



NHERI SIMCENTER PROGRAMMING BOOTCAMP

JULY 30 THROUGH AUGUST 3, 2018, AT UC BERKELEY'S RICHMOND
FIELD STATION

- **VirtualBox**
- **Unix Basics**
- **Using GitHub**

CONFIGURING YOUR VIRTUAL MACHINE

■ Do You need the VirtualBox provided with this course?

- NO, but it is highly recommended on Windows and MacOS.
- The virtual machine is ready to use without extra install

■ What if I do not want to use VirtualBox?

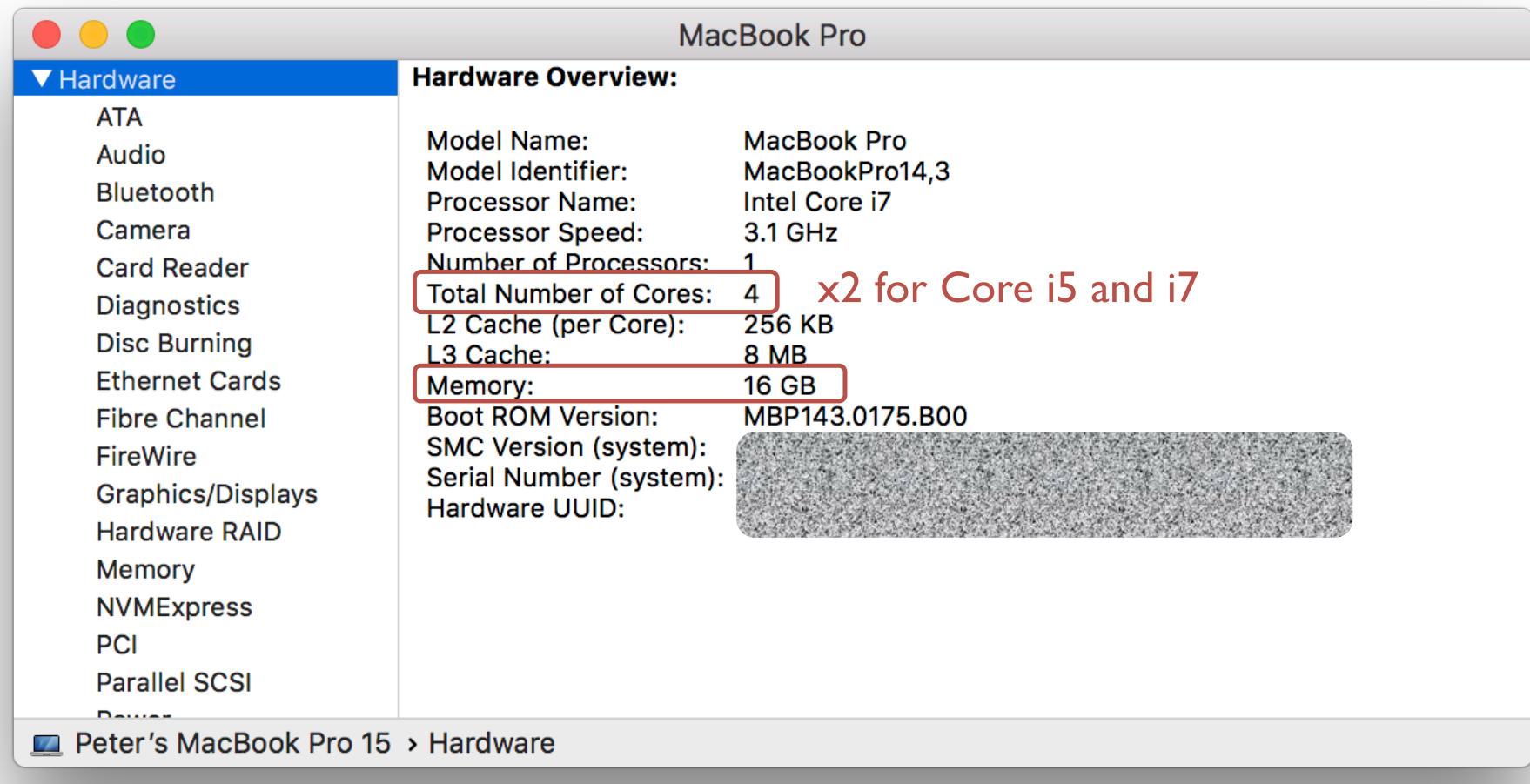
■ You need to install

- Developer tools (compiler, debugger, make utilities, git utilities)
- Python3, numpy, scipy, matplotlib
- PyCharm CE or VS Code or a decent editor

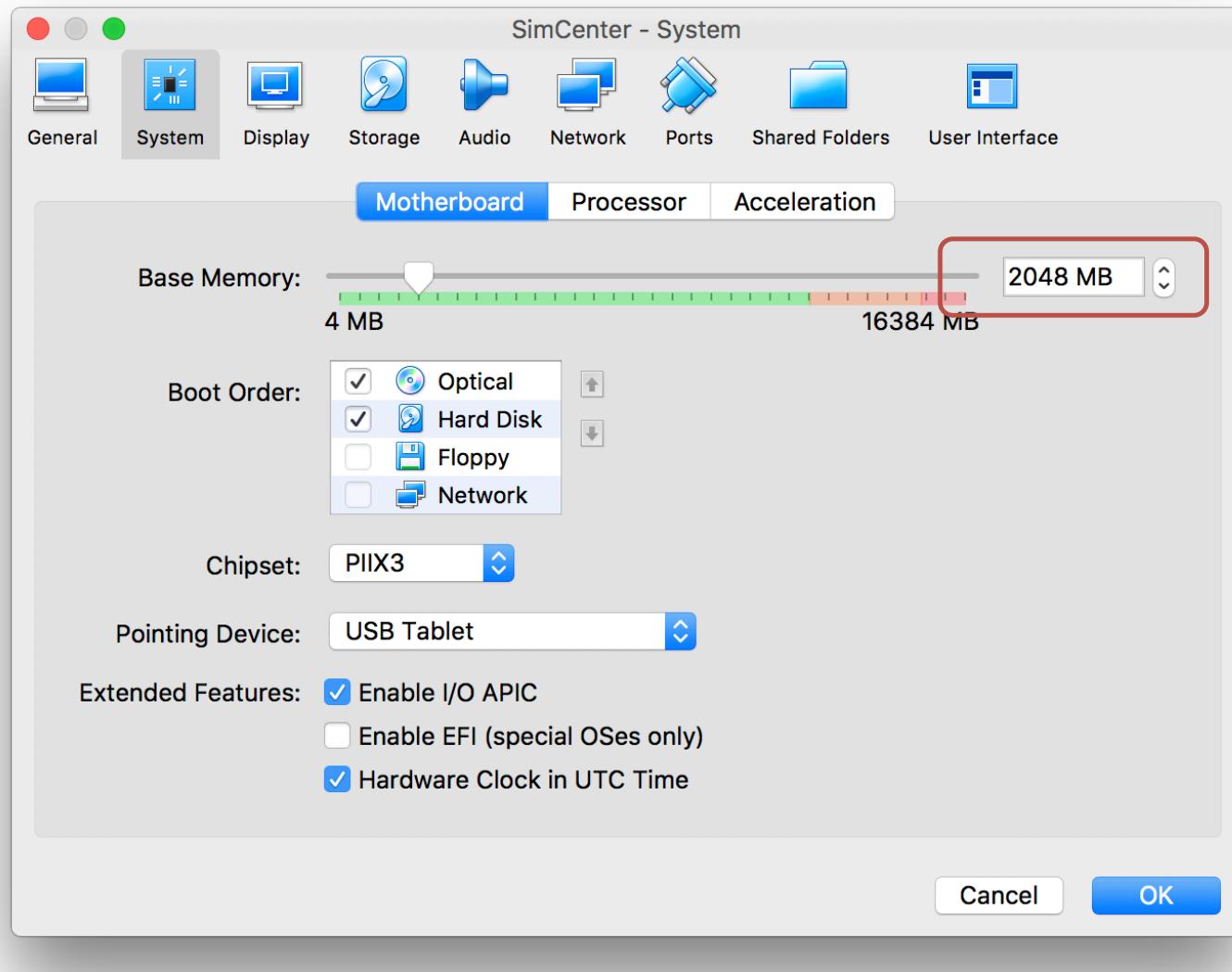
■ **We cannot support and service every private configuration, so you need to work a bit more on your own if you take this route.**

