互联网应用开发技术

*Web Application Development*

# 第9课
# WEB前后台通信-AJAX & JSON

**Episode Nine**

## AJAX & JSON

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  - XMLHttpRequest
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# Ajax



- AJAX = Asynchronous JavaScript and XML

- Traditionally webpages required reloading to update their content.
  - For web-based email this meant that users had to manually reload their inbox to check and see if they had new mail.
  - This had huge drawbacks: it was slow and it required user input.
  - When the user reloaded their inbox, the server had to reconstruct the entire web page and resend all of the HTML, CSS, JavaScript, as well as the user's email.
  - This was hugely inefficient.

# Ajax



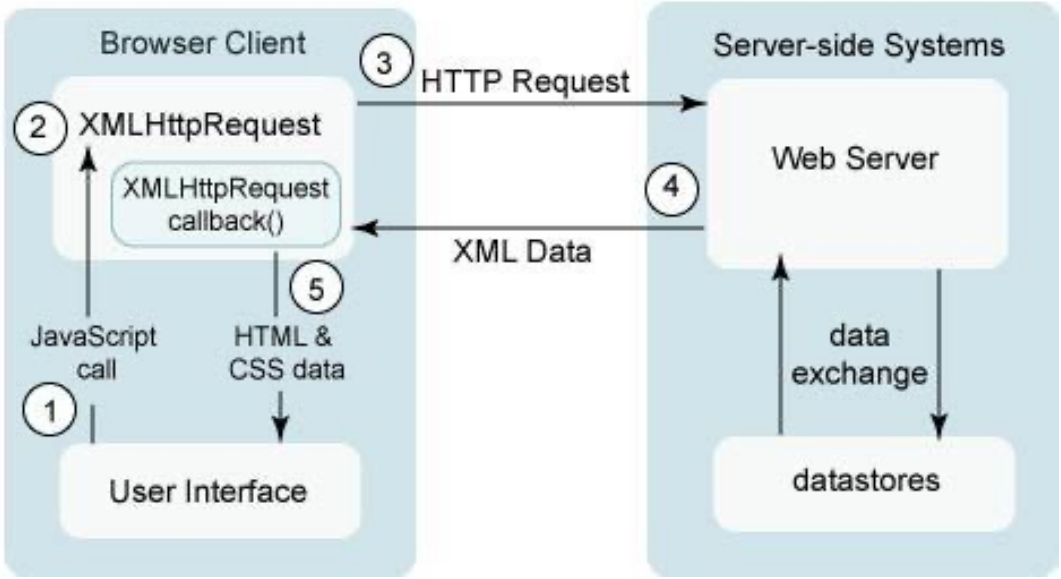
- Ideally, the server should only have to send the user's new messages, not the entire page.
  - By 2003, all the major browsers solved this issue by adopting the XMLHttpRequest (XHR) object, allowing browsers to communicate with the server without requiring a page reload.
  - The XMLHttpRequest object is part of Ajax.

- Using Ajax, data could then be passed between the browser and the server, using the XMLHttpRequest API, without having to reload the web page.

# Ajax



- Ajax requests are triggered by JavaScript code;
  - your code sends a request to a URL, and when it receives a response, a callback function can be triggered to handle the response.
  - Because the request is asynchronous, the rest of your code continues to execute while the request is being processed, so it‘s imperative that a callback be used to handle the response.



# Ajax -XMLHttpRequest



- XMLHttpRequest
  - It is the basis of Ajax
  - All modern browsers, such as IE7+, Firefox, Chrome, Safari and Opera, have built-in `XMLHttpRequest`
  - In IE 5 and IE 6, it is `ActiveXObject`

- Obtain `XMLHttpRequest`

```
var xmlhttp;
xmlhttp = new XMLHttpRequest();
```

  - Or in IE 5 and IE 6

```
xmlhttp = new ActiveXObject("Microsoft.XMLHTTP");
```

# Ajax -XMLHttpRequest



- Obtain `XMLHttpRequest`

```
var xmlhttp;
if(window.XMLHttpRequest) {
    xmlHttpRequest = new XMLHttpRequest();
} else if(window.ActiveXObject) {
    xmlHttpRequest = new ActionXObject("Microsoft.XMLHTTP");
}
```

# Ajax - Send



- Send request to Server

```
xmlhttp.open("GET","test1.txt",true);
xmlhttp.send();

open(method,url,async)
    method: type of request, GET or POST
    url: location of required file
    async: true or false

send(string)
    string: only used in POST
```

# Ajax - Get or Post ?



- The two most common "methods" for sending a request to a server are GET and POST.

- The GET method should be used for non-destructive operations
  - that is, operations where you are only "getting" data from the server, not changing data on the server.
  - For example, a query to a search service might be a GET request.
  - GET requests may be cached by the browser, which can lead to unpredictable behavior if you are not expecting it.
  - GET requests generally send all of their data in a query string.

- The POST method should be used for destructive operations
  - that is, operations where you are changing data on the server.
  - For example, a user saving a blog post should be a POST request.
  - POST requests are generally not cached by the browser;
  - a query string can be part of the URL, but the data tends to be sent separately as post data.

# Ajax - Get



- Get

```
xmlHttpRequest.open("GET","GetUser",true);
xmlHttpRequest.onreadystatechange = ajaxCall;
xmlHttpRequest.send();
```

- Add information into request

```
xmlHttpRequest.open("GET","GetUser?id=1",true);
xmlHttpRequest.onreadystatechange = ajaxCall;
xmlHttpRequest.send();
```

The information can be retrieved as request parameters

# Ajax - Post



- Post

```
xmlHttpRequest.open("POST","GetUser",true);
xmlHttpRequest.setRequestHeader("Content-type",
          "application/x-www-form-urlencoded");
xmlHttpRequest.onreadystatechange = ajaxCall;
xmlHttpRequest.send("id=" + id);
```

- The information in send method can be retrieved as request parameters.

# Ajax - onreadystatechange



- onreadystatechange
  - Onreadystatechange: the function invoked when `readyState` is changed.
  - readyState: the state of XMLHttpRequest, ranges from 0 to 4
  - status: 200-OK, 404-no page

```
xmlhttp.onreadystatechange=function() {
 if (xmlhttp.readyState==4 && xmlhttp.status==200)
 {
    document.getElementById("myDiv").innerHTML=
        xmlhttp.responseText;
 }
}
```

# Ajax - response



- XMLHttpRequest
  - responseText: response data in string.
  - responseXML: response data in XML

- responseText

```
document.getElementById("myDiv").innerHTML=
            xmlHttpRequest.responseText;
```

- responseXML

```
xmlDoc=xmlHttpRequest.responseXML;
txt="";
x=xmlDoc.getElementsByTagName("username");
for (i=0;i<x.length;i++) {
 txt=txt + x[i].childNodes[0].nodeValue + "<br />";
}
document.getElementById("myDiv").innerHTML=txt;
```

# Ajax – an example



- Index.html

```
<!doctype html>
<html>
<head>
    <meta charset="utf-8" />
    <title>Demo</title>
</head>
<body>
    <script src="js/jquery-2.1.0.js"></script>

    <script type="text/javascript">
      var xmlHttpRequest = null;
      function ajaxRequest() {
        if(window.ActiveXObject) {
            xmlHttpRequest = new ActionXObject("Microsoft.XMLHTTP");
        }
        else if(window.XMLHttpRequest) {
            xmlHttpRequest = new XMLHttpRequest();
        }
```

# Ajax – an example



- Index.html

```
if(xmlHttpRequest != null) {
    var id = document.getElementById("id").value;

    xmlHttpRequest.open("GET", "GetUser?id="+id, true);
    xmlHttpRequest.onreadystatechange = ajaxCall;
    xmlHttpRequest.send();
```

  - or

```
    xmlHttpRequest.open("POST","GetUser",true);
    xmlHttpRequest.setRequestHeader("Content-type",
        "application/x-www-form-urlencoded");
    xmlHttpRequest.onreadystatechange = ajaxCall;
    xmlHttpRequest.send("id=" + id);
  }
}
```

