IN323 Software Engineering
Software Configuration Management with Subversion

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DMIA – ISAE

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First problem: manage change

Problem

How to « remember » changes made to an application?

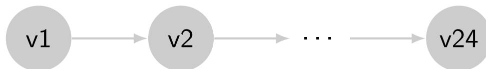
Why?

- « go back » to remove bad changes
- be able to propose a stable version of the application when continuing its development
- be able to propose an older version of the application by starting back from an older version
- ...

First problem: discussion...

Idea

Have an history of the application using **versions**.



But...

- which types of file can you manage?
  ➥ **source codes**, configuration and build files
- how to manage history?
  - create directories with version numbers et copy **all** necessary files at each time
    ➥ not usable!
  - add version numbers on file names
    ➥ how to guarantee numbers coherence?
    ➥ not possible for instance in Java for source files!

Second problem: share code

Problem

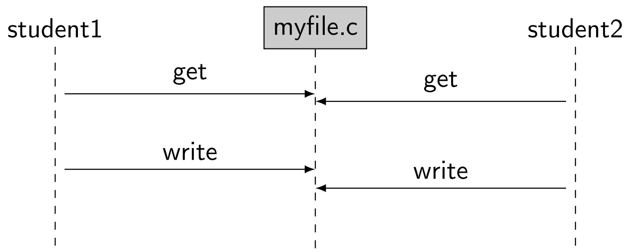
How to allow several developers/designers to share code/documents to work **at the same time**?

Why?

- to allow a team to work easily on the same project, particularly on the source code
- to manage **conflicts** when two persons work on the same document

Second problem: students solutions...

1. sharing documents by **email**
   - ➥ completely unmanageable
2. **open rights** on one student's account
   - ➥ unsecured...
   - ➥ cannot manage conflicts



Second problem: students solutions. . .

3. use Dropbox or equivalent system
   - not really a solution
   - limited history
   - no diffs, no commit messages
   - limited conflict management

Outline

1. **Revision control**
2. Subversion
3. Process

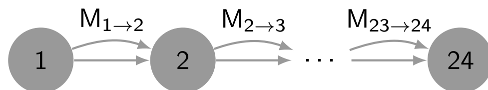
Revision control

To solve the previous problems, we will use a **revision control** system.

A revision control software (RCS) allows to easily manage:

- changes made on the project files
- multiple users working on the project
- branches to develop experimental features or correct bugs without changing the application main version

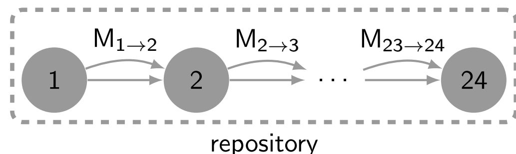
Revision control: concepts



Documents evolutions are represented by **revisions**.
Revisions are often denoted by natural numbers: revision 1, revision 2 etc.

To go from a revision to another, **changesets** are applied to the project files.
A changeset can change **several files**: it represents the transition from a "coherent" state of the project to another "coherent" state.
Revision control softwares **only keep changesets**.

Revision control: concepts

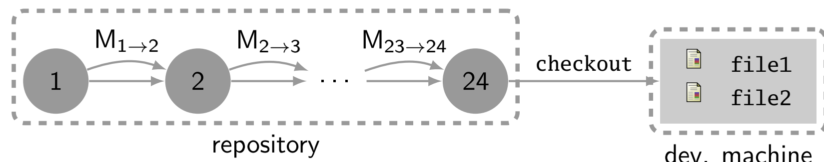


Files managed by the RCS are kept in a **repository**.

