Version Control

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On today's menu…

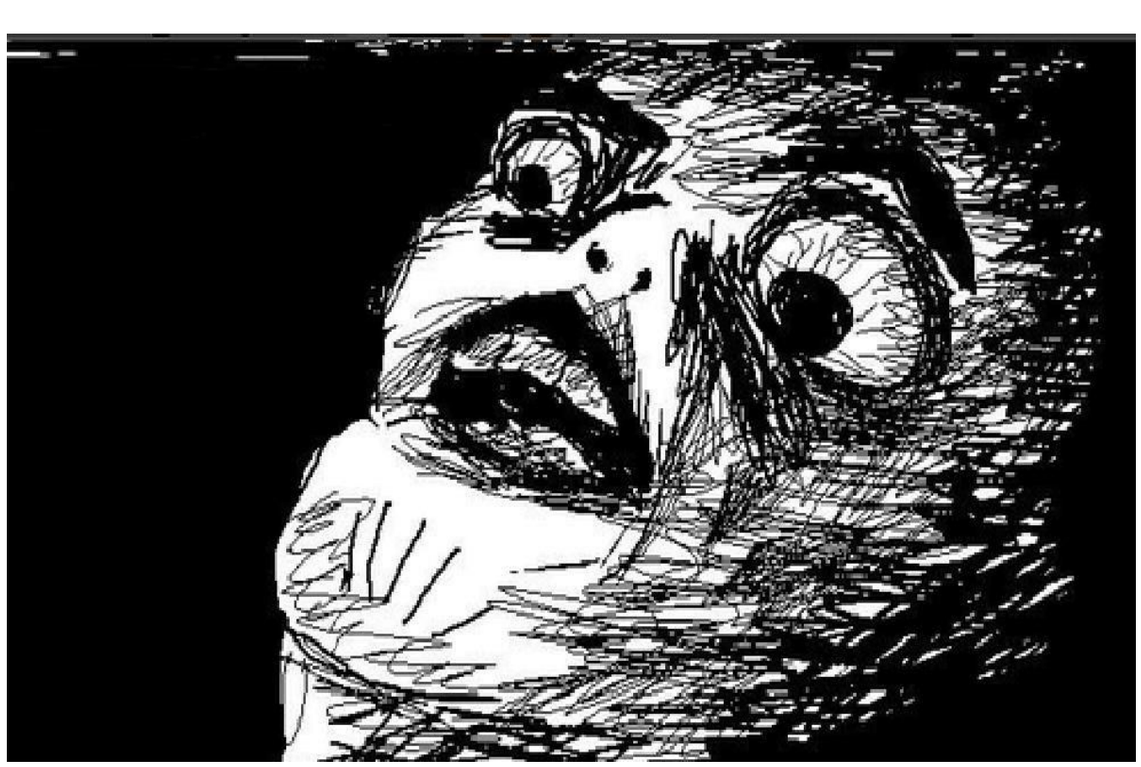
- The problems with lots of code and lots of people
- Version control systems
  - what are they?
  - how are they used?
  - centralised versus distributed version control
  - Features of version control including branching

Dealing with Change

- How do you manage your coursework?
  - Modifying existing code (using Q1 for a basis for Q2)
  - Backing up working code
  - Checking if an idea works (Do I use a Hashtable or a HashMap?)
  - Sharing code in group projects

(Bad) Solutions

- Copying (Coursework_working.java, Coursework_tmp.java)
- Copy & Paste code snippets
- Copy entire directories
- Emailing code to people

