

Q

What are the DOM and the BOM?

JS and the DOM

When a web page is loaded, the browser creates a **Document Object Model of the page**, which is as a tree of Objects.

Every element in a document—the document as a whole, the head, tables within the document, table headers, text within the table cells—is part of its DOM, so they can **all be accessed and manipulated using the DOM and a scripting language like JavaScript.**

With the object model, JavaScript can:

- change all the HTML [elements, attributes, styles] in the page
- add or remove existing HTML elements and attributes
- react to HTML events in the page
- create new HTML events in the page

HTML page as object container

```
<body style="margin: 2px">
  <table width="95%" align="center" cellpadding="0" cellspacing="0">
    <tbody>
      <tr>
        <td>...</td>
      </tr>
      <tr>
        <td>
          <!-- Body Layout -->
          <table width="95%" cellpadding="0" cellspacing="0" align="center">
            <tbody>
              <tr>
                <td>...</td>
              </tr>
              <tr>
                <td>
                  <td class="r3c1"></td>
                  <td class="r3c2"></td>
                  <td class="content">
                    <div class="header">...</div>
                    <div class="topnav" align="center" style="clear: both">...</div>
                    <table width="100%" class="contenttable">
                      <tbody>
                        <tr>
                          <td class="leftnav">...</td>
                          <td class="contentarea">...</td>
                          <td class="rightnav">
                            <table width="100%" cellpadding="2" cellspacing="0">
                              <tbody>
                                <tr>
                                  <td>
                                    <!-- Start Nav Item 1358 -->
                                  </td>
                                </tr>
                                <tr>
                                  <td>
                                    <div class="nav">
                                      <a href="http://latemar.science.unitn.it/segue/index.php?action=site&site=2022WebArch&section=488&page=1641">...</a>
                                    </div>
                                  </td>
                                </tr>
                              </tbody>
                            </table>
                          </td>
                        </tr>
                      </tbody>
                    </table>
                  </td>
                </tr>
              </tbody>
            </table>
          </td>
        </tr>
      </tbody>
    </table>
  </body>
```

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didattica per competenze

Various Stuff

- The LODE system
- Io e Wikipedia
- Carta servizi per studenti con



Using languages

implementations of the DOM can be built for any language:
e.g.

Javascript

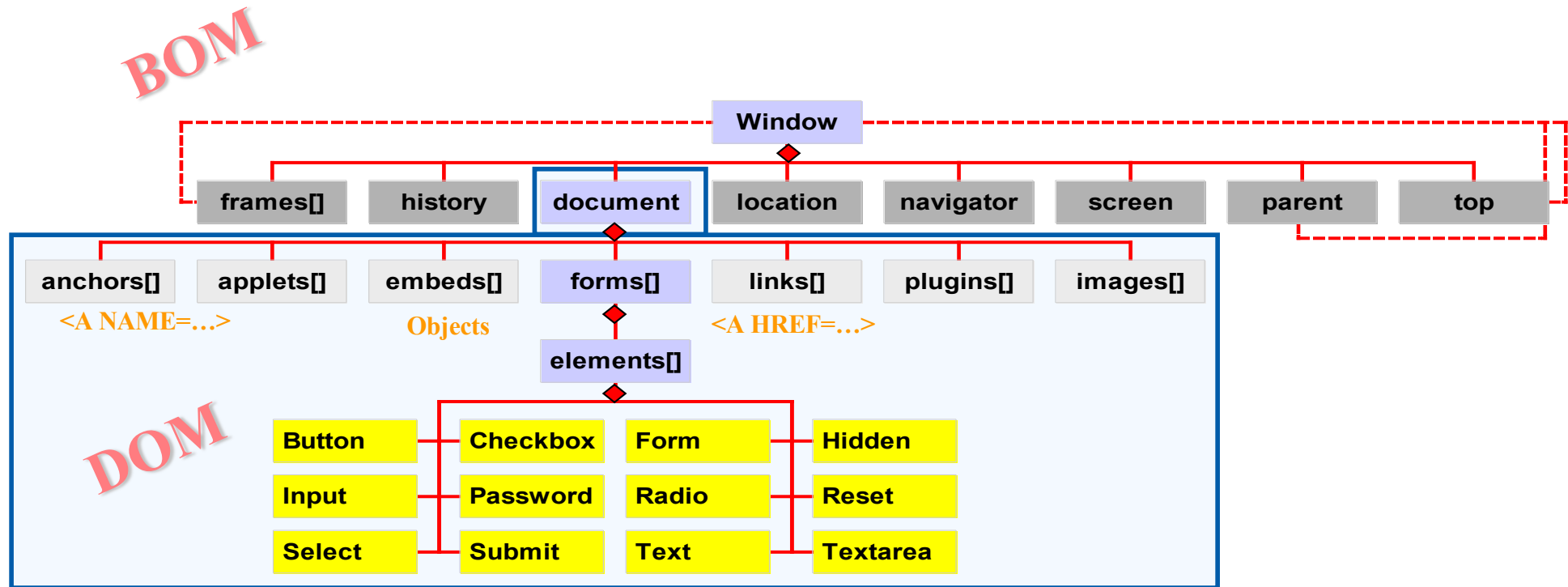
Java

Python

...

But Javascript is the **only one that can work client-side.**

Object hierarchy



Symbol \blacklozenge means containment (has-a)

Dashed line means “is an instance of”

Q

**What are the fundamental objects
in DOM/BOM?**

Fundamental datatypes - 1

- **Node** (Abstract base class)

Every object located within a document is a node. In an HTML document, an object can be an **element node** but also a **text node** or **attribute node**.

