JavaScript

1. Introduction

JavaScript is a dynamic computer programming language. It is lightweight and most commonly used as a part of web pages, whose implementations allow client-side script to interact with the user and make dynamic pages. It is an interpreted programming language with object-oriented capabilities.

JavaScript was first known as **LiveScript,** but Netscape changed its name to JavaScript, possibly because of the excitement being generated by Java. JavaScript made its first appearance in Netscape 2.0 in 1995 with the name **LiveScript**. The general-purpose core of the language has been embedded in Netscape, Internet Explorer, and other web browsers.

The **ECMA-262 Specification** defined a standard version of the core JavaScript language.

- JavaScript is a lightweight, interpreted programming language.
- Designed for creating network-centric applications.
- Complementary to and integrated with Java.
- Complementary to and integrated with HTML.
- Open and cross-platform

2. Client-Side JavaScript

Client-side JavaScript is the most common form of the language. The script should be included in or referenced by an HTML document for the code to be interpreted by the browser.

It means that a web page need not be a static HTML, but can include programs that interact with the user, control the browser, and dynamically create HTML content.

The JavaScript client-side mechanism provides many advantages over traditional CGI server-side scripts. For example, you might use JavaScript to check if the user has entered a valid e-mail address in a form field.

The JavaScript code is executed when the user submits the form, and only if all the entries are valid, they would be submitted to the Web Server.

JavaScript can be used to trap user-initiated events such as button clicks, link navigation, and other actions that the user initiates explicitly or implicitly.

3. Advantages of JavaScript

The merits of using JavaScript are −

- **Less server interaction** − You can validate user input before sending the page off to the server. This saves server traffic, which means less load on your server.
- **Immediate feedback to the visitors** − They don't have to wait for a page reload to see if they have forgotten to enter something.
- **Increased interactivity** − You can create interfaces that react when the user hovers over them with a mouse or activates them via the keyboard.
- **Richer interfaces** − You can use JavaScript to include such items as drag-and-drop components and sliders to give a Rich Interface to your site visitors.

4. Limitations of JavaScript

We cannot treat JavaScript as a full-fledged programming language. It lacks the following important features −

- Client-side JavaScript does not allow the reading or writing of files. This has been kept for security reason.
- JavaScript cannot be used for networking applications because there is no such support available.
- JavaScript doesn’t have any multi-threading or multiprocessor capabilities.

Once again, JavaScript is a lightweight, interpreted programming language that allows you to build interactivity into otherwise static HTML pages.

5. Syntax

JavaScript can be implemented using JavaScript statements that are placed within the **<script>... </script>** HTML tags in a web page.

```
<html>
  <body>
    <script language = "javascript" type = "text/javascript">
      <!--
        document.write("Hello World!")
      //-->
    </script>
  </body>
</html>
```

- JavaScript ignores spaces, tabs, and newlines that appear in JavaScript programs.
- Simple statements in JavaScript are generally followed by a semicolon character.
- JavaScript is a case-sensitive language.

6. Functions

- A JavaScript function is a block of code designed to perform a particular task.
- A JavaScript function is executed when "something" invokes it (calls it).

```
function name(parameter1, parameter2, parameter3) {
  // code to be executed
}
```

6.1. Function Invocation

The code inside the function will execute when "something" **invokes** (calls) the function:

- When an event occurs (when a user clicks a button)
- When it is invoked (called) from JavaScript code
- Automatically (self invoked)

7. Objects

JavaScript is an Object Oriented Programming (OOP) language.

You have already learned that JavaScript variables are containers for data values.

This code assigns a **simple value** (Fiat) to a **variable** named car:

```
var car = "Fiat";
```

Objects are variables too. But objects can contain many values.

This code assigns **many values** (Fiat, 500, white) to a **variable** named car:

```
var car = {type:"Fiat", model:"500", color:"white"};
```

> The values are written as **name:value** pairs (name and value separated by a colon).

7.1. Object Definition

You define (and create) a JavaScript object with an object literal:

```
var person = {
  firstName: "John",
  lastName : "Doe",
  id       : 5566,
  fullName : function() {
    return this.firstName + " " + this.lastName;
  }
};
```

7.2. Object Methods

Objects can also have **methods**.

Methods are **actions** that can be performed on objects.

Methods are stored in properties as **function definitions**.

Property	Property Value
firstName	John
lastName	Doe
age	50
eyeColor	blue
fullName	function() {return this.firstName + " " + this.lastName;}

7.3. The this Keyword

In a function definition, this refers to the "owner" of the function.

In the example above, this is the **person object** that "owns" the fullName function.

In other words, this.firstName means the firstName property of **this object**.

7.4. Accessing Object Properties

```
person.lastName;
person["lastName"];
```

7.5. Accessing Object Methods

```
name = person.fullName();
// If you access a method without the () parentheses, it will return the function definition:
name = person.fullName;
```

8. Events

HTML events are **“things”** that happen to HTML elements.

