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
- The Knockout JavaScript Framework
- Long Polling
- WebSocket

The Document Object Model, DOM

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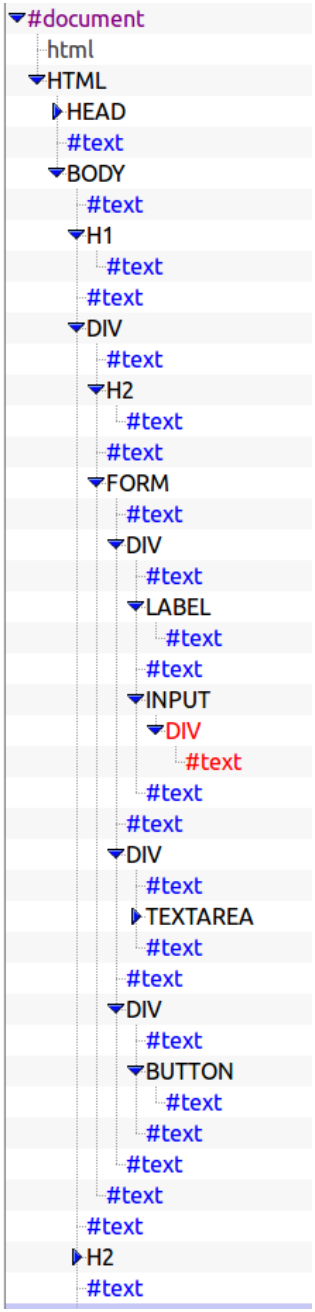
- Defines objects representing HTML elements, methods to access HTML elements, and events generated by HTML elements.
- The best that can be said about browser support is that it varies.
  - Try the features you want to use in all relevant browsers, check **`caniuse.com`**, etc

The DOM Tree



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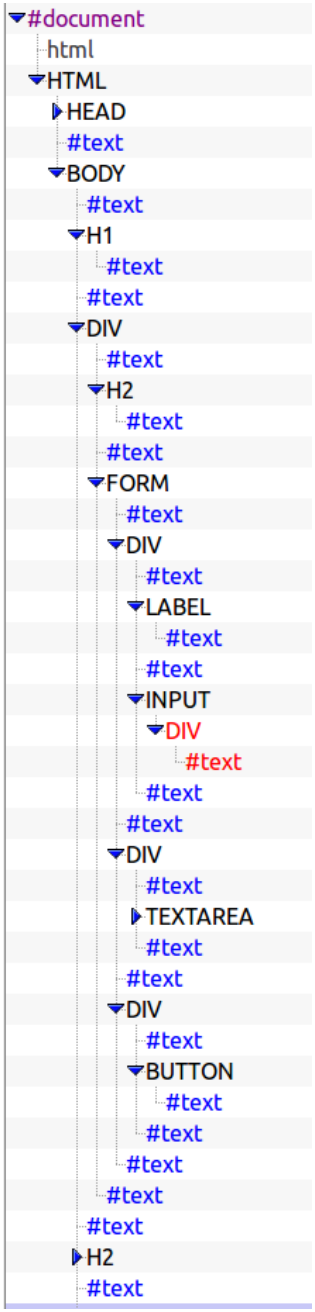

- The DOM objects are organized in a tree.
- The picture to the left is a part of the DOM tree for the course's chat program.

The DOM JavaScript API

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- 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

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

  Properties of HTML elements **`innerHTML`**, **`attribute`**

  Add or delete elements **`createElement`**, **`removeChild`**, **`appendChild`**

  Collections of HTML elements **`cookie`**, **`URL`**, **`elements`**, **`forms`**

Change CSS Rules

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```
document.getElementById(id).style.<property>
    = <some style>
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- For example, the statement

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

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

Events

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- 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`**

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

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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();
}
```

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

Event Listeners

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<button id="myBtn">Try it</button>
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```
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) {
   var curr = document.
      getElementById("event-log").innerHTML;
   document.getElementById("event-log").
      innerHTML = curr + " " + sourceNo;
}
```

Event Bubbling Example

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```

JavaScript:

```
function show(sourceNo) {
   var 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.

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```
<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) {
   var 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.

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

```
function show(sourceNo, event) {
   var 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.

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- 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

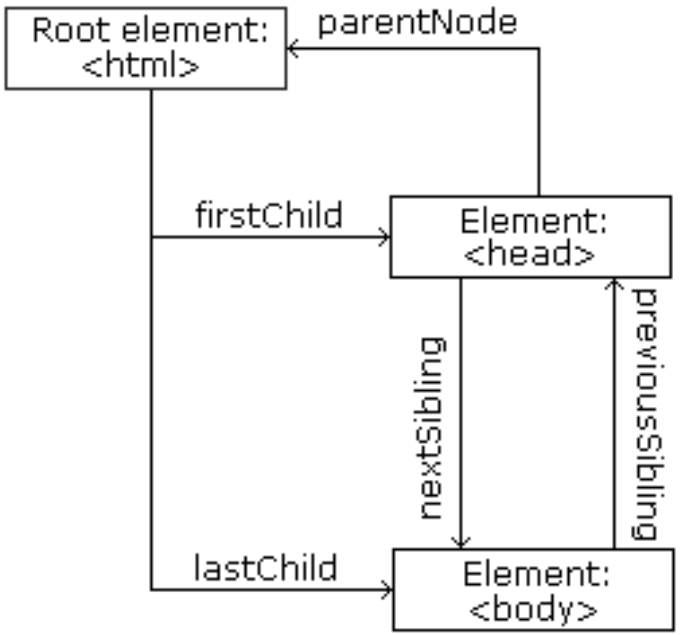

Image from
http://www.w3schools.com/js/js_htmldom_navigation.asp

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

Navigating the DOM Tree

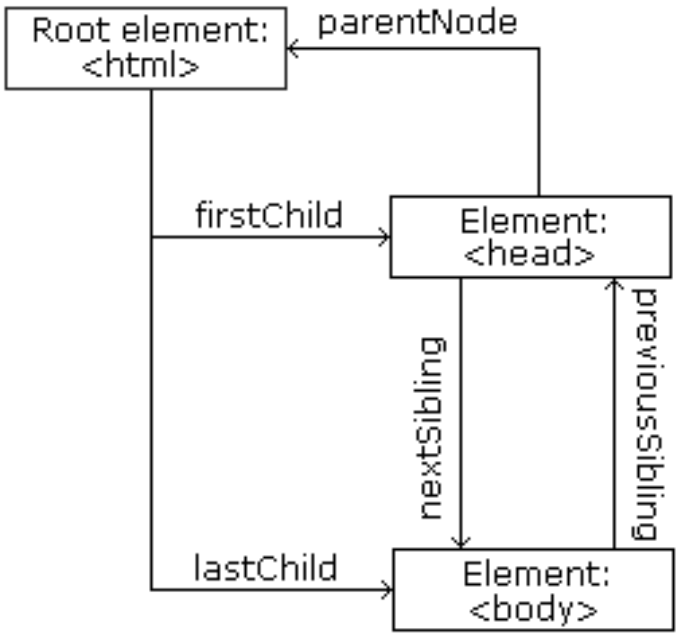

Image from
http://www.w3schools.com/js/js_htmldom_navigation.asp

- 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**:

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

Using **nodeValue**:

```
var 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>
```

```
var elem = document.createElement("p");
var 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>
```

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

Question 2

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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.

