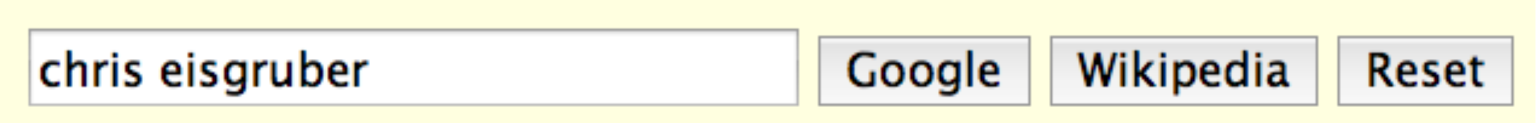
DOM: Document Object Model

- **browser presents an object interface**
  - accessible from and modifiable by Javascript
- **DOM entities have methods, properties, events**
  - element properties can be accessed & changed
  - elements can be added or removed
- **document object holds page contents**
  - elements stored in a tree: HTML tags, attributes, text, code, ...
  - each element is accessible through the DOM
  - through functions called from Javascript
- **page is "reflowed" (smart redraw) when anything changes**

- **window object also has methods, properties, events**
  - alert(msg), prompt(msg), open(url), ...
  - size, position, history, status bar, ...
  - onload, onunload, ...
  - window.document: the document displayed

Basic events on forms


chris eisgruber

```
<head>
<script>
function setfocus() { document.srch.q.focus(); }
</script>
</head>
<body onload='setfocus();'>
<H1>Basic events on forms</H1>
<form name=srch
      action="http://www.google.com/search?q="+srch.q.value>
<input type=text size=25
       id=q name=q value="" onmouseover='setfocus()'>
<input type=button value="Google" name=but
    onclick='window.location="http://www.google.com/
                                        search?q="+srch.q.value'>
<input type=button value="Wikipedia" name=but
    onclick='window.location="http://en.wikipedia.com/
                                            wiki/"+srch.q.value'>
<input type=reset onclick='srch.q.value=""' >
</form>
```

More examples...

- **in a form:**

```
<form>
 <input type=button value="Hit me"
    onClick='alert("Ouch! That hurt.")'> <P>
 <input type=text name=url size=40 value="http://">
 <input type=button value="open"
    onClick='window.open(url.value)'> <P>
 <input type=text name=url2 size=40 value="http://">
 <input type=button value="load"
    onClick='window.location=url2.value'> <P>
 <input type=button value="color it "
    onClick='document.bgColor=color.value'>
 <input type=text name=color value='type a color'>
 <input type=button value='make it white'
    onClick='document.bgColor="white"'>
</form>
```

- **in a tag**

```
<body onLoad='alert("Welcome to my page")'>
```

- **on an image**

```
<img src="smiley.jpg" onMouseover='src="frowny.gif"'
                      onMouseout='src="smiley.jpg"'>
```

- **etc.**

Dynamic CSS

- **style properties can be set dynamically**
  - color, alignment, border, margins, padding, ...
  - for individual elements, or all elements of a type, or of a given name
  - can be queried and set by Javascript

```
<script>
  window.onload = function() {
     var p = document.getElementsByTagName("P");
     for (var i = 0; i < p.length; i++) {
        p[i].onmouseover = function() {
           this.style.backgroundColor = "#deadbe";
        };
        p[i].onmouseout = function() {
           this.style.backgroundColor = "white";
        };
     }
  }
</script>
```

CSS dynamic positioning

- **DOM elements have "style" attributes for positioning**
  - a separate component of CSS
  - provides direct control of where elements are placed on page
  - elements can overlap other elements
    - on separate layers
- **basis of animation, drag & drop**
- **often controlled by Javascript**

```
<img src="dog.jpg" id="dog" onClick='hit()'
    style="position:absolute; left:100px; top:60px" >
```

