JSON – JavaScript Object Notation

Some of the slides taken from Douglas Crockford / Paypal Inc.

What is JSON

- **JSON**, short for **JavaScript Object Notation**, is a lightweight data interchange format.
  - It is a text-based, human-readable format for representing simple data structures and associative arrays (called objects).
- The JSON format is specified in RFC 4627 by Douglas Crockford.
  - The official MIME type for JSON is application/json. The JSON file extension is .json.
- The JSON format is often used for transmitting structured data over a network connection in a process called serialization.
  - Its main application is in Ajax web application programming, where it serves as an alternative to the use of the XML format.
- Code for parsing and generating JSON data is readily available for a large variety of programming languages. The www.json.org website provides a comprehensive listing of existing JSON bindings, organized by language.

Brief History

- JSON was based on a subset of the JavaScript programming language (specifically, Standard ECMA-262 - now in its 5th Edition)
    - however it is considered to be a language-independent data format.
    - For the complete specification see
    http://www.ecma-international.org/publications/files/ECMA-ST/ECMA-404.pdf
    The JavaScript ECMA standard is based upon Netscape's JavaScript and Microsoft's Jscript
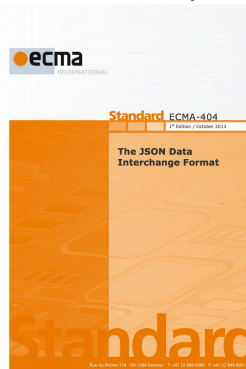
- Douglas Crockford was the original developer of JSON while he was at State Software, Inc. He is now Senior JavaScript Architect at Paypal
- http://www.json.org/, is a website devoted to JSON discussions and includes many JSON parsers

How to use the JSON format

- A JSON file allows one to load data from the server or to send data to it.
- Working with JSON involves three steps: (i) the browser processing, (ii) the server processing, and (iii) the data exchange between them.

1. **Client side (browser)**
   - The content of a JSON file (or stream), or the definition of JSON data is assigned to a variable, and this variable becomes an object of the program.

2. **Server side**
   - a JSON file (or stream) on the server can be operated upon by various programming languages, including PHP and Java thanks to parsers that process the file and may even convert it into classes and attributes of the language.

3. **Data exchange**
   - Loading a JSON file from the server may be accomplished in JavaScript in several ways:
   - directly including the file into the HTML page, as a JavaScript .json external file.
   - loading by a JavaScript command
   - using XMLHttpRequest
   - To convert JSON into an object, it can be passed to the JavaScript eval() function.
   - Sending the file to the server may be accomplished by XMLHttpRequest. The file is sent as a text file and processed by the parser of the programming language that uses it.

JSON and XMLHttpRequest Example

- **The XMLHttpRequest code:**

```
var req = new XMLHttpRequest();
req.open("GET", "file.json", true);
req.onreadystatechange = myCode; // the callback
req.send(null);
```

- **The JavaScript callback: eval() parses JSON, creates an object and assigns it to variable doc**

```
function myCode() {
  if (req.readyState == 4) {
    if (req.Status == 200) {
      var doc = eval('(' + req.responseText + ')');
  }
}
```

- **Using the data:**

```
var menuName = doc.getElementById('menu'); // finding a field menu
doc.menu.value = "my name is"; // assigning a value to the field
```

- **How to access data:**

```
doc.commands[0].title // read value of the "title" field in the array
doc.commands[0].action // read value of the "action" field in the array
```

JavaScript eval()

- The JavaScript eval( ) function evaluates a string and executes it as if it was JavaScript code, e.g.

```
<script type="text/javascript">
eval("x=10;y=20;document.write(x*y)");
document.write("<br />");
document.write(eval("2+2"));
document.write("<br />");
var x=10;
document.write(eval(x+17));
document.write("<br />"); </script>
```

- produces the output

```
200
4
27
```

- Because JSON-formatted text is also syntactically legal JavaScript code, an easy way for a JavaScript program to parse JSON-formatted data is to use the built-in JavaScript eval() function

- the JavaScript interpreter itself is used to *execute* the JSON data to produce native JavaScript objects.

- The eval() technique is subject to security vulnerabilities if the data and the entire JavaScript environment is not within the control of a single trusted source; See:

- https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/eval

JSON Basic Data Types

- *String* (double-quoted unicode with backslash escaping)
- *Numbers* (integer, real, or floating point)
- *Booleans* (true and false)
- *Object* (collection of key:value pairs, comma-separated and enclosed in curly brackets)
- *Array* (an ordered sequence of values, comma-separated and enclosed in square brackets)
- *Null* (a value that isn't anything)

String

- Sequence of 0 or more Unicode characters
- No separate character type
  - A character is represented as a string with a length of 1
- Wrapped in "double quotes"
- Backslash escapement

Object

- Objects are unordered containers of key/value pairs
- Objects are wrapped in **{ }**
- **,** separates key/value pairs
- **:** separates keys and values
- Keys are strings
- Values are JSON values
- Can be used to represent: struct, record, hashtable, object

Example Object

```
{"name":"Jack B. Nimble","at large":
true,"grade":"A","level":3,
"format":{"type":"rect","width":1920,
"height":1080,"interlace":false,
"framerate":24}}
```

Example Object Formatted

```
{
    "name":        "Jack B. Nimble",
    "at large": true,
    "grade":       "A",
    "level": 3,
    "format": {
        "type":        "rect",
        "width":       1920,
        "height":      1080,
        "interlace": false,
        "framerate": 24
    }
}
```

Array

- Arrays are ordered sequences of values
- Arrays are wrapped in **[ ]** (square brackets)
- **,** separates values
- JSON does not talk about indexing.
  - An implementation can start array indexing at 0 or 1.