# Ajax – an example



- Index.html

```
function ajaxCall() {
      if(xmlHttpRequest.readyState == 4 ) {
          if(xmlHttpRequest.status == 200) {
              var text = xmlHttpRequest.responseText;
              document.getElementById("myDiv").innerHTML =
                    "<h2>"+ text + "</h2>";
          }
      }
  }
  </script>

  <div id="myDiv"><h2>Let AJAX change this text</h2></div>
  User id: <input type="text" name="id" id="id" /> <br/>
  <button type="button" onclick="ajaxRequest()">
      Query
  </button>
 </body>
</html>
```

# Ajax – an example



- UserServlet

```
package user;
@WebServlet("/GetUser")
public class UserServlet extends HttpServlet {
    private static final long serialVersionUID = 18925377774889413L;

    @Resource(name="jdbc/sample")
    DataSource ds;

    protected void processRequest(HttpServletRequest request,
            HttpServletResponse response)
            throws ServletException, IOException {
        PrintWriter out = response.getWriter();
        System.out.println("doGet invoked!");

        try {
            String id = (String) request.getParameter("id");
            Connection con = ds.getConnection();
            PreparedStatement ps = con.prepareStatement(
                    "SELECT * FROM tbl_user WHERE id = ?");
            ps.setString(1, id);
```

# Ajax – an example



- UserServlet

```
            ResultSet rs = ps.executeQuery();
            rs.last();
            int count = rs.getRow();

            if ( count == 0) {
                    out.println("no such user");
            } else{
                    String s = "username: " + rs.getString(2) +
                                    " email: " + rs.getString(2);
                    out.println(s);
            }
            out.flush();
        } catch(Exception e){
            e.printStackTrace();
        }
        finally {
            out.close();
        }
    }
```

# Ajax – an example



- UserServlet

```
    @Override
    protected void doGet(HttpServletRequest request,
                         HttpServletResponse response)
            throws ServletException, IOException {
        processRequest(request, response);
    }

    @Override
    protected void doPost(HttpServletRequest request,
                          HttpServletResponse response)
            throws ServletException, IOException {
        processRequest(request, response);
    }

    @Override
    public String getServletInfo() {
        return "Short description";
    }
}
```

# Ajax – an example

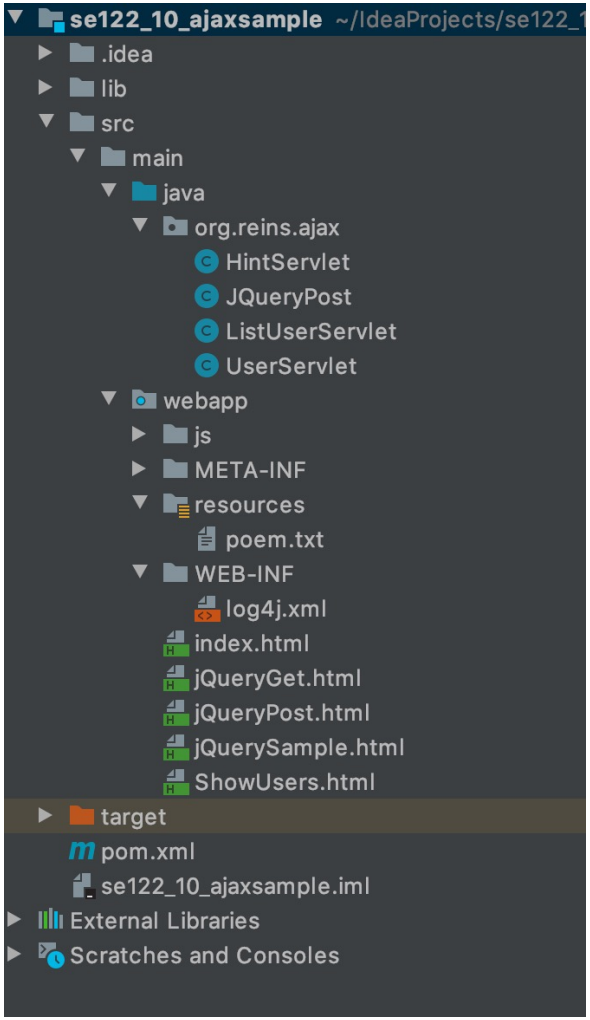


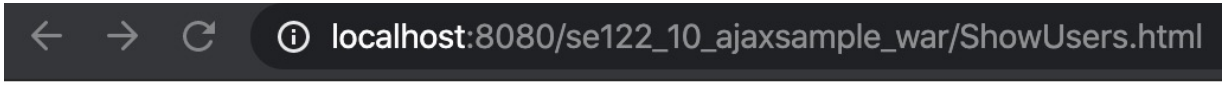
- Context.xml

```
<Context>
  <Resource name="jdbc/sample“
            auth="Container"
            type="javax.sql.DataSource"
            maxActive="100"
            maxIdle="30"
            maxWait="10000"
            username="root"
            password="reins2011!"
            driverClassName="com.mysql.jdbc.Driver"
      url="jdbc:mysql://localhost:3306/ajax"/>
</Context>
```

# Ajax – an example





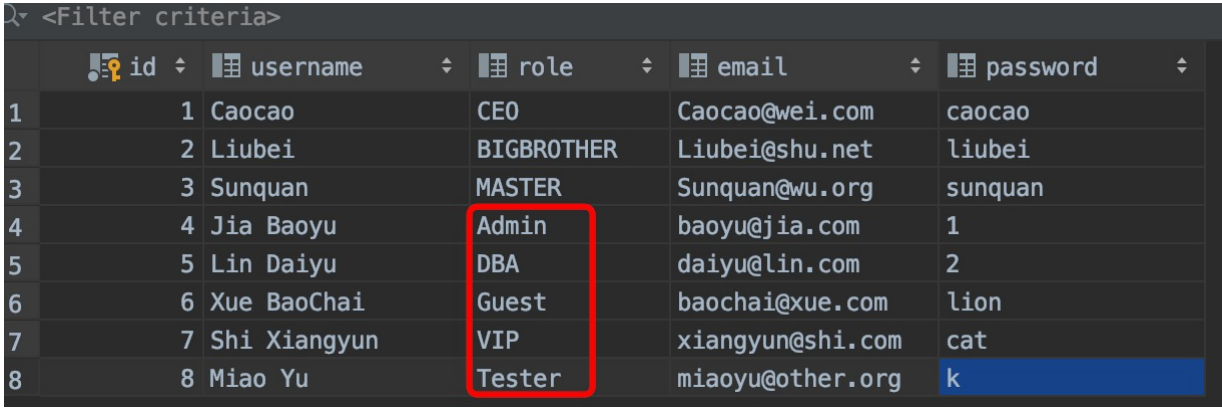




Choose a User Admin

**Username:** Jia Baoyu

**Email:** baoyu@jia.com

**Password:** 1




| | id | username | role | email | password |
|---|---|---|---|---|---|
| 1 | 1 | Caocao | CEO | Caocao@wei.com | caocao |
| 2 | 2 | Liubei | BIGBROTHER | Liubei@shu.net | liubei |
| 3 | 3 | Sunquan | MASTER | Sunquan@wu.org | sunquan |
| 4 | 4 | Jia Baoyu | Admin | baoyu@jia.com | 1 |
| 5 | 5 | Lin Daiyu | DBA | daiyu@lin.com | 2 |
| 6 | 6 | Xue BaoChai | Guest | baochai@xue.com | lion |
| 7 | 7 | Shi Xiangyun | VIP | xiangyun@shi.com | cat |
| 8 | 8 | Miao Yu | Tester | miaoyu@other.org | k |

# Ajax - Asyn



- Asyn = true

```
xmlHttpRequest.open("GET", "GetUser?id="+id, true);
xmlHttpRequest.onreadystatechange = ajaxCall;
xmlHttpRequest.send();
function ajaxCall() {
  if(xmlHttpRequest.readyState == 4 ) {
     if(xmlHttpRequest.status == 200) {
        var text = xmlHttpRequest.responseText;
          document.getElementById("myDiv").innerHTML =
                  "<h2>"+ text + "</h2>";
     }
  }
}
```