- **Document** (is-a Node)

- the root document object itself.

- **Element** (is-a Node)

The most general base class from which all element objects (i.e. objects that represent elements) in a Document inherit.



Fundamental datatypes - 2

- **Attr** (is-a Node)

An object reference that exposes a special interface for attributes. Attributes are nodes in the DOM just like elements are.

- **NodeList** (has Node(s))

A nodeList is an array of elements. Items in a nodeList are accessed by index: `list.item(1)` or `list[1]`

- **NamedNodeMap**

A namedNodeMap is an associative array, where the items are accessed by name. They can also be accessed by index using the `item()` method (but nodes they are in no particular order in the list). You can also add and remove items from a namedNodeMap.



Node

- All of the following types inherit the Node interface's methods and properties:

`Document`, `Element`, `Attr`, `CharacterData` (which `Text`, `Comment`, and `CDATASection` inherit), `ProcessingInstruction`, `DocumentFragment`, `DocumentType`, `Notation`

see <https://developer.mozilla.org/en-US/docs/Web/API/Node>



Node properties

- **Node.nodeType** - Read only ==>
- **Node.nodeName** - Read only
(An HTMLElement will contain the name of the corresponding tag, like 'audio' for an HTMLAudioElement, a Text node will have the '#text' string, or a Document node will have the '#document' string).
- **Node.baseURI** - Read only
- **Node.textContent** – read/write

Node Type	
ELEMENT_NODE	1
ATTRIBUTE_NODE	2
TEXT_NODE	3
CDATA_SECTION_NODE	4
ENTITY_REFERENCE_NODE	5
ENTITY_NODE	6
PROCESSING_INSTRUCTION_NODE	7
COMMENT_NODE	8
DOCUMENT_NODE	9
DOCUMENT_TYPE_NODE	10
DOCUMENT_FRAGMENT_NODE	11
NOTATION_NODE	12

Node: Read only navigation properties

- `Node.childNodes`
- `Node.firstChild`
- `Node.lastChild`

- `Node.nextSibling`
- `Node.previousSibling`

- `Node.parentNode`
- `Node.parentElement`
- `Node.ownerDocument`

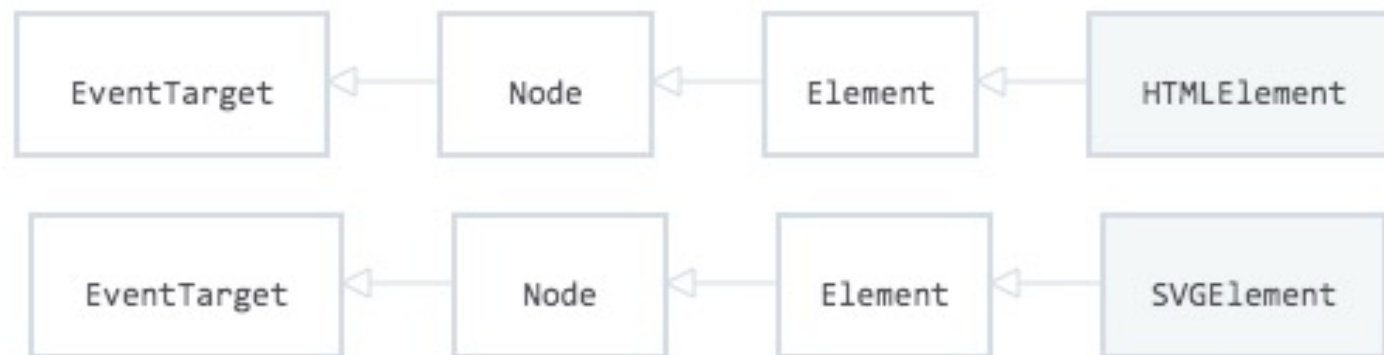
Element

■ Element

the most general base class from which all element objects (i.e. objects that represent elements) in a Document inherit.

It only has methods and properties common to all kinds of elements. More specific classes inherit from Element.

For example, the HTMLElement interface is the base interface for HTML elements, while the SVGElement interface is the basis for all SVG elements.



see <https://developer.mozilla.org/en-US/docs/Web/API/Element>



Some Element properties

- `Element.id`
- `Element.attributes`
- `Element.className`
- `Element.innerHTML`
- `Element.outerHTML` (markup of the element including its content)

- `Element.clientHeight` - the inner height of the element.
- `Element.clientLeft` - the width of the left border of the element.
- `Element.clientTop` - the width of the top border of the element.
- `Element.clientWidth` - the inner width of the element.

JS output

Writing into an HTML element, using:

- `innerHTML` (*Element property*)

```
<div onmouseover="this.innerHTML='How are you?';">  
  Hello</div>
```

- `innerText` (*HTMLElement property*)

```
<div onmouseover="this.innerText='How are you?';">  
  Hello</div>
```

- `textContent` (*Node property*)

```
<div onmouseover="this.textContent='How are you?';">  
  Hello</div>
```



