Web Programming

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World Wide Web

- Wikipedia definition: a system of interlinked hypertext documents accessed via the Internet.

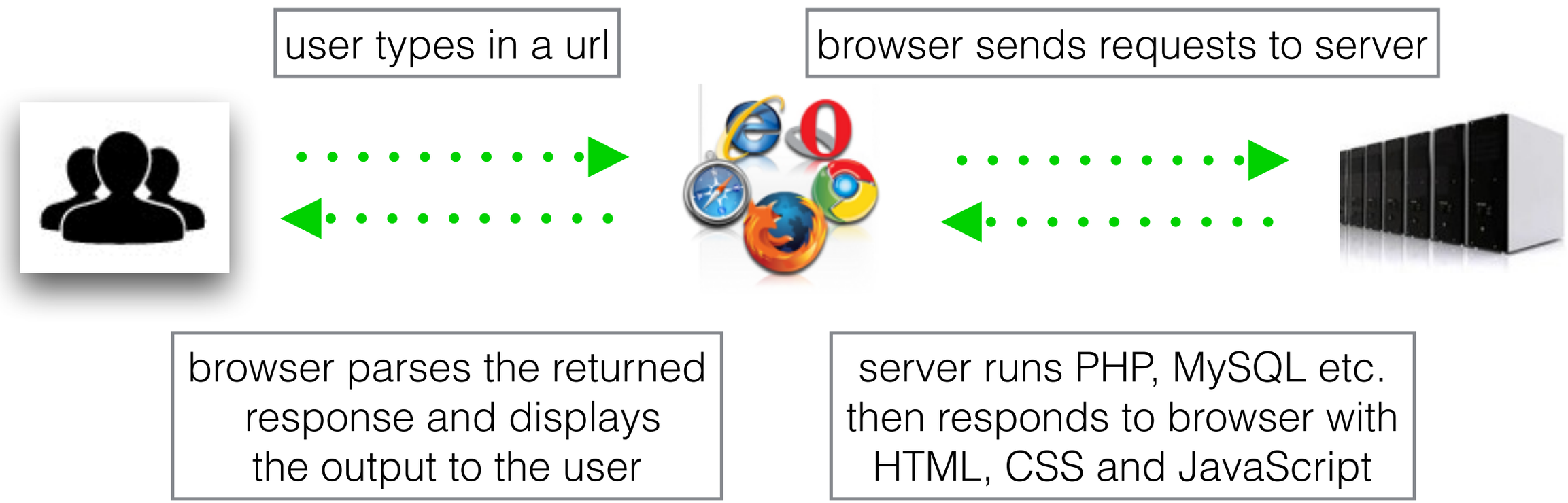
image from http://www.syslog.cl.cam.ac.uk/

Web ≠ Internet

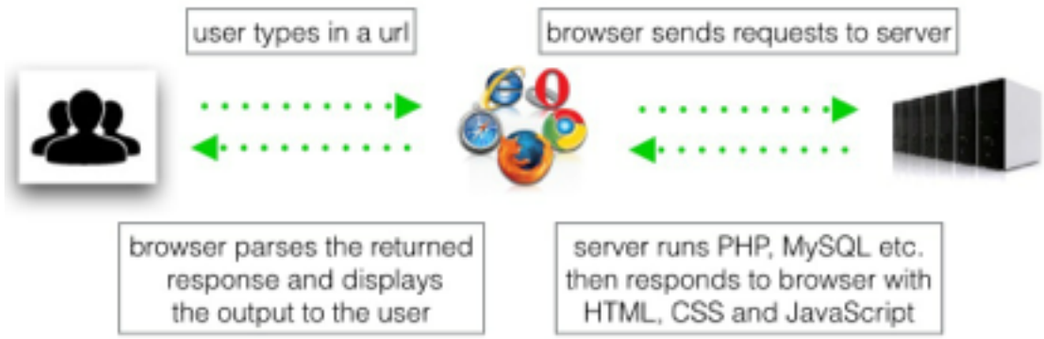
World Wide Web: a collection of interlinked multimedia documents that are stored on the Internet and accessed using a common protocol (HTTP)

Internet: a physical network connecting millions of computers using the same protocols for sharing/ transmitting information (TCP/IP)

Web Programming



Web Programming



Static

- Web Document (HTML, CSS)

Dynamic

- Client-side programming (JavaScript …)

  can download program with Web page, execute on client machine

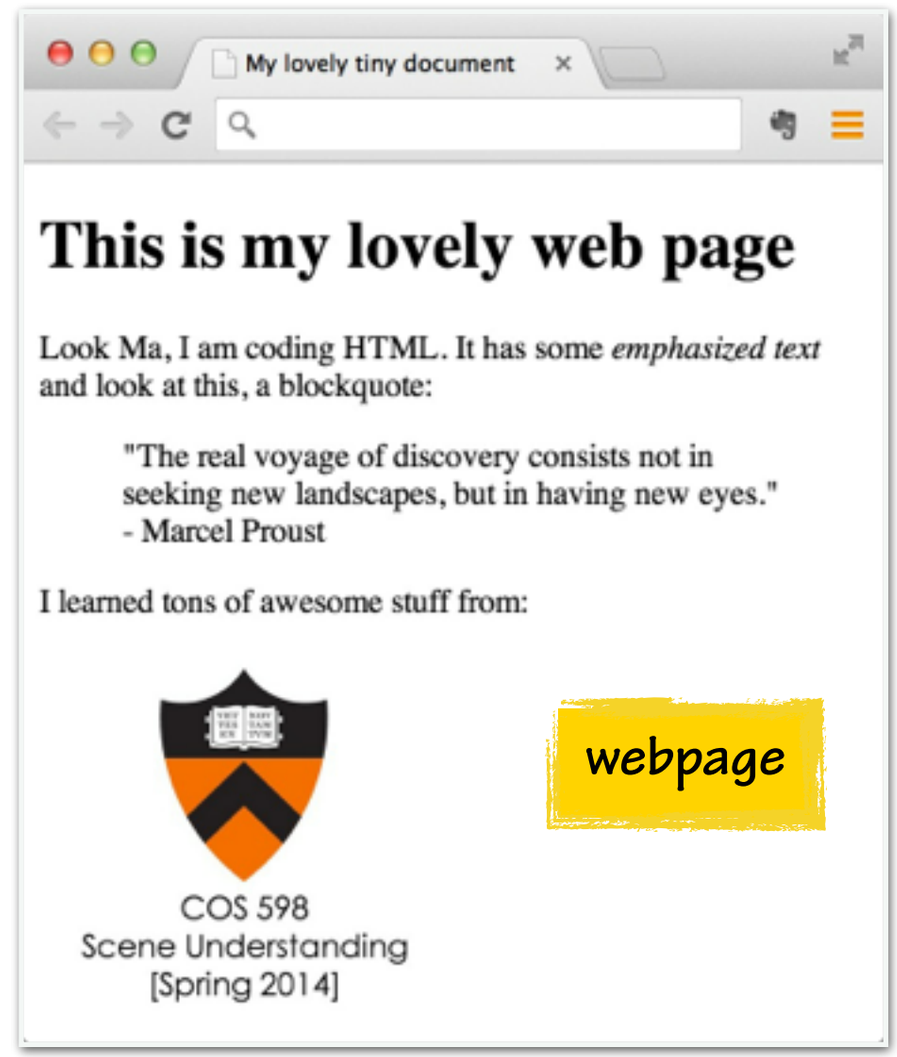
- Server-side programming (PHP, CGI, Perl …)

  can store and execute program on Web server, link from Web page

HTML

What is HTML?

HyperText Markup Language (HTML) is the core language of nearly all Web content.



HTML: The Document Tree

This hierarchical structure is called the DOM: the Document Object Model.

cos598demo.html

```html
<!DOCTYPE html>
<html lang="en">
    <head>
        <title>My lovely tiny document</title>
        <meta content="text/html;charset=UTF-8"/>
    </head>
    <body>
        <!-- heading -->
        <h1>This is my lovely web page</h1>
        <p>
            Look Ma, I am coding <abbr title="Hyper Text Markup
             Language">HTML</abbr>. It has some <em> emphasized
             text</em> and look at this, a blockquote:
        </p>
        <blockquote>
            <p>"The real voyage of discovery consists not in
                seeking new landscapes, but in having new eyes."
                - Marcel Proust</p>
        </blockquote>
        <p> I learned tons of awesome stuff from:</p>
        <img src="./img/cos598.jpg" alt="cos598" width="200">
    </body>
</html>
```

head

body

My lovely tiny document

This is my lovely web page

Look Ma, I am coding HTML. It has some *emphasized text* and look at this, a blockquote:

> "The real voyage of discovery consists not in seeking new landscapes, but in having new eyes."
> - Marcel Proust

I learned tons of awesome stuff from:

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Line 24, Column 1 Tab Size: 4 HTML

HTML: Elements

Elements: the basic building blocks which define the semantic meaning of their content.

cos598demo.html

```
1   <!DOCTYPE html>
2   <html lang="en">
3       <head>
4           <title>My lovely tiny document</title>
5           <meta content="text/html;charset=UTF-8"/>
6       </head>
7       <body>
8           <!-- heading -->
9           <h1>This is my lovely
10          <p>
11              Look Ma, I am coding <abbr title="Hyper Text Markup
12               Language">HTML</abbr>. It has some <em> emphasized
13               text</em> and look at this, a blockquote:
14          </p>
15          <blockquote>
16              <p>"The real voy
17                  seeking new
18                  - Marcel Pr
19          </blockquote>
20          <p>I learned tons of awesome stuff from:</p>
21          <img src="./img/cos598.jpg" alt="cos598" width="200">
22      </body>
23  </html>
```

"<p>" element indicates a paragraph

the "<img>" element indicates an image

My lovely tiny document

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Line 24, Column 1 Tab Size: 4 HTML

HTML: Tags

cos598demo.html

```
1  <!DOCTYPE html>
2  <html lang="en">
3      <head>
4          <meta charset="utf-8">
5          <title>My lovely tiny document</title>
6      </head>
7      <body>
8          <!-- heading -->
9          <h1>This is my lovely web page</h1>
10         <p>
11             Look Ma, I am coding <abbr title="Hyper Text Markup
12              Language">HTML</abbr>. It has some <em> emphasized
13              text</em> and look at this, a blockquote:
14         </p>
15
16
17                 seeking new landscapes, but in having new eyes."
18                 - Marcel Proust</p>
19         </blockquote>
20         <p> I learned tons of awesome stuff from:</p>
21         <img src="./img/cos598.jpg" alt="cos598" width="200">
22     </body>
23 </html>
```

<h1>: opening tag

<h1>: closing tag

empty elements like <img> doesn't need closing tag

My lovely tiny document

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Line 24, Column 1 Tab Size: 4 HTML

HTML: Attributes

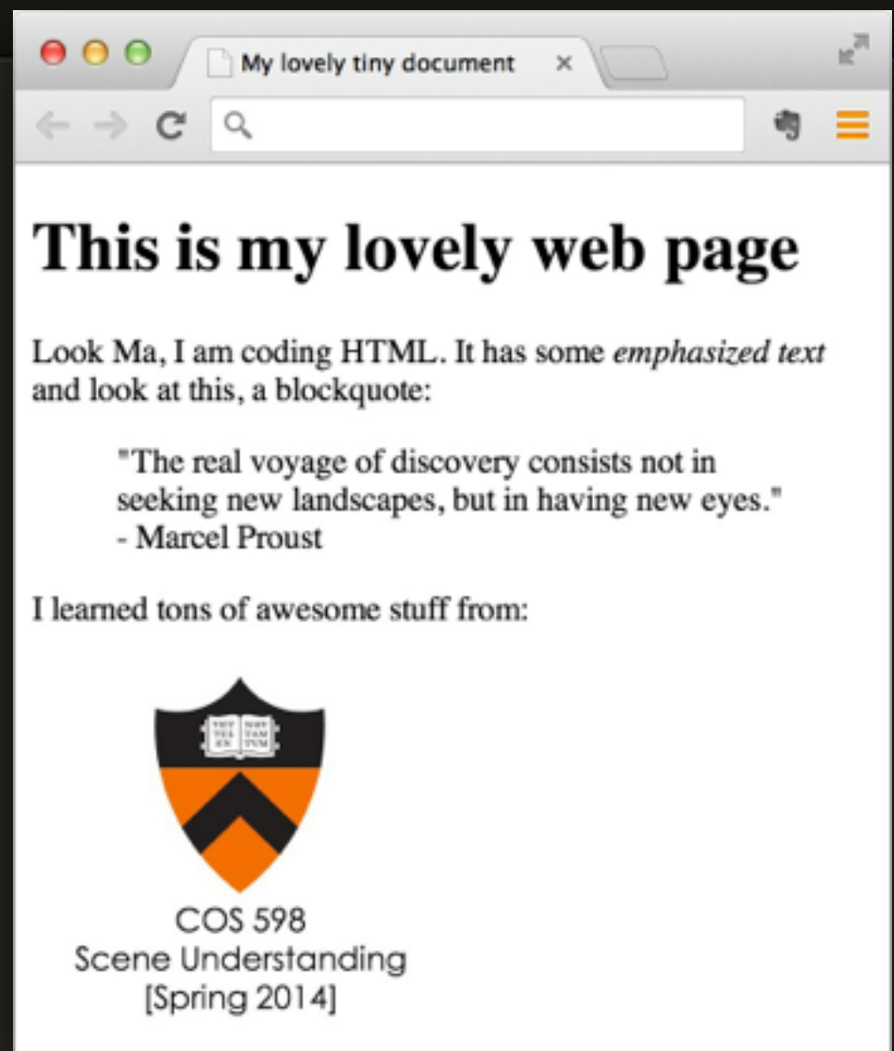
cos598demo.html

```html
<!DOCTYPE html>
<html lang="en">
    <head>
        <title>My lovely tiny document</title>
        <meta content="text/html;charset=UTF-8"/>
    </head>
    <body>
        <!-- heading -->
        <h1>This is my lovely web page</h1>

                                                Text Markup
                                                > emphasized
                                                te:

            <p>"The real voyage of discovery consists not in
                seeking new landscapes, but in having new eyes."
                - Marcel Proust</p>
        </blockquote>
        <p> I learned tons of awesome stuff from:</p>
        <img src="./img/cos598.jpg" alt="cos598" width="200">
    </body>
</html>
```

Attributes usually consist of 2 parts:
An attribute name: e.g. width
An attribute value: e.g. 200