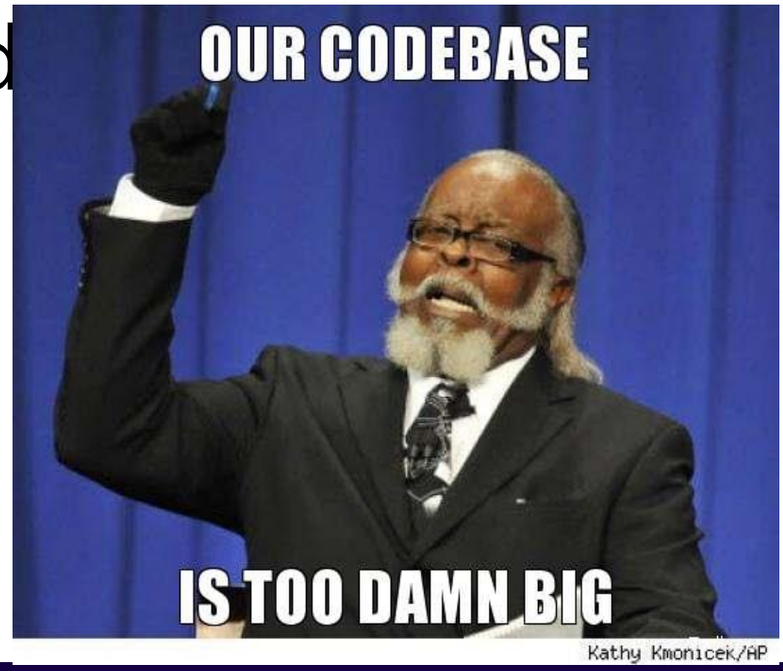


Open Source

- You thought coursework was bad?
- Linux kernel has thousands of regular developers, millions of files.
- Developers spread over the globe across multiple time zones

Big code bases

- Operating systems code
  - Win 95 approx 5 million lines of code (1995)
  - Linux kernel 2.6.37 14 million lines of code (2011)
- Modern PC game
  - Unreal 3 approx 500,000 lines of cod

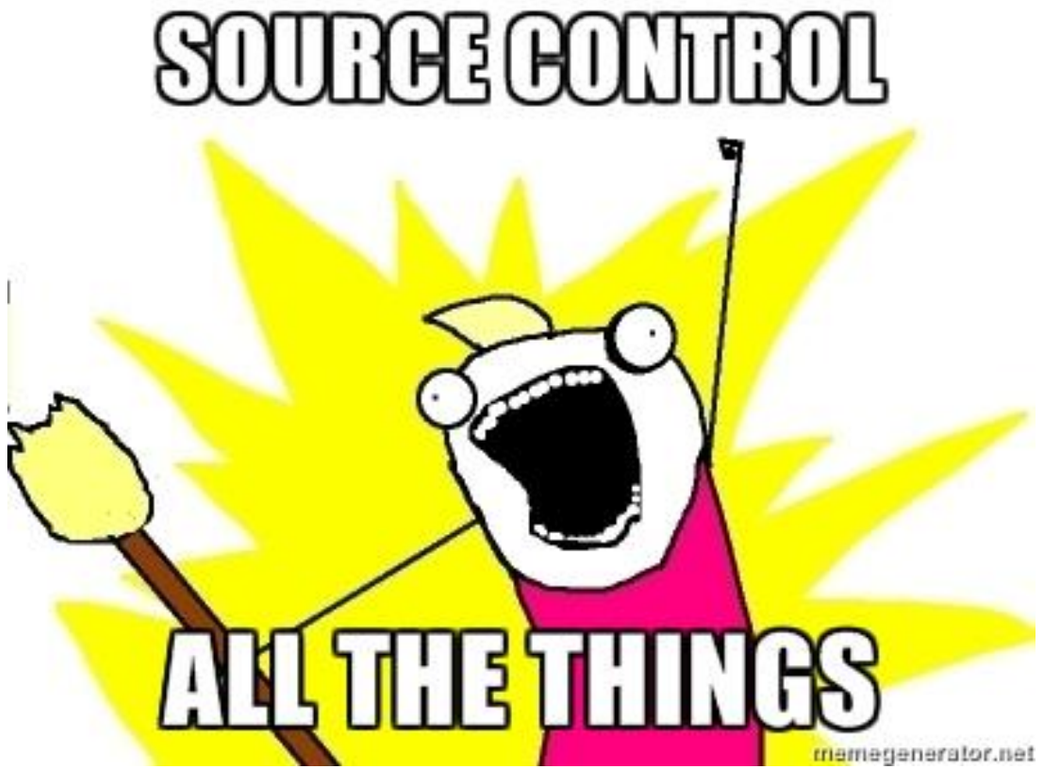


Making a mess

- The Linux kernel runs on different processors (ARM, x86, MIPS). These can require significant differences in low level parts of the code base
- Many different modules
- Old versions are required for legacy systems
- Because it is open source, any one can download and suggest changes.
- How can we create a single kernel from all of this?

