Using JavaScript for Client-Side Behavior

Internet Applications, ID1354

Contents

Section

- The Document Object Model, DOM
- The Browser Object Model, BOM
- The jQuery JavaScript Library
- AJAX
- Long Polling
- Server-Sent Event
- WebSocket
- The Knockout JavaScript Framework

The Document Object Model, DOM

- The W3C Document Object Model, DOM, is an API that allows programs to access and update document content.

The Document Object Model, DOM

- The W3C Document Object Model, DOM, is an API that allows programs to access and update document content.
- Defines objects representing HTML elements, methods to access HTML elements, and events generated by HTML elements.

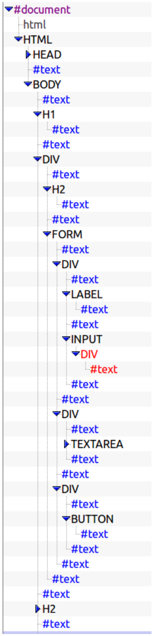
The Document Object Model, DOM

- The W3C Document Object Model, DOM, is an API that allows programs to access and update document content.
- Defines objects representing HTML elements, methods to access HTML elements, and events generated by HTML elements.
- The best that can be said about browser support is that it varies.

The Document Object Model, DOM

- The W3C Document Object Model, DOM, is an API that allows programs to access and update document content.
- Defines objects representing HTML elements, methods to access HTML elements, and events generated by HTML elements.
- The best that can be said about browser support is that it varies.
  - Try the features you want to use in all relevant browsers, check **`caniuse.com`**, etc

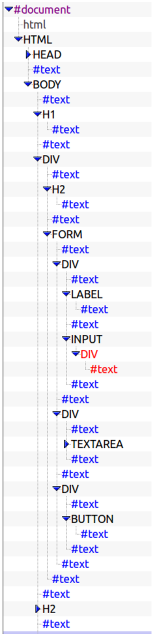
The DOM Tree



```
#document
  html
  HTML
    HEAD
    #text
    BODY
      #text
      H1
        #text
      #text
      DIV
        #text
        H2
          #text
        #text
        FORM
          #text
          DIV
            #text
            LABEL
              #text
            #text
            INPUT
              DIV
                #text
            #text
          #text
          DIV
            #text
            TEXTAREA
            #text
          #text
          DIV
            #text
            BUTTON
              #text
            #text
          #text
        #text
      #text
      H2
      #text
```

- The DOM objects are organized in a tree.

The DOM Tree



```
▼#document
  html
 ▼HTML
   ▶HEAD
    #text
   ▼BODY
      #text
     ▼H1
        #text
      #text
     ▼DIV
        #text
       ▼H2
          #text
        #text
       ▼FORM
          #text
         ▼DIV
            #text
           ▼LABEL
              #text
            #text
           ▼INPUT
             ▼DIV
                #text
            #text
          #text
         ▼DIV
            #text
           ▶TEXTAREA
            #text
          #text
         ▼DIV
            #text
           ▼BUTTON
              #text
            #text
          #text
        #text
      #text
     ▶H2
      #text
```

- The DOM objects are organized in a tree.
- The picture to the left is a part of the DOM tree for the course's chat program.

The DOM JavaScript API

- All HTML elements are represented by objects.

The DOM JavaScript API

- All HTML elements are represented by objects.
- The HTML objects have properties you can get or set, to read or update the objects.

The DOM JavaScript API

- All HTML elements are represented by objects.
- The HTML objects have properties you can get or set, to read or update the objects.
- The HTML objects have methods, for example for adding and deleting elements.

The DOM JavaScript API

- All HTML elements are represented by objects.
- The HTML objects have properties you can get or set, to read or update the objects.
- The HTML objects have methods, for example for adding and deleting elements.
- An example is the JavaScript statement

```
document.getElementById("demo").innerHTML =
    "Hello World!";
```

  that uses the method **`getElementById`** to find the HTML object for the element with id **`demo`**, and sets the HTML of that object to **`"Hello World!"`**, using the **`innerHTML`** property.

The **`document`** Object

- The object **`document`** can be accessed by any JavaScript code. It represents the entire web page and is the entry point to the DOM API.

The **`document`** Object

- The object **`document`** can be accessed by any JavaScript code. It represents the entire web page and is the entry point to the DOM API.
- Sample methods in **`document`** are

Find HTML elements	**`getElementById`**, **`getElementsByTagName`**, **`getElementsByClassName`**

The **document** Object

- The object **document** can be accessed by any JavaScript code. It represents the entire web page and is the entry point to the DOM API.
- Sample methods in **document** are

Find HTML elements	**getElementById**, **getElementsByTagName**, **getElementsByClassName**
Properties of HTML elements	**innerHTML**, **attributes**

The **`document`** Object

- The object **`document`** can be accessed by any JavaScript code. It represents the entire web page and is the entry point to the DOM API.
- Sample methods in **`document`** are

Find HTML elements	**`getElementById`**, **`getElementsByTagName`**, **`getElementsByClassName`**
Properties of HTML elements	**`innerHTML`**, **`attributes`**
Add or delete elements	**`createElement`**, **`removeChild`**, **`appendChild`**

The **`document`** Object

- The object **`document`** can be accessed by any JavaScript code. It represents the entire web page and is the entry point to the DOM API.
- Sample methods in **`document`** are

Find HTML elements	**`getElementById`**, **`getElementsByTagName`**, **`getElementsByClassName`**
Properties of HTML elements	**`innerHTML`**, **`attributes`**
Add or delete elements	**`createElement`**, **`removeChild`**, **`appendChild`**
Collections of HTML elements	**`cookie`**, **`URL`**, **`elements`**, **`forms`**

Change CSS Rules

- To change CSS rules use the following type of statement:

```
document.getElementById(id).style.<property>
    = <some style>
```

Change CSS Rules

- To change CSS rules use the following type of statement:

```
document.getElementById(id).style.<property>
    = <some style>
```

- For example, the statement

```
document.getElementById("p2").style.color =
    "blue";
```

changes the font color of element with id **`p2`** to blue.

Events

- The DOM defines many events, for example **`onClick`**, which is fired by an element when the user clicks on it.

Events

- The DOM defines many events, for example **`onClick`**, which is fired by an element when the user clicks on it.
- To react to an event, add JavaScript code to the event handler attribute of the element that generates the event.

Events

- The DOM defines many events, for example **`onClick`**, which is fired by an element when the user clicks on it.
- To react to an event, add JavaScript code to the event handler attribute of the element that generates the event.
- For example, to change text in the paragraph when the user clicks it:

```
<p onclick="clicked(this)">Click Me!</p>
```

```
function clicked(source) {
    source.innerHTML = "You clicked";
}
```

Examples of Events

Mouse events **`onclick`**, **`ondblclick`**, **`onmousedown`**, **`onmouseover`**

Examples of Events

Mouse events **`onclick`**, **`ondblclick`**, **`onmousedown`**, **`onmouseover`**

Keyboard events **`onkeydown`**, **`onkeypress`**, **`onkeyup`**, fired in that order.

Examples of Events

Mouse events **`onclick`**, **`ondblclick`**, **`onmousedown`**, **`onmouseover`**

Keyboard events **`onkeydown`**, **`onkeypress`**, **`onkeyup`**, fired in that order.

Object events **`onload`**, **`onunload`**

Examples of Events

Mouse events **`onclick`**, **`ondblclick`**, **`onmousedown`**, **`onmouseover`**

Keyboard events **`onkeydown`**, **`onkeypress`**, **`onkeyup`**, fired in that order.

Object events **`onload`**, **`onunload`**

Form events **`onchange`**, **`onselect`**

Event Listeners

- The JavaScript function **addEventListener()** attaches an event listener to the specified element.

```
<button id="myBtn">Try it</button>
<p id="demo"></p>
```

```
document.getElementById("myBtn").
   addEventListener("click", displayDate);

function displayDate()  {
  document.getElementById("demo").
     innerHTML = Date();
}
```

Event Listeners

- The JavaScript function **addEventListener()** attaches an event listener to the specified element.

```
<button id="myBtn">Try it</button>
<p id="demo"></p>
```

```
document.getElementById("myBtn").
   addEventListener("click", displayDate);

function displayDate()  {
  document.getElementById("demo").
     innerHTML = Date();
}
```

- Multiple event listeners, even of the same type, can be attached to the same element.

Event Listeners

- The JavaScript function **addEventListener()** attaches an event listener to the specified element.

```
<button id="myBtn">Try it</button>
<p id="demo"></p>
```

```
document.getElementById("myBtn").
   addEventListener("click", displayDate);

function displayDate()  {
  document.getElementById("demo").
     innerHTML = Date();
}
```

- Multiple event listeners, even of the same type, can be attached to the same element.
- Event listeners is preferred over **onEvent** attributes since it separates JavaScript from HTML, thereby increasing cohesion.

Passing Parameters to Event Listeners

- The following code illustrates how to pass parameters to event listeners.

```
<button id="myBtn">Try it</button>
<p id="demo"></p>
```

```
document.getElementById("myBtn").
   addEventListener("click", function() {
      showLabel(this);
   });

function showLabel(source) {
  document.getElementById("demo").innerHTML
     = source.innerHTML;
}
```

Question 1

Event Bubbling

- When an element fires an event, also the event handlers of its parents are invoked.

Event Bubbling

- When an element fires an event, also the event handlers of its parents are invoked.
- An event first triggers the deepest possible element, then its parents in nesting order.

Event Bubbling Example

- **HTML:**

```
<div onclick="show(1)">1
    <div onclick="show(2)">2
        <div onclick="show(3)">3
            <p id="event-log"></p>
        </div>
    </div>
</div>
```

JavaScript:

```
function show(sourceNo) {
   let curr = document.
      getElementById("event-log").innerHTML;
   document.getElementById("event-log").
      innerHTML = curr + " " + sourceNo;
}
```

Event Bubbling Example

- **HTML:**

```
<div onclick="show(1)">1
    <div onclick="show(2)">2
        <div onclick="show(3)">3
            <p id="event-log"></p>
        </div>
    </div>
</div>
```

JavaScript:

```
function show(sourceNo) {
   let curr = document.
      getElementById("event-log").innerHTML;
   document.getElementById("event-log").
      innerHTML = curr + " " + sourceNo;
}
```

- When clicking the innermost div (number 3), the output is `3 2 1`

Stopping the Bubbling

- Bubbling is prevented by calling **`stopPropagation()`** on the **`event`** object.

