麼要版本控制？

- 「凡走過必留下痕跡」
  - 改了東西，不會改不回來
- 「三個臭皮匠勝過一個諸葛亮」
  - 大家一起改，還能清楚知道對方改了什麼

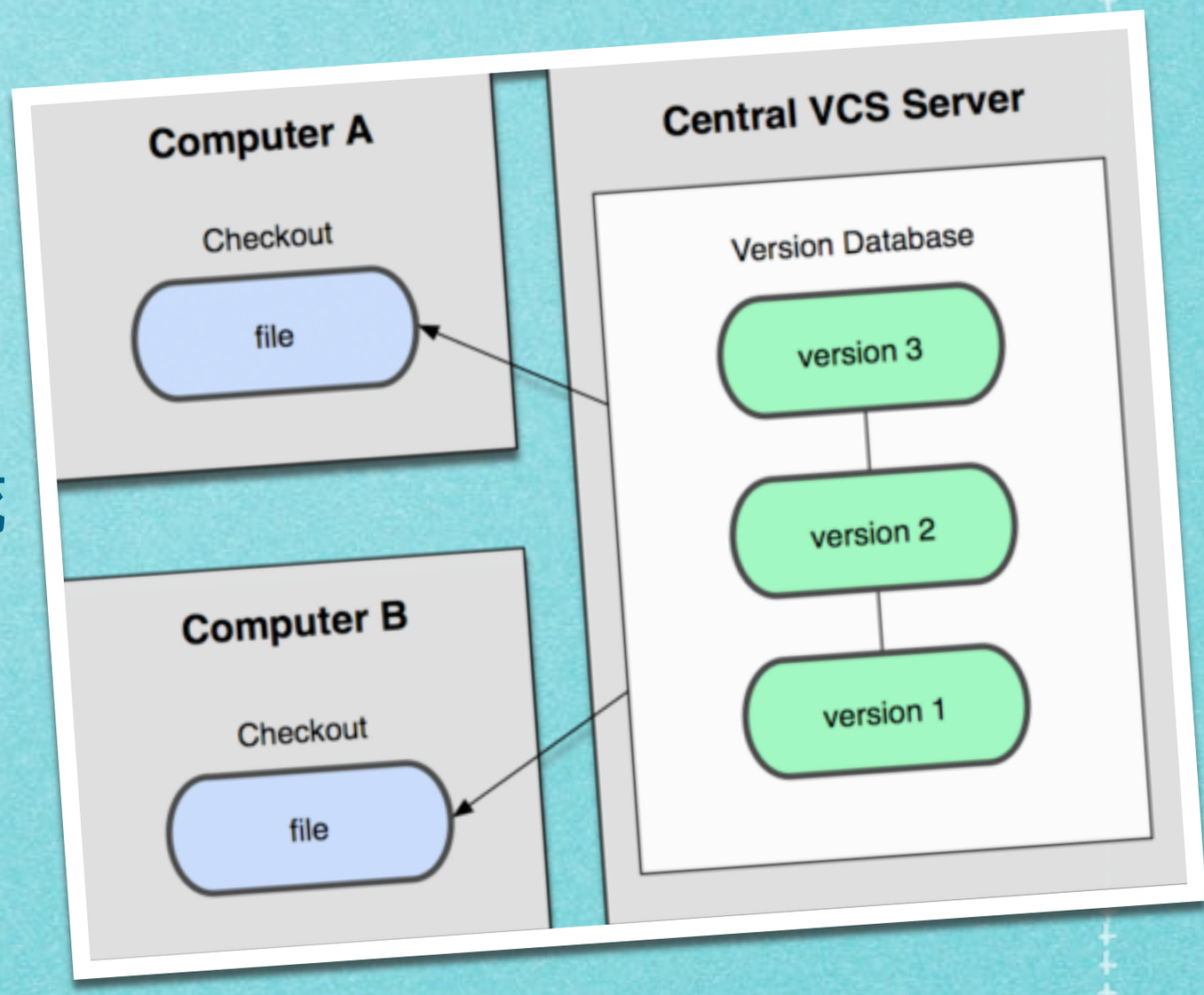
Local 式版本控制

- 在「自己的電腦裡」建立一個版本資料庫
- rcs 指令
- 問題：如何協作？



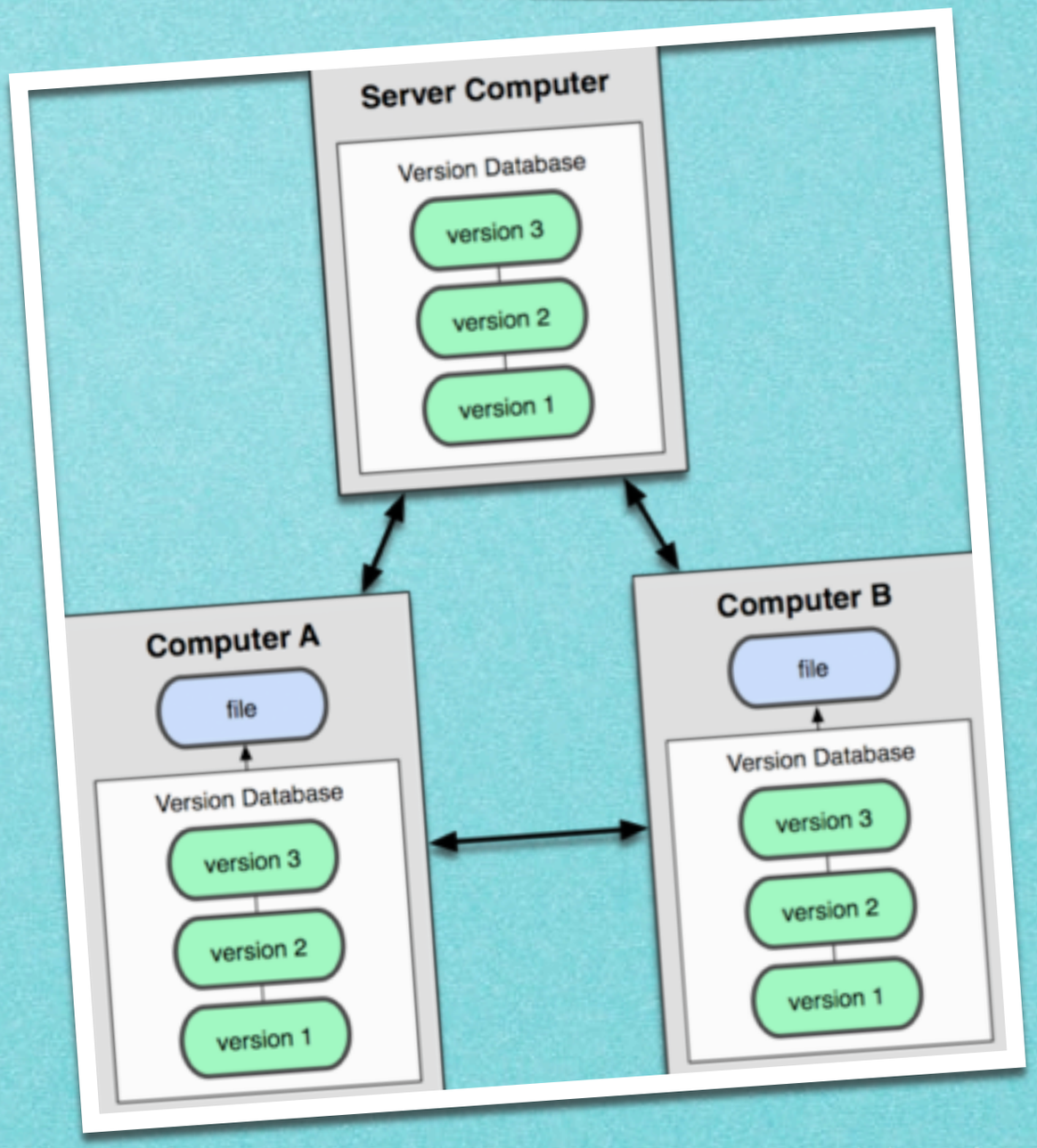
中心式版本控制

- 在一台Server上，儲存所有的版本記錄
- 從裡頭Checkout
  將變更Commit上去
- Subversion（SVN）是主流
- 問題：
  - Server會掛！
  - 開發太亂！



分散式版本控制

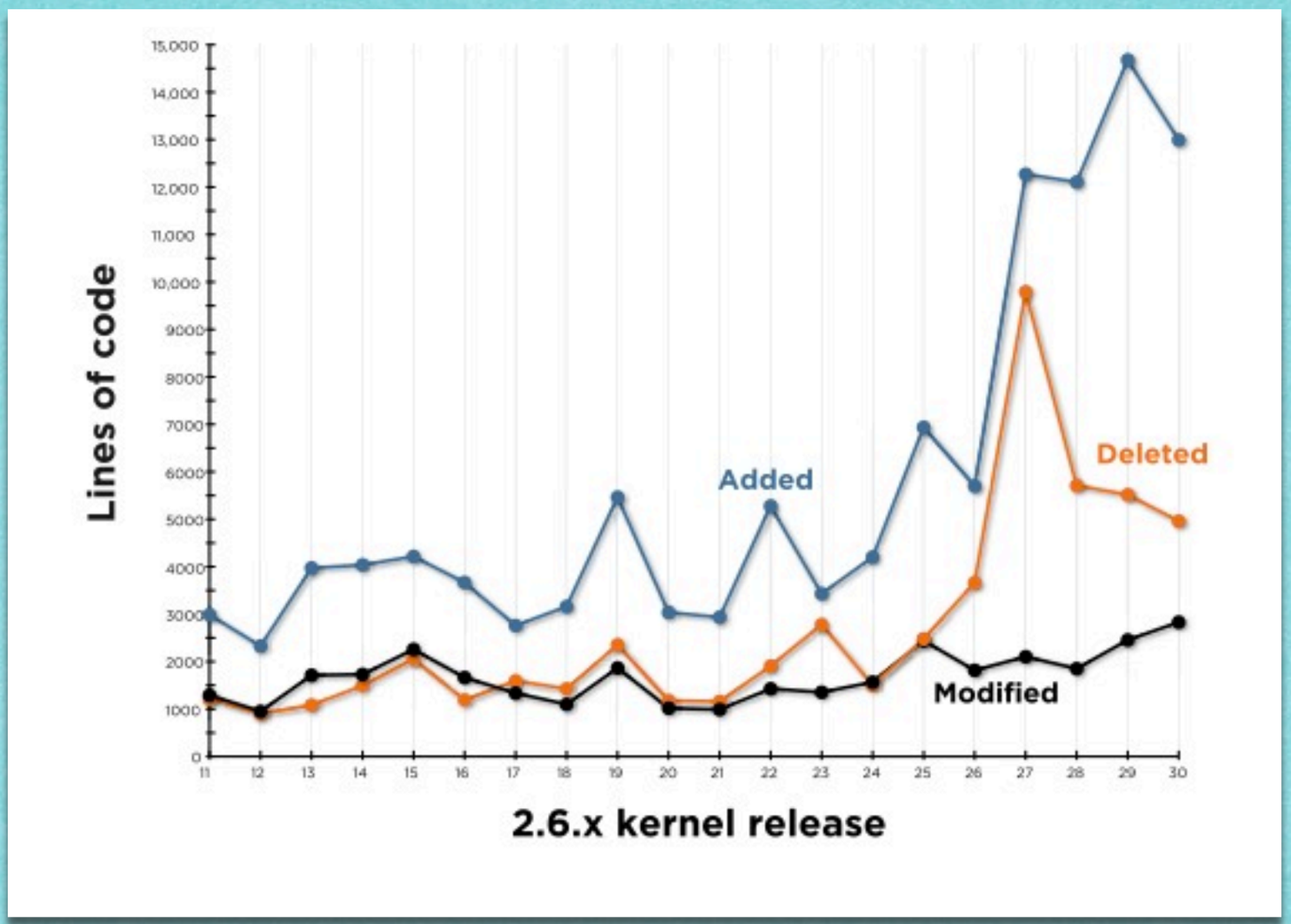
- 「大家都有完整資料庫」
- 「大家都能獨立工作」
- 「Server爛了不要緊，拿到一份好的資料庫灌回去就可以全部復原！」
- 現在爆紅的 git, Mecurial (hg), bazaar (bzr) 都屬此類
- 問題：亂成一團？？？
  用好的Branch機制來解決！



從 *Git* 的誕生講起

Linux Kernel 是一切的開端

(http://en.wikipedia.org/wiki/Linux_kernel, Wikipedia contributors, CC-BY-SA)



極端龐大的資訊量

(From: Linux Kernel Development: How Fast it is Going, Who is Doing It, What They are Doing, and Who is Sponsoring It, Fair use(?))

先前的嘗試：BitKeeper

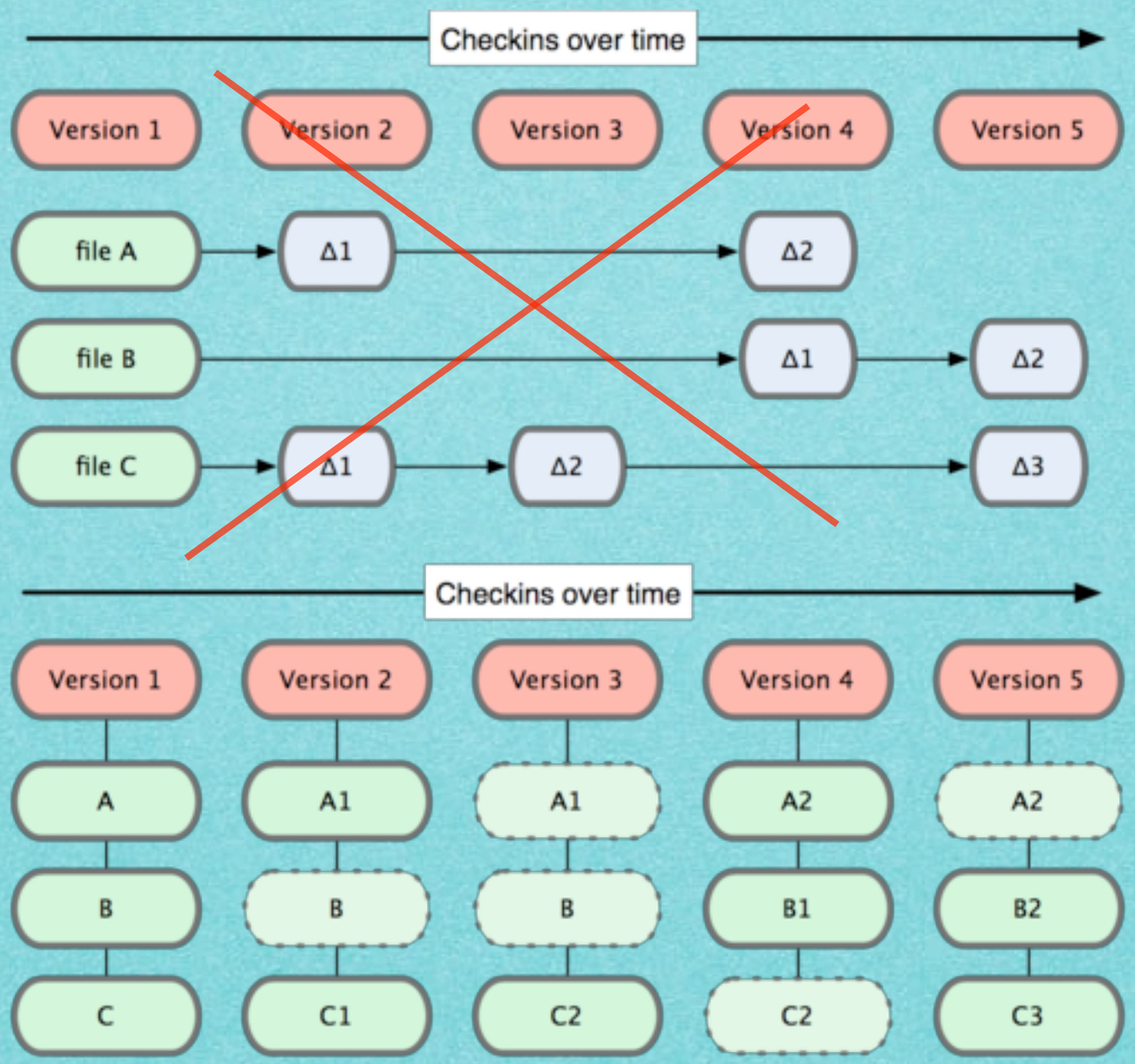
- Linus Torvalds：「我就是不喜歡中央式的系統！」
  - 所以 Linux Kernel 以前的變更都是用 Patch + 壓縮檔來散布
- 2002年， Linus 採用 BitKeeper 分散版本控制系統（專有！）
- 社群不滿，甚至嘗試逆向工程，於是跟 BitKeeper 開發商鬧翻
- Git 因此而生
- (pic: http://commons.wikimedia.org/wiki/File:Linus_Torvalds.jpeg CC-BY-SA-3.0 & GFDL)

Git 的設計目標

- 超快
- 超簡單
- 支援非線性的開發
  - 大家都可以自己改，改完合併來合併去，不必受到一條主線的拘束
- 完全分散式
- 可以處理 Linux Kernel 「超大」的資料量
- And then realize that nothing is perfect. Git is just *closer* to perfect than any other SCM out there. -- Linus on Git mailing list