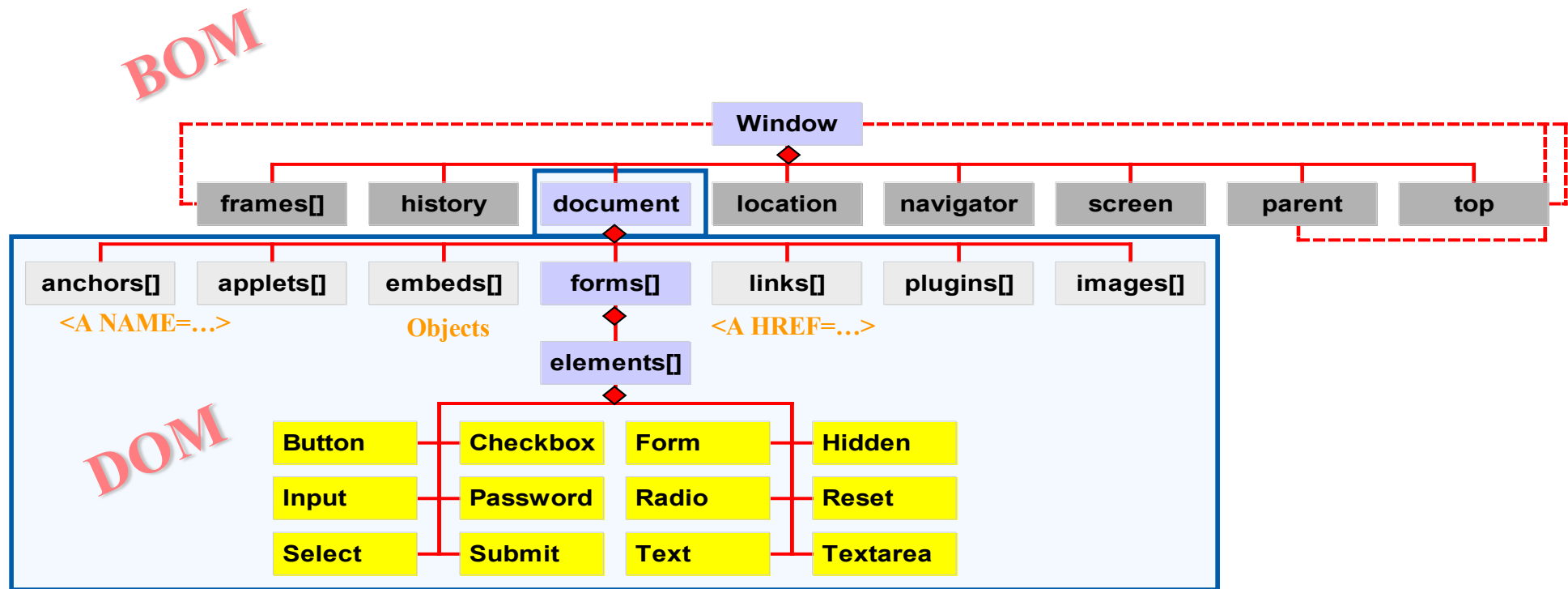
other Element main properties

- `element.style`
- `element.setAttribute()`
- `element.getAttribute()`
- `element.addEventListener()`

Element "name" property

- **name** gets or sets the name property of an element in the DOM. It only applies to the following elements: `<a>`, `<applet>`, `<button>`, `<form>`, `<frame>`, `<iframe>`, ``, `<input>`, `<map>`, `<meta>`, `<object>`, `<param>`, `<select>`, and `<textarea>`. BUT "obsolete" for `<a>`
- **Note:** The name property doesn't exist for other elements; unlike `tagName` and `nodeName`, it is not a property of the `Node`, `Element` or `HTMLElement` interfaces.
- `name` can be used in the `document.getElementsByName()` method, a form and with the form elements collection. When used with a form or elements collection, it may return a single element or a collection.

Object hierarchy



Symbol  means containment (has-a)

Dashed line means “is an instance of”

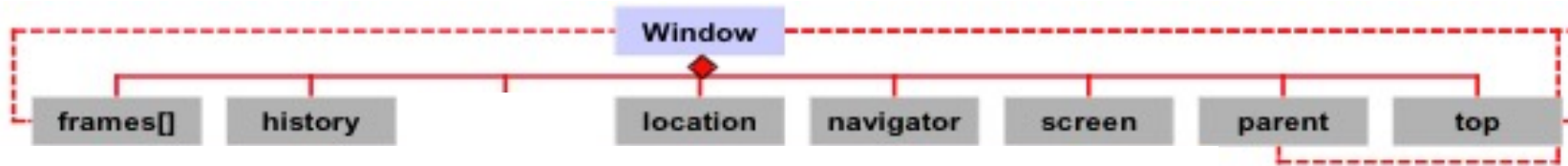


Q

What is the BOM, and which are its components?

BOM

Window



“A web browser window or frame”

Main properties

Objects

history

frames[]

document

location

navigator

screen

parent – top

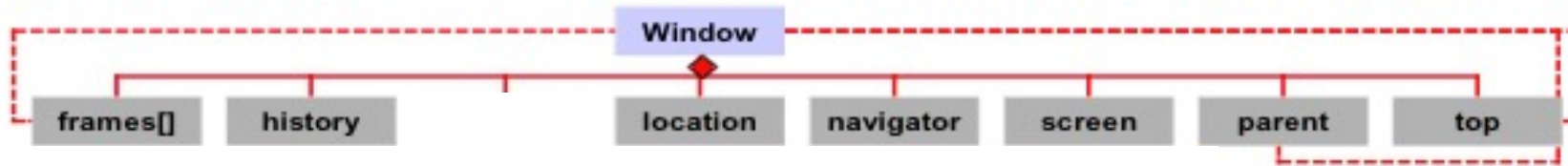
Other properties

status – defaultStatus

name

BOM

Window



Main methods

alert(), prompt(), confirm()

focus(), blur()

moveBy(), moveTo()

resizeBy(), resizeTo()

