GitHub

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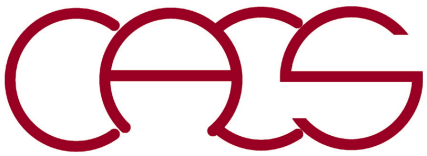
Goal: Use GitHub for version control, collaborative software development & dissemination (digital business card)



GitHub

- **GitHub is a code hosting platform for version control & collaboration. Please sign up at:** https://github.com/
- **Read "Chapter 15—Local version control" & "Chapter 16—Remote version control" of *Effective Computation in Physics* by Scopatz and Huff; USC students have free access to the book through Safari Online:** https://libraries.usc.edu/databases/safari-books
- **Software Carpentry has a good tutorial on "Version control with Git":** http://swcarpentry.github.io/git-novice
- **How to create a README file for your repository using the Markdown language:** https://www.markdownguide.org/cheat-sheet

Version Control with Git

- **Git: Distributed version-control system software**
- **While your own computer may have Git installed, here we will use Discovery cluster as an example**
- **Getting help**

```
~$ git --help
```

- **Configuring Git**

```
~$ git config -global user.name “XXX”
~$ git config -global user.email “your_ID@usc.edu”
~$ git config -global core.editor “vim”
```

Choose your username

Your USC ID

Prompt, indicating you are working in your home directory (~)

Text editor to be used, like nano, emacs, vim

Create a Local Repository

- **As an example, let us create a directory named** SimpleMD **and populate it with simple molecular-dynamics (MD) files:** md.c, md,h, md.in

- **Enter the** SimpleMD **directory, and type:**

```
~/SimpleMD $ git init
~/SimpleMD $ git add *
~/SimpleMD $ git commit
```

Create an empty Git repository

Stage all files in the directory to be tracked by Git

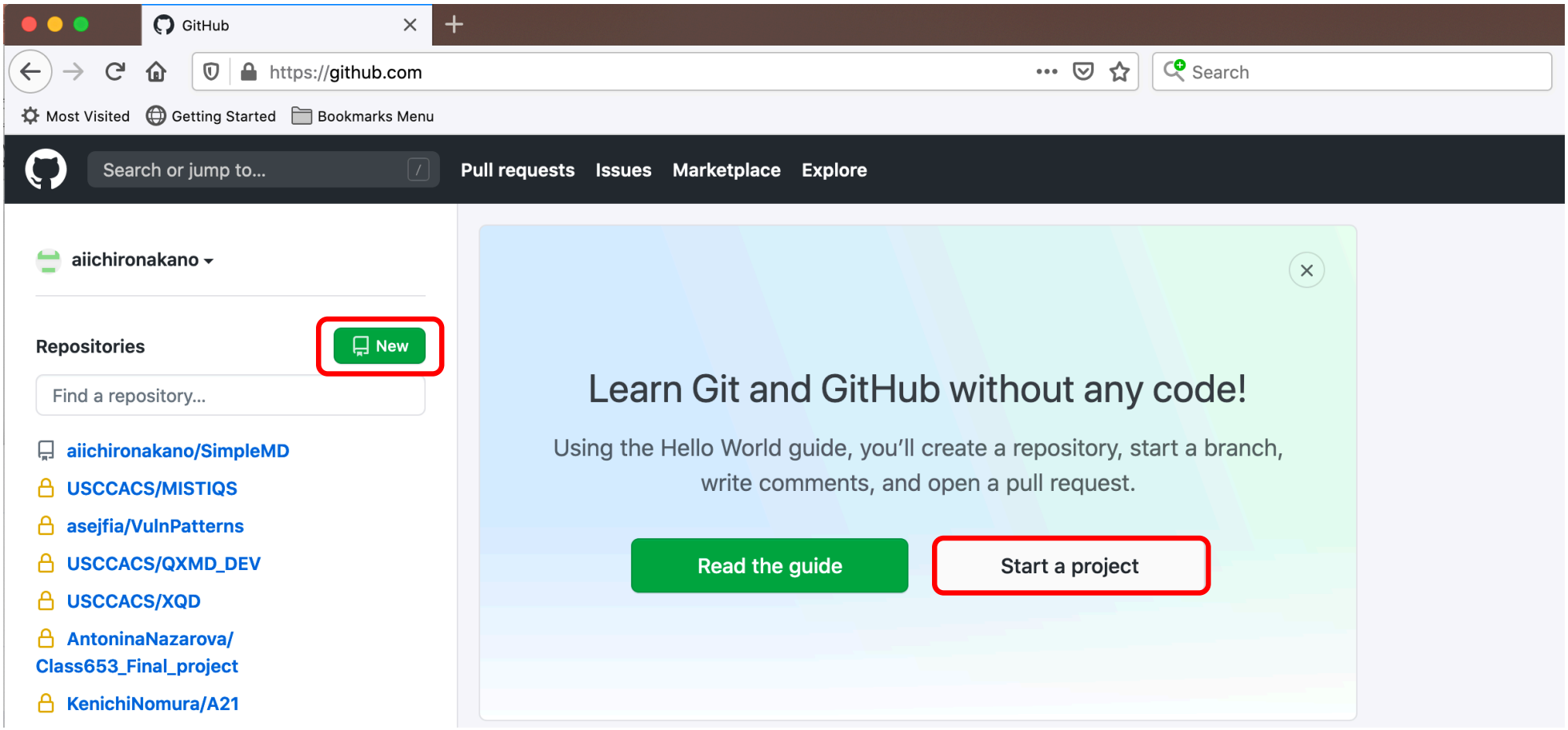
Record changes to the repository

You will be asked to enter a comment in the text editor you have configured earlier; add an informative comment like "repository created" or "file XXX modified with a feature YYY"

