



*L3 Mention Informatique Parcours Informatique et MIAGE* 

# Génie Logiciel Avancé

Part IV : Version and Configuration Management

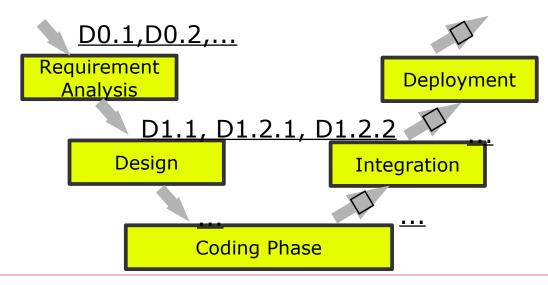
> Burkhart Wolff wolff@lri.fr

## Plan of the Chapter

- Motivation: Version and Configuration Management as "the" means for collaborative development
- Version management
  - Centralized Version Control
  - Distributed Version Control
  - Organizing Merges
- Beyond Versions: Configurations
  - Build Management
  - Advanced Configuration Management

#### Motivation

- Recall: SE Processes are based
  - on a large flow of documents and code
  - ... that have to be edited collaboratively
  - ... distributed consistently
  - ... while controlling access



#### Motivation

- Important TECHNICAL means to support the process
  - Explicit tools for Version Management (CVS, svn, git, mercurial, sourcedepot, ...)
  - Create and track revisions of files and file-trees
  - Create and track differences between files and filetrees
  - Acces control to the various parties of process
  - Locking of documents
  - Merging of revisions
  - Quality control
  - ... actually, it is dead-useful for everything !!!

## Concepts of Centralized Version Control

- Working copises (in user space)
- Repository (on the server-side)
- update: syncing with the repository

## Server Repository

Centralized version control

- commit ipdate Indate Working Working Working CODV CODV copy Workstation/PC #1 Workstation/PC #2 Workstation/PC #3
- commit: creating a new revision of a document (involves new registration, inclusion in documents, consistency checks)
- operations lock, checkout, import, ...

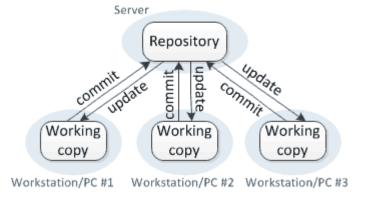
## Concepts of Centralized Version Control

- First widely used system: CVS
- Nowadays in use : svn

SUBVERSION°

https://subversion.apache.org/





... for everything ...

 my working copy for this course material

 Version management is not just for code

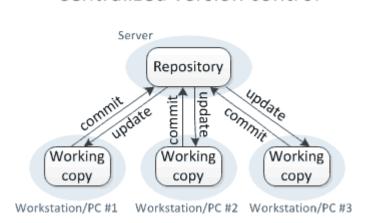
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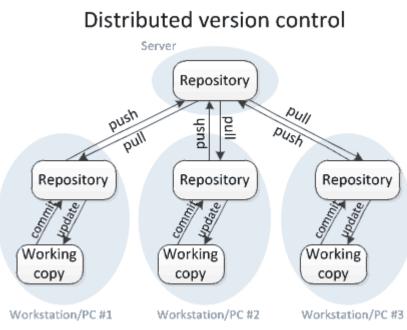
## One step further: Distributed Version Control

Hierarchy of repositories:



Centralized version control

- one more sync-level, but more precise history in practice...
  wor
  since everybody can check in locally
- hierarchy strictly speaking not necessary



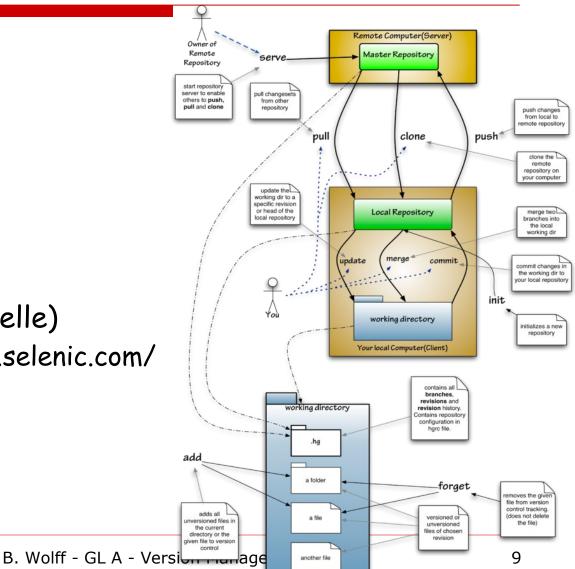
### **Distributed Version Control Systems**

