Using Git for Science

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PSY6422

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Find this at: https://github.com/ABRG-Models/GitTutorial

Introduction

- This session is about a command-line tool called Git.
- Git is a tool for managing text, so these slides are naturally text heavy!
- We'll use it with the help of a website built around Git: github.com
- I'll give an overview of Git, including its jargon (clone,commit,checkout...) and why it's such a useful tool, then we'll go through some example tasks together.

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1. Revision control allows you to have different versions of a single file without having to explicitly make copies
2. Most revision control tools allow several people to work on the same files

File versions

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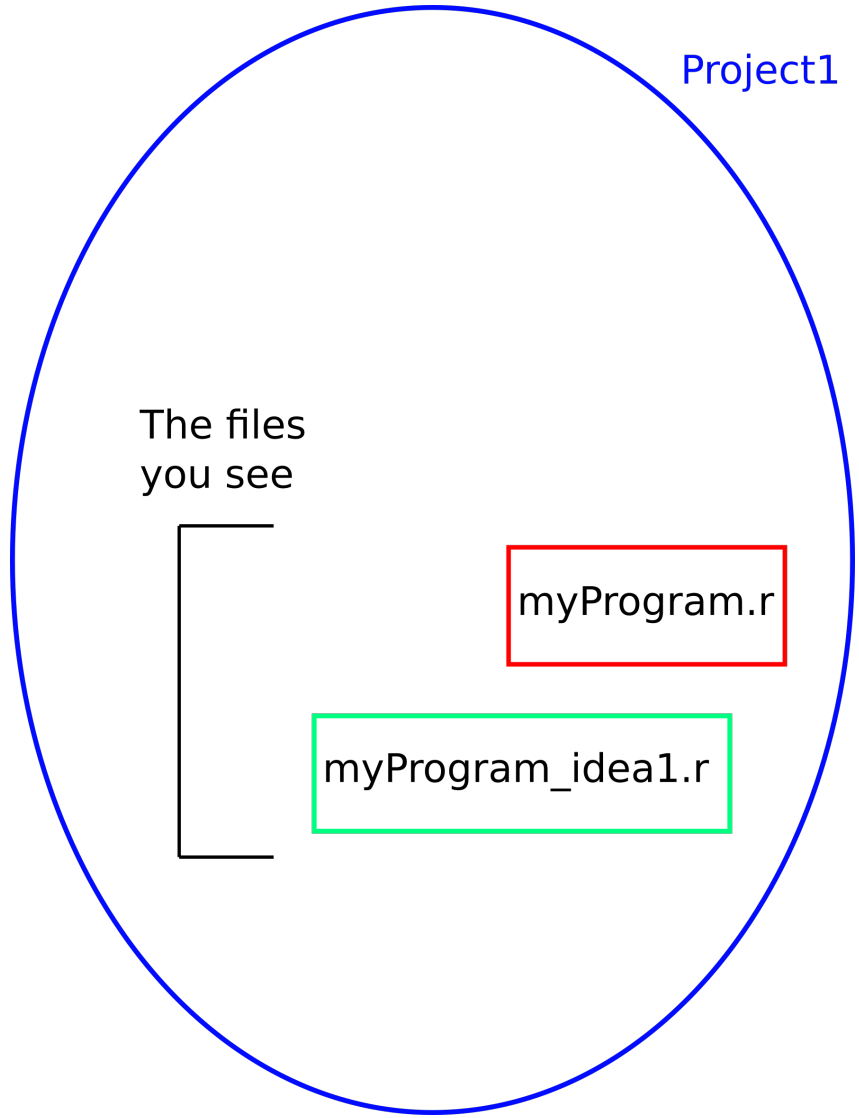
With revision control, you only have

