Internet Engineering
JS & AJAX & JSON & jQuery
مهندسی اینترنت

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Content

- JavaScript

- Prototype-based Programming

- XMLHttpRequest

- Document Object Model (DOM)

- Extensible Markup Language (XML)

- AJAX

- JSON

- jQuery

JavaScript

JavaScript (JS)

- An **object-based scripting programming** language based on the **concept of prototypes** (پیش الگو).

- **JS** is a high-level, interpreted scripting language

- Best known for its use in **websites**.

- As a multi-paradigm language, JavaScript supports **event-driven, functional**, and **imperative** (including **object-oriented** and **prototype-based**) programming styles. رویداد محور ، کاربردی و ضروری

JavaScript (JS) …

- It has **APIs** for working with **text, arrays, dates, regular expressions**, and the **DOM**,

- But the language itself does **not include any I/O**, such as **networking, storage, or graphics** facilities.
  - It relies upon the **host environment** in which it is embedded to provide these features.

JavaScript (JS) …

- JavaScript engines embedded in a web browser allow JavaScript to **connect to both the server side** and **the client side** of **web applications**.

- **Connections are made through DOM interfaces.**

- One major use of web-based JavaScript is to **write functions that are embedded in HTML pages**.

- Functions interact with the DOM of the page to perform tasks not possible in static HTML alone, such as:
  - opening a new window
  - checking input values
  - changing images as the mouse cursor moves over
  - etc.

JavaScript …

- JavaScript is the programming language of HTML and the Web.

<p style="text-align:center">getElementById()</p>

This example uses the method to "find" an HTML element (with id="demo") and changes the element content (innerHTML) to "Hello JavaScript":

```
document.getElementById("demo").style.fontSize = "35px";
```

Example

Changing the style of an HTML element, is a variant of changing an HTML attribute

What Can JavaScript Do?

JavaScript can change the style of an HTML element.

Click Me!

What Can JavaScript Do?

JavaScript can change the style of an HTML element.

Click Me!

```
<!DOCTYPE html>
<html>
<body>

<h2>What Can JavaScript Do?</h2>

<p id="demo"> JavaScript can change the style of an HTML element. </p>

<button type="button"
onclick="document.getElementById('demo').style.fontSize='35px'"> Click
Me!</button>


</body>
</html>
```

Prototype-based Programming

Prototype-based Programming

- A **style** and **subset** of object-oriented programming in which:

  - **classes are** *not present*

  - **behavior reuse** (known as inheritance in class-based languages) is done by *cloning* existing objects which serve as prototypes for the new ones

  - also known as *class-less*, *prototype-oriented*, or *instance-based* programming.

- Prototype-based languages have only *objects.*

- A prototype system starts with **at least one atomic object** loaded.

- **New objects** contain a **pointer** to the object that created them.

- **Additional data can be added to any object at any point at runtime**.

XMLHttpRequest

XMLHttpRequest

- **XMLHTTP** is a **set of APIs** that can be used to **transfer and manipulate XML data** to and from a **web server using HTTP.**

- Used to establish **an independent connection** channel between **Client-Side** and **Server-Side**.

- Used by:
  - JavaScript
  - Jscript
  - VBScript
  - other web browser **scripting languages**.

Document Object Model (DOM)

Document Object Model (DOM)

- DOM is a **language-independent interface** that treats an XML or HTML document as a **tree structure** wherein **each node is an object** representing a part of the document.

- DOM methods allow programmatic access to the tree; with them one **can change the structure, style or content of a document**.