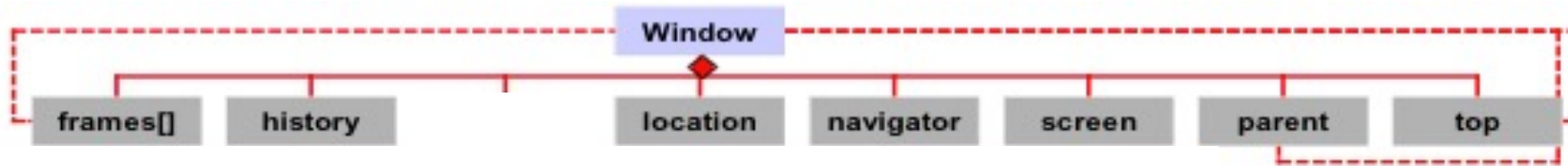
scroll(), scrollBy(), scrollTo()

setInterval(), clearInterval()

setTimeout(), clearTimeout()

BOM

Screen



“Information about the display”

Main properties

availHeight, availWidth

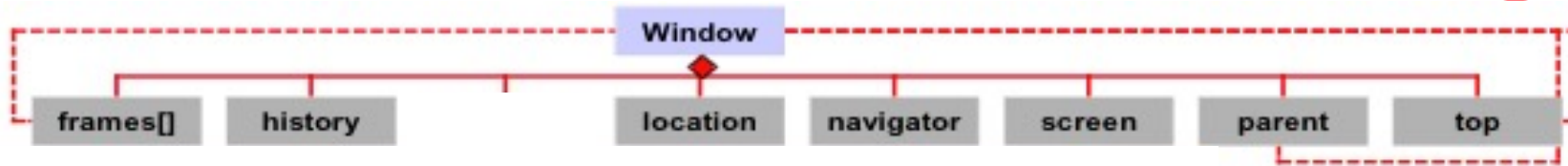
height, width

colorDepth, pixelDepth

hash

BOM

Navigator



“Information about the browser in use”

Main properties

appName

appVersion

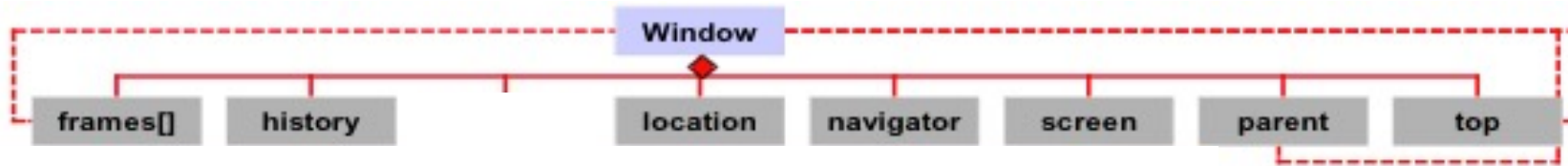
Platform

Main methods

javaEnabled()

BOM

History



“The URL history of the browser”

Main properties

length

Main methods

back()

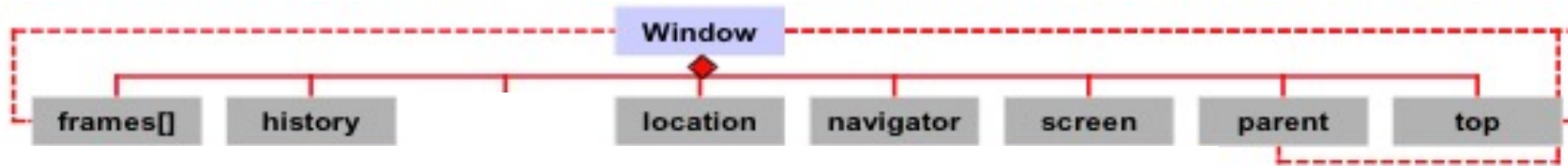
forward()

go(+/-n)

go(target_substring)

BOM

Location



“The specification of the current URL ”

Main properties

href

protocol, hostname, port

search

hash

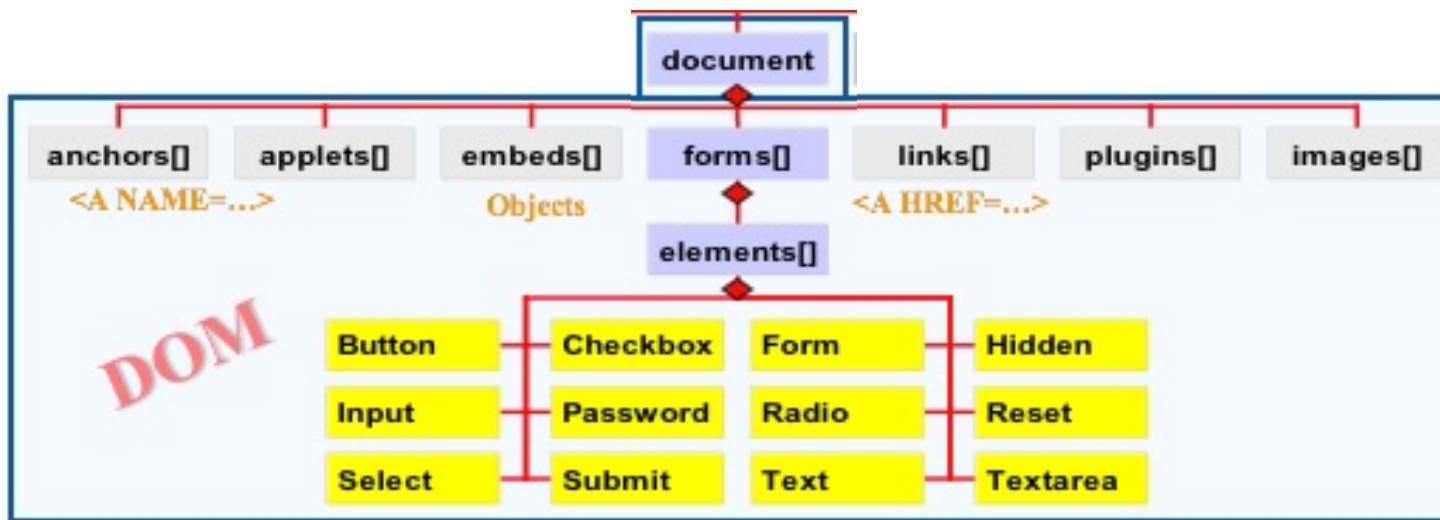
Main methods

reload()

replace()

Q

Which are the main DOM components?



