Methods: Version Control

Module Website:

`http://www.cs.nott.ac.uk/∼lad/SWT`

Labs are in the Middle Row of A32 every Thursday and Friday from 2pm until 4pm. See website for details.

Remember Lab exercises will be assessed in the Exam!

NB. I only rarely answer queries sent by email. Please use the module noticeboard.

By the end of this Lecture you should be able to..

- Describe the principles behind version control systems and explain what problems they address.
- Describe the Copy-Modify-Merge cycle.
- Explain how Locking and Version Tracking avoid conflicts and discuss the benefits of each technique.

Version Control

Things change ...

- New Requirements lead to
- New or changed designs that lead to
- New or changed source code, etc.
- or bugs are discovered and must be fixed

...software engineers need to keep track of all these changes

Version Control Systems Support

Synchronisation Manages the changes made by different programmers so they don’t need to continually email code between each other.

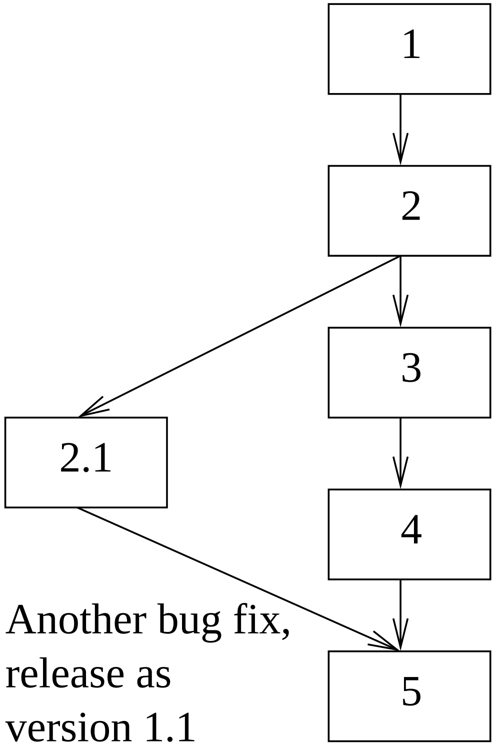
Rollback Changes are not always an improvement. Often you need to return to a prior version.

Experimentation Lets software engineers explore “what if” scenarios.

Internationlization Different versions for different languages.

Historical Record A customer reports a bug on version 1.1 but you are at version 2.3. You need a way to recreate version 1.1 to check out the bug.

Tracking Changes



First draft of code, buggy

Fix some bugs, release version 1.0

Begin adding spellcheck feature

spellcheck feature complete, may have bugs

Another bug fix, release as version 1.1

changes merged, more bugs fixed, release as version 2.0

Version Graphs

- All changes to a single file are tracked via a graph
  - nodes are distinct versions
  - edges denote that the target node was derived from the source node

- There are three possible configurations

Extension A single version derived from a single version

Split Multiple versions derived from a single one

Merge A single version derived from multiple versions; most systems have support for this much major differences have to be resolved by hand.

Version Control Files

Graphs are stored (centrally) in version control files

Space saving techniques may be used.