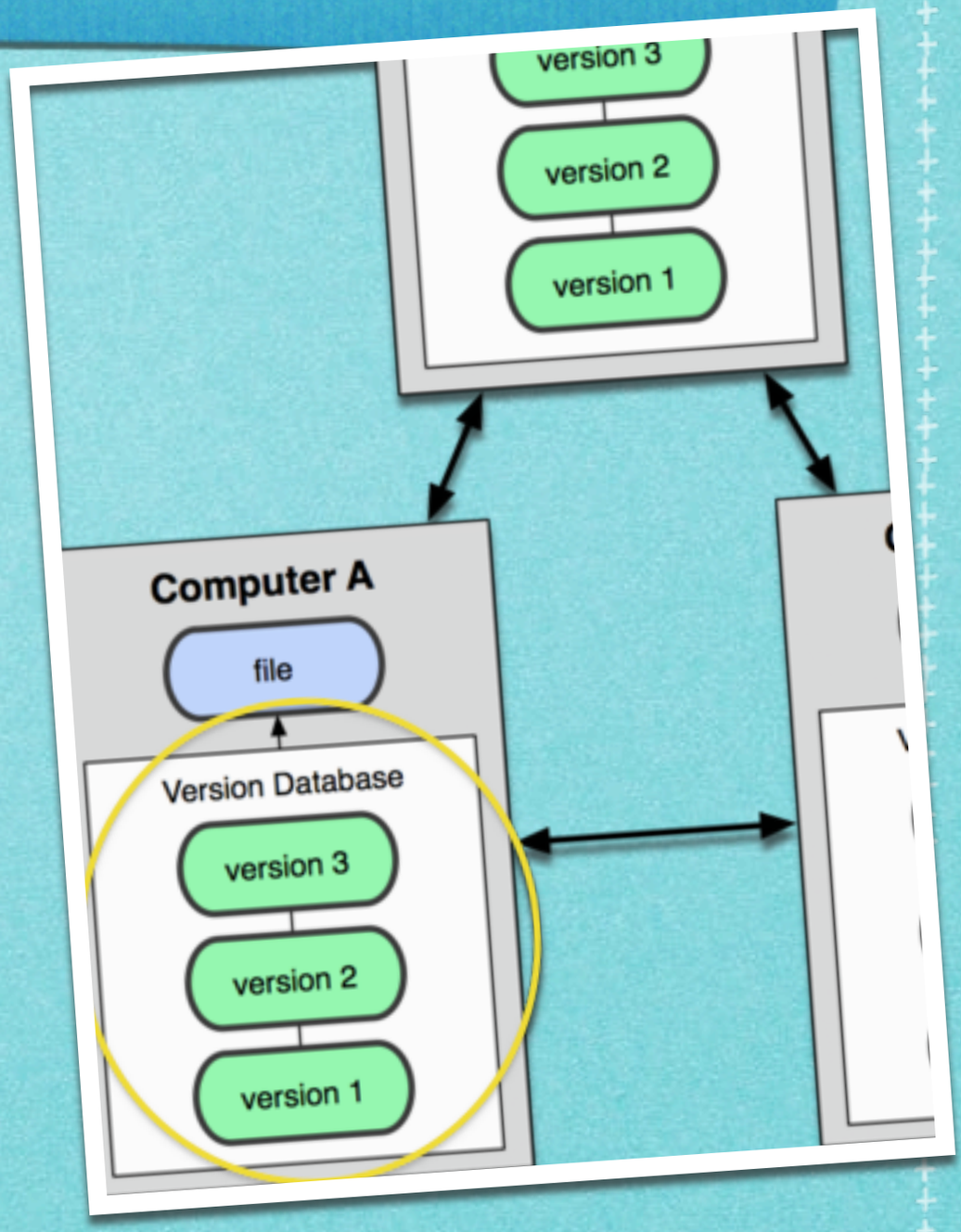
Git Basics

Git不是記「檔案的差異」，
而是記錄「檔案的快照」



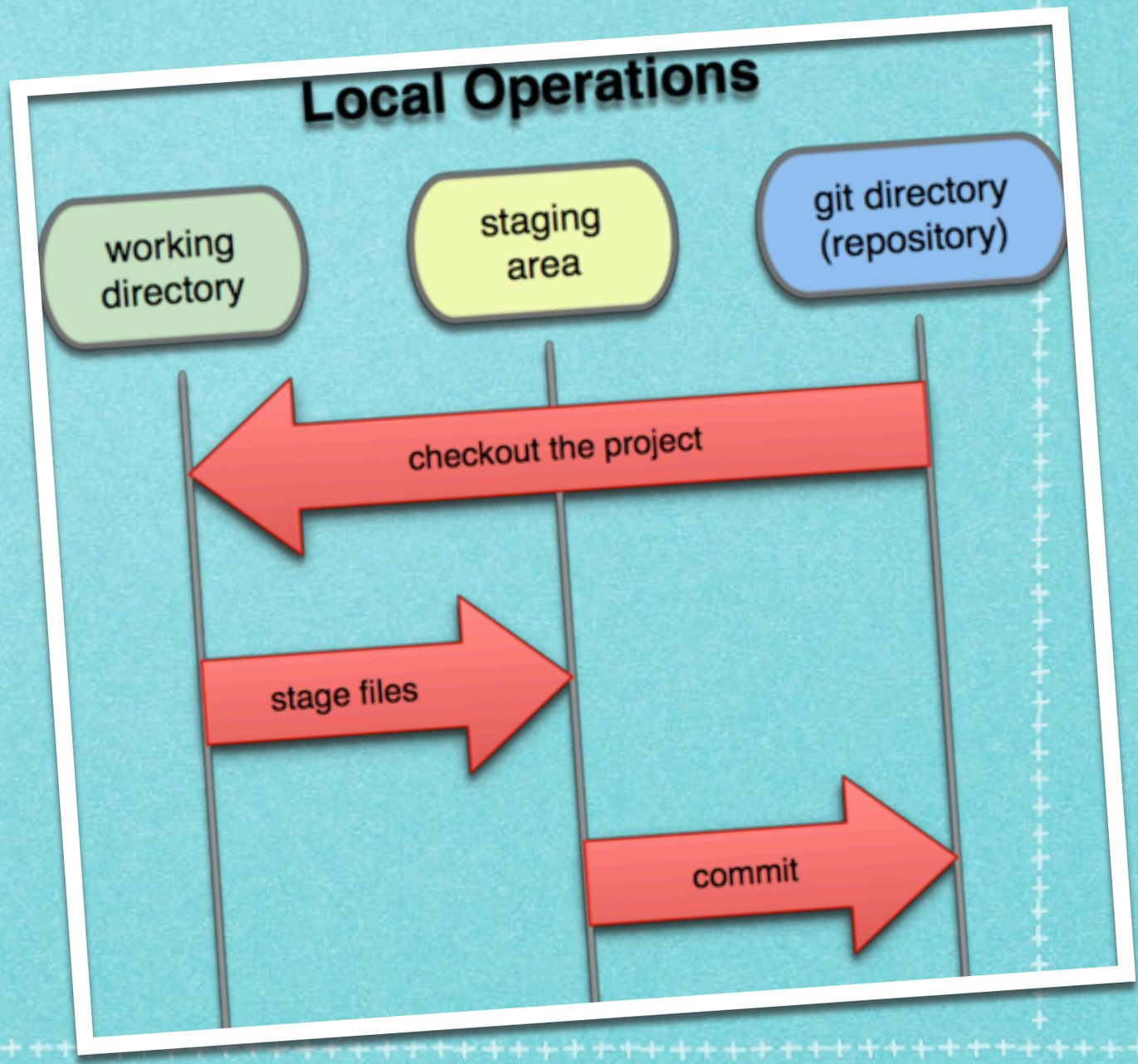
Git 幾乎什麼事都在本機進行！

- 你不只有一份完整的資料庫.....
- 閱讀版本歷史、提交變更這些動作都可以在本機進行
- 不需要網路連線也能單獨工作！



Git 的檔案處理

- 使用 Checksum 來確保檔案的完整性
- 設計上「只會增加資料」，因此東西可以輕鬆復原
- 在本機的檔案管理中，增添了「Staging」的觀念



Using Git

建立一個新的 Git Repository

- 「Repository」（倉庫、套件庫）就是一份版本控制中的「版本資料庫」

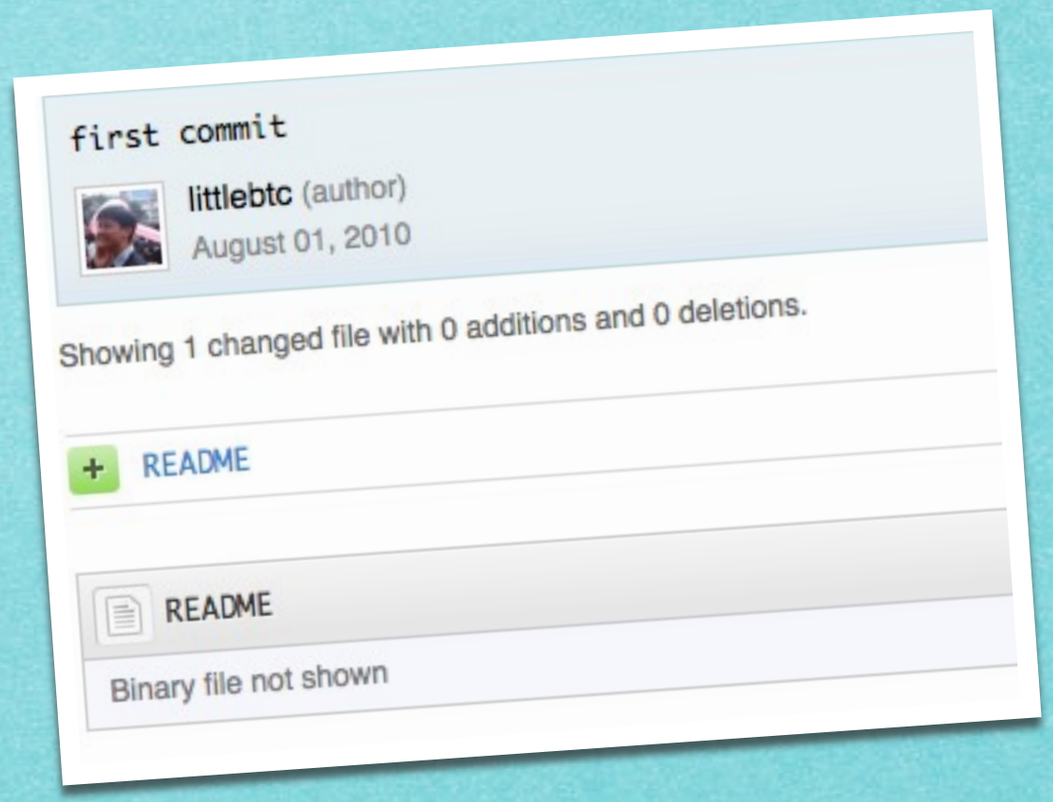
- 找一個空的資料夾，然後執行：
  `git init`

- 套件庫需要的資訊會放在.git資料夾裡

Initial Commit

- 新增一個檔案README
- 把所有檔案加進去
- 然後提交變更

```
touch README
git add .
git commit -m 'Initial commit'
```

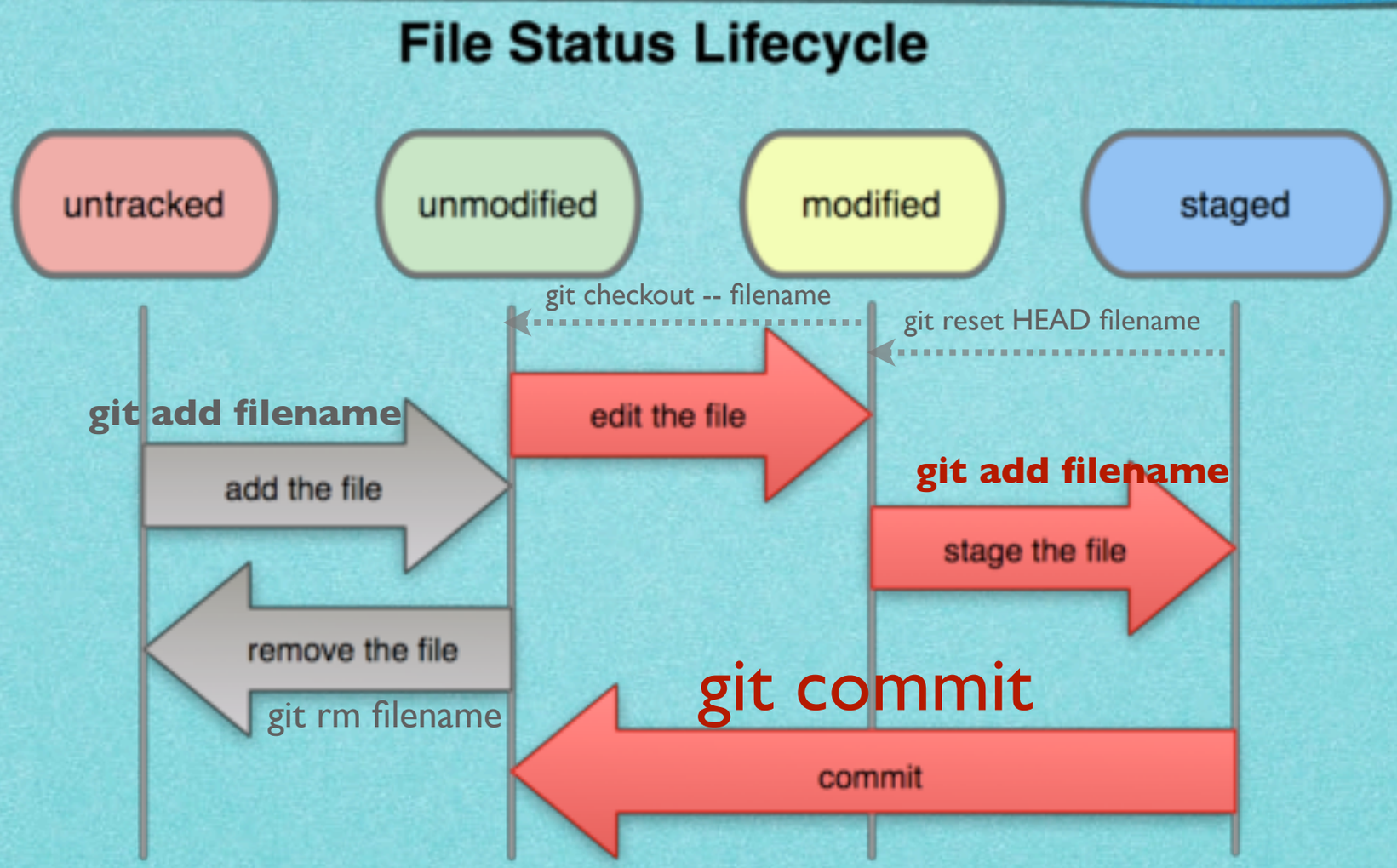


複製別人的 Repository

Clone的專案會放在目前路徑下的新目錄。

```
$ git clone http://github.com/jquery/jquery.git
Initialized empty Git repository in /Users/littlebtc/work/jquery/.git/
remote: Counting objects: 14043, done.remote: Compressing objects: 100%
(4070/4070), done.
remote: Total 14043 (delta 9717), reused 13753 (delta 9452)
Receiving objects: 100% (14043/14043), 12.45 MiB | 288 KiB/s, done.
Resolving deltas: 100% (9717/9717), done.
```

File Status



- 在 .gitignore 檔案中列出的檔案名稱將被忽略
  （.gitignore這個檔也要commit!）
- 使用 git status 來檢查檔案狀態

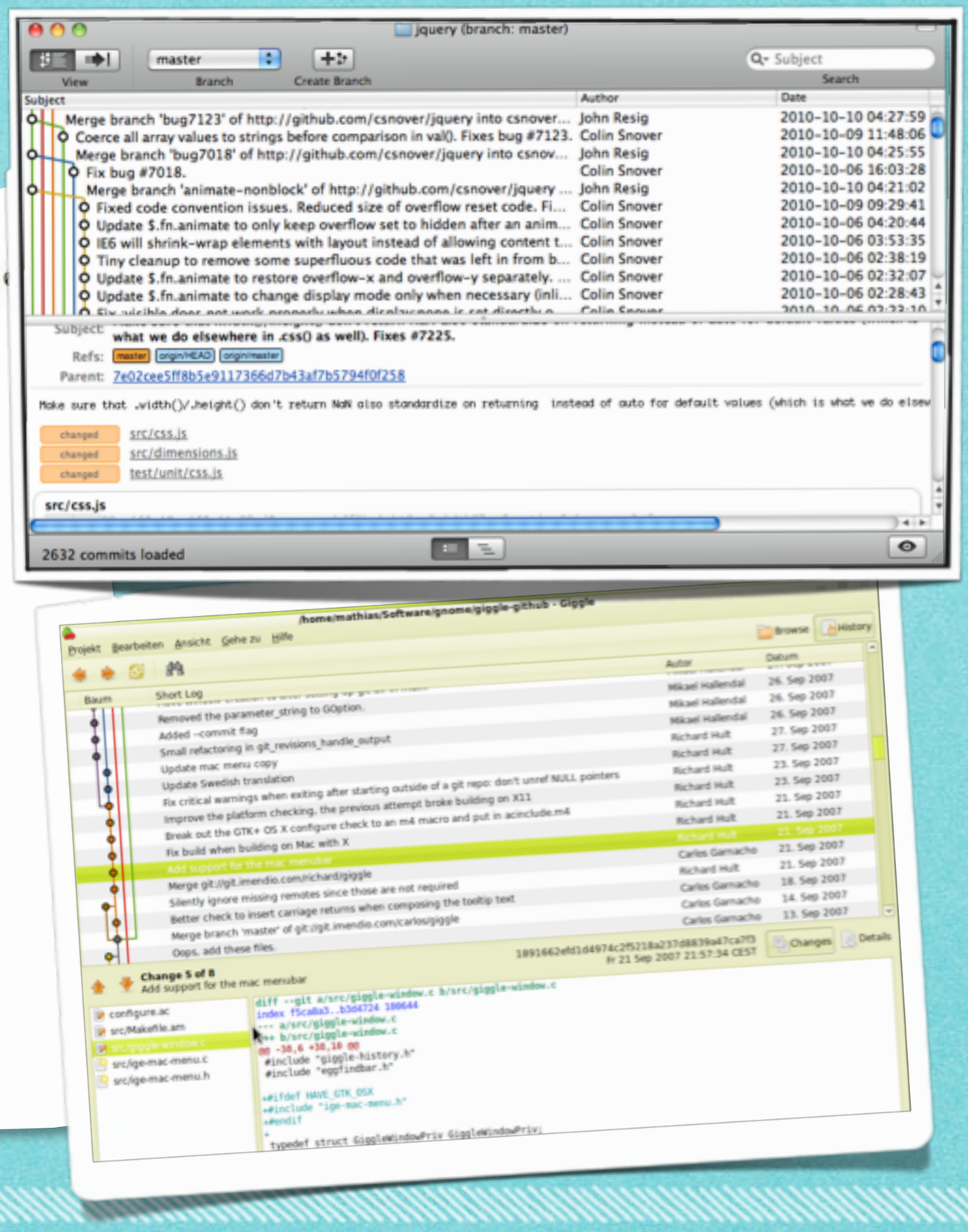
git status

```
littlebtc-MBP:ccmediacollector littlebtc$ git status
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       modified:   install.rdf
#
# Changed but not updated:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#       modified:   content/collection/collection.js
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#       modules/ContentFetcher.jsm
#       skin/note.png
```

如何檢視Commit log？

- `git log` (console)
- GitX (Mac)
- giggle (Linux) (截圖來自官網)

```
commit 55bfb94547350744f029a3cd4501e0c833a7c1d1
Author: Hsiao-Ting Yu <sst.dreams@gmail.com>
Date:   Thu Oct 14 08:24:08 2010 +0800

    Empty babelzilla-locale since there will have lots of changes on (

commit eea5dacfca545308b2826b78a4ae81a4feb54c30
Author: Hsiao-Ting Yu <sst.dreams@gmail.com>
Date:   Wed Oct 13 22:16:45 2010 +0000

    Compatibility -> 4.0b8pre

commit 7ed45a2865684b5d18de3133213a2cb1a7d90567
Author: Hsiao-Ting Yu <sst.dreams@gmail.com>
Date:   Fri Oct 8 03:38:09 2010 +0000

    combine smilefoxPanel / firefox_overlay

commit ae37a2928b9867d6ae74b6241e8acb1487deb208
Author: Hsiao-Ting Yu <sst.dreams@gmail.com>
Date:   Fri Oct 8 03:37:53 2010 +0000

    combine smilefoxPanel / firefox_overlay

commit f3fc9e4a8f56dc12e5a5efab2c372a35ac262db3
Author: Hsiao-Ting Yu <sst.dreams@gmail.com>
Date:   Fri Oct 8 03:36:21 2010 +0000

    Bug fixes

commit e8e385679cef48b83f1c17f1b1a180e475c7cf95
Author: Hsiao-Ting Yu <sst.dreams@gmail.com>
Date:   Fri Oct 8 03:35:23 2010 +0000

    Try to fix conflict problem for "early rejection".

commit 7ec150b22a646f1eecf390858617bc7b851b9edf
Author: Hsiao-Ting Yu <sst.dreams@gmail.com>
Date:   Wed Sep 15 00:25:16 2010 +0000

    Compatibility: -> 4.0b7pre

commit a7781d2bfdf84991dfc2e5e30372a0b0ab9b9b09
Author: Hsiao-Ting Yu <sst.dreams@gmail.com>
Date:   Sat Sep 11 23:23:17 2010 +0000
```



改爛了...!?

- 改變最後一次的 Commit：
  `git commit --amend`
- 把 Stage 的檔案給 Unstage：
  `git reset HEAD file`
- 把修改過的檔案回到未修改狀態：
  `git checkout -- file`

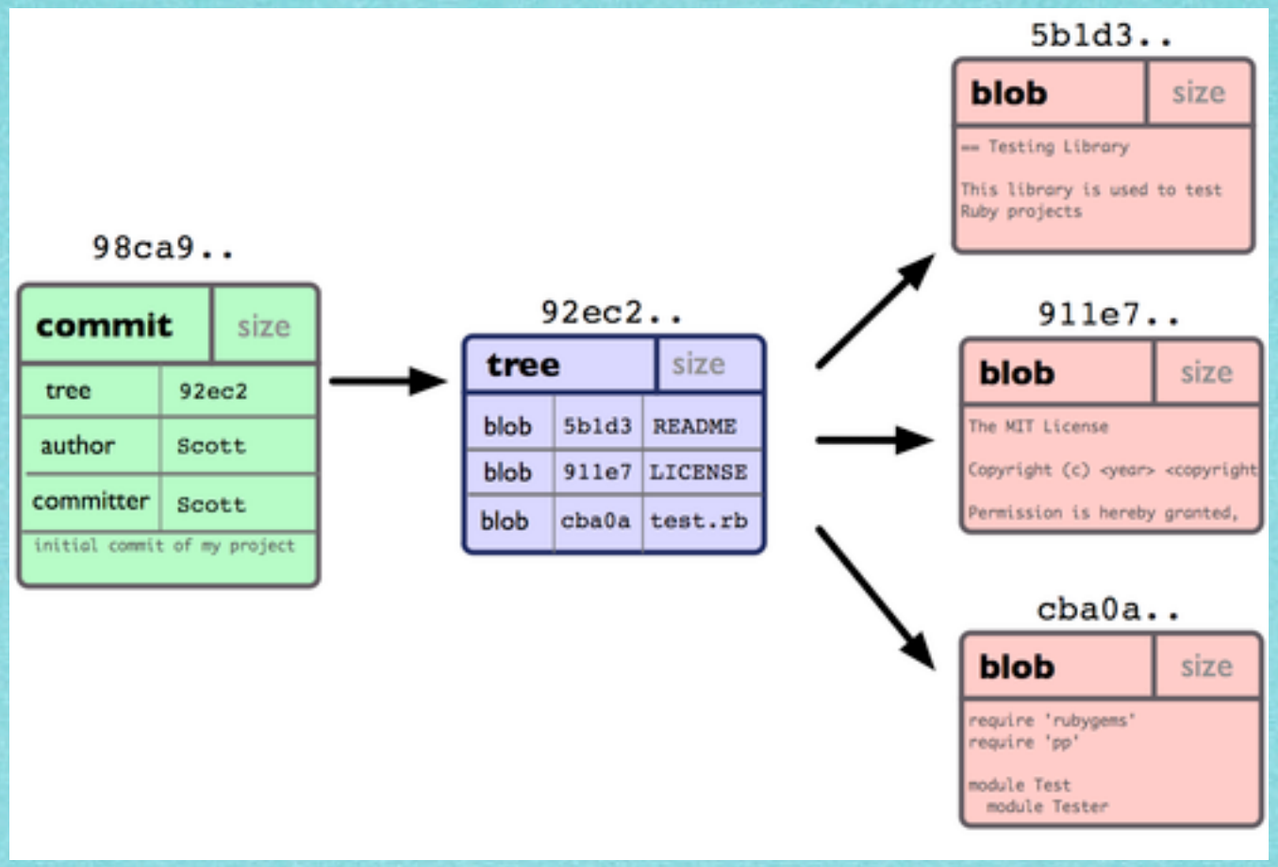
Remote Server!!

