Git - An Introduction

Cameron Taylor

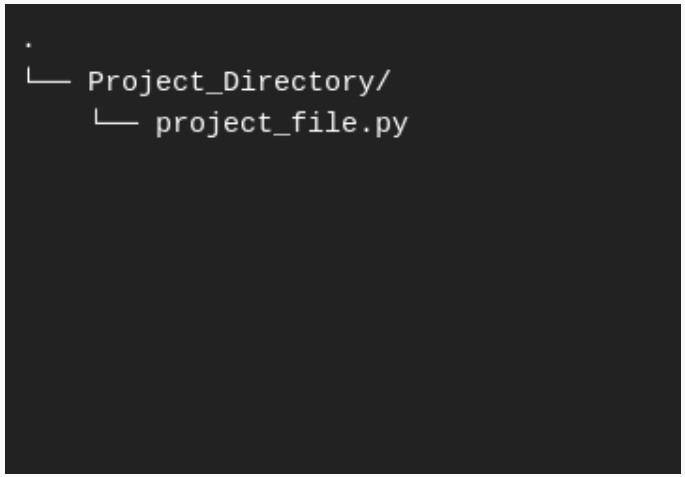
February 17, 2025

The University of Melbourne

Version Control Systems

Scenario: A New Project

Imagine you're working on a project and create the new project file.



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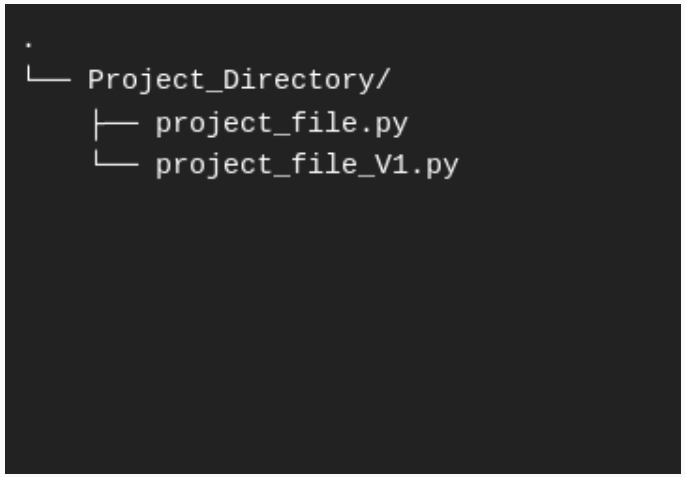

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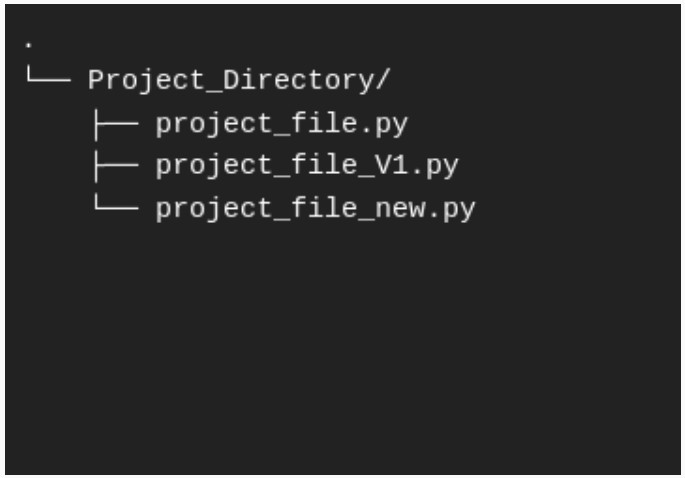
You work on a file for a bit until you're at a point where you have basic function and want to save your progress.

You leave for the weekend and come back after reaching the conclusion that your approach was wrong, and now want to restart.



