

# Tools

SWE 432, Fall 2016

Design and Implementation of Software for the Web

# Today

- Before we can really make anything, there's a bunch of technical stuff to get out of the way
- Tools make our lives so much easier
  - Actually, this is what a lot of software engineering research is - making better tools for making software!
- Today we'll cover version control, and some really basic hello world stuff in HTML\* and Javascript\*

**\*See next 2 lectures for a lot more detail**

# Version Control

We've always had some kind of version control



**Carbon copies?**

# Git

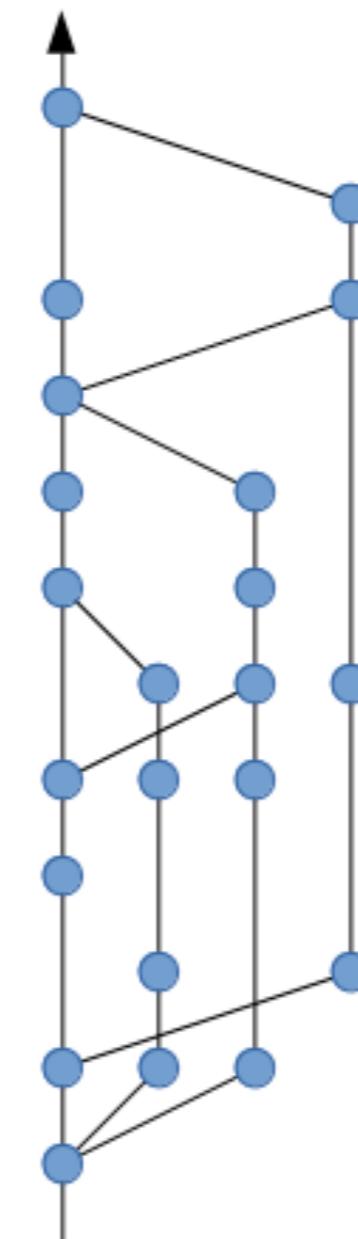
- One of the latest generation of **Version Control Systems** (VCS)
- Came out of the Linux development community
- Fast
- Supports non-linear development
- Fully distributed (no need for “central” server)
- Able to handle large projects effectively

