CSI5380: Systems and Architectures for Electronic Commerce

Project Part 1: “DreamTeam” CD Store – Design Documentation

Daniel Antwi

Khaled El Ghayesh

Elena Ciobanu

Cristian Gadea

October 2011

Contents

[Figures 4](#_Toc307238606)

[1. Introduction 5](#_Toc307238607)

[2. Assumptions 5](#_Toc307238608)

[3. Project Files 5](#_Toc307238609)

[3.1. Utilities 5](#_Toc307238610)

[3.1.1. In DBAgent/src as part of com.cdstore.dbagent 5](#_Toc307238611)

[3.1.2. In DBAgent/src 5](#_Toc307238612)

[3.1.3. In Utilities/src as part of com.cdstore.entities 6](#_Toc307238613)

[3.1.4. In Utilities/src as part of com.cdstore.shoppingcart 6](#_Toc307238614)

[3.2. CatalogService 6](#_Toc307238615)

[3.2.1. In CatalogService/src as part of com.cdstore.catalogservice 6](#_Toc307238616)

[3.2.2. In CatalogService/WebContent/WEB-INF 7](#_Toc307238617)

[3.3. OrderService 7](#_Toc307238618)

[3.3.1. In OrderService/src as part of com.cdstore.orderprocess 7](#_Toc307238619)

[3.3.2. In OrderService/WebContent/WEB-INF 7](#_Toc307238620)

[3.4. CDStore 7](#_Toc307238621)

[3.4.1. In CDStore/src as part of com.cdstore.beans 7](#_Toc307238622)

[3.4.2. In CDStore/src as part of com.cdstore.catalogservice 8](#_Toc307238623)

[3.4.3. In CDStore/src as part of com.cdstore.controller 8](#_Toc307238624)

[3.4.4. In CDStore/src as part of com.cdstore.filter 8](#_Toc307238625)

[3.4.5. In CDStore/src as part of com.cdstore.orderservice 8](#_Toc307238626)

[3.4.6. In CDStore/src as part of com.cdstore.orderservice 8](#_Toc307238627)

[3.4.7. In CDStore/WebContent/css 9](#_Toc307238628)

[3.4.8. In CDStore/WebContent/jspf 9](#_Toc307238629)

[3.4.9. In CDStore/WebContent/view 9](#_Toc307238630)

[3.4.10. In CDStore/WebContent/WEB-INF 9](#_Toc307238631)

[3.4.11. In CDStore/WebContent 9](#_Toc307238632)

[4. Deployment 10](#_Toc307238633)

[5. Packages and Architecture 10](#_Toc307238634)

[6. Conclusion 12](#_Toc307238635)

[7. References 13](#_Toc307238636)

# Figures

[Figure 1: Deployment Diagram 10](#_Toc307238637)

[Figure 2: DreamTeam CDStore Packages and Architecture 12](#_Toc307238638)

# Introduction

The DreamTeam CD Store is an electronic commerce application that allows users to browse and order CDs. The CD Store was developed using technologies that include JSP (JavaServer Pages), Servlets, Web Services, and relational database management systems. Users are able to browse the list of available CDs in the music category of their choice once they have registered and logged in. The list of CDs and information about them is obtained from a relational database. Users can add CDs to a Shopping Cart, update the quantity of each CD in their cart, remove CDs from their cart, and view a summary of their order before they enter their credit card information and submit the order. The web application is secured using industry standard SSL (Secure Socket Layer) technology.

Details on building and deploying the project are provided in the included README.txt file.

# Assumptions

The following assumptions were made when designing and developing this project:

* Little emphasis is placed on the visual aspect of the user interface (no images are used)
* Little validation is done on the client side to ensure users enter the proper values into forms (no JavaScript is used)
* Users cannot modify their account once it has been created
* A successful user order is shipped to the address with which the account was created

# Project Files

This section contains a summary of all key files that make up the assignment source code. Additional project files used for building/deployment are described in the README.txt file.

