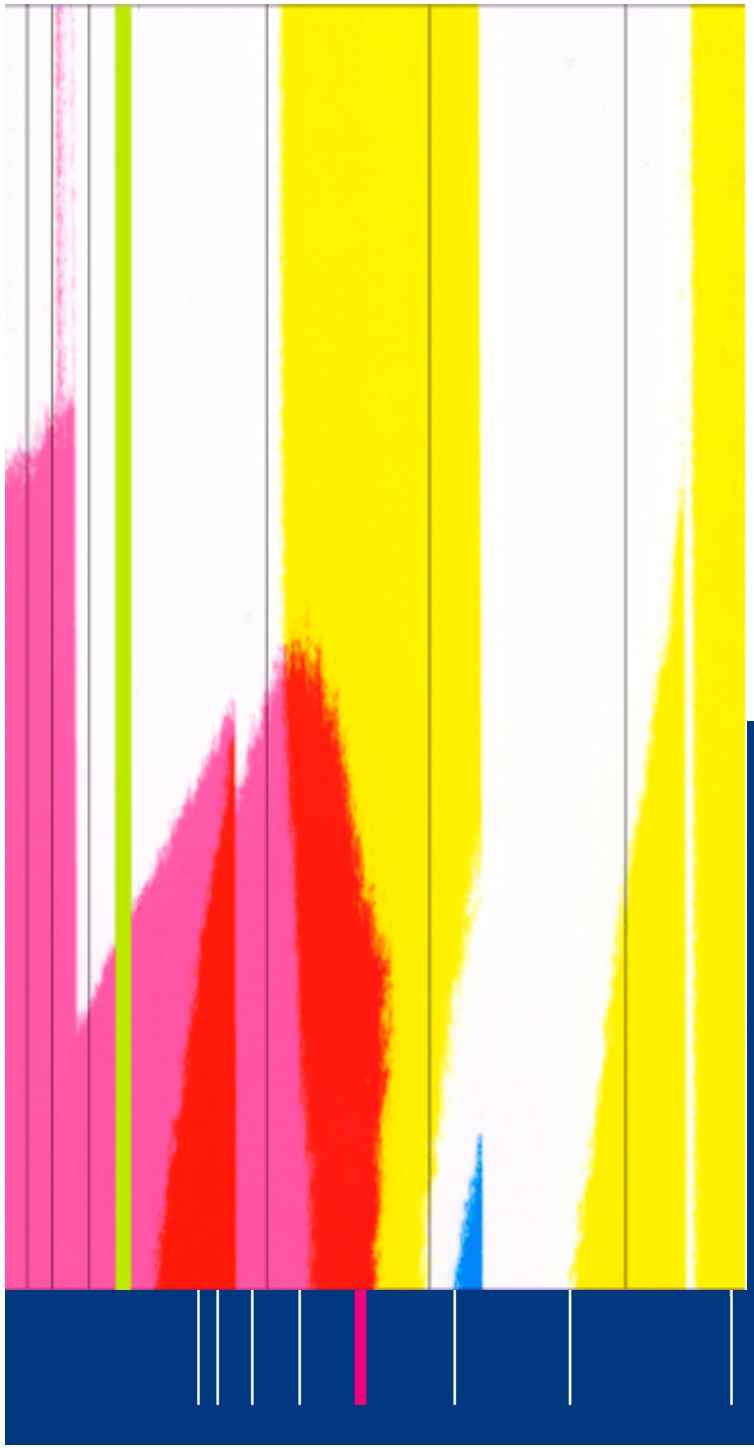


Git :

Le fil d'Ariane de vos projets, pilier des forges modernes

Claire Mouton
JDEV 2017 – 4 et 5 juillet 2017

Basé sur les travaux de :
Christophe Demarey, Julien Vandaele
Research Centre INRIA Lille – Nord Europe

Creatis

Why using SCM (Source Code Mangement)?

Old school

cp myAlgo.c myAlgoWithFunctionalityB

cp myAlgo.c myAlgoWithFunctionalityC

=> Which one is the latest?

cp myAlgo.c myAlgo-v1.c

cp myAlgo.c myAlgo-v2.c

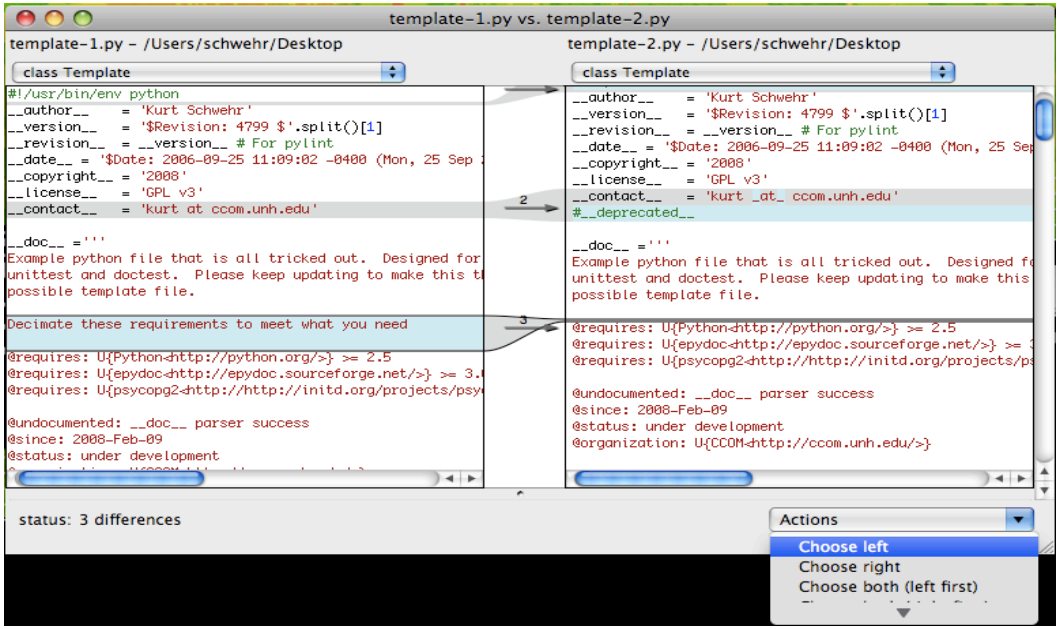
=> Which one has functionality B ?

SCM

- **One revision per functionality**
- **Author name + date**

Why using SCM?

- Retrieve a previous version
- Know when a feature / a bug has been introduced
  - Be able to diff files to easily find a bug, …



Why using SCM?

Cooperative work

- Share the same vision of a software / document
  - A single reference repository
  - Avoid sending files via email to your colleagues
  - Be able to work in parallel on the same files
    - No manual diff
    - Automatic merge
    - Conflict management

Product management

- Mainline for the development release
- Branches for experiments, maintenance revisions
- Tags for releases

What are SCM usages?

- Version history
  - Navigation
  - Retrieve older versions
  - ...
- Collaborative work
  - Simultaneous work of several people on the same project
    - ex: Conflicts resolution
  - Fork / work on another branch
    - ex: A PhD student who wants to start an experimentation

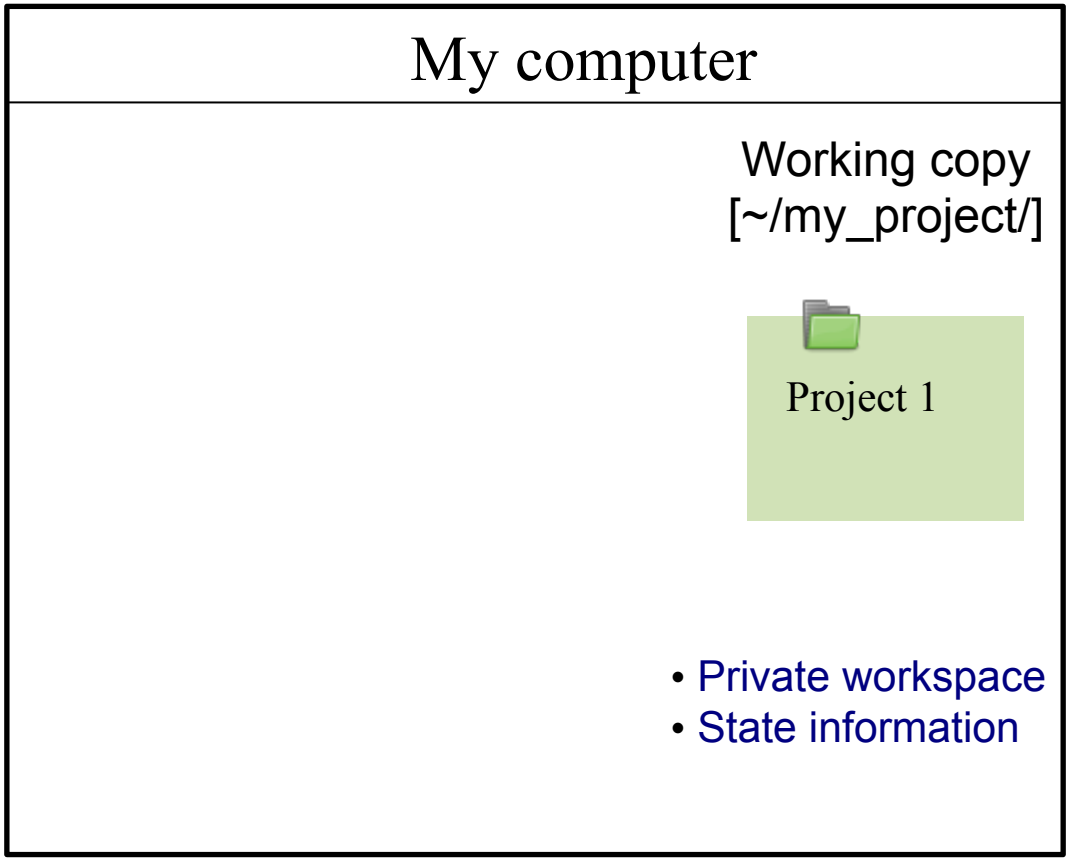
- Applies to text files (code in any language, article/documentation .tex, web site, system configuration files, .odt) (based on diff)

- Less suitable for binaries, images, .dll, ...

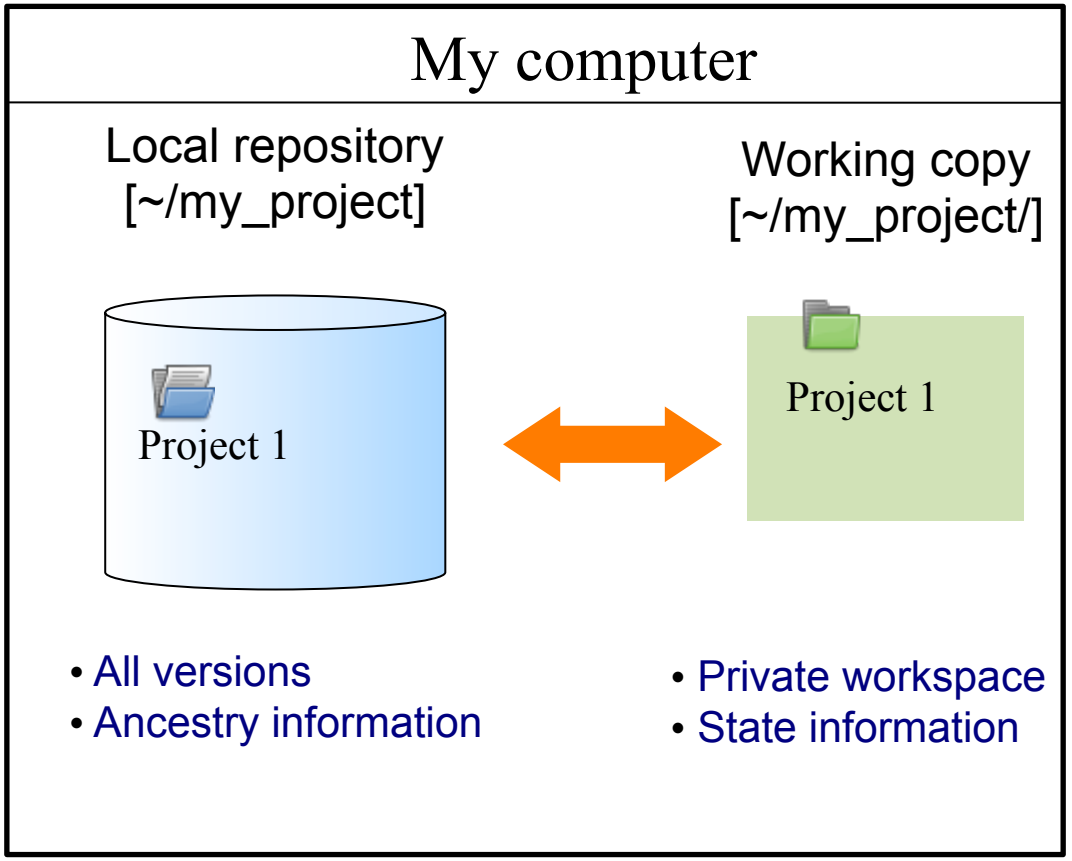
- Shouldn't be used to backup! Even if it saves a copy of your work...

Core Notions

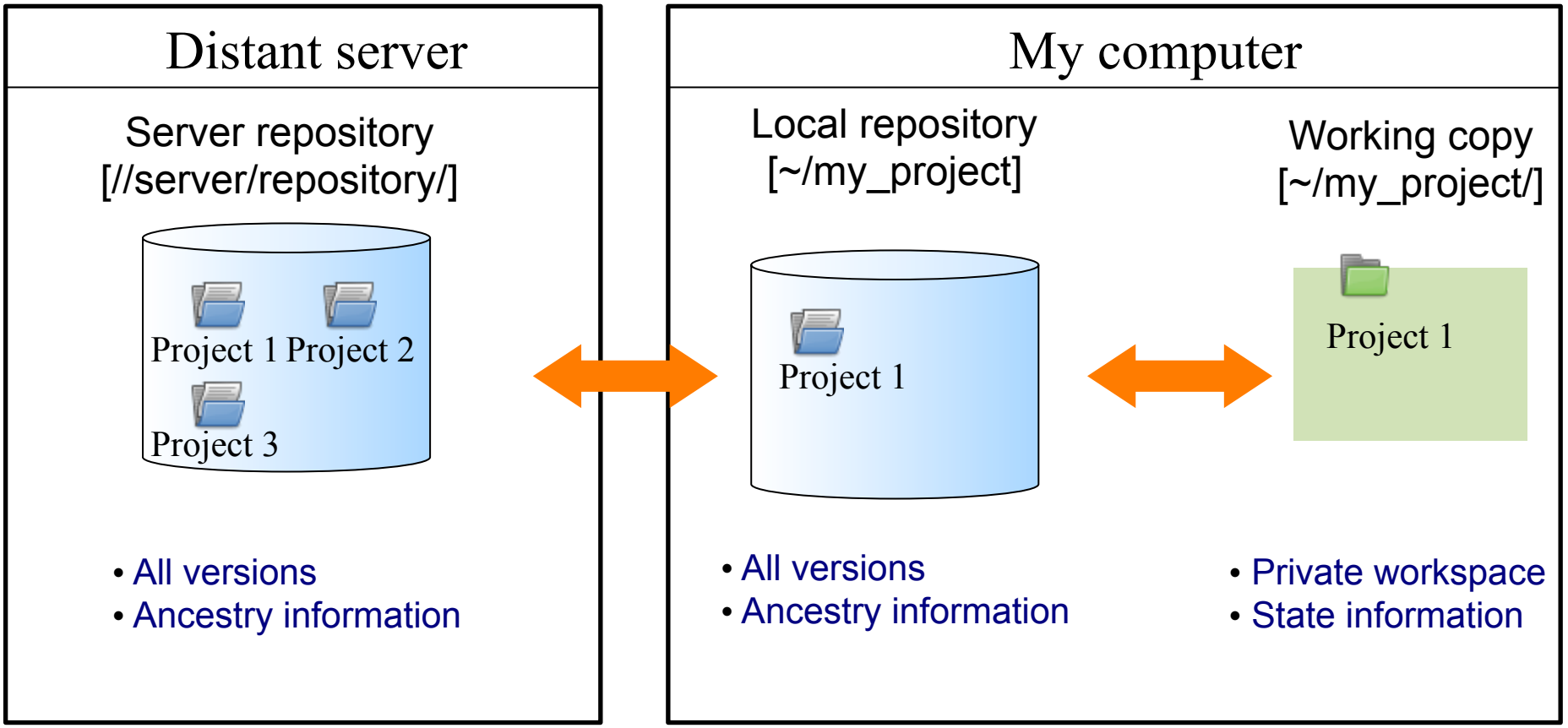
Core notions > *Organization*



Core notions > *Organization*

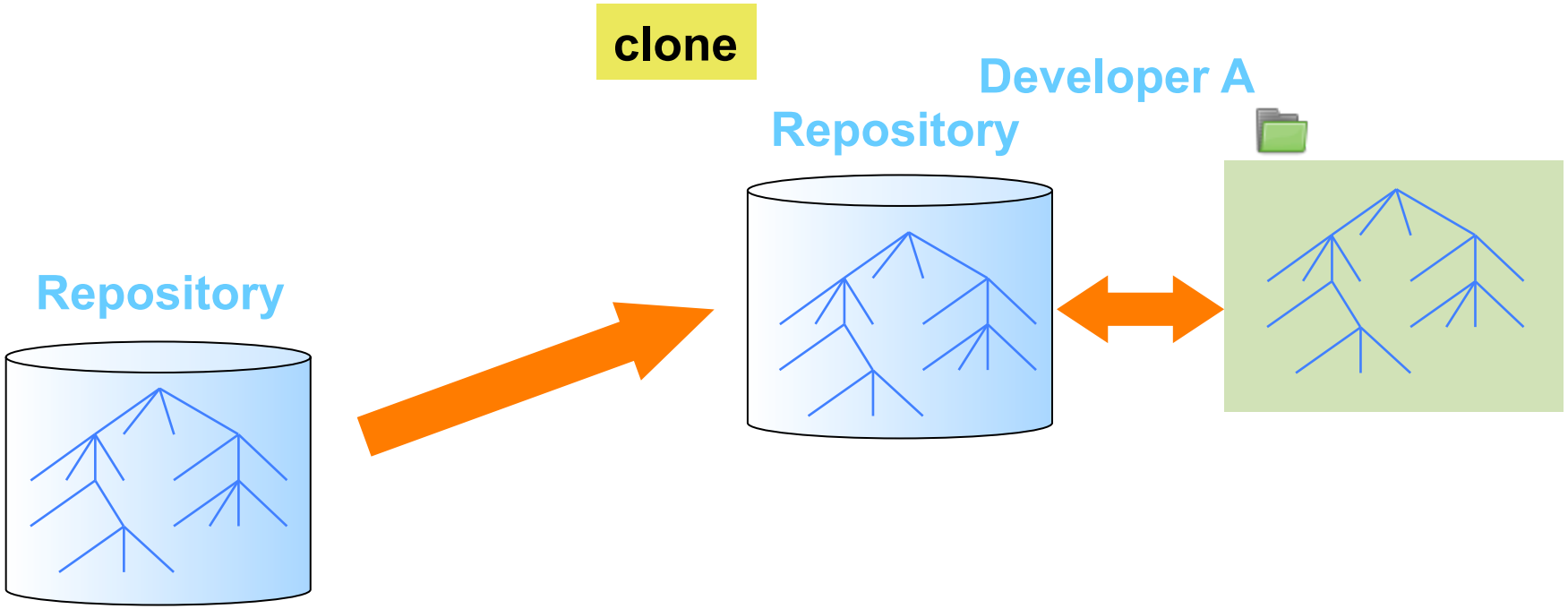


Core notions > *Organization*

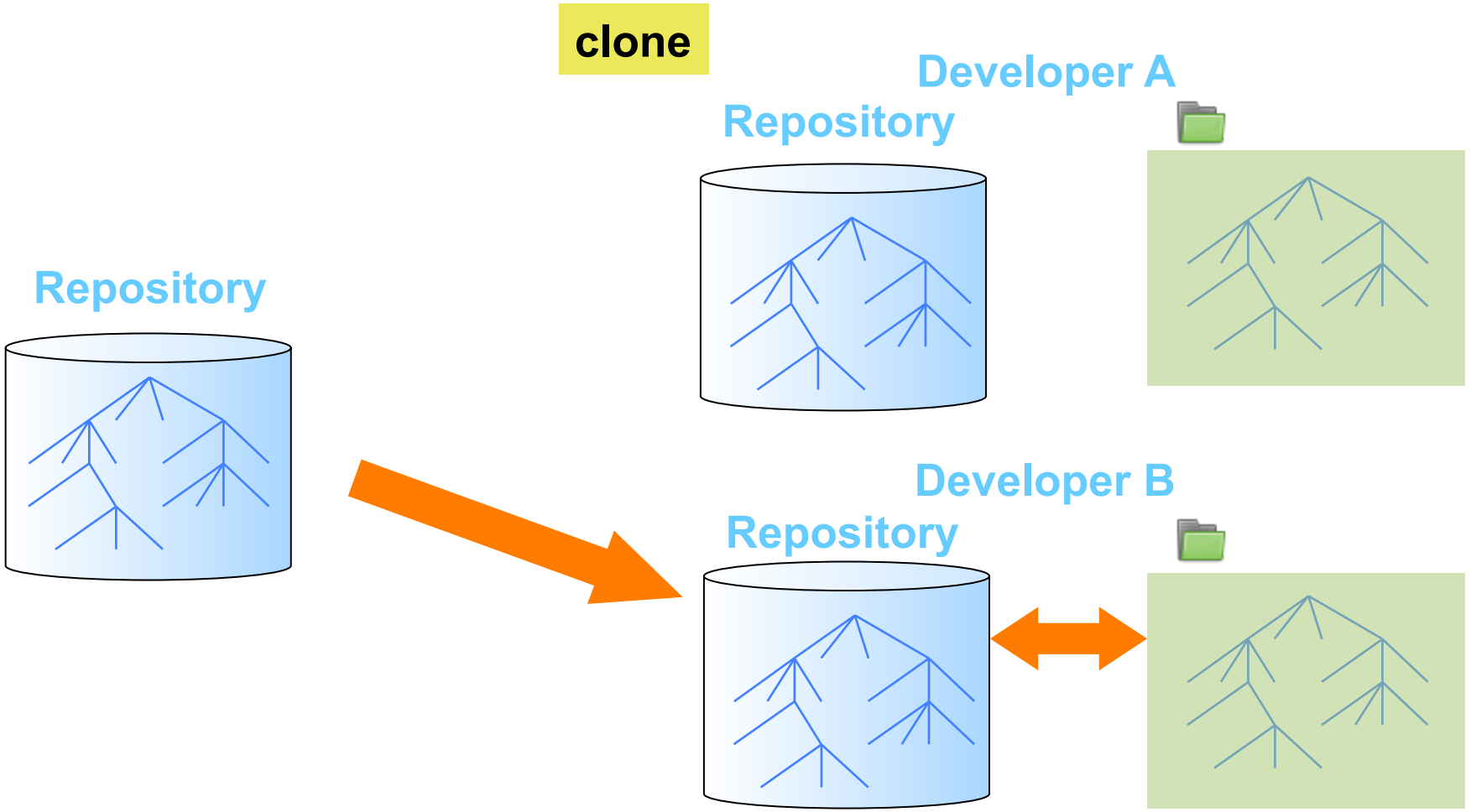


Core notions >
A scenario with 2 developers and a remote repository?