Stopping the Bubbling

- Bubbling is prevented by calling `stopPropagation()` on the `event` object.

-
  ```
  <div onclick="show(1)">1
      <div onclick="show(2)">2
          <div onclick='show(3, event)'>3
              <p id="log"></p>
          </div>
      </div>
  </div>
  ```

  ```
  function show(sourceNo, event) {
     let curr = document.
        getElementById("log").innerHTML;
     document.getElementById("log").
        innerHTML = curr + " " + sourceNo;
     event.stopPropagation();
  }
  ```

Stopping the Bubbling

- Bubbling is prevented by calling **`stopPropagation()`** on the **`event`** object.

-
  ```
  <div onclick="show(1)">1
      <div onclick="show(2)">2
          <div onclick='show(3, event)'>3
              <p id="log"></p>
          </div>
      </div>
  </div>
  ```

  ```
  function show(sourceNo, event) {
     let curr = document.
        getElementById("log").innerHTML;
     document.getElementById("log").
        innerHTML = curr + " " + sourceNo;
     event.stopPropagation();
  }
  ```
- When clicking the innermost div, output is now **3**

Event Capturing

- Before bubbling, the event goes the other way, from outermost to innermost element. This is called capturing.

Event Capturing

- Before bubbling, the event goes the other way, from outermost to innermost element. This is called capturing.
- The capturing phase is ignored by all **`onEvent`** attributes and event listeners, except listeners with the **`useCapture`** argument set to true:

```
document.getElementById("myId").
   addEventListener("click", handler, true);
```

Navigating the DOM Tree

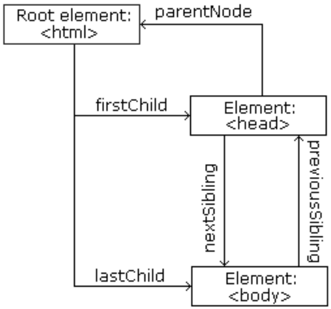


Image from
http://www.w3schools.com/js/js_htmldom_navigation.asp

- The image to the left illustrates parent, child and sibling relationships between nodes in the DOM tree.

Navigating the DOM Tree

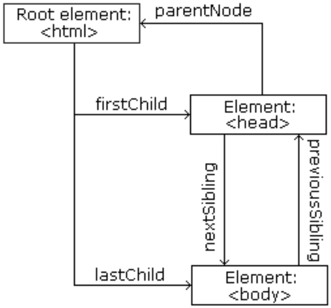


Image from
http://www.w3schools.com/js/js_htmldom_navigation.asp

- The image to the left illustrates parent, child and sibling relationships between nodes in the DOM tree.
- The DOM tree can be navigated with the node properties **`parentNode`**, **`childNodes`**, **`firstChild`**, **`lastChild`**, **`nextSibling`**, and **`previousSibling`**

Navigating the DOM Tree (Cont'd)

- Note that, in the code below, the **`<p>`** node contains a child text node with the value **`the text`**

```
<p>the text</p>
```

Navigating the DOM Tree (Cont'd)

- Note that, in the code below, the **`<p>`** node contains a child text node with the value **`the text`**

```
<p>the text</p>
```

- Text content can be accessed with the **`innerHTML`** and **`nodeValue`** properties.

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

Using **`innerHTML`**:

```
let text = document.getElementById("demo").
   innerHTML;
```

Using **`nodeValue`**:

```
let text = document.getElementById("demo").
childNodes[0].nodeValue;
```

Adding Elements

- To add a new element, first create it, then insert it in the DOM tree.

```
<div id="target"></div>
```

```
let elem = document.createElement("p");
let text =
   document.createTextNode("added element");
elem.appendChild(text);
document.getElementById("target").
   appendChild(elem);
```

Removing Elements

- To remove an element, use the **`removeChild`** method.

```
<div id="parent">
  <p>To be removed</p>
</div>
```

```
let parent =
   document.getElementById("parent");
let child =
   parent.getElementsByTagName("p")[0];
parent.removeChild(child);
```

Question 2

Section

- The Document Object Model, DOM
- The Browser Object Model, BOM
- The jQuery JavaScript Library
- AJAX
- Long Polling
- Server-Sent Event
- WebSocket
- The Knockout JavaScript Framework

The Browser Object Model, BOM

- While the DOM provides an API for accessing the current document, the Browser Object Model, BOM, provides an API that gives access to the browser.

The Browser Object Model, BOM

- While the DOM provides an API for accessing the current document, the Browser Object Model, BOM, provides an API that gives access to the browser.
- The BOM is not standardized, but more or less the same methods are implemented in all modern browsers.

The Browser Object Model, BOM

- While the DOM provides an API for accessing the current document, the Browser Object Model, BOM, provides an API that gives access to the browser.
- The BOM is not standardized, but more or less the same methods are implemented in all modern browsers.
- The following slides contain a short overview of major objects and methods, to give an idea of what can be done with the BOM.

BOM Objects

- The **`window`** object has:
  - Properties for height and width of the browser window.
  - Methods to open, close, move and resize the browser window.
  - Methods to execute some code at specified time-intervals.

BOM Objects

- The **`window`** object has:
  - Properties for height and width of the browser window.
  - Methods to open, close, move and resize the browser window.
  - Methods to execute some code at specified time-intervals.
- The **`location`** object has:
  - Properties that gives information about the current URL.
  - The **`assign`** method that loads a new document.

BOM Objects (Cont'd)

- The **`navigator`** object can give information about browser type and browser features.

BOM Objects (Cont’d)

- The **`navigator`** object can give information about browser type and browser features.
- The **`screen`** object has properties for height, width and pixel depth of the user’s screen.

BOM Objects (Cont'd)

- The **`navigator`** object can give information about browser type and browser features.
- The **`screen`** object has properties for height, width and pixel depth of the user's screen.
- The **`document`** object has the **`cookie`** property, which is used to get and set cookies.

Section

The jQuery Library

- jQuery is an API that simplifies many common JavaScript tasks, like DOM manipulation, CSS manipulation, event handling, effects and animation.

The jQuery Library

- jQuery is an API that simplifies many common JavaScript tasks, like DOM manipulation, CSS manipulation, event handling, effects and animation.
- There are many jQuery plugins that provide more features.

The jQuery Library

- jQuery is an API that simplifies many common JavaScript tasks, like DOM manipulation, CSS manipulation, event handling, effects and animation.
- There are many jQuery plugins that provide more features.
- jQuery hides cross-browser issues, all jQuery code will work the same way in all browsers supporting jQuery.

The jQuery Library

- jQuery is an API that simplifies many common JavaScript tasks, like DOM manipulation, CSS manipulation, event handling, effects and animation.
- There are many jQuery plugins that provide more features.
- jQuery hides cross-browser issues, all jQuery code will work the same way in all browsers supporting jQuery.
- jQuery is very commonly used.

Installing jQuery

- jQuery is a JavaScript file, to use it you just have to provide a link to that file.

Installing jQuery

- jQuery is a JavaScript file, to use it you just have to provide a link to that file.
- The jQuery library file comes in two versions:
  - A development version, which is uncompressed and therefore readable.
  - A live website version, which has been minified and compressed and therefore is not readable. Instead it is shorter and thereby faster to download.

Installing jQuery (Cont'd)

- Either you download it from **`jquery.com`** and place it on your server, or you provide a link to a Content Delivery Network, CDN, as follows:

```
<script src="https://cdnjs.cloudflare.com/
ajax/libs/jquery/3.3.1/jquery.min.js">
</script>
```

Installing jQuery (Cont'd)

- Either you download it from **jquery.com** and place it on your server, or you provide a link to a Content Delivery Network, CDN, as follows:

```
<script src="https://cdnjs.cloudflare.com/
ajax/libs/jquery/3.3.1/jquery.min.js">
</script>
```

- Using a CDN is normally faster, since:

Installing jQuery (Cont'd)

- Either you download it from **jquery.com** and place it on your server, or you provide a link to a Content Delivery Network, CDN, as follows:

```
<script src="https://cdnjs.cloudflare.com/
ajax/libs/jquery/3.3.1/jquery.min.js">
</script>
```

- Using a CDN is normally faster, since:
  - The file is delivered from the CDNs server closest to the user.

Installing jQuery (Cont'd)

- Either you download it from **`jquery.com`** and place it on your server, or you provide a link to a Content Delivery Network, CDN, as follows:

```
<script src="https://cdnjs.cloudflare.com/
ajax/libs/jquery/3.3.1/jquery.min.js">
</script>
```

- Using a CDN is normally faster, since:
  - The file is delivered from the CDNs server closest to the user.
  - Many users already have downloaded jQuery from the CDN when visiting another site. As a result, it is loaded from browser cache.

The jQuery Function

- Very central to jQuery is the jQuery function, which has two names, **`jQuery`** and the commonly used **`$`**.

The jQuery Function

- Very central to jQuery is the jQuery function, which has two names, **`jQuery`** and the commonly used **`$`**.
- Remember that **`$`** is a perfectly legal JavaScript identifier, there is nothing magic about that name.

The jQuery Function

- Very central to jQuery is the jQuery function, which has two names, **`jQuery`** and the commonly used **`$`**.
- Remember that **`$`** is a perfectly legal JavaScript identifier, there is nothing magic about that name.
- The jQuery function normally takes one parameter, which is either a CSS selector or a reference to an object in the document, and returns a jQuery object wrapping all HTML element(s) corresponding to the search criteria.

```
$(document) //The document object.
$(this)     //The current element.
$(".c")     //All elements with class "c"
$(div)      //All div elements.
```

The jQuery Function

- Very central to jQuery is the jQuery function, which has two names, **`jQuery`** and the commonly used **`$`**.
- Remember that **`$`** is a perfectly legal JavaScript identifier, there is nothing magic about that name.
- The jQuery function normally takes one parameter, which is either a CSS selector or a reference to an object in the document, and returns a jQuery object wrapping all HTML element(s) corresponding to the search criteria.

```
$(document) //The document object.
$(this)     //The current element.
$(".c")     //All elements with class "c"
$(div)      //All div elements.
```

- Any CSS selector can be used as search criteria.

The jQuery Object

- The jQuery object also has two names, **`jQuery`** and the commonly used **`$`**.

The jQuery Object

- The jQuery object also has two names, **`jQuery`** and the commonly used **`$`**.
- The jQuery object contains many methods that operate on the wrapped HTML element. For example the **`html`** method that gets or sets the HTML content of the wrapped element:

```
/* Store the HTML of the element with
id "someId" in the variable "content". */
let content = $("#someId").html();

/* Set the HTML of the element with
id "someId" to "content<br/>". */
$("#someId").html(content + "<br/>");
```

The jQuery Object (Cont'd)

- The jQuery object supports array subscripting via brackets:

```
$("h1")[0]; //The first h1 element.
```

The jQuery Object (Cont'd)

- The jQuery object supports array subscripting via brackets:

```
$("h1")[0]; //The first h1 element.
```

- The jQuery object also has utility methods that are not related to a HTML element:

```
// Returns the string "extra whitespace"
$.trim( "   extra whitespace       " );
```

Event Handlers

- In jQuery, an event handling function is passed as argument to a method with the event name in the jQuery object wrapping the desired event source.

Event Handlers

- In jQuery, an event handling function is passed as argument to a method with the event name in the jQuery object wrapping the desired event source.
- The following code adds an event handler to all **`<p>`** elements. The event handler will change the paragraph's text to **`You clicked`** when the user clicks it.

```
$("p").click(function(){
  $(this).html("You clicked");
});
```

The Document Ready Event

- jQuery defines the document ready event, which is fired when the DOM has been constructed.

