Welcome to CSE 330/503
Creative Programming and Rapid Prototyping

Course Information

- **Instructor**
  - Todd Sproull
  - todd@wustl.edu
  - Jolley 536
  - Office Hours by Appointment
- **Course Website**
  - http://research.engineering.wustl.edu/~todd/cse330/
- **Labs**
  - Urbauer Lab, Rooms 214 ,215, 216, 218, and 222

Grading

- 6 modules to complete during the semester
- Most modules contain individual and group assignments
- Demo each completed module during the lab session
- Modules are due by the end of class on the due date
- You must "commit" the module by the end of class to receive credit
  - Otherwise it is a 0
  - You may demo a lab that was committed on time up to 4 days after the due date for full credit
- CSE 503S students will also complete a performance evaluation study of their creative project

What is this class all about?

- A tour of Web 2.0 technologies
  - Cloud Computing
    - Amazon EC2
  - LAMP
    - Linux
    - Apache
    - MySQL
    - PHP
  - Python
  - Javascript

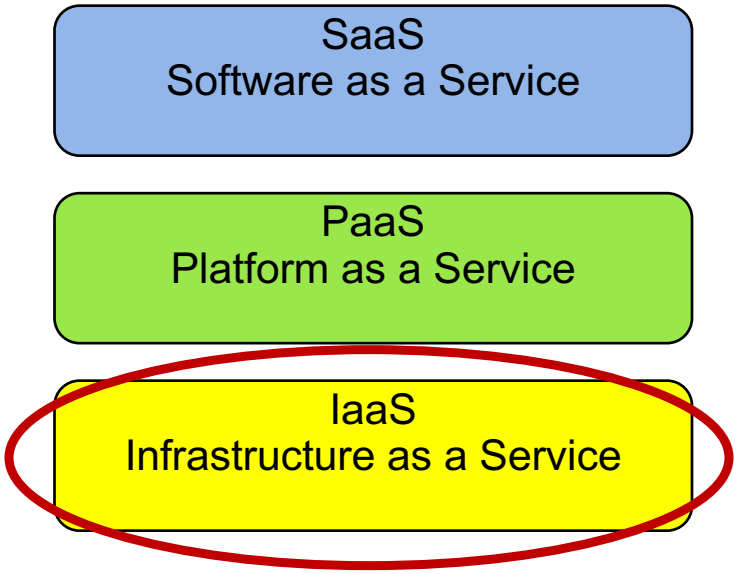
Cloud Computing

What is Cloud Computing?

Cloud computing is using the Internet to access someone else's software running on someone else's hardware in someone else's data center.

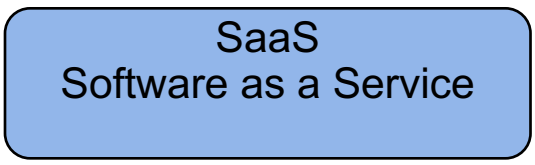
- Lewis Cunningham

Types of Cloud Computing



Software as a Service (SaaS)

- **Cloud based delivery of complete software applications that run on infrastructure the SaaS vendor manages**
- **Accessed over the Internet and typically charged on a subscription**
- **Examples**
  - Gmail and Yahoo Mail
  - Google Docs
  - Box.net
  - Netflix



Platform as a Service – (PaaS)

- **Features**
  - Storage
  - Databases
  - Cloud Middleware
  - Scalability

- **Examples**
  - Google App Engine
  - Amazon Web Services S3
  - Heroku

PaaS
Platform as a Service

Infrastructure as a Service – (IaaS)

- **Features**
  - Virtualization
  - Nearly instant scalability
  - Everything is a service
  - Utility style (pay for what you use)
  - Hardware, OS, Software, Storage & Network

- **Examples**
  - Amazon Web Services (AWS)
  - EMC Fortress (Storage Cloud)
  - HP Adaptive IaaS

IaaS
Infrastructure as a Service

Amazon Elastic Cloud Computing (EC2)

- **This semester we are using Amazon Web Services (AWS) to run the Linux Operating System in a virtual machine**
  - We avoid purchasing 100 PCs for the course
    - Instead we have virtual machines (VM)s to use
  - These machines our hosted in the ***cloud***
  - You connect to an ***instance*** of a particular configuration of Linux

