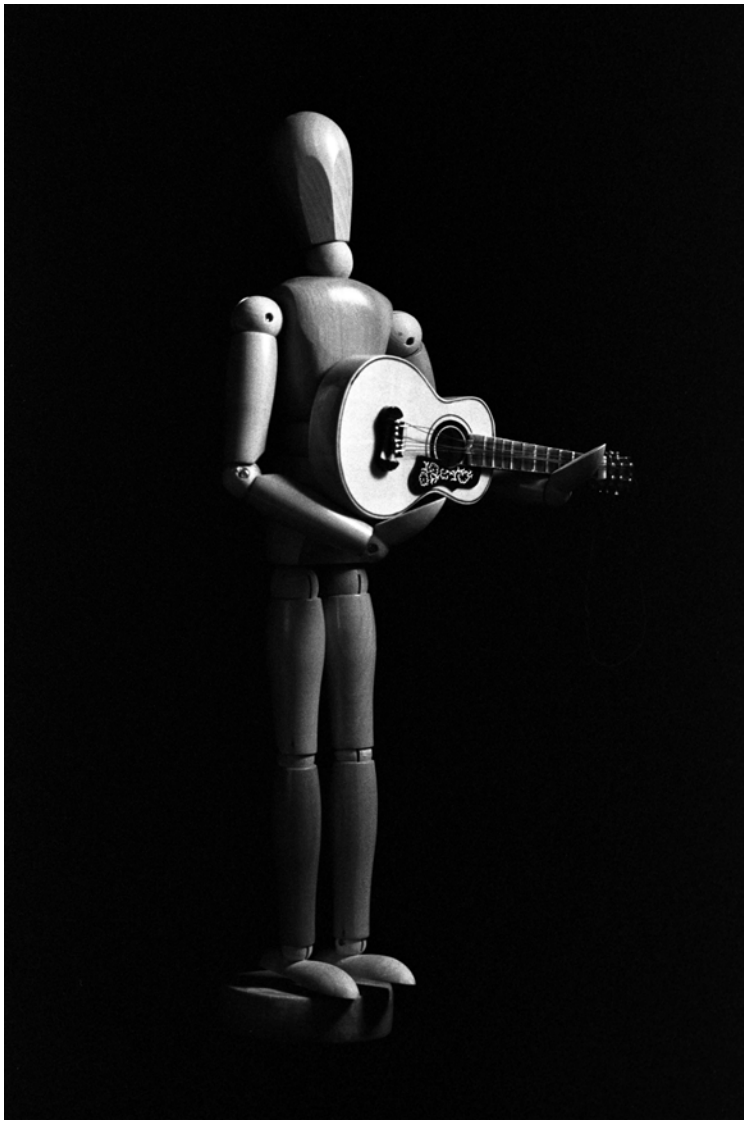
Chapter12



Complex Data Access Objects

Learning Objectives

- *Use the services of a DAO from within another DAO*
- *Incorporate cross-reference tables in SQL queries*
- *Use the services of multiple DAO objects in unit tests*
- *Refactor code to simplify implementation where possible*
- *Understand how to insert data into and delete data from database cross-reference tables*
- *Verify cascade delete foreign key constraints via unit testing*

Introduction

This chapter continues the discussion of data access objects (DAOs). It shows you how to create complex DAOs that utilize the services of other data access objects. The specific example I will employ in this chapter will be to complete the implementation of the EmployeeDAO by using the services of a TrainingDAO to populate the EmployeeVO.Courses property. The EmployeeVO.Courses property will undergo an evolutionary change in the underlying list's data type to better express the notion of a completed course. This will lead to a change in the name of the Courses property itself.

Implementation of the TrainingDAO will demonstrate the use of SQL queries that utilize cross-reference tables. Recall that a many-to-many or N-to-N database relationship is implemented with a cross-reference table. In the case of the EmployeeTraining database, the data indicating which courses an employee has completed is stored in the tbl_EmployeeCourse_XREF table.

Regarding the deletion of employees, although an organization may never delete employees from their database, it's a good idea to test the deletion of employees to ensure all related data is also deleted from the database. This should happen in foreign key relationships where the constraint is set to cascade delete. Implementing the TrainingDAO presents us with the perfect opportunity to perform this testing.

Finally, any new functionality added to the application will need to be tested either by adding new unit tests or modifying existing unit tests.

Plan Of Attack

Table 12-1 lists the development tasks that need to be executed in this chapter.

Development Task	Considerations
Verify the CourseVO class	Recall that the CourseVO class was implemented in Chapter 9 - The Infrastructure Layer.
Implement the CourseDAO class	Create the CourseDAO class. This class will be responsible for interaction with the tbl_Course_LU table.
Implement CourseDAO unit tests	When both the CourseVO and CourseDAO have been coded up, create unit tests to test the CourseDAO class.
Implement the CompletedCourseVO class	Implement a new value object that represents the course an employee completed along with the date completed and the grade received.
Modify the EmployeeVO class	- Modify the EmployeeVO class to contain a list of CompletedCourseVOs (List<CompletedCourseVO>). - Change the name of the Courses property to CompletedCourses. - Refactor the code to simplify the implementation.
Implement the TrainingDAO class	Implement a TrainingDAO class whose responsibility it is to handle interaction with the tbl_EmployeeCourse_XREF table.
Modify the EmployeeDAO class	Modify the EmployeeDAO class to use the services of the TrainingDAO to populate the EmployeeVO.CompletedCourses property.
Implement unit tests	Test any new functionality added during this development cycle.

Table 12-1: Chapter Development Tasks

Development Task	Considerations
Verify employee data cascade delete	Verify the database cascade delete constraint specified between the tbl_Employee and tbl_EmployeeCourse_XREF tables.

Table 12-1: Chapter Development Tasks

Referring to table 21-1 — The development tasks start with the verification of the CourseVO. Recall that I initially implemented the CourseVO in Chapter 9 - The Infrastructure Layer. Upon inspecting the CourseVO I may decide to beef up its functionality to ensure all property values are initialized to an acceptable default state.

The CourseDAO class depends upon the CourseVO class. The purpose of the CourseDAO class is to interact with the tbl_Course table in the database. In this chapter I will just present the completed class without stepping through the implementation of each method. Once the CourseDAO class is completed I'll test it by creating one or more units tests.

Next, I will create a new value object class named CompletedCourseVO that better represents the notion of a completed course, the data for which is stored in the tbl_EmployeeCourse_XREF table. I will then revisit the EmployeeVO class and change the type of the Courses property to List<CompletedCoursesVO> and rename it CompletedCourses to better reflect the data it contains. (Note: This type of change often occurs during the course of application development when you realize what you created one day with good intentions will simply not work and must be changed. That such a change can be made without much hassle is the hallmark of a flexible application architecture.)

Following the change to the EmployeeVO class I will implement a new TrainingDAO class whose responsibility is to interact with the tbl_EmployeeCourse_XREF table. When I've finished the implementation of the TrainingDAO class I'll need to modify the EmployeeDAO class to use its services to populate the EmployeeVO.CompletedCourses property when retrieving employee data from the database. This development task will necessitate a discussion of business rules as they apply to the creation of employees resulting in a level of DAO method atomicity.

Finally, I'll need to add several new unit tests to test the new application functionality. Now that the TrainingDAO is created it will be a good time to test the cascade delete constraint between the tbl_Employee and tbl_EmployeeCourse_XREF tables. Recall that the foreign key constraint between the two tables is set to cascade delete, which means that when an employee record is deleted from the tbl_Employee table, all the corresponding records in the tbl_EmployeeCourse_XREF table should be automatically deleted as well.

