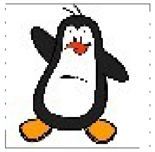

Video Lecture # 06
Overview of VCSs
`git`

Course: SYSTEM PROGRAMMING

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Agenda

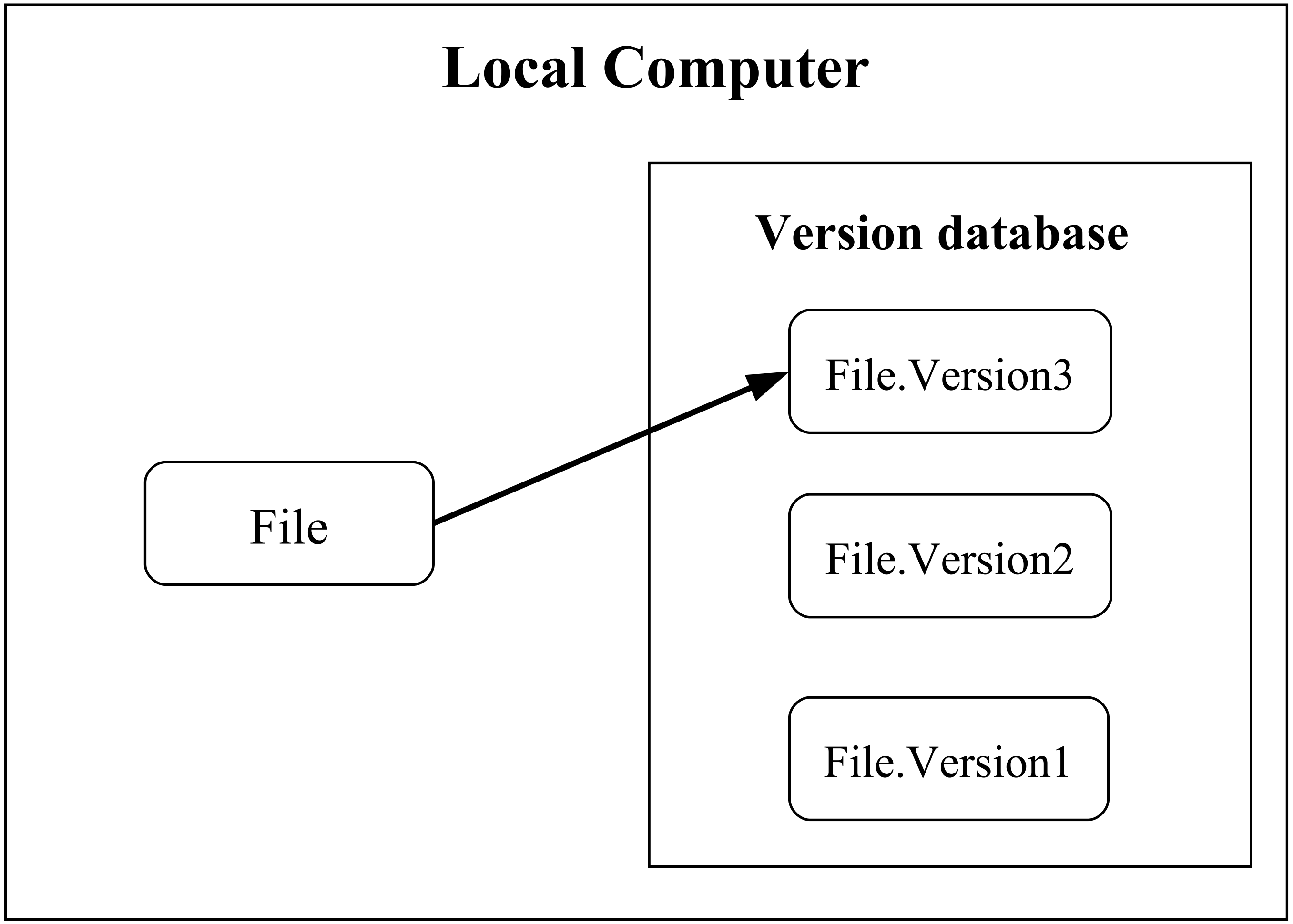
- Intro to Version Control
- Types of Revision Control Systems
  - Local Data Model (sccs, rcs)
  - Centralized Data Model (cvs, svn)
  - Distributed Data Model (bitkeeper, git, mercurial, darcs)
- Downloading, installing and configuring git
- Working with git
  - Initializing a git repository
  - Adding and committing files to git repository
  - Viewing logs and status
  - Deleting, renaming and comparing files
  - Ignoring files
  - Undoing changes and moving to old commits