- Asyn = false

```
xmlHttpRequest.open("GET", "GetUser?id="+id, false);
xmlHttpRequest.send();
document.getElementById("myDiv").innerHTML =
           "<h2>"+ xmlHttpRequest.responseText + "</h2>";
```

# Ajax - callback function



- Callback function

```
<html>
 <head>
  <script type="text/javascript">
   var xmlhttp;
   function loadXMLDoc(url,cfunc)
   {
      if (window.XMLHttpRequest)
      {// code for IE7+, Firefox, Chrome, Opera, Safari
         xmlhttp=new XMLHttpRequest();
      }
      else
      {// code for IE6, IE5
         xmlhttp=new ActiveXObject("Microsoft.XMLHTTP");
      }
      xmlhttp.onreadystatechange=cfunc;
      xmlhttp.open("GET",url,true);
      xmlhttp.send();
}
```

# Ajax - callback function



- Callback function

```
function myFunction()
{
 loadXMLDoc("/ajax/test1.txt",function()
  {
   if (xmlhttp.readyState==4 && xmlhttp.status==200)
   {
    document.getElementById("myDiv").innerHTML=xmlhttp.responseText;
   }
  });
 }
 </script>
</head>
<body>
  <div id="myDiv"><h2>Let AJAX change this text</h2></div>
  <button type="button" onclick="myFunction()">Change Content</button>
</body>
</html>
```

# Ajax - another example



- Index.html(snippet)

```
User id: <input type="text" name="id" id="id"
   onkeyup="showHint(this.value)"/> <br/>
<p>Suggestion: <span id="txtHint"></span></p>

function showHint(str)
{
    var xmlhttp;

    if (str.length==0)
    {
      document.getElementById("txtHint").innerHTML="";
      return;
    }

    if (window.XMLHttpRequest)
      xmlhttp=new XMLHttpRequest();
    else
      xmlhttp=new ActiveXObject("Microsoft.XMLHTTP");

    xmlhttp.onreadystatechange=function()
    {
      if (xmlhttp.readyState==4 && xmlhttp.status==200)
        document.getElementById("txtHint").innerHTML=xmlhttp.responseText;
    }

    xmlhttp.open("GET","Hint?q="+str,true);
    xmlhttp.send();
}
```

# Ajax - another example



- HintServlet.java(snippet)

```
@WebServlet("/Hint")
public class HintServlet extends HttpServlet {
  protected void processRequest(HttpServletRequest request,
     HttpServletResponse response) throws ServletException, IOException {
        PrintWriter out = response.getWriter();
        String hint = "";
        String a[] = new String[30];
        a[0] = "Anna";  a[1] = "Brittany"; a[2] = "Cinderella";
        ……
        String q = request.getParameter("q");
            if (q.length() > 0) {
             for (int i = 0; i < 30; i++)
              if (a[i].indexOf(q) >= 0)
                if (hint == "")
                  hint = a[i];
                    else
                  hint = hint + ", " + a[i];
             if (hint == "")
              out.println("no suggestion");
             else
              out.println(hint);

    }
```

# Ajax - list user information



- ShowUser.html

```
<html>
<head>
  <script type="text/javascript">
   function showUsers(str) {
     var xmlhttp;
     if (str == "") {
       document.getElementById("txtHint").innerHTML = "";
       return;
     }
     if (window.XMLHttpRequest) {// code for IE7+, Firefox, Chrome, Opera, Safari
       xmlhttp = new XMLHttpRequest();
     } else {// code for IE6, IE5
       xmlhttp = new ActiveXObject("Microsoft.XMLHTTP");
     }
     xmlhttp.onreadystatechange = function() {
       if (xmlhttp.readyState == 4 && xmlhttp.status == 200) {
         document.getElementById("txtHint").innerHTML = xmlhttp.responseText;
       }
     }
     xmlhttp.open("GET", "ListUsers?q=" + str, true);
     xmlhttp.send();
   }
 </script>
</head>
```

# Ajax - list user information



- ShowUser.html

```
<body>
   <form action="" style="margin-top: 15px;">
     <label>Choose a User
      <select name="users"
        onchange="showUsers(this.value)"
        style="font-family: Verdana, Arial, Helvetica, sans-serif;">
       <option value="Admin">Admin</option>
       <option value="DBA ">DBA</option>
       <option value="Guest">Guest</option>
       <option value="VIP">VIP</option>
       <option value="Tester">Tester</option>
       <option value="Developer">Developer</option>
      </select>
     </label>
   </form>
   <br />
  <div id="txtHint">Here's the information of chosen user:</div>
 </body>
</html>
```

# Ajax - list user information



- ListUserServlet.html

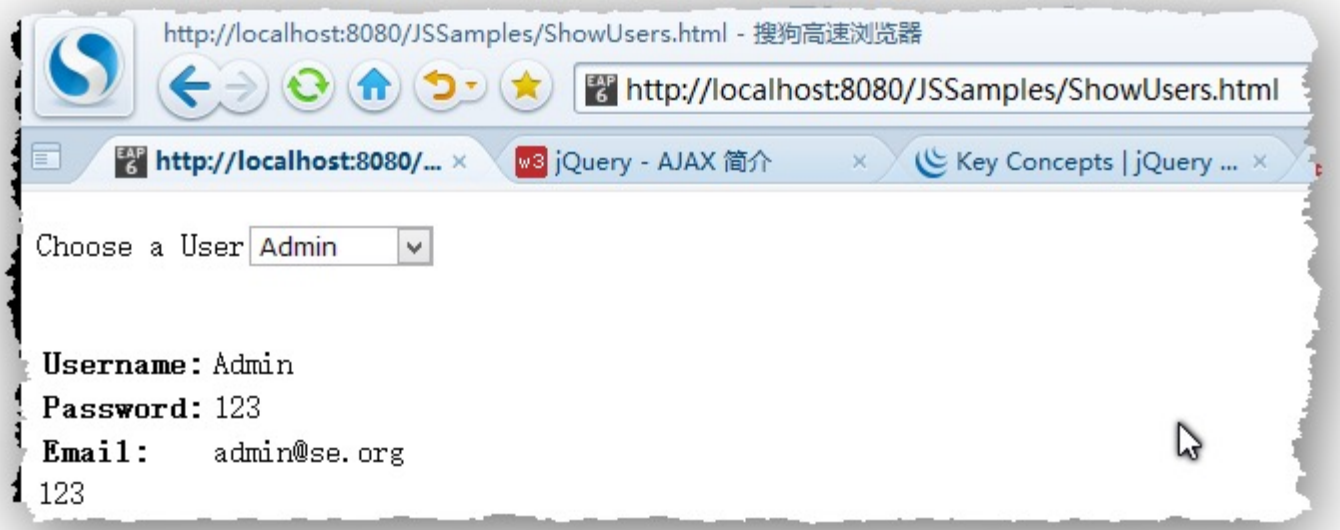
```
@WebServlet("/ListUsers")
public class ListUserServlet extends HttpServlet {
@Resource(name="jdbc/sample")
    DataSource ds;
    protected void processRequest(HttpServletRequest request,
            HttpServletResponse response)throws ServletException, IOException {
            PrintWriter out = response.getWriter();

            String username = (String) request.getParameter("q");
            Connection con = ds.getConnection();
            PreparedStatement ps = con.prepareStatement("SELECT * FROM tbl_user WHERE username = ?");
            ps.setString(1, username);
            ResultSet rs = ps.executeQuery();
            rs.last();
            int count = rs.getRow();

            if ( count == 0) {
            out.println("no such user");
            } else{
               out.println("<table>");
               out.println("<tr><td><b> Username: </b></td>" + "<td>"+ rs.getString(2) + "</td></tr>");
               out.println("<tr><td><b> Password: </b></td>" + "<td>"+ rs.getString(3) + "</td></tr>");
               out.println("<tr><td><b> Email: </b></td>" + "<td>"+ rs.getString(4) + "</td></tr>");
               out.write("</table>");
            }
    }
```

# Ajax - list user information





# jQuery Ajax



- jQuery provides Ajax support that abstracts away painful browser differences.
  - It offers both a full-featured `$.ajax()` method

