Outline

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Version Control Introduction

Troy C. Haskin

University of Wisconsin–Madison

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1. Motivation
   - Paper Example
   - Other Examples
2. Version Control System
   - Introduction
   - How it Works
3. Git and GitHub
4. End

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Paper Workflow

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A typical workflow of writing a paper:

- Start with an idea/outline
- Make a draft
- Proof
- Edit
- Repeat until done

Workflow Shortcomings

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Individual paper:

- Forget what changes were and were not made
- Make big changes but like the way it was
- Want to use the material again but alter for a different audience, journal, etc.

Group paper:

- Don't know what changes were and were not made
- Not sure what version of the paper you or others have
- Not sure who or what was added to the version in-use

Solution

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A common solution not using a version control system (VCS):

- Make a new directory and name appropriately
  - `NuclearEngineeringAndDesign`
  - `AnnalsOfNuclearEnergy`
- Make a new copy of the file and name it something different
  - `AwesomePaper-Draft1.docx`
  - `AwesomePaper-AdvisorsNotes.docx`
  - `AwesomePaper-Draft2NeedCitations.docx`
  - `AwesomePaper-Final.docx`
  - `AwesomePaper-FinalAdvisorNotes.docx`
  - `AwesomePaper-FinalFinal.docx`

Solution Shortcomings

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- Proliferation of files and directories
- No automatic list of changes; "proper" naming attempts to correct this (e.g., `Draft2NeedCitations`)
- Ability to go back to an earlier version would complicate naming
- Collaboration issues still not addressed

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RELAP/MELCOR Inputs:

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- Build the model by slowly adding control volumes and heat structures
- Adjust geometry input as more information becomes available
- Correct issues as they're discovered
- Might break things and need to find a older, working version
- **Re-use the input for multiple different simulations or numerical experiments**

Writing Programs

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- Start simple and add more functionality
- Fix bugs as they're discovered
- Might break things and need to find a older, working version
- Someone else might want to leap off of the work already done but apply it differently

Same Problems

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- These examples, and many more, all have the problems presented by the paper example.
- The problems only become worse as the work becomes larger or more people become involved.

What's the solution?

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What is it?

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Definition A system that records changes to a file or set of files over time so that you can recall specific versions later. [src]

Features:

- Revert a file or an entire project back to a previous state
- Review changes made over time
- See who last modified something
- Create an off-shoot from a current project state (branching)
- Create a brand new project from a current project (forking)
- Work locally and save to an online system (distributed systems)

Advantages / Disadvantages

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Advantages

- History of the project is automatically cataloged
- All versions of the project are saved and ID-ed automatically
- Line-by-line and person-by-person reviewable history.

Disadvantages:

- Can't see line-by-line changes for binary files (e.g., `docx` or image files)
- Not good for saving humongous files (large binary data files shouldn't be versioned)
- Requires discipline and effort to log and sync changes
- Becomes much, much more complicated for larger projects (not a worry for us)

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Definitions (Examples to follow)

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Repository A directory that holds all project files and VCS information.

Commit A submission of changes from the user to the VCS; this creates a new version and saves the previous state in the history

Commit Message A short/long description of the changes present in the commit.

Branch A new, separate line of history starting from a certain version; changes can be made to a branch without affecting what it was branched from