Two Examples of JSON Arrays

- **One dimensional**

```
["Sunday", "Monday", "Tuesday", "Wednesday",
 "Thursday", "Friday", "Saturday"]
```

- **Two dimensional**

```
[
    [0, -1, 0],
    [1, 0, 0],
    [0, 0, 1]
]
```

Arrays vs Objects

- Use objects when the key names are arbitrary strings
- Use arrays when the key names are sequential integers

JSON is Not XML

JSON
- Objects
- Arrays
- Strings
- Numbers
- Booleans
- null

XML
- element
- attribute
- Attribute string
- content
- <![CDATA[ ]]>
- Entities
- Declarations
- Schema
- Stylesheets
- Comments
- Version
- namespace

JSON vs. XML Example

JSON
```
{
  "menu": "File",
  "commands": [
    {
      "title": "New",
      "action":"CreateDoc"
    },
    {
      "title": "Open",
      "action": "OpenDoc"
    },
    {
      "title": "Close",
      "action": "CloseDoc"
    }
  ]
}
```

XML Equivalent
```
<?xml version="1.0" ?>
 <root>
   <menu>File</menu>
   <commands>
     <item>
       <title>New</value>
       <action>CreateDoc</action>
     </item>
     <item>
       <title>Open</value>
       <action>OpenDoc</action>
     </item>
     <item>
       <title>Close</value>
       <action>CloseDoc</action>
     </item>
   </commands>
 </root>
```
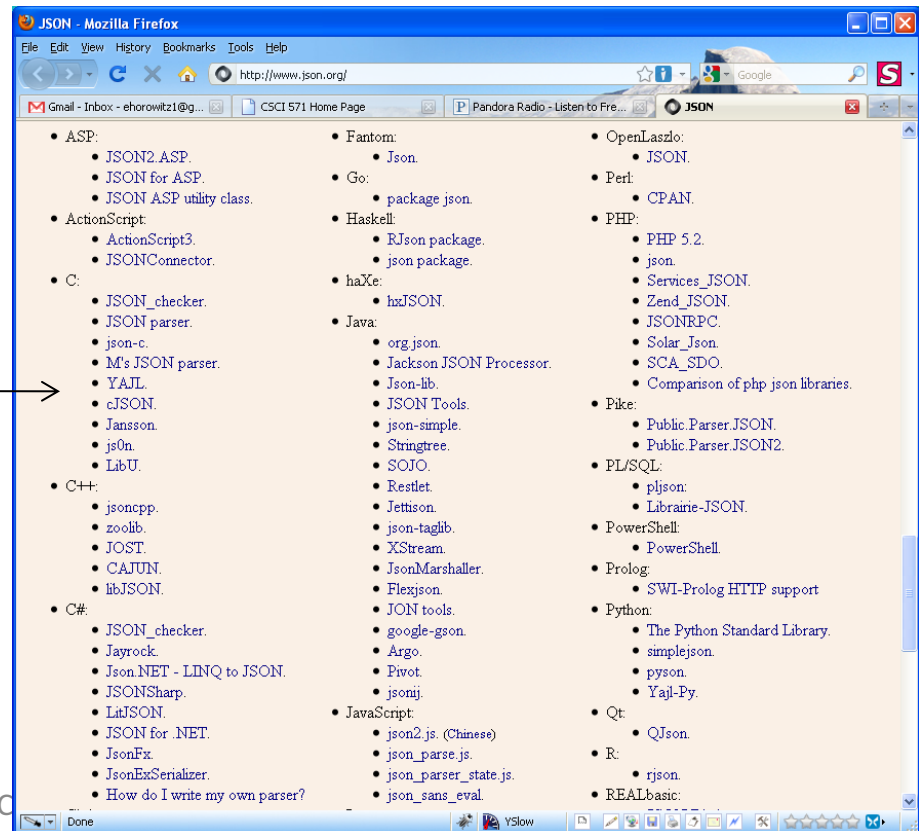
Rules for JSON Parsers

- A JSON decoder must accept all well-formed JSON text

- A JSON decoder may also accept non-JSON text

- A JSON encoder must only produce well-formed JSON text

- A list of decoders for JSON can be found at

http://www.json.org/

JSON parsers for programming
languages include: C, C++,
C#, Java, JavaScript, Perl, PHP

2008-2016 C

17

Same Origin Policy

- Same origin policy is a security feature that browsers apply to client-side scripts

- It prevents a document or script loaded from one "origin" from getting or setting properties of a document from a different "origin"
  - Rationale: the browser should not trust content loaded from arbitrary websites