Scenario: A New Project

```
.
└── Project_Directory/
    ├── project_file.py
    ├── project_file_V1.py
    ├── project_file_new.py
    ├── project_file_new_V1.py
    ├── project_file_final.py
    ├── project_file_final_final.py
    ├── project_file_actual_final.py
    └── ... etc
```

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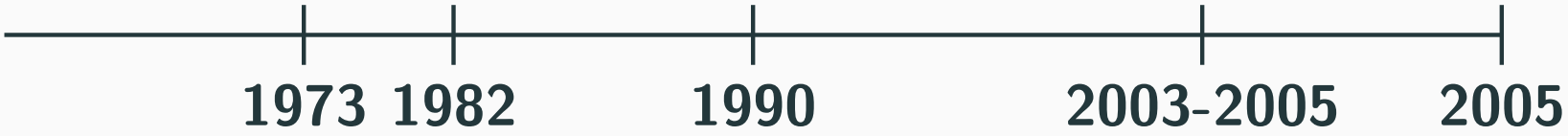
There have been efforts to automate this since the 80s.

Version Control Systems - A History

Source Code Control System (SCCS)



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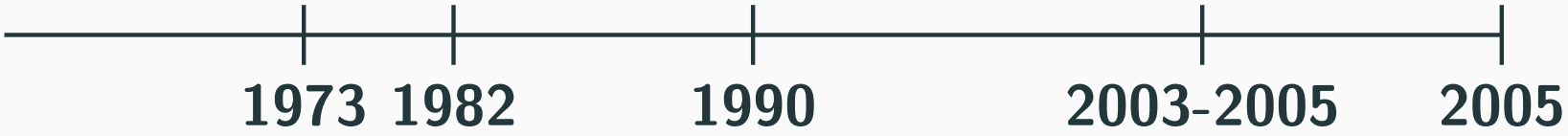

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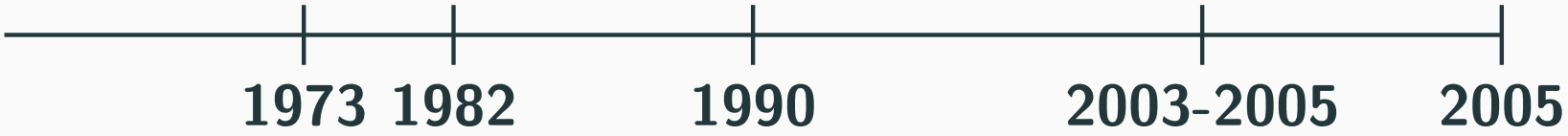

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Developed at Bell Labs for an IBM System/370.

Was the dominant version control system until later systems, such as RCS and CVS, were released.

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Version Control Systems Timeline - RCS

1982 Revision Control System was introduced.

Figure 2: GNU mascot Heckert

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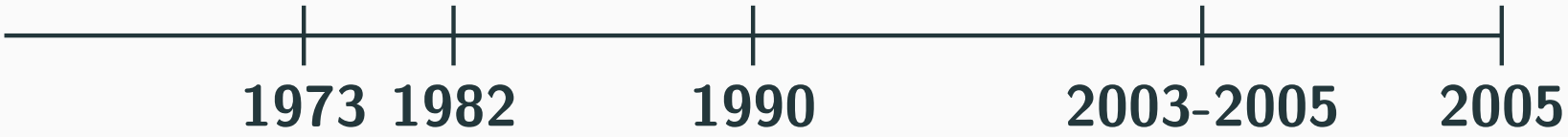

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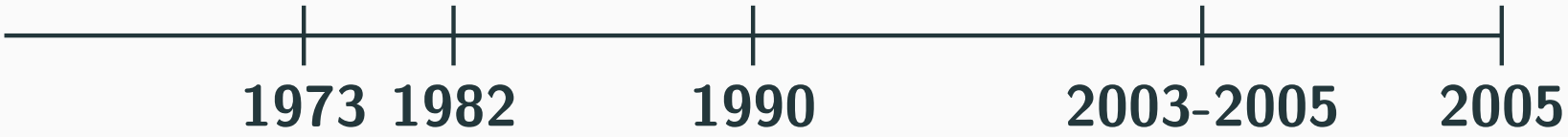

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Used a model that locked files when they were being edited, known as a 'pessimistic locking model'. If you also wanted to edit it, you had to wait.

