Bộ môn: Kỹ Thuật Phần Mềm

Lập trình WWW *Java*

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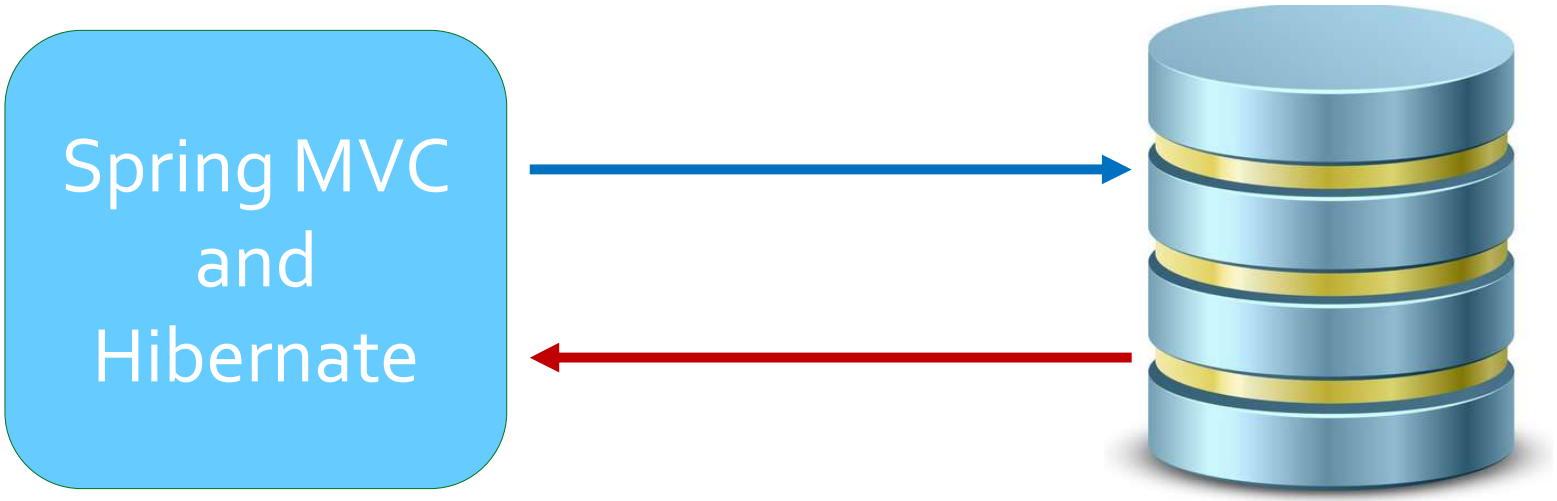
Spring MVC – Web App - Hibernate

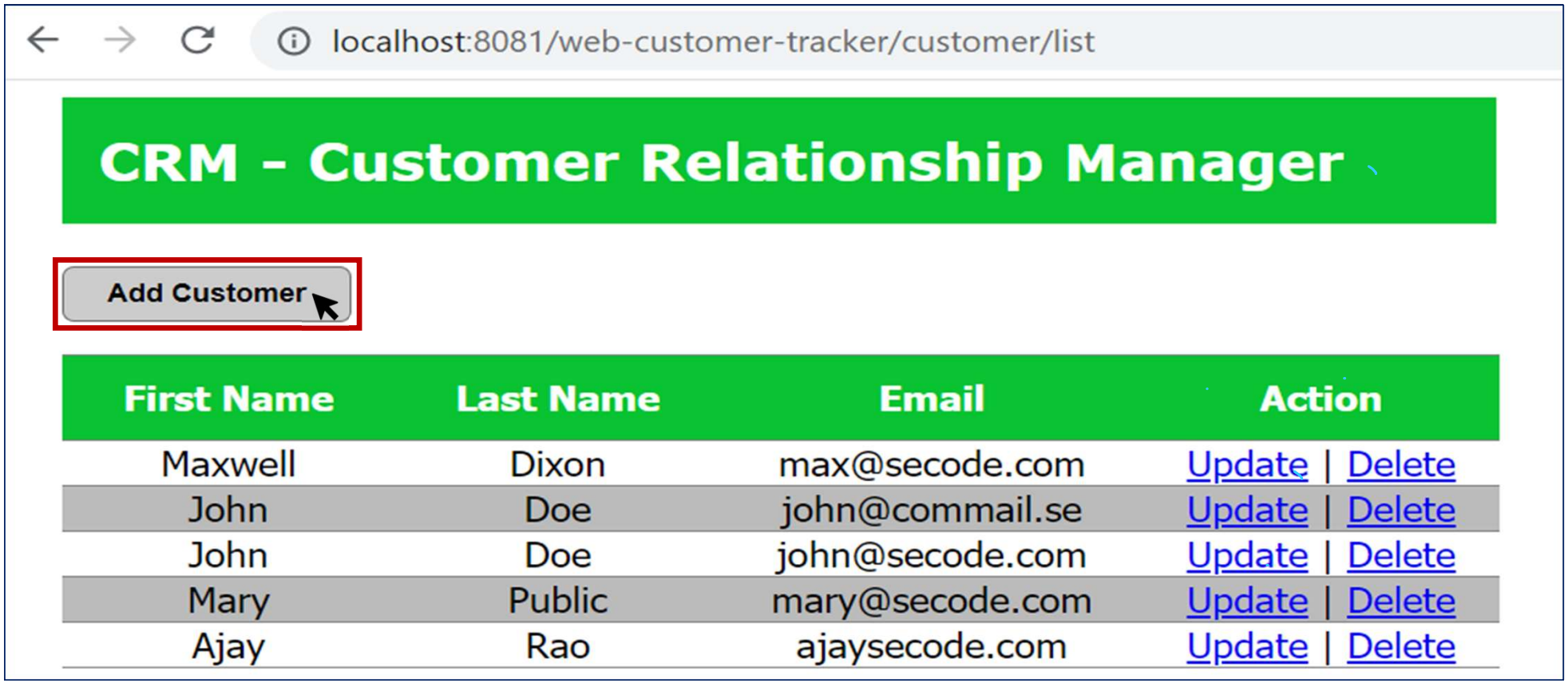
Full working Spring MVC and Hibernate app that connects to a database



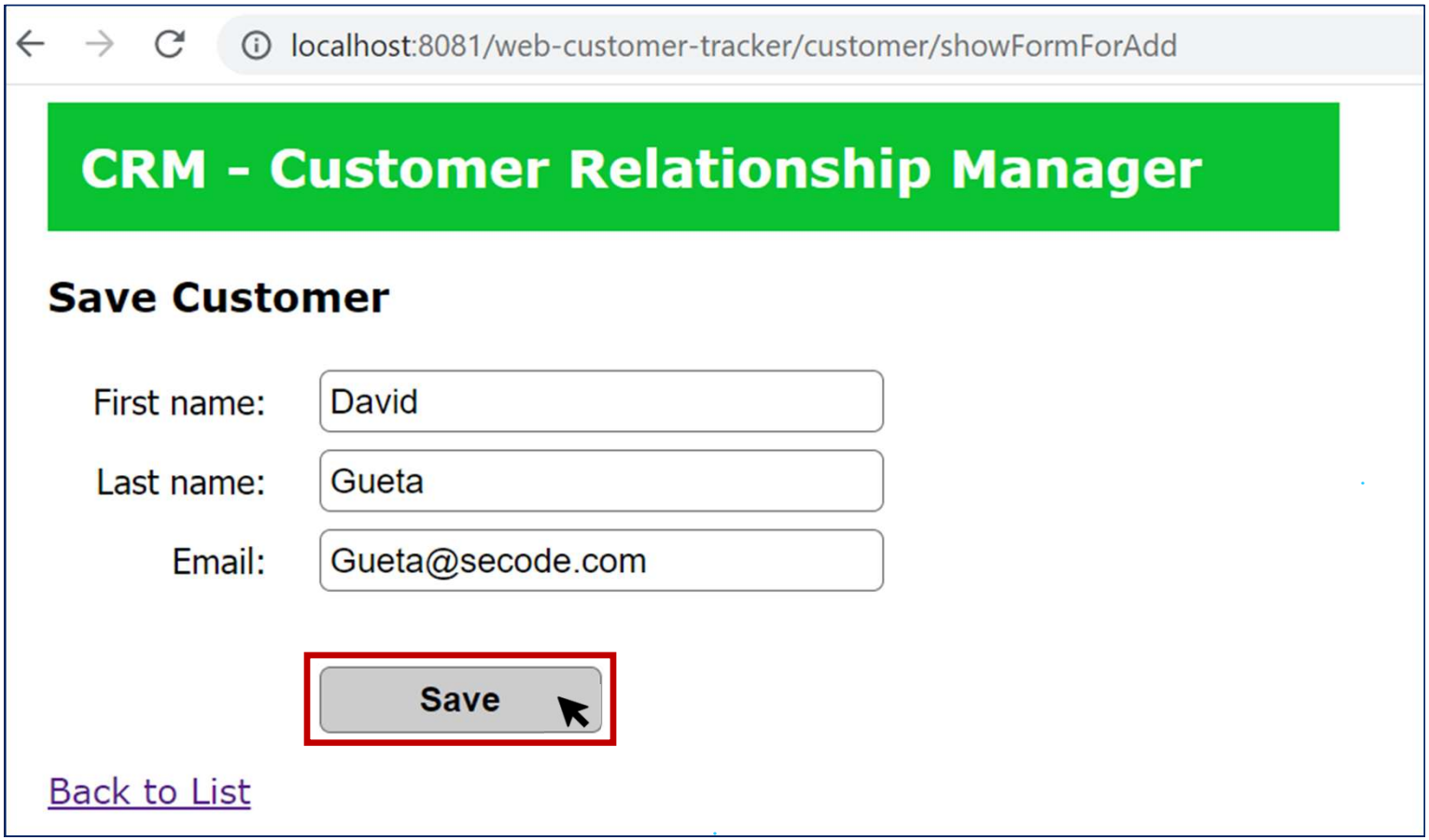
Customer relationship management system or CRM

- Setup Database
- Setup Dev Environment
- Listing the customers
- Add a new customer
- Update a customer
- Delete a customer