- Once an **event is triggered, the event handlers get executed.**
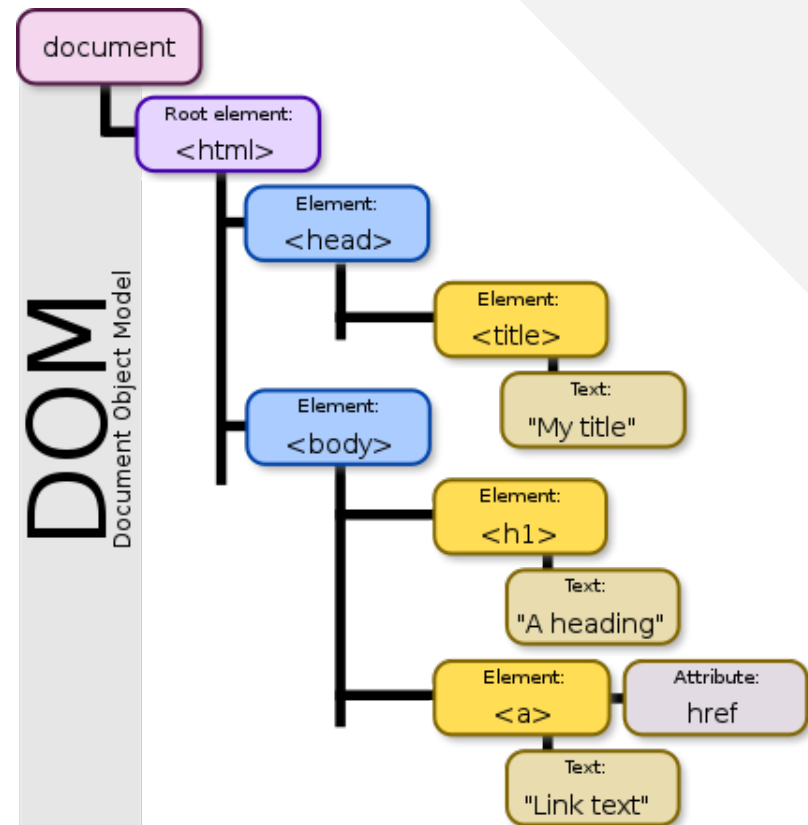
Extensible Markup Language (XML)

Extensible Markup Language (XML)

- XML is a markup language that defines a **set of rules** for **encoding documents** in a format that is both **human-readable** and **machine-readable**.

- Although the design of XML focuses on **documents**, the language is widely used for the representation of arbitrary **data structures**, such as those used in **web services**.

```
<?xml version="1.0"?>
<quiz>
 <qanda seq="1">
  <question>
   Who was the forty-second
   president of the U.S.A.?
  </question>
  <answer>
   William Jefferson Clinton
  </answer>
 </qanda>
 <!-- Note: We need to add
  more questions later.-->
</quiz>
```

XML

AJAX

AJAX

- **AJAX** stands for **Asynchronous JavaScript And XML.**

- It is a group of web development programs used <u>to design websites</u>.

- The programs create interactive web applications using a combination of:

  - **Standards-based presentation: <u>XHTML and CSS</u>**

  - **Dynamic display and interaction: <u>DOM</u>**

  - **Data interchange and manipulation: <u>XML and XSLT</u>**

  - **Asynchronous data retrieval: <u>XMLHttpRequest</u>**

  - **Binding everything together: <u>JavaScript</u>**

AJAX …

- AJAX enables web pages to **send** data to and **receive** data from a **server without changing or hindering the web page itself**.

- It allows for **asynchronous communication.**

  - **Instead of freezing up** until the completeness, the browser can **communicate with server and continue as normal**.

Traditional model vs. AJAX model

browser client

user interface

HTTP request

http(s) transport

HTML+CSS data

web server

datastores, backend processing, legacy systems

server-side systems
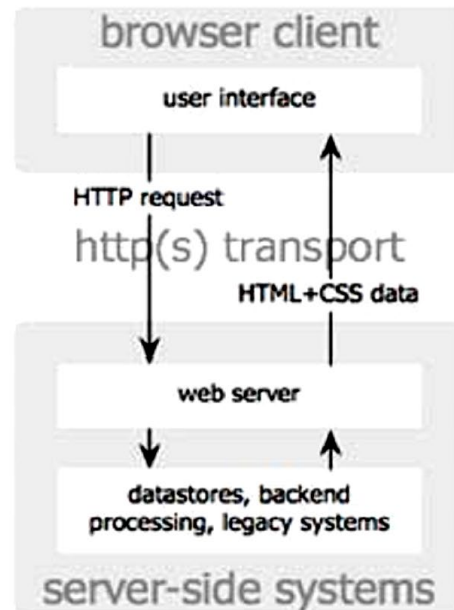
classic
web application model