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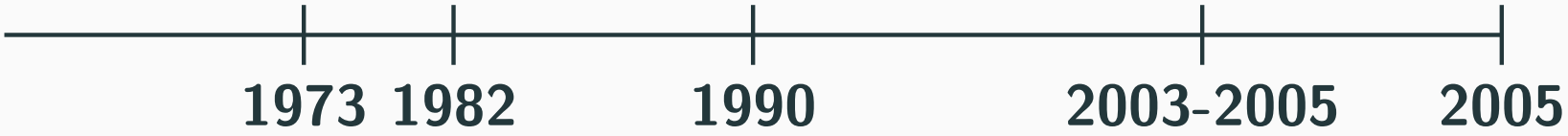

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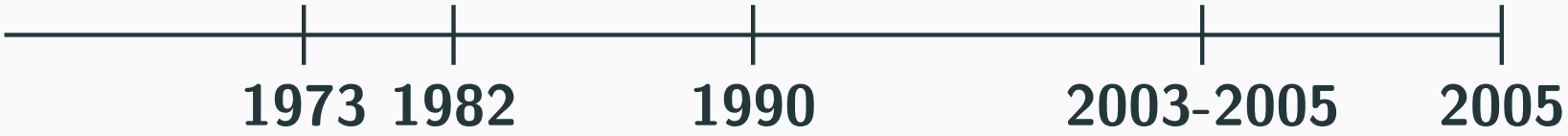

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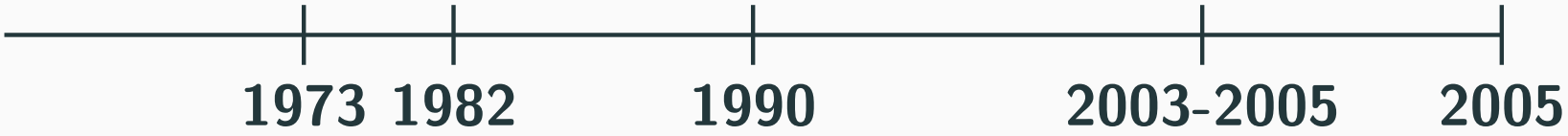

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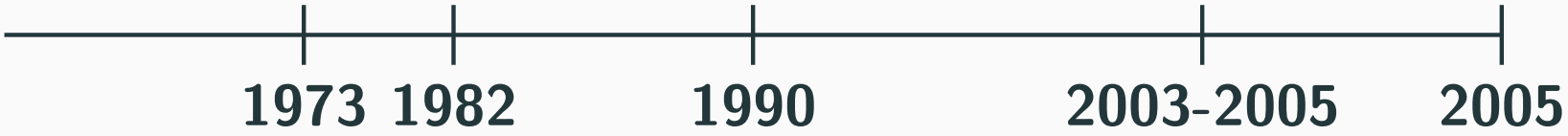

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Replaced 'pessimistic' model with an 'optimistic' model, meaning multiple people could edit the same file, merging later.

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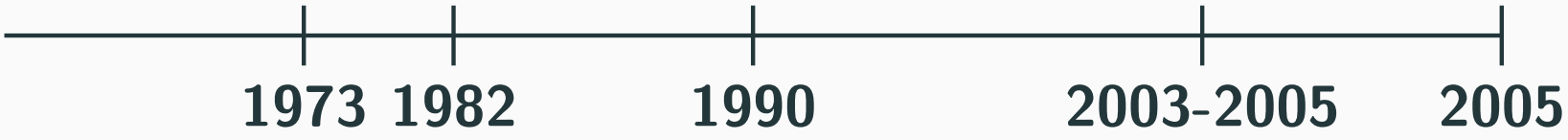

