Berner Fachhochschule - Technik und Informatik

Object-Oriented Programming 2

Topic 0: Version Control Systems

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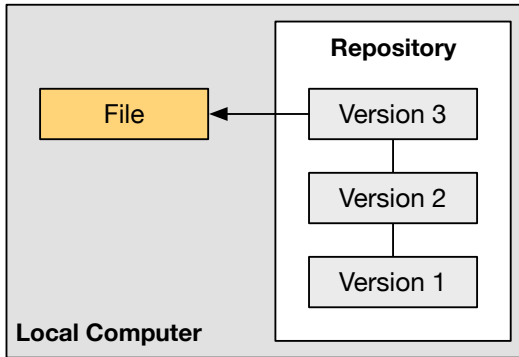Haute école spécialisée bernoise
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Version Control Systems

- ► Version control systems (VCS) are widely used in today's software engineering practice
- ► Benefits of using a VCS in software engineering:
    - → Software development in teams
    - → Remote collaboration
    - → Keep control over changes to source code
    - → Management of versions and updates
    - → Automatic backup
- ► Most popular VCS
    - → RCS (since 1982 almost not used anymore)
    - → CVS (since 1986, almost not used anymore)
    - → Subversion (since 2000, still in use today)
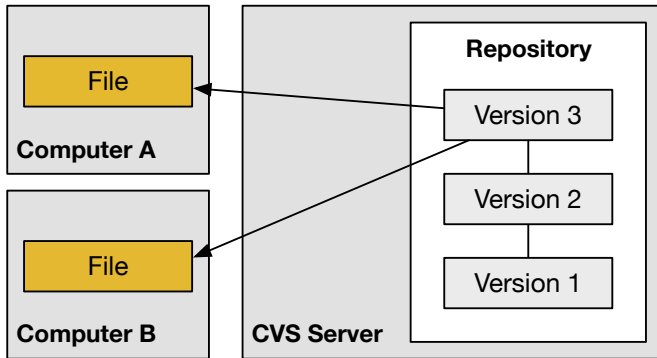   - → Git (since 2005, the most widely used VCS today)

Git and Github

- ▶ Git is a free open-source VCS designed by Linus Torvalds
    - → Current version: 2.12.2 (March 2017)
    - → Web page: https://git-scm.com
    - → Tutorial: "Become a Git Guru"

- ▶ Git is a distributed VCS, which means that the whole version database (called repository) is stored everywhere

- ▶ A distributed VSC combines the advantages of a local (such as RVC) a centralized VCS (such as Subversion)

- ▶ Dedicated Git server software helps to add access control, manage multiple repositories, and display them on the web

- ▶ Two of the most popular Git servers are GitHub and GitLab

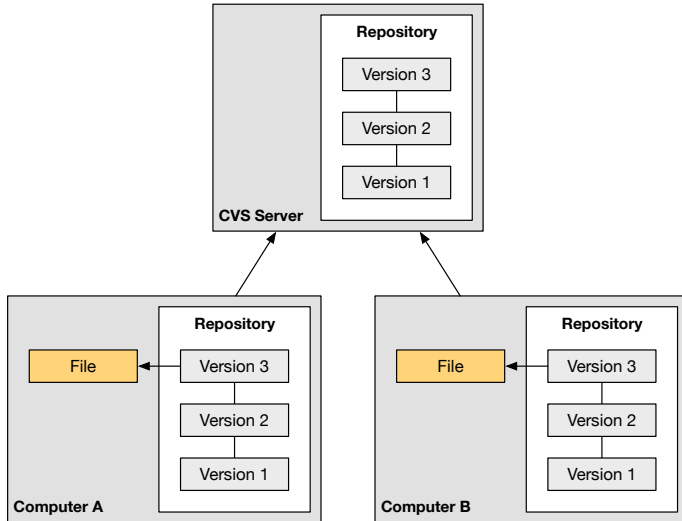Berner Fachhochschule
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Local VCS

Centralised VCS

Distributed VCS

Git Commands

- ▶ `clone`: Makes a repository copy from a remote source
- ▶ `add`: Adds files changed locally to stage (ready to commit)
- ▶ `commit`: Includes staged files into local repository (the changes are described in the commit message)
- ▶ `push`: Sends the all changed files from local repository to remote repository
- ▶ `pull`: Fetches all changed files from remote repository and merges them with the local one (`fetch` followed by `merge`)
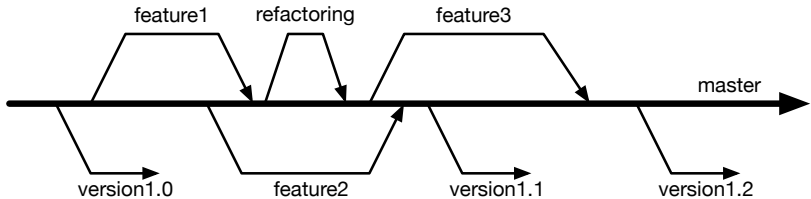- ▶ Calling `pull` followed by `push` is called synchronization, but sync is not an official Git command

Git Workflow

Clone

Push

Clone

Push

Pull

Pull

Add, Commit

Add, Commit
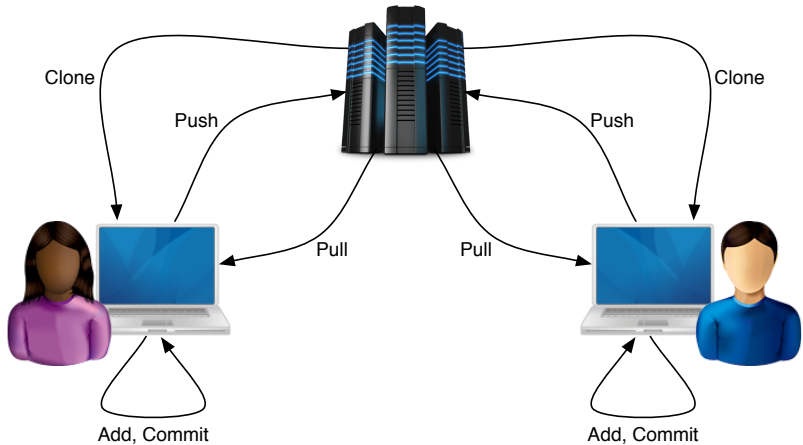
Branching and Merging

- Git repositories can have multiple branches
- Initially, a Git repository contains a single master branch
- Creating branches keeps multiple streams of work independent from each other (e.g., new features)
- If independent work in a branch has stabilized, it can be merged into the master branch
- The release of a new software version (and its updates) can be defined as a separate branch
- Each team decides about the optimal workflow for its projects

Branching and Merging

Conflict Solving

- Collaboration in teams can lead to code conflicts
- Most of the potential conflicts are resolved automatically by Git during the merge operation
- A conflict appears when two developers edit the same line of code simultaneously
- In such a case, both lines of code appear in the merged document
- After solving the conflict (someone has to decide which code will be kept), `commit` and `push` operations are needed to update the merged files in the repository and the server

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Conflict Solving

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Using Git in Practice

▶ Git is a command line tool, but there are various graphical Git tools to simplify its use

▶ For repositories hosted on GitHub, the tool GitHub Desktop is recommended

  → History of commits
  → Selection of current branch
  → List of uncommitted changes
  → Menus and buttons for basic Git commands (clone, commit, pull, push, etc.)

▶ Git is also directly accessible from IDEs such as Eclipse

  → Install the EGit plug-in
  → It is good practice to place any Git repositories outside the Eclipse workspace