Document

Main methods

open()

close()

clear()

write()

Main properties

Arrays of Component Objects

anchors[]

applets[]

embeds[]

forms[]

links[]

plugins[]

"An HTML document"

Other properties

bgColor, fgColor, linkColor, vlinkColor

lastModified

title, URL, referrer, cookie

see <https://developer.mozilla.org/en-US/docs/Web/API/Document>



Element selection

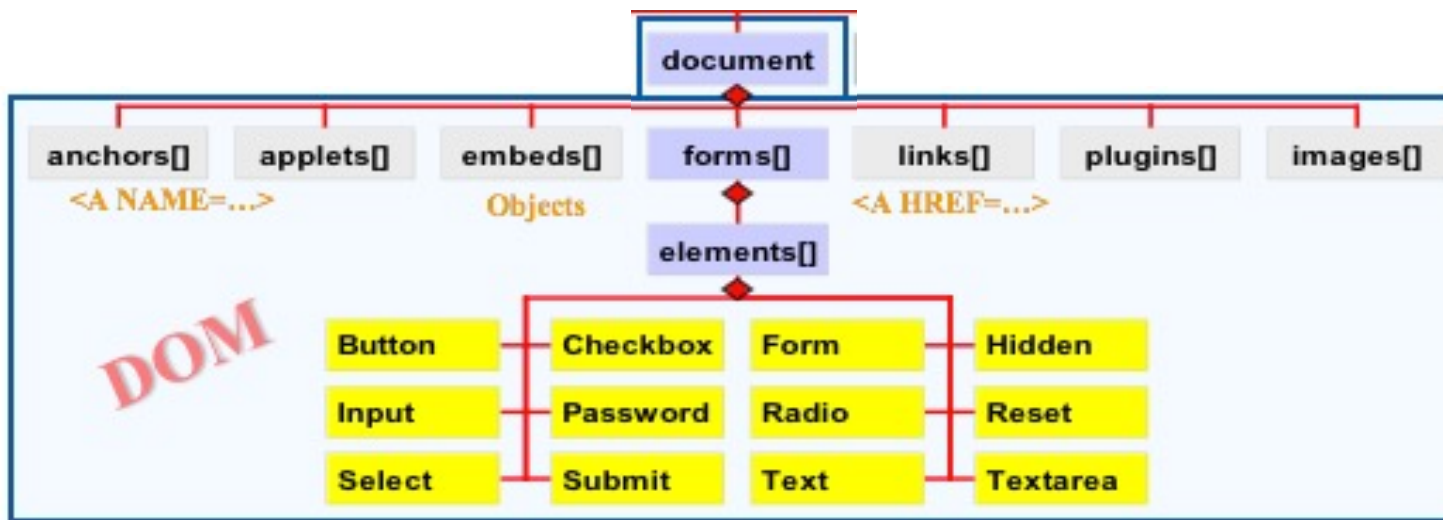
- `document.getElementById(id)`
- `document.getElementsByName(name)`
- `document.getElementsByTagName(name)`
- `document.getElementsByClassName(name)`

```
<!DOCTYPE html>
<html>
  <head>
    <style>.rosso { background: red;}</style>
  </head>
  <body>
    <div id="pippo">Il mio id è Pippo</div>
    <b name="pluto">Il mio nome è Pluto</b>
    <div class="rosso">La mia classe è "rosso"</div>
    <script>window.alert("ByName :"+
      document.getElementsByName("pluto")[0].innerText);</script>
    <script>window.alert("ByTagName :"+
      document.getElementsByTagName("div")[0].innerText);</script>
    <script>window.alert("ByClassName :"+
      document.getElementsByClassName("rosso")[0].innerText);</script>
    <script>window.alert("ByID :"+
      document.getElementById("pippo").innerText);</script>
  </body>
</html>
```

DOM Structure modification

- `document.createElement(element)`
- `document.removeChild(element)`
- `document.appendChild(element)`
- `document.replaceChild(newElement, oldElement)`

```
<!DOCTYPE html>
<html>
  <body>
    <div id="1">UNO</div>
    <div>TRE</div>
    <script>
      var node = document.createElement("DIV");
      //var textnode = document.createTextNode("DUE");
      //node.appendChild(textnode);
      node.innerText="DUE";
      document.getElementById("1").appendChild(node);
    </script>
  </body>
</html>
```



Image

“An image embedded in an HTML document”