Not just code!

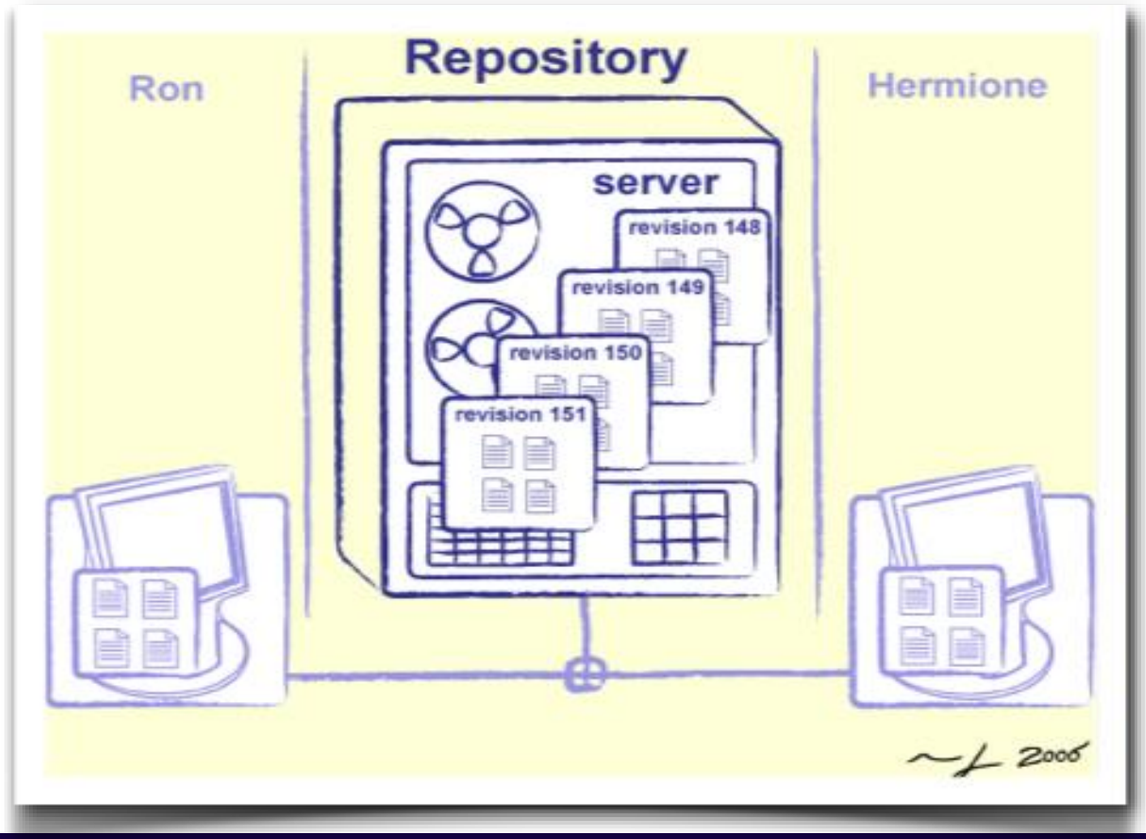
- A *Code Base* does not just mean code!
- Also includes:
  - Documentation
  - Build Tools (Makefiles etc)
  - Configuration files
- But NOT a certain type of file




