AquaLogic Data Services Platform™ Tutorial: Part I

A Guide to Developing BEA AquaLogic Data Services Platform (DSP) Projects

Note: This tutorial is based in large part on a guide originally developed for enterprises evaluating the BEA AquaLogic Data Services Platform for their specific requirements. In some cases illustrations, directories, and paths reference Liquid Data, the previous name of the Data Services Platform.

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About This Document

Welcome to the *AquaLogic Data Services Platform (DSP) Samples Tutorial*. In this document, you are provided with step-by-step instructions that show how you can use DSP to solve the types of data integration problems frequently faced by Information Technology (IT) managers and staff. These issues include:

What is the best way to normalize data drawn from widely divergent sources?

Having normalized the data, can you access it, ideally through a single point of access?

After you define a single point of access, can you develop reusable queries that are easily tested, stored, and retrieved?

After you develop your query set, can you easily incorporate results into widely available applications?

Other questions may occur. Is the data-rich solution scalable? Is it reusable throughout the enterprise? Are the original data sources largely transparent to the application — or do they become an issue each time you want to make a minor adjustments to queries or underlying data sources?

Document Organization

This two-part guide is organized into 33 lessons that illustrate many aspects of Data Services Platform functionality:

Data service development. In which you specify the query functions that DSP will use to access, aggregate, and transform distributed, disparate data into a unified view. In this stage, you also specify the XML type that defines the data view that will be available to client-side applications.

Data modeling. In which you define a graphical representation of data resource relationships and functions.

Client-side development. In which you define an environment for retrieving data results.

Each lesson in the tutorial consists of an overview plus "labs" that demonstrate DSP's capabilities on a topic-by-topic basis. Each lab is structured as a series of procedural steps that details the specific actions needed to complete that part of the demonstration.

The lessons are divided into two parts:

Part 1: Core Training includes Lessons 1 through 16, which illustrate the DSP capabilities that are most commonly used.

Part 2: Power-User Training includes Lessons 17 through 33; these illustrate DSP's more advanced capabilities.

Note: The lessons build on each other and must be completed in sequential order. Unless a step or lesson is labeled as *optional* it should be completed. Otherwise you may not be able to successfully complete a subsequent, dependent lesson.

Technical Prerequisites

The lessons within this guide require a familiarity with the following topics: data integration and aggregation concepts, the BEA WebLogic® Platform™ (particularly WebLogic Server and WebLogic Workshop), Java, query concepts, and the environment in which you will install and use DSP.

For some lessons, a background in XQuery is helpful.

System Requirements

To complete the lessons, your computer requires:

Server:	BEA WebLogic Server 8.1 Service Pack 5
Application:	BEA AquaLogic Data Services Platform 2.1
Operating System:	Windows 2000 or Windows XP
Memory:	512 MB RAM minimum; 1 GB RAM recommended
Browser:	Internet Explorer 6 or higher

Data Sources Used Within These Tutorials

The *DSP Samples Tutorial* builds data services that draw on a variety of underlying data sources. These data sources, which are provided with the product, are described in the following table:

Data Source Type	Data Source	Data
Relational	Customer Relationship Management (CRM) RTLCUSTOMER database	Customer and credit card data
Relational	Order Management System (OMS) RTLAPPLOMS database	Apparel product, order, and order line data
Relational	Order Management System (OMS) RTLELECOMS database	Electronics product, order, and order line data
Relational	RTLSERVICE database	Customer service data, organized in a single Service Case table
Web service	CreditRatingWS	Credit rating data
Stored procedure	GETCREDITRATING_SP	Customer credit rating information
Java function	Functions.DSML	Java function enabling LDAP access
Java function	Functions.excel_jcom	Excel spreadsheet data, via JCOM
Java function	Functions.CreditCardClient	Customer credit card information, via an XMLBean
XML files	ProductUNSPSC.xsd	Third-party product information
Flat file	Valuation.csv	Data received from an internal department that deals with customer scoring and valuation models

Related Information

In addition to the material covered in this guide, you may want to review the wealth of resources available at the BEA Web site, WebLogic developer site, and third-party sites. Information at these sites includes datasheets, product brochures, customer testimonials, product documentation, code samples, white papers, and more.

For more information about Java and XQuery, refer to the following sources:

The Sun Microsystems, Inc. Java site at:

`http://java.sun.com/`

The World Wide Web Consortium XML Query section at:

`http://www.w3.org/XML/Query`

For more information about BEA products, refer to the following sources:

DSP documentation site at:

`http://edocs.bea.com/aldsp/docs21/`

BEA e-docs documentation site at:

`http://e-docs.bea.com/`

BEA online community for WebLogic developers at:

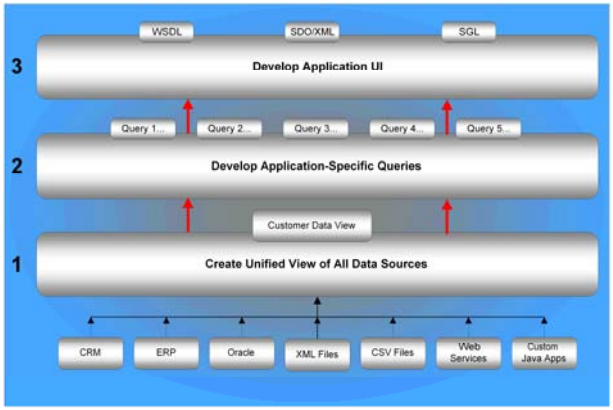
`http://dev2dev.bea.com`

Part 1 Core Training

BEA AquaLogic Data Services Platform approaches the problem of creating integration architectures by providing tools that let you build *physical data services* around individual physical data sources, and then develop *logical data services* and business logic that integrate and return data from multiple physical and logical data services. Logical data services use easily-maintained, graphically-designed XML queries (XQueries) to access, aggregate, transform, and deliver its data results.