Diff A comparison of two files with line-by-line differences highlighted

Sync/Push A synchronization of a local repository with a non-local one

History/Commit Example

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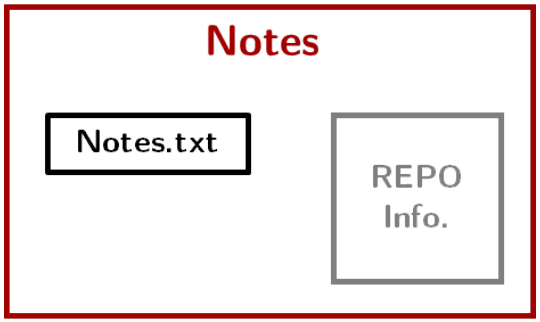
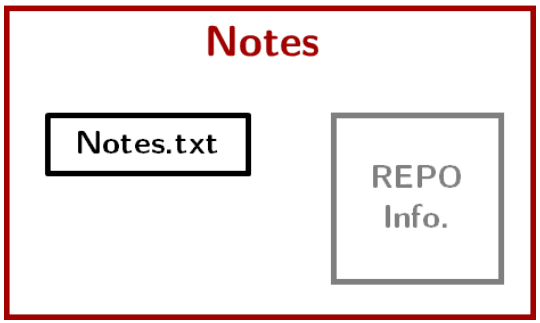
Create repository called "Notes".



Add a new file Notes.txt



History:

REPO Info. initially empty

History/Commit Example

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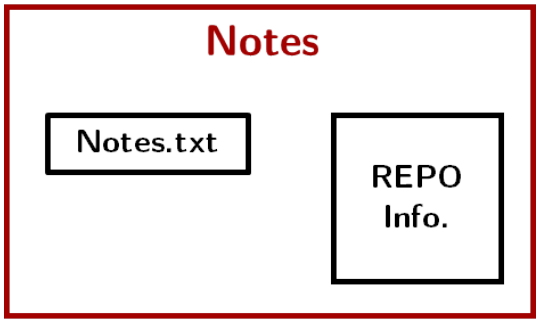
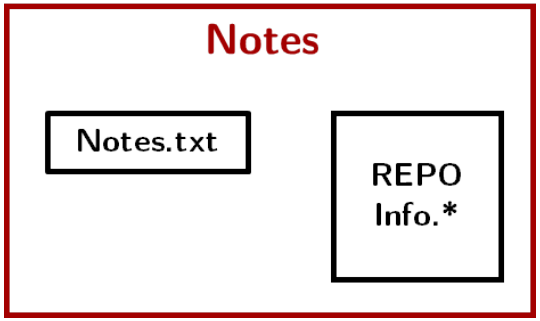
Commit new file to VCS.



Add a new note to file.



History:

1. 'Notes.txt' created.

History/Commit Example

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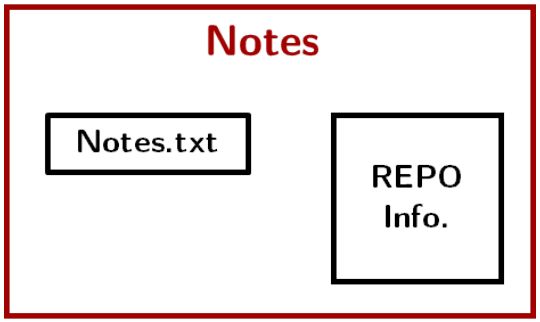
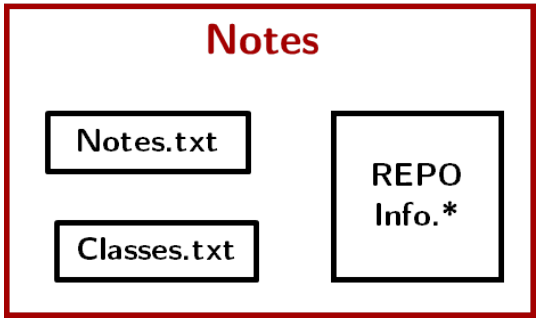
Commit new line to VCS.



Add a new file.



History:

1. 'Notes.txt' created.
2. Added new note to 'Notes.txt'.