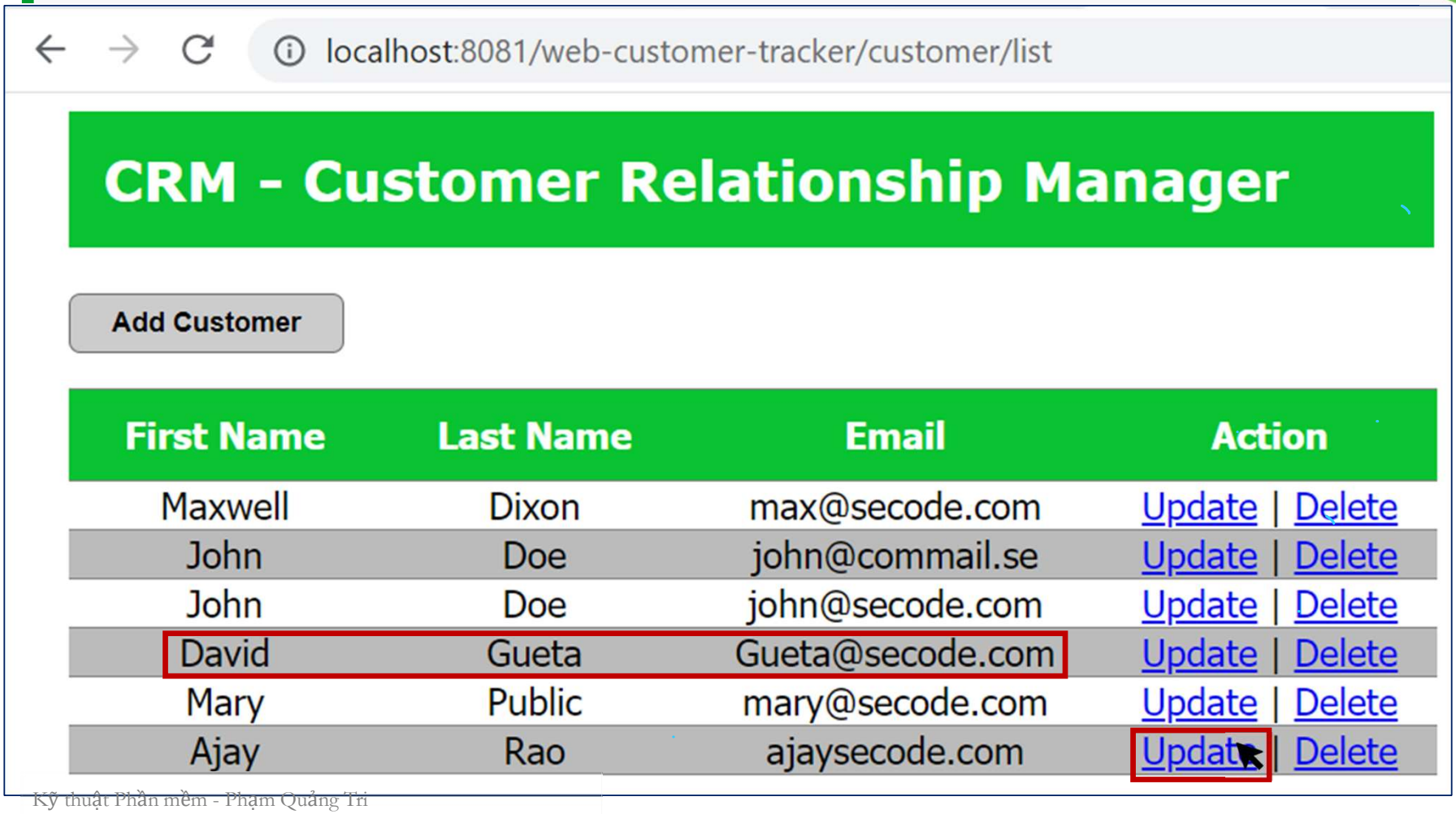
Application Demo - List



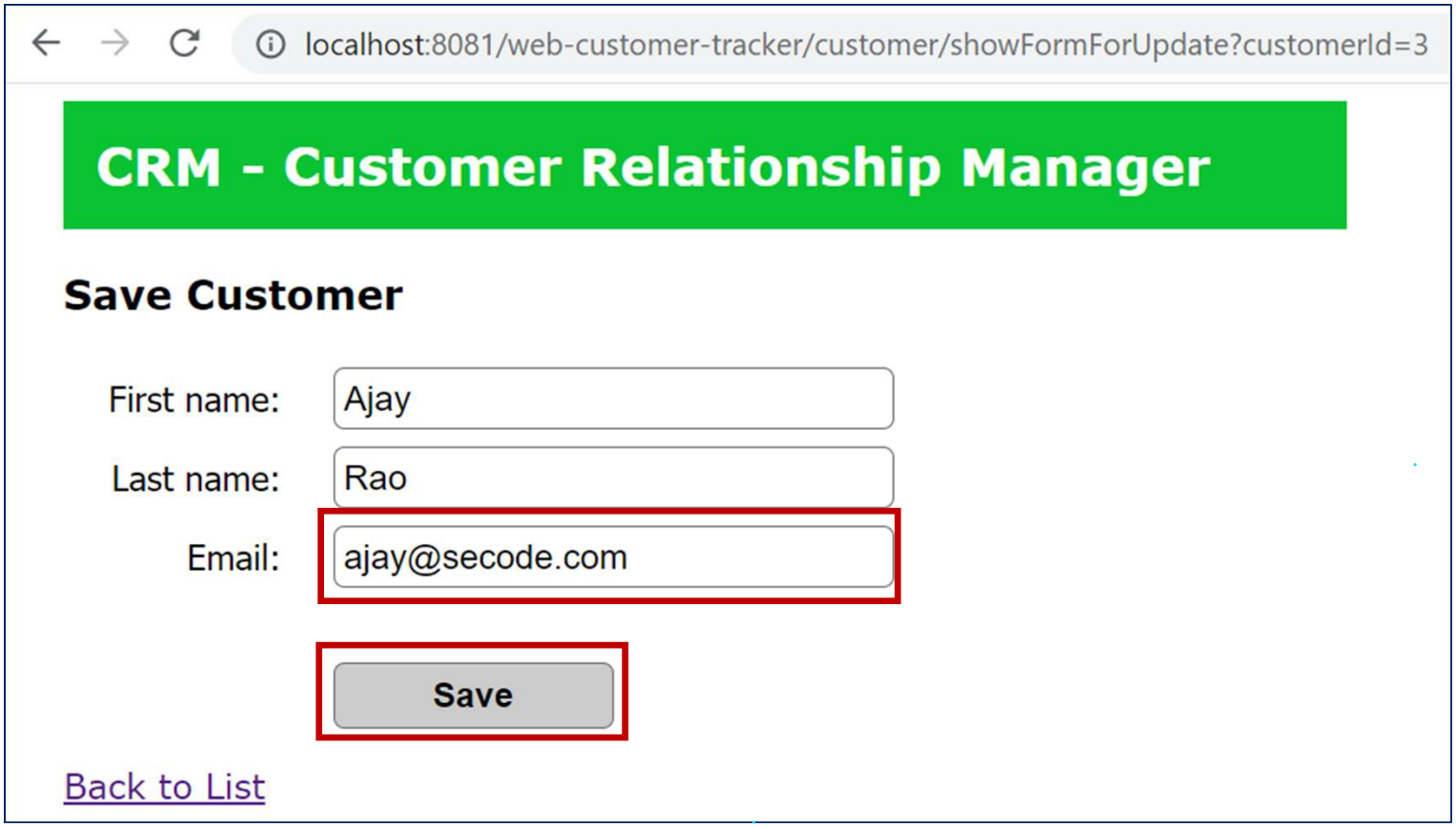
Application Demo – Add new



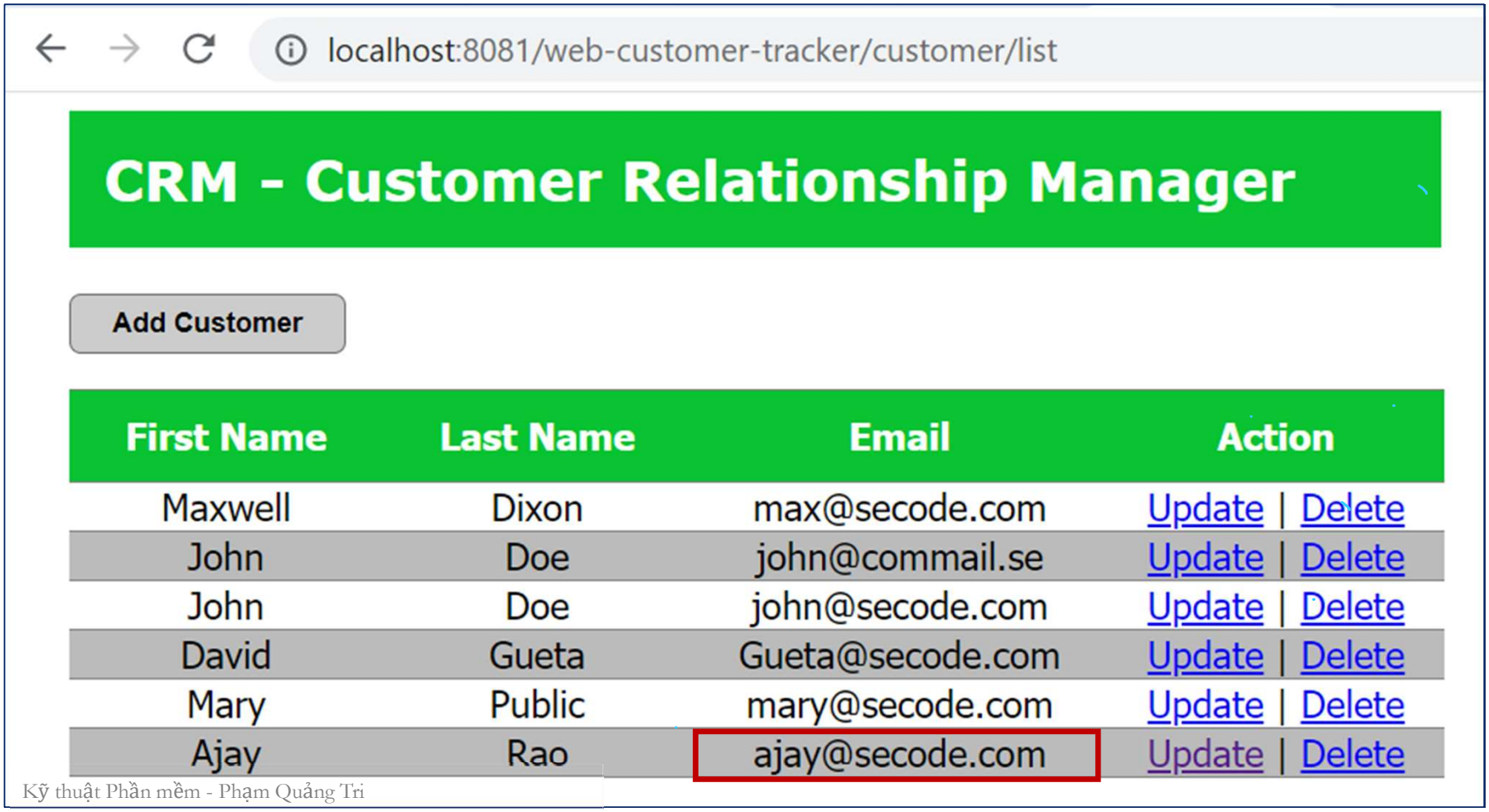
Application Demo - Update



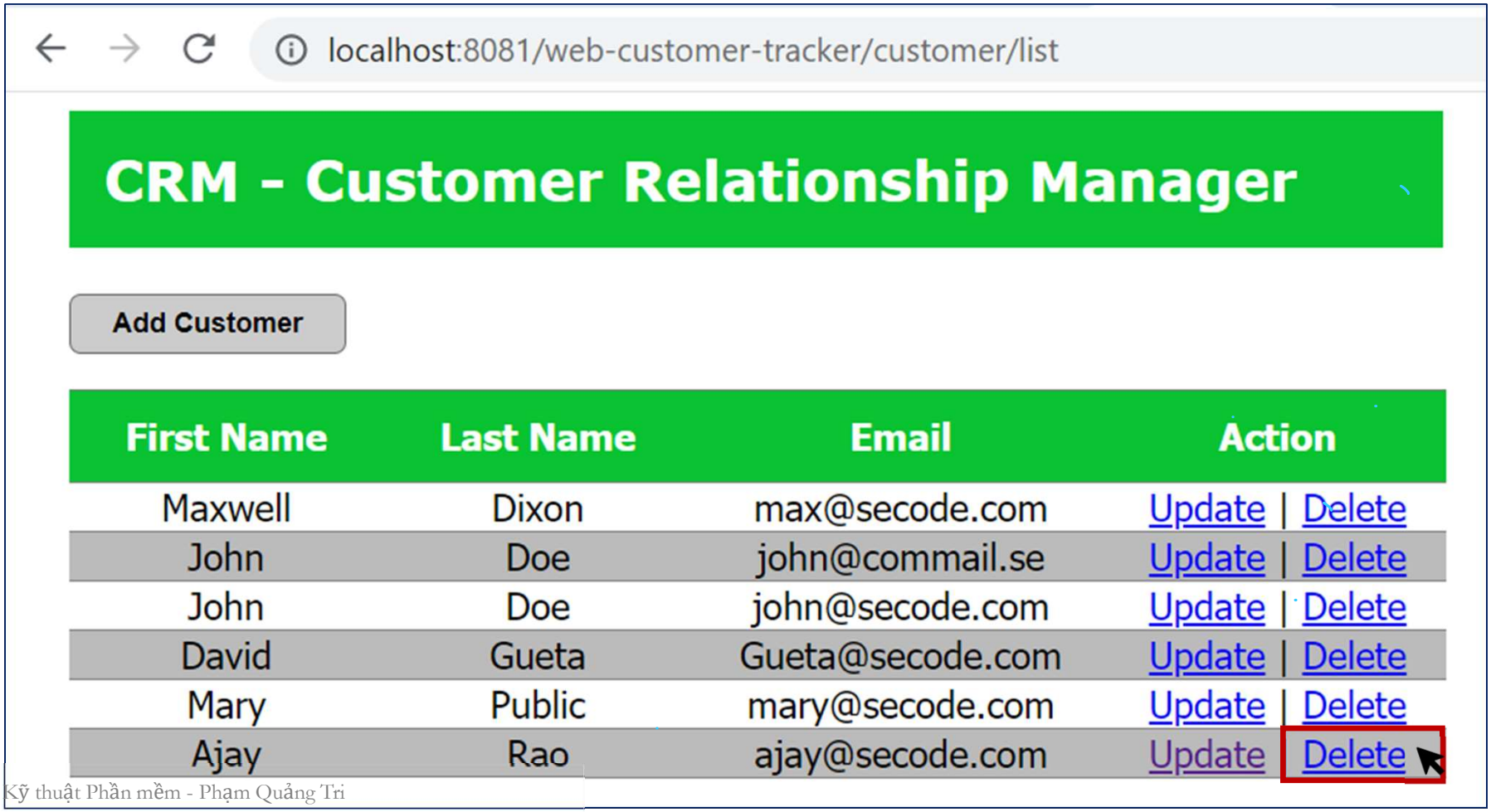
Application Demo - Update



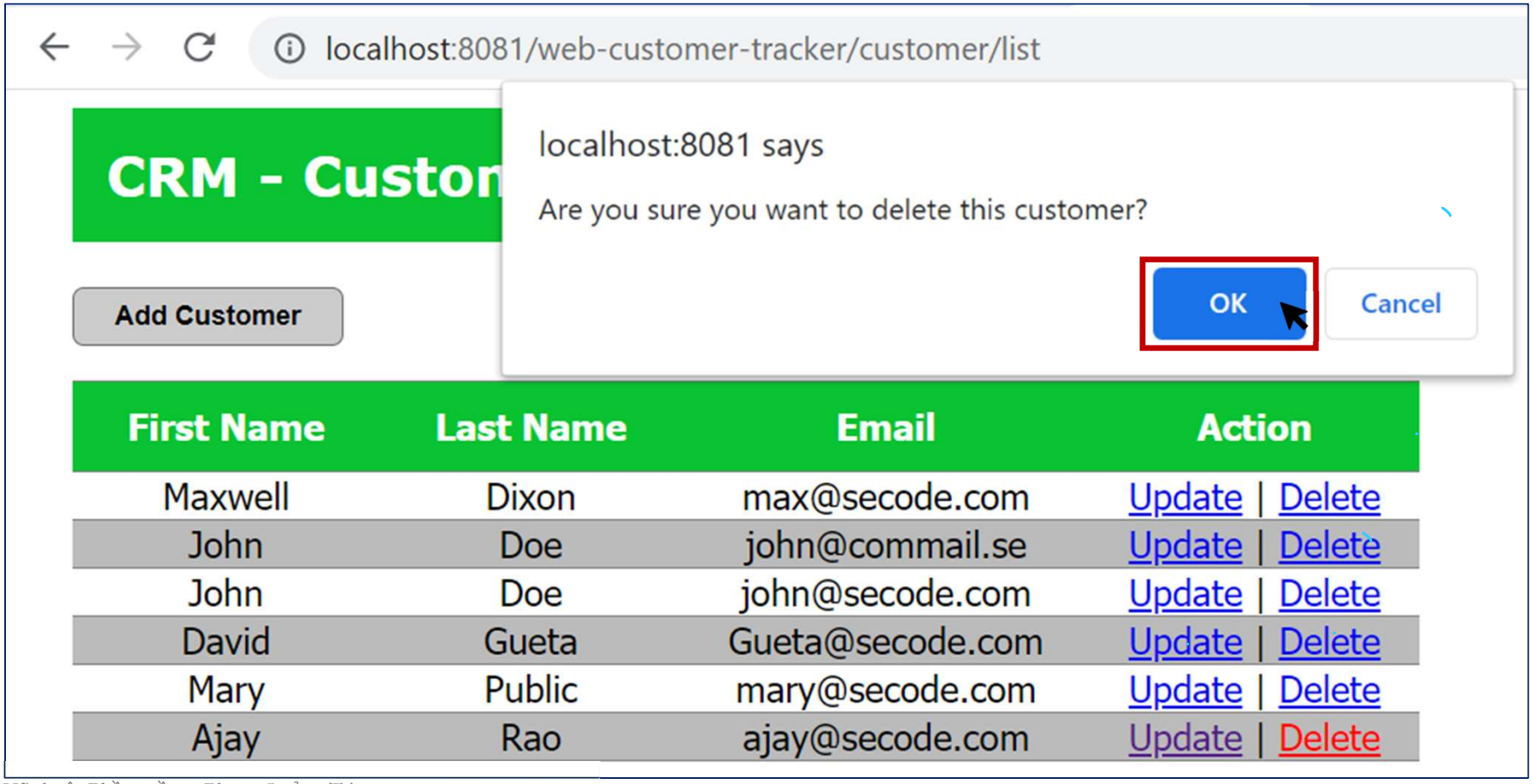
Application Demo - Update



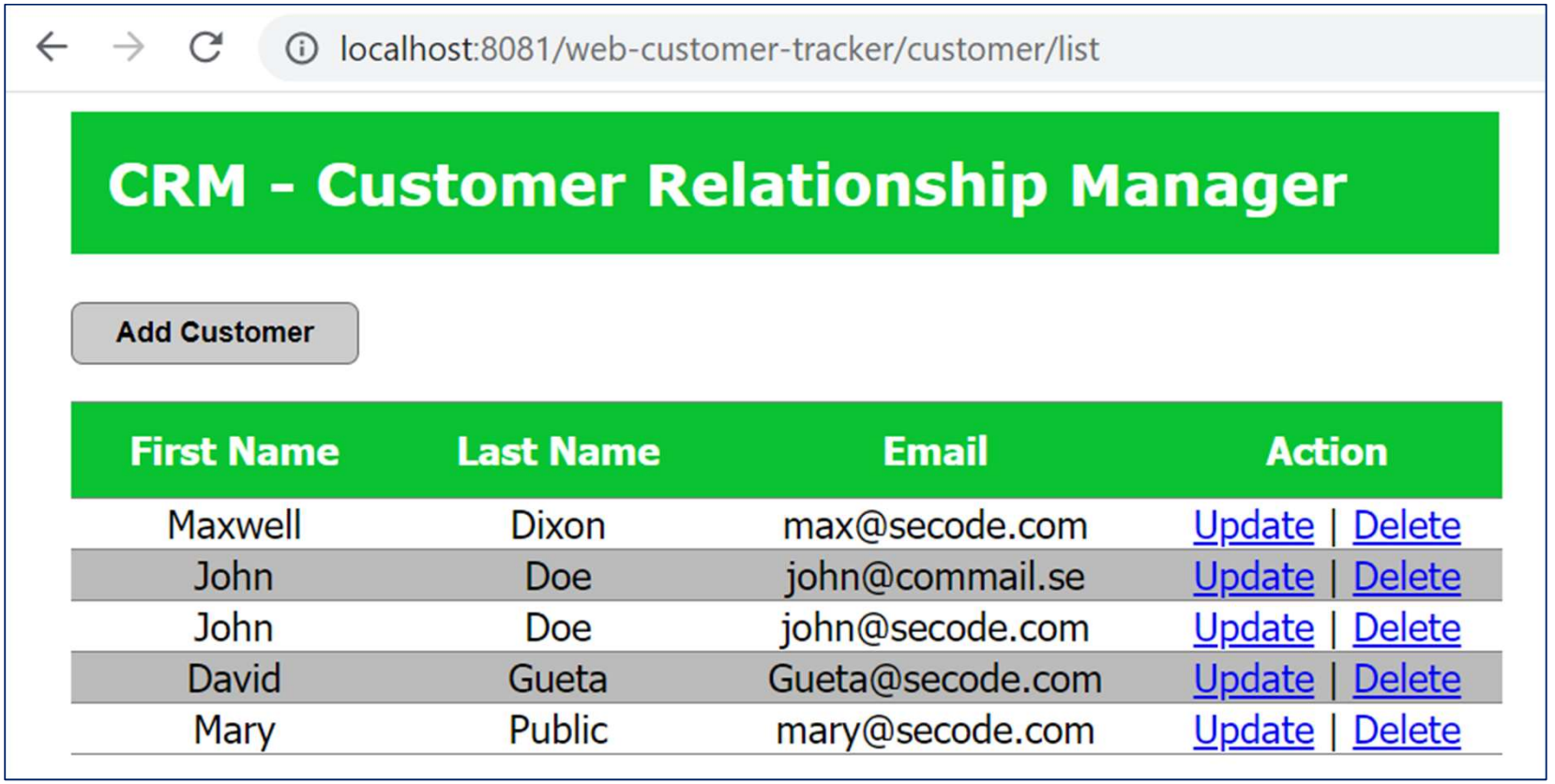
Application Demo - Delete



Application Demo - Delete



Application Demo - Delete



Setup Database

Customer relationship management system or CRM

1. Create a new sql server for application:
   - Id: springstudent
   - Pass: springstudent
2. Create database: web_customer_tracker
3. Create table: customer
4. Input sample data

	id	first_name	last_name	email
1	1	David	Adams	david@secode.com
2	2	John	Doe	john@secode.com
3	3	Ajay	Rao	ajaysecode.com
4	4	Mary	Public	mary@secode.com
5	5	Maxwell	Dixon	max@secode.com