# Linear vs Nonlinear Development

Linear history

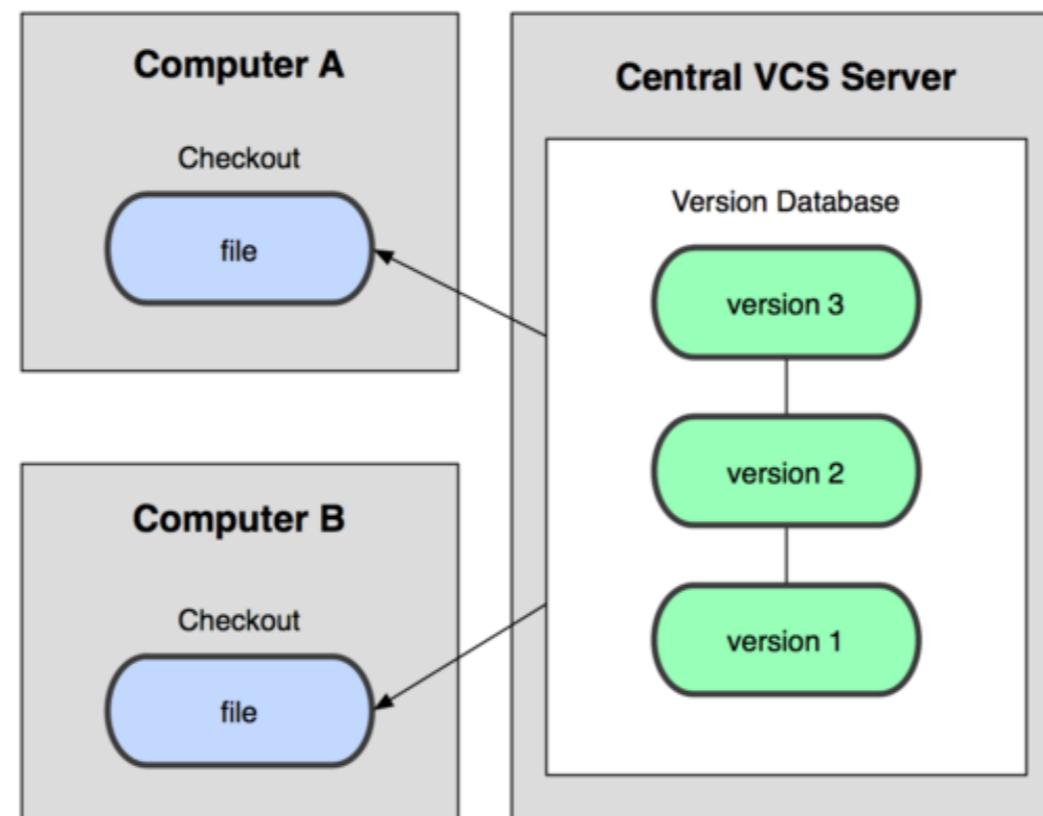


Non-linear history



# Distribution Model

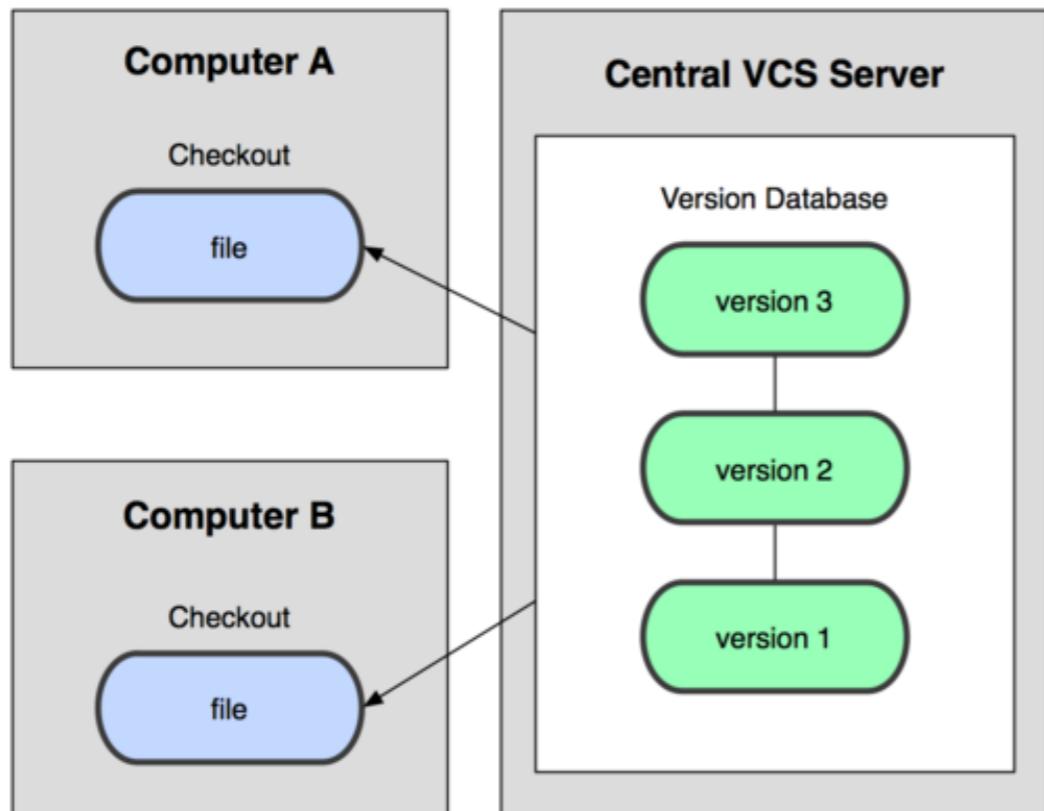
## Centralized Model



Examples:  
CVS, Subversion, Perforce

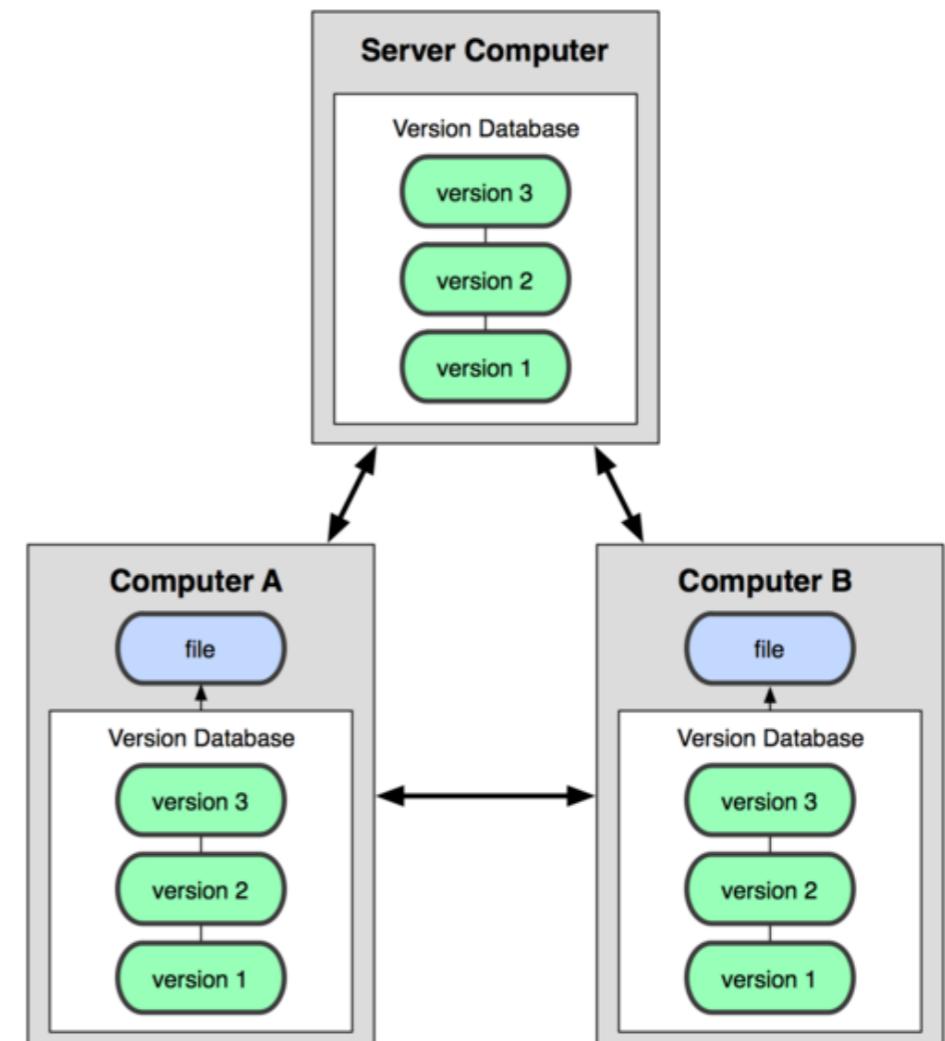