- Given the URL: http://www.example.com/dir/page.html

URL	Outcome	Reason
http://www.example.com/dir2/other.json	Success	Same protocol and host
http://www.example.com/dir/inner/other.json	Success	Same protocol and host
http://www.example.com:81/dir2/other.json	Failure	Same protocol and host but different port
https://www.example.com/dir2/other.json	Failure	Different protocol
http://en.example.com/dir2/other.json	Failure	Different host
http://example.com/dir2/other.json	Failure	Different host

JSON: The Cross-Domain Hack

- JSON and the <script> tag provide a way to get around the Same Origin Policy

<script src=http://otherdomain.com/data.js>

</script>

- The src attribute of a script tag can be set to a URL from any server, and every browser will go and retrieve it, and read it into your page

- So a script tag can be set to point at a URL on another server with JSON data in it, and that JSON will become a global variable in the webpage

- So JSON can be used to grab data from other servers, without the use of a server-side proxy

JSON and Dynamic Script Tag "Hack"

- Using JSON it is possible to get around the limitation that data can only come from a single domain
- To do this one needs to
  - to find a website that returns JSON data, and
  - A JavaScript program that contains a JSONScriptRequest class that creates a dynamic <script> tag and its contents
- The implementation of this class can be found at the class website under Special Topics - JSON:

http://cs-server.usc.edu:45678/jsr_class.js

- and also at

http://www.xml.com/lpt/a/1636

- The most important line in the script (the "hack") is the following one:

```
this.scriptObj.setAttribute("src", this.fullUrl + this.noCacheIE);
```

which sets the src attribute of the <script> tag to a new URL

Source Code for jsr_class.js

```javascript
// Constructor -- pass a REST request URL to the constructor
function JSONscriptRequest(fullUrl) {
            // REST request path
            this.fullUrl = fullUrl;
            // Keep IE from caching requests
            this.noCacheIE = '&noCacheIE=' + (new Date()).getTime();
            // Get the DOM location to put the script tag
            this.headLoc = document.getElementsByTagName("head").item(0);
            // Generate a unique script tag id
            this.scriptId = 'JscriptId' + JSONscriptRequest.scriptCounter++;  }
// Static script ID counter
JSONscriptRequest.scriptCounter = 1;
// buildScriptTag method
JSONscriptRequest.prototype.buildScriptTag = function () {
            // Create the script tag
            this.scriptObj = document.createElement("script");
            // Add script object attributes
            this.scriptObj.setAttribute("type", "text/javascript");
            this.scriptObj.setAttribute("charset", "utf-8");
            this.scriptObj.setAttribute("src", this.fullUrl + this.noCacheIE);
            this.scriptObj.setAttribute("id", this.scriptId); }
// removeScriptTag method
JSONscriptRequest.prototype.removeScriptTag = function () {
            // Destroy the script tag
            this.headLoc.removeChild(this.scriptObj); }
// addScriptTag method
JSONscriptRequest.prototype.addScriptTag = function () {
            // Create the script tag
            this.headLoc.appendChild(this.scriptObj); }
```

Critical line

Example Using JSON and JSONscriptRequest class

<html><body>

// Include the JSONscriptRequest class

<script type="text/javascript" src="jsr_class.js"> </script>

<script type="text/javascript">

 // Define the callback function

 function getGeo(jsonData) {

   alert('Latitude = ' + jsonData.ResultSet.Result[0].Latitude + ' Longitude = ' +

    jsonData.ResultSet.Result[0].Longitude);

   bObj.**removeScriptTag**();

 }

// The web service call

var req = 'http://api.local.yahoo.com/MapsService/V1/geocode?appid=YahooDemo&output=json&callback=getGeo&location=94107';

// Create a new request object

bObj = new **JSONscriptRequest**(req);

// Build the dynamic script tag

bObj.**buildScriptTag**();

// Add the script tag to the page

bObj.**addScriptTag**();

</script></body></html>
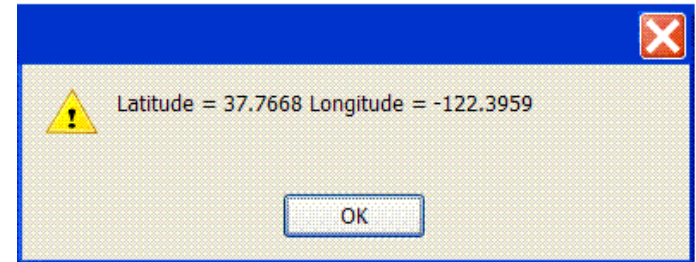
output

buildScriptTag creates
<script src="getGeo({"ResultSet":{"Result":[{"precision":"zip",...>

Adding the <script> tag to the page causes getGeo to be called
And the JSON-encoded data to be passed to the getGeo function;
The JavaScript interpreter automatically turns JSON into a
JavaScript object, and the returned data can be referenced
immediately

The MarkitOnDemand Example

- MarkitOnDemand provides Stock Lookup and Stock Quote APIs.

- To access the service you do not an need an Application ID.