CONFIGURING YOUR VIRTUAL MACHINE

- Check your system resources (Option-apple-system info OR settings system (?))



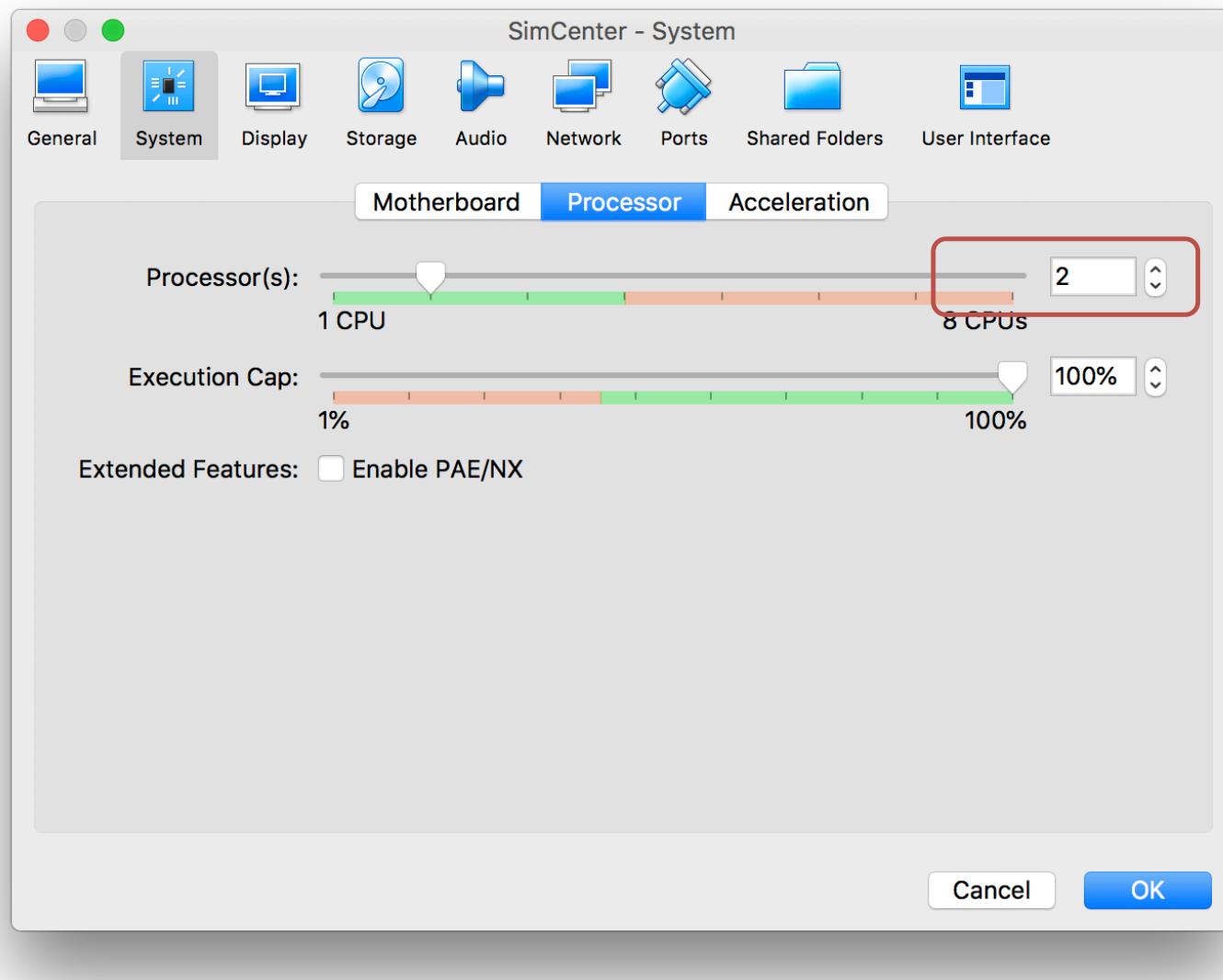
CONFIGURING YOUR VIRTUAL MACHINE



Half of your physical memory.

