Version Control Workshop: Git and GitHub (Day 2)

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Overview

1. GitHub Pages and Jekyll
2. GitHub Mobile App
3. GitHub Student Developer Pack
4. GitHub Community
5. Programming Challenges

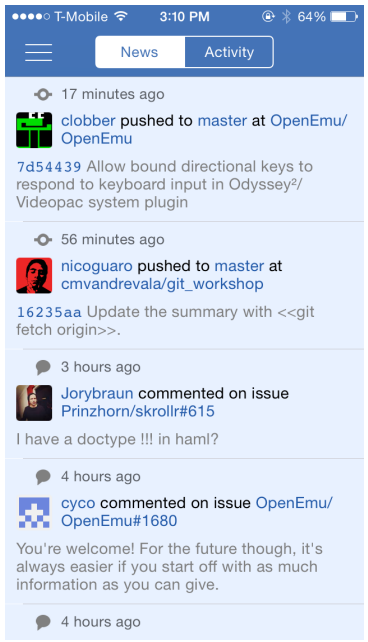
Pages

1. GitHub allow users to have one personal (static) site.
2. It also allows one site per project.
3. Jekyll is the site-generator behind GitHub Pages.

Mobile App

Android

Mac



It is not a replacement for a desktop client, but it is good enough to keep track of some changes on the go.

GitHub Student Developer Pack

A couple of months ago GitHub (with some companies) released a pack of free tools for students:

- https://education.github.com/pack

GitHub Student Developer Pack

Some of these tools include:

1. **Atom:** A text editor developed by GitHub
2. **CrowdFlower:** Data enrichment, data mining, and crowdsourcing services
3. **DNSimple:** Domain name registration service
4. **GitHub:** Five free private GitHub repositories
5. **SendGrid:** Email services
6. **Unreal Engine:** A suite of game development tools for PC, console, mobile and web

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GitHub Open Source Projects

Some major open source projects include:

- **Jekyll:** https://github.com/jekyll/jekyll
- **Linux Kernel:** https://github.com/torvalds/linux
- **Matplotlib:** https://github.com/matplotlib/matplotlib
- **Ruby on Rails:** https://github.com/rails/rails
- **Scipy Lecture Notes:** https://github.com/scipy-lectures/scipy-lecture-notes

More Cool Projects

- **D3:** `https://github.com/mbostock/d3`
- **Flatland - A Romance of Many Dimensions:** `https://github.com/Ivesvdf/flatland`
- **Generate DOI for Github Repos:** `https://guides.github.com/activities/citable-code/`
- **GitBook (Books Editor):** `https://www.gitbook.io/`
- **GitHub Visualizer:** `http://ghv.artzub.com/`
- **ShareLatex:** `https://github.com/sharelatex/sharelatex`

GitHub Community

- **Choosing an OSS License:** `http://choosealicense.com/`
- **GitHub Explore:** `https://github.com/trending`
- **Gitter:** `https://gitter.im`
- **LearnProgramming:** `http://learnprogramming.github.io/`

Verlet Integration

- Verlet integration is a numerical method used to integrate Newton's equations of motion.
- It is frequently used to calculate trajectories of particles in molecular dynamics simulations and computer graphics.

Verlet Integration

- If we do a Taylor expansion of the position vector $\vec{x}(t \pm \Delta t)$ forwards and backward we get:

$$\vec{x}(t + \Delta t) = \vec{x}(t) + \vec{v}(t)\Delta t + \frac{\vec{a}(t)\Delta t^2}{2} + \frac{\vec{b}(t)\Delta t^3}{6} + \mathcal{O}(\Delta t^4)$$

$$\vec{x}(t - \Delta t) = \vec{x}(t) - \vec{v}(t)\Delta t + \frac{\vec{a}(t)\Delta t^2}{2} - \frac{\vec{b}(t)\Delta t^3}{6} + \mathcal{O}(\Delta t^4),$$

Verlet Integration

- Adding these two expansions gives:

$$\vec{x}(t + \Delta t) = 2\vec{x}(t) - \vec{x}(t - \Delta t) + \vec{a}(t)\Delta t^2 + \mathcal{O}(\Delta t^4)\,.$$

We can see that the first and third-order terms from the Taylor expansion cancel out, thus making the Verlet integrator an order more accurate than integration by simple Taylor expansion alone.

Verlet Integration

So we can use as time stepper the equation

$$\boxed{\vec{x}(t+\Delta t) = 2\vec{x}(t) - \vec{x}(t-\Delta t) + \vec{a}(t)\Delta t^2} \ ,$$

or in terms of forces

$$\boxed{\vec{x}(t+\Delta t) = 2\vec{x}(t) - \vec{x}(t-\Delta t) + \frac{\vec{F}(t)}{m}\Delta t^2} \ ,$$

Verlet Integration

Our goal is to create a solver for Newton equations using Verlet integration. We can split the project into small groups.

A possible division of labors is:

- Force Routines (Springs, Electrostatic Interactions, etc.)
- Verlet Step Calculator for Different Coordinates (x, y, z)
- Verlet Time Stepper;
- Plotting Capabilities
- Main Routines

Programming Challenges

- We have a set of simple programming challenges stored in the programming_challenges directory of the main repo.
- Try to commit your code in three ways:
  1. Locally on your computer
  2. Remotely on your GitHub account
  3. Via pull request on Cyrus' GitHub account