- Stock Lookup JSON call looks like this:

```
http://dev.markitondemand.com/MODApis/Api/v2/Lookup/json?input=AA
    P
```

- Stock Quote JSON call looks like this:

```
http://dev.markitondemand.com/MODApis/Api/v2/Quote/json?symbol=AA
    PL
```

- Documentation for Market Data APIs can be found here

http://dev.markitondemand.com/MODApis/

- MarkitOnDemand will return data in multiple formats including JSON and XML

Sample JSON Output

- Here is an example of the MarkitOnDemand Lookup API returning JSON

- `http://dev.markitondemand.com/MODApis/Api/v2/Lookup/json?input=AAP`

```
[{
        "Symbol": "AAP",
        "Name": "Advance Auto Parts Inc",
        "Exchange": "NYSE"
}, {
        "Symbol": "AAP",
        "Name": "Advance Auto Parts Inc",
        "Exchange": "BATS Trading Inc"
}, {
        "Symbol": "AAPL",
        "Name": "Apple Inc",
        "Exchange": "NASDAQ"
}, {
        "Symbol": "AVSPY",
        "Name": "AAPL ALPHA INDEX",
        "Exchange": "NASDAQ"
}, {
        "Symbol": "AIX",
        "Name": "NAS OMX Alpha   AAPL vs. SPY  Settle",
        "Exchange": "NASDAQ"
}]
```

Sample JSON Output

- Here is an example of the MarkitOnDemand Quote API returning JSON
- `http://dev.markitondemand.com/MODApis/Api/v2/Quote/json?symbol=AAPL`

```
{
        "Status": "SUCCESS",
        "Name": "Apple Inc",
        "Symbol": "AAPL",
        "LastPrice": 106.01,
        "Change": 1.43000000000001,
        "ChangePercent": 1.36737425894053,
        "Timestamp": "Wed Mar 16 15:59:00 UTC-04:00 2016",
        "MSDate": 42445.6659722222,
        "MarketCap": 587781243830,
        "Volume": 2953715,
        "ChangeYTD": 105.26,
        "ChangePercentYTD": 0.712521375641269,
        "High": 106.31,
        "Low": 104.6,
        "Open": 104.62
}
```

XMLHttpRequest Compared to the Dynamic Script Tag

	XmlHttpRequest	Dynamic script Tag
Cross-browser compatible?	No	Yes
Cross-domain browser security enforced?	Yes (*)	No
Can receive HTTP status codes?	Yes	No (fails on any HTTP status other than 200)
Supports HTTP GET and POST?	Yes	No (GET only)
Can send/receive HTTP headers?	Yes	No
Can receive XML?	Yes	Yes (but only embedded in a JavaScript statement)
Can receive JSON?	Yes	Yes (but only embedded in a JavaScript statement)
Offers synchronous and asynchronous calls?	Yes	No (asynchronous only)

Dynamic script tag is used by internet advertisers who use it to pull their ads into a web page

The script tag's main advantages are that it is not bound by the web browser's cross-domain security restrictions and that it runs identically on more web browsers than XMLHttpRequest.

If your web service happens to offer JSON output and a callback function, you can easily access web services from within your JavaScript applications without having to parse the returned data

* CORS-compatible browsers allow cross-domain XMLHttpRequest

Arguments against JSON

- JSON doesn't have namespaces
- JSON has no validator
  - Every application is responsible for validating its inputs
- JSON is not extensible
  - But it does not need to be
- JSON is not XML
  - But a JavaScript compiler is a JSON decoder

Features that make JSON well-suited for data transfer

- It is both a human and machine-readable format;
- It has support for unicode, allowing almost any information in any human language to be communicated
- The format is self-documenting in that it describes structure and field names as well as specific values
- The strict syntax and parsing requirements allow the parsing algorithms to remain simple, efficient, and consistent
- JSON has the ability to represent the most general of computer science data structures: records, lists and trees

Security Issues

- The eval() function is very fast. However, it can compile and execute any JavaScript program, so there can be security issues

- In general
  - your browser should not trust machines not under your absolute control
  - Your server must validate everything the client tells it

- To help guard the browser from insecure JSON input, use JSON.parse instead of eval ; e.g. JSON.parse is used this way

    var myObject = JSON.parse(myJSONtext, reviver);

- The optional reviver parameter is a function that will be called for every key and value at every level of the final result. Each value will be replaced by the result of the reviver function. This can be used to reform generic objects into instances of pseudoclasses, or to transform date strings into Date objects.

- JSON.parse() is included in ECMAScript 5th Ed. and all the recent desktop browsers (Chrome, Firefox 3.5+, IE 8+, Opera 10.5+, Safari 4+) and all mobile browsers. See:

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/JSON/parse

More Discussion of JSON.parse

- In JavaScript there is a function called JSON.parse. It uses a single call to eval to do the conversion, guarded by a single regexp test to assure that the input is safe.

- The input object is traversed recursively, and various functions are called for each member of the object in post-order (i.e. every object is reviewed after all its members have been reviewed).