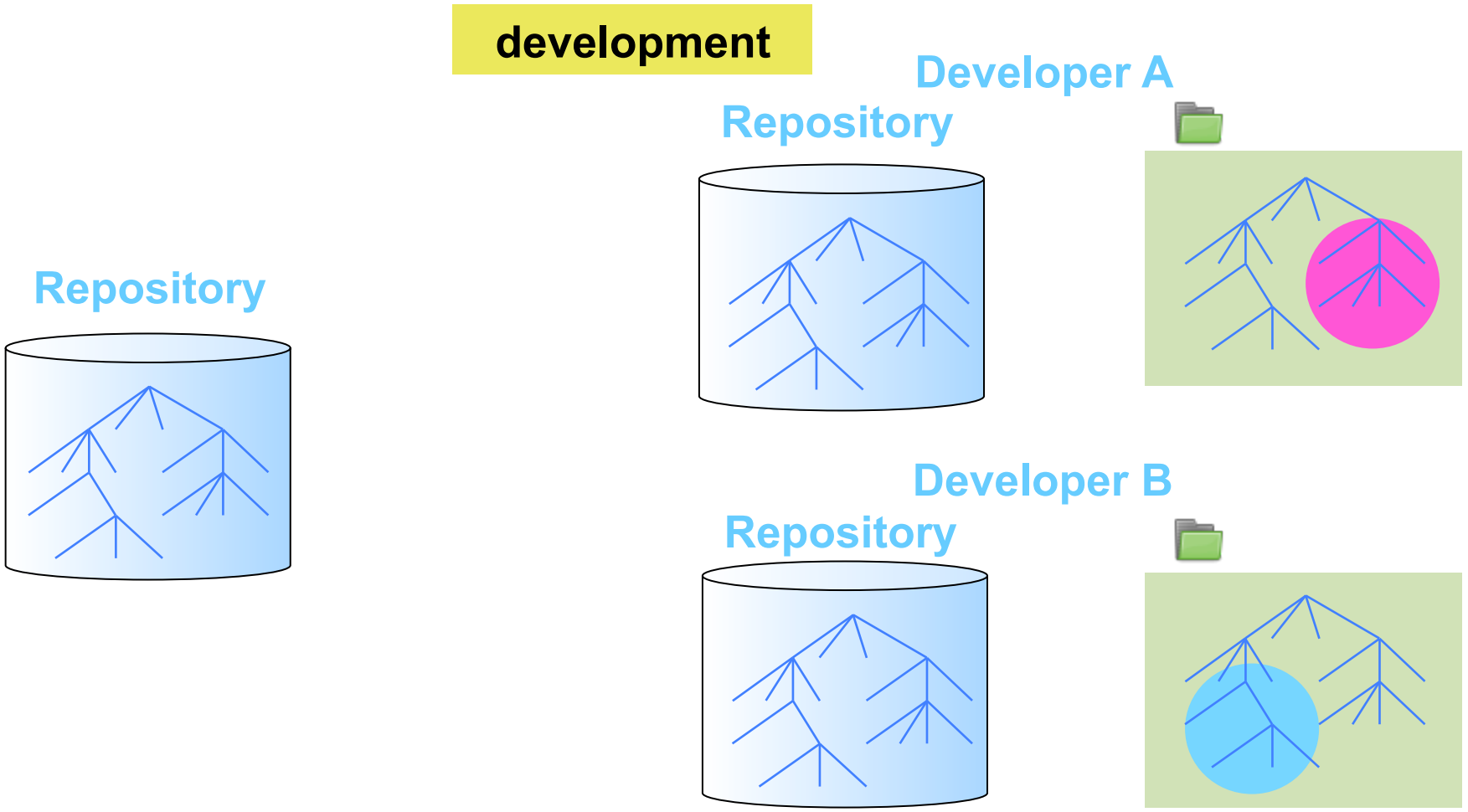
Core notions > *Get a project*



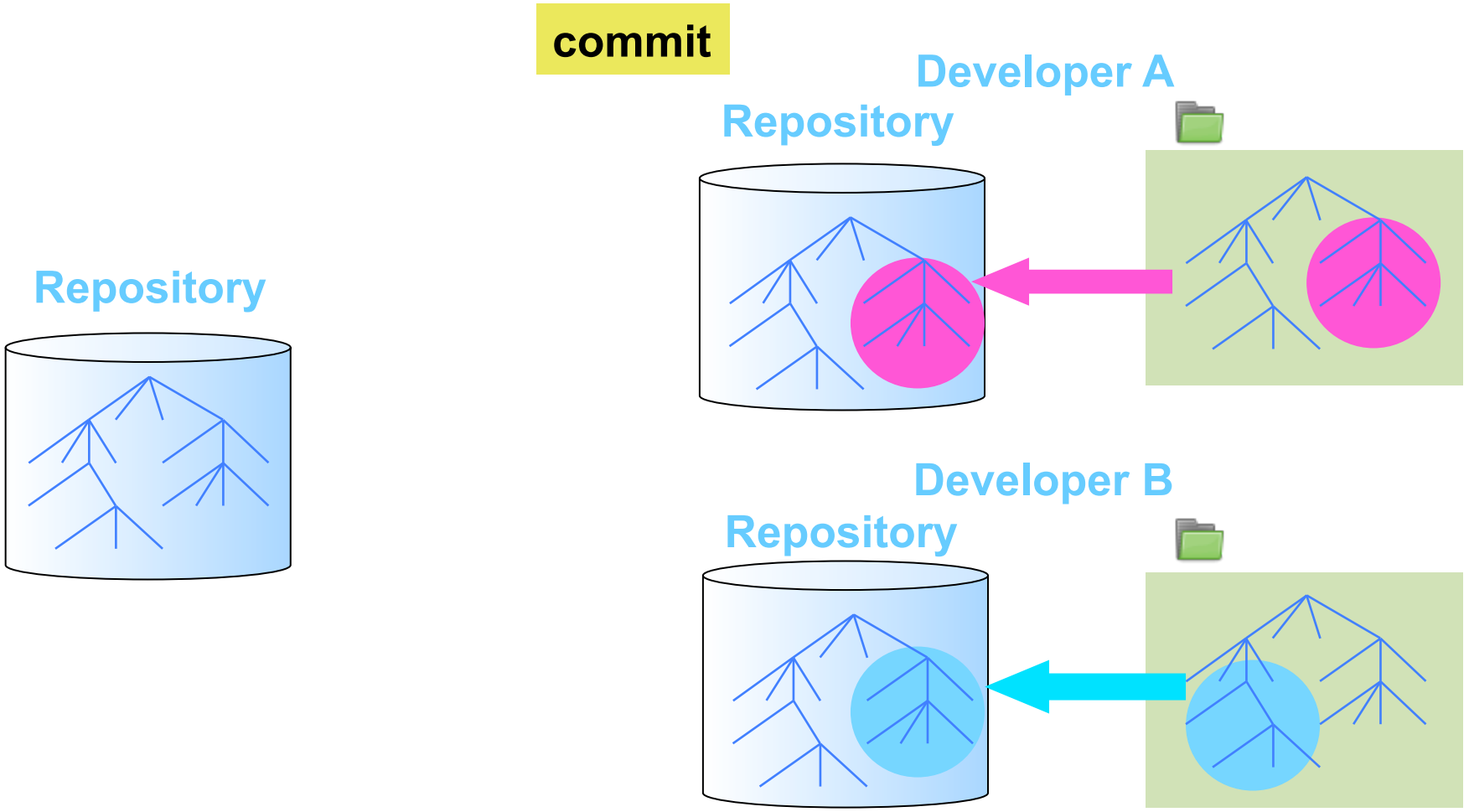
Core notions > *Get a project*



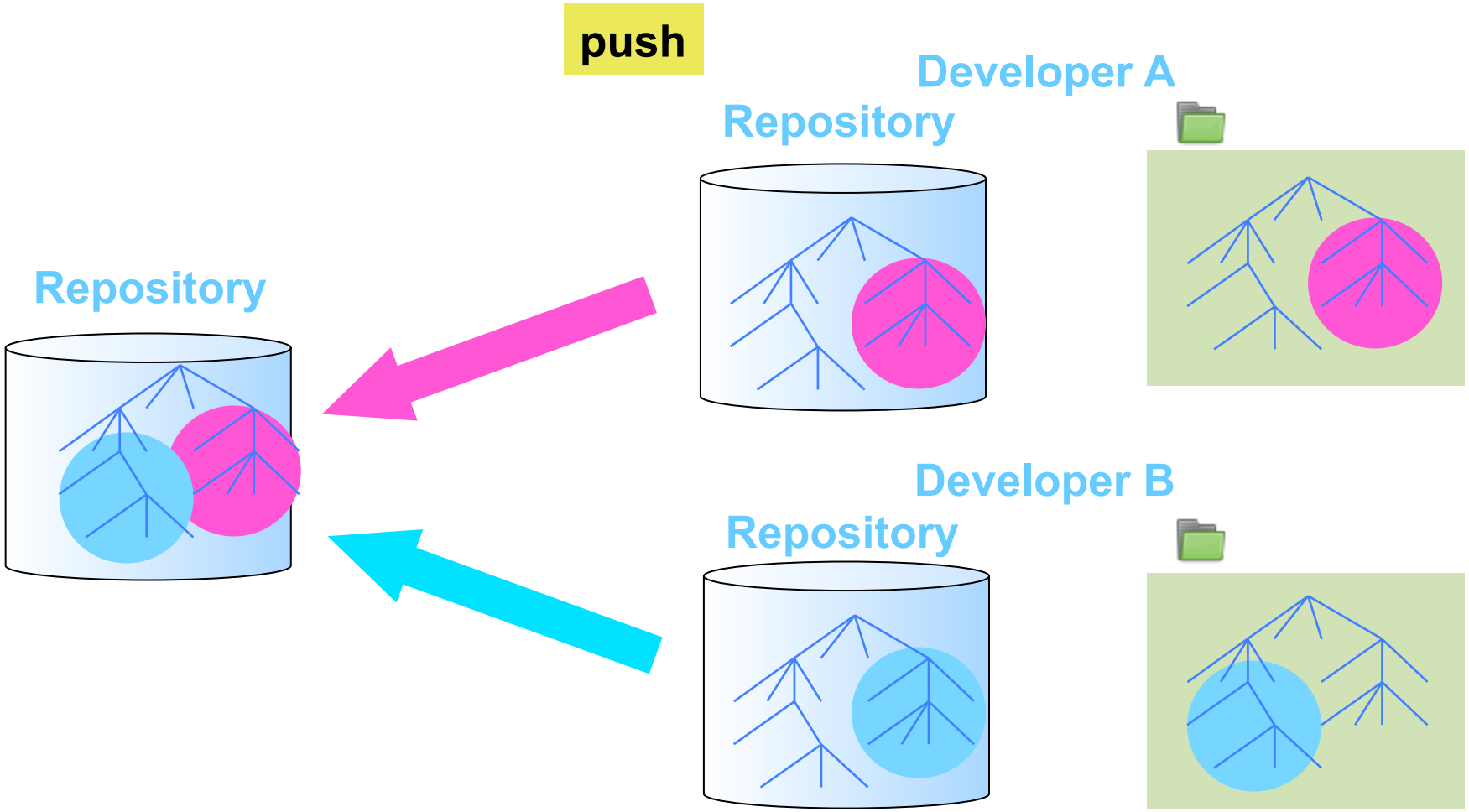
Core notions > *Commit*



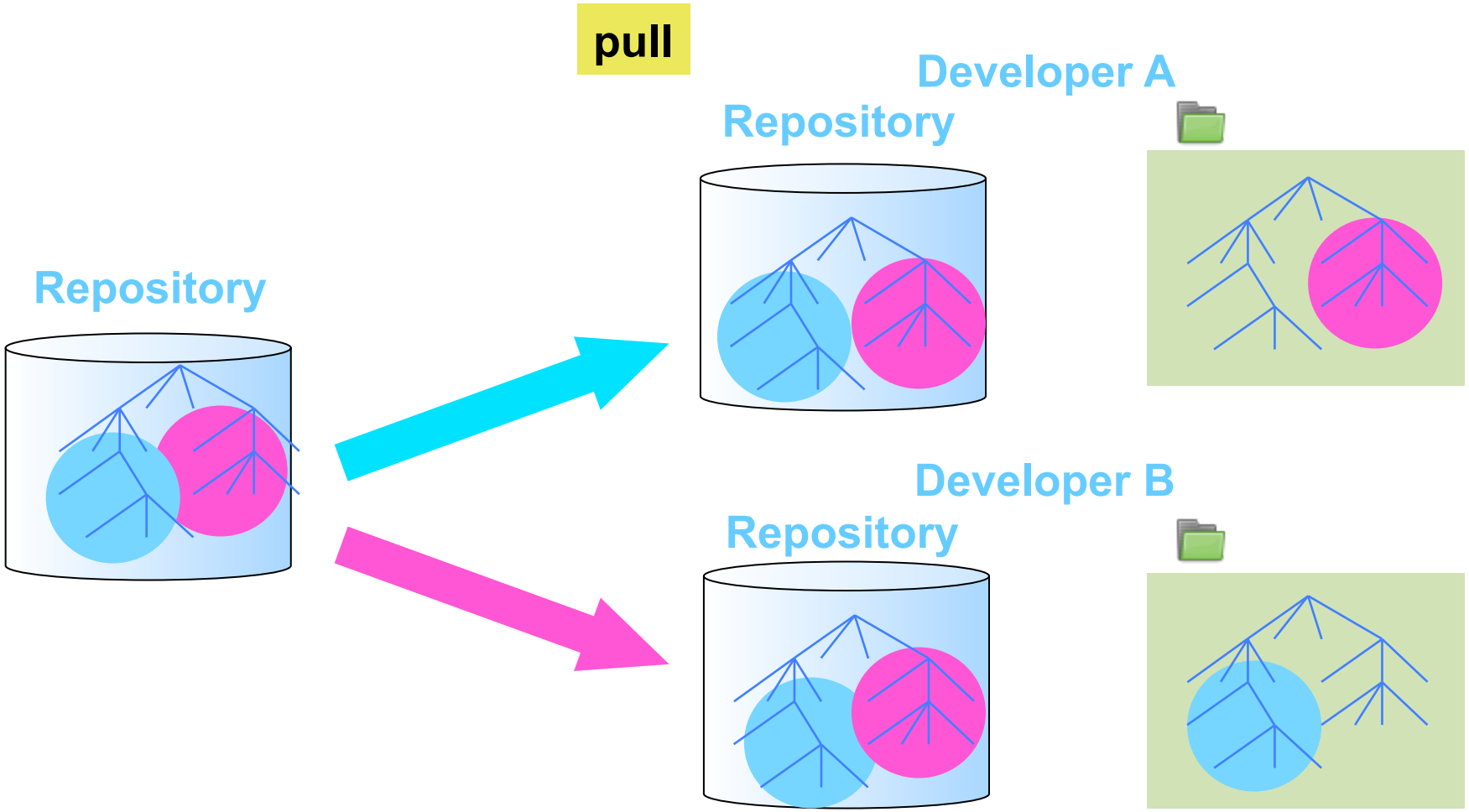
Core notions > *Commit*



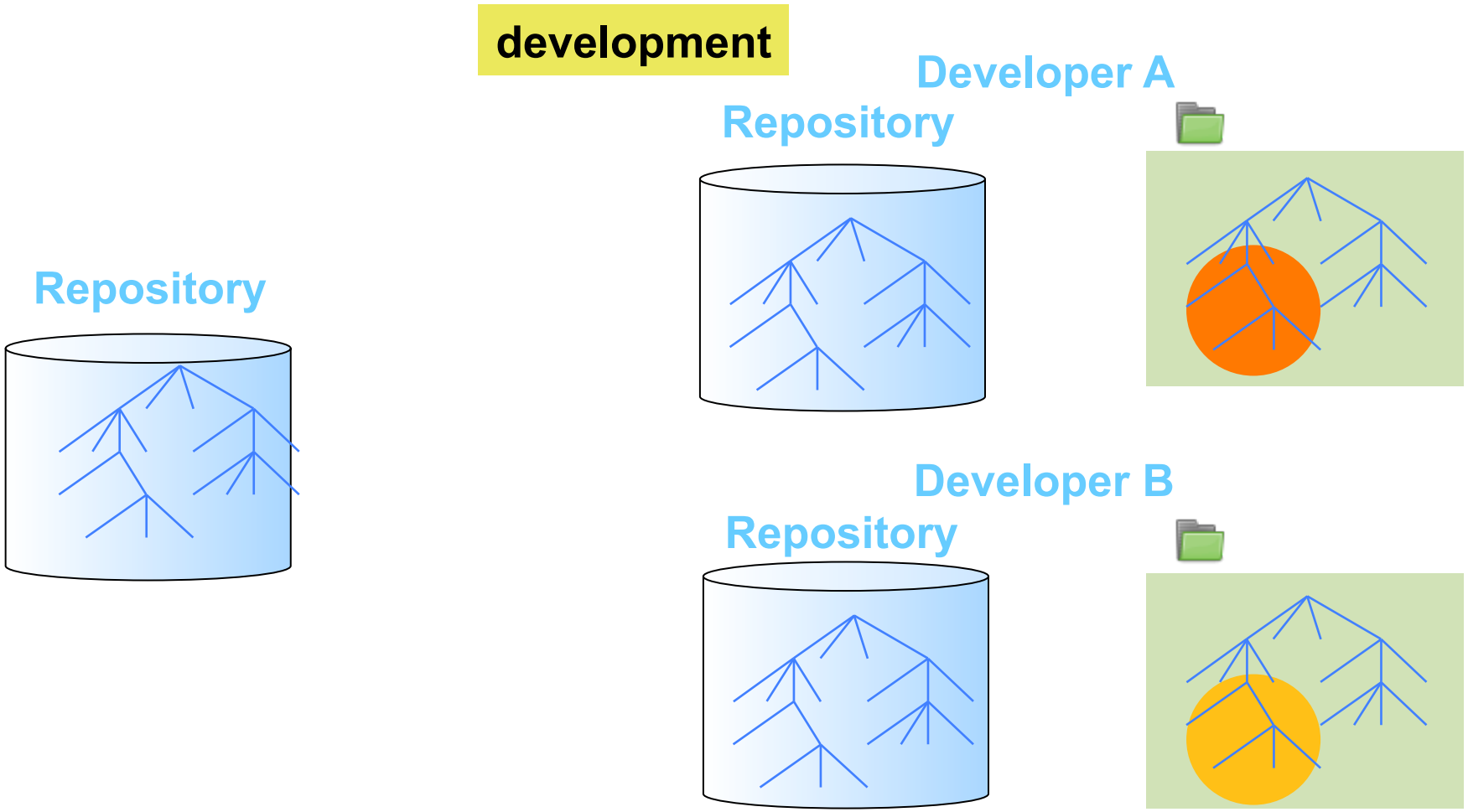
Core notions > *Commit*



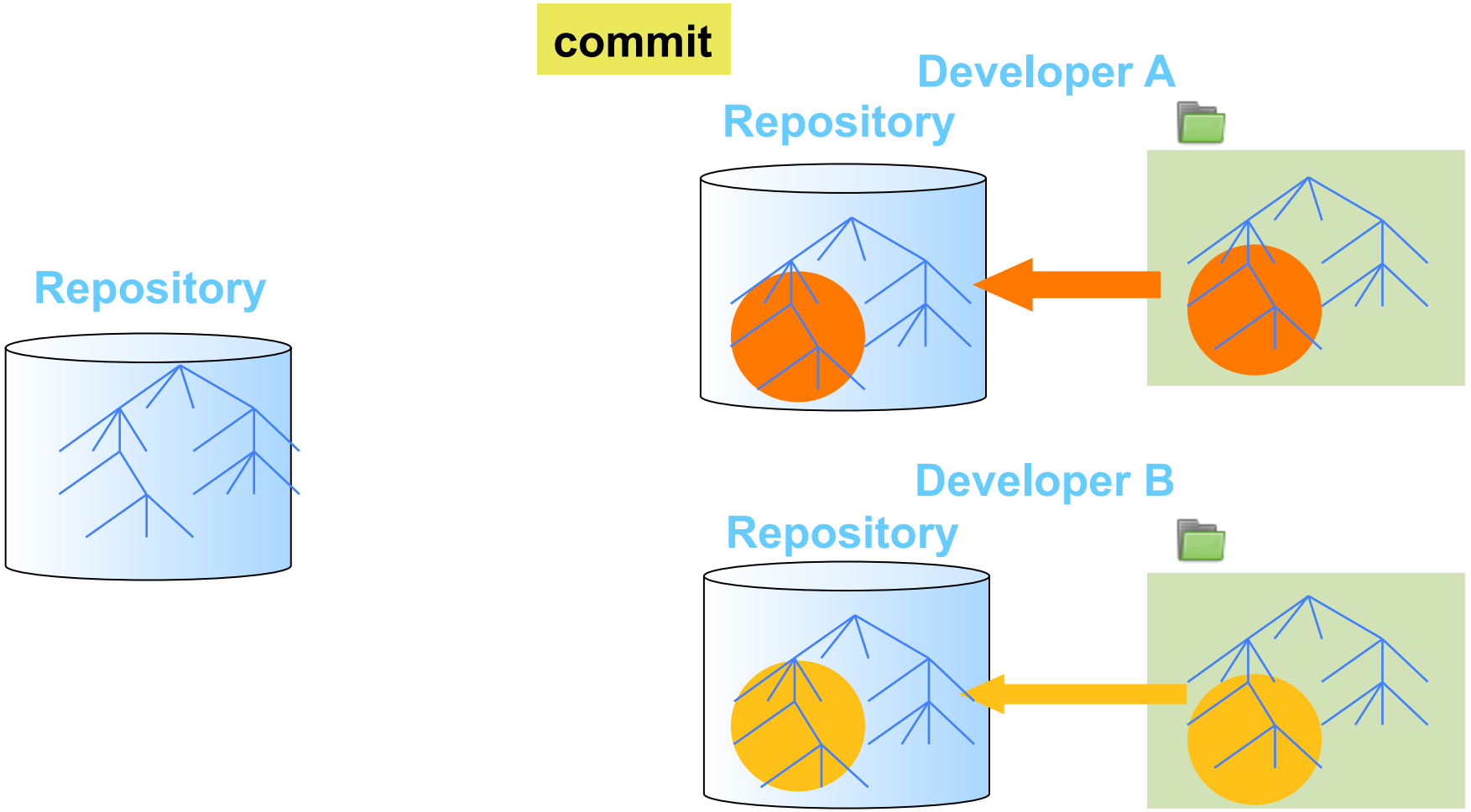
Core notions > *Commit*



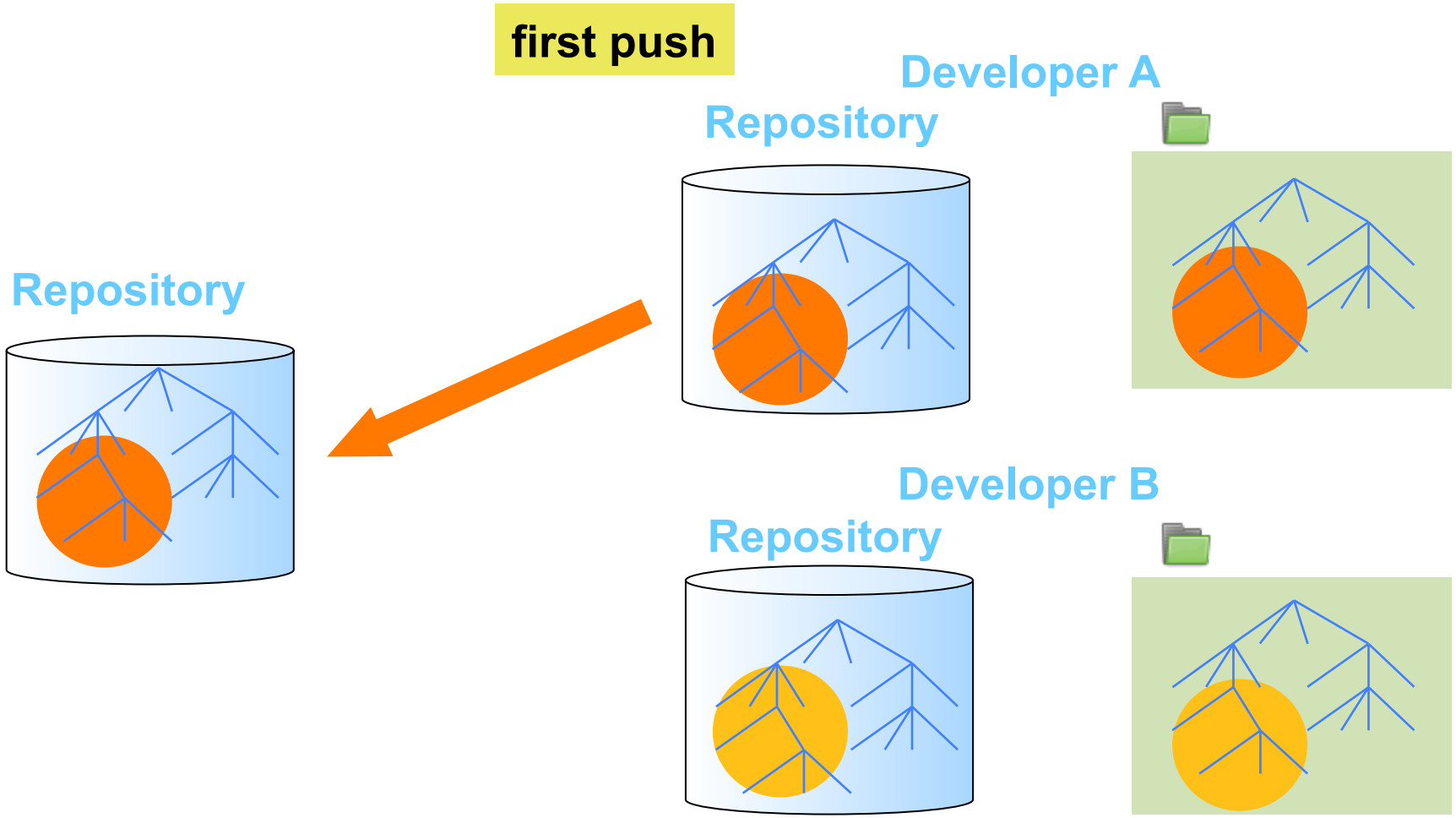
Core notions > *Conflict*



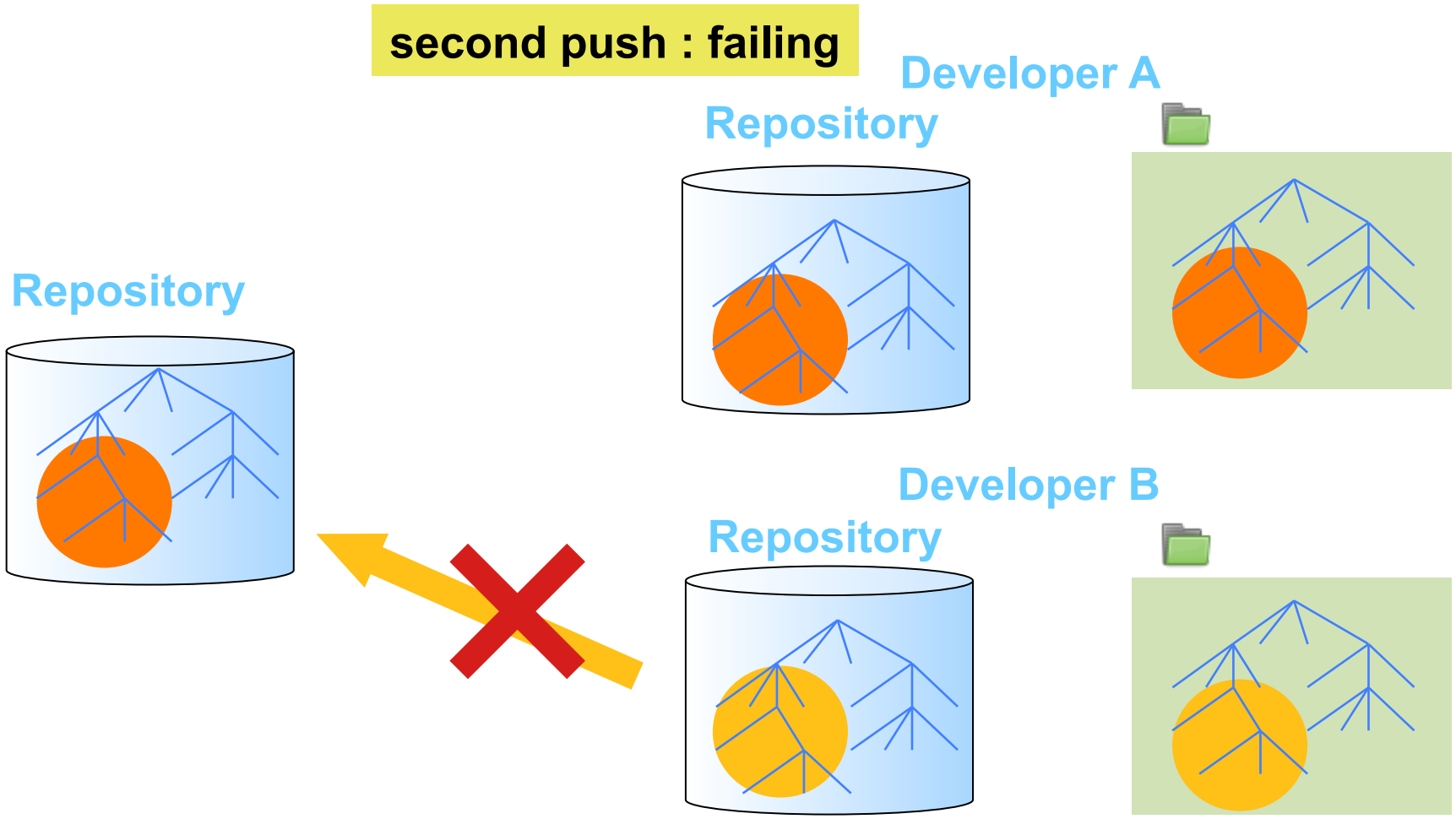
Core notions > *Conflict*



Core notions > *Conflict*

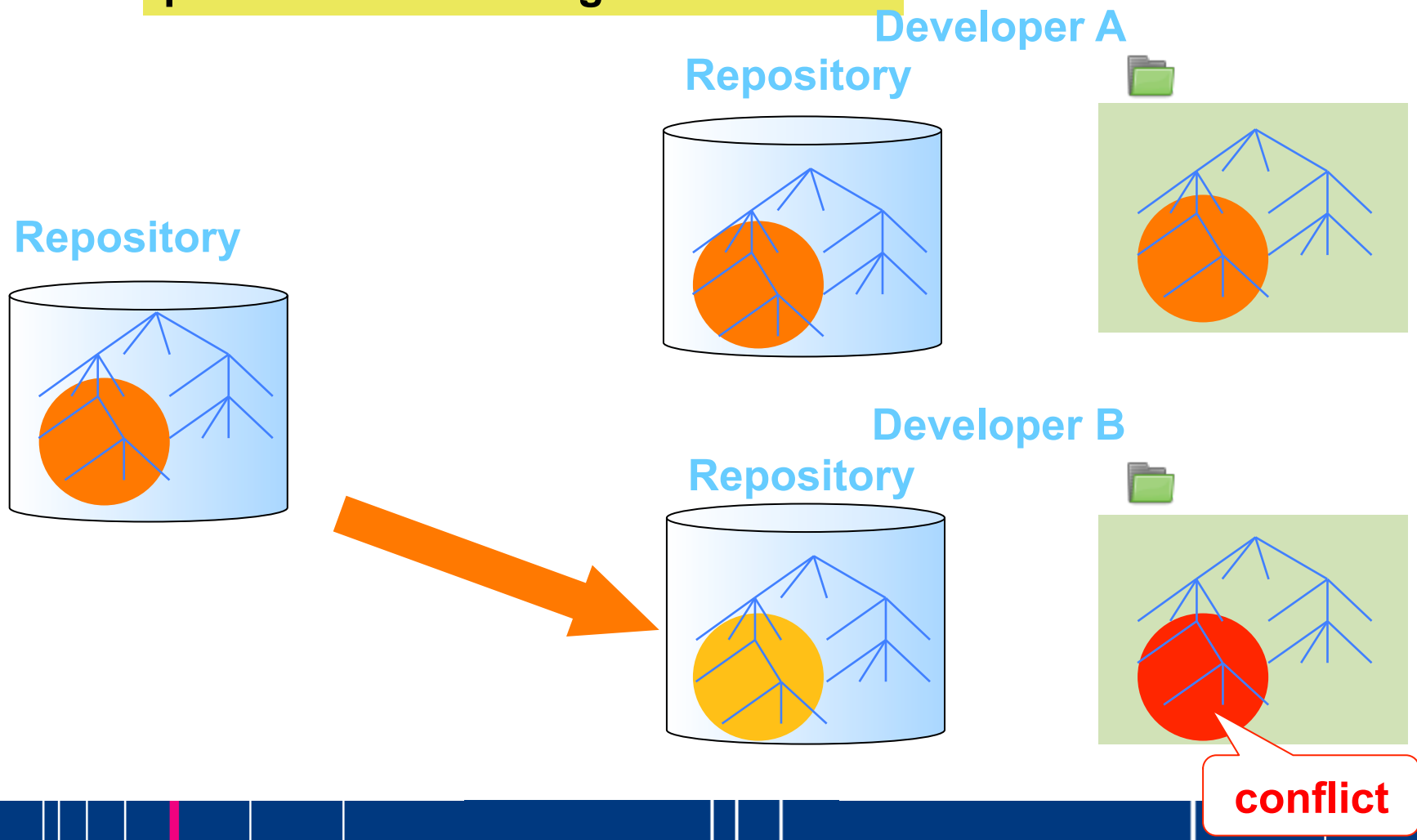


Core notions > *Conflict*

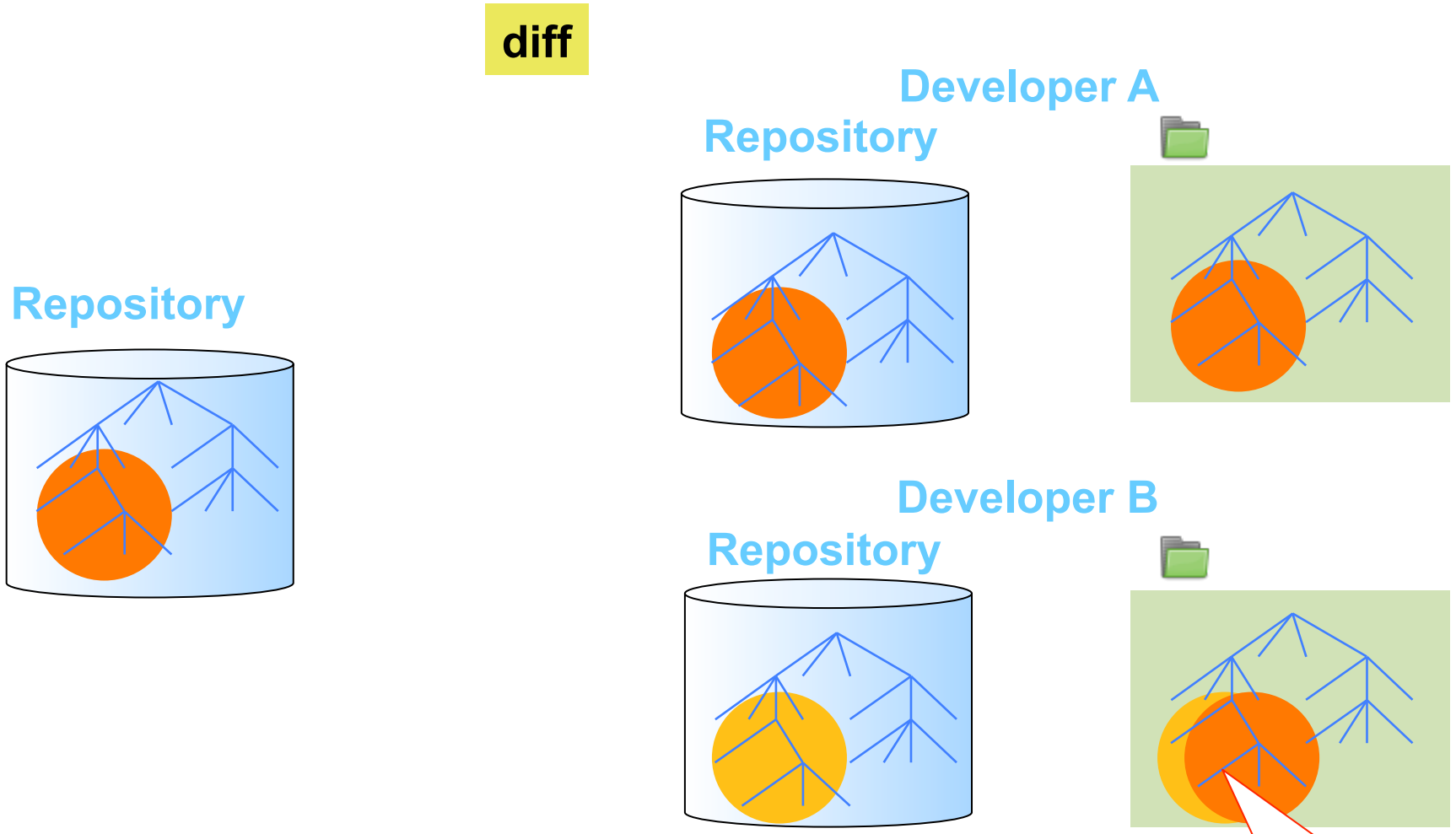


Core notions > *Conflict*

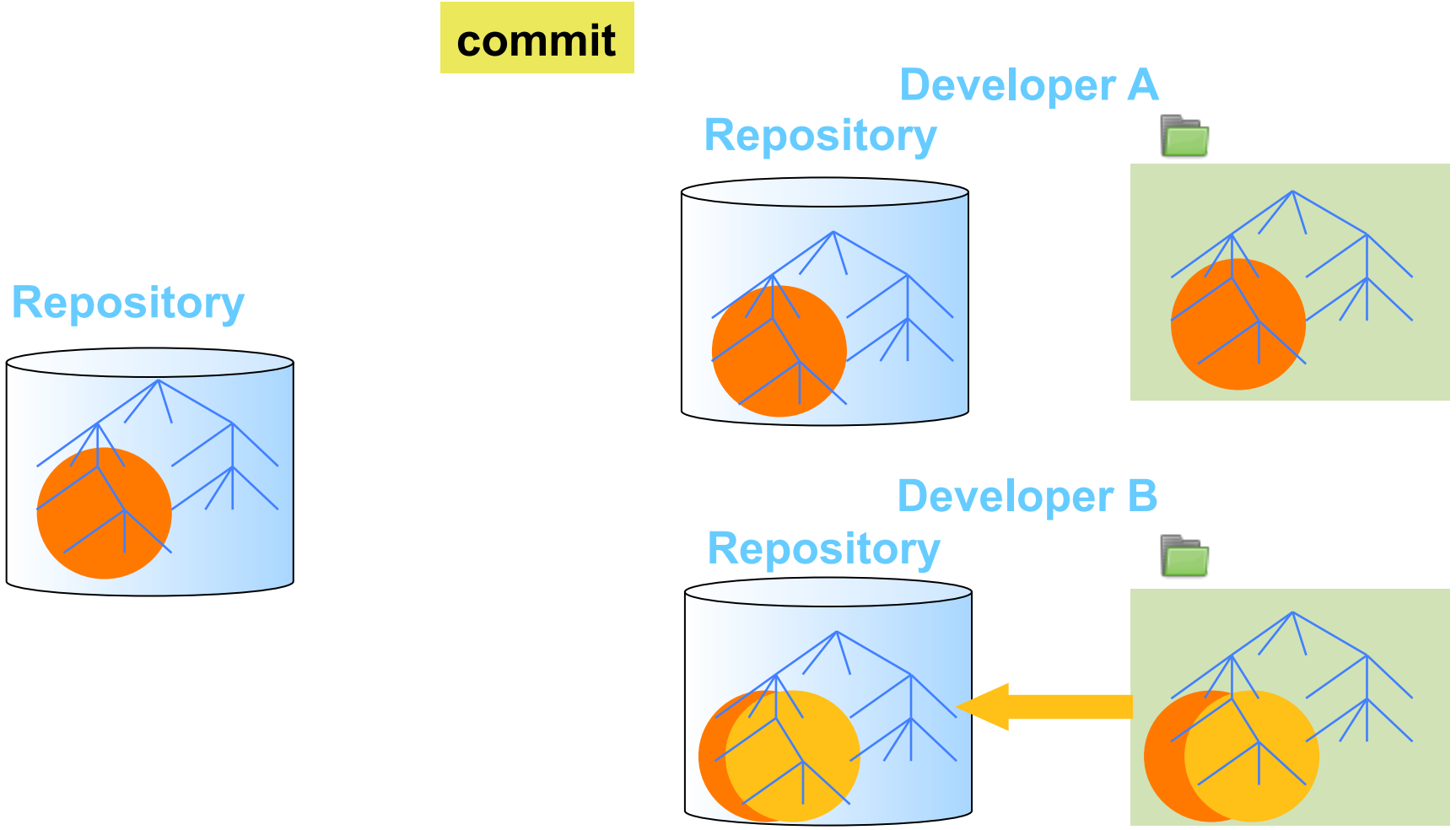
pull : automatic merge and conflict



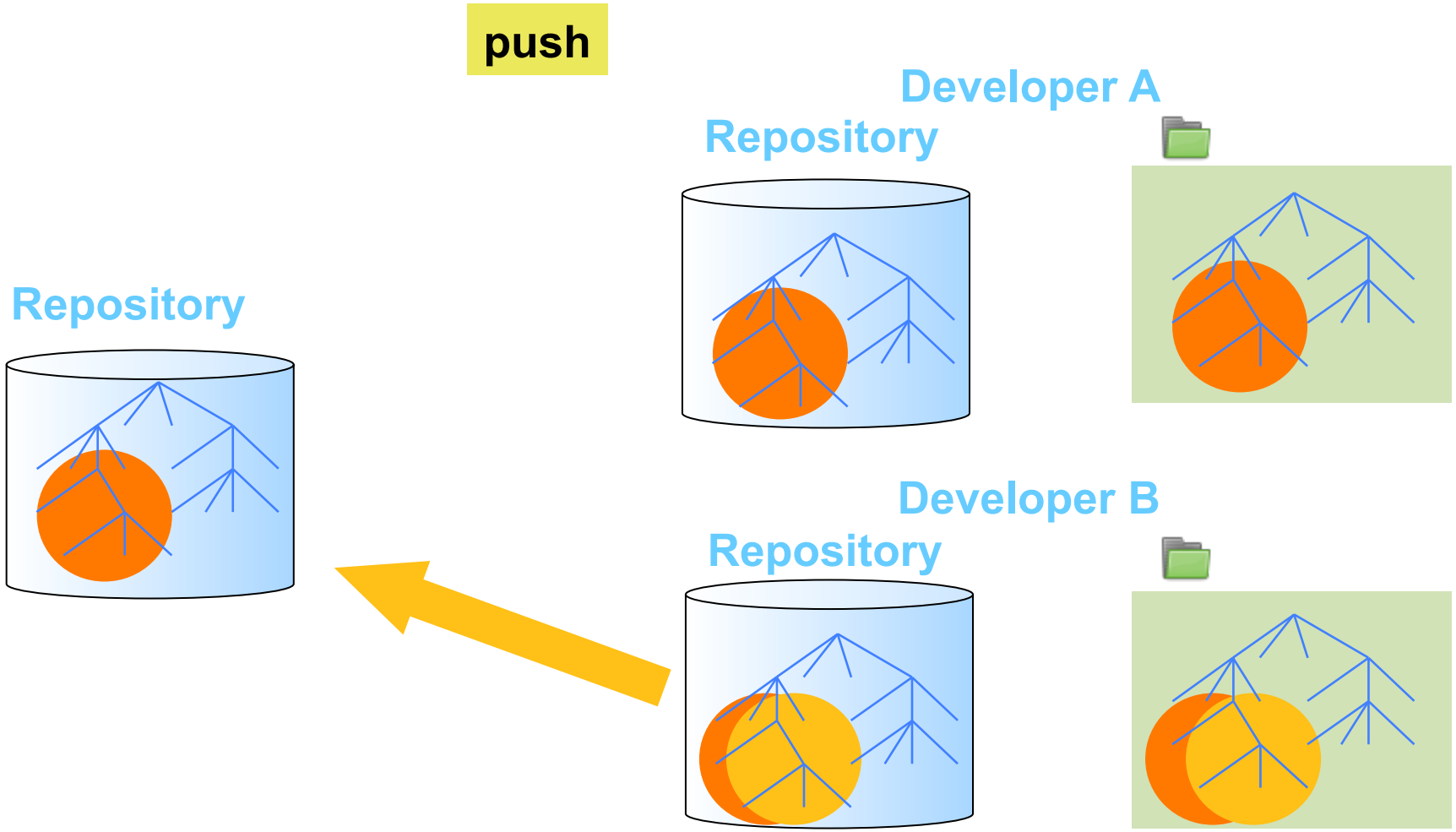
Core notions > *Conflict*



Core notions > *Conflict*



Core notions > *Conflict*



Core notions > *Version tagging*

tag

- Often used to tag the repository on important events such as a software release or article submission
- Allows you to easily retrieve a specific version of the software/article