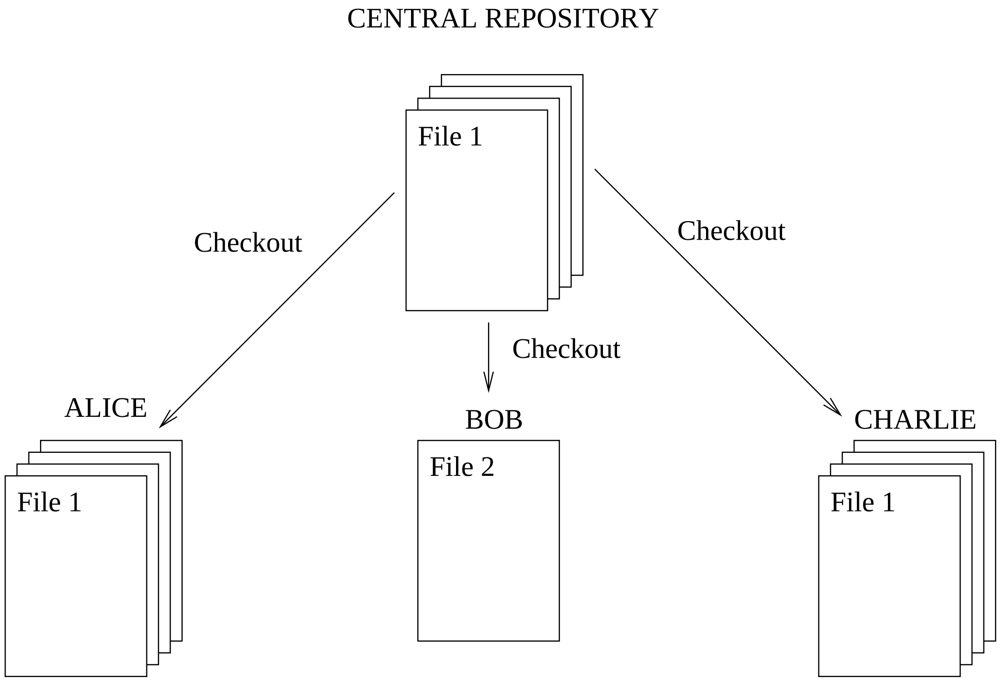
- Forward deltas – The original version is stored, all subsequent versions are stored as sets of changes or “deltas”.
- Backward deltas – The most recent version is stored, all previous versions are stored as sets of changes.

Version Control Systems

A Version control system lets you “check out” versions of a version control file.

For instance, if I ask for version 2.2, and we are using a forward delta system, it starts with the original file and applies all of the deltas that lead to version 2.2 in the version graph