- **Branch: Git allows you to create multiple branches of the repository to be tracked in parallel, using the** git branch **command. When a repository is initialized, a single branch called "master" is automatically created.**

Create a GitHub Repository

- **Repository:** Used to organize a project; it can contain folders, files, data, images, *etc*.
- **Create a GitHub repository:** Click "New" repository or "Start a project" button after signing in github.com.



Declare a Remote

- **Suppose you have created a GitHub repository named** SimpleMD **under your GitHub account (in my case** aiichironakano**), the URL (uniform resource locator) is** https://github.com/aiichironakano/SimpleMD.git
- **In the previous example of the** SimpleMD **directory on Discovery, type:**
  ~/SimpleMD $ `git remote origin` https://github.com/aiichironakano/SimpleMD.git

  Create an alias named "origin" for the remote repository, with which the local copy to be synchronized

  ~/SimpleMD $ `git push origin master`

  Push commits in the master branch of the local repository to the remote repository

- **Other GitHub users can now clone (*i.e.*, create a local copy of) your online repository by typing:**
  ~/ $ `git clone` https://github.com/aiichironakano/SimpleMD.git
- **For the other user to retrieve updated commits into his/her local master branch in later times, that user should type (origin is the automatically-created alias):**
  ~/ $ `git pull origin master`

Use version control for team final projects

Create a README File

- **Each repository has a README file that concisely summarizes the software**
- **Here is a sample** README.md **file written in the Markdown language:**

```
# SimpleMD: Simple Molecular Dynamics
This is a readme file for a simple molecular dynamics (MD) program
for Lennard-Jones potential.
## 0. Prerequisites
Only needed is C compiler.
## 1. How to compile and run
If the C compiler on your computer is cc (also common is gcc for Gnu C
  compiler), type:
cc -O -o md md.c -lm
This will create an executable named md. To run the executable, type:
./md < md.in
## 2. Files
The following files are included in this folder, in addition to this readme
  file, readme.md.
<ul>
<li>md.c: Main C program</li>
<li>md.h: Header file for md.c</li>
<li>md.in: Input parameter file (to be redirected to the standard input)</li>
</ul>
![Screen shot of MD simulation](ScreenShot.png)
```

heading level 1

heading level 2

unordered list

List item

image

The image file, ScreenShot.png**, needs be placed in the repository along with** README.md

Every final project needs to create a README file

See https://www.markdownguide.org/cheat-sheet

README in Web Browser

SimpleMD: Simple Molecular Dynamics `# (heading level 1)`

This is a readme file for a simple molecular dynamics (MD) program for Lennard-Jones potential.

0. Prerequisites `## (heading level 2)`

Only needed is C compiler.

1. How to compile and run

If the C compiler on your computer is cc (also common is gcc for Gnu C compiler), type:

cc -O -o md md.c -lm

This will create an executable named md. To run the executable, type:

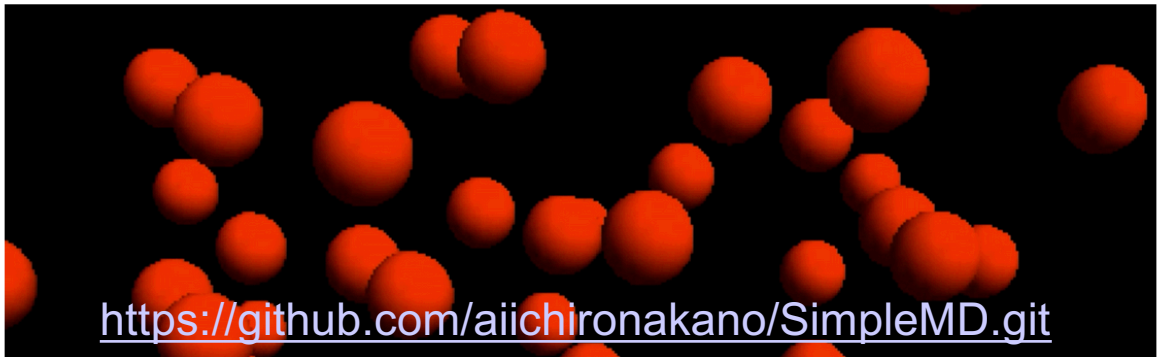
./md < md.in

2. Files

The following files are included in this folder, in addition to this readme file, readme.md.

