

AJAX

CS472 Web Programming

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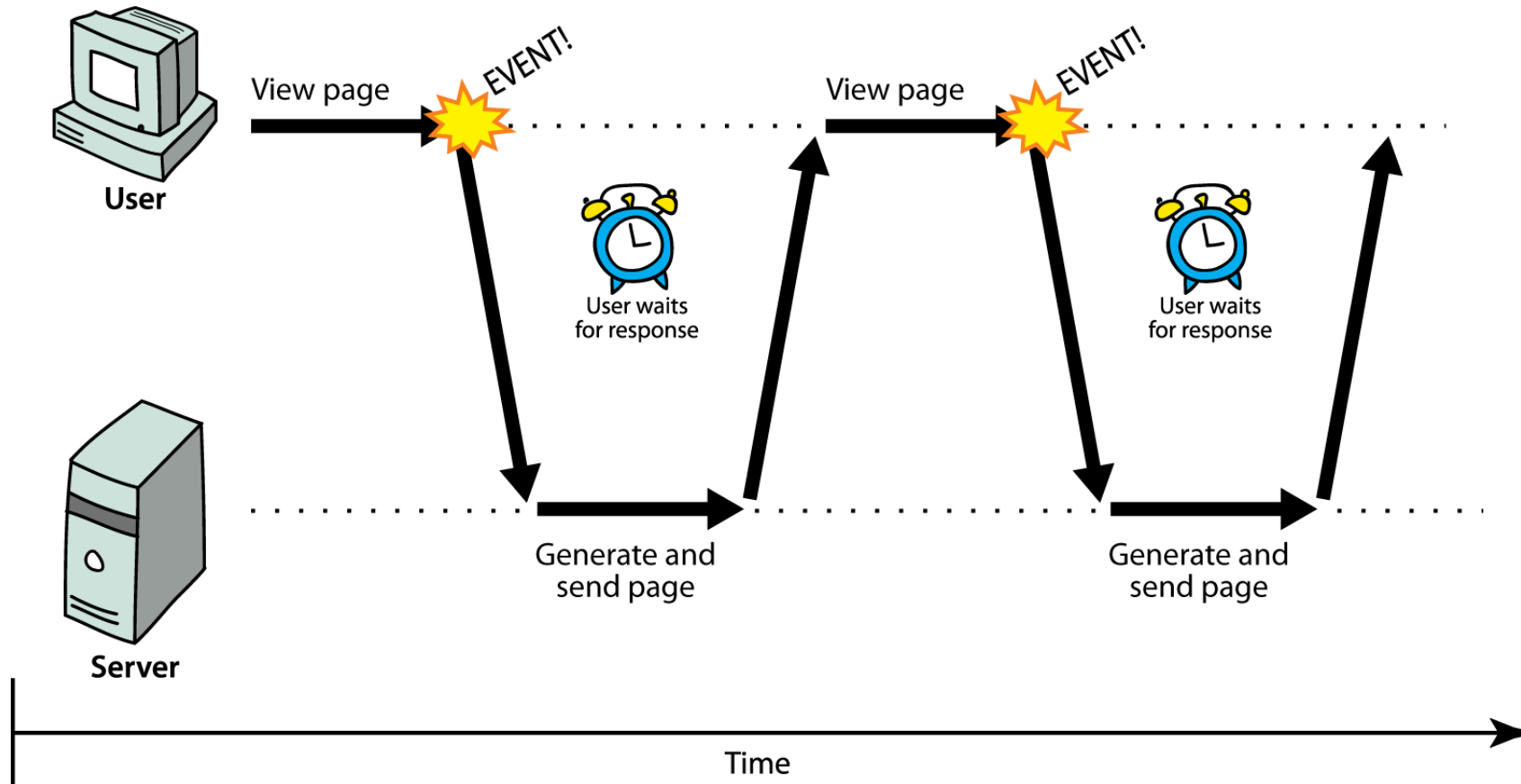
