

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

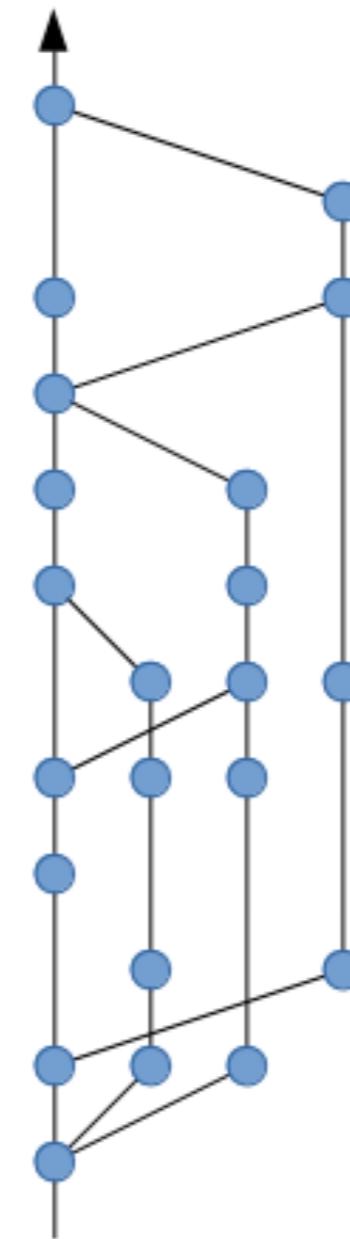
- One of the latest generation of **V**ersion **C**ontrol **S**ystems (VCS)
- Came out of the Linux development community
- Fast
- Supports non-linear development
- Fully distributed (no need for “central” server)
- Able to handle large projects effectively