Line 24, Column 1 Tab Size: 4 HTML

HTML: <img> Tag

cos598demo.html

```html
<!DOCTYPE html>
<html lang="en">
    <head>
        <title>My lovely tiny document</title>
        <meta content="text/html;charset=UTF-8"/>
    </head>
    <body>
        <!-- heading -->
                kup
                zed
            <p> "The real voyage of discovery consists not in
                seeking new landscapes, but in having new eyes."
                - Marcel Proust</p>
        </blockquote>
        <p> I learned tons of awesome stuff from:</p>
        <img src="./img/cos598.jpg" alt="cos598" width="200">
    </body>
</html>
```

The <img> tag defines an image in an HTML page.
It has two required attributes:
src - specifies the URL of an image
alt - specifies an alternate text for an image

My lovely tiny document

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Line 24, Column 1 Tab Size: 4 HTML

HTML: Doctype and Comments

cos598demo.html

```html
<!DOCTYPE html>
<html lang="en">
    <head>
        <title>My lovely tiny document</title>
        <meta content="text/html;charset=UTF-8"/>
    </head>
    <body>
        <!--
        <h1>
        <p>
                                                    Markup
            Language">HTML</abbr>. It has some <em> emphasized
            text</em> and look at this, a blockquote:
        </p>
        <blockquote>
            <p>"The real voyage of discovery consists not in
                seeking new landscapes, but in having new eyes."
                - Marcel Proust</p>
        </blockquote>
        <p> I learned tons of awesome stuff from:</p>
        <img src="./img/cos598.jpg" alt="cos598" width="200">
    </body>
</html>
```

an HTML document must contain a doctype declaration as the first line

My lovely tiny document

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Line 24, Column 1 | Tab Size: 4 | HTML

In-Class Exercise

- Task List
  1. Change the content shown on the tab
  2. Create a paragraph and write some stuff in that paragraph
  3. Change the width of the image to 500px
- Cheat sheet
  1. <title> … </title>
  2. …
  3. <img … width="…">

CSS

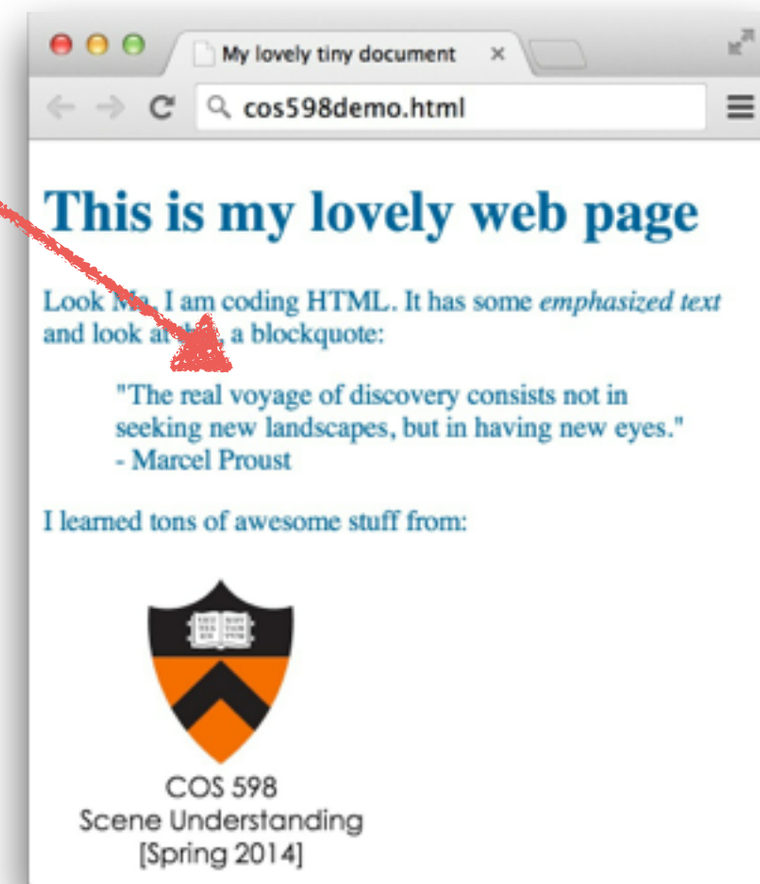
some examples borrowed from https://developer.mozilla.org/

What is CSS?

Cascading Style Sheets (CSS) is a language for specifying how documents are presented to users.

define the color of body

```
<head>
    <title>My lovely tiny document</title>
    <meta content="text/html;charset=UTF-8"/>
    <style type="text/css">
        body {color:#006699;}
    </style>
</head>
```



CSS syntax

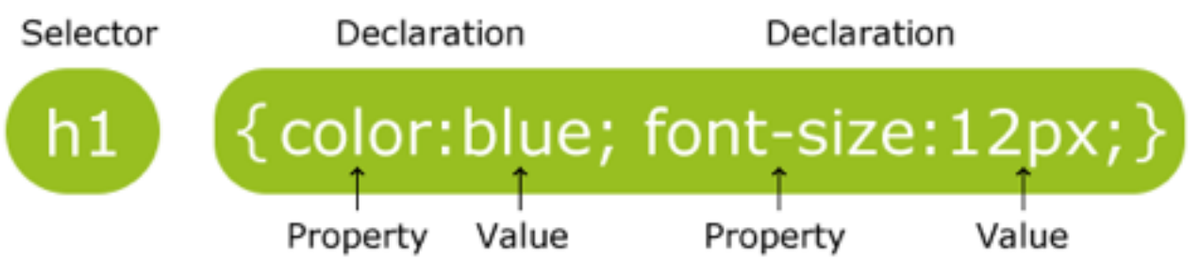


image from w3school

Why Use CSS?

Keep the information content of a document separate from the details of how to display it (also know as ‘style’) so that you can:

- Avoid duplication
- Make maintenance easier
- Use the same content with different styles for different purposes

How to Insert CSS?

- External Style Sheet

```
<head>
    <link rel="stylesheet" type="text/css" href="mystyle.css">
</head>
```

- Internal Style Sheet

```
<head>
    <style type="text/css">
        body {color:#006699;}
    </style>
</head>
```

- Inline Styles

```
<p style="color:sienna;margin-left:20px;">This is a paragraph.</p>
```

CSS Box Model and Positioning

All HTML elements can be considered as boxes.

You can specify an element's position in four ways:
relative, fixed, absolute, static

In-Class Exercise

- Task List
  1. Write CSS as **internal style sheet** and change the color of the body content to **'#FF0000'**
  2. Write CSS as **inline style sheet** and change the font size of one paragraph to **'50px'**
- Cheat sheet
  1. <style> … </style>

```
<head>
    <style type="text/css">
        body {color:#006699;}
    </style>
</head>
```

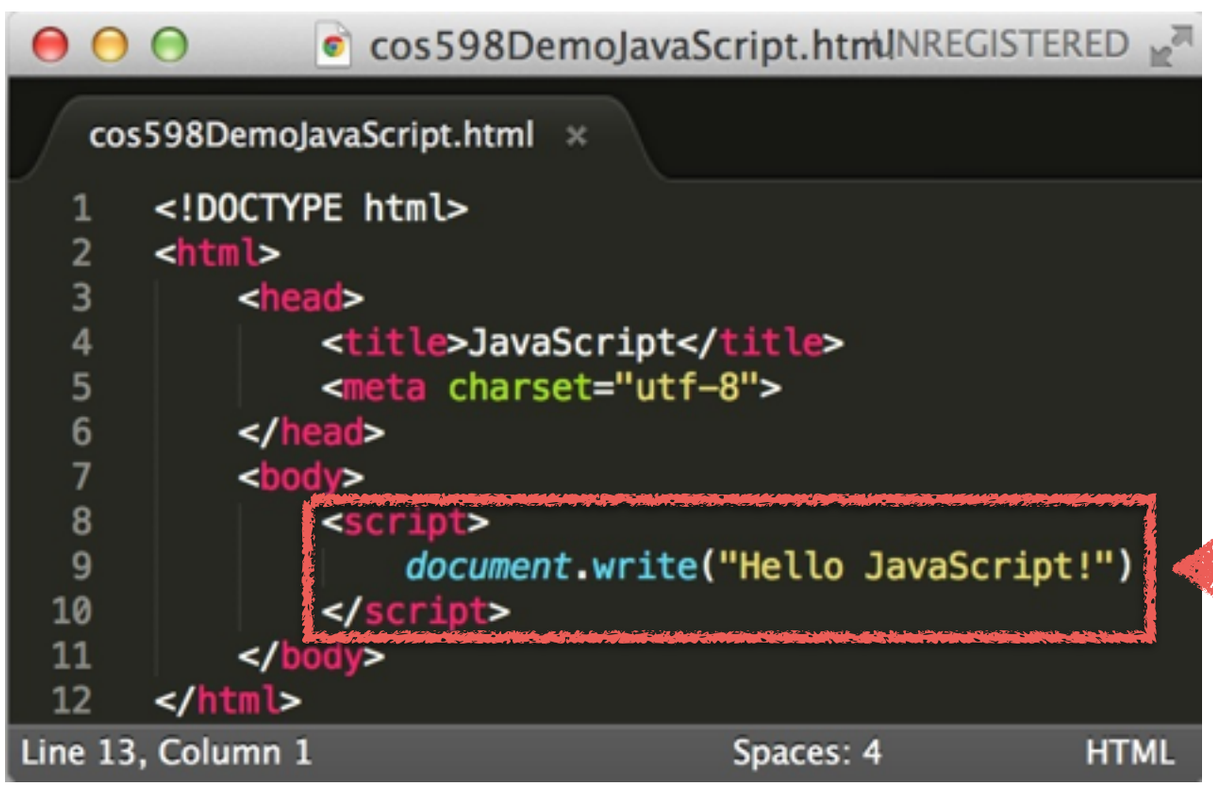
  2. <p style="font-size:…">

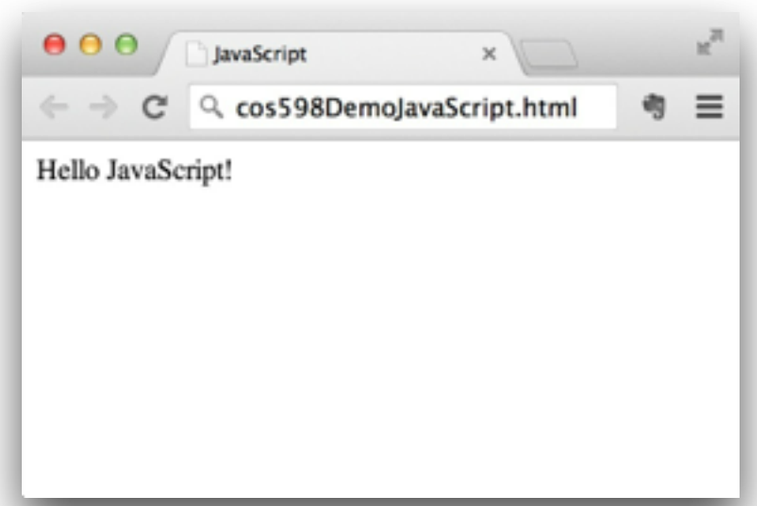
```
<p style="color:sienna;margin-left:20px;">This is a paragraph.</p>
```

JavaScript

What is JavaScript?

A scripting language. JavaScript code can be inserted into any HTML page, and it can be executed by all types of web browsers.





put all your JavaScript code in <script> block

JavaScript: Syntax

- Comment: // or /* */
- Variables: var x = 0
- Data types: undefined, null, number, string, boolean …
- Operators: +,-,*,/%, >, < …
- Control structure: if… else, for, while, switch …
- Native objects: array, date, error, math

JavaScript: Object

```
> var course = new Object();
  course.coursename = "Scene Understanding";
  course.year = 2014;
  course.instructor = "Jianxiong Xiao";

> course.instructor
  "Jianxiong Xiao"

> course.instructor.length
  14

> course.instructor.toUpperCase()
  "JIANXIONG XIAO"
```

create an JavaScript object

accessing object properties: objectName.propertyName

accessing object methods: objectName.methodName()

JavaScript: Array

For Matlab users,
note: index starts from zero!

```
> var course = new Array();
  course[0] = "Scene Understanding";
  course[1] = 2014;
  course[2] = "Jianxiong Xiao";

> course
  ["Scene Understanding", 2014, "Jianxiong Xiao"]
> course[0]
  "Scene Understanding"

> course[0] = "Computer Vision";
> course
  ["Computer Vision", 2014, "Jianxiong Xiao"]
```

create an array: you can have different objects in on array

access data

modify data

JavaScript: Math

- Constants:
  - Math.PI
- Methods:
  - Math.round(), Math.floor(), Math.ceil()
  - Math.sin(), Math.cos()
  - Math.abs()
  - Math.sqrt(), Math.pow(), Math.exp()
  - Math.max(), Math.min()
  - Math.random()

JavaScript: Function

- A simple example

function name

```
> function addTwoNumbers(a,b)
  {
      return a+b;
  }

> var a = 1, b = 2;
> var c = addTwoNumbers(a,b);

> console.log(c);
  3
```

arguments

call a function

- Important concept: callback functions

JavaScript: Library

- To use a JavaScript framework library in your web pages, just include the library in a <script> tag:

```
<script src="http://ajax.googleapis.com/ajax/libs/jquery/1.11.0/jquery.min.js"></script>
```

- Computer Vision library:

jsfeat GitHub http://inspirit.github.io/jsfeat/

In-Class Exercise

- Write a function to compute the multiplication of two numbers
- Define two variables num1=5, num2=7
- Define another variable num3, set the value as the multiplication of num1 and num2 using the function that you just created, and check check the value of num3f

```
> function addTwoNumbers(a,b)
  {
      return a+b;
  }

> var a = 1, b = 2;
> var c = addTwoNumbers(a,b);

> console.log(c);
  3
```

jQuery

some examples borrowed from http://www.w3schools.com/

What is jQuery?