- For each member, the following occurs:
  - If reviewer returns a valid value, the member value is replaced with the value returned by reviewer.
  - If reviewer returns what it received, the structure is not modified.
  - If reviewer returns null or undefined, the object member is deleted.

- The reviewer argument is often used to transform JSON representation of ISO date strings into UTC format Date objects.

- Here is the original source code for JSON.parse
```
JSON.parse = function (text) {
return
(/^(\s|[,:{}\[\]]|"(\\["\\bfnrtu]|[^\x00-\x1f"\\])*"|-
?\d+(\.\d*)?([eE][+-]?\d+)?|true|false|null)+$/.test(text))
&& eval('(' + text + ')'); };
```

- According to Doug Crockford, "It is ugly, but it is really efficient. "

- For the actual source implementation and explanation of the behavior of the "reference implementation" of JSON.parse see
  - https://github.com/douglascrockford/JSON-js and http://www.json.org/js.html
  - (for applications that need to run on obsolete browsers)

- JQuery provides implicit ParseJSON() and responseJSON property. See
  - http://api.jquery.com/jquery.parsejson/ and http://api.jquery.com/jQuery.ajax/

Douglas Crockford Discusses AJAX

- Go to
- https://www.youtube.com/watch?v=-C-JoyNuQJs
- Start video at -27 minutes and run it as long as it is interesting
- He gets to JSON at -13 minutes

JSONP

- JSONP or "JSON with padding" is a JSON extension wherein the name of a callback function is specified as an input argument of the call itself.

- It is now used by many Web 2.0 applications such as Dojo Toolkit Applications or Google Toolkit Applications.

- Further extensions of this protocol have been proposed

- Because JSONP makes use of script tags, calls are essentially open to the world. For that reason, JSONP may be inappropriate to carry sensitive data

- JSONP is supported by jQuery. See:

    https://learn.jquery.com/ajax/working-with-jsonp/

JSONP Example

- Consider the following <script> tag which includes a src attribute referring to a Google spreadsheet

<script
    src="http://spreadsheets.google.com/feeds/list/o03712292828507838454.2635427448373779250/od6/public/basic?alt=json-in-script&callback=listTasks"> </script>

- the URL in the above script will return the following JSON result:

listTasks ({"version":"1.0","encoding":"UTF-8", "feed":{
 "entry":[{
  {"title":
  {"type":"text","$t":"Make google gadget w/spreadsheet example"},
"content":{"type":"text","$t":"Status: Done"}},
 {"title":
 {"type":"text","$t":"Do final project for class"},
 "content":{"type":"text","$t":"Status: NotStarted"}
}]} });

- notice the src attribute's URL has alt=json-in-script and callback=listTasks. This tells google that it wants not just JSON (data) but JSONP (data passed as a parameter of the listed function listTasks).

- The about output is JSON data, surrounded by the Procedure call "listTasks", with the data as a "parameter".

- Try this in a browser:
  http://spreadsheets.google.com/feeds/list/o03712292828507838454.2635427448373779250/od6/public/basic?alt=json-in-script&callback=listTasks

What is Actually Returned Today (since 2010)

listTasks ({"version":"1.0","encoding":"UTF-8", "**feed**":{"xmlns":"http://www.w3.org/2005/Atom",

"xmlns$openSearch":"http://a9.com/-/spec/opensearchrss/1.0/",

"xmlns$gsx":"http://schemas.google.com/spreadsheets/2006/extended",

"id":{"$t":"https://spreadsheets.google.com/feeds/list/o03712292828507838454.2635427448373779250/od6/public/basic"},

"updated":{"$t":"2006-12-05T10:35:42.800Z"},"category":[{"scheme":"http://schemas.google.com/spreadsheets/2006",

"term":"http://schemas.google.com/spreadsheets/2006#list"}],"title":{"type":"text","$t":"Sheet1"},

"link":[{"rel":"alternate","type":"text/html",

"href":"https://spreadsheets.google.com/pub?key\u003do03712292828507838454.2635427448373779250"},

{"rel":"http://schemas.google.com/g/2005#feed","type":"application/atom+xml",

"href":"https://spreadsheets.google.com/feeds/list/o03712292828507838454.2635427448373779250/od6/public/basic"},

{"rel":"self","type":"application/atom+xml",

"href":"https://spreadsheets.google.com/feeds/list/o03712292828507838454.2635427448373779250/od6/public/basic?alt\u003djson
-in-script"}],

"author":[{"name":{"$t":"pamela.fox"},"email":{"$t":"pamela.fox@gmail.com"}}],"openSearch$totalResults":{"$t":"2"},

"openSearch$startIndex":{"$t":"1"},

"**entry**":[{"id":{"$t":"https://spreadsheets.google.com/feeds/list/o03712292828507838454.2635427448373779250/od6/public/basic/c
okwr"},

"updated":{"$t":"2006-12-05T10:35:42.800Z"},"category":[{"scheme":"http://schemas.google.com/spreadsheets/2006",

"term":"http://schemas.google.com/spreadsheets/2006#list"}],"**title**":{"type":"text",

"**$t**":"Make google gadget w/spreadsheet example"},"**content**":{"type":"text","**$t**":"status: Done"},

