HTML5-REST-Jakarta Overview

by

Ronald Cook

www.linkedin.com/in/ronald-cook-programmer

March 2023

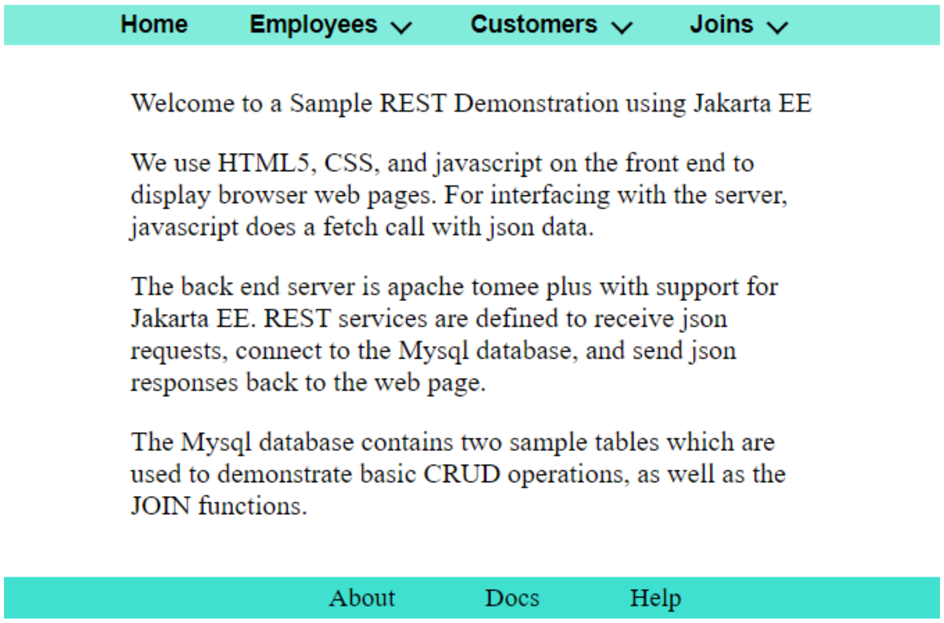
Overview of HTML5-REST-Jakarta

Introduction

The purpose of this project is to learn some details about a simple application based on HTML5, javascript, json, REST, Jakarta, and MySql. The UI front end is created with HTML5, CSS and javascript, while Jakarta implements the back end. The application demonstrates javascript web components, json processing, and SQL queries.

Configuration

See the pom.xml for the versions of each component in the application. Eclipse or another IDE may be used to build the war file. The MySql database must be launched before this application runs. The sql file, simplemodels-dump.sql, may be used to populate the database with some initial records. All application urls go to the a server that implements the JakartaEE 10 API, such as Wildfly 27. Once the server is started, open a browser and enter the URL: localhost:8080/html5-jakarta-1.0 to open the home page, shown below.



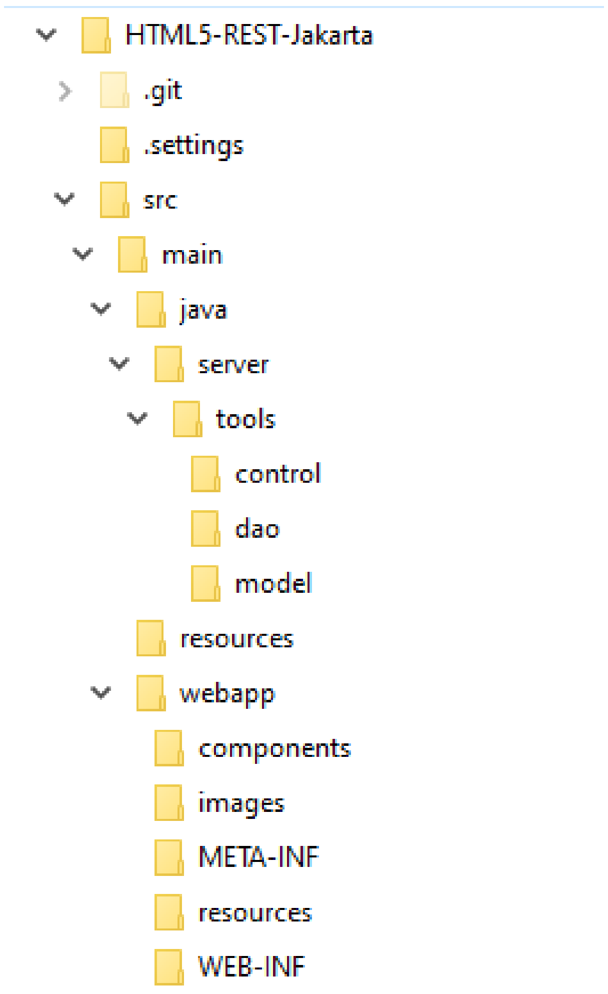
Welcome to a Sample REST Demonstration using Jakarta EE

We use HTML5, CSS, and javascript on the front end to display browser web pages. For interfacing with the server, javascript does a fetch call with json data.

The back end server is apache tomee plus with support for Jakarta EE. REST services are defined to receive json requests, connect to the Mysql database, and send json responses back to the web page.

The Mysql database contains two sample tables which are used to demonstrate basic CRUD operations, as well as the JOIN functions.

The application code structure is shown here:



```
HTML5-REST-Jakarta
  .git
  .settings
  src
    main
      java
        server
          tools
            control
            dao
            model
      resources
      webapp
        components
        images
        META-INF
        resources
        WEB-INF
```

In the discussion that follows, it is most instructive to review the code to fully understand how it works.