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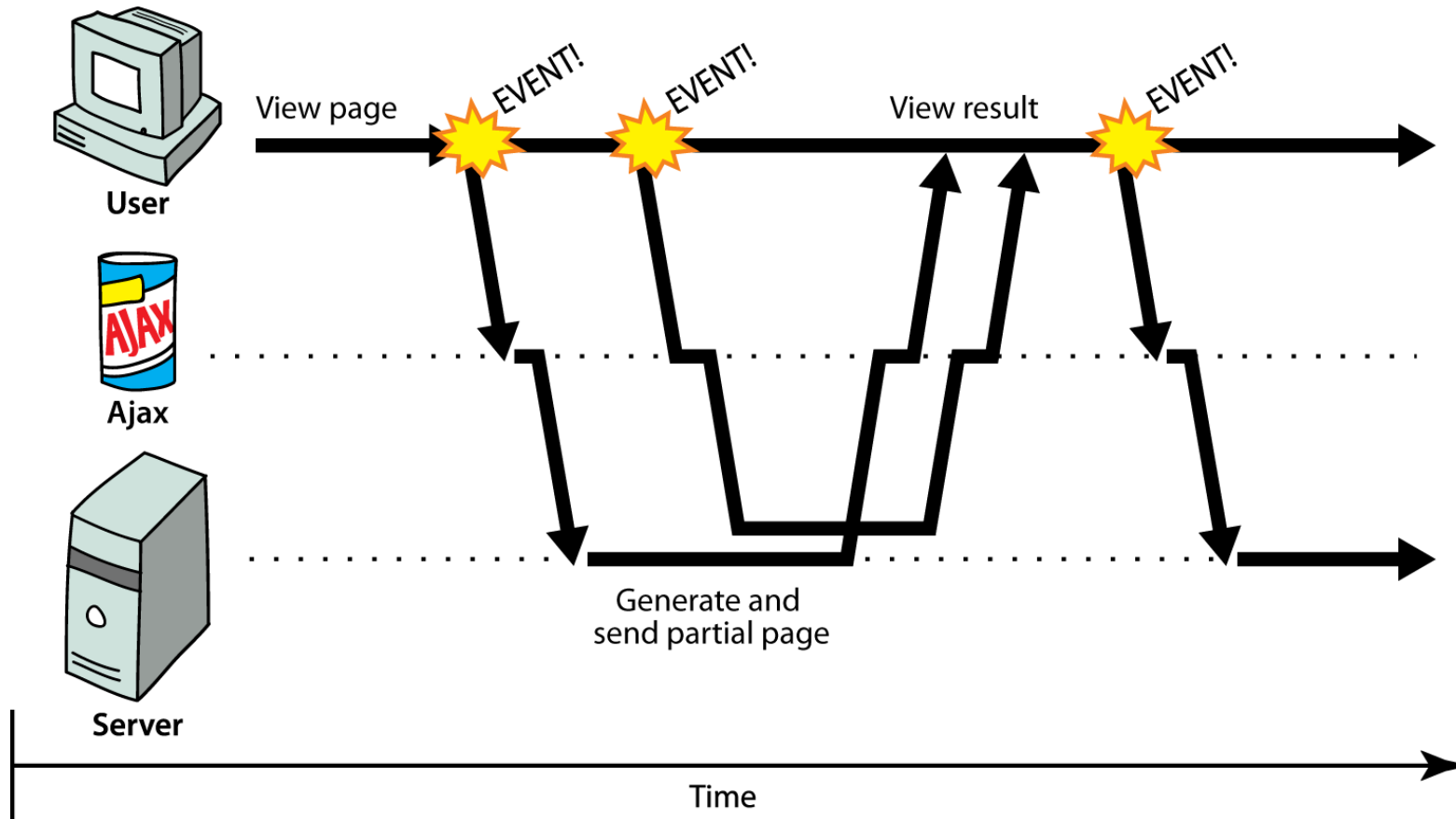
Synchronous web communication