# Distribution Model

## Centralized Model



Examples:  
CVS, Subversion, Perforce

## Distributed Model



Examples:  
Git, Mercurial

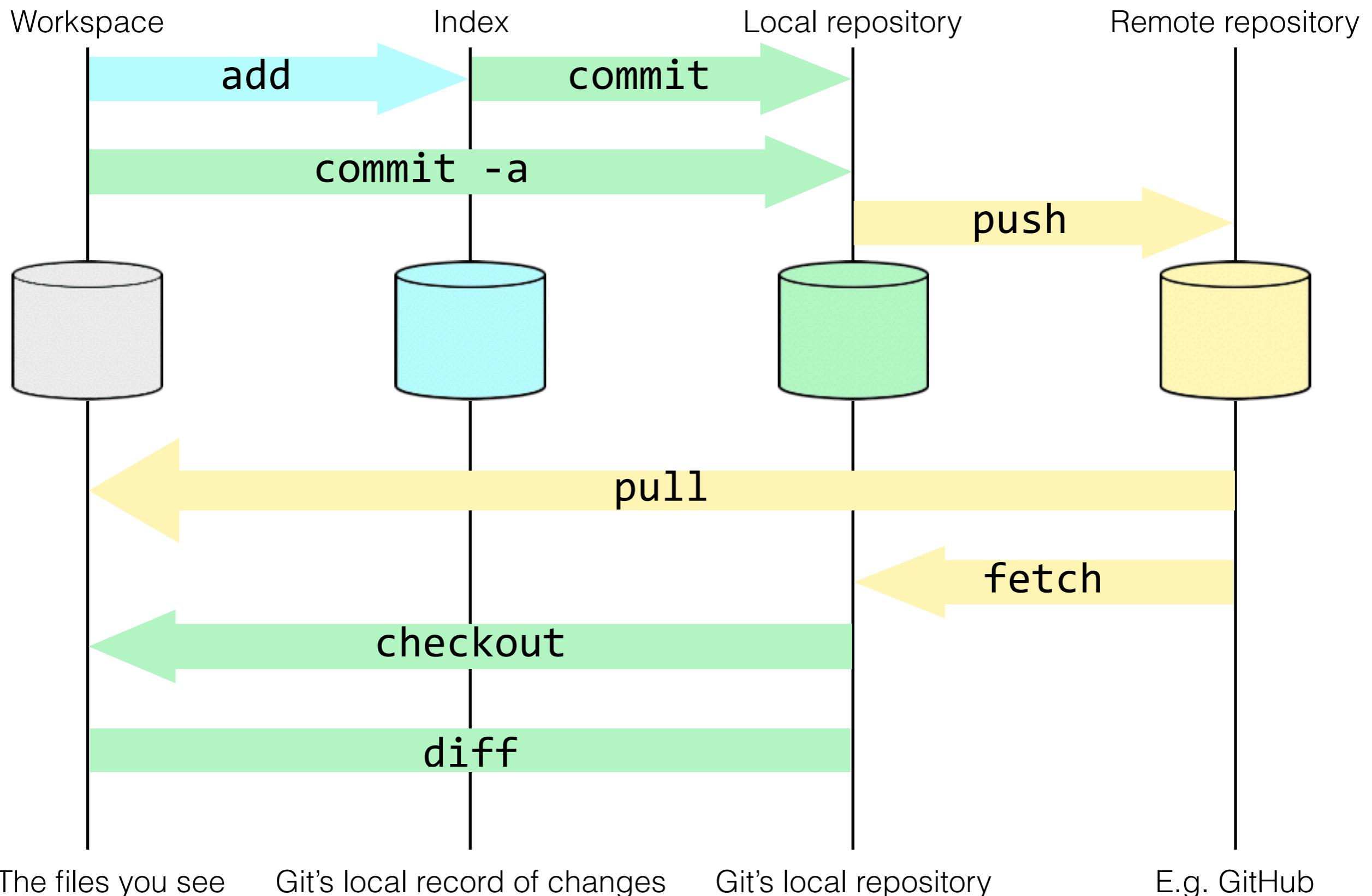
**No central point of failure**  
**No latency when doing most operations**