Developing DSP services involves three basic steps:

1. **Create a unified view of information from all relevant sources.** This step, which involves development of physical data services and (optionally) data models, is typically performed by a data services architect who understands the information available in underlying sources and can define the unified view that different projects will use. DSP is capable of modeling relational and non-relational sources; it includes tools for introspection and mapping of the underlying sources to the unified data view.
2. **Develop application-specific queries.** This step, which involves development of logical data services, is typically performed by application developers who write simple queries against the unified view to get the required data. DSP provides tools to visually create robust XQueries and also publish them as services.
3. **Tie query results to client applications.** This step, which involves accessing data through a variety of consuming applications, is typically performed by application developers who execute the queries and receive results as XML or Java objects. In addition, DSP provides an out-of- the-box Workshop control to easily develop portal or Web applications from which to access data retrieved by a data service.



Data Services Platform Development Process

As part of the development process, DSP provides flexible options for updating both relational and non-relational data sources. DSP lets you write update logic via an EJB in BEA WebLogic Server™; via a database, JMS, or Data Services Platform Control in Workshop; or via a business process in BEA WebLogic Integration™.

In addition, DSP provides visual tools for managing various administrative tasks, including controlling data service metadata, caching, and security.

Within Part 1, examples are provided that illustrate DSP's most commonly used capabilities: developing and testing physical and logical data services, accessing data services through various consuming applications, updating underlying data sources, and managing various administrative tasks.

Note: The lessons within Part 1 build upon one another and should be completed in sequential order.

Lesson 1 Introducing the Data Services Platform Environment

BEA AquaLogic Data Services Platform provides the tools and components that let you build physical data services around individual physical data sources, and then develop the logical data services and business logic that integrate data from multiple physical and logical data services. The environment also lets you test the data service and manage data service metadata, caching, and security.

The basic menus, behavior, and look-and-feel associated with the WebLogic Workshop environment apply to DSP. However, there are several tools and components within WebLogic Workshop that are especially relevant to DSP. In this lesson, you will learn about a few of those tools and components. In addition, you will learn how to complete several basic tasks, such as starting and stopping WebLogic Server, that are essential to using WebLogic Workshop.

As the first lesson within the *AquaLogic Data Services Platform Samples Tutorial*, there are no dependencies on other lessons. However, your familiarity with WebLogic Workshop is assumed. Workshop is fully described in online documentation, which you can view at:

```
http://edocs.bea.com/workshop/docs81/index.html
```

Objectives

After completing this lesson, you will be able to:

Navigate the DSP environment.

Start and stop WebLogic Server.

Save a Data Services application and associated files.

Overview

WebLogic Workshop consists of two parts: an Integrated Development Environment (IDE) and a standards-based runtime environment. The purpose of the IDE is to remove the complexity in building applications for the entire WebLogic platform. Applications you build in the IDE are constructed from high-level components rather than low-level API calls. Best practices and productivity are built into both the IDE and runtime.

Lab 1.1 Starting WebLogic Workshop

The first step is starting WebLogic Workshop and opening the RTLApp sample application, which you will use in the next lab.

Objectives

In this lab, you will:

Start WebLogic Workshop.

Open the RTLApp application.

Instructions

1. Choose Start → Programs → BEA WebLogic Platform 8.1 → WebLogic Workshop 8.1. If this is the first time you are starting WebLogic Workshop, then the SamplesApp project opens. Otherwise, the project that you last opened appears.
2. Choose File → Open → Application.

3. Open the RTLApp.work file from the following location:

```
<beahome> \weblogic81\samples\LiquidData\RTLApp\
```

Note: Depending on your computer settings, the .work extension may not be visible.

In Figure 1-1, the RTLApp application opens in Design View for the Case data service. If this is not the view that you see, double-click `Case.ds` located at `DataServices/ RTLServices` and select the Design View tab.

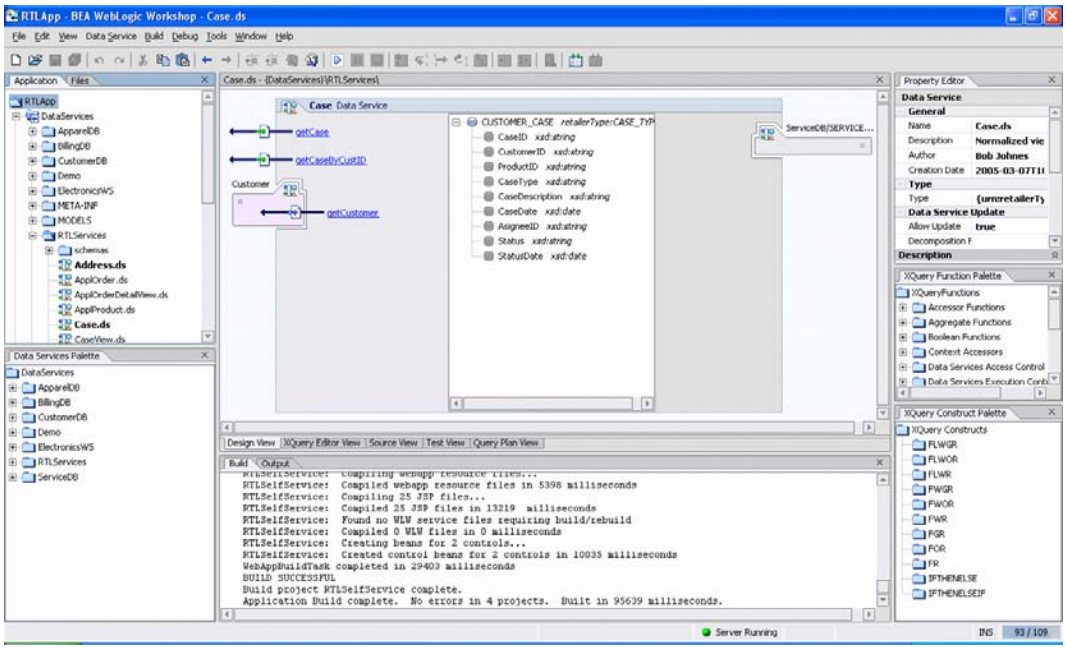


Figure 1-1 RTLApp in Design View for Case.ds

Note: The RTLApp application opens in the last active view. This action also resets the default WebLogic server home directory instance to the ldplatform sample domain.

Lab 1.2 Navigating the DSP Integrated Development Environment (IDE)

Within the WebLogic Workshop environment, there are several tools and components that are relevant to developing DSP applications and projects. Five of the most frequently used are:

Application Pane

Design View

XQuery Editor View

Source View

Test View

Screenshots of the environment are taken from within the RTLApp application.