Checking Out

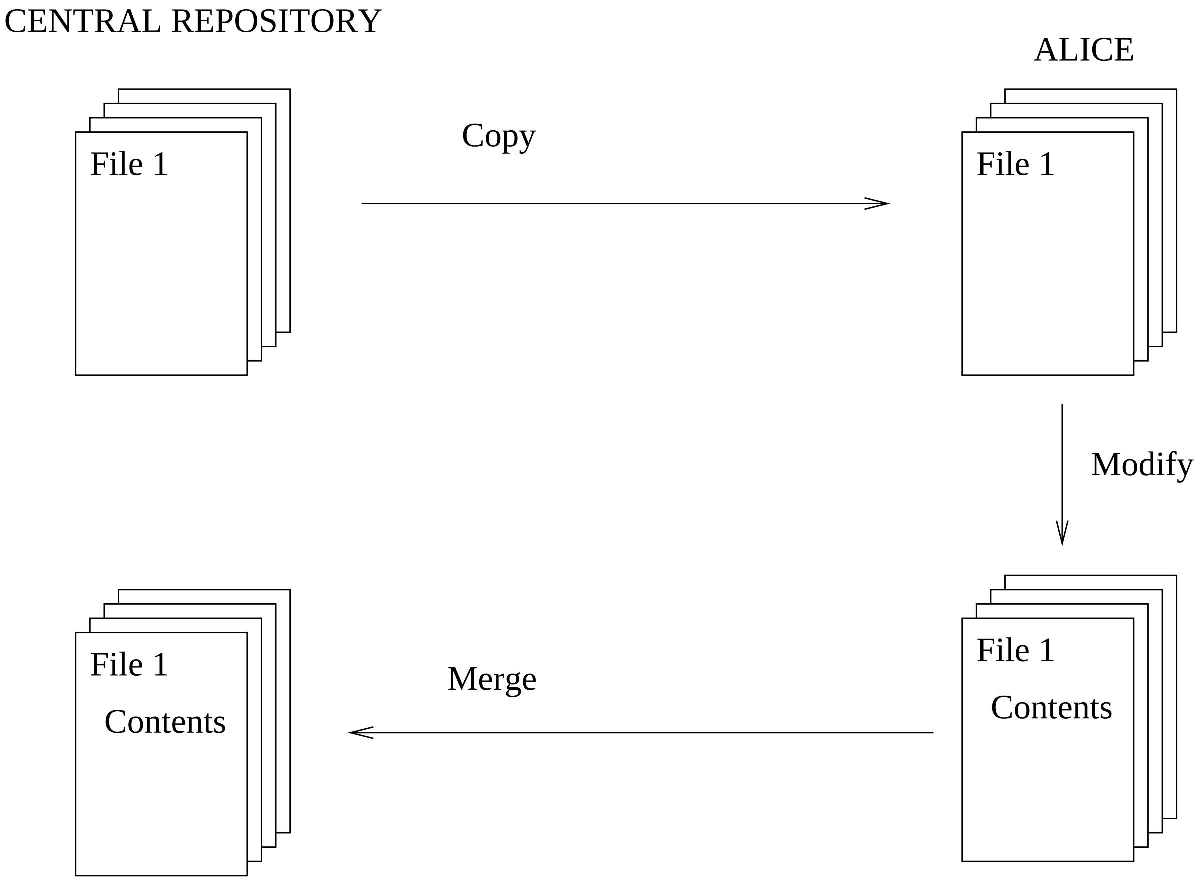


- Alice and Charlie have checked out all files.
- Bob has just checked out File 2.