- Project1/myProgram.r

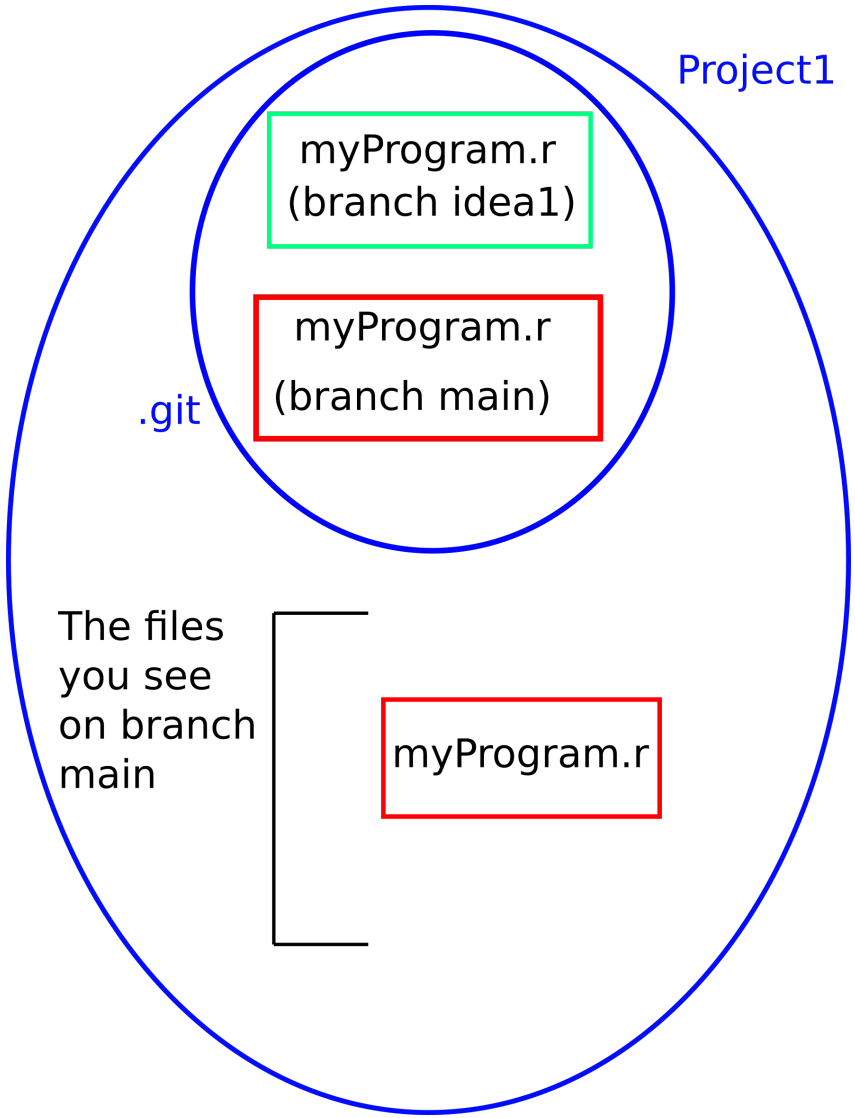
File versions

- Ellipses are folders (aka directories)
- Boxes are files



A file with a view

- Git presents a view of the file
- Versions of the file not being viewed are stored away (in .git)