History/Commit Example

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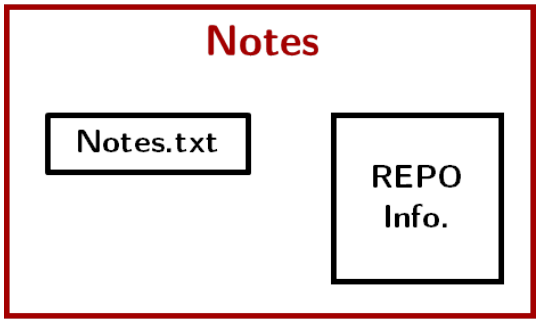
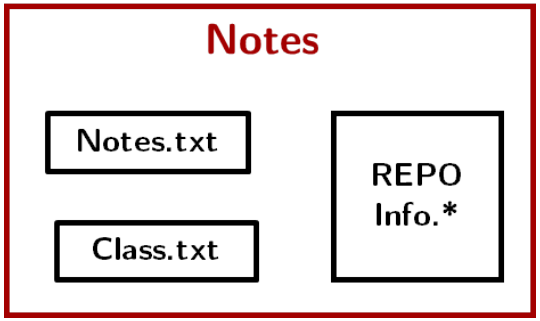
Commit new file to VCS.



And so on ...



History:

1. 'Notes.txt' created.
2. Added new note to 'Notes.txt'.
3. Added new file 'Classes.txt'.

History of This Presentation

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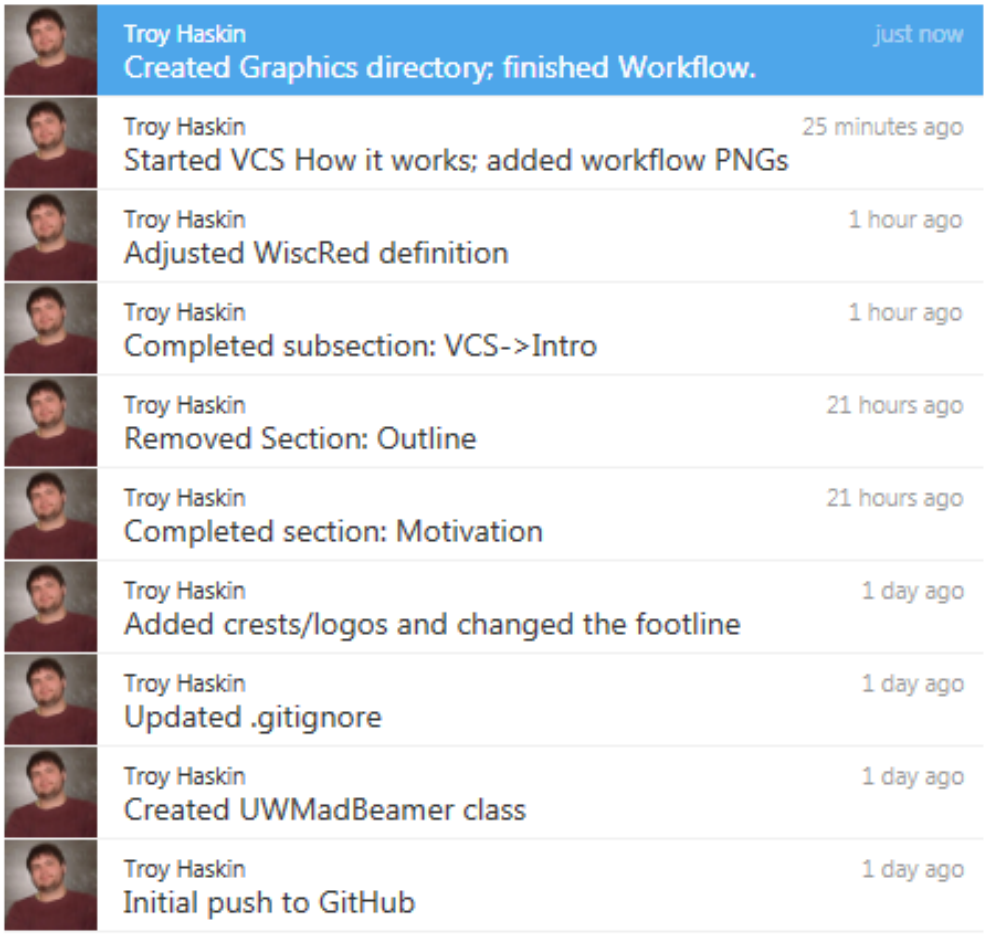
History



