

Using Git

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2012

Outline

- 1 Revision Control System
- 2 Git: Basic Principles
- 3 An Example Using Git
- 4 Advices Using Git

Backups: The Old Good Time

- **Basic problems:**

- ▶ “Oh, my disk crashed.” / “Someone has stolen my laptop!”
- ▶ “@#%!!, I’ve just deleted this important file!”
- ▶ “Oops, I introduced a bug a long time ago in my code, how can I see how it was before?”

Backups: The Old Good Time

- Basic problems:

- ▶ “Oh, my disk crashed.” / “Someone has stolen my laptop!”
- ▶ “@#%!!, I’ve just deleted this important file!”
- ▶ “Oops, I introduced a bug a long time ago in my code, how can I see how it was before?”

- Historical solutions:

- ▶ Replicate:

```
$ cp -r ~/project/ ~/backup/
```

(or better, copy to a remote machine like telesun)

- ▶ Keep history:

```
$ cp -r ~/project/ ~/backup/project-2012-02-02
```

- ▶ ...

Collaborative Development: The Old Good Time

- **Basic problems:** Several persons working on the same set of files
 - ① “Hey, you’ve modified the same file as me, how do we merge?”,
 - ② “Your modifications are broken, your code doesn’t even compile. Fix your changes before sending it to me!”,

Collaborative Development: The Old Good Time

- Basic problems: Several persons working on the same set of files
 - ① “Hey, you’ve modified the same file as me, how do we merge?”,
 - ② “Your modifications are broken, your code doesn’t even compile. Fix your changes before sending it to me!”,
- Historical solutions:
 - ▶ Never two person work at the same time. ⇒ Doesn’t scale up!
Unsafe.
 - ▶ People work on the same directory (same machine, NFS, ACLs . . .)
⇒ Painful because of (2) above.
 - ▶ People work trying to avoid conflicts, and merge later.

Merging: Problem and Solution

● My version

```
#include <stdio.h>

int main () {
    printf("Hello");

    return EXIT_SUCCESS;
}
```

● Your version

```
#include <stdio.h>

int main () {
    printf("Hello!\n");

    return 0;
}
```

Merging: Problem and Solution

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● Common ancestor

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This merge can be done for you by an automatic tool

Merging relies on history!

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Collaborative development linked to backups

Merging

Space of possible revisions
(arbitrarily represented in 2D)

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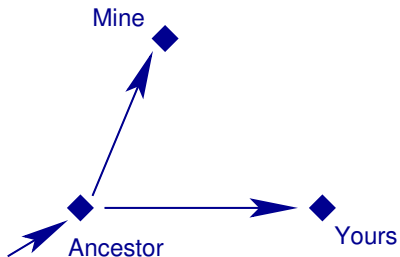
Mine



Yours

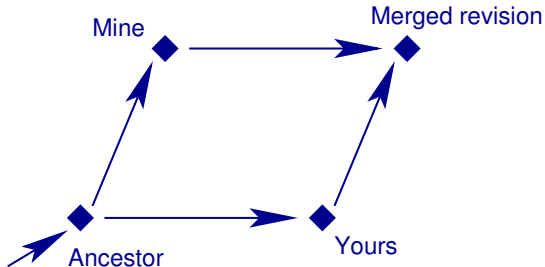
Merging

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Space of possible revisions
(arbitrarily represented in 2D)



Revision Control System: Basic Idea

- Keep track of **history**:
 - ▶ `commit` = snapshot of the current state,
 - ▶ Meta-data (user's name, date, descriptive message,...) recorded in `commit`.
- Use it for **merging**/collaborative development.
 - ▶ Each user works on its own copy,
 - ▶ User explicitly “takes” modifications from others when (s)he wants.

