"Web 2.0"

- **buzzword**
  - probably originated with O'Reilly conference in 9/05
- **what's different from "Web 1.0"?**
  - [technical aspects, not business]
- **Web as platform; cloud computing**
  - systems as services, not on a PC, e.g., Google Docs
- **continuous software update**
  - because it's on the server
- **data as central component**
  - e.g., Amazon, Google, Yahoo, Facebook, Flickr, ...
- **lightweight programming & data transfer**
  - Atom, REST instead of SOAP
  - JSON instead of XML
- **mashups using APIs**
  - Google maps, Yahoo pipes,
- **"collective intelligence" (?)**
  - Wikipedia, Google page rank, online reviews, blogs, crowd-sourcing, Twitter, ...

XMLHttpRequest ("XHR")

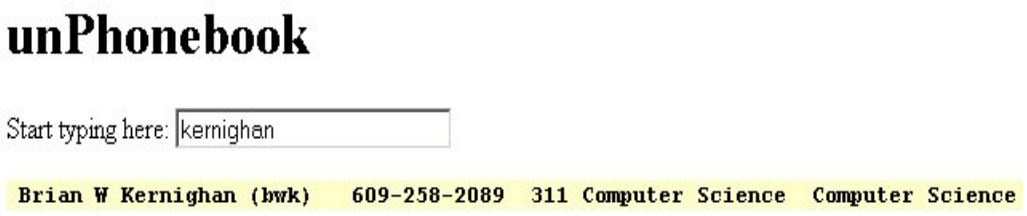
- **interactions between client and server are usually synchronous**
  - there can be significant delay
  - page has to be completely redrawn
- **XMLHttpRequest provides <u>asynchronous</u> communication with server**
  - often no visible delay
  - page does not have to be completely redrawn
- **first widespread use in Google Suggest, Maps, Gmail (Feb 2005)**
  - "The real importance of Google's map and satellite program, however, is not its impressive exterior but the novel technology, known as Ajax, that lies beneath." (James Fallows, *NY Times*, 4/17/05)
- **Ajax: Asynchronous Javascript + XML**
  (shorthand/marketing/buzzword term coined 2/05)
  - (X)HTML + CSS for presentation
  - DOM for changing display
  - Javascript to implement client actions
  - XML for data exchange with server (but it doesn't have to use XML)
  - "server agnostic": server can use any technology

Ajax interface to Princeton directory

```
<h1> unPhonebook</h1>

<form name=phone>
Type here:
<input type="text" id="pat"
    onkeyup='geturl(pat.value);' >
</form>

<pre id="place"></pre>
```



Basic structure of Ajax code

```
var req;
function geturl(s) {
   if (s.length > 1) {
      url = 'http://www.cs.princeton.edu/~bwk/phone3.cgi?' + s;
      loadXMLDoc(url);  // loads asynchronously
   }
}
function loadXMLDoc(url) {
   if (window.XMLHttpRequest) { // native XMLHttpReques
      req = new XMLHttpRequest();
   } else if (window.ActiveXObject) {  // IE ActiveX
      req = new ActiveXObject("Microsoft.XMLHTTP");
   }
   if (req) {
      req.onreadystatechange = processReqChange;
      req.open("GET", url);
      req.send(null);
   }
}
function processReqChange() {
   if (req.readyState == 4) {  // completed request
      if (req.status == 200)
         show(req.responseText); // or responseXML
   }
}
function show(s) {   // show whatever came back
   document.getElementById("place").innerHTML = s
}
```

Server script (phone2.cgi)

```
q1=`echo $QUERY_STRING | gawk '{split($0,x,"%20"); print x[1]}' `
q2=`echo $QUERY_STRING | gawk '{split($0,x,"%20"); print x[2]}' `
/usr/local/bin/ldapsearch -x -h ldap.princeton.edu -u -b \
   o='Princeton University,c=US' "(cn=*$q1*)"  uid cn telephoneNumber \
             studenttelephoneNumber studentstreet street ou |
php -r '
while (!feof(STDIN)) {
   $d = (fgets(STDIN));
   if (preg_match("/^#/", $d)) continue;
   if (preg_match("/^dn:|^ufn:/", $d)) continue;
   if (preg_match("/^cn:/", $d))
      if (strlen($d) > strlen($cn)) $cn = $d;
   if (preg_match("/telephoneNumber|street/", $d))
      $out = $out . " " . trim($d);
   if (preg_match("/^ou:/", $d)) $out = $out . " " . trim($d);
   if (strlen(trim($d))==0 && strlen($cn . $out) > 0) {
      $out = trim($cn) . " " . $out;
      $out = preg_replace("/Undergraduate Class of/", "", $out);
      $out = preg_replace("/cn:|ou:|telephoneNumber:|(student)?street:/'
      $out = preg_replace("/@Princeton.EDU/", "", $out);
      print "$out\n";
      $out = $cn = "";
   }
}' | grep -i ".*$q2" | sed -e /Success/d
```

Simpler server script (phone3.cgi)

```
#!/bin/sh
PATH=.:/usr/bin:/usr/local/bin

echo "Content-Type: text/html"; echo

q1=`echo $QUERY_STRING |
  gawk '{ n=split($0, x, "%20"); print x[1]}'`
q2=`echo $QUERY_STRING |
  gawk '{ n=split($0, x, "%20"); print x[2]}'`
q3=`echo $QUERY_STRING |
  gawk '{ n=split($0, x, "%20"); print x[3]}'`

grep -i "$q1" phone.txt |
grep -i ".$q2" |
grep -i ".$q3"
```

- **works on precomputed data file**

Javascript objects

- **everything in Javascript is an object**
  - except numbers, booleans, **`null`**, **`undefined`**
- **create objects with**

```
var obj = new Object();
var obj = {};
```