DEVELOPERS
Y U NO USE SOURCE CONTROL
memegenerator.net

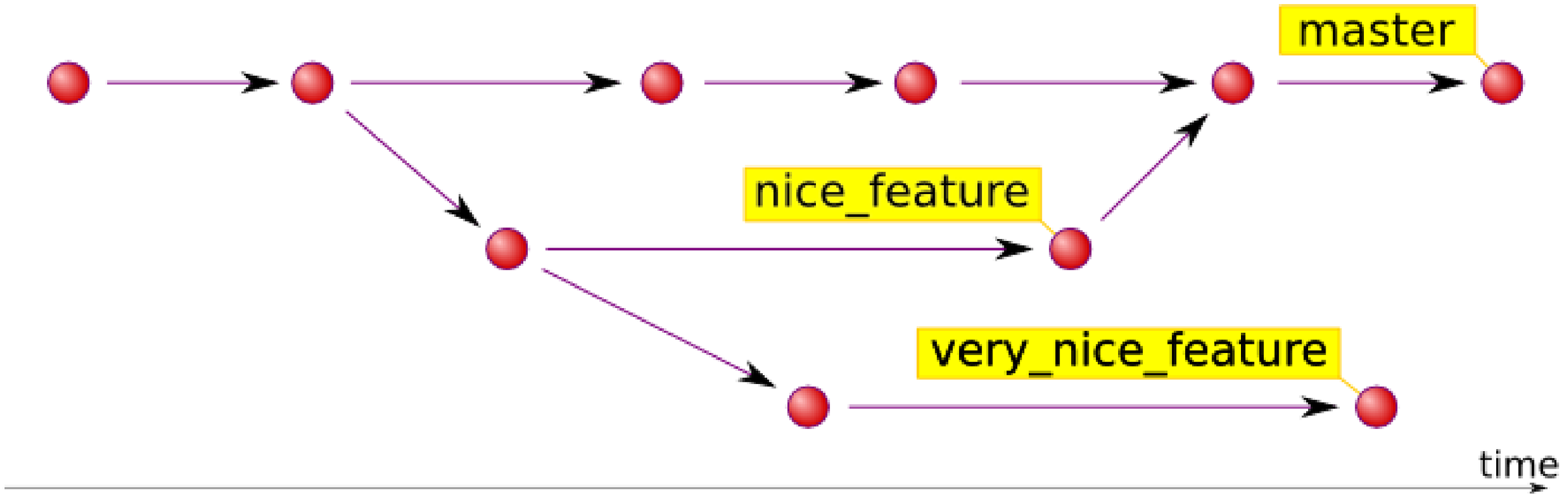
Control the process automatically

- Manage these things using a version control system (VCS)
- A version control system is a system which allows for the management of a code base.



Details of the process

- Files are kept in a *repository*
- Repositories can be local or remote to the user
- The user edits a copy called the *working copy*
- Changes are *committed* to the repository when the user is finished making changes
- Other people can then access the repository to get the new code
- Can also be used to manage files when working across multiple computers