Setup Dev Environment

Setup Dev Environment

1. Setup pom.xml
2. Setup config files:
   - *spring-mvc-crud-demo-servlet.xml;*
   - *web.xml*

Setup Dev Environment - pom.xml

```
<!-- https://mvnrepository.com/artifact/com.microsoft.sqlserver/mssql-jdbc -->
<dependency>
    <groupId>com.microsoft.sqlserver</groupId>
    <artifactId>mssql-jdbc</artifactId>
    <version>8.4.1.jre11</version>
</dependency>
<!-- https://mvnrepository.com/artifact/org.hibernate/hibernate-core -->
<dependency>
    <groupId>org.hibernate</groupId>
    <artifactId>hibernate-core</artifactId>
    <version>5.4.16.Final</version>
</dependency>
<!-- https://mvnrepository.com/artifact/com.mchange/c3p0 -->
<dependency>
    <groupId>com.mchange</groupId>
    <artifactId>c3p0</artifactId>
    <version>0.9.5.2</version>
</dependency>
```

MS SQL Server connection driver

Hibernate driver

Connection Pool driver

Setup Dev Environment - pom.xml


```
<!-- https://mvnrepository.com/artifact/org.hibernate/hibernate-c3p0 -->
<dependency>
    <groupId>org.hibernate</groupId>
    <artifactId>hibernate-c3p0</artifactId>
    <version>5.2.12.Final</version>
</dependency>
<!-- https://mvnrepository.com/artifact/com.mchange/mchange-commons-java -->
<dependency>
    <groupId>com.mchange</groupId>
    <artifactId>mchange-commons-java</artifactId>
    <version>0.2.11</version>
</dependency>
```

Connection Pool driver

Connection Pool driver

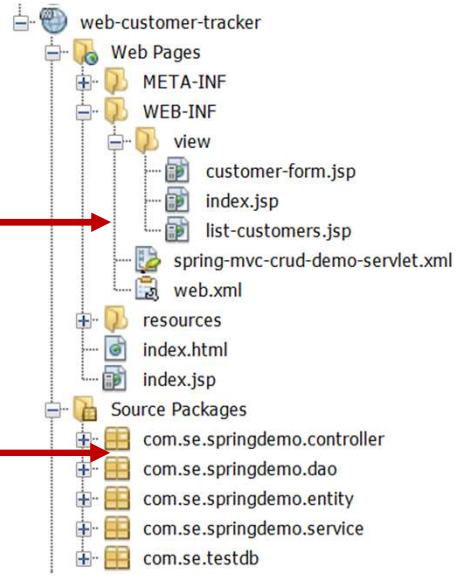
Setup Dev Environment - spring-mvc-crud-demo-servlet.xml


```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xmlns:context="http://www.springframework.org/schema/context"
  xmlns:tx="http://www.springframework.org/schema/tx"
       xmlns:mvc="http://www.springframework.org/schema/mvc"
       xsi:schemaLocation="
            http://www.springframework.org/schema/beans
            http://www.springframework.org/schema/beans/spring-beans.xsd
            http://www.springframework.org/schema/context
            http://www.springframework.org/schema/context/spring-context.xsd
            http://www.springframework.org/schema/mvc
            http://www.springframework.org/schema/mvc/spring-mvc.xsd
            http://www.springframework.org/schema/tx
            http://www.springframework.org/schema/tx/spring-tx.xsd">
```

List of Name Spaces

Setup Dev Environment - spring-mvc-crud-demo-servlet.xml

```
<!-- Define Spring MVC view resolver -->
<bean
   class="org.springframework.web.servlet.view.InternalResourceViewResolver">
   <property name="prefix" value="/WEB-INF/view/" />
   <property name="suffix" value=".jsp" />
</bean>
<!-- Add support for component scanning -->
<context:component-scan base-package="com.se.springdemo" />
<!-- Add support for conversion, formatting and validation support -->
<mvc:annotation-driven/>
```



Setup Dev Environment - spring-mvc-crud-demo-servlet.xml


```
<!-- Step 1: Define Database DataSource / connection pool -->
<bean id="myDataSource" class="com.mchange.v2.c3p0.ComboPooledDataSource"
    destroy-method="close">
      <property name="driverClass" value="com.microsoft.sqlserver.jdbc.SQLServerDriver" />
      <property name="jdbcUrl" value="jdbc:sqlserver://localhost:1433;databaseName=web_customer_tracker" />
      <property name="user" value="springstudent" />
      <property name="password" value="springstudent" />
      <!-- these are connection pool properties for C3P0 -->
      <property name="minPoolSize" value="5" />
      <property name="maxPoolSize" value="20" />
      <property name="maxIdleTime" value="30000" />
 </bean>
<!-- Step 2: Setup Hibernate session factory -->
      <bean id="sessionFactory" class="org.springframework.orm.hibernate5.LocalSessionFactoryBean">
      <property name="dataSource" ref="myDataSource" />
      <property name="packagesToScan" value="com.se.springdemo.entity" />
      <property name="hibernateProperties">
        <props>
          <prop key="hibernate.dialect">org.hibernate.dialect.SQLServer2012Dialect</prop>
           <prop key="hibernate.show_sql">true</prop>
        </props>
      </property>
</bean>
```

Setup Dev Environment - spring-mvc-crud-demo-servlet.xml

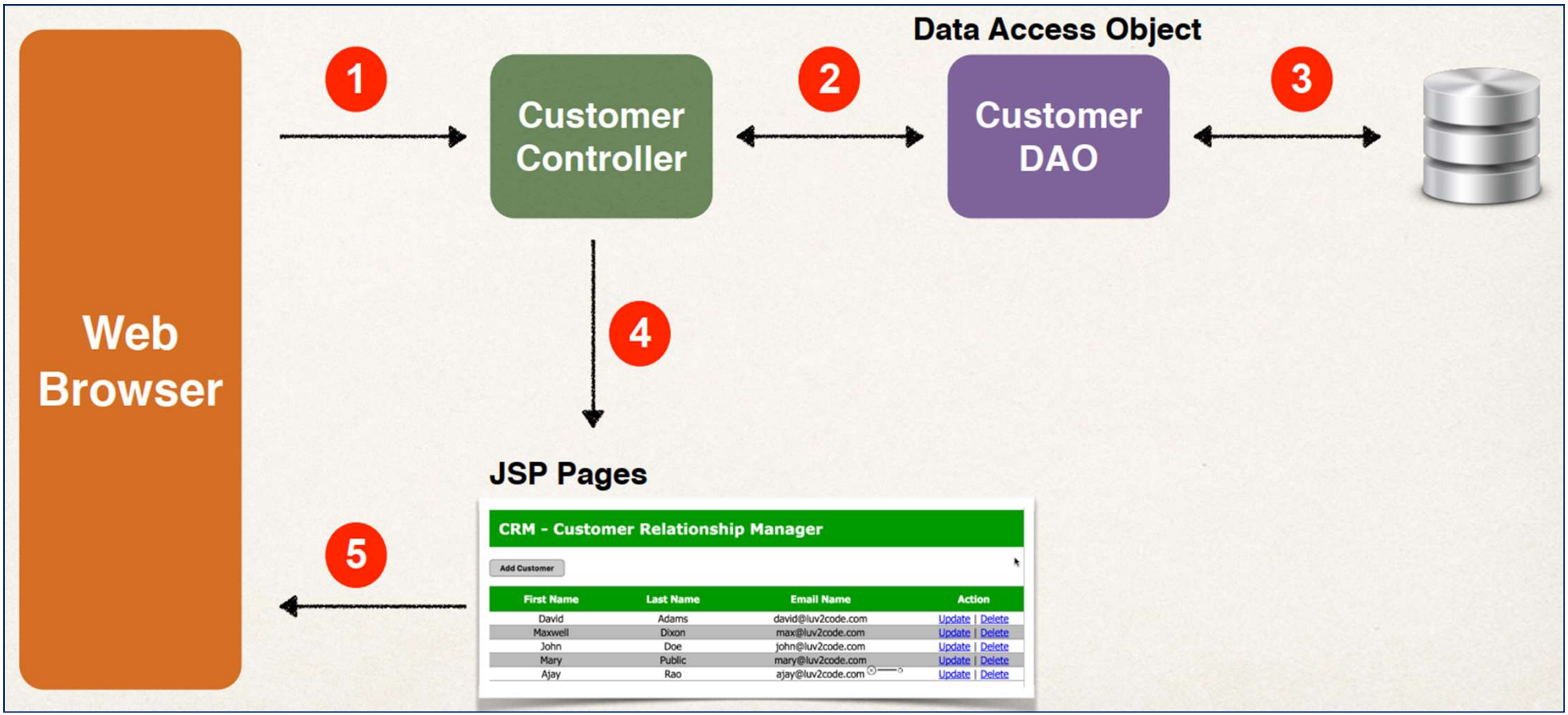

```
<!-- Step 3: Setup Hibernate transaction manager -->
        <bean id="myTransactionManager"
    class="org.springframework.orm.hibernate5.HibernateTransactionManager">
  <property name="sessionFactory" ref="sessionFactory"/>
</bean>
```

Defined in step 2

```
<!-- Step 4: Enable configuration of transactional behavior based on annotations -->
        <tx:annotation-driven proxy-target-class="true" transaction-manager="myTransactionManager" />
<!-- Add support for reading web resources: css, images, js, etc ... -->
        <mvc:resources location="/resources/" mapping="/resources/**"></mvc:resources>
```