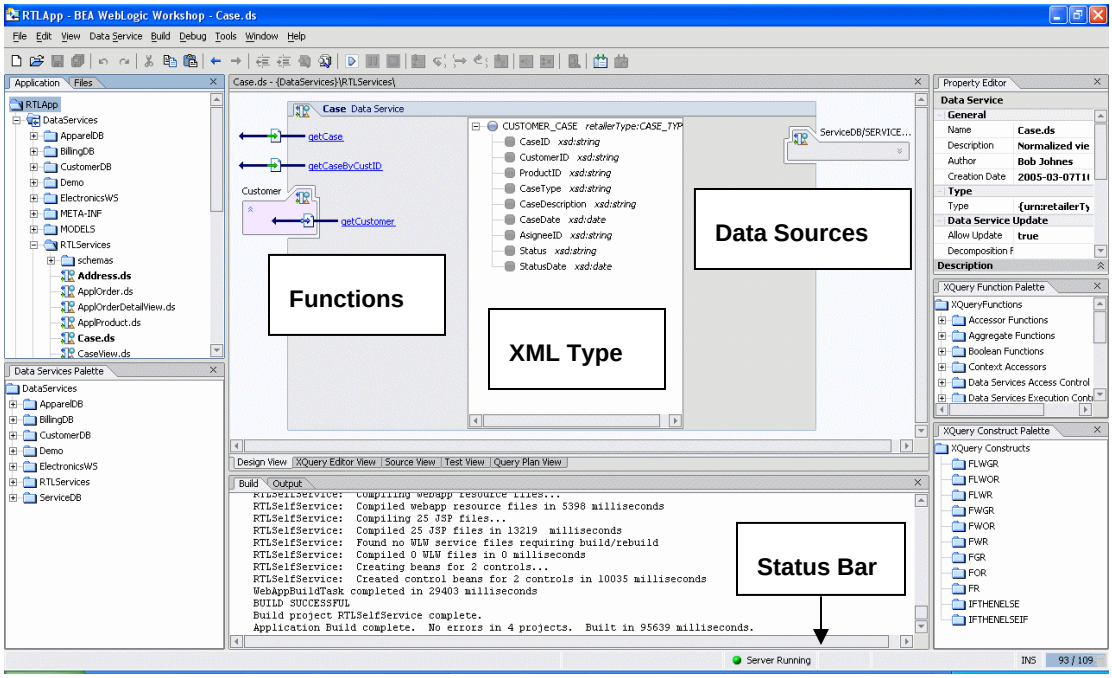


Figure 1-2 Data Services Platform Running in WebLogic Workshop

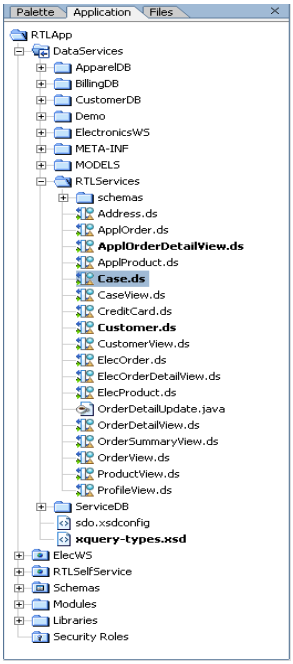
Objectives

In this lab, you will:

Explore five of the most frequently used development tools.

Discover the features and functions of these tools.

Application Pane



The *Application* pane displays a hierarchical representation of a DSP application.

A Workshop *application* is a collection of all resources and components—projects, schemas, modules, libraries, and security roles—deployed as a unit to an instance of WebLogic Server. Only one application can be active at a time. Open files display in boldface type.

If the *Application* pane is not open, complete one of the following options:

Choose View → Application.

Press Alt+1.

Design View

Design View presents an editable, graphical representation of a data service. It is a single point of consolidation for a data service's query functions and other business logic. Using Design View, you can:

View the data service's XML type, native data types, functions, and data source relationships.

Add functions and data source relationships.

Create an XML type definition for elements within the data service, such as xs:string or xs:date.

Associate the data service with an XML Schema Definition (`.xsd`) that defines the unified view for all retrieved data.

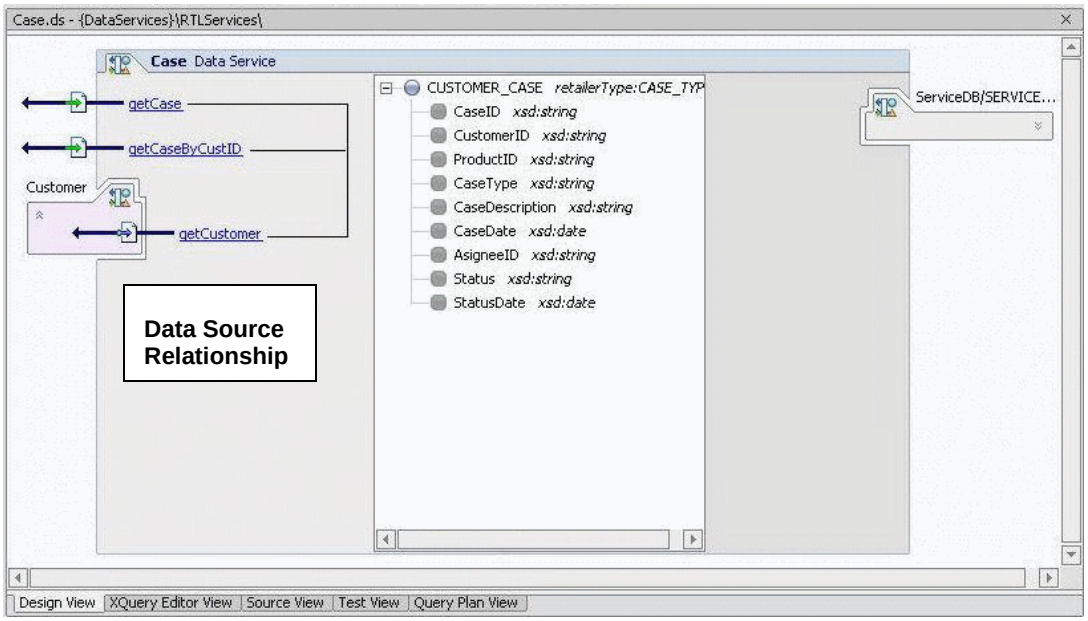


Figure 1-3 Design View of a Logical Data Service

If Design View is not open, complete the following steps:

1. Open a data service such as `Case.ds` located in `DataServices/RTLServices`.
2. Select the Design View tab.

XQuery Editor View

XQuery Editor View provides a graphical, drag-and-drop approach to constructing queries. Using this view, you can inspect or edit the query Return type and add the data source nodes, parameters, expressions, conditions, and source-to-target mappings that comprise data service query functions.