# Utilities

# In DBAgent/src as part of com.cdstore.dbagent

**DBAgent.java**

* Uses JDBC to connect to the MySQL database to provide persistence-related actions such as checking the user’s login information and retrieving the list of CDs

# In DBAgent/src

**queries.properties**

* Configuration file containing the SQL queries to be executed on the database

# In Utilities/src as part of com.cdstore.entities

**Account.java**

* Entity that defines Account objects as per database schema

**Address.java**

* Entity that defines Address objects as per database schema

**Category.java**

* Entity that defines Category objects as per database schema

**CD.java**

* Entity that defines CD objects as per database schema

**Order.java**

* Entity that defines Order objects as per database schema

**OrderDetails.java**

* Entity that defines OrderDetails objects as per database schema

# In Utilities/src as part of com.cdstore.shoppingcart

**ShoppingCart.java**

* Code for the creation of shopping cart objects and retrieval/modification of items within them, reused from [1]

**ShoppingCartItem.java**

* ShoppingCartItem entity code for defining items that can be added to a shopping cart, reused from [1]

# CatalogService

# In CatalogService/src as part of com.cdstore.catalogservice

**ProductCatalog.java**

* The Web Service interface class of the product catalog that is implemented by the actual implementation class as well as used by the web client for retrieving CD information

**ProductCatalogImpl.java**

* The Web Service implementation of the product catalog that uses the DBAgent to fulfill services requested via SOAP (Simple Object Access Protocol)

# In CatalogService/WebContent/WEB-INF

**sun-jaxws.xml**

* File used to define Web Service endpoints to the package containing the catalog Web Services code

**web.xml**

* deployment description file for the catalog Web Service

# OrderService

# In OrderService/src as part of com.cdstore.orderprocess

**OrderProcess.java**

* The Web Service interface class of the order process that is implemented by the actual implementation class as well as used by the web client for managing accounts and orders

**OrderProcessImpl.java**

* The Web Service implementation of the order process that uses the DBAgent to fulfill services requested via SOAP

# In OrderService/WebContent/WEB-INF

**sun-jaxws.xml**

* File used to define Web Service endpoints to the package containing the order process Web Services code

**web.xml**

* deployment description file for the catalog Web Service

# CDStore

# In CDStore/src as part of com.cdstore.beans

**CDStoreBean.java**

* Backing bean used by the session controller to communicate with the product catalog Web Services

**OrderBean.java**

* Backing bean used by the session controller to communicate with the order process Web Services

# In CDStore/src as part of com.cdstore.catalogservice

**ProductCatalog.java**

* The Web Service interface class of the product catalog that is required for using the catalog web service

**ProductCatalogServiceClient.java**

* Class that provides a getServiceInterface method for the session controller to call when accessing the product catalog Web Services

# In CDStore/src as part of com.cdstore.controller

**SessionController.java**

* The session controller handles the user inputs and uses the Web Services to access the persisted data and display the appropriate HTML content to the user

# In CDStore/src as part of com.cdstore.filter

**SessionController.java**

* The session filter is used to ensure only logged in users (who have a valid session) are able to access certain JSP pages

# In CDStore/src as part of com.cdstore.orderservice

**OrderProcess.java**

* The Web Service interface class that is required for using the order process web service

**OrderProcessServiceClient.java**

* Class that provides a getServiceInterface method for the session controller to call when accessing the order process Web Services

# In CDStore/src as part of com.cdstore.orderservice

**navigation.properties**

* A configuration file used by the session controller to determine the name of the next JSP file to load in response to a specific user action

# In CDStore/WebContent/css

**style.css**

* Cascading Style Sheets file to define the visual aspects of various HTML elements

# In CDStore/WebContent/jspf

**footer.jspf**

* Footer HTML content included on every page containing copyright information etc.

**header.jspf**

* Header HTML content included on every page containing the store name etc.