Branching Example

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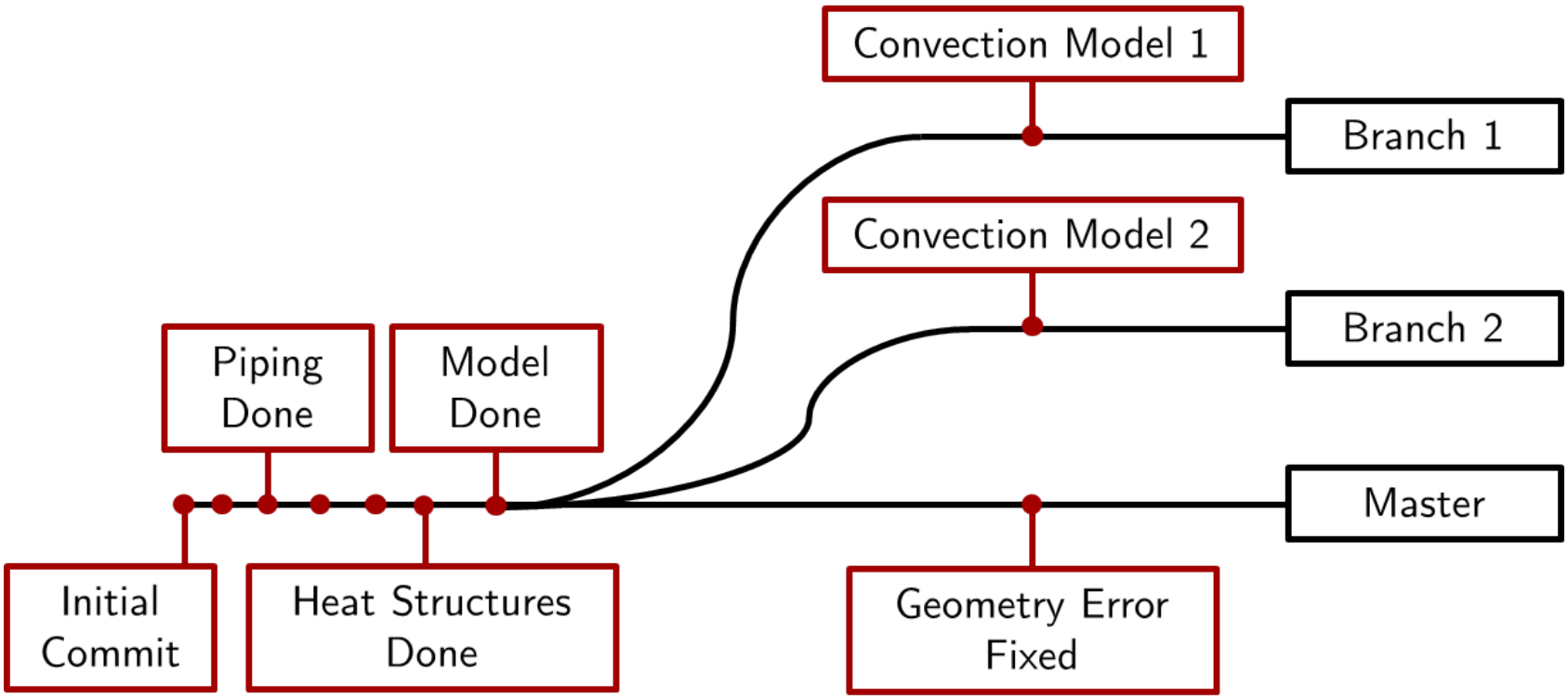
Branches share a common ancestor but can have different histories after the branch commit.