- jQuery is a lightweight JavaScript library to make it much easier to use JavaScript on your website.
- Install jQuery
  - Download the jQuery library from jQuery.com

```
<head>
<script src="jquery-1.11.0.min.js"></script>
</head>
```

  - Include jQuery from a CDN, like Google

```
<head>
<script src="http://ajax.googleapis.com/ajax/libs/jquery/1.11.0/jquery.min.js"></script>
</head>
```

jQuery Syntax

- $(selector).action()

A (selector) to "query (or find)" HTML elements

$ sign to access jQuery

A jQuery action() to be performed on the element(s)

```
$("p").click(function(){
        // action goes here!!
        $(this).hide(); // hide the current <p> element
});
```

- Some commonly used DOM events:

Mouse Events	Keyboard Events	Form Events	Document/Window Events
click	keypress	submit	load
dblclick	keydown	change	resize
mouseenter	keyup	focus	scroll
mouseleave		blur	unload

jQuery Basics

```
<!-- not use jquery -->
<input type="button" id="mybutton" onclick="alertMsg()" value="cos598button"/>
<script type="text/javascript">
    function alertMsg(){
        alert('someone clicked me!');
    }
    window.onload=function(){
        document.getElementById('mybutton').click();
    };
</script>
```

```
<!-- use jquery -->
<input type="button" id="mybutton" value="cos598button"/>
<script type="text/javascript">
    $(document).ready(function(){
        $('#mybutton').click(function(){
            alert('someone clicked me!');
        });
        $('#mybutton').click();
    });
</script>
```

It is good practice to wait for the document to be fully loaded and ready before working with it.

jQuery Tablesorter

Tablesorter is a jQuery plugin for turning a standard HTML table with THEAD and TBODY tags into a sortable table without page refreshes： http://tablesorter.com/

jQuery Tablesorter

Step 1: create a table in HTML

```html
<table id="mycos598Table" class="tablesorter">
<thead>
<tr>
    <th><span>Last Name</span></th>
    <th><span>First Name</span></th>
    <th><span>Due</span></th>
</tr>
</thead>
<tbody>
<tr>
    <td>Huiwen</td>
    <td>Chang</td>
    <td>$100.00</td>
</tr>
<tr>
    <td>Xinyi</td>
    <td>Fan</td>
    <td>$20.00</td>
</tr>
</tbody>
</table>
```

Step 2: include a single line of code

```html
<script type="text/javascript">
    $(document).ready(function() {
        $("#mycos598Table").tablesorter();
    });
</script>
```

Step 3: sit there and collect money from your classmates

My Lovely Classmates

COS 598
Scene Understanding
[Spring 2014]

Last Name	First Name	Due
Huiwen	Chang	$100.00
Maciej	Halber	$50.00
Xinyi	Fan	$20.00
Sema	Berkiten	$15.00
Yinda	Zhang	$10.00
Zhirong	Wu	$-5.00

JavaScript Minification

- Minification is the process of removing all unnecessary characters from source code without changing its functionality.

what's in jquery.min.js:

```
/*! jQuery v1.9.1 | (c) 2005, 2012 jQuery Foundation, Inc. | jquery.
org/license
//@ sourceMappingURL=jquery.min.map
*/(function(e,t){var n,r,i=typeof t,o=e.document,a=e.location,s=e.jQuery,u=e.
$,l={},c=[],p="1.9.1",f=c.concat,d=c.push,h=c.slice,g=c.indexOf,m=l.
toString,y=l.hasOwnProperty,v=p.trim,b=function(e,t){return new b.fn.init(
e,t,r)},x=/[+-]?(?:\d*\.|)\d+(?:[eE][+-]?\d+|)/.source,w=/\S+/g,T=/^[
\s\uFEFF\xA0]+|[\s\uFEFF\xA0]+$/g,N=/^(?:(<[\w\W]+>)[^>]*|#([\w-]*))$/,C=/^<(
\w+)\s*\/?>(?:<\/\1>|)$/,k=/^[\],:{}\s]*$/,E=/(?:^|:|,)(?:\s*\[)+/g,S=/\\(?:[
"\\\/bfnrt]|u[\da-fA-F]{4})/g,A=/"[^"\\\r\n]*"|true|false|null|-?(?:\d*\.|)\d+
(?:[eE][+-]?\d+|)/g,j=/^-ms-/,D=/-([\da-z])/gi,L=function(e,t){return t.
toUpperCase()},H=function(e){(o.addEventListener||"load"===e.
type||"complete"===o.readyState)&&(q(),b.ready())},q=function(){o.
addEventListener?(o.removeEventListener("DOMContentLoaded",H,!1),e.
removeEventListener("load",H,!1)):(o.detachEvent("onreadystatechange",H),e.
detachEvent("onload",H))};b.fn=b.
prototype={jquery:p,constructor:b,init:function(e,n,r){var i,a;if(!e)return
this;if("string"==typeof e){if(i="<"===e.charAt(0)&&">"===e.charAt(e.length-1)
&&e.length>=3?[null,e,null]:N.exec(e),!i||!i[1]&&n)return!n||n.jquery?(n||r).
find(e):this.constructor(n).find(e);if(i[1]){if(n=n instanceof b?n[0]:n,b.
merge(this,b.parseHTML(i[1],n&&n.nodeType?n.ownerDocument||n:o,!0)),C.test(i[1
])&&b.isPlainObject(n))for(i in n)b.isFunction(this[i])?this[i](n[i]):this.
attr(i,n[i]);return this}if(a=o.getElementById(i[2]),a&&a.parentNode){if(a.
id!==i[2])return r.find(e);this.length=1,this[0]=a}return this.context=o,this.
selector=e,this}return e.nodeType?(this.context=this[0]=e,this.length=1,this)
:b.isFunction(e)?r.ready(e):(e.selector!==t&&(this.selector=e.selector,this.
context=e.context),b.makeArray(e,this))},selector:"",length:0,size:function()
{return this.length},toArray:function(){return h.call(this)},get:function(e)
{return null==e?this.toArray():0>e?this[this.length+e]:this[e]
```

a simple example

```
// this is a variable
var a = 7;

// this is another variable
var b = 17;
```

Online Javascript Compression Tool

```
var a=7;var b=17;
```

white space characters, new line characters, comments are removed

JSON

- JSON (JavaScript Object Notation) is a way to store information in an organized, easy-to-access manner (especially compared to old fashion: XML).

JSON data is written as name/value pairs: "lastName":"Song"

an array of objects

```
> var students;
  undefined
> students = [
      { "firstName":"Shuran" , "lastName":"Song" },
      { "firstName":"Fisher" , "lastName":"Yu" },
      { "firstName":"Chenyi" , "lastName": "Cheng" }
  ];
  [▶ Object , ▶ Object , ▶ Object ]
> students[0].firstName + " " + students[0].lastName;
  "Shuran Song"
> students[0].lastName = "Yu";
  "Yu"
> students[0].firstName + " " + students[0].lastName;
  "Shuran Yu"
>
```