# In CDStore/WebContent/view

**cart.jsp**

* HTML content that uses JSP to display the items currently in the user’s shopping cart with options for removing items and changing quantities

**cdstore.jsp**

* HTML content that uses JSP to allow users to browse CDs, sort them by category, and add them to their shopping cart

**checkout.jsp**

* HTML content that uses JSP to allow users to view a summary of their order and confirm their order by entering their credit card information

**resultpage.jsp**

* HTML content that uses JSP to display if the order was processed successfully or not

# In CDStore/WebContent/WEB-INF

**web.xml**

* Deployment description file for the CDStore web client that specifies the location of the index.jsp file, servlets, and constants such as the tax amount

# In CDStore/WebContent

**creataccount.jsp**

* HTML content that uses JSP to display the account creation form

**createaccountaction.jsp**

* JSP page for processing the submission of the account creation form

**index.jsp**

* HTML content that uses JSP to allow the user to submit their username/password and log into the CDStore system

**loginaction.jsp**

* JSP page for processing the submission of the login information

# Deployment



Figure : Deployment Diagram

As explained in the README.txt file, the project is deployed as four separate WAR files (CatalogService.war, OrderService.war, and CDStore.war) and one JAR file (Utilities.jar, which contains the dbagent, entities and shoppingcart packages). The user’s web browser will connect to the application server running the CDStore.war, which requires Utilities.jar as a dependency. The Web Services consist of CatalogService and OrderService, which also require the Utilities.jar library. However, the Web Services can be deployed on a separate application server since communication takes place over HTTP (SOAP), as shown in Figure 1. In addition, the application server can be configured to connect to a separate machine running the Database Server. While the architecture supports such a wide deployment, it is possible to run the client web browser, servlet container, web services containers and CD Store database on the same machine. In test deployments, Firefox was used as the web browser, Tomcat as the application server, and MySQL as the database.

# Packages and Architecture

Figure 2 shows the main packages that make up the DreamTeam CDStore web application. In the deployment, the PersistenceSubsystem and UtilitiesSubsystem are combined into the Utilities.jar file. The architecture, however, has the packages of the PersistenceSubsystem, WebServicesSubsystem and ClientDisplaySubsystem separated from the com.cdstore.entities and com.cdstore.shoppingcart packages. These two packages make up the UtilitiesSubsystem and are shared by the three other subsystems, showing its reusability. The ClientDisplaySubsystem features a Model-View-Controller architecture, whereby the SessionController (*the controller*) is responsible for receiving the user interactions from the JSP files (*the view*, shown in Figure 2 as the package com.cdstore.webview, although implemented in the WebContent folder) and obtaining the appropriate data from the DBAgent and Web Services (*the model*). The SessionController does this by using the CDStoreBean and OrderBean to communicate with the DBAgent via the twoWeb Services, namely ProductCatalog and OrderProcess. This is done through request SOAP messages that are generated based on the interfaces defined in ProductCatalogInterface and OrderProcessInterface, and response SOAP messages that are returned by the Web Services once they have contacted the DBAgent.

The SessionController is therefore responsible for actions such as updating a user’s shopping cart with new items when then user has clicked the button to do this. The Filter Pattern is also implemented through the SessionFilter, which filters the access to different elements of the view so that users are not able to access the CD store page with the catalog without having first logged in.

As an example of reuse of existing code from other projects, the com.cdstore.shoppingcart package reuses code from the example provided by Oracle Corporation [1].



Figure : DreamTeam CDStore Packages and Architecture

# Database Design

The com.cdstore.entities package previously shown in Figure 2 reflects the database schema shown in Figure 3. Of special note is how each “cd” is assigned a “category”, each “order” has an “orderdetails”, which has a “cd”, and each “order” is tied to an “account” which has an “address”.