Synchronous: user must wait while new pages load (click, wait, refresh)



Asynchronous web communication

Asynchronous: user can keep interacting with page while data loads



Web applications and Ajax

- **Web Application:** a dynamic web site that mimics the feel of a desktop app
 - Presents a continuous user experience rather than disjoint pages
 - Examples: [Gmail](#), [Google Maps](#), [Google Docs and Spreadsheets](#)
- **Ajax:** Asynchronous JavaScript and XML
 - Not a programming language; a particular way of using JavaScript
 - Downloads data from a server in the background
 - Allows dynamically updating a page without making the user wait
 - Avoids the "click-wait-refresh" pattern
 - Example: [Google Suggest](#)

XMLHttpRequest *(and why we won't use it)*

- JavaScript includes an **XMLHttpRequest** object that can fetch files from a web server
- Supported in IE5+, Safari, Firefox, Opera, Chrome, etc. (with minor compatibilities)
- It can do this asynchronously (in the background, transparent to user)
- The contents of the fetched file can be put into current web page using the DOM
- Sounds great!...

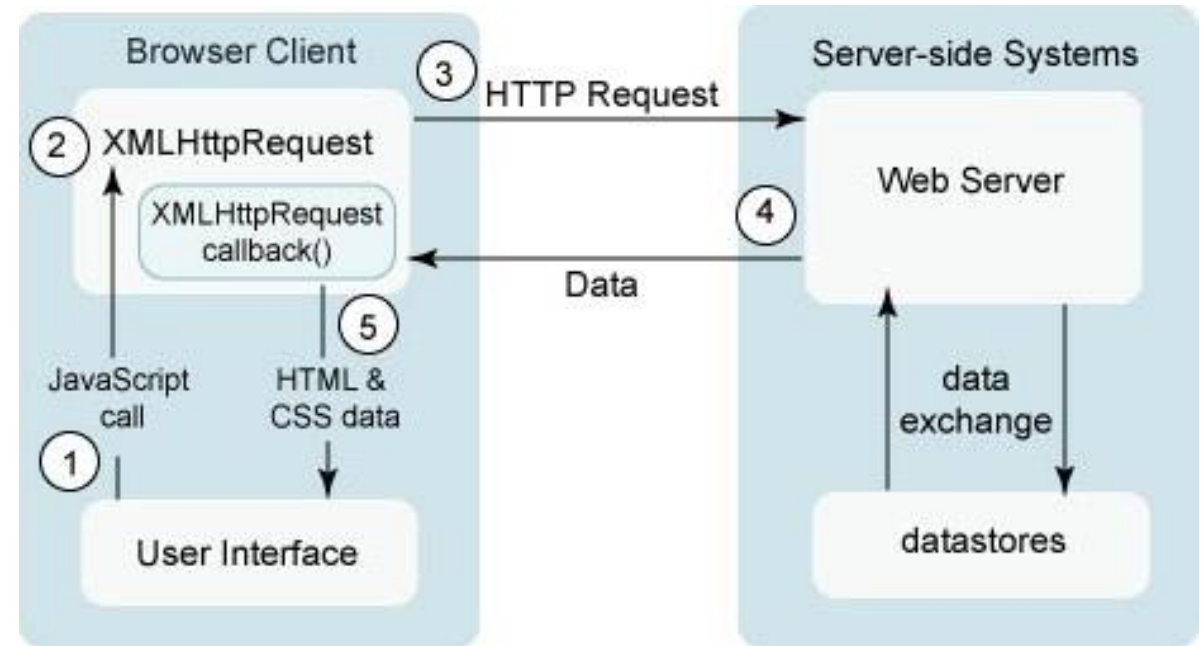
XMLHttpRequest *(and why we won't use it)*

- It is clunky to use, and has various browser incompatibilities
- jQuery provides a better wrapper for Ajax, so we will use that instead