access the first entry

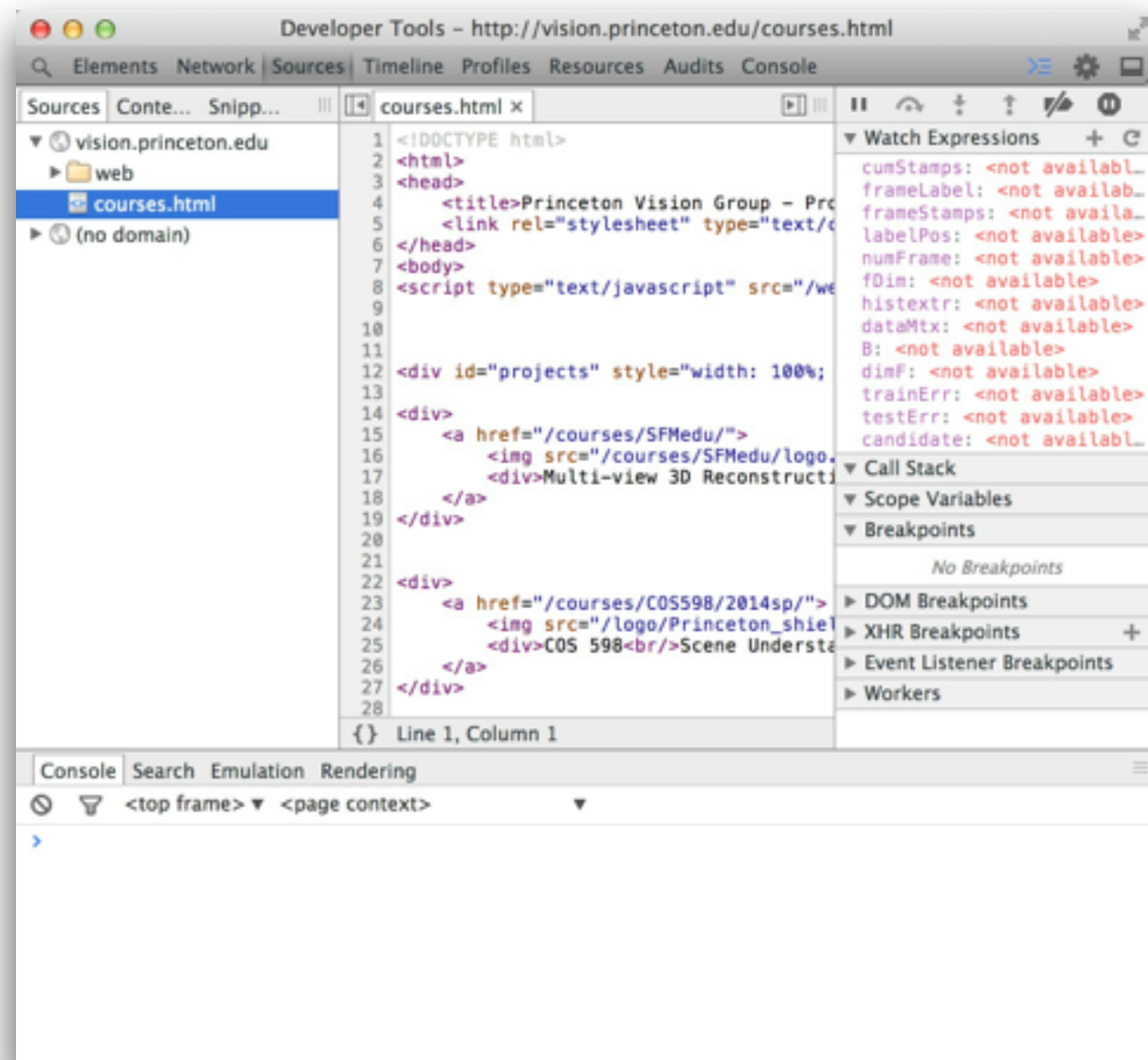
modified the data

Debugging JavaScript

some examples borrowed from https://developers.google.com

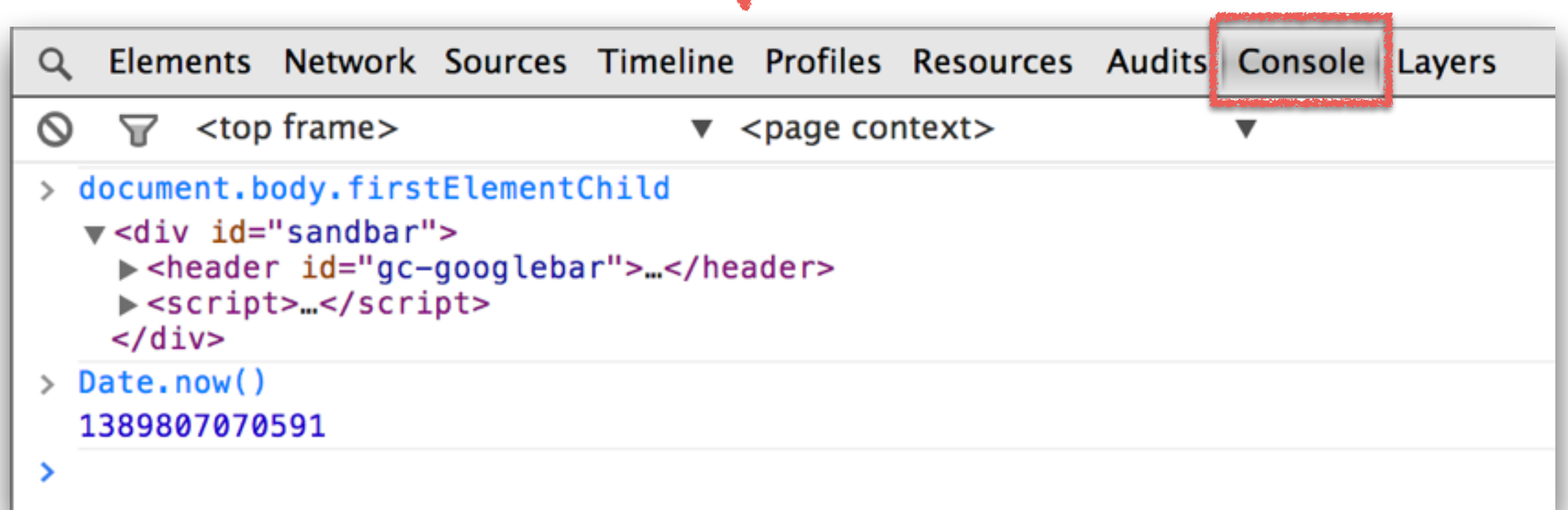
Chrome DevTools

https://developers.google.com/chrome-developer-tools/

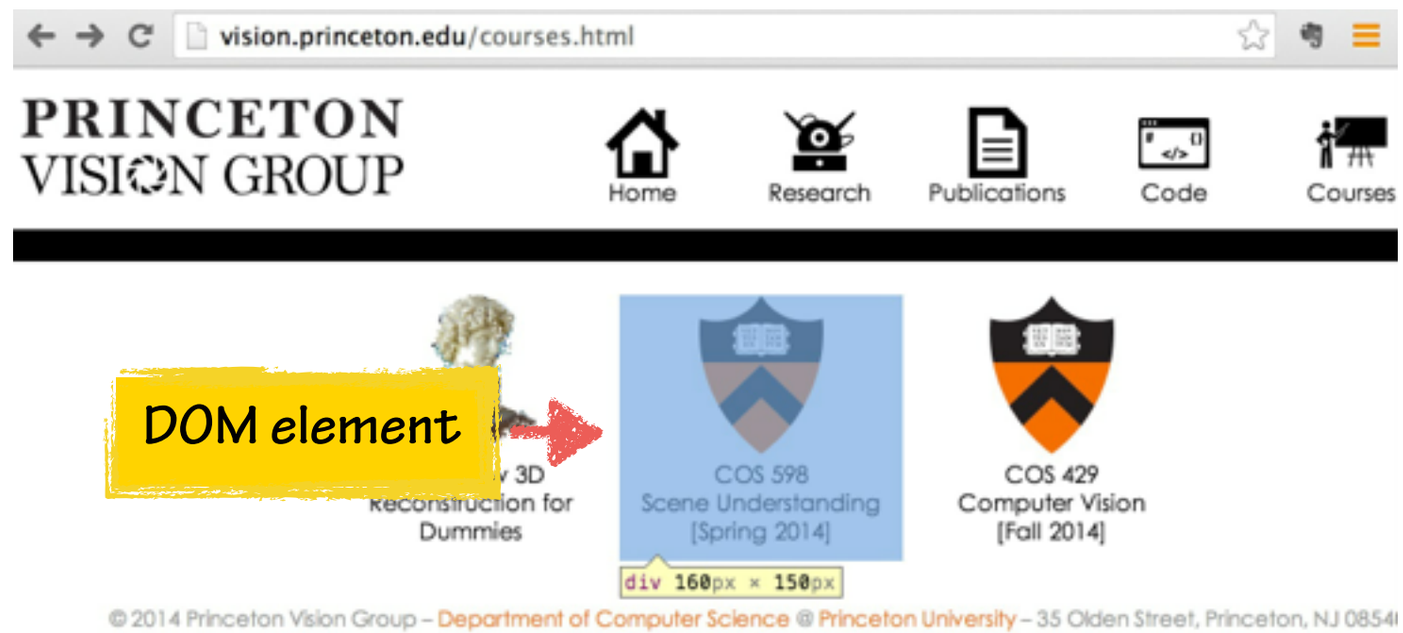


Chrome DevTools: Console

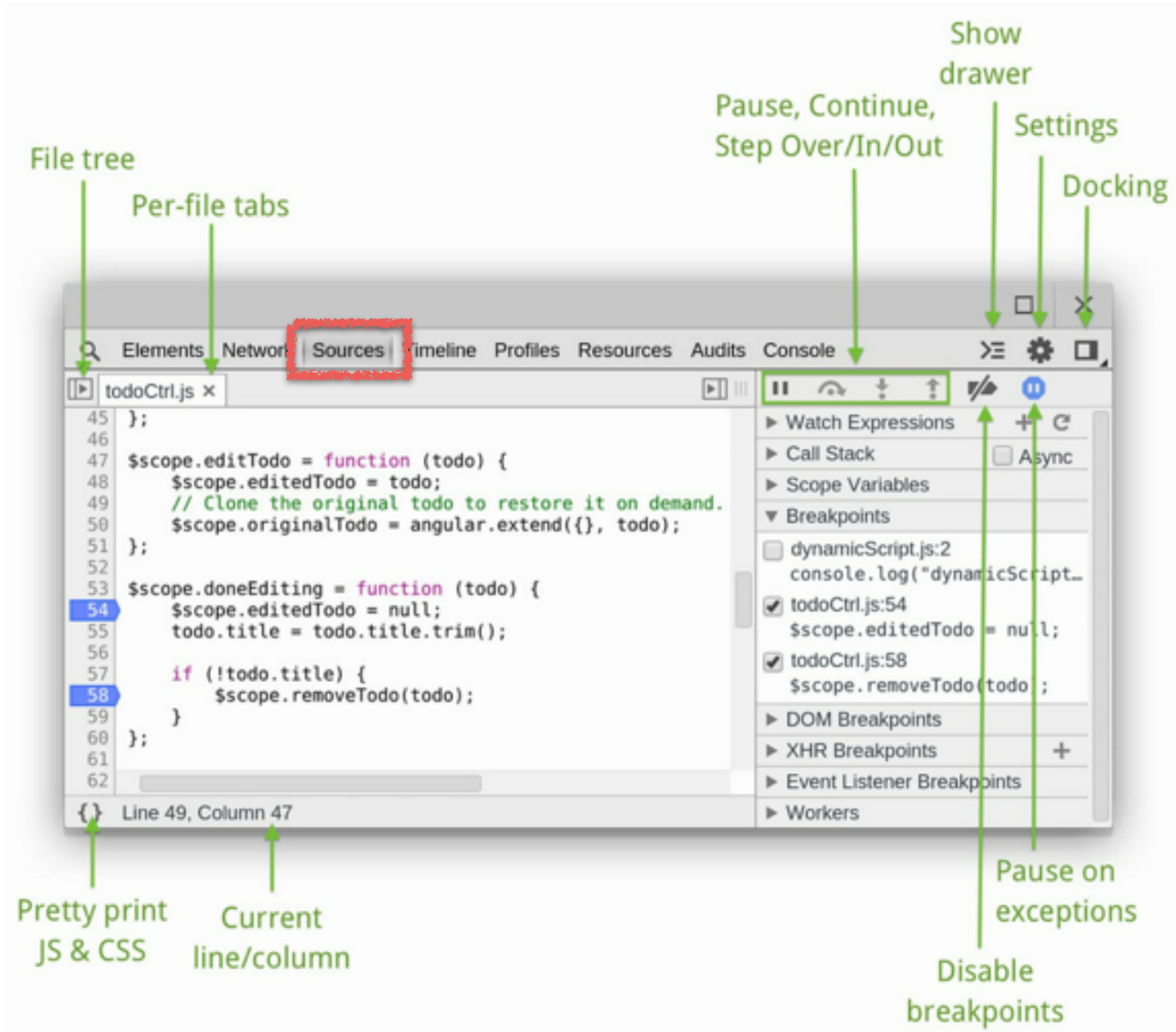
you can enter commands and interact with the document and the Chrome DevTools