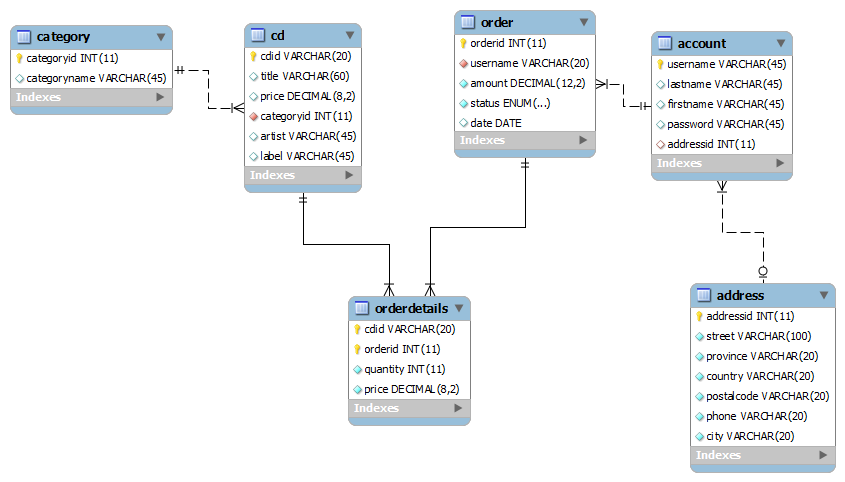
****

Figure : DreamTeam CDStore Database Schema

# Sequence Diagrams



Figure : Interaction Diagram for Successful Login

The sequence chart of Figure 4 illustrates a typical login procedure. The user running a web browser performs a HTTP GET request for the index.jsp page, which is generated on the web server based on the servlets identified in the web.xml file; namely, the doGet method of the SessionController servlet. The user then enters their username/password and presses the “Login” button, which causes a HTTP POST message to be sent to the web server. This will be received and processed by the doPost method of the SessionController, which will create an OrderBean object for the session and use it to call getAccount on the ProductCatalog Web Service. The method call and parameters will be encoded in the SOAP format. Once received and decoded by the web service, the getAccount method in the DBAgent class will be called, which will query the relational database using JDBC. DBAgent will then receive a ResultSet object containing the query results, which will be transformed into an Account object (based on the entity) before being returned to the Web Service. The product catalog Web Service will then encode the Account object into SOAP and return it to OrderBean, which will pass it to the SessionController. The SesionController will determine if the object contains an error message or is a valid user. If the Account object is valid, the HTML content of the cdstore.jsp page will be generated and transmitted to the user over HTTP.

Figure 5 shows an interaction with the ProductCatalog Web Service and a GET request triggering a database lookup. When a user clicks a category on the cdstore.jsp page, a HTTP GET request is sent to the web server containing the ID of the selected category. The SessionController then calls getCDList(categoryId) in the session’s CDStoreBean instance. This request is delegated to the ProductCatalog Web Service via SOAP, and again to the DBAgent, which does a JDBC lookup in the database and returns a ResultSet. The ResultSet is then converted into an array of CD objects (based on the CD entity) and returned to the Web Service, which returns the array to the calling CDStoreBean. The CDStoreBean then returns the array of CDs to the SessionController, which inserts them into the HTML output and transmits them to the user’s web browser.

Other scenarios, such as the checkout and confirmation process, involve writing data (rather than simply reading it) to the database by using JDBC, although the flow of events remains similar.

****

Figure : Interaction Diagram for Retrieving CDs in a Category

# Screenshots

# Conclusion

By using technologies such as JSP and Web Services, an electronic commerce system was developed that allows customers to log in and browse a CD Store catalog, as well as submit orders for CDs. Future extensions could include JavaScript-based client data validation and a cleaner user interface. The main focus of the next part of the project, however, will be to create a Personalization Service with emphasis on product recommendation algorithms, cookie usage for obtaining various metrics about user browsing habits, as well as data mining and visual representation of the obtained values.

# References

1. Oracle Corporation. (2011). The NetBeans E-commerce Tutorial - Preparing the Page Views and Controller Servlet. Retrieved October 24, 2011, from http://netbeans.org/kb/docs/javaee/ecommerce/page-views-controller.html