A typical Ajax request

1. User clicks, invoking an event handler
2. Handler's code creates an XMLHttpRequest object
3. XMLHttpRequest object requests response from server
4. Server retrieves appropriate data, sends it back
5. XMLHttpRequest fires an event when data arrives (callback, you can attach a handler function to this event)
6. Your callback event handler processes the data and displays it



Main Point

The key component that a browser provides to enable Ajax is the XMLHttpRequest object, which is supported by all modern browsers. This object opens a connection with a server, sends a message, waits for the response, and then activates a given callback method. **Science of Consciousness:** The TM Technique is supported by any human nervous system. It allows us to connect with the source of thought, experience restful alertness, and then return to activity with that influence of calm alertness.

jQuery's ajax method

- Call the \$.ajax() method
- Argument accepts an object literal full of options that dictate the behavior of the AJAX request:
 - The url to fetch, as a String,
 - The type of the request, GET or POST.. etc
- Hides icky details of the raw XMLHttpRequest; works well in all browsers

```
$.ajax({  
  "url": "http://foo.com",  
  "option" : "value",  
  "option" : "value",  
  ...  
  "option" : "value"  
});
```

\$.ajax() options

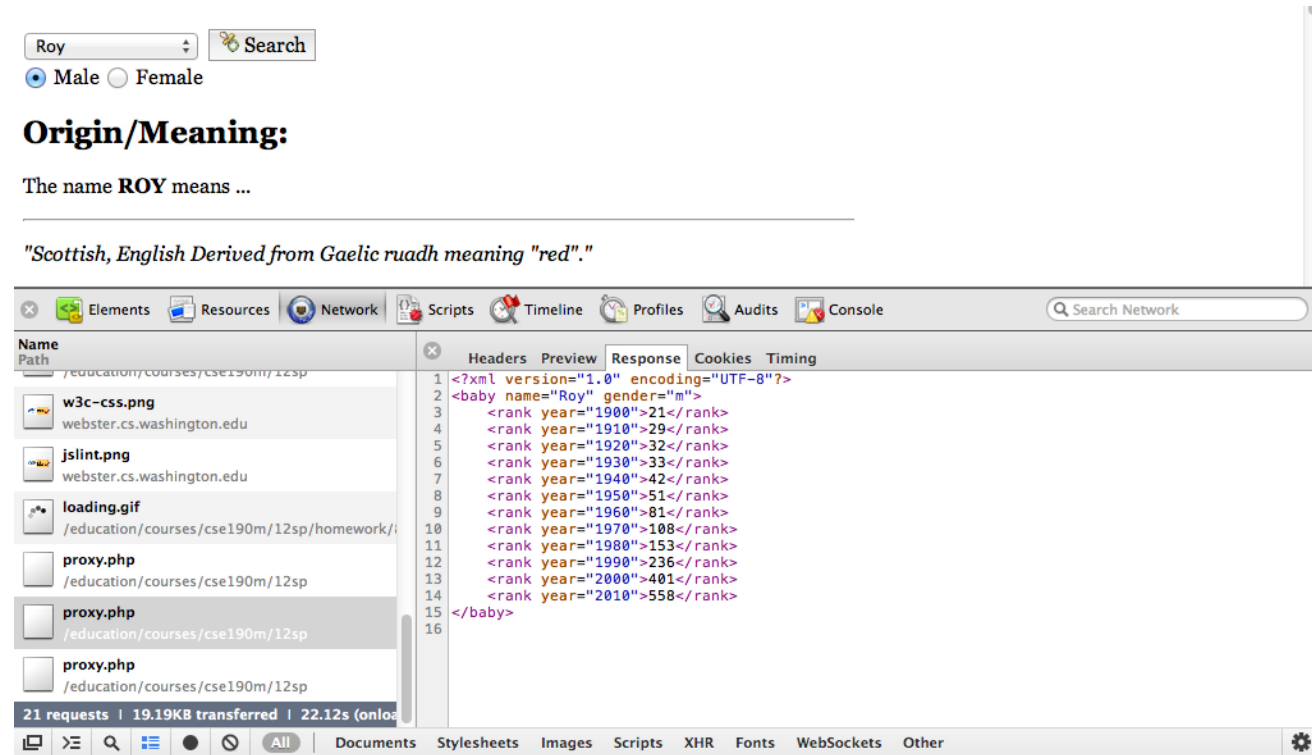
option	description
url	The URL to make a request from
type	whether to use POST or GET
data	an object literal filled with query parameters and their values
dataType	The type of data you are expecting to receive, one of: "text", "html", "json", "xml"
timeout	an amount of time in seconds to wait for the server before giving up
success	<i>event:</i> called when the request finishes successfully
error	<i>event:</i> called when the request fails
complete	<i>event:</i> called when the request finishes successfully or erroneously