"link":[{"rel":"self","type":"application/atom+xml",

"href":"https://spreadsheets.google.com/feeds/list/o03712292828507838454.2635427448373779250/od6/public/basic/cokwr"}]},

{"id":{"$t":"https://spreadsheets.google.com/feeds/list/o03712292828507838454.2635427448373779250/od6/public/basic/cpzh4"},

"updated":{"$t":"2006-12-05T10:35:42.800Z"},"category":[{"scheme":"http://schemas.google.com/spreadsheets/2006",

"term":"http://schemas.google.com/spreadsheets/2006#list"}],"**title**":{"type":"text","**$t**":"Do final project for class"},

"**content**":{"type":"text","**$t**":"status: NotStarted"},"link":[{"rel":"self","type":"application/atom+xml",

"href":"https://spreadsheets.google.com/feeds/list/o03712292828507838454.2635427448373779250/od6/public/basic/cpzh4"}]}]}});

JSONP Example, Cont'd

- When dynamically executed (e.g. using JavaScript's "eval" on it), it invokes the function listTasks :

```
function listTasks(root) {
var feed = root.feed;
var entries = feed.entry || [];
var html = [''];
html.push('<ul>');
for (var i = 0; i < feed.entry.length; ++i) {
var entry = feed.entry[i];
var title = entry.title.$t;
var content = entry.content.$t;
html.push('<li>', title, ' (', content, ')  </li>');
}
html.push('</ul>');
document.getElementById("agenda").innerHTML =
html.join("");
}
```

For more discussion of JSONP see
http://www.west-wind.com/Weblog/posts/107136.aspx

- The "output" of such a function in the example would be like this:

```
<ul>
 <li> Make google gadget w/spreadsheet example (Status: Done) </li>
 <li> Do final project for class (Status: NotStarted) </li>
<ul>
```

- and it is stored in the "html" variable.
- You then assign such HTML to the "innerHTML" of the element with Id "agenda", which then shows it on the web page.

PHP Now Includes JSON functionality

- As of PHP 5.2, the JSON extension is bundled and compiled into PHP by default
- JSON functions include
  - json_encode - returns the JSON representation of a value
  - json_decode - decodes a JSON string
  - json_last_error - returns the last error that occurred
  - Json_last_error_message – returns error string of last json_encode or json_decode
- See:

  http://php.net/manual/en/book.json.php

Example of json_encode

```php
<?php
 $arr = array('a' => 1, 'b' => 2, 'c' => 3, 'd' => 4, 'e' => 5);
 echo json_encode($arr);
?>
```

which produces the following output

{"a":1,"b":2,"c":3,"d":4,"e":5}

Example: How PHP objects can be converted into JSON

```php
<?php
 class Emp {   public $name = "";
               public $hobbies = "";
               public $birthdate = "";    }
 $e = new Emp();
 $e->name = "robert";
 $e->hobbies = "sports";
 # $e->birthdate = date('m/d/Y h:i:s a', "8/5/1974 12:20:03 p");
 $e->birthdate = date('m/d/Y h:i:s a', strtotime("8/5/1974 12:20:03"));
 echo json_encode($e);
 ?>
```

which produces the following result:

{"name":"robert","hobbies":"sports","birthdate":"08\/05\/1974 12:20:03 pm"}

Example: Decoding JSON in PHP

```php
<?php
 $json = '{"a":1,"b":2,"c":3,"d":4,"e":5}';
var_dump(json_decode($json, true));
?>
```

which produces the following result

```
array(5) {
 ["a"] => int(1)
 ["b"] => int(2)
 ["c"] => int(3)
 ["d"] => int(4)
 ["e"] => int(5)
}
```

Parameters of json_decode
- **json_string**: It is encoded string which must be UTF-8 encoded data
- **assoc**: It is a boolean type parameter, when set to TRUE, returned objects will be converted into associative arrays.
- **depth**: It is an integer type parameter which specifies recursion depth
- **options**: It is an integer type bitmask of JSON decode, JSON_BIGINT_AS_STRING is supported