  - Use / distribute a given release
  - Reproduce bugs for a given release

```
my_project-v1.3
```

- Push a tag:

```
git push origin mytag
```

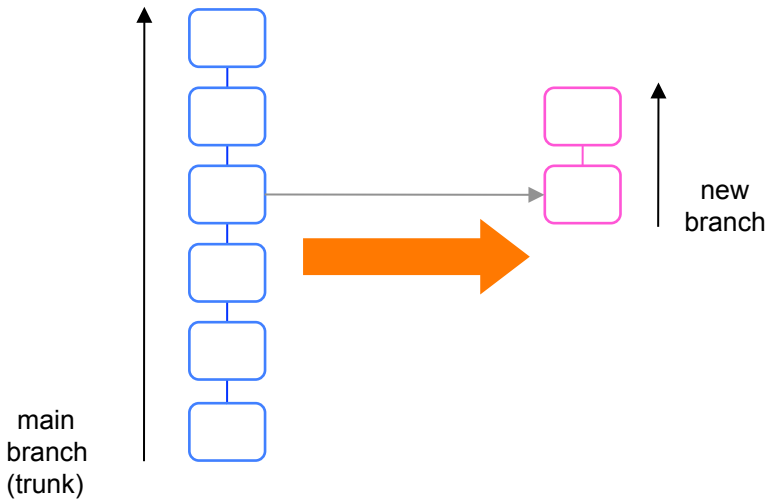
or `git push --tags`

Core notions > *Branch*

Why?

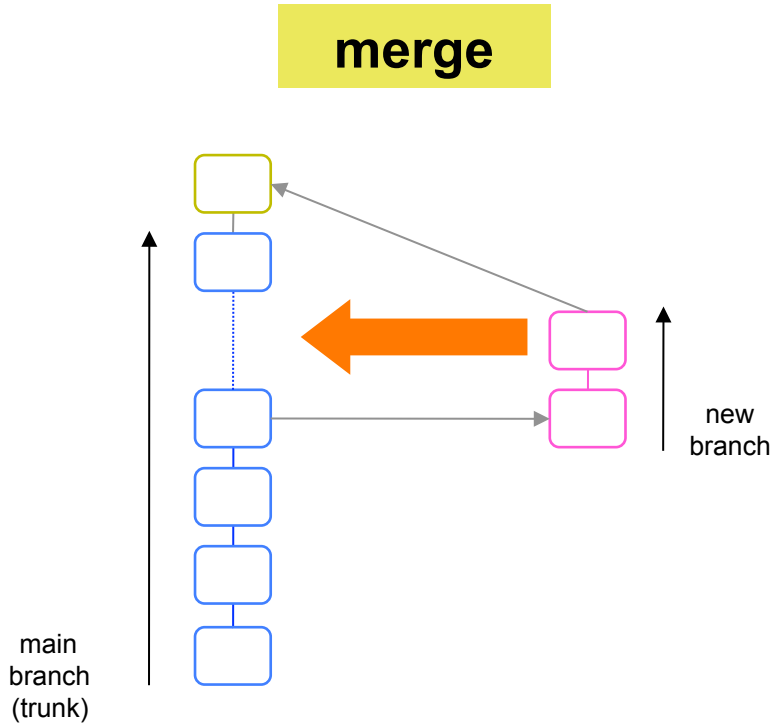
Core notions > *Branch*

branch



- Maintenance and development (maintain version N and develop version N+1)
- Work on a project sub-set (one branch per feature)
- Experimental development
- Save commits temporarily

Core notions > *Branches merging*



"Merge branches" :

Bring changes from a branch to another branch

Work unit of Source Code Management

A *repository* contains the complete history of the project (i.e. all the revisions)

A *revision* (a.k.a. *commit* or *version)*

- Is a snapshot of all the tracked files
- Is usually based upon one other revision
- Corresponds to an identified author
- Contains a message that explains the rationale for the modifications introduced by the revision and any other info the author considers relevant
- Is atomic

  For example, changeset = modifications on « calc.c AND calc.h ».