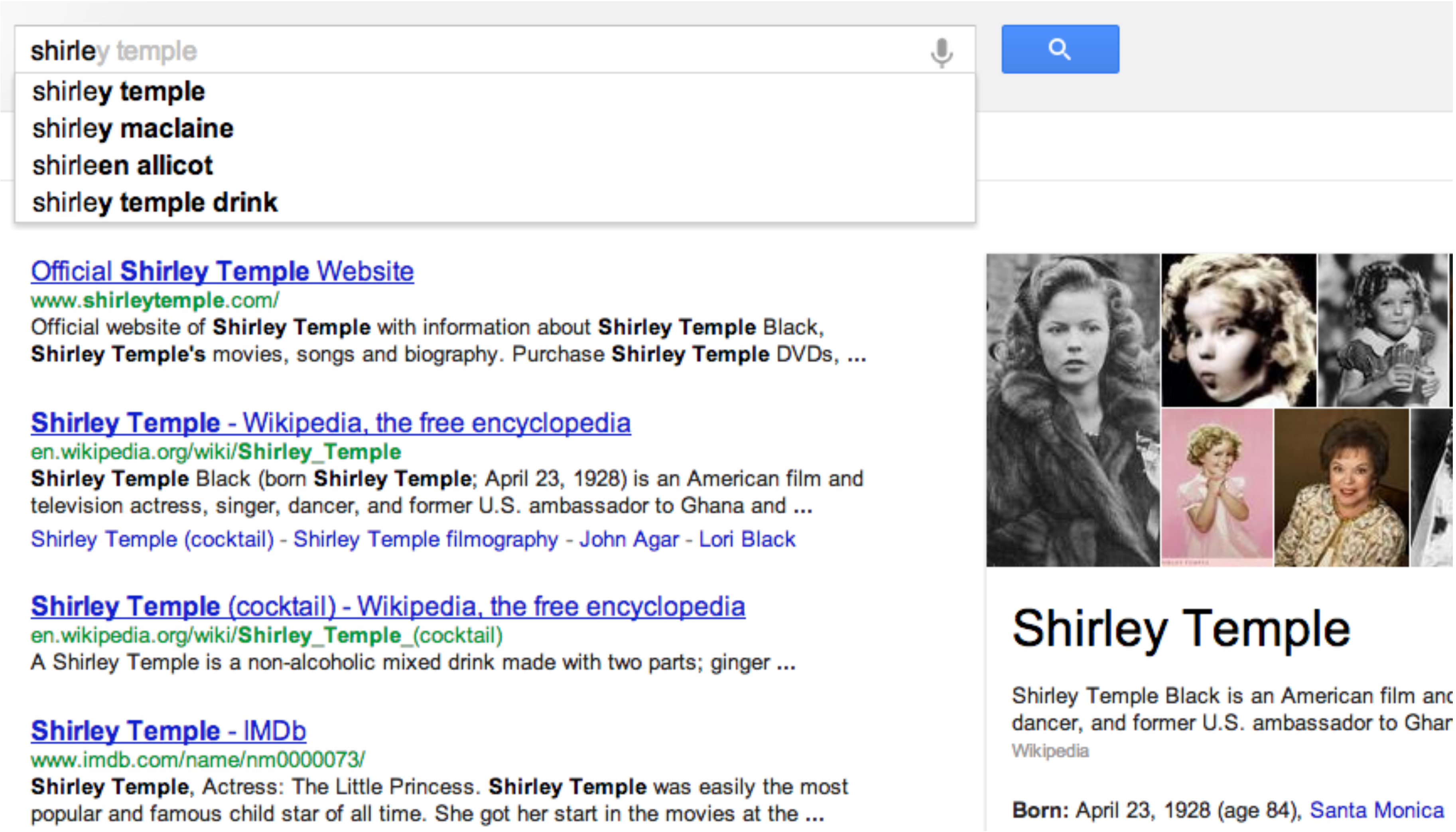
```
var dog = document.getElementById("dog")
dog.style.left = 300 * Math.random() + "px"
dog.style.top = 300 * Math.random() + "px"
```

XMLHttpRequest ("XHR")

- **interactions between client and server are usually synchronous**
  - there can be significant delay
  - page has to be completely redrawn
- **XMLHttpRequest provides asynchronous 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 and 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

Google “suggest”, “instant”



shirley temple

shirley temple
shirley maclaine
shirleen allicot
shirley temple drink

Official **Shirley Temple** Website
www.**shirleytemple**.com/
Official website of **Shirley Temple** with information about **Shirley Temple** Black, **Shirley Temple's** movies, songs and biography. Purchase **Shirley Temple** DVDs, ...

Shirley Temple - Wikipedia, the free encyclopedia
en.wikipedia.org/wiki/**Shirley_Temple**
Shirley Temple Black (born **Shirley Temple**; April 23, 1928) is an American film and television actress, singer, dancer, and former U.S. ambassador to Ghana and ...
Shirley Temple (cocktail) - Shirley Temple filmography - John Agar - Lori Black

Shirley Temple (cocktail) - Wikipedia, the free encyclopedia
en.wikipedia.org/wiki/**Shirley_Temple**_(cocktail)
A Shirley Temple is a non-alcoholic mixed drink made with two parts; ginger ...