# GitHub



- You don't need a central server to use git
- But it sure makes it easier
- GitHub: Free open source hosting site
  - For students, free private repositories too!
- Set up a user account
- Create a repository
- Add collaborators

# Git, High level



# Typical Use Case



Person 1

Create Project & Repo

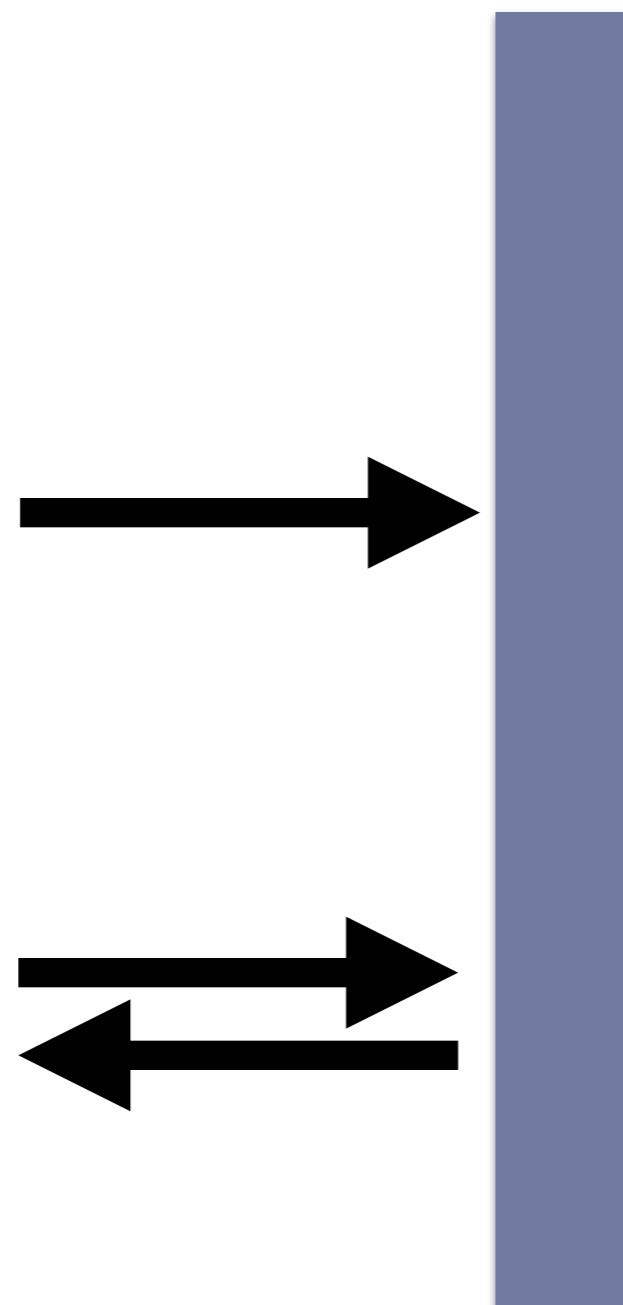
Push to Github

Edit/commit

Edit/commit

Edit/commit

Pull/push



GitHub



Person 2

Clone from Github

Edit/commit/push

Edit/commit

Edit/commit

Pull/push

# Git Demo

<https://try.github.io/levels/1/challenges/1>

Download and install git:

<https://git-scm.com/downloads>

Also: Git Cheat Sheet

<https://services.github.com/kit/downloads/github-git-cheat-sheet.pdf>



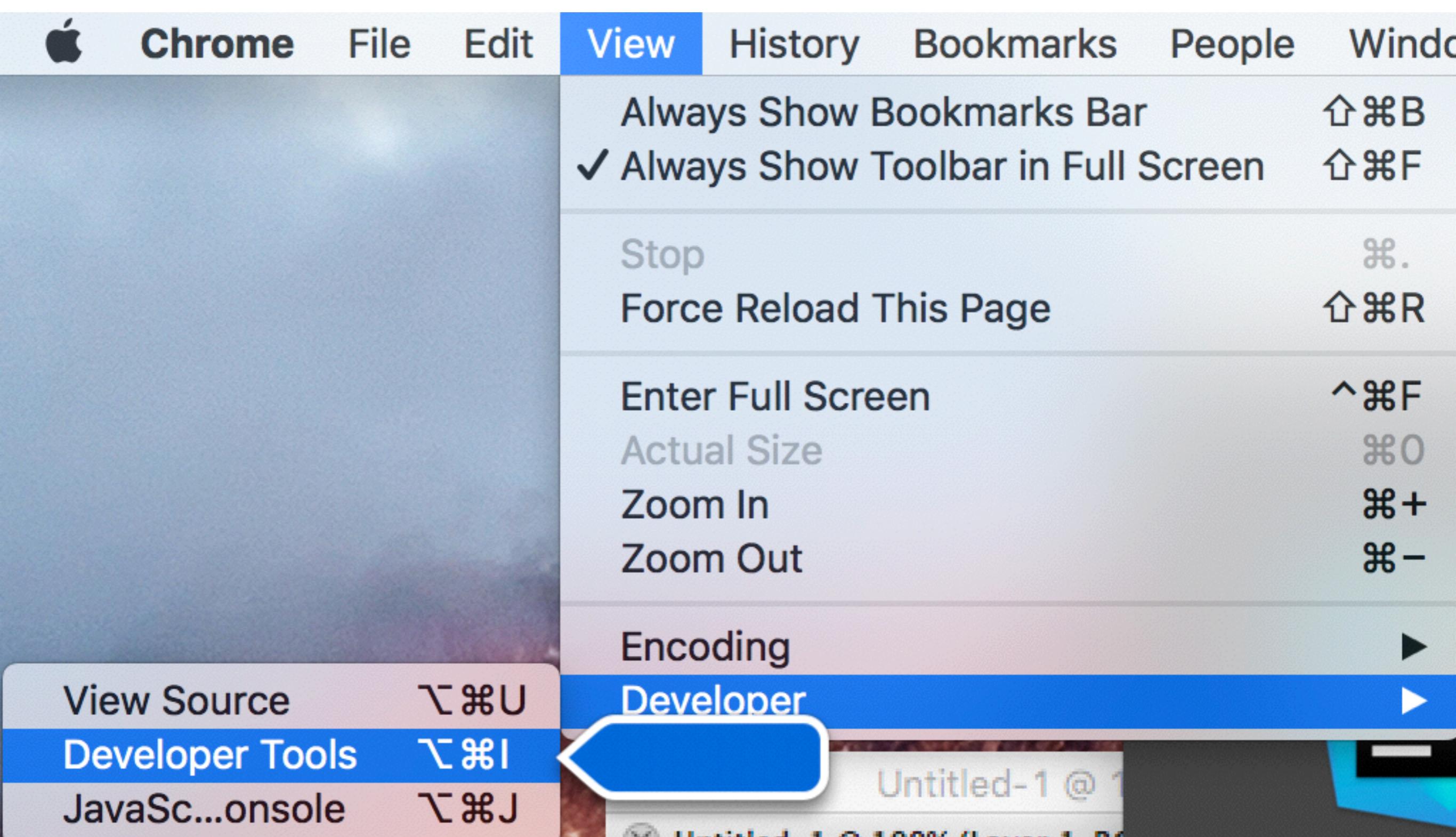
# Chrome Developer Tools

## + HTML + JavaScript

# Chrome Developer Tools

- A suite of tools built into Chrome (Safari and other browsers have similar tools) to help with debugging web apps
- Key features:
  - View the HTML elements that make up the current page
  - Access a JavaScript Console
  - View all supplemental files loaded by a page
  - View all outbound requests that a page made
  - Plus more (we'll skip for now)
- Let's all open Chrome together now!

# Accessing Chrome Dev Tools



# Inspecting HTML Elements



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Search

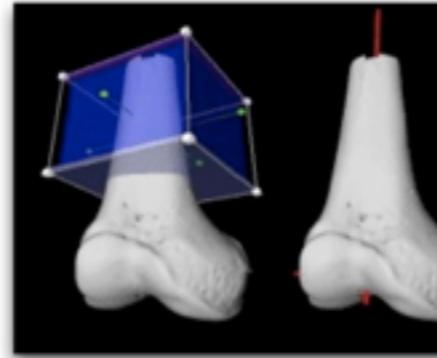
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**Research**

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Teleoperated knee surgery can be improved by building a graphical model from the patient's MRI scan. From [Project Page](#)

Elements Console Sources Network

```
<br>
<a href="/recruitment/2015" target="_parent">Recruitment</a>
<br>
<a href="/wiki/pmwiki.php/Main/FacultyOfficeHours" target="_parent">Office Hours</a>
<br>
<!--
<a href="/alumni/" target="_parent">Alumni&nbsp;Chapter</a><br>
-->
<a href="/facultywiki/pmwiki.php/Main/HomePage" target="_parent">Information&nbsp;for&nbsp;Faculty</a>
<br>
<a href="/news/report/" target="_parent">Departmental Report</a>
```

After highlighting an element in the browser, the “elements” section filters to highlight the code that generates that element

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Graduate Certificates  
Admissions

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Prof. Zoran Duric has b

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html body

Styles Event Listeners DOM Breakpoints Properties

Filter :hov .cls +

element.style {

```
ODY { site.css:3
margin: 0px;
padding: 0px;
border: 0px;
font-family: 'Lucida Grande', Helvetica, Arial, Geneva, 'Vera Sans', Sans-Serif;
font-size: 100%;
width: 100%;
line-height: 130%;}
```

body { user agent stylesheet
display: block;
margin: 0px;}

Filter Show all

► border-bottom-color: #rgb(0, 0, 0) none
► border-bottom-style: none
► border-bottom-width: 0px
► border-image-outset: 0px
► border-image-repeat: stretch

Console

top Preserve log



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img.picture | 272 x 200

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Teleoperated knee surgery can be improved by building a graphical model from the patient's MRI scan. From Prof. Jim Chen and the GMU Graphics Group.