Verify CourseVO

I originally created the CourseVO class back in Chapter 9 - The Infrastructure Layer. Now that it's time to start working on the CourseDAO, it's a good idea to revisit the CourseVO and see if any changes need to be made to the code.

Upon inspection I realize that I would like to initialize the instance properties with explicit values. The modified code for the CourseVO class is listed in example 12.1

12.1 CourseVO.cs (Modified)

```
1       using System;
2       using System.Collections.Generic;
3       using System.Linq;
4       using System.Text;
5
6       namespace Infrastructure.ValueObjects
7       {
8           public class CourseVO
9           {
10              #region Public_Properties
11              public int CourseID { get; set; }
12              public String Code { get; set; }
13              public String Title { get; set; }
14              public String Description { get; set; }
15              #endregion
16
17              #region Constructors
18              public CourseVO(): this(0, string.Empty, string.Empty, string.Empty) { }
```



```
19
20              public CourseVO(int courseID, string code, string title, string description){
21                  CourseID = courseID;
22                  Code = code;
23                  Title = title;
24                  Description = description;
25              }
26
27              public CourseVO(string code, string title, string description){
28                  Code = code;
29                  Title = title;
30                  Description = description;
31              }
32              #endregion
33
34              public override string ToString(){
35                  return CourseID + " " + Code + " " + Title + " " + Description;
36              }
37          } // end CourseVO class
38      } // end namespace
```

Referring to example 12.1 — I've modified the default constructor on line 18 to pass in a set of default values for each of the properties. The CourseID property would normally be created with a default value of zero since it's an Int32 type, but the string properties would be created with default values of null, and that doesn't sit too well with me, so I initialize each of the string properties (Code, Title, and Description) to String.Empty.

Now that the CourseVO is squared away, I can start work on the CourseDAO.

Implement CourseDAO

The purpose of the CourseDAO is to interact with the tbl_Course table. The CoureDAO class depends upon the CourseVO class. The code for the CourseDAO is given in example 12.2.

12.2 CourseDAO.cs

```
1       using System;
2       using System.Collections.Generic;
3       using System.Linq;
4       using System.Text;
5       using System.Data;
6       using System.Data.Common;
7
8       using Microsoft.Practices.EnterpriseLibrary.Data;
9       using Microsoft.Practices.EnterpriseLibrary.Data.Sql;
10
11      using Infrastructure.Exceptions;
12      using Infrastructure.ValueObjects;
13
14      namespace DataAccess.DAO {
15          public class CourseDAO : BaseDAO {
16              #region SQL Command Constants
17              // SQL command parameter constants
18              private const string COURSE_ID = "@courseid";
19              private const string CODE = "@code";
20              private const string TITLE = "@title";
21              private const string DESCRIPTION = "@description";
22              #endregion SQL Command Constants
23
24              #region SQL Query String Constants
25              // SQL string constants
26              private const string SELECT_ALL_COLUMNS =
27                  "SELECT tbl_Course_LU.CourseID, " +
28                          "Code, " +
29                          "Title, " +
30                          "Description ";
31
32              private const string SELECT_ALL_COURSES =
33                  SELECT_ALL_COLUMNS +
34                  "FROM tbl_Course_LU";
35
36              private const string SELECT_COURSE_BY_ID =
37                  SELECT_ALL_COLUMNS +
38                  "FROM tbl_Course_LU " +
39                  "WHERE CourseID = " + COURSE_ID;
40
41              private const string INSERT_COURSE =
42                  "INSERT INTO tbl_Course_LU " +
```



```
43                     "(Code, Title, Description) " +
44                 "VALUES (" + CODE + ", " + TITLE + ", " + DESCRIPTION + ") " +
45                 "SELECT scope_identity()";
46
47             private const string UPDATE_COURSE =
48                 "UPDATE tbl_Course_LU " +
49                 "SET Code = " + CODE + ", " +
50                      "Title = " + TITLE + ", " +
51                      "Description = " + DESCRIPTION + " " +
52                 "WHERE CourseID = " + COURSE_ID;
53
54
55             private const string DELETE_COURSE =
56                 "DELETE FROM tbl_Course_LU " +
57                 "WHERE CourseID = " + COURSE_ID;
58             #endregion SQL Query String Constants
59
60
61             #region Constructor
62             public CourseDAO() : base(System.Reflection.MethodBase.GetCurrentMethod().DeclaringType) { }
63             #endregion Constructor
64
65             #region Public Methods
66
67             public List<CourseVO> SelectAllCourses() {
68                 LogDebug("Entering SelectAllCourses() method...");
69                 List<CourseVO> list = new List<CourseVO>();
70                 IDataReader reader = null;
71
72                 try {
73                     DbCommand command = Database.GetSqlStringCommand(SELECT_ALL_COURSES);
74                     reader = Database.ExecuteReader(command);
75                     while (reader.Read()) {
76                         list.Add(FillInCourseVO(reader));
77                     }
78                 }
79                 catch (Exception e) {
80                     LogError("Exception in SelectAllCourses() method...", e);
81                     throw new DBException("Exception in SelectAllCourses() method...", e);
82                 }
83                 finally {
84                     CloseReader(reader);
85                 }
86
87                 return list;
88             }
89
90
91             public CourseVO SelectCourse(int id) {
92                 LogDebug("Entering SelectCourse() method with CourseID = " + id);
93                 CourseVO vo = null;
94                 IDataReader reader = null;
95
96                 try {
97                     DbCommand command = Database.GetSqlStringCommand(SELECT_COURSE_BY_ID);
98                     Database.AddInParameter(command, COURSE_ID, DbType.Int32, id);
99                     reader = Database.ExecuteReader(command);
100                    if (reader.Read()) {
101                        vo = FillInCourseVO(reader);
102                    }
103                    else {
104                        throw new DBException("No course found for CourseID: " + id);
105                    }
106                }
107                catch (Exception e) {
108                    LogError("Error getting course by CourseID " + id, e);
109                    throw new DBException("Error getting course by CourseID " + id);
110                }
111                finally {
112                    base.CloseReader(reader);
113                }
114
115                return vo;
116            }
117
118
119            public CourseVO InsertCourse(CourseVO vo) {
120                LogDebug("Entering InsertCourse() method for course: " + vo);
121                int courseID = 0;
122
123                try {
```



```
124                     DbCommand command = Database.GetSqlStringCommand(INSERT_COURSE);
125                     Database.AddInParameter(command, CODE, DbType.String, vo.Code);
126                     Database.AddInParameter(command, TITLE, DbType.String, vo.Title);
127                     Database.AddInParameter(command, DESCRIPTION, DbType.String, vo.Description);
128                     courseID = Convert.ToInt32(Database.ExecuteScalar(command));
129                 }
130                 catch (Exception e) {
131                     LogError("Exception inserting course into database!", e);
132                     throw new DBException("Exception inserting course into database!", e);
133                 }
134 
135                 return SelectCourse(courseID);
136             }
137 
138 
139             public CourseVO UpdateCourse(CourseVO vo) {
140                 LogDebug("Entering the UpdateCourse() method with course: " + vo);
141                 int rowsAffected = 0;
142 
143                 try {
144                     DbCommand command = Database.GetSqlStringCommand(UPDATE_COURSE);
145                     Database.AddInParameter(command, CODE, DbType.String, vo.Code);
146                     Database.AddInParameter(command, TITLE, DbType.String, vo.Title);
147                     Database.AddInParameter(command, DESCRIPTION, DbType.String, vo.Description);
148                     Database.AddInParameter(command, COURSE_ID, DbType.Int32, vo.CourseID);
149                     rowsAffected = Database.ExecuteNonQuery(command);
150                 }
151                 catch (Exception e) {
152                     LogError("Error updating course record: " + e);
153                     throw new DBException("Error updating course record: " + e);
154                 }
155 
156                 if (rowsAffected == 0) {
157                     LogError("No rows updated for course: " + vo);
158                     throw new DBException("No rows updated for course: " + vo);
159                 }
160                 return SelectCourse(vo.CourseID);
161             }
162 
163 
164             public void DeleteCourse(CourseVO vo) {
165                 LogDebug("Entering DeleteCourse() method with course: " + vo);
166                 int rowsAffected = 0;
167 
168                 try {
169                     DbCommand command = Database.GetSqlStringCommand(DELETE_COURSE);
170                     Database.AddInParameter(command, COURSE_ID, DbType.Int32, vo.CourseID);
171                     rowsAffected = Database.ExecuteNonQuery(command);
172                 }
173                 catch (Exception e) {
174                     LogError("Error deleting course from database: " + vo);
175                     throw new DBException("Error deleting course from database: " + vo, e);
176                 }
177 
178                 if (rowsAffected == 0) {
179                     LogError("No row deleted from database for course: " + vo);
180                     throw new DBException("No row deleted from database for course: " + vo);
181                 }
182             }
183 
184             #endregion Public Methods
185 
186             #region Private Methods
187 
188             private CourseVO FillInCourseVO(IDataReader reader) {
189                 CourseVO vo = new CourseVO();
190                 vo.CourseID = reader.GetInt32(0);
191                 vo.Code = reader.GetString(1);
192                 vo.Title = reader.GetString(2);
193                 vo.Description = reader.GetString(3);
194                 return vo;
195             }
196 
197             #endregion Private Methods
198 
199         } // end CourseDAO class definition
200     } // end namespace
201 
```