jQuery AJAX example

```
$.ajax({  
    "url": "foo/bar/mydata.txt",  
    "type": "GET",  
    "success": myAjaxSuccessFunction,  
    "error": ajaxFailure  
});  
  
function myAjaxSuccessFunction(data) {  
    // do something with the data  
}  
  
function ajaxFailure(xhr, status, exception) {  
    console.log(xhr, status, exception);  
}
```

Debugging AJAX code

- Chrome DevTool's **Network** tab shows each request, parameters, response, errors
- expand a request by clicking on it and look at **Response** tab to see Ajax result
- check the **Console** tab for any errors that are thrown by requests



Examples – Check in DevTools!

Adding AJAX code to load in a hw output file into the textarea ([output](#) page)

Another example: The [quotes](#) page

Better jQuery AJAX

Rather than specify all of the options in an object literal...

```
$.ajax({ "url": "http://foo.com",  
        "type": "GET",  
        "success": functionName,  
        "error": ajaxFailure });
```

one can pass the URL as the first parameter and the rest as an object literal.
Why? It makes it even easier to see what this AJAX request is doing.

```
$.ajax("http://foo.com", { "type": "GET",  
                           "success": functionName,  
                           "error": ajaxFailure });
```

Even Better jQuery AJAX

Using these event handler function calls `done()` and `fail()` instead

```
$.ajax("http://foo.com", { "type": "GET" })  
    .done(functionName)  
    .fail(functionName);
```


Passing query parameters to a request

```
$.ajax("lookup_account.php", { "type": "GET",  
                                "data": { "name": "Asaad Saad",  
                                           "height": 180,  
                                           "password": "abcdef" },  
                                }) .done(function)  
                                   .fail(function);
```

- Don't concatenate the parameters onto the URL yourself with "?" + ...
 - won't properly URL-encode the parameters
 - won't work for POST requests
- Query parameters are passed as a data object literal
(the above is equivalent to: "name=Asaad+Saad&height=180&password=abcdef")

Creating a POST request

type should be changed to "POST" (GET is default)

```
$.ajax("url", {  
    "type": "POST",  
    "data": {  
        "name": value,  
        "name": value,  
        ...,  
        "name": value  
    },  
}) .done(function)  
   .fail(function);
```

`$.get()` and `$.post()` shortcuts

Often you don't need the flexibility of `$.ajax()` function

- The options are hard to remember
- You don't usually need all of the options

These shortcut functions are preferred when additional options are not needed.

```
$.get(url, {data})  
  .done(function)  
  .fail(function);
```

```
$.post(url, {data})  
  .done(function)  
  .fail(function);
```

More about \$.get() and \$.post()

Why bother making the distinction if it all boils down to a call to \$.ajax() under the hood

- It is less error prone
- It is easier to read

function	description
\$.ajax()	A general function for making AJAX requests, other AJAX functions rely on this
\$.get()	makes a GET request via AJAX
\$.post()	makes a POST request via AJAX

Main Points

- Ajax operations always require a url for the target on the server, a designation of whether to send a Get or Post request, one or more callback functions to be called with the result, and optionally a set of request parameters. jQuery provides convenient wrapper methods: `$.ajax()`, `$.get()`, and `$.post`. **Science of Consciousness:** Ajax operations are requests that result in actions. Intentions that arise from deep levels of consciousness will result in more powerful thoughts that are supported by all the laws of nature.
- The browser console window is critical to debugging Ajax code since it allows the developer to easily see the request that was sent and the response that was returned. **Science of Consciousness:** Checking is critical to ensure that we are practicing our TM Technique easily and effortlessly..