Merge Example

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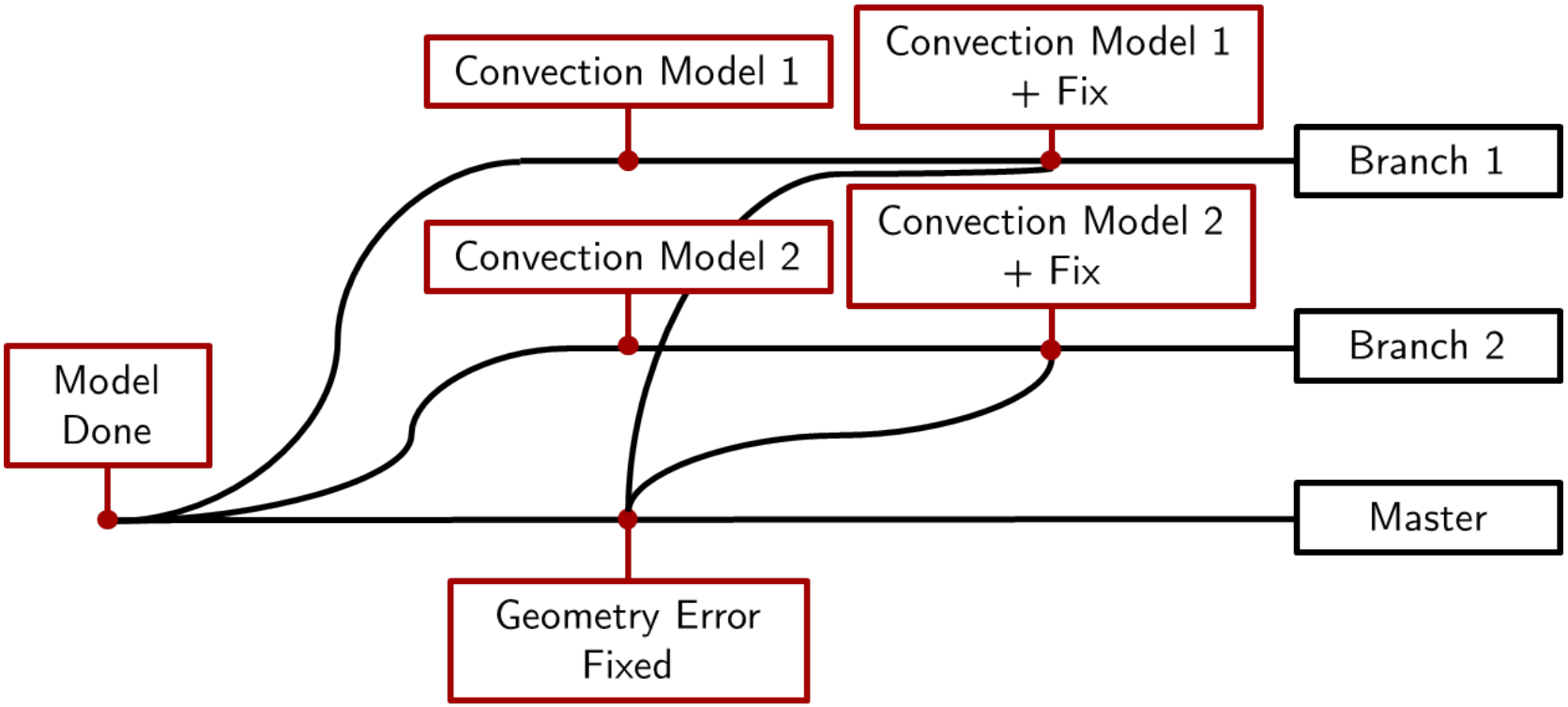
It is possible to merge histories in branches but can lead to (mismatched or ambiguous histories that require resolution).



Ignoring Files

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As was stated before, versioning large binary files is not good practice. Large restart or plot files should be stored elsewhere.

In order to accomplish this, all VCSs have a manner of ignoring files.

For Git, what we will cover next, it involves editing the `.gitignore` file.

That's it

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And that covers the broad introduction.

There is more, of course, but that will wait for later.

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The Program and the Website

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Git My VCS program of choice; created to manage one of the largest collaborative projects in history — the Linux Kernel.

GitHub A website the allows online hosting of repositories and uses Git as its VCS. Public repositories are completely free; private repositories cost money.

