jQuery Ajax Support:
Part 4 –
Promises and Deferred Objects

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For customized training related to JavaScript or Java, email hall@coreservlets.com
Marty is also available for consulting and development support

Taught by lead author of Core Servlets & JSP, co-author of Core JSF (4th Ed), and this tutorial.

Available at public venues, or custom versions can be held on-site at your organization.

- Courses developed and taught by Marty Hall
  - JavaScript, jQuery, Ext JS, JSP 2.3, PrimeFaces, Java 8 programming, Spring Framework, Spring MVC, Android, GWT, custom mix of topics
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Topics in This Section

- **Using Promises for Ajax**
  - To simplify adding additional handlers later

- **Combining Promises**
  - To test if multiple calls have finished

- **Using Deferred Objects and Promises in Your Own Code**
  - To manage your own delayed or asynchronous tasks

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Motivation

• **Problem**
  – Standard jQuery supported only a single callback handler
    • So, if you wanted to add more functionality, you had to modify the code of the original handler, making refactoring hard and breaking things if that handler was shared

• **Solution**
  – Add handlers separately using Deferred and Promise API

• **Extra benefit**
  – Familiar to users of other frameworks, since this API (CommonsJS Promises/A Interface) is used elsewhere

Big Idea

• **Replace this:**
  
  ```javascript
  $.ajax({
    url: remoteAddress,
    success: successHandler,
    complete: completeHandler,
    error: errorHandler
  });
  ```

• **With this:**

  ```javascript
  var req = $.ajax({ url: remoteAddress });
  req.done(successHandler);
  req.always(completeHandler);
  req.fail(errorHandler);
  ```

• **But now:**

  – If you later want to add an additional success handler:
    ```javascript
    req.done(additionalSuccessHandler);
    ```
Example: Displaying Remote Data

- **Standard approach**

  ```javascript
  $.ajax({
    url: address,
    success:
      function(text) {
        insertText(text, resultRegion);
      }
  });
  ```

  This is the code that was shown in the earlier sections, and it works fine in most cases.

- **Refactoring: Highlighting Result**

  - **Option 1: modify insertText**

    ```javascript
    function insertText2(text, resultRegion) {
      $(resultRegion).html(text);
      highlight(resultRegion);
    }
    ```

  - **Option 2: modify main $.ajax call**

    ```javascript
    $.ajax({
      url: address,
      success:
        function(text) {
          insertText(text, resultRegion);
          highlight(resultRegion);
        }
    });
    ```
Example: Displaying Remote Data

• Deferred approach

```javascript
var req = $.ajax({ url: address });
req.done(function(text) { insertText(text, resultRegion); });
```

Works the same as the first example.

Refactoring: Highlighting Result

• Easier
  – An additional line instead of changing old code

```javascript
var req = $.ajax({ url: address });
req.done(function(text) { insertText(text, resultRegion); });
req.done(function(text) { highlight(resultRegion); });
```
Displaying Temporary Messages During Ajax Requests

Overview

- **Task done in earlier sections: show message while waiting**
  - Display info in region that has “display: none”, before sending Ajax request, change region to use “display: inline”, when request finishes, hide the region again

- **Comparing the two approaches (next slides)**
  - They are about the same: no clear advantage to either approach
  - Conclusions in principle
    - No need to redo existing legacy code
      - In most situations, deferred approach has no clear advantages
    - Use deferred approach for new applications
      - It is superior in some situations (highlighting example and upcoming examples with $.when)
      - It is familiar to users of some other libraries
      - It is (arguably) no longer or harder to understand even when it is not better
  - Observations in practice
    - Most jQuery developers still use the standard approach
Shared HTML

```html
<fieldset>
  <legend>...: Showing Temporary Messages</legend>
  <input type="button" value="Show Time"
        id="..."/>
  <h2 id="..." style="display: none">
    <img src="/images/ajax-loader.gif"/>
    Waiting for server...
  </h2>
</fieldset>
```

Shared Server Code

```java
<% try { Thread.sleep(5000); } catch(Exception e) {} %>
It is now <%= new java.util.Date() %>
```

Waits 5 seconds and then outputs the current date and time
### Standard Approach

```
$(resultRegion).html(''); // Erase any previous results
$(workingRegion).show();
$.ajax(
    {
        url: address,
        success: function(text) {
            insertText(text, resultRegion);
            highlight(resultRegion);
        },
        complete: function(text) {
            $(workingRegion).hide();
        }
    });
```

### Deferred Approach

```
$(resultRegion).html(''); // Erase any previous results
$(workingRegion).show();
var req = $.ajax({ url: address });
req.done(function(text) { insertText(text, resultRegion); });
req.done(function(text) { highlight(resultRegion); });
req.complete(function(text) { $(workingRegion).hide(); });
```
$.when: Checking Multiple Promises

Big Idea

- **You can run code after all async calls**
  - For when you don’t know the order in which tasks will complete, but you want to do something only after all have finished