XMLHttpRequest security restrictions

- Ajax must be run on a web page stored on a web server
 - cannot be run from a web page stored on your hard drive
 - can open an html page from hard drive and run normal JavaScript
 - will not work if there is an Ajax call on that same page because the call must go to a 'domain' from which the page is served
- Ajax can only fetch files from the same server that the page is on
http://www.foo.com/a/b/c.html can only fetch from www.foo.com



Main Points

The same origin policy is a security constraint on browsers that restricts scripts to only contact a site with the same domain name, application protocol, and port. This means that browsers only allow Ajax calls to the same web server from which the page originated. **Science of Consciousness:** If we are calm and alert then we are more secure from disruptions by external distractions or deceptions.

AJAX user feedback

- Ajax calls are silent, no visual action to users.
- Users don't like unresponsiveness
- Often you show some sort of loader image or text while the request is made



User feedback with `always()`

The general technique is to `show()` some feedback when the AJAX request starts and `hide()` it again once it finishes.

- The `always()` function is an event that the AJAX request fires every time the request finishes, whether it was successful or not
- This might be some typical user feedback code

Async ↓

```
$.get("url")
    .done(function)
    .fail(function)
    .always(function() {
        $("#loader").hide();
    });

$("#loader").show();
```

Global AJAX events

- User feedback and similar scenarios are so common that jQuery made global events for them
- Any element can register for these events just like a `click()` event method

event method	description
<code>.ajaxStart()</code>	fired when new AJAX activity begins
<code>.ajaxStop()</code>	fired when AJAX activity has halted
<code>.ajaxSend()</code>	fired each time an AJAX request is made
<code>.ajaxSuccess()</code>	fired each time an AJAX request finishes successfully
<code>.ajaxError()</code>	fired each time an AJAX request finishes with errors
<code>.ajaxComplete()</code>	fired each time an AJAX request finishes

User feedback example

```
$(function() {  
    //loader will show whenever any ajax call is made on this page  
    $("#loader").hide();  
    $(document).ajaxStart(function() { $("#loader").show(); })  
        .ajaxStop(function() { $("#loader").hide(); });  
  
    $("#mybutton").click(function() {  
        $.get("http://foo.com")  
            .done(function)  
            .fail(function);  
    });  
});
```

JavaScript Object Notation (JSON)

JavaScript Object Notation (JSON): Data format that represents data as a set of JavaScript objects

- Natively supported by all modern browsers (and libraries to support it in old ones)
- Becoming more popular than XML due to its simplicity and ease of use

<http://www.json.org/>

XML vs JSON

```
<?xml version="1.0" encoding="UTF-8"?>
<note private="true">
  <from>Alice Smith (alice@example.com)</from>
  <to>Robert Jones (roberto@example.com)</to>
  <to>Charles Dodd (cdodd@example.com)</to>
  <subject>Tomorrow's "Birthday Bash" event!</subject>
  <message language="english">
    Hey guys, don't forget to call me this weekend!
  </message>
</note>

{
  "private": "true",
  "from": "Alice Smith (alice@example.com)",
  "to": [
    "Robert Jones (roberto@example.com)",
    "Charles Dodd (cdodd@example.com)"
  ],
  "subject": "Tomorrow's \"Birthday Bash\" event!",
  "message": {
    "language": "english",
    "text": "Hey guys, don't forget to call me this weekend!"
  }
}
```

JavaScript Object Notation (JSON)

JSON is a syntax for storing and exchanging data and an efficient alternative to XML

```
{"employees": [  
  {"firstName":"John", "lastName":"Doe"},  
  {"firstName":"Anna", "lastName":"Smith"},  
  {"firstName":"Peter", "lastName":"Jones"}  
]}
```

A name/value pair consists of a field name (**in double quotes**), followed by a colon, followed by a value.