Front End Discussion

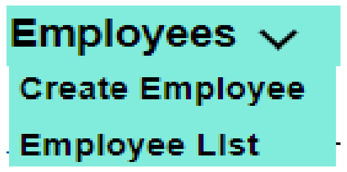
The sample application consists of just a few screens: Home, Add Employee, Employee List, Add Customer, Customer List, and a series of Joins.

Header and Footer

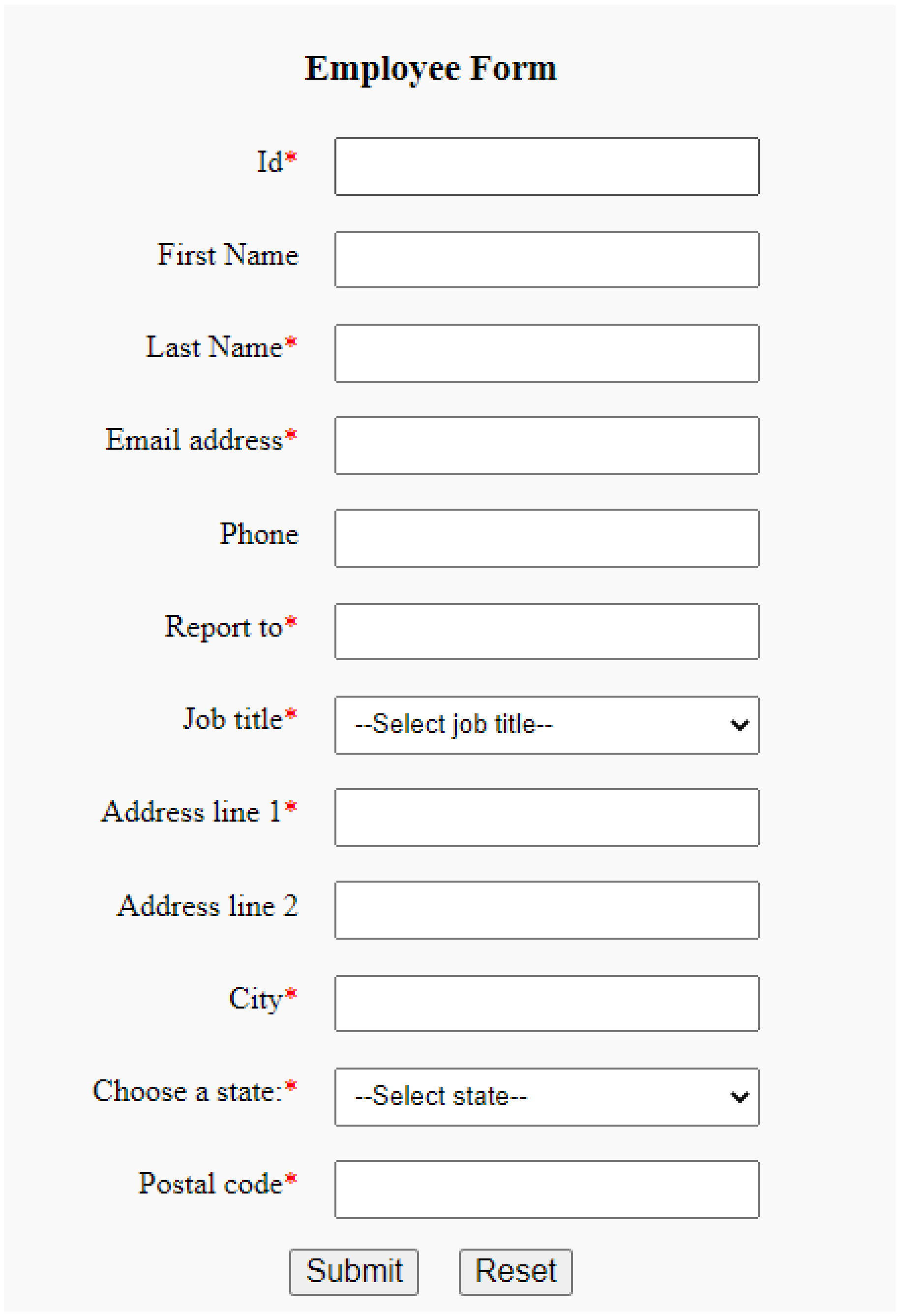
At the top of every screen there is a horizontal navigation bar which is defined in the javascript web component header.js, using HTML header and nav tags, and an HTML list. The CSS file, navDrop.css, provides spacing, color. At the bottom of every screen, another navigation bar is defined in web component footer.js, which uses the HTML footer tag.

Employees

Employees menu has two options.



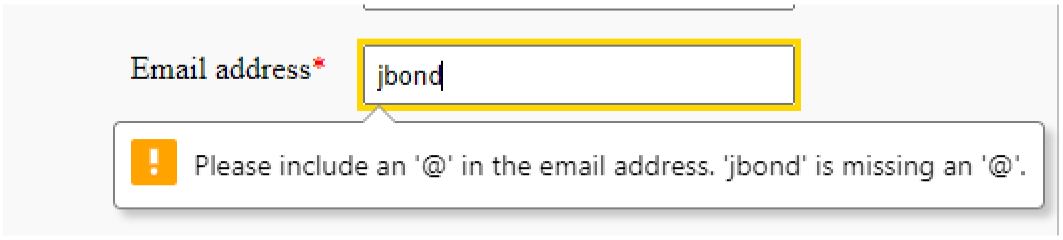
The Create Employee form contains input fields for Id, Name, Phone, Email, Report to, Job title, and Address info. Examine employeeForm.html and entryForm.css to see how the form is designed. Note how the form is centered horizontally with CSS "margin-left:auto" and "margin-right:auto". The labels and input fields are grouped under a fieldset tag and arranged using "display: grid".