Identifying a commit

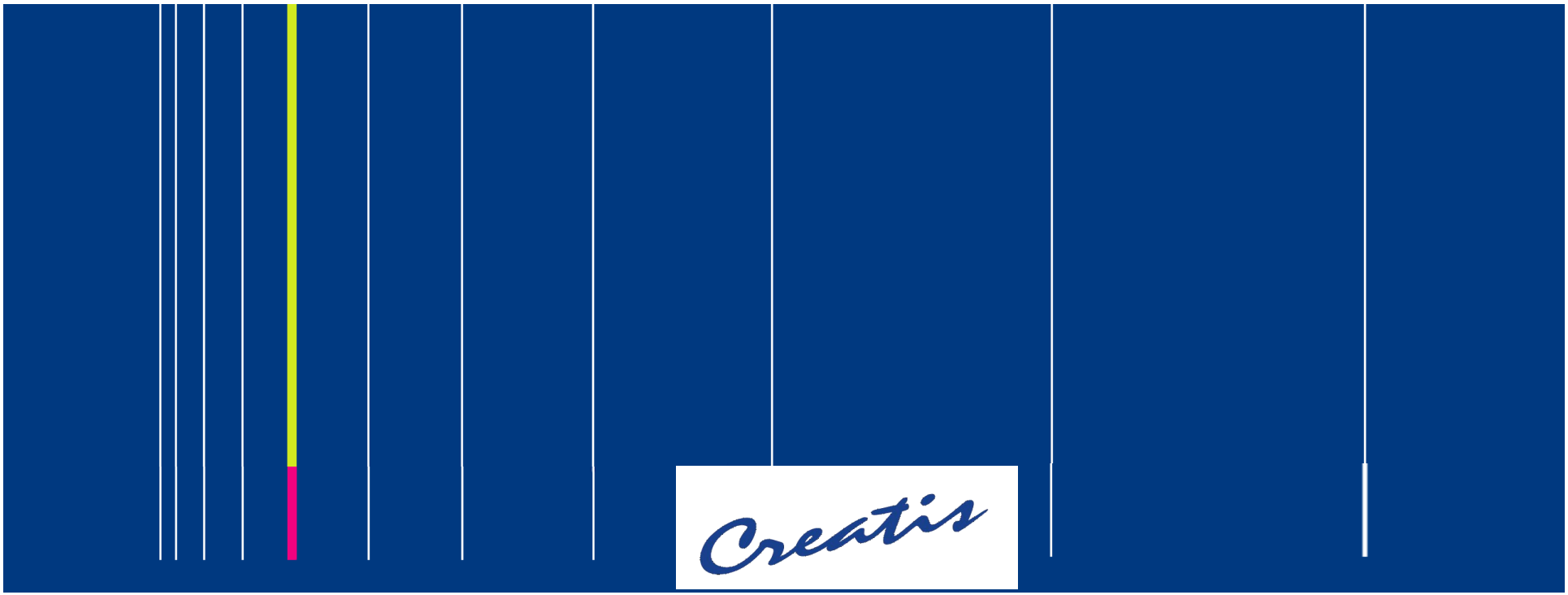
A commit has a unique identifier :

- Revision number (SHA-1 identifier)
- String (commit message)

A commit can be identified in multiple ways, e.g.:

- Its SHA1 (possibly abbreviated)
- A reference (e.g. HEAD)
- An indirect reference : HEAD^, HEAD~, ...
- A branch name
- ...
- A tag

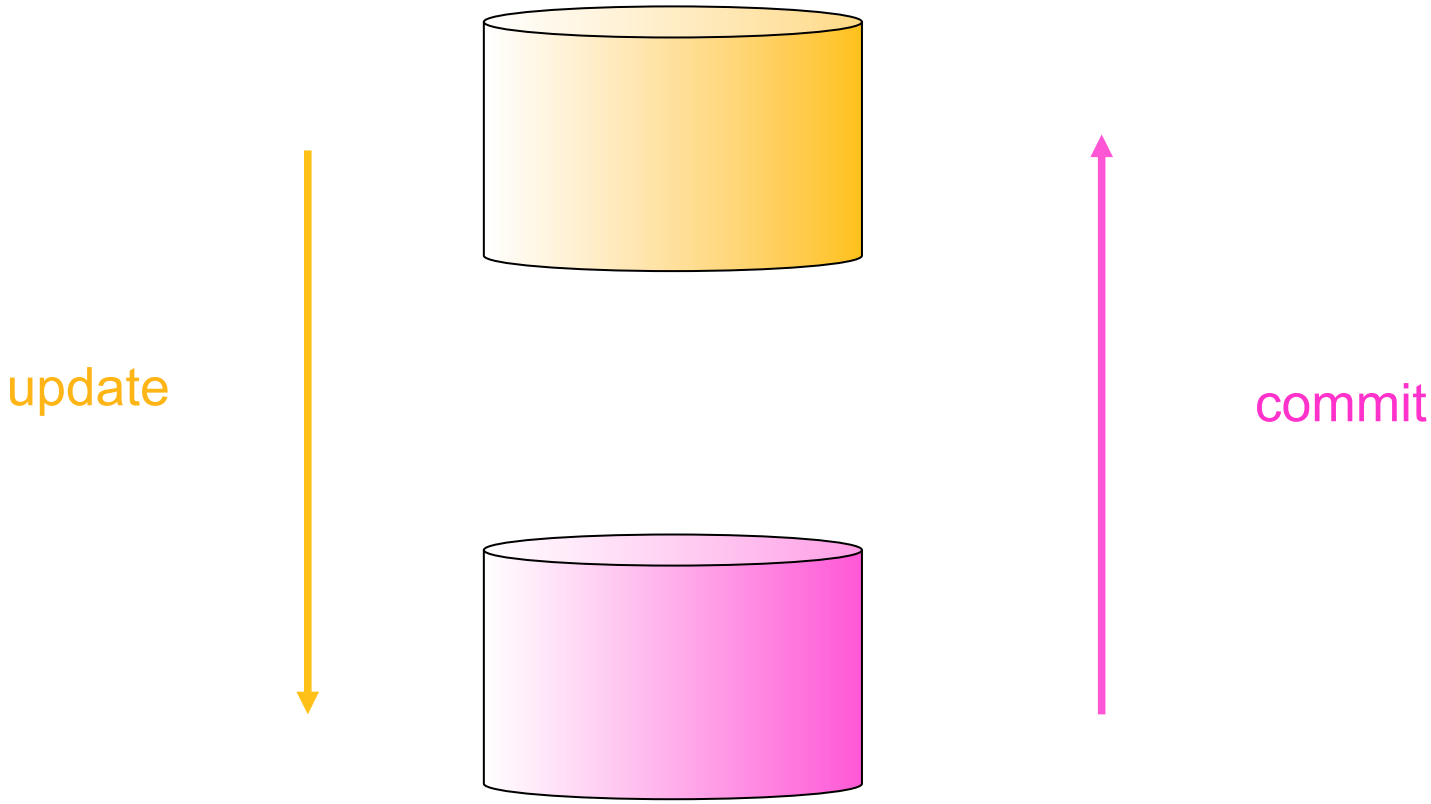
Centralized SCM
> **CVS and Subversion** (SVN)



CVS and its evolution, SVN

- Are versioned :
  - Files
  - Directories
  - Meta-data (properties)
- Possible to move / rename elements (no history loss)
- Atomic commit
  - Done only if the whole operation is a success
  - One revision number by commit (per file for CVS)

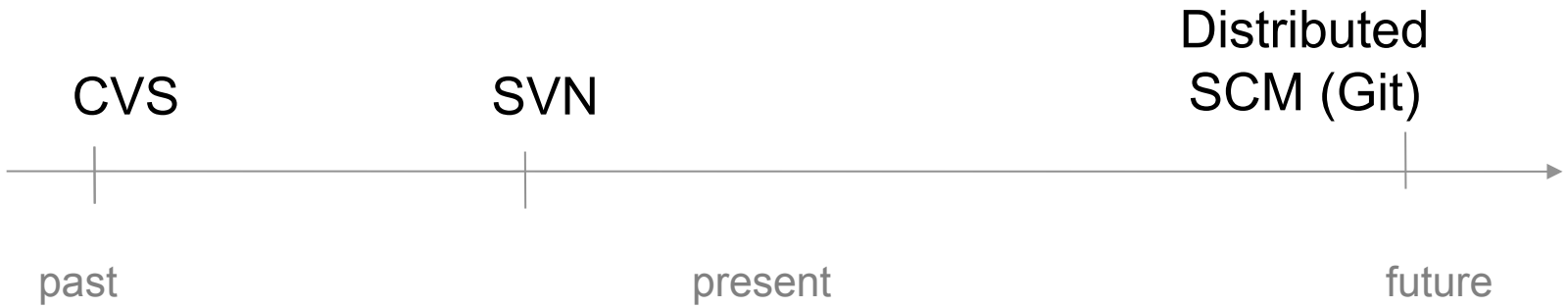
SVN
> *Exchanges with (remote) repository*



Conclusion on centralized SCM

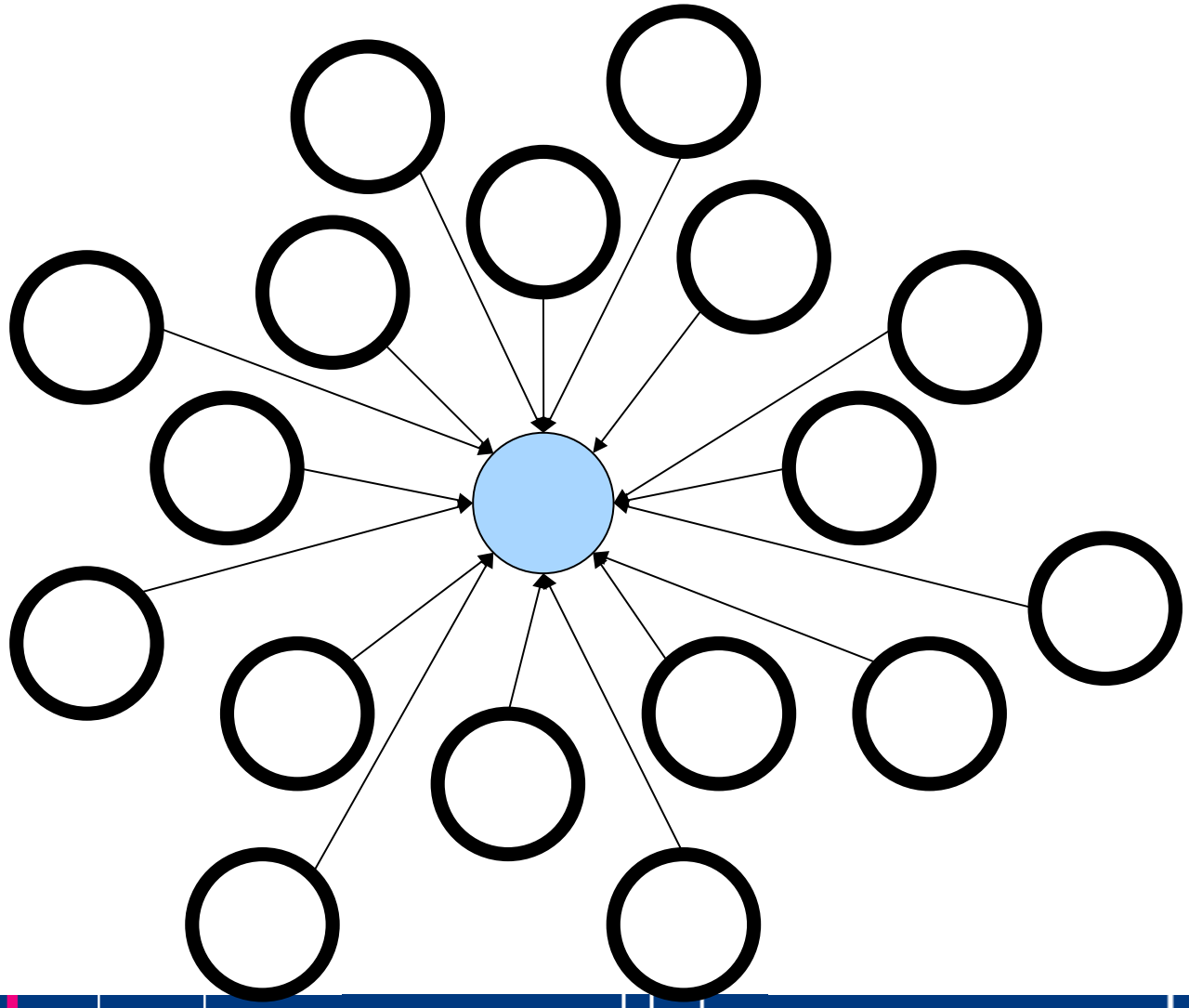
- ✚ A central/core repository
- ✚ Easy to use

- ➖ Need to be on line for almost commands
- ➖ Privileged users (committers)

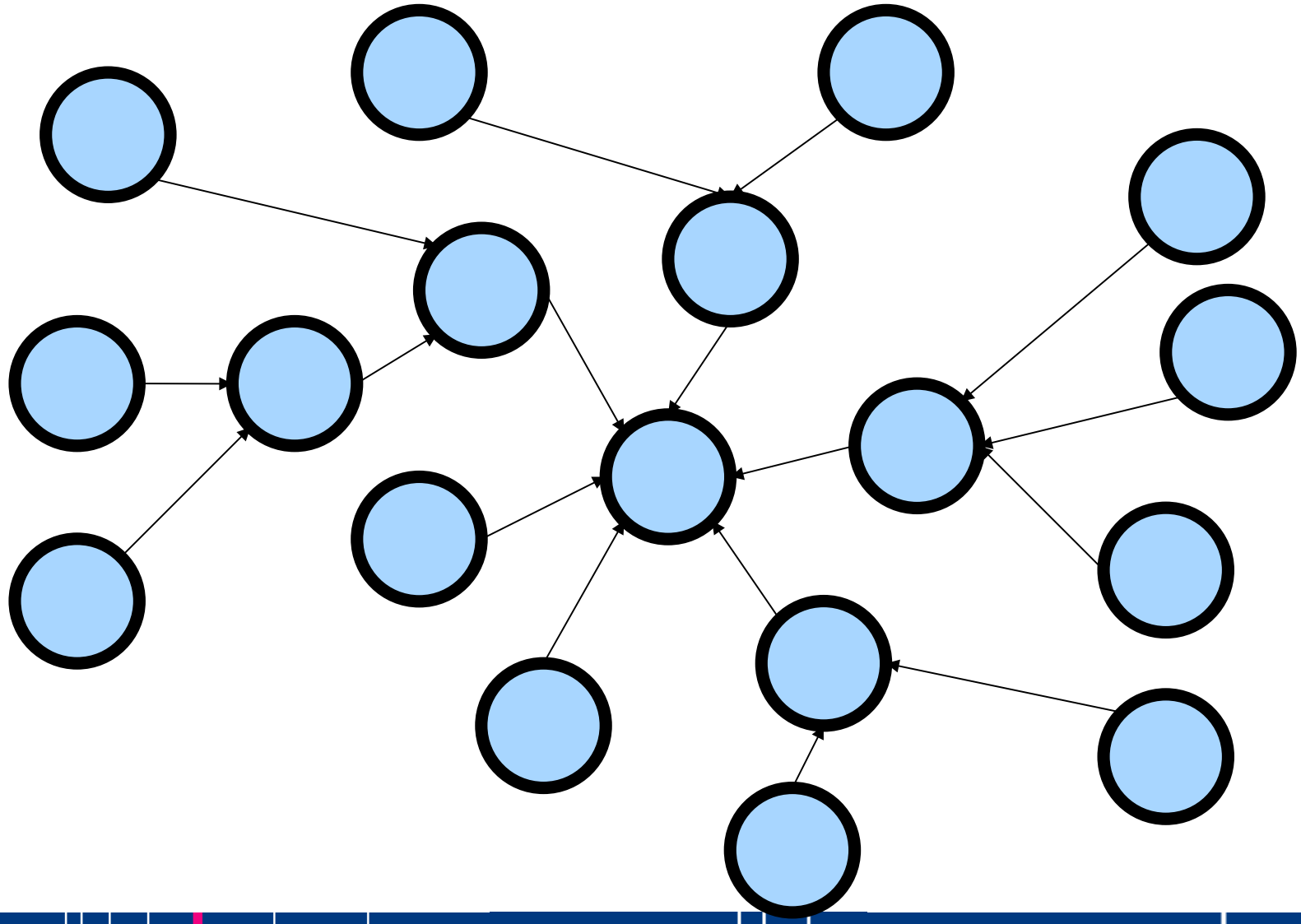


Distributed SCM

Policy example: centralized



Policy example: distributed

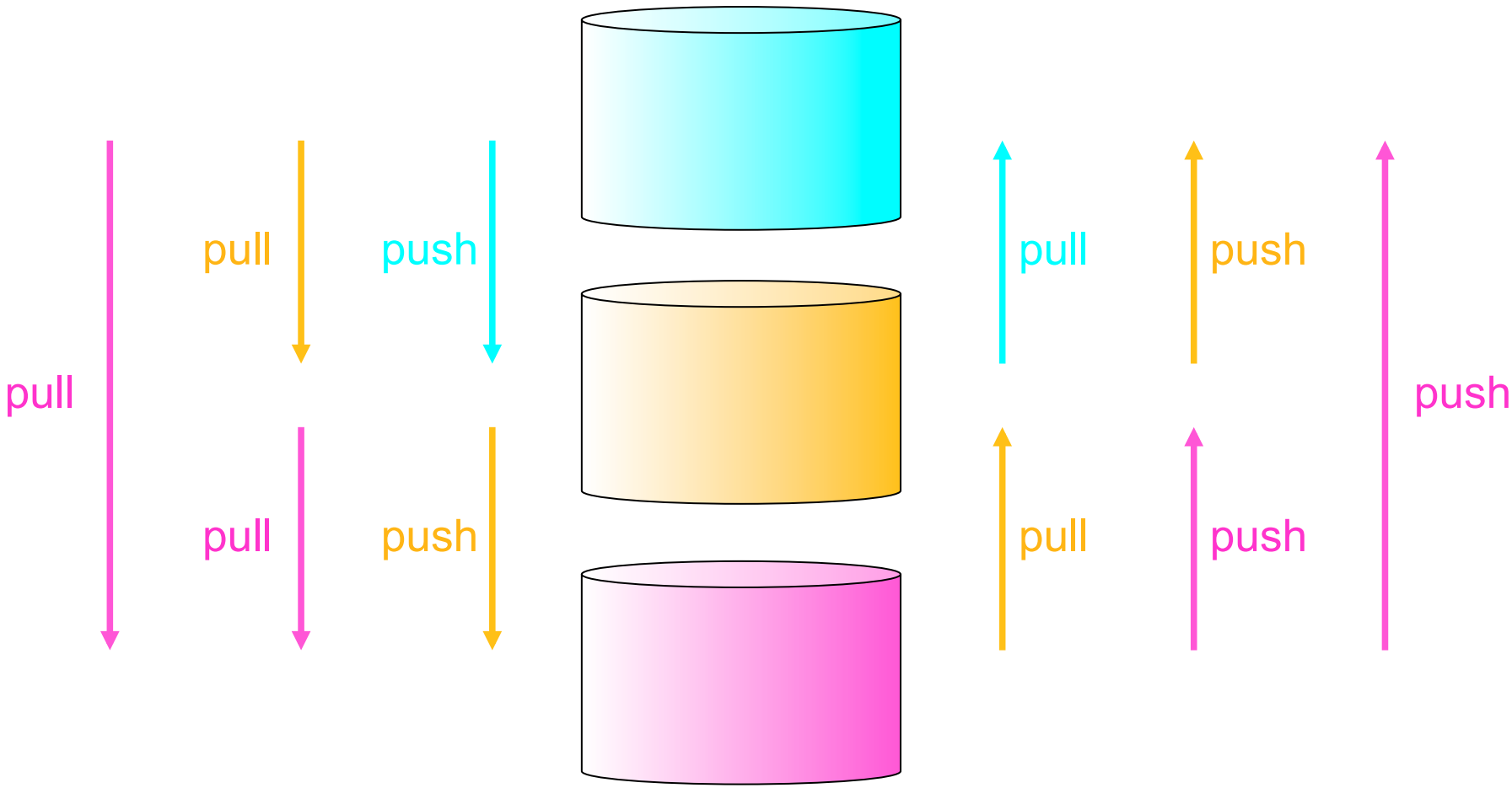


Decentralized benefits ?

Decentralized benefits

- Each developer can have his own repository
  - Off-line use (commands available offline)
    - ex: Do a local commit
  - Create a branch without having to ask authorization
    - ex: Open Source community
- Synchronisation needed between repositories
  - pull = get changes from a remote repository to your local repository
  - push = post your changes to a remote repository

Exchanges between (remote) repositories

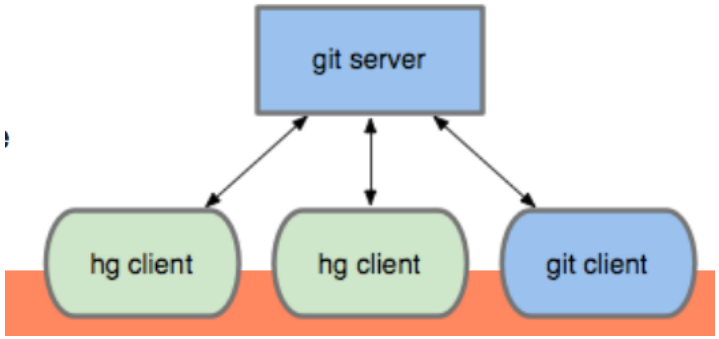


Outil	Type	Description	Projets qui l'utilisent
CVS	Centralisé	C'est un des plus anciens logiciels de gestion de versions. Bien qu'il fonctionne et soit encore utilisé pour certains projets, il est préférable d'utiliser SVN (souvent présenté comme son successeur) qui corrige un certain nombre de ses défauts, comme son incapacité à suivre les fichiers renommés par exemple.	OpenBSD…
SVN (Subversion)	Centralisé	Probablement l'outil le plus utilisé à l'heure actuelle. Il est assez simple d'utilisation, bien qu'il nécessite comme tous les outils du même type un certain temps d'adaptation. Il a l'avantage d'être bien intégré à Windows avec le programme Tortoise SVN, là où beaucoup d'autres logiciels s'utilisent surtout en ligne de commande dans la console. Il y a un tutoriel SVN sur le Site du Zéro.	Apache, Redmine, Struts…
Mercurial	Distribué	Plus récent, il est complet et puissant. Il est apparu quelques jours après le début du développement de Git et est d'ailleurs comparable à ce dernier sur bien des aspects. Vous trouverez un tutoriel sur Mercurial sur le Site du Zéro.	Mozilla, Python, OpenOffice.org…
Bazaar	Distribué	Un autre outil, complet et récent, comme Mercurial. Il est sponsorisé par Canonical, l'entreprise qui édite Ubuntu. Il se focalise sur la facilité d'utilisation et la flexibilité.	Ubuntu, MySQL, Inkscape…
Git	Distribué	Très puissant et récent, il a été créé par Linus Torvalds, qui est entre autres l'homme à l'origine de Linux. Il se distingue par sa rapidité et sa gestion des branches qui permettent de développer en parallèle de nouvelles fonctionnalités.	Kernel de Linux, Debian, VLC, Android, Gnome, Qt…

Hg-Git mercurial plugin

Adds the ability to push to and pull from a Git server repository from Mercurial.

This means you can collaborate on Git based projects from Mercurial, or use a Git server as a collaboration point for a team with developers using both Git and Mercurial.

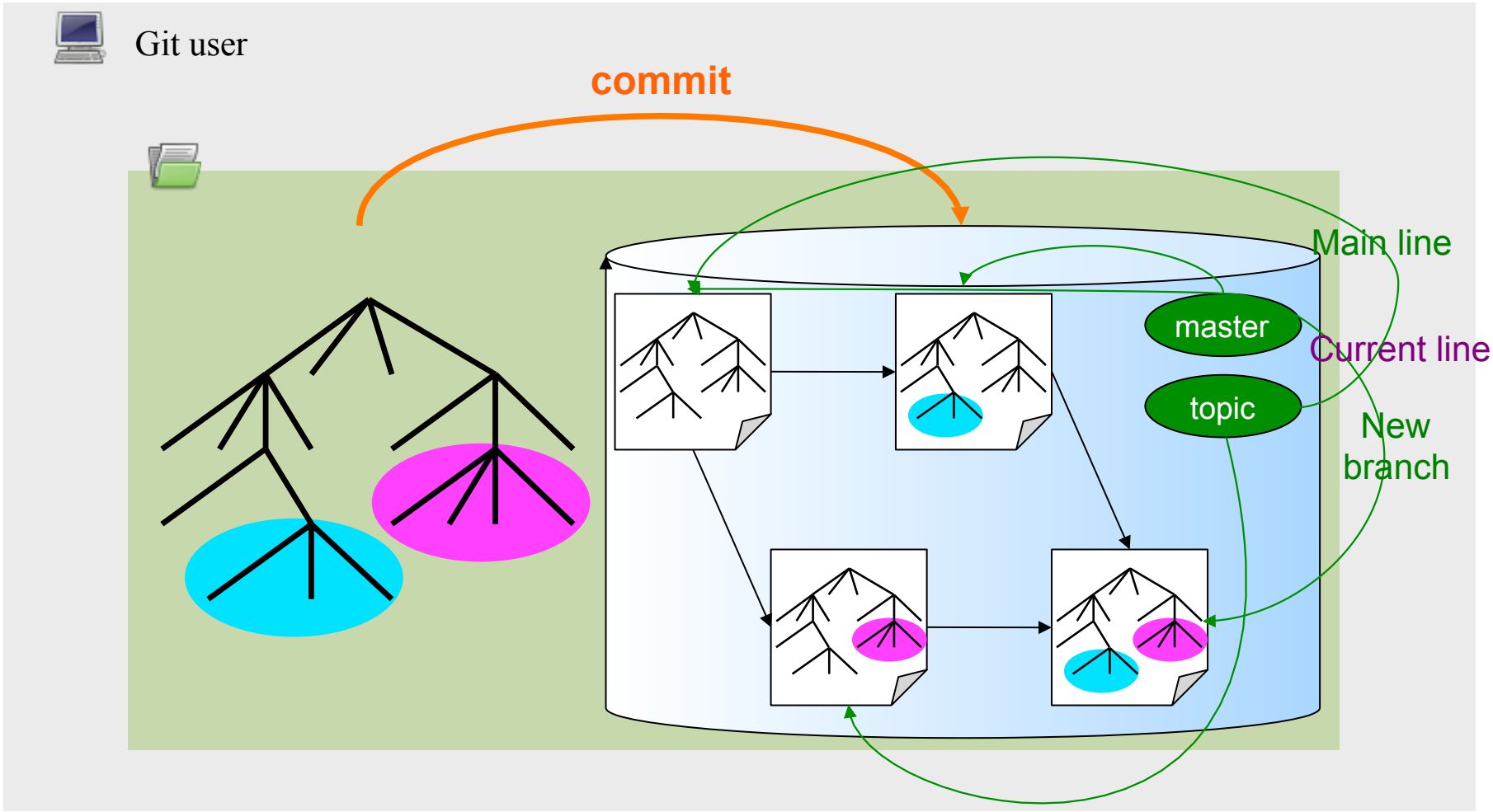


http://hg-git.github.io/

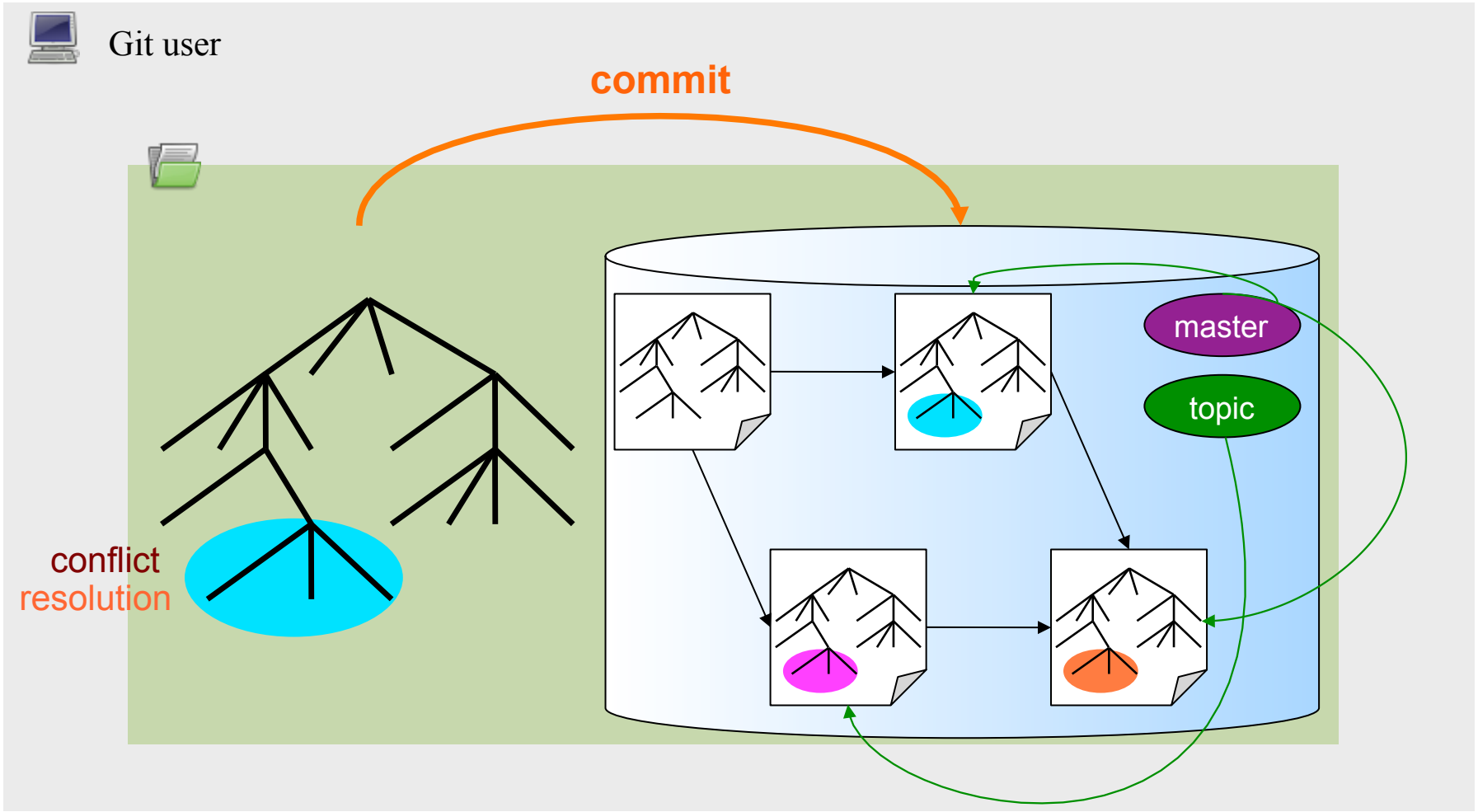
https://www.mercurial-scm.org/wiki/HgGit