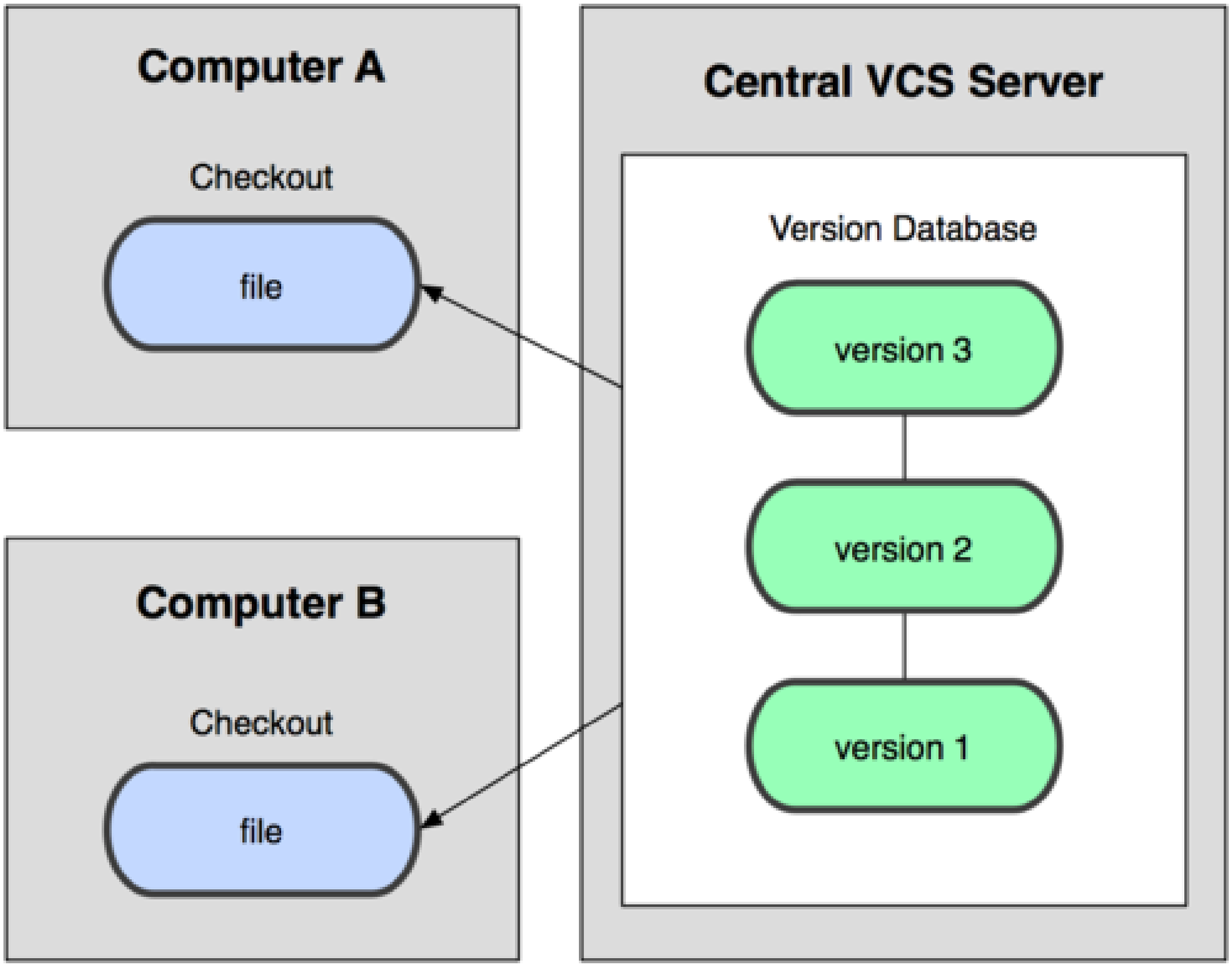

master
nice_feature
very_nice_feature
time

Centralised Version Control

- A single server holds the code base
- Clients access the server by means of check-in/check-outs
- Examples include CVS, Subversion, Visual Source Safe.