Overview of Revision/Version Control System

- A Version Control System is a software tool that records changes to a file or a set of files over time, so that you can recall specific versions later
- Before VCSs exists we used different ways for maintaining versions of file(s) e.g. using **save as** for every new change made to file and making a copy and then giving a version number and date of update to that file
- A VCS allows us to
  - Maintain a history of different versions of a file
  - To move back and forth between these versions
  - Compare different versions
  - Merge multiple versions of same file to create a new version
  - Lock other users when one user is altering a file
  - Conflict resolution

Types of VCSs
I - Local Data Model

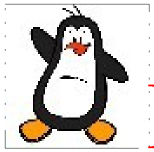
Local Data Model



Local Data Model (cont..)

<u>Source Code Control System</u>: (SCCS-1972)

- Written in C, developed by AT&T and bundled free with UNIX
- It was not the first VCS, rather the first to become popular
- SCCs keeps the original file as it is and instead of saving the complete new version just save the snapshot of the changes
- If you want ver.3 of a file, you take ver.1 of the file and apply two set of changes to it to get to ver.3



Local Data Model (cont..)

Revision Control System: (RCS-1982)

- Written in C, developed at Purdue University
- SCCS was for UNIX only, while RCS was for PCs as well
- RCS keeps the most recent version of a file in its whole form and if you want a previous version, you make changes to the latest version to re-create the older version
- This is faster than SCCS, as most of the time we need to work with the latest version of the file