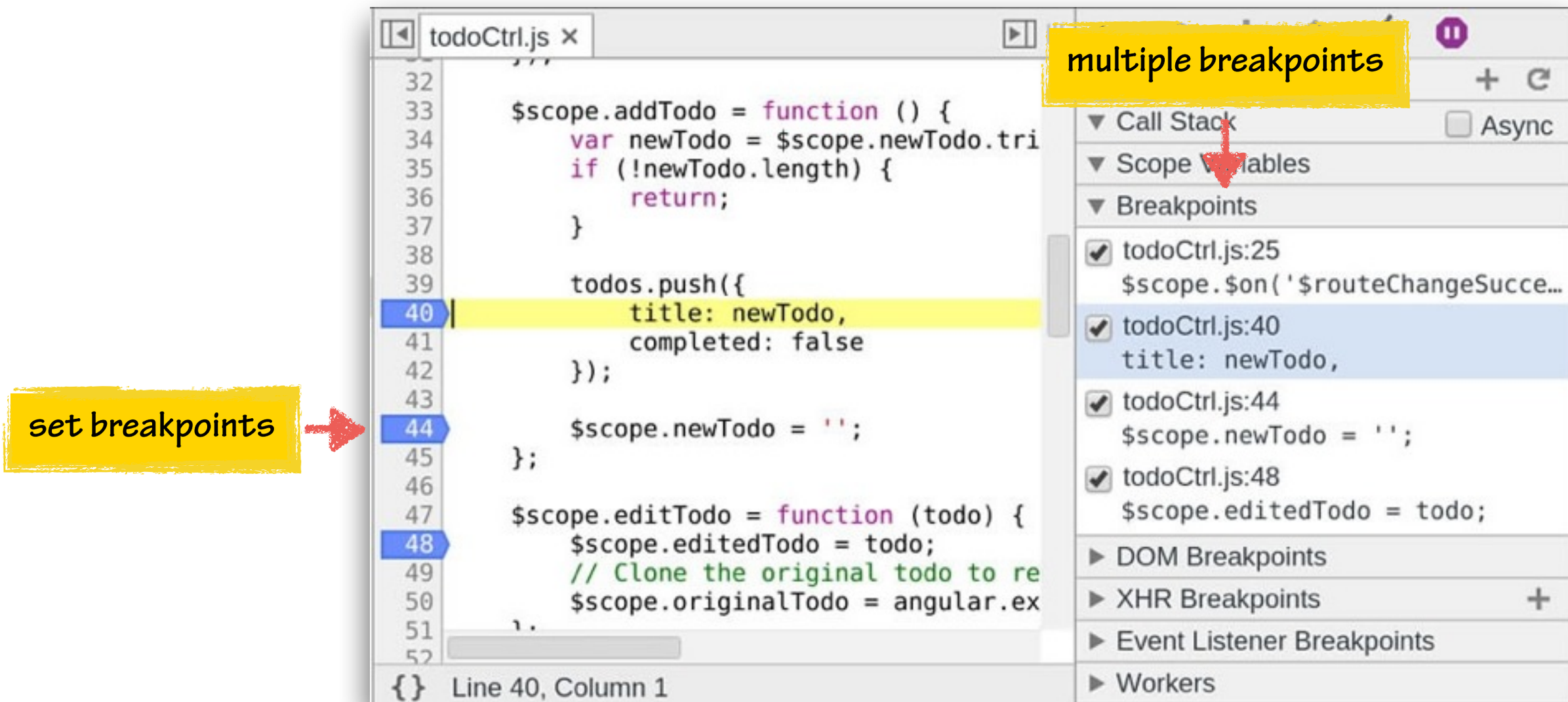
Chrome DevTools: Inspect Element



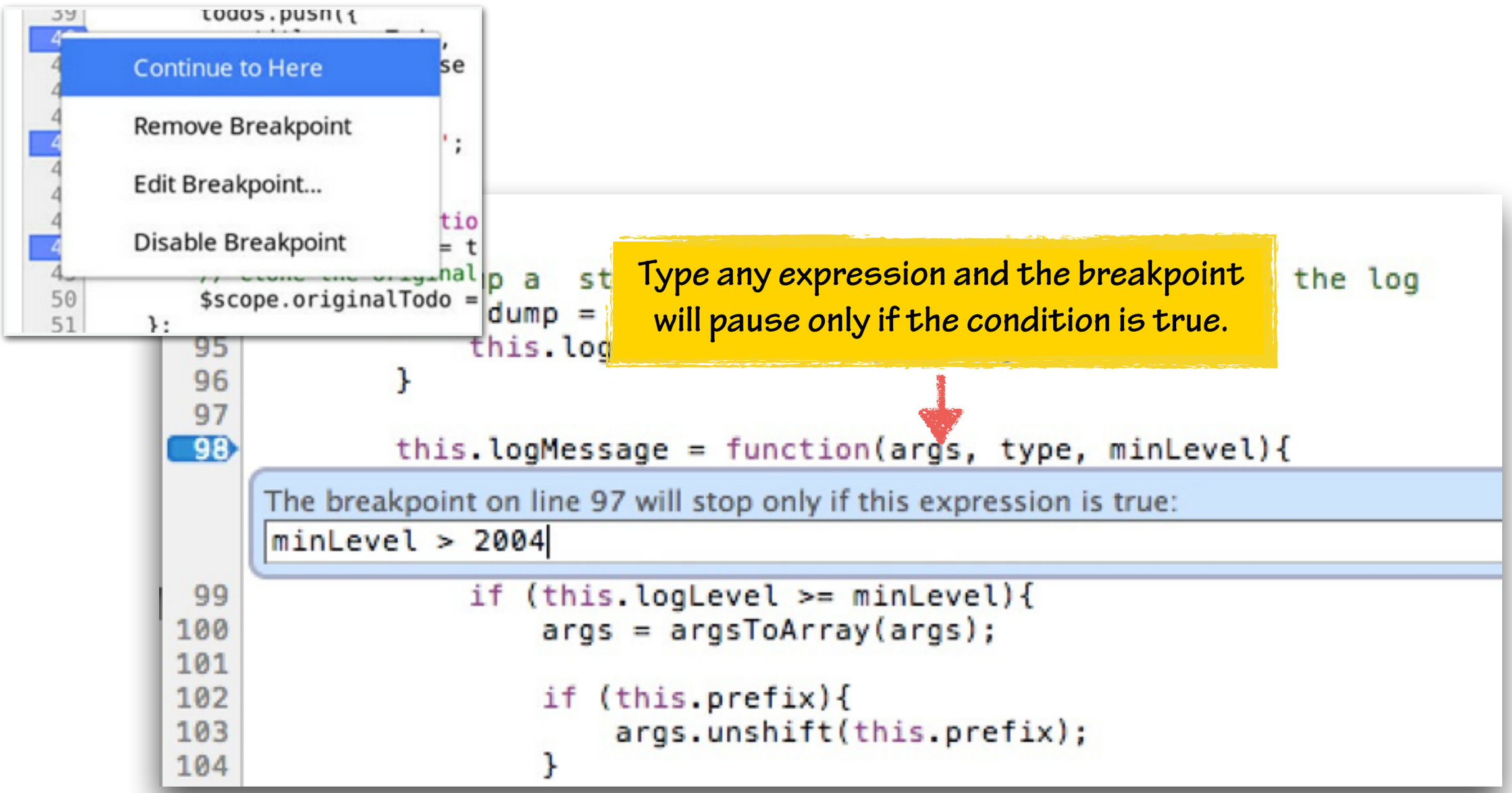
Debugging Javascript: the Sources Panel



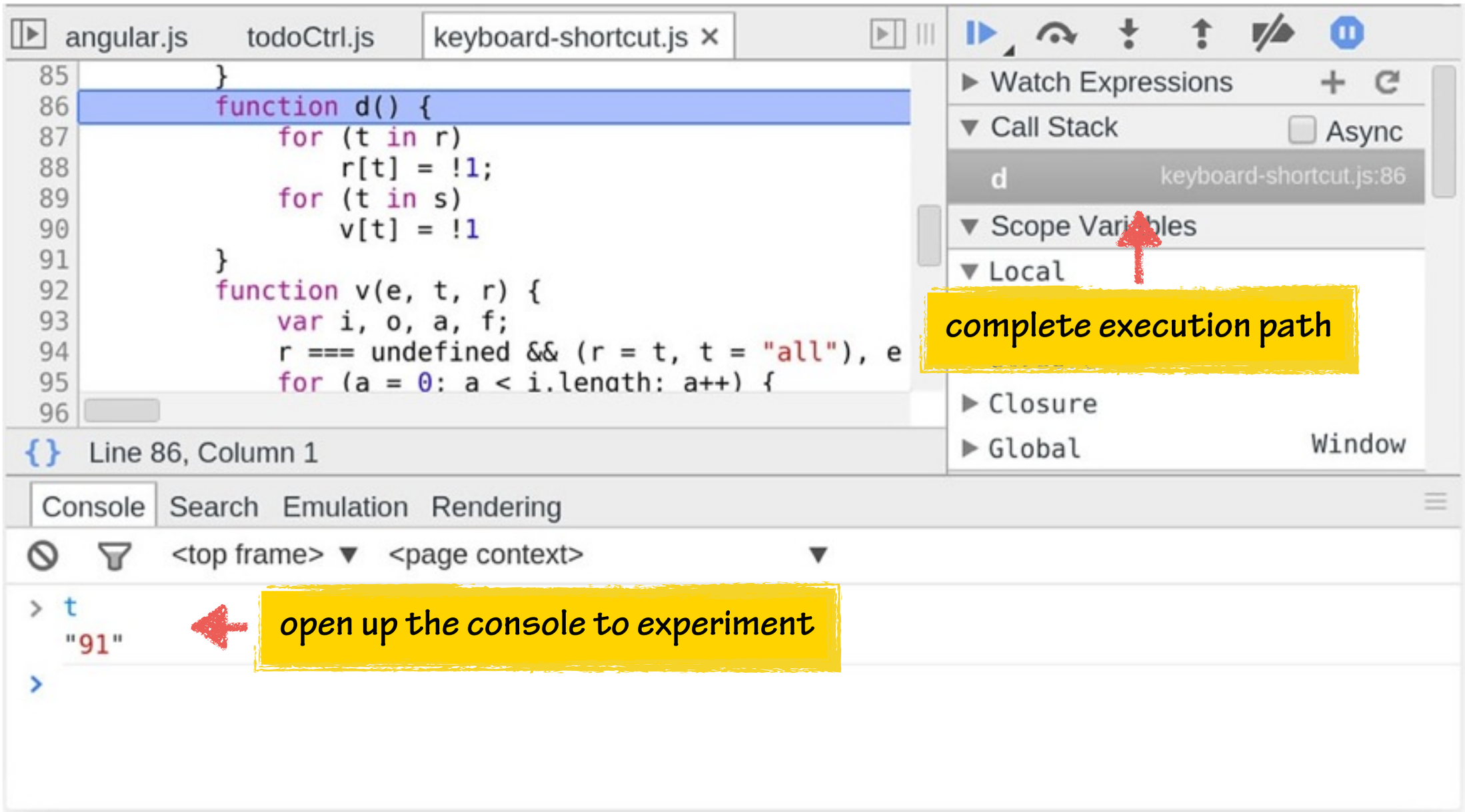
Debugging Javascript: Breakpoints



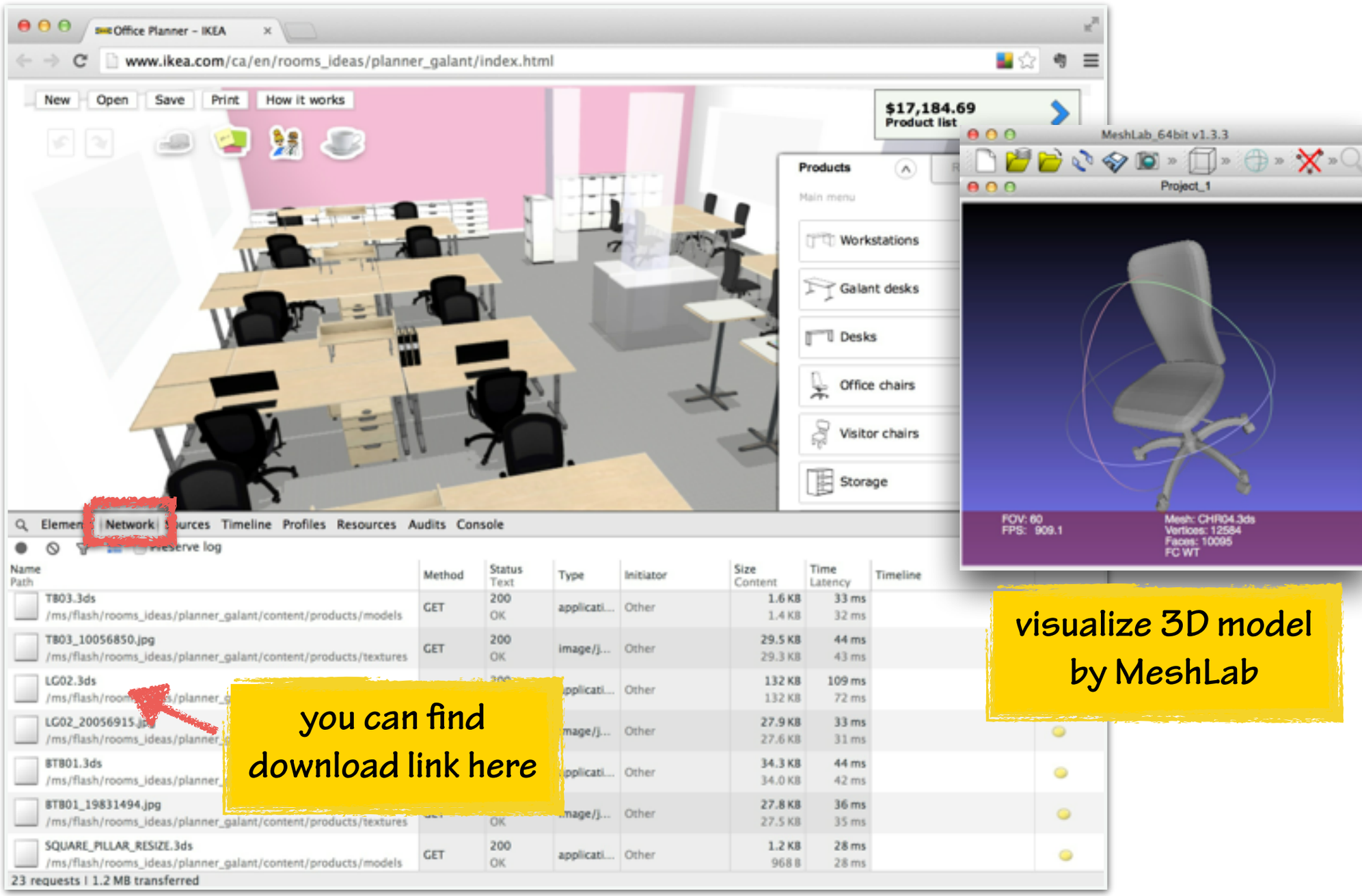
Debugging Javascript: Conditional Statement



Debugging Javascript: Evaluate While Paused

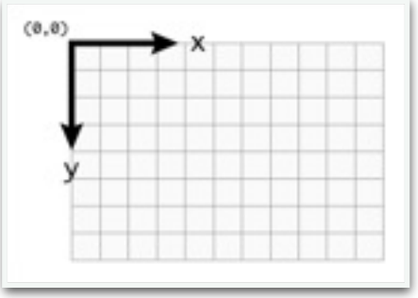


Debugging Javascript: Intercept Network Data

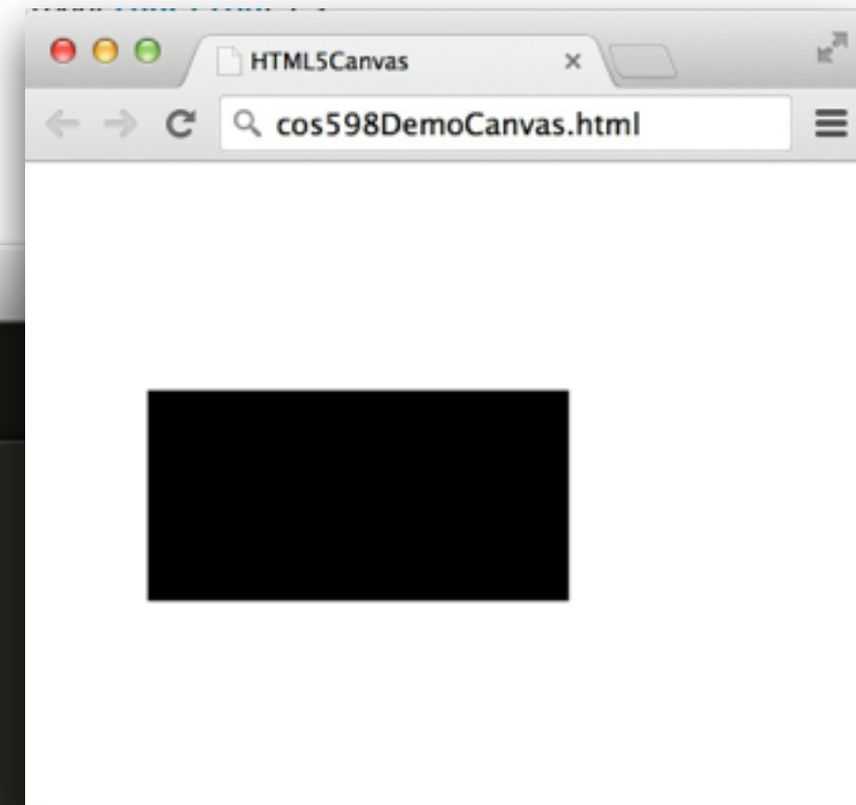


HTML5

some examples borrowed from http://code.tutsplus.com/



HTML5: Canvas Element



cos598DemoCanvas.html

cos598DemoCanvas.html

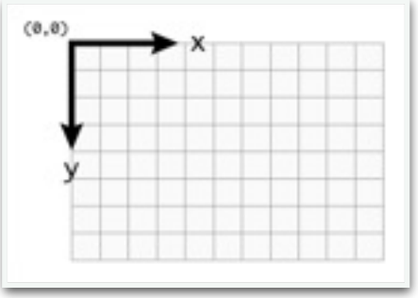
```
1   <!DOCTYPE html>
2   <html>
3       <head>
4           anvas</title>
5           ="utf-8">
6       </head>
7
8       <body>
9           <canvas id="cos598canvas" width="500" height="500"></canvas>
10          <script>
            var canvas = document.getElementById("cos598canvas");
            var ctx = canvas.getContext("2d");
            ctx.fillRect(50, 100, 200, 100);
14          </script>
15      </body>
16  </html>
```

Line 17, Column 1

canvas element

2d rendering context

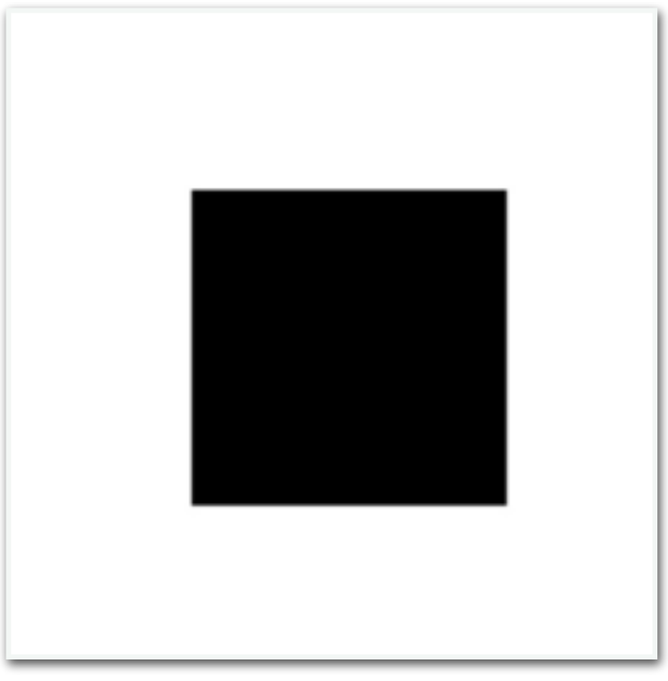
draw a rectangle
ctx.fillRect(x, y, width, height);



HTML5 Canvas: Fill vs. Stroke

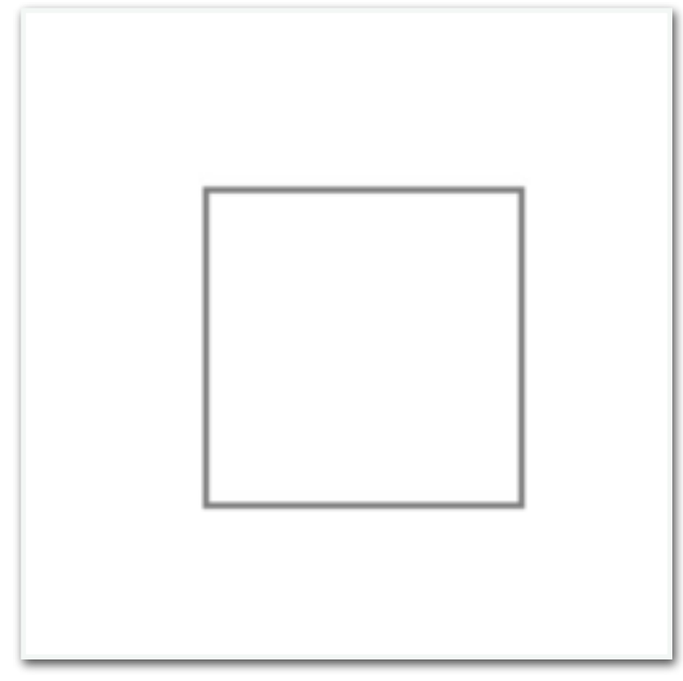
fillRect()

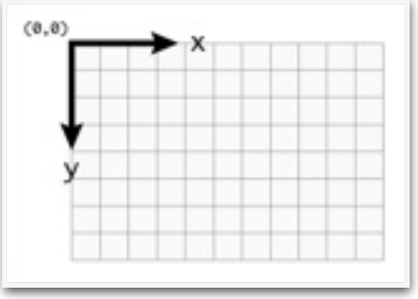
```
ctx.fillRect(50, 50, 100, 100);
```



strokeRect()

```
ctx.strokeRect(50, 50, 100, 100);
```

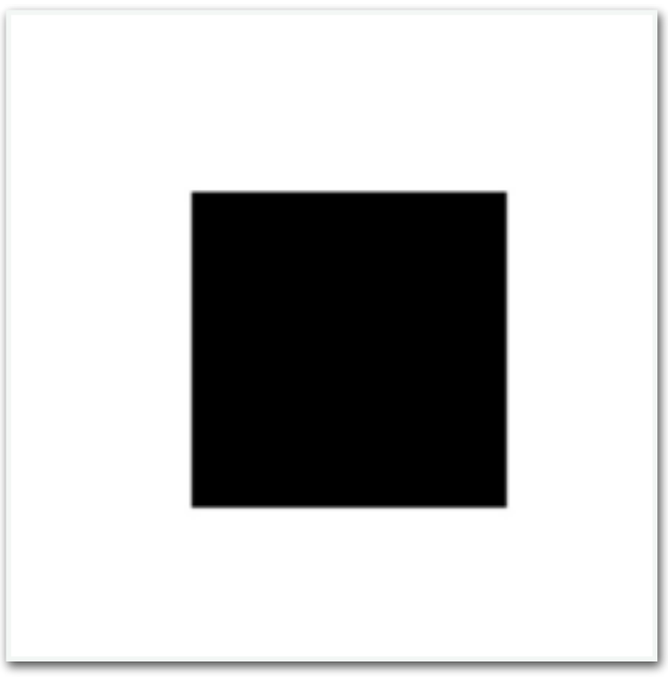




HTML5 Canvas: Changing Color

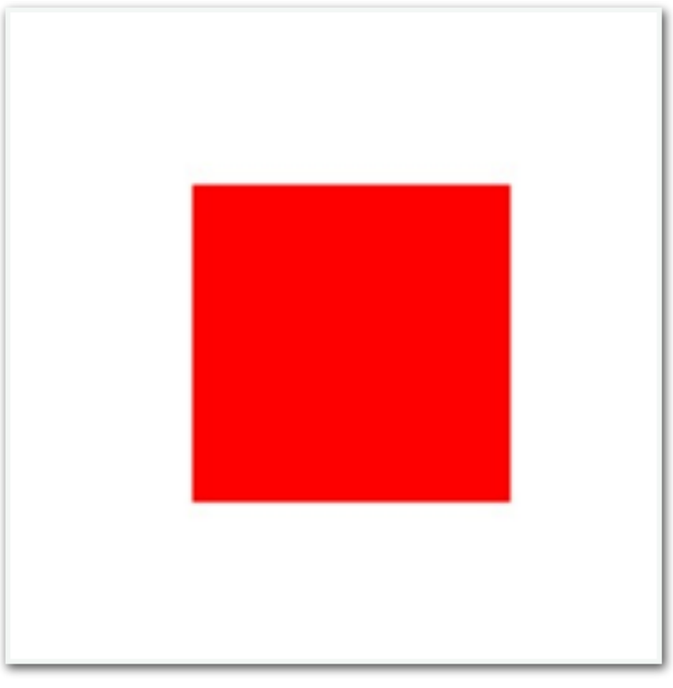
fillRect()