Referring to example 12.2 — The implementation of the CourseDAO class is straightforward. It's responsible for inserting, updating, retrieving, and deleting data from the tbl_Course table.

Implement CourseDAOTest Class

Now that the CourseDAO class has been implemented it's time to implement a set of unit tests to exercise its various methods. The code for the CourseDAOTest class is listed in example 12.3.

12.3 CourseDAOTest.cs

```
1       using System;
2       using System.Collections.Generic;
3       using System.Linq;
4       using System.Text;
5       using System.Drawing;
6       using System.Drawing.Imaging;
7       using System.IO;
8
9       using NUnit.Framework;
10
11      using Microsoft.Practices.EnterpriseLibrary.Data;
12      using Microsoft.Practices.EnterpriseLibrary.Data.Sql;
13      using System.Data.Sql;
14      using System.Data.SqlClient;
15      using System.Data;
16      using System.Data.Common;
17
18      using Infrastructure.ValueObjects;
19      using Infrastructure.Exceptions;
20      using DataAccess.DAO;
21
22
23      namespace Tests.DataAccess.DAO {
24          [TestFixture]
25          public class CourseDAOTest {
26
27              // course reference data matches first database record
28              private const int COURSE_ID = 1;
29              private const string CODE = "IST101";
30              private const string TITLE = "Introduction to Programming";
31              private const string DESCRIPTION = "Description test here...";
32
33
34              // other test constants
35              private const int NUMBER_OF_COURSES_IN_DATABASE = 5;
36
37              // fields
38              private CourseDAO _courseDAO;
39              private EmployeeDAO _employeeDAO;
40              private CourseVO _referenceCourse;
41
42
43              [SetUp]
44              public void SetUp() {
45                  _courseDAO = new CourseDAO();
46                  _employeeDAO = new EmployeeDAO();
47                  _referenceCourse = new CourseVO(COURSE_ID, CODE, TITLE, DESCRIPTION);
48              }
49
50              [Test]
51              public void SelectAllCoursesTest() {
52                  List<CourseVO> list = _courseDAO.SelectAllCourses();
53                  Assert.IsTrue(list.Count == NUMBER_OF_COURSES_IN_DATABASE);
54              }
55
56
57              [Test]
58              public void InsertAndDeleteCourseTest() {
59                  CourseVO vo = new CourseVO();
60                  vo.Code = "FRE201";
61                  vo.Title = "Intermediate French";
62                  vo.Description = "Dites-moi quelque choses en francais!";
63                  Assert.IsTrue(vo.CourseID == 0);
64                  vo = _courseDAO.InsertCourse(vo);
65                  Assert.IsTrue(vo.CourseID > 0);
66                  List<CourseVO> list = _courseDAO.SelectAllCourses();
67                  Assert.IsTrue(list.Count == (NUMBER_OF_COURSES_IN_DATABASE + 1));
68                  _courseDAO.DeleteCourse(vo);
69                  list = _courseDAO.SelectAllCourses();
70                  Assert.IsTrue(list.Count == NUMBER_OF_COURSES_IN_DATABASE);
71              }
```



```
72
73
74              [Test]
75              public void UpdateCourseTest() {
76                  CourseVO vo = _courseDAO.SelectCourse(1);
77                  Assert.IsTrue(vo.CourseID == _referenceCourse.CourseID);
78                  Assert.IsTrue(vo.Code == _referenceCourse.Code);
79                  Assert.IsTrue(vo.Title == _referenceCourse.Title);
80                  Assert.IsTrue(vo.Description == _referenceCourse.Description);
81                  vo.Code = "1234";
82                  vo.Title = "Changed";
83                  vo.Description = "Changed here too...";
84                  vo = _courseDAO.UpdateCourse(vo);
85                  Assert.IsTrue(vo.CourseID == _referenceCourse.CourseID);
86                  Assert.IsTrue(vo.Code == "1234");
87                  Assert.IsTrue(vo.Title == "Changed");
88                  Assert.IsTrue(vo.Description == "Changed here too...");
89                  vo.Code = _referenceCourse.Code;
90                  vo.Title = _referenceCourse.Title;
91                  vo.Description = _referenceCourse.Description;
92                  vo = _courseDAO.UpdateCourse(vo);
93                  Assert.IsTrue(vo.CourseID == _referenceCourse.CourseID);
94                  Assert.IsTrue(vo.Code == _referenceCourse.Code);
95                  Assert.IsTrue(vo.Title == _referenceCourse.Title);
96                  Assert.IsTrue(vo.Description == _referenceCourse.Description);
97              }
98          } // end class definition
99      } // end namespace
100
```

Referring to example 12.3 — This set of unit tests uses two DAO classes: CourseDAO and EmployeeDAO. The reference course data constants defined on lines 28 through 31correspond to the first test record inserted into the tbl_Course table. By now you should be able to scan through the code and figure out on your own what the unit tests are doing.

Use a unit test naming convention that lends a hint about the type of test being conducted. For example, on line 58, the method name alone, InsertAndDeleteCourseTest(), pretty much sums up what this test is doing. Note that even though test data has been inserted into the various database tables, it's often necessary to create new database records as part of a unit test. Your goal in writing unit tests it to not only test the code you have written, but also to leave the database in a stable state. If you insert a new record into the database as part of a unit test, you should delete that temporary record at the end of the test to return the database to its pre-test state. The two unit tests that make up the TrainingDAOTest class demonstrate this concept.