Employee Form

Id*	
First Name	
Last Name*	
Email address*	
Phone	
Report to*	
Job title*	--Select job title--
Address line 1*	
Address line 2	
City*	
Choose a state:*	--Select state--
Postal code*	

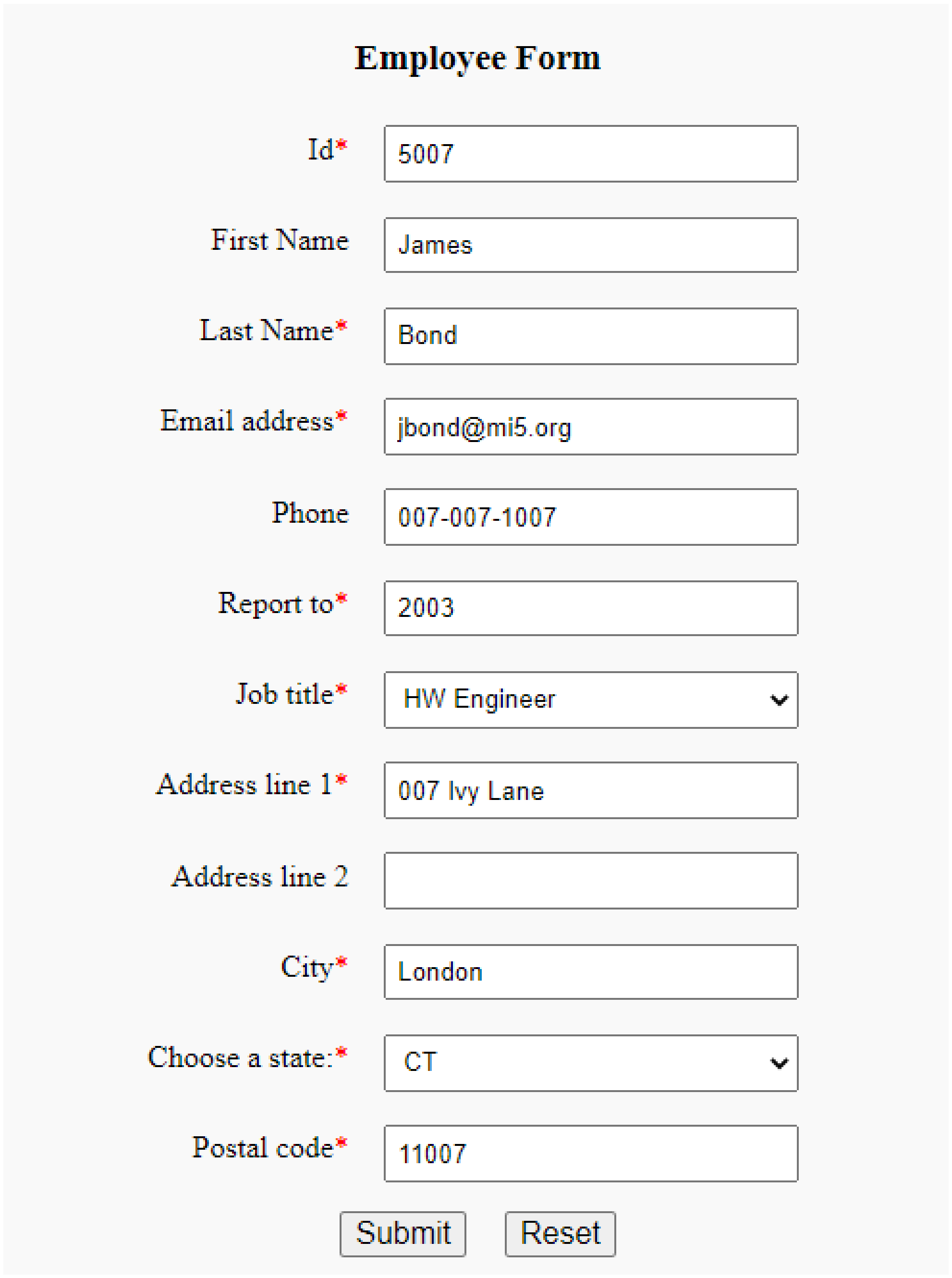
The buttons are center aligned with “display: flex” and “justify-content: center” CSS. The Reset button is used to clear all form fields. The Submit button will send the form fields to a POST request using a javascript fetch, in which the employee object is converted into json for the Jakarta REST service, explained later.

If the user omits a required input, the submit halts, and an HTML5 built-in form validation message appears below the missing input field.



Email address*	jbond

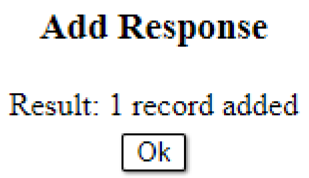
Please include an '@' in the email address. 'jbond' is missing an '@'.