The repository, like a DBMS, respects the **ACID** properties to ensure the atomicity and coherence of changes:

- **atomicity** of **changesets**
- **consistency**
- **isolation** from other changes
- **durability**

Revision control: concepts

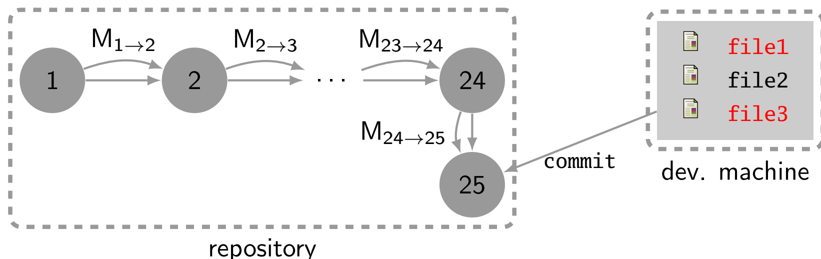


Files managed by the RCS are kept in a **repository**.

To work on the project, you have to make a **local copy** of the repository. You will obtain by default the last revision of the repository, buy you can choose.

This operation is called a **checkout**.

Revision control: concepts



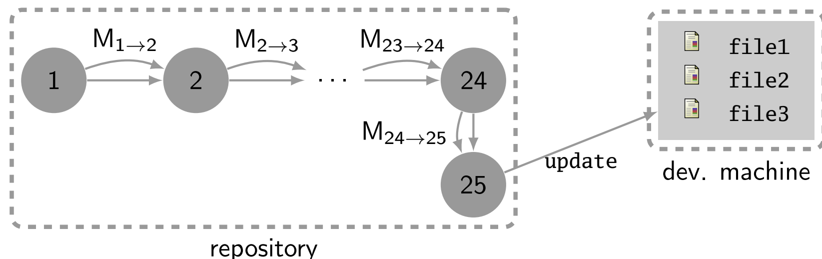
When you have made the desired changes on the files, you can submit your changes to the repository.

This operation is called a **commit**.

N.B.

Conflicts may arise during this operation!

Revision control: concepts



When you want your local copy to be up-to-date with the repository, you make an **update** operation.

N.B.

Conflicts may arise during this operation!

Outline

1 Revision control

2 **Subversion**
- Basic usage
- Conflicts management
- Viewing logs and changes
- Branches

3 Process

Subversion

The RCS we will use at ISAE is Subversion, a free software available on multiple platforms.

The Apache Software Foundation (2013).
Apache Subversion.
http://subversion.apache.org/.

Collins-Sussman, B., B. W. Fitzpatrick, and C. Michael Pilato (2004).
Version control with Subversion.
O'Reilly.
http://svnbook.red-bean.com/.

Mason, Mike (2006).
Pragmatic Version Control Using Subversion.
2nd edition.
Pragmatic Programmers.

Outline

1 Revision control

2 **Subversion**
- Basic usage
- Conflicts management
- Viewing logs and changes
- Branches

3 Process

Usual commands

~alice/ – rev. 1

file1.txt
Coucou

REPOSITORY – rev. 1

file1.txt
Coucou

~bob/ – rev. 1

file1.txt
Coucou

Alice copies the repository (idem for Bob):

shell (alice)

```
[alice@computer]~ $ svn checkout URL_REPOSITORY
A    scm/alice/file1.txt
Checked out revision 1.
```

Usual commands

~alice/ – rev. 1	REPOSITORY – rev. 1	~bob/ – rev. 1
file1.txt Coucou	**file1.txt** Coucou	**file1.txt** Coucou
file2.txt Hello		

Alice creates a new file.

Usual commands

~alice/ – rev. 1

file1.txt

Coucou

file2.txt

Hello

REPOSITORY – rev. 1

file1.txt

Coucou

~bob/ – rev. 1

file1.txt

Coucou

She can verify that her local copy is not identical to the repository.

shell (alice)

```
[alice@computer]~ $ svn status
?       file2.txt
```

Usual commands

~alice/ – rev. 2

file1.txt

Coucou

file2.txt

Hello

REPOSITORY – rev. 2

file1.txt

Coucou

file2.txt

Hello

~bob/ – rev. 1

file1.txt

Coucou

She can then **add** the file and **submit** it to the repository.