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Elements Console Sources Network

tbody

tr class="main">td valign="top" class="nav">td valign="top" class="main">map name="bannermap">!-- Random Picture and Caption -->div class="text">table width="250" class="picture" cellpadding="0" cellspacing="0" border="0" align="right">tbody

td class="picture"><script type="text/javascript" language="Javascript">>...</script>a class="picture" border="0" href="http://graphics.gmu.edu/knee/index.html">img class="picture" alt="Splash Image" src="/covers/cover3.jpg">

html body

Styles Event Listeners DOM Breakpoints Properties

Filter :hov .cls + element.style { margin -

body { font-family: 'Vera Sans', 'Lucida Grande', 'Helvetica', 'Arial', 'Geneva', 'sans-serif'; font-size: 100%; width: 100%; line-height: 130%; } body { user agent stylesheet display: block; margin: 8px; }

Console

top Preserve log

You can even change the HTML or CSS!





# Using the JavaScript Console

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Console Sources Network

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Console

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nav.html ▾ □ Preserve log

console.log("Hello World");

Console

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console.log("Hello World");

Hello World

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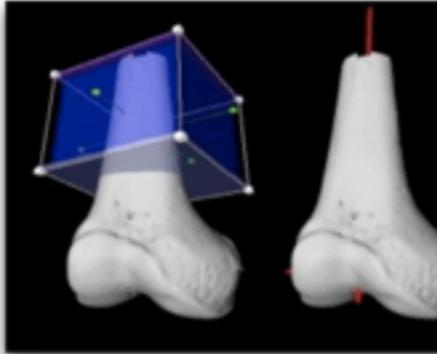
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Prof. Zoran Duric appointed as Deputy Editor of [Journal of Pattern Recognition \(more\)](#)

Prof. Zoran Duric has been appointed as a member of the [International Conference on Image Processing \(more\)](#)

Teleoperated knee surgery can be performed using a robotic arm.

\*\*\*\*\* GENERAL \*\*\*\*\*

BODY { margin: 0px; padding: 0px; border: 0px; font-family: 'Lucida Grande', 'Lucida Sans Unicode', 'Lucida Sans', 'DejaVu Sans', 'Bitstream Vera Sans', 'Trebuchet MS', sans-serif; font-size: 100%; width: 100%; line-height: 130%; }

/\* We say this instead of just A:link, A:visited, A:active { text-decoration: none; border-bottom: 1px dotted; /\* IE can't do dotted! And use the standard stuff. \*/ \_text-decoration: underline; \_border-bottom: none; }

Breakpoints

No Breakpoints

DOM Breakpoints

XHR Breakpoints

Event Listener Breakpoints

Event Listeners

Console

nav.html

Preserve log

console.log("Hello World");

Hello World

undefined

console.log(\$0);

<h1>The Best Department</h1>

undefined

>

# Network Panel

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View all resources loaded in a timeline

7 / 13 requests | 19.2 KB / 158 KB transferred | Finish: 397 ms | DOMContentLoaded

Console

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Filter  Regex  Hide data URLs

All XHR JS CSS Img Media Font Doc WS Manifest Other

200 ms 400 ms 600 ms 800 ms 1000 ms

Name	St...	Ty...	Initiator	Size	TL...	Timeline – Start Time
nav.css	200	st...	nav.htm...	2...	5...	
spacer.png	200	png	nav.htm...	3...	4...	
ga.js	307		nav.htm...	0 B	0 ...	
ga.js	200	sc...	http://...	15...	6...	
__utm.gif?ut...	307		Other	0 B	14...	
__utm.gif?ut...	200	gif	http://...	18...	13...	
favicon.ico	200	vn...	Other	2...	3...	

Let's spend 5 minutes  
playing with Chrome  
Developer Tools



IDEs

# Integrated Development Environments (IDEs)

- **Integrates** everything you need to **develop** into a single **environment**
- E.g. text editor (with complex highlighting, auto complete, etc), version control access, debugger, etc.
- You don't have to use one. It sure makes things handy though!
- We recommend you use WebStorm for this class. You can get a free student license: **<https://www.jetbrains.com/student/>**