- Branch 和 Remote 之間的互動！
  - 預設的 Branch 叫 master（稍後詳述）
  - 預設的 Remote 叫 origin
- `git pull origin =`
  `git fetch origin + git merge origin/master`
  拉下來之後 Merge
- `git push origin master`
  把 Master 給 Push 到 Origin

"Remote" 的 Protocol

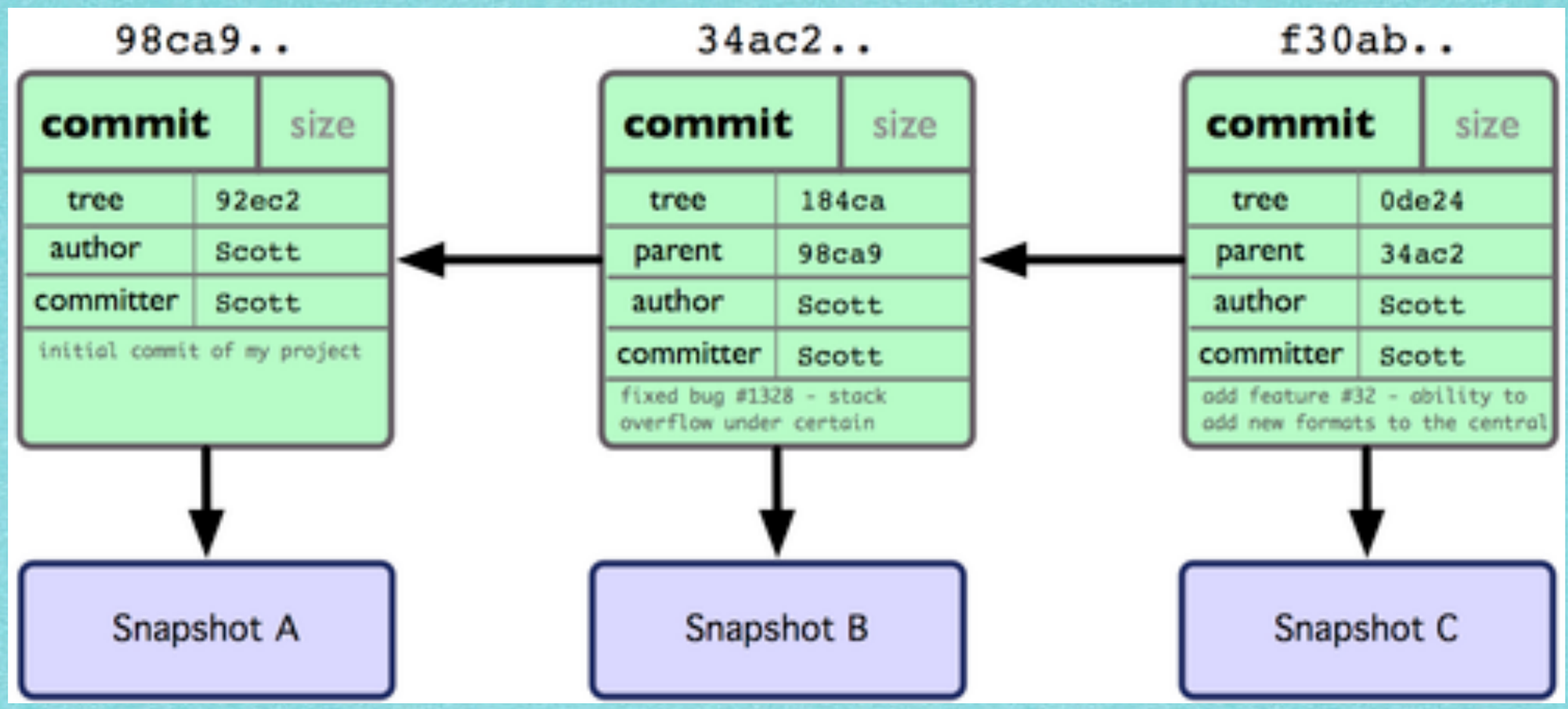
- file://（本機）
- **ssh://**（效率好、匿名訪問不可、適合寫入）
- **git://**（效率很棒、不好設定、適合讀取）
- http:// or https://（簡單、效率低）