Outline

- 1 Revision Control System
- 2 **Git: Basic Principles**
- 3 An Example Using Git
- 4 Advices Using Git

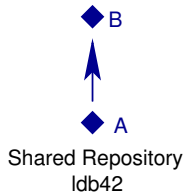
Git: Basic concepts

- Each working directory contains:
 - ▶ The files you work on (as usual)
 - ▶ The history, or “repository” (in the directory `.git/`)
- Basic operations:
 - ▶ **git clone**: get a copy of an existing repository (files + history)
 - ▶ **git commit**: create a new revision in a repository
 - ▶ **git pull**: get revisions from a repository
 - ▶ **git push**: send revisions to a repository
 - ▶ **git add**, **git rm** and **git mv**: tell Git which files should be tracked
 - ▶ **git status**: know what's going on
- For us:
 - ▶ Each team creates a shared repository, in addition to work trees

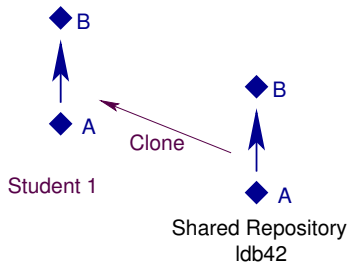
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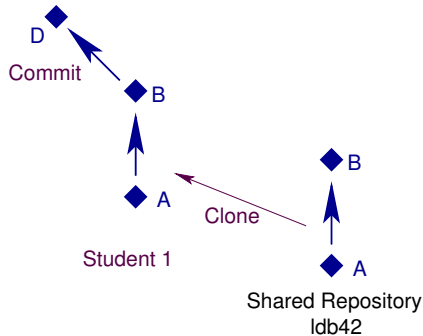
Starting the project with Git