Employee Form

Id*	5007
First Name	James
Last Name*	Bond
Email address*	jbond@mi5.org
Phone	007-007-1007
Report to*	2003
Job title*	HW Engineer
Address line 1*	007 Ivy Lane
Address line 2	
City*	London
Choose a state:*	CT
Postal code*	11007

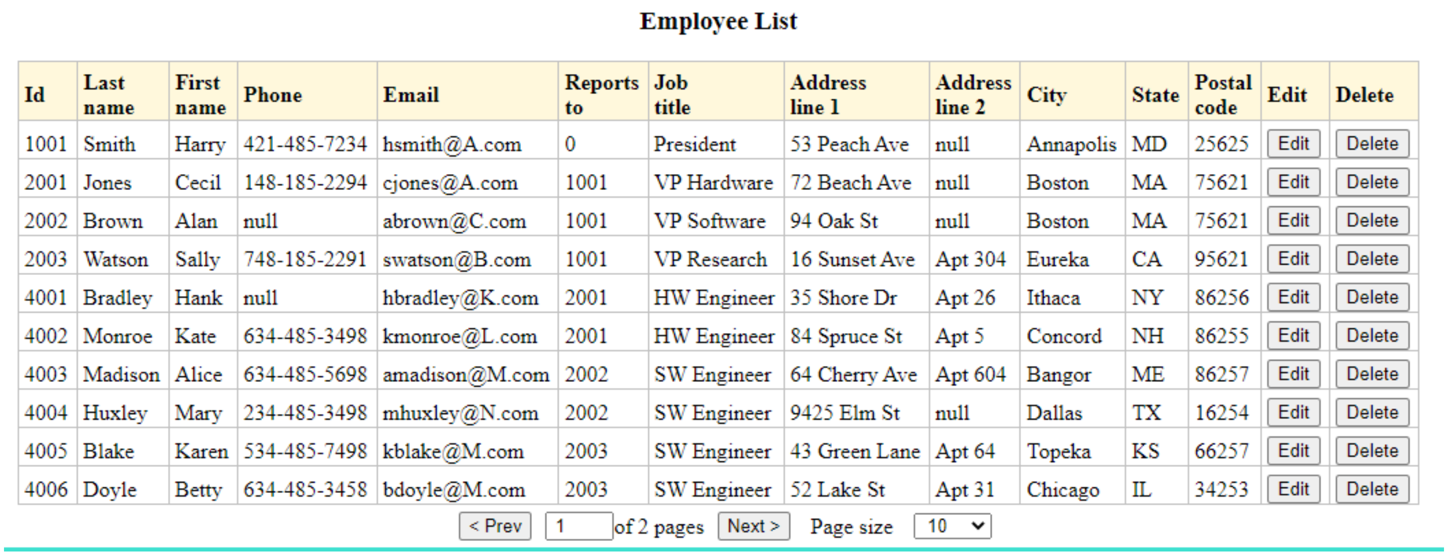
If submit is successful, a "notifier" web component appears showing the response from the server.



Add Response

Result: 1 record added

The Employee List screen displays a table of employees, with additional columns to edit or delete the data. At the bottom of this screen there is a row of page info, created by the pager.js web component. Note employeeList.html uses a table template, which is populated by javascript from listUtils.js. Paging data is sent to the REST server as a POST request to specify page size and page number to retrieve from the database. The response is a one page list of data to display. Each row is based on the Employee object, which is also passed to the edit/delete buttons.



Employee List

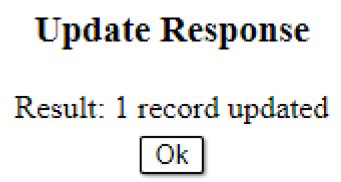
Id	Last name	First name	Phone	Email	Reports to	Job title	Address line 1	Address line 2	City	State	Postal code	Edit	Delete
1001	Smith	Harry	421-485-7234	hsmith@A.com	0	President	53 Peach Ave	null	Annapolis	MD	25625	Edit	Delete
2001	Jones	Cecil	148-185-2294	cjones@A.com	1001	VP Hardware	72 Beach Ave	null	Boston	MA	75621	Edit	Delete
2002	Brown	Alan	null	abrown@C.com	1001	VP Software	94 Oak St	null	Boston	MA	75621	Edit	Delete
2003	Watson	Sally	748-185-2291	swatson@B.com	1001	VP Research	16 Sunset Ave	Apt 304	Eureka	CA	95621	Edit	Delete
4001	Bradley	Hank	null	hbradley@K.com	2001	HW Engineer	35 Shore Dr	Apt 26	Ithaca	NY	86256	Edit	Delete
4002	Monroe	Kate	634-485-3498	kmonroe@L.com	2001	HW Engineer	84 Spruce St	Apt 5	Concord	NH	86255	Edit	Delete
4003	Madison	Alice	634-485-5698	amadison@M.com	2002	SW Engineer	64 Cherry Ave	Apt 604	Bangor	ME	86257	Edit	Delete
4004	Huxley	Mary	234-485-3498	mhuxley@N.com	2002	SW Engineer	9425 Elm St	null	Dallas	TX	16254	Edit	Delete
4005	Blake	Karen	534-485-7498	kblake@M.com	2003	SW Engineer	43 Green Lane	Apt 64	Topeka	KS	66257	Edit	Delete
4006	Doyle	Betty	634-485-3458	bdoyle@M.com	2003	SW Engineer	52 Lake St	Apt 31	Chicago	IL	34253	Edit	Delete

< Prev 1 of 2 pages Next > Page size 10

When the user presses the Edit button, javascript is called with the employee object argument, which is converted to json, and saved in sessionStorage for use in employeeForm. The ID distinguishes a new employee from an updated employee.