Decentralized SCM
> **Git basic**

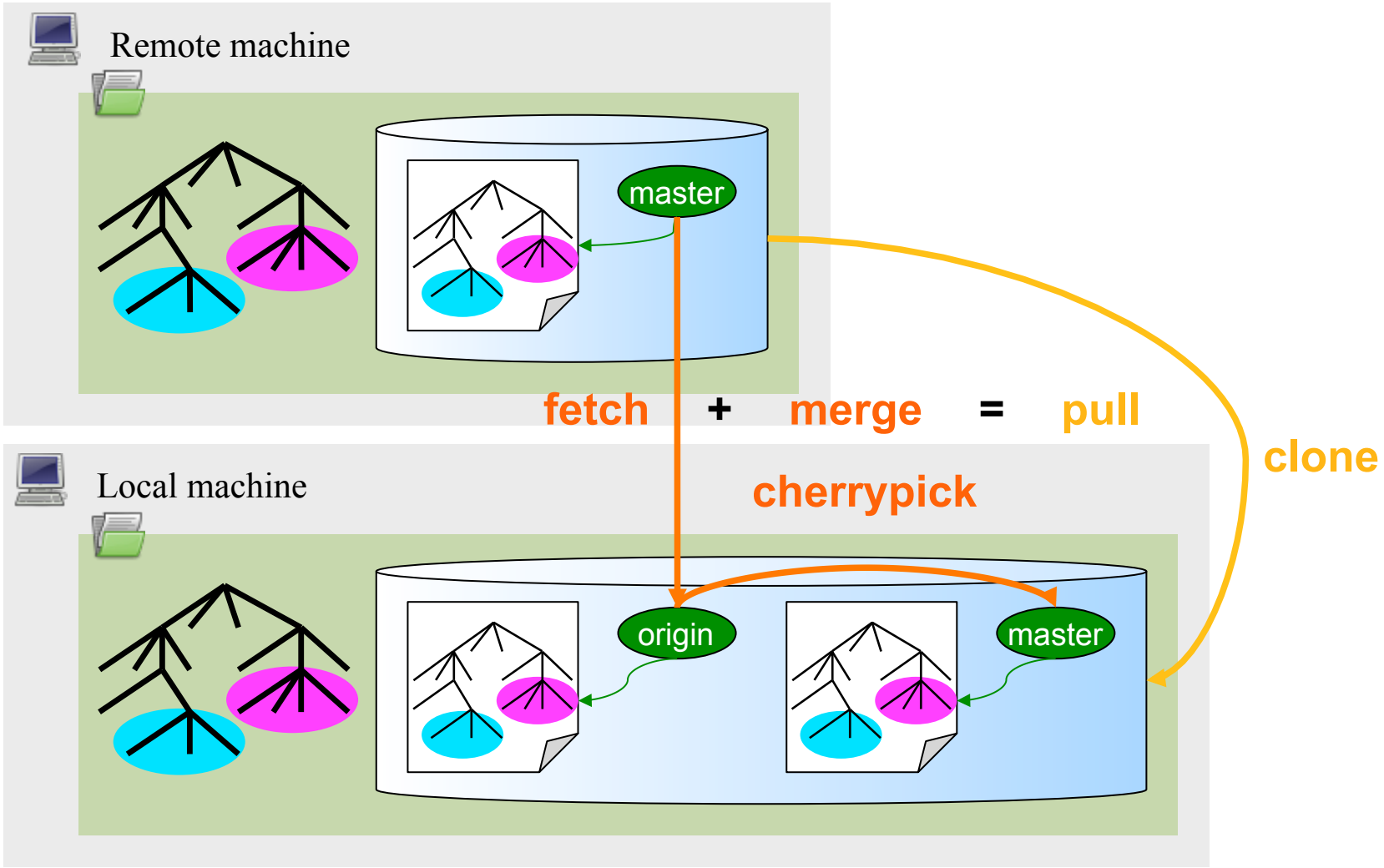
Git > *Local operations*



Git > *Conflict*

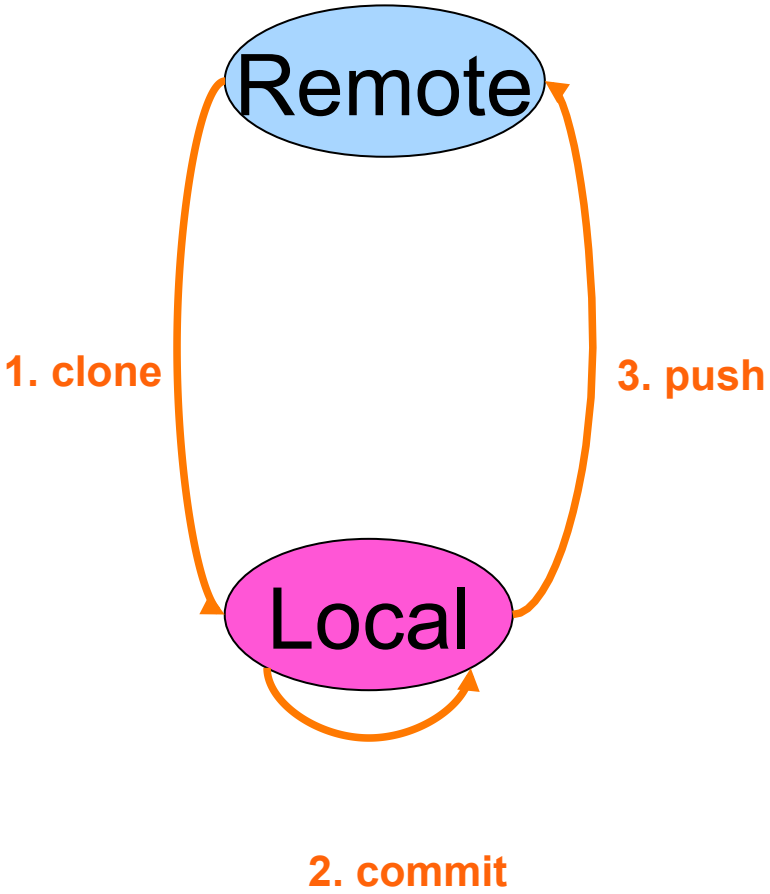


Git > *Distant operations*



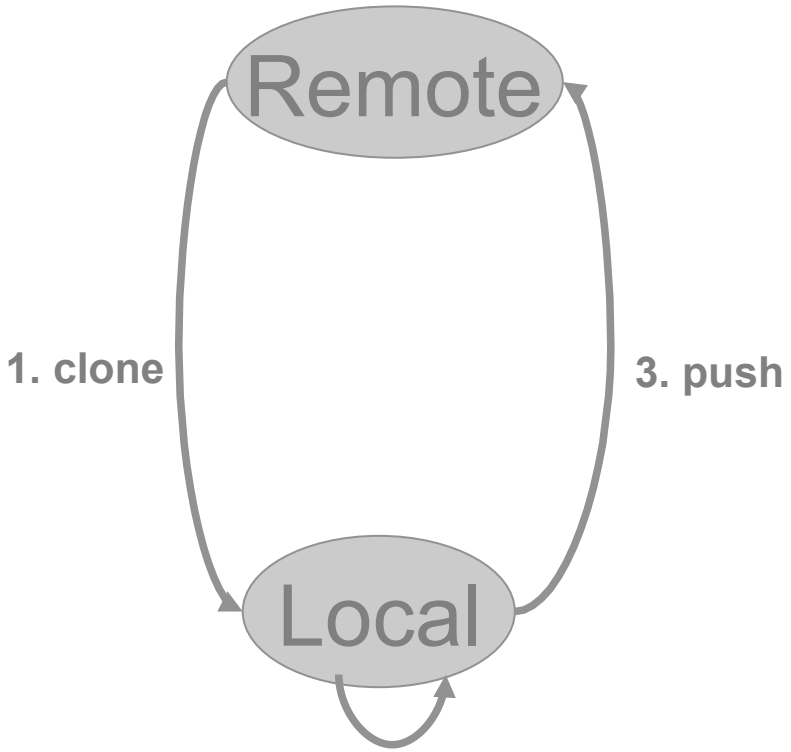
Git > *Workflow*

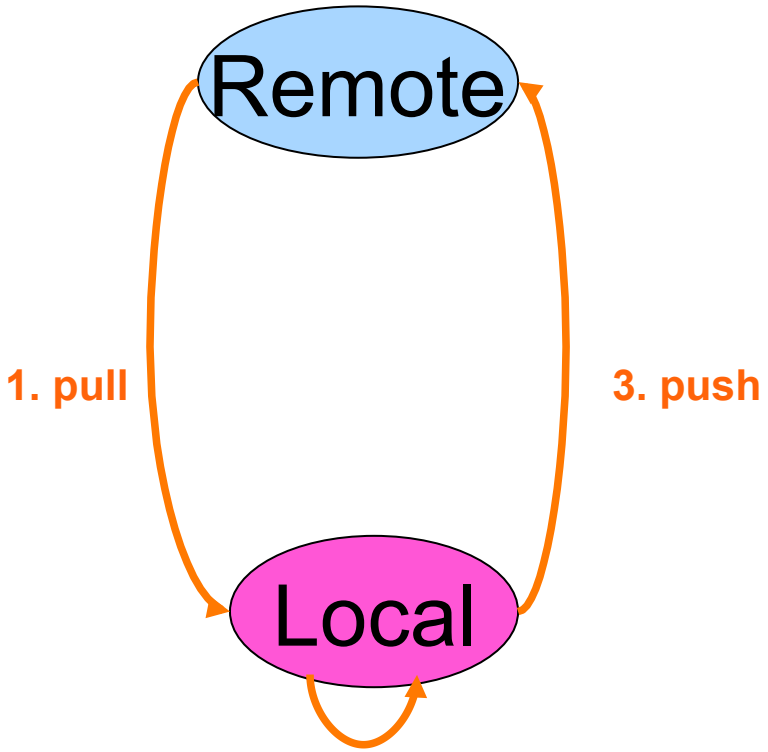
> Classic working



Git > *Workflow*

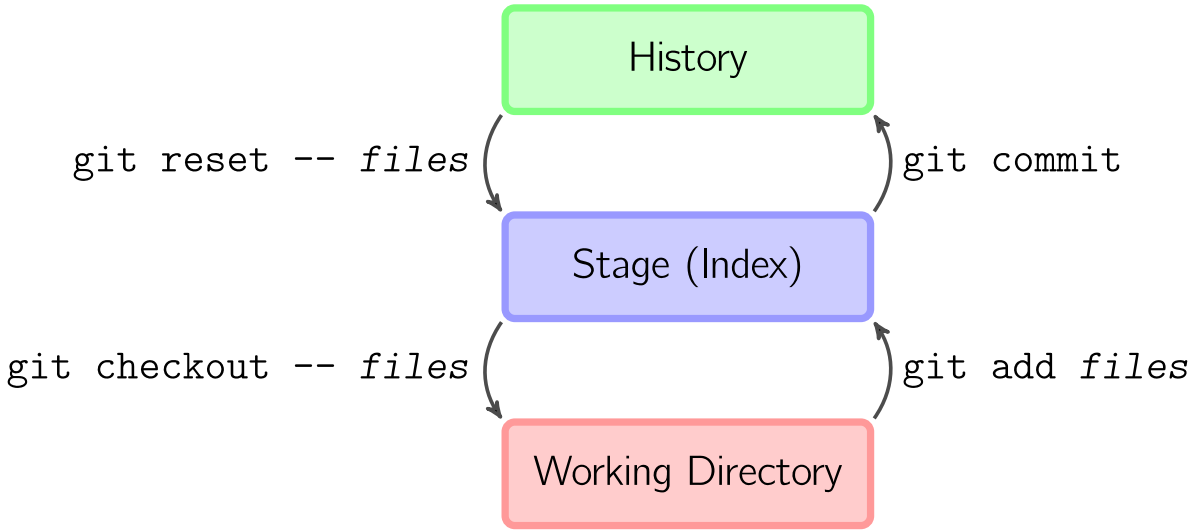
> Classic working





Decentralized SCM
> **Git more advanced**

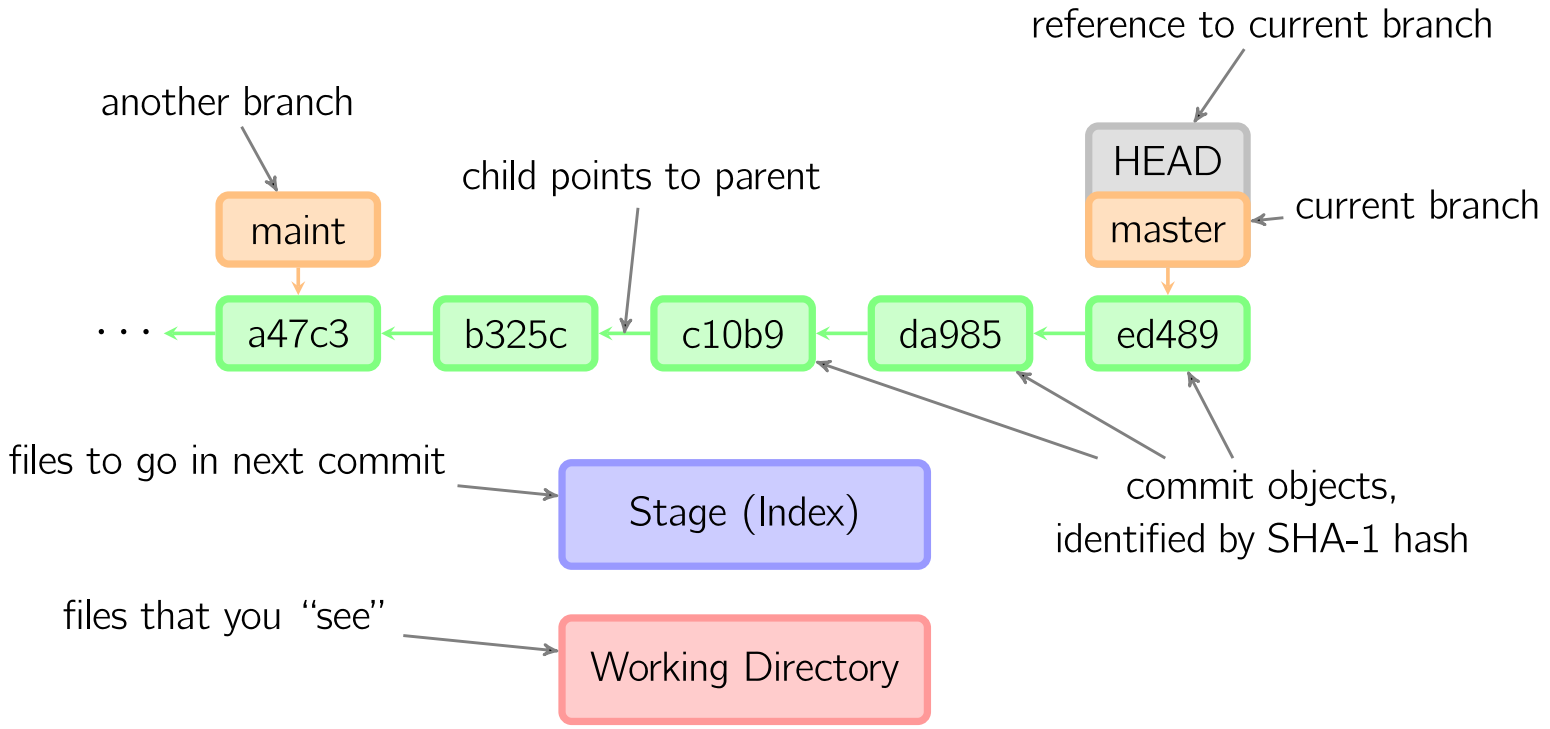
Zones and transitions



Source :

http://marklodato.github.io/visual-git-guide/index-en.html

Zones and transitions



Source :

http://marklodato.github.io/visual-git-guide/index-en.html

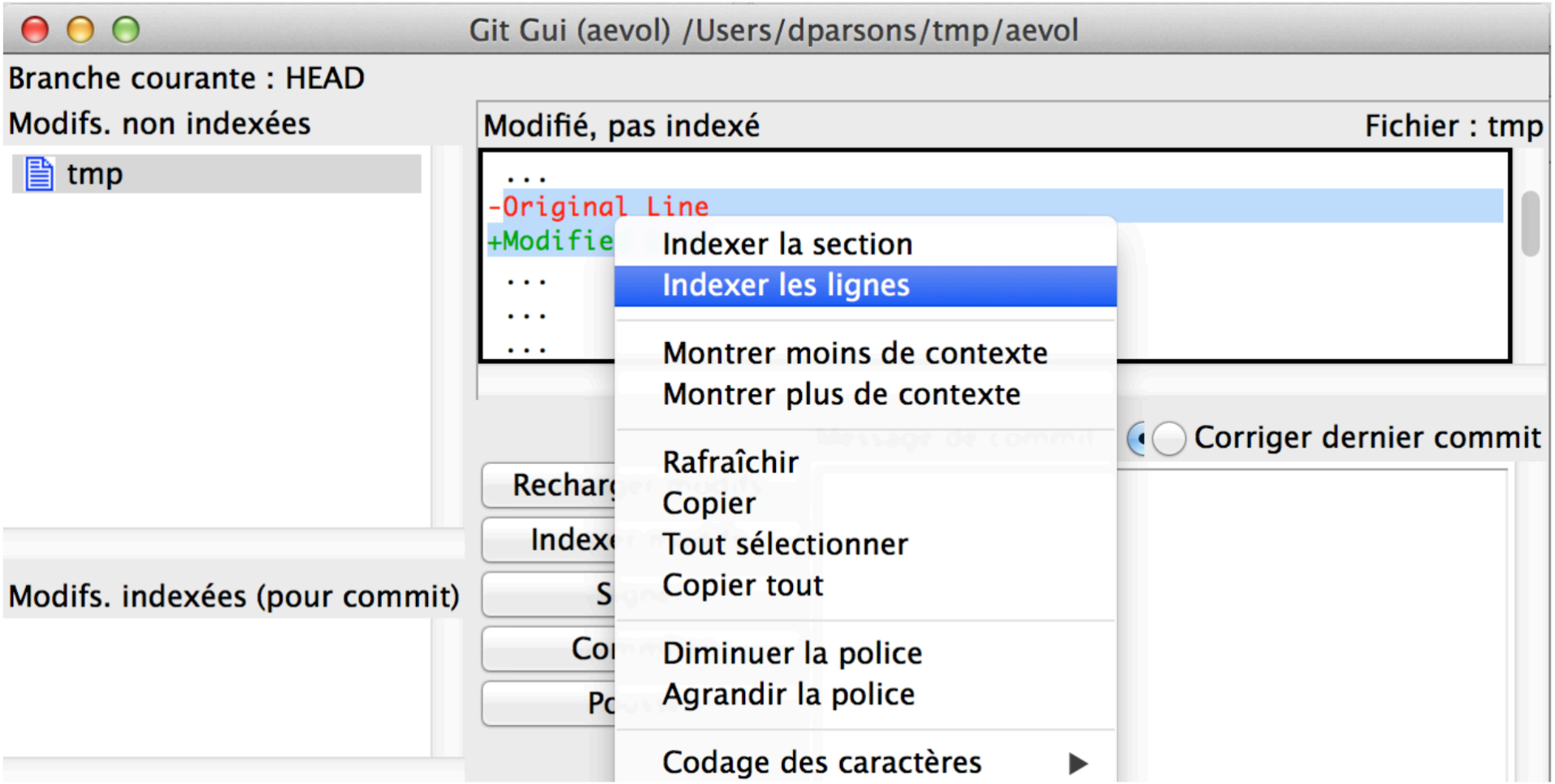
Refine your git add ! > *Partial commits*

git add [-p | --patch]

Interactively choose hunks of patch between the index and the work tree and add them to the index.

This gives the user a chance to review the difference before adding modified contents to the index.

Refine your git add ! > *git gui*



Find the culprit !

git blame

Show what revision and author last modified each line of a file.

Clean everything in a wink !

git stash

Stash the changes in a dirty working directory away.

git stash list

git stash show

git stash drop

git stash (pop | apply)

Where is Charlie !

git grep

Print lines matching a pattern.

Look for specified patterns in the tracked files in the work tree.

No, thanks !

.gitignore

Exclude files from versioning.

Templates adapted for specific languages.

https://github.com/github/gitignore

Too big ?!?

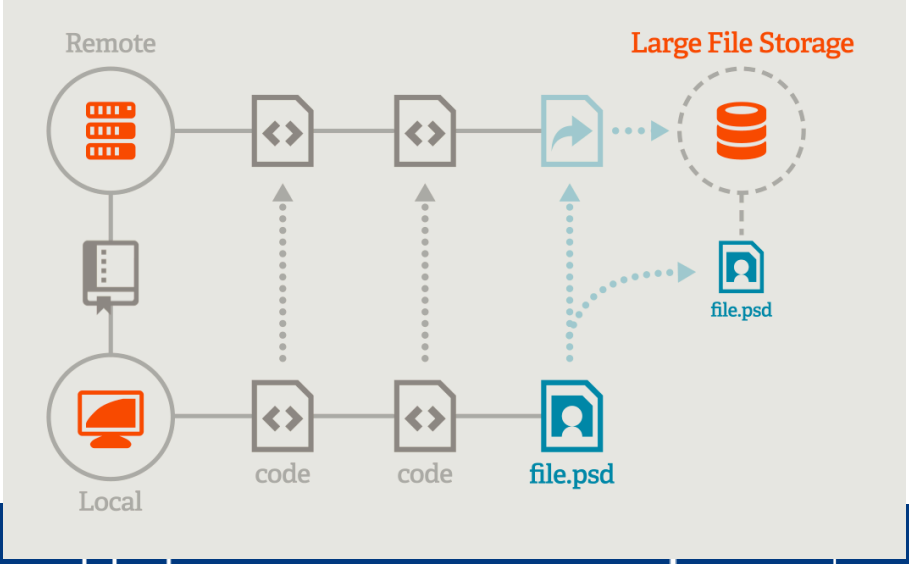
git-lfs (Large File Storage)

Alternative to git annex.

