

# Local Version Control (sccs, rcs)

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### Localized Version Control

The earliest version control systems in wide use were **sccs** and the open source **rcs**.

- We'll focus on **rcs**
- The “repository” of historical information is kept as a “special” subdirectory, named RCS
- Sharing of repositories is possible only via the operating system's underlying mechanism for sharing access to directories
  - permissions, linking

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### Basic rcs Operations

- **ci** Check In a file from the working directory into the repository



- **co** Check Out a file from the repository into the working directory
- **rcsdiff** Compare two versions of a file.
- **rcsmerge**

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## 1 History

### History

- `mkdir RCS`

Creates an RCS repository for the files in the current directory (only)

- The repository is currently empty

- `ci filename`

Checks files in to the repository



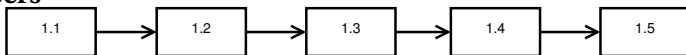
- If the file is not in there yet, it is added
  - If it is in there, then this becomes the new/current revision
  - Each check in is assigned a new, ascending revision number
  - Somewhat surprisingly, deletes the file from the current directory
- `co -l filename`

Checks out the most recent version of that file from the repository, storing it in the working directory.

- Adding a `-r v` option allows check out of a specific revision number

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### Revision Numbers



- Clearly there was an intent that revision numbers also serve as version numbers.



- A special option allows you to force a change to the leading digit, e.g., to move from version 1.12 to 2.0
- Problem is that each file's revision number changes independently
  - So your intended release “version 2.1” might use revision 2.1, revision 2.5 of `adt.cpp`, revision 2.3 of `main.cpp`, etc.
- Versions can be checked out by date instead:
  - “check out whatever version was current as of 12/13/2012”
    - Repeated over all files, would give a coherent view of the project status as of that date

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### Naming Revisions

- Revisions can be named:



```
ci -N "v1.2" -t "Public release 1.2" *.h *.cpp
```

and later checked out by name instead of by exact revision number

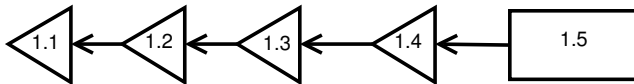
- Note also the option to add explanatory text at the time of the checkout
  - Later version managers would make this “mandatory”

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### Implementation

**rcs** is essentially a systematic way of creating and organizing patches.

- The repository always contains the current version of the file plus enough diffs/patches to move back to any prior revision.



- The current version is always available immediately.



- Diffs are used to go back in time
  - \* Originally considered an important point in supporting efficient access to the most commonly needed file.
  - \* Now, probably not so important

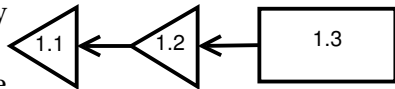
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## 2 Exploration

### Exploring Alternatives

Suppose that we have worked through a few revisions and then get an idea that might not pay off.

We can start a *branch* to explore our idea while others continue work on the main trunk.



```
ci -r1.3.1 filename
```





Checks in our current version of *filename* as a new branch of development, numbered 1.3.1.1

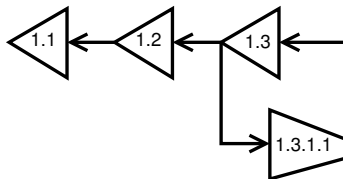
- 1.3.1.1 is the trunk version from which we branched out
- 1.3.1.1 is the branch number
- 1.3.1.1 is the revision number within the branch

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### Working in a Branch

Subsequent check-ins of both the main trunk (1.3) and of our branch version

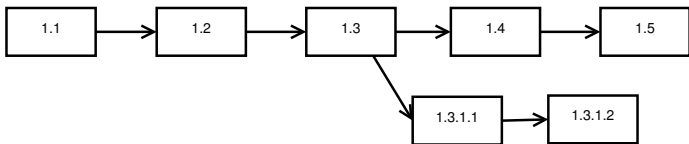
will maintain separate revision numbers:



- Note that checking out the most recent version along a branch is not as efficient as checking out the most recent version on the trunk.