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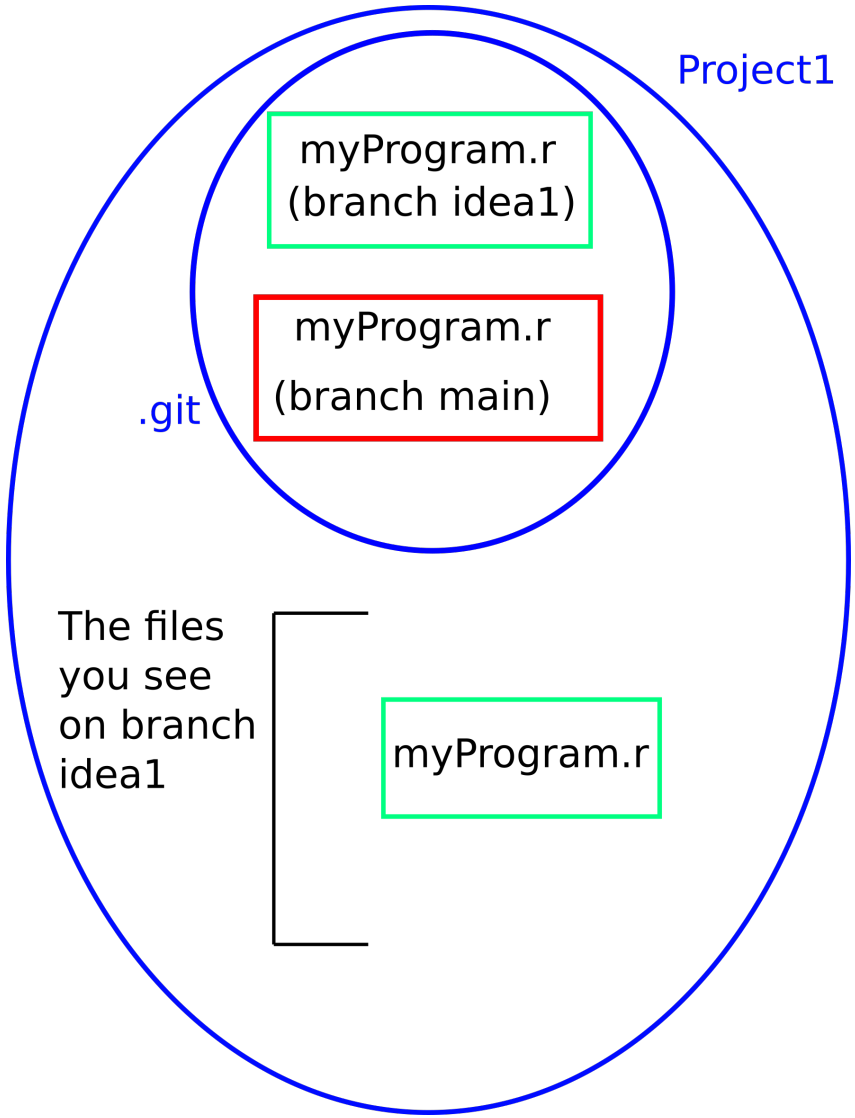
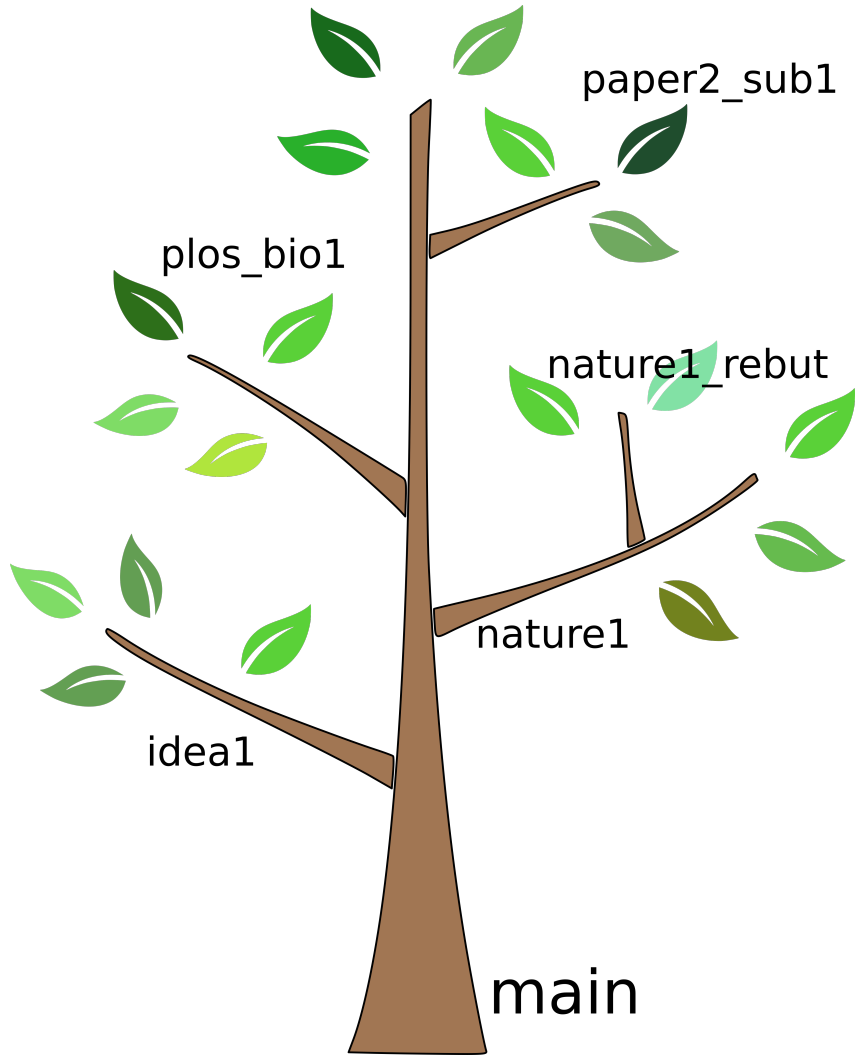


Branches instead of file versions

When you use git, you use branches to work with different file versions. There's one central branch, which is usually called **main**.