Amazon EC2 Costs

- **You are only billed for the computing resources you use**
- **When you are done using an instance you can "stop" it from running so you do not continue to be billed**
- **Free Tier available for limited use**
  - Sufficient for this course
  - No need to stop a Free Tier instance for the entire semester

Free Tier

As part of AWS's Free Usage Tier, new AWS customers can get started with Amazon EC2 for free. Upon sign-up, new AWS customers receive the following EC2 services each month for one year:

- 750 hours of EC2 running Linux, RHEL, or SLES t2.micro instance usage
- 750 hours of EC2 running Microsoft Windows Server t2.micro instance usage
- 750 hours of Elastic Load Balancing plus 15 GB data processing
- 30 GB of Amazon Elastic Block Storage in any combination of General Purpose (SSD) or Magnetic, plus 2 million I/Os (with Magnetic) and 1 GB of snapshot storage
- 15 GB of bandwidth out aggregated across all AWS services
- 1 GB of Regional Data Transfer

How much does this cost?

Linux | RHEL | SLES | Windows | Windows with SQL Standard | Windows with SQL Web

Region: US East (N. Virginia)

	vCPU	ECU	Memory (GiB)	Instance Storage (GB)	Linux/UNIX Usage
General Purpose - Current Generation					
t2.micro	1	Variable	1	EBS Only	$0.013 per Hour
t2.small	1	Variable	2	EBS Only	$0.026 per Hour
t2.medium	2	Variable	4	EBS Only	$0.052 per Hour
m3.medium	1	3	3.75	1 x 4 SSD	$0.070 per Hour
m3.large	2	6.5	7.5	1 x 32 SSD	$0.140 per Hour
m3.xlarge	4	13	15	2 x 40 SSD	$0.280 per Hour
m3.2xlarge	8	26	30	2 x 80 SSD	$0.560 per Hour
Compute Optimized - Current Generation					
c3.large	2	7	3.75	2 x 16 SSD	$0.105 per Hour
c3.xlarge	4	14	7.5	2 x 40 SSD	$0.210 per Hour
c3.2xlarge	8	28	15	2 x 80 SSD	$0.420 per Hour
c3.4xlarge	16	55	30	2 x 160 SSD	$0.840 per Hour
c3.8xlarge	32	108	60	2 x 320 SSD	$1.680 per Hour
GPU Instances - Current Generation					
g2.2xlarge	8	26	15	60 SSD	$0.650 per Hour

AWS Website

Module 1 – HTML and CSS

- **HyperText Markup Language (HTML)**
  - Main "markup language" for displaying web pages in a web browser
- **Cascading Style Sheets (CSS)**
  - Language for describing the "look and feel" of a markup language (such as HTML)
- **Module 1 is due on Wednesday September 7th**
  - You must commit the module to Bitbucket by the end of class (11:30 AM)

HTML History

- **In 1989 Tim Berners-Lee introduced three technologies that allowed documents to be distributed and read**
  - HTML (HyperText Markup Language)
    - A simple language to layout documents
  - HTTP (Hypertext transfer protocol)
    - Technology that transfers a page from one computer to another
  - Browser Technology
    - Software that reads the HTML pages

What is HTML?

- **Initially just a text file with a few special codes (called tags)**
- **Clear text, case insensitive**
- **Ignores white space**
- **Comprised of tags <tag> </tag>**
  - eg This is some cool content inside a paragraph tag.
    - The tag and contents is called an element
    - Stuff between the tags is the elements contents
- **Elements have attributes**
  - Allow you to create a particular *class* of an element
  - You can also create a unique *id* for an element

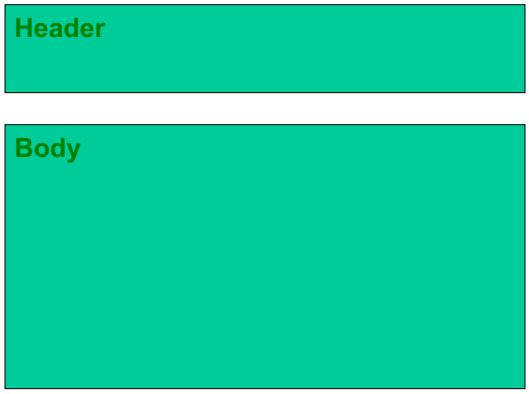
HTML Version Timeline

- **1992: HTML 1.0 original proposal**
- **1994: HTML 2.0**
- **1996: HTML 3.2, end of browser wars**
- **1997: HTML 4.0, stylesheets introduced**
- **1999: HTML 4.01, everyone is happy**
- **2000: XHTML 1.0, an XML version of HTML**
- **2001: XHTML 1.1**
- **2002: XHTML 2.0**
- **2008: HTML 5.0 published as working draft**
- **2011: HTML 5 "Last Call" from HTML Working Group**