Implement CompletedCourseVO

The CompletedCourseVO is a user-defined type whose purpose is to convey throughout the application the notion of a completed course, the data for which is stored in the tbl_EmployeeCourse_XREF table. I start the implementation of the CompletedCourseVO by looking at the tbl_EmployeeCourse_XREF table creation script that I have repeated here in example 12.4.

12.4 tbl_EmployeeCourse_XREF table creation script

```
1       IF NOT EXISTS (SELECT *
1                      FROM sys.objects
1                      WHERE object_id = OBJECT_ID(N'[dbo].[tbl_EmployeeCourse_XREF]') AND type in (N'U'))
2       BEGIN
3       CREATE TABLE [dbo].[tbl_EmployeeCourse_XREF](
4           [FK_EmployeeID] [int] NOT NULL,
5           [FK_CourseID] [int] NOT NULL,
6           [DateCompleted] [datetime] NOT NULL,
7           [Grade] [float] NOT NULL
8       ) ON [PRIMARY]
9       END
10      GO
```

Referring to example 12.4 — Note that the Grade column is defined as an SQL float type. This corresponds to a C#.NET double type.

The code for the CompletedCourseVO class is given in example 12.5.

12.5 CompletedCourseVO.cs

```
1       using System;
2       using System.Collections.Generic;
3       using System.Linq;
```



```
4       using System.Text;
5
6       namespace Infrastructure.ValueObjects {
7           public class CompletedCourseVO {
8
9               #region Public Properties
10              public int      EmployeeID     { get; set; }
11              public CourseVO Course         { get; set; }
12              public DateTime DateCompleted  { get; set; }
13              public double Grade            { get; set; }
14              #endregion
15
16              #region Constructors
17              public CompletedCourseVO() : this(0, new CourseVO(), DateTime.Now, 0.0) { }
18
19
20              public CompletedCourseVO(int employeeID, CourseVO course, DateTime dateCompleted, double grade)
{
21                  EmployeeID = employeeID;
22                  Course = course;
23                  DateCompleted = dateCompleted;
24                  Grade = grade;
25              }
26              #endregion
27
28              public override string ToString() {
29                  return EmployeeID + " " + Course + " " + DateCompleted + " " + Grade;
30              }
31          } // end CompletedCourseVO class definition
32      } // end namespace
```

Referring to example 12.5 — The CompletedCourseVO class implementation consists of four properties. Note that instead of just using the CourseID, which is what's captured in the tbl_EmployeeCourse_XREF table, I've created a field called Course, which is of type CourseVO. The rest of the implementation is straightforward. The default constructor explicitly initializes the VO's properties to known values.

Now that the CompletedCourseVO is completed, it's time to revisit the EmployeeVO and modify its code to use the new class.

Modify EmployeeVO To Use CompletedCourseVO

The EmployeeVO class needs to be modified to use the newly created CompletedCourseVO in place of the CourseVO. The code for the modified EmployeeVO class is listed in example 12.6.

12.6 EmployeeVO.cs (modified)

```
1       using System;
2       using System.Collections.Generic;
3       using System.Linq;
4       using System.Text;
5
6       namespace Infrastructure.ValueObjects
7       {
8           public class EmployeeVO
9           {
10              #region Public_Properties
11              public int EmployeeID { get; set; }
12              public string FirstName { get; set; }
13              public string MiddleName { get; set; }
14              public string LastName { get; set; }
15              public DateTime Birthday { get; set; }
16              public byte[] Picture { get; set; }
17              public DateTime HireDate { get; set; }
18              public bool IsActive { get; set; }
19              public List<CompletedCourseVO> CompletedCourses { get; set; }
20              #endregion
21
22              #region Constructors
23
24              public EmployeeVO() { }
25
26              public EmployeeVO(int employeeID, string first_name, string middle_name, string last_name,
27                                DateTime birthday, byte[] picture, DateTime hiredate, bool is_active,
28                                List<CompletedCourseVO> completedCourses){
29                  EmployeeID = employeeID;
30                  FirstName = first_name;
```



```
31                  MiddleName = middle_name;
32                  LastName = last_name;
33                  Birthday = birthday;
34                  Picture = picture;
35                  HireDate = hiredate;
36                  IsActive = is_active;
37                  CompletedCourses = completedCourses;
38              }
39
40              public EmployeeVO(string first_name, string middle_name, string last_name,
41                                DateTime birthday, byte[] picture, DateTime hiredate, bool is_active,
42                            List<CompletedCourseVO> completedCourses){
43                  FirstName = first_name;
44                  MiddleName = middle_name;
45                  LastName = last_name;
46                  Birthday = birthday;
47                  Picture = picture;
48                  HireDate = hiredate;
49                  IsActive = is_active;
50                  CompletedCourses = completedCourses;
51              }
52
53              public override string ToString(){
54                  return EmployeeID + " " + FirstName + " " + MiddleName + " " + LastName + " " +
55                         Birthday.ToShortDateString() + " " + HireDate.ToShortDateString() + " " + IsActive;
56              }
57
58              #endregion
59          } // end EmployeeVO class
60      }
```

Referring to example 12.6 — I changed the name of the Courses property to CompletedCourses and changed its underlying data type to List<CompletedCoursesVO>. Note that changes like this will have a ripple effect throughout the application wherever the old EmployeeVO.Courses property is currently being used. Changes like this are commonplace in an evolving application development effort and are made as a matter of routine.

Refactoring EmployeeVO

The code for the EmployeeVO shown in example 12.6 above can stand to be improved on several fronts. First, the bold-faced code highlights not only the changes made to the class, but also how much code repetition there is in the class. Second, I'd like to explicitly set the properties to known default values. Example 12.7 gives the modified EmployeeVO class code.

12.7 EmployeeVO.cs (refactored)

```
1       using System;
2       using System.Collections.Generic;
3       using System.Linq;
4       using System.Text;
5
6       namespace Infrastructure.ValueObjects
7       {
8           public class EmployeeVO
9           {
10              #region Public Properties
11              public int EmployeeID { get; set; }
12              public string FirstName { get; set; }
13              public string MiddleName { get; set; }
14              public string LastName { get; set; }
15              public DateTime Birthday { get; set; }
16              public byte[] Picture { get; set; }
17              public DateTime HireDate { get; set; }
18              public bool IsActive { get; set; }
19              public List<CompletedCourseVO> CompletedCourses { get; set; }
20              #endregion Public Properties
21
22              #region Constructors
23
24              public EmployeeVO():this(0, string.Empty, string.Empty, string.Empty, DateTime.MinValue, null,
25                                       DateTime.MinValue, true, new List<CompletedCourseVO>())  { }
26
27
28              public EmployeeVO(string first_name, string middle_name, string last_name,
29                                DateTime birthday, byte[] picture, DateTime hiredate, bool is_active,
30                                List<CompletedCourseVO> completedCourses)
31                  : this(0, first_name, middle_name, last_name, birthday, picture, hiredate, is_active,
32                         completedCourses) { }
33
```



```
34
35
36              public EmployeeVO(int employeeID, string first_name, string middle_name, string last_name,
37                                DateTime birthday, byte[] picture, DateTime hiredate, bool is_active,
38                                List<CompletedCourseVO> completedCourses){
39                  EmployeeID = employeeID;
40                  FirstName = first_name;
41                  MiddleName = middle_name;
42                  LastName = last_name;
43                  Birthday = birthday;
44                  Picture = picture;
45                  HireDate = hiredate;
46                  IsActive = is_active;
47                  CompletedCourses = completedCourses;
48              }
49
50             #endregion Constructors
51
52              #region Overridden Object Methods
53
54              public override string ToString(){
55                  return EmployeeID + " " + FirstName + " " + MiddleName + " " + LastName + " " +
56                         Birthday.ToShortDateString() + " " + HireDate.ToShortDateString() + " " + IsActive;
57              }
58
59              #endregion Overridden Object Methods
60
61          } // end EmployeeVO class
62      }
63
```

Referring to example 12.7 — Note that all these changes were made without breaking any existing functionality, and with the exception of the change to the default constructor, were made for purely aesthetic purposes.