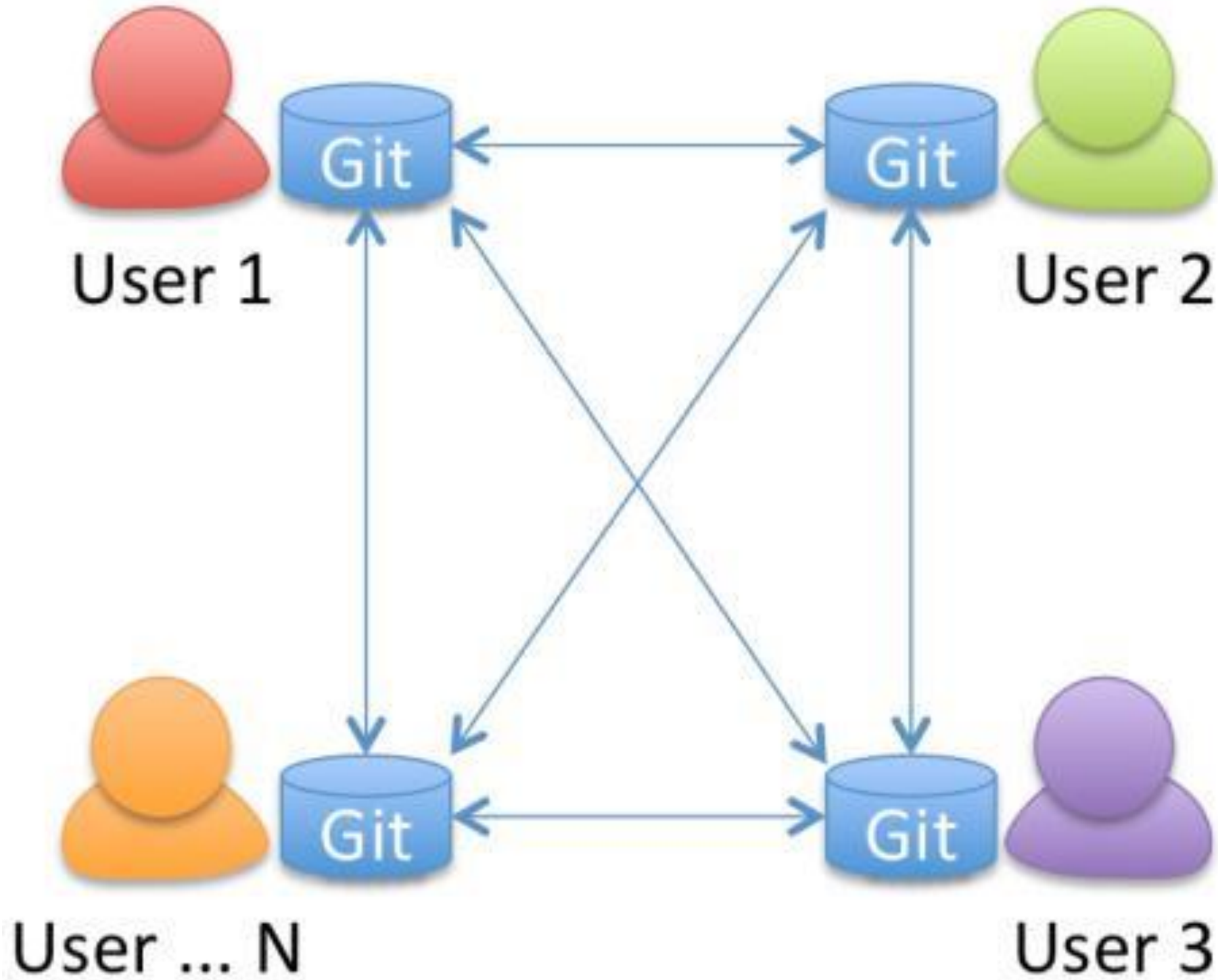
Advantages: Easier to maintain a single server.

Disadvantages: Single point of failure.


Computer A
Checkout
file
Computer B
Checkout
file
Central VCS Server
Version Database
version 3
version 2
version 1

Distributed Version Control

- Each client (essentially) holds a complete copy of the code base.
- Code is shared between clients by push/pulls
  - Advantages: Many operations cheaper. No single point of failure
  - Disadvantages: A bit more complicated!


Git
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User 1
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User 3

More Uses of Version Control

- Version control is not just useful for collaborative working, essential for quality source code development
- Often want to undo changes to a file
  - start work, realize it's the wrong approach, want to get back to starting point
  - like "undo" in an editor…
  - keep the whole history of every file and a *changelog*
- Also want to be able to see who changed what, when
  - The best way to find out how something works is often to ask the person who wrote it

Branching

- Branches allows multiple copies of the code base within a single repository.
  - Different customers have different requirements
    - Customer A wants features A,B, C
    - Customer B wants features A & C but not B because his computer is old and it slows down too much.
    - Customer C wants only feature A due to costs
  - Each customer has their own branch.
- Different versions can easily be maintained

Selecting a VCS

- When choosing a VCS consider:
  - How many files and developers are likely to be involved in the project?
  - Speed for common operations (check-in, check-out)
  - Is there a server? Does it need to be powerful?