- The convenience methods provided by jQuery are:
  - `$.get`
    - Perform a GET request to the provided URL.
  - `$.post`
    - Perform a POST request to the provided URL.
  - `$.getScript`
    - Add a script to the page.
  - `$.getJSON`
    - Perform a GET request, and expect JSON to be returned.
  - `$().load()`
    - Load object asynchronously

# jQuery Ajax - $().load()



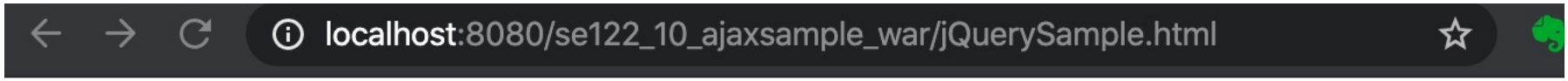
- jQuerySample.html

```
<!DOCTYPE html>
<html>
 <head>
  <script src="js/jquery-2.1.0.js"></script>
  <script>
   $(document).ready(function(){
    $("#btn1").on("click", (function(){
     $('#test').load('resources/poem.txt');
    })
   })
  </script>
 </head>

 <body>
  <button id="btn1" type="button">Obtain external text</button>
  <h3 id="test">Let AJAX change this text</h3>
 </body>
</html>
```

# jQuery Ajax - $().load()






Obtain external text

**Sky–clear Sand Withered vines,an old tree,crows at dusk, A little bridge, a bony horse in the west wind, A heartbroken man is at the end of the world.**

# jQuery Ajax - $.get()



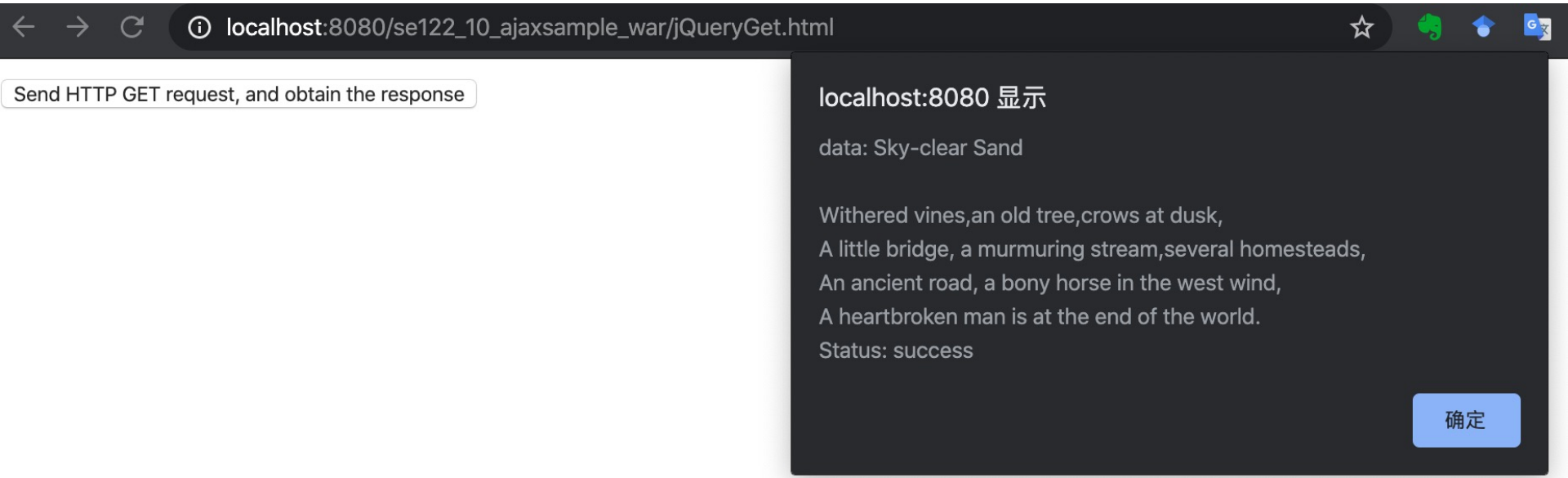
- $.get(*URL*, *callback*);

- jQueryGet.html

```
<!DOCTYPE html>
<html>
 <head>
  <script src="js/jquery-2.1.0.js"></script>
  <script>
   $(document).ready(function(){
    $("button").on("click", ( function(){
     $.get("resources/poem.txt",function(data,status){
      alert("data:" + data + "\nStatus: " + status);
     });
    });
   });
  </script>
 </head>
 <body>
  <button> Send HTTP GET request, and obtain the response</button>
 </body>
</html>
```

# jQuery Ajax - $.get()





# jQuery Ajax - $.post()



- $.post(*URL*, *data*, *callback*);

- jQueryPost.html

```
<html>
<head>
<script src="js/jquery-2.1.0.js"></script>
<script>
$(document).ready(function(){
  $("button").on("click", ( function(){
    $.post("JQueryPost",
    {
      name:"Donald Duck",
      city:"Duckburg"
    },
    function(data,status){
      alert("data: " + data + "\nStatus: " + status);
    });
  });
});
</script>
</head>
<body>
 <button>Send HTTP GET request, and obtain the response</button>
</body>
</html>
```

# jQuery Ajax - $.post()



- $.post(*URL*, *data*, *callback*);

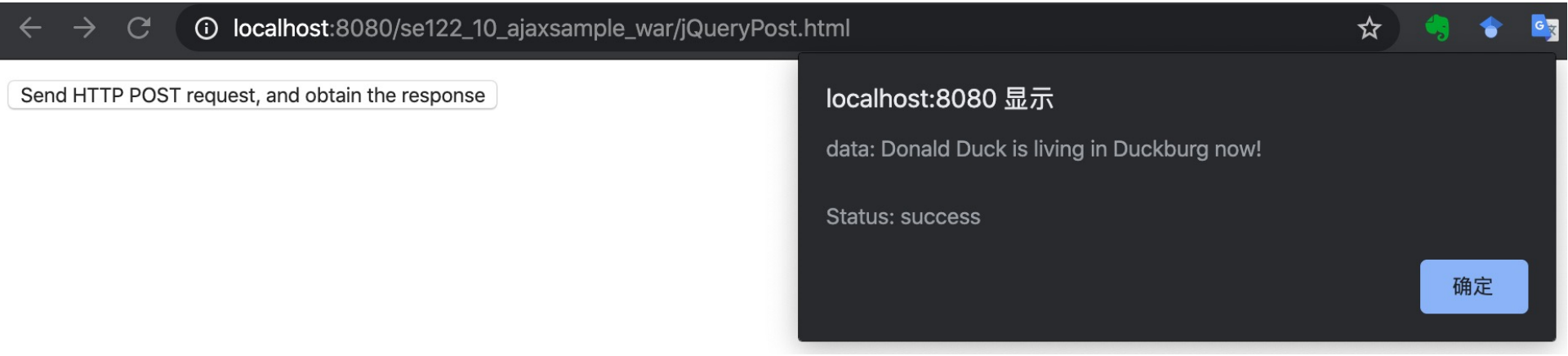
- JQueryPost.java

```
@WebServlet("/JQueryPost")
public class JQueryPost extends HttpServlet {
private static final long serialVersionUID = 1L;

    protected void processRequest(
            HttpServletRequest request,
            HttpServletResponse response)
            throws ServletException, IOException {
        PrintWriter out = response.getWriter();
        out.println(request.getParameter("name") +
                    " is living in " +
                    request.getParameter("city") +
                    " now!");
    }
```