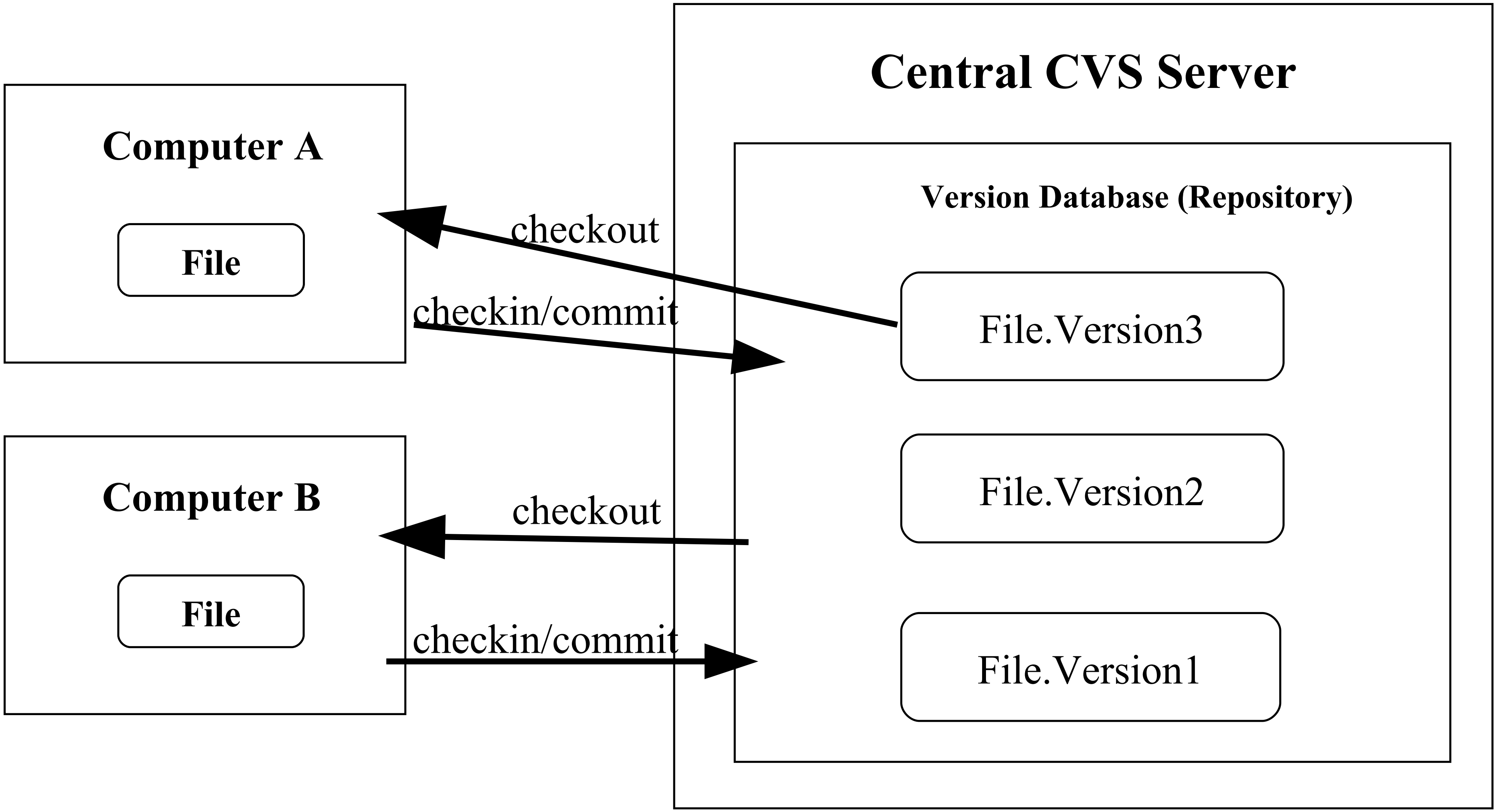
Local Data Model (cont..)

Limitations of Local VCSs:

- You can track changes in a single file and not in a set of files or in a whole project
- Only one user can work with a file at a single time, therefore, multiple users / team members cannot collaborate and work on the same project

Types of VCSs
II - Centralized Data Model

Centralized Data Model (cont..)



Centralized Data Model (cont..)

Concurrent Version System: (CVS-1990)

- Written in C and is open source
- Available for UNIX like OSs (UNIX, Linux, Solaris) as well as for MS Windows
- Introduced the idea of branching. A set of files may be branched at a point in time so that, from that time onward, two copies of those files may be developed in different ways independently of each other
- **Limitations**
  - CVS lacks atomic operations. Uses lock-modify-unlock model, allowing a user to place a lock on the checkout data in the repository, avoiding concurrency problems
  - No file renaming as cannot track directories

Centralized Data Model (cont..)

Apache Subversion System: (SVN-2000)

- Written in C, and is open source
- Cross platform and is faster than CVS
- Supports atomic commits
- Can track directories, so you can rename files within directories
- It can also track non-text files like images