GitHub Applications

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GitHubWindows An application for Windows 7/8 that syncs repositories between a computer and GitHub

GitHubMac An application for OSX 10.7+ that syncs repositories between a computer and GitHub

Both programs allow for creation, commits, branching, merging, and more.

My GitHub For Windows

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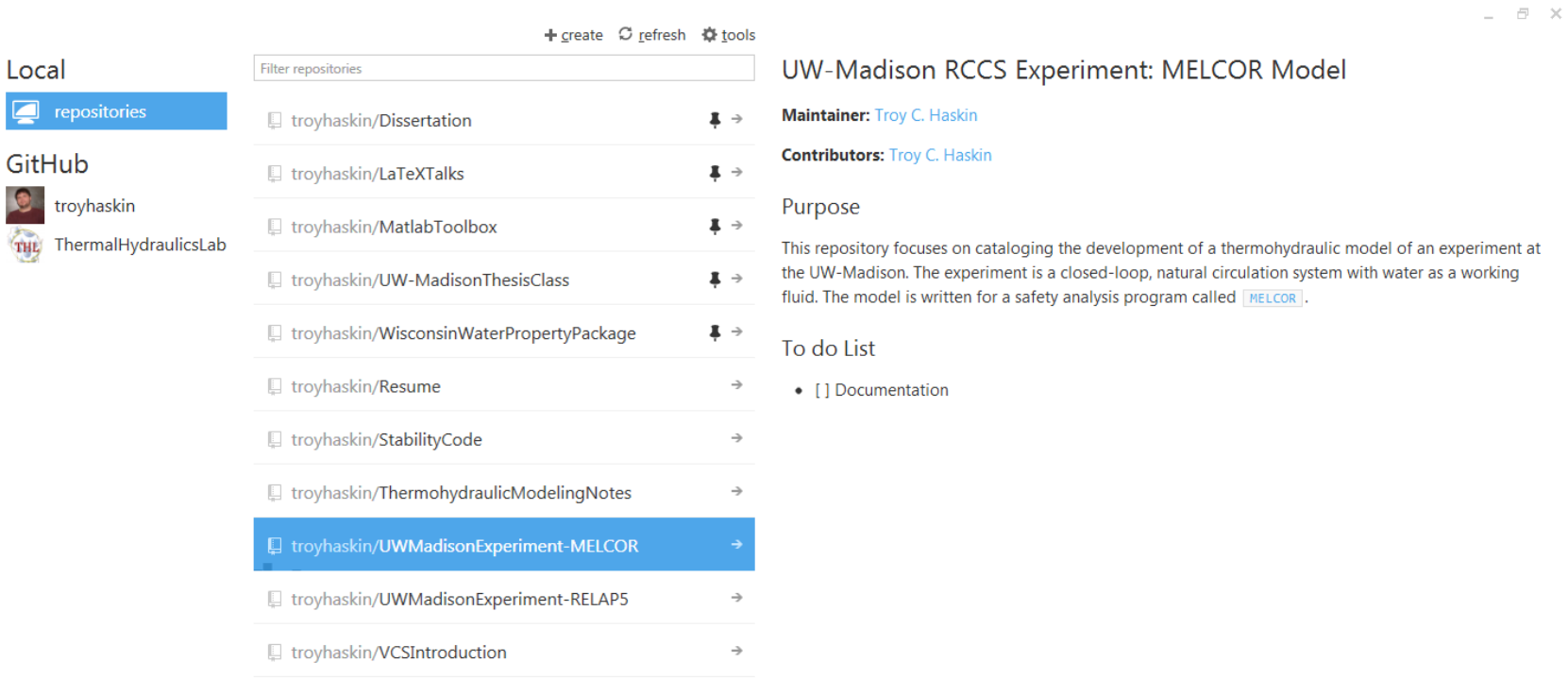