Clone

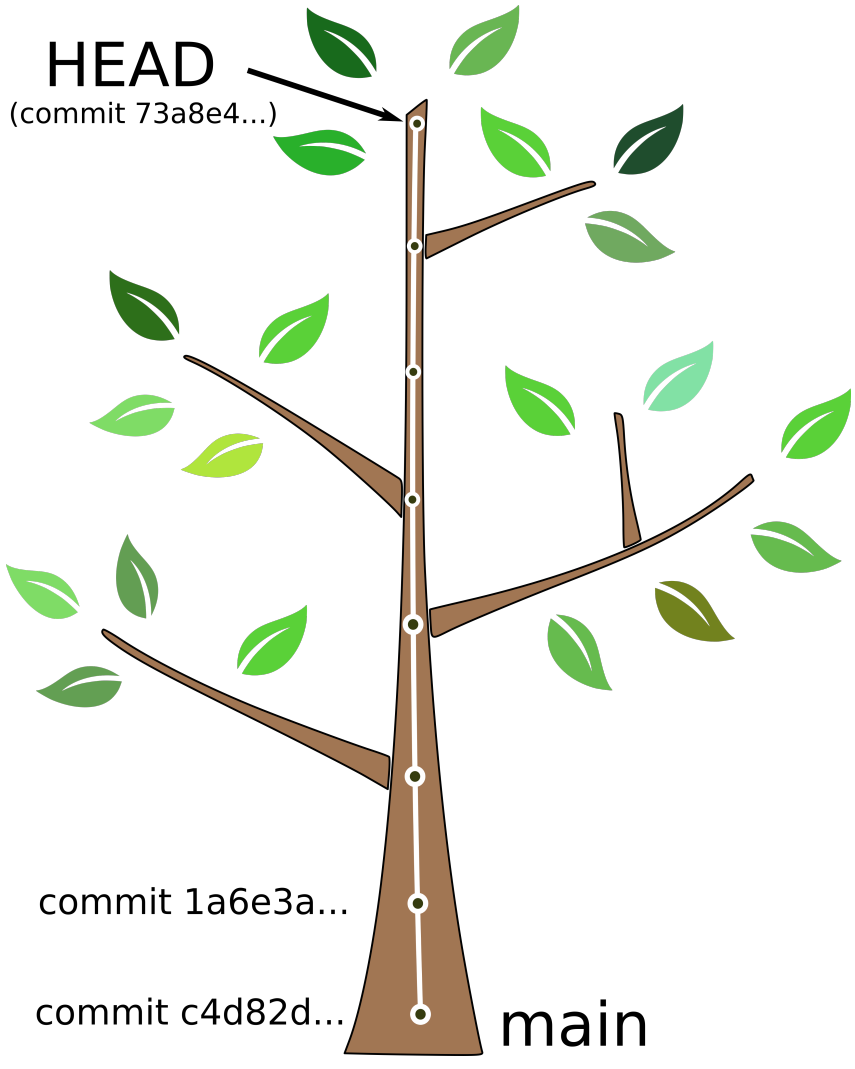
- When you clone a repository from github, you'll get all **myProgram.r** as it exists on the **main** branch
- Also you get all the information needed to see **myProgram.r** on any of the other branches (each has a name)



A sequence of changes on main

Commits

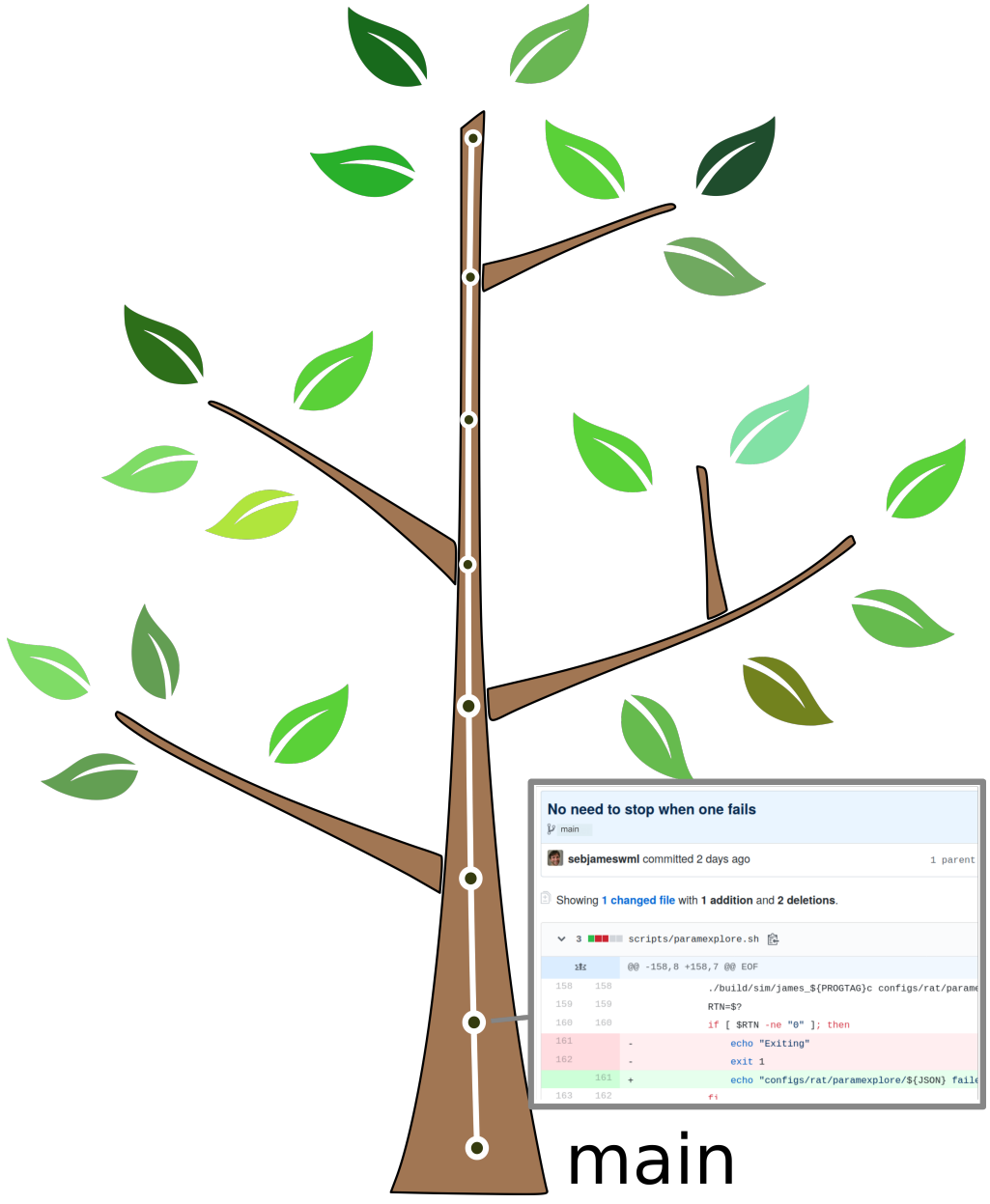
- There can be different versions of myProgram.r available on **main**; but it's a sequence of changes.
- Each change is a commit to main.
- Each commit has a universally unique identifier.
- When you first clone, you'll see the files at the HEAD of **main**