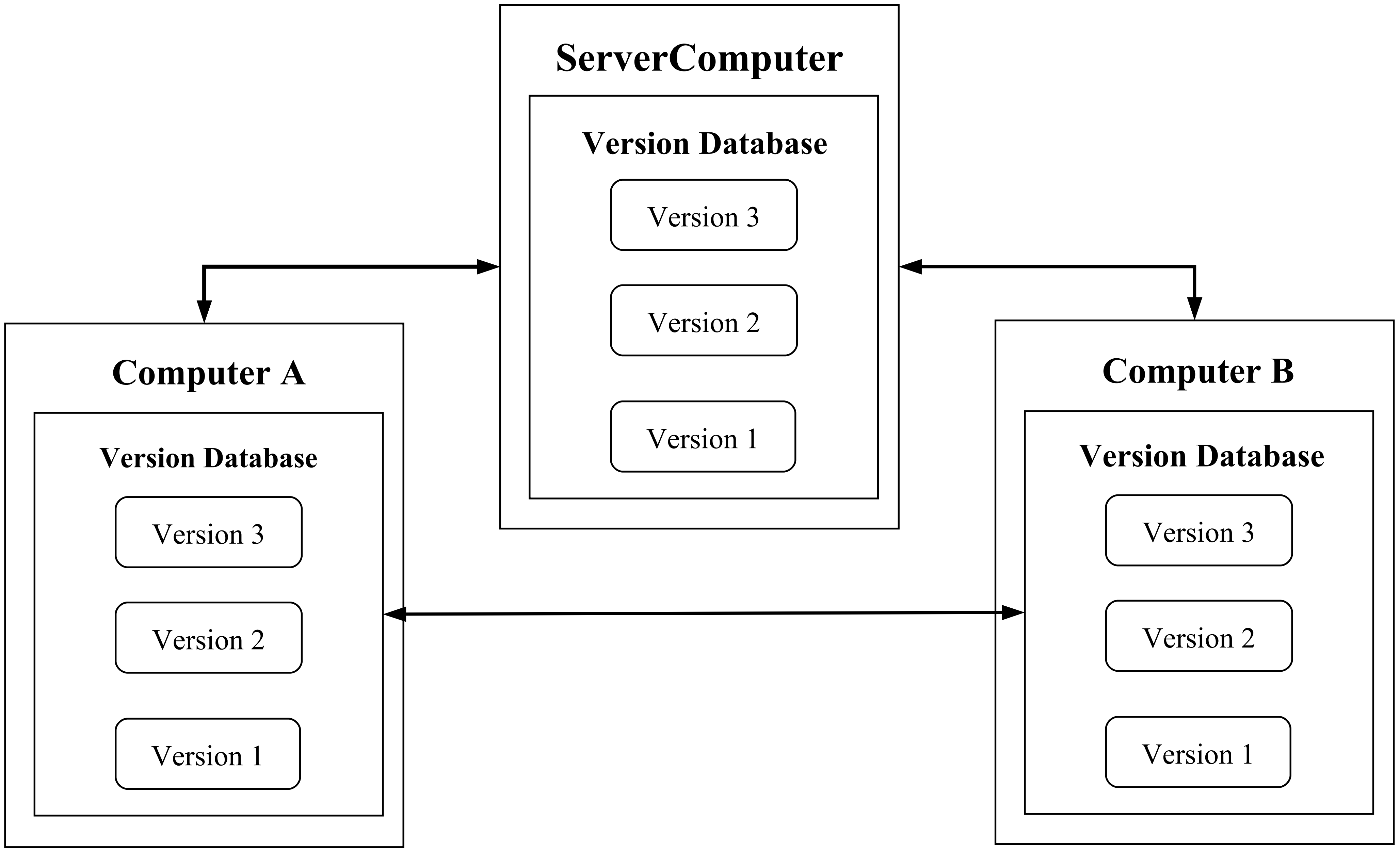
Centralized Data Model (cont..)

Limitations of Centralized VCSs:

- Single point of failure as the centralized server containing the version database may crash
- No collaboration if server is down
- Developers do not have history of project on their local machines

Types of VCSs
III - Distributed Data Model

Distributed Data Model



Distributed Data Model (cont..)

Bitkeeper -2000

- Written in C, and is proprietary and closed source
- A community version of bitkeeper with limited functionalities was free and that was used to manage Linux Kernel source from 2002 to 2005
- In April 2005, the "community version of bitkeeper" stopped being free and it was then **git** was born

Distributed Data Model (cont..)