- Opensource:
  - > git (Linux)



mercurial (Isabelle) http://mercurial.selenic.com/





2014-2015

#### Consequences for a development process

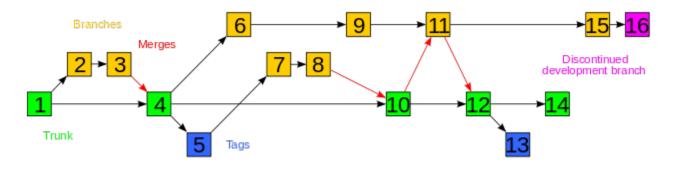
The entire development becomes visible, trackable, reproducible, and can be an object in its own right (if formal): apply changeset XYZ ...

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### Problems of a distributed development

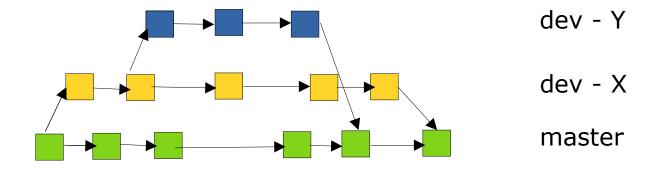
 If not synced via explicit locks, a development looks like this:



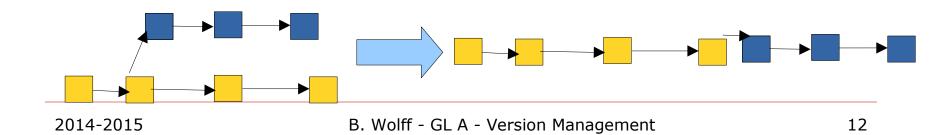
- Merging: For binary formats, only special purpose merges work (as in MS Word, for example ...)
- For textual formats :

#### Problems of a distributed development

Pragmatics: Merging Strategy



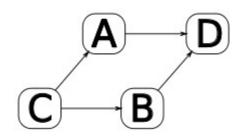
Rebase Strategy:



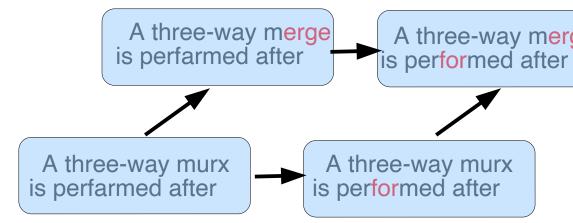
## A partial solution ...

#### For textual formats:

A three-way merge is performed after an automated difference analysis between a file 'A' and a file 'B' while also considering the origin, or common ancestor, of both files. It is a rough merging method, but widely applicable since it only requires one common ancestor to reconstruct the changes that are to be merged.





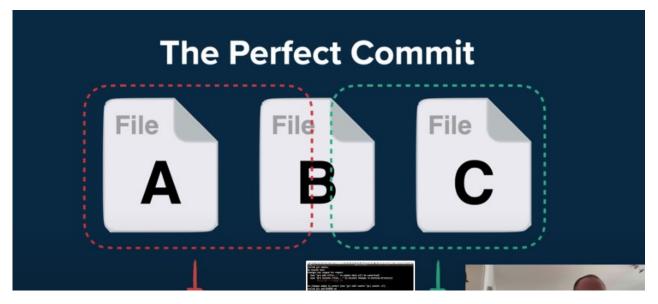


Tools: For example xmerge, which also offer conflict resolution by hand ...

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More : partial adds , partial commits



Youtube on git:

https://www.youtube.com/watch?v=Uszj\_k0DGsg

## A better solution ...

In a distributed development process, where a very large number of merges occurs routinely, the validation of the intermediate results becomes crucial.

(This limits the use of informal documents.)

- validation on any check-in
   (for example: automated type-checking)
- validation for UML documents
   (self-defined consistency checkers for UML models)
- automated static analysis and tests during systematic and periodic builds ...
- ... more advanced methods, using proof techiques.

## Build Management: A Build-Server

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## Build Management: A Build-Server

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## **Towards Configuration Management**

- ... generalizes Version-Management
  - by configuration descriptions (including functionality environment, hardware,...)
  - attempts to GENERATE
     a revision on the basis
    - of meta-data over dependencies and change-sets
  - works with heavy
     virtualization techniques
     nowadays (Google, Microsoft)