Branches



先從 *Commit* 說起

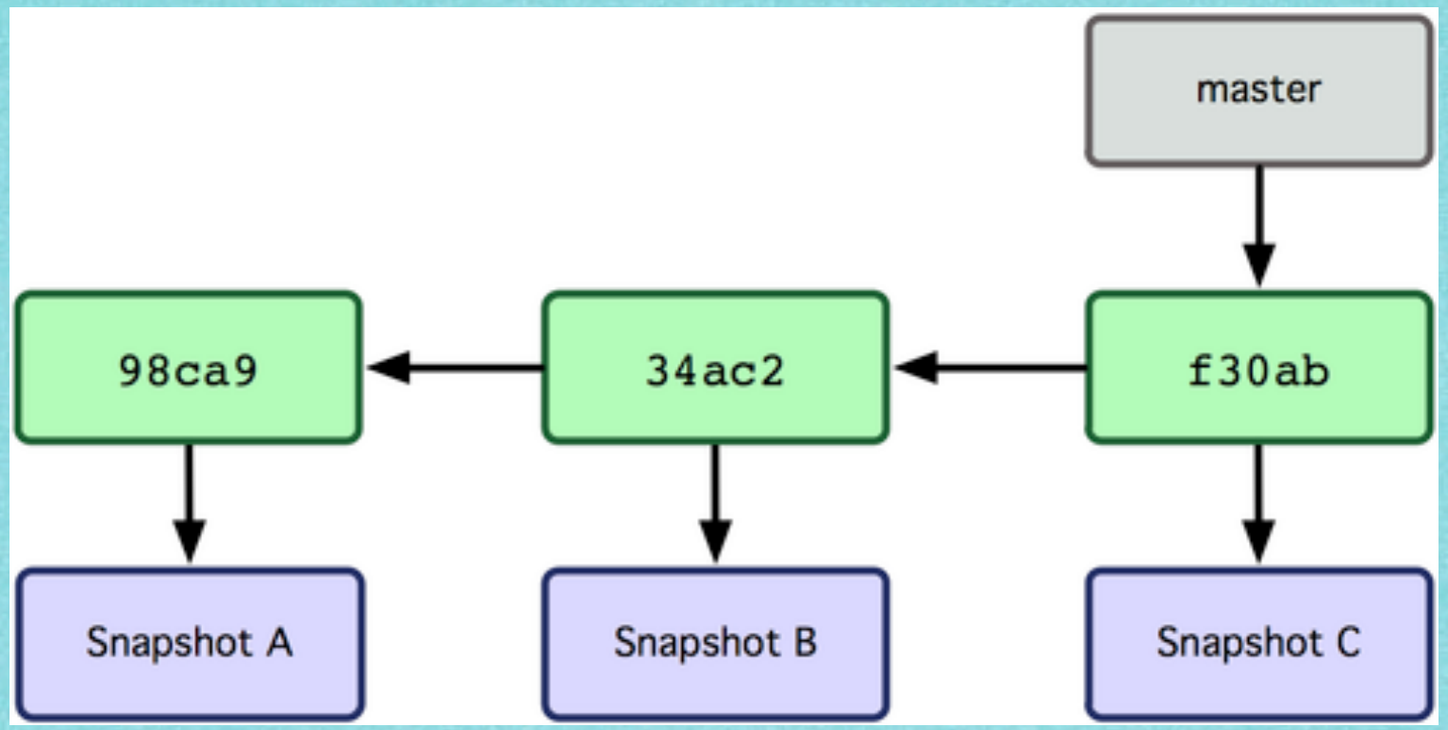
git 是這樣看待 *Commit* 的



很多 *commit*

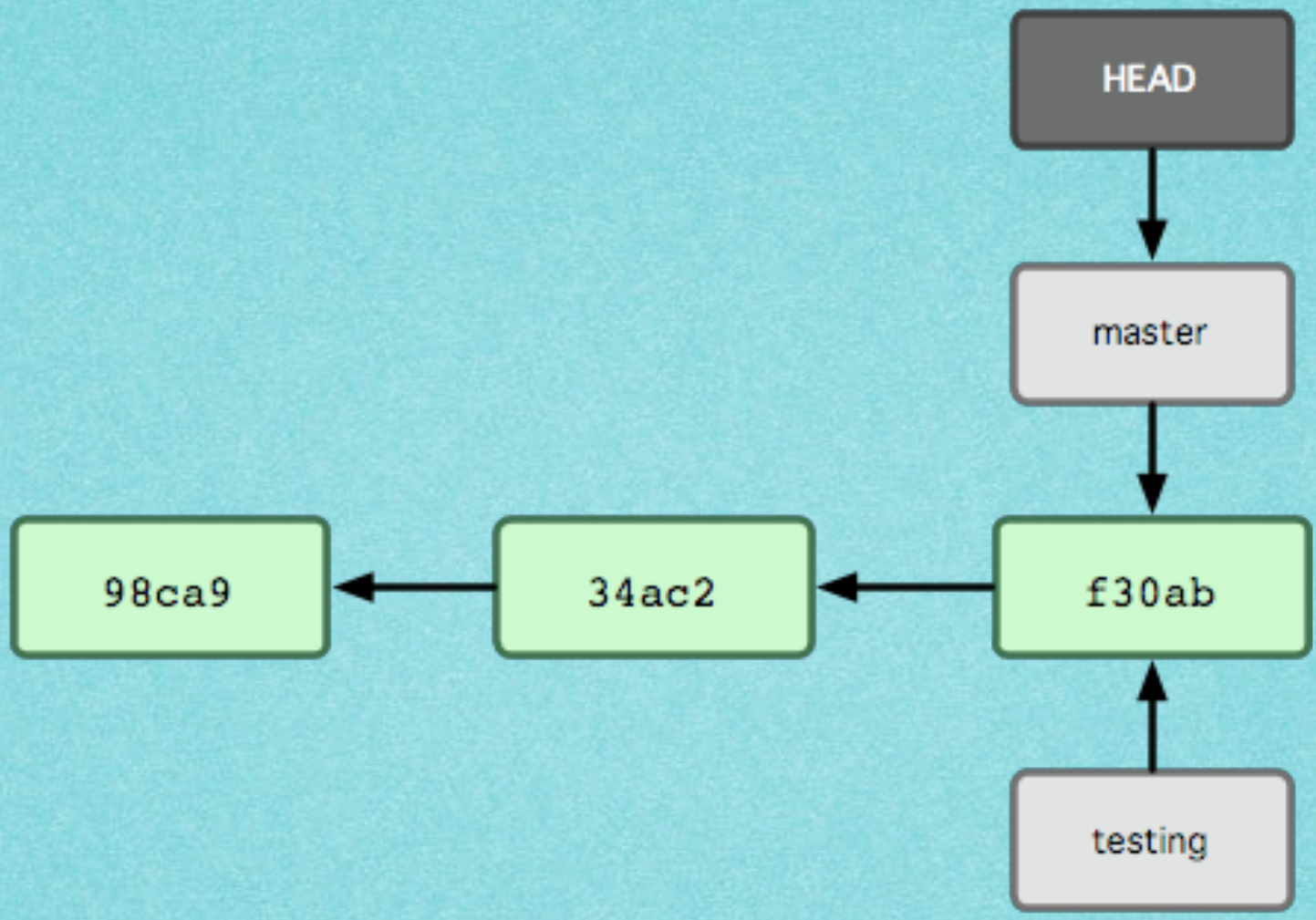
*Commit*之間互相連結

每個*Commit*對應一個*Snapshot Tree*



於是有了*branch*

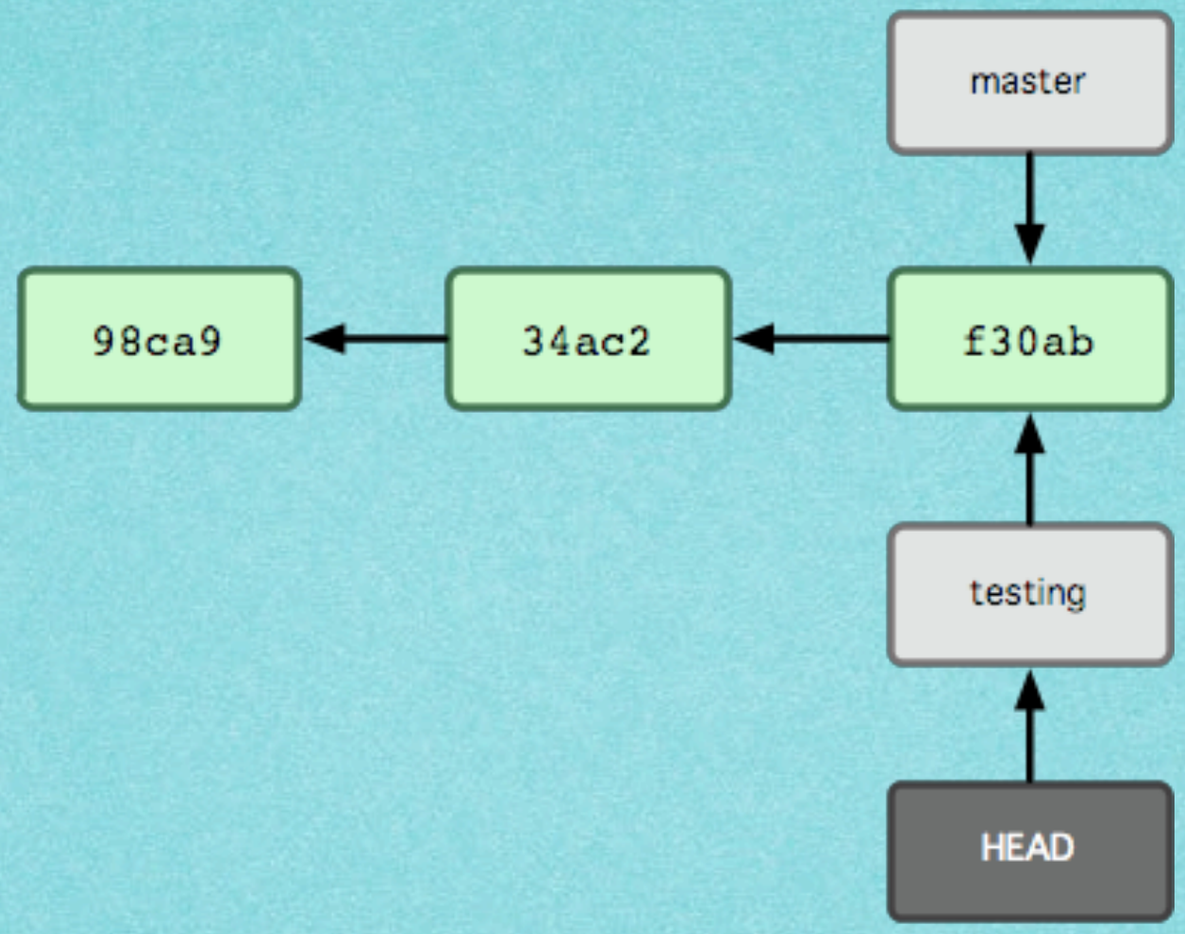
「標記我們在哪個*commit*上」



git branch testing

新增一個"*testing*" *branch*

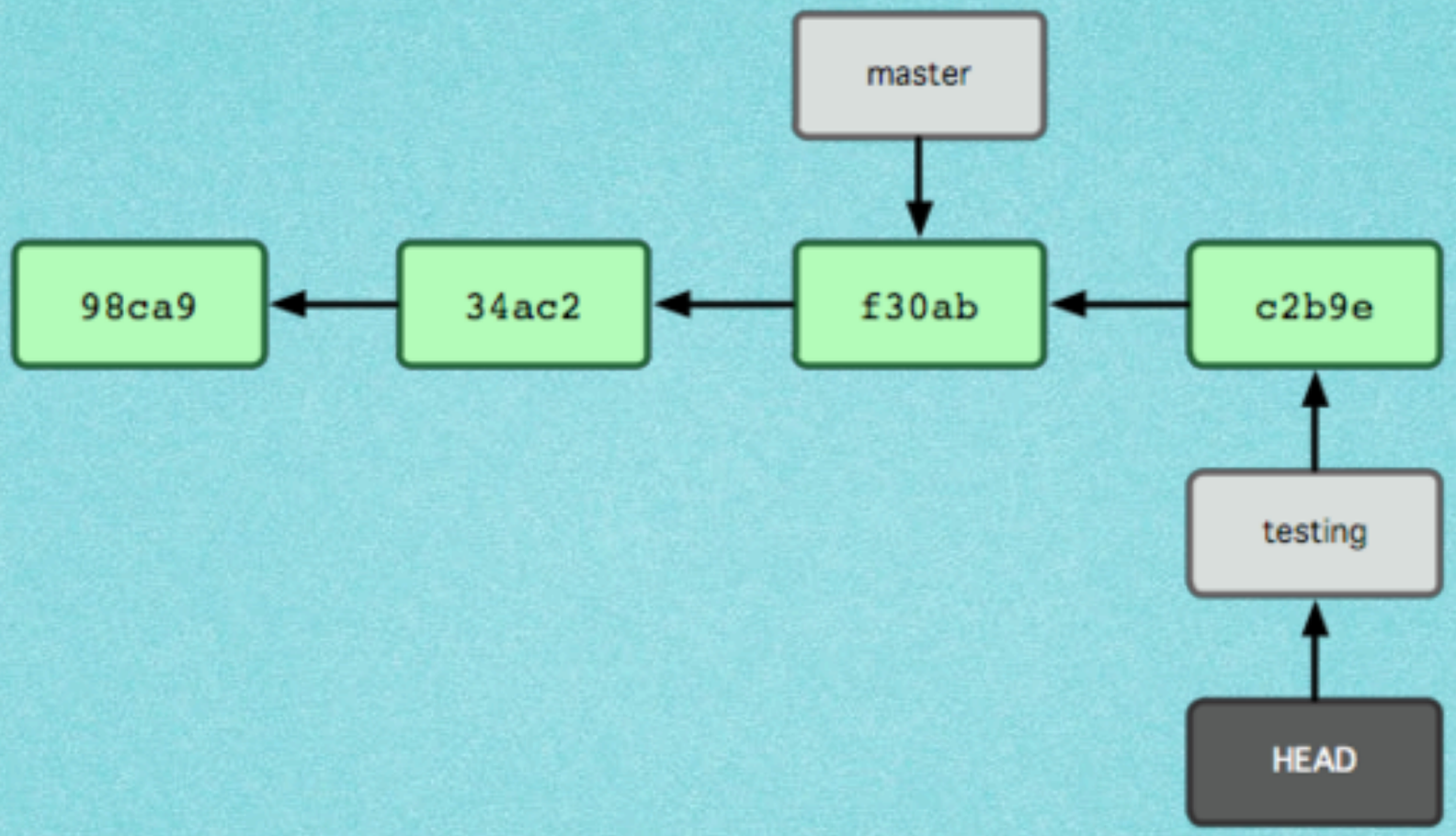
*git*會使用「*HEAD*」紀錄目前所在的*Branch*



git checkout testing

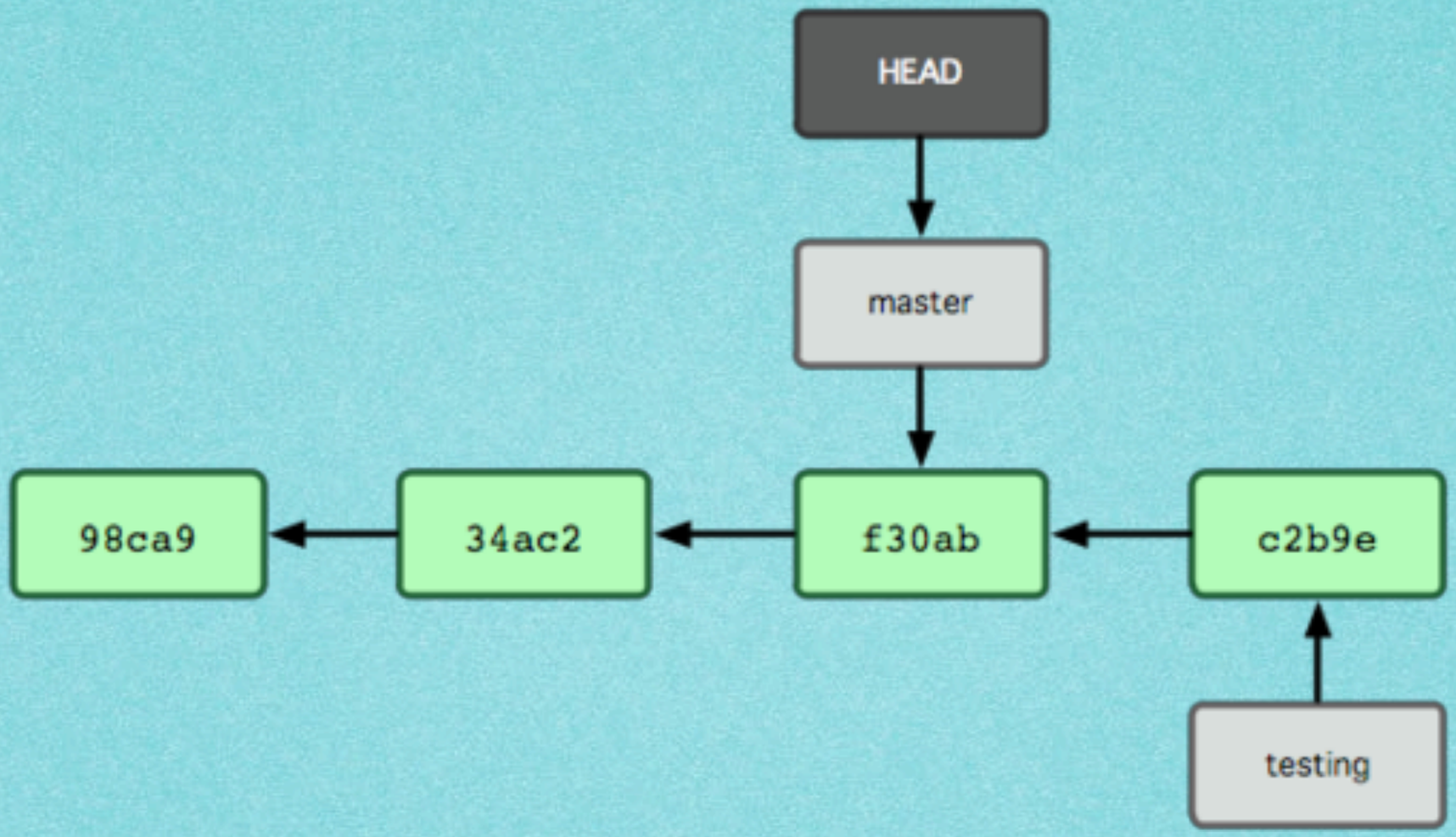
把「*HEAD*」變成 *Testing Branch*

or git checkout -b testing ：開新 *Branch*過後切



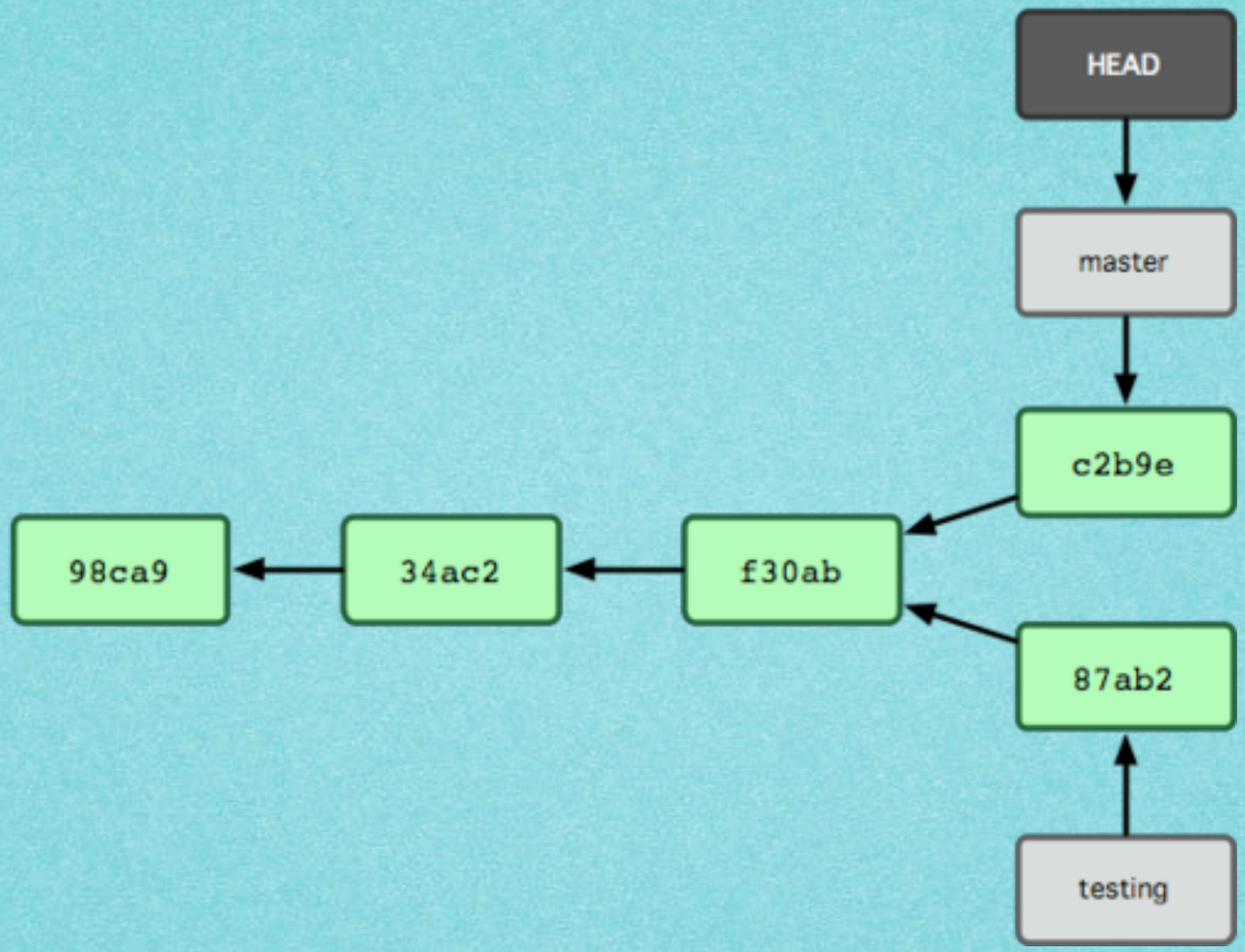
這時如果*Commit*下去...

變成只算在 *testing* 不算 *master*



git checkout master

回到*Master*了，那麼*What's next?*



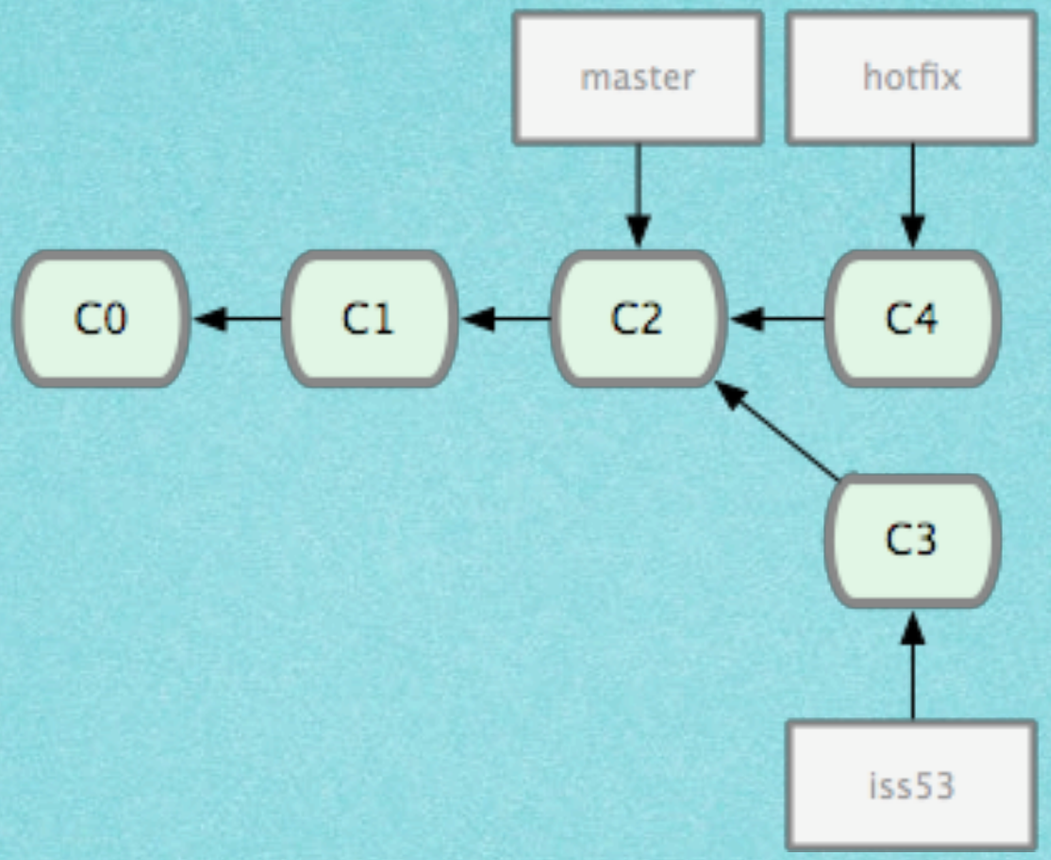

```
git commit -m 'Change the master!'
```

岔開來了！

如何重新變回一條？

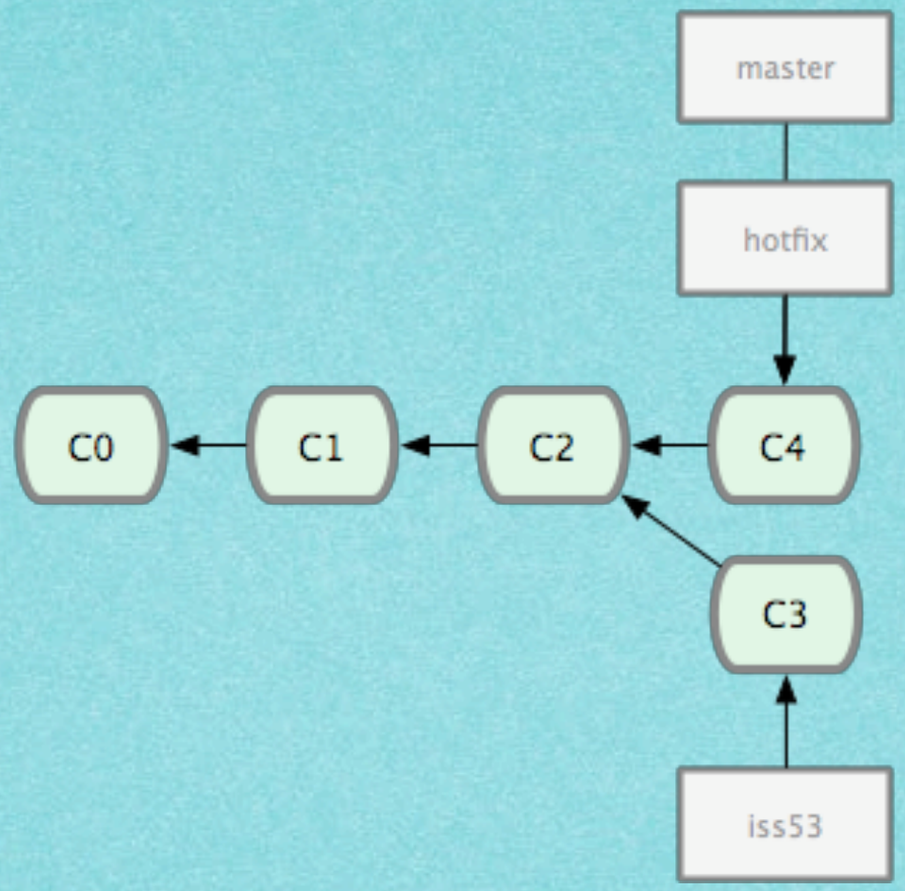
- Merge
  - 把岔開來的分支在往後「合起來」
  - 通常的建議方式
- Rebase
  - 把岔開來的分支「裝回去」主線
  - 「還沒**Push**出去的東西」才可以**Rebase**！

Merge



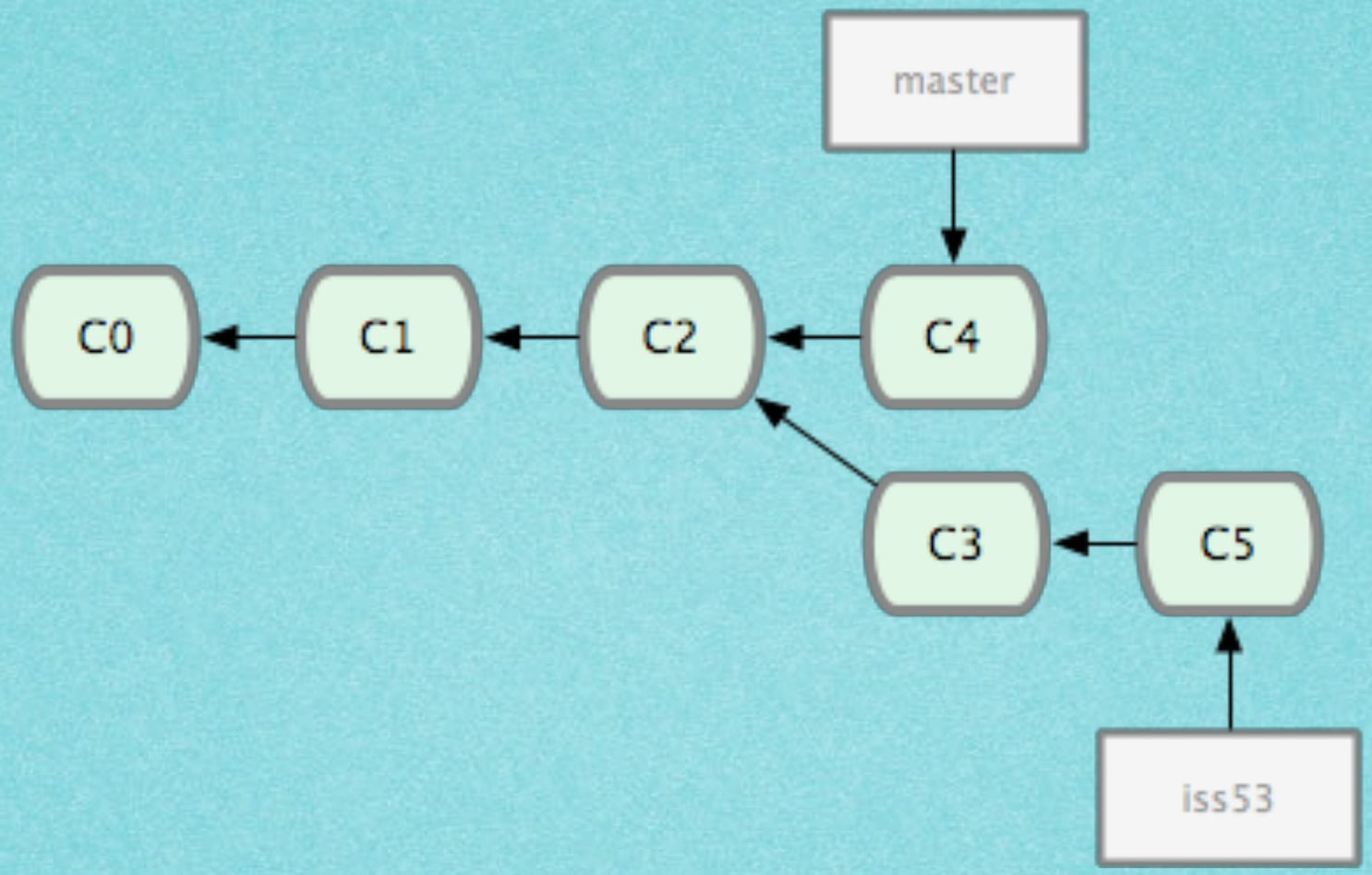
*Branch*滿天飛

有緊急的 *Bug*，我開了一個 *hotfix branch* 弄好了。
現在要怎麼處理 *master*？




```
git checkout master
git merge hotfix
```

切到 *master* 之後，把 *master* 和 *hotfix* 「合併」
因為這種合併只需要*Commit*往前推，叫做***fast-foward***



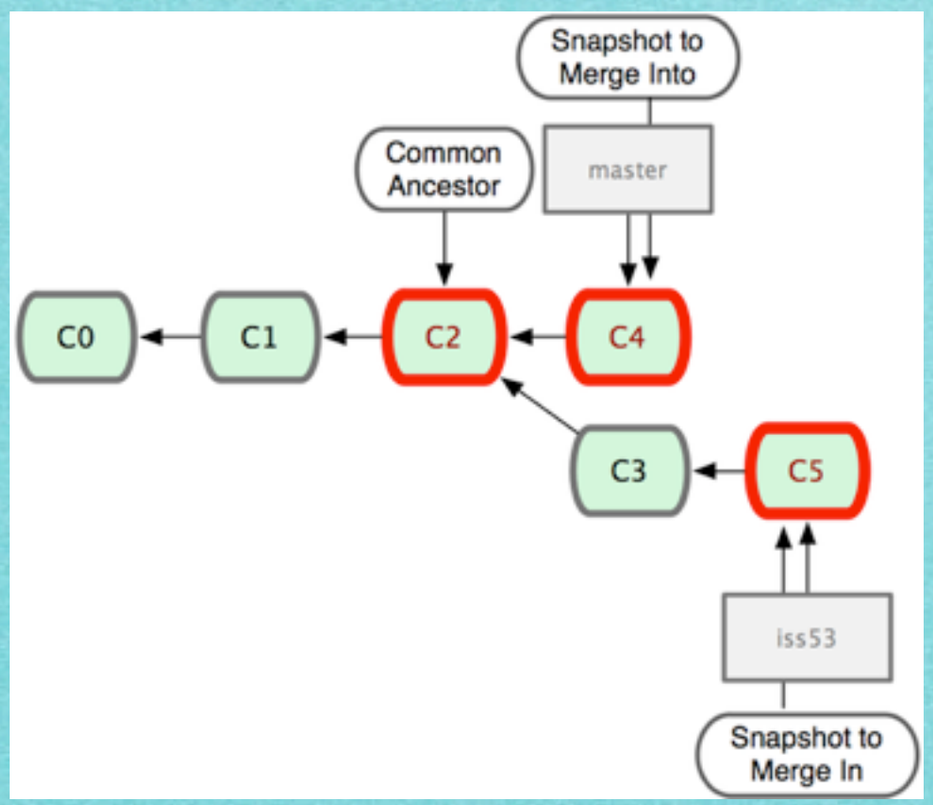
*Branch*滿天飛

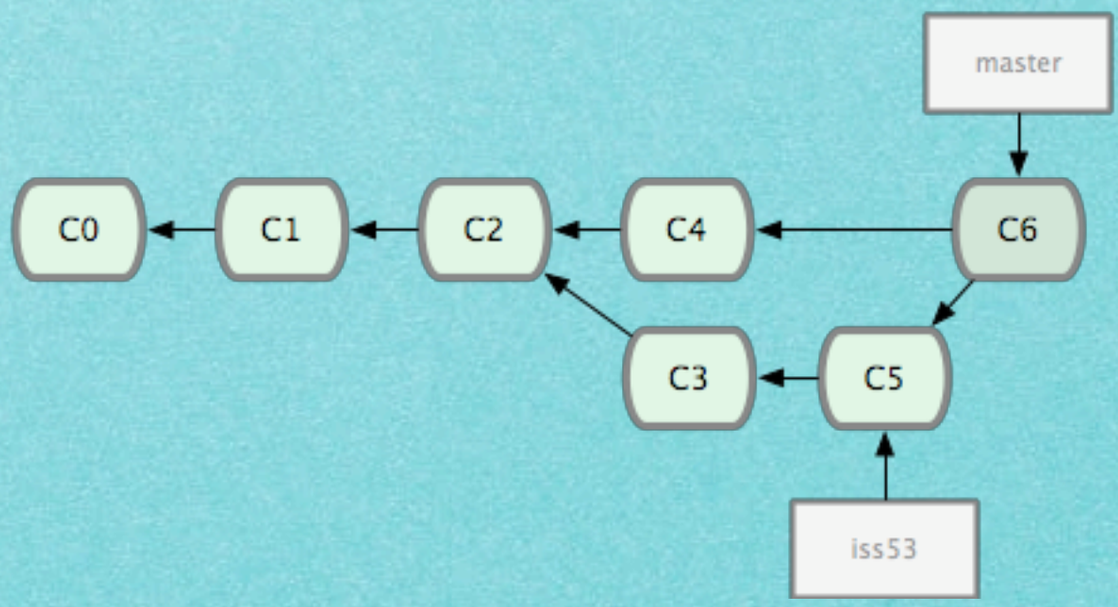
好，我繼續來寫 *Issue 53* 的 *branch*

總算寫完了！我要*Merge*！

git 最終的 merge 方式

```
$ git checkout master
$ git merge iss53
Merge made by recursive.
 README |    1 +
 1 files changed, 1 insertions(+), 0 deletions(-)
```