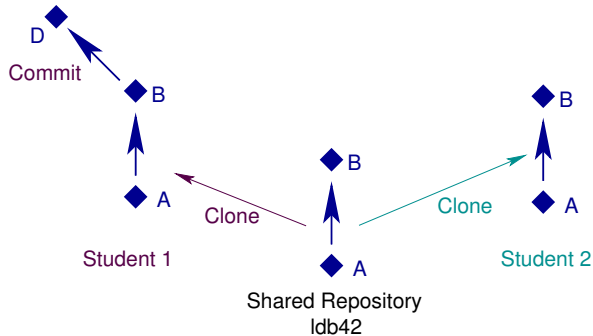
Starting the project with Git



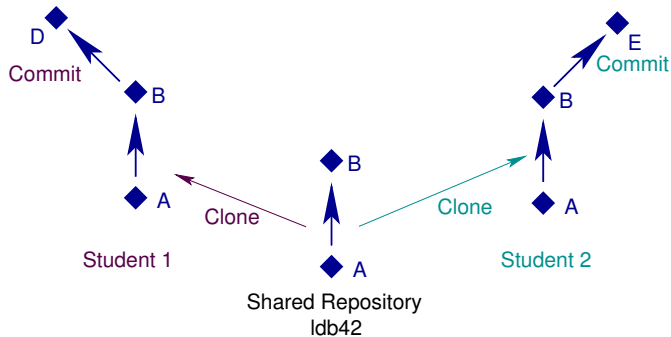
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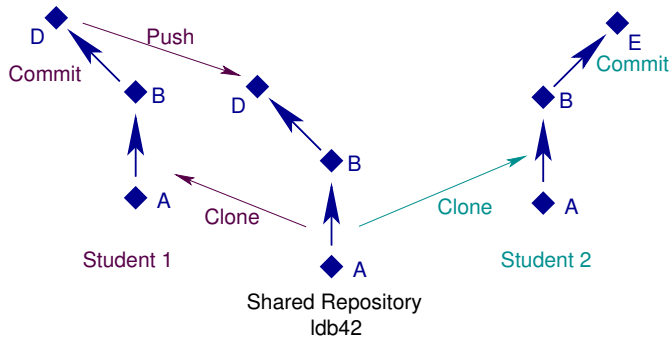
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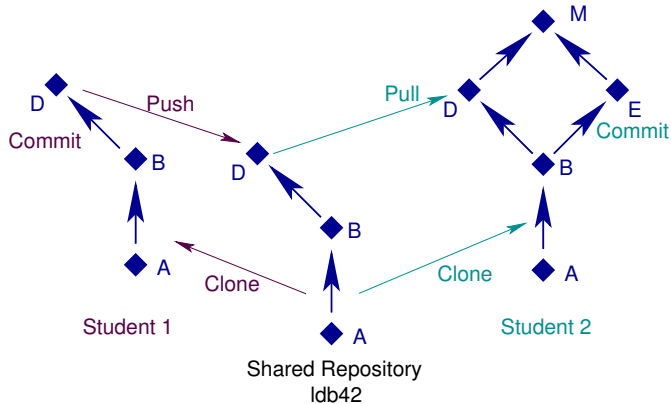
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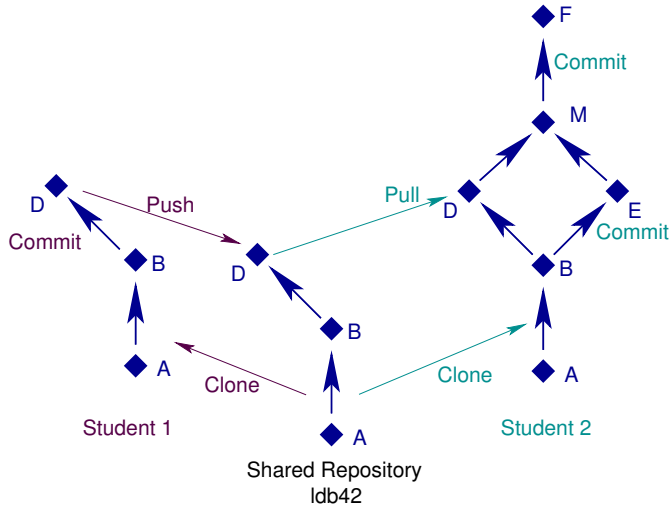
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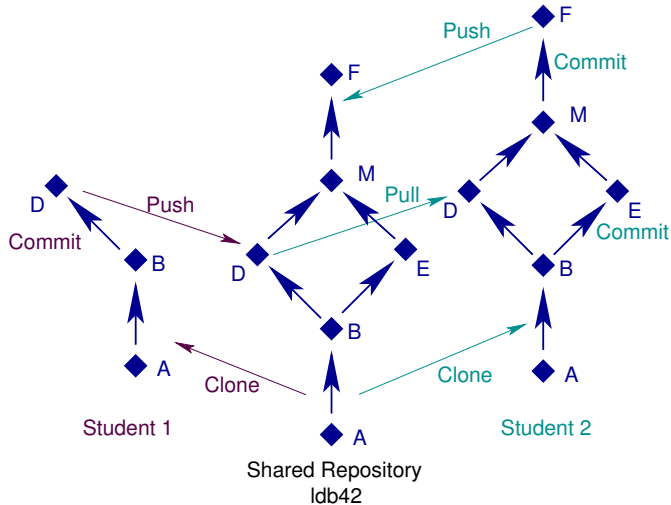
Starting the project with Git



Starting the project with Git



Starting the project with Git



Starting the project with Git: in Practice

```
Alice$ git clone ssh://ldb42@telesun.imag.fr/~git ipsim
Initialized empty Git repository in /perms/Alice/ipsim/.git/
remote: Counting objects: 960, done.
remote: Compressing objects: 100% (555/555), done.
remote: Total 960 (delta 341), reused 949 (delta 330)
Receiving objects: 100% (960/960), 1.51 MiB, done.
Resolving deltas: 100% (341/341), done.
```

Starting the project with Git: in Practice

```
Alice$ git clone ssh://ldb42@telesun.imag.fr/~git ipsim  
Alice$ cd ipsim/sandbox  
Alice$ vi hello.c
```

Starting the project with Git: in Practice

```
Alice$ git clone ssh://ldb42@telesun.imag.fr/~git ipsim
Alice$ cd ipsim/sandbox
Alice$ vi hello.c
Alice$ git status
# On branch master
# Changed but not updated:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes ...)
#
#       modified:   hello.c
#
```

Starting the project with Git: in Practice

```
Alice$ git clone ssh://ldb42@telesun.imag.fr/~git ipsim
Alice$ cd ipsim/sandbox
Alice$ vi hello.c
Alice$ git status
Alice$ git diff HEAD
--- a/projet/sandbox/hello.c
+++ b/projet/sandbox/hello.c
@@ -1,5 +1,5 @@
  /* Chacun ajoute son nom ici */
-/* Auteurs : ... et ... */
+/* Auteurs : Alice et ... */

#include <stdio.h>
```