An open source Git extension for versioning large files via symlinks.

Git Large File Storage (LFS) replaces large files such as audio samples, videos, datasets, and graphics with text pointers inside Git, while storing the file contents on a remote server like GitHub.com or GitHub Enterprise.

https://git-lfs.github.com/



Too big ?!?

BFG Repo-Cleaner

Removes large or troublesome blobs like git-filter-branch does, but faster.

The BFG is a simpler, faster alternative to *git-filter-branch* for cleaning bad data out of your Git repository history:

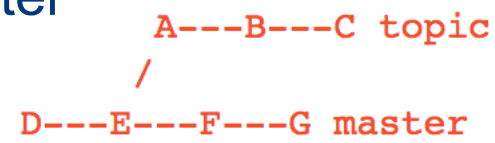
- Removing **Crazy Big Files, Binary Files**
- Removing **Passwords**, **Credentials** & other **Private data**

https://rtyley.github.io/bfg-repo-cleaner/

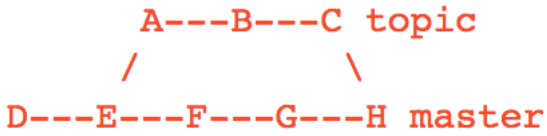
Merge versus rebase > *Merge*

git-merge - Join two or more development histories together

Current branch is master



git merge topic



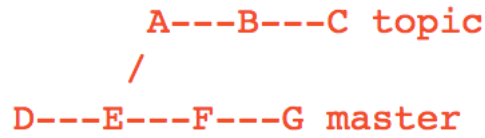
Replays the changes made on the topic branch since it diverged from master (i.e., E) until its current commit (C) on top of master, and records the result in a new commit along with the names of the two parent commits and a log message from the user describing the changes.

https://git-scm.com/docs/git-merge

Merge versus rebase > *Rebase*

git-rebase - Reapply commits on top of another base tip

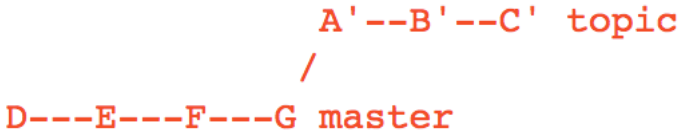
Current branch is topic



git rebase master

OR

git rebase master topic



The commit tree for the topic branch has been rewritten so that the master branch is a part of the commit history. This leaves the chain of commits linear and much easier to read.

Merge versus rebase > *When use what ?*

Don't use rebase …

If the branch is public and shared with others. Rewriting publicly shared branches will tend to screw up other members of the team.

Use rebase …

When the *exact* history of the commit branch is important (since rebase rewrites the commit history).

Advice

Use rebase for short-lived, local branches ;

Use merge for branches in the public repository.

http://gitimmersion.com/lab_34.html

Merge > *Conflict management*

CONFLICT (content): Merge conflict in <nom-fichier>

 # Unmerged paths:

 # (use "git reset HEAD <some-file>..." to unstage)

 # (use "git add/rm <some-file>..." as appropriate to mark resolution)

#

 # both modified: <some-file>

Fix the conflict by editing <some-file> (look for <<<< ==== >>>>)

git add <some-file>

git commit –m « Merged master fixed confclict »

Cherrypick

- Selects changes to apply from a branch to another one

How to get back ? > *When use what ?*

If you haven't pushed your work yet :

git commit --amend

To modify the last commit.

How to get back ? > *When use what ?*

If you haven't pushed your work yet :

*git reset HEAD^*

To cancel the last commit. The modifications will remain in the working directory.

git reset --hard HEAD

To restore the version of the last commit (by removing the new files and the modifications)

*git reset --hard HEAD^*

To remove the last commit, the new files and the modifications of the files.

WARNING : these 2 operations can not be cancelled

How to get back ? > *When use what ?*

If you haven't pushed your work yet :

git checkout -- file_name

file_name will be at its state in the last commit.

git reset HEAD file_to_remove_from_the_index

To revert the *git add* on file_to_remove_from_the_index.

How to get back ? > *When use what ?*

Git status is your friend !

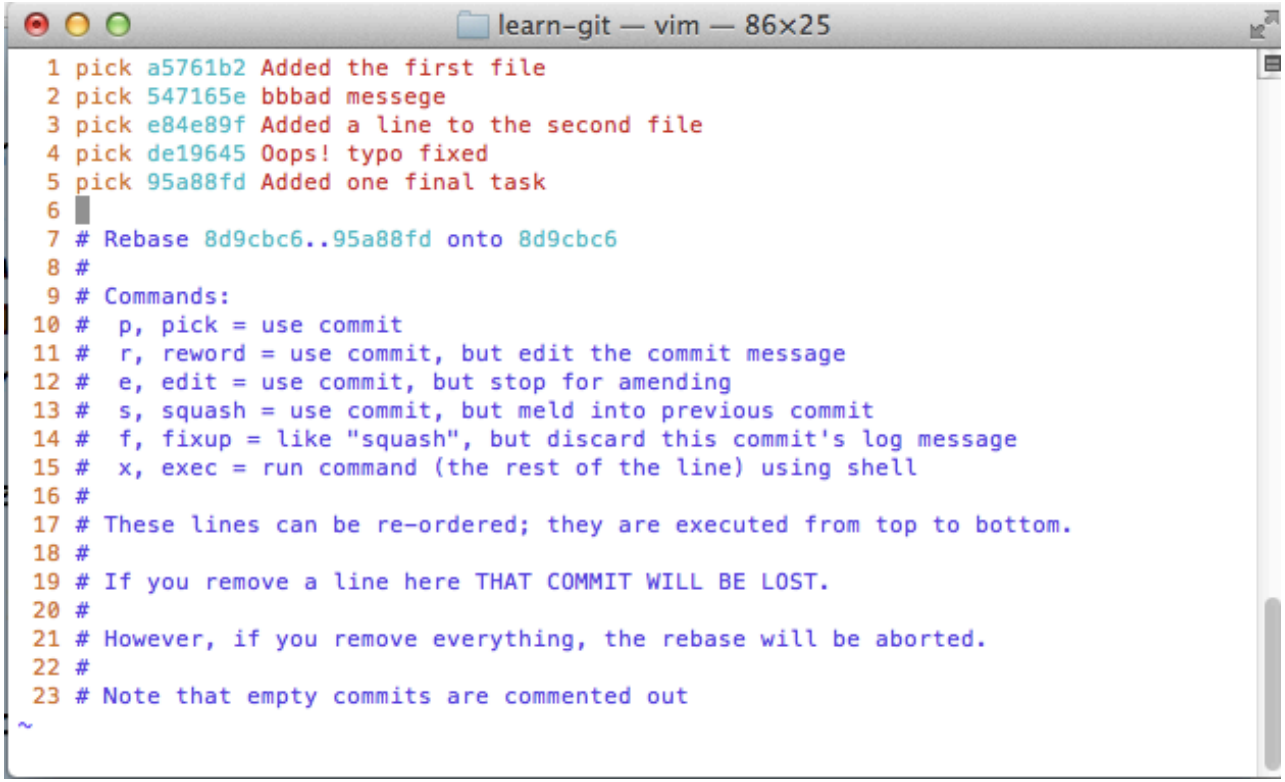
```
~/p/p/slides (:gh-pages) git status
# On branch gh-pages
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       modified:   css/theme/jr0cket.css
#
# Changes not staged for commit:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#       modified:   getting-started-with-git.html
#       modified:   getting-started-with-git.org
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#       images/
~/p/p/slides (:gh-pages) _
```

How to get back ? > *When use what ?*

If you haven't pushed your work yet :

git rebase [-i | --interactive] HEAD~5

To modify the message commits, their order or their number.



How to get back ? > *When use what ?*

If you have already pushed your work :

Do not modify the history !!!

git revert 6261cc2

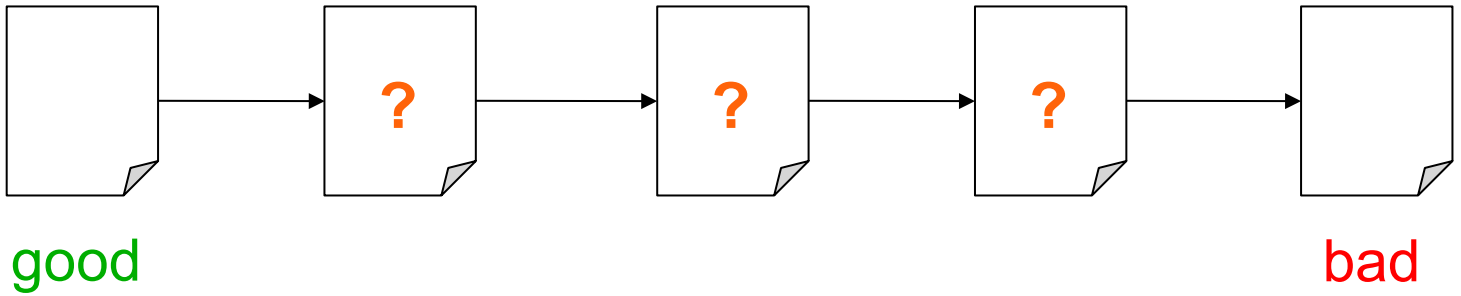
To create the inverse commit of *6261cc2.*

How to get back ? > *Cheat-sheet*

	HEAD	Index	Workdir	WD Safe?
Commit Level				
`reset --soft [commit]`	REF	NO	NO	YES
`reset [commit]`	REF	YES	NO	YES
`reset --hard [commit]`	REF	YES	YES	**NO**
`checkout [commit]`	HEAD	YES	YES	YES
File Level				
`reset (commit) [file]`	NO	YES	NO	YES
`checkout (commit) [file]`	NO	YES	YES	**NO**

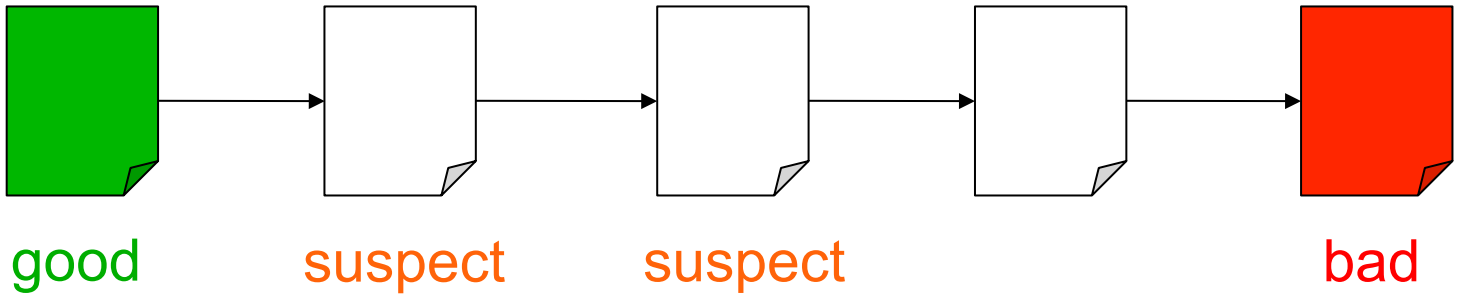
Git > *Bisection*

Finds the commit introducing a bug by dichotomy



Git > *Bisection*

Finds the commit introducing a bug by dichotomy



Git > *Bisection*

Finds the commit introducing a bug by dichotomy

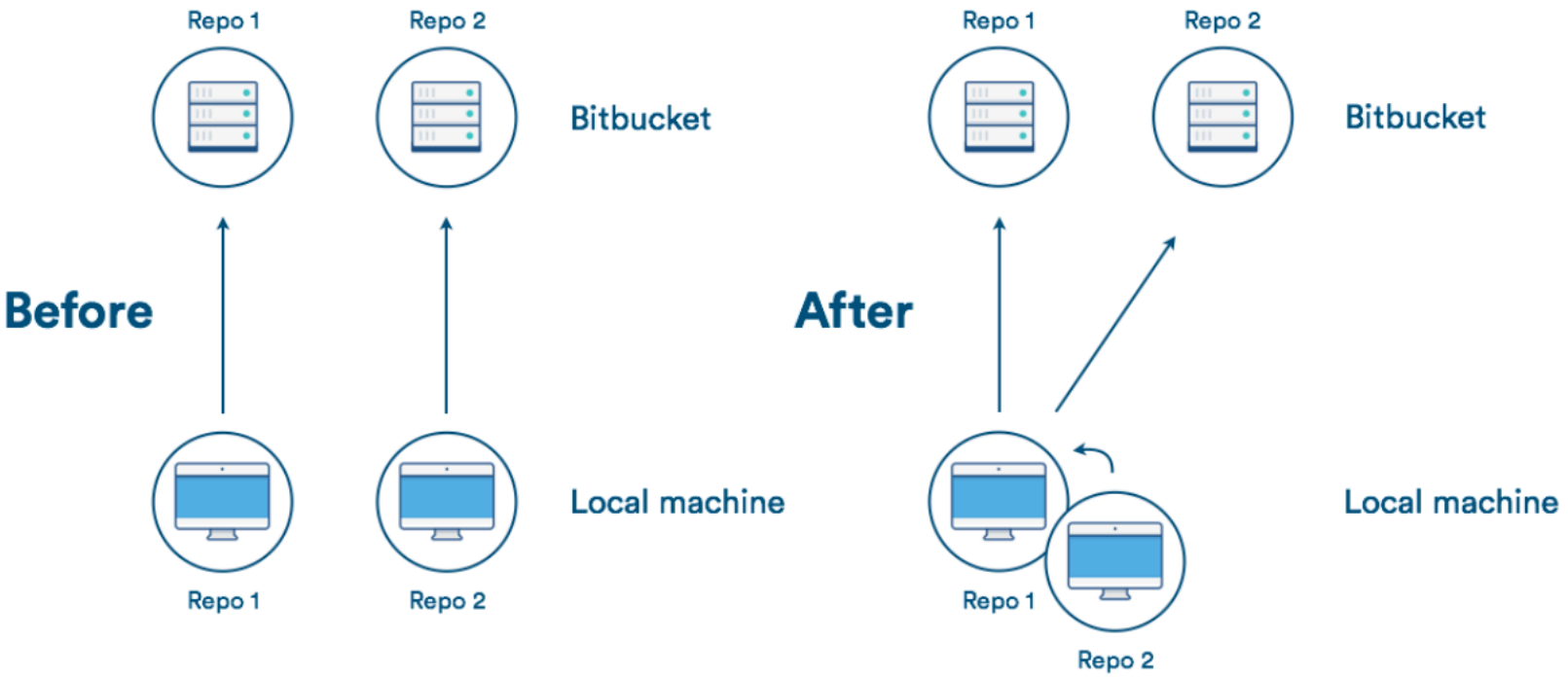
```
$ git bisect start
$ git bisect bad # Current version is bad
$ git bisect good <a-good-old-version>
Bisecting: 675 revisions left to test after this (roughly 10 steps)
$ git bisect good|bad
…
```

Git > *Subrepo*

Alternatives to: submodules, subtrees
Git subrepo allows you to work with embedded git repositories

```
# Clone an existing repo as a subrepo (in a subdirectory)
$ git subrepo clone <url> [<subdir>]

# Create an embedded git repo
$ git subrepo init <subdir>

# Pull from upstream
$ git subrepo pull <subdir>

# Push to upstream
$ git subrepo push <subdir>
```

Git > *Subtree*



https://github.com/ingydotnet/git-subrepo

Git > *Hooks*

Custom scripts in .git/hooks triggered on specific events.
Predefined hooks on platforms such as forges or GitLab/GitHub.

- Client-side hooks: on events such as commit or merge
  - *pre-commit:* to run test, to format the code or check the doc
  - *prepare-commit-msg:* to edit the default commit message
  - *commit-msg:* to check commit message compliance to a pattern
  - *post-commit:* for notification
  - *post-checkout, post-merge, pre-rebase, pre-push*
- Server-side hooks: on events such as reception of a pushed commit
  - *pre-receive*: access control, no non-fast-forwards
  - *update*: similar (pre-receive runs only once, whereas update runs once per branch)
  - *post-receive*: notification to a list by e-mail, to a continuous integration server, to update a ticket-tracking system

https://git-scm.com/book/it/v2/Customizing-Git-Git-Hooks
https://fr.atlassian.com/git/tutorials/git-hooks/

Git > *Hooks*

Decentralized SCM
> **Git synthesis**

Git

- Good visualization and branch handling, available locally:

saving of intermediary states, working on distinct features, experiments, …

- Easy merge of branches, cherrypick for one single commit
- All operations available locally, except push and pull
- Flexible: undo / modify commits, locally before sharing
- Hooks pre/post (commit, update ...)
- Bisection: finds the guilty commit (the one that introduced the bug)
- Efficient on big projects (Linux kernel)
- Available on Linux, OS X and Windows

Around Git

GUIs

- Built-in GUI tools (Windows, Linux, MacOS):
  - for browsing : gitk
  - for committing : git-gui
- qgit (a repository browser written in C++ using Qt)
- SmartGit (Windows, Linux, MacOS)
- TortoiseGit via Putty (Windows)
- GitHub Desktop (Windows, MacOS)
- SourceTree (Windows, MacOS)
- https://git-scm.com/downloads/guis/