Essential features

- Check-in and check-out of items to repository
- Creation of baselines (labels/tags)
  - Version 1.0 released!
- Control and manipulation of branching
  - management of multiple versions
- Overview of version history

Additional Features (1)

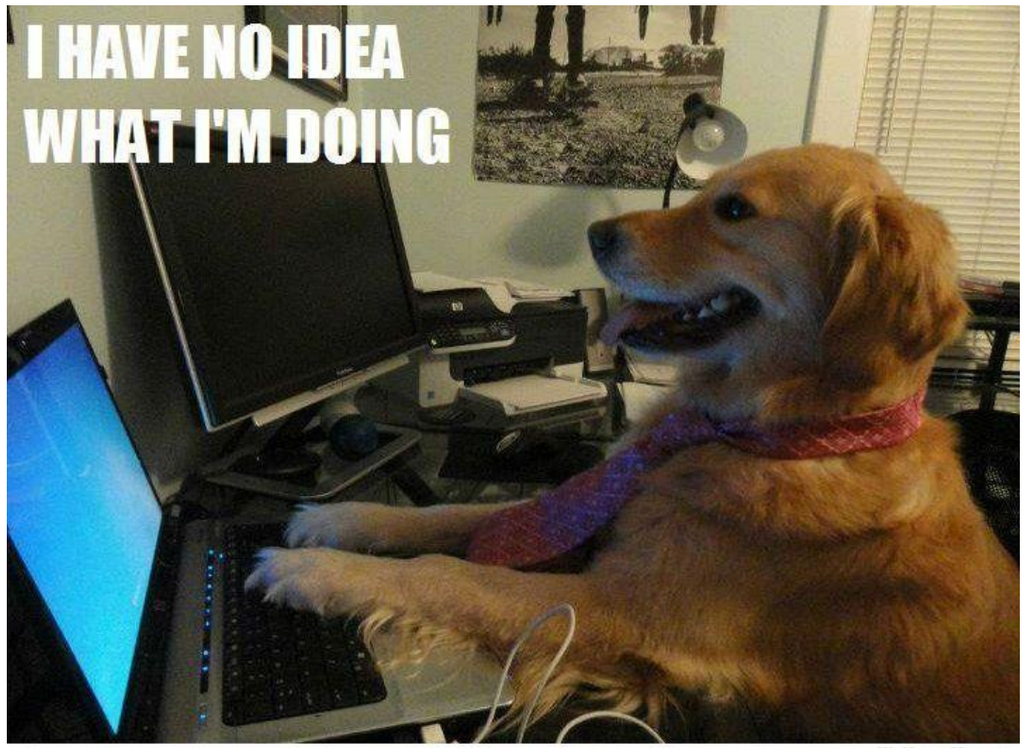
- *Change Management:*
  - Professional software will have bugs. Customers will find them. How do we know if a bug has been fixed?
  - Check-outs of code usually controlled.
    - A bug report will identify where the bug is in the code.
    - The fixed code (patch) is checked in and linked to bug report
    - Hence we can see exactly what changes were made in response to a specific bug. Good for accountability

Additional Features (2)

- Code responsibility & Code audits.
  - You stole my code!
  - Who is responsible for this module?
  - Legal stuff
- Forking – Common with Open source software
  - A subset of developers *fork* off a parent project to produce a second copy of the project. Reasons vary but often done to make a more specific version.
- Metrics (Managers only!)

Check Outs

- If you want to make a change the file needs to be *checked out* from the repository
- Usually done a file at a time.
- Some VCSs will lock checked out files so only one person may edit at a time.