The Document Ready Event

- jQuery defines the document ready event, which is fired when the DOM has been constructed.
- It is usually best to wait for this event before running JavaScript code, to avoid operating on elements that have not been defined.

The Document Ready Event

- jQuery defines the document ready event, which is fired when the DOM has been constructed.
- It is usually best to wait for this event before running JavaScript code, to avoid operating on elements that have not been defined.
- It is normally not necessary to wait for the JavaScript load event, which fires when everything, including images, is loaded and rendered.

The Document Ready Event

- jQuery defines the document ready event, which is fired when the DOM has been constructed.
- It is usually best to wait for this event before running JavaScript code, to avoid operating on elements that have not been defined.
- It is normally not necessary to wait for the JavaScript load event, which fires when everything, including images, is loaded and rendered.
- Therefore, JavaScript code is normally written like this:

```
$(document).ready(function(){
   // JavaScript code here...
});
```

CSS Rules

- When passed a CSS property name, the **`css`** method returns the value of that property.

```
$("body").css("background-color");
```

CSS Rules

- When passed a CSS property name, the `css` method returns the value of that property.

```
$("body").css("background-color");
```

- When passed one or more property:value pairs, those rules are set for the specified element(s).

```
$("body").css("background-color","yellow");
```

Effects

- There are lots of effects provided by jQuery, here are some examples.

Effects

- There are lots of effects provided by jQuery, here are some examples.
  - The **`hide`** and **`show`** methods can hide/show elements. It is also possible to specify the speed of the (dis)appearance.

Effects

- There are lots of effects provided by jQuery, here are some examples.
  - The **`hide`** and **`show`** methods can hide/show elements. It is also possible to specify the speed of the (dis)appearance.
  - Various **`fade`** methods causes an element to fade in/out.

Effects

- There are lots of effects provided by jQuery, here are some examples.
  - The **`hide`** and **`show`** methods can hide/show elements. It is also possible to specify the speed of the (dis)appearance.
  - Various **`fade`** methods causes an element to fade in/out.
  - Various **`slide`** methods causes an element to slide up/down.

Effects

- There are lots of effects provided by jQuery, here are some examples.
  - The **`hide`** and **`show`** methods can hide/show elements. It is also possible to specify the speed of the (dis)appearance.
  - Various **`fade`** methods causes an element to fade in/out.
  - Various **`slide`** methods causes an element to slide up/down.
  - The **`animate`** method is used to create custom animations.

Effects (Cont'd)

- Effects can have callback functions that are executed when the effect is done.

```
$("button").click(function(){
  $("p").hide("slow",function(){
    alert("The paragraph is now hidden");
  });
});
```

jQuery Method Chaining

- Many of the element manipulation methods of the jQuery object return the jQuery object itself.

jQuery Method Chaining

- Many of the element manipulation methods of the jQuery object return the jQuery object itself.
- This means it is possible to create chains of such methods.

```
$("button").click(function(){
  $("#p1").css("color","blue")
    .slideUp(3000)
    .slideDown(2000);
});
```

Element Content and Element Attributes

- The **`text`** method is used to access text content of an HTML element, the **`html`** method is used for text content with HTML tags, the **`val`** method is used for form field values, and **`attr`** is used for an element's attributes.

Element Content and Element Attributes

- The **`text`** method is used to access text content of an HTML element, the **`html`** method is used for text content with HTML tags, the **`val`** method is used for form field values, and **`attr`** is used for an element's attributes.
- If called without arguments, these methods return the current value. If called with arguments they set a new value.

```
$("#btn").click(function(){
  let current = $("#test").html());
});
```

```
$("#btn").click(function(){
  $("#textField").val("New value");
});
```

Element Content and Element Attributes (Cont'd)

- The **`text`**, **`html`**, **`val`**, and **`attr`** methods can have callback functions.

Element Content and Element Attributes (Cont'd)

- The **`text`**, **`html`**, **`val`**, and **`attr`** methods can have callback functions.
- The callback function takes two parameters, the index of the current element in the list of elements selected and the original value.

Element Content and Element Attributes (Cont'd)

- The **`text`**, **`html`**, **`val`**, and **`attr`** methods can have callback functions.
- The callback function takes two parameters, the index of the current element in the list of elements selected and the original value.
- The return value of the callback function becomes the new text of the element.

```
$("#btn").click(function(){
  $("p").text(function(i,oldText){
    return "Old text: " + oldText +
           ", index: " + i;
  });
});
```

To Add or Remove Elements

- The **append**, **prepend**, **before**, and **after** methods are used to add elements.

```
// Append a list item to the ordered list
// with id "someList".
$("#someList").
    append("<li>Appended item</li>");
```

To Add or Remove Elements

- The **append**, **prepend**, **before**, and **after** methods are used to add elements.

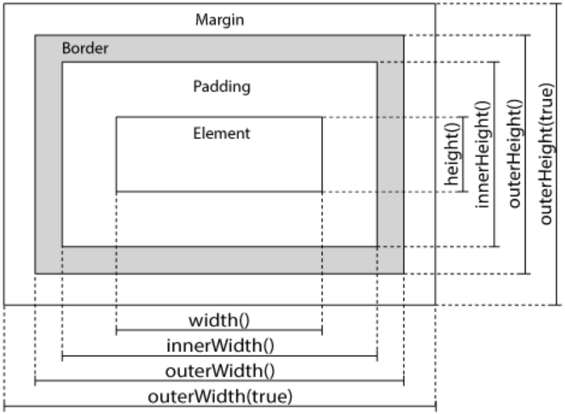
```
// Append a list item to the ordered list
// with id "someList".
$("#someList").
    append("<li>Appended item</li>");
```

- The **remove** and **empty** methods are used to remove elements.

```
// Remove the element with id "#menu".
$("#menu").remove();
```

Dimensions

The following image, taken from **`http://www.w3schools.com/jquery/jquery_dimensions.asp`**, illustrates the methods used to set or get element dimensions.



Traversing the DOM Tree

Here are samples of jQuery methods used to traverse the DOM tree.

Traversing the DOM Tree

Here are samples of jQuery methods used to traverse the DOM tree.

`parent` Returns the parent on the nearest higher level.

Traversing the DOM Tree

Here are samples of jQuery methods used to traverse the DOM tree.

`parent`	Returns the parent on the nearest higher level.
`parents`	Returns all parents all the way up to the html element.

Traversing the DOM Tree

Here are samples of jQuery methods used to traverse the DOM tree.

`parent`	Returns the parent on the nearest higher level.
`parents`	Returns all parents all the way up to the html element.
`children`	Returns all children on the nearest lower level.

Traversing the DOM Tree

Here are samples of jQuery methods used to traverse the DOM tree.

`parent`	Returns the parent on the nearest higher level.
`parents`	Returns all parents all the way up to the html element.
`children`	Returns all children on the nearest lower level.
`find`	Returns all descendants on all lower levels.

Traversing the DOM Tree

Here are samples of jQuery methods used to traverse the DOM tree.

`parent`	Returns the parent on the nearest higher level.
`parents`	Returns all parents all the way up to the html element.
`children`	Returns all children on the nearest lower level.
`find`	Returns all descendants on all lower levels.
`siblings`	Returns all siblings.

Traversing the DOM Tree

Here are samples of jQuery methods used to traverse the DOM tree.

`parent`	Returns the parent on the nearest higher level.
`parents`	Returns all parents all the way up to the html element.
`children`	Returns all children on the nearest lower level.
`find`	Returns all descendants on all lower levels.
`siblings`	Returns all siblings.
filtering	The **`first`**, **`last`**, **`eq`**, and **`filter`** methods can be used to filter the search results of the methods above.

Question 3

Section

Loading an Entire Page

- Traditionally, an entire page is loaded when the user clicks a link or a button, all HTML in the page is read from the server.

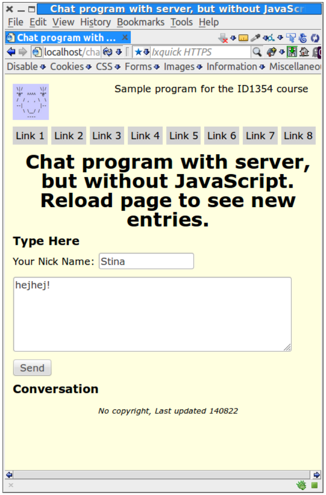
Loading an Entire Page

- Traditionally, an entire page is loaded when the user clicks a link or a button, all HTML in the page is read from the server.
- Dynamic data is included on the server, before the HTML is sent to the client, for example using a PHP program.

Loading an Entire Page

- Traditionally, an entire page is loaded when the user clicks a link or a button, all HTML in the page is read from the server.
- Dynamic data is included on the server, before the HTML is sent to the client, for example using a PHP program.
- This behavior is appropriate if the entire page content really must change, but that is often not the case.

Loading an Entire Page


Chat program with server, but without JavaScr

Sample program for the ID1354 course

Link 1 Link 2 Link 3 Link 4 Link 5 Link 6 Link 7 Link 8

Chat program with server, but without JavaScript. Reload page to see new entries.

Type Here

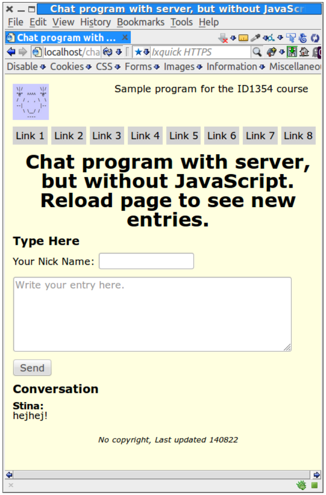
Your Nick Name: Stina

hejhej!

Send

Conversation

No copyright, Last updated 140822


Chat program with server, but without JavaScr

Sample program for the ID1354 course

Link 1 Link 2 Link 3 Link 4 Link 5 Link 6 Link 7 Link 8

Chat program with server, but without JavaScript. Reload page to see new entries.

Type Here

Your Nick Name:

Write your entry here.

Send

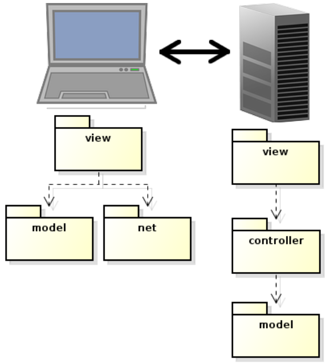
Conversation

Stina:
hejhej!

No copyright, Last updated 140822

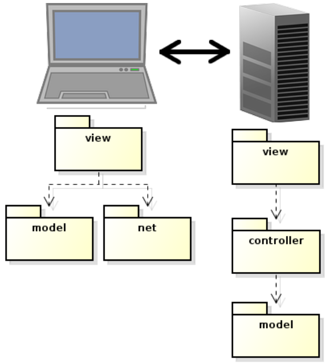
Consider for example the sample chat application. All that happens when the user clicks **Send** is that the new entry is added, the rest of the page is untouched.