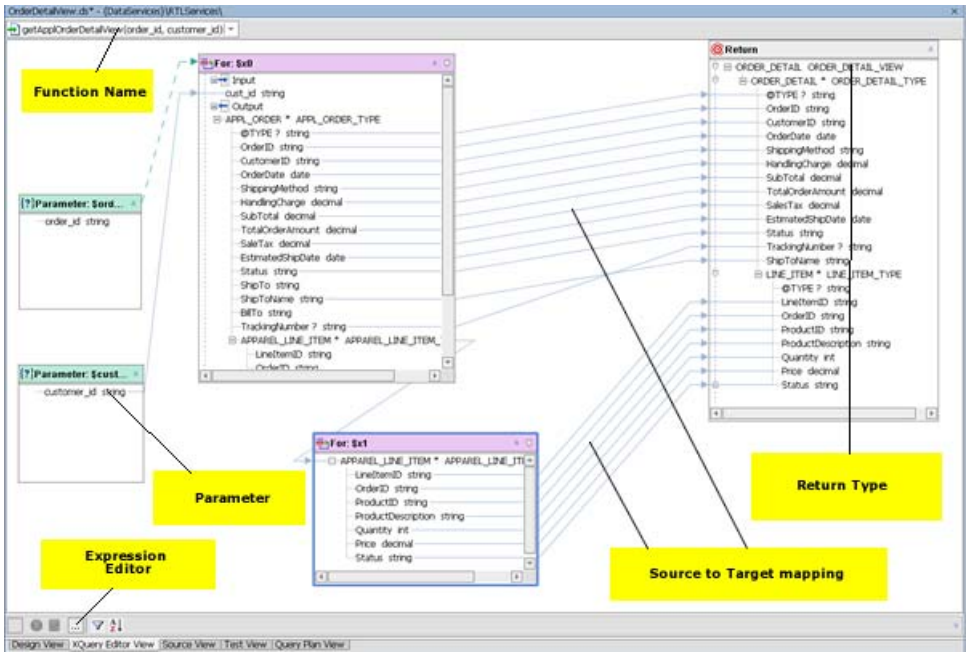


Figure 1-4 XQuery Editor View

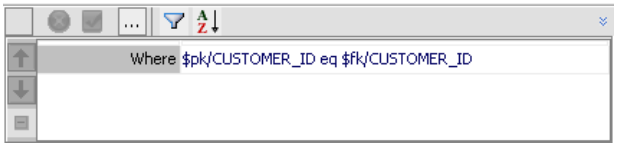
If XQuery Editor View is not open:

1. Open a data service such as `Case.ds` located in `DataServices/RTLServices`.
2. Select the XQuery Editor View tab.

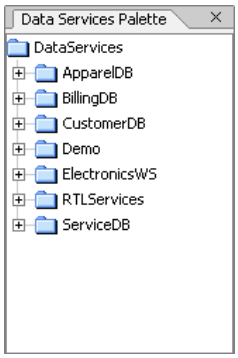
XQuery Editor View Tools

XQuery Editor View includes several editors and palettes that simplify the construction of queries:

Expression Editor. Lets you add where and order by conditions to parameter, let or for nodes. The Expression Editor is only active when you select a specific node.



Data Services Palette. Lets you add previously-defined query functions as data sources. Each function displays as a for node, which serves as a for clause within the FLWOR (for-let-where-order by-return) statement that is the heart of an XQuery.



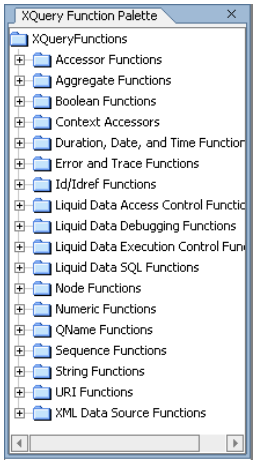
To add data sources, drag and drop an item from the Data Services Palette into the XQuery Editor View work area. After you drop the node into XQuery Editor View, the node's data source schema (shape) displays in the XQuery Editor View.

If the Data Services Palette is not open, choose View → Windows → Data Services Palette.

XQuery Function Palette. Lets you add any of the more than 100 built-in functions provided within the XQuery language. In addition, you can add any of the special built-in functions defined by BEA.

To add a built-in function, drag and drop the selected item into the Expression Editor.

If XQuery Function Palette is not open, choose View → Windows → XQuery Function Palette.



Any work created in XQuery Editor View is immediately reflected in Source View, which permits you to augment the graphical approach to constructing queries with direct work on the XQuery syntax. Two-way editing is supported. Changes you make in Source View are reflected in XQuery Editor View, and vice versa.

Source View

Source View lets you view and/or modify a data service's XQuery annotated source code. Although DSP provides extensive visual design tools for developing a data service, sometimes you may need to work directly with the underlying XQuery syntax.

Two-way editing is supported. Changes you make in Source View are reflected in XQuery Editor View, and vice versa.