Therefore, the same form can be used to process both cases. However, in case of adding a new employee, a POST request is sent, whereas for the case of an update, a PUT request is sent.

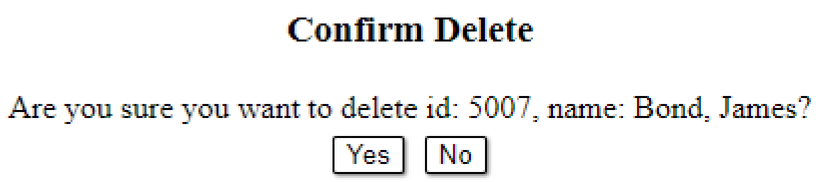
If an update is successful, a “notifier” web component appears showing the response from the server.



Update Response

Result: 1 record updated

For a delete case, the “confirmer” web component pops up to allow the user to cancel:



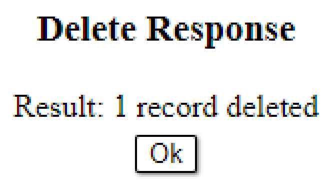
Confirm Delete

Are you sure you want to delete id: 5007, name: Bond, James?

When the user selects yes, the delete Id is sent to the REST service in a url:

http://localhost:8080/html5-jakarta-1.0/api/employees/5007

The “notifier” web component shows the result of the delete request.



Delete Response

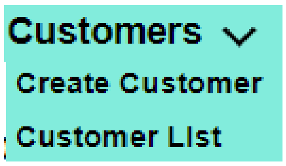
Result: 1 record deleted

The “pager” web component buttons below the table allow the user to display the next page of data, previous page, or selected page. Paging requires a REST call to the back end via the url:

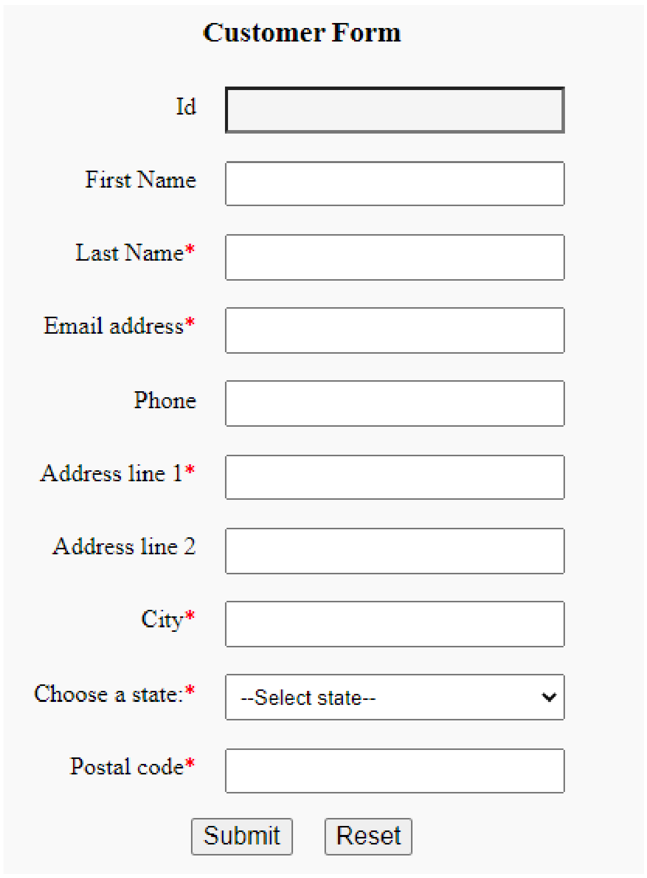
http://localhost:8080/html5-jakarta-1.0/api/employees/page

Customers

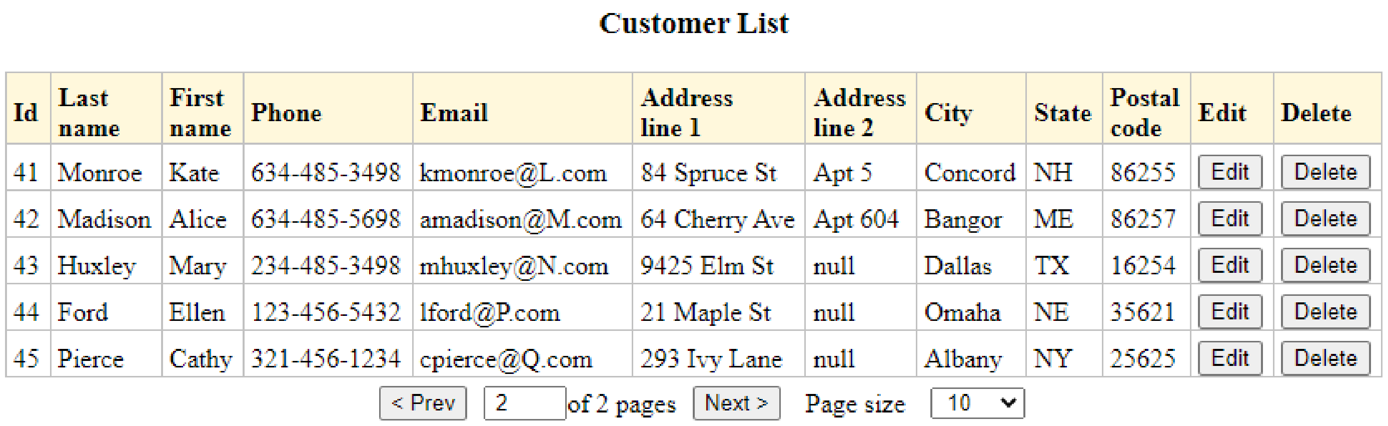
Customers menu has two options.