Repetition: The MVVM Pattern



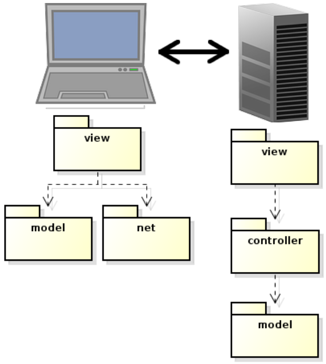
- The philosophy behind Model-View-ViewModel, MVVM, is to send only state changes from server to client.

Repetition: The MVVM Pattern



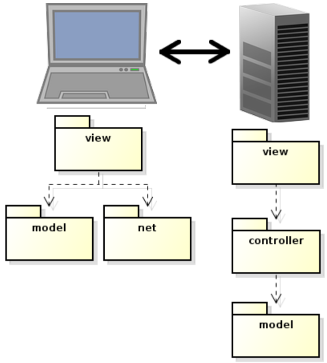
- The philosophy behind Model-View-ViewModel, MVVM, is to send only state changes from server to client.
- State changes, which means new data, are stored in the viewmodel.

Repetition: The MVVM Pattern



- The philosophy behind Model-View-ViewModel, MVVM, is to send only state changes from server to client.
- State changes, which means new data, are stored in the viewmodel.
- Therefore, the viewmodel will always contain the current state of the application.

Repetition: The MVVM Pattern



- The philosophy behind Model-View-ViewModel, MVVM, is to send only state changes from server to client.
- State changes, which means new data, are stored in the viewmodel.
- Therefore, the viewmodel will always contain the current state of the application.
- The browser view must reflect the viewmodel state, preferably using the observer pattern.

AJAX: To Load Only Data

- The dominating method to request data from the server, without reloading the web page, is **A**synchronous **J**avaScript **A**nd **X**ML, AJAX.

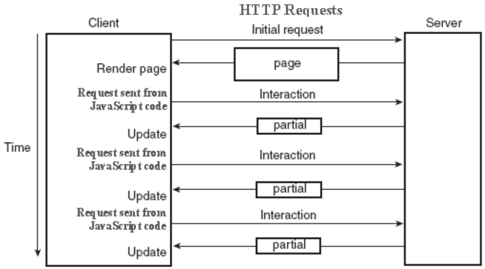
AJAX: To Load Only Data

- The dominating method to request data from the server, without reloading the web page, is **A**synchronous **J**avaScript **A**nd **X**ML, AJAX.
- AJAX is basically a way to use existing technologies, such as JavaScript, HTTP and XML.
  - No new language or markup.

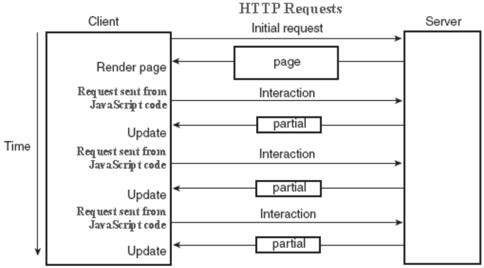
AJAX: To Load Only Data

- The dominating method to request data from the server, without reloading the web page, is **A**synchronous **J**avaScript **A**nd **X**ML, AJAX.
- AJAX is basically a way to use existing technologies, such as JavaScript, HTTP and XML.
  - No new language or markup.
- The only thing specific for AJAX is a JavaScript object, called **`XMLHttpRequest`**, which is standardized by W3C.

How Does It Work?

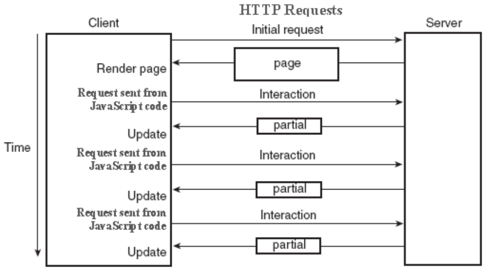


How Does It Work?



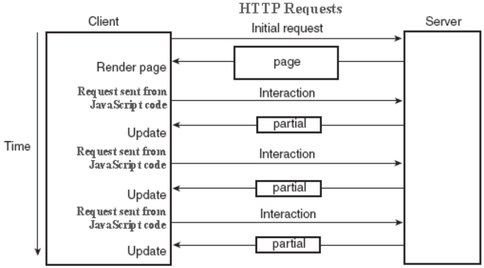
- Web page is loaded only on first request.

How Does It Work?



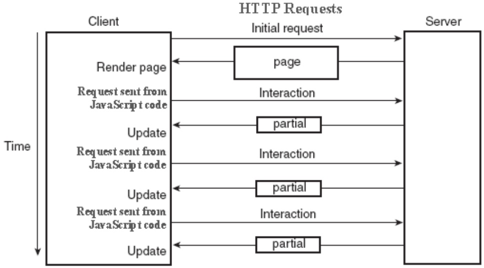
- Web page is loaded only on first request.
- Subsequent requests come from JavaScript code, using **`XMLHttpRequest`**.

How Does It Work?



- Web page is loaded only on first request.
- Subsequent requests come from JavaScript code, using **`XMLHttpRequest`**.
- The server returns only data, no markup.

How Does It Work?



- Web page is loaded only on first request.
- Subsequent requests come from JavaScript code, using **`XMLHttpRequest`**.
- The server returns only data, no markup.
- Returned data is available to JavaScript code, and is used to update the web page, by updating the DOM.

How Does It Work? (Cont'd)

- Note that AJAX requests are ordinary HTTP GET or HTTP POST requests.

How Does It Work? (Cont'd)

- Note that AJAX requests are ordinary HTTP GET or HTTP POST requests.
- The server directs the request to the resource specified in the URL, just as when loading a HTML document.

How Does It Work? (Cont'd)

- Note that AJAX requests are ordinary HTTP GET or HTTP POST requests.
- The server directs the request to the resource specified in the URL, just as when loading a HTML document.
- An AJAX request is normally handled by a program, for example PHP, which generates a response containing the new data.

Data Format

- Client and server need to agree on the format of the data included in the HTTP response.

Data Format

- Client and server need to agree on the format of the data included in the HTTP response.
- XML is an obvious option, but it has some drawbacks:

Data Format

- Client and server need to agree on the format of the data included in the HTTP response.
- XML is an obvious option, but it has some drawbacks:
    - Interpreting an XML document requires extra code.

Data Format

- Client and server need to agree on the format of the data included in the HTTP response.
- XML is an obvious option, but it has some drawbacks:
  - Interpreting an XML document requires extra code.
  - Using a XSLT stylesheet to generate a view is a bit tricky.

Data Format

- Client and server need to agree on the format of the data included in the HTTP response.
- XML is an obvious option, but it has some drawbacks:
  - Interpreting an XML document requires extra code.
  - Using a XSLT stylesheet to generate a view is a bit tricky.
  - XML documents are quite long and wordy.

Data Format

- Client and server need to agree on the format of the data included in the HTTP response.
- XML is an obvious option, but it has some drawbacks:
  - Interpreting an XML document requires extra code.
  - Using a XSLT stylesheet to generate a view is a bit tricky.
  - XML documents are quite long and wordy.
- Therefore, **J**ava**S**cript **O**bject **N**otation, JSON, is normally used instead of XML.
  - Compact and easy to translate to JavaScript objects.

JSON

- The JSON syntax is very simple:

JSON

- The JSON syntax is very simple:
  - Data is name/value pairs:

```
"firstName":"Olle"
```

JSON

- The JSON syntax is very simple:
  - Data is name/value pairs:

    ```
    "firstName":"Olle"
    ```

  - Data is separated by commas.

JSON

- The JSON syntax is very simple:
  - Data is name/value pairs:

    ```
    "firstName":"Olle"
    ```

  - Data is separated by commas.
  - Objects are denoted with **{** and **}**:

    ```
    {"firstName":"Olle", "lastName":"Olsson"}
    ```

JSON

- The JSON syntax is very simple:
  - Data is name/value pairs:

```
"firstName":"Olle"
```

  - Data is separated by commas.
  - Objects are denoted with **{** and **}**:

```
{"firstName":"Olle", "lastName":"Olsson"}
```

  - Arrays are denoted with **[** and **]**:

```
"employees":[
  {"firstName":"Olle", "lastName":"Olsson"},
  {"firstName":"Stina", "lastName":"Nilsson"}
]
```

JSON

- The JSON syntax is very simple:
  - Data is name/value pairs:

    ```
    "firstName":"Olle"
    ```

  - Data is separated by commas.
  - Objects are denoted with `{` and `}`:

    ```
    {"firstName":"Olle", "lastName":"Olsson"}
    ```

  - Arrays are denoted with `[` and `]`:

    ```
    "employees":[
      {"firstName":"Olle", "lastName":"Olsson"},
      {"firstName":"Stina", "lastName":"Nilsson"}
    ]
    ```

  - Data types are JavaScript types, for example string, **“abcd”**; integer, **123**; boolean, **false**

JSON is not an Alternative to XML

- Note that JSON is not a general alternative to XML. There is nothing like namespace, DTD, Schema, XSLT or anything else of all the XML standards.

JSON is not an Alternative to XML

- Note that JSON is not a general alternative to XML. There is nothing like namespace, DTD, Schema, XSLT or anything else of all the XML standards.
- JSON is just a format suitable for transferring JavaScript values.

The Client: jQuery AJAX Methods

- Instead of covering the **`XMLHttpRequest`** object, we will look at some convenient jQuery functions.

The Client: jQuery AJAX Methods

- Instead of covering the **`XMLHttpRequest`** object, we will look at some convenient jQuery functions.
- **`getJSON`** sends a HTTP GET request. Data can be included as a query string and the response is parsed as JSON data.

The Client: jQuery AJAX Methods

- Instead of covering the **XMLHttpRequest** object, we will look at some convenient jQuery functions.
- **getJSON** sends a HTTP GET request. Data can be included as a query string and the response is parsed as JSON data.

-
  ```
  $.getJSON(url, "reqData=" + someVariable,
            function(returnedData) {
              //Handle returnedData, which is
              //the received JSON data, parsed
              //to a JavaScript variable.
            });
  ```

  An HTTP GET request is sent to the URL specified in **url**. The request has the query string **reqData=<value of someVariable>** and the anonymous callback function is executed when the server's response arrives.

jQuery AJAX Methods (Cont'd)

- **`post`** sends data with a HTTP POST request.

jQuery AJAX Methods (Cont'd)

- **`post`** sends data with a HTTP POST request.
- **`$.post(url, "data=" + someVariable);`**

  An HTTP POST request is sent to the URL specified in **`url`**. The request has the body **`data=<value of someVariable>`**.

jQuery AJAX Methods (Cont'd)

- `post` sends data with a HTTP POST request.
- `$.post(url, "data=" + someVariable);`

  An HTTP POST request is sent to the URL specified in `url`. The request has the body `data=<value of someVariable>`.
- jQuery has many more AJAX methods.