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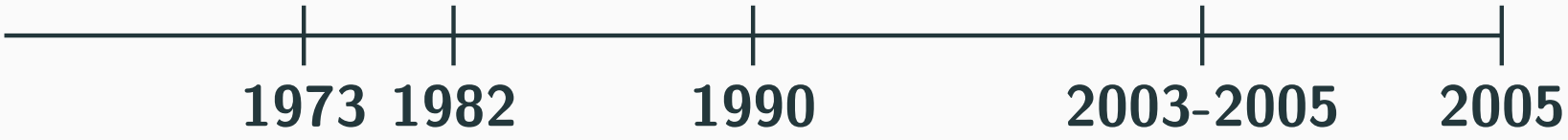

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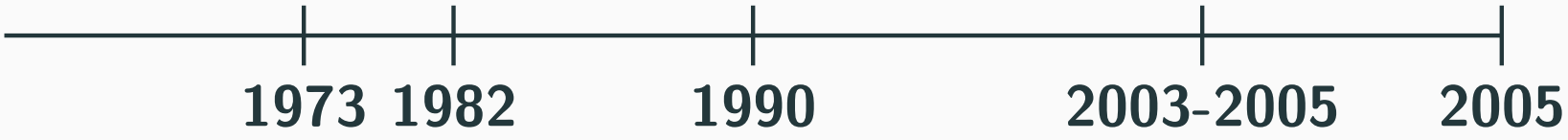

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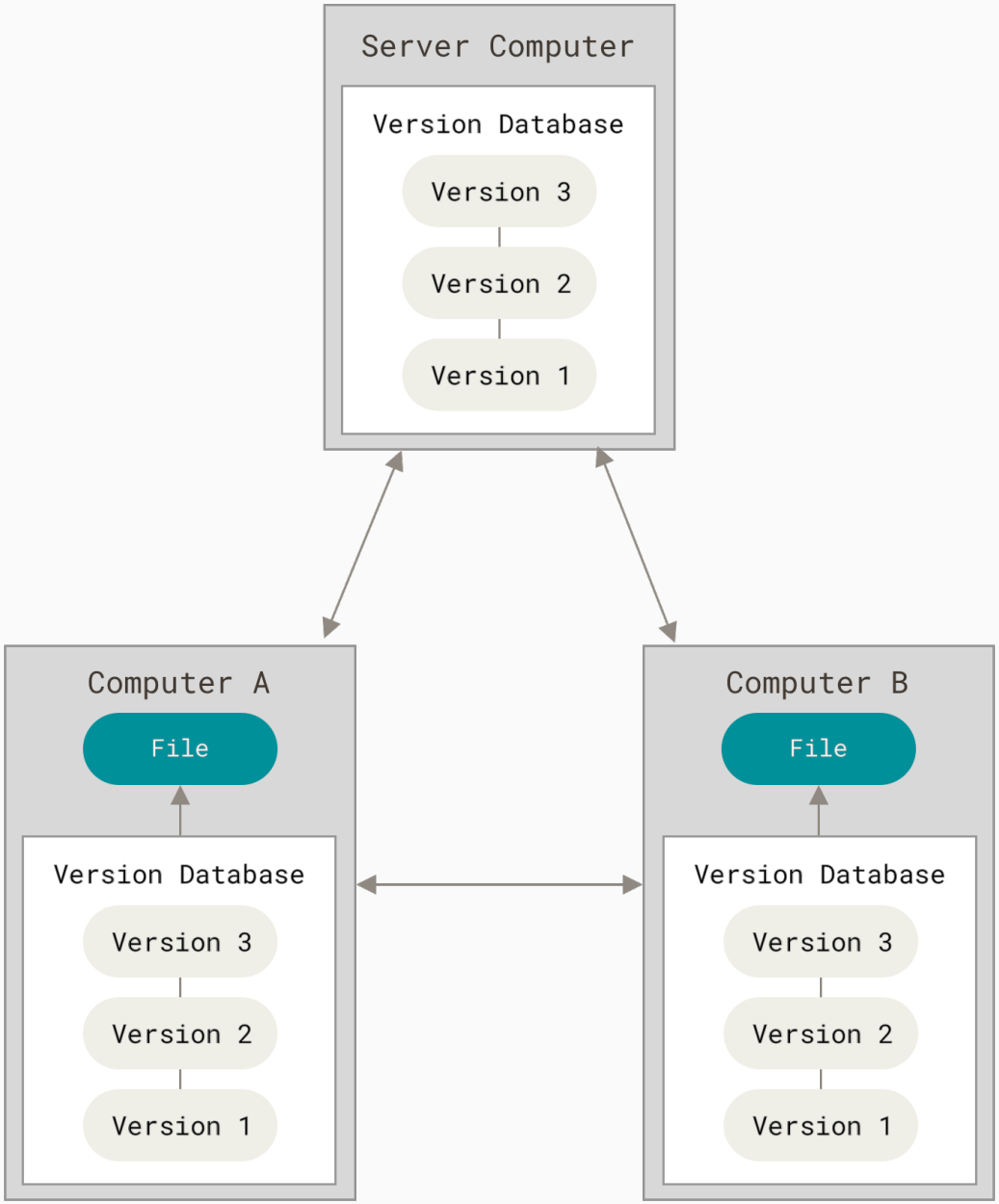
Almost all processes occur offline, and are very fast as a result.