Starting the project with Git: in Practice

```
Alice$ git clone ssh://ldb42@telesun.imag.fr/~git ipsim
Alice$ cd ipsim/sandbox
Alice$ vi hello.c
Alice$ git status
Alice$ git diff HEAD
Alice$ git commit -a
[master d943af5] Added my name.
 1 files changed, 1 insertions(+), 1 deletions(-)
```


Starting the project with Git: in Practice

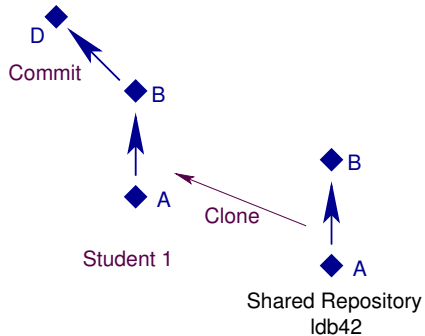
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Alice$ cd ipsim/sandbox
Alice$ vi hello.c
Alice$ git status
Alice$ git diff HEAD
Alice$ git commit -a
Alice$ git log
commit d943af53ec13b43eac31d4cca3b11f51746a90cc
Author: Alice <Alice@ensimag.imag.fr>
```

Added my name.

```
commit 96e1dead6dc0f8e23308726d22bbf42d0e99352f
Author: Equipe ldb42 <ldb42@telesun.imag.fr>
```

Personalisation du dépôt pour ldb42

Starting the project with Git



Starting the project with Git: in Practice

```
Bob$ git clone ssh://ldb42@telesun.imag.fr/~git ipsim
Initialized empty Git repository in /perms/Bob/ipsim/.git/
remote: Counting objects: 960, done.
remote: Compressing objects: 100% (555/555), done.
remote: Total 960 (delta 341), reused 949 (delta 330)
Receiving objects: 100% (960/960), 1.51 MiB, done.
Resolving deltas: 100% (341/341), done.
```

Starting the project with Git: in Practice

```
Bob$ git clone ssh://ldb42@telesun.imag.fr/~git ipsim  
Bob$ cd ipsim/sandbox  
Bob$ vi hello.c
```

Starting the project with Git: in Practice

```
Bob$ git clone ssh://ldb42@telesun.imag.fr/~git ipsim
Bob$ cd ipsim/sandbox
Bob$ vi hello.c
Bob$ git commit -a
[master ae00028] Removed a piece of code.
 1 files changed, 0 insertions(+), 10 deletions(-)
```

Starting the project with Git: in Practice

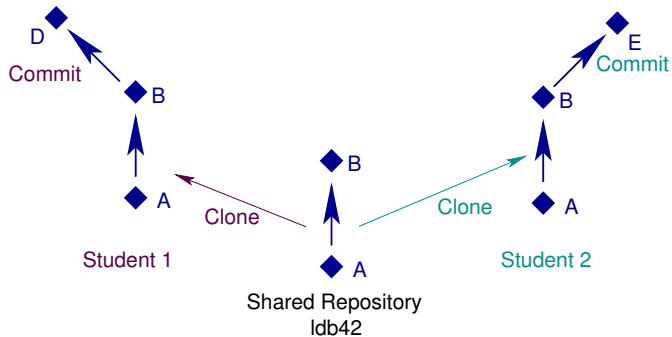
```
Bob$ git clone ssh://ldb42@telesun.imag.fr/~/.git ipsim
Bob$ cd ipsim/sandbox
Bob$ vi hello.c
Bob$ git commit -a
Bob$ git log
commit ae000285167885b286401ea3eb3379a7a3946260
Author: Bob <Bob@telesun.imag.fr>
Date: Thu Nov 19 16:52:53 2009 +0100
```

Removed a piece of code.