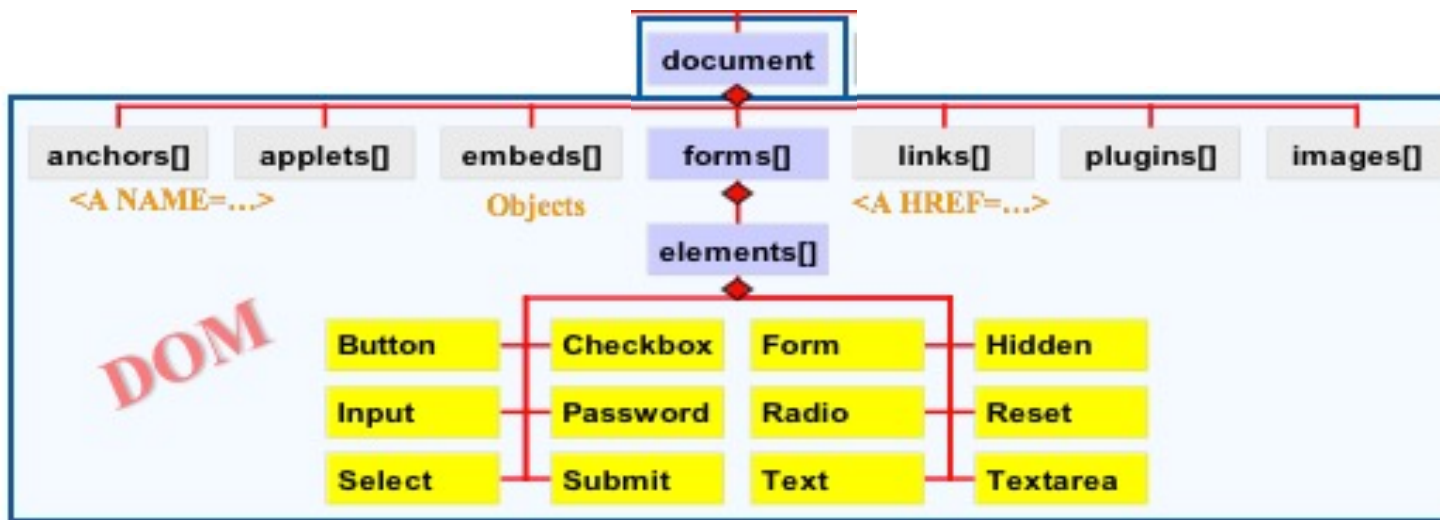
Main properties

border *[width in pixels]*

height

width

src *[URL of the image to be displayed]*



Form

“An HTML input form”

Main properties

`action` [*destination URL*]

`method` [*get/post*]

`name` [*name of Form*]

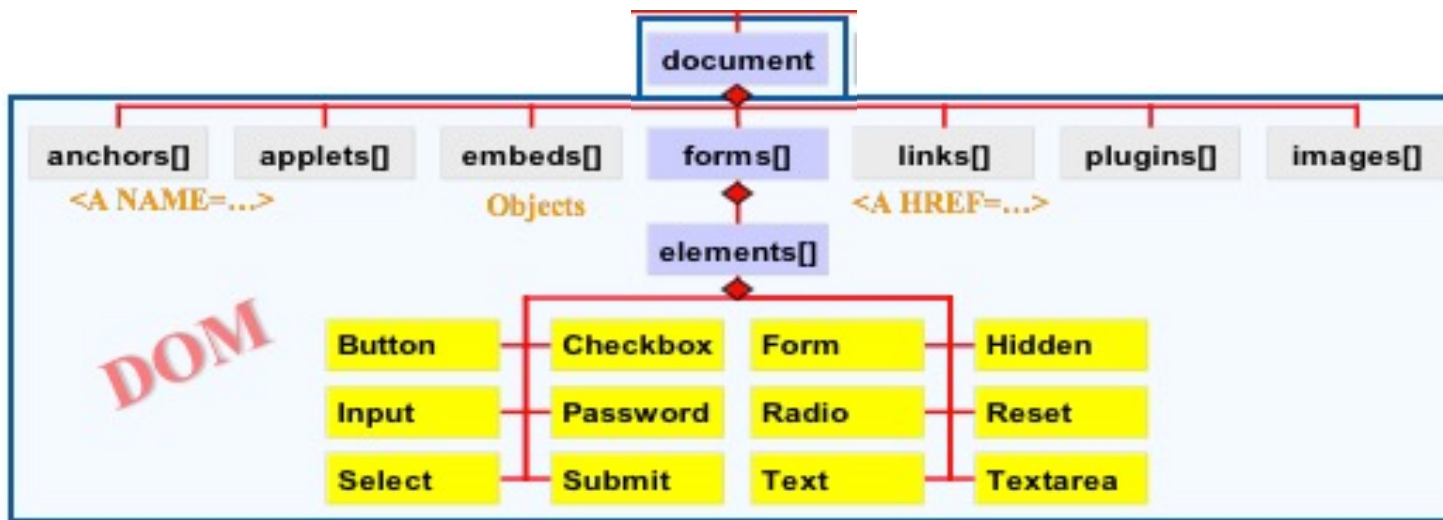
`target` [*destination Window*]

`Elements[]` [*list ; of contained elements*]

Main methods

`reset()`

`submit()`



Applet

“An applet embedded in a Web page”

Properties

Same as the public fields of the Java applet

Methods

Same as the public methods of the Java applet

Q

Which are the main DOM events?

Event

- The Event interface represents an event which takes place in the DOM.
- An event can be **triggered by the user action** (e.g. clicking the mouse button) or generated by APIs to **represent the progress of an asynchronous task**.
- It can also be **triggered programmatically**, such as by calling the `HTMLElement.click()` method of an element, or by defining the event, then sending it to a specified target using `EventTarget.dispatchEvent()`.
- There are many types of events, some of which use other interfaces based on the main Event interface. Event itself contains the properties and methods which are common to all events.

Event

UIEvent:

- Input https://www.w3schools.com/jsref/obj_inputevent.asp
- Keyboard https://www.w3schools.com/jsref/obj_keyboardevent.asp
- Focus https://www.w3schools.com/jsref/obj_focusevent.asp
- Mouse https://www.w3schools.com/jsref/obj_mouseevent.asp
- Drag&drop https://www.w3schools.com/jsref/obj_dragevent.asp
- ...