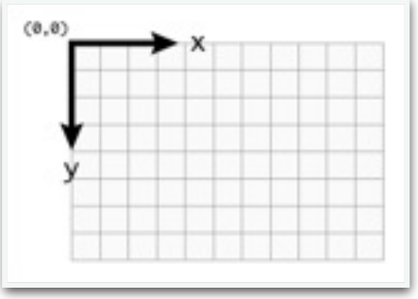
```
ctx.fillRect(50, 50, 100, 100);
```



fillStyle()

```
ctx.fillStyle = "rgb(255, 0, 0)";
ctx.fillRect(50, 50, 100, 100);
```

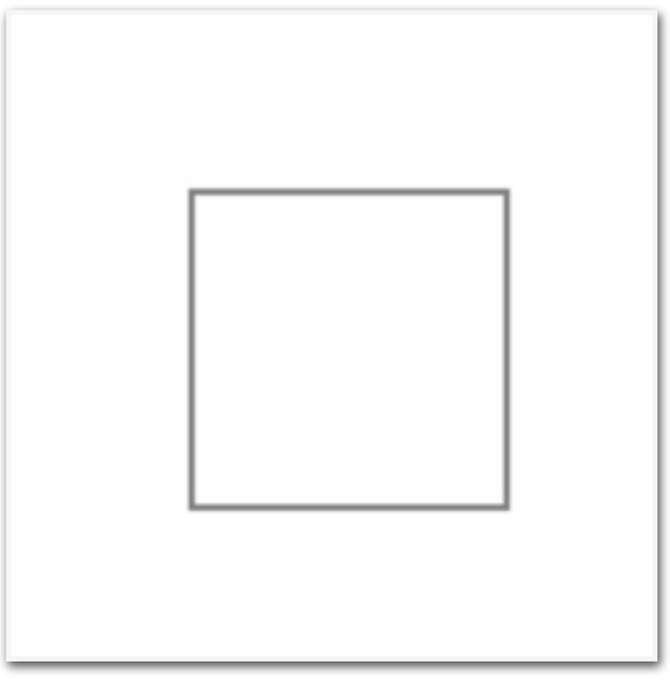




HTML5 Canvas: Changing Color

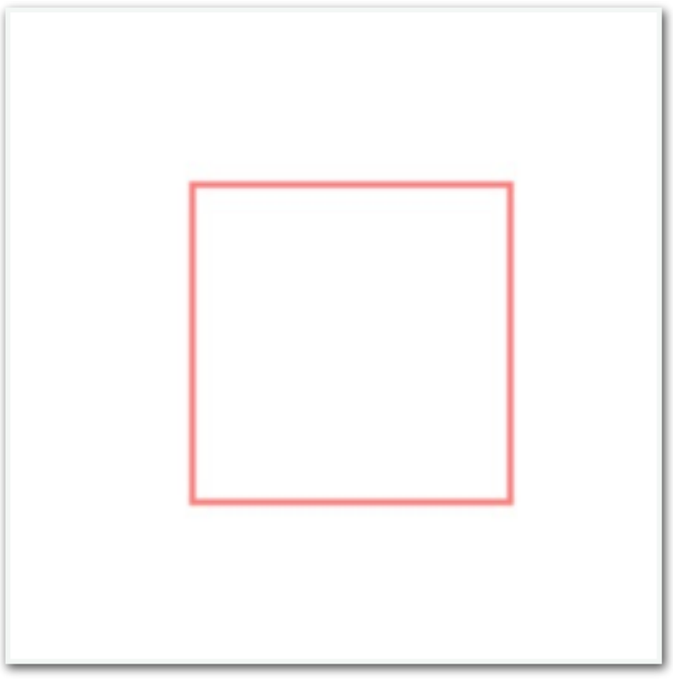
strokeRect()

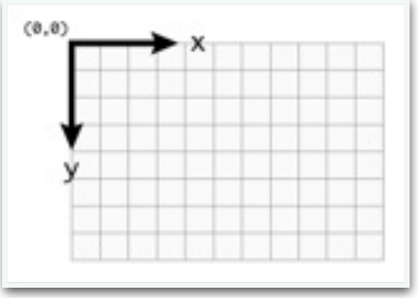
```
ctx.strokeRect(50, 50, 100, 100);
```



strokeStyle()

```
ctx.strokeStyle = "rgb(255, 0, 0)";
ctx.strokeRect(50, 50, 100, 100);
```

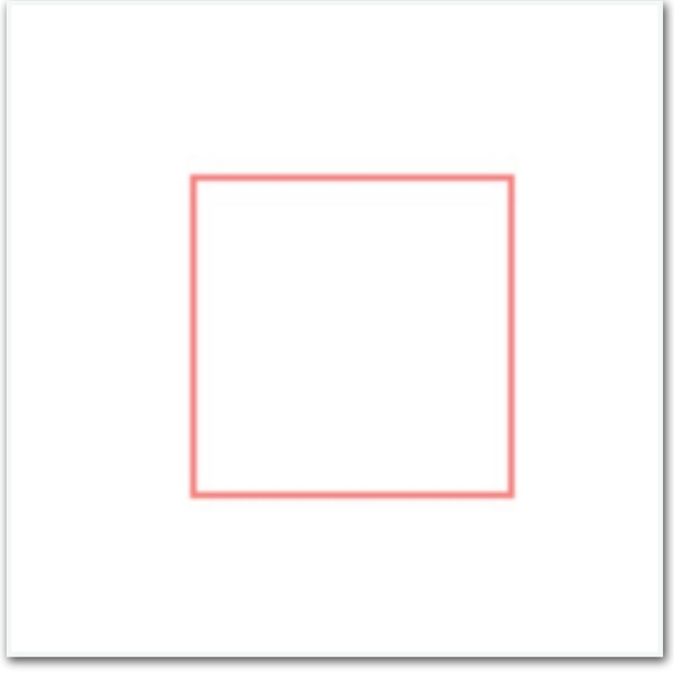




HTML5 Canvas: Setting Line Width

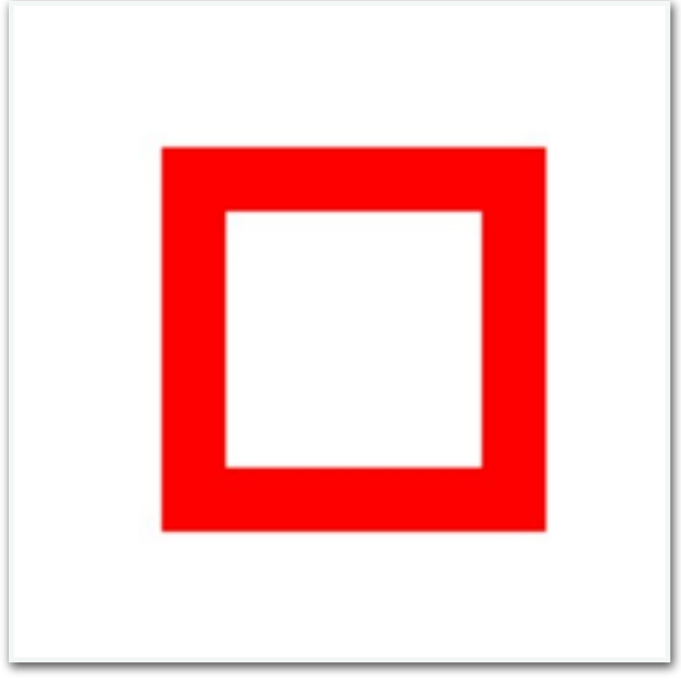
strokeStyle()

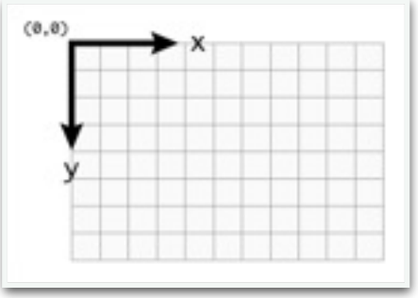
```
ctx.strokeStyle = "rgb(255, 0, 0)";
ctx.strokeRect(50, 50, 100, 100);
```



lineWidth

```
ctx.lineWidth = 20;
ctx.strokeStyle = "rgb(255, 0, 0)";
ctx.strokeRect(50, 50, 100, 100);
```





HTML5 Canvas: Drawing Paths

start a new path

move the cursor

draw a line

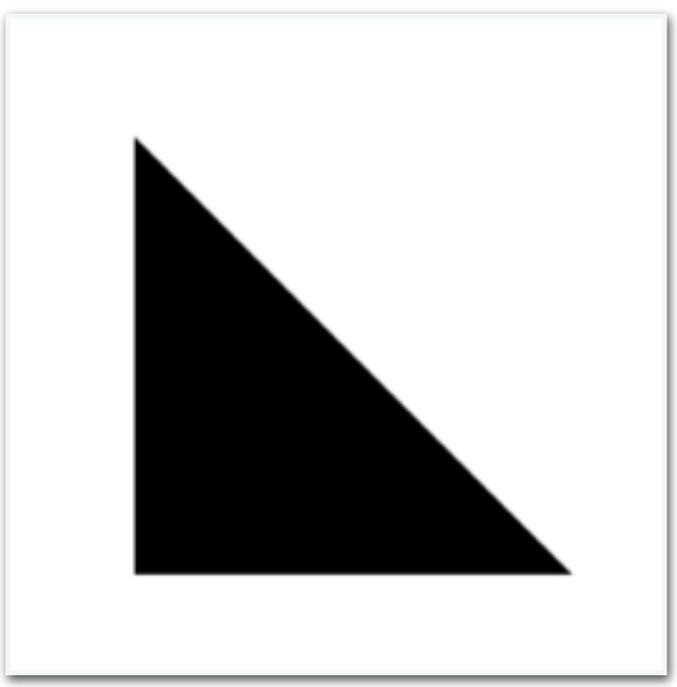
close the path

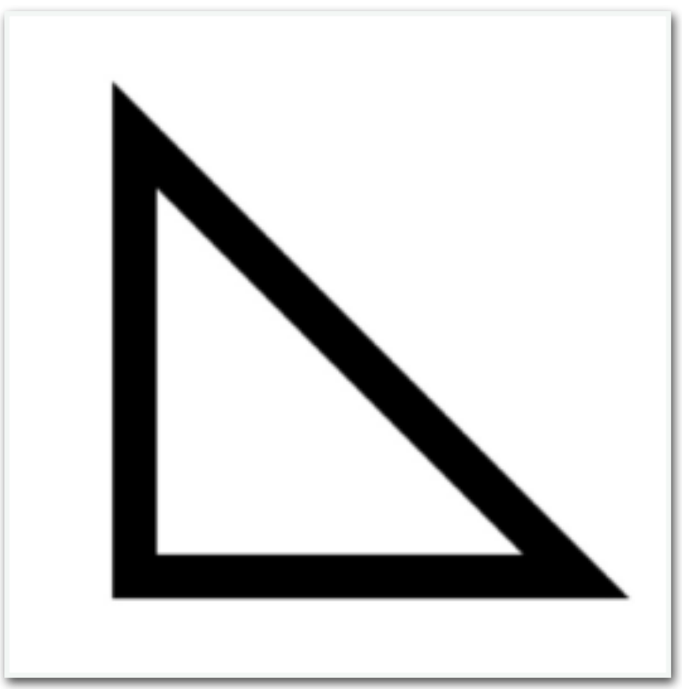
fill the path

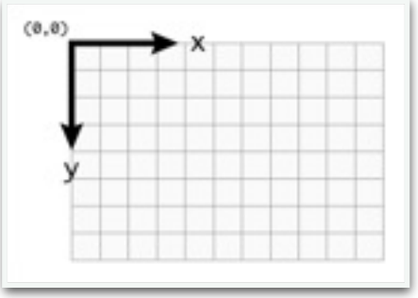
```
ctx.beginPath();
ctx.moveTo(50, 50);
ctx.lineTo(50, 250);
ctx.lineTo(250, 250);
ctx.closePath();
ctx.fill();
```

outline the path

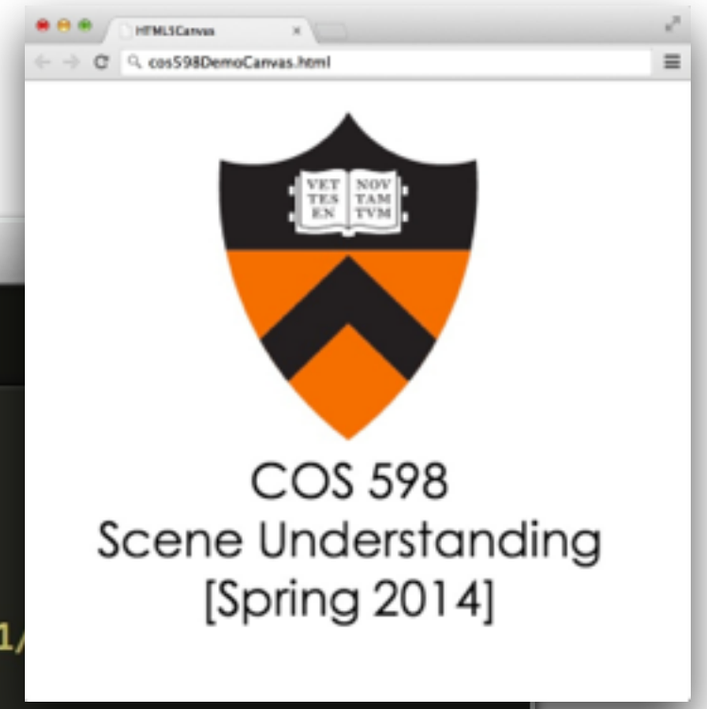
```
ctx.lineWidth = 20;
ctx.beginPath();
ctx.moveTo(50, 50);
ctx.lineTo(50, 250);
ctx.lineTo(250, 250);
ctx.closePath();
ctx.stroke();
```