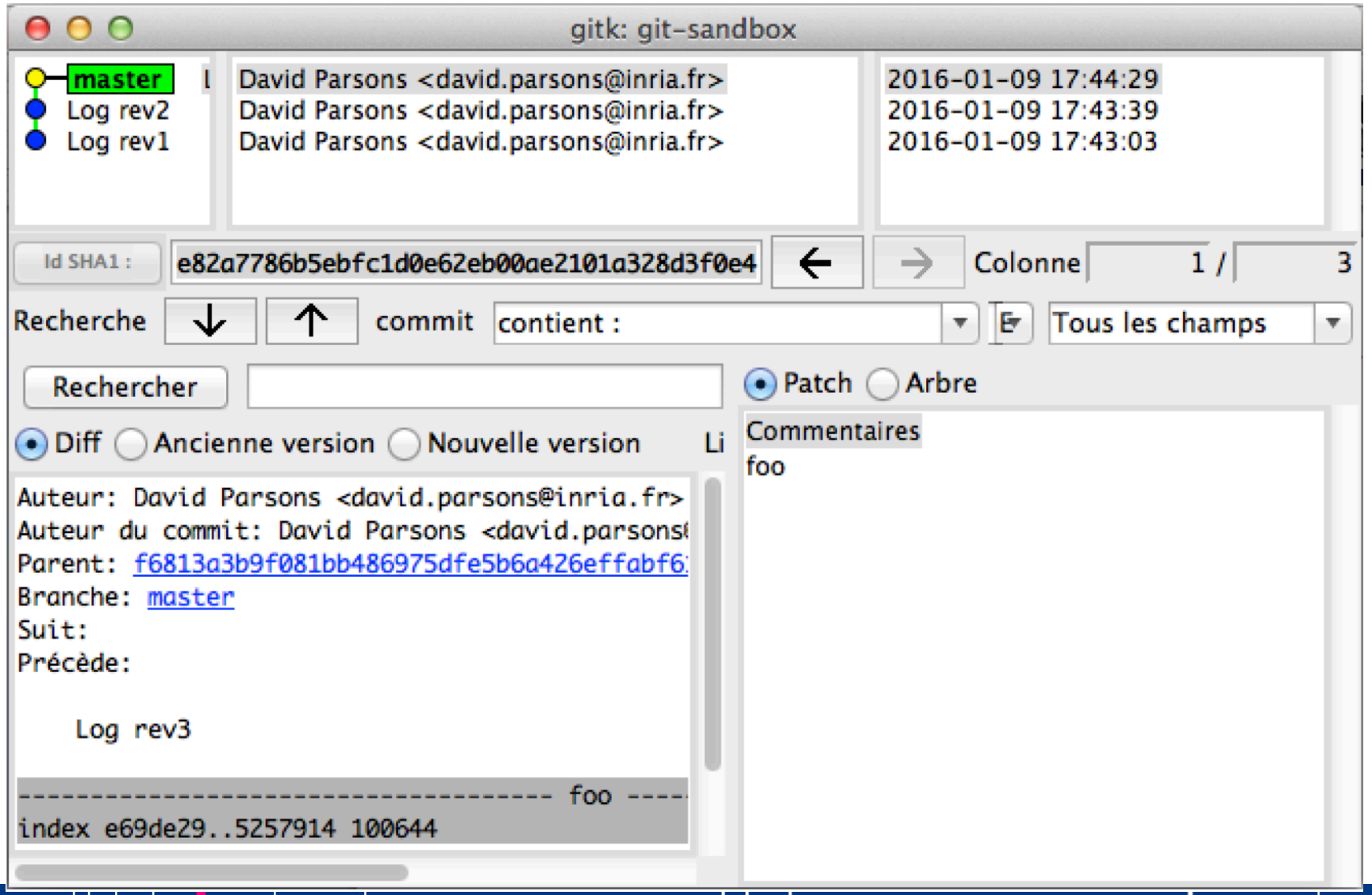
Users

Linux kernel
Wine
X.org
Android
Kitware

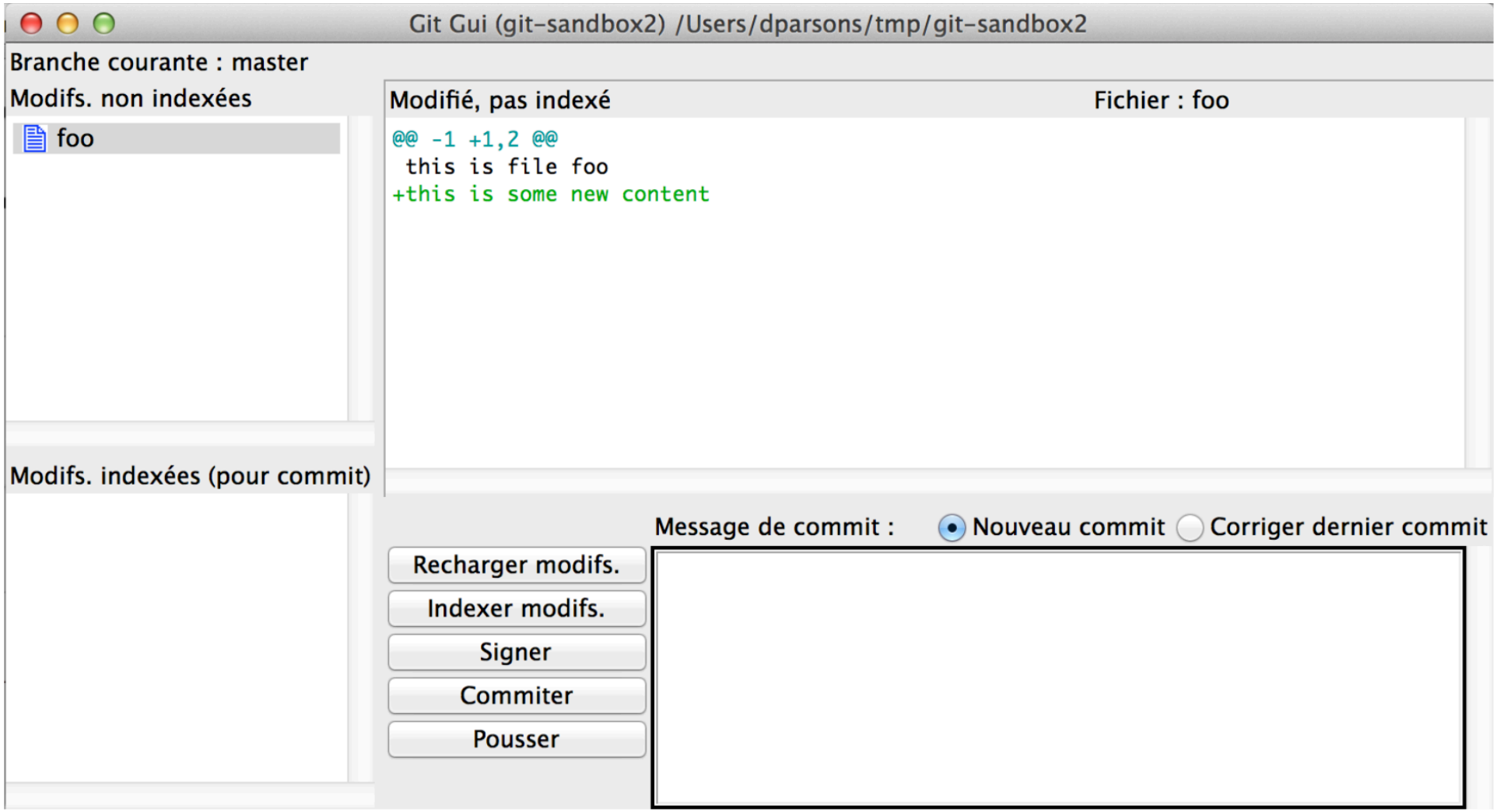
Useful links

- http://git-scm.com/

Around Git > *gitk*

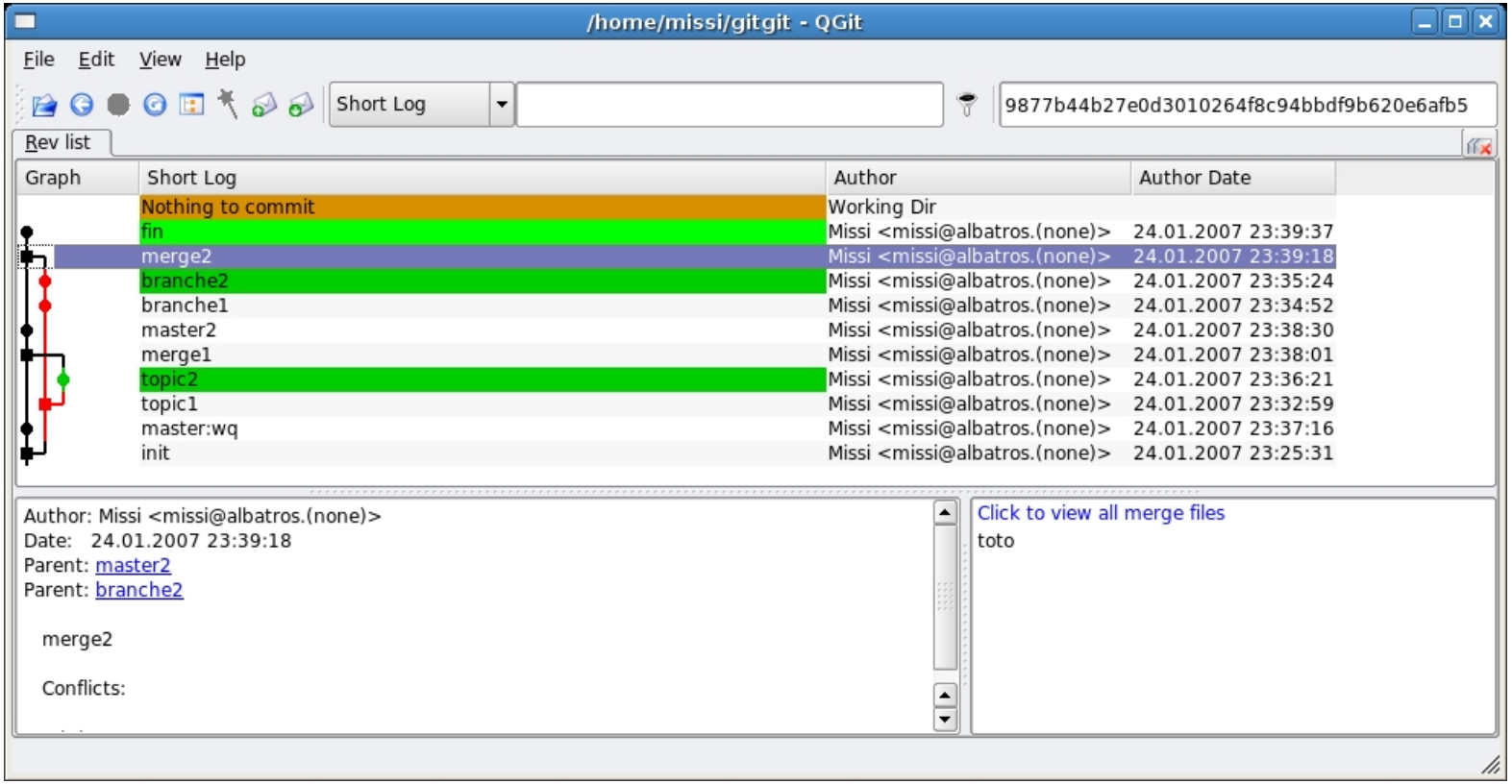


Around Git > *git-gui*

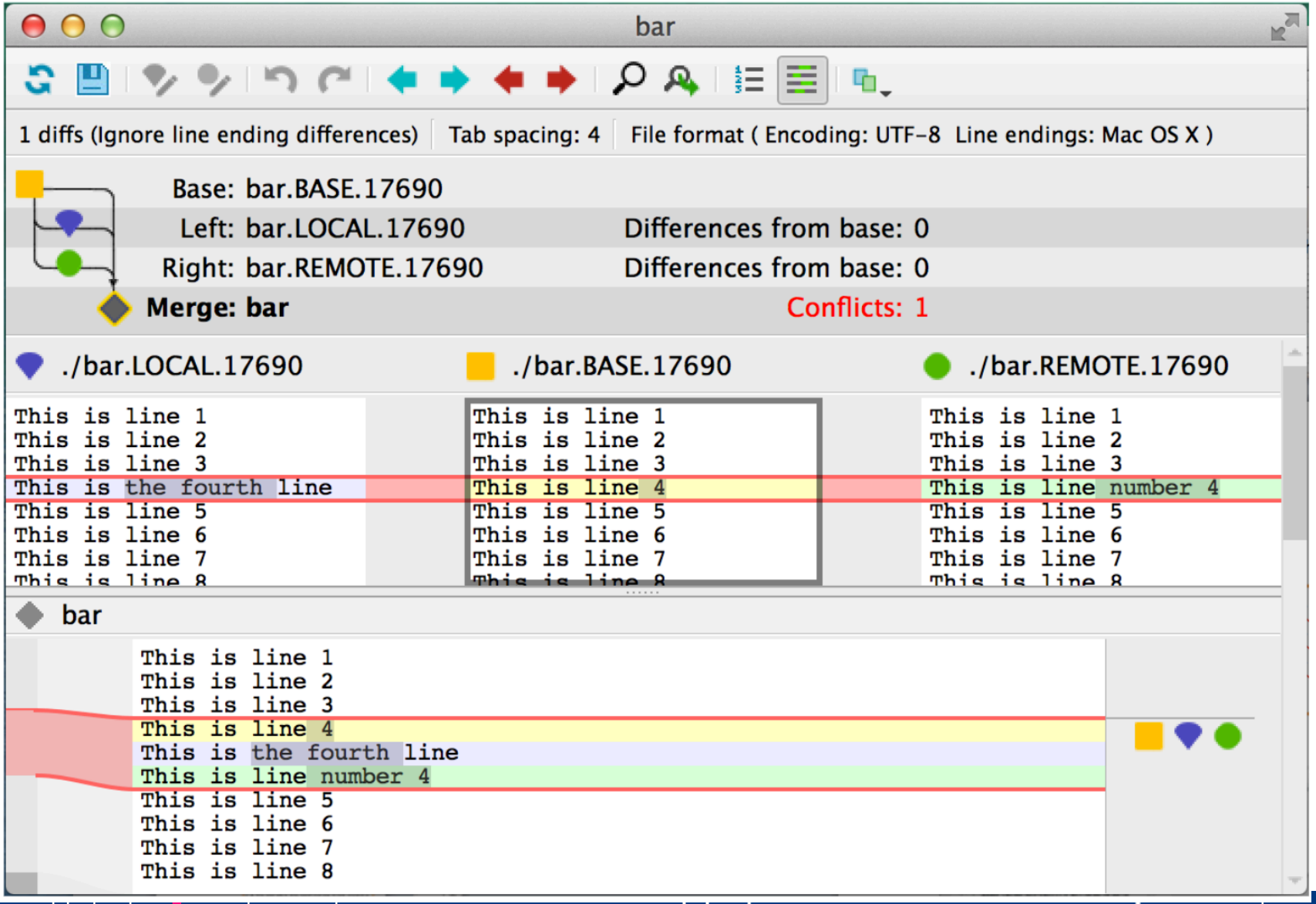


Around Git > *qgit*

Browse revisions history
View patch content and changed files
Graphically follow different development branches

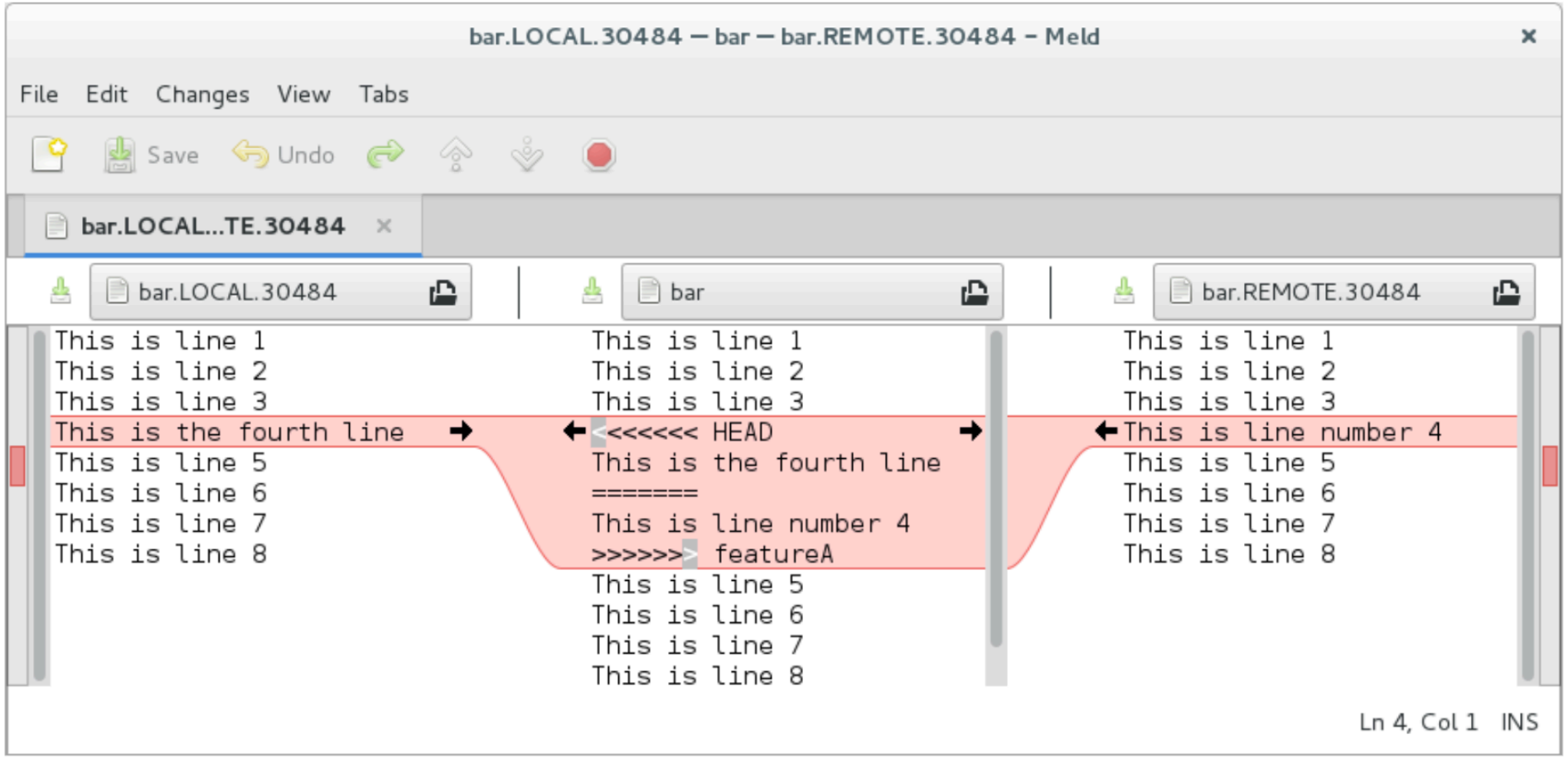


Around Git > *mergetool*



Around Git > *configuring mergetool*


```
$ git config --global merge.tool meld
$ git config --global mergetool.meld.cmd 'meld $LOCAL $MERGED $REMOTE'
$ git config --global mergetool.meld.trustExitCode false
$
```



Around Git > *online visualization of your repository*

- gitweb by default
- gitolite
- gitblit
- gitbucket
- gogs
- kallithea

Around Git > *online visualization of your repository*

Gitolite CREATIS example :
The list of projects

git://git.creatis.insa-lyon.fr / git

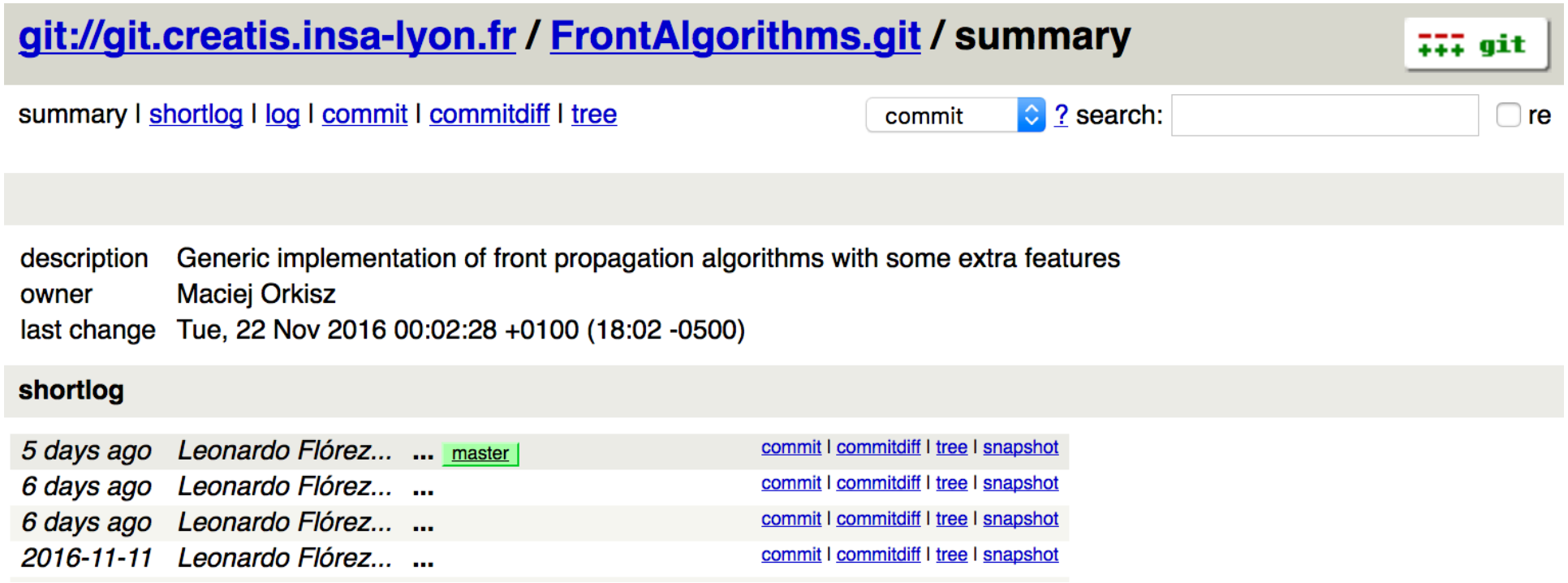
re Search

List all projects

Project	Description	Owner	Last Change	
CreaPhase.git	Propagation-based phase contra...	*Loriane Weber*	*2 months ago*	summary | shortlog | log | tree
FrontAlgorithms.git	Generic implementation of...	*Maciej Orkisz*	*2 days ago*	summary | shortlog | log | tree
GRIDA.git	Grid Data Management Agent	*Sorina Pop*	*No commits*	summary | shortlog | log | tree
bbtk.git	Black Box Tool Kit	*Eduardo Davila*	*6 days ago*	summary | shortlog | log | tree

Around Git > *online visualization of your repository*

Gitolite CREATIS example :
The log for one project



Around Git > *online visualization of your repository*

Gitolite CREATIS example :

A commit

git://git.creatis.insa-lyon.fr / FrontAlgorithms.git / commit

summary | shortlog | log | commit | commitdiff | tree
(parent: 86a6d5d) | patch

commit ? search: re

... master

```
author     Leonardo Flórez-Valencia <florez-l@javeriana.edu.co>
           Tue, 22 Nov 2016 00:02:28 +0100 (18:02 -0500)
committer  Leonardo Flórez-Valencia <florez-l@javeriana.edu.co>
           Tue, 22 Nov 2016 00:02:28 +0100 (18:02 -0500)
commit     3e69c5942ef8dd71c4e25da906eac97ffb63a79d
tree       9226bc46572e17f1c1c42a02c0d3f3b90b1c2b23        tree | snapshot
parent     86a6d5df2aa1aa5292a5fa851d98bfc13939bdf3         commit | diff
```

...

lib/CMakeLists.txt	diff | blob | history
lib/fpaInstances/CMakeLists.txt	diff | blob | history
plugins/CMakeLists.txt	diff | blob | history

Around Git > *online visualization of your repository*

Gitolite CREATIS example : A commitdiff

git://git.creatis.insa-lyon.fr / FrontAlgorithms.git / commitdiff

summary | shortlog | log | commit | commitdiff | tree
raw | patch | inline | side by side (parent: 86a6d5d)

commit ? search: re

... master

```
author    Leonardo Flórez-Valencia <florez-l@javeriana.edu.co>
          Tue, 22 Nov 2016 00:02:28 +0100 (18:02 -0500)
committer Leonardo Flórez-Valencia <florez-l@javeriana.edu.co>
          Tue, 22 Nov 2016 00:02:28 +0100 (18:02 -0500)
```

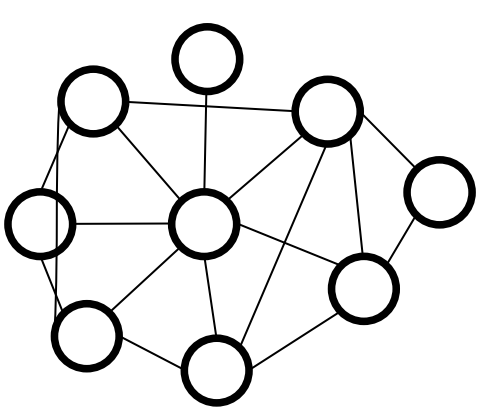
lib/CMakeLists.txt	patch | blob | history
lib/fpaInstances/CMakeLists.txt	patch | blob | history
plugins/CMakeLists.txt	patch | blob | history

```
diff --git a/lib/CMakeLists.txt b/lib/CMakeLists.txt
index d65d98b..20f87ed 100644 (file)
--- a/lib/CMakeLists.txt
+++ b/lib/CMakeLists.txt
@@ -8,6 +8,8 @@ CompileLibFromDir(fpa SHARED fpa)
 ## == Build instances for cpPlugins ==
 ## ====================================

-SUBDIRS(fpaInstances)
+IF(USE_cpPlugins)
+  SUBDIRS(fpaInstances)
+ENDIF(USE_cpPlugins)

 ## eof - $RCSfile$
```

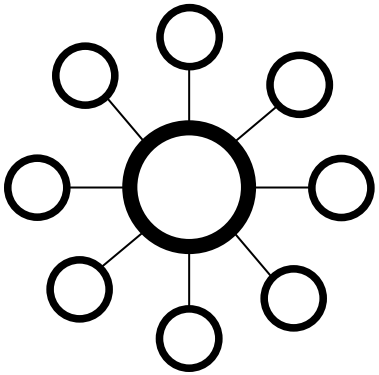
Conclusion

Conclusion

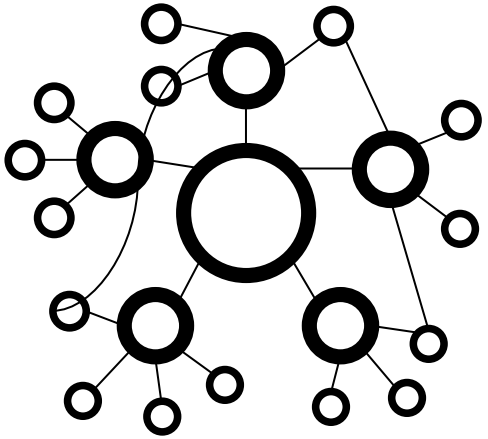
- A decentralized SCM remains a **tool**
  - No default usage policy
  - Policy to be defined
    - From centralized to decentralized
    - Pull-only vs shared-push



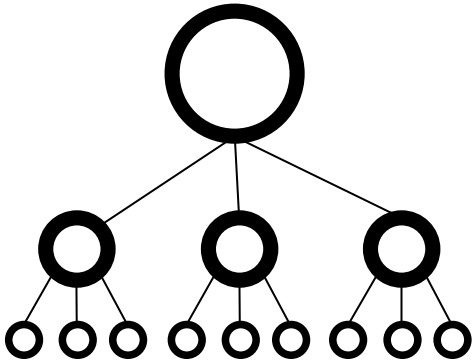
Anarchic



Centralized



Linux kernel model

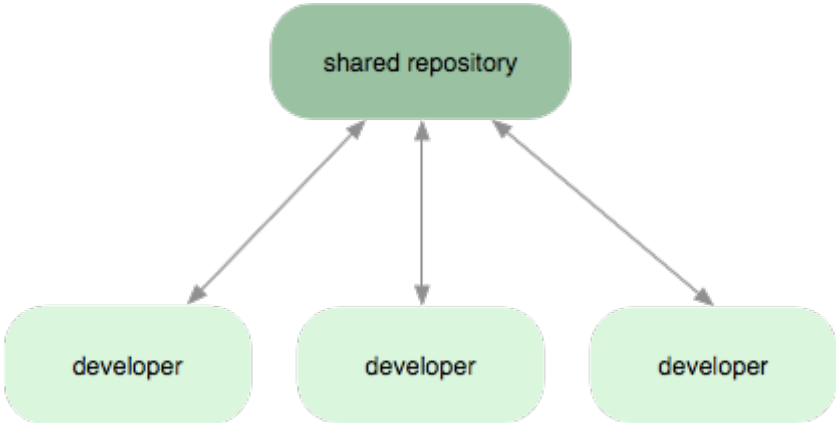


Branch by functionality
or
Release train

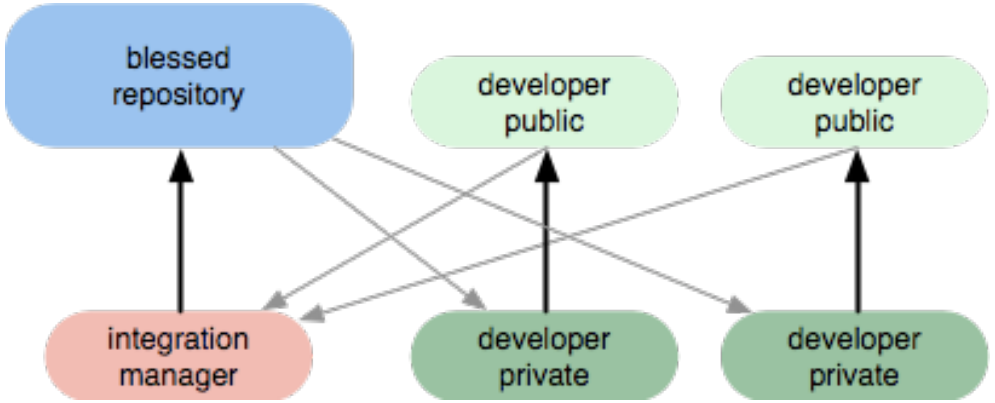
Conclusion

- Workflow examples :
  - Centralized workflow
  - One branch per functionality
  - Workflow Gitflow (branches *master, develop, release-v**)
  - Duplication workflow (fork to get your own public repository)

https://fr.atlassian.com/git/tutorials/comparing-workflows/
http://nvie.com/posts/a-successful-git-branching-model/



Centralized-style workflow



Integration manager workflow

Examples and Demonstration

Example 1, with CVS or SVN

- We are working on an improvement, not already ready to be published
- A bug is reported, it needs to be fixed quickly
- How would you do with CVS or SVN?

- Do a second checkout, fix the bug there and update the first checkout in which we developed

OR

- Save the current patch (cvs diff > file), restore the unmodified version, fix the bug, reapply the patch in the hope that conflicts will be avoided…
  - Do not forget the removed/added files
  - Not easily scalable…

Example 1, with Git

- We are working on an improvement, not already ready to be published
- A bug is reported, it needs to be fixed quickly
- How would you do with Git?

- Quickly *commit* the current state of the improvement
  - It will be modified later
- Create a *branch* of the public version and *checkout* to it
- Fix the bug and *push* the commit
- *Checkout* to get back to the initial branch
- *Merge* to get the bug fixing if necessary

Example 2, with CVS or SVN

- We are working on a new feature in the plane or in the train

- Save intermediary versions
  - cvs diff > patch1_doingX_butnotY
- When back on-line, commit the different steps of the work
  - cvs up to the revision at the working time
  - Apply a patch
  - cvs up
  - Resolve conflicts, especially if new files were added
  - cvs commit
  - Do it again for each patch…

Example 2, with Git

- We are working on a new feature in the plane or in the train

- Save intermediary versions
  - git commit
- Modify a previous version
  - git commit –amend
- Publish the different steps of the work
  - git push

Example 3

- We maintain a modified version of a software A
- How to update from a new version of A?
- With CVS or SVN:
  - Find the latest revision X that has been retrieved
  - Find the current revision Y that we want to retrieve
  - Merge between X and Y
  - cvs commit

  (The last versions of SVN remember what has already been merged.)
- With Git:
  - git pull A Y
    - Automatically finds out what should be merged

Example 4

- We would like to test a modification on several machines

- With CVS or SVN:
  - We create a branch for a single (or some) commits ?
  - We send patch(es) manually to each machine?
    - Do not forget cvs up each time

- With Git:
  - Create a branch and git push/pull from/to each machine
    - A central repository is useless

SVN to Git migration tools

Subversion

When choosing git migration tools you need to clearly grasp the difference between an *gateway* (supporting live operation on a Subversion repository through git) and an *importer* (designed to move an entire Subversion history to git). The programs in this section were usually designed for one of these purposes and may have serious hidden flaws if used for the other.