Shirley Temple - IMDb
www.imdb.com/name/nm0000073/
Shirley Temple, Actress: The Little Princess. **Shirley Temple** was easily the most popular and famous child star of all time. She got her start in the movies at the ...

Shirley Temple

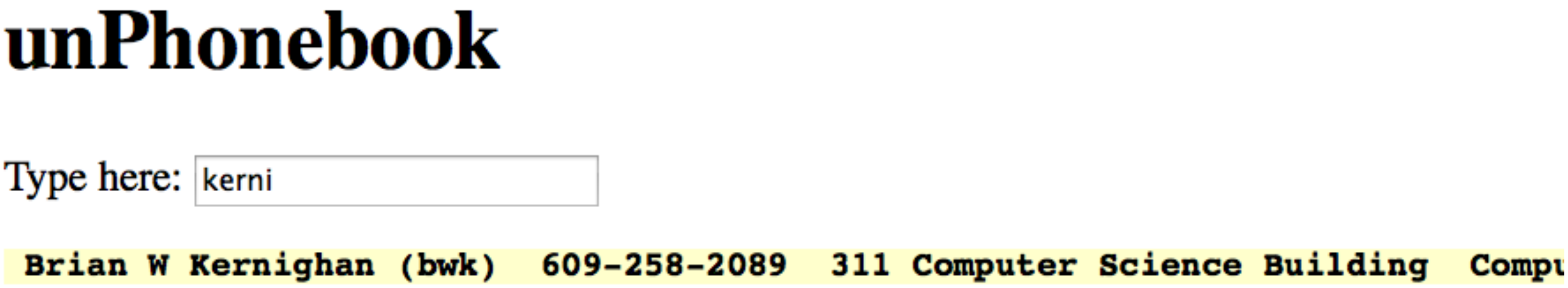
Shirley Temple Black is an American film anc
dancer, and former U.S. ambassador to Ghar
Wikipedia

Born: April 23, 1928 (age 84), Santa Monica

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>
```



unPhonebook

Type here: kerni

```
Brian W Kernighan (bwk)   609-258-2089   311 Computer Science Building   Compu
```

Basic structure of Ajax code in browser

```
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) {
   req = new XMLHttpRequest();
   if (req) {
      req.onreadystatechange = processReqChange;
      req.open("GET", url);
      req.send(null);
   }
}
function processReqChange() {
   if (req.readyState == 4) {    // completed request
      if (req.status == 200)     // successful
         show(req.responseText); // could be responseXML
   }
}
function show(s) {   // show whatever came back
   document.getElementById("place").innerHTML = s
}
```

XHR with nested function definition

```
function loadXMLDoc(url) {
   req = new XMLHttpRequest();
   if (req) {
      req.onreadystatechange = function() {
         window.status = req.statusText;
         if (req.readyState == 4) {  // completed request
            if (req.status == 200)   // successful
               show(req.responseText);
         }
      };
      req.open("GET", url);
      req.send(null);
   }
}
```

Callbacks

- **callback: a function that is passed as an argument to another function, and executed sometime later**
  - functions can be passed around like variables
    - e.g., function pointers in C; like ordinary variables in most languages

- **extensively used in Javascript because we don't want the browser to block waiting for response**

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

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**

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**
  - especially access to DOM

- **packages for layout with CSS**

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

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

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 such libraries**
  - jQuery, jQueryUI, Dojo, Yahoo User Interface (YUI), mooTools, Prototype / Scriptaculous, ...

- **see `http://code.google.com/apis/libraries/`**
  - single library for uniform access to ~10 Javascript libraries
  - experiment at **`http://code.google.com/apis/ajax/playground`**

jQuery example

```
<script>
   function geturl(s) {
      if (s.length > 1) {
         var url = 'http://www.cs.princeton.edu/
                                 ~bwk/phone3.cgi?' + s;
         $.get(url, function(res) {
            $('pre').empty().append(res);;
         });
      }
   }
</script>
<form name=phone>
Type here:
   <input type="text" id="pat" onkeyup='geturl(pat.value);'>
</form>
<pre id="place"></pre>
```