What's in a commit?

Commits contain changes

- One commit can include the changes to one file
- One commit can also include changes to multiple files
- Each commit has a commit message

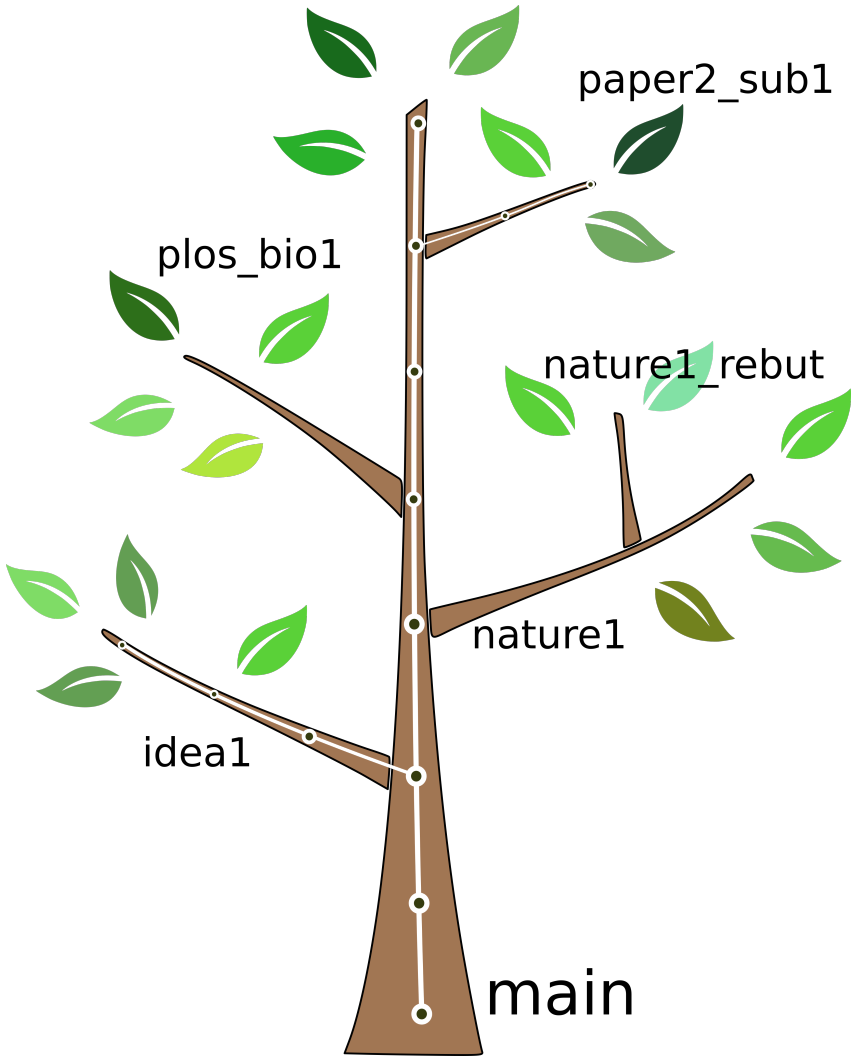


Checkout a branch

Checkout

When you checkout a branch, it updates your file to the content it has on that particular branch