The Server: JSON handling in PHP

- Remember that an AJAX request is a normal HTTP request.

The Server: JSON handling in PHP

- Remember that an AJAX request is a normal HTTP request.
- Therefore, to handle an AJAX request is no different from other request handling.

The Server: JSON handling in PHP

- Remember that an AJAX request is a normal HTTP request.
- Therefore, to handle an AJAX request is no different from other request handling.
- What is specific for AJAX interaction, is that we have to generate a JSON response.

The Server: JSON handling in PHP

- Remember that an AJAX request is a normal HTTP request.
- Therefore, to handle an AJAX request is no different from other request handling.
- What is specific for AJAX interaction, is that we have to generate a JSON response.

- `json_encode($aPhpObject)`

  The **`json_encode`** PHP method encodes the PHP object in **`aPhpObject`** to JSON representation.

JSON handling in PHP (Cont’d)

```
class SomeClass implements \JsonSerializable {
   private $some_var;
   ...
   public function jsonSerialize() {
      $json_obj = new \stdClass;
      $json_obj->someVar = $this->some_var;
      ...
      return $json_obj;
   }
```

- The object that shall be JSON encoded must be of a class that implements **`JsonSerializable`**.

JSON handling in PHP (Cont'd)

```
class SomeClass implements \JsonSerializable {
   private $some_var;
   ...
   public function jsonSerialize() {
      $json_obj = new \stdClass;
      $json_obj->someVar = $this->some_var;
      ...
      return $json_obj;
   }
```

- The object that shall be JSON encoded must be of a class that implements **`JsonSerializable`**.
- That class must have a method called **`jsonSerialize`**, which returns an object containing all relevant fields.

JSON handling in PHP (Cont'd)

```
class SomeClass implements \JsonSerializable {
   private $some_var;
   ...
   public function jsonSerialize() {
      $json_obj = new \stdClass;
      $json_obj->someVar = $this->some_var;
      ...
      return $json_obj;
   }
```

- The object that shall be JSON encoded must be of a class that implements `JsonSerializable`.
- That class must have a method called `jsonSerialize`, which returns an object containing all relevant fields.
- That returned object must be possible to encode with `json_encode`.

Question 4

Section

- The Document Object Model, DOM
- The Browser Object Model, BOM
- The jQuery JavaScript Library
- AJAX
- Long Polling
- Server-Sent Event
- WebSocket
- The Knockout JavaScript Framework

Long Polling

- Long Polling, also called Comet, is a programming technique that enables web servers to push data to a client even if the client has not explicitly requested that data.

Long Polling

- Long Polling, also called Comet, is a programming technique that enables web servers to push data to a client even if the client has not explicitly requested that data.

1. The browser makes an Ajax request to the server, no matter whether there is data to fetch or not.

Long Polling

- Long Polling, also called Comet, is a programming technique that enables web servers to push data to a client even if the client has not explicitly requested that data.

1. The browser makes an Ajax request to the server, no matter whether there is data to fetch or not.
2. The request is left unanswered by the server, until there is data to send to the browser.

Long Polling

- Long Polling, also called Comet, is a programming technique that enables web servers to push data to a client even if the client has not explicitly requested that data.

1. The browser makes an Ajax request to the server, no matter whether there is data to fetch or not.
2. The request is left unanswered by the server, until there is data to send to the browser.
3. When receiving the server response, the browser immediately makes a new request in order to obtain the *next* data set.

Long Polling

- Long Polling, also called Comet, is a programming technique that enables web servers to push data to a client even if the client has not explicitly requested that data.

1. The browser makes an Ajax request to the server, no matter whether there is data to fetch or not.
2. The request is left unanswered by the server, until there is data to send to the browser.
3. When receiving the server response, the browser immediately makes a new request in order to obtain the *next* data set.
4. Start over from point one again.

Long Polling JavaScript Client

```
$(document).ready(function () {
  function fetchFromServer() {
    $.getJSON("get-msg.php",
              function (response) {
                  $("#fromServer").
                    prepend("<p>" + response +
                            "</p>");
                  fetchFromServer();
              });
  }

  fetchFromServer();
});
```

Long polling is achieved by the call to **`fetchFromServer`** in red. This way a new call is made as soon a response has been handled.

Long Polling PHP Server

```
1  define("ONE_SEC", 1);
2  define("FILE_PATH", "msg-to-client.txt");
3
4  while (TRUE) {
5      $msg = \file_get_contents(FILE_PATH);
6      if ($msg !== '') {
7          \file_put_contents(FILE_PATH, '');
8          echo \json_encode($msg);
9          return;
10     }
11     \sleep(ONE_SEC);
12 }
```

- Line eleven pauses execution one second.

A Word of Warning

- The server will not handle multiple simultaneous requests in the same session. If one request is being handled, other requests in the same session are blocked.

A Word of Warning

- The server will not handle multiple simultaneous requests in the same session. If one request is being handled, other requests in the same session are blocked.
- Therefore, if the server has started a session, it is best to stop the session before calling **`sleep`**.

A Word of Warning

- The server will not handle multiple simultaneous requests in the same session. If one request is being handled, other requests in the same session are blocked.
- Therefore, if the server has started a session, it is best to stop the session before calling `sleep`.

-
  ```
  \session_write_close();
  \sleep(self::ONE_SEC);
  \session_start();
  ```

  `session_write_close` saves session data and closes the session. This is what happens every time a response has been sent, if a session was started.

One More Word of Warning

- The php engine does not allow a script to execute more than a specified time, which by default is 30s. To make a long polling request wait indefinitely, turn this off by calling **`\set_time_limit(0);`**

The Last Word of Warning

- Long polling has som drawbacks that must be considered.

The Last Word of Warning

- Long polling has som drawbacks that must be considered.
  - Each new request requires a new HTTP connection. Even if the TCP connection of the previous request is reused (which is not necessarily the case) there is still some overhead.

The Last Word of Warning

- Long polling has som drawbacks that must be considered.
  - Each new request requires a new HTTP connection. Even if the TCP connection of the previous request is reused (which is not necessarily the case) there is still some overhead.
  - The client code tends to get a bit messy, at least compared to Server-Sent Events and WebSockets.

The Last Word of Warning

- Long polling has som drawbacks that must be considered.
  - Each new request requires a new HTTP connection. Even if the TCP connection of the previous request is reused (which is not necessarily the case) there is still some overhead.
  - The client code tends to get a bit messy, at least compared to Server-Sent Events and WebSockets.
  - In the end it is some kind of hack, HTTP is used in a way it was not designed for.

Section

Server-Sent Event, SSE

- Server-sent event, SSE, is a HTML5 feature that solves the same problem as long polling, it enables web servers to push data to a client.

Server-Sent Event, SSE

- Server-sent event, SSE, is a HTML5 feature that solves the same problem as long polling, it enables web servers to push data to a client.
- SSE is preferred over long polling, because of the long polling drawbacks mentioned above.

Server-Sent Event, SSE

- Server-sent event, SSE, is a HTML5 feature that solves the same problem as long polling, it enables web servers to push data to a client.
- SSE is preferred over long polling, because of the long polling drawbacks mentioned above.
- Note that SSE is only for one-way messaging, from server to client. WebSockets is the best technology for duplex communication.

SSE JavaScript Client

```
1  $(document).ready(function () {
2      let evtSource = new EventSource("sse.php");
3      evtSource.addEventListener("msg",
4                                  function(event) {
5          $("#fromServer").prepend("<p>" +
6                                    event.data +
7                                    "</p>");
8      });
9  });
```

- The connection to the server is established when the **`EventSource`** object is created on line two.

SSE JavaScript Client

```
1  $(document).ready(function () {
2      let evtSource = new EventSource("sse.php");
3      evtSource.addEventListener("msg",
4                                    function(event) {
5          $("#fromServer").prepend("<p>" +
6                                     event.data +
7                                     "</p>");
8      });
9  });
```

- The connection to the server is established when the **`EventSource`** object is created on line two.
- The function on lines four to seven is executed each time an event of the type **`msg`** (the first argument of the function) is received.

SSE PHP Server

```php
define("ONE_SEC", 1);
define("FILE_PATH", "msg-to-client.txt");
set_time_limit(0);

header('Cache-Control: no-cache');
header("Content-Type: text/event-stream\n\n");

while (TRUE) {
    $msg = \file_get_contents(FILE_PATH);
    if ($msg !== '') {
        \file_put_contents(FILE_PATH, '');
        echo "event: msg\n";
        echo "data: $msg";
        echo "\n\n";
        ob_flush();
        flush();
    }
    \sleep(ONE_SEC);
}
```

SSE PHP Server, Cont'd

- It is recommended to disable caching, line five.

SSE PHP Server, Cont’d

- It is recommended to disable caching, line five.
- The mime type must be **`text/event-stream`**, line six.

SSE PHP Server, Cont'd

- It is recommended to disable caching, line five.
- The mime type must be **`text/event-stream`**, line six.
- The header section of a HTTP response shall end with double newline, line six.

SSE PHP Server, Cont'd

- It is recommended to disable caching, line five.
- The mime type must be **`text/event-stream`**, line six.
- The header section of a HTTP response shall end with double newline, line six.
- The event type is sent on line twelve.

SSE PHP Server, Cont'd

- It is recommended to disable caching, line five.
- The mime type must be **`text/event-stream`**, line six.
- The header section of a HTTP response shall end with double newline, line six.
- The event type is sent on line twelve.
- The event content is sent on line 13.

SSE PHP Server, Cont'd

- It is recommended to disable caching, line five.
- The mime type must be **`text/event-stream`**, line six.
- The header section of a HTTP response shall end with double newline, line six.
- The event type is sent on line twelve.
- The event content is sent on line 13.
- Also the event shall end with a double newline, line 14.
- Lines 15-16 flushes the server's output buffers, to make sure the message is actually delivered.

SSE PHP Server, Cont'd

- It is recommended to disable caching, line five.
- The mime type must be **`text/event-stream`**, line six.
- The header section of a HTTP response shall end with double newline, line six.
- The event type is sent on line twelve.
- The event content is sent on line 13.
- Also the event shall end with a double newline, line 14.
- Lines 15-16 flushes the server's output buffers, to make sure the message is actually delivered.
- Line 18 pauses execution one second.

Section

- The Document Object Model, DOM
- The Browser Object Model, BOM
- The jQuery JavaScript Library
- AJAX
- Long Polling
- Server-Sent Event
- WebSocket
- The Knockout JavaScript Framework

WebSocket

- WebSocket is a W3C specification.

WebSocket

- WebSocket is a W3C specification.
- Specifies a full-duplex, persistent, TCP connection between browser and server.

WebSocket

- WebSocket is a W3C specification.
- Specifies a full-duplex, persistent, TCP connection between browser and server.
- Endpoints are identified by URIs.
    - ws://host:port/path (plain websocket connection)
    - wss://host:port/path (encrypted websocket connection)

WebSocket

- WebSocket is a W3C specification.
- Specifies a full-duplex, persistent, TCP connection between browser and server.
- Endpoints are identified by URIs.
    - ws://host:port/path (plain websocket connection)
    - wss://host:port/path (encrypted websocket connection)
- Web sockets are message based, endpoints exchange messages (text or binary).