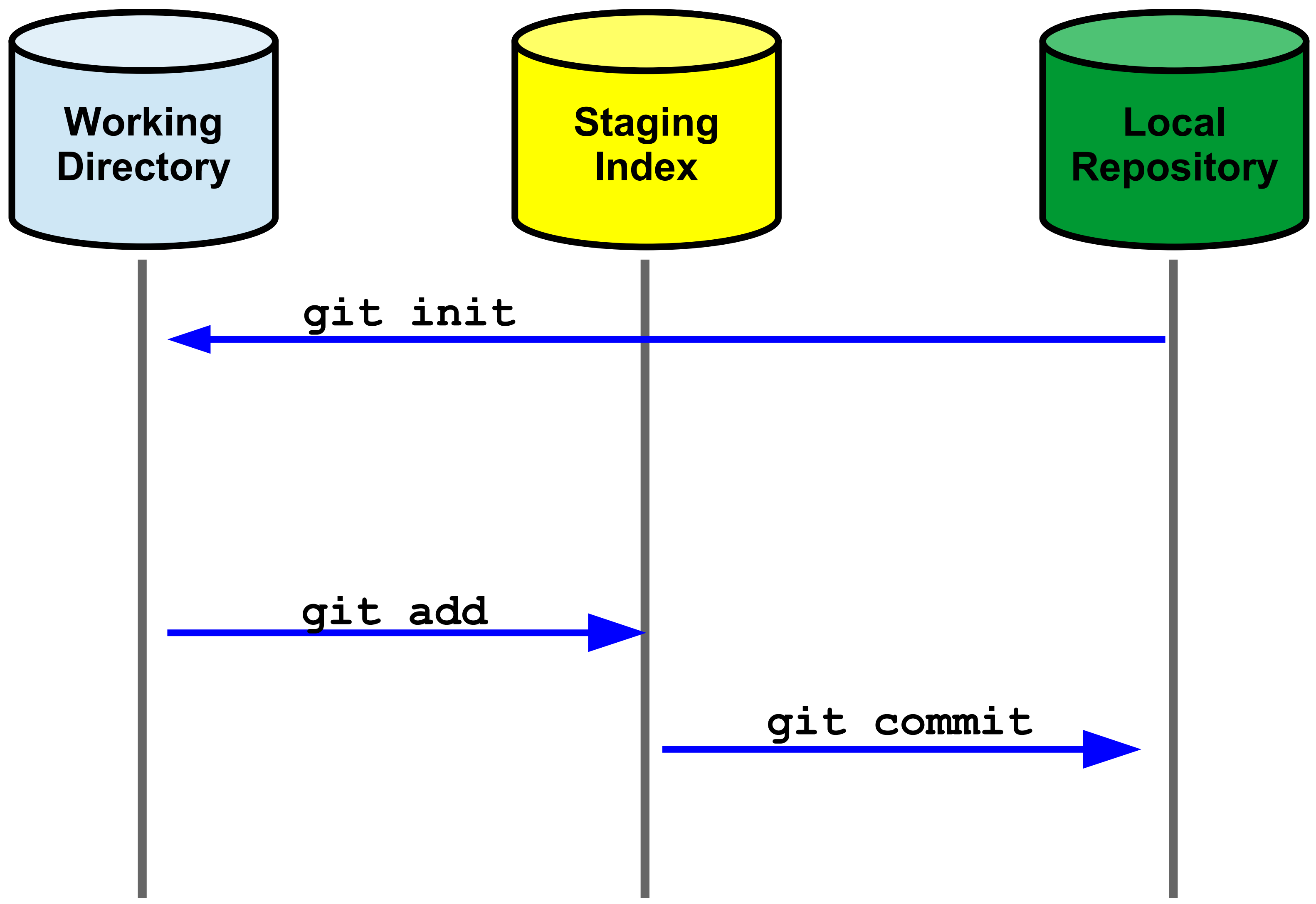
git - 2005

- Developed by Linux Torvald in 2005,
- Git is free and open source distributed version control system designed to handle everything from small to very large projects with speed and efficiency
- It is compatible with all UNIX-like systems (Linux, MacOS, Solaris, PCBSD, …) and MS Windows
- It is written mainly in C along with:
  - TCL: A general purpose interpreted dynamic programming language, which is embedded into C programs for rapid prototyping
  - Perl: A general purpose interpreted dynamic programming language and is popular for its string parsing abilities
  - Python: A general purpose interpreted dynamic programming language and supports multiple programming paradigms like procedural, object oriented, imperative and functional