JQuery JSON Support

- JQuery Ajax APIs provide extensive support for JSON and JSONP
- jQuery.ajax([settings]) includes the following JSON-related settings:
  - **crossDomain** (default: **false** for same-domain requests, **true** for cross-domain requests) - If you wish to force a crossDomain request (such as JSONP) on the same domain, set the value of crossDomain to true. This allows, for example, server-side redirection to another domain.
  - **dataType** (xml, json, script, or html) - The type of data that you're expecting back from the server.
    - "json": Evaluates the response as JSON and returns a JavaScript object. The JSON data is parsed in a strict manner.
    - If json dataType is specified, the response is parsed using jQuery.parseJSON before being passed, as an object, to the success handler. The parsed JSON object is made available through the responseJSON property.
    - "jsonp": Loads in a JSON block using JSONP. Adds an extra "?callback=?" to the end of your URL to specify the callback.
    - If jsonp is specified, $.ajax() will automatically append a query string parameter of (by default) callback=? to the URL.
  - **jsonp** - Override the callback function name in a JSONP request. This value will be used instead of 'callback' in the 'callback=?' part of the query string in the url.
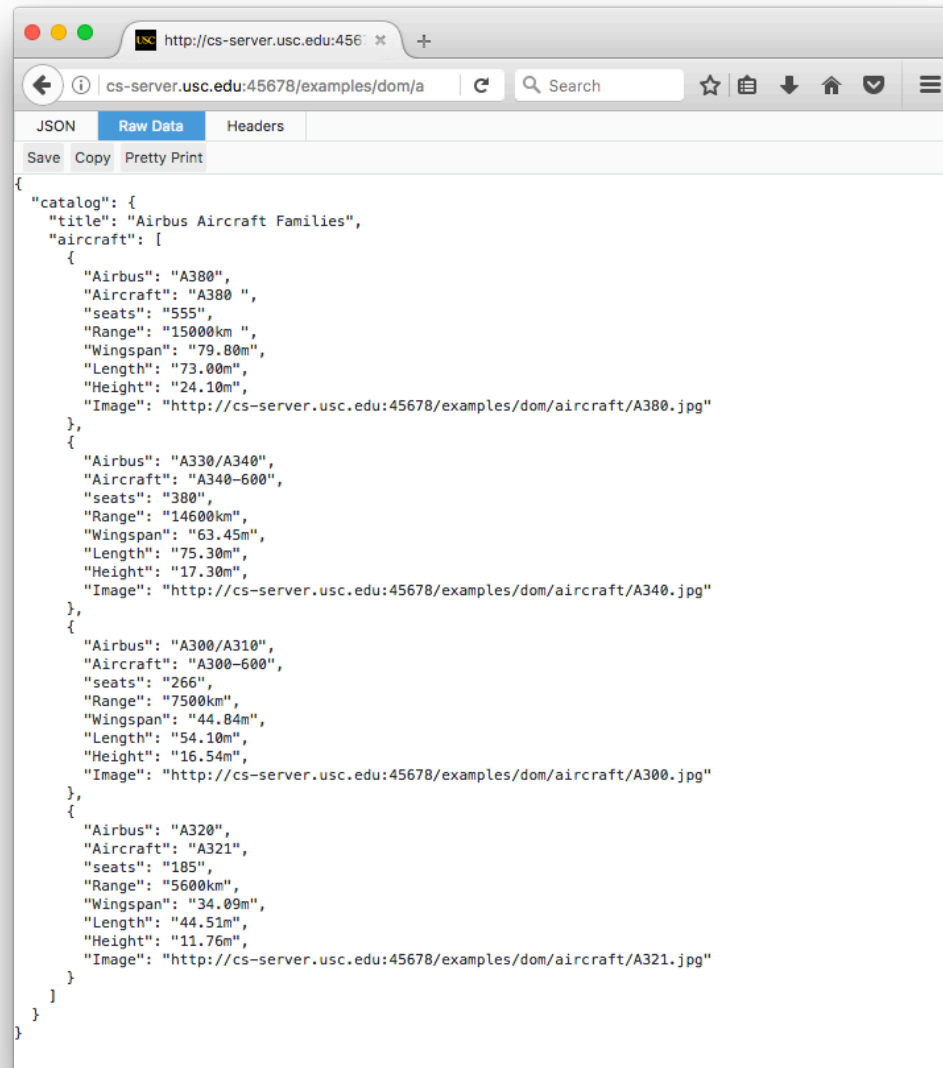 - See http://api.jquery.com/jquery.ajax/

Example 14: A Longer DOM Example in JSON
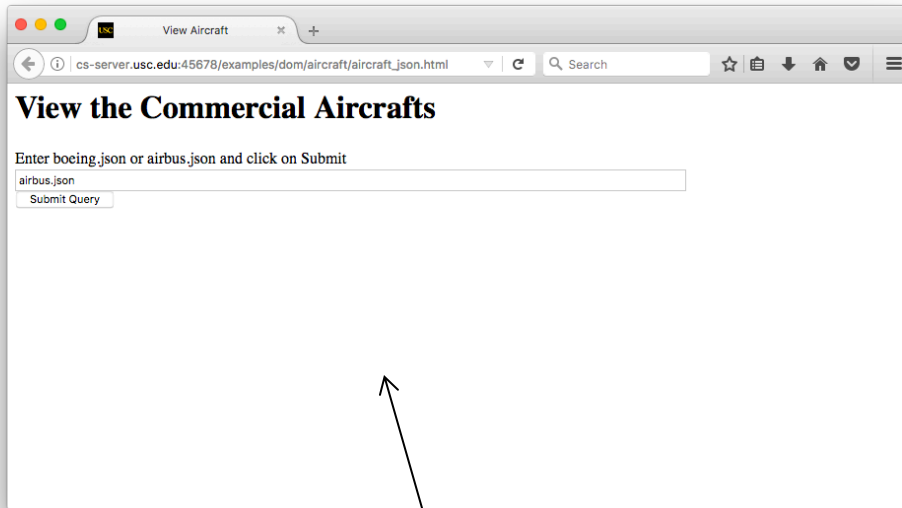
Given a URL of a JSON file that describes a set of aircraft, re-format the data into an HTML page