My GitHub For Windows

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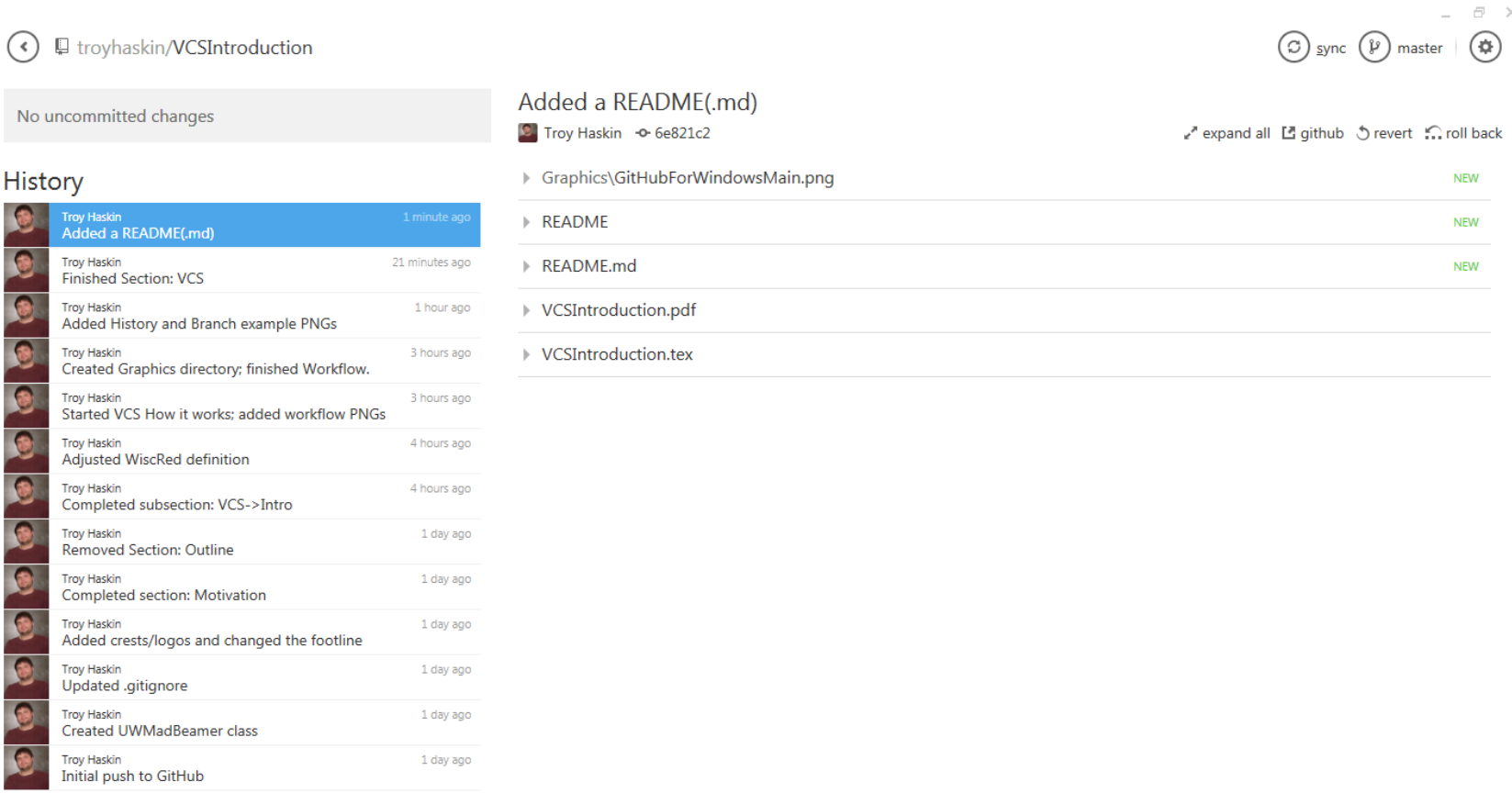

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Thank You!

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Links:

- Troy's GitHub Page
- THL's GitHub Page
- GitHubWindows
- GitHubMac
- RELAP/MELCOR `.gitignore` file