WebSocket

- WebSocket is a W3C specification.
- Specifies a full-duplex, persistent, TCP connection between browser and server.
- Endpoints are identified by URIs.
  - ws://host:port/path (plain websocket connection)
  - wss://host:port/path (encrypted websocket connection)
- Web sockets are message based, endpoints exchange messages (text or binary).
- A generic transport service, like TCP. Just like many connection-oriented protocols are built on top of TCP (HTTP, FTP, POP3, IMAP, etc), there are many message-oriented protocols on top of web sockets.

A New Kind of Web?

- The W3C specification defines a JavaScript endpoint, and is implemented by all major browsers.

A New Kind of Web?

- The W3C specification defines a JavaScript endpoint, and is implemented by all major browsers.
- There are endpoints for all major server-side technologies, e.g., PHP, Java, .NET, Python, Ruby.

A New Kind of Web?

- The W3C specification defines a JavaScript endpoint, and is implemented by all major browsers.
- There are endpoints for all major server-side technologies, e.g., PHP, Java, .NET, Python, Ruby.
- In conclusion, any browser or server can have a full-duplex connection with any other browser or server.

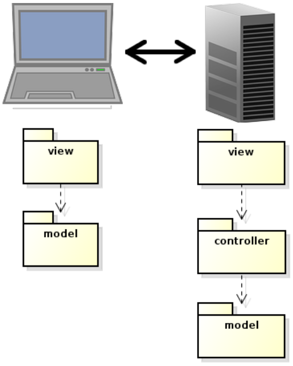
A New Kind of Web?

- The W3C specification defines a JavaScript endpoint, and is implemented by all major browsers.
- There are endpoints for all major server-side technologies, e.g., PHP, Java, .NET, Python, Ruby.
- In conclusion, any browser or server can have a full-duplex connection with any other browser or server.
- The browser is no longer a just a user interface. It becomes a node in a network, that can be programmed (in JavaScript) to do anything, and that can communicate (over websockets) with any other node.

Section

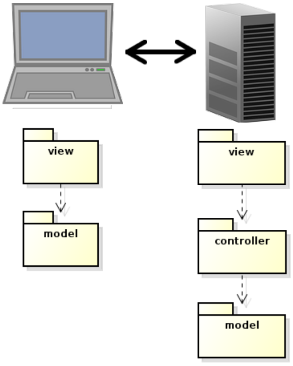
- The Document Object Model, DOM
- The Browser Object Model, BOM
- The jQuery JavaScript Library
- AJAX
- Long Polling
- Server-Sent Event
- WebSocket
- The Knockout JavaScript Framework

Reminder: The MVVM Pattern



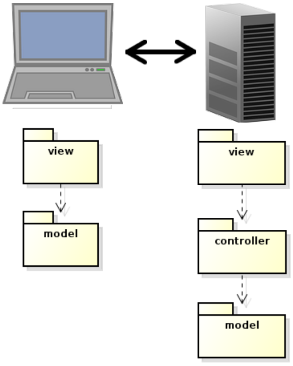
- The MVVM pattern intodoces a client-side model which reflects the server-side model and is responsible for notifying the view of updates.

Reminder: The MVVM Pattern



- The MVVM pattern intoduces a client-side model which reflects the server-side model and is responsible for notifying the view of updates.
- The server-side view is relieved from creating the HTML. There will not be PHP in the HTML files!

Reminder: The MVVM Pattern



- The MVVM pattern intoduces a client-side model which reflects the server-side model and is responsible for notifying the view of updates.
- The server-side view is relieved from creating the HTML. There will not be PHP in the HTML files!
- Also, network communication is reduced, since only model updates are fetched from the server. There is no need to reload the entire web page at each user action.

MVVM JavaScript Frameworks

- The code for implementing the Observer pattern to have the view reflect changes in the viewmodel (and viewmodel reflect changes in the view), will be the same for more or less all applications.

MVVM JavaScript Frameworks

- The code for implementing the Observer pattern to have the view reflect changes in the viewmodel (and viewmodel reflect changes in the view), will be the same for more or less all applications.
- Also the code for viewmodel-to-server communication will be quite similar in all applications.

MVVM JavaScript Frameworks

- The code for implementing the Observer pattern to have the view reflect changes in the viewmodel (and viewmodel reflect changes in the view), will be the same for more or less all applications.
- Also the code for viewmodel-to-server communication will be quite similar in all applications.
- This calls for a client-side framework, since we do not want to rewrite the same code for each new application. This is exactly the purpose of Knockout.

MVVM JavaScript Frameworks

- The code for implementing the Observer pattern to have the view reflect changes in the viewmodel (and viewmodel reflect changes in the view), will be the same for more or less all applications.
- Also the code for viewmodel-to-server communication will be quite similar in all applications.
- This calls for a client-side framework, since we do not want to rewrite the same code for each new application. This is exactly the purpose of Knockout.
- There are also many alternative frameworks, for example Backbone and Angular. These are more used and more powerful than Knockout, but too complicated for this course.

The Knockout JavaScript Framework

- Like jQuery, Knockout is a JavaScript file the can be linked from a CDN, for example:

```
<script src="https://cdnjs.cloudflare.com/
  ajax/libs/knockout/3.4.2/knockout-min.js">
</script>
```

The Knockout JavaScript Framework

- Like jQuery, Knockout is a JavaScript file the can be linked from a CDN, for example:

```
<script src="https://cdnjs.cloudflare.com/
  ajax/libs/knockout/3.4.2/knockout-min.js">
</script>
```

- Knockout should be used together with jQuery, which handles low-level DOM interaction.

The Knockout JavaScript Framework

- Like jQuery, Knockout is a JavaScript file the can be linked from a CDN, for example:

```
<script src="https://cdnjs.cloudflare.com/
  ajax/libs/knockout/3.4.2/knockout-min.js">
</script>
```

- Knockout should be used together with jQuery, which handles low-level DOM interaction.
- Knockout implements the MVVM pattern, by managing View-to-Viewmodel bindings.

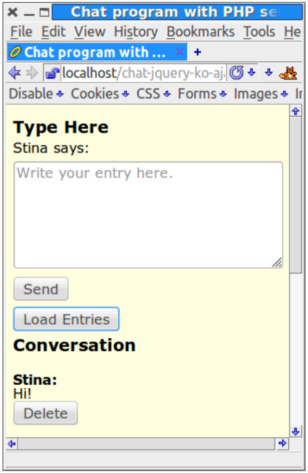
The Knockout JavaScript Framework

- Like jQuery, Knockout is a JavaScript file the can be linked from a CDN, for example:

```
<script src="https://cdnjs.cloudflare.com/
  ajax/libs/knockout/3.4.2/knockout-min.js">
</script>
```

- Knockout should be used together with jQuery, which handles low-level DOM interaction.
- Knockout implements the MVVM pattern, by managing View-to-Viewmodel bindings.
- The following slides contain a brief introduction to Knockout. For a more extensive guide, see **`http://knockoutjs.com/documentation/introduction.html`**

The Chat Application


Chat program with PHP se
File Edit View History Bookmarks Tools He
Chat program with ...
localhost/chat-jquery-ko-aj
Disable Cookies CSS Forms Images Ir
Send
Load Entries
Delete

Type Here

Stina says:

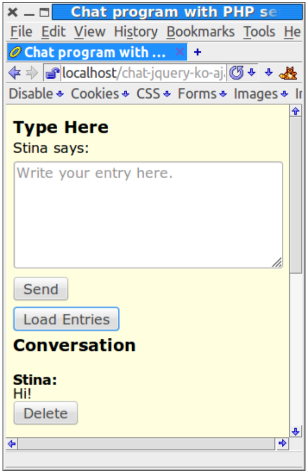
Write your entry here.

Conversation

Stina:
Hi!

- To illustrate this Knockout tutorial, we will use the chat application.

The Chat Application


Chat program with PHP se
File Edit View History Bookmarks Tools He
Chat program with ...
localhost/chat-jquery-ko-aj
Disable Cookies CSS Forms Images I

Type Here

Stina says:

Write your entry here.

Send

Load Entries

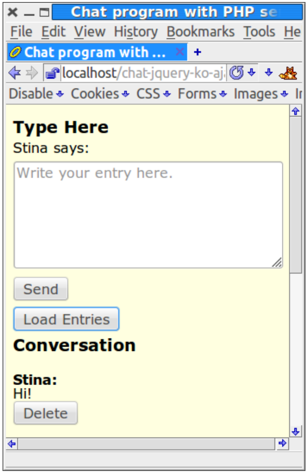
Conversation

Stina:
Hi!

Delete

- To illustrate this Knockout tutorial, we will use the chat application.
- We will create a viewmodel that holds the current conversation.

The Chat Application


Chat program with PHP se
File Edit View History Bookmarks Tools He
Chat program with ...
localhost/chat-jquery-ko-aj
Disable Cookies CSS Forms Images Ir

Type Here

Stina says:

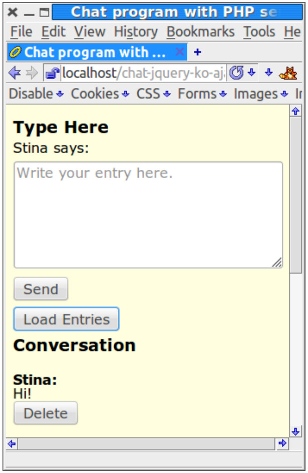
Write your entry here.

Conversation

Stina:
Hi!

- To illustrate this Knockout tutorial, we will use the chat application.
- We will create a viewmodel that holds the current conversation.
- The view shall be updated as soon as the the viewmodel changes state.

The Chat Application


Chat program with PHP se
File Edit View History Bookmarks Tools He
Chat program with ...
localhost/chat-jquery-ko-aj
Disable Cookies CSS Forms Images Ir
Send
Load Entries
Delete

Type Here
Stina says:
Write your entry here.

Conversation

Stina:
Hi!

- To illustrate this Knockout tutorial, we will use the chat application.
- We will create a viewmodel that holds the current conversation.
- The view shall be updated as soon as the viewmodel changes state.
- The viewmodel can change state either because the user wrote an entry or because another user wrote an entry, which was loaded from the server to this user's viewmodel.

The Knockout Viewmodel

- The viewmodel is an ordinary JavaScript object, but to make use of Knockout's viewmodel-to-view binding (observer pattern), the properties must be declared as observables.

```
function Person(name, age) {
  let self = this;
  self.name = ko.observable(name);
  self.age = ko.observable(age);
}
```

The Knockout Viewmodel

- The viewmodel is an ordinary JavaScript object, but to make use of Knockout's viewmodel-to-view binding (observer pattern), the properties must be declared as observables.

```
function Person(name, age) {
  let self = this;
  self.name = ko.observable(name);
  self.age = ko.observable(age);
}
```

- To read or write a property value, call the property as a function.

```
let olle = new Person("Olle", 35);
olle.name();  // Returns "Olle"
olle.age(36); // Sets the age to 36.
```

The Chat Application’s Viewmodel

- The Chat’s viewmodel has two objects.