When JavaScript is used in HTML pages, JavaScript can **“react”** on these events.

8.1. HTML Events

Here are some examples of HTML events:

- An HTML web page has finished loading
- An HTML input field was changed
- An HTML button was clicked

```
<button onclick="document.getElementById('demo').innerHTML = Date()">The time is?</button>
<button onclick="this.innerHTML = Date()">The time is?</button>
<button onclick="displayDate()">The time is?</button>
```

8.2. Common HTML Events

Here is a list of some common HTML events:

Event	Description
onchange	An HTML element has been changed
onclick	The user clicks an HTML element
onmouseover	The user moves the mouse over an HTML element
onmouseout	The user moves the mouse away from an HTML element
onkeydown	The user pushes a keyboard key
onload	The browser has finished loading the page

9. Form Validation

HTML form validation can be done by JavaScript.

If a form field (fname) is empty, this function alerts a message, and returns false, to prevent the form from being submitted:

```
function validateForm() {
  var x = document.forms["myForm"]["fname"].value;
  if (x == "") {
    alert("Name must be filled out");
    return false;
  }
}
```

The function can be called when the form is submitted:

```
<form name="myForm" action="/action_page.php" onsubmit="return validateForm()" method="post">
Name: <input type="text" name="fname">
<input type="submit" value="Submit">
</form>
```

9.1. HTML Form Example

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

<h2>JavaScript Can Validate Input</h2>

<p>Please input a number between 1 and 10:</p>

<input id="numb">

<button type="button" onclick="myFunction()">Submit</button>

<p id="demo"></p>

<script>
function myFunction() {
  var x, text;

  // Get the value of the input field with id="numb"
  x = document.getElementById("numb").value;

  // If x is Not a Number or less than one or greater than 10
  if (isNaN(x) || x < 1 || x > 10) {
    text = "Input not valid";
```

```
  } else {
    text = "Input OK";
  }
  document.getElementById("demo").innerHTML = text;
}
</script>

</body>
</html>
```

9.2. Automatic HTML Form Validation

HTML form validation can be performed automatically by the browser:

If a form field (fname) is empty, the `required` attribute prevents this form from being submitted:

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

<form action="/action_page.php" method="post">
  <input type="text" name="fname" required>
  <input type="submit" value="Submit">
</form>

<p>If you click submit, without filling out the text field,
your browser will display an error message.</p>

</body>
</html>
```

9.3. Data Validation

Data validation is the process of ensuring that user input is clean, correct, and useful.

Typical validation tasks are:

- has the user filled in all required fields?
- has the user entered a valid date?
- has the user entered text in a numeric field?

Most often, the purpose of data validation is to ensure correct user input.

Validation can be defined by many different methods, and deployed in many different ways.

- **Server side validation** is performed by a web server, after input has been sent to the server.
- **Client side validation** is performed by a web browser, before input is sent to a web server.

9.4. Constraint Validation HTML Input Attributes

Attribute	Description
disabled	Specifies that the input element should be disabled
max	Specifies the maximum value of an input element
min	Specifies the minimum value of an input element
pattern	Specifies the value pattern of an input element
required	Specifies that the input field requires an element
type	Specifies the type of an input element

10. JSON

JSON is a format for storing and transporting data.

JSON is often used when data is sent from a server to a web page.

10.1. What is JSON?

- JSON stands for **J**ava**S**cript **O**bject **N**otation
- JSON is a lightweight data interchange format
- JSON is language independent *****
- JSON is “self-describing” and easy to understand

> The JSON syntax is derived from JavaScript object notation syntax, but the JSON format is text only. Code for reading and generating JSON data can be written in any programming language.

10.2. JSON Example

This JSON syntax defines an employees object: an array of 3 employee records (objects):

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

10.3. The JSON Format Evaluates to JavaScript Objects

The JSON format is syntactically identical to the code for creating JavaScript objects.

Because of this similarity, a JavaScript program can easily convert JSON data into native JavaScript objects.

10.4. JSON Syntax Rules

- Data is in name/value pairs
- Data is separated by commas
- Curly braces hold objects
- Square brackets hold arrays

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

10.5. Converting a JSON Text to a JavaScript Object

A common use of JSON is to read data from a web server, and display the data in a web page.

For simplicity, this can be demonstrated using a string as input.

```
// First, create a JavaScript string containing JSON syntax:
var text = '{ "employees" : [' +
'{ "firstName":"John" , "lastName":"Doe" },' +
'{ "firstName":"Anna" , "lastName":"Smith" },' +
'{ "firstName":"Peter" , "lastName":"Jones" } ]}';
// Then, use the JavaScript built-in function JSON.parse() to convert the string into a JavaScript object:
var obj = JSON.parse(text);
```

Finally, use the new JavaScript object in your page:

```
<p id="demo"></p>

<script>
document.getElementById("demo").innerHTML =
obj.employees[1].firstName + " " + obj.employees[1].lastName;
</script>
```

11. AJAX

AJAX is a developer's dream, because you can:

- Read data from a web server - after the page has loaded
- Update a web page without reloading the page
- Send data to a web server - in the background

11.1. AJAX Example Explained

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

<div id="demo">
<h2>The XMLHttpRequest Object</h2>
<button type="button" onclick="loadDoc()">Change Content</button>
</div>

<script>
function loadDoc() {
  var xhttp = new XMLHttpRequest();
  xhttp.onreadystatechange = function() {
    if (this.readyState == 4 && this.status == 200) {
      document.getElementById("demo").innerHTML =
      this.responseText;
    }
  };
  xhttp.open("GET", "ajax_info.txt", true);
  xhttp.send();
}
</script>

</body>
</html>
```

11.2. What is AJAX?

AJAX = **A**synchronous **J**avaScript **A**nd **X**ML.

AJAX is not a programming language.

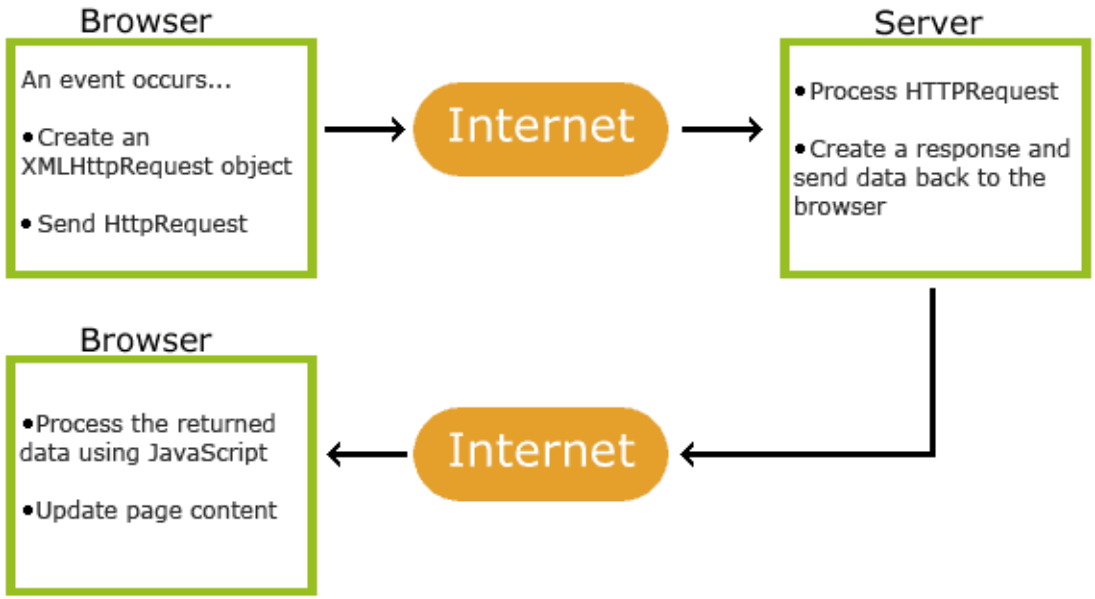
AJAX just uses a combination of:

- A browser built-in `XMLHttpRequest` object (to request data from a web server)
- JavaScript and HTML DOM (to display or use the data)

> AJAX is a misleading name. AJAX applications might use XML to transport data, but it is equally common to transport data as plain text or JSON text.

AJAX allows web pages to be updated asynchronously by exchanging data with a web server behind the scenes. This means that it is possible to update parts of a web page, without reloading the whole page.

11.3. How AJAX Works



1. An event occurs in a web page (the page is loaded, a button is clicked)
2. An XMLHttpRequest object is created by JavaScript
3. The XMLHttpRequest object sends a request to a web server
4. The server processes the request
5. The server sends a response back to the web page
6. The response is read by JavaScript
7. Proper action (like page update) is performed by JavaScript

12. AJAX Java Example

The following example demonstrates how a web page can communicate with a web server while a user types characters in an input field:

```
<html>
<body>

<p><b>Start typing a name in the input field below:</b></p>

<p>Suggestions: <span id="txtHint"></span></p>

<form>
First name: <input type="text" onkeyup="showHint(this.value)">
</form>

<script>
function showHint(str) {
 if (str.length == 0) {
  document.getElementById("txtHint").innerHTML = "";
  return;
 } else {
  var xmlhttp = new XMLHttpRequest();
  xmlhttp.onreadystatechange = function() {
   if (this.readyState == 4 && this.status == 200) {
    document.getElementById("txtHint").innerHTML = this.responseText;
   }
```

```
    };
    xmlhttp.open("GET", "gethint.jsp?q=" + str, true);
    xmlhttp.send();
  }
}
</script>

</body>
</html>
```

Code explanation:

- Create an XMLHttpRequest object
- Create the function to be executed when the server response is ready
- Send the request off to a PHP file (gethint.php) on the server
- Notice that q parameter is added gethint.php?q="+str
- The str variable holds the content of the input field

Thank you

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