JSON values can be:

- A number (integer or floating point)
- A string (in double quotes)
- A Boolean (true or false)
- An array (in square brackets)
- An object (in curly braces)
- null

Browser JSON methods

- You can use Ajax to fetch data that is in JSON format
- Then call `JSON.parse` on it to convert it into an object
- Then interact with that object as you would with any other JavaScript object

method	description
<code>JSON.parse(<i>string</i>)</code>	converts the given string of JSON data into an equivalent JavaScript object and returns it
<code>JSON.stringify(<i>object</i>)</code>	converts the given object into a string of JSON data (the opposite of <code>JSON.parse</code>)

JSON expressions exercise

Given the JSON data at right, what expressions would produce:

- The window's title?

```
var title = data.window.title;
```

- The image's third coordinate?

```
var coord = data.image.coords[2];
```

- The number of messages?

```
var len = data.messages.length;
```

- The y-offset of the last message?

```
var y = data.messages[len - 1].offset[1];
```

```
var jsonString = '{
  "window": {
    "title": "Sample Widget",
    "width": 500,
    "height": 500
  },
  "image": {
    "src": "images/logo.png",
    "coords": [250, 150, 350, 400],
    "alignment": "center"
  },
  "messages": [
    {"text": "Save", "offset": [10, 30]},
    {"text": "Help", "offset": [ 0, 50]},
    {"text": "Quit", "offset": [30, 10]},
  ],
  "debug": "true"
}';
var data = JSON.parse(jsonString);
```


JSON and AJAX

Your event handler is passed a JSON object as a parameter

```
$.get("url")  
    .done(functionName); // we are expecting a JSON string/object  
  
function functionName(jsonData) {  
    // do stuff with the jsonData Object  
    // if string: JSON.parse(jsonData); (not necessary if dataType: json)  
}
```

Exercise: Parsing JSON

Suppose we have a service <http://jsonplaceholder.typicode.com> about blogs.

- Write a page that processes this JSON blog data.
- Display all users [/users](#)
- Display all posts from selected user [/posts?userId=1](#)
- Display all comments from selected post [/comments?postId=1](#)

- Create one page with input form to take userId from the browser
- Display user name and email and address and all posts belongs to this userId
- For every post, you need to show a button (show comments) once clicked you need to show all comments for the specific post.
- The trick is to hide postId in data- attribute in each post. (HTML5 compatible)
- To display the comments you need to create the output comment elements and append them to the DOM (faster, memory efficient)
- You may need to use `$(DOM).on()` to attach event handler with functions to newly created elements

Main Point

JSON has become more widely used for Ajax data representations than XML because JSON is easier to write and read and is almost identical to JavaScript object literal syntax. **Science of Consciousness:** We always prefer to do less and accomplish more. Actions arising from deep levels of consciousness are more efficient and effective.

CONNECTING THE PARTS OF KNOWLEDGE WITH THE WHOLENESS OF KNOWLEDGE

Ajax and Advanced techniques

1. Client side programming with JavaScript is useful for making web applications highly responsive.
 2. Ajax allows JavaScript to access the server in a very efficient manner using asynchronous messaging and partial page refreshing.
-
3. **Transcendental consciousness** is the experience of the home of all the laws of nature where all information is available at every point.
 4. **Impulses within the transcendental field:** Communication at this level is instantaneous and effortless.
 5. **Wholeness moving within itself:** In unity consciousness daily life is experienced in terms of this frictionless and effortless flow of information.