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- The **`location`** object has:
  - Properties that gives information about the current URL.
  - The **`assign`** method that loads a new document.

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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.

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The jQuery Library

- jQuery provides 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.

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- 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/
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- 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.

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- 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.
$("#someId") //All elements with id "someId"
$(div)        //All div elements.
```

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- Any CSS selector can be used as search criteria.

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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"". */
var 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

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- 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

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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"));
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CSS Rules

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$("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");
```

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  - The **`hide`** and **`show`** methods can hide/show elements. It is also possible to specify the speed of the (dis)appearance.
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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(){
  var 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.

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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
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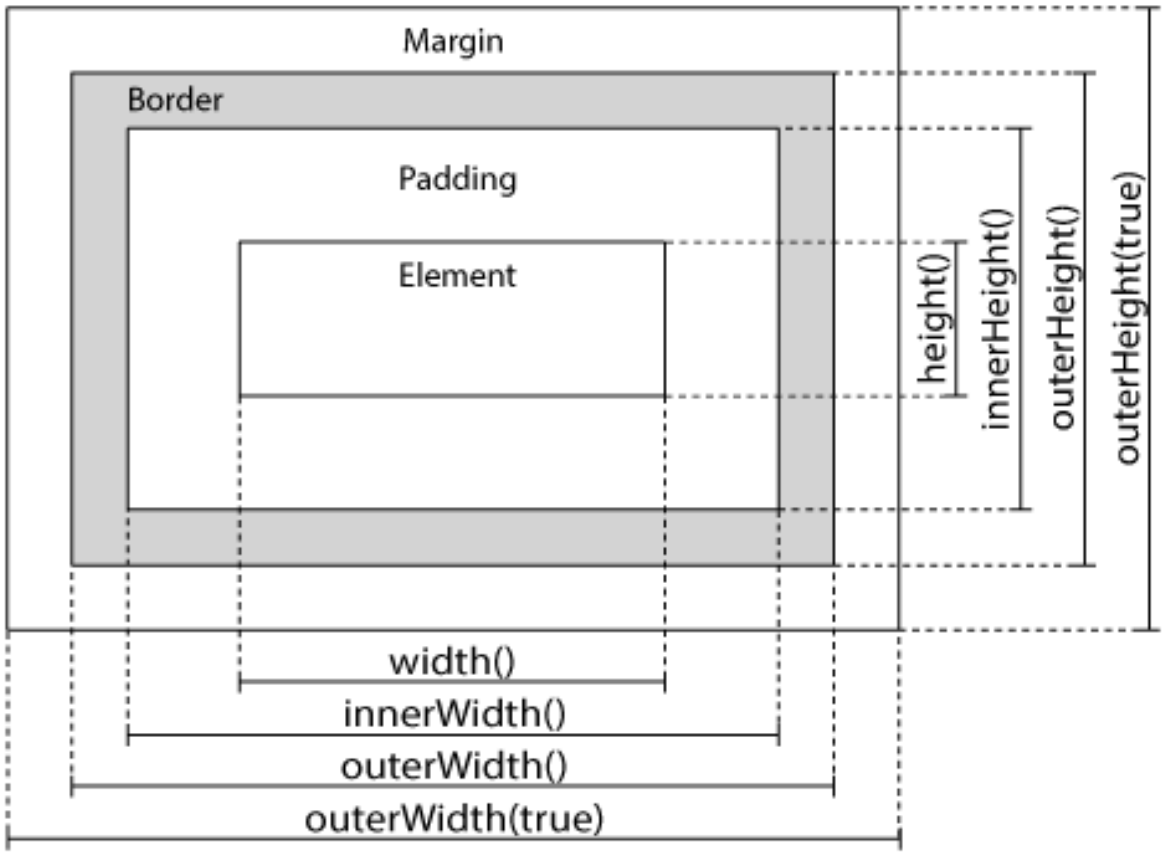
```

- 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.