browser client

user interface

JavaScript call

HTML+CSS data

Ajax engine

HTTP request

http(s) transport

XML data

web and/or XML server

datastores, backend processing, legacy systems

server-side systems

Ajax
web application model

Jesse James Garrett / adaptivepath.com
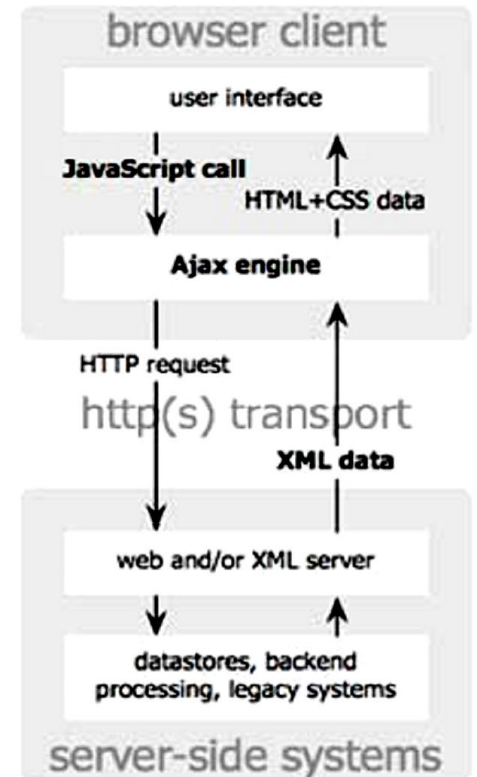
Synchronous interaction vs. Asynchronous interaction
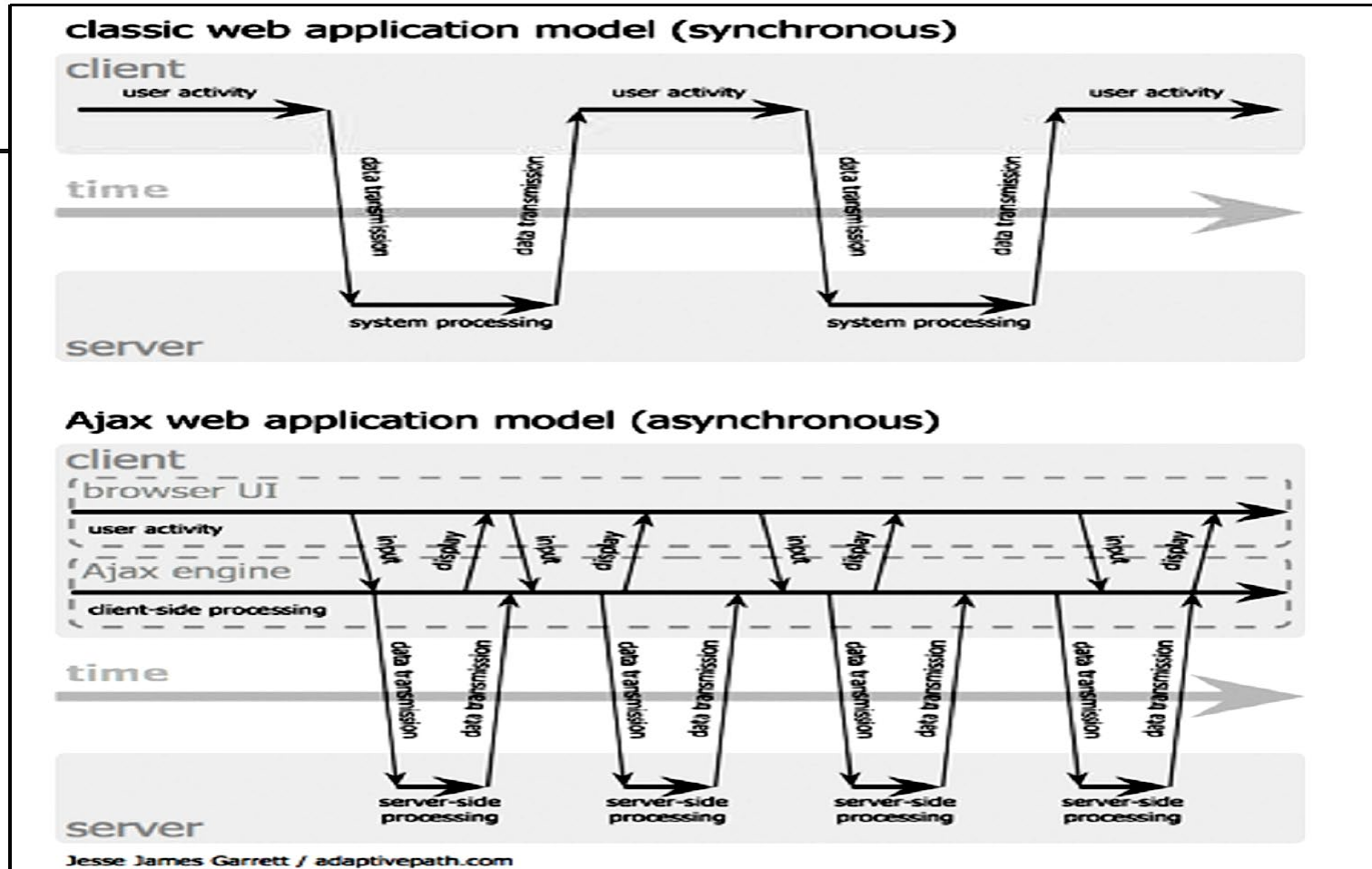
Process of AJAX call
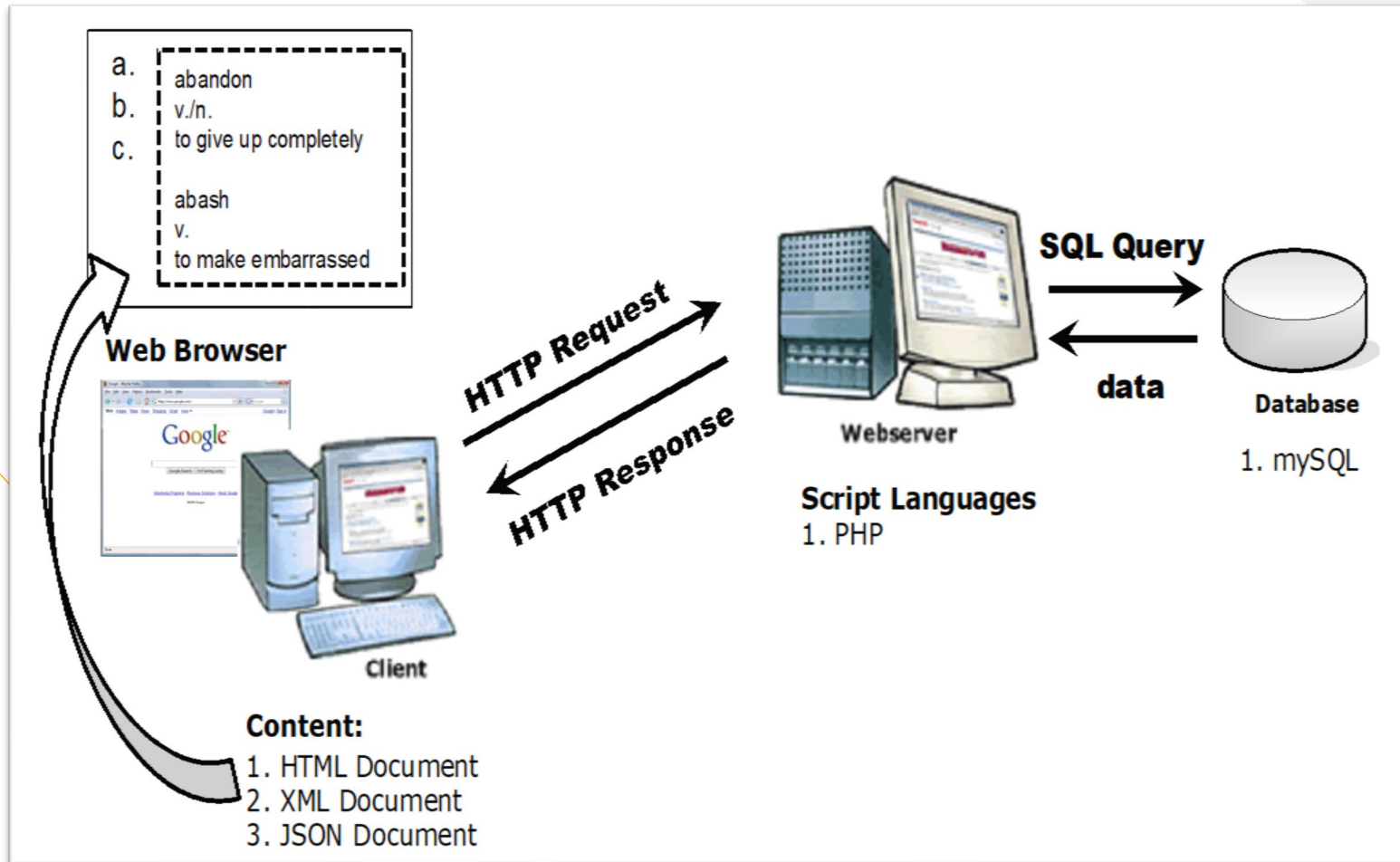
Basic Ajax Process