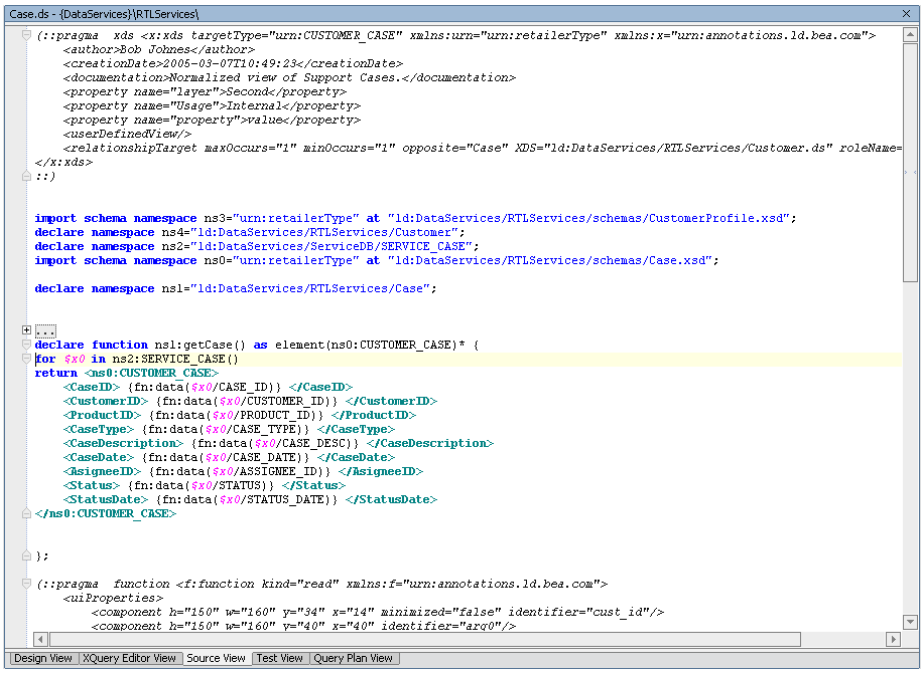


Figure 1-5 Source View

If Source View is not open, complete the following steps:

1. Open a data service such as `Case.ds` located in `DataServices/RTLServices`.
2. Select the Source View tab.

Within Source View, you can use the XQuery Construct Palette, which lets you add any of several built-in generic FLWOR statements to the XQuery syntax. You can then customize the generic statement to match your particular needs.

To add a FLWOR construct, drag and drop the selected item into the appropriate *declare function* space.

If XQuery Construct Palette is not open, choose View → Windows → XQuery Construct Palette.

Test View

Test View provides a means of running developed query functions within the IDE. Options available in Test View depend on the query being tested. For example, if the query supports parameters, then the Parameters section appears, providing a field for each parameter required by the query.

Using Test View, you can select a specific function, specify appropriate parameters, and execute the query to determine that it is functioning properly. In addition, you can edit the results of the query and pass the modifications back to the underlying data source.

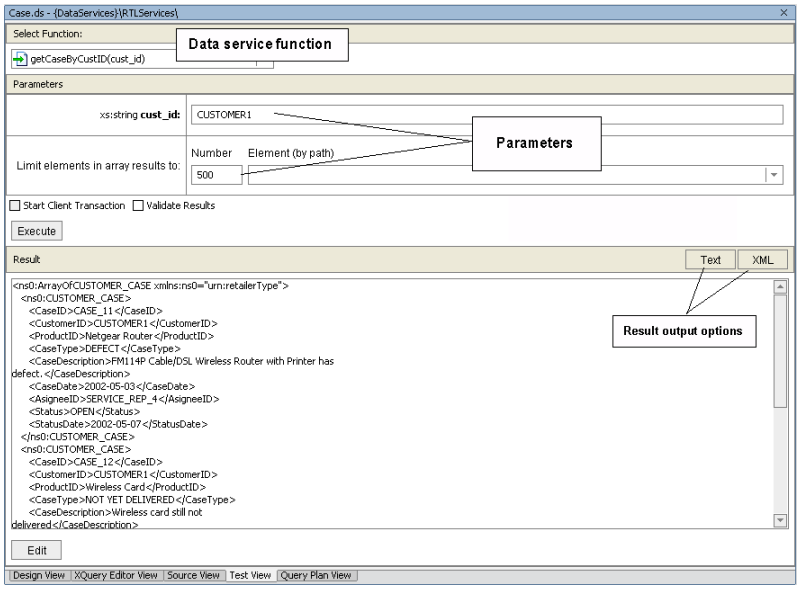


Figure 1-6 Test View

If Test View is not open, complete the following steps:

1. Open a data service such as `Case.ds` located in `DataServices/RTLServices`.
2. Select the Test View tab.

Lab 1.3 Starting WebLogic Server

WebLogic Server need not be running while you are designing a DSP project. However, before you import source metadata or test a developed function, you must start an instance of WebLogic Server.

Any DSP projects that you create will run on your system's installation of WebLogic Server, at least until you deploy them.

Note: Multiple versions of WebLogic Server can exist, even on local, sample systems. If you have previously run an instance of WebLogic Server you should shut down that server and change your WebLogic Workshop server settings. This can be done through the Workshop Tools→Application Properties dialog box.

Objectives

In this lab, you will:

Discover ways to start WebLogic Server.

Confirm that your server is running.

Instructions

There are three ways to start WebLogic Server. Start the server using one of the following ways:

Menu Command	**WebLogic Workshop → Tools → WebLogic Server → Start WebLogic Server**
Shortcut Keys	Ctrl + Shift + S
Procedure	Right-click the red Server Stopped icon, located at the bottom of the WebLogic Workshop window. Then click Start WebLogic Server.

Starting the WebLogic Server may take some time. During the server startup sequence, you *may* see the following message box:

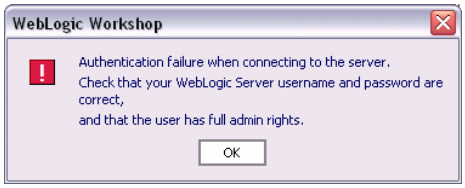
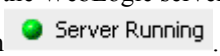


Figure 1-7 (Possible) WebLogic Server Startup Message

If this box displays, click OK.

When WebLogic Server is running, the WebLogic server icon, which appears on the WebLogic Workshop status bar, will turn green 

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Lab 1.4 Stopping WebLogic Server

There may be times when you want to stop WebLogic Server while still working within DSP for WebLogic Workshop.

Objectives

In this lab, you will:

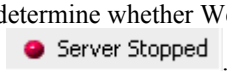
Discover how to stop WebLogic Server.

Confirm that the server is not running.

Instructions

You can stop WebLogic Server using any one of the following ways:

Menu Command	**WebLogic Workshop → Tools → WebLogic Server → Stop WebLogic Server**
Shortcut Keys	Ctrl + Shift + T
Procedure	Right-click the green Server Running icon, located at the bottom of the WebLogic Workshop window. Then click Stop WebLogic Server.