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filtering The **`first`**, **`last`**, **`eq`**, and **`filter`** methods can be used to filter the search results of the methods above.

Question 3

Section

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

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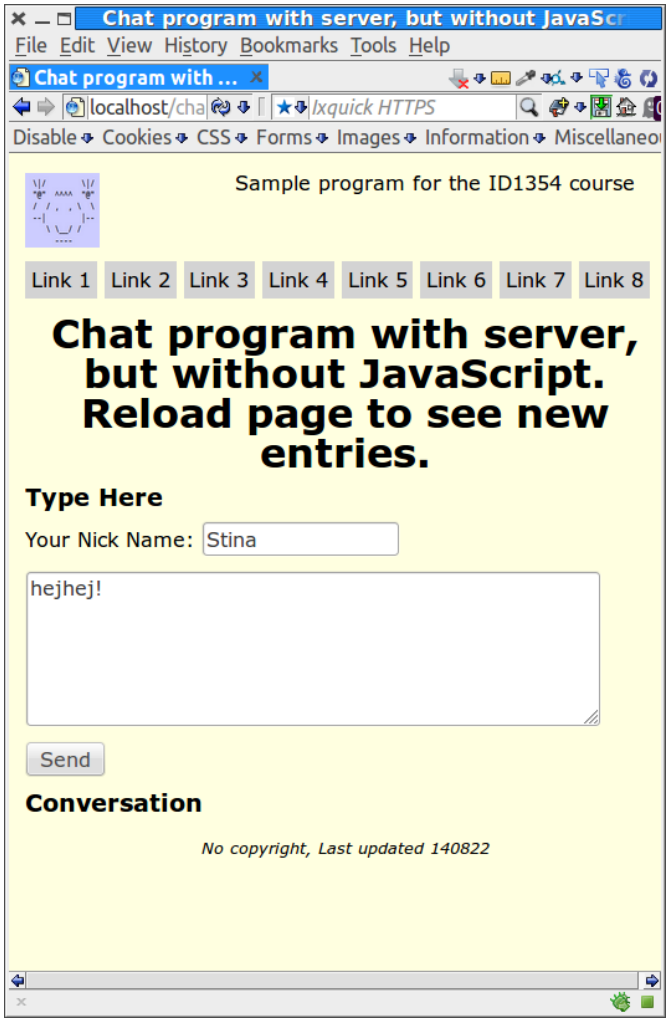
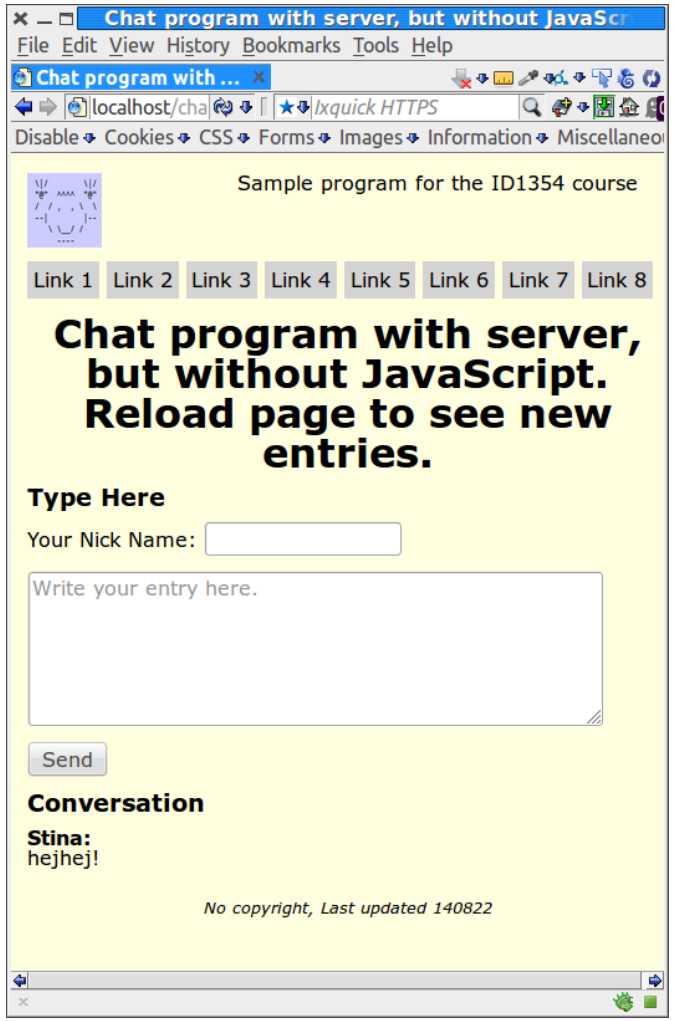
- Here, to load an entire page means that all HTML in the page is read from the server.
- Dynamic data is included on the server, before the HTML is sent to the client, for example using a PHP program.
- This behavior is appropriate if the entire page content really must change, but that is often not the case.

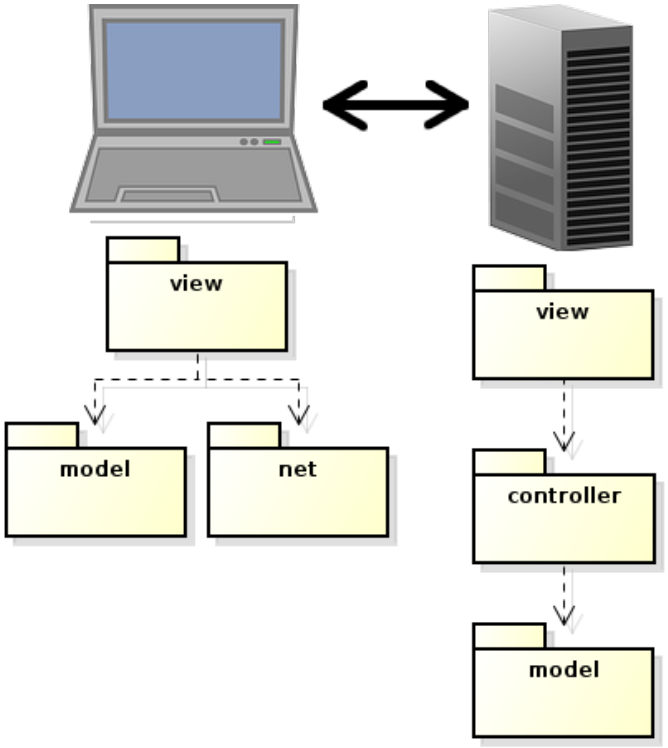
Loading an Entire Page





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



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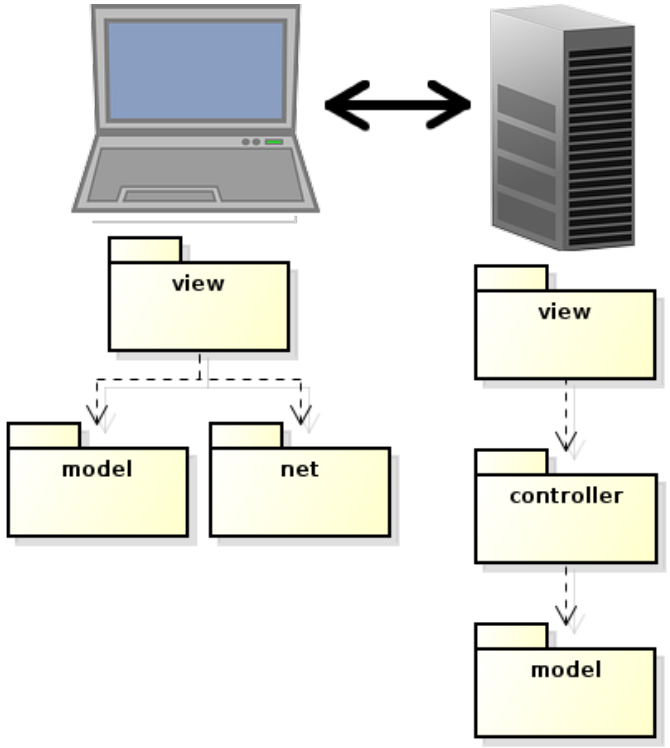

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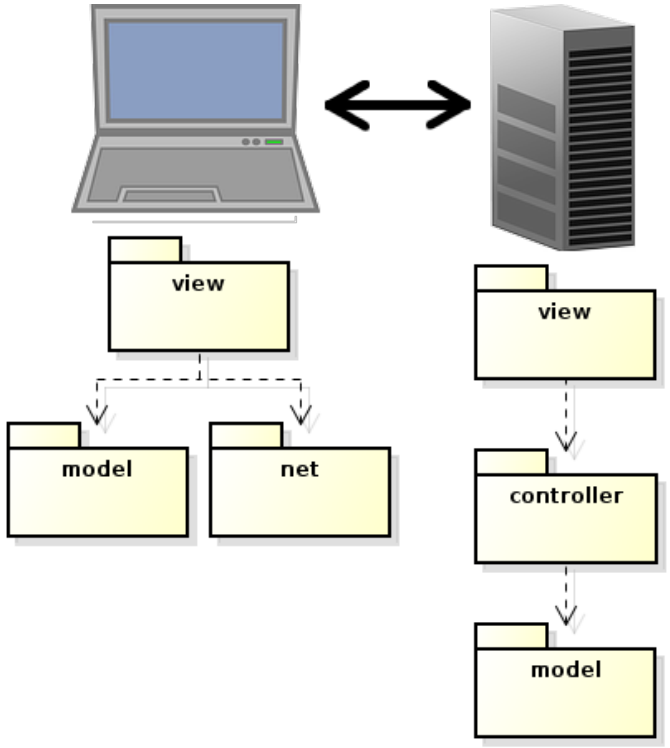

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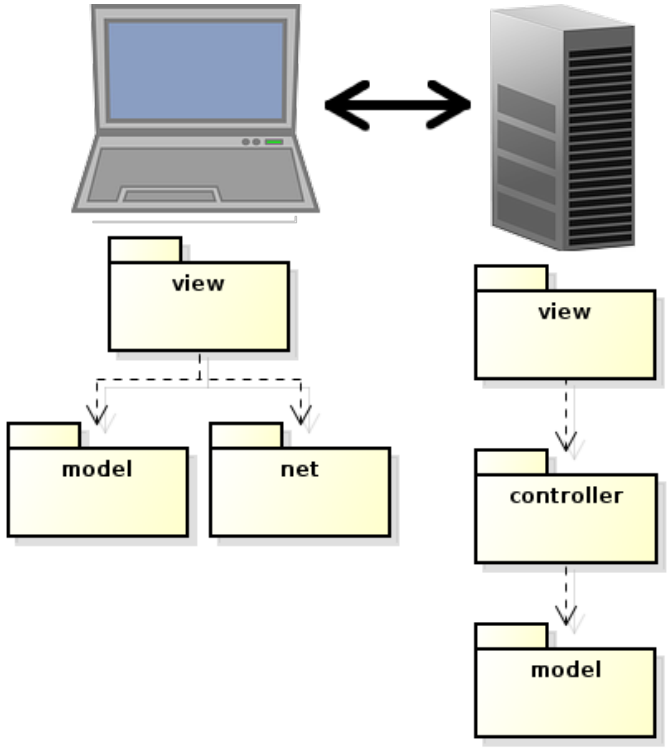

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- Therefore, the viewmodel will always contain the current state of the application.
- The browser view must reflect the viewmodel state, preferably using the observer pattern.

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- AJAX is basically a way to use existing technologies, such as JavaScript, HTTP and XML.
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- The only thing specific for AJAX is a JavaScript object, called **`XMLHttpRequest`**, which is standardized by W3C.

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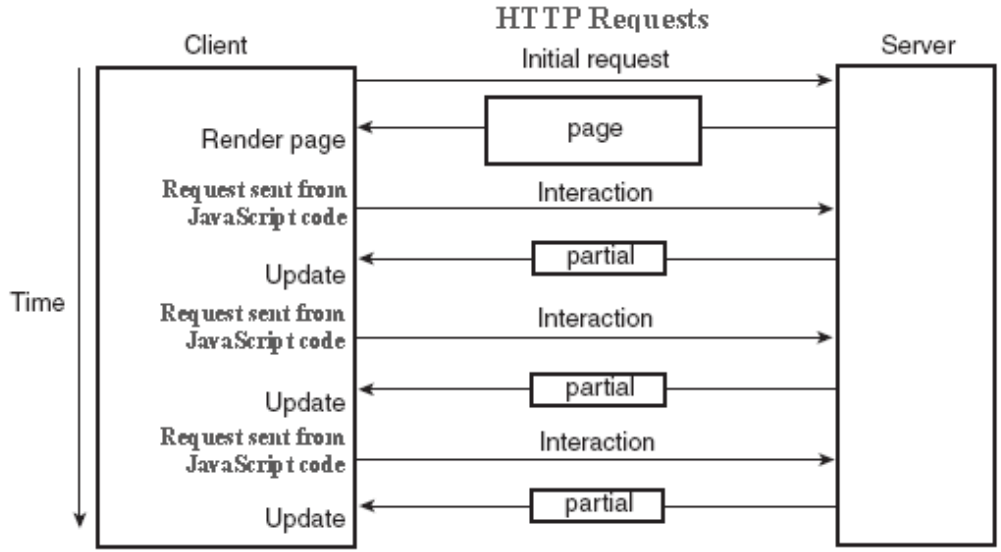

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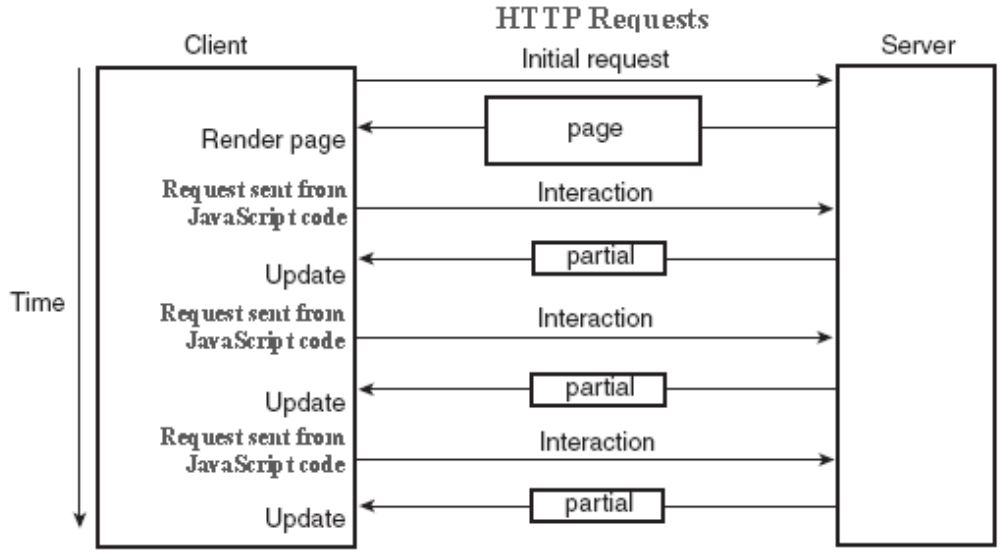

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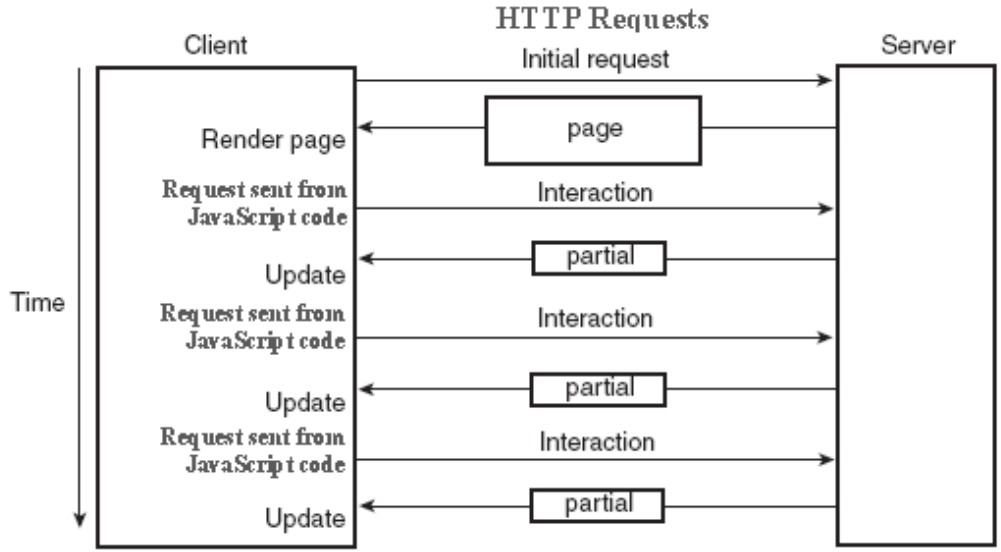

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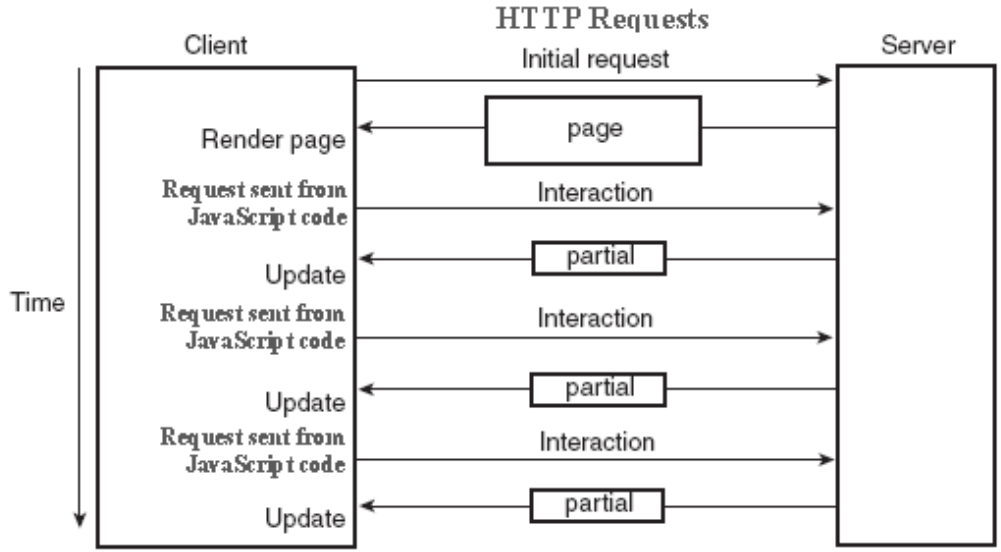

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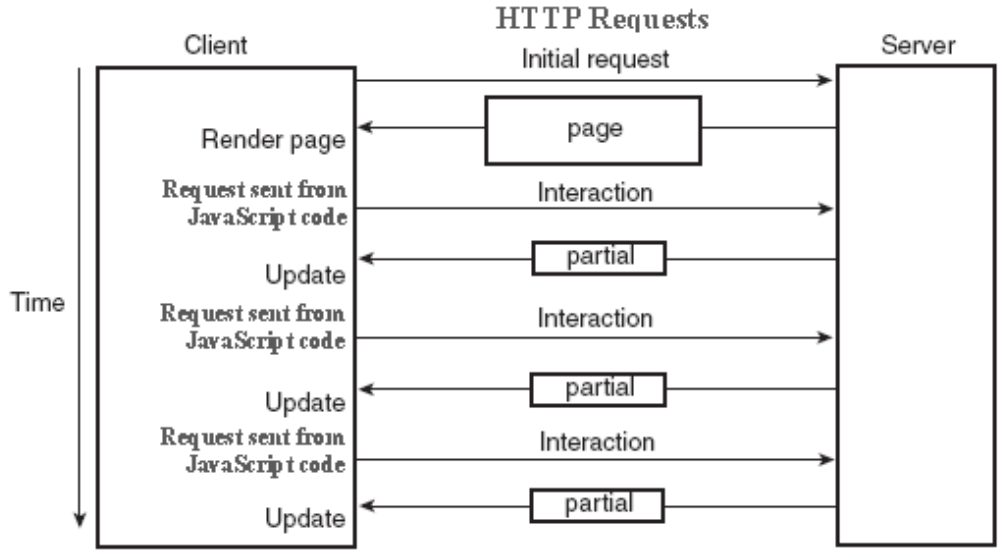