shell (alice)

```
[alice@computer]~ $ svn add file2.txt
A         file2.txt
Adding         file2.txt
[alice@computer]~ $ svn commit -m "adding file2.txt"
Transmitting file data .
Committed revision 2.
```

Usual commands

~alice/ – rev. 2

file1.txt

Coucou

file2.txt

Hello

REPOSITORY – rev. 2

file1.txt

Coucou

file2.txt

Hello

~bob/ – rev. 2

file1.txt

Coucou

file2.txt

Hello

Bob can update his local copy.

shell (bob)

```
[bob@computer]~ $ svn update
Updating '.':
A    file2.txt
Updated to revision 2.
```

Usual commands

~alice/ – rev. 2	REPOSITORY – rev. 3	~bob/ – rev. 3
file1.txt Coucou	**file1.txt** Coucou	**file1.txt** Coucou
file2.txt Hello	**file2.txt** Hello	**file2.txt** Hello
	file3.txt c'est moi	**file3.txt** c'est moi

Bob adds a file and submit it.

Usual commands

~alice/ – rev. 4

file1.txt

Coucou

file2.txt

Bonjour

REPOSITORY – rev. 4

file1.txt

Coucou

file2.txt

Bonjour

file3.txt

c'est moi

~bob/ – rev. 3

file1.txt

Coucou

file2.txt

Hello

file3.txt

c'est moi

Alice modifies `file2.txt` and submit it.

shell (alice)

```
[alice@computer]~ $ svn commit -m "changing Hello in file2.txt"
Sending        file2.txt
Transmitting file data .
Committed revision 4.
```

Outline

1. Revision control
2. **Subversion**
   - Basic usage
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Conflicts

~alice/ – rev. 1

file1.txt
Coucou

REPOSITORY – rev. 1

file1.txt
Coucou

~bob/ – rev. 1

file1.txt
Coucou

Conflicts

~alice/ – rev. 2	REPOSITORY – rev. 2	~bob/ – rev. 1
file1.txt	**file1.txt**	**file1.txt**
Bonjour	Bonjour	Coucou

Alice modifies `file1.txt` and commits her version.

Conflicts

~alice/ - rev. 2

file1.txt

Bonjour

REPOSITORY - rev. 2

file1.txt

Bonjour

~bob/ - rev. 1

file1.txt

Hello

Bob modifies `file1.txt` and wants to commit his version.

shell (bob)

```
[bob@computer]~ $ svn commit -m "changing Coucou to Hello in file1.txt"
Sending        file1.txt
svn: E155011: Commit failed (details follow):
svn: E155011: File '/home/tof/Cours/IN323/bob/file1.txt' is out of date
svn: E160028: File '/file1.txt' is out of date
```

Conflicts

~alice/ – rev. 2

file1.txt

Bonjour

REPOSITORY – rev. 2

file1.txt

Bonjour

~bob/ – rev. 1

file1.txt

Hello

Bob can update his local copy.

shell (bob)

```
[bob@computer]~ $ svn update
Updating '.':
C    file1.txt
Updated to revision 2.
Summary of conflicts:
  Text conflicts: 1
```

Conflicts

~alice/ - rev. 2

file1.txt

Bonjour

REPOSITORY - rev. 2

file1.txt

Bonjour

~bob/ - rev. 1

file1.txt

Hello

Bob chooses to edit (e) this file. He obtains a **temporary** file containing both his version and the repository version.

file1.txt.tmp

```
<<<<<<< .mine
Hello
=======
Bonjour
>>>>>>> .r2
```

Conflicts

~alice/ - rev. 2	REPOSITORY - rev. 2	~bob/ - rev. 2
file1.txt	**file1.txt**	**file1.txt**
Bonjour	Bonjour	Hello

Bob modifies the temporary file to keep his version. He choose to mark the conflict as **resolved**.

shell (bob)

```
[bob@computer]~ $ svn resolved file1.txt
Resolved conflicted state of 'file1.txt'
```