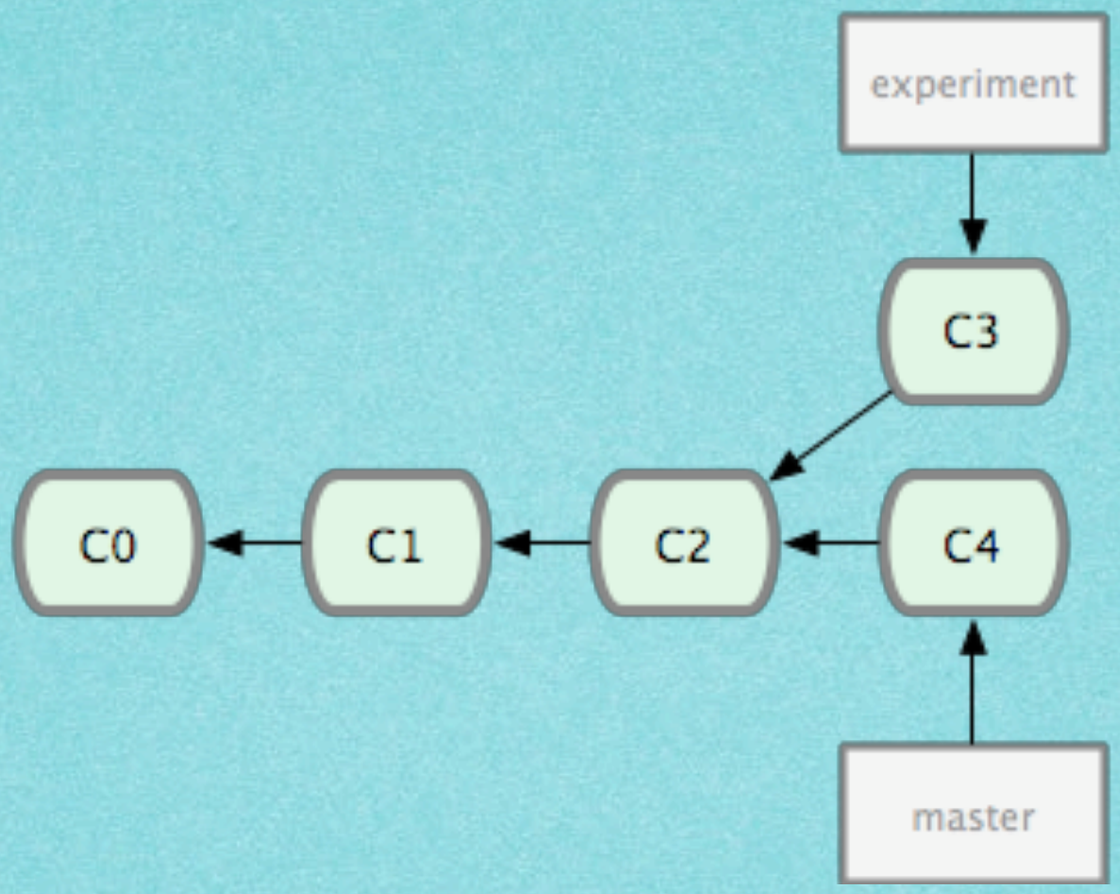


CONFLICT！衝到了！

- 別慌張！
  - git status 一下看是哪個檔案出問題
  - 到出問題的檔案找問題，手動解決
  - 再檢查 git status 後，用 git commit 手動 Merge（會自動生成 Merge 的 Commit Message）

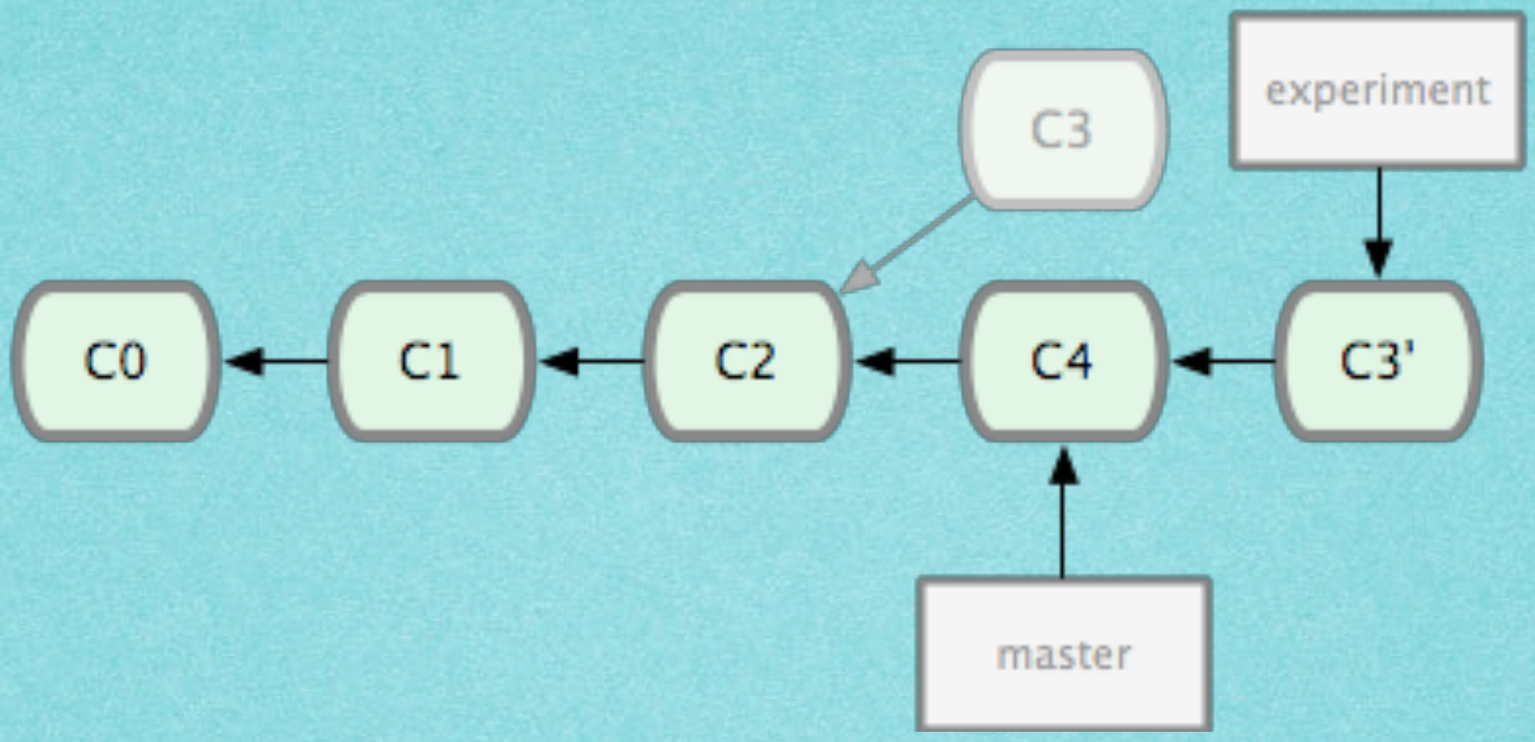
```
<<<<<<< HEAD:index.html
<div id="footer">contact : email.support@github.com</div>
=======
<div id="footer">
  please contact us at support@github.com
</div>
>>>>>>> iss53:index.html
```

Rebase



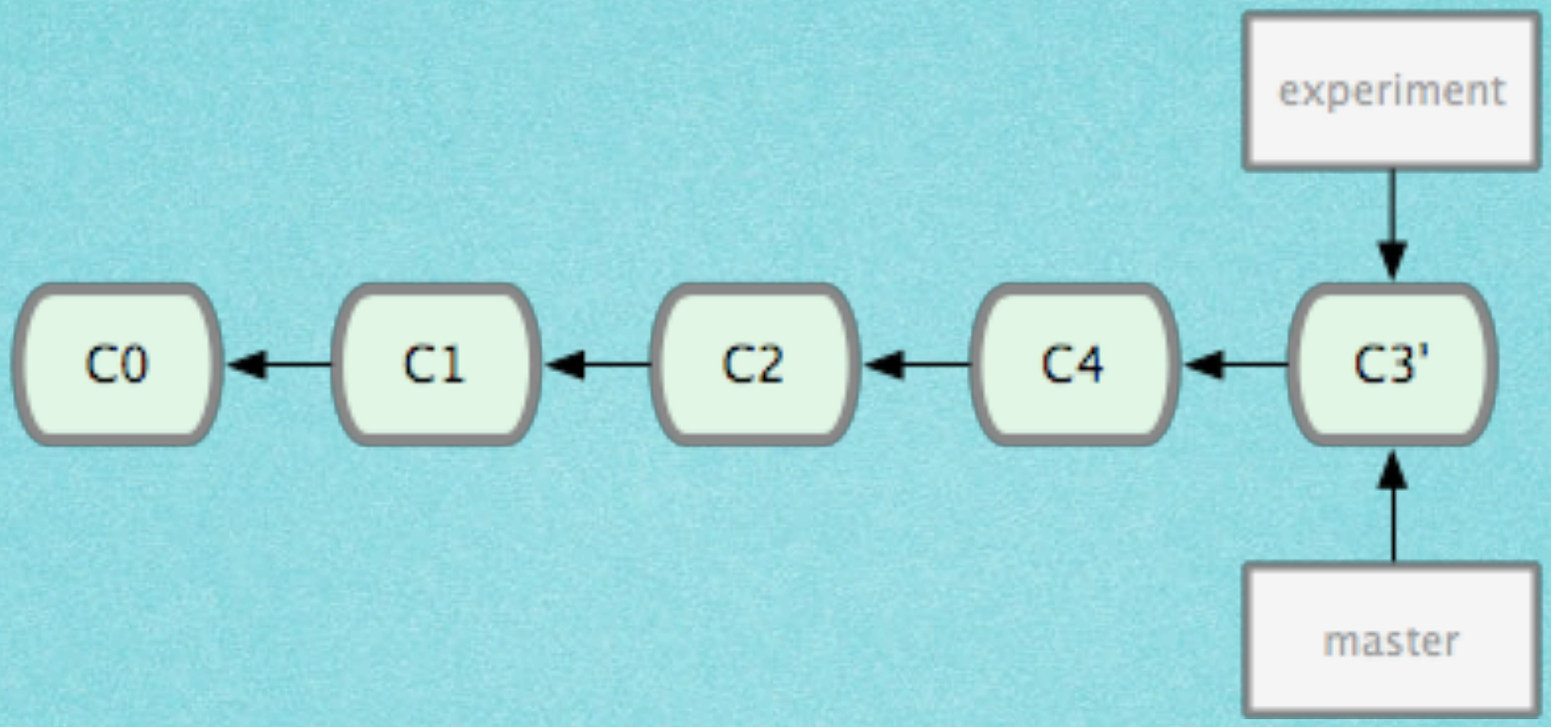
回到類似先前的情境

除了*Merge*以外，我有沒有其他的辦法可以處理掉 *experiment branch?*




```
git checkout experiment
git rebase master
```

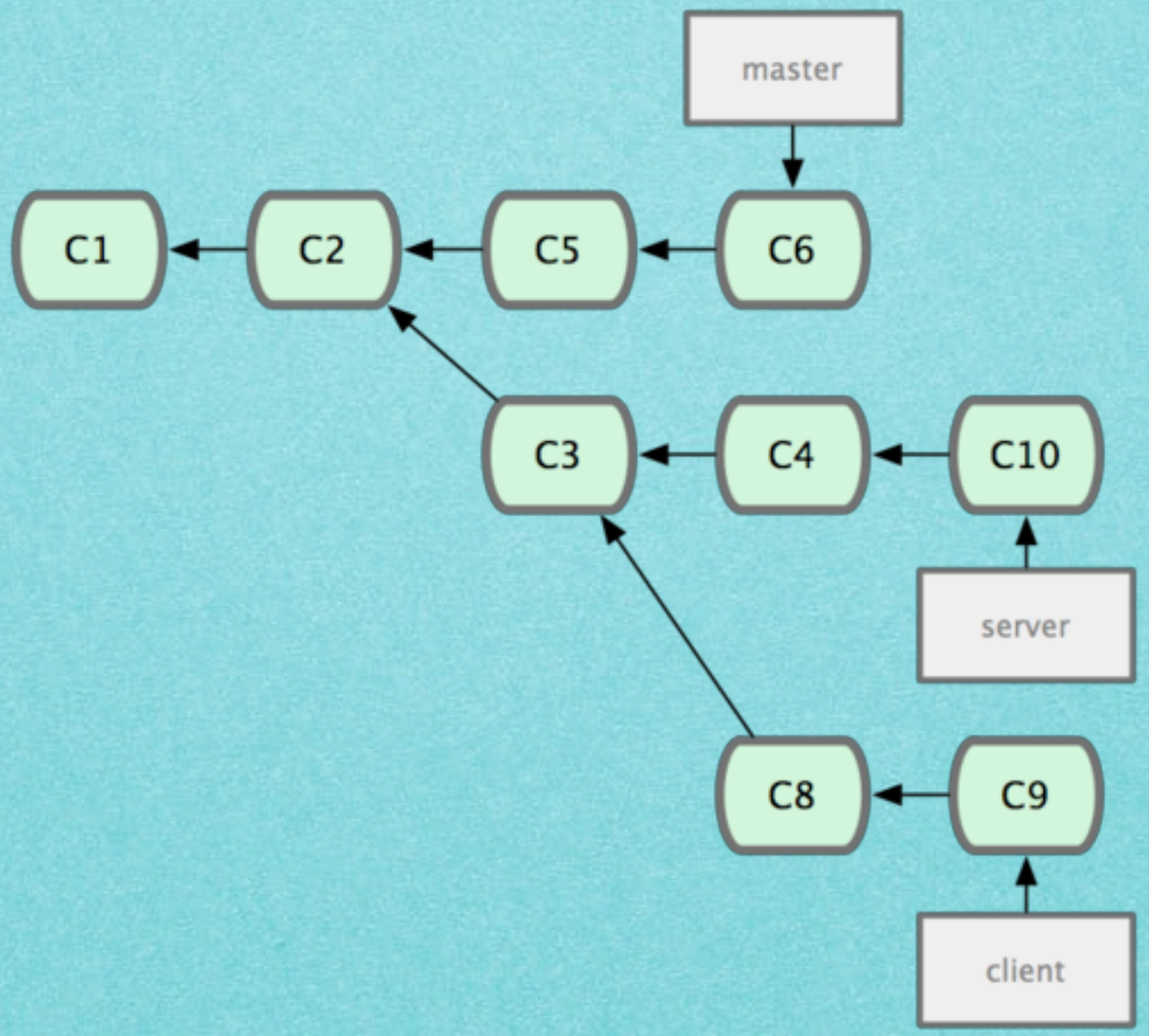
把*C3*上的變更*Rebase*到*C4*之上(**onto** *C4*)

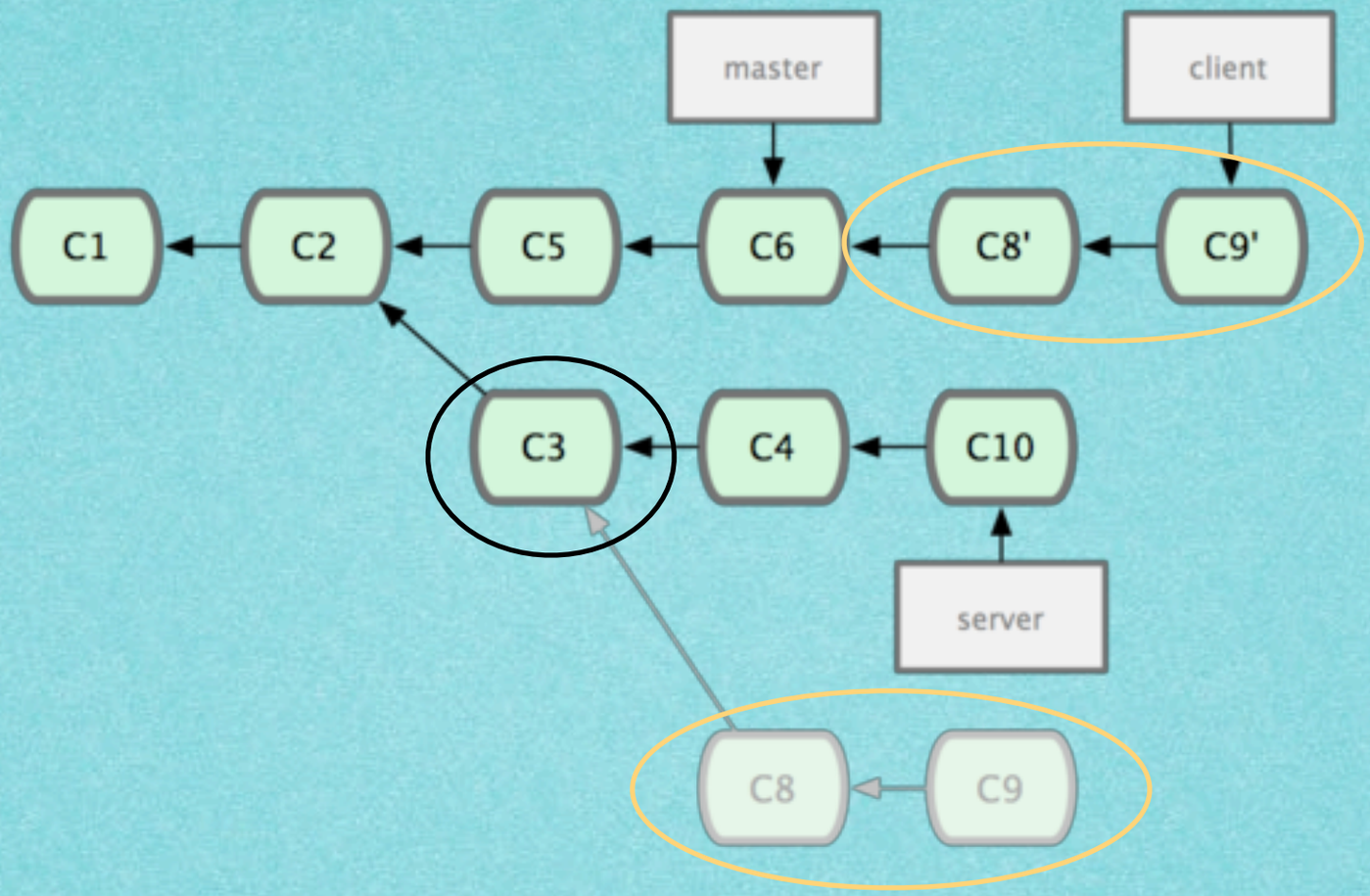



```
git checkout master
git merge experiment
```