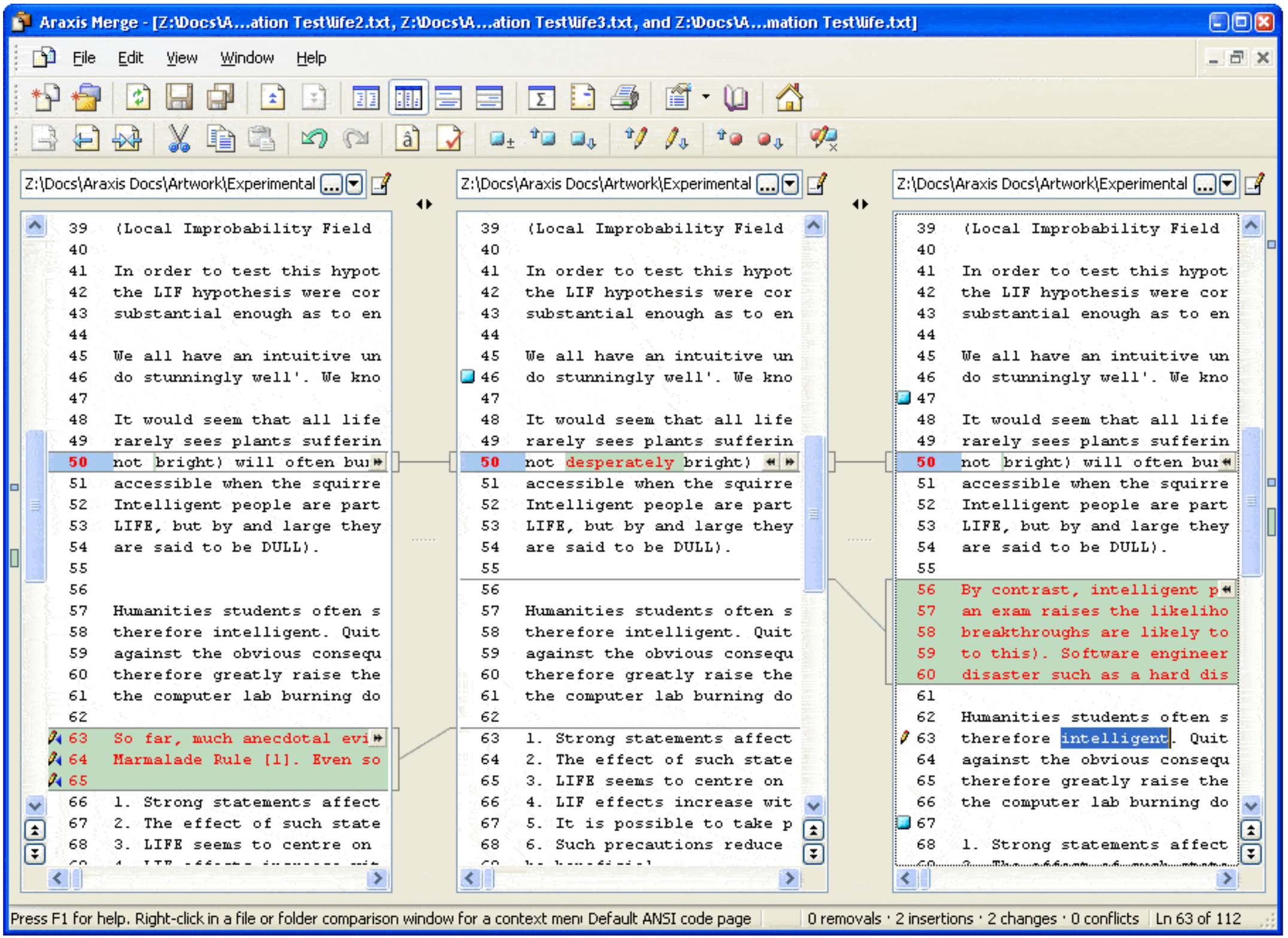


Check-In

- When changes are completed the new code is *checked-in*.
- A *commit* consists of a set of checked in files and the diff between the new and parent versions of each file.
- Each check-in is accompanied by a user name and other meta data.
- Check-ins can be exported from the Version Control system the form of a *patch*.

Merging

- There are occasions when multiple versions of a file need to be collapsed into a single version.
  - E.g. A feature from one branch is required in another
- This process is known as a merge.
- Difficult and dangerous to do in CVS
- Easy and cheap to do it git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Press F1 for help. Right-click in a file or folder comparison window for a context menu Default ANSI code page
0 removals · 2 insertions · 2 changes · 0 conflicts
Ln 63 of 112

Version Control in action

- I use git for my day to day work. One developer, lots of code written over 3 years in multiple languages (C, Python, Java, shell, awk)
- I need a regular back-up system but work on at least 3 PCs (Home, work and work linux).

Using a git repository

- `$ git init`
- `$ git add <filename>`
- `$ git commit -a`
- `$ git branch`
- `$ git checkout`
- `$ git push`
- `$ git pull`