HTML5 Canvas: Drawing an Image



cos598DemoCanvas.html

```html
<!DOCTYPE html>
<html>
    <head>
        <title>HTML5Canvas</title>
        <meta charset="utf-8">
        <script src="http://ajax.[illegible]y/1/[illegible]

    </head>
    <body>
        <canvas id="cos598canvas" width="1000" height="1000"></canvas>
        <script>
            var canvas = document.getElementById("cos598canvas");
            var ctx = canvas.getContext("2d");
            var image = new Image();
            image.src = "./img/cos598.jpg";
            $(image).load(function() {
                ctx.drawImage(image, 0, 0, image.width, image.height);
            });
        </script>
    </body>
</html>
```

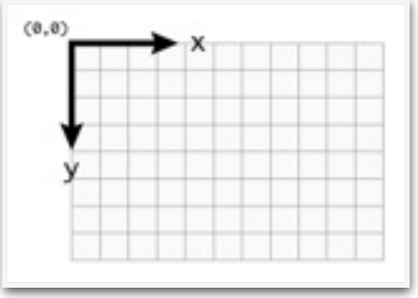
Line 8, Column 12 HTML

an HTML DOM element: image element

bug: you should swap these two lines

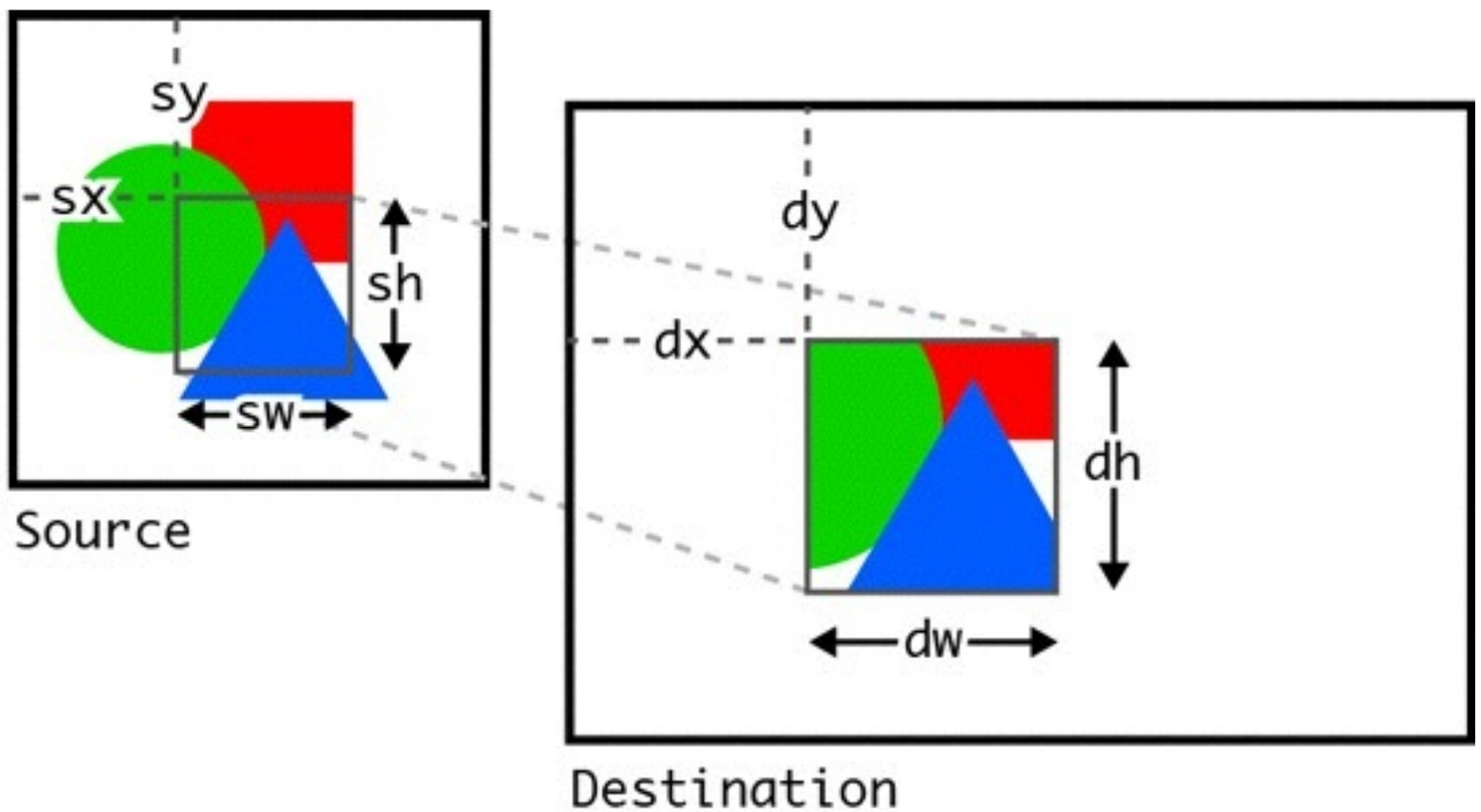
image load event

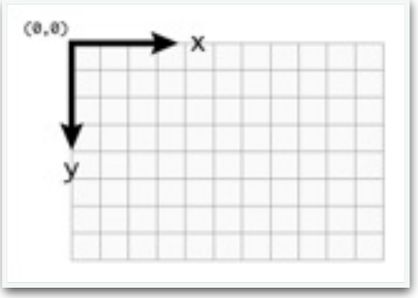
draw the image on 2d rendering context



HTML5 Canvas: Drawing an Image

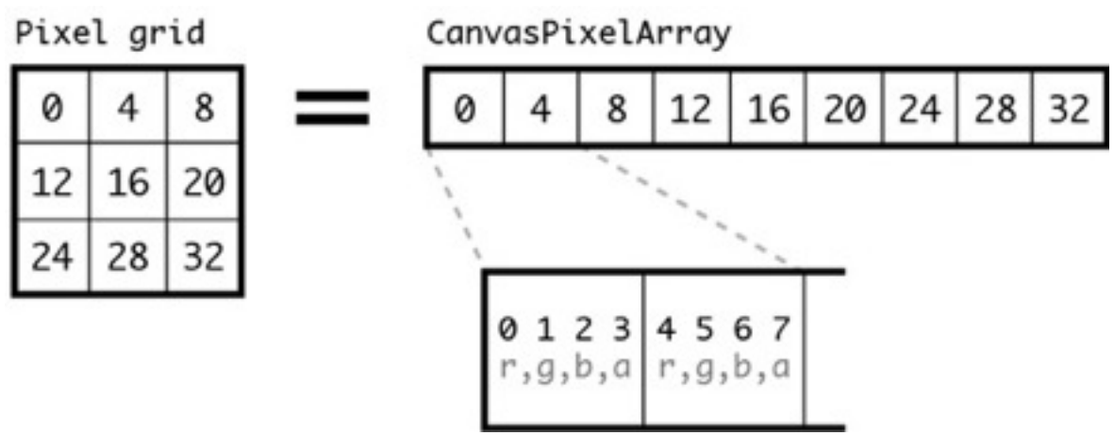
```
ctx.drawImage(image, sx, sy, sw, sh, dx, dy, dw, dh);
```



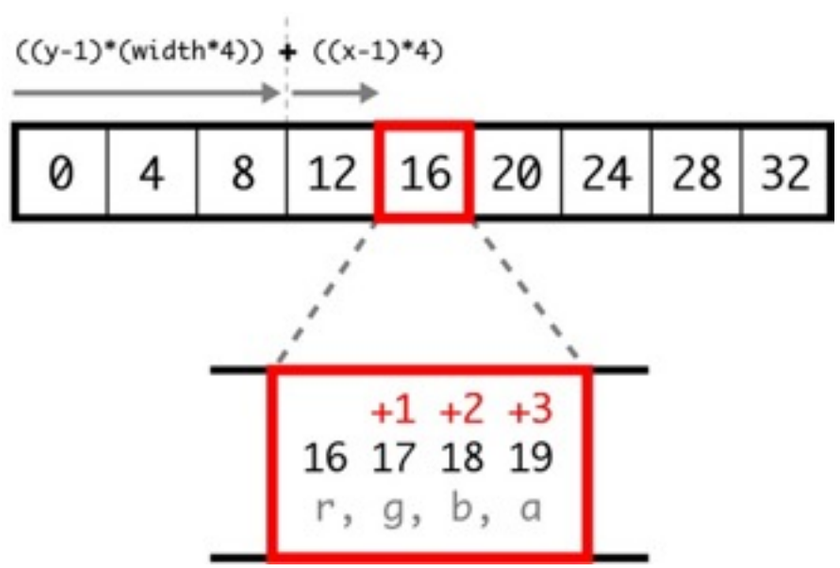


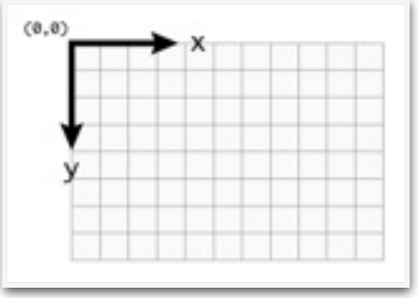
HTML5 Canvas: Accessing Pixels

```
var imageData = ctx.getImageData(x, y, width, height);
```

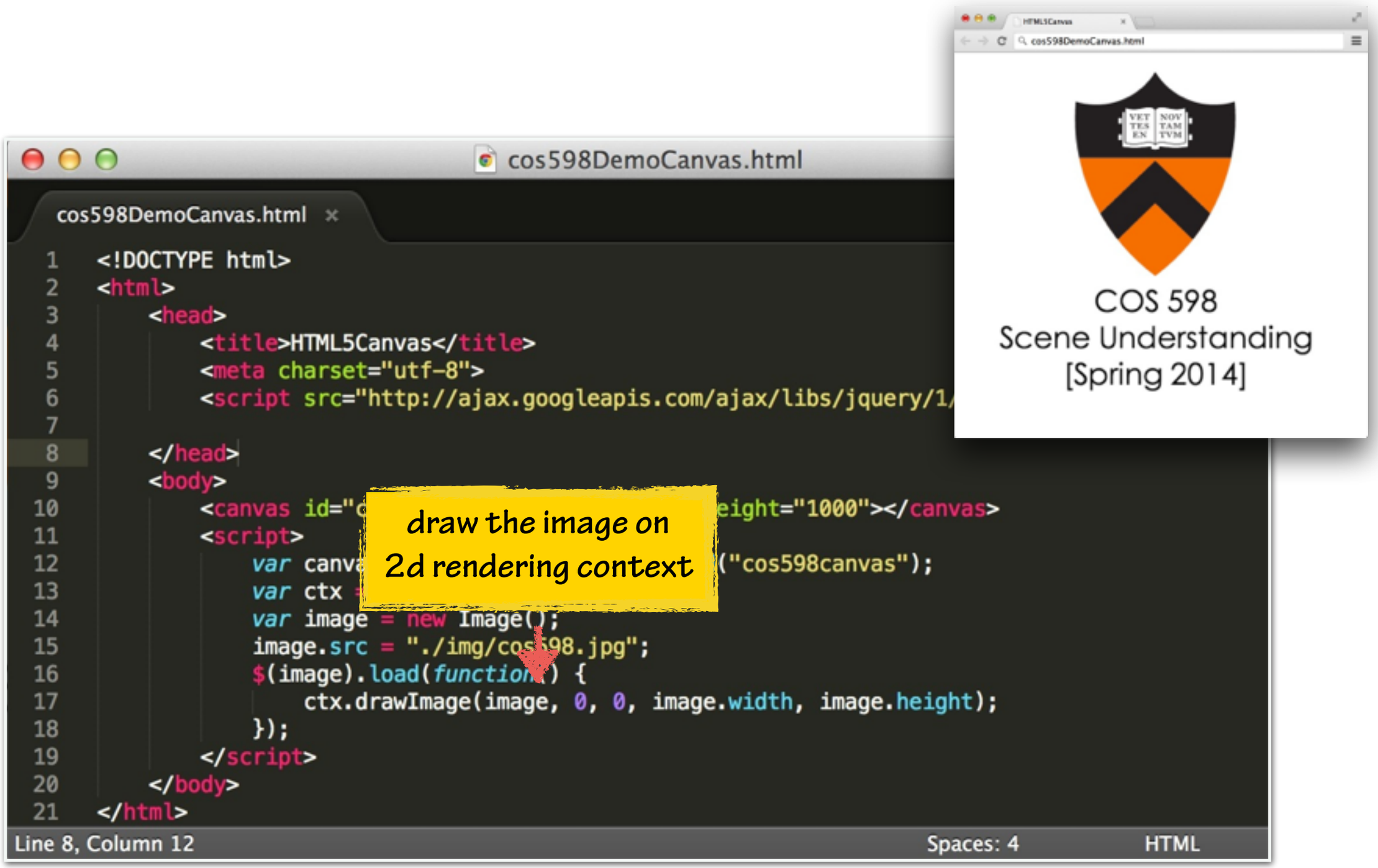


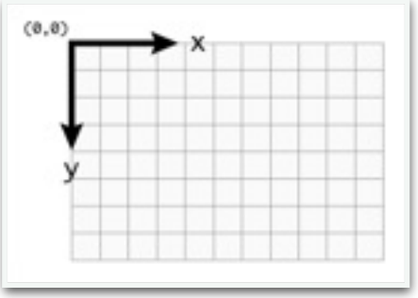

```
var redValueForPixel = ((y - 1) * (width * 4)) + ((x - 1) * 4);
```