Conflicts

~alice/ - rev. 2	REPOSITORY - rev. 3	~bob/ - rev. 3
file1.txt	**file1.txt**	**file1.txt**
Bonjour	Hello	Hello

Bob can then commit its changes to the repository.

shell (bob)

```
[bob@computer]~ $ svn commit -m "changing Coucou to Hello in file1.txt"
Sending        file1.txt
Transmitting file data .
Committed revision 3.
```

Conflicts

~alice/ – rev. 2

file1.txt

Guten Tag

REPOSITORY – rev. 3

file1.txt

Hello

~bob/ – rev. 3

file1.txt

Hello

Alice modifies her local copy of `file1.txt`. She updates her copy, discovers the conflict and chooses to **postpone** (`p`) the conflict management.

shell Alice

```
[alice@computer]~ $ svn update
Updating '.':
C    file1.txt
Updated to revision 3.
Summary of conflicts:
  Text conflicts: 1
```

Conflicts

~alice/ - rev. 2

```
file1.txt
<<<<<<< .mine
Guten Tag

=======
Hello
>>>>>>> .r3
```

REPOSITORY - rev. 3

```
file1.txt
Hello
```

~bob/ - rev. 3

```
file1.txt
Hello
```

Subversion has created several files corresponding to different versions of `file1.txt`: one for revision 2, one for revision 3 and the local copy (`file1.txt.mine`).
`file1.txt` has the same syntax as presented previously.

shell Alice

```
[alice@computer]~ $ ls
file1.txt
file1.txt.mine
file1.txt.r2
file1.txt.r3
```

Conflicts

~alice/ – rev. 2

```
file1.txt
---------
Guten Tag
```

REPOSITORY – rev. 3

```
file1.txt
---------
Hello
```

~bob/ – rev. 3

```
file1.txt
---------
Hello
```

Alice can choose the file she wants or modify `file1.txt`. She can specify to Subversion that she wants to keep her local copy to solve the conflict. She has to commit her changes after (not done here!).

shell Alice

```
[alice@computer]~ $ svn resolve --accept mine-full file1.txt
Resolved conflicted state of 'file1.txt'
```

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Logs

Obtaining the commit messages for a specific file:

shell (bob)

```
[bob@computer]~ $ svn log file1.txt
------------------------------------------------------------------------
r3 | bob | 2014-07-09 11:09:05 +0200 (Wed, 09 Jul 2014) | 1 line

changing Coucou to Hello in file1.txt
------------------------------------------------------------------------
r2 | alice | 2014-07-09 11:09:01 +0200 (Wed, 09 Jul 2014) | 1 line

changing Coucou to Bonjour in file1.txt
------------------------------------------------------------------------
r1 | tof | 2014-07-09 11:08:58 +0200 (Wed, 09 Jul 2014) | 1 line

initial import of file1.txt
------------------------------------------------------------------------
```

Diffs

Obtaining the set of changes between two revisions for a file:

shell (bob)

```
[bob@computer]~ $ svn diff -r2:3 file1.txt
Index: file1.txt
===================================================================
--- file1.txt   (revision 2)
+++ file1.txt   (revision 3)
@@ -1 +1 @@
-Bonjour
+Hello
```

N.B.

The result of **diff** is called a **patch**: those are the changes to apply on `file1.txt` to go from revision 2 to revision 3.

Outline

1. Revision control
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What are branches useful for?

Definition (branch)

A **branch** is a development line that exists independently of other lines.

Branches in Subversion allow to:

- create multiple versions of the same product
- create a branch for debugging
- create a branch for experimental features
- mix and match different lines of development
- maintain a release branch for production code
- ...

What are tags useful for?

Definition (tag)

A **tag** is a symbolic name for a set files.