- **JavaScript**

  - Design an object for sending HTTP requests

  - Initiate request

    - Get request object
      - Supply as onreadystatechange attribute of request
    - Initiate a GET or POST request to a JSP page
      - Get the address from a variable instead of hardcoding it
    - Send data

  - Handle response

    - Wait for readyState of 4 and HTTP status of 200
    - Do something with result

- **HTML**

  - Load JavaScript

  - Designate control that initiates request

  - Give ids to input elements and to output placeholder design

```html
<html>
<head>
<link rel="stylesheet" href="example1.css" type="text/css"/>
<script type="text/javascript">

 var ajax;

 function ajaxCreate(){
  if(window.XMLHttpRequest){
   //For IE7+, Firefox, Chrome, Opera, Safari
   return new XMLHttpRequest();
  } else {
   //For IE6, IE5
   return new ActiveXObject("Microsoft.XMLHTTP");
  }
 }


 function receiveData(){
  if(ajax.readyState == 4){
   if(ajax.status == 200){
    var content = document.getElementById('content');
    content.innerHTML = ajax.responseText;
   }else{
    alert("Server process error");
   }
  }
 }


 function sendRequest(url){
  ajax = ajaxCreate();

  if(!ajax){
   alert("Browser is not compatable with XMLHttpRequest");
   return 0;
  }

  ajax.onreadystatechange = receiveData;
  ajax.open("GET", url, true);
  ajax.send(null);

}

</script>
</head>

<body>
 <div class="letters">
  <div class="letter" id="letter-a">
   <h3>
    <a href="javascript:sendRequest('example1.php')">A</a>
   </h3>
  </div>
 </div>
 <div id="content"></div>
</body>
</html>
```

POST and GET calls in AJAX

- GET places **arguments in the query string**, but POST doesn't.

- No noticeable difference in AJAX - AJAX request does not appear in the address bar.

- GET call in AJAX still has the size limitation on the amount of data that can be passed.

- General principle:

  - **GET method: it is used to retrieve data to display in the page and the data is not expected to be changed on the server.**

  - **POST method: it is used to update information on the server.**

AJAX …

- Google is the biggest known supporter of AJAX and has invested millions of dollars to advance it.

- Major Google products, such as Orkut, Gmail, Google Suggest, and Google Maps are AJAX applications.

- Amazon has also launched it's own search engine, A9, on AJAX.

AJAX Applications

- **Real-Time Form Data Validation**
  - Form data such as user IDs, serial numbers, postal codes, or even special coupon codes that require server-side validation can be validated in a form before the user submits a form.

- **Autocompletion**
  - A specific portion of form data such as an email address, name, or city name may be autocompleted as the user types.

- **Master Details Operations**
  - Based on a client event, an HTML page can fetch more detailed information on data such as a product listing that enables the client to view the individual product information without refreshing the page.

- **Sophisticated User Interface Controls**
  - Controls such as tree controls, menus, and progress bars may be provided that do not require page refreshes.