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### Merging a Branch

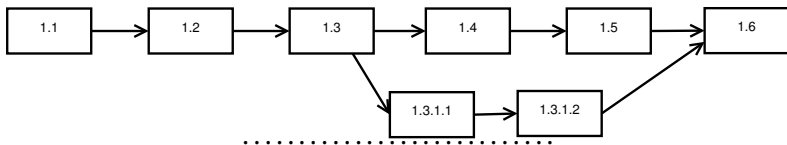


- If the idea in the branch does not pay off, the branch can simply be abandoned.
- You decide to adopt the changes in the branch, you can elect to *merge* it back into the trunk.
  - The **rcsmerge** command is used to conduct the merge,



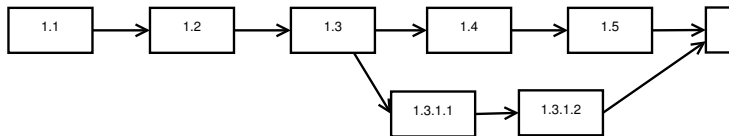
- \* Need to resolve any conflicts introduced by continued development along the trunk.

- then the resulting combined file checked in with a trunk number



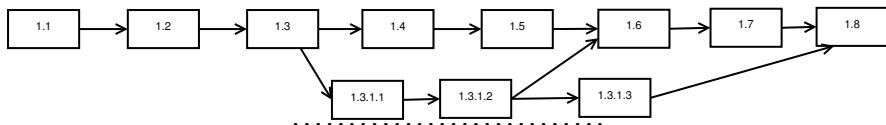
### Multiple Merges

After a merge



- We might opt to discontinue using the branch
- Or we might continue working long it, eventually generating more changes to be merged into the system

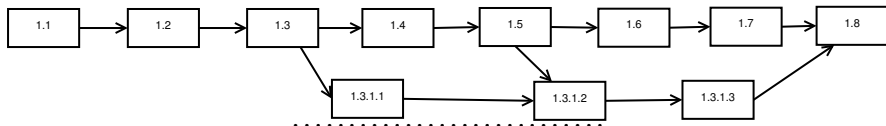




### Combating Drift

Over time, a long-running branch can get so far out of sync with changes being made to the trunk that the final merge becomes difficult or even impossible.

- An effective strategy for combating this is to periodically merge the trunk into the branch
  - the reverse of the “normal” merge direction



## 3 Collaboration

### Collaboration

**rcs** supports collaboration by *locking* files

- Most checkouts like this

```
co filename
```

obtain a read-only copy of the file.

- \*nix permissions 400
- Can be used to compile system, but cannot be changed
  - \* (Of course, you can always **chmod**, but that's cheating.

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### Locks

- A checkout like this



```
co -l filename
```

requests a *locked* version of the file.

- Request fails if a locked version already exists somewhere.
- If successful, programmer receives a copy with write permission.
- Lock persists until the programmer checks in changes or explicitly releases the lock (which deletes the file from their directory, forcing them to check out an unlocked, read-only version again).

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## 4 Strengths and Weaknesses

### Strengths and Weaknesses

- **rcs** addresses history, exploration, & collaboration concerns



- but has weaknesses in each area

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### History

- **rcs** tracks files in a directory.
  - Each file is tracked separately.
- No support for deletion of file
  - Unless you *know* not to request a file, you will always get the last version before it was deleted.
- No support for creation of new files
  - If you request revisions associated with very old dates, you will get version 1.1 even if the file did not actually exist as of that date.



- No support for renaming files
  - Appears to be a deletion and a subsequent creation of a new, unrelated file
- Each directory is tracked separately
  - Poor support for multi-directory projects

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### Exploration Issues

- Branching and merging is often confusing.

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### Collaboration Issues

- Locks are frequently abused
  - e.g., people forget to release a lock, forcing team members to wait
  - People grab locks they don't really need.
- Cheating on locks is easy
  - People get in the habit of cheating to cope with lock abuse
  - And eventually start cheating with less and less provocation.

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