```
commit 96eldead6dc0f8e23308726d22bbf42d0e99352f
Author: Equipe ldb42 <ldb42@telesun.imag.fr>
Date: Thu Nov 19 16:30:54 2009 +0100
```

Personalisation du dépôt pour ldb42

Starting the project with Git



Starting the project with Git: in Practice

```
Bob$ git push
Counting objects: 9, done.
Delta compression using up to 16 threads.
Compressing objects: 100% (4/4), done.
Writing objects: 100% (5/5), 432 bytes, done.
Total 5 (delta 2), reused 0 (delta 0)
To ssh://ldb42@telesun.imag.fr/~git
    96eldea..ae00028  master -> master
```


Starting the project with Git: in Practice

```
Bob$ git push
```

```
# back to Alice
```

```
Alice$ git push
```

```
To ssh://ldb42@telesun.imag.fr/~git
```

```
! [rejected]        master -> master (non-fast forward)
```

```
error: failed to push some refs to 'ssh://ldb42@telesun.imag.fr/~git'
```

```
To prevent you from losing history, non-fast-forward updates were rejected
```

```
Merge the remote changes before pushing again.  See the 'non-fast forward'  
section of 'git push --help' for details.
```

Starting the project with Git: in Practice

```
Bob$ git push

# back to Alice
Alice$ git push
Alice$ git pull
Unpacking objects: 100% (5/5), done.
From ssh://telesun.imag.fr/~git
   96eldea..ae00028  master    -> origin/master
Auto-merging sandbox/hello.c
Merge made by recursive.
  sandbox/hello.c |   10 -----
  1 files changed, 0 insertions(+), 10 deletions(-)
```

Starting the project with Git: in Practice

```
Bob$ git push

# back to Alice
Alice$ git push
Alice$ git pull
Alice$ vi hello.c
Alice$ git commit -a
[master ee9f864] Test
 1 files changed, 1 insertions(+), 0 deletions(-)
```

Starting the project with Git: in Practice

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Bob$ git push

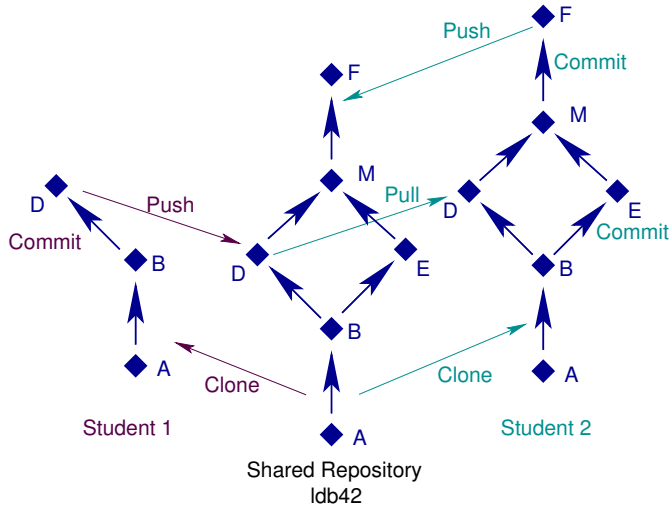
# back to Alice
Alice$ git push
Alice$ git pull
Alice$ vi hello.c
Alice$ git commit -a
Alice$ git log --graph --oneline
* ee9f864 Test
* 830a084 Merge branch 'master' of ...
|\
| * ae00028 Removed a piece of code.
* | d943af5 Added my name.
|/
* 96eldea Personalisation du dépôt pour ldb42
```

Starting the project with Git: in Practice

```
Bob$ git push

# back to Alice
Alice$ git push
Alice$ git pull
Alice$ vi hello.c
Alice$ git commit -a
Alice$ git log --graph --oneline
Alice$ git push
Counting objects: 23, done.
Delta compression using up to 16 threads.
Compressing objects: 100% (12/12), done.
Writing objects: 100% (15/15), 1.20 KiB, done.
Total 15 (delta 6), reused 0 (delta 0)
To ssh://ldb42@telesun.imag.fr/~git
   ae00028..ee9f864  master -> master
```

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Advices Using Git (for beginners)

- **Never** exchange files outside Git's control (email, scp, usb key), except if you *really* know what you're doing;

Advices Using Git (for beginners)

- **Never** exchange files outside Git's control (email, scp, usb key), except if you *really* know what you're doing;
- Always use `git commit -a`;
- Make a `git push` after each `git commit -a` (use `git pull` if needed);
- Do `git pull` regularly, to remain synchronized with your teammates. You need to make a `git commit -a` before you can make a `git pull` (this is to avoid mixing manual changes with merges).