airbus.json

```
{
 "catalog": {
  "title": "Airbus Aircraft Families",
  "aircraft": [
   {
    "Airbus": "A380",
    "Aircraft": "A380 ",
    "seats": "555",
    "Range": "15000km ",
    "Wingspan": "79.80m",
    "Length": "73.00m",
    "Height": "24.10m",
    "Image": "http://cs-server.usc.edu:45678/examples/dom/aircraft/A380.jpg"
   },
   {
    "Airbus": "A330/A340",
    "Aircraft": "A340-600",
    "seats": "380",
    "Range": "14600km",
    "Wingspan": "63.45m",
    "Length": "75.30m",
    "Height": "17.30m",
    "Image": "http://cs-server.usc.edu:45678/examples/dom/aircraft/A340.jpg"
   },
   {
    "Airbus": "A300/A310",
    "Aircraft": "A300-600",
    "seats": "266",
    "Range": "7500km",
    "Wingspan": "44.84m",
    "Length": "54.10m",
    "Height": "16.54m",
    "Image": "http://cs-server.usc.edu:45678/examples/dom/aircraft/A300.jpg"
   },
   {
    "Airbus": "A320",
    "Aircraft": "A321",
    "seats": "185",
    "Range": "5600km",
    "Wingspan": "34.09m",
    "Length": "44.51m",
    "Height": "11.76m",
    "Image": "http://cs-server.usc.edu:45678/examples/dom/aircraft/A321.jpg"
   }
  ]
 }
}
```

HTML Code for the Initial Input

```
<h1>View the Commercial Aircrafts </h1>
Enter XML file
<form name="myform" method="POST" id="location">
<input type="text" name="URL" maxlength="255" size="100"
    value="airbus.xml" />
<br />
<input type="button" name="submit" value="Submit Query"
    onClick="viewJSON(this.form)" />
</form>
```

43

viewXML Routine

```
function viewJSON(what){
var URL = what.URL.value;
  function loadJSON(url) {
     if (window.XMLHttpRequest)
     {// code for IE7+, Firefox, Chrome, Opera, Safari
      xmlhttp=new XMLHttpRequest();
   } else {// code for IE6, IE5
    xmlhttp=new ActiveXObject("Microsoft.XMLHTTP");  }
  xmlhttp.open("GET",url,false);
  xmlhttp.send();
  jsonObj= JSON.parse(xmlhttp.responseText);
  return jsonObj;   }
  jsonObj = loadJSON(URL);
 if (window.ActiveXObject) //if IE, simply execute script (due to async prop).
 {  if (jsonObj.parseError.errorCode != 0) {
   var myErr = jsonObj.parseError;
   generateError(jsonObj);
   hWin = window.open("", "Error", "height=300,width=340");
   hWin.document.write(html_text);
  } else {  generateHTML(jsonObj);
        hWin = window.open("", "Assignment4", "height=800,width=600");
        hWin.document.write(html_text);   }
} else //else if FF, execute script once JSON object has loaded
 {  jsonObj.onload=generateHTML(jsonObj);
   hWin = window.open("", "Assignment4", "height=800,width=600");
   hWin.document.write(html_text);  } hWin.document.close();  }
```

generateXML Routine

```
function generateHTML(jsonObj)  {
      root=jsonObj.DocumentElement;
      html_text="<html><head><title>JSON Parse Result</title></head><body>";
       html_text+="<table border='2'>";
      caption=jsonObj.catalog.title;
      html_text+="<caption align='left'><h1>"+caption+"</h1></caption>";
       planes=jsonObj.catalog.aircraft; // an array of planes
       planeNodeList=planes[0];
       html_text+="<tbody>";
      html_text+="<tr>";
      x=0;  y=0;
       // output the headers
       var header_keys = Object.keys(planeNodeList);
       for(i=0;i<header_keys.length;i++)        {
                header=header_keys[i];
                if(header=="Airbus") {  header="Family";  x=120;  y=55;  }
                if(header=="Boeing") {  header="Family";  x=100;  y=67;  }
                if(header=="seats")    header="Seats";
                if(header=="Wingspan")   header="Wing Span";
                if(header=="height")  header="Height";
                html_text+="<th>"+header+"</th>";
      }
```

generateXML Routine (cont'd)

```
html_text+="</tr>";
// output out the values
      for(i=0;i<planes.length;i++) //do for all planes (one per row)
    {
                planeNodeList=planes[i]; //get properties of a plane (an object)
                html_text+="<tr>";      //start a new row of the output table
                var aircraft_keys = Object.keys(planeNodeList);
                for(j=0;j<aircraft_keys.length;j++)
              {
                    prop = aircraft_keys[j];
                    if(aircraft_keys[j]=="Image")
                    {//handle images separately
                            html_text+="<td><img src='"+ planeNodeList[prop] +"' width='"+x+"' height='"+y+"'></td>";
                    } else {
                            html_text+="<td>"+ planeNodeList[prop] +"</td>";
                    }
              }
      html_text+="</tr>";
}
html_text+="</tbody>";
 html_text+="</table>";
html_text+="</body></html>";  }
```