≥ 4096 MB,
if available

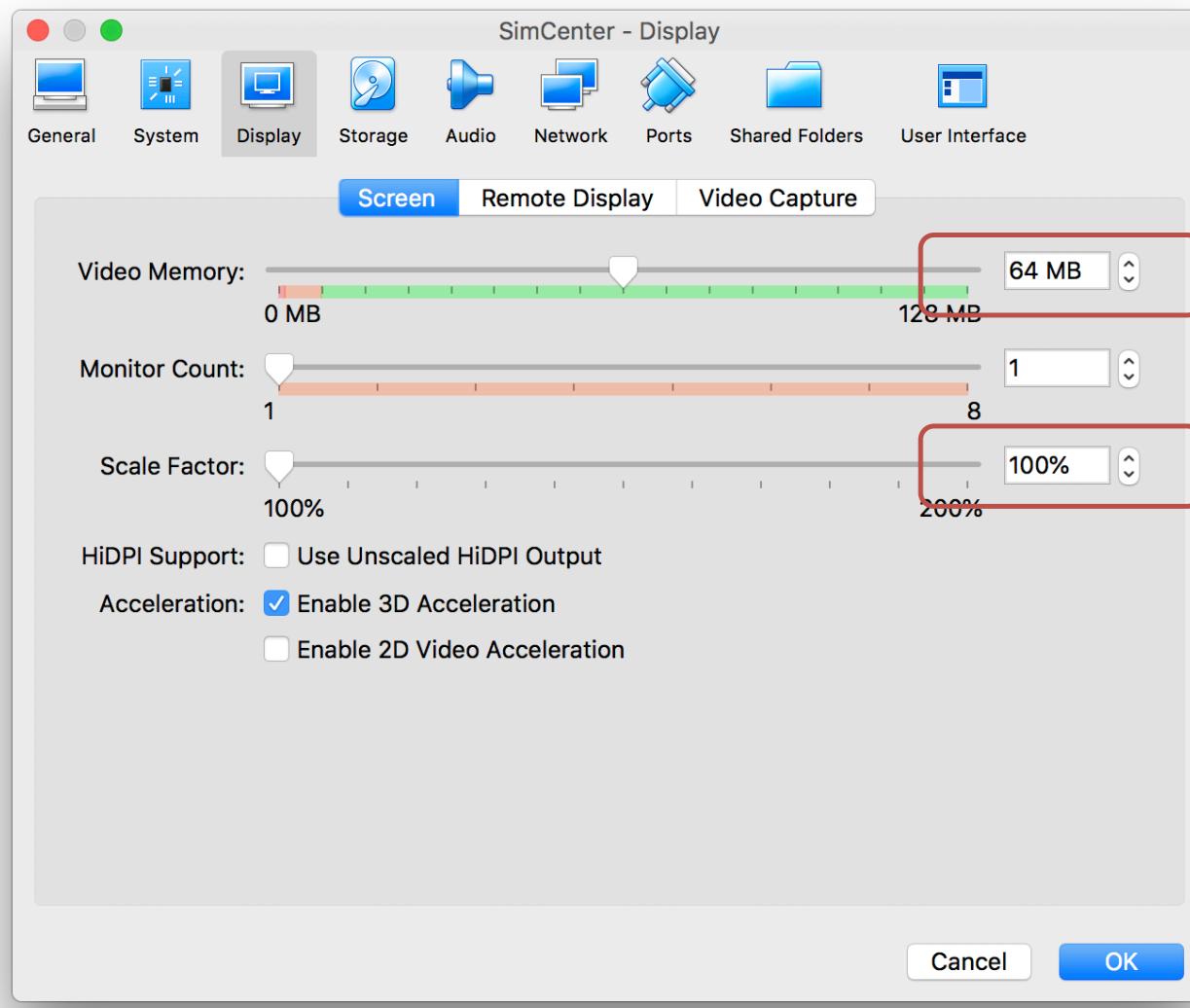
CONFIGURING YOUR VIRTUAL MACHINE



Half of your physical threads
(=cores * 2
for i5 and i7)

≥ 2 ,
4 if available

CONFIGURING YOUR VIRTUAL MACHINE



\geq half of
your physical
memory.

Set to 200% on
Windows laptops
with high
resolution displays.
(fixes tiny fonts)

USING THE UNIX COMMAND LINE

■ Start a terminal:



■ Command prompt:

A screenshot of a terminal window titled "simcenter@SimCenter-VirtualBox: ~". The window has a dark theme with a red border. The title bar shows the user's name and host. The menu bar includes "File", "Edit", "View", "Search", "Terminal", and "Help". The command line prompt "simcenter@SimCenter-VirtualBox:~\$" is visible at the bottom of the window. The main area of the terminal is currently empty, showing a dark gray background.

USING THE UNIX COMMAND LINE

■ \$ ls

```
simcenter@SimCenter-VirtualBox:~$ ls
Desktop Documents Downloads Music Pictures Public Qt Templates Videos
simcenter@SimCenter-VirtualBox:~$ █
```

■ \$ ls -l

```
simcenter@SimCenter-VirtualBox:~$ ls -l
total 36
drwxr-xr-x 2 simcenter simcenter 4096 Jul 11 19:36 Desktop
drwxr-xr-x 3 simcenter simcenter 4096 Jul 22 21:42 Documents
drwxr-xr-x 2 simcenter simcenter 4096 Jul 11 22:39 Downloads
drwxr-xr-x 2 simcenter simcenter 4096 Jul 11 19:36 Music
drwxr-xr-x 2 simcenter simcenter 4096 Jul 11 19:36 Pictures
drwxr-xr-x 2 simcenter simcenter 4096 Jul 11 19:36 Public
drwxr-xr-x 8 simcenter simcenter 4096 Jul 11 22:42 Qt
drwxr-xr-x 2 simcenter simcenter 4096 Jul 11 19:36 Templates
drwxr-xr-x 2 simcenter simcenter 4096 Jul 11 19:36 Videos
simcenter@SimCenter-VirtualBox:~$ ll
```

USING THE UNIX COMMAND LINE

■ Getting help:

■ \$ man ls

■ Getting help on the man command?

■ \$ man man

```
LS(1)                               User Commands                         LS(1)
NAME
    ls - list directory contents
SYNOPSIS
MAN(1)                               Manual pager utils                  MAN(1)

NAME
    man - an interface to the on-line reference manuals
DESCRIPTION
SYNOPSIS
man [-C file] [-d] [-D] [--warnings[=warnings]] [-R encoding] [-L locale] [-m system[,...]] [-M path] [-S list] [-e extension] [-i|-I] [--regex|--wildcard] [--names-only] [-a] [-u] [--no-subpages] [-P pager] [-r prompt] [-7] [-E encoding] [--no-hyphenation] [--no-justification] [-p string] [-t] [-T[device]] [-H[browser]] [-X[dpi]] [-Z] [[section] page[.section]] ...
man -k [apropos options] regexp ...
man -K [-w|-W] [-S list] [-i|-I] [--regex] [section] term ...
man -f [whatis options] page ...
man -l [-C file] [-d] [-D] [--warnings[=warnings]] [-R encoding] [-L locale] [-P pager] [-r prompt] [-7] [-E encoding] [-p string] [-t] [-T[device]] [-H[browser]] [-X[dpi]] [-Z] file ...
man -w|-W [-C file] [-d] [-D] page ...
man -c [-C file] [-d] [-D] page ...
man [-?V]

Manual page man(1) line 1 (press h for help or q to quit)
```

NAVIGATING THE FILE SYSTEM

■ Changing directories (folders)

■ `$ cd DIR_NAME`

■ Creating a directory

■ `$ mkdir DIR_NAME`

■ Deleting an empty directory

■ `$ rmdir DIR_NAME`

Remarks:

- Space separates keywords
- DO NOT use space in filenames
- Space in filename or directory name needs to be quoted:
 - “My Folder”
 - My\ Folder

WORKING WITH FILES

- Creating an empty file
 - `$ touch FILE_NAME`
- Copying an existing file
 - `$ cp SOURCE_FILE_NAME TARGET_FILE_NAME`
- Deleting an existing file
 - `$ rm FILE_NAME`
- Renaming a file
 - `$ mv CURRENT_FILE_NAME NEW_FILE_NAME`

VIEWING FILES

■ Quick viewing

- \$ cat FILE_NAME

■ View and search

- \$ less FILE_NAME

■ Filter a file based on keywords

- \$ grep KEY FILE_NAME # case sensitive

- \$ grep -i KEY FILE_NAME # case insensitive

NAVIGATING THE FILE SYSTEM

■ Special directories:

- . This directory
 - `./FILE_NAME`

- .. One up in the hierarchy
 - `../FILE_NAME`
 - `../OTHER_FOLDER/FILE_NAME`
 - `../../FILE_NAME`

CONFIGURATION AND HIDDEN FILES

■ \$ ls -la OR \$ ll

```
simcenter@SimCenter-VirtualBox:~$ ll
total 112
drwxr-xr-x 18 simcenter simcenter 4096 Jul 28 14:41 .
drwxr-xr-x  3 root      root     4096 Jul 11 19:32 ..
-rw-------  1 simcenter simcenter 1382 Jul 22 22:18 .bash_history
-rw-r--r--  1 simcenter simcenter  220 Jul 11 19:32 .bash_logout
-rw-r--r--  1 simcenter simcenter 3771 Jul 22 21:53 .bashrc
drwx----- 16 simcenter simcenter 4096 Jul 11 23:14 .cache/
drwx----- 16 simcenter simcenter 4096 Jul 22 22:14 .config/
drwxr-xr-x  2 simcenter simcenter 4096 Jul 11 19:36 Desktop/
drwxr-xr-x  3 simcenter simcenter 4096 Jul 22 21:42 Documents/
drwxr-xr-x  2 simcenter simcenter 4096 Jul 11 22:39 Downloads/
drwx-----  2 simcenter simcenter 4096 Jul 11 22:50 .gconf/
drwx-----  3 simcenter simcenter 4096 Jul 22 22:02 .gnupg/
-rw-------  1 simcenter simcenter 2984 Jul 28 14:41 .ICEauthority
drwx-----  3 simcenter simcenter 4096 Jul 11 19:36 .local/
drwx-----  5 simcenter simcenter 4096 Jul 11 20:27 .mozilla/
drwxr-xr-x  2 simcenter simcenter 4096 Jul 11 19:36 Music/
drwxr-xr-x  2 simcenter simcenter 4096 Jul 11 19:36 Pictures/
-rw-r--r--  1 simcenter simcenter   807 Jul 11 19:32 .profile
drwxr-xr-x  2 simcenter simcenter 4096 Jul 11 19:36 Public/
drwxr-xr-x  8 simcenter simcenter 4096 Jul 11 22:42 Qt/
drwx-----  2 simcenter simcenter 4096 Jul 22 22:02 .ssh/
-rw-r--r--  1 simcenter simcenter     0 Jul 11 21:56 .sudo_as_admin_successful
drwxr-xr-x  2 simcenter simcenter 4096 Jul 11 19:36 Templates/
-rw-r-----  1 simcenter simcenter     5 Jul 28 14:41 .vboxclient-clipboard.pid
-rw-r-----  1 simcenter simcenter     5 Jul 28 14:41 .vboxclient-display.pid
-rw-r-----  1 simcenter simcenter     5 Jul 28 14:41 .vboxclient-draganddrop.pid
-rw-r-----  1 simcenter simcenter     5 Jul 28 14:41 .vboxclient-seamless.pid
drwxr-xr-x  2 simcenter simcenter 4096 Jul 11 19:36 Videos/
-rw-----  1 simcenter simcenter 1816 Jul 22 21:53 .viminfo
simcenter@SimCenter-VirtualBox:~$
```

PIPES

- Every program (and command) has three (3) standard data stream:
 - STDIN == 0 ... standard input (usually the keyboard)
 - STDOUT == 1 ... standard output (usually the terminal)
 - STDERR == 2 ... standard error (usually the terminal)
- Redirecting standard streams:
 - `$ my_program < INPUT_FILE > OUTPUT_FILE 2> ERROR_FILE`
- Connecting programs: output of program1 as input of program2
 - `$ program1 | program2`
 - `$ program1 <INPUT_FILE | program2 >RESULT_FILE`

MODIFYING CONTENT

- Many cool editors out there: `gedit`, `pica`, `vim`, `emacs`, ...
- Which one to pick?
 - The one you've been using most and, thus, know most useful tricks.
 - Trying a new, more powerful one? Expect a learning phase!
- Which one NOT to use (**they do text & formatting mix-up/mess-up**):
 - MS Word
 - LibreWord
- This course:
 - `$ gedit` ... basic text editing
 -  Qt Creator ... C++ and Qt coding and debugging
 - VS Code ... a free VS lite from MicroSoft

REVISION CONTROL / SHARED DEVELOPMENT

■ Problem:

■ You develop software:

- Using office computer and home computer
- Want to try a new feature without breaking the code
- Want to incorporate help from colleagues; share with advisor; ...
- Need to reuse portions in other projects
- Want to keep backups of all changes
- Need to review changes

■ Solution:

■ Use a Revision control system

REVISION CONTROL: GITHUB

■ GitHub

- Get your free account on <http://github.com>

■ Basic Idea (simplified):

- Store change sets (do not copy files or directory trees)
- Preserve and make every stage of your development accessible
- Store those change sets on the cloud (backup of everything ☺)

■ Key Features:

- Automated merging (push/pull/fetch/merge)
- Branching: try something without breaking the main development
- Integrate or share changes by others without manual work

REVISION CONTROL: GITHUB

The screenshot shows a GitHub profile page for user [pmackenz](https://github.com/pmackenz). The profile picture is a portrait of a man with glasses and a checkered shirt. The bio section includes the name "Peter Mackenzie-Helnwein" and the handle "pmackenz". It also mentions "Research Faculty at @UniversityOfWashington, @CivilAndEnvironmentalEngineering". Below the bio is a "Edit bio" button. The "Organizations" section lists "University of Washington" with locations "Seattle, WA" and a link "<https://www.ce.washington.edu>".

The main content area has tabs for "Overview", "Repositories 15", "Stars 0", "Followers 1", and "Following 0". A green rounded rectangle highlights the "Pinned repositories" section, which contains five repository cards:

- AgaveClientInterface**: Forked from NHERI-SimCenter/AgaveClientInterface. Qt Library for HTTPS communication with SimCenter agave. Not a standalone program, but can be used by Qt applications. Language: C++.
- AgaveExplorer**: Forked from NHERI-SimCenter/AgaveExplorer. UI program for accessing Agave resources. Language: C++.
- CWE-Simulation-Tool**: Forked from NHERI-SimCenter/CWE-Simulation-Tool. SimCenter CFD Agave Client Program for NHERI. Language: C++.
- PileGroupTool**: Forked from NHERI-SimCenter/PileGroupTool. An Application for Understanding Behaviour of Laterally Loaded Piles. Language: C++.
- PyPCFD**: Particle flow formulation for incompressible flow. Language: Python, 2 forks.
- SimCenterCommon**: Forked from NHERI-SimCenter/SimCenterCommon. Language: C++.

A green rounded rectangle highlights the "Activity" section at the bottom, which shows a heatmap of contributions over the last year. The heatmap grid shows activity levels for specific days of the week and months. A legend indicates contribution counts: "Less" (light green), "More" (dark green).