Linear vs Nonlinear Development

Linear history

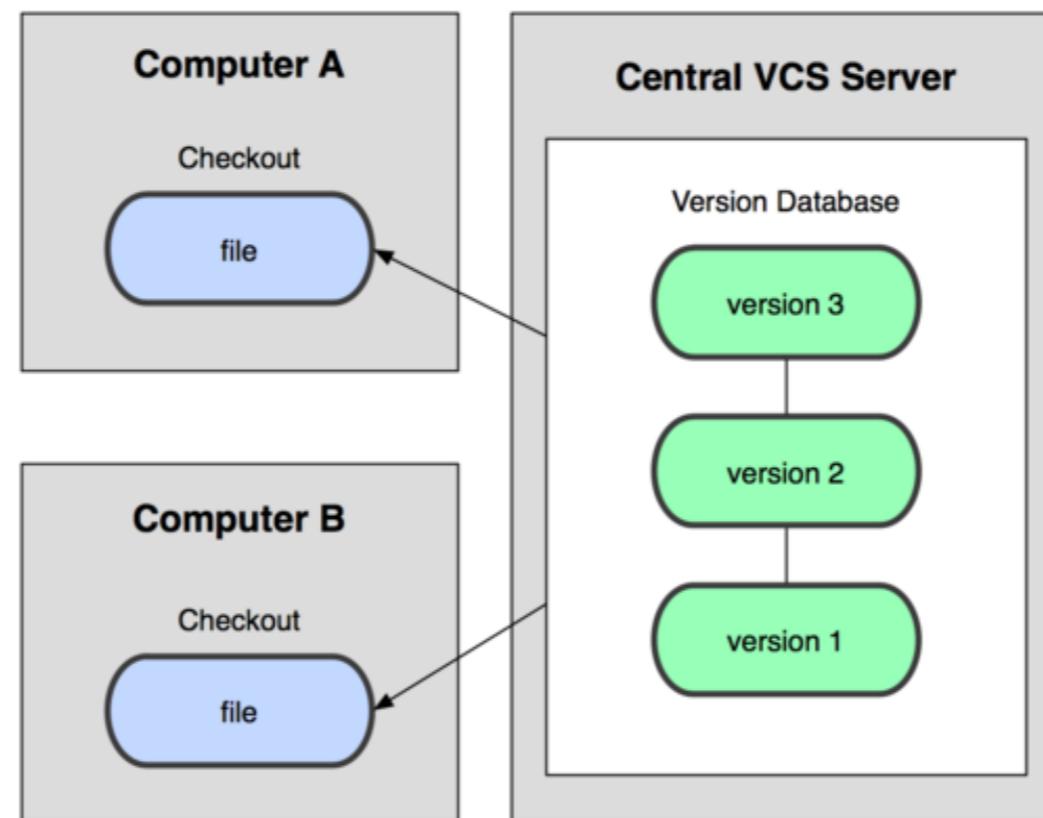


Non-linear history



Distribution Model

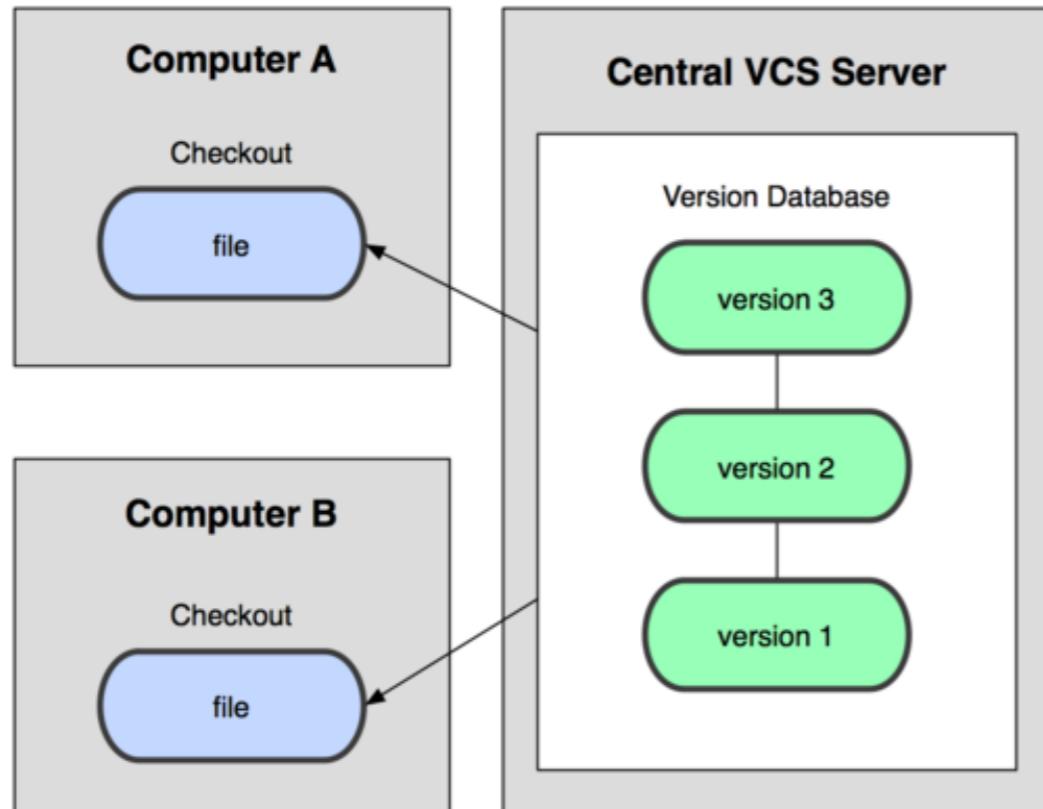
Centralized Model



Examples:
CVS, Subversion, Perforce