The Chat Application’s Viewmodel

- The Chat’s viewmodel has two objects.
  - **`EntryToAdd`** represents a newly written entry that shall be sent to the server.

The Chat Application's Viewmodel

- The Chat's viewmodel has two objects.
  - **`EntryToAdd`** represents a newly written entry that shall be sent to the server.
  - **`Conversation`** represents the entire conversation.

The Chat Application's Viewmodel

- The Chat's viewmodel has two objects.
  - **EntryToAdd** represents a newly written entry that shall be sent to the server.
  - **Conversation** represents the entire conversation.
- The **EntryToAdd** object has two properties, **nickName** and **msg**

```
function EntryToAdd() {
    let self = this;
    self.nickName = ko.observable();
    self.msg = ko.observable("");
    ...
}
```

The Chat Application’s Viewmodel (Cont’d)

```
let entryToAdd = new EntryToAdd();
ko.applyBindings(entryToAdd,
                 document.getElementById('new-entry'));
```

- The viewmodel must be registered with Knockout to enable notifying the observers in the view.

The Chat Application’s Viewmodel (Cont’d)

```
let entryToAdd = new EntryToAdd();
ko.applyBindings(entryToAdd,
                 document.getElementById('new-entry'));
```

- The viewmodel must be registered with Knockout to enable notifying the observers in the view.
- After a JavaScript object has been registered with knockout using the function **`applyBindings`**, it will always have the same state as the elements in the DOM.

The Chat Application's Viewmodel (Cont'd)

```
let entryToAdd = new EntryToAdd();
ko.applyBindings(entryToAdd,
                 document.getElementById('new-entry'));
```

- The viewmodel must be registered with Knockout to enable notifying the observers in the view.
- After a JavaScript object has been registered with knockout using the function **`applyBindings`**, it will always have the same state as the elements in the DOM.
  - When the object changes state, the DOM will change state. When the DOM changes state, the object will change state.

The Chat Application's Viewmodel (Cont'd)

```
let entryToAdd = new EntryToAdd();
ko.applyBindings(entryToAdd,
                 document.getElementById('new-entry'));
```

- The viewmodel must be registered with Knockout to enable notifying the observers in the view.
- After a JavaScript object has been registered with knockout using the function **`applyBindings`**, it will always have the same state as the elements in the DOM.
  - When the object changes state, the DOM will change state. When the DOM changes state, the object will change state.
- The second parameter tells to which element in the DOM **`entryToAdd`** shall be bound. There can only be at most one bound object per element.

Data Bindings

- A HTML element in the view is connected to a viewmodel property with a binding.

Data Bindings

- A HTML element in the view is connected to a viewmodel property with a binding.
- A binding is declared by adding the **`data-bind`** attribute to the HTML element.

Data Bindings

- A HTML element in the view is connected to a viewmodel property with a binding.
- A binding is declared by adding the **`data-bind`** attribute to the HTML element.
- There are many different types of bindings, like:

Data Bindings

- A HTML element in the view is connected to a viewmodel property with a binding.
- A binding is declared by adding the **data-bind** attribute to the HTML element.
- There are many different types of bindings, like:

text	The property value is inserted to the HTML element.

```
The message is:
<span data-bind="text: msg"></span>
```

Data Bindings

- A HTML element in the view is connected to a viewmodel property with a binding.
- A binding is declared by adding the **`data-bind`** attribute to the HTML element.
- There are many different types of bindings, like:

text
: The property value is inserted to the HTML element.

```
The message is:
<span data-bind="text: msg"></span>
```

visible
: Decides if the element is rendered.

```
<div data-bind=
   "visible: shouldShowMessage">
```

Data Bindings

- A HTML element in the view is connected to a viewmodel property with a binding.
- A binding is declared by adding the **`data-bind`** attribute to the HTML element.
- There are many different types of bindings, like:

text
: The property value is inserted to the HTML element.

```
The message is:
<span data-bind="text: msg"></span>
```

visible
: Decides if the element is rendered.

```
<div data-bind=
   "visible: shouldShowMessage">
```

css
: Adds or removes CSS classes. The following binding adds the class **`warning`** if the **`profit`** property is negative.

```
<div data-bind=
   "css: {warning: profit() < 0 }">
```

Form Field Bindings

There are also bindings for form elements, such as:

click	Specifies a method that is called when the element is clicked.

```
<button data-bind=
   "click: clickHandler">Click me</button>
```

Form Field Bindings

There are also bindings for form elements, such as:

click
: Specifies a method that is called when the element is clicked.

```
<button data-bind=
   "click: clickHandler">Click me</button>
```

textInput
: Binds a text field or text area to a viewmodel property

```
<input type="text"
   data-bind="textInput: username"/>
```

Form Field Bindings

There are also bindings for form elements, such as:

click
: Specifies a method that is called when the element is clicked.

```
<button data-bind=
   "click: clickHandler">Click me</button>
```

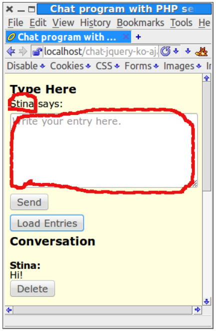
textInput
: Binds a text field or text area to a viewmodel property

```
<input type="text"
   data-bind="textInput: username"/>
```

enable
: The element is enabled only when the value is **`true`**

```
Your cellphone number:
<input type='text' data-bind=
   "textInput: cellphoneNumber, enable: hasCellphone"/>
```

Chat Message Data-Bindings


Chat program with PHP se
File Edit View History Bookmarks Tools He
Chat program with ...
localhost/chat-jquery-ko-aj
Disable Cookies CSS Forms Images

Type Here

Stina says:

Write your entry here.

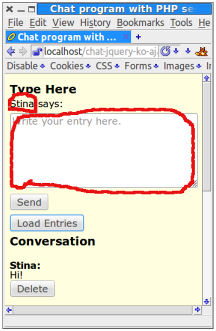
Conversation

Stina:
Hi!

- Now let us create the data bindings for the nick name text and msg text area.

```
<label id="nickNameLabel" for="entry">
    <span data-bind="text: nickName">
    </span>
    says:
</label>
...
<textarea id= "entry" rows = 5
          data-bind="textInput: msg"
          placeholder="Write entry here.">
</textarea>
```

Chat Message Data-Bindings


Chat program with PHP se
File Edit View History Bookmarks Tools He
Chat program with ...
localhost/chat-jquery-ko-aj
Disable Cookies CSS Forms Images
Send
Load Entries
Delete

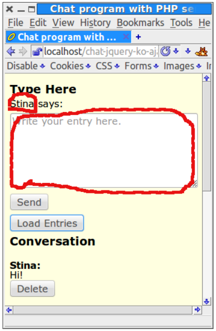
Type Here
Stina says:
Write your entry here.
Conversation
Stina:
Hi!

- Now let us create the data bindings for the nick name text and msg text area.

```
<label id="nickNameLabel" for="entry">
    <span data-bind="text: nickName">
    </span>
    says:
</label>
...
<textarea id= "entry" rows = 5
          data-bind="textInput: msg"
          placeholder="Write entry here.">
</textarea>
```

- Now the **`nickname`** element and the **`nickName`** property in the **`EntryToAdd`** object will always have the same value.

Chat Message Data-Bindings


Chat program with PHP se
File Edit View History Bookmarks Tools He
Chat program with ...
localhost/chat-jquery-ko-aj
Disable Cookies CSS Forms Images
Send
Load Entries
Delete

Type Here
Stina says:
Write your entry here.

Conversation

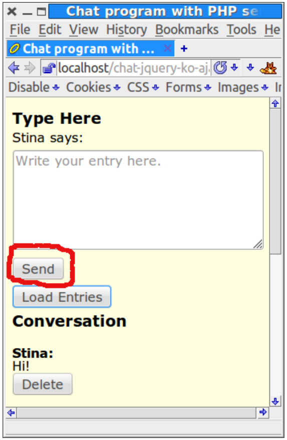
Stina:
Hi!

- Now let us create the data bindings for the nick name text and msg text area.

```
<label id="nickNameLabel" for="entry">
    <span data-bind="text: nickName">
    </span>
    says:
</label>
...
<textarea id= "entry" rows = 5
          data-bind="textInput: msg"
          placeholder="Write entry here.">
</textarea>
```

- Now the **`nickname`** element and the **`nickName`** property in the **`EntryToAdd`** object will always have the same value.
- Also, the text in the textarea will always be the same as the value of the **`msg`** property.

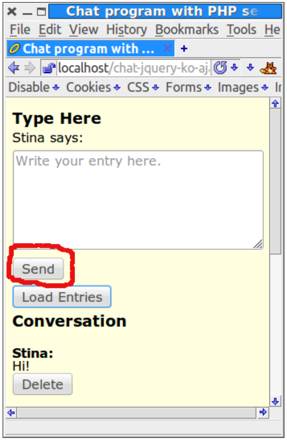
Click Data-Bindings



```
<button data-bind="click: sendEntry">
  Send
</button>
```

- Then let us create the data-binding for the Send button.

Click Data-Bindings


Chat program with PHP se
File Edit View History Bookmarks Tools He
Chat program with ...
localhost/chat-jquery-ko-aj
Disable Cookies CSS Forms Images

Type Here
Stina says:
Write your entry here.
Send
Load Entries
Conversation
Stina:
Hi!
Delete

```
<button data-bind="click: sendEntry">
  Send
</button>
```

- Then let us create the data-binding for the Send button.
- Here we specified that the **`sendEntry`** method is called when the user clicks the button.

The **sendEntry** Method

```
1  self.sendEntry = function () {
2      if (self.msg() !== "") {
3          $.post(writeUrl,
4                 "msg=" + ko.toJS(self.msg));
5          self.msg("");
6      }
7  };
```

- Line 2 checks that the user has typed a message.

The **`sendEntry`** Method

```
1  self.sendEntry = function () {
2      if (self.msg() !== "") {
3          $.post(writeUrl,
4                  "msg=" + ko.toJS(self.msg));
5          self.msg("");
6      }
7  };
```

- Line 2 checks that the user has typed a message.
- Lines 3-4 sends the new entry to the server in a HTTP **`post`** request.

The **sendEntry** Method

```
1  self.sendEntry = function () {
2      if (self.msg() !== "") {
3          $.post(writeUrl,
4                 "msg=" + ko.toJS(self.msg));
5          self.msg("");
6      }
7  };
```

- Line 2 checks that the user has typed a message.
- Lines 3-4 sends the new entry to the server in a HTTP **`post`** request.
- The call to **`ko.toJS`** on line 4 converts the message to plain JavaScript, instead of an observable.