`git`

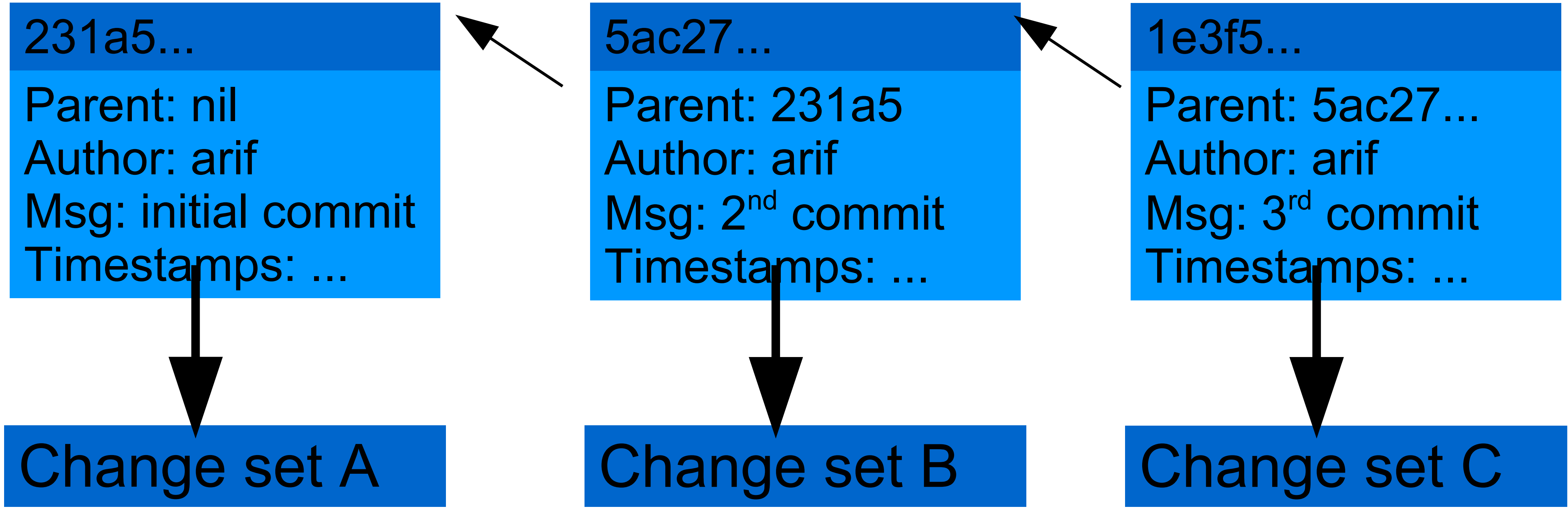
Installation & Configuration
A helloworld with git