Importers and gateways are listed first, then exporters, then auxiliary tools. See git-svn on how to use Git as an Subversion client. Here is a feature matrix of the production-quality importers:

	reposurgeon	git-svn	svn2git	SubGit	agito
role?	importer	gateway	importer	gateway	importer
handles branching?	yes	yes	yes	yes	yes
makes annotated tags?	yes	no	yes	yes	yes
splits mixed-branch commits?	yes	no	no	yes	yes
makes .gitignore files?	yes	no	no	yes	yes
documentation	excellent	good	good	excellent	passable
written in	Python	Perl	Ruby	Java	Python
last activity?	2015	2012	2012	2013	2012
maintainer	Eric S. Raymond	Eric Wong	James Coglin, Kevin Menard	TMate Software	Simon Howard

https://git.wiki.kernel.org/index.php/Interfaces,_frontends,_and_tools#Subversion

Demonstration with the GUI SmartGit

- History browsing
- Commit locally
- Push to remote repository
- Pull from remote repository

Advised practice > *How to commit properly?*

Advised practice > *How to commit properly?*

- A commit is not a backup!
- A commit should be atomic: it corresponds to one specific feature (a bug correction, a new function…).
- Before a commit:
  - Clean the code (explicit variable names, comments, Doxygen documentation, …).
  - Check the compilation and the execution.
  - Pass the tests.
  - Git diff to choose what you are committing.
- Commit message:
  - Concise and precise. For example:
    - # IssueNb Added the method FunctionName to the class ClassName.
    - # IssueNb Removed the file BadClass.c.
    - # IssueNb Fixed a bug in Class::Method : the method performed bad access.

Advised practice

- Commits should be atomic, with pertinent messages
- Synchronize frequently to avoid conflicts
- Bug / task manager allowing to link a commit to an issue

Classic workflow

Every one has a local repository on his machine, a reference repository exists on a server.

git clone repository_URL – to retrieve a module

git pull origin master – to retrieve the latest version from the server to update your local version

git status – is recommended to see the status of your local repository and the modifications ready for the commit (i.e. in the index)

git diff – to check the current modifications since the last commit

git add modified_file – to add a new file to the module

git commit -a –m"Appropriate message describing the fixed bug or the feature added." – to create a local commit for all added files

git push origin master – to post your local commits to a remote repository

git log – to view the history with commit messages and authors

git command --help – integrated help

Git Cheat Sheet

http://git.or.cz/

Remember: git command --help

Global Git configuration is stored in $HOME/.gitconfig (git config --help)

Create

From existing data

```
cd ~/projects/myproject
git init
git add .
```

From existing repo

```
git clone ~/existing/repo ~/new/repo
git clone git://host.org/project.git
git clone ssh://you@host.org/proj.git
```

Show

Files changed in working directory

```
git status
```

Changes to tracked files

```
git diff
```

What changed between $ID1 and $ID2

```
git diff $id1  $id2
```

History of changes

```
git log
```

History of changes for file with diffs

```
git log -p $file $dir/ec/tory/
```

Who changed what and when in a file

```
git blame $file
```

A commit identified by $ID

```
git show $id
```

A specific file from a specific $ID

```
git show $id:$file
```

All local branches

```
git branch
```

(star '*' marks the current branch)

Cheat Sheet Notation

$id : notation used in this sheet to represent either a commit id, branch or a tag name
$file : arbitrary file name
$branch : arbitrary branch name

Concepts

Git Basics

master : default development branch
origin : default upstream repository
HEAD : current branch
HEAD^ : parent of HEAD
HEAD~4 : the great-great grandparent of HEAD

Revert

Return to the last committed state

```
git reset --hard
```

⚠ you cannot undo a hard reset

Revert the last commit

```
git revert HEAD
```

Creates a new commit

Revert specific commit

```
git revert $id
```

Creates a new commit

Fix the last commit

```
git commit -a --amend
```

(after editing the broken files)

Checkout the $id version of a file

```
git checkout $id $file
```

Branch

Switch to the $id branch

```
git checkout $id
```

Merge branch1 into branch2

```
git checkout $branch2
git merge branch1
```

Create branch named $branch based on the HEAD

```
git branch $branch
```

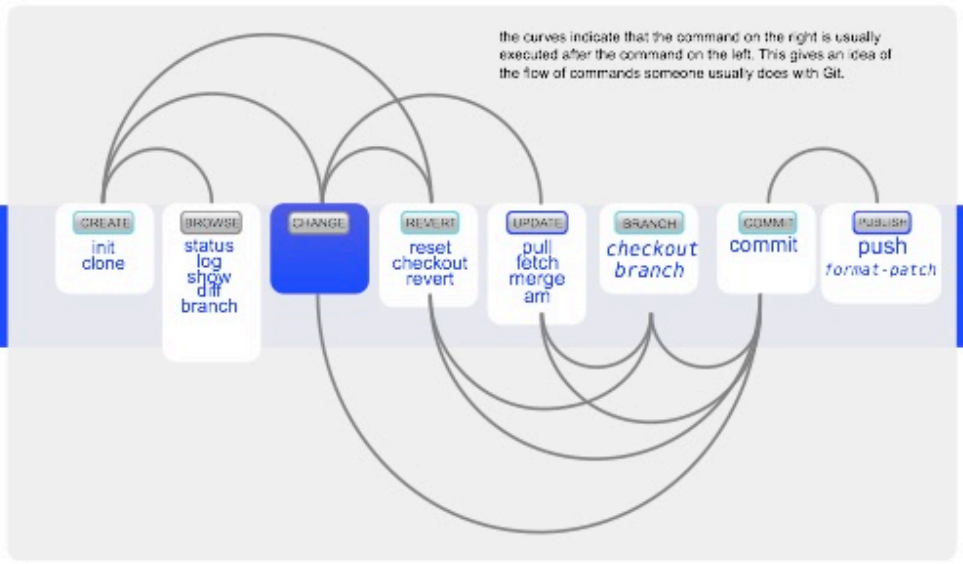
Create branch $new_branch based on branch $other and switch to it

```
git checkout -b $new_branch $other
```

Delete branch $branch

```
git branch -d $branch
```

Commands Sequence



Update

Fetch latest changes from origin

```
git fetch
```

(but this does not merge them)

Pull latest changes from origin

```
git pull
```

(does a fetch followed by a merge)

Apply a patch that some sent you

```
git am -3 patch.mbox
```

(in case of a conflict, resolve and use git am --resolved)

Publish

Commit all your local changes

```
git commit -a
```

Prepare a patch for other developers

```
git format-patch origin
```

Push changes to origin

```
git push
```

Mark a version / milestone

```
git tag v1.0
```

Useful Commands

Finding regressions

```
git bisect start          (to start)
git bisect good $id       ($id is the last working version)
git bisect bad $id        ($id is a broken version)

git bisect bad/good       (to mark it as bad or good)
git bisect visualize      (to launch gitk and mark it)
git bisect reset          (once you're done)
```

Check for errors and cleanup repository

```
git fsck
git gc --prune
```

Search working directory for foo()

```
git grep "foo()"
```

Resolve Merge Conflicts

To view the merge conclicts

```
git diff                  (compare conflict diff)
git diff --base $file     (against base file)
git diff --ours  $file    (against your changes)
git diff --theirs $file   (against other changes)
```

To discard conflicting patch

```
git reset --hard
git rebase --skip
```

After resolving conflicts, merge with

```
git add $conflicting_file   (do for all resolved files)
git rebase --continue
```

Configuration

```
git config --global user.name "nom"
git config --global user.email "prenom.nom@cnrs.fr"
git config --global color.ui auto
git config --global credential.helper cache
git config --global http.postBuffer 524288000
```

- Vérifier la configuration

```
git config --global -l
```

Créer un dépôt

- Créer un dépôt vide

```
git init projet
```

- Créer un dépôt en clonant un dépôt distant

```
git clone url
```

- Créer un dépôt local dans un répertoire local existant

```
cd repertoire_projet
git init git add -A
```

Ignorer des fichiers

- Créer la liste des fichiers à ignorer et la publier

```
git config --global core.excludefiles **/*.log
```

Modifier le fichier .gitignore

```
git add .gitignore
git commit -m "Partage des fichiers à ignorer"
```

- Afficher la liste de tous les fichiers ignorés

```
git ls-files --other --ignored --exclude-standard
```

Historique

- Afficher tous les commits (format par défaut ou court)

```
git log
git log --pretty=-short
```

- Afficher les *x* derniers commits

```
git log -n x
```

- Afficher les commits d'un fichier ou d'un répertoire

```
git log fichier
git log repertoire/
```

- Afficher des statistiques pour chaque fichier modifié

```
git log --stat
```

- Afficher le contenu d'un commit

```
git show id_commit
```

Modifications locales

- Annuler les modifications réalisées dans un fichier

```
git checkout -- fichier
git reset [--mixed] HEAD fichier
```

- Ajouter des fichiers au prochain commit

```
git add fichier1 fichier2 fichier3
```

- Enlever un fichier du prochain commit

```
git rm --cached fichier
```

- Supprimer un fichier

```
git rm fichier
```

- Supprimer récursivement les fichiers d'un répertoire

```
git rm repertoire/ -r
```

- Renommer un fichier

```
git mv fichier nouveau_nom
```

- Déplacer un fichier

```
git mv fichier destination/
```

- Afficher l'état des fichiers nouveaux ou modifiés

```
git status
```

- Afficher les modifications des fichiers suivis modifiés

```
git diff
```

- Afficher les modifications du prochain commit

```
git diff --cached
```

- Effectuer un commit

```
git commit
git commit -a (ajouter automatiquement les fichiers)
git commit -m "Message du commit"
```

- Modifier le dernier commit

```
git commit --amend
```

- Etiqueter le dernier commit

```
git tag nom_tag
```

- Annuler les *n* derniers commit

```
git revert HEAD ( dernier commit )
git revert HEAD~ ( 2 derniers commit )
git revert HEAD~2 ( 3 derniers commit )
```

- Retourner à la version du dernier commit
  (Supprime les nouveaux fichiers et les modifications)
  ATTENTION : Cette opération ne peut pas être annulée

```
git reset --hard HEAD
```

Branches

- Afficher la liste des branches

```
git branch
```

- Créer une nouvelle branche

```
git branch nom_branche
```

- Basculer sur une branche

```
git checkout nom_branche
```

- Fusionner une branche dans la branche courante

```
git merge nom_branche
```

- Supprimer localement une branche

```
git branch -d nom_branche
```

- Afficher les différences entre deux branches

```
git diff nom_branche1...nom_branche2
```

Dépôts distants

- Afficher la liste des dépôts déclarés

```
git remote -v
```

- Afficher des informations sur un dépôt

```
git remote show nom_depot (ex:origin)
```

- Déclarer un dépôt

```
git remote add chemin|url
```

- Déclarer le dépôt origin

```
git remote add origin url
```

- Récupérer les données d'un dépôt déclaré

```
git fetch nom_depot
```

- Récupérer les données de la branche d'un dépôt et fusionner dans la branche courante

```
git pull [nom_depot] [nom_branche_distante]
```

- Publier les modifications locales d'une branche

```
git push [nom_depot] [nom_branche_locale]
```

- Supprimer une branche dans un dépôt déclaré

```
git push nom_depot :nom_branche_distante
git push nom_depot --delete
  nom_branche_distante
```

- Publier les information de tags

```
git push nom_depot --tags
```

GitHub

AIDE-MÉMOIRE GITHUB GIT

Git est le sytème de gestion de version décentralisé open source qui facilite les activités GitHub sur votre ordinateur. Cet aide-mémoire permet un accès rapide aux instructions des commandes Git les plus utilisées.

INSTALLER GIT

GitHub fournit des clients desktop qui incluent une interface graphique pour les manipulations les plus courantes et une "an automatically updating command line edition of Git" pour les scénari avancés.

GitHub pour Windows
https://windows.github.com

GitHub pour Mac
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Les distributions de Git pour Linux et les systèmes POSIX sont disponibles sur le site web officiel de Git SCM.

Git pour toutes les plate-formes
http://git-scm.com

CONFIGURATION DES OUTILS

Configurer les informations de l'utilisateur pour tous les dépôts locaux

```
$ git config --global user.name "[nom]"
```

Définit le nom que vous voulez associer à toutes vos opérations de commit

```
$ git config --global user.email "[adresse email]"
```

Définit l'email que vous voulez associer à toutes vos opérations de commit

```
$ git config --global color.ui auto
```

Active la colorisation de la sortie en ligne de commande

CRÉER DES DÉPÔTS

Démarrer un nouveau dépôt ou en obtenir un depuis une URL existante

```
$ git init [nom-du-projet]
```

Crée un dépôt local à partir du nom spécifié

```
$ git clone [url]
```

Télécharge un projet et tout son historique de versions

EFFECTUER DES CHANGEMENTS

Consulter les modifications et effectuer une opération de commit

```
$ git status
```

Liste tous les nouveaux fichiers et les fichiers modifiés à commiter

```
$ git diff
```

Montre les modifications de fichier qui ne sont pas encore indexées

```
$ git add [fichier]
```

Ajoute un instantané du fichier, en préparation pour le suivi de version

```
$ git diff --staged
```

Montre les différences de fichier entre la version indexée et la dernière version

```
$ git reset [fichier]
```

Enleve le fichier de l'index, mais conserve son contenu

```
$ git commit -m "[message descriptif]"
```

Enregistre des instantanés de fichiers de façon permanente dans l'historique des versions

GROUPER DES CHANGEMENTS

Nommer une série de commits et combiner les résultats de travaux terminés

```
$ git branch
```

Liste toutes les branches locales dans le dépôt courant

```
$ git branch [nom-de-branche]
```

Crée une nouvelle branche

```
$ git checkout [nom-de-branche]
```

Bascule sur la branche spécifiée et met à jour le répertoire de travail

```
$ git merge [nom-de-branche]
```

Combine dans la branche courante l'historique de la branche spécifiée

```
$ git branch -d [nom-de-branche]
```

Supprime la branche spécifiée

GitHub

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Définit l'email que vous voulez associer à toutes vos opérations de commit

```
$ git config --global color.ui auto
```
Active la colorisation de la sortie en ligne de commande

CRÉER DES DÉPÔTS

Démarrer un nouveau dépôt ou en obtenir un depuis une URL existante

```
$ git init [nom-du-projet]
```
Crée un dépôt local à partir du nom spécifié

```
$ git clone [url]
```
Télécharge un projet et tout son historique de versions

EFFECTUER DES CHANGEMENTS

Consulter les modifications et effectuer une opération de commit

```
$ git status
```
Liste tous les nouveaux fichiers et les fichiers modifiés à commiter

```
$ git diff
```
Montre les modifications de fichier qui ne sont pas encore indexées

```
$ git add [fichier]
```
Ajoute un instantané du fichier, en préparation pour le suivi de version

```
$ git diff --staged
```
Montre les différences de fichier entre la version indexée et la dernière version

```
$ git reset [fichier]
```
Enleve le fichier de l'index, mais conserve son contenu

```
$ git commit -m "[message descriptif]"
```
Enregistre des instantanés de fichiers de façon permanente dans l'historique des versions

GROUPER DES CHANGEMENTS

Nommer une série de commits et combiner les résultats de travaux terminés

```
$ git branch
```
Liste toutes les branches locales dans le dépôt courant

```
$ git branch [nom-de-branche]
```
Crée une nouvelle branche

```
$ git checkout [nom-de-branche]
```
Bascule sur la branche spécifiée et met à jour le répertoire de travail

```
$ git merge [nom-de-branche]
```
Combine dans la branche courante l'historique de la branche spécifiée

```
$ git branch -d [nom-de-branche]
```
Supprime la branche spécifiée

AIDE-MÉMOIRE GITHUB GIT

CHANGEMENTS AU NIVEAU DES NOMS DE FICHIERS

Déplacer et supprimer des fichiers sous suivi de version

```
$ git rm [fichier]
```
Supprime le fichier du répertoire de travail et met à jour l'index

```
$ git rm --cached [fichier]
```
Supprime le fichier du système de suivi de version mais le préserve localement

```
$ git mv [fichier-nom] [fichier-nouveau-nom]
```
Renomme le fichier et prépare le changement pour un commit

EXCLURE DU SUIVI DE VERSION

Exclure des fichiers et chemins temporaires

```
*.log
build/
temp-*
```
Un fichier texte nommé `.gitignore` permet d'éviter le suivi de version accidentel pour les fichiers et chemins correspondant aux patterns spécifiés

```
$ git ls-files --other --ignored --exclude-standard
```
Liste tous les fichiers exclus du suivi de version dans ce projet

ENREGISTRER DES FRAGMENTS

Mettre en suspens des modifications non finies pour y revenir plus tard

```
$ git stash
```
Enregistre de manière temporaire tous les fichiers sous suivi de version qui ont été modifiés ("remiser son travail")

```
$ git stash pop
```
Applique une remise et la supprime immédiatement

```
$ git stash list
```
Liste toutes les remises

```
$ git stash drop
```
Supprime la remise la plus récente

VÉRIFIER L'HISTORIQUE DES VERSIONS

Suivre et inspecter l'évolution des fichiers du projet

```
$ git log
```
Montre l'historique des versions pour la branche courante

```
$ git log --follow [fichier]
```
Montre l'historique des versions, y compris les actions de renommage, pour le fichier spécifié

```
$ git diff [premiere-branche]...[deuxieme-branche]
```
Montre les différences de contenu entre deux branches

```
$ git show [commit]
```
Montre les modifications de métadonnées et de contenu inclues dans le commit spécifié

REFAIRE DES COMMITS

Corriger des erreurs et gérer l'historique des corrections

```
$ git reset [commit]
```
Annule tous les commits après `[commit]`, en conservant les modifications localement

```
$ git reset --hard [commit]
```
Supprime tout l'historique et les modifications effectuées après le commit spécifié

SYNCHRONISER LES CHANGEMENTS

Référencer un dépôt distant et synchroniser l'historique de versions

```
$ git fetch [nom-de-depot]
```
Récupère tout l'historique du dépôt nommé

```
$ git merge [nom-de-depot]/[branche]
```
Fusionne la branche du dépôt dans la branche locale courante

```
$ git push [alias] [branche]
```
Envoie tous les commits de la branche locale vers GitHub

```
$ git pull
```
Récupère tout l'historique du dépôt nommé et incorpore les modifications

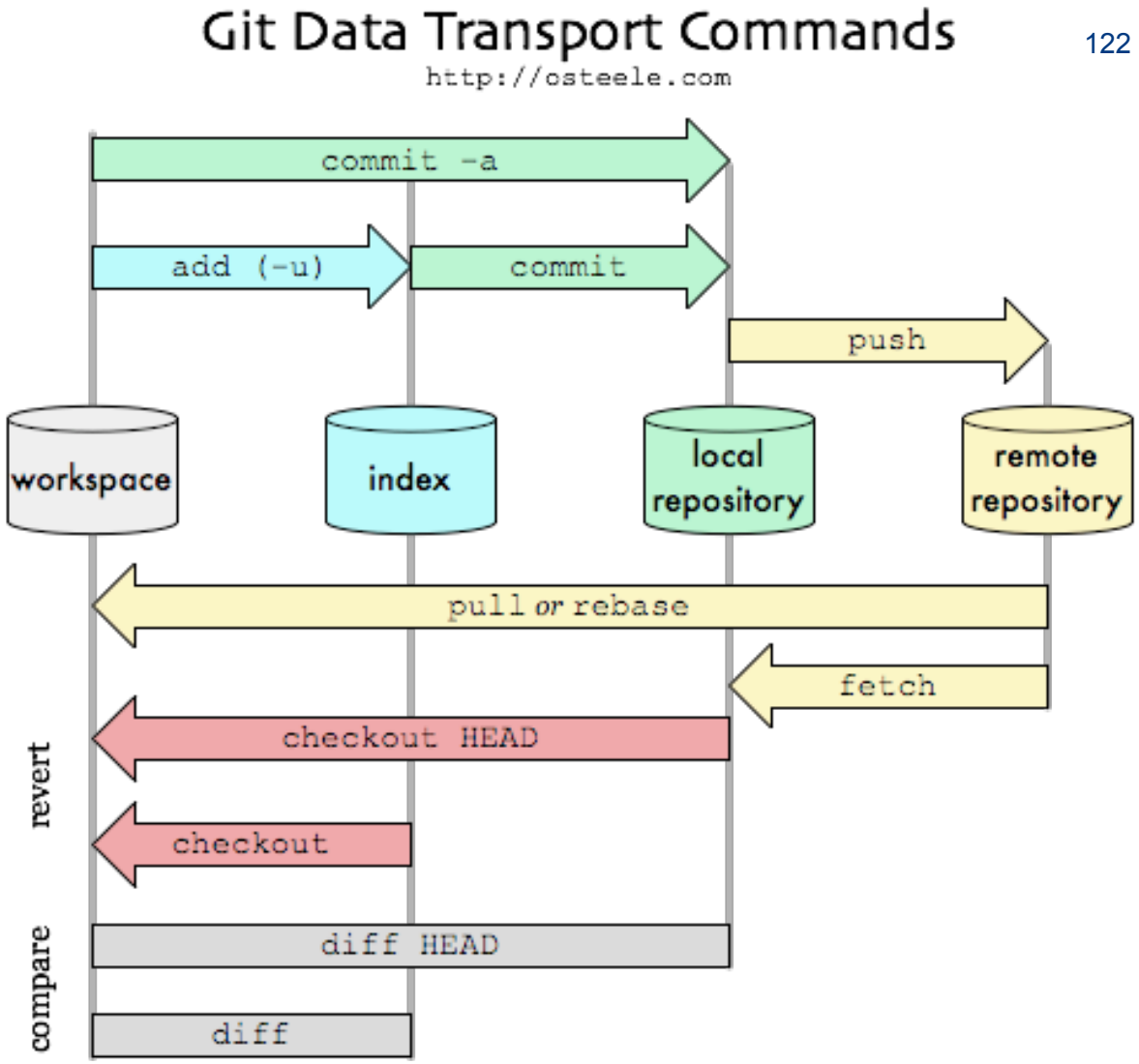
GitHub Training

Formez-vous à l'utilisation de GitHub et Git. Contactez l'équipe de formation ou visitez notre site web pour connaître les dates de formation et les disponibilités pour des cours privés.

training@github.com
training.github.com

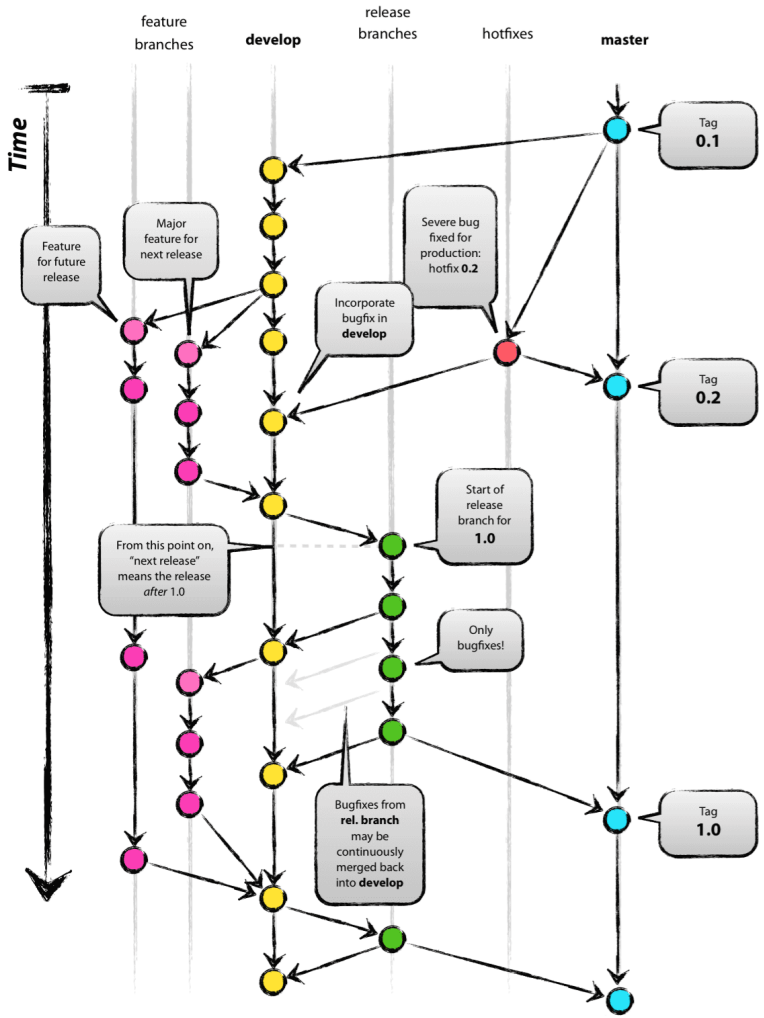
Source :

https://services.github.com/on-demand/downloads/fr/github-git-cheat-sheet.pdf



Source :

http://stackoverflow.com/questions/3689838/difference-between-head-working-tree-index-in-git



Source :

http://nvie.com/posts/a-successful-git-branching-model/