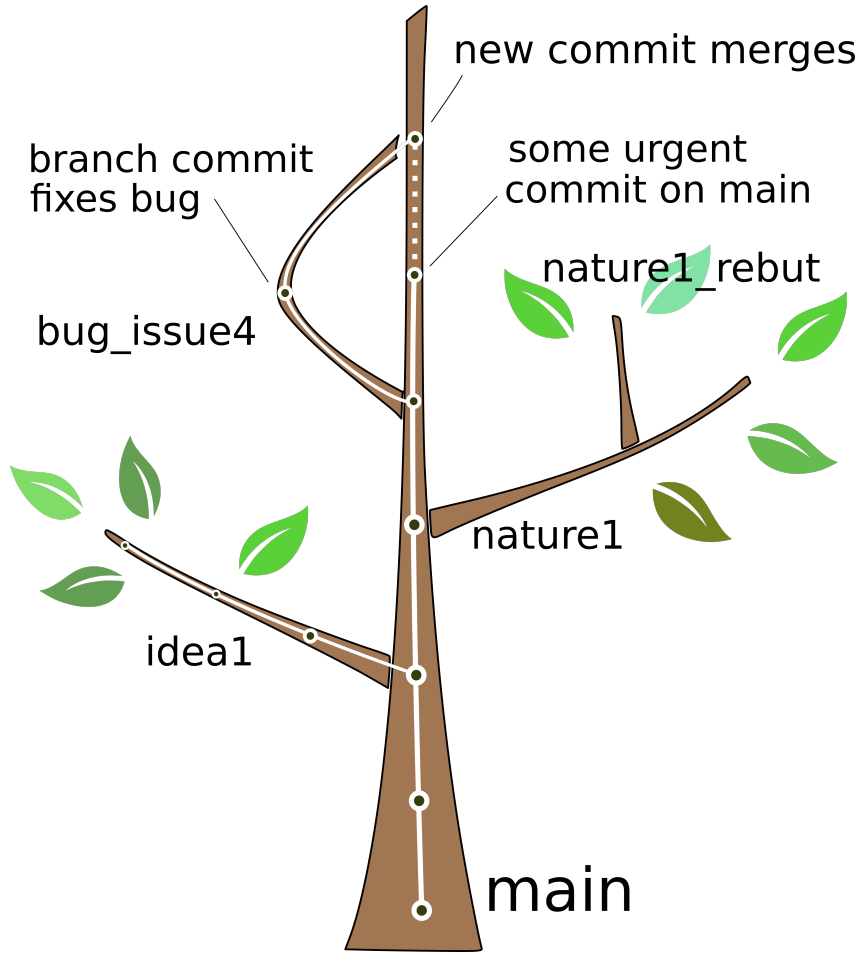
- Checkout **idea1**; get myProgram.r with the code for your first idea.
- Checkout **paper2_sub1**; get myProgram.r as it was when you submitted your second paper based on the project.



Merge a branch

Here's where the tree analogy begins to break down a little.

- Here, a bug was fixed on **bug_issue4**. While that was happening, someone committed an important commit onto main
- To bring the bug fix into main, the **bug_issue4** branch is merged into **main** which creates its own commit



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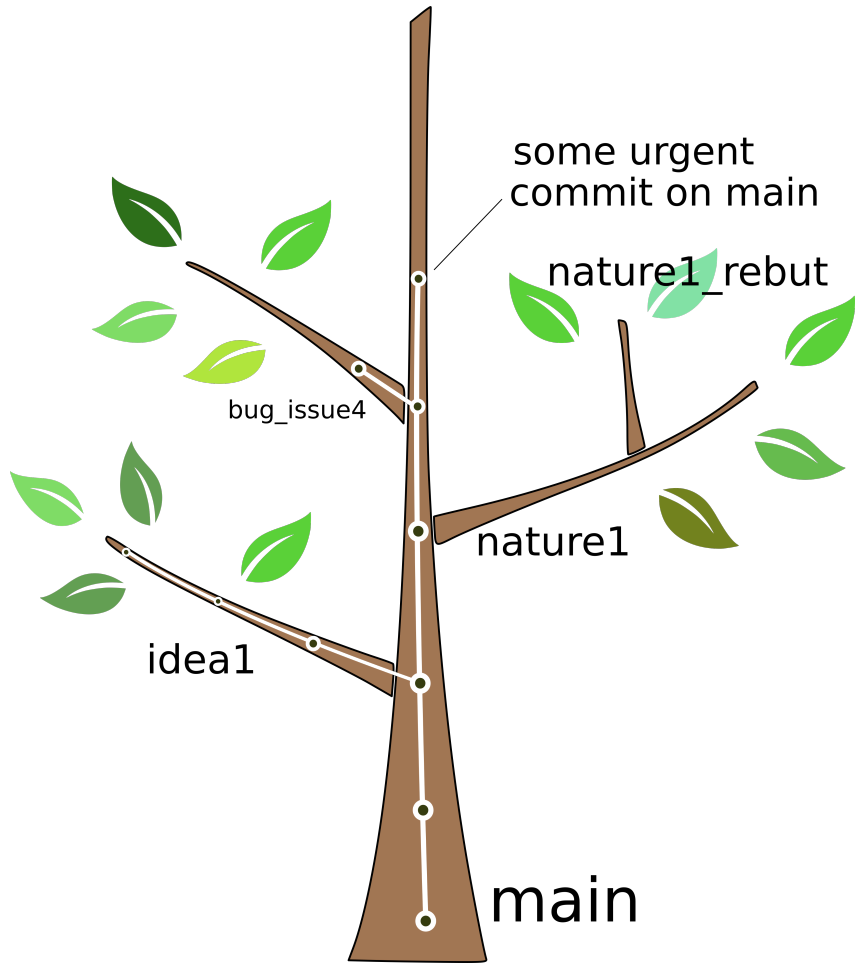
Rebase means get out the saw

The developer of the bug in **bug_issue4** wants to test the bug fix works alongside the urgent commit.