- **objects are collections of named values**
  - name-value pairs
  - essentially just associative arrays
  - can access elements with either syntax

```
obj.property = whatever;
obj["property"] = whatever;
```

- **values can be anything**
  - basic values like numbers
  - arrays
  - functions
  - objects

Javascript objects (2)

- **function literals**
  - functions are just values

```
var max = function(a,b) { if (a>b) return a; else return b; }
```

- **object literals (initializers):**

```
var course = {
  dept: "cos",
  numbers: [109, 333],
  prof: {
    name1: "brian", name2: "kernighan",
    office: { bldg: "cs", room: "311" },
    email: "bwk"
  },
  toString: function() {
    s = this.dept + this.numbers + " "
    + this.prof.name1 + " " +  this.prof.name2 + " "
    + this.prof.office.bldg + this.prof.office.room
    + " " + this.prof.email;
    return s
  }
}
```

Javascript objects (3)

- **each object has a prototype property that is used to make new instances**
- **changing the prototype affects all subsequent ones**

```
function Point(x,y) {
   this.x = x; this.y = y;
}
Point.prototype.dist = function(that) {
   var dx = this.x - that.x;
   var dy = this.y - that.y;
   return Math.sqrt(dx*dx+dy*dy);
}
Point.prototype.toString = function() {
  return '(' + this.x + "," + this.y + ')';
}
Point.ORIGIN = new Point(0,0);
var p = new Point(3,4);
var d = p.dist(Point.ORIGIN);
var msg = "Dist to " + p + " is " + d;
```

JSON : Javascript Object Notation

- **lightweight data interchange format**
  - based on object literals
  - an alternative to XML
  - maps easily to most other languages
- **two basic structures**
  - **object**: unordered collection of name-value pairs
    just an associative array or hash table
    `{ string: value, string, value, ... }`
  - **array**: ordered collection of values
    `[ value, value, ... ]`
  - **string** is "..."
  - **value** is string, number, true, false, object or array
- **Javascript eval function can convert this into a data structure:**
    `var obj = eval(json_string) # bad idea!`
  - this is potentially unsafe, since the string can contain more than just JSON
- **see json.org**

YAML

```yaml
%YAML 1.2
---
YAML: YAML Ain't Markup Language

What It Is: YAML is a human friendly data serialization
  standard for all programming languages.

YAML Resources:
  YAML 1.2 (3rd Edition): http://yaml.org/spec/1.2/spec.html
  YAML 1.1 (2nd Edition): http://yaml.org/spec/1.1/
  YAML 1.0 (1st Edition): http://yaml.org/spec/1.0/
  YAML Trac Wiki: http://trac.yaml.org/
  YAML Mailing List: yaml-core@lists.sourceforge.net
  YAML IRC Channel: "#yaml on irc.freenode.net"
  YAML Cookbook (Ruby): http://yaml4r.sourceforge.net/cookbook/ (
  YAML Reference Parser: http://yaml.org/ypaste/

Projects:
  C/C++ Libraries:
  - libyaml       # "C" Fast YAML 1.1
  - Syck          # (dated) "C" YAML 1.0
  - yaml-cpp      # C++ YAML 1.1 implementation
  Java:
  - JvYaml        # Java port of RbYaml
  - SnakeYAML     # Java 5 / YAML 1.1
  - YamlBeans     # To/from JavaBeans
  - JYaml         # Original Java Implementation
```

Libraries, API's, Frameworks

- **browsers are not perfectly standardized**
- **DOM and CSS coding is messy and complicated**
- **web services are ever more complex**

- **how do we make it easy to create applications?**

- **libraries of common Javascript operations**

- **API's, often Javascript, to access services**

- **frameworks: development environments for integrated client & server programming**

From developer.yahoo.com

```
YAHOO.util.Connect = {
   _msxml_progid:[
      'MSXML2.XMLHTTP.5.0',
      'MSXML2.XMLHTTP.4.0',
      'MSXML2.XMLHTTP.3.0',
      'MSXML2.XMLHTTP',
      'Microsoft.XMLHTTP'
      ],
   createXhrObject:function(transactionId) {
      var obj,http;
      try {
         http = new XMLHttpRequest();
         obj = { conn:http, tId:transactionId };
      }
      catch(e) {
         for (var i=0; i<this._msxml_progid.length; ++i){
            try {
              http = new ActiveXObject(this._msxml_progid[i]);
              obj = { conn:http, tId:transactionId };
              break;
            }
            catch(e){}
         }
      }
      finally {
         return obj;
      }
   }, ...
```

Javascript libraries

- **library of Javascript functions that typically provides**
  - easier access to DOM
  - convenience functions for arrays, iterators, etc.
  - uniform interface to Ajax
  - visual effects like fading, flying, folding, ...
  - drag and drop
  - in-place editing
  - extensive set of widgets: calendar, slider, progress bar, tabs, ...
- **there are lots of these!**
  - Prototype & Scriptaculous, Dojo, jQuery, MochiKit, MooTools, Yahoo User Interface (YUI) ...
- **see code.google.com/apis/ajaxlibs/**
  - single library for uniform access to ~10 Javascript libraries

Callbacks

- **callback: a function that is passed as an argument to another function, and executed after the parent function has been executed**
  - functions can be passed around like variables
- **callback with no argument**

```
foo(args, myCallback);
```

- **callback with arguments: anonymous function that calls the callback when invoked**

```
foo(args, function() {
  myCallback(param1, param2);
});
```

  - still have to get the arguments to it
- **Google maps uses this a lot**

```
getLatLng(address:String, callback:function)
```

  - "Sends a request to Google servers to geocode the specified address. If the address was successfully located, the user-specified callback function is invoked with a GLatLng point. Otherwise, the callback function is given a null point."