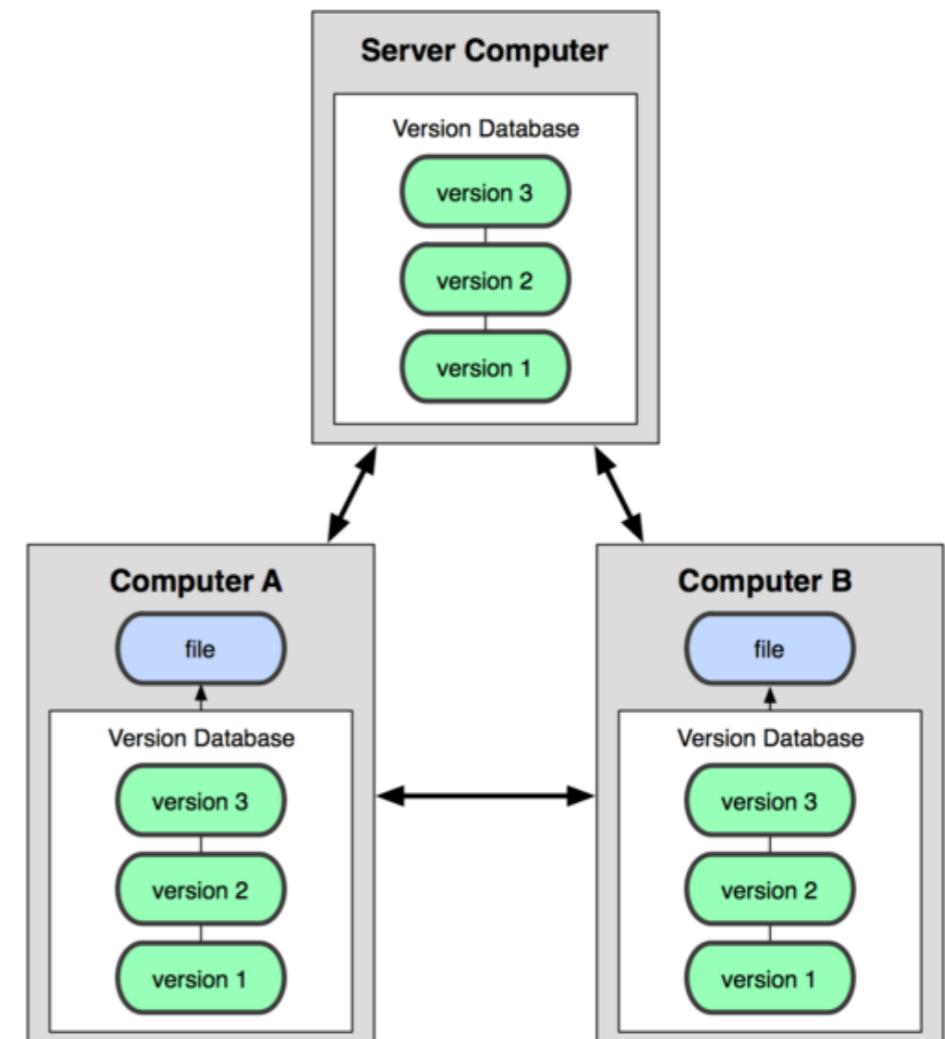
Distribution Model

Centralized Model



Examples:
CVS, Subversion, Perforce

Distributed Model



Examples:
Git, Mercurial

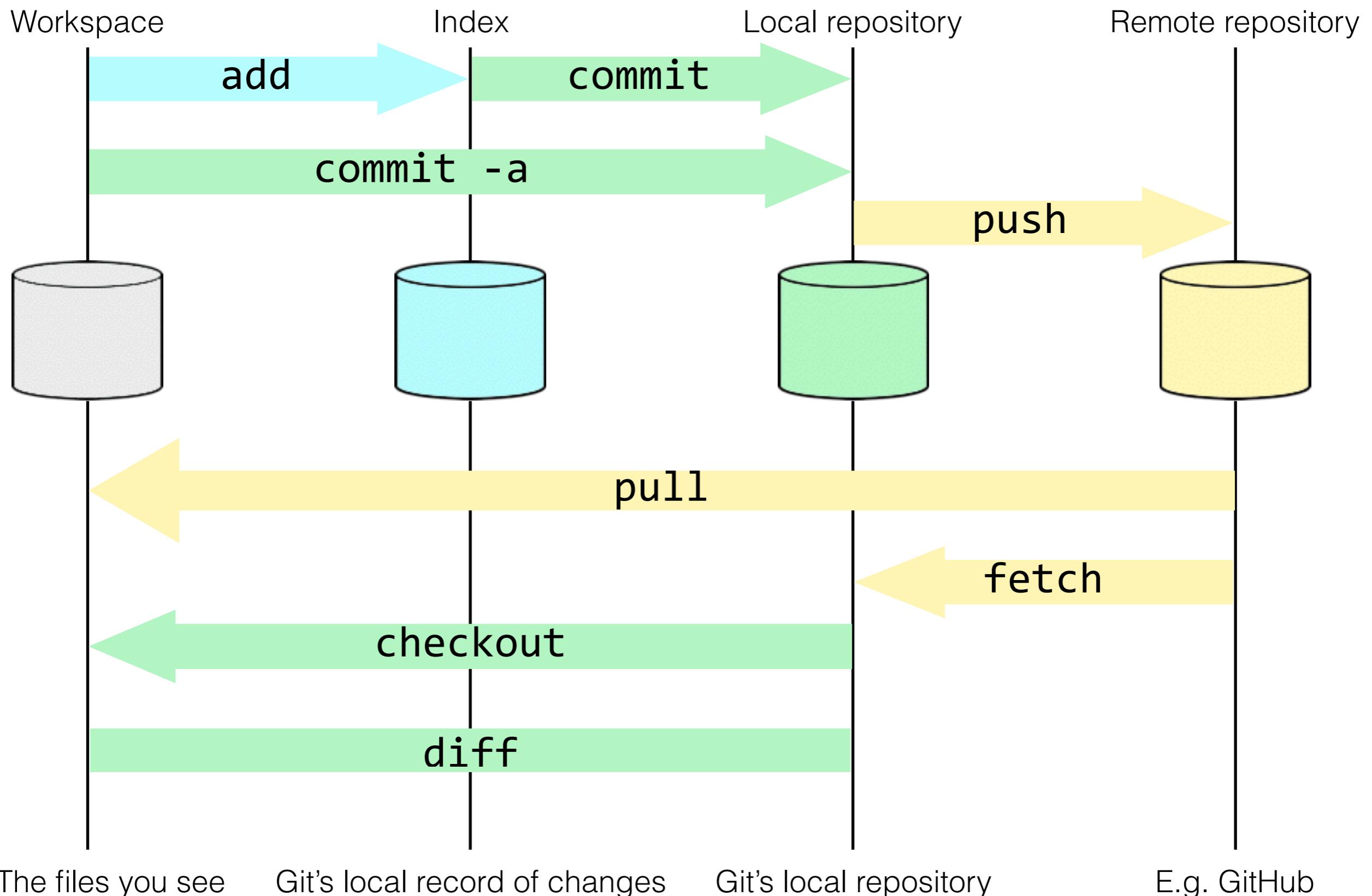
No central point of failure
No latency when doing most operations