Distributed Version Control Systems



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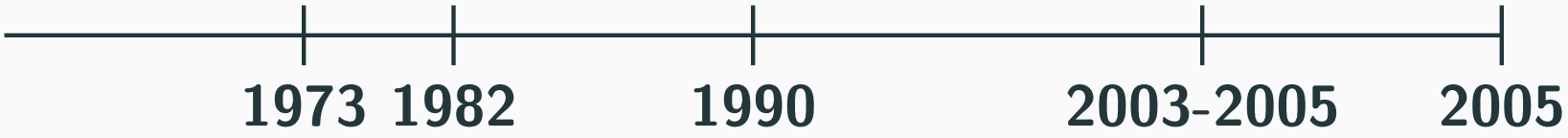

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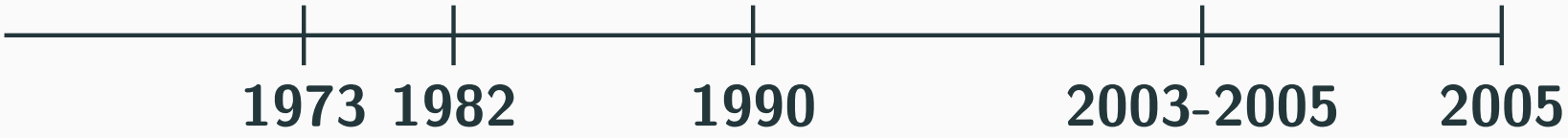

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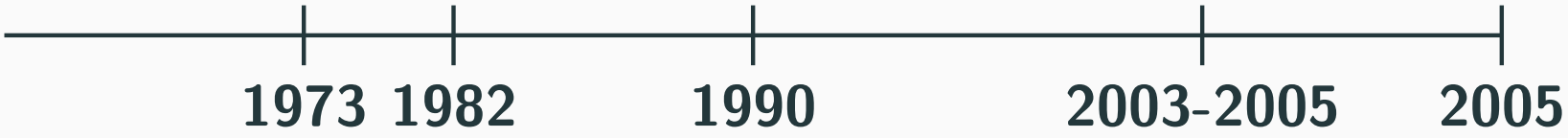

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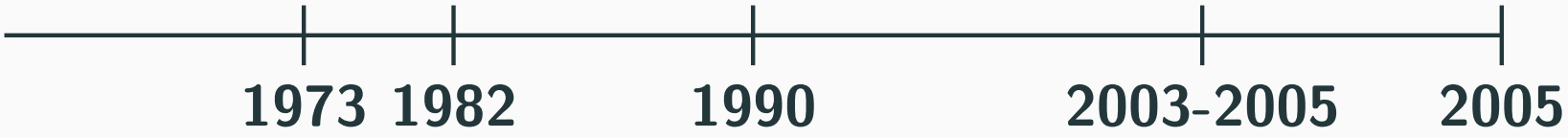

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Linus achieved his performance goals on **29th April 2005**.