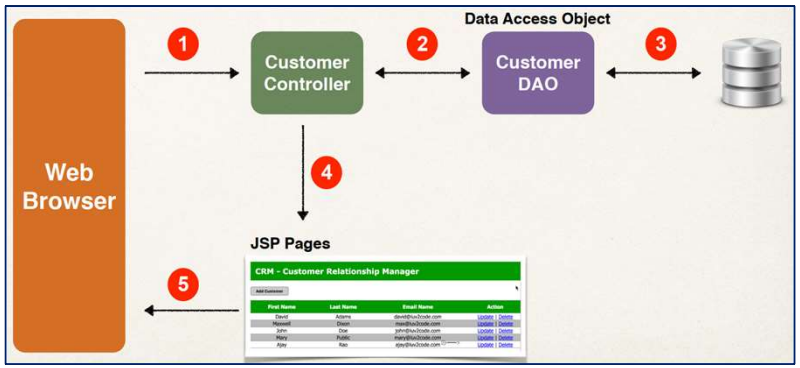
List of Customers

List Customers – App Process



List Customers Development Process

1. Create Customer.java
2. Create:
   - Interface CustomerDAO.java
   - Class CustomerDAOImlp.java
3. Create controller CustomerController.java
4. Create view list-customer.jsp

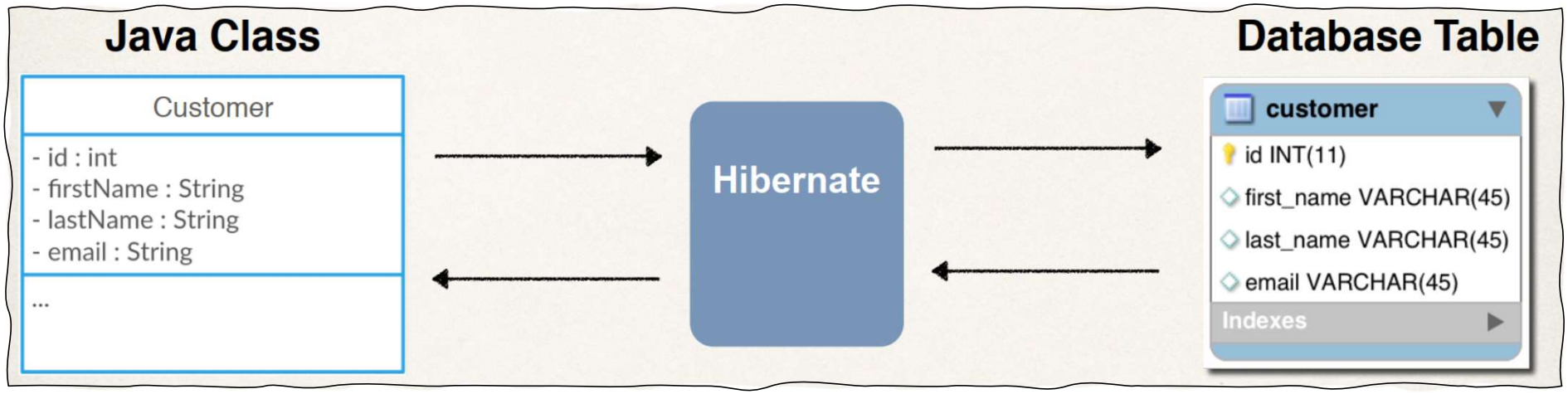


List Customers - Hibernate Terminology (Refresh)

Entity Class

Java class that is mapped to a database table

List Customers – Object Relation Mapping (ORM)



Step 1: Create Customer.java Mapping

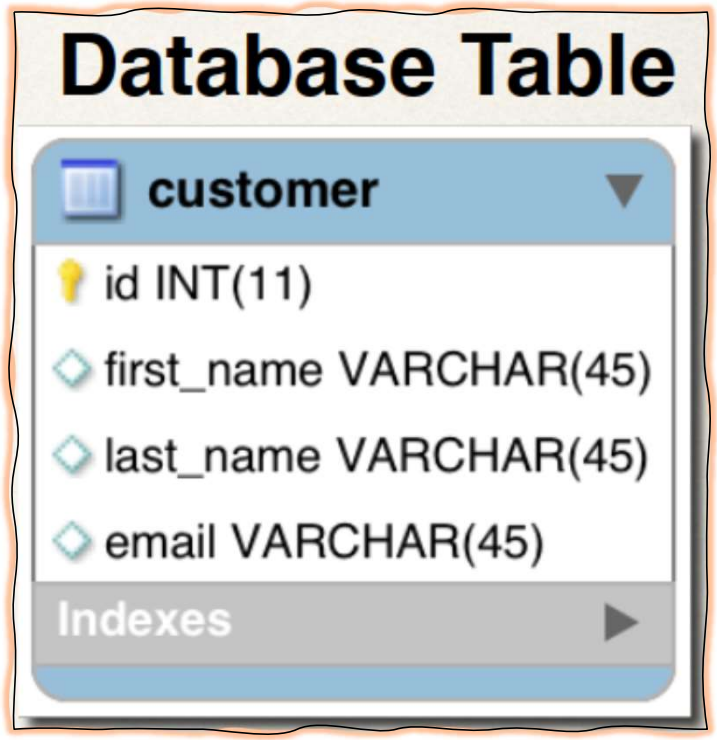
File: com.se.springdemo.entity
Customer.java

```
@Entity
@Table(name="customer")
public class Customer {
    @Id
    @GeneratedValue(strategy=GenerationType.IDENTITY)
    @Column(name="id")
    private int id;

    @Column(name="first_name")
    private String firstName;

    @Column(name="last_name")
    private String lastName;

    @Column(name="email")
    private String email;
```

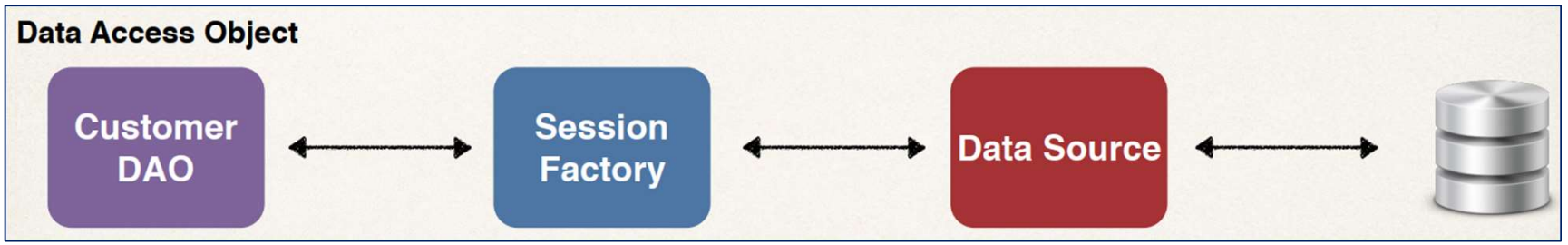



```
<property name="packagesToScan" value="com.se.springdemo.entity" />
```

Step 2: Create Customer Data Access Object (DAO)

» For Hibernate, our **DAO** needs a **Hibernate SessionFactory**

» **Hibernate Session Factory** needs a **Data Source** (defines database connection info)



Step 2: Dependencies

These are all dependencies!
We will wire them together with Dependency Injection (DI)

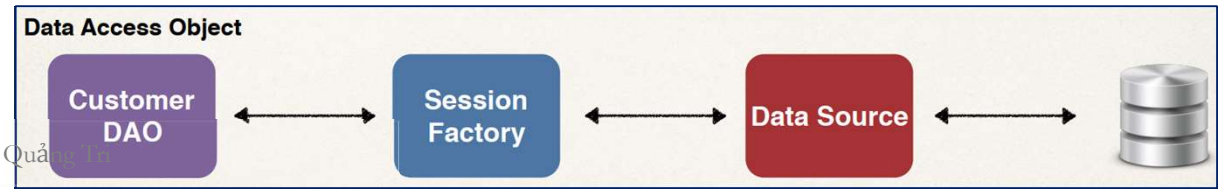
Step 2: Create Customer Data Access Object (DAO)

Data source

```
<bean id="myDataSource" class="com.mchange.v2.c3p0.ComboPooledDataSource"
    destroy-method="close">
    ...
</bean>
```

Session Factory

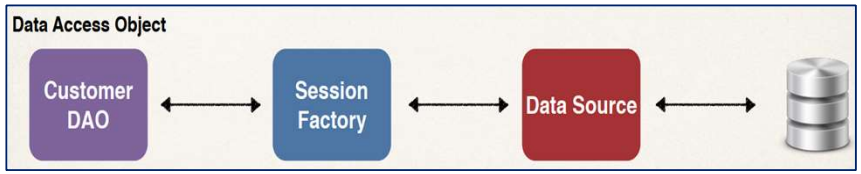
```
<bean id="sessionFactory" class="org.springframework.orm.hibernate5.LocalSessionFactoryBean">
<property name="dataSource" ref="myDataSource" />
<property name="packagesToScan" value="com.se.springdemo.entity" />
...
</bean>
```



Step 2: Create Customer Data Access Object (DAO)

DAO Interface – CustomerDAO.java

```
package com.se.springdemo.dao;
import ...3 lines
public interface CustomerDAO {
        public List<Customer> getCustomers();
        public void saveCustomer(Customer theCustomer);
        public Customer getCustomer(int theId);
        public void deleteCustomer(int theId);
}
```



CustomerDAO Implement- CustomerDAOImpl .java

```
@Repository
public class CustomerDAOImpl implements CustomerDAO {
        // need to inject the session factory
    @Autowired
    private SessionFactory sessionFactory;
    @Transactional
    public List<Customer> getCustomers() {
        // get the current hibernate session
        Session currentSession = sessionFactory.getCurrentSession();
        // create a query  ... sort by last name
        Query<Customer> theQuery =
                currentSession.createQuery("from Customer order by lastName",
                                           Customer.class);
        // execute query and get result list
        List<Customer> customers = theQuery.getResultList();
        // return the results
        return customers;
    }
```

Step 2: Create Customer Data Access Object (DAO)

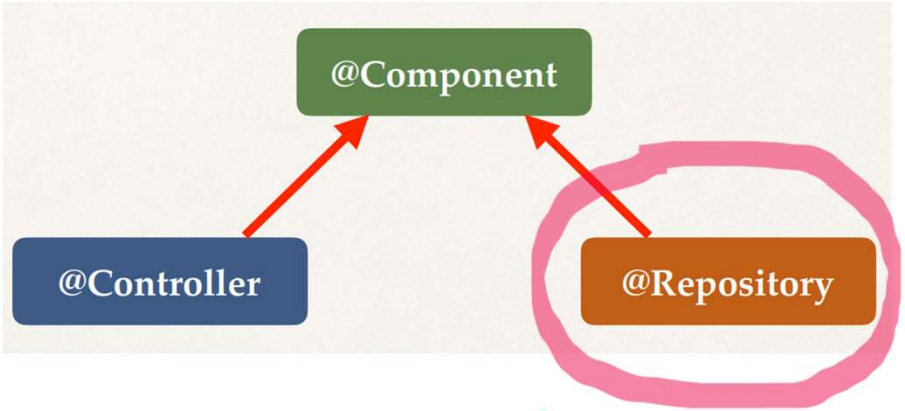
Spring @Transaction:

- **Automagically** begin and end a transaction for your Hibernate code
- **No need** for you to explicitly do this in your code

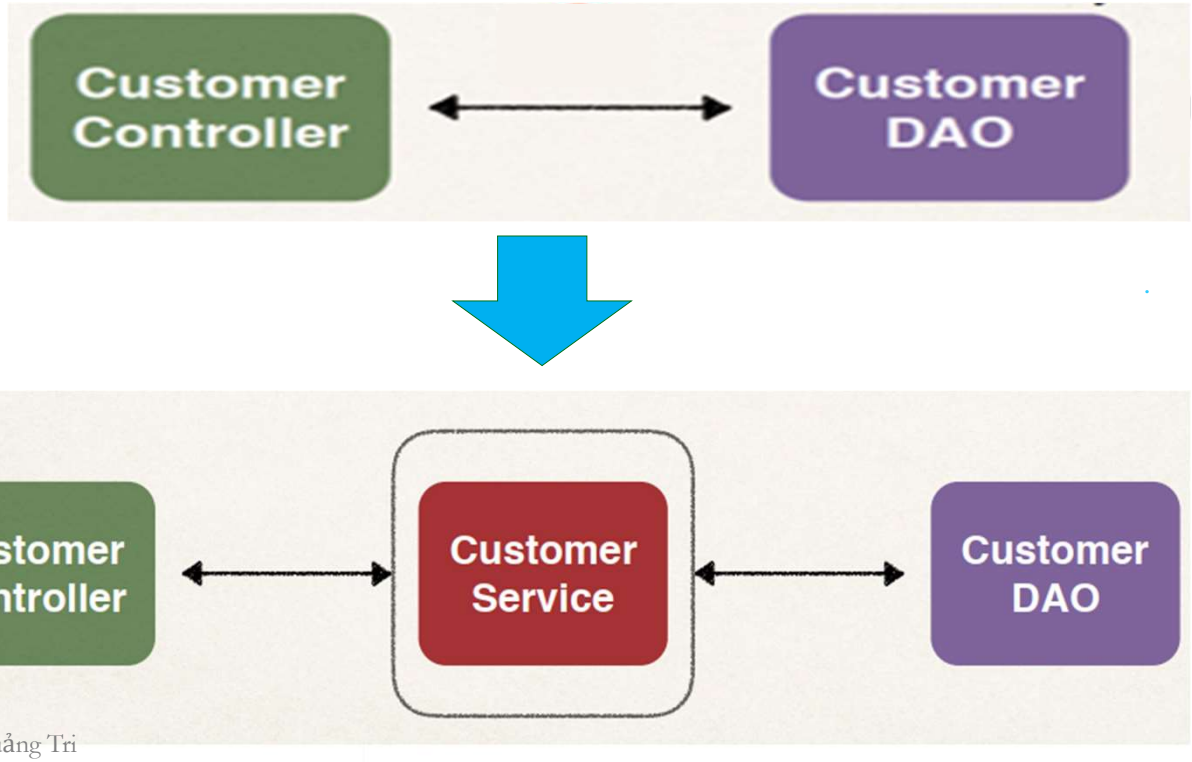
Step 2: Create Customer Data Access Object (DAO)

Specialized Annotation for DAOs:

- Applied to DAO implementation
- Spring will **automatically register** the **DAO implementation**
- Spring also **provides translation** of any **JDBC related exceptions**



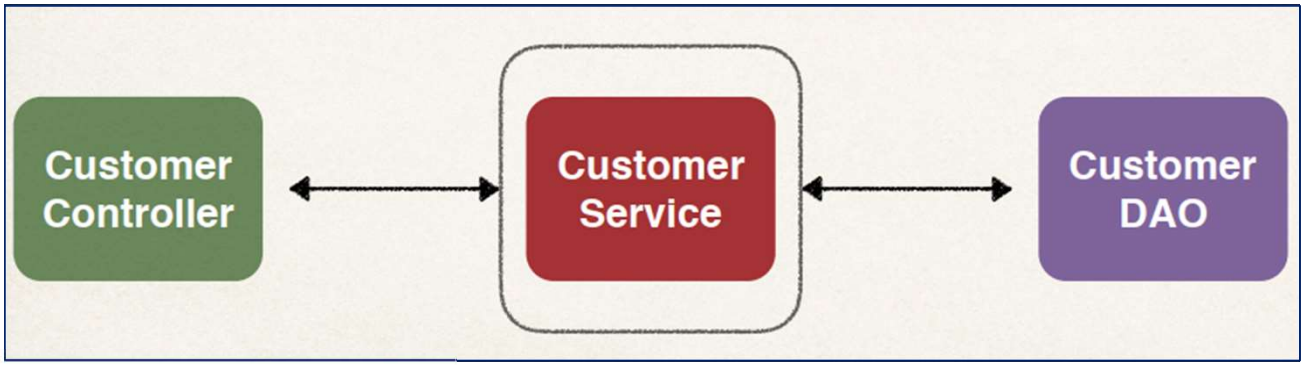
Step 3: Create CustomerController - Service Layer



Step 3: Create CustomerController - Service Layer

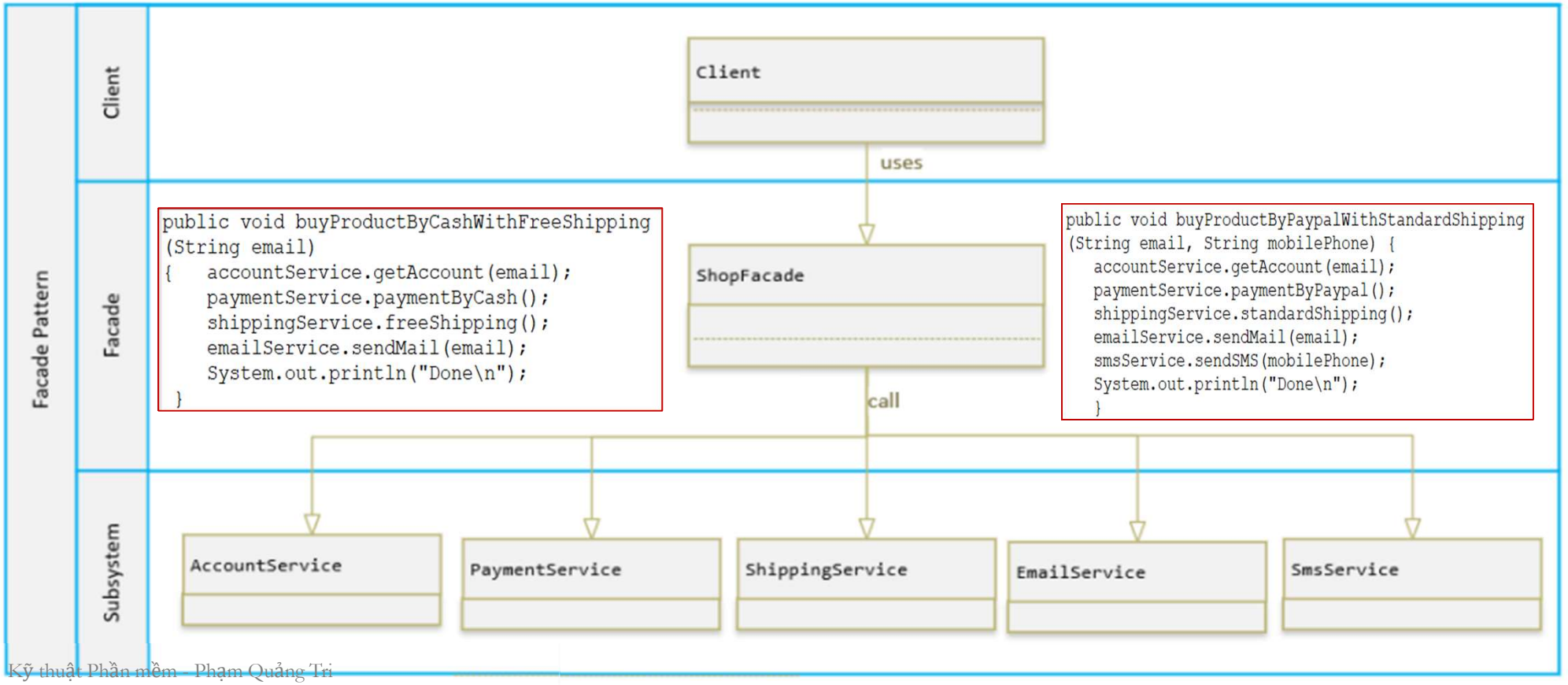
Purpose of Service Layer:

- Service Facade design pattern
- Intermediate layer for custom business logic
- Integrate data from multiple sources (DAO/repositories)