- **Refreshing Data on the Page**
  - HTML pages may poll data from a server for up-to-date data such as scores, stock quotes, weather, or application-specific data.

- **Server-side Notifications**
  - An HTML page may simulate a server-side push by polling the server for event notifications that may notify the client with a message, refresh page data, or redirect the client to another page.

AJAX Drawbacks

- Complexity

- Standardization of the XMLHttpRequest Object

- JavaScript Technology Implementations

- Debugging

- Viewable Source

JSON

Text

- Text is a data transmission format on the Internet

- A need to transmit complicated (structured) data
  - Book info, movie info, etc

- Idea:
  - Encode data
  - Transmit in text format
  - Decode data

term: 'ABANDON', …

Webserver
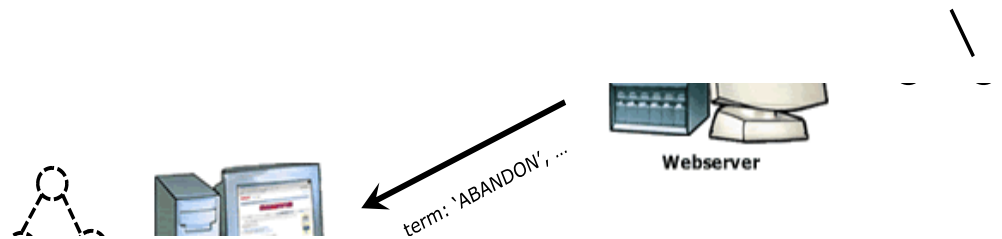
JSON

- JSON is short for **JavaScript Object Notation**.

- Basically, it is a way to **store information** in an organized and easy-to-access manner.

- JSON is built on two structures:

  - **Object:** A collection of name and value pairs

  - **Array:** An ordered list of values

JSON …

- JSON is **derived** from the **JavaScript scripting** language for **representing simple data structures** and **associative arrays**, called **Objects**.

- However, as compared to JavaScript, it is **language-independent**, with parsers available for many languages.

- The JSON filename extension is **.json**.

JSON …

- The JSON format is quite similar to XML and works as an alternative for the latter.

- It is primarily used to **transmit data between a server and web application**.

- It is often used for **serializing** and **transmitting structured data** over a network connection.

Explanation	Examples

object with one member	```
	{
	"course-name": "6.470"
	}
	``

object with two members (separated by a comma)	```
	{
	"course-name": "6.470",
	"units": 6
	}
	``

array with 3 elements	`["foo", "bar", 12345]`

object with an array as a value	```
	{
	"course-name": "6.470",
	"times": ["12-4","12-4", "12-4"]
	}
	``

objects with objects and arrays	```
	{
	 "John":
	 {
	     "label":"John",
	      "data":[[1880,0.081536],[1881,0.08098],[1882,0.078308
	      ]]
	},
	 "James":
	 {
	     "label":"James",
	     "data":[[1880,0.050053],[1881,0.05025],[1882,0.048278]]
	     }
	}
	``