The Create Customer form contains input fields similar to the Employee Form above, and common functions are invoked from formUtils.js.



The Customer List displays a table similar to the Employee List described above, with shared functions located in listUtils.js.

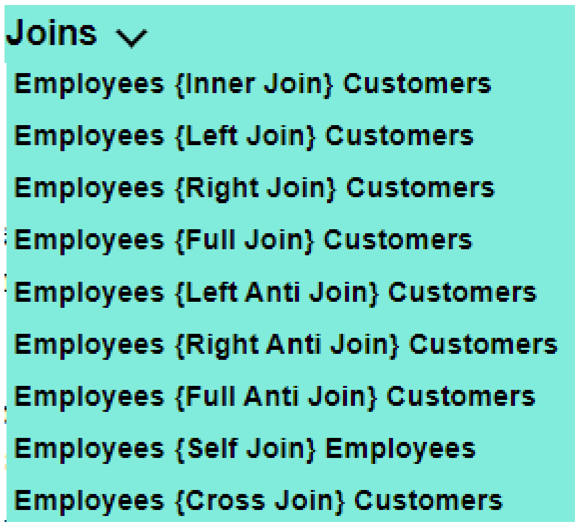


Customer List

Id	Last name	First name	Phone	Email	Address line 1	Address line 2	City	State	Postal code	Edit	Delete
41	Monroe	Kate	634-485-3498	kmonroe@L.com	84 Spruce St	Apt 5	Concord	NH	86255	Edit	Delete
42	Madison	Alice	634-485-5698	amadison@M.com	64 Cherry Ave	Apt 604	Bangor	ME	86257	Edit	Delete
43	Huxley	Mary	234-485-3498	mhuxley@N.com	9425 Elm St	null	Dallas	TX	16254	Edit	Delete
44	Ford	Ellen	123-456-5432	lford@P.com	21 Maple St	null	Omaha	NE	35621	Edit	Delete
45	Pierce	Cathy	321-456-1234	cpierce@Q.com	293 Ivy Lane	null	Albany	NY	25625	Edit	Delete