Projects

Activity

REVISION CONTROL: GITHUB

The screenshot shows a GitHub repository page for 'pmackenz / PileGroupTool'. A blue arrow points from the 'Project' label to the repository name in the header. Another blue arrow points from the 'Files And Folders' label to the commit history table.

pmackenz / PileGroupTool
forked from NHERI-SimCenter/PileGroupTool

Code Pull requests 0 Projects 0 Wiki Insights Settings

An Application for Understanding Behaviour of Laterally Loaded Piles

470 commits 3 branches 0 releases 5 contributors

Branch: develop New pull request Create new file Upload files Find file Clone or download

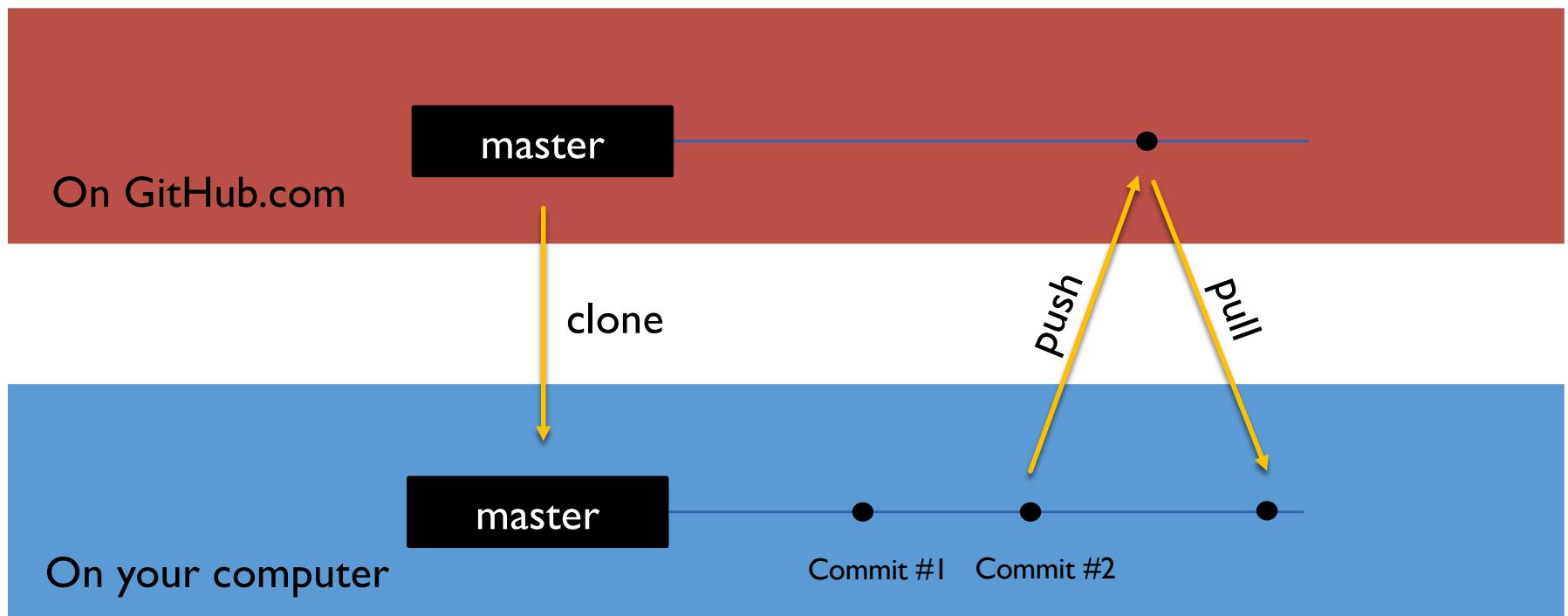
This branch is 2 commits ahead, 12 commits behind NHERI-SimCenter.develop.

File/Folder	Description	Commit Date
FEA	Fixing load placement to center of pile cap	2 months ago
build-qwt-Desktop_Qt_5_10_1_MS...	Fixing Windows fonts and other style features	2 months ago
dialogs	simplifying version check for model file	2 months ago
docs	Adding images for documentation	3 months ago
help	get rid of mac-generated indeces	2 months ago
images	get rid of mac-generated indeces	2 months ago
imagesCommon	Adding the SimCenter layout	a year ago
includes	Completed and tested recorder	3 months ago
lib-deprecated	marked blas.lib and lapack.lib as deprecated.	3 months ago
mainWindow	simplifying version check for model file	2 months ago
ops	Far into generating an OpenSees input file	3 months ago
plots	Fixing Windows fonts and other style features	2 months ago

Project

Files
And
Folders

GITHUB (SIMPLE)



REVISION CONTROL: GITHUB

The screenshot shows a GitHub repository page for 'pmackenz / PileGroupTool'. A blue arrow points from the word 'Project' in a teal box on the left to the repository name at the top. Another blue arrow points from the green box containing 'Clone (fetch a local copy)' to the 'Clone or download' button. A large green oval encircles the commit history table. A blue arrow points from the teal box containing 'Files And Folders' to the commit history table.

An Application for Understanding Behaviour of Laterally Loaded Piles

470 commits | 3 branches | 0 releases | 5 contributors

Branch: develop | New pull request | Create new file | Upload files | Find file | Clone or download

This branch is 2 commits ahead, 12 commits behind NHERI-SimCenter.develop.

Author	Commit Message	Date
pmackenz	Adjustment for renaming the widget packet	Latest commit 4622f42 20 days ago
FEA	Fixing load placement to center of pile cap	2 months ago
build-qwt-Desktop_Qt_5_10_1_MS...	Fixing Windows fonts and other style features	2 months ago
dialogs	simplifying version check for model file	2 months ago
docs	Adding images for documentation	3 months ago
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imagesCommon	Adding the SimCenter layout	a year ago
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mainWindow	simplifying version check for model file	2 months ago
ops	Far into generating an OpenSees input file	3 months ago
plots	Fixing Windows fonts and other style features	2 months ago
src	Organizing the source	5 months ago

Clone
(fetch a
local copy)