Let's now turn our attention to a DAO whose job it is to interact with the tbl_EmployeeCourse_XREF table.

Implement TrainingDAO

The hardest part about implementing this class was coming up with a decent name. I chose TrainingDAO because it best represented the notion of the type of data being captured in the tbl_EmployeeCourse_XREF table. At first I thought this functionality might fit into the CourseDAO, but when I started down that implementation path, I realized I was confusing the purpose of the CourseDAO class. This leads to the notion that an application's architecture should lend itself to being understood. To me, it simply wasn't intuitive that the CourseDAO would be the place to retrieve an employee's completed courses. Thus the need for another DAO whose name and purpose were a better fit for the job at hand.

The code for the TrainingDAO class is given in example 12.8.

12.8 TrainingDAO.cs

```
1       using System;
2       using System.Collections.Generic;
3       using System.Linq;
4       using System.Text;
5       using System.Data;
6       using System.Data.Common;
7
8       using Microsoft.Practices.EnterpriseLibrary.Data;
9       using Microsoft.Practices.EnterpriseLibrary.Data.Sql;
10
11      using Infrastructure.Exceptions;
12      using Infrastructure.ValueObjects;
13
14
15      namespace DataAccess.DAO {
16          public class TrainingDAO : BaseDAO {
17              #region SQL Command Parameters
18              //SQL command parameter constants
19              private const string FK_EMPLOYEE_ID = "@fkEmployeeId";
20              private const string FK_COURSE_ID = "@fkCourseID";
21              private const string DATE_COMPLETED = "@dateCompleted";
22              private const string GRADE = "@grade";
23              #endregion
24
25              #region SQL Query String Constants
26              //SQL query string constants
```



```
27              private const string SELECT_ALL_COLUMNS =
28                  "SELECT FK_EmployeeID, FK_CourseID, DateCompleted, Grade ";
29
30              private const string SELECT_ALL_TRAINING_COMPLETED =
31                  SELECT_ALL_COLUMNS +
32                  "FROM tbl_EmployeeCourse_XREF";
33
34              private const string SELECT_COURSES_COMPLETED_BY_EMPLOYEE_ID =
35                 SELECT_ALL_COLUMNS +
36                 "FROM tbl_EmployeeCourse_XREF " +
37                 "WHERE tbl_EmployeeCourse_XREF.FK_EmployeeID = " +FK_EMPLOYEE_ID;
38
39              private const string INSERT_COMPLETED_TRAINING =
40                  "INSERT INTO tbl_EmployeeCourse_XREF " +
41                     "(FK_EmployeeID, FK_CourseID, DateCompleted, Grade) " +
42                   "VALUES (" + FK_EMPLOYEE_ID + ", " + FK_COURSE_ID + ", " + DATE_COMPLETED + ", " + GRADE +
")";
43
44
45              private const string DELETE_EMPLOYEE_TRAINING =
46                  "DELETE FROM tbl_EmployeeCourse_XREF " +
47                  "WHERE FK_EmployeeID = " + FK_EMPLOYEE_ID;
48              #endregion
49
50              #region Constructor
51
52              public TrainingDAO() : base(System.Reflection.MethodBase.GetCurrentMethod().DeclaringType) { }
53
54              #endregion
55
56              #region Public Methods
57              public List<CompletedCourseVO> SelectAllCompletedTraining() {
58                  LogDebug("Entering SelectAllCompletedTraining() method...");
59                  List<CompletedCourseVO> list = new List<CompletedCourseVO>();
60                  IDataReader reader = null;
61                  try {
62                      DbCommand command = Database.GetSqlStringCommand(SELECT_ALL_TRAINING_COMPLETED);
63                      reader = Database.ExecuteReader(command);
64                      CourseDAO courseDAO = new CourseDAO();
65                      while (reader.Read()) {
66                          list.Add(FillInCompletedCourseVO(reader, courseDAO));
67                      }
68                  }
69                  catch (Exception e) {
70                      LogError("Exception in SelectAllCompletedTraining() method...", e);
71                      throw new DBException("Exception in SelectAllCompletedTraining() method...", e);
72                  }
73                  finally {
74                      CloseReader(reader);
75                  }
76                  return list;
77              }
78
79
80              public List<CompletedCourseVO> InsertCompletedTraining(CompletedCourseVO vo) {
81                  LogDebug("Entering InsertCompletedTraining() method with CompletedCourseVO = " + vo);
82                  List<CompletedCourseVO> list = new List<CompletedCourseVO>();
83                  try {
84                      DbCommand command = Database.GetSqlStringCommand(INSERT_COMPLETED_TRAINING);
85                      Database.AddInParameter(command, FK_EMPLOYEE_ID, DbType.Int32, vo.EmployeeID);
86                      Database.AddInParameter(command, FK_COURSE_ID, DbType.Int32, vo.Course.CourseID);
87                      Database.AddInParameter(command, DATE_COMPLETED, DbType.DateTime, vo.DateCompleted);
88                      Database.AddInParameter(command, GRADE, DbType.Double, vo.Grade);
89                      Database.ExecuteScalar(command);
90                  }
91                  catch (Exception e) {
92                      LogError("Error inserting completed training record!", e);
93                      throw new DBException("Error inserting completed training record!", e);
94                  }
95                  return this.GetTrainingCompletedByEmployee(vo.EmployeeID);
96              }
97
98
99              public List<CompletedCourseVO> InsertEmployeeTrainingRecords(EmployeeVO employeeVO) {
100                 LogDebug("Entering InsertEmployeeTrainingRecords() method with employeeVO = " + employeeVO);
101                 foreach (CompletedCourseVO completedCourse in employeeVO.CompletedCourses) {
102                     this.InsertCompletedTraining(completedCourse);
103                 }
104                 return this.GetTrainingCompletedByEmployee(employeeVO.EmployeeID);
105             }
106
```



```
107
108             public void DeleteEmployeeTrainingRecords(int employeeID) {
109                 LogDebug("Entering DeleteEmployeeTraining() method for employeeID = " + employeeID);
110                 try {
111                     DbCommand command = Database.GetSqlStringCommand(DELETE_EMPLOYEE_TRAINING);
112                     Database.AddInParameter(command, FK_EMPLOYEE_ID, DbType.Int32, employeeID);
113                     Database.ExecuteNonQuery(command);
114                 }
115                 catch (Exception e) {
116                     LogError("Error deleting employee training records!", e);
117                     throw new DBException("Error deleting employee training records!", e);
118                 }
119             }
120
121
122             public List<CompletedCourseVO> GetTrainingCompletedByEmployee(int employeeID) {
123                LogDebug("Entering GetTrainingCompletedByEmployee() method for employeeID = " + employeeID);
124                 List<CompletedCourseVO> list = new List<CompletedCourseVO>();
125                 IDataReader reader = null;
126                 try {
127                     DbCommand command =
128                                   Database.GetSqlStringCommand(SELECT_COURSES_COMPLETED_BY_EMPLOYEE_ID);
129                     Database.AddInParameter(command, FK_EMPLOYEE_ID, DbType.Int32, employeeID);
130                     reader = Database.ExecuteReader(command);
131                     CourseDAO courseDAO = new CourseDAO();
132                     while (reader.Read()) {
133                         list.Add(FillInCompletedCourseVO(reader, courseDAO));
134                     }
135                 }
136                 catch (Exception e) {
137                     LogError("Error selecting courses completed for employeeID = " + employeeID, e);
138                     throw new DBException("Error selecting courses completed for employeeID = "
139                                           + employeeID, e);
140                 }
141                 finally {
142                     CloseReader(reader);
143                 }
144                 return list;
145             }
146
147             #endregion Public Methods
148
149             #region Private Methods
150
151             private CompletedCourseVO FillInCompletedCourseVO(IDataReader reader, CourseDAO courseDAO) {
152                 CompletedCourseVO vo = new CompletedCourseVO();
153                 vo.EmployeeID = reader.GetInt32(0);
154                 vo.Course = courseDAO.SelectCourse(reader.GetInt32(1));
155                 vo.DateCompleted = reader.GetDateTime(2);
156                 vo.Grade = reader.GetDouble(3);
157
158                 return vo;
159             }
160
161             #endregion Private Methods
162
163         } // end TrainingDAO class definition
164     } // end namespace
165
```