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- Files have a 'life cycle' in git.

Git Life Cycle

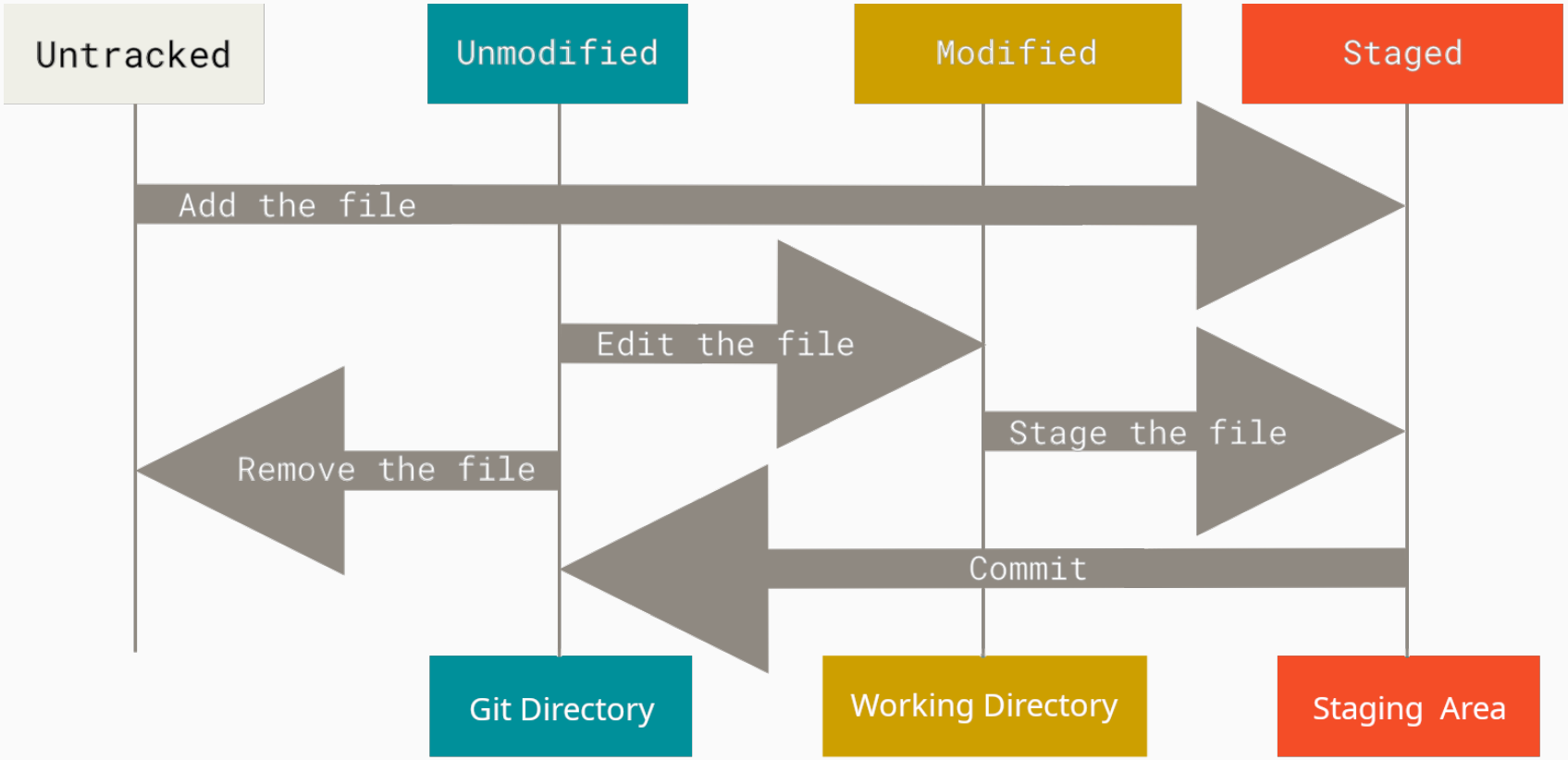

Figure 6: Life cycle of a file in a git repository

Using git

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- Git is an open source software, and can be installed easily via many package managers.