Check the WebLogic Server icon of WebLogic Workshop to determine whether WebLogic Server is stopped. If WebLogic Server is stopped, the icon will turn red 

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Lab 1.5 Saving Your Work

As you build your data services, you may want to save your work on a regular basis.

Objectives

In this lab, you will:

Discover three ways to save your work while working within the application.

Discover how to save one or more files when exiting the application or closing WebLogic Workshop.

Instructions

You can save your work using the following commands:

Menu Command	Icon
File → Save	
File → Save As	Not Applicable
File → Save All	

Save All is generally recommended for DSP applications. The Save As and Save All options are only available if you have made changes to your application.

In addition, if you exit WebLogic Workshop and there are any unsaved changes, you are provided with an option to save either specific or all edited files.

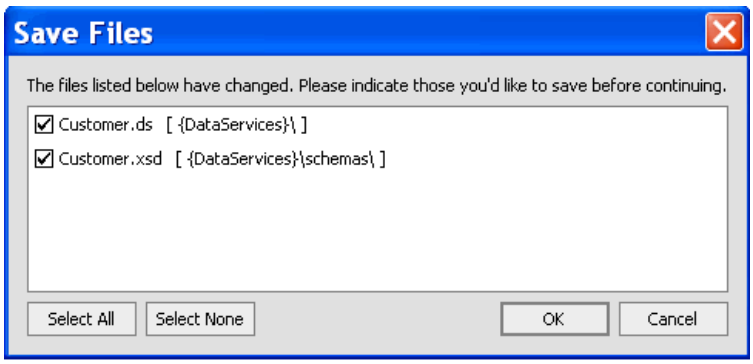


Figure 1-8 Save File Options on Exiting WebLogic Workshop

Lesson Summary

In this lesson, you learned how to:

Use several of the key tools within DSP for WebLogic Workshop environment.

Start and stop the WebLogic Server.

Save files within a Data Services application.

Lesson 2 Creating a Physical Data Service

A *data service* is simply a file containing XQuery functions and supporting structured information. The most basic data service is a *physical data service*, which models a *single* physical data source residing in a relational database, Web service, flat file, XML file, or Java function.

Data Services Platform approaches the problem of creating integration architectures by building data services around multiple physical data services. Therefore, in this lesson, you will create data services based on relational data included in the sample PointBase database provided with DSP:

Customer Relationship Management (CRM) data, stored in the RTLCUSTOMER database.

Order Management System (OMS) data for apparel and electronic products, stored in the RTLAPPLOMS and RTLELECOMS databases.

Customer service data, stored in the RTLSERVICE database.

Objectives

After completing this lesson, you will be able to:

Create a DSP application and project.

Generate multiple physical data services, based on underlying relational data sources.

Test a physical data service.

Overview

A data service is a collection of one or several related query functions. The service typically models a unit of enterprise information, such as customer or product data.

The *shape* of a data service is defined by an XML type that classifies each data element as a particular form of information, according to its allowable contents and units of data. For example, an xs:string type can be a sequence of alphabetic, numeric, and/or special characters, while an xs:date type can only be numeric characters presented in a *YYYY-MM-DD* format. DSP uses the XML type to model and normalize disparate data into a unified view.

The data service interface consists of *public functions* that enable client-based consuming applications to retrieve data from the modeled data source.

Lab 2.1 Creating a DSP Application

Because a data service is part of a specific DSP project, and a project is part of a single WebLogic Workshop application, you will first need to create the application, and then a project, before creating a physical data service. (Alternatively, an existing application could be used; in that case you would simply create a DSP project within the application.)

An *application*, which is deployed as a single unit to an instance of WebLogic Server, is a J2EE enterprise application that ultimately produces a J2EE Enterprise Application Archive (EAR) file. This, in turn, provides you with a multi-user application that is ready for Internet deployment. Except in specific cases, such as accessing remote EJBs or Web services, an application is self-contained. The application's components may reference each other, but may not generally reference components in other applications. An application's components include:

One or more projects, data services, schemas, and libraries.

Zero or more modules and security roles.

An application should represent a related collection of business solutions. For example, if you are deploying two Web sites — one an e-commerce site and the other a human resources portal for employees — you would probably create separate WebLogic applications for each.

An application is also the top-level unit of work that you manipulate within the WebLogic Workshop environment. Only one application can be active at a time.

Objectives

In this lab, you will:

Create a DSP-enabled application.

Explore default application components.

Instructions

1. Choose File → New → Application
2. In the New Application dialog box, select Data Services Application.
3. Enter Evaluation in the Name field.

Note: The sample code used to work on this tutorial uses Evaluation as the application name. Ensure that you name the DSP application as Evaluation so that the sample works successfully with your application.

4. Click Create.

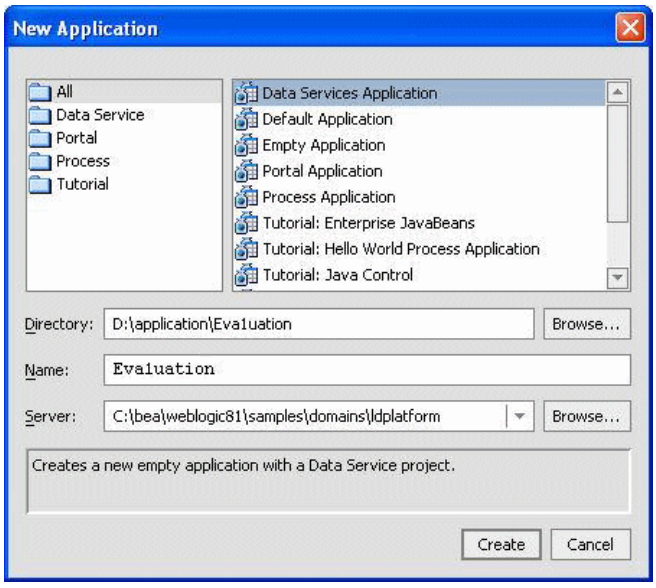


Figure 2-1 Creating a DSP Application

The components of the application are represented in a hierarchical tree structure in the Application pane. When you first create a Data Services application, the following default components are automatically generated:

Data Service project. Takes the name of your application (in this case, Evaluation). Within the project folder, there is initially a single component, the xquery-types `.xsd` file. This file is an XML Schema Definition (XSD) that describes the contents, semantics, and structure of the project.