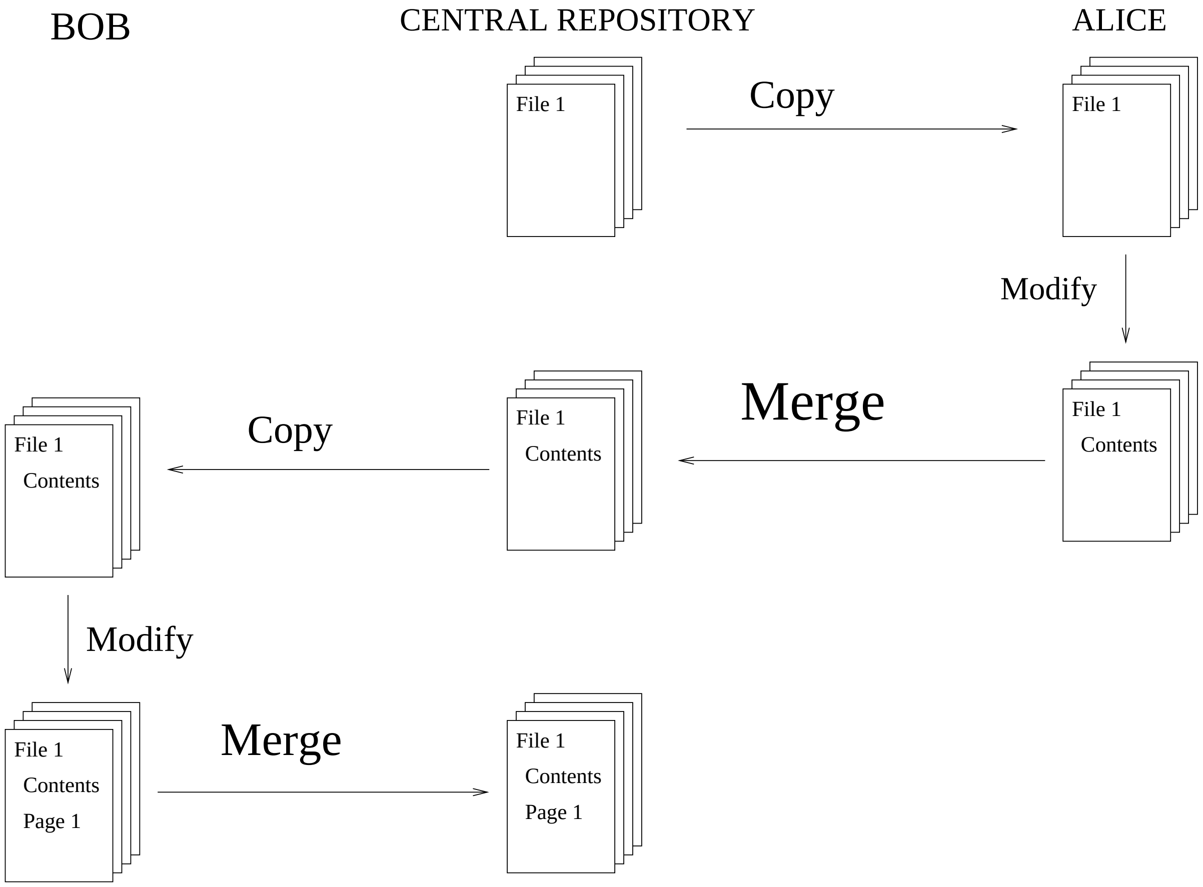
Copy-Modify-Merge

1. A Developer copies the version of the system they are interested into their own filespace.
2. They then make any changes they want to the system.
3. This is then merged back into the central version (which may have been modified by other developers in the meantime).

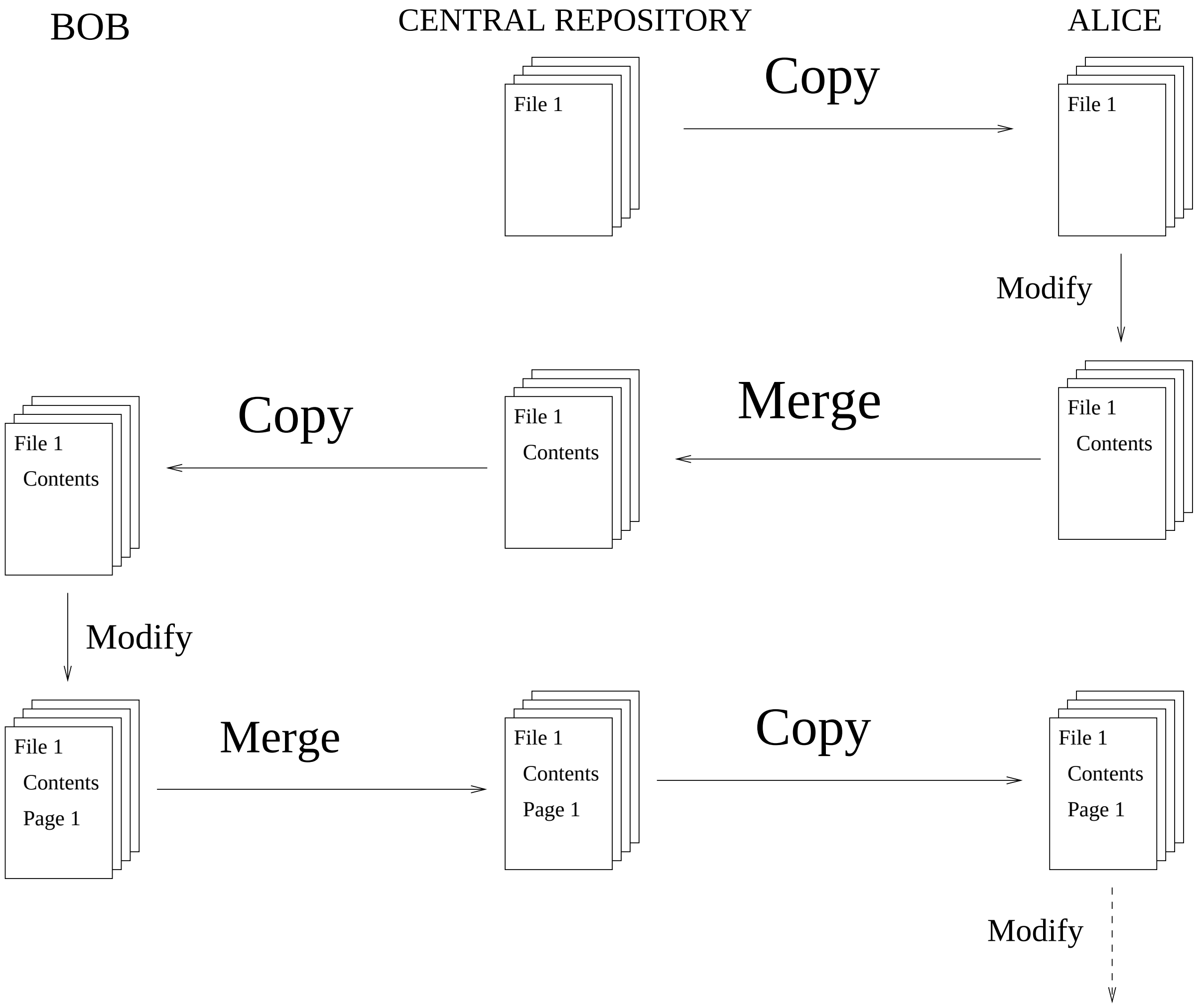
Copy-Modify-Merge (Alice Modifies a File)