Basic Workflow of `git`

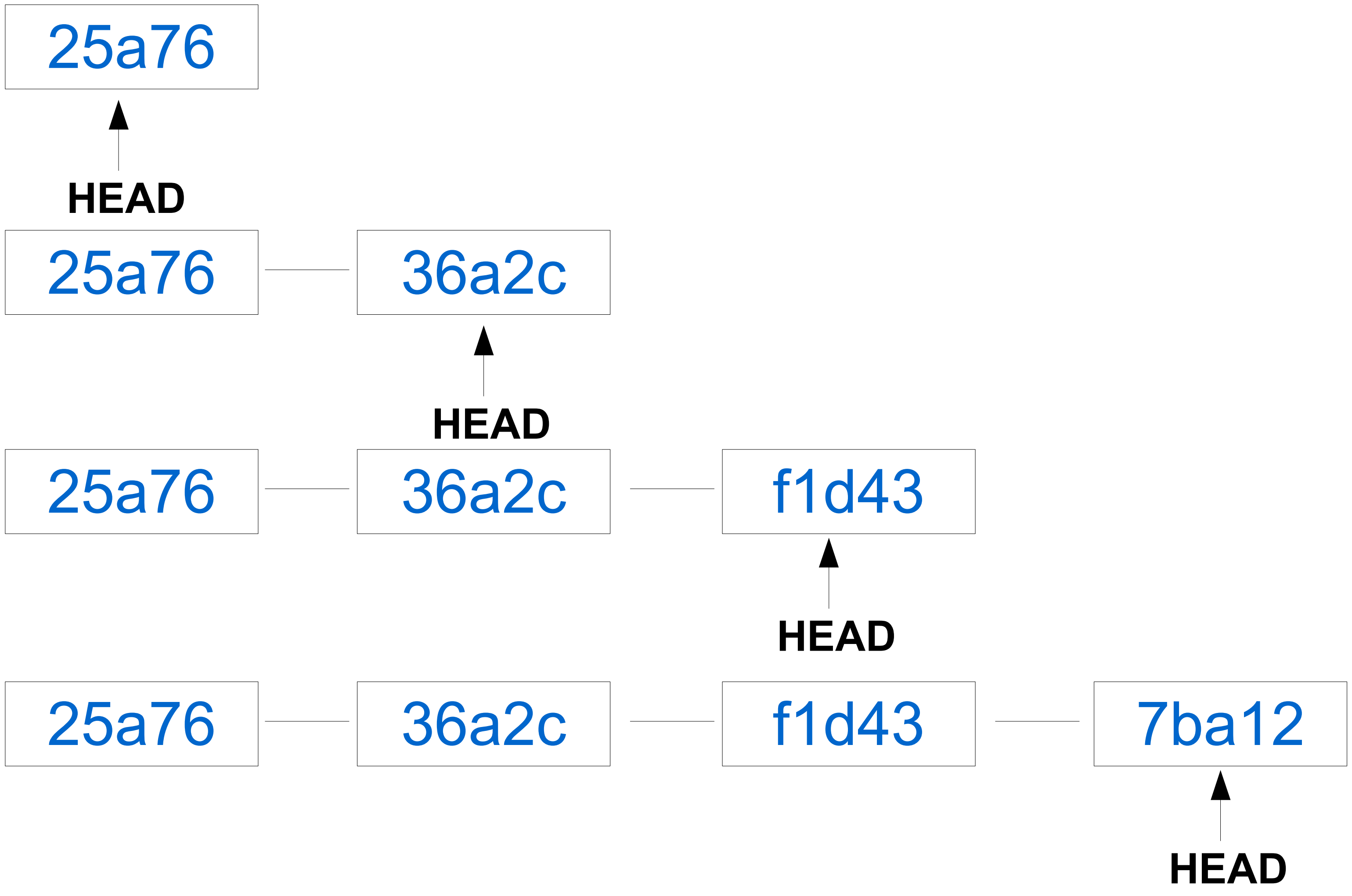


The commit Objects

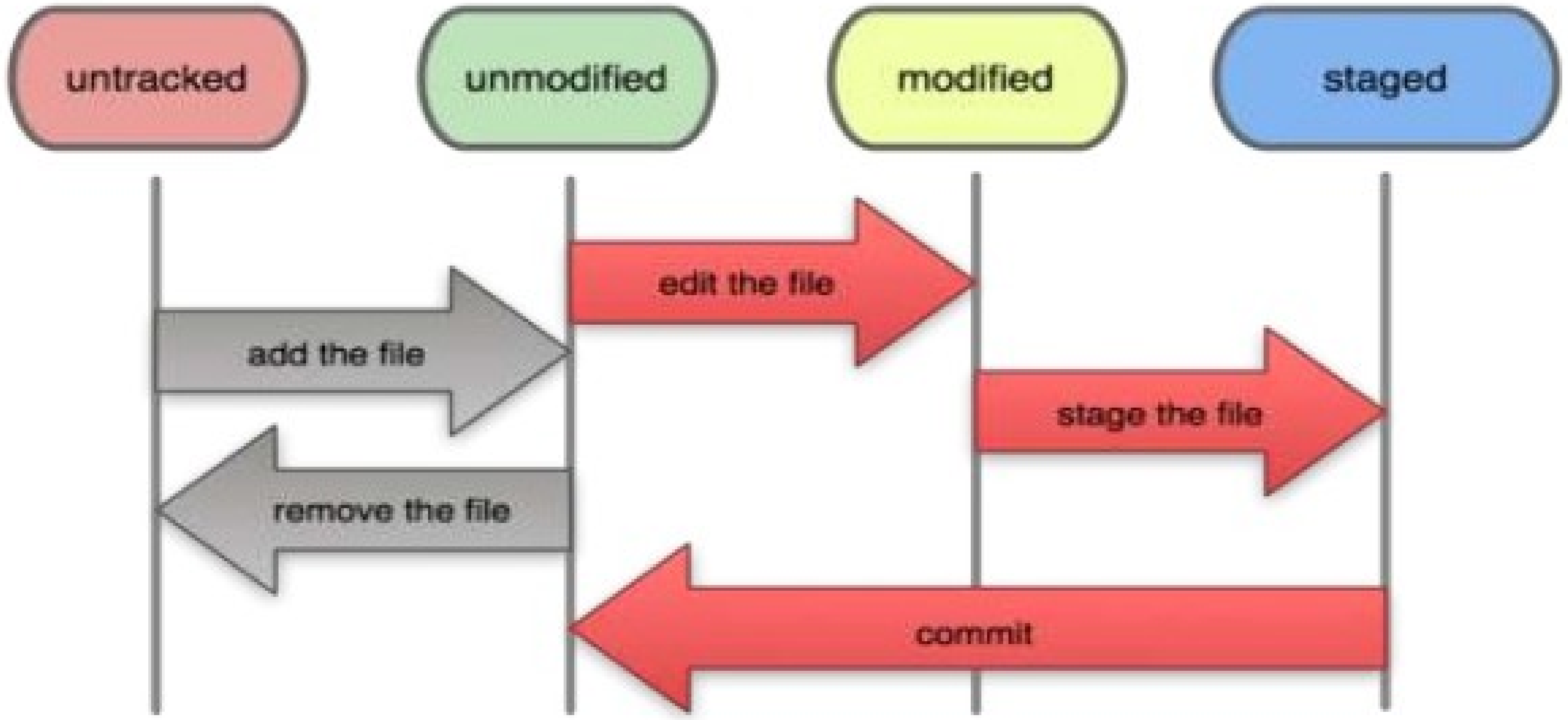
Suppose you have made three commits in your project, that means there are three change sets. Each commit object refers to a change set. Following figure illustrates how the series of commits are linked together. Note that the parent of each refers to a previous commit. We can see who has committed, when, why and with what change



HEAD Pointer in git



Life cycle of a file in git



Move to an old commit

We can move the head pointer to some previous commit and start recording the commits from that commit object onwards. There are three ways of doing this

Soft Reset: `$ git reset --soft <ID>`

- Head is moved to the specified commit ID
- No changes are made in the staging index or working directory

Mixed Reset: `$ git reset --mixed <ID>`

- Head is moved to the specified commit ID
- Staging index is also changed to match the local repository
- No changes are made in the working directory

Hard Reset: `$ git reset --hard <ID>`

- Head is moved to the specified commit ID
- Staging index and working directory both match the local repository

Things To Do

If you have problems visit me in counseling hours. . . .