Referring to example 12.8 — The TrainingDAO class converts data stored in the tbl_EmployeeCourse_XREF table into CompletedCourseVOs and vice versa. Note that the FillInCompletedCourseVO() method defined on line 151 takes two arguments: an IDataReader and a CourseDAO. The courseDAO parameter is used on line 154 to populate the CompletedCourse.Course property by retrieving the desired course from the tbl_Course_LU table. Note also that although the SQL server type of the tbl_EmployeeCourse_XREF.Grade column is [float], it corresponds to the .NET double type, thus on line 156 the IDataReader.GetDouble() method is used to retrieve the value from the database.

Now that we have a TrainingDAO it's time to create some unit tests.

Implement TrainingDAO Unit Tests

Before using the TrainingDAO class somewhere in the application it needs to be tested. Example 12.9 gives the code for the TrainingDAOTest class.

12.9 TrainingDAOTest.cs

```
1       using System;
2       using System.Collections.Generic;
3       using System.Linq;
4       using System.Text;
5       using System.Drawing;
6       using System.Drawing.Imaging;
7       using System.IO;
8
9       using NUnit.Framework;
10
11      using Microsoft.Practices.EnterpriseLibrary.Data;
12      using Microsoft.Practices.EnterpriseLibrary.Data.Sql;
13      using System.Data.Sql;
14      using System.Data.SqlClient;
15      using System.Data;
16      using System.Data.Common;
17      using System.Transactions;
18
19      using Infrastructure.ValueObjects;
20      using Infrastructure.Exceptions;
21      using DataAccess.DAO;
22
23      namespace Tests.DataAccess.DAO {
24
25          [TestFixture]
26          public class TrainingDAOTest {
27
28              private EmployeeVO newEmployee;
29              private CourseDAO _courseDAO;
30              private EmployeeDAO _employeeDAO;
31              private TrainingDAO _trainingDAO;
32
33              [SetUp]
34              public void SetUp() {
35                  newEmployee = new EmployeeVO();
36                  newEmployee.FirstName = "Diana";
37                  newEmployee.MiddleName = "Lee";
38                  newEmployee.LastName = "Bath";
39                  newEmployee.Birthday = new DateTime(1961, 3, 3);
40                  newEmployee.HireDate = new DateTime(2012, 12, 24);
41                  newEmployee.IsActive = true;
42
43                  _courseDAO = new CourseDAO();
44                  _employeeDAO = new EmployeeDAO();
45                  _trainingDAO = new TrainingDAO();
46              }
47
48
49              [Test]
50              public void InsertAndDeleteTrainingTest() {
51                  // Insert new employee
52                  newEmployee = _employeeDAO.InsertEmployee(newEmployee);
53
54                  // Get list of courses
55                  List<CourseVO> courseList = _courseDAO.SelectAllCourses();
56
57                  // Should be at least four courses in database for testing
58                  Assert.IsTrue(courseList.Count > 4);
59
60                  // Assign some completed courses to employee
61                  newEmployee.CompletedCourses.Add(new CompletedCourseVO(newEmployee.EmployeeID,
62                                                                         courseList[0], DateTime.Now, 100.00));
63                  newEmployee.CompletedCourses.Add(new CompletedCourseVO(newEmployee.EmployeeID,
64                                                                         courseList[1], DateTime.Now, 100.00));
65                  newEmployee.CompletedCourses.Add(new CompletedCourseVO(newEmployee.EmployeeID,
66                                                                         courseList[2], DateTime.Now, 100.00));
67
68                  // Insert one completed employee training into tbl_EmployeeCourse_XREF table
69                  _trainingDAO.InsertCompletedTraining(new CompletedCourseVO(newEmployee.EmployeeID,
70                                                                         courseList[3], DateTime.Now, 100.00));
71
```



```
72                  // Retrieve completed training record
73                  List<CompletedCourseVO> employeeTrainingList =
74                                          _trainingDAO.GetTrainingCompletedByEmployee(newEmployee.EmployeeID);
75                  Assert.IsTrue(employeeTrainingList.Count == 1);
76
77                  // Insert remaining training
78                  newEmployee.CompletedCourses = _trainingDAO.InsertEmployeeTrainingRecords(newEmployee);
79                  Assert.IsTrue(newEmployee.CompletedCourses.Count == 4);
80
81                  // Delete all employee training records
82                  _trainingDAO.DeleteEmployeeTrainingRecords(newEmployee.EmployeeID);
83
84                  // See if the employee has completed any training .. should return empty list
85                  newEmployee.CompletedCourses =
86                                          _trainingDAO.GetTrainingCompletedByEmployee(newEmployee.EmployeeID);
87                  Assert.IsTrue(newEmployee.CompletedCourses.Count == 0);
88
89                  // Delete employee
90                  _employeeDAO.DeleteEmployee(newEmployee);
91              }
92
93
94              [Test]
95              public void EmployeeCourseXREFCascadeDeleteTest() {
96                  // Insert new employee
97                  newEmployee = _employeeDAO.InsertEmployee(newEmployee);
98
99                  // Get list of courses
100                 List<CourseVO> courseList = _courseDAO.SelectAllCourses();
101
102                 // Should be at least four courses in database for testing
103                 Assert.IsTrue(courseList.Count > 4);
104
105                // Add some completed courses to employee
106                 newEmployee.CompletedCourses.Add(new CompletedCourseVO(newEmployee.EmployeeID,
107                                                                        courseList[0], DateTime.Now, 100.00));
108                 newEmployee.CompletedCourses.Add(new CompletedCourseVO(newEmployee.EmployeeID,
109                                                                        courseList[1], DateTime.Now, 100.00));
110                 newEmployee.CompletedCourses.Add(new CompletedCourseVO(newEmployee.EmployeeID,
111                                                                        courseList[2], DateTime.Now, 100.00));
112
113                 // Insert completed training
114                 _trainingDAO.InsertEmployeeTrainingRecords(newEmployee);
115
116                 // Retrieve completed training
117                 newEmployee.CompletedCourses =
118                                         _trainingDAO.GetTrainingCompletedByEmployee(newEmployee.EmployeeID);
119                 Assert.IsTrue(newEmployee.CompletedCourses.Count == 3);
120
121                 // Delete employee
122                 _employeeDAO.DeleteEmployee(newEmployee);
123
124                 // Should be no training for this employee
125                List<CompletedCourseVO> completedCourseList =
126                                    _trainingDAO.GetTrainingCompletedByEmployee(newEmployee.EmployeeID);
127                 Assert.IsTrue(completedCourseList.Count == 0);
128             }
129         } // end TrainingDAOTest class definition
130     } // end namespace
```