Diagrams of the syntax of JSON

```
{
    "course-name" : "6.470"
}
```

```
["foo", "bar", 12345]
```

```
{
 "course-name" : "6.470",
 "times": ["12-4","12-4", "12-4"]
}
```
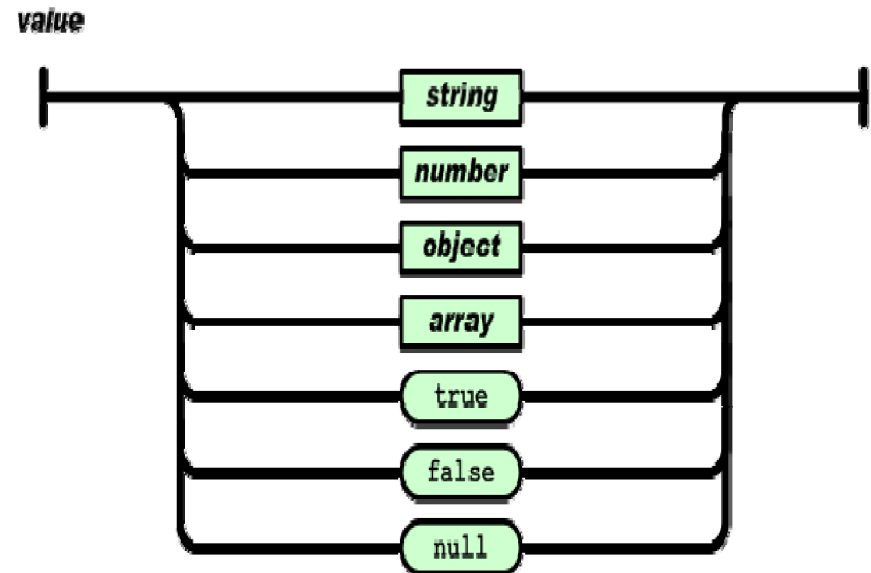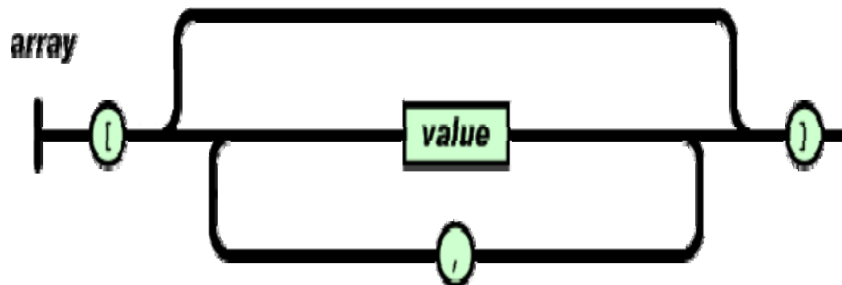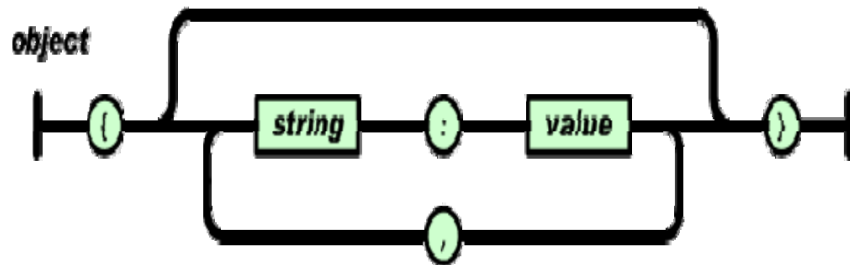
Diagrams of the syntax of JSON ...