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```
git config --global user.name ``<NAME>"
git config --global user.email <EMAIL>
```

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```
git init <DIR>
```

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- These can be new files, or files that have been edited and are in a modified stage.
- Moves files from the working directory to the staging area.
- the flag of `--a` or `-all` can be added to stage all files. This can be bad as we should not track files that are dynamic, i.e. log files, result files, config files, etc.

```
git add [<files>][-A]
```

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- This will take a snapshot of the file.
- Information related to the commit is also stored in the git directory, i.e. name of files, date and time, author, and commit message.
- You need to include a commit message when commiting. Can be done in the command line as shown, or in the default text editor if `-m '<MESSAGE>'` is not included.

```
git commit -m '<COMMIT MESSAGE>'
```

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- GitHub is a common choice, although there are alternatives.
- A local repository can be pushed to a remote repository to upload the commits from the local git repo.
- **Everything mentioned previously has been local. A remote repository is not needed for version control.**

Git - Other Concepts

Branching: Allows for a seperate environment where changes can be made without risking the codebase. Can be merged with the main branch to implement changes.

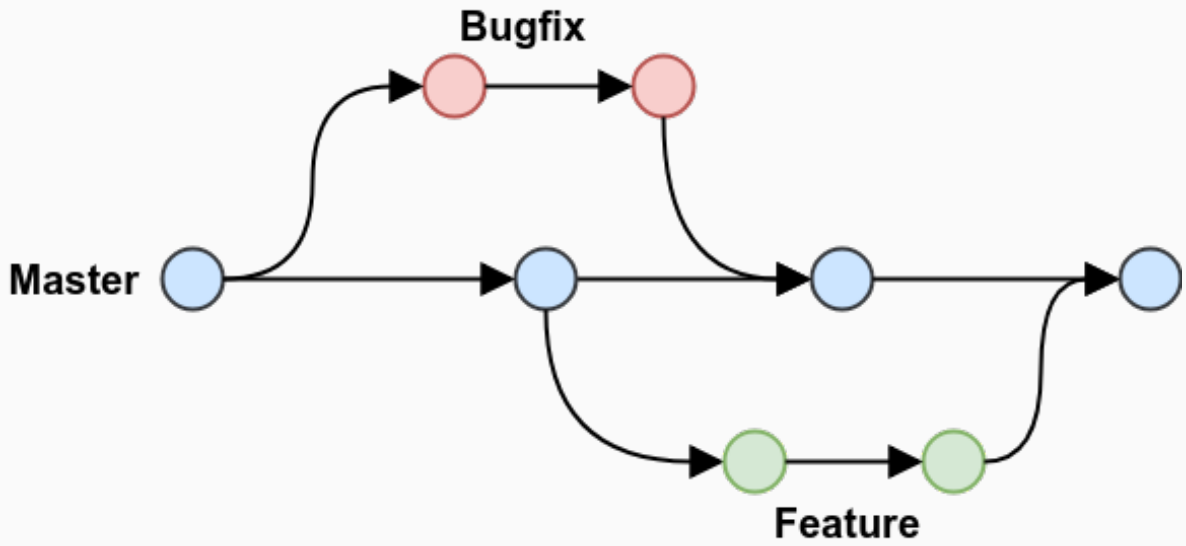

Figure 7: Branching of git repository.

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- Revert: To revert to a previous commit, `git revert` creates a new commit that undose the previous commit.
- Stashing: This command saves the state of the working directory, but reverts to the last commmit. Used as a way of getting a clean directory.

Using Git - Summary

What commands do I need?

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To get basic functionality from git, commands to maintain the basic git life cycle are only needed. Generally, remember to following:

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git commit -m "<COMMIT MESSAGE>"
git push
```

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