HTML – Fundamentals

- **Document Structure**

< HTML >



< / HTML>

HTML – Fundamentals

```
<html>
    <head>
        <title> The title of your html page </title>

    </head>
    <body>

        <! - - your web page content and markup  - ->

    </body>
</html>
```

HTML – Simple Example

```
<html>
    <head>
        <title> My first webpage </title>

    </head>
    <body>
        Hello World
            <! - - This is a boring webpage… - ->

    </body>
</html>
```


HTML – Fundamentals - Example

header

<body>

Todd Sproull

Here is my contact info:

</body>

HTML - Fundamentals

header

<body>

Todd Sproull

Here is my contact info:

</body>

HTML - Fundamentals

header

<body>

Todd Sproull

Here is my contact info:

Office: Jolley Hall, Room 536

Email: todd@wustl.edu

Phone:314-935-7140

</body>

HTML - Fundamentals

header

<body>

```
Todd Sproull <br> <br>
Here is my contact info: <br>
<ol><li>Office: Jolley Hall, Room 536<li>
<li>Email: todd@wustl.edu
<li>Phone:314-935-7140</li></ol>
<img
  src= 'http://www.myserver.com/images/me.jpg' />
```

</body>

HTML - Fundamentals

header

<body>

```
Todd Sproull <br> <br>
Here is my contact info: <br>
<ol><li>Office: Jolley Hall, Room 536<li>
<li>Email: todd@wustl.edu
<li>Phone:314-935-7140</li>
<img src= 'me.jpg' /> <br></ol>
<a href= 'cse436.html' >Read about my iPhone
  class</a>
```

</body>

HTML – Example

DEMO

HTML Compliance

- We want to follow best practices and adhere to standards when possible in this course
- W3C provides an online Markup Validation Service for us to test out our web pages
  - http://validator.w3.org/
- All web pages developed in this course must pass this validation

HTML and CSS Tutorials

- **Plenty of really good examples available online**
  - http://classes.engineering.wustl.edu/cse330/index.php/HTML_and_CSS
  - http://webplatform.org
- **A basic understanding of HTML is necessary for this course**
- **The goal of this course is not to teach all of the amazing aspects of web design**
  - But you MUST create W3C compliant web pages
- **The header <!DOCTYPE HTML> declares an HTML 5 webpage**
  - Which is what we will use in this course

Cascading Style Sheets

- **A powerful way to specify styles and formatting across all documents in a web site**
- **Style sheets can be specified inline or as a separate document**
- **Helps to keep a common look and feel**

Cascading Style Sheets (CSS)

- **Styles enable you to define a consistent 'look' for your documents by describing once how headings, paragraphs, quotes, etc. should be displayed.**
- **Style sheet syntax is made up of three parts:**

selector {property: value}

selector = element.class

CSS

- **General form:**

selector {property: value} or

selector {property 1: value 1;
property 2: value 2;
...
property n: value n }

CSS Examples


```
H1 {text-align: center;
    color: blue;
    font: Arial, Times New Roman}

P {text-align: left;
   color: red;
   font-family: Tahoma, Arial Narrow;
   font-style: italics}
```


Using CSS - Example Page

```
<head>
   <title> My Page Title </title>

   <style TYPE="text/css" >
   <! - -
   element.class { property:value; }
   element.class { property:value; }
   - - >
   </style>
</head>
```

Using CSS - Example Page

```
<html>
  <head>

    <title> CSS Example </title>

    <style TYPE="text/css >
        h1 { color:blue; }
    </style>

  </head>

  <body>
    <h1> Hello </h1>
  </body>

</html>
```

Using CSS - Example Page – External File

```
<html>
  <head>

    <title> CSS Example </title>

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

</head>

  <body>
    <h1> Hello </h1>
  </body>

</html>
```

CSS Examples

```
h1 {text-align: center; color: blue}

a  {color:green; font-familiy:arial,courier; font-weight:bold;}

td { align:center; background-color:grey; border-color:red;}

div {position:absolute; visibily:hidden; margin:10px }

font {color:navy; font-size:2pt; font-face:trebuchet; }
```