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



E.g. The files you see

Git's local record of changes

Git's local repository

E.g. GitHub

Typical Use Case



Person 1

Create Project & Repo

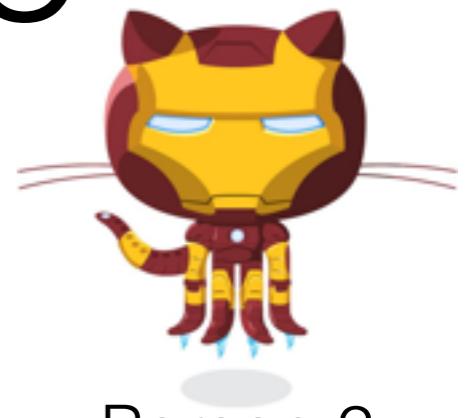
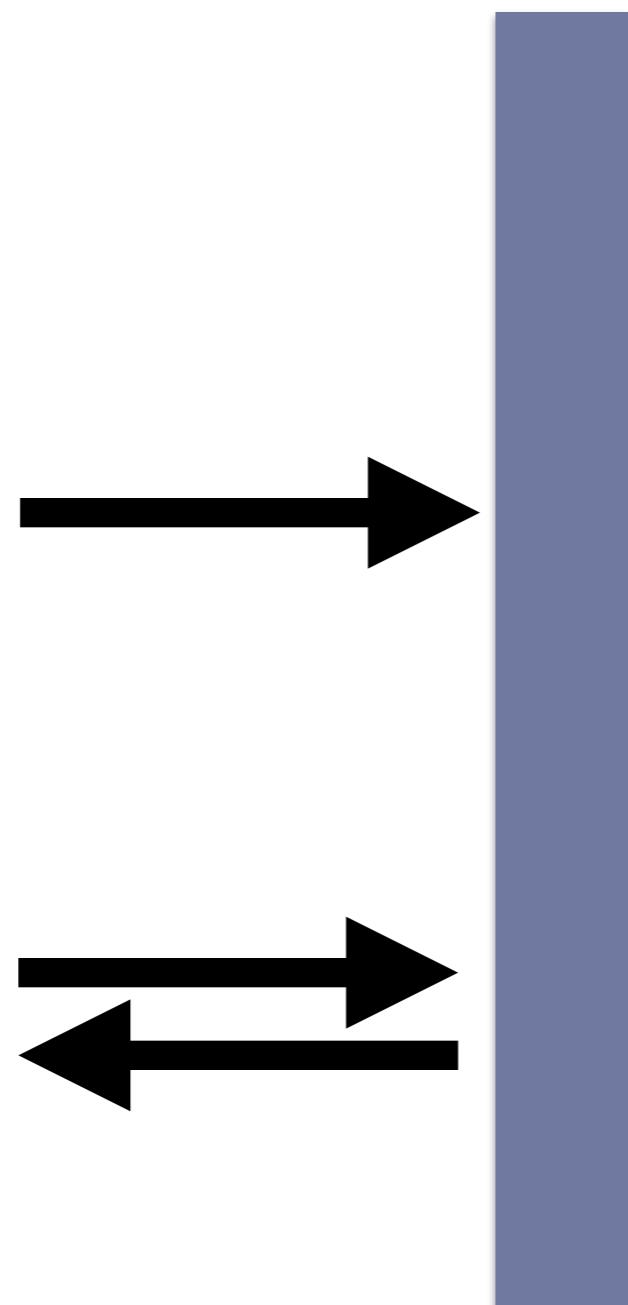
Push to Github