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- Returned data is available to JavaScript code, and is used to update the web page, by updating the DOM.

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- An AJAX request is normally handled by a program, for example PHP, which generates a response containing the new data.

Data Format

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  - 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.

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

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

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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)

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jQuery AJAX Methods (Cont'd)

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- jQuery has many more AJAX methods.

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

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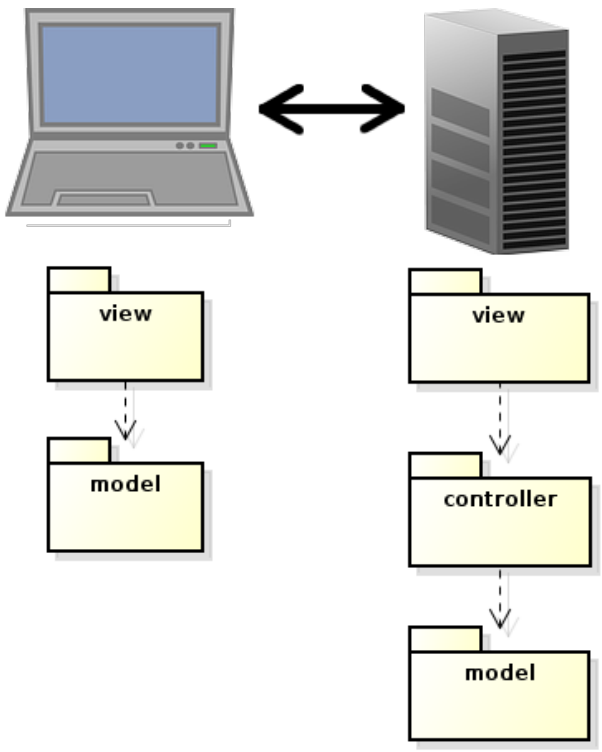
- The object that shall be JSON encoded must be of a class that implements **`JsonSerializable`**.
- That class must have a method called **`jsonSerialize`**, which returns an object containing all relevant fields.
- That returned object must be possible to encode with **`json_encode`**.

Question 4

Section

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

Reminder: The MVVM Pattern



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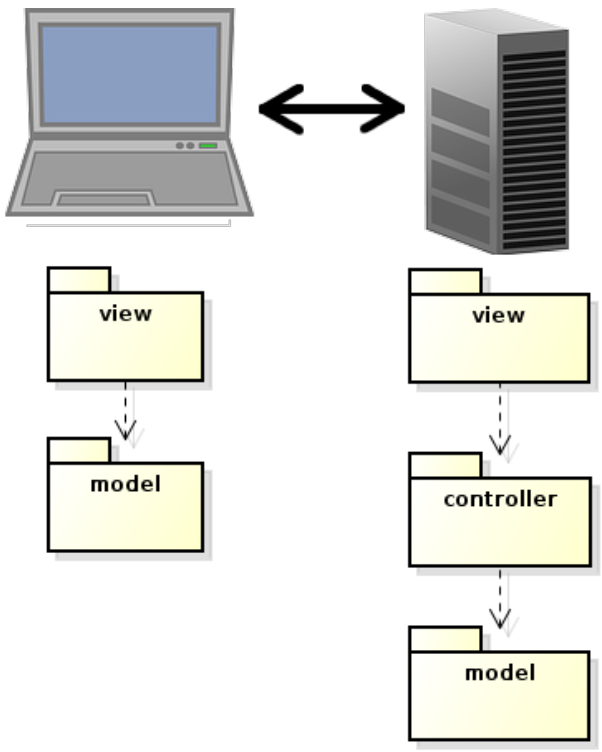

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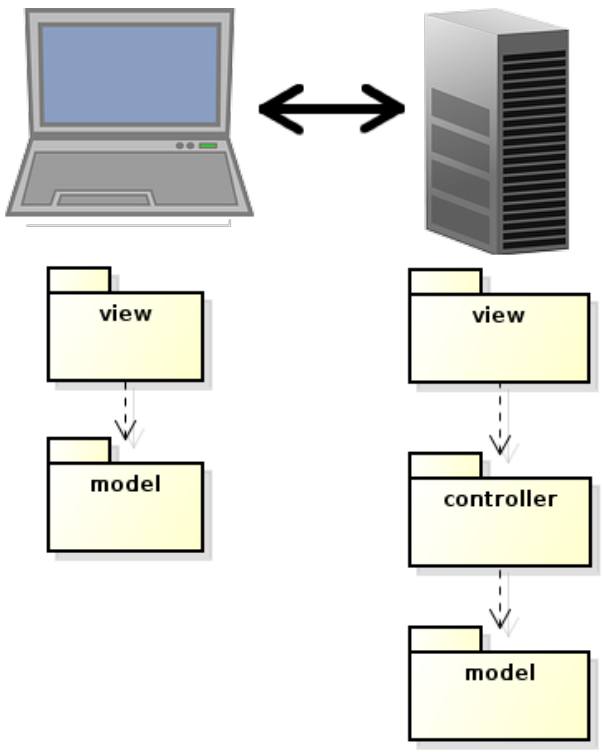

- The MVVM pattern intoduces a client-side model which reflects the server-side model and is responsible for notifying the view of updates.
- The server-side view is relieved from creating the HTML. There will not be PHP in the HTML files!
- Also, network communication is reduced, since only model updates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

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- 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, perhaps the most commonly used is Backbone. Backbone is 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:

```
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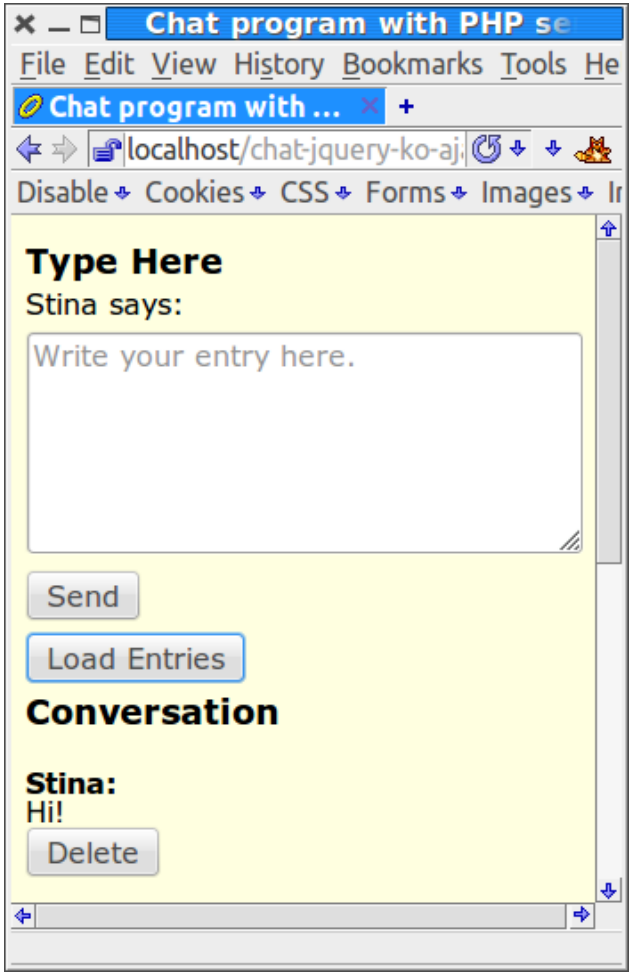
- The following slides contain a brief introduction to Knockout. For a more extensive guide, see **http://knockoutjs.com/documentation/introduction.html**