- **Syntax**

  ```javascript
  var request1 = $.ajax({ url: "..." });
  request1.done(individualSuccessHandler1);
  var request2 = $.ajax({ url: "..." });
  request2.done(individualSuccessHandler2);
  ...
  $.when(request1, request2, ...)
      .done(compositeSuccessHandler)
      .always(compositeCompleteHandler)
      .fail(compositeFailureHandler);
  ```

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Example: Temporary Message

- **Fire off two calls to server**
  - Each is slow
  - Each will result in data inserted into page
  - Order of return is not known
- **Display “working…” message**
  - Exactly as shown earlier
- **Hide “working” message**
  - Only when *both* results are finished

Temporary Data: JavaScript

```javascript
function showTimeAndNumber() {
  var address1 = "show-time-slow.jsp";
  var resultRegion1 = "#deferred-when-time-result";
  var address2 = "show-number-slow.jsp";
  var resultRegion2 = "#deferred-when-number-result";
  var workingRegion = "#deferred-when-working";
  $(resultRegion1).html("");
  $(resultRegion2).html("");
  $(workingRegion).show();
  var req1 = $.ajax({ url: address1 });
  req1.done(function(text) { insertText(text, resultRegion1); });
  req1.done(function(text) { highlight(resultRegion1); });
  var req2 = $.ajax({ url: address2 });
  req2.done(function(text) { insertText(text, resultRegion2); });
  req2.done(function(text) { highlight(resultRegion2); });
  $.when(req1, req2).always(function(text) { $(workingRegion).hide(); });
}
```
Deferred Approach: Using $.when

```html
<fieldset>
  <legend>Deferred Approach: Using $.when</legend>
  <input type="button" value="Show Time and Number"
        id="deferred-when-button"/>
  <h2 id="deferred-when-working" style="display: none">
    <img src="/images/ajax-loader.gif"/>
    Waiting for server...
  </h2>
  <h2><span id="deferred-when-time-result"></span><br/>
      <span id="deferred-when-number-result"></span></h2>
</fieldset>
```

Temporary Data: JSP

- `show-time-slow.jsp`

```jsp
<% try { Thread.sleep(5000); } catch(Exception e) {} %>
It is now <%= new java.util.Date() %>
```

- `show-number-slow.jsp`

```jsp
<% try{ Thread.sleep(4000); } catch(Exception e) {} %>
Number: <%= Math.random() %>
```
Temporary Data: Results

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Making Your Own Deferred Objects

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Big Idea

- **Create a Deferred Object**
  ```javascript
  var dfd = $.Deferred();
  ```
- **Do a long-running or asynchronous task**
  - Call `dfd.reject()` if it fails
  - Call `dfd.resolve()` if it succeeds
- **Return a Promise**
  ```javascript
  return(dfd.promise());
  ```
- **This return value can be used like “req” before**
  - Can use `.done`, `.always`, `.fail`, `.when`, etc.

Example

- **Do some slow-but-local task**
  - Use `fadeIn` to slowly make result appear
    - Note that `fadeIn` takes a function as a second argument, so you can supply `dfd.resolve` to it instead of calling `dfd.resolve()` explicitly
  - Return a Promise
- **Display temporary message**
  - Once slow tasks returns a Promise, this code will be almost exactly the same as in the last Ajax example
Local Tasks: JavaScript

```javascript
function showNum(resultRegion, millis) {
    var dfd = $.Deferred();
    $(resultRegion).html("Number: " + Math.random());
    $(resultRegion).fadeIn(millis, dfd.resolve);
    return(dfd.promise());
}

function showNumbers() {
    var workingRegion = "#deferred-custom-working";
    var resultRegion1 = "#deferred-custom-number-result-1";
    var resultRegion2 = "#deferred-custom-number-result-2";
    $(resultRegion1).hide();
    $(resultRegion2).hide();
    $(workingRegion).show();
    $.when(showNum(resultRegion1, 6000), showNum(resultRegion2, 3000))
        .done(function(text) { $(workingRegion).hide(); });
}
```

Local Tasks: HTML

```html
<fieldset>
<legend>Creating Your Own Deferred</legend>
<input type="button" value="Show Two Numbers"
        id="deferred-custom-button"/>
<h2 id="deferred-custom-working" style="display: none">
    <img src="/images/ajax-loader.gif"/>
    Calculating...
</h2>
<h2><span id="deferred-custom-number-result-1" style="display: none"></span><br/>
    <span id="deferred-custom-number-result-2" style="display: none"></span>
</h2>
</fieldset>
```
Local Tasks: Results

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**Summary**

- **Basics**
  
  ```javascript
  $.ajax({
    url: remoteAddress,
    success: successHandler,
    complete: completeHandler,
    error: errorHandler
  });
  
  var req = $.ajax({
    url: remoteAddress
  });
  req.done(successHandler);
  req.always(completeHandler);
  req.fail(errorHandler);
  ```

- **Checking multiple Promises**
  - `$.when(req1, req2).always(…);`

- **Managing your own tasks**
  - Create Deferred, call resolve(), return promise()