Edit/commit

Edit/commit

Edit/commit

Pull/push



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>



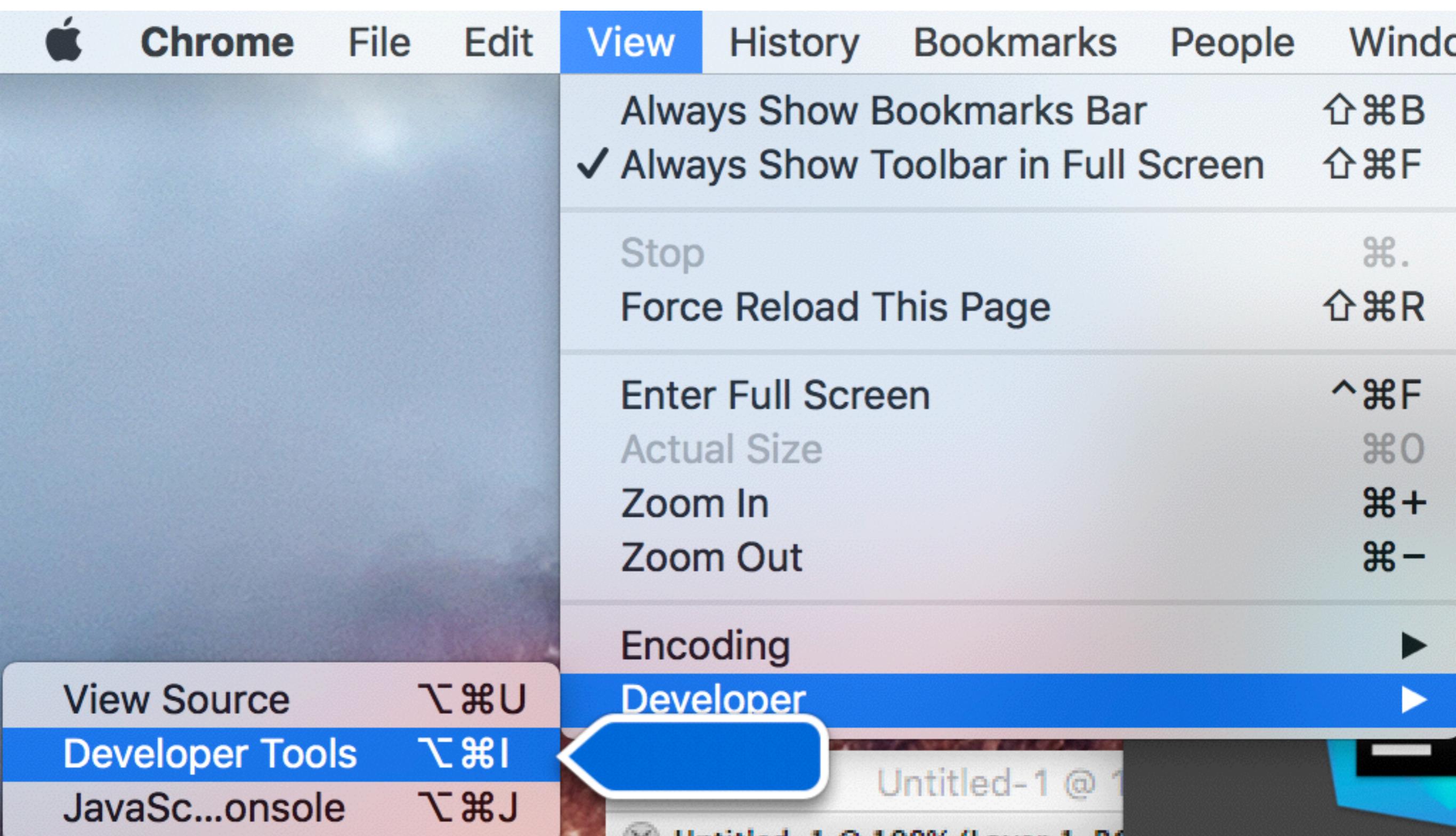
Chrome Developer Tools

+ 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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Elements Console Sources Network

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Faculty in the department have research interests in networking, architecture, parallel and distributed computing, performance evaluation, software engineering, multimedia, graphics and visualization, databases, software engineering, data mining, security, information systems, artificial intelligence, computer vision, and robotics.

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

Prof. Zoran Duric has b

Click the inspector to highlight actual HTML elements in browser

Margin: 0px; Padding: 0px; Border: 0px; Font-family: 'Lucida Grande', Helvetica, Arial, Geneva, sans-serif; Font-size: 100%; Width: 100%; Line-height: 130%;

body { display: block; margin: 0px; }

element.style { margin: 0px; padding: 0px; border: 0px; font-family: 'Lucida Grande', Helvetica, Arial, Geneva, sans-serif; font-size: 100%; width: 100%; line-height: 130%; }

BODY { site.css:3 margin: 0px; padding: 0px; border: 0px; font-family: 'Lucida Grande', Helvetica, Arial, Geneva, sans-serif; font-size: 100%; width: 100%; line-height: 130%; }