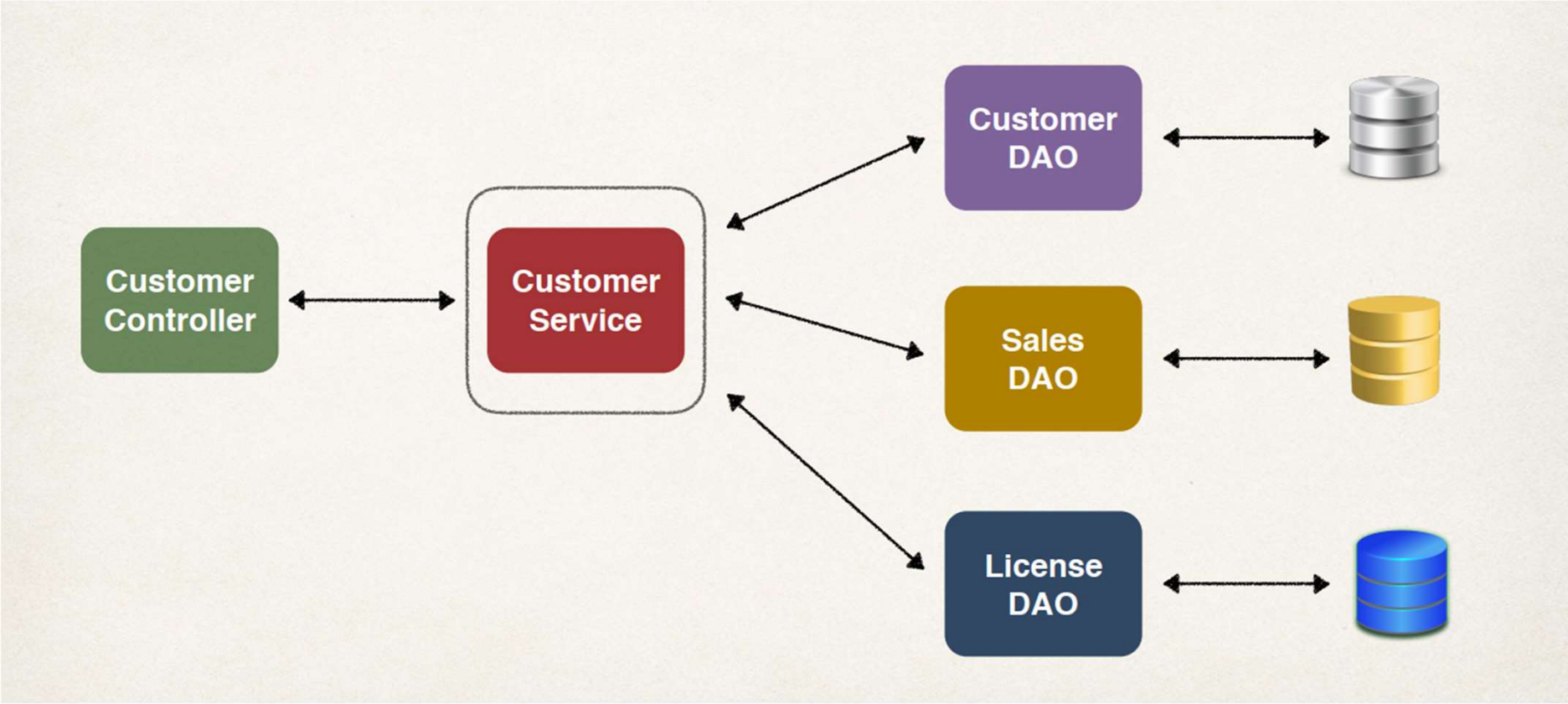
Step 3: Create CustomerController - Service Layer

Facade design pattern:



Step 3: Create CustomerController - Service Layer

Integrate Multiple Data sources

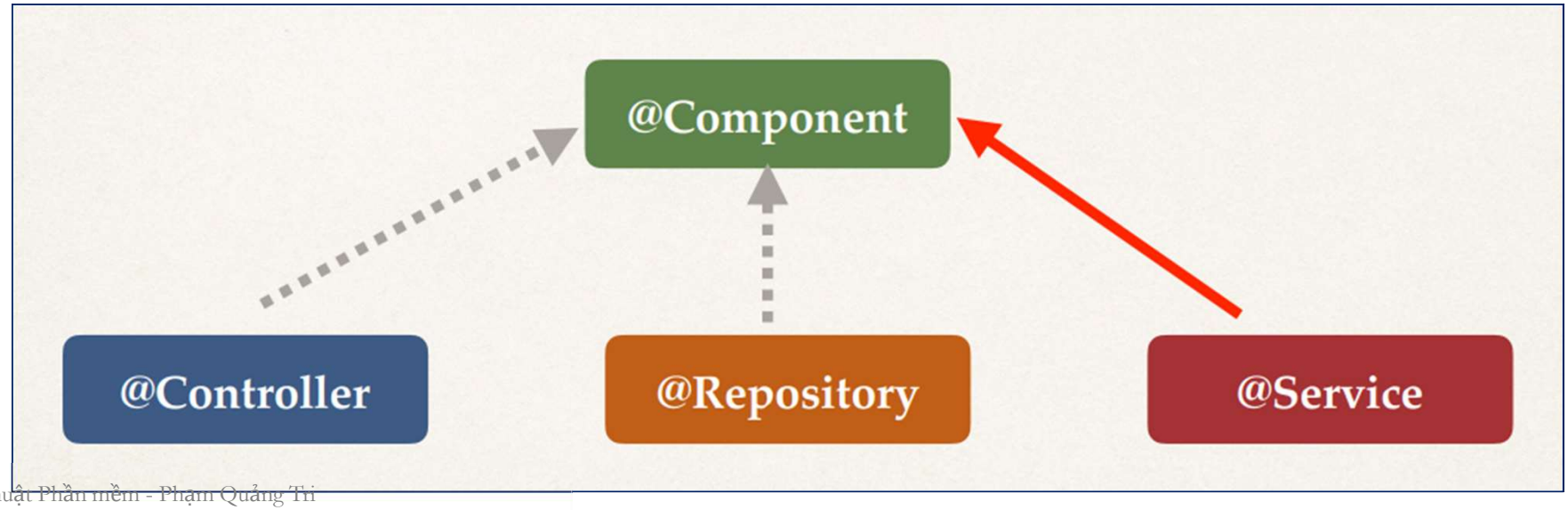


Step 3: Create CustomerController - Service Layer

Specialized Annotation for Services:

» Applied to **Service implementation**

» Spring will **automatically register** the **Services implementation**



Step 3: Create CustomerController - Service Layer

Interface **CustomerService.java**

```
public interface CustomerService {
        public List<Customer> getCustomers();
        public void saveCustomer(Customer theCustomer);
        public Customer getCustomer(int theId);
        public void deleteCustomer(int theId);
}
```

Class **CustomerController.java**

```
@Controller
@RequestMapping("/customer")
public class CustomerController {
   @Autowired
   // need to inject our customer service
   private CustomerService customerService;
   @GetMapping("/list")
   public String listCustomers(Model theModel) {
      // get customers from the service
      List<Customer> theCustomers = customerService.getCustomers();
      // add the customers to the model
      theModel.addAttribute("customers", theCustomers);
      return "list-customers"; }
```

Class **CustomerServiceImpl.java**

```
@Service
public class CustomerServiceImpl implements CustomerService {
   // need to inject customer dao
   @Autowired
   private CustomerDAO customerDAO;
   @Override
   @Transactional
   public List<Customer> getCustomers() {...3 lines }
   @Override
   @Transactional
   public void saveCustomer(Customer theCustomer) {...4 lines }
   @Override
   @Transactional
   public Customer getCustomer(int theId) {...4 lines }
   @Override
   @Transactional
   public void deleteCustomer(int theId) {...4 lines }
}
```

Step 4: Create view list-customer.jsp

File: list-customers.jsp

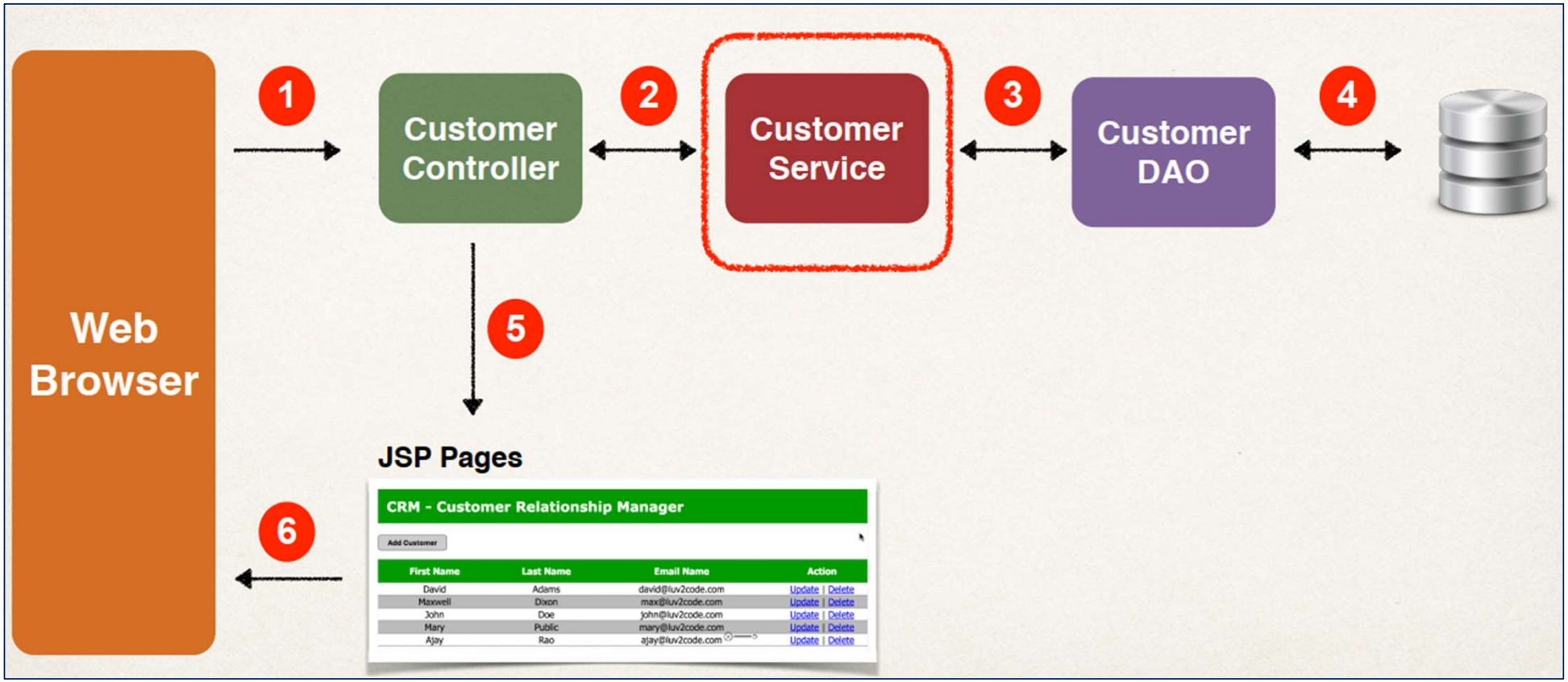
```
<%@ taglib uri="http://java.sun.com/jsp/jstl/core" prefix="c" %>
<!DOCTYPE html>
<html>
<head>
    <title>List Customers</title>
    <!-- reference our style sheet -->
    <link type="text/css"
          rel="stylesheet"
          href="${pageContext.request.contextPath}/resources/css/style.css" />
</head>
```

Step 4: Create view list-customer.jsp

File: list-customers.jsp

```
<c:forEach var="tempCustomer" items="${customers}">
    <!-- construct an "update" link with customer id -->
    <c:url var="updateLink" value="/customer/showFormForUpdate">
        <c:param name="customerId" value="${tempCustomer.id}" />
    </c:url>
    <!-- construct an "delete" link with customer id -->
    <c:url var="deleteLink" value="/customer/delete">
        <c:param name="customerId" value="${tempCustomer.id}" />
    </c:url>
    <tr>
        <td> ${tempCustomer.firstName} </td>
        <td> ${tempCustomer.lastName} </td>
        <td> ${tempCustomer.email} </td>
        <td>
            <!-- display the update link -->
            <a href="${updateLink}">Update</a>
            |
            <a href="${deleteLink}"
              onclick="if (!(confirm('Are you sure you want to delete this customer?'))) return false">Delete</a>
        </td>
    </tr>
</c:forEach>
```