The Chat Application



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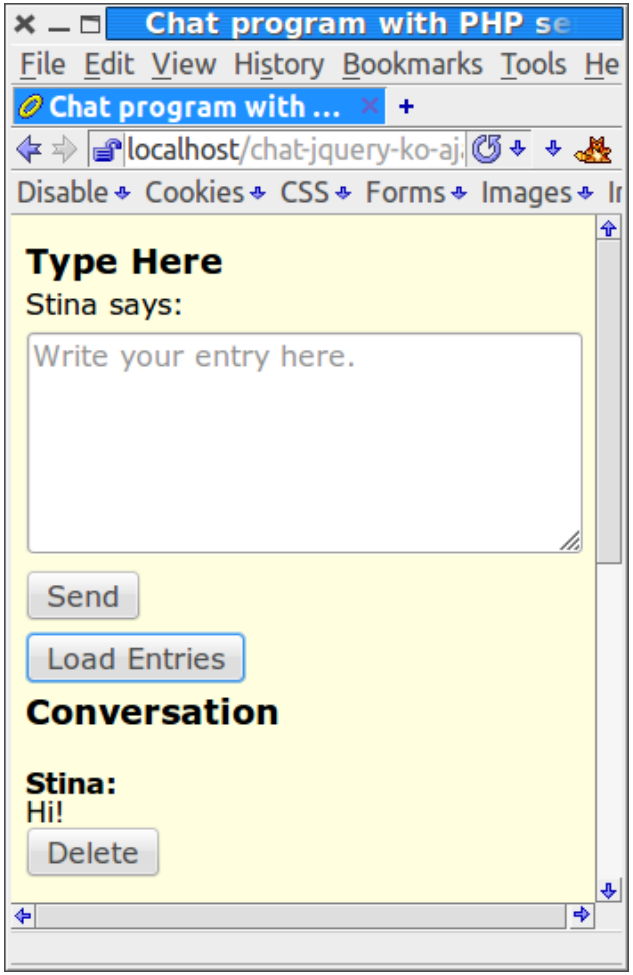

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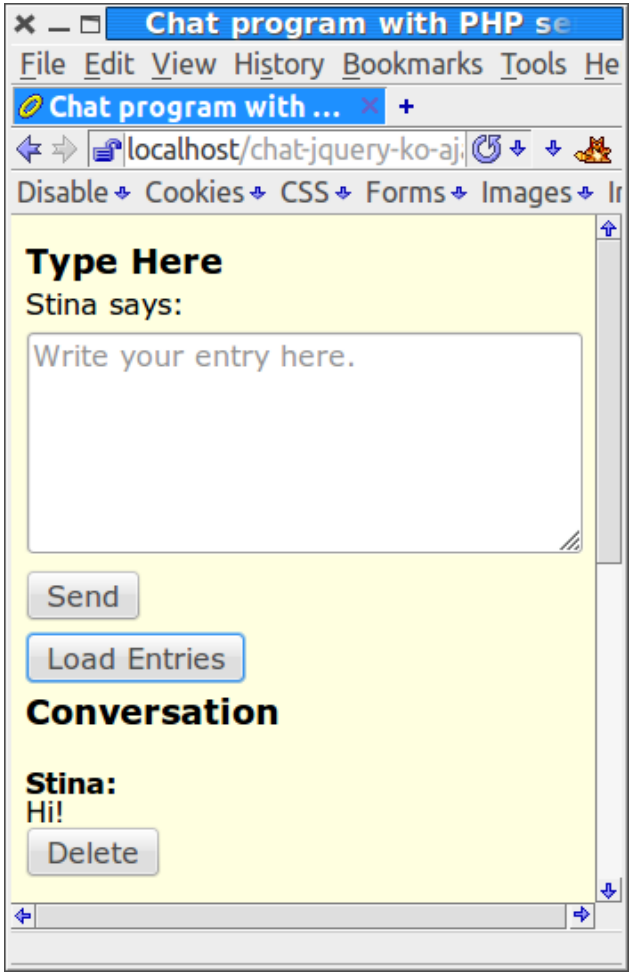