Generic Events

- Events https://www.w3schools.com/jsref/obj_event.asp
- Animation https://www.w3schools.com/jsref/obj_animationevent.asp
- Clipboard https://www.w3schools.com/jsref/obj_clipboardevent.asp
- ...

Event

- Events can be managed by EventHandlers
on*Event*="*javascript code*"

```
<!DOCTYPE html>
<html>
<head><script>
function displayDate() {
    document.getElementById("demo").innerHTML = Date();
}
</script></head>
<body>
<p onclick="displayDate()" id="demo">
Click me to display the date.</p>
</body>
</html>
```

References

Standard ECMA-262 ECMAScript Language Specification:

<http://www.ecma-international.org/publications/standards/Ecma-262.htm>

Books:

- D.Flanagan “Javascript. The definitive guide” O’ Reilly.
- D.Goodman “Dynamic HTML. The definitive reference” O’ Reilly



DOM in action: examples

Events example 1

```
<!DOCTYPE html>
<head>
  <title>Form Example</title>
  <script>
    function setColor() {
      var choice;
      choice = document.colorForm.color.selectedIndex;
      switch(choice) {
        case 0: document.bgColor = "FF0000"; break;
        case 1: document.bgColor = "00FF00"; break;
        case 2: document.bgColor = "0000FF"; break;
        case 3: document.bgColor = "FFFFFF"; break;
        case 4: document.bgColor = "FFFF00"; break;
        case 5: document.bgColor = "FF00FF"; break;
      }
    }
  </script>
</head>
```



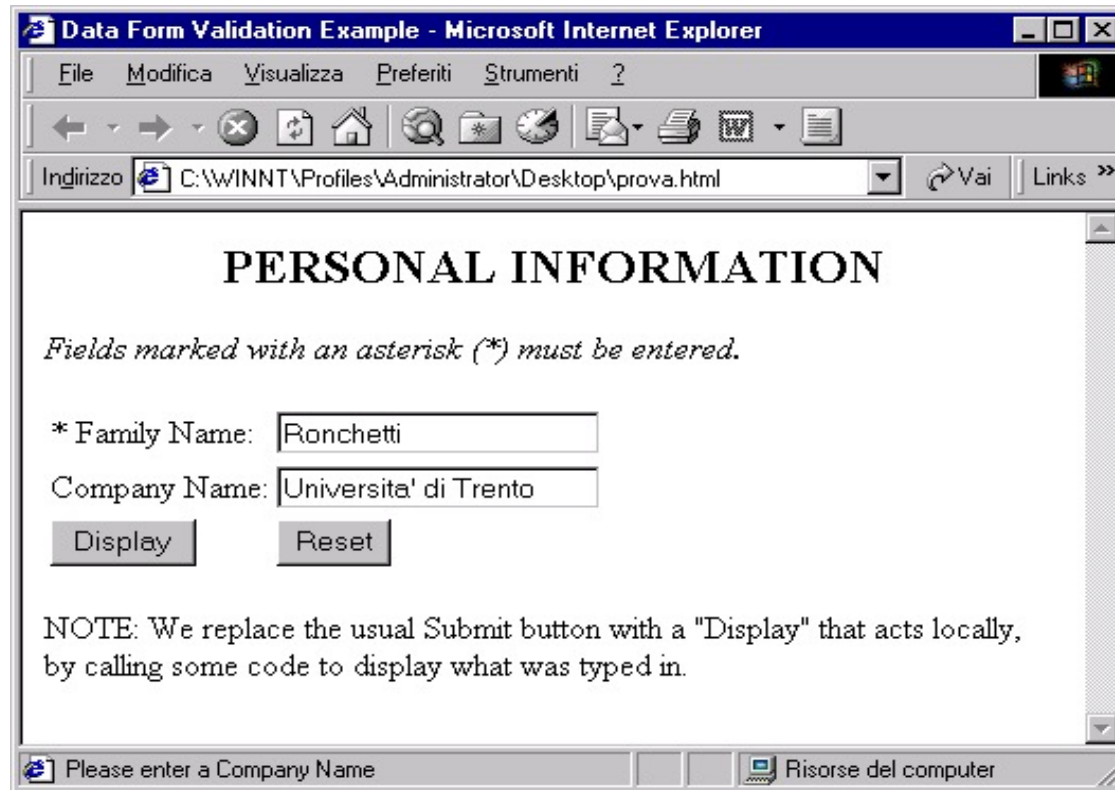
Events example 1

```
<body>
  <h1>Color Changer</h1>
  <br><br>
  Select Your Favorite Background Color:
  <form id="colorForm">
    <select id="color" onChange=setColor() >
      <option value="red">Red</option>
      <option VALUE="green">Green</option>
      <option VALUE="blue">Blue</option>
      <option VALUE="white">White</option>
      <option VALUE="yellow">Yellow</option>
      <option VALUE="purple">Purple</option>
    </select>
  </form>
</body>
</html>
```