# jQuery Ajax - $.post()

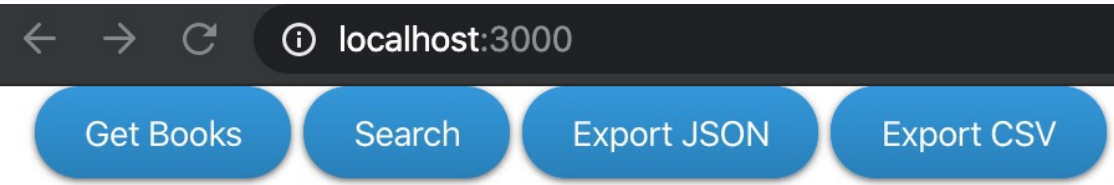




# React: Ajax & JSON



- Ajax & JSON in React




| Book | Author | Language | Published | Sales |
|---|---|---|---|---|
| The Lord of the Rings | J. R. R. Tolkien | English | 1954-1955 | 150 million |
| Le Petit Prince (The Little Prince) | Antoine de Saint-Exupéry | French | 1943 | 140 million |
| Harry Potter and the Philosopher's Stone | J. K. Rowling | English | 1997 | 107 million |
| And Then There Were None | Agatha Christie | English | 1939 | 100 million |
| Dream of the Red Chamber | Cao Xueqin曹雪芹 | Chinese | 1754-1791 | 100 million |
| The Hobbit | J. R. R. Tolkien | English | 1937 | 100 million |
| She: A History of Adventure | H. Rider Haggard | English | 1887 | 100 million |

# React: Ajax & JSON



- App.js

```
const data = [];
class Excel extends React.Component {
  getBooks = () => {
    fetch("http://localhost:8080/se122_10_reactdb_war/BookManager")
      .then(response => response.json())
      .then(data => {
        // alert("data:" + data);
        this.setState({
          data: data,
        });
      }).catch(function (ex) {
      console.log('parsing failed', ex)
    })
  }
  renderToolbar = () => {
    return (
      <div className="toolbar">
        <button onClick={this.getBooks}>Get Books</button>
        <button onClick={this.toggleSearch}>Search</button>
        <a onClick={this.download.bind(this, 'json')}
          href="data.json">Export JSON</a>
        <a onClick={this.download.bind(this, 'csv')}
          href="data.csv">Export CSV</a>
      </div>
    );
  };
```

# React: Ajax & JSON

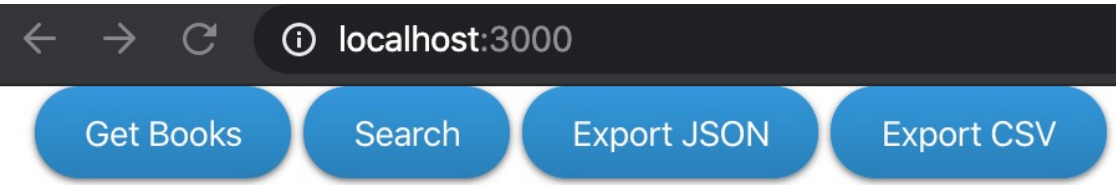


- Initial State

# React: Ajax & JSON



- After click the button “Get Books”

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| The Lord of the Rings | J. R. R. Tolkien | English | 1954-1955 | 150 million |
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| Harry Potter and the Philosopher's Stone | J. K. Rowling | English | 1997 | 107 million |
| And Then There Were None | Agatha Christie | English | 1939 | 100 million |
| Dream of the Red Chamber | Cao Xueqin曹雪芹 | Chinese | 1754-1791 | 100 million |
| The Hobbit | J. R. R. Tolkien | English | 1937 | 100 million |
| She: A History of Adventure | H. Rider Haggard | English | 1887 | 100 million |

# React: Ajax & JSON



- Book.java

```
@Entity
@Table(name = "book")
public class Book {

  private Long id;

   private String title;
   private String author;
   private String language;
   private String published;
   private String sales;

   public Book() {}

   @Id
   @GeneratedValue(generator = "increment")
   @GenericGenerator(name = "increment",
                     strategy = "increment")
   public Long getId() {
      return id;
   }
   public void setId(Long id) {
      this.id = id;
   }
   public String getTitle() {      return title;   }
   public void setTitle(String title) {      this.title = title;   }

   public String getAuthor() {      return author;   }
   public void setAuthor(String author) {
      this.author = author;
   }

   public String getLanguage() {      return language;   }
   public void setLanguage(String language) {
      this.language = language;
   }

   public String getPublished() {      return published;   }
   public void setPublished(String published) {
      this.published = published;
   }

   public String getSales() {      return sales;   }
   public void setSales(String sales) {
      this.sales = sales;
   }

}
```

# React: Ajax & JSON



- BookManagerServlet.java

```
@WebServlet("/BookManager")
public class BookManagerServlet extends HttpServlet {
   private static final long serialVersionUID = 1L;

   public BookManagerServlet() {
      super();
   }

   protected void doGet(HttpServletRequest request, HttpServletResponse response)
                              throws ServletException, IOException {
      try {
         HibernateUtil.getSessionFactory().getCurrentSession().beginTransaction();
         PrintWriter out = response.getWriter();
         response.setContentType("application/json; charset=UTF-8");
         response.setHeader("Access-Control-Allow-Origin", "http://localhost:3000");


         System.out.println("This is a book manager");

         Session session = HibernateUtil.getSessionFactory().getCurrentSession();
         List<Book> result = session.createQuery("from Book").list();
         Iterator<Book> it = result.iterator();
```

# React: Ajax & JSON



- BookManagerServlet.java

```
        ArrayList<JSONArray> booksJson = new ArrayList<JSONArray>();
        while (it.hasNext()) {
           Book book = (Book) it.next();
           ArrayList<String> arrayList = new ArrayList<String>();
           arrayList.add(book.getTitle());
           arrayList.add(book.getAuthor());
           arrayList.add(book.getLanguage());
           arrayList.add(book.getPublished());
           arrayList.add(book.getSales());
           booksJson.add((JSONArray) JSONArray.toJSON(arrayList));
        }
        String  booksString = JSON.toJSONString(booksJson, SerializerFeature.BrowserCompatible)
        System.out.println(booksString);
        session.getTransaction().commit();
        out.println(booksString);
        out.flush();
        out.close();
      } catch (Exception ex) {
        HibernateUtil.getSessionFactory().getCurrentSession().getTransaction().rollback();
        if (ServletException.class.isInstance(ex)) {
           throw (ServletException) ex;
        } else {
           throw new ServletException(ex);
        }
      }
  }
```