The **sendEntry** Method

```
1  self.sendEntry = function () {
2      if (self.msg() !== "") {
3          $.post(writeUrl,
4                 "msg=" + ko.toJS(self.msg));
5          self.msg("");
6      }
7  };
```

- Line 2 checks that the user has typed a message.
- Lines 3-4 sends the new entry to the server in a HTTP **post** request.
- The call to **ko.toJS** on line 4 converts the message to plain JavaScript, instead of an observable.
- Line 5 clears the text area.

Read Nickname From Server

- One question remains, how did the nickname show up correctly in the view? Note that it is not inserted in php code on the server (very good!):

```
<label id="nickNameLabel" for="entry">
    <span data-bind="text: nickName">
    </span>
    says:
</label>
```

Read Nickname From Server

- One question remains, how did the nickname show up correctly in the view? Note that it is not inserted in php code on the server (very good!):

```
<label id="nickNameLabel" for="entry">
    <span data-bind="text: nickName">
    </span>
    says:
</label>
```

- The answer is that the nickname was read in an extra AJAX call from the **`EntryToAdd`** constructor.

```
function EntryToAdd() {
    let self = this;
    self.nickName = ko.observable();
    ...
    $.getJSON(nickNameUrl, function (username) {
        self.nickName(username);
    });
}
```

Read Nickname From Server (Cont'd)

- The ajax call on the previous slide is handled by the **`GetUsername`** request handler (code below is not complete).

```
class GetUsername extends AbstractRequestHandler {

    protected function doExecute() {
        $this->addVariable('jsonData',
                           $contr->getUsername());
        return 'json-view';
    }

}
```

Read Nickname From Server (Cont'd)

- The ajax call on the previous slide is handled by the **GetUsername** request handler (code below is not complete).

```
class GetUsername extends AbstractRequestHandler {

    protected function doExecute() {
        $this->addVariable('jsonData',
                                $contr->getUsername());
        return 'json-view';
    }

}
```

- **json-view.php** just echos the value of **$jsonData**.

```
echo \json_encode($jsonData);
```

The **`Conversation`** object in the viewmodel

- Now we have covered everything in the **`EntryToAdd`** object in the viewmodel.

The **`Conversation`** object in the viewmodel

- Now we have covered everything in the **`EntryToAdd`** object in the viewmodel.
- There is one more object in the viewmodel, **`Conversation`**, which contains the entire chat conversation.

The **`Conversation`** object in the viewmodel

- Now we have covered everything in the **`EntryToAdd`** object in the viewmodel.
- There is one more object in the viewmodel, **`Conversation`**, which contains the entire chat conversation.
- **`Conversation`** has a property, **`entries`** that holds an array of all conversation entries.

The **`Conversation`** object in the viewmodel

- Now we have covered everything in the **`EntryToAdd`** object in the viewmodel.
- There is one more object in the viewmodel, **`Conversation`**, which contains the entire chat conversation.
- **`Conversation`** has a property, **`entries`** that holds an array of all conversation entries.
- To understand how that works, we must look at how knockout binds arrays to elements in the DOM.

Observable Arrays

- To observe an array, use **`observableArray`**.

```
let myObservableArray = ko.observableArray();
```

Observable Arrays

- To observe an array, use **`observableArray`**.

```
let myObservableArray = ko.observableArray();
```

- The **`entries`** property in **`Conversation`** is an **`observableArray`** and holds an array of objects having the two properties **`nickName`** and **`msg`**

```
function Conversation(entryToAdd) {
    let self = this;
    ...
    self.entries = ko.observableArray();
    ...
}
```

Flow Control Data-Bindings

- When binding **`entries`** to the DOM, we must use the flow control data bindings **`if`** and **`foreach`**. Let's first have a look at those.

Flow Control Data-Bindings

- When binding **`entries`** to the DOM, we must use the flow control data bindings **`if`** and **`foreach`**. Let's first have a look at those.
- **`foreach`** binds each element in an array to the DOM.

Flow Control Data-Bindings

- When binding `entries` to the DOM, we must use the flow control data bindings `if` and `foreach`. Let's first have a look at those.
- `foreach` binds each element in an array to the DOM.
- Whenever elements are added, removed, or re-ordered in a bound observable array, the DOM will be updated to reflect the new array contents.

foreach Data-Binding (Cont'd)

Assuming **people** is a JavaScript array of objects with **firstName** and **lastName** properties, the following generates a table with one object per row.

```
<table>
  <thead>
      <tr><th>First name</th>
      <th>Last name</th></tr>
  </thead>
  <tbody data-bind="foreach: people">
      <tr>
          <td data-bind="text: firstName"></td>
          <td data-bind="text: lastName"></td>
      </tr>
  </tbody>
</table>
```

foreach Data-Binding (Cont'd)

- The current array element is referred using **$data**

```
<ul data-bind="foreach: months">
  <li>
    <span data-bind="text: $data"></span>
  </li>
</ul>
```

n>

foreach Data-Binding (Cont'd)

- The current array element is referred using **$data**

```
<ul data-bind="foreach: months">
  <li>
    <span data-bind="text: $data"></span>
  </li>
</ul>
```

- **as** gives an alias to the current array element.

```
<ul data-bind=
     "foreach: { data: categories, as: 'category' }">
    <li>
        <ul data-bind=
             "foreach: { data: items, as: 'item' }">
            <li>
                <span data-bind="text: category.name">
                </span>:
                <span data-bind="text: item.name"></span>
            </li>
        </ul>
    </li>
</ul>
```

Containerless Control Flow Syntax

- If there is no containing element for the data-binding, use the containerless syntax, based on HTML comment tags.

```
<!-- ko foreach: {data:items, as:'item'} -->
    <p>
        <span data-bind="text:item.price">
        </span>
    </p>
<!-- /ko -->
```

Containerless Control Flow Syntax

- If there is no containing element for the data-binding, use the containerless syntax, based on HTML comment tags.

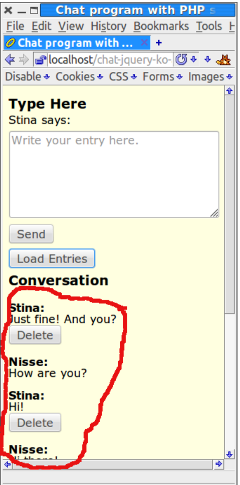
```
<!-- ko foreach: {data:items, as:'item'} -->
    <p>
        <span data-bind="text:item.price">
        </span>
    </p>
<!-- /ko -->
```

- An **`if`** data-binding displays the enclosed elements only if the condition is true.

```
<!-- ko if: item.isOffer -->
  <p>
    Offer!
  </p>
<!-- /ko -->
```

The Conversation Data-Binding

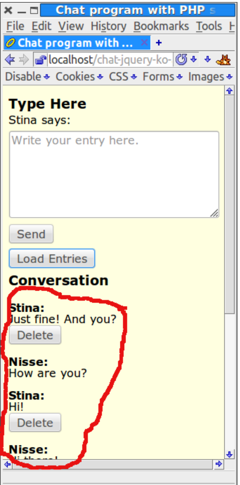
- Now we can create the data binding for the conversation part of the chat application (code is not complete).


Type Here
Stina says:
Write your entry here.
Send
Load Entries
Conversation
Stina:
Just fine! And you?
Delete
Nisse:
How are you?
Stina:
Hi!
Delete
Nisse:
Chat program with PHP
File Edit View History Bookmarks Tools
Chat program with ...
localhost/chat-jquery-ko-
Disable Cookies CSS Forms Images

```
<!-- ko foreach: {data: entries, as: 'entry'} -->
  <p>
    <span data-bind='text: entry.nickName'></span>:
  </p>
  <!-- ko foreach: entry.msg -->
    <p>
        <span data-bind='text: $data'></span>
    </p>
  <!-- /ko -->
  <!-- ko if: entry.iWroteThisEntry -->
    <p>
        <button data-bind=
                'click: $parent.deleteEntry'>
            Delete
        </button>
    </p>
  <!-- /ko -->
<!-- /ko -->
```

The Conversation Data-Binding

- Now we can create the data binding for the conversation part of the chat application (code is not complete).
- The inner loop is needed for multi-line messages.



Type Here
Stina says:
Write your entry here.
Send
Load Entries
Conversation
Stina:
Just fine! And you?
Delete
Nisse:
How are you?
Stina:
Hi!
Delete
Nisse:

Chat program with PHP
File Edit View History Bookmarks Tools
Chat program with ...
localhost/chat-jquery-ko-
Disable Cookies CSS Forms Images

```
<!-- ko foreach: {data: entries, as: 'entry'} -->
  <p>
    <span data-bind='text: entry.nickName'></span>:
  </p>
  <!-- ko foreach: entry.msg -->
    <p>
        <span data-bind='text: $data'></span>
    </p>
  <!-- /ko -->
  <!-- ko if: entry.iWroteThisEntry -->
    <p>
        <button data-bind=
                'click: $parent.deleteEntry'>
            Delete
        </button>
    </p>
  <!-- /ko -->
<!-- /ko -->
```

No PHP! (Almost)

- That was all, now we have seen an overview of some features in Knockout, and also created the chat application.

No PHP! (Almost)

- That was all, now we have seen an overview of some features in Knockout, and also created the chat application.
- As a result, there is now no PHP code left in the html files!

No PHP! (Almost)

- That was all, now we have seen an overview of some features in Knockout, and also created the chat application.
- As a result, there is now no PHP code left in the html files!
    - Except for including fragments and creating link paths.

Without JavaScript framework

Without a JavaScript framework that handles viewmodel-to-DOM bindings, where would we store the nickname and chat conversation? There are three options, each with serious drawbacks.

Without JavaScript framework

Without a JavaScript framework that handles viewmodel-to-DOM bindings, where would we store the nickname and chat conversation? There are three options, each with serious drawbacks.

1. Write the JavaScript code that is now in the framework. This means quite a lot of quite tricky handling of the DOM, knockout.js contains thousands of lines of JavaScript code.

Without JavaScript framework

Without a JavaScript framework that handles viewmodel-to-DOM bindings, where would we store the nickname and chat conversation? There are three options, each with serious drawbacks.

1. Write the JavaScript code that is now in the framework. This means quite a lot of quite tricky handling of the DOM, knockout.js contains thousands of lines of JavaScript code.
2. Do not create a viewmodel, but store the data only in the DOM. This is the case in the chat example without knockout on the course web. Even for this small program it means quite a lot of searching through HTML elements and parsing string.

Without JavaScript framework

Without a JavaScript framework that handles viewmodel-to-DOM bindings, where would we store the nickname and chat conversation? There are three options, each with serious drawbacks.

1. Write the JavaScript code that is now in the framework. This means quite a lot of quite tricky handling of the DOM, knockout.js contains thousands of lines of JavaScript code.
2. Do not create a viewmodel, but store the data only in the DOM. This is the case in the chat example without knockout on the course web. Even for this small program it means quite a lot of searching through HTML elements and parsing string.
3. Store data only on the server. This means there is no JavaScript client at all, and we are back to reloading the entire page whenever the user does something.