Rebase過後就可以fast-forward Merge了！

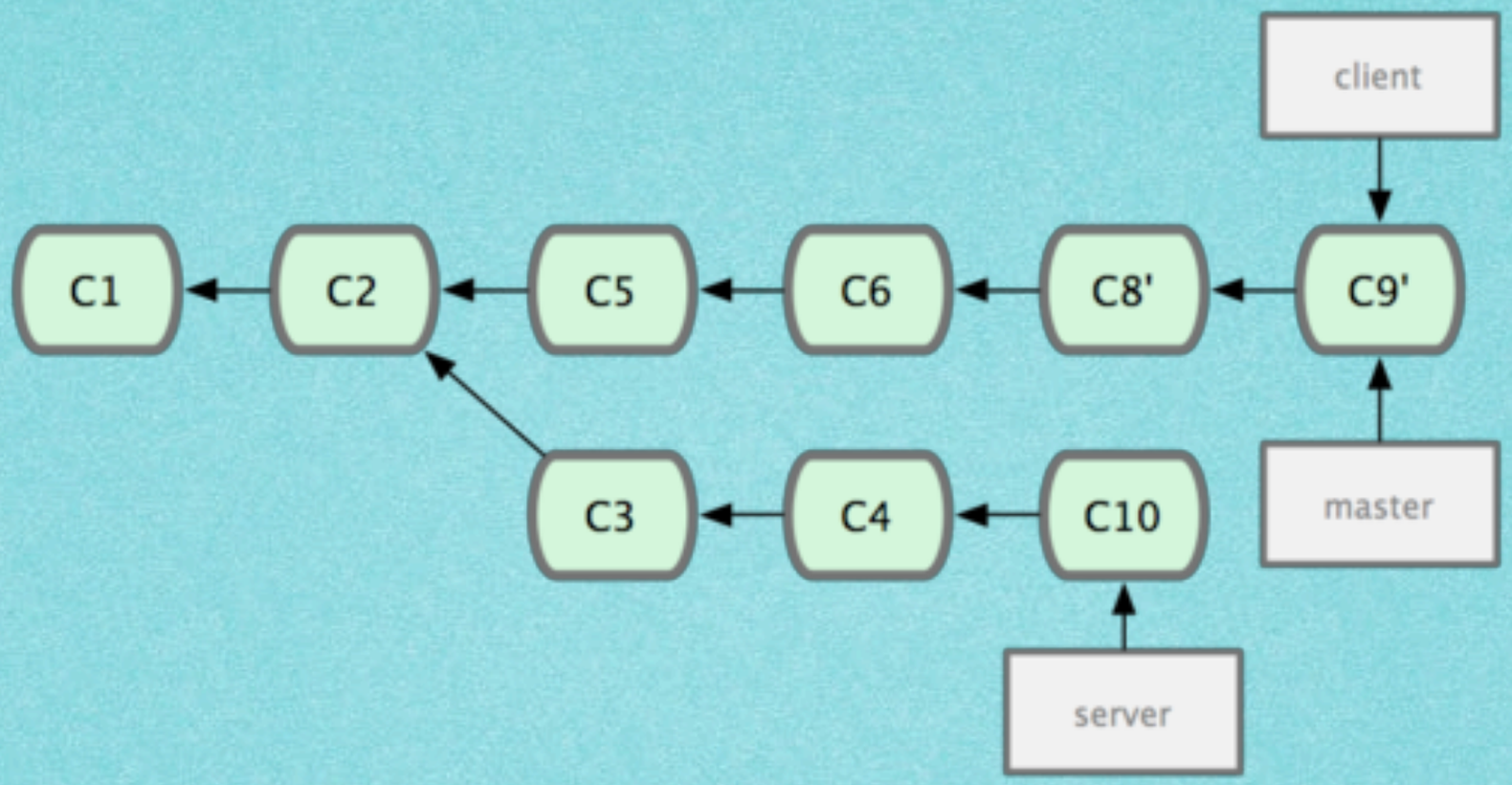
當事情更複雜...





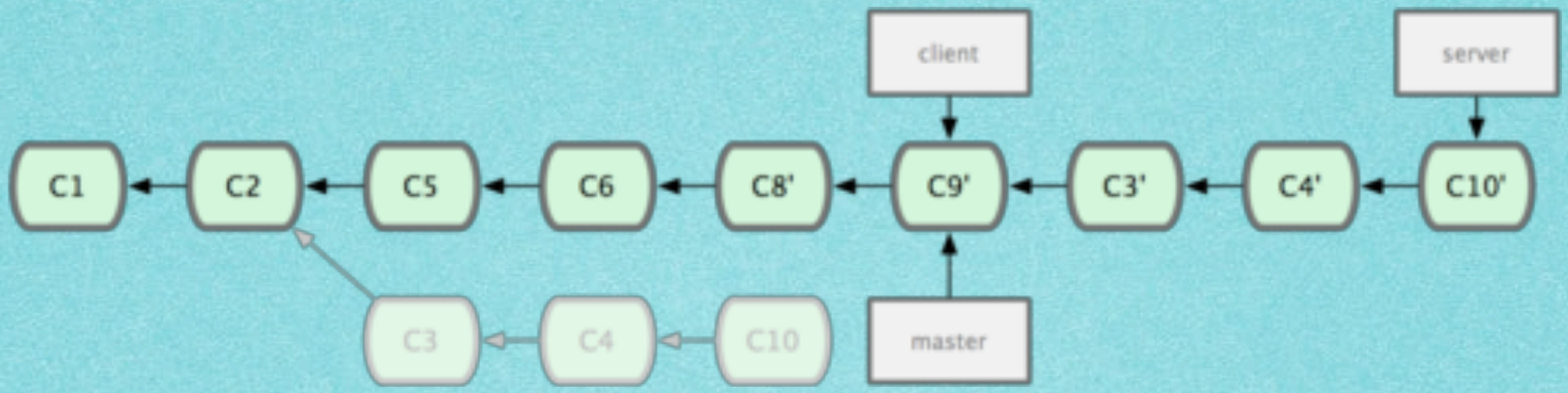

```
git rebase --onto master server client
```

「檢查*client*的*Branch*，
從*client*和*server*的共同祖先看作了哪些變動，
把那些變更重新在*master*上面作過一遍」



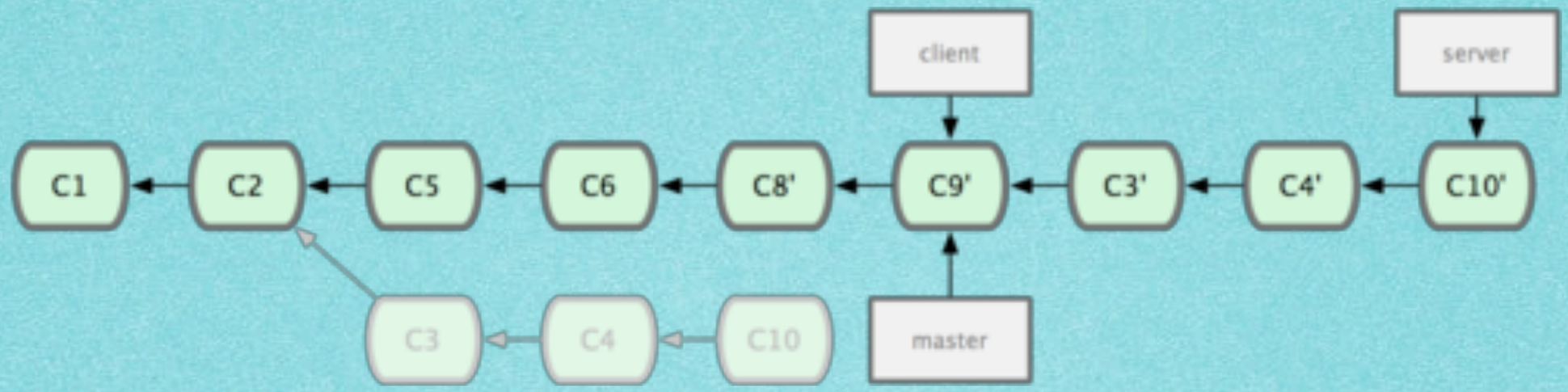

```
git checkout master
git merge client
```

對*client*作*fast-forward Merge*



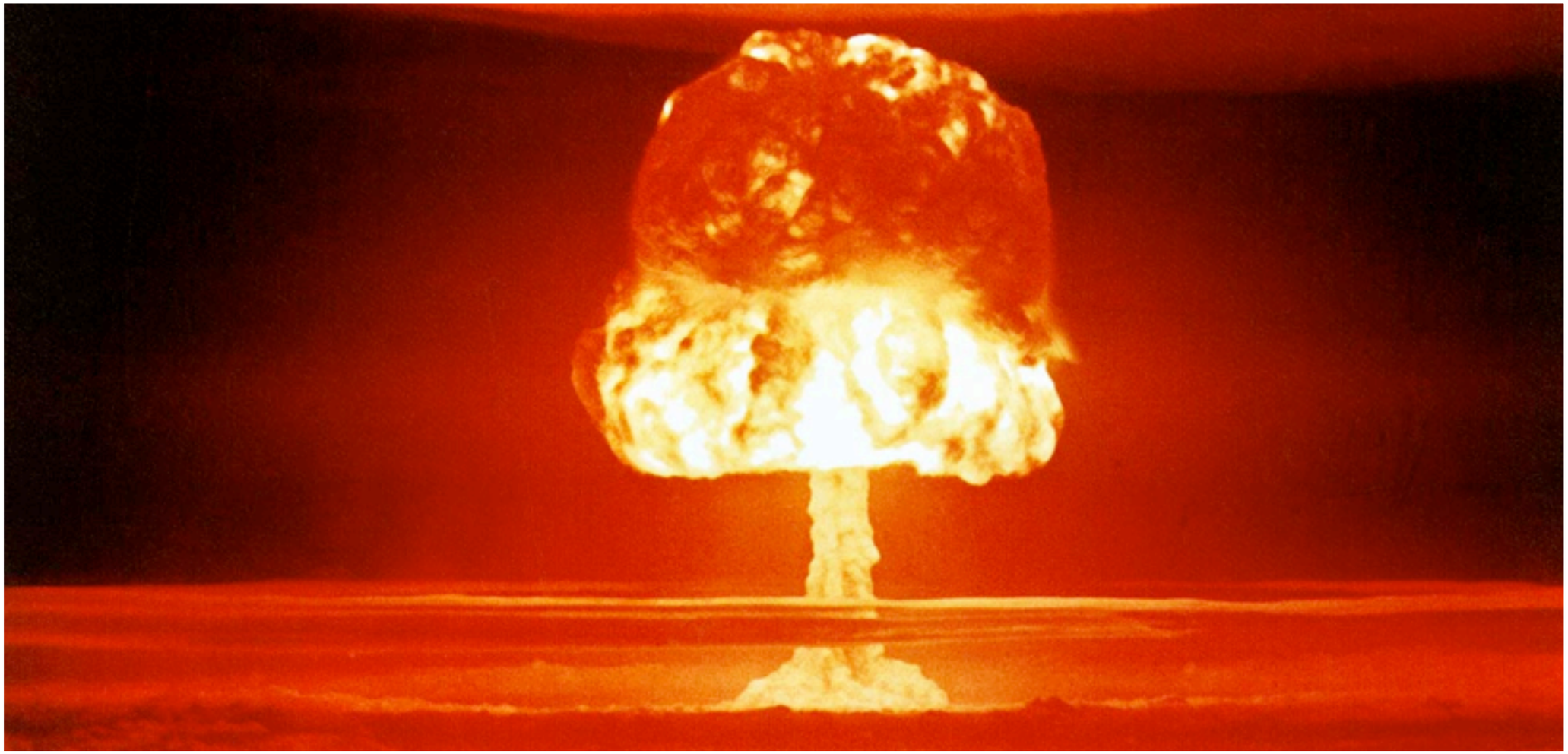

```
git rebase master server
```

直接指定要將哪個*Branch*的更動（*server*）
重新在哪個*Branch*作過一遍（*master*）




```
git checkout master
  git merge server
git branch -d client
git branch -d server
```

通通都*Merge*完之後
把兩條不要的*Branch*砍掉囉 :)



「千萬不要」對已經*Push*的東西作*Rebase*！

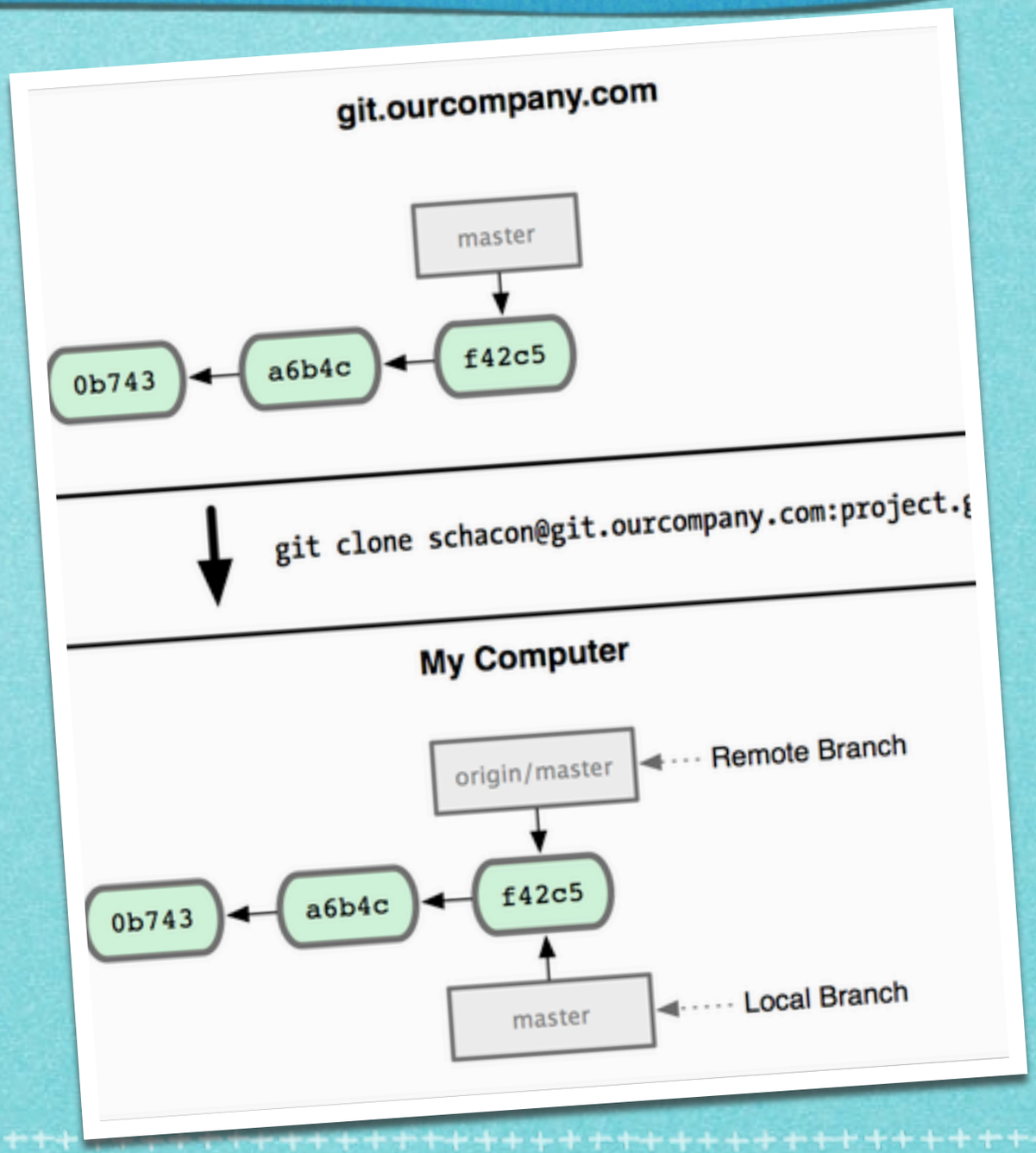
除非你想成為害群之馬。

Pic: http://commons.wikimedia.org/wiki/File:Castle_Romeo.jpg, Public Domain, United States Department of Energy

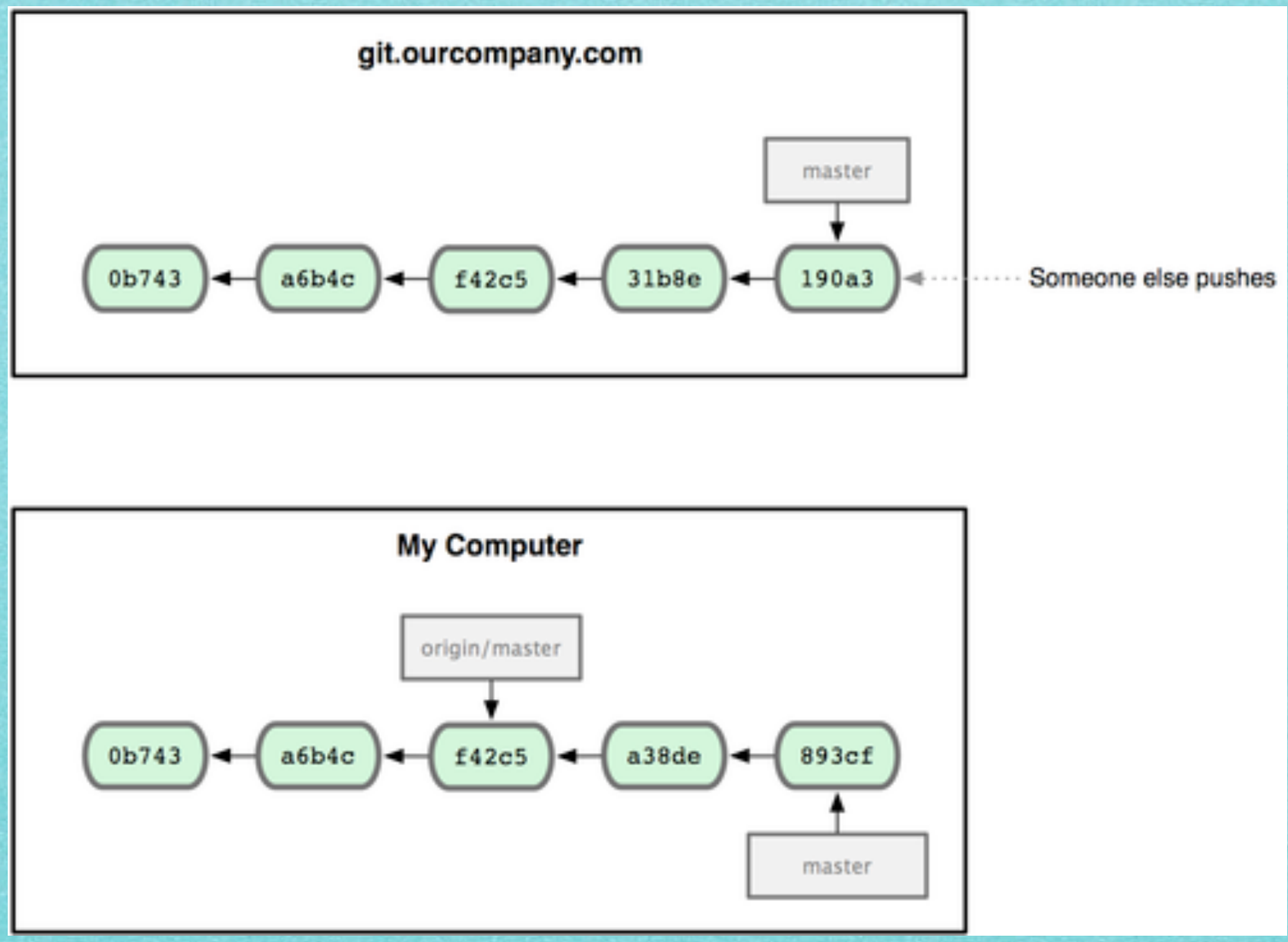
Remote Branches

Remote Branch

- 記錄「遠端套件庫」上的Branch狀態
- origin上的master分支就是origin/master
- 所以git clone會跑出origin/master和master