Filter :hover .cls +

Filter Show all

Console

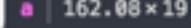
top Preserve log

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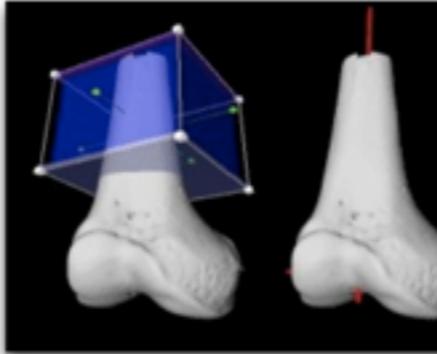
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Teleoperated knee surgery can be improved by building a graphical model from the patient's MRI scan. From Pi

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```
<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&ampnbspChapter</a><br>
-->
<a href="/facultywiki/pmwiki.php/Main/HomePage" target="_parent">Information&ampnbspfor&ampnbspFaculty</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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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,Gen. 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: 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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mouse pointer icon transparent cursor » Legacy Icon Tags » icon 086245-rounded-glossy-black

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img.picture | 272x200

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Teleoperated knee surgery can be improved by building a graphical model from the patient's MRI scan. From [Tim Chen and the GMU Graphics Group](#)

You can even change the HTML or CSS!

html body

Styles Event Listeners DOM Breakpoints Properties

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

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

Console

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img.picture | 272x200

Random Picture and Caption

img.picture alt="Splash Image" src="/covers/cover3.jpg">

margin -

Show all

border-bottom-color: none
border-bottom-style: none
border-bottom-width: 0px
border-image-outset: 0px
border-image-repeat: stretch

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You can even change the HTML or CSS!

padding-bottom: 5px;
border-top: 1px solid black;
margin: 0px;
font-size: 100%;
font-style: italic;
font-weight: bold;
text-align: right;
color: black;

h1 { user agent stylesheet
display: block;

Filter :hover .cls + element.style { margin: -1px -1px 0px 0px; }

Filter Show all

border-bottom-color: none;
border-bottom-style: none;
border-bottom-width: 0px;
border-image-outset: 0px;
border-image-repeat: stretch;

Console

nav.html Preserve log

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Elements Console Sources Network

body><div class="spacer"></div><div class="navbody"><table border="0" cellpadding="0" cellspacing="0" class="search">...</table><h1>The Best Department</h1> == \$0<div class="list">...</div><h1>Research</h1><div class="list">...</div><h1>Academics</h1><div class="list">...</div><h1>Student Information</h1><div class="list">...</div></div><!-- Navigation Skipper, see top of this page --><script type="text/javascript">...</script></p>

Using the JavaScript Console

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nav.html ▾ Preset log

console.log("Hello World");

Console

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console.log("Hello World");
Hello World
undefined

VM2660:1

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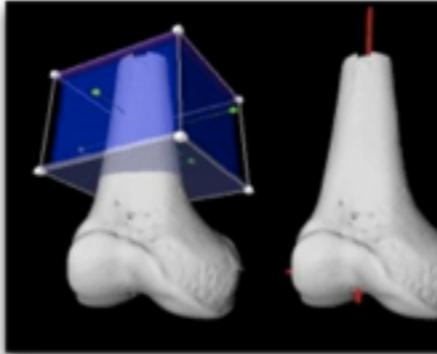
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Prof. Zoran Duric appointed as Deputy Editor of [Journal of Pattern Recognition \(more\)](#)

Prof. Zoran Duric has been elected to the Board of Directors of the International Society for Pattern Recognition (ISPR)

Teleoperated knee surgery can be performed using a robotic arm controlled by a surgeon.

***** GENERAL *****

BODY { margin: 0px; padding: 0px; border: 0px; font-family: 'Lucida Grande', 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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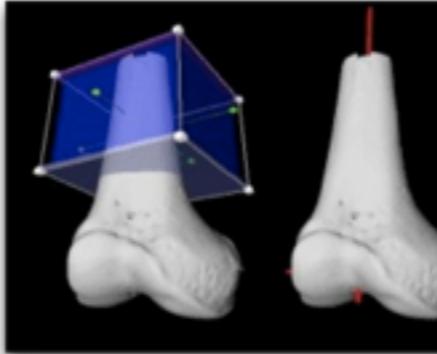
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Teleoperated knee surgery can be improved by building a graphical model from the patient's MRI scan. From Paper: "A Graphical Model for Teleoperated Knee Surgery" by Zoran Duric et al.

View all resources loaded in a timeline

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Prof. Zoran Duric has been invited to speak at the [International Conference on Machine Learning \(ICML\) 2013](#).

Network Timeline:

Name	St...	Ty...	Initiator	Size	TL...	Timeline – Start Time
nav.css	200	st...	nav.htm...	2...	5...	2 ms
spacer.png	200	png	nav.htm...	3...	4...	400 ms
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...	