Alice modifies a file followed by Bob



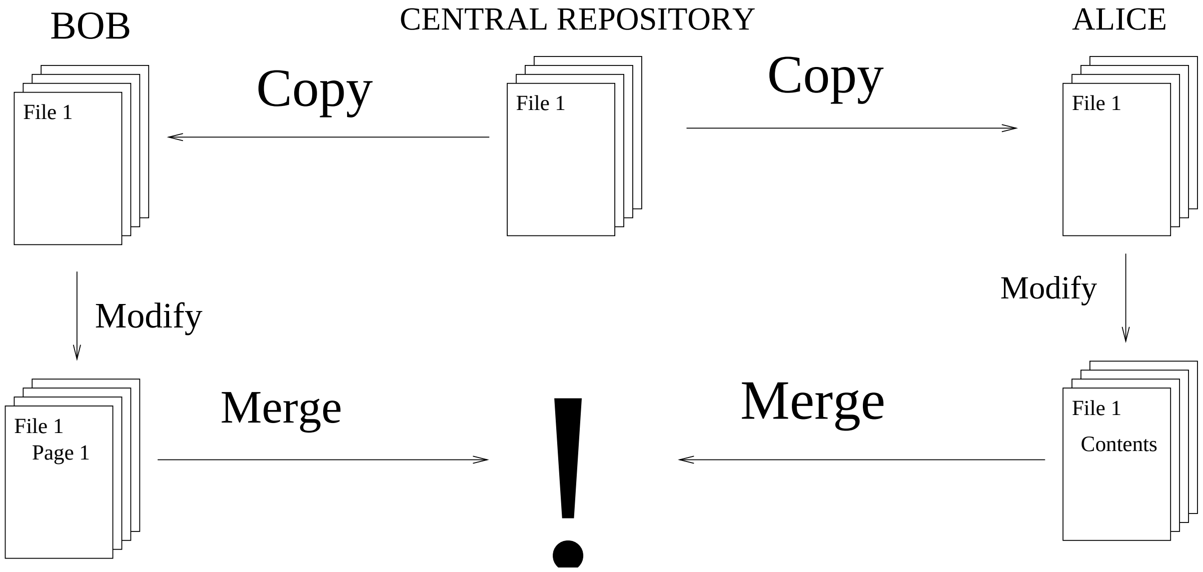
Alice, Bob, Alice



Conflicts

Suppose Alice and Bob both copy the same file, make some changes and then try to merge them. What Happens?