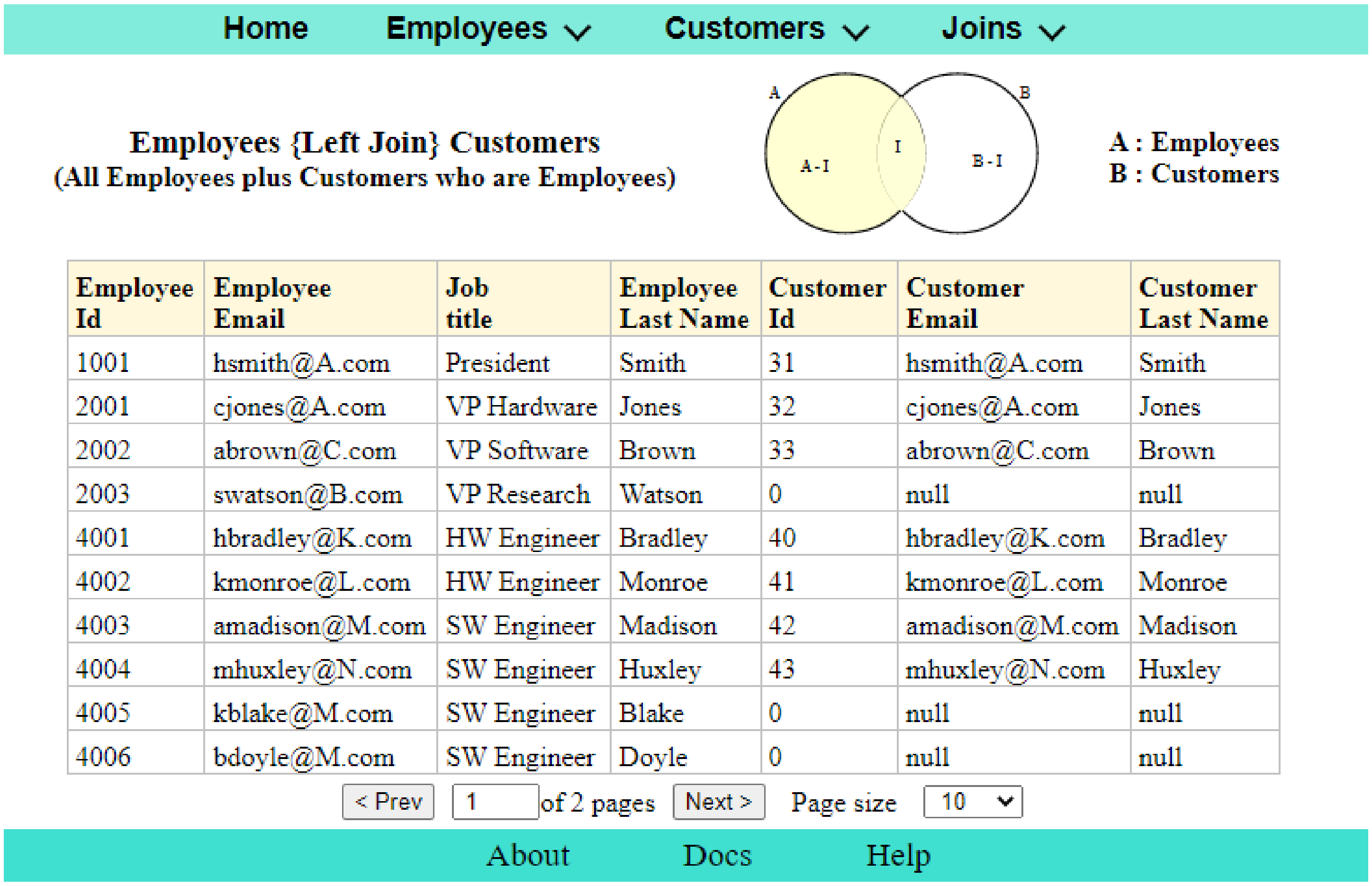
Joins

Joins menu has several options.



Joins
Employees {Inner Join} Customers
Employees {Left Join} Customers
Employees {Right Join} Customers
Employees {Full Join} Customers
Employees {Left Anti Join} Customers
Employees {Right Anti Join} Customers
Employees {Full Anti Join} Customers
Employees {Self Join} Employees
Employees {Cross Join} Customers

Each option demonstrates a basic SQL join operation between the employees database table and the customers table. The results are displayed in a Joins List table similar to Employees and Customers. For example, the left join list looks like the following:



Employees {Left Join} Customers
(All Employees plus Customers who are Employees)

A : Employees
B : Customers

Employee Id	Employee Email	Job title	Employee Last Name	Customer Id	Customer Email	Customer Last Name
1001	hsmith@A.com	President	Smith	31	hsmith@A.com	Smith
2001	cjones@A.com	VP Hardware	Jones	32	cjones@A.com	Jones
2002	abrown@C.com	VP Software	Brown	33	abrown@C.com	Brown
2003	swatson@B.com	VP Research	Watson	0	null	null
4001	hbradley@K.com	HW Engineer	Bradley	40	hbradley@K.com	Bradley
4002	kmonroe@L.com	HW Engineer	Monroe	41	kmonroe@L.com	Monroe
4003	amadison@M.com	SW Engineer	Madison	42	amadison@M.com	Madison
4004	mhuxley@N.com	SW Engineer	Huxley	43	mhuxley@N.com	Huxley
4005	kblake@M.com	SW Engineer	Blake	0	null	null
4006	bdoyle@M.com	SW Engineer	Doyle	0	null	null

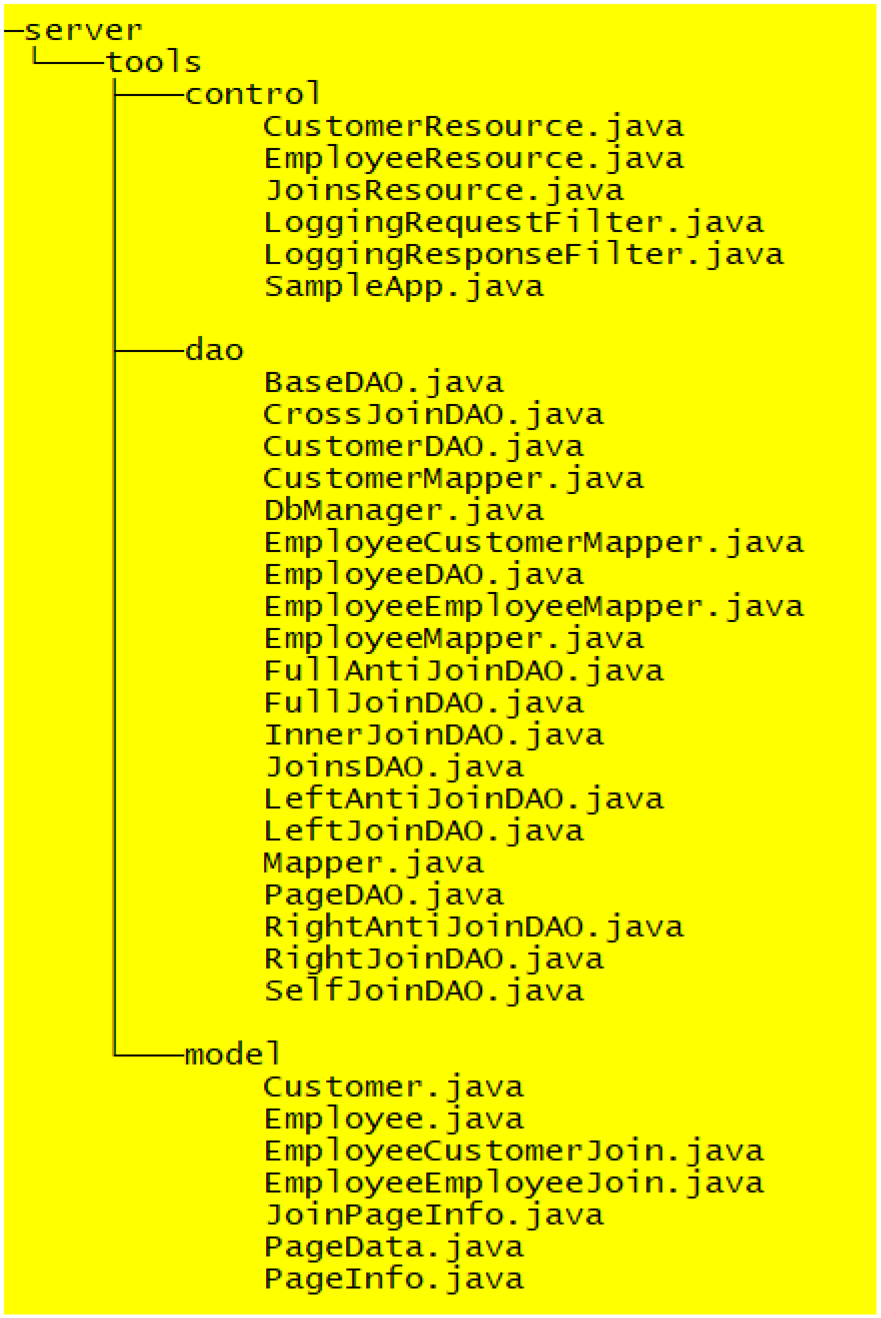
Because there are several join options, header.js calls the javascript function join when the user clicks on the option. The join function extracts the join type and join title from the html, and stores them in localStorage for use by joinList.html.