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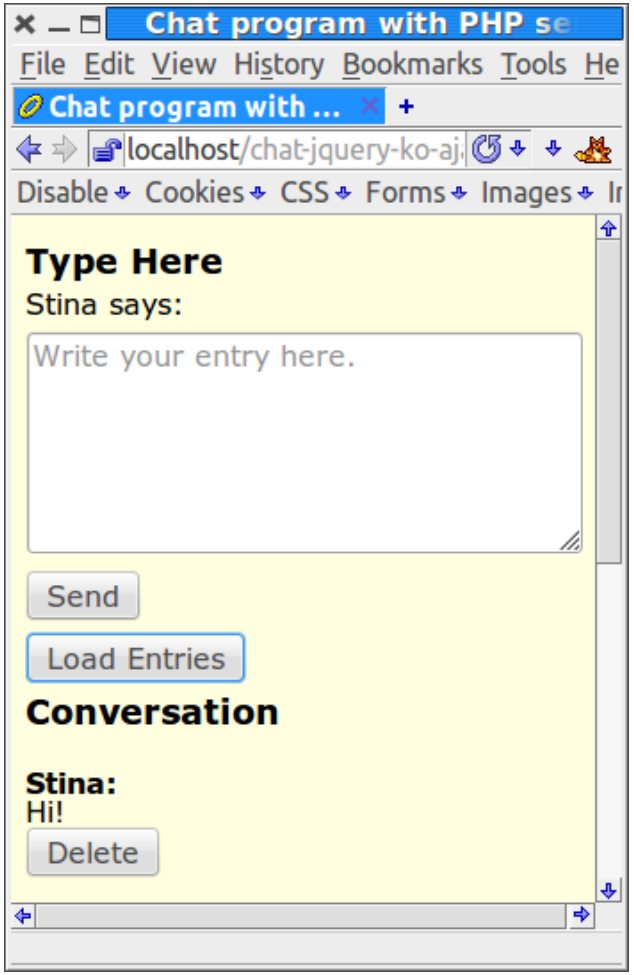

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- We will create a viewmodel that holds the current conversation.
- The view shall be updated as soon as the viewmodel changes state.
- The viewmodel can change state either because the user wrote an entry or because another user wrote an entry, which 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.

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function Person(name, age) {
  var self = this;
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- To read or write a property value, call the property as a function.

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

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  - **`Conversation`** represents the entire conversation.
- The **`EntryToAdd`** object has two properties, **`nickName`** and **`msg`**

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

The Chat Application's Viewmodel (Cont'd)

```
var 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)


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var entryToAdd = new EntryToAdd();
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- 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.

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- 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.

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- 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

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The message is:
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```
The message is:
<span data-bind="text: msg"></span>
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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>
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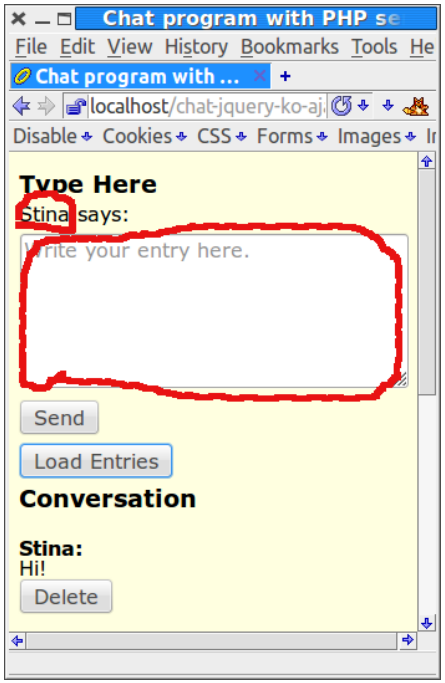
textInput Binds a text field or text area to a viewmodel property

```
<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"/>
```

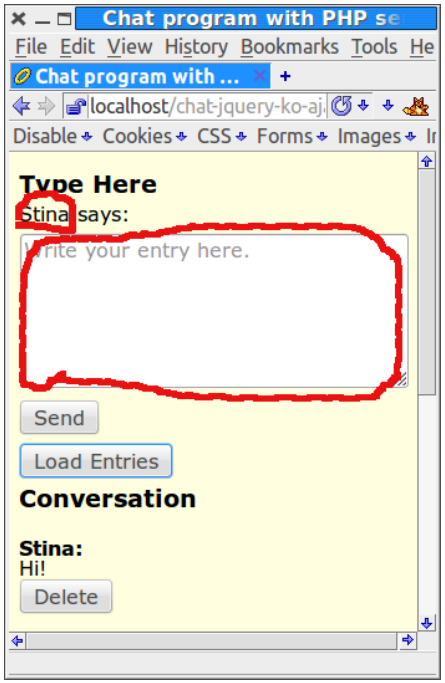
Value Data-Bindings



- 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>
```

Value Data-Bindings



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

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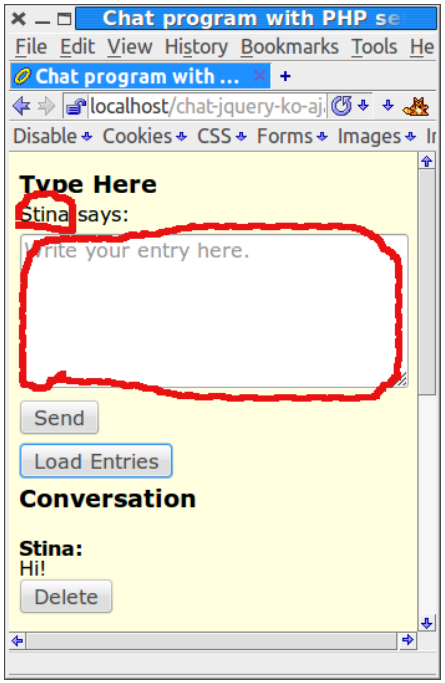