# React: Ajax & JSON



Get Books | Search | Export JSON | Export CSV

| Book | Author | Language | Published | Sales |
|---|---|---|---|---|
| The Lord of the Rings | J. R. R. Tolkien | English | 1954-1955 | 150 million |
| Le Petit Prince (The Little Prince) | Antoine de Saint-Exup[illegible]ry | French | 1943 | 140 million |
| Harry Potter and the Philosopher's Stone | J. K. Rowling | English | 1997 | 107 million |
| And Then There Were None | Agatha Christie | English | 1939 | 100 million |
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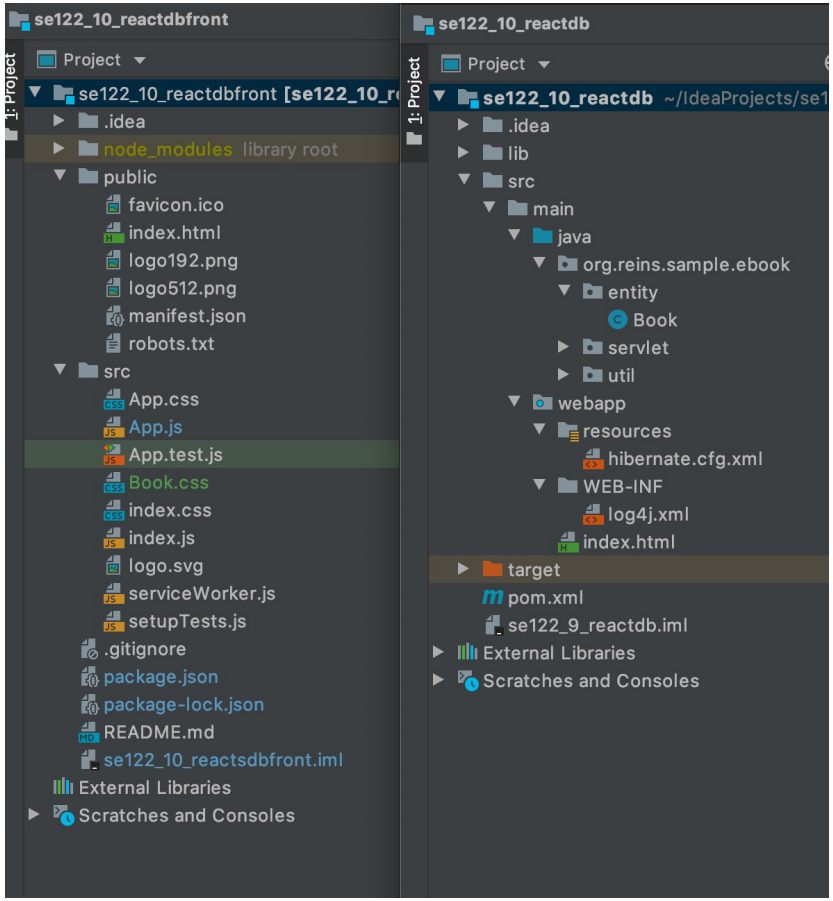
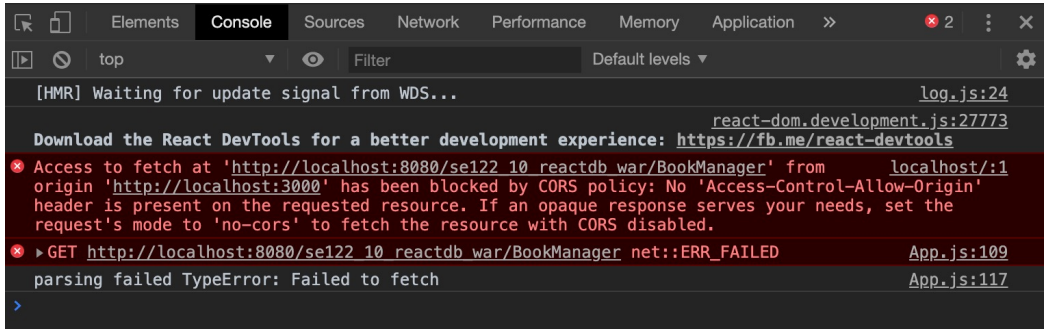
| The Hobbit | J. R. R. Tolkien | English | 1937 | 100 million |
| She: A History of Adventure | H. Rider Haggard | English | 1887 | 100 million |

```
import com.alibaba.fastjson.JSON;
import com.alibaba.fastjson.JSONArray;
import com.alibaba.fastjson.serializer.SerializerFeature;

response.setContentType("application/json; charset=UTF-8");

String  booksString = JSON.toJSONString(booksJson, SerializerFeature.BrowserCompatible);
```

# React: Ajax & JSON

REliable, INtelligent & Scalable Systems




**No 'Access-Control-Allow-Origin' header is present on the requested resource'**

**Same Origin Policy**

BookManagerServlet.java

```
response.setHeader("Access-Control-Allow-Origin", "http://localhost:3000");
```

# JSON

- JSON is a text-based data exchange format derived from JavaScript that is used in web services and other connected applications.

- JSON defines only two data structures: objects and arrays.
  - An object is a set of name-value pairs, and an array is a list of values.
  - JSON defines six data types: *string, number, object, array, true, false and null*

- The following example shows JSON data for a sample object that contains name-value pairs.

```
{
 "firstName": "Duke",
 "lastName": "Java",
 "age": 18,
 "streetAddress": "100 Internet Dr",
 "city": "JavaTown",
 "state": "JA",
 "postalCode": "12345",
 "phoneNumbers": [
    { "Mobile": "111-111-1111" },
    { "Home": "222-222-2222" }
  ]
 }
```

# JSON Syntax



- JSON has the following syntax:
  - Objects are enclosed in braces ({ }),
    - their name-value pairs are separated by a comma (,),
    - and the name and value in a pair are separated by a colon (:).
    - Names in an object are strings, whereas values may be of any of the six data types, including another object or an array.
  - Arrays are enclosed in brackets ([ ]),
    - and their values are separated by a comma (,).
    - Each value in an array may be of a different type, including another array or an object.
  - When objects and arrays contain other objects or arrays, the data has a tree-like structure.

# Uses of JSON



- JSON is often used as a common format to
  - serialize and deserialize data in applications that communicate with each other over the Internet.

- The HTTP header used to
  - indicate that the content of a request or a response is JSON data is the following:

```
Content-Type: application/json
```

- For generating and parsing JSON data,
  - there are two programming models, which are similar to those used for XML documents:
    - The object model creates a tree that represents the JSON data in memory.
    - The streaming model uses an event-based parser that reads JSON data one element at a time.

# JSON Processing in the Java EE



- The Java API for JSON Processing contains the following packages:
  - The `javax.json` package contains a reader interface, a writer interface, and a model builder interface for the object model. This package also contains other utility classes and Java types for JSON elements.
  - The `javax.json.stream` package contains a parser interface and a generator interface for the streaming model.

  - In `javax.json`
    - `Json, JsonReader, JsonObjectBuilder, JsonArrayBuilder, JsonWriter, JsonValue, JsonStructure, JsonObject, JsonArray, JsonString, JsonNumber, JsonException`
  - In `javax.json.stream`
    - `JsonParser, JsonGenerator`

# Using the Object Model API



- Creating an Object Model from JSON Data

```
import java.io.FileReader;
import javax.json.Json;
import javax.json.JsonReader;
import javax.json.JsonStructure;
...
JsonReader reader = Json.createReader(new FileReader("jsondata.txt"));
JsonStructure jsonst = reader.read();
```

- The object reference jsonst can be
  - either of type JsonObject or of type JsonArray, depending on the contents of the file.
  - JsonObject and JsonArray are subtypes of JsonStructure.

# Using the Object Model API



- Creating an Object Model from Application Code

```
import javax.json.Json;
import javax.json.JsonObject;
...
JsonObject model = Json.createObjectBuilder()
  .add("firstName", "Duke")
  .add("lastName", "Java")
  .add("age", 18)
  .add("streetAddress", "100 Internet Dr")
  .add("city", "JavaTown")
  .add("state", "JA")
  .add("postalCode", "12345")
  .add("phoneNumbers", Json.createArrayBuilder()
    .add(Json.createObjectBuilder()
      .add("type", "mobile")
      .add("number", "111-111-1111"))
    .add(Json.createObjectBuilder()
      .add("type", "home")
      .add("number", "222-222-2222")))
  .build();
```

# Using the Object Model API



- Navigating an Object Model

```
public static void navigateTree(JsonValue tree, String key) {
 if (key != null)
  System.out.print("Key " + key + ": ");
 switch(tree.getValueType()) {
  case OBJECT:
   System.out.println("OBJECT");
   JsonObject object = (JsonObject) tree;
   for (String name : object.keySet())
    navigateTree(object.get(name), name);
   break;
  case ARRAY:
   System.out.println("ARRAY");
   JsonArray array = (JsonArray) tree;
   for (JsonValue val : array)
    navigateTree(val, null);
   break;
  case STRING:
   JsonString st = (JsonString) tree;
   System.out.println("STRING " + st.getString());
   break;
  case NUMBER:
   JsonNumber num = (JsonNumber) tree;
   System.out.println("NUMBER " + num.toString());
   break;
  case TRUE:
  case FALSE:
  case NULL:
   System.out.println(tree.getValueType().toString());
   break;
 }
}
```

# Using the Object Model API



- Writing an Object Model to a Stream

```
StringWriter stWriter = new StringWriter();
try (JsonWriter jsonWriter = Json.createWriter(stWriter))
{
  jsonWriter.writeObject(model);
}

String jsonData = stWriter.toString();
System.out.println(jsonData);
```

# Using the Streaming API



- Reading JSON Data Using a Parser

```
JsonParser parser = Json.createParser(new StringReader(jsonData));
while (parser.hasNext()) {
 JsonParser.Event event = parser.next();
 switch(event) {
   case START_ARRAY:
   case END_ARRAY:
   case START_OBJECT:
   case END_OBJECT:
   case VALUE_FALSE:
   case VALUE_NULL:
   case VALUE_TRUE:
     System.out.println(event.toString());
     break;
   case KEY_NAME:
     System.out.print(event.toString() + " " + parser.getString() + " - ");
     break;
   case VALUE_STRING:
   case VALUE_NUMBER:
     System.out.println(event.toString() + " " + parser.getString());
     break;
 }
```