These items are then used to format the title, sub title, and image above the result list, as shown above. The join type must be included along with the page info in the REST request to the back end.

Back End Discussion

The REST service is implemented by Jakarta with JDBC, to perform CRUD and Join operations on a MySql database. DbManager.java sets up the database configuration parameters. EmployeeResource, CustomerResource, and JoinsResource map REST url paths to database access.

The back end code structure follows:



```
─server
 └───tools
     ├───control
     │       CustomerResource.java
     │       EmployeeResource.java
     │       JoinsResource.java
     │       LoggingRequestFilter.java
     │       LoggingResponseFilter.java
     │       SampleApp.java
     │
     ├───dao
     │       BaseDAO.java
     │       CrossJoinDAO.java
     │       CustomerDAO.java
     │       CustomerMapper.java
     │       DbManager.java
     │       EmployeeCustomerMapper.java
     │       EmployeeDAO.java
     │       EmployeeEmployeeMapper.java
     │       EmployeeMapper.java
     │       FullAntiJoinDAO.java
     │       FullJoinDAO.java
     │       InnerJoinDAO.java
     │       JoinsDAO.java
     │       LeftAntiJoinDAO.java
     │       LeftJoinDAO.java
     │       Mapper.java
     │       PageDAO.java
     │       RightAntiJoinDAO.java
     │       RightJoinDAO.java
     │       SelfJoinDAO.java
     │
     └───model
             Customer.java
             Employee.java
             EmployeeCustomerJoin.java
             EmployeeEmployeeJoin.java
             JoinPageInfo.java
             PageData.java
             PageInfo.java
```

Jakarta Application

SampleApp extends the Jakarta Application class, and specifies the top level url path (api) for all REST services. EmployeeResource, CustomerResource, and JoinsResource each define additional url path suffixes to the top level. For example, the complete url path to display the Employee List is:

“http://localhost:8080/html5-jakarta-1.0/api/employees/page”

where html5-jakarta-1.0 is the name given to the war file.

Employee Rest Service

As an example, a REST request to get a list of employees goes through the LoggingRequestFilter, then to EmployeeResource, where getEmployeesByPage is called. Jakarta automatically parses the request and converts the json body into a PageInfo object, which is passed to EmployeeDao. There, two queries are constructed, one for selecting the list items, and another to retrieve the total count of the items in the database table.

This information and PageInfo are passed to PageDao<T>, where prepared statements are created and executed. The returned object has type PageData<T>, where T is the Employee class in this example. PageData contains an updated PageInfo, and list content specified by List<T>. But how is List<T> populated with the query results? List<Employee> is created with EmployeeMapper, which implements the interface Mapper<T>, by calling mapRow to convert the SQL resultSet into the Employee object.

By using a generic type T, PageDao, PageData, and Mapper are reusable classes. Back at EmployeeResource, PageData is added to the Response entity which is returned to the front end web page.

Note that in all the model classes, there are no setters and getters for simplicity. Since the conversions to and from json does not require setters and getters, there is no point in implementing them.

Also, note that Jakarta does support persistence frameworks, but here we simply used JDBC. For Jakarta Persistence API, see for example: https://itnext.io/whatsnew-in-jakarta-persistence-3-1-by-examples-81b292e8b3a4, or http://www.mastertheboss.com/java-ee/jakarta-ee/jakarta-persistence-3-1-new-features/.

Customer REST Service

The CustomerResource and related classes are similar to EmployeeResource. They share the PageInfo, PageDao, PageData classes, while implementing custom Mapper classes.

Joins REST Service

The JoinsResource classes are a bit more complex due to the join type. For instance, when the left join page request is processed by JoinsResource, JoinsDao is called, which filters the join type in a case statement. From there, another dao is called, such as LeftJoinDao, which defines the customized queries for a SQL left join operation. Then the generic classes, PageDao, PageData, and Mapper, access the database as described above. Finally, in JoinsResource, PageData is added to the Response entity which is returned to the front end web page.

Conclusion

We have discussed a sample web application based on HTML5, REST, and Jakarta. On the front end, reusable javascript web components have been created for header, footer, pager, confirmer, and notifier. The javascript fetch function has been used to send and receive json to and from the back end. Jakarta REST functions process the json seemlessly and interface with the MySql database using basic JDBC functionality. This small application has demonstrated many implementation details. Hopefully, you can reuse some of these features in your own applications.