Files
And
Folders

REVISION CONTROL: GITHUB

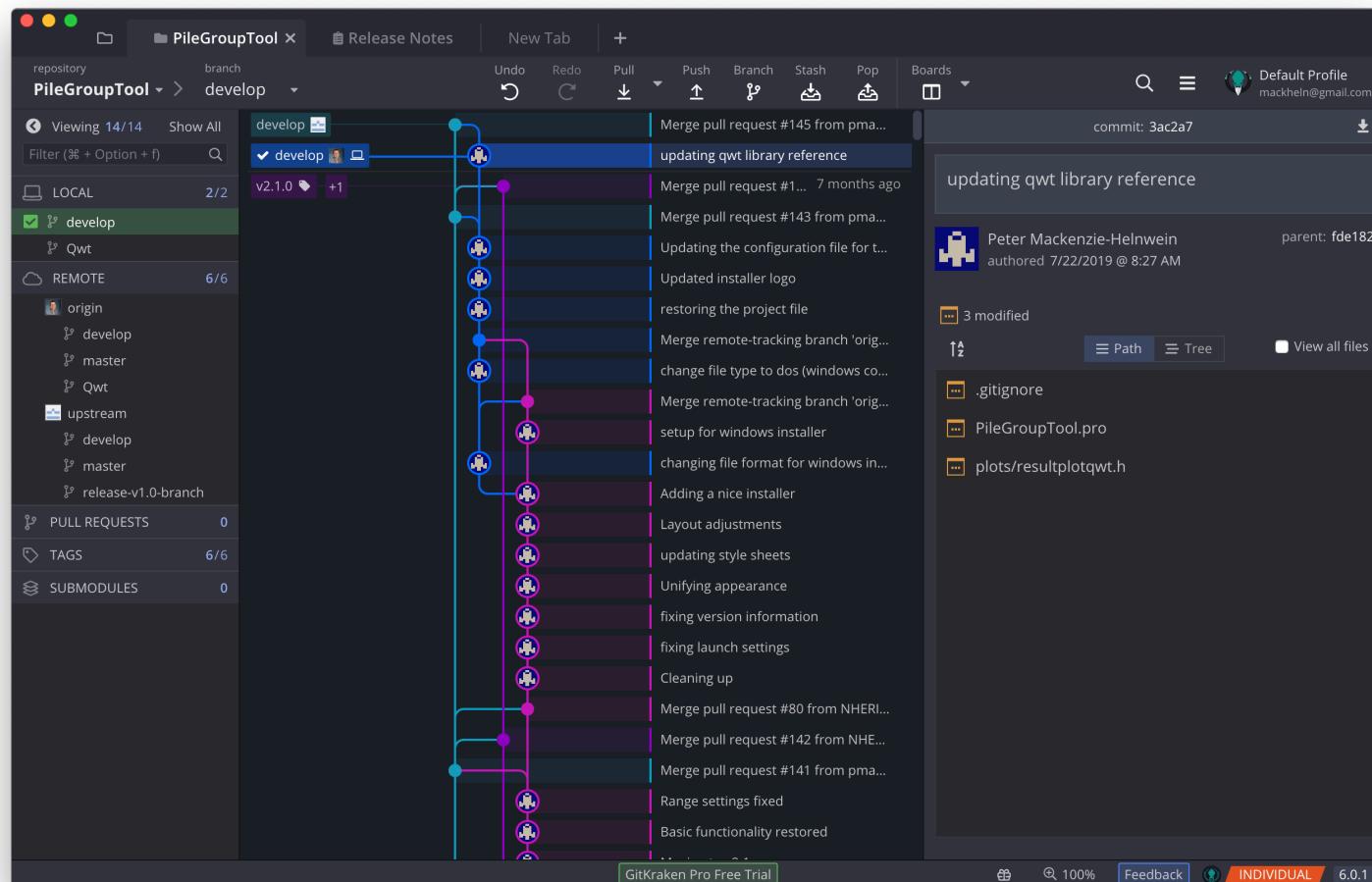
■ What goes on GitHub?

- Everything needed to build/compile your code
 - .c, .cpp, .h, .pro, .tex
 - documentation

■ What does NOT go onto GitHub?

- Everything the compiler generates
 - .o, .aux, .log, .pdf

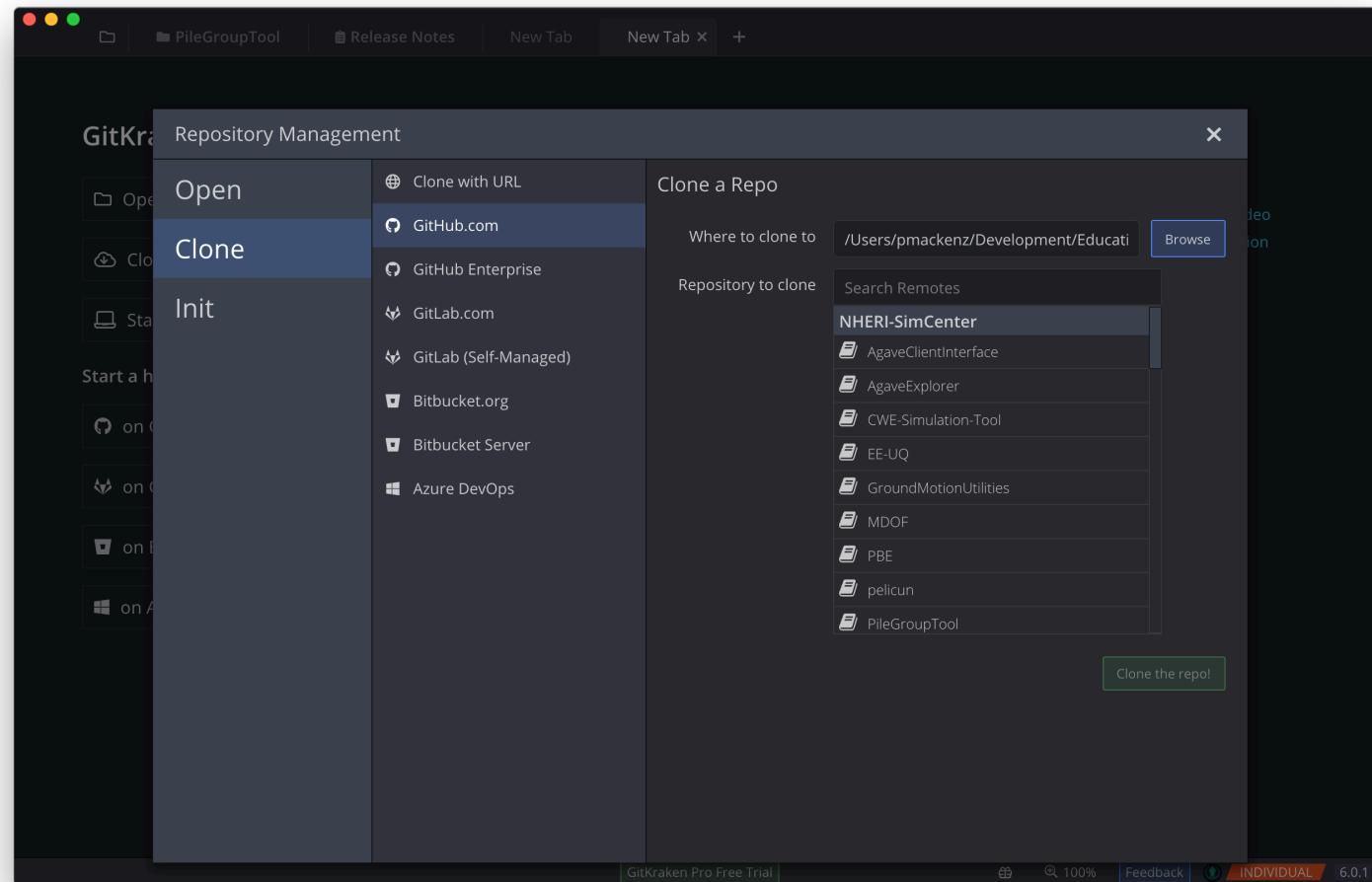
GITKRAKEN



Performs most functions to communicate between your local computer and github.com