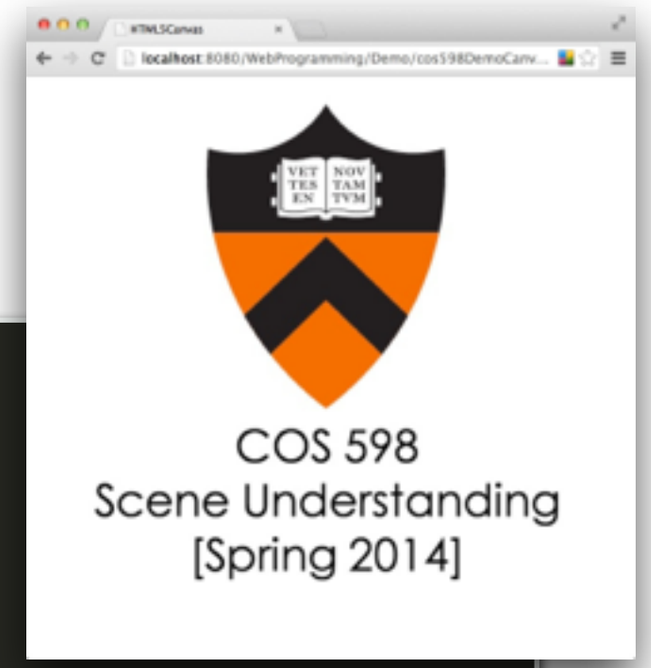


HTML5 Canvas: Pixel Manipulation





HTML5 Canvas: Pixel Manipulation



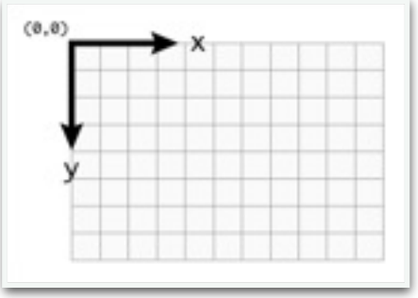

```
<body>
    <canvas id="cos598canvas" width="1000" height="1000"></canvas>
    <script>
        var canvas = document.getElementById("cos598canvas"); // canvas
        var ctx = canvas.getContext("2d"); // 2d rendering context
        var image = new Image(); // a new image element
        image.src = "./img/cos598.jpg"; // image source
        $(image).load(function() { // load event
            ctx.drawImage(image, 0, 0, image.width, image.height); // draw image
            var imageData = ctx.getImageData(0, 0, image.width, image.height); // get image data
            var pixels = imageData.data;
            // pixel manipulation
            var numPixels = imageData.width * imageData.height;
            for (var i = 0; i < numPixels; i++) {
                pixels[i*4] = 255-pixels[i*4]; // red
                pixels[i*4+1] = 255-pixels[i*4+1]; // green
                pixels[i*4+2] = 255-pixels[i*4+2]; // blue
            };
            ctx.clearRect(0, 0, canvas.width, canvas.height); // clear the canvas
            ctx.putImageData(imageData, 0, 0); // draw image data
        });
    </script>
</body>
```

access pixel values

invert R, G, B colors

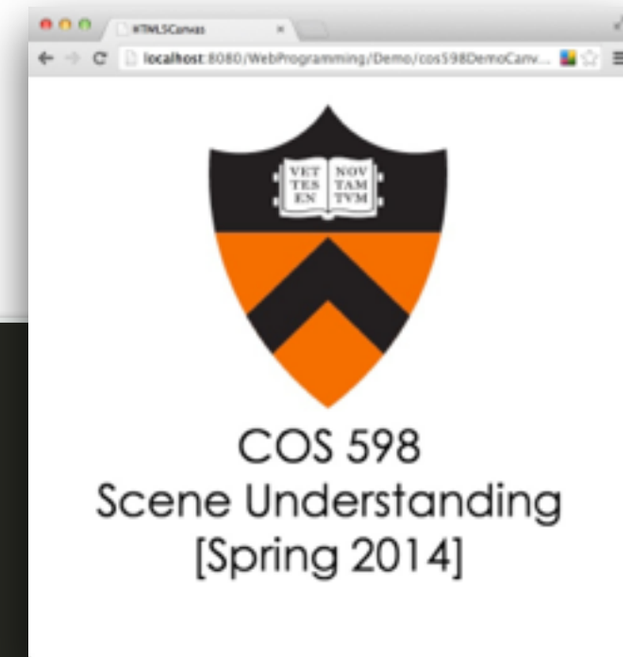
clear canvas

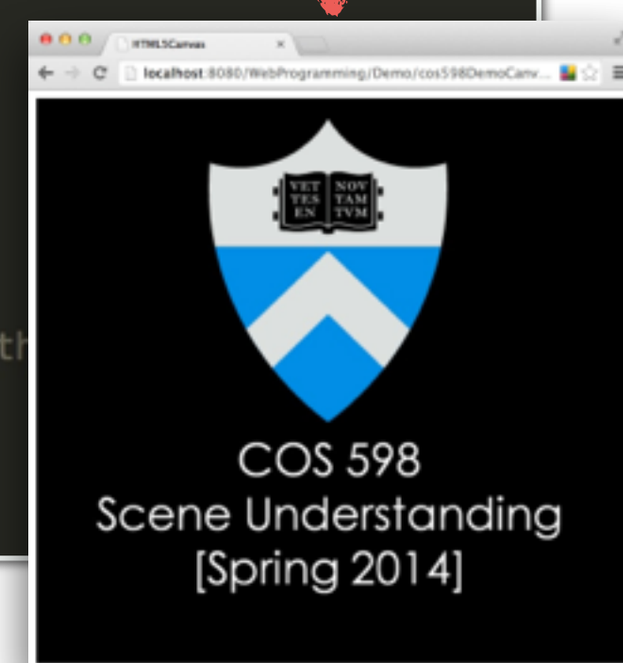
draw the new image



HTML5 Canvas: Pixel Manipulation

```
<body>
    <canvas id="cos598canvas" width="1000" height="1000"></canvas>
    <script>
        var canvas = document.getElementById("cos598canvas"); // canvas
        var ctx = canvas.getContext("2d"); // 2d rendering context
        var image = new Image(); // a new image element
        image.src = "./img/cos598.jpg"; // image source
        $(image).load(function() { // load event
            ctx.drawImage(image, 0, 0, image.width, image.height); // draw image
            var imageData = ctx.getImageData(0, 0, image.width, image.height); // get image data
            var pixels = imageData.data;
            // pixel manipulation
            var numPixels = imageData.width * imageData.height;
            for (var i = 0; i < numPixels; i++) {
                pixels[i*4] = 255-pixels[i*4]; // red
                pixels[i*4+1] = 255-pixels[i*4+1]; // green
                pixels[i*4+2] = 255-pixels[i*4+2]; // blue
            };
            ctx.clearRect(0, 0, canvas.width, canvas.height); // clear th
            ctx.putImageData(imageData, 0, 0); // draw image data
        });
    </script>
</body>
```



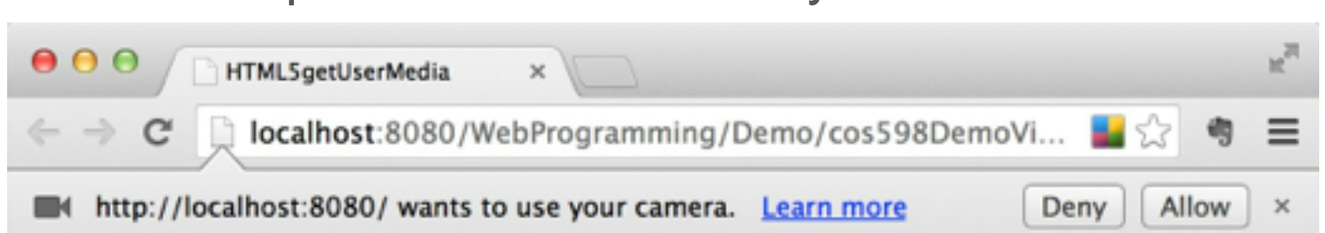


HTML5: getUserMedia() & Video

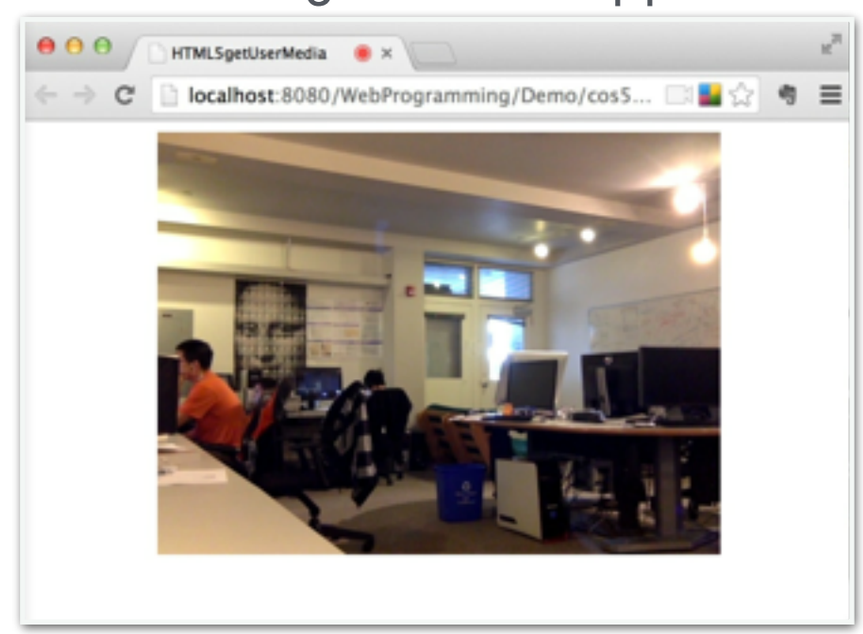
Step 1: include the following codes in your JavaScript

```
<div style="text-align:center;">
    <video id="stream" width = 400 autoplay></video>
</div>
<script>
    var video = document.getElementById("stream");
    window.URL = window.URL || window.webkitURL; // work on different platform
    navigator.getUserMedia  = navigator.getUserMedia || navigator.webkitGetUserMedia ||
            navigator.mozGetUserMedia || navigator.msGetUserMedia;
    if (navigator.getUserMedia) {
        navigator.getUserMedia(
            {video: true},
            function(stream) {video.src = window.URL.createObjectURL(stream);},
            function(error) {console.log('Camera access has been denied!', error);}
            );
    }else{
        alert("Cannot getUserMedia");
    }
</script>
```

Step 2: allow access to your camera



Step 3: you are ready to spy on your friends using this web app

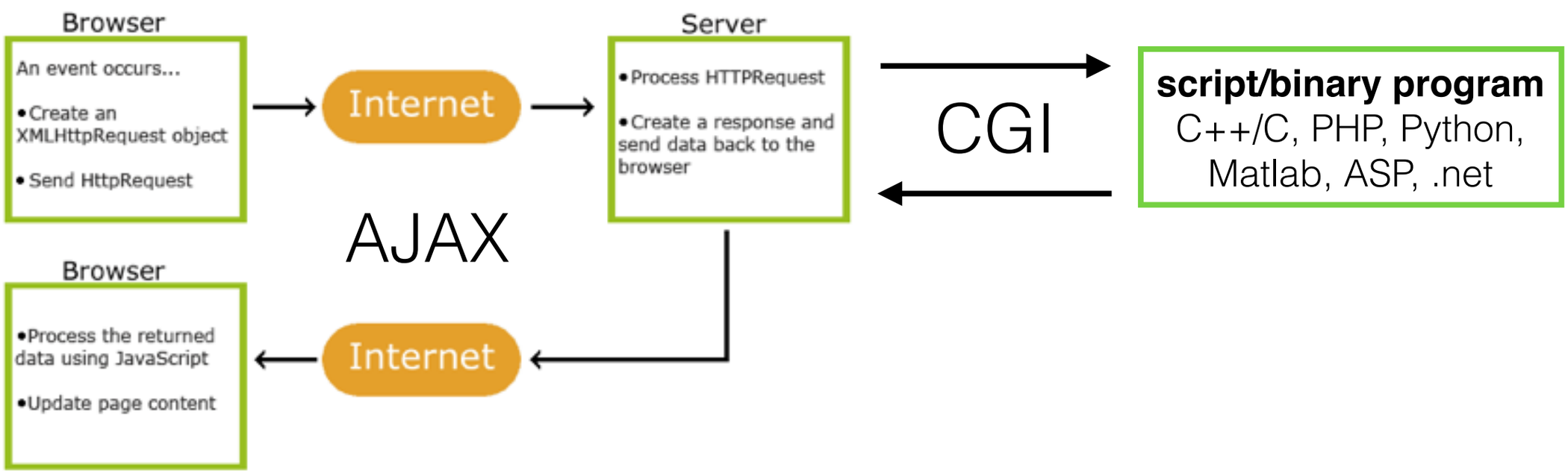


Server-side Programming

some examples borrowed from http://www.w3schools.com/

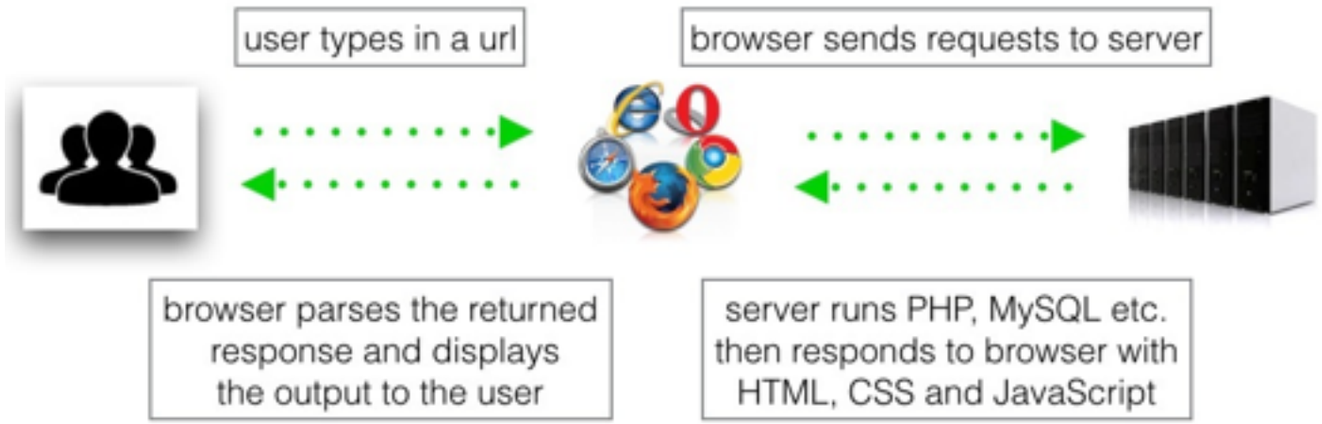
Server-side Programming

- AJAX: exchange data with a server & update parts of a web page — without reloading the whole page.
- Examples: Google Maps, Gmail, Youtube …



- Turn your computer to a server: 1) ip address 2) install apache2

Summary



Language	Role	Where it Runs
HTML	Content and Stucture	Browser
CSS	Style and Presentation	Browser
JavaScript	Client Side Scripting	Browser
PHP/Python/ ASP/…	Server Side Scripting	Server
MySQL	Data Management	Server

Useful Resources

- w3schools

- Google

Thank You