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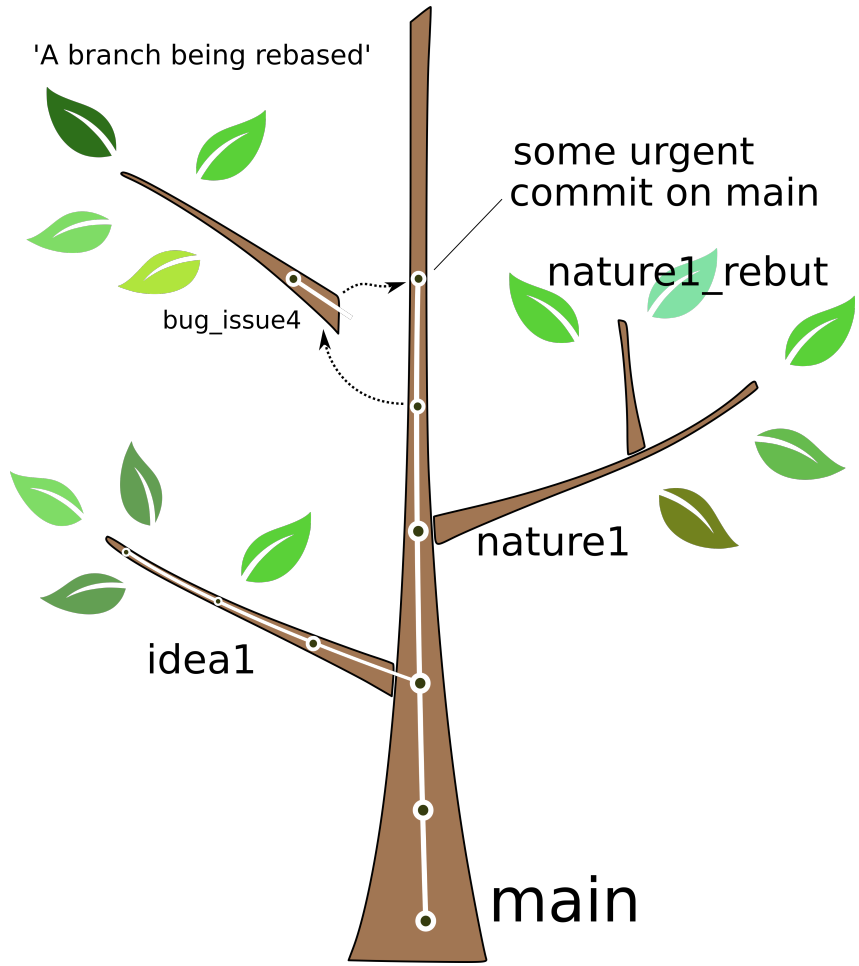

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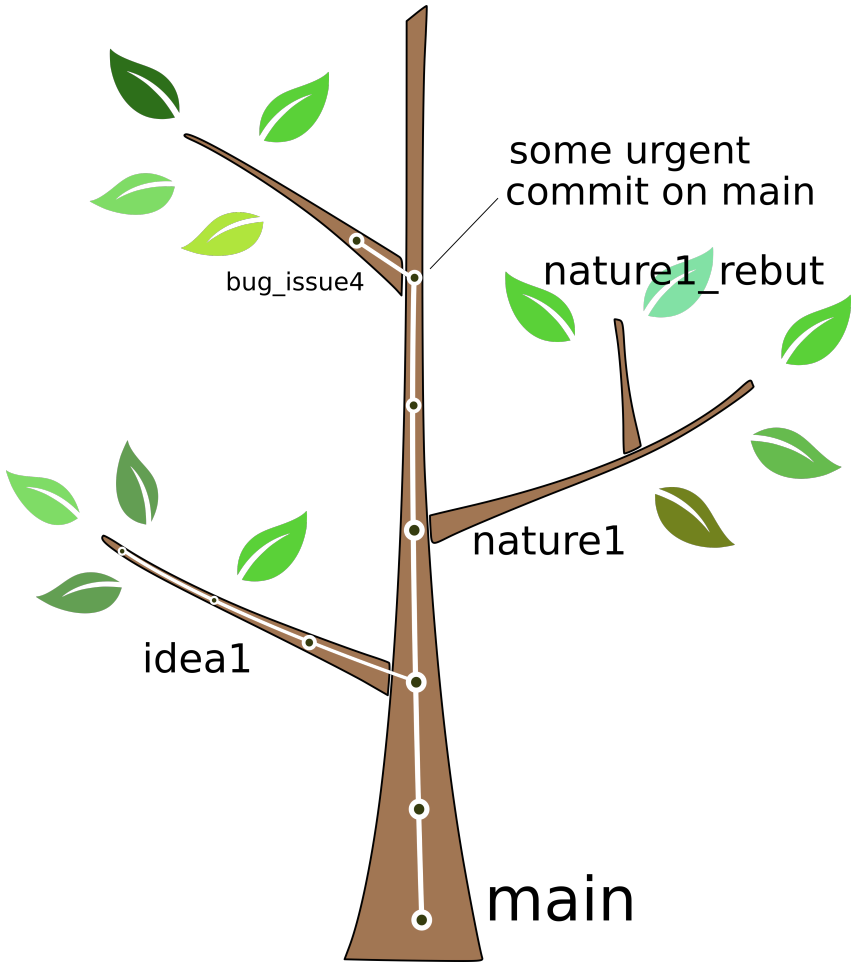
- Git has a way to 'saw off' the branch **bug_issue4** and 'glue it back onto main'
- Now the bug can be tested, alongside the recent change in **main**, before it is then merged into **main**.
- Prefer merge over rebase