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

Console

nav.html Preserve log

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/>**

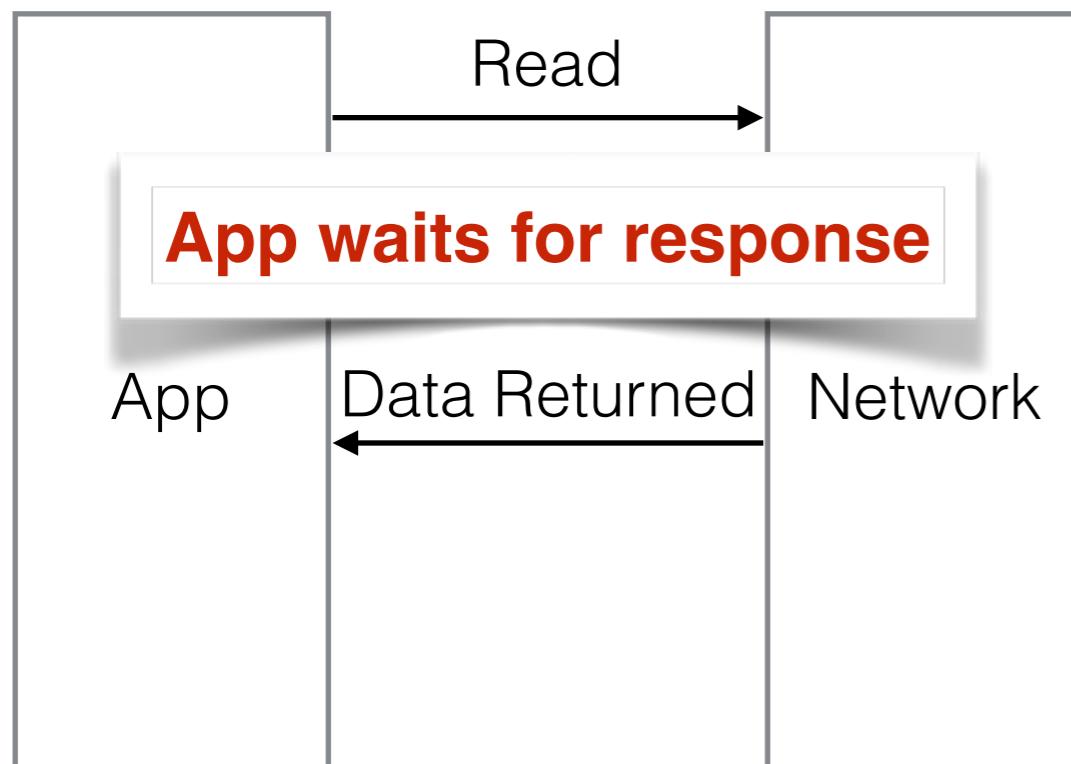
Node.js

Node.js

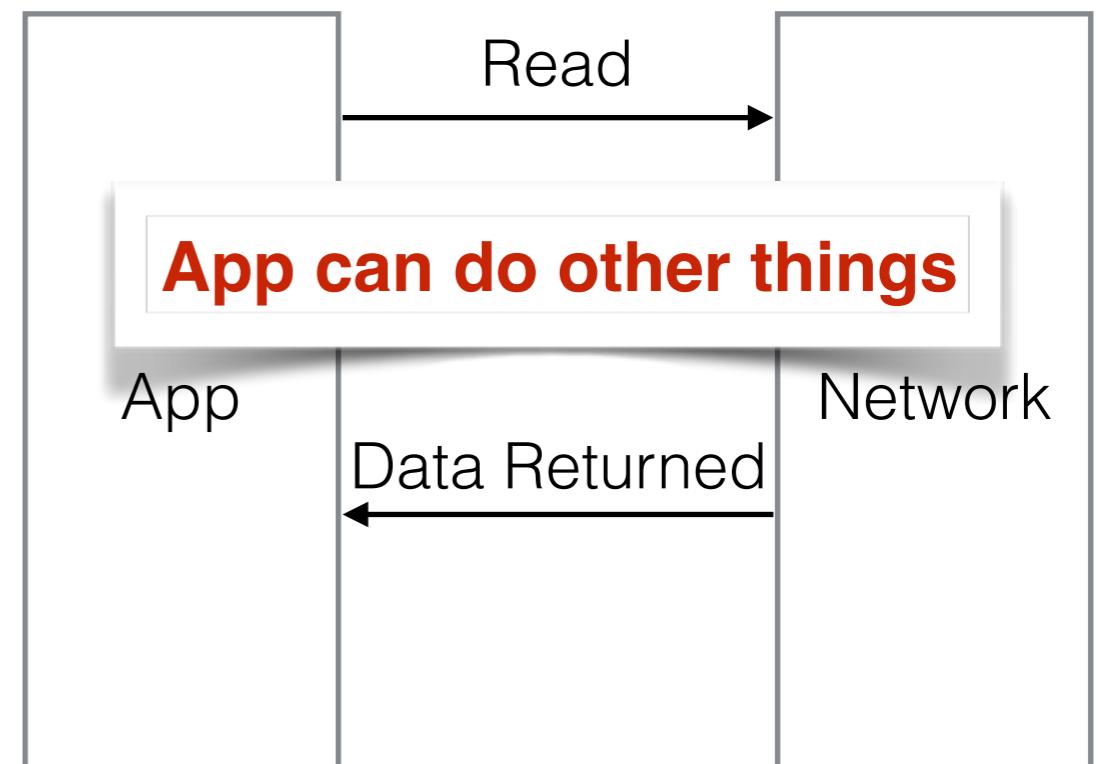
- Node.js is not a web server
- Node.js is a *runtime* for JavaScript based on Chrome's JavaScript runtime
- Uses an **event-driven, non-blocking I/O model**
- Your code runs single threaded
- Has a large ecosystem of packages (**npm**)