# Using the Streaming API



- Writing JSON Data Using a Generator

```
FileWriter writer = new FileWriter("test.txt");
JsonGenerator gen = Json.createGenerator(writer);
gen.writeStartObject()
 .write("firstName", "Duke")
 .write("lastName", "Java")
 .write("age", 18)
 .write("streetAddress", "100 Internet Dr")
 .write("city", "JavaTown")
 .write("state", "JA")
 .write("postalCode", "12345")
 .writeStartArray("phoneNumbers")
   .writeStartObject()
     .write("type", "mobile")
     .write("number", "111-111-1111")
   .writeEnd()
   .writeStartObject()
     .write("type", "home")
     .write("number", "222-222-2222")
   .writeEnd()
 .writeEnd()
.writeEnd();
gen.close();
```

# An example



- index.html

```
……
<form action="" style="margin-top: 15px;">
<table>
 <tr>
        <td align="right">First Name:</td>
        <td><input type="text" name="firstname" id="firstname" size=20 /></td>
 </tr>
 ……
 <tr>
        <td align="right">Phone Number 1:</td>
        <td>
          <input type="text" name="phoneNumber1" id="phoneNumber1" size=20 />
          <select name="phoneType1" id="phoneType1">
                  <option value="Home">Home</option>
                  <option value="Mobile">Mobile</option>
          </select>
        </td>
 </tr>
 ……
</table>
<p>
 <button type="button" onclick="ajaxRequest()">Create a JSON Object</button>
</p>
<textarea id="textarea" cols="70" rows="20"></textarea>
</form>
……
```

# An example



- index.html

```
var infoMsg = new Object();

infoMsg.firstname = document.getElementById("firstname").value;
……
var phone = new Object();
var phoneType1 = document.getElementById("phoneType1").
        options[document.getElementById("phoneType1").selectedIndex].text;
var phoneNumber1 = document.getElementById("phoneNumber1").value;
phone[phoneType1] = phoneNumber1;
var phoneType2 = document.getElementById("phoneType2").
        options[document.getElementById("phoneType2").selectedIndex].text;
var phoneNumber2 = document.getElementById("phoneNumber2").value;
phone[phoneType2] = phoneNumber2;

infoMsg.phoneNumbers = phone;

var jsonstr = JSON.stringify(infoMsg);

xmlHttpRequest.open("POST","JsonServlet",true);
xmlHttpRequest.setRequestHeader("Content-type","application/x-www-form-urlencoded");
xmlHttpRequest.onreadystatechange = ajaxCall;
xmlHttpRequest.send("content=" + jsonstr);

console += "Sent: " + jsonstr + "\n";
document.getElementById("textarea").innerHTML = console;
```

# An example



- JsonServlet.java

```
protected void processRequest(HttpServletRequest request,
      HttpServletResponse response)
      throws ServletException, IOException {

   String content = request.getParameter("content");
   parseJson(content);

   PrintWriter out = response.getWriter();
   out.println(buildJson());
}

public void parseJson(String content) {
   try (JsonReader reader =
         Json.createReader(new StringReader(content))) {
      parsed = reader.readObject();
   }
   this.printTree(parsed, 0, "");
}
```

# An example



- JsonServlet.java

```
public void printTree(JsonValue tree, int level, String key) {
    switch (tree.getValueType()) {
      case OBJECT:
        JsonObject object = (JsonObject) tree;
        System.out.println( level + " " +
                tree.getValueType().toString()  + " " +  key + "--");
        for (String name : object.keySet()) {
          this.printTree(object.get(name), level+1, name);
        }
        break;
      case ARRAY:
        JsonArray array = (JsonArray) tree;
                        System.out.println( level + " " +
                tree.getValueType().toString() + " " + key + "--");
        for (JsonValue val : array) {
          this.printTree(val, level+1, "");
        }
        break;
          ……
    }
}
```

# An example



- JsonServlet.java

```
public String buildJson() {
    JsonObject model = Json.createObjectBuilder()
        .add("firstName", "Tom")
        .add("lastName", "Jerry")
        .add("age", 10)
        .add("streetAddress", "Disney Avenue")
        .add("city", "los angles")
        .add("state", "CA")
        .add("postalCode", "12345")
        .add("phoneNumbers", Json.createArrayBuilder()
            .add(Json.createObjectBuilder()
                .add("number", "911")
                .add("type", "HOME"))
            .add(Json.createObjectBuilder()
                .add("number", "110")
                .add("type", "OFFICE")))
    .build();
```

# An example



- JsonServlet.java

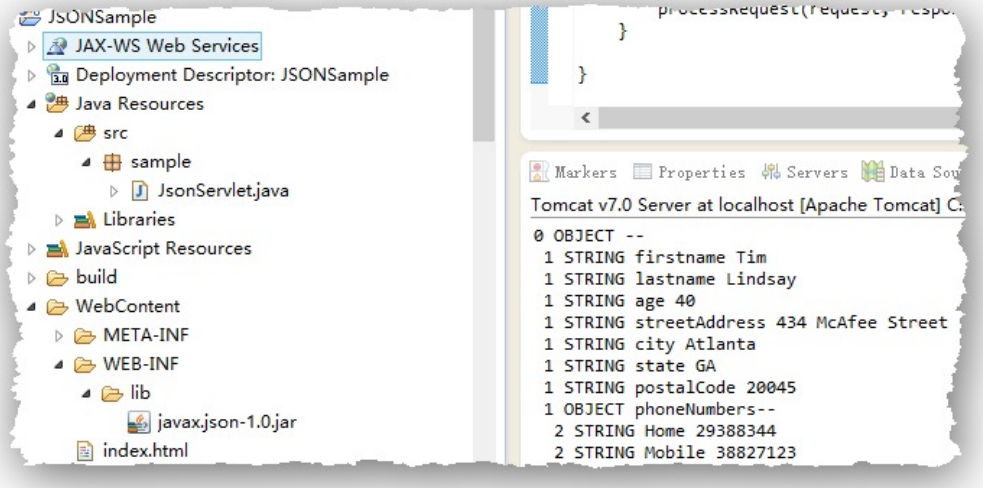
```
StringWriter stWriter = new StringWriter();
try (JsonWriter jsonWriter = Json.createWriter(stWriter)) {
   jsonWriter.writeObject(model);
}
return stWriter.toString();
```

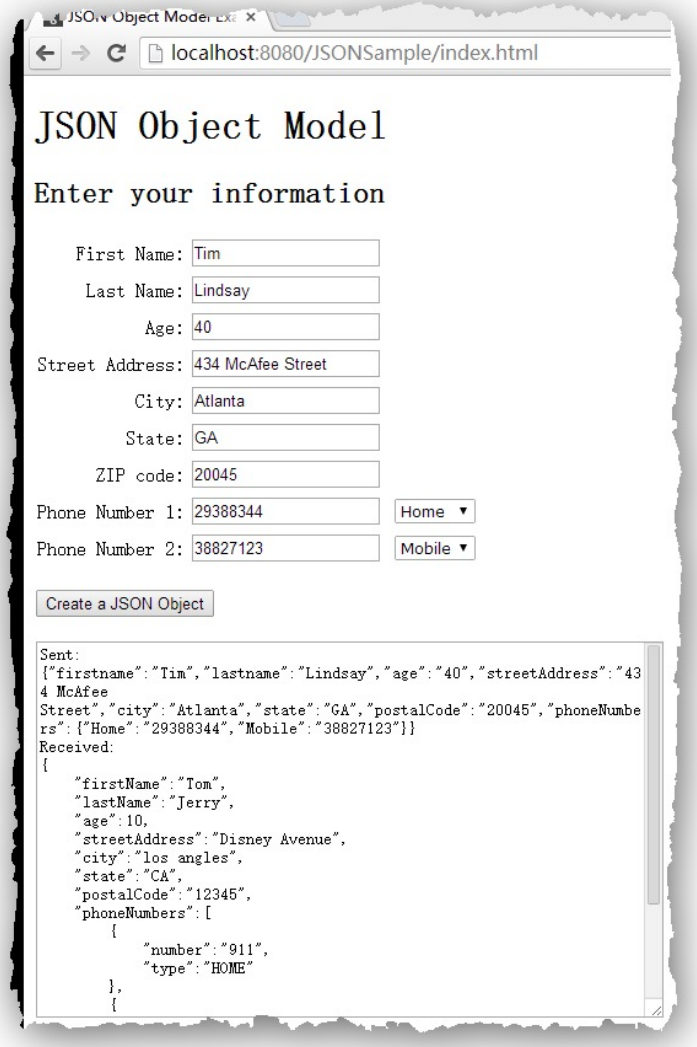
- or

```
/* Write formatted JSON Output */
Map<String,String> config = new HashMap<>();
config.put(JsonGenerator.PRETTY_PRINTING, "");
JsonWriterFactory factory = Json.createWriterFactory(config);

StringWriter stWriterF = new StringWriter();
try (JsonWriter jsonWriterF = factory.createWriter(stWriterF)) {
   jsonWriterF.writeObject(model);
}

return stWriterF.toString();
}
```