Sometimes "name" is used instead of "id",
now it's deprecated



A more complex example -1



PERSONAL INFORMATION

Fields marked with an asterisk () must be entered.*

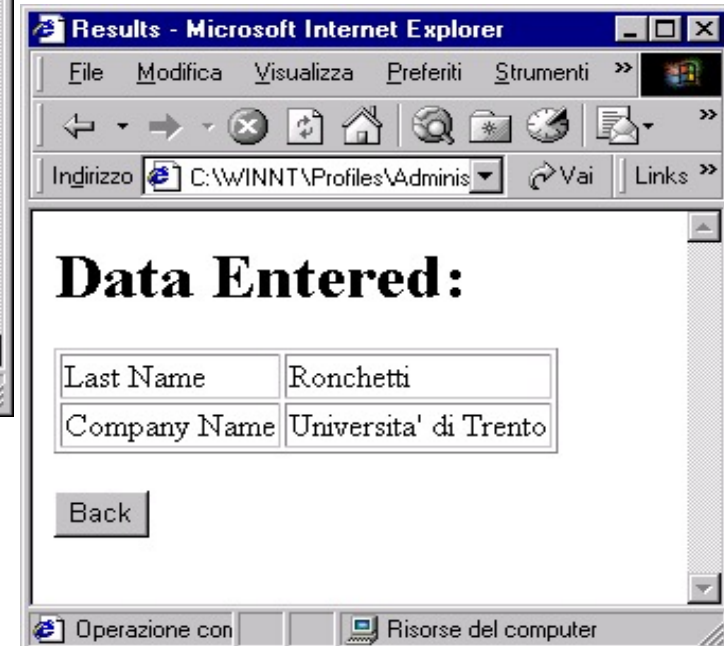
* Family Name:

Company Name:

NOTE: We replace the usual Submit button with a "Display" that acts locally, by calling some code to display what was typed in.

Please enter a Company Name

A simple data entry validation page



Data Entered:

Last Name	Ronchetti
Company Name	Universita' di Trento



A more complex example -2

Start of file “FormValidation.html”

```
<HTML>
```

```
<HEAD>
```

```
<TITLE>Data Form Validation Example</TITLE>
```

```
<SCRIPT LANGUAGE="JavaScript1.1" SRC="FormCheck.js"></SCRIPT>
```

Load file “FormCheck.js”,
which contains several JavaScript functions



A more complex example -6

```
<BODY BGCOLOR="#ffffff">
<CENTER><H2>PERSONAL INFORMATION </H2></CENTER>
<P><P><I>Fields marked with an asterisk (*) must be entered.</I>
<FORM NAME="PersonalInfo">
<TABLE>
<TR>
  <TD>* Family Name:</TD>
  <TD><INPUT TYPE="text" NAME="LastName"
    onChange="checkString(this,sLastName)" ></TD>
  First Field
</TR>
<TR>
  <TD>Company Name:</TD>
  <TD><INPUT TYPE="text" NAME="Company" ></TD>
  Second Field
</TR>
```

Start of “BODY” portion of “FormValidation.html”



A more complex example -3

```
function isEmpty(s)
{ return ((s == null) || (s.length == 0))
}
```

Check that the string
“s” is not empty

```
function warnEmpty (theField, s)
{
  var mPrefix = "You did not enter a value into the ";
  var mSuffix = " field. This is a required field. Please enter it now.";
  theField.focus();
  alert(mPrefix + s + mSuffix);
  return false;
}
```

Issue a warning
message

All this is contained in the file “FormCheck.js”



A more complex example -4

```
function validatePersonalInfo(form)
```

```
{  return (  
    checkString(form.elements["LastName"],sLastName)  
  )  
}
```

Validate the form

(should run over all fields

And perform suitable checks)

```
function checkString (theField, s)
```

```
{  
  if (isEmpty(theField.value)) return warnEmpty (theField, s);  
  else return true;  
}
```

Check that “theField”
is not empty

All this is contained in the file “FormCheck.js”



A more complex example -5

<SCRIPT>

Global variables

**var sCompany="Company Name"; var sLastName="Last Name"; var
form="PersonalInfo";**

Value-printing
function

function displayPersonalInfo(form)

```
{ var outputTable = "<HTML><HEAD><TITLE>Results</TITLE></HEAD>" +  
  "<BODY><H1>Data Entered:</H1><TABLE BORDER=1>" +  
  "<TR><TD>" + sLastName + "</TD><TD>" + form.elements["LastName"].value +  
  "</TD></TR>" +  
  "<TR><TD>" + sCompany + "</TD><TD>" + form.elements["Company"].value +  
  "</TD></TR></TABLE><FORM>" +  
  "<INPUT TYPE=\"BUTTON\" NAME=\"Back\" VALUE=\"Back\"  
  onClick=\"location.reload()\"> </FORM></BODY></HTML>"  
  document.writeln(outputTable)  
  document.close()  
  return true  
} </SCRIPT>
```

Add a Button to
reload the page

</HEAD>

End of “HEAD” portion of “FormValidation.html”



A more complex example -7

```
<TR>
  <TD>
    <INPUT TYPE="BUTTON" NAME="fakeSubmit" VALUE="Display"
      onClick="if (validatePersonalInfo(this.form)) displayPersonalInfo(this.form); ">
    </TD>
    <TD><INPUT TYPE = "reset" VALUE = "Reset">
    </TD>
  </TR>
</TABLE>
<P> NOTE: We replace the usual Submit button with a "Display" that acts locally,
<BR>by calling some code to display what was typed in.
</FORM>
</BODY>
</HTML>
```

First Button

Second Button

End of file "FormValidation.html"



Q

**How do I refresh on a periodic base
the content of a page?**

Refreshing pages

1) You can (fully) reload a page without using JavaScript, just using a HTTP header

```
<meta http-equiv="refresh" content="30">
```

https://www.w3schools.com/tags/att_meta_http_equiv.asp

2) You can use Javascript in two ways:

setInterval and setTimeout.

setTimeout inherently triggers only once
setInterval continues indefinitely.

https://www.w3schools.com/jsref/met_win_setinterval.asp

https://www.w3schools.com/jsref/met_win_settimeout.asp