More CSS Examples - Classes

```
element.class {property:value; }

h1  {color: blue}
h1.widget  {color: green; }

a  {color:green; font-familiy:arial,courier; font-weight:bold;}
a.menu  {color:cyan; font-familiy:arial,courier; font-style:italics;}
```

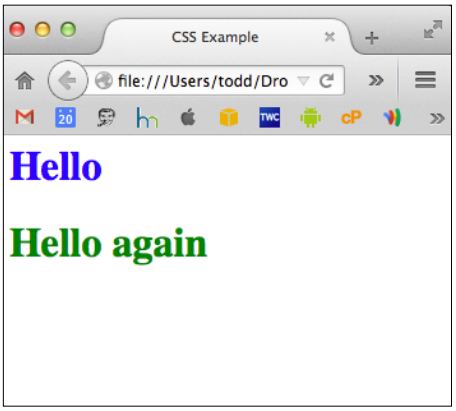
```
<h1>  Hello </h1>
<h1 class="widget"> Hello again </h1>
```

Using CSS Classes - Example Page

```
<html>
  <head>
    <title> CSS Example </title>

    <style TYPE="text/css >
      h1 { color:blue; }
      h1.widget { color:green; }
    </style>

  </head>
  <body>
    <h1> Hello </h1>
    <h1 class="widget"> Hello again </h1>
  </body>
</html>
```



HTML Forms

- **<form> is just another kind of HTML tag**
- **HTML forms are used to create (rather primitive) GUIs on Web pages**
  - Usually the purpose is to ask the user for information
  - The information is then sent back to the server
- **A form is an area that can contain form elements**
  - Forms can be used for other things, such as a GUI for simple programs

The <form> tag

- **The <form *arguments*> … </form> tag encloses form elements (and probably other HTML as well)**
- **The arguments to form tell what to do with the user input**
  - action="*url*" (required)
    - Specifies where to send the data when the Submit button is clicked
  - method="get" (default)
    - Form data is sent as a URL with ?form_data info appended to the end
    - Can be used *only* if data is all ASCII and not more than 100 characters
  - method="post"
    - Form data is sent in the body of the URL request
    - Cannot be bookmarked by most browsers
  - target="*target*"
    - Tells where to open the page sent as a result of the request
    - *target*= _blank means open in a new window
    - *target*= _top means use the same window

HTML Form Example

formExampleGet.html

```
<!DOCTYPE HTML>
<head> <title> My HTML Form </title></head>
<body>
<form name="input" action="http://someWebsite.com/" method="get">

   Username: <input type="text" name="user" />

  <input type="submit" value="Submit" />

  </form>
</body>
</form>
```


HTML Forms

DEMO

Get vs Post

- **Mantra**
  - you "must not use GET requests to make changes"
- **GET should never change data on the server**
- **Differences:**
  - http://stackoverflow.com/questions/198462/is-either-get-or-post-more-secure-than-the-other
  - http://www.diffen.com/difference/Get_vs_Post

Course Website, Wiki, and Module 1

Piazza

- We are using Piazza as a forum to answer questions about the course
- Make sure you sign up at piazza.com and join the CSE 330 course discussion

Collaboration Policy

http://research.engineering.wustl.edu/~todd/cse330/info.html

Git

Git: A Fast Version Control System

- **Git**
  - Is **distributed**
  - Has **no master** copy
  - Has fast merges
  - Scales up
  - Convenient tools still being built
  - Safeguards against corruption

What is version control?

- **Basic functionality:**
  - keep track of changes made to files (allows roll-backs)
  - merge the contributions of multiple developers
- **Benefits:**
  - facilitates backups
  - increased productivity (vs manual version control)
  - encourages experimentation
  - helps to identify/fix conflicts
  - makes source readily available – less duplicated effort

Our First Git Repository

- ***mkdir first-git-repo***
- ***cd first-git-repo***
- ***git init***
  - Creates the basic artifacts in the .git directory
- ***echo "Hello World" > hello.txt***
- ***git add .***
  - Adds content to the index
  - Index reflects the working version
  - Must be run prior to a commit
- ***git commit -a -m 'Check in number one'***

- **We will cover Git in more detail in later modules**

Demo of Git, Bitbucket, and SourceTree