Modules. Initially an empty folder.

Libraries. Contains the `ld-server-app.jar` file. This file contains various folders and files, as displayed in Figure 2-2.

Note: Initially, the Libraries folder is empty. The `ld-server-app.jar` file is created only after you build the Evaluation project.

Security Roles. Initially an empty folder.

Figure 2-2 displays the default folders created for the Evaluation application.

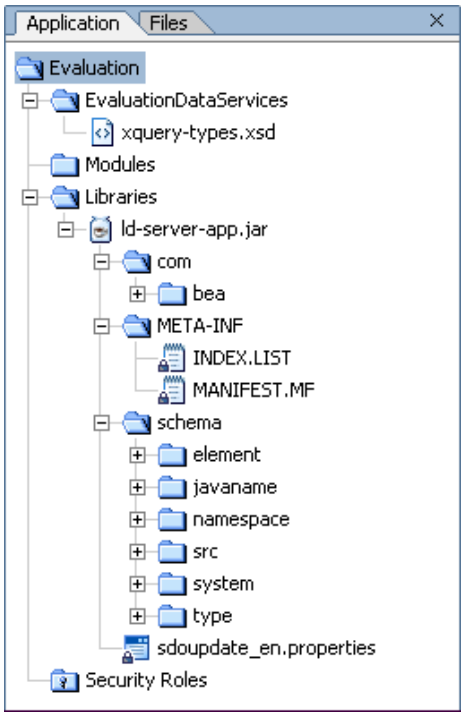


Figure 2-2 Initial Application Structure

Lab 2.2 Creating a Data Services Project

A *project* groups related files—data services, models, and metadata—within an application. Each application can support multiple projects. As you develop the application, you may want to create new projects for the following reasons:

To separate unrelated functionality. Each project should contain closely-related components. For example, if you want to create one or more data services that expose order status to your customers, and also one or more Web services that expose inventory status to your suppliers, you would probably organize these two sets of unrelated Web services into two projects.

To control build units. Each project produces a particular type of file when the project is built. For example, a Java project produces a JAR file. If you want to reuse the Java classes, you would segregate the Java classes into a separate project, and then reference the resulting JAR file from other projects in your application.

Although a default Data Services project is created when you create a new Data Service application, for this tutorial you will create a new project.

Objectives

In this lab, you will:

Create a new Data Service project.

Review the results.

Instructions

1. Choose File → New → Project
2. In the New Project dialog box, select Data Service Project.
3. Enter DataServices in the Project name field.
4. Click Create.

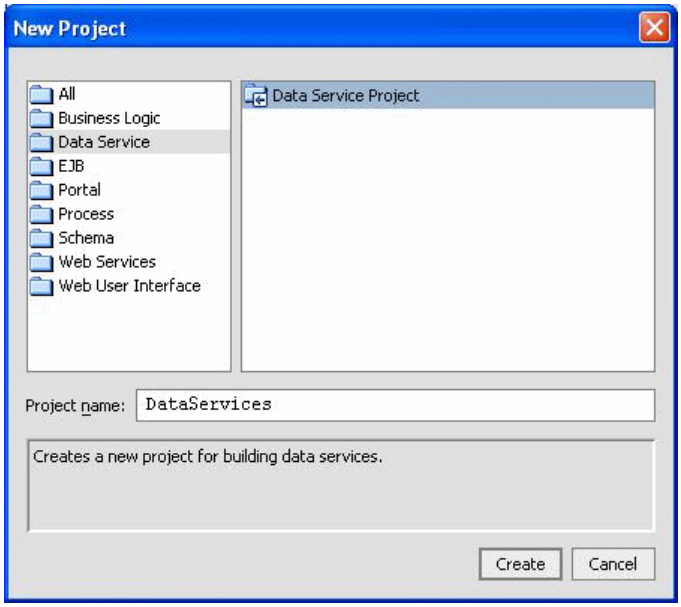


Figure 2-3 Creating a New Data Service Project

The components of your new Data Service project are represented in a hierarchical tree structure in the Application pane. At present, there is only one component in the project, the xquery-types `.xsd` file. This file is an *XML schema definition* that describes the contents, semantics, and structure of the project.

Lab 2.3 Creating Project Sub-Folders

Folders let you logically group different data services, and their associated files, within a single project. For example, if you had three data sources — one relational database containing tables for customer-oriented information and two Web services providing credit rating and information — you would probably want to create two folders, one for the database and one for the Web services.

Objectives

In this lab, you will:

Create four sub-folders within the DataServices project folder.

Review the results.

Instructions

1. Right-click the DataServices project folder.
2. Choose New → Folder.
3. Enter CustomerDB in the Name field.
4. Click OK.
5. Repeat steps 1 through 4 to create additional data service folders for:

   ApparelDB

   ElectronicsDB

   ServiceDB

After adding these four folders, your DataServices project folder should look similar to Figure 2-4.

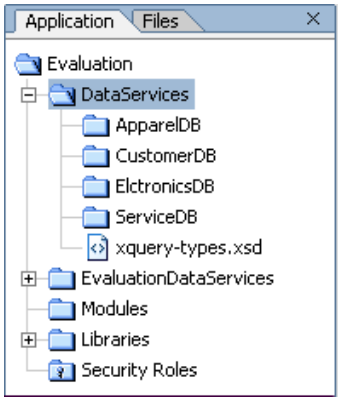


Figure 2-4 Project Sub-Folders

Lab 2.4 Importing Relational Source Metadata

When you installed DSP, several sample data sources were also installed. One such sample data source is the Avitek RTL PointBase database. It contains a number of relational database schemas that provide the metadata needed to build your physical data services, including:

Customer Relationship Management (CRM) data, stored in the RTLCUSTOMER database.

Order Management System (OMS) data for apparel products, stored in the RTLAPPLOMS database.

Order Management System (OMS) data electronic products, stored in the RTLELECOMS database.

Customer service data, stored in the RTLSERVICE database.

A physical data service, which models physical data existing somewhere in your enterprise, is automatically generated when you import relational source metadata. Each generated physical data service represents a single data source that can be integrated with other physical or logical data services.