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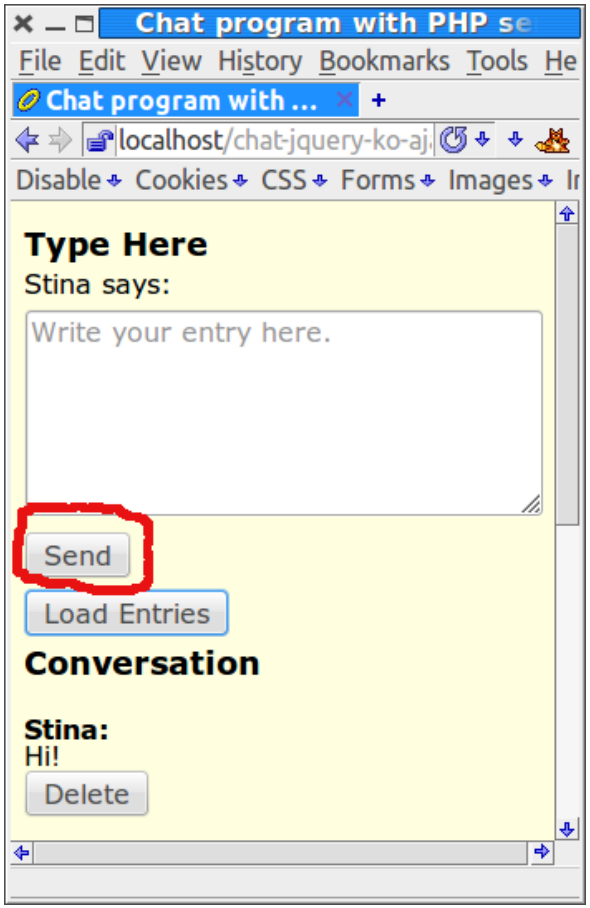
```

- 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

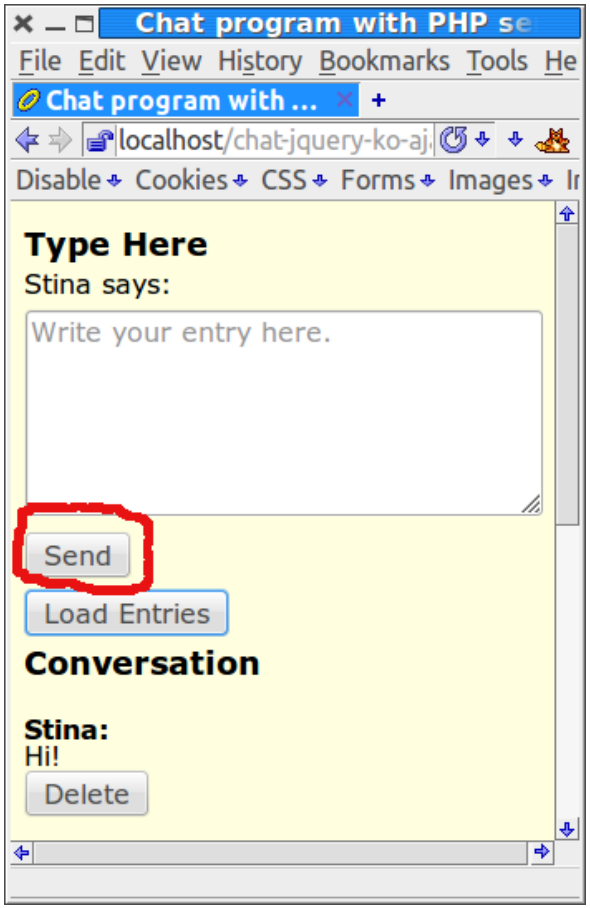
Click Data-Bindings




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

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

Click Data-Bindings




```
<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

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- Lines 3-4 sends the new entry to the server in a HTTP **`post`** request.

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- 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 JSON format.
- 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">
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    <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() {
    var 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)

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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.

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- 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`**.

```
var myObservableArray = ko.observableArray();
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```
var 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) {
    var 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.

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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 to 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>
```

`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"></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 -->
```

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<!-- ko foreach: {data:items, as:'item'} -->
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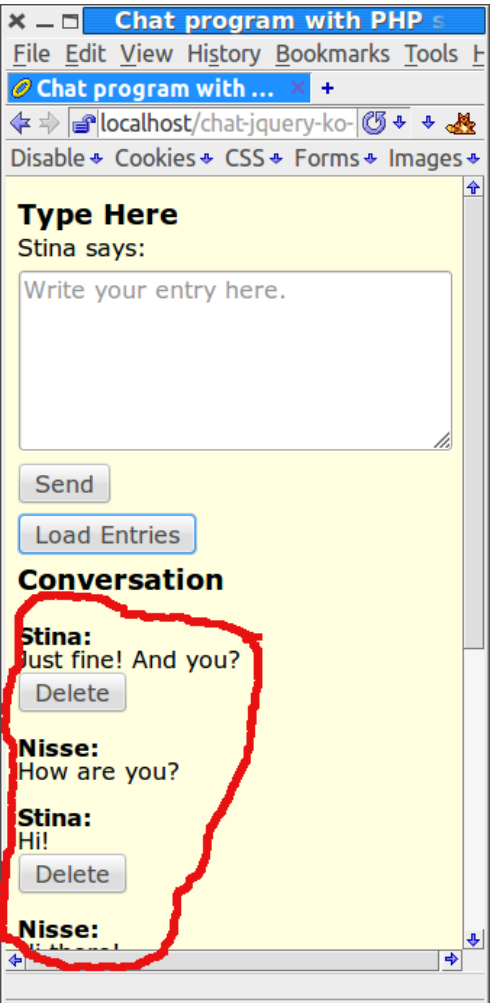
        </span>
    </p>
<!-- /ko -->
```

- 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

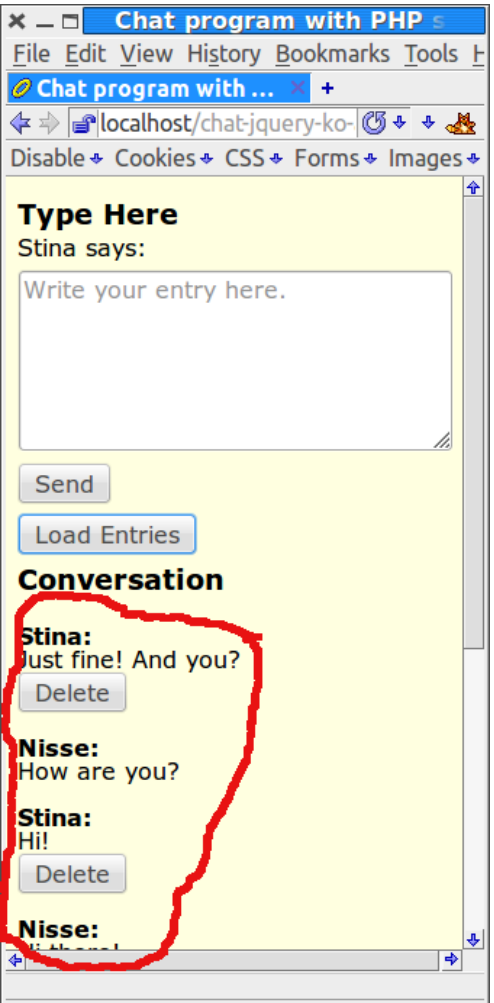
- Now we can create the data binding for the conversation part of the chat application (code is not complete).




```
<!-- 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.

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- As a result, there is now no PHP code left in the html files!
  - Except for including fragments and creating link paths.

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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.

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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 thousand 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.

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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 thousand 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.

Section

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

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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.

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- 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.
  ```

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  - ws://host:port/path (plain websocket connection)
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- 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?

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- There are endpoints for all major server-side technologies, e.g., PHP, Java, .NET, Python, Ruby.

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- 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.