Revised App Process

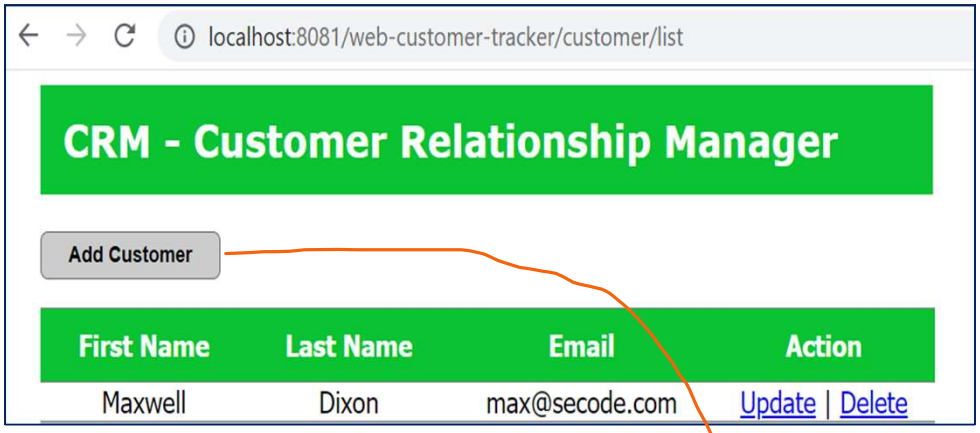


Add Customers

Add Customer Process

1. Create HTML form for new customer

2. Process Form Data: Controller -> Service -> DAO

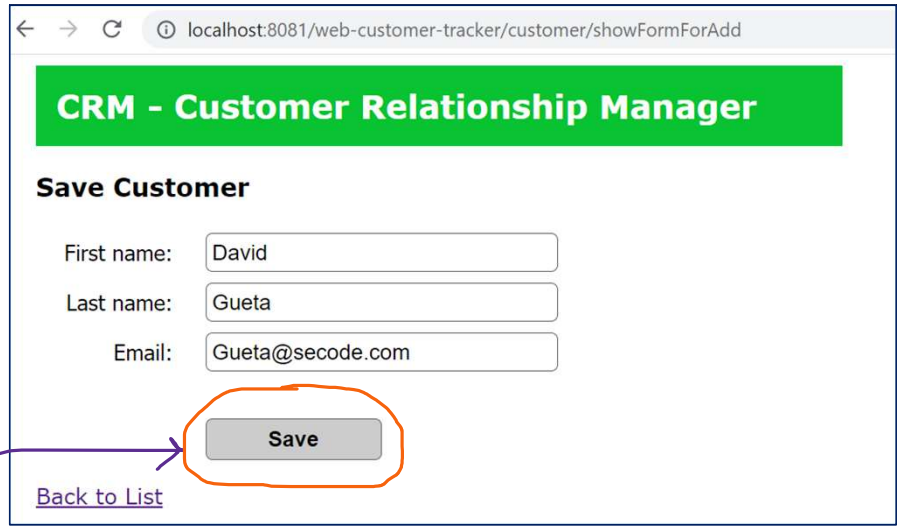



```
@Controller
@RequestMapping("/customer")
public class CustomerController {
  public String showFormForAdd(Model theModel) {
      // create model attribute to bind form data
      Customer theCustomer = new Customer();
      theModel.addAttribute("customer", theCustomer);
      return "customer-form";    }
```

```
<input type="button" value="Add Customer"
       onclick="window.location.href='showFormForAdd'; return false;"
        <%--  window.location.href returns the href (URL) of the current page--%>
       class="add-button"  />
```

Step 1: Create HTML form for new customer (2)

```
<form:form action="saveCustomer" modelAttribute="customer" method="POST">
    <!-- need to associate this data with customer id -->
  <form:hidden path="id" />
  <table>  <tbody>
        <tr>
            <td><label>First name:</label></td>
            <td><form:input path="firstName" /></td>
        </tr>
        <tr>
            <td><label>Last name:</label></td>
            <td><form:input path="lastName" /></td>
        </tr>
        <tr>
            <td><label>Email:</label></td>
            <td><form:input path="email" /></td>
        </tr>
        <tr>
            <td><label></label></td>
            <td><input type="submit" value="Save" class="save" /></td>
        </tr>
        </tbody>  </table>
</form:form>
```




```
@Controller
@RequestMapping("/customer")
public class CustomerController {
   @Autowired
   // need to inject our customer service
   private CustomerService customerService;
    @PostMapping("/saveCustomer")
   public String saveCustomer(@ModelAttribute("customer") Customer theCustomer) {
      // save the customer using our service
      customerService.saveCustomer(theCustomer);
      return "redirect:/customer/list";
   }
```

Step 2: Process Form Data Controller -> Service -> DAO

Interface **CustomerService.java**

```
public interface CustomerService {
        public List<Customer> getCustomers();
        public void saveCustomer(Customer theCustomer);
        public Customer getCustomer(int theId);
        public void deleteCustomer(int theId);
}
```

Class **CustomerServiceImpl.java**

```
@Service
public class CustomerServiceImpl implements CustomerService {
    // need to inject customer dao
    @Autowired
    private CustomerDAO customerDAO;
    @Override
    @Transactional
    public List<Customer> getCustomers() {...3 lines }
    @Override
    @Transactional
    public void saveCustomer(Customer theCustomer) {...4 lines }
    @Override
    @Transactional
    public Customer getCustomer(int theId) {...4 lines }
    @Override
    @Transactional
    public void deleteCustomer(int theId) {...4 lines }
}
```

Class **CustomerController.java**

```
@Controller
@RequestMapping("/customer")
public class CustomerController {
    @Autowired
    // need to inject our customer service
    private CustomerService customerService;
    @GetMapping("/showFormForAdd")
    public String showFormForAdd(Model theModel) {
        // create model attribute to bind form data
        Customer theCustomer = new Customer();
        theModel.addAttribute("customer", theCustomer);
        return "customer-form";    }
    @PostMapping("/saveCustomer")
    public String saveCustomer(@ModelAttribute("customer") Customer theCustomer) {
        // save the customer using our service
        customerService.saveCustomer(theCustomer);
        return "redirect:/customer/list";
    }
```

Update Customers

Update Customer

» **Prepopulate the form**

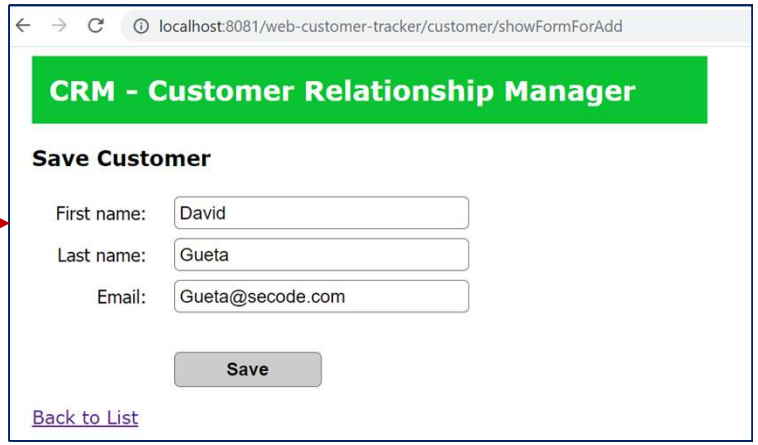
» **Process Form Data: Controller -> Service -> DAO**


```
@Controller
@RequestMapping("/customer")
public class CustomerController {
  @GetMapping("/showFormForUpdate")
public String showFormForUpdate(@RequestParam("customerId") int theId,
                Model theModel) {
    // get the customer from our service
    Customer theCustomer = customerService.getCustomer(theId);
    // set customer as a model attribute to pre-populate the form
    theModel.addAttribute("customer", theCustomer);
    // send over to our form
    return "customer-form";    }
```

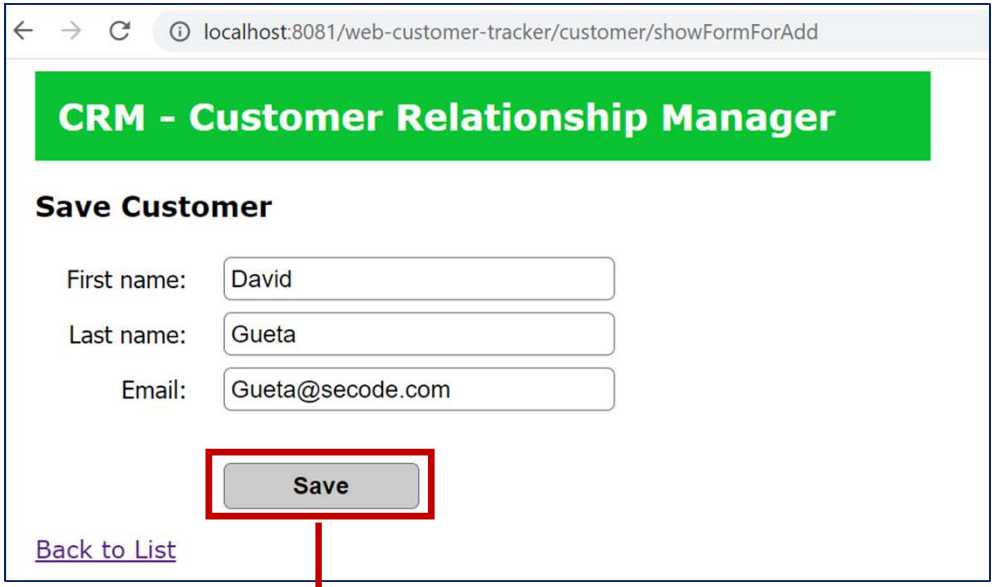
```
<c:forEach var="tempCustomer" items="${customers}">
    <!-- construct an "update" link with customer id -->
    <c:url var="updateLink" value="/customer/showFormForUpdate">
        <c:param name="customerId" value="${tempCustomer.id}" />
    </c:url>
```

Update Customer – Prepopulate the form

```
@Controller
@RequestMapping("/customer")
public class CustomerController {
  @GetMapping("/showFormForUpdate")
public String showFormForUpdate(@RequestParam("customerId") int theId,
                Model theModel) {
      // get the customer from our service
      Customer theCustomer = customerService.getCustomer(theId);
      // set customer as a model attribute to pre-populate the form
      theModel.addAttribute("customer", theCustomer);
      // send over to our form
      return "customer-form";    }
```



Update Customer – Process form Data

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        public List<Customer> getCustomers();
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Questions