Guides you through the process and enforces comments on commit 😊

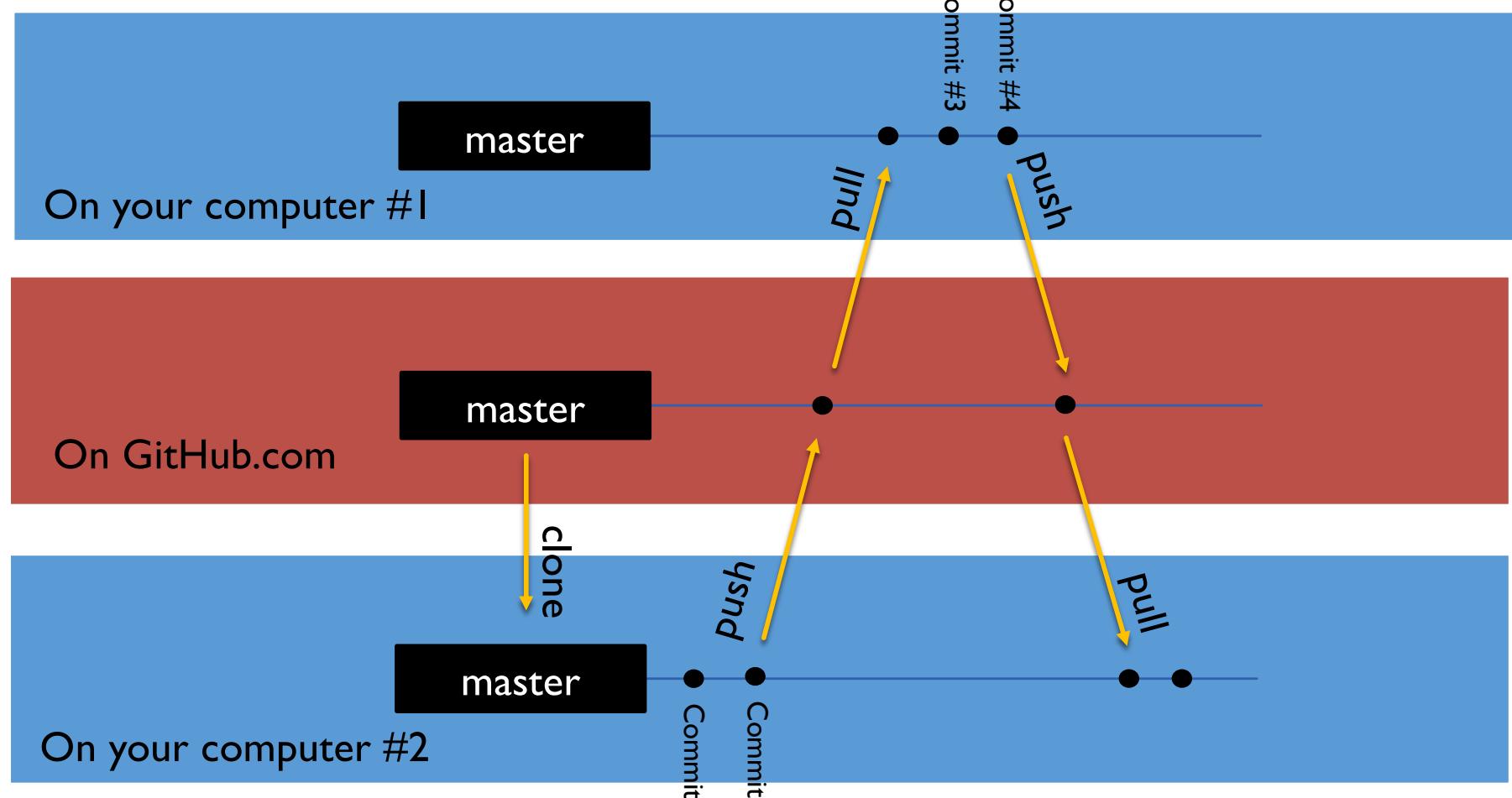
GITKRAKEN



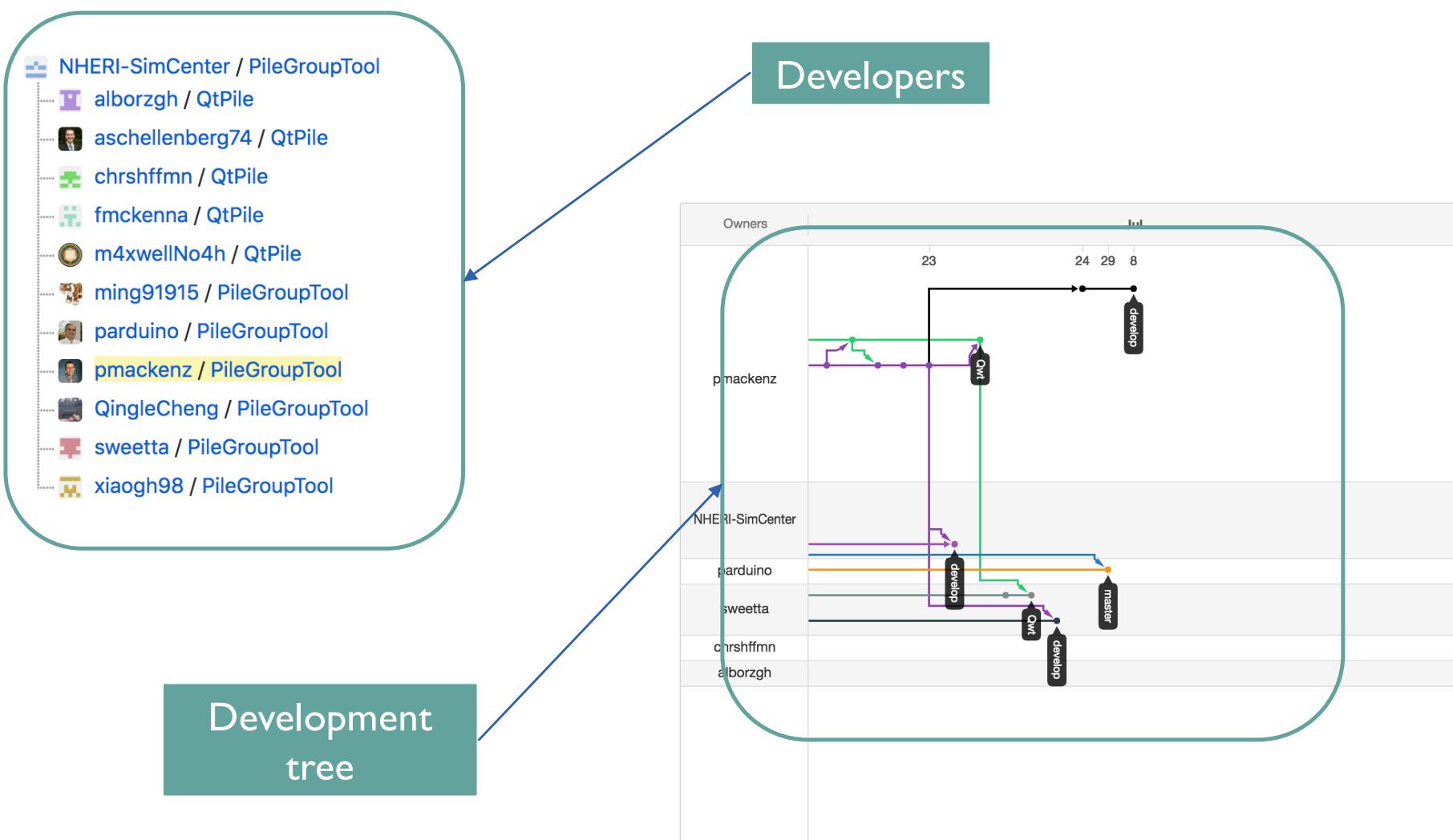
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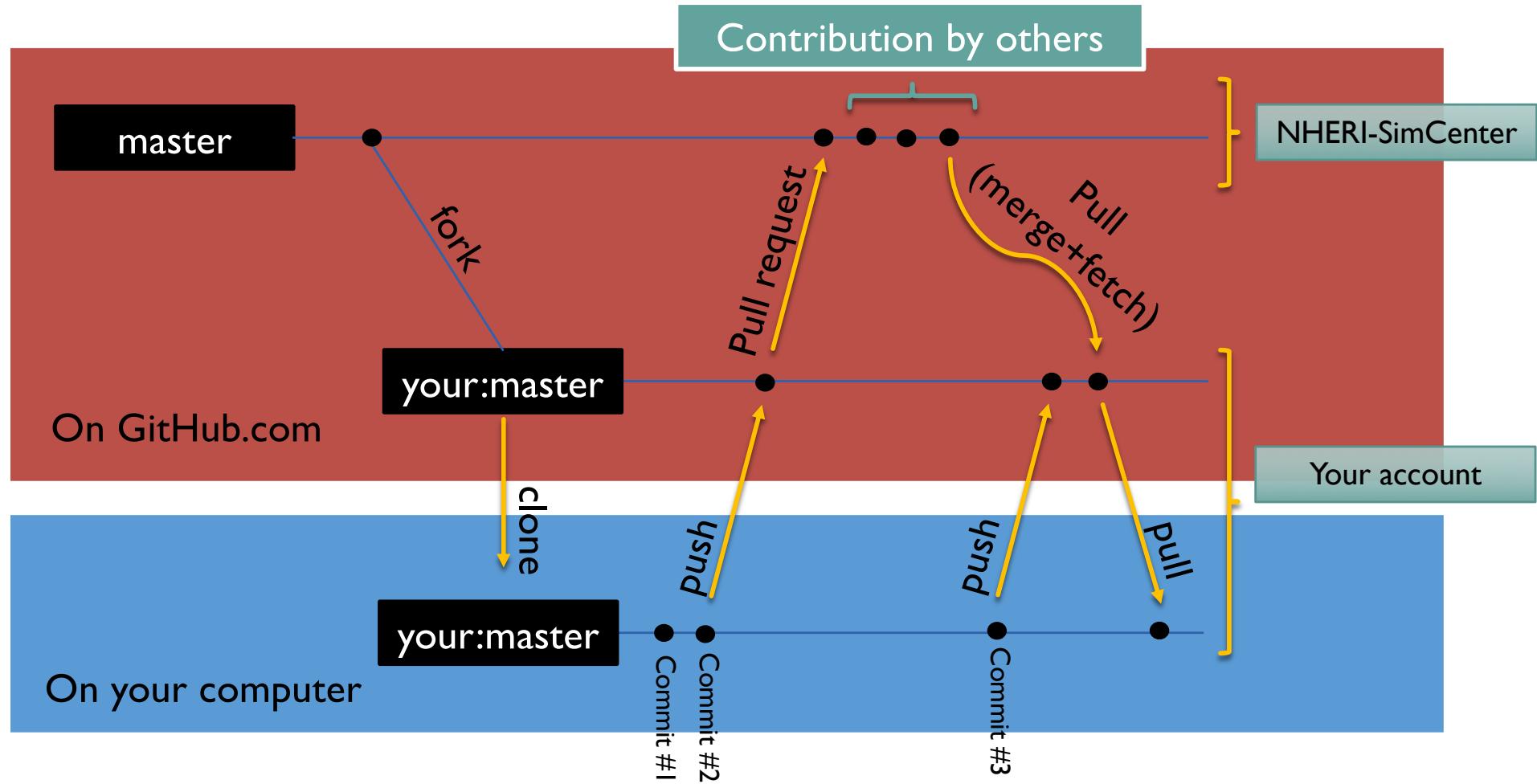
GITHUB (2 COMPUTERS)



REVISION CONTROL: GITHUB



GITHUB (MONITORED PROJECT)



REVISION CONTROL: GITHUB

The screenshot shows a GitHub project page for 'pmackenz / PileGroupTool'. A green box labeled 'Project' highlights the repository name at the top. A blue arrow points from the 'Fork' button (which is highlighted with a red box) to a green box labeled 'Fork (create a private fork)'. Another blue arrow points from the commit history area to a green box labeled 'Files And Folders'.

Project

Fork (create a private fork)

Files And Folders

pmackenz / PileGroupTool
forked from NHERI-SimCenter/PileGroupTool

Pull requests Issues Marketplace Explore

Unwatch 1 Star 0 Fork 1

An Application for Understanding Behaviour of Laterally Loaded Piles

470 commits 3 branches 0 releases 5 contributors

Branch: develop New pull request Create new file Upload files Find file Clone or download

This branch is 2 commits ahead, 12 commits behind NHERI-SimCenter.develop.

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src Organizing the source 5 months ago

REVISION CONTROL: GITHUB

■ Collaboration Guidelines

- In the code: **Comments, comments, comments**
- Commit frequently and sync frequently to avoid conflicts
- Every commit deserves a proper description. **NO commit without comments!**
- Only commit IF code compiles (or use private branch)
- **WHO BREAKS THE CODE HAS TO HANG A RUBBER CHICKEN OVER THE DOOR TILL BUG IS FIXED** (blame game)
- Unstable development belongs into a branch
- Branches need to be reintegrated into main development once stable and compatible.

GITHUB.COM

■ When to use the web interface?

- Creating pull requests to the monitored project
- Submitting and reviewing issues
- Statistics
- Viewing revision tree details

■ Other options:

- Use the git command line tool (most powerful but most complex)

EXERCISE

1. Create a private fork of
<https://github.com/NHERI-SimCenter/SimCenterBootcamp2019>
2. Clone to your machine
3. Add a folder (your_name_without_spaces) to your branch
4. Add a README.txt file to this folder
5. Commit (locally)
6. Push to your fork on github.com