Referring to example 12.9 — The TrainingDAOTest class consists of two unit test methods: InsertAndDeleteTrainingTest() and EmployeeCourseXREFCascadeDeleteTest(). The TrainingDAOTest class also uses the services of three DAOs: TrainingDAO, CourseDAO, and EmployeeDAO. In the first unit test, a new employee is inserted into the database. Next, all the courses are retrieved from the database and then three completed courses are added to the employee's CompletedCourses property. On line 69, one completed course for the employee is inserted into the database, followed on line 73 by the retrieval of that completed course to ensure the insertion and retrieval worked properly. On line 78 the remaining employee's completed courses are inserted into the database and the Assert.IsTrue() statement on line 79 verifies that the completed course count in the database for the employee now stands at four. On line 82 all the employee's training records are deleted and again an assertion is made to ensure the deletion works as expected. Finally, the employee is deleted from the database to return it to its pre-test state.

The second unit test verifies the cascade delete constraint that says when a tbl_Employee record is deleted, its related entries in the tbl_EmployeeCourse_XREF table should also be deleted.

Now that the TrainingDAO has been tested, it can be used in the EmployeeDAO to populate an EmployeeVO.CompletedCourses property.

Modify EmployeeDAO To Use TrainingDAO

The modified EmployeeDAO class is given in example 12.10.