Tags in Subversion allow to:

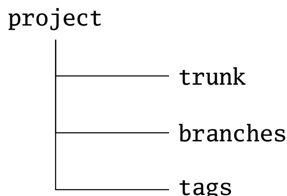
- have a symbolic name for a set of files, each with a particular revision number
- put milestones in your project
- eventually mix revision numbers

Branches and tags: example

- release version 1.0 of your project:
  - create a tag `REL-1.0`
  - create a branch `RB-1.0` to eventually work on this release
- fix the bug number 3035:
  - create a branch `BUG-3035`
  - create a tag `PRE-3035`
  - after correcting the bug, create a tag `POST-3035`
- experiment with a new GUI:
  - create a branch `TRY-new-GUI`
- ...

Organizing your project

A classical repository organization for Subversion projects:



- `trunk`: contains the main development line
- `branches`: contains branches ☺
- `tags`: contains tags ☺

Creating the necessary directories

Bob wants to create a release branch for his project. He needs first to create the `branches` directory:

shell (bob)

```
[bob@computer]~ $ svn mkdir URL/branches -m "creating branches dir."

Committed revision 4.
```

N.B.

Use **`svn mkdir`** with URL to create directories to be managed by subversion, it is easier and faster.

Creating a branch

Creating branches or tags in Subversion is just copying directories!

Bob wants to create a branch using the trunk main development line:

shell (bob)

```
[bob@computer]~ $ svn copy -m "creating branch for DEV 1.0" URL/trunk
    URL/branches/DEV-1.0

Committed revision 5.
```

Now he can checkout the branch as usual:

shell (bob)

```
[bob@computer]~ $ svn checkout URL/branches/DEV-1.0 dev-1.0
A    dev-1.0/file1.txt
Checked out revision 5.
```

Switching to a branch

Bob can also switch to a branch from another one (here from `trunk` for instance):

shell (bob)

```
[bob@computer]~ $ svn switch URL/branches/DEV-1.0
At revision 5.
```

All changes made here are taken into account in the `DEV-1.0` branch.

Merging branches

Suppose now that Bob changed `file1.txt` in the `DEV-1.0` branch and wants to merge its changes into the main development line (execute this in a working copy of the `trunk`):

shell (bob)

```
[bob@computer]~ $ svn merge URL/branches/DEV-1.0
--- Merging r5 through r6 into '.':
U    file1.txt
[bob@computer]~ $ svn commit -m "merging branch DEV-1.0 into trunk"
--- Recording mergeinfo for merge of r5 through r6 into '.':
 U   .
Sending        .
Sending        file1.txt
Transmitting file data .
Committed revision 7.
```

N.B.

Beware of conflicts, update your working copy before merging!

Outline

1. Revision control
2. Subversion
3. **Process**

How to use Subversion?

checkout

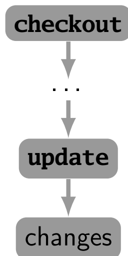
...

update

Verifications

- code compiles
- tests passed

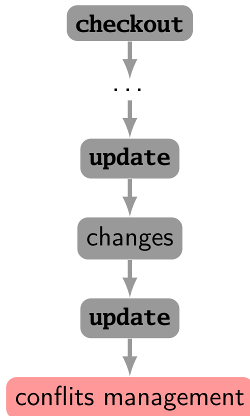
How to use Subversion?



Verifications

- code compiles
- tests passed

How to use Subversion?



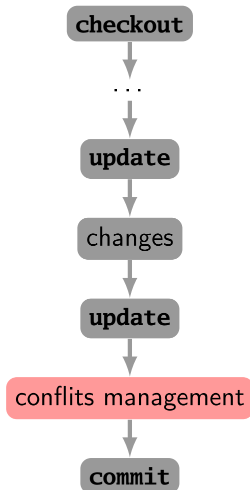
Verifications

- ➥ code compiles
- ➥ tests passed

Conflicts management

Working with other dev. needed!

How to use Subversion?



Message

Use **explicit commit** message!
Describe **what** is concerned with the commit, not **how** you achieve the modifications (that is the function of the diff/patch).

When committing

- each commit must be **coherent**: your application should compile and work normally
- commit **each time** you add/correct a single functionality. Do not commit big changesets
- to be able to do regression tests, you must have small changesets