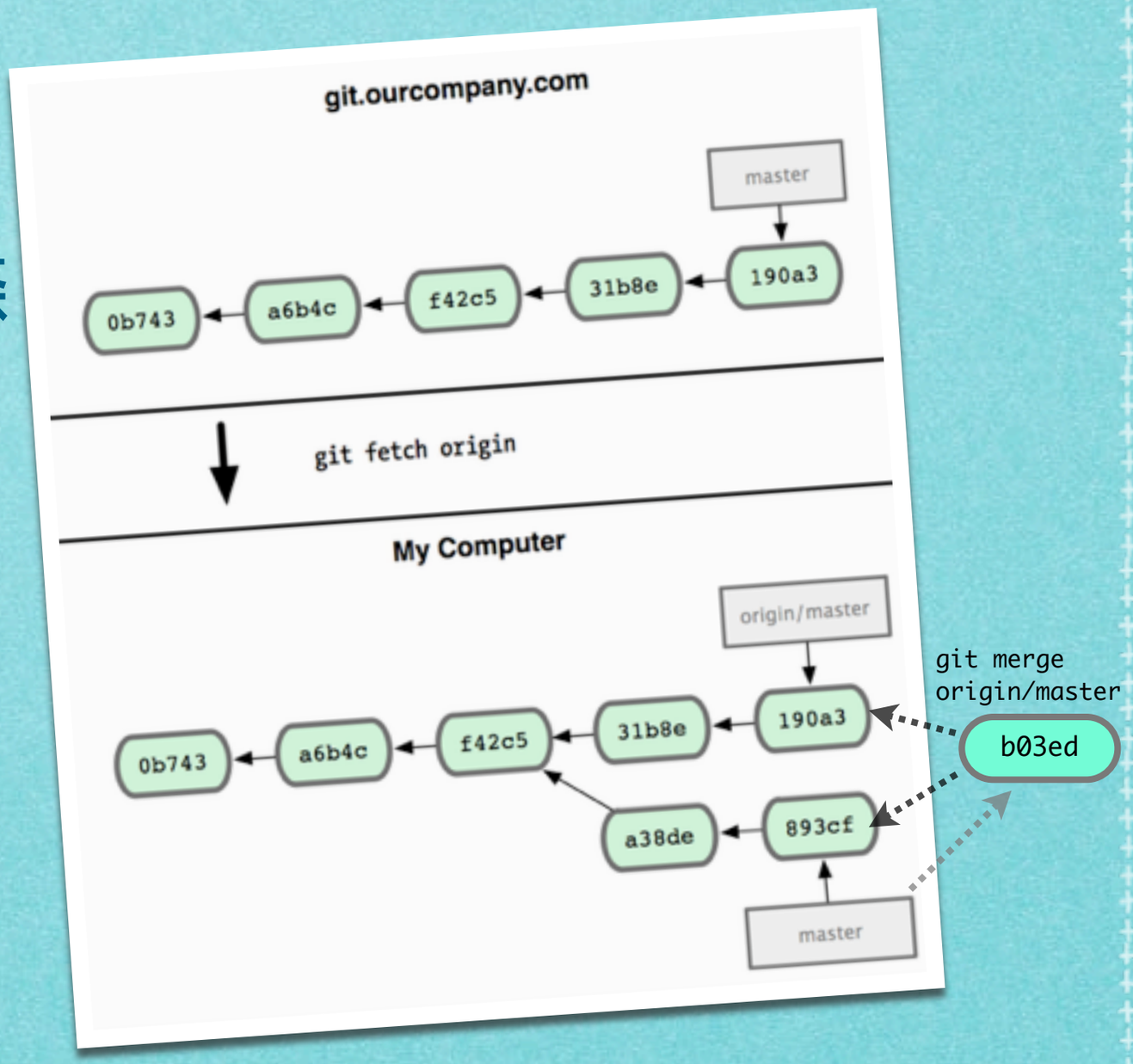
當你與Remote Branch 同時改了東西...



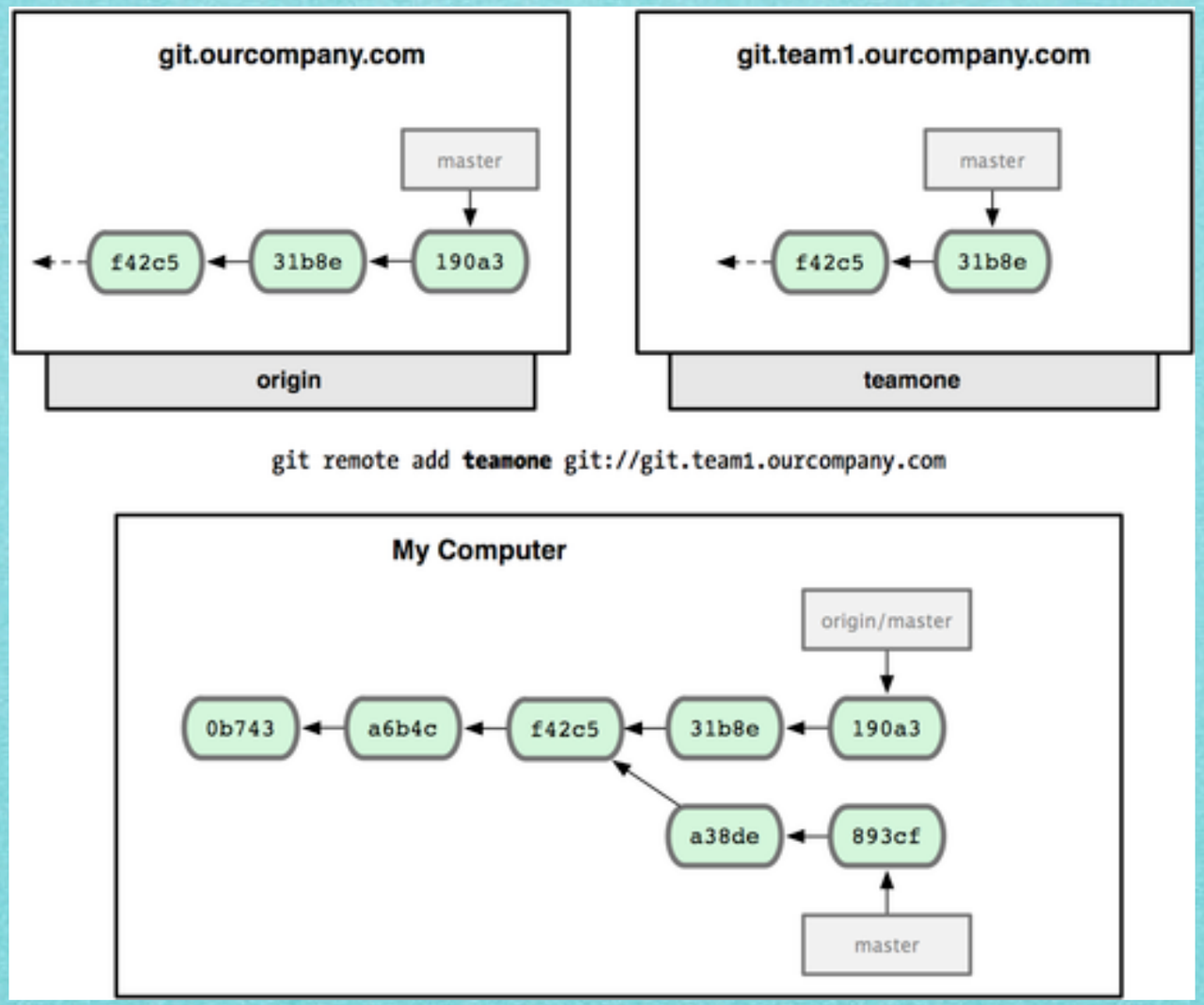
Pull = Fetch + Merge

- 把Origin作Fetch之後，兩邊同時有更動，因此會變成兩條分支
- 通常的作法是，用Merge合併回一條
- 所以會有git pull：

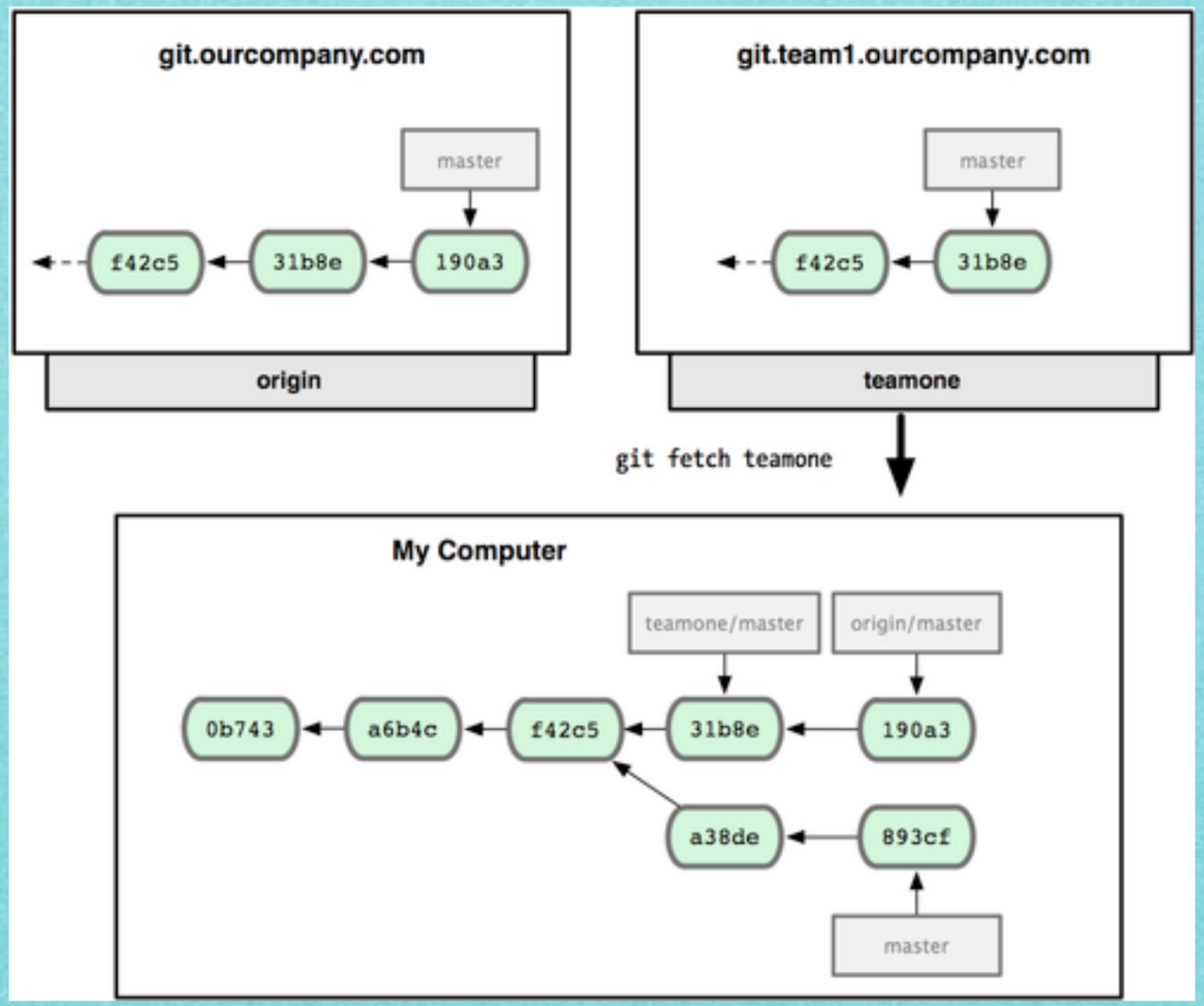
```
git pull origin =
git fetch origin 之後
git merge origin/master
```



新增一個Remote

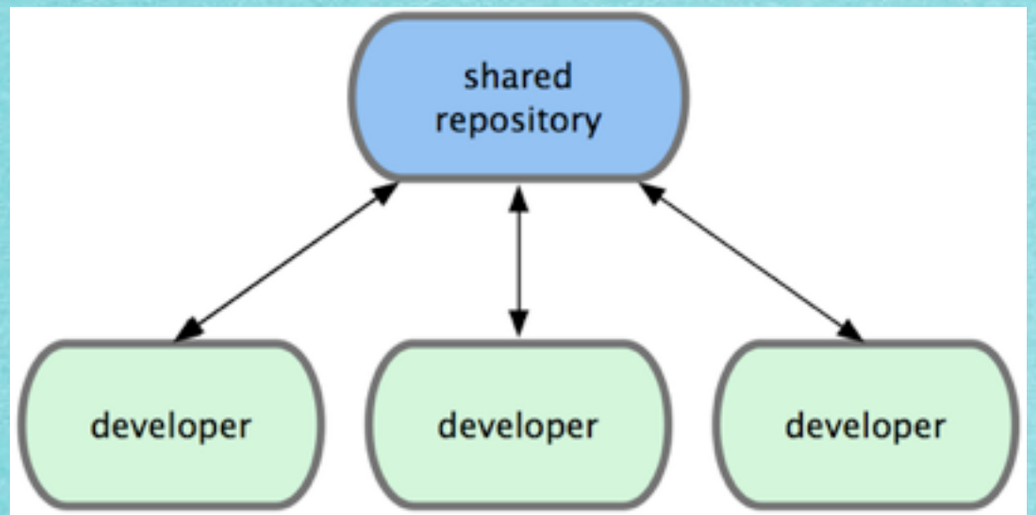

git.ourcompany.com
master
f42c5
31b8e
190a3
origin
git.team1.ourcompany.com
master
f42c5
31b8e
teamone
git remote add teamone git://git.team1.ourcompany.com
My Computer
origin/master
0b743
a6b4c
f42c5
31b8e
190a3
a38de
893cf
master

Fetch後會有新的Remote Branch



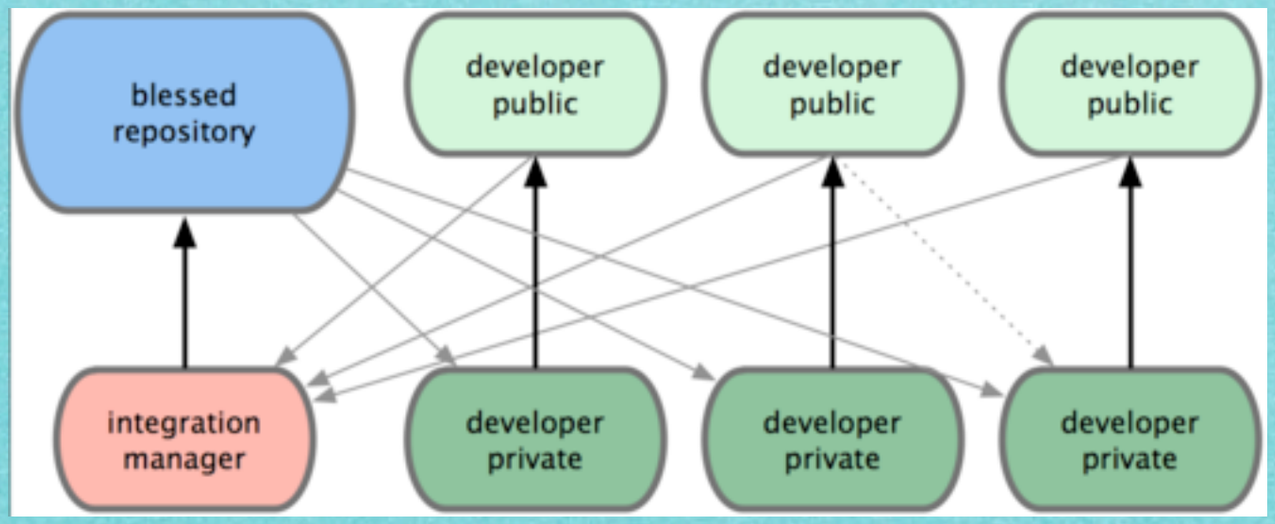
Distributed Workflows

開發方式任你選擇

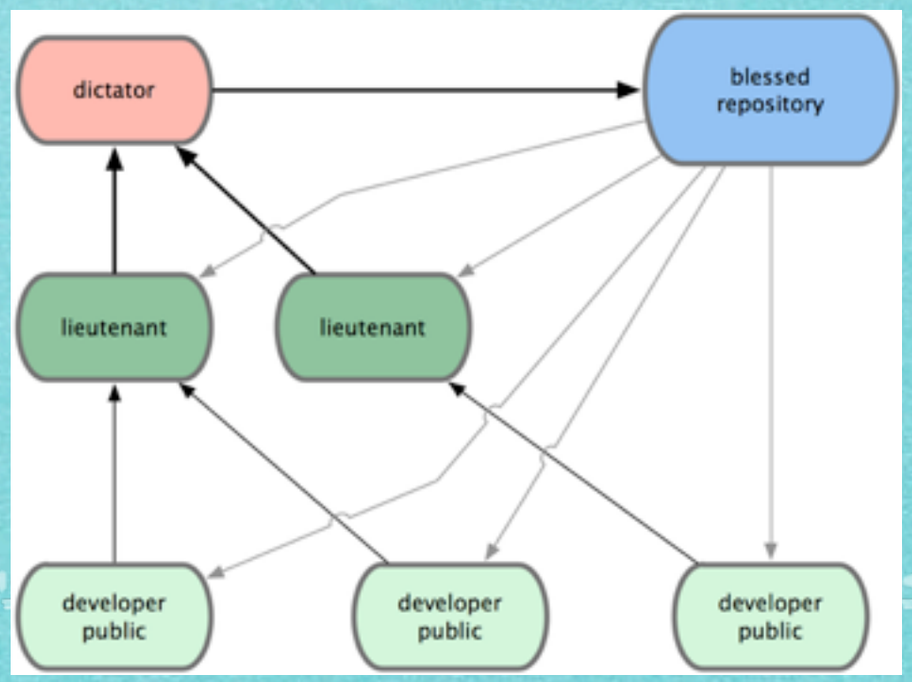


中央式的開發

整合管理員



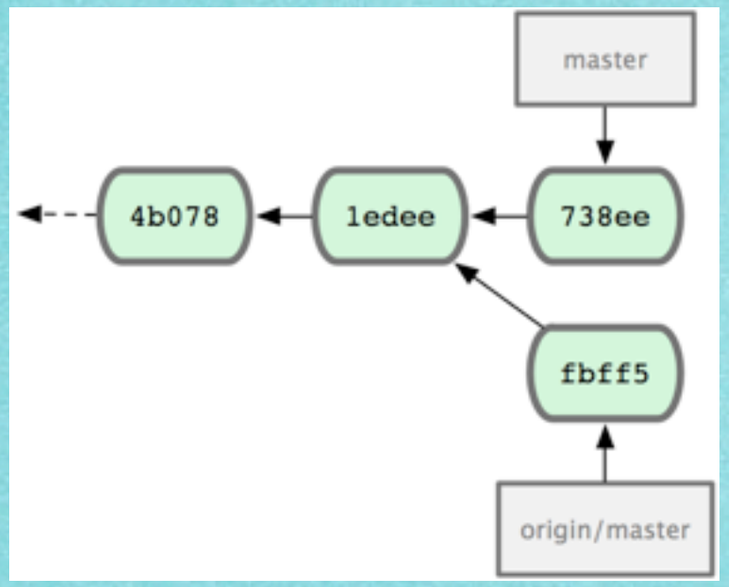
司令官和副手

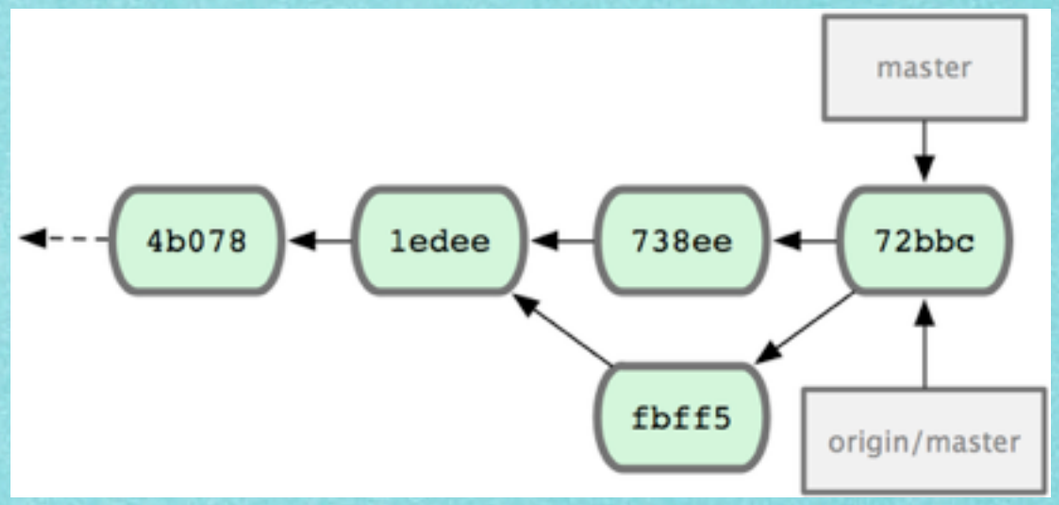


一些基本守則

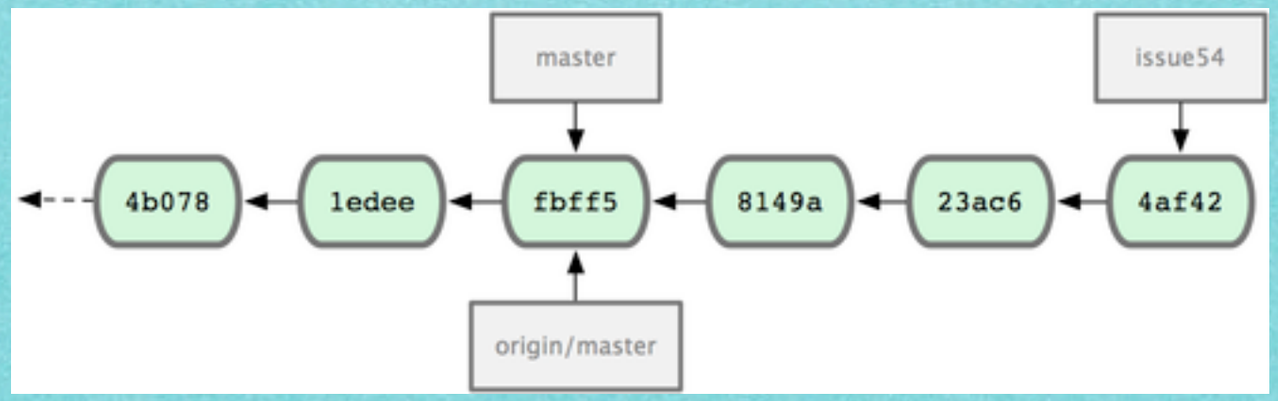
- 當你要Commit/送交Patch時：
  - 用`git diff --check`檢查行尾有沒有多餘的空白
  - 「每個Commit只改一件事情」
    如果一個檔案有多個變更，用`git add --patch`
    只選擇檔案中的部分變更進Stage
  - 寫清楚Commit Message！