Working with other people

This is ‘main feature 2’. Now, rewind a little, forget the trees, and think about working with a set of plain files on your computer.

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- Just after you emailed them, you find an error in your fix, and you have to send another email...
- Now imagine that one of your colleagues found a separate fix in the same file and emails that around. Which fix is more important? Who is going to merge the two fixes together?

This is where a central copy of the repository becomes important.

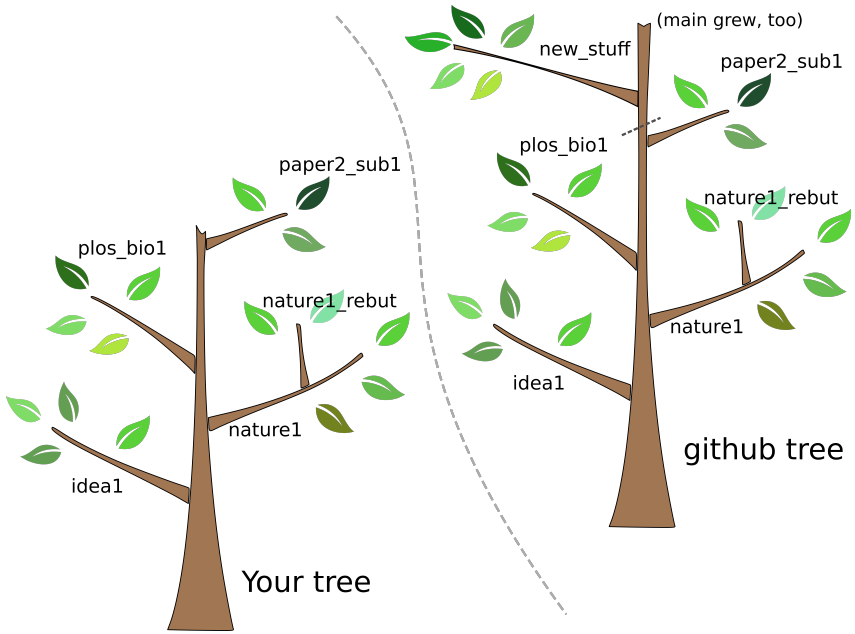
Fetch and pull

Now imagine there is a shared tree living at github.com.

Fetch

When you fetch new changes to the repo, information about new branches and commits that were added are copied into your local copy of the repo.

- Any of the existing branches could have extended
- New branches could have appeared
- You can pull a branch and that will always do a fetch first



Push your commits

You worked on a new feature, using a new branch. You changed some existing files and added some new ones. You're ready to copy that back to github.com.

Push

The process of copying new commits and branches as achieved with git push.

- You make sure you have committed your changes to your branch
- You push your branch to the online repository (i.e. github)
- If there are changes on your branch on the online repository that you don't have yet, then you'll have to pull first, merge changes and then push.

Other revision control systems

Git is not the only game in town. Others include:

- RCS (Revision Control System)
- SCCS (Source Code Control System)
- CVS (Concurrent Versions System)
- Subversion
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Git is not the first revision control system, and its developers could draw on a lot of collective knowledge when designing it.

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- In 2005 Linus fell out with BitMover Inc., and Git was created to replace it (and so all was well again in the world of free software OS development - git is fully free).
- The name git doesn't really mean anything.

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- It also means you can 'fork' a repository
- Typically you will work with a common remote repository (github) as your upstream source.

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- It's now a big business; it was acquired by Microsoft in 2018

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- You can include your paper (and your data) alongside your model code in a single, public repository
- Use of Github is a very effective way to share your published models with your peers

The rest of the session

- Create repository on github, clone, add something
- git add, git move, git remove, git branch -D etc
- git checkout -b newbranch
- Github READMEs and markdown
- Github issues
- doxygen and codedocs.xyz
- Demonstration of branches for papers (BarrelEmerge)

For a good hands-on tutorial, head over to:
http://sebjameswml.github.io/git-novice/
or try the more up to date version of that 'Software Carpentry' resource at:
http://swcarpentry.github.io/git-novice/