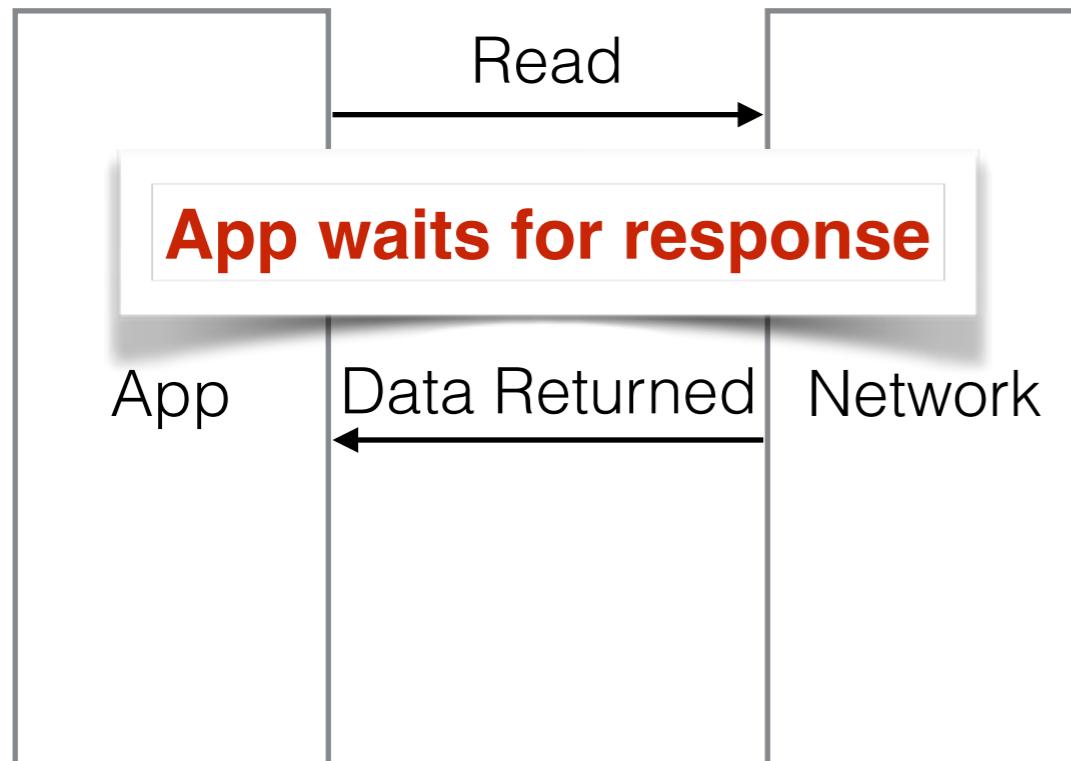
# Node.js

# Node.js

- Node.js is not a web server
- Node.js is a *runtime* for JavaScript based on Chrome's JavaScript runtime
- Uses an **event-driven, non-blocking I/O model**
- Your code runs single threaded
- Has a large ecosystem of packages (**npm**)