私人小團體協作



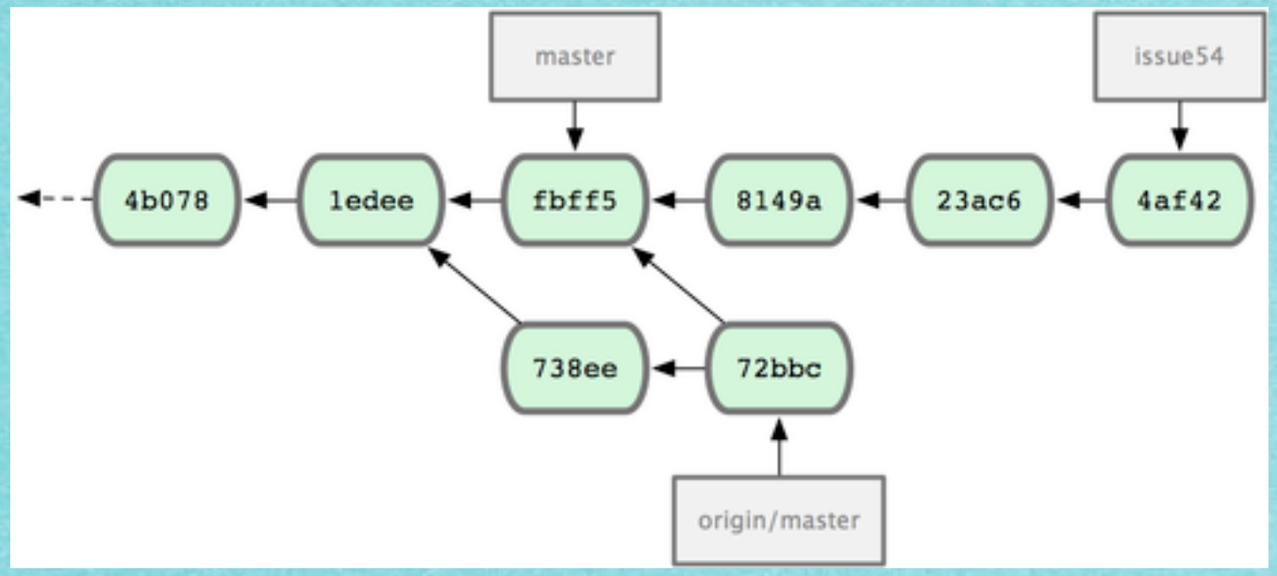


John 改了738ee之後Fetch跑出兩條，於是Merge起來，一切正常後Push



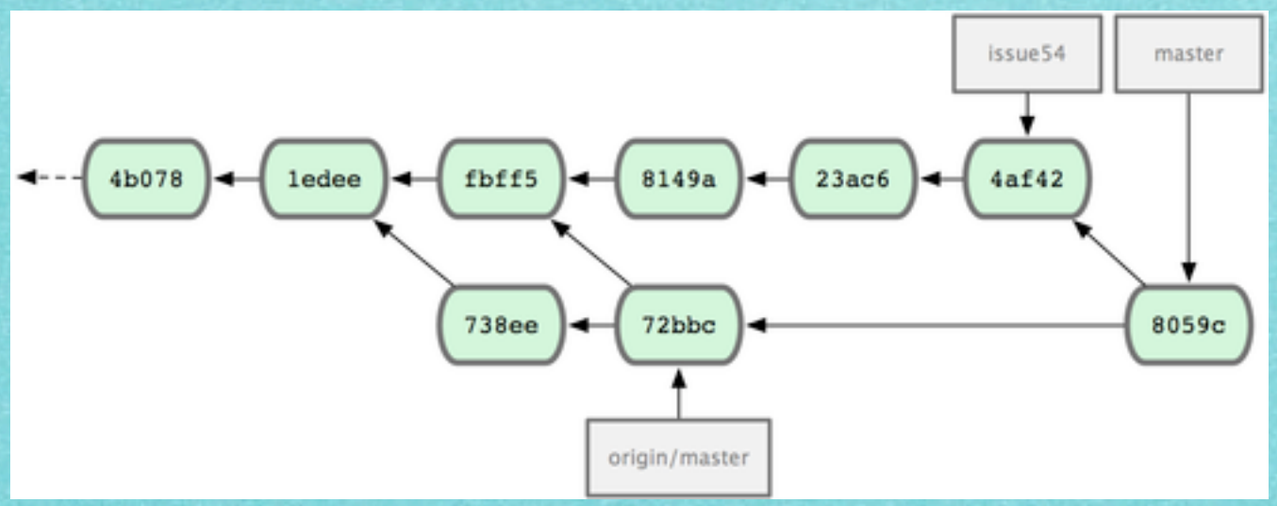
Jessica 開了一個Branch專心來處理 Issue 54 的臭蟲

Jessica會怎麼做？



Fetch之後，Jessica發現John有更動，檢查過後，先合併issue54（Fast-foward）：

```
git checkout master
git merge issue54
```

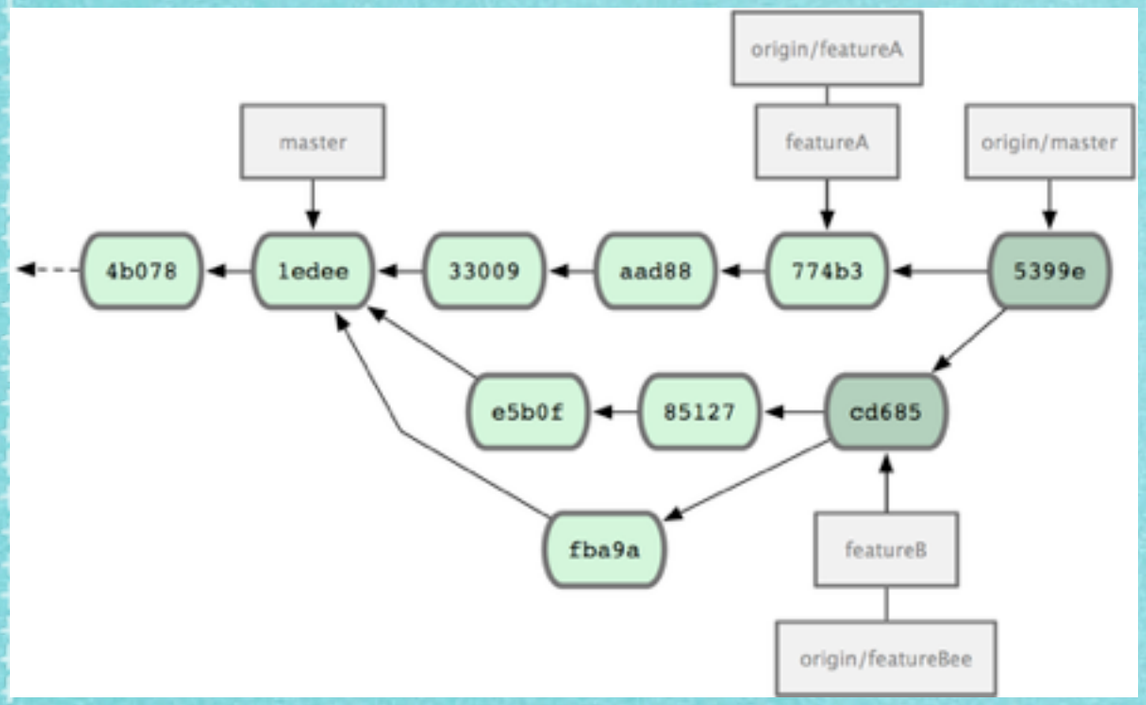


然後合併origin/master：

```
git merge origin/master
```

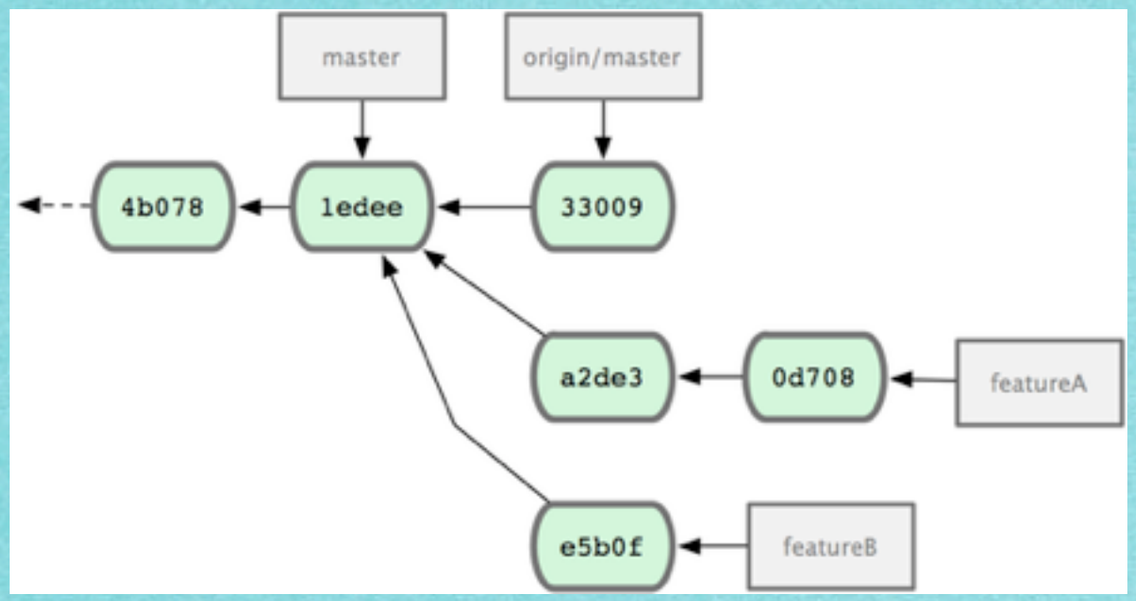
就可以快樂Push了！

規模較大私人團體的協作



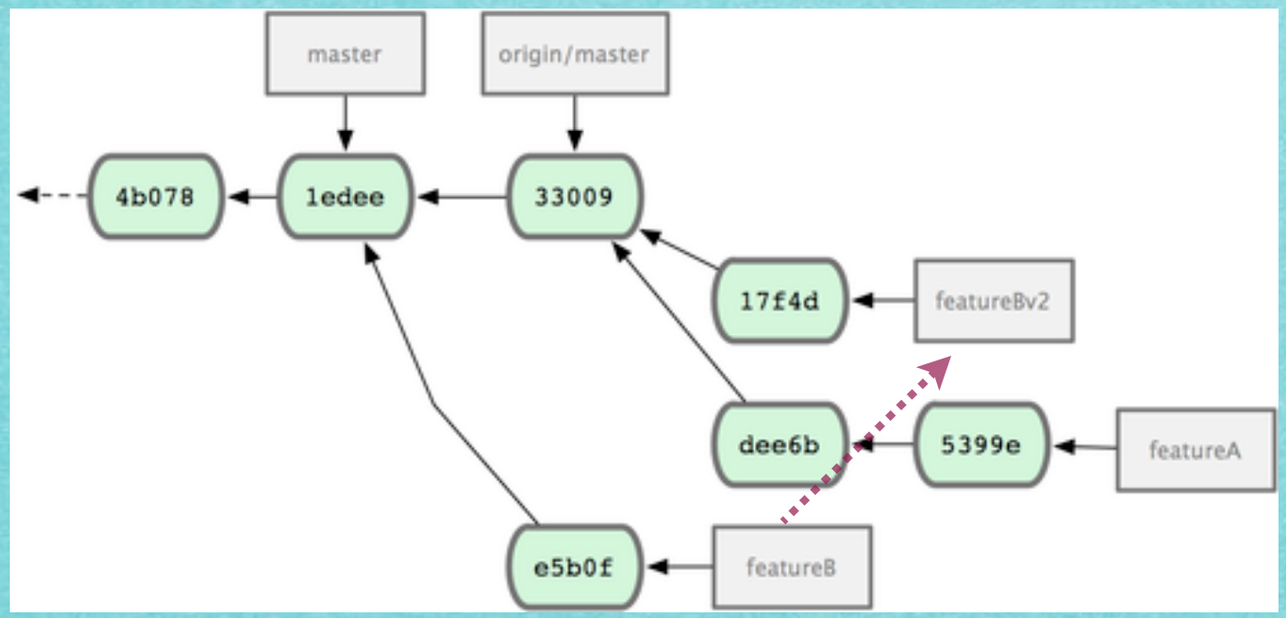
三個人一起工作
開兩個Branch寫兩種功能
最後把一切Merge起來

公開的小型協作



開了A、B兩個Branch之後
先用Rebase把A組好：

```
$ git checkout featureA
$ git rebase origin/master
$ git push -f myfork featureA
```

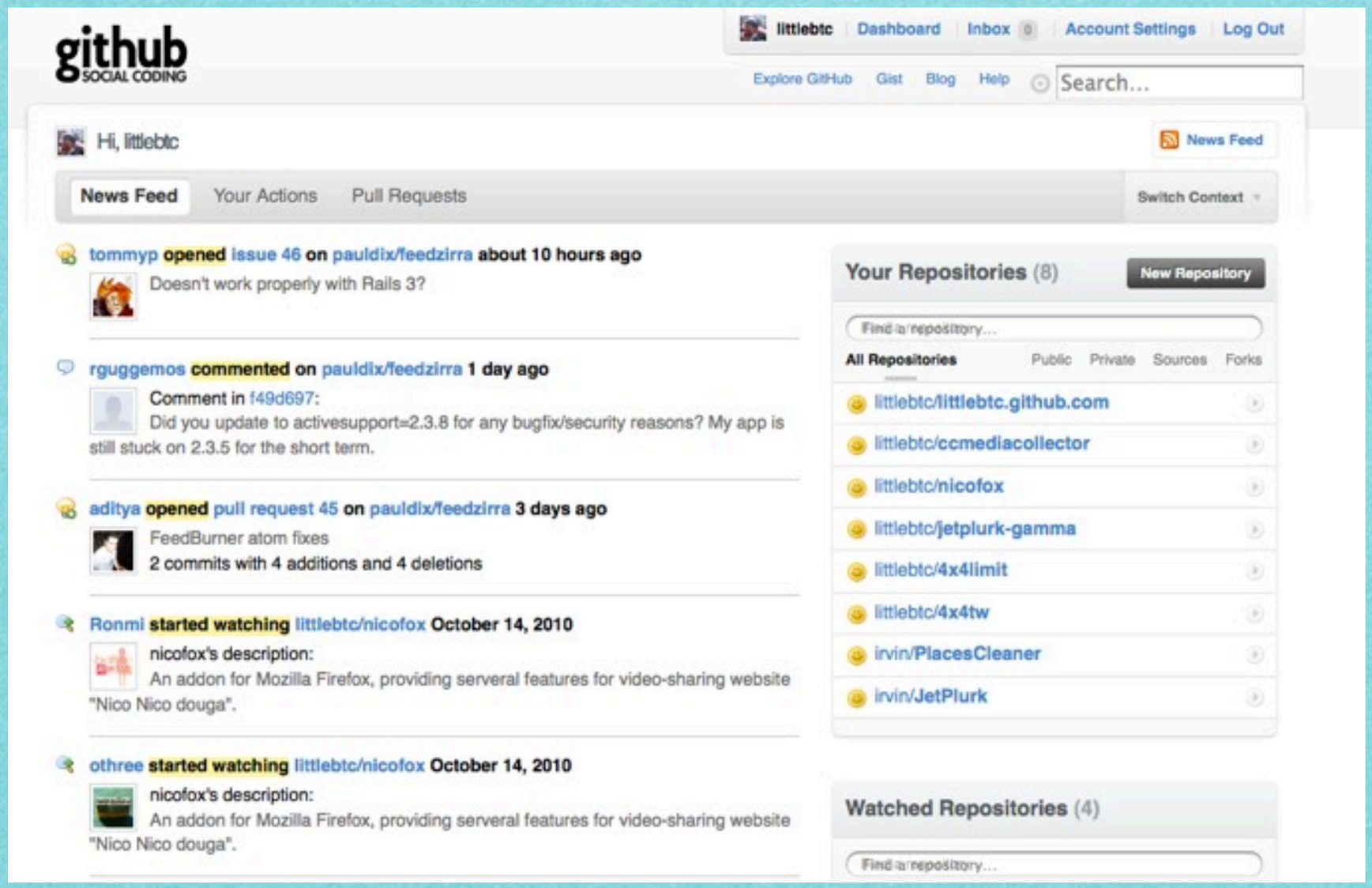


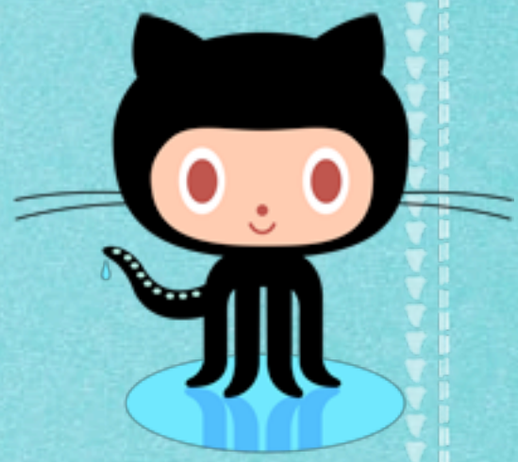
再用「奇妙Merge」
把B組回去：

```
$ git checkout -b featureBv2 origin/master
$ git merge --no-commit --squash featureB
$ (change implementation)
$ git commit
$ git push myfork featureBv2
```

... Still a lot to learn!

github 很好玩！





...而且對公開的 Open Source 專案免費！

了解更多

- *Pro Git* 線上電子書： http://progit.org/
  這份投影片大部分的內容都出於此處，是很好的 Git 線上說明！

- ihower 的 Git 文章系列： http://ihower.tw/blog/archives/category/git