"data":[[1880,0.081536],[1881,0.08098],[1882,0.078308]]
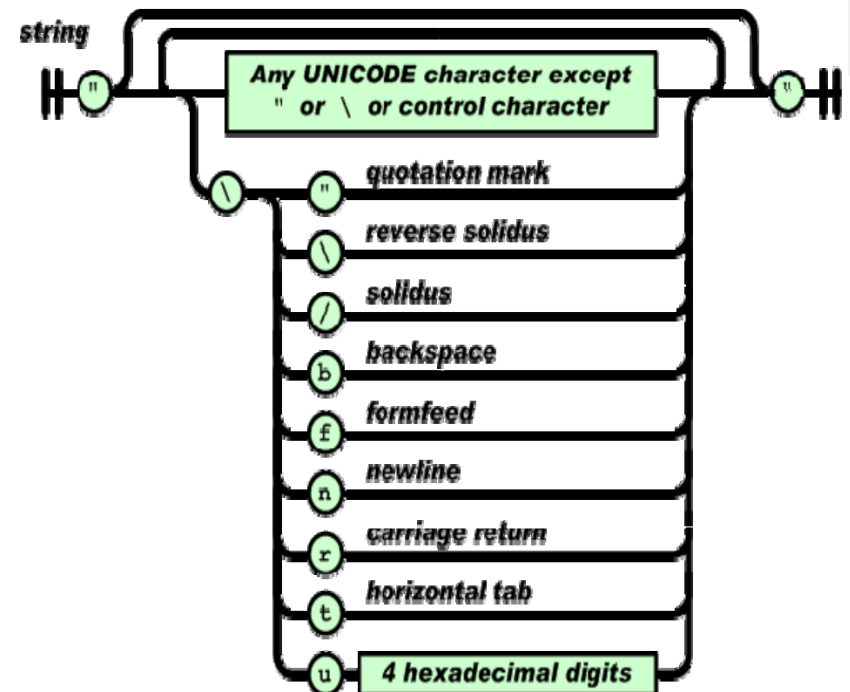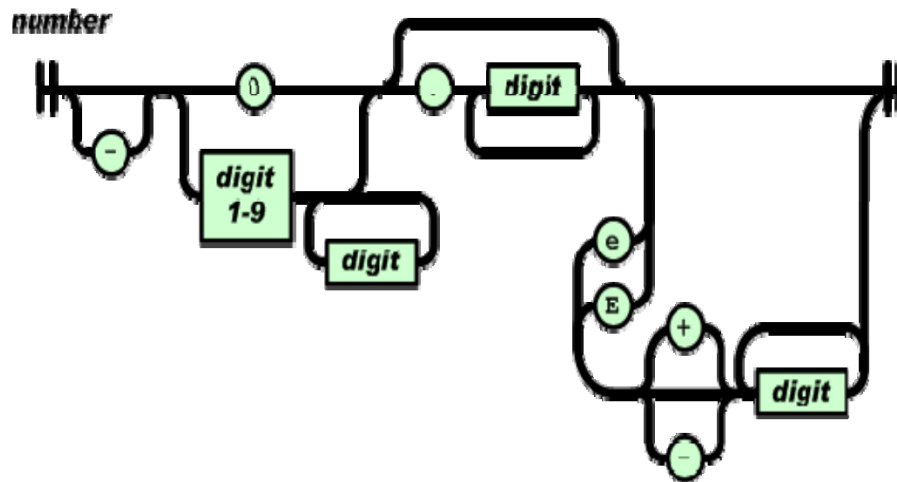
JSON easier to be evaluated

8]]

              }
           }

- To get the value 1880 marked with red color:

  We can use **a.John.data[0][0]**

AJAX Vs JSON

Different Between AJAX and JSON

- The main difference between AJAX and JSON is that **AJAX is a set of various technologies**, which are used to **launch asynchronous HTTP requests** to a server using various data formats, such as JavaScript, XML, HTML, plain text or even JSON.

- **JSON is a format** which can be **used by AJAX for data exchange**. It is a way of **encoding** that can be efficiently parsed by almost all programming languages.

- In AJAX, JSON can be used to **pass raw data to or from a server-side component**.

jQuery

jQuery

- jQuery is a **fast and concise JavaScript Library** that simplifies HTML document traversing, event handling, animating, and Ajax interactions for **rapid web development**.

- JavaScript libraries and frameworks:
  - Prototype, jQuery, Dojo, Echo, GWT, MooTools, Rico, YUI, etc.

jQuery Advantages

- Providing common utilities

- Handling cross-platform issues

- (Might) provide extendibility - plugins

- Faster Web development

jQuery Idea

- Putting together a set of functions

- Navigate a document Event handling

- Select DOM elements

- Create animations

- Ajax development

- Extendibility: plugins

jQuery Usage

- **Step 1:** Download the latest jQuery from jQuery.com

- **Step 2:** Link the downloaded .js file

    <script type="text/javascript" src="jquery-1.3.2.js">
</script>

    It adds jQuery() function in the global namespace

    The function is also aliased as **$()**.

- **Step 3:** Write your code

…

```javascript
<script type="text/javascript">
$(document).ready(function(){
  $('#large').bind('click', function(){
    $('p').removeClass().addClass('large');
  });
  $('#medium').bind('click', function(){
    $('p').removeClass().addClass('medium');
  });
  $('#small').bind('click', function(){
    $('p').removeClass().addClass('small');
  });
  // Set default font size as medium
  $('#medium').trigger('click');
  });
</script>
```

…

Example

- Ajax Request:
    - $.ajax(*options*) => options: a set of key/value pairs
    - $.get(url, [data], [callback], [type])
    - $.post(url, [data], [callback], [type])
    - $.getJSON(url, [data], [callback], [type])
    - $.getScript(url, [callback])

Thanks for your Attention.