A Conflict

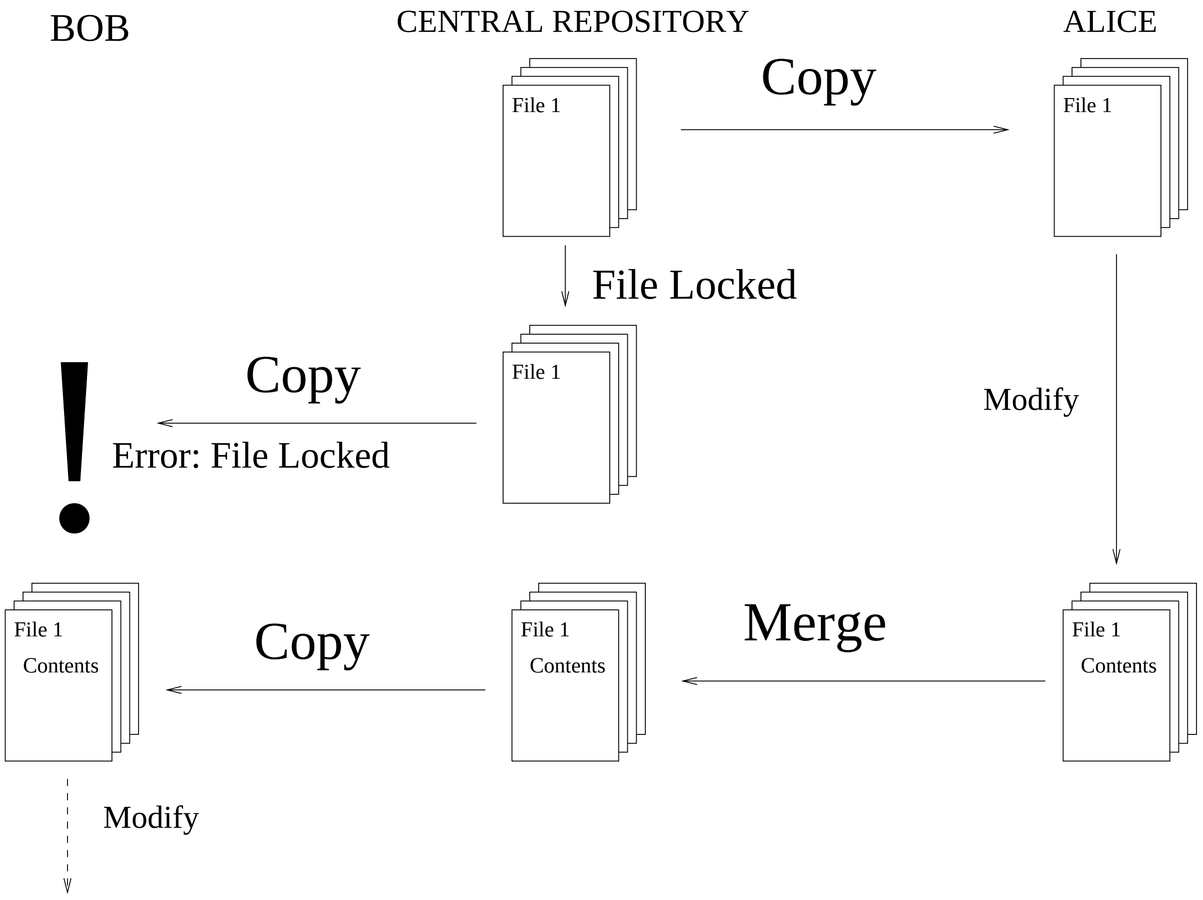

BOB
CENTRAL REPOSITORY
ALICE
Copy
Copy
File 1
File 1
File 1
Modify
Modify
File 1
Page 1
Merge
!
Merge
File 1
Contents