Non-Blocking I/O

Regular (blocking) I/O

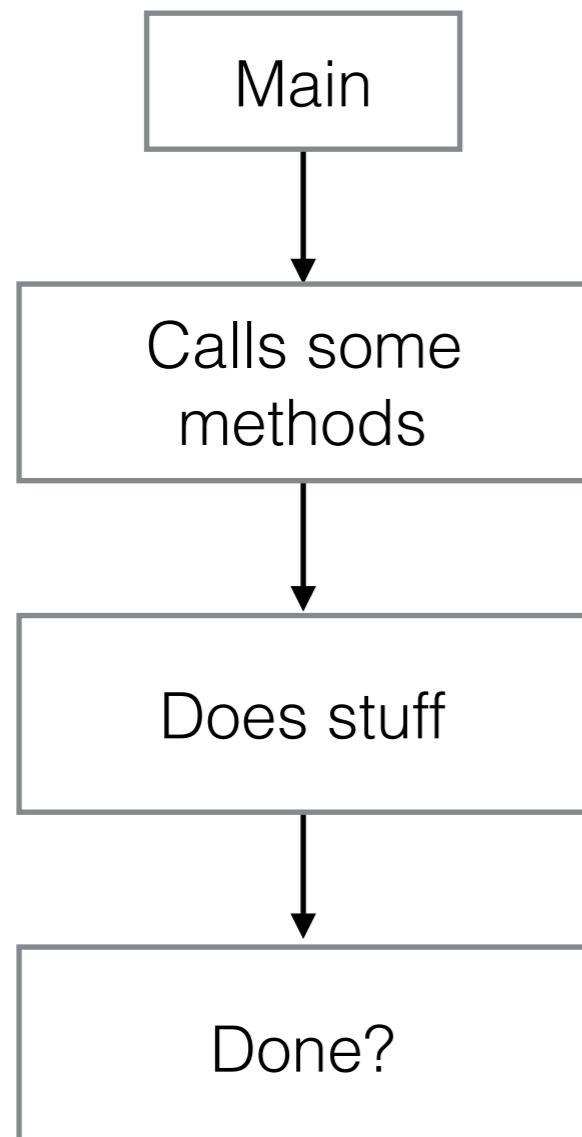


Non-Blocking I/O

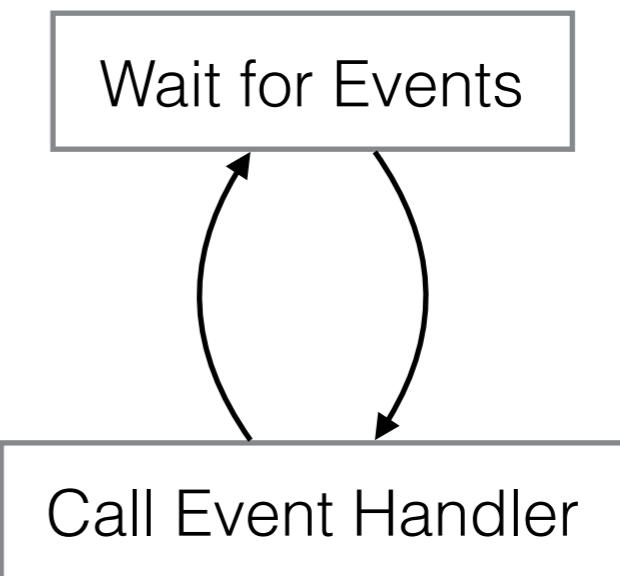


Event-Driven Programming

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),
- 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);
});
```

**Creates a configuration file
for your project**

**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



Github

Magic deployment!

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://www.socrative.com) and select “Student Login”

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

ID is your @gmu.edu email

For question 3:

Write one project idea that you have