# Non-Blocking I/O

Regular (blocking) I/O

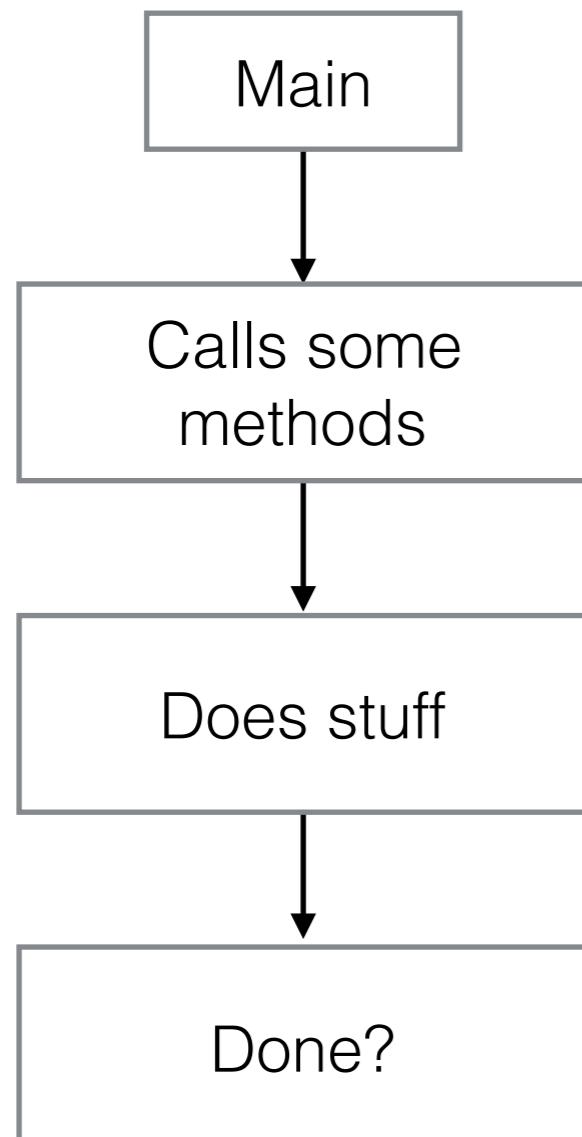


Non-Blocking I/O

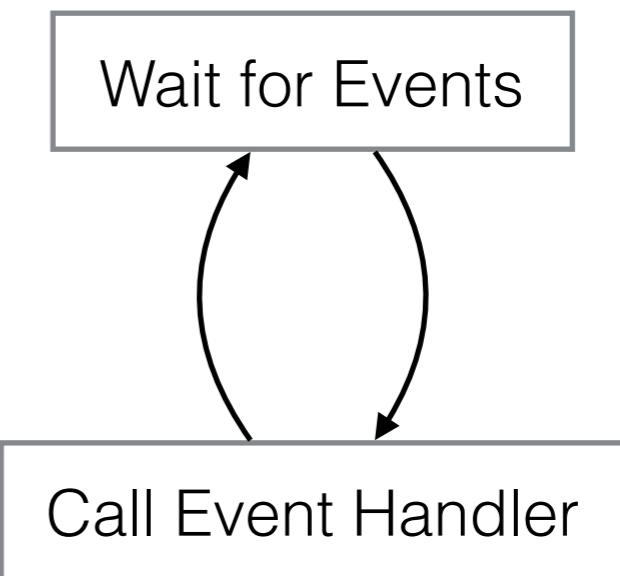


# Event-Driven Programming

## Procedural



## Event-Driven



**Event-driven  
programming relies on  
non-blocking I/O**

**Non-blocking I/O is easy  
with events... data being  
returned is just an event!**

# Packages

- Easily re-use libraries written by others
- npm manages libraries that your app uses: it downloads them, keeps them up to date, and ensures that they are in the right spot
- Example packages:
  - express (web server)
  - gulp (build system)

# Node.js Getting Started

- Download and install it: <https://nodejs.org/en/>
  - We recommend v4.5.0 LTS (LTS -> Long Term Support, designed to be super stable)
- Demo: Hello world server
- Demo will show:
  - Using package manager to get a package (express)
  - Running a simple node application

# Demo: Hello World Server

- 1: Make a directory, myapp
- 2: Enter that directory, type **npm init** (accept all defaults),

**Creates a configuration file for your project**

- 3: Type **npm install express --save**
- 4: Create text file app.js:

```
var express = require('express');
var app = express();
var port = process.env.port || 3000;
app.get('/', function (req, res) {
  res.send('Hello World!');
});

app.listen(port, function () {
  console.log('Example app listening on port' + port);
});
```

**Tells NPM that you want to use express, and to save that in your project config**

**Let's not worry about JavaScript syntax until next Thursday!**

- 5: Type **node app.js**
- 6: Point your browser to <http://localhost:3000>

**Runs your app**

# Building & Grunt

# Build Systems & JavaScript

- You've probably used a build system before
  - Make, ant, maven, gradle, etc.
- Apps written in JavaScript get a build system too!
  - Need to package together modules that we use, possibly also compile the JavaScript into some intermediate language before running it
- Why use a build system?
  - Builds should be repeatable
  - Builds should be reproducible
  - Builds should be standard

# What else does a build system do for JS?

- Transcompile
- Transform modules
- Minification
- Preprocess stylesheets
- Cache Busting
- Image Optimization
- Run Tests

# Grunt: A JS Build System

- One of many build systems for JS
- Configuration is written in JS
- Grunt is installed as an npm module (see <http://gruntjs.com/getting-started> )

# Example Grunt Configuration

```
module.exports = function(grunt) {  
  
  // Project configuration.  
  grunt.initConfig({  
    pkg: grunt.file.readJSON('package.json'),  
    uglify: {  
      options: {  
        banner: '/*! <%= pkg.name %> <%= grunt.template.today("yyyy-mm-dd") %> */\n'  
      },  
      build: {  
        src: 'src/<%= pkg.name %>.js',  
        dest: 'build/<%= pkg.name %>.min.js'  
      }  
    }  
  });  
  
  // Load the plugin that provides the "uglify" task.  
  grunt.loadNpmTasks('grunt-contrib-uglify');  
  
  // Default task(s).  
  grunt.registerTask('default', ['uglify']);  
  
};
```

# Deploying & Heroku

# Deployment

- Our little hello world example was cool, but how do we share with our friends?
- We need somewhere to run our node scripts
- Option 1: Use a machine that you have access to
- Option 2: Use a deployment service

# Heroku

**Hosts personal projects for free  
Uses git as an interface**

Create Project & Repo

Push to Github

Edit/commit

Edit/commit

Edit/commit

Pull/push

Push



**Magic deployment!**

Github

Heroku

# Heroku Example!

Let's adapt our example to run on Heroku

(See <https://devcenter.heroku.com/articles/getting-started-with-nodejs> for reference)

# Heroku Example

1: Create account, install Heroku on your machine

2: In our app directory, create file “Procfile” with following contents:

```
web: node app.js
```

**Tells Heroku what to do  
when it gets your app**

3: Make the app a git repository: `git init; git add app.js Procfile package.json; git commit -m "Initial Commit"`

**Because Heroku uses git**

4: Type `heroku create` and follow instructions

**Deploys your code**

5: `git push heroku master`

6: Visit your app at the site listed in the result of the push (e.g. <https://salty-depths-97600.herokuapp.com>)

Reminder: HW0 due  
Tuesday!

# Exit-Ticket Activity

Go to [socrative.com](https://socrative.com) and select “Student Login”

Class: SWE4320001 (Prof LaToza) or SWE4320002 (Prof Bell)

ID is your [@gmu.edu](mailto:@gmu.edu) email

For question 3:

Write one project idea that you have