Locking or Version Tracking

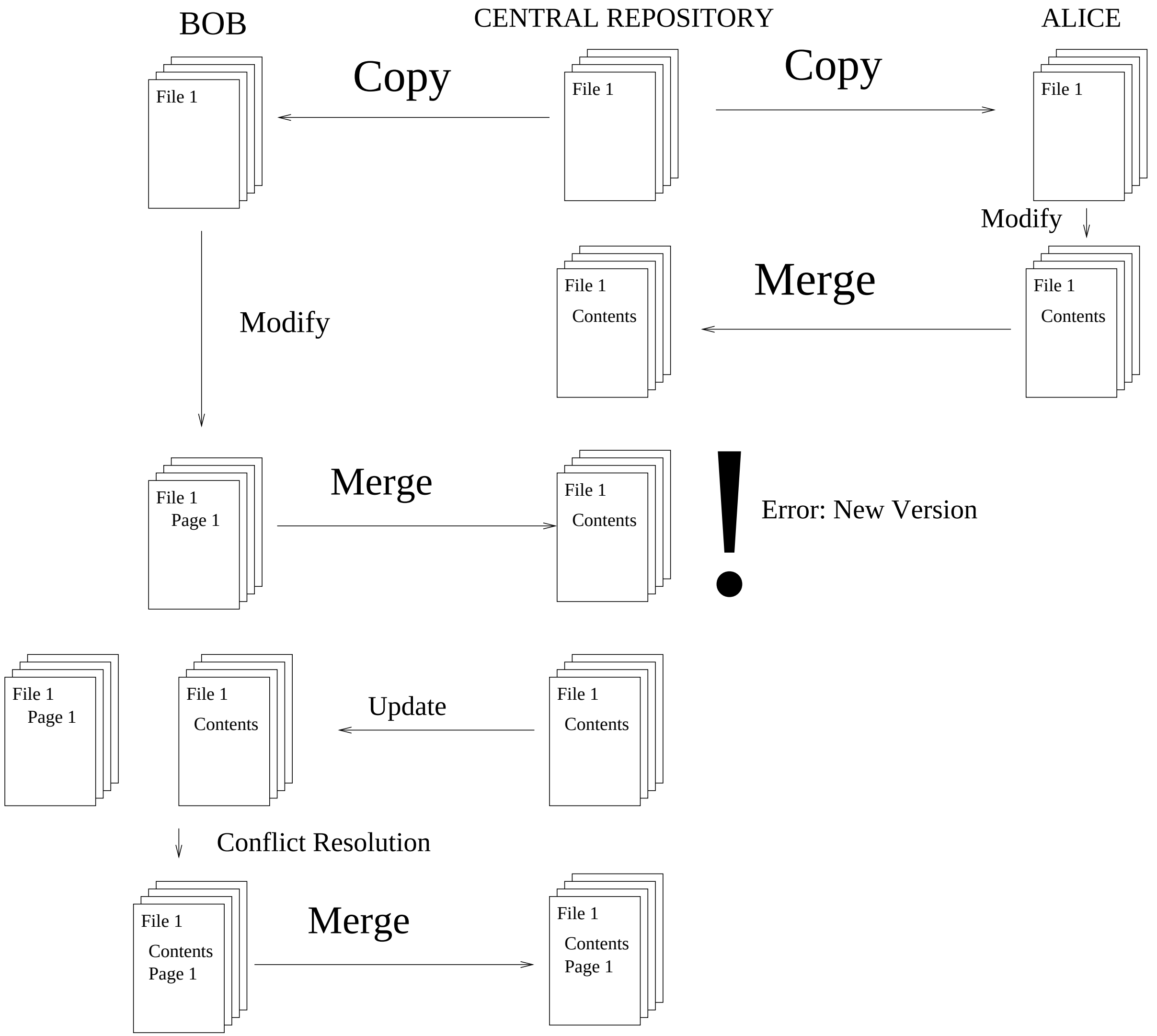
Version Control Systems vary in how they cope with conflicts.

- Some systems implement locking so it is impossible for two people two both have a file checked out at the same time.
- Other systems may keep track of the versions of a file each user has and require them to update their version before they can merge it.

File Locking in Action



Version Tracking in Action



Conflict Resolution

- Many version control systems support conflict resolution making guesses about an appropriate way to merge the two versions of the file.
- In the end though they will give up and leave it to the user to do this by hand.

Locking Vs. Version Tracking

- Locking prevents complicated conflict resolution problems arising.
- Locking also prevents duplication of effort (two programmers both doing the same thing at the same time).

- Version tracking prevents one person’s work being held up because someone else is using the file they want – or worse still has forgotten to check the file back in.
- Version tracking allows two developers to work on different sections of the same file at once.

Summary

- Version Control Systems are a way of tracking and recording changes to a software project.
- They help teams of people coordinate their work.
- They are not psychic! unless they are a central part of a project methodology they are more trouble than they're worth!