12.10 EmployeeDAO.cs (modified)

```
1       using System;
2       using System.Collections.Generic;
3       using System.Linq;
4       using System.Text;
5       using System.Data;
6       using System.Data.Common;
7
8       using Microsoft.Practices.EnterpriseLibrary.Data;
9       using Microsoft.Practices.EnterpriseLibrary.Data.Sql;
10
11      using Infrastructure.Exceptions;
12      using Infrastructure.ValueObjects;
13
14      namespace DataAccess.DAO {
15          public class EmployeeDAO : BaseDAO {
16              #region SQL Command Parameter Constants
17              // SQL Command Parameter Constants
18              private const String EMPLOYEE_ID = "@employeeID";
19              private const String FIRST_NAME = "@firstName";
20              private const String MIDDLE_NAME = "@middleName";
21              private const String LAST_NAME = "@lastName";
22              private const String BIRTHDAY = "@birthday";
23              private const String PICTURE = "@picture";
24              private const String HIRE_DATE = "@hireDate";
25              private const String IS_ACTIVE = "@isactive";
26              #endregion SQL Command Parameter Constants
27
28              #region SQL Query String Constants
29              // SQL Query String Constants
30              private const String SELECT_ALL_COLUMNS =
31                  "SELECT tbl_Employee.EmployeeID, " +
32                          "FirstName, " +
33                          "MiddleName, " +
34                          "LastName, " +
35                          "Birthday, " +
36                          "HireDate, " +
37                          "IsActive, " +
38                          "Picture ";      // now retrieving Picture column
39
40              private const String SELECT_ALL_EMPLOYEES =
41                  SELECT_ALL_COLUMNS +
42                  "FROM tbl_Employee ";
43
44
45              private const String SELECT_EMPLOYEE_BY_ID =
46                  SELECT_ALL_COLUMNS +
47                  "FROM tbl_Employee " +
48                  "WHERE EmployeeID = " + EMPLOYEE_ID;
49
50
51
52
53              private const String INSERT_EMPLOYEE =
54                  "INSERT INTO tbl_Employee " +
55                          "(FirstName, MiddleName, LastName, Birthday, Picture, HireDate, IsActive) " +
56                  "VALUES (" + FIRST_NAME + ", " + MIDDLE_NAME + ", " + LAST_NAME + ", " + BIRTHDAY + "," +
57                               PICTURE + ", " + HIRE_DATE + ", " + IS_ACTIVE + ") " +
58                  "SELECT scope_identity()";
59
60
61              private const String UPDATE_EMPLOYEE =
62                  "UPDATE tbl_Employee " +
63                  "SET FirstName = " + FIRST_NAME + ", " +
64                       "MiddleName = " + MIDDLE_NAME + ", " +
65                       "LastName = " + LAST_NAME + ", " +
66                       "Birthday = " + BIRTHDAY + ", " +
67                       "Picture = " + PICTURE + ", " +
68                       "HireDate = " + HIRE_DATE + ", " +
69                       "IsActive = " + IS_ACTIVE + " " +
70                  "WHERE EmployeeID = " + EMPLOYEE_ID;
71
72
73              private const String DELETE_EMPLOYEE =
```



```
74                  "DELETE FROM tbl_Employee " +
75                  "WHERE EmployeeID = " + EMPLOYEE_ID;
76
77
78              private const String UPDATE_ISACTIVE_COLUMN =
79                  "UPDATE tbl_Employee " +
80                  "SET IsActive = " + IS_ACTIVE + " " +
81                  "WHERE EmployeeID = " + EMPLOYEE_ID;
82
83              #endregion SQL Query String Constants
84
85              #region Constructor
86              public EmployeeDAO() : base(System.Reflection.MethodBase.GetCurrentMethod().DeclaringType) { }
87              #endregion Constructor
88
89              #region Public Methods
90
91              public List<EmployeeVO> SelectAllEmployees() {
92                  LogDebug("Entering SelectAllEmployees() method...");
93
94                  List<EmployeeVO> list = new List<EmployeeVO>();
95                  IDataReader reader = null;
96                  TrainingDAO trainingDAO = new TrainingDAO();
97
98                  try {
99                      DbCommand command = Database.GetSqlStringCommand(SELECT_ALL_EMPLOYEES);
100                     reader = Database.ExecuteReader(command);
101                     while (reader.Read()) {
102                         list.Add(FillInEmployeeVO(reader, trainingDAO));
103                     }
104                 }
105                 catch (Exception e) {
106                     LogError("Exception in SelectAllEmployees() method.", e);
107                     throw new DBException("Exception in SelectAllEmployees() method.", e,
108                                           BaseException.Severity.ERROR);
109                 }
110                 finally {
111                     base.CloseReader(reader);
112                 }
113
114                 return list;
115             }
116
117
118             public EmployeeVO SelectEmployee(int id) {
119                 LogDebug("Entering SelectEmployee() method for EmployeeID = " + id);
120                 EmployeeVO vo = null;
121                 IDataReader reader = null;
122                 TrainingDAO trainingDAO = new TrainingDAO();
123
124                 try {
125                     DbCommand command = Database.GetSqlStringCommand(SELECT_EMPLOYEE_BY_ID);
126                     Database.AddInParameter(command, EMPLOYEE_ID, DbType.Int32, id);
127                     reader = Database.ExecuteReader(command);
128                     if (reader.Read()) {
129                         vo = FillInEmployeeVO(reader, trainingDAO);
130                     }
131                     else {
132                         throw new DBException("No employee found for EmployeeID: " + id);
133                     }
134                 }
135                 catch (Exception e) {
136                     LogError("Error getting employee by EmployeeID " + id, e);
137                     throw new DBException("Error getting employee by EmployeeID " + id);
138                 }
139                 finally {
140                     base.CloseReader(reader);
141                 }
142
143                 return vo;
144             }
145
146
147             public EmployeeVO InsertEmployee(EmployeeVO vo) {
148                 LogDebug("Entering InsertEmployee() method with employee: " + vo.ToString());
149                 int employeeID = 0;
150                 try {
151                     DbCommand command = Database.GetSqlStringCommand(INSERT_EMPLOYEE);
152                     Database.AddInParameter(command, FIRST_NAME, DbType.String, vo.FirstName);
153                     Database.AddInParameter(command, MIDDLE_NAME, DbType.String, vo.MiddleName);
154                     Database.AddInParameter(command, LAST_NAME, DbType.String, vo.LastName);
```



```
155                     Database.AddInParameter(command, BIRTHDAY, DbType.DateTime, vo.Birthday);
156                     Database.AddInParameter(command, PICTURE, DbType.Binary, vo.Picture);
157                     Database.AddInParameter(command, HIRE_DATE, DbType.DateTime, vo.HireDate);
158                     Database.AddInParameter(command, IS_ACTIVE, DbType.Boolean, vo.IsActive);
159                     employeeID = Convert.ToInt32(Database.ExecuteScalar(command));
160                 }
161                 catch (Exception e) {
162                     LogError("Error inserting employee into database!", e);
163                     throw new DBException("Error inserting employee into database!", e,
164                                           BaseException.Severity.ERROR);
165                 }
166 
167                 return SelectEmployee(employeeID);
168             }
169 
170 
171             public EmployeeVO UpdateEmployee(EmployeeVO vo) {
172                 LogDebug("Entering the UpdateEmployee() method with Employee: " + vo);
173                 int rowsAffected = 0;
174 
175                 try {
176                     DbCommand command = Database.GetSqlStringCommand(UPDATE_EMPLOYEE);
177                     Database.AddInParameter(command, FIRST_NAME, DbType.String, vo.FirstName);
178                     Database.AddInParameter(command, MIDDLE_NAME, DbType.String, vo.MiddleName);
179                     Database.AddInParameter(command, LAST_NAME, DbType.String, vo.LastName);
180                     Database.AddInParameter(command, BIRTHDAY, DbType.DateTime, vo.Birthday);
181                     Database.AddInParameter(command, PICTURE, DbType.Binary, vo.Picture);
182                     Database.AddInParameter(command, HIRE_DATE, DbType.DateTime, vo.HireDate);
183                     Database.AddInParameter(command, IS_ACTIVE, DbType.Boolean, vo.IsActive);
184                     Database.AddInParameter(command, EMPLOYEE_ID, DbType.Int32, vo.EmployeeID);
185                     rowsAffected = Database.ExecuteNonQuery(command);
186                 }
187                 catch (Exception e) {
188                     LogError("Error updating employee record: " + e);
189                     throw new DBException("Error updating employee record: " + e);
190                 }
191 
192                 if (rowsAffected == 0) {
193                     LogError("No rows updated for employee: " + vo);
194                     throw new DBException("No rows updated for employee: " + vo);
195                 }
196                 return SelectEmployee(vo.EmployeeID);
197             }
198 
199 
200             public void DeleteEmployee(EmployeeVO vo) {
201                 LogDebug("Entering DeleteEmployee() method with employee: " + vo);
202                 int rowsAffected = 0;
203 
204                 try {
205                     DbCommand command = Database.GetSqlStringCommand(DELETE_EMPLOYEE);
206                     Database.AddInParameter(command, EMPLOYEE_ID, DbType.Int32, vo.EmployeeID);
207                     rowsAffected = Database.ExecuteNonQuery(command);
208                 }
209                 catch (Exception e) {
210                     LogError("Error deleting employee from database: " + vo);
211                     throw new DBException("Error deleting employee from database: " + vo, e);
212                 }
213 
214                 if (rowsAffected == 0) {
215                     LogError("No row deleted from database for employee: " + vo);
216                     throw new DBException("No row deleted from database for employee: " + vo);
217                 }
218             }
219 
220 
221             public void SetEmployeeIsActiveState(int id, bool state) {
222                 LogDebug("Entering SetEmployeeIsActiveState() for EmployeeID = " + id + " and state = " +
223                          state);
224                 int rowsAffected = 0;
225 
226                 try {
227                     DbCommand command = Database.GetSqlStringCommand(UPDATE_ISACTIVE_COLUMN);
228                     Database.AddInParameter(command, IS_ACTIVE, DbType.Boolean, state);
229                     Database.AddInParameter(command, EMPLOYEE_ID, DbType.Int32, id);
230                     rowsAffected = Database.ExecuteNonQuery(command);
231                 }
232                 catch (Exception e) {
233                     LogError("No rows updated for EmpoyeeID = " + id, e);
234                     throw new DBException("No rows updated for EmployeeID = " + id, e);
235                 }
```



```
236
237                 if (rowsAffected == 0) {
238                     LogError("EmployeeID " + id + " does not exist in the database.");
239                     throw new DBException("EmployeeID " + id + " does not exist in the database.");
240                 }
241             }
242
243             #endregion Public Methods
244
245             #region Private Methods
246
247             private EmployeeVO FillInEmployeeVO(IDataReader reader, TrainingDAO trainingDAO) {
248                 EmployeeVO vo = new EmployeeVO();
249
250                 vo.EmployeeID = reader.GetInt32(0);
251                 vo.FirstName = reader.GetString(1);
252                 vo.MiddleName = reader.GetString(2);
253                 vo.LastName = reader.GetString(3);
254                 vo.Birthday = reader.GetDateTime(4);
255                 vo.HireDate = reader.GetDateTime(5);
256                 vo.IsActive = reader.GetBoolean(6);
257
258                 if (!reader.IsDBNull(7)) {
259                     vo.Picture = (byte[])reader.GetValue(7);
260                 }
261
262                 vo.CompletedCourses = trainingDAO.GetTrainingCompletedByEmployee(vo.EmployeeID);
263
264                 return vo;
265             }
266             #endregion Private Methods
267
268         } // end EmployeeDAO class
269     } // end namespace
```

Referring to example 12.10 — The changes to the EmployeeDAO class are highlighted in bold. I'll start with the changes made to the FillInEmployeeVO() method that begins on line 247. I've added a second parameter to the method of type TrainingDAO named trainingDAO. The trainingDAO parameter is then used on line 262 to populate an EmployeeVO's CompletedCourses property. In the SelectAllEmployees() and SelectEmployee() methods you can see where I've added the declaration for a local method variable of type TrainingDAO to be passed in to the FillInEmployeeVO() method.

Note that I did not add the capability to insert an employee's completed training when an employee is inserted into the database nor when an employee is updated. I believe these actions are best left to a business object, where complex DAO interaction can be controlled with transactions. This topic is covered in detail in the next chapter.

Summary

One data access object can use the services of another data access object to create complex DAOs.

Your goal in writing unit tests is not only to test the code you have written, but also to leave the database in a stable state. If you insert a new record into the database as part of a unit test, you should delete that temporary record at the end of the test to return the database to its pre-test state.

Refactor code where possible to simplify implementation and remove repetitive code.

One purpose or goal of an application architecture is to help programmers understand how the application works. In other words, architecture should be an aid to understanding. Many design and implementation decisions should be made with this architectural goal in mind.

Trust your instincts. If something doesn't feel right about the code, it might not be right. Functionality that doesn't seem to fit in a DAO may be better placed in a business object.

References

None

Notes