- md.c: Main C program
- md.h: Header file for md.c
- md.in: Input parameter file (to be redirected to the standard input)

`<ul> </ul> (unordered list)`



`! (image)`

Fancier example at https://github.com/USCCACS/QXMD, including user's manual

Git Cheat Sheet (1)

Install

GitHub for Windows
https://windows.github.com

GitHub for Mac
https://mac.github.com

Git for All Platforms
http://git-scm.com

Git distributions for Linux and POSIX systems are available on the official Git SCM web site.

Configure tooling

Configure user information for all local repositories

`$ git config --global user.name "[name]"`
Sets the name you want attached to your commit transactions

`$ git config --global user.email "[email address]"`
Sets the email you want attached to your commit transactions

`$ git config --global color.ui auto`
Enables helpful colorization of command line output

Branches

Branches are an important part of working with Git. Any commits you make will be made on the branch you're currently "checked out" to. Use `git status` to see which branch that is.

`$ git branch [branch-name]`
Creates a new branch

`$ git checkout [branch-name]`
Switches to the specified branch and updates the working directory

`$ git merge [branch]`
Combines the specified branch's history into the current branch. This is usually done in pull requests, but is an important Git operation.

`$ git branch -d [branch-name]`
Deletes the specified branch

Create repositories

When starting out with a new repository, you only need to do it once; either locally, then push to GitHub, or by cloning an existing repository.

`$ git init`
Turn an existing directory into a git repository

`$ git clone [url]`
Clone (download) a repository that already exists on GitHub, including all of the files, branches, and commits

The .gitignore file

Sometimes it may be a good idea to exclude files from being tracked with Git. This is typically done in a special file named `.gitignore`. You can find helpful templates for `.gitignore` files at github.com/github/gitignore.

Synchronize changes

Synchronize your local repository with the remote repository on GitHub.com

`$ git fetch`
Downloads all history from the remote tracking branches

`$ git merge`
Combines remote tracking branch into current local branch

`$ git push`
Uploads all local branch commits to GitHub

`$ git pull`
Updates your current local working branch with all new commits from the corresponding remote branch on GitHub. `git pull` is a combination of `git fetch` and `git merge`

Git Cheat Sheet (2)

Make changes

Browse and inspect the evolution of project files

`$ git log`
Lists version history for the current branch

`$ git log --follow [file]`
Lists version history for a file, including renames

`$ git diff [first-branch]...[second-branch]`
Shows content differences between two branches

`$ git show [commit]`
Outputs metadata and content changes of the specified commit

`$ git add [file]`
Snapshots the file in preparation for versioning

`$ git commit -m "[descriptive message]"`
Records file snapshots permanently in version history

Redo commits

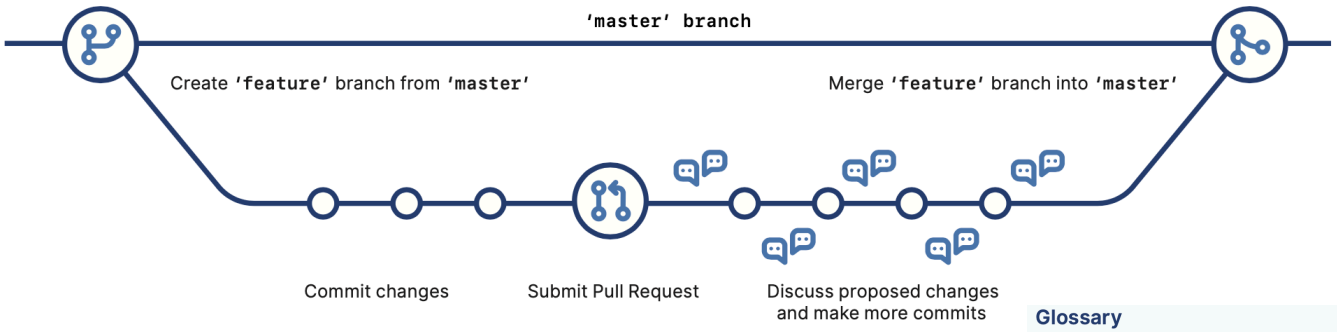
Erase mistakes and craft replacement history

`$ git reset [commit]`
Undoes all commits after [commit], preserving changes locally

`$ git reset --hard [commit]`
Discards all history and changes back to the specified commit

CAUTION! Changing history can have nasty side effects. If you need to change commits that exist on GitHub (the remote), proceed with caution. If you need help, reach out at github.community or contact support.

GitHub Flow



Glossary

`git`: an open source, distributed version-control system
`GitHub`: a platform for hosting and collaborating on Git repositories
`commit`: a Git object, a snapshot of your entire repository compressed into a SHA
`branch`: a lightweight movable pointer to a commit
`clone`: a local version of a repository, including all commits and branches
`remote`: a common repository on GitHub that all team member use to exchange their changes
`fork`: a copy of a repository on GitHub owned by a different user
`pull request`: a place to compare and discuss the differences introduced on a branch with reviews, comments, integrated tests, and more
`HEAD`: representing your current working directory, the HEAD pointer can be moved to different branches, tags, or commits when using `git checkout`