# An example




JSONSample
JAX-WS Web Services
Deployment Descriptor: JSONSample
Java Resources
src
sample
JsonServlet.java
Libraries
JavaScript Resources
build
WebContent
META-INF
WEB-INF
lib
javax.json-1.0.jar
index.html
}
}
Markers
Properties
Servers
Tomcat v7.0 Server at localhost [Apache Tomcat]
0 OBJECT --
1 STRING firstname Tim
1 STRING lastname Lindsay
1 STRING age 40
1 STRING streetAddress 434 McAfee Street
1 STRING city Atlanta
1 STRING state GA
1 STRING postalCode 20045
1 OBJECT phoneNumbers--
2 STRING Home 29388344
2 STRING Mobile 38827123


localhost:8080/JSONSample/index.html
JSON Object Model
Enter your information
First Name: Tim
Last Name: Lindsay
Age: 40
Street Address: 434 McAfee Street
City: Atlanta
State: GA
ZIP code: 20045
Phone Number 1: 29388344 Home
Phone Number 2: 38827123 Mobile
Create a JSON Object
Sent:
{"firstname":"Tim","lastname":"Lindsay","age":"40","streetAddress":"434 McAfee Street","city":"Atlanta","state":"GA","postalCode":"20045","phoneNumbers":{"Home":"29388344","Mobile":"38827123"}}
Received:
{
"firstName":"Tom",
"lastName":"Jerry",
"age":10,
"streetAddress":"Disney Avenue",
"city":"los angles",
"state":"CA",
"postalCode":"12345",
"phoneNumbers":[
{
"number":"911",
"type":"HOME"
},
{

# Postman

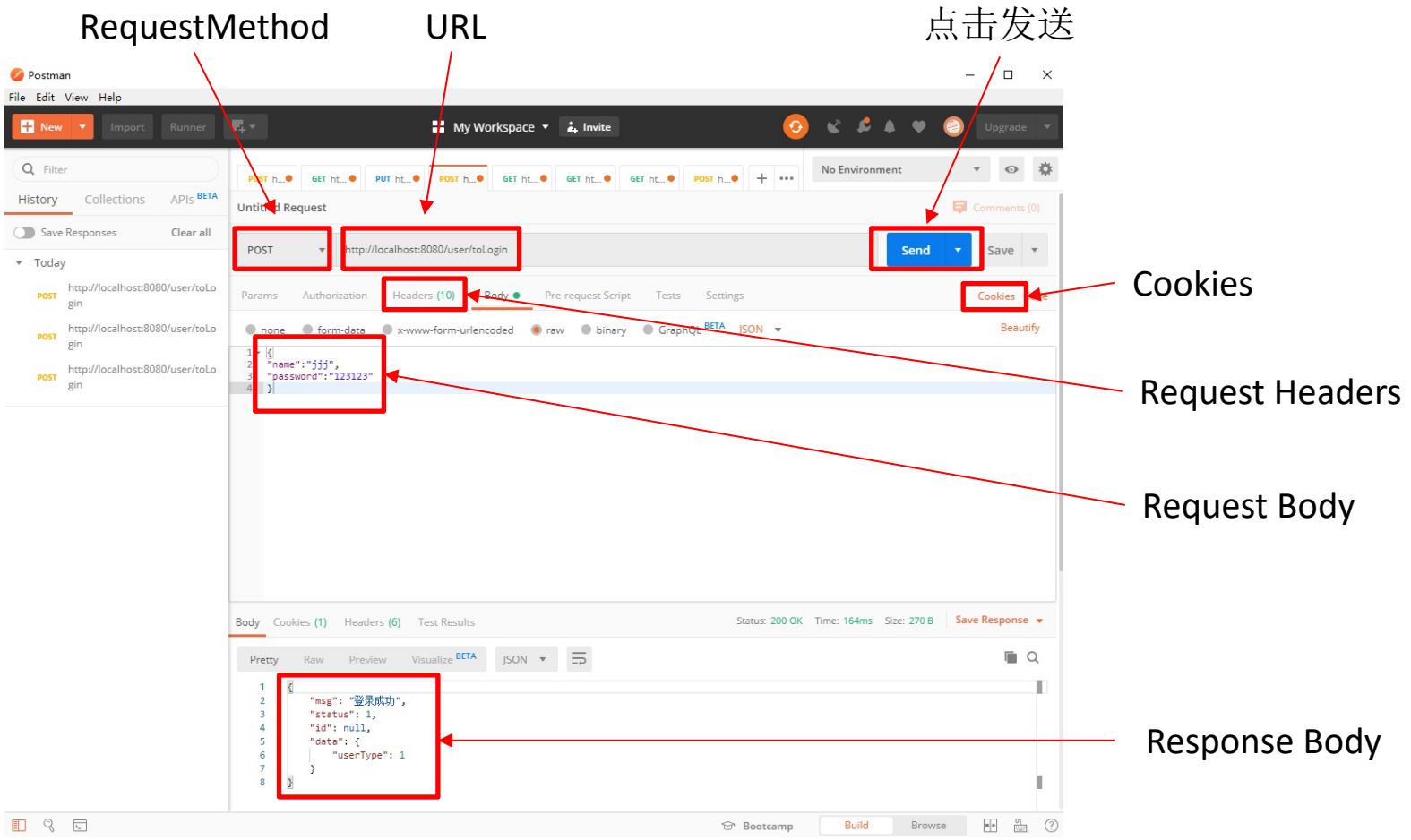


- 下载
  - https://www.getpostman.com
- 文档
  - https://learning.getpostman.com/docs/postman/launching-postman/introduction/

用于接口测试

# Postman




RequestMethod
URL
点击发送
Cookies
Request Headers
Request Body
Response Body
POST
http://localhost:8080/user/toLogin
Send
Save
Params
Authorization
Headers (10)
Body
Pre-request Script
Tests
Settings
Cookies
{
"name":"jjj",
"password":"123123"
}
Body
Cookies (1)
Headers (6)
Test Results
Status: 200 OK
Time: 164ms
Size: 270 B
Save Response
Pretty
Raw
Preview
Visualize
JSON
{
"msg": "登录成功",
"status": 1,
"id": null,
"data": {
"userType": 1
}
}

# References



- Ajax
  - http://www.w3school.com.cn/ajax/index.asp
- jQuery Ajax
  - http://www.w3school.com.cn/jquery/jquery_ajax_intro.asp
- jQuery Ajax
  - http://learn.jquery.com/ajax/
- Fastjson 常见问题
  - https://www.w3cschool.cn/fastjson/fastjson-howto.html
- No 'Access-Control-Allow-Origin' header is present on the requested resource'， 跨域访问的解决方法
  - https://blog.csdn.net/dear_little_bear/article/details/83999391
- fetch API
  - https://developer.mozilla.org/en-US/docs/Web/API/Fetch_API
  - https://www.w3cschool.cn/fetch_api/


- *Web*开发技术
- *Web Application Development*

# Thank You!