Objectives

In this lab, you will:

Import source metadata from four RTL PointBase databases, thereby generating multiple physical data services.

Review the results.

Instructions

Note: WebLogic Server must be running. If it is not already running, start the server (Lab 1-3) before you begin this lab.

1. Right-click the CustomerDB folder.
2. Choose Import Source Metadata from the pop-up menu.
3. Select Relational from the Data Source Type drop-down list and click Next.

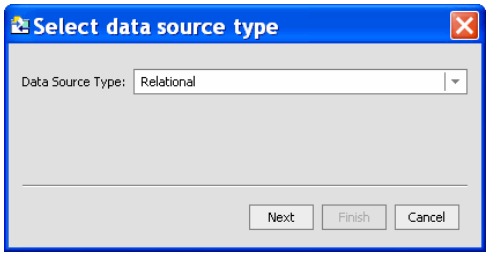


Figure 2-5 Select Data Source

4. Specify the data source, by completing the following steps:
    a. Select cgDataSource from the Data Source drop-down list.
    b. Click Select All and then click Next.

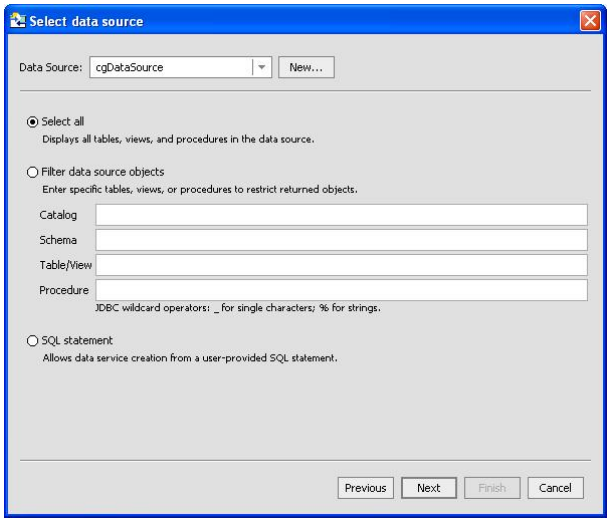


Figure 2-6 Select Data Source

WebLogic Server fetches the specified data, and then displays the Select Database Objects to Import dialog box. The source metadata for each selected object will be used to generate a physical data service.

5. Expand the RTLCUSTOMER and RTLBILLING folders, located in the left pane.
6. Select all tables from both schemas and click Add. The selected objects display in the right pane.

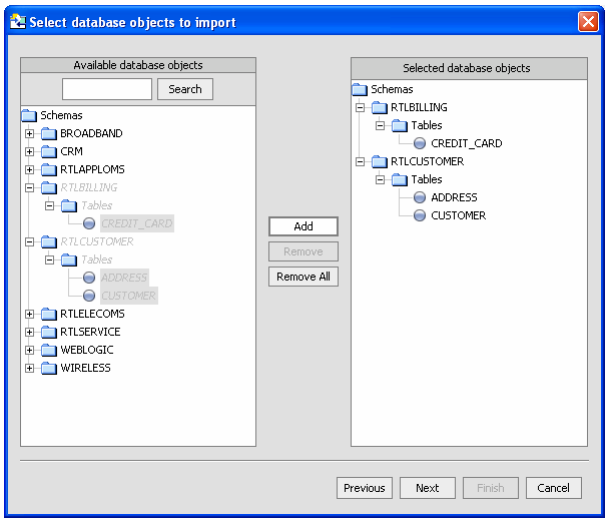


Figure 2-7 Selected Database Objects to Import

7. Click Next. A Summary dialog box opens, displaying the following information:

    XML type, for database objects whose source metadata will be imported.

Data Service Name, for each data service that will be generated from the source metadata. (Any name conflicts appear in red; you can modify any data service name.)

Target Namespace, for the data service being generated. This is optional.

Location, where the generated data services will reside.

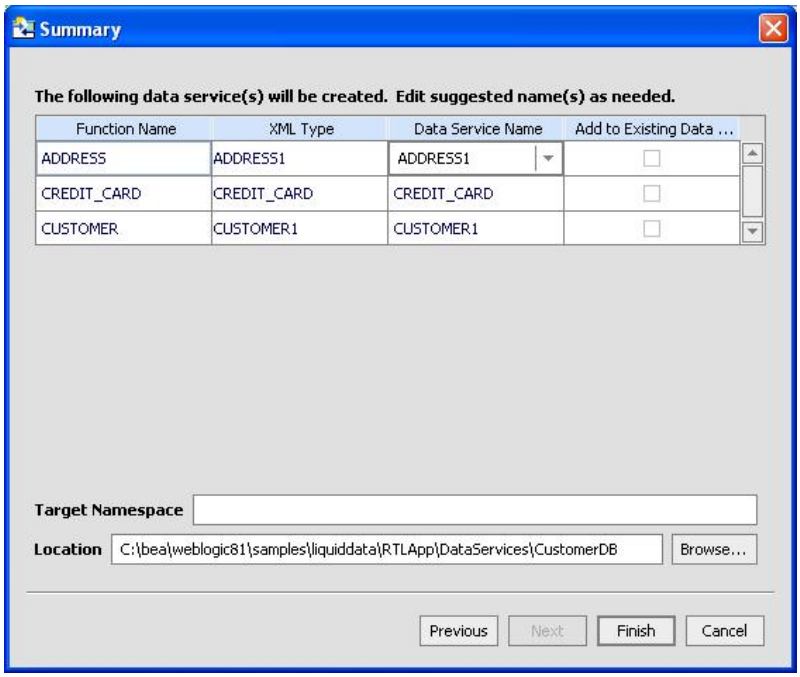


Figure 2-8 Summary

8. Click Finish.
9. Repeat steps 1 through 8 to import source metadata into the ApparelDB, ElectronicsDB, and ServiceDB folders, substituting the following information for steps 1 and 5:

Database Objects (Step 1)	Data Source (Step 5)
ApparelDB	RTLAPPLOMS
ElectronicsDB	RTLELECOMS
ServiceDB	RTLSERVICE

The Application pane should appear similar to Figure 2-9. If you expand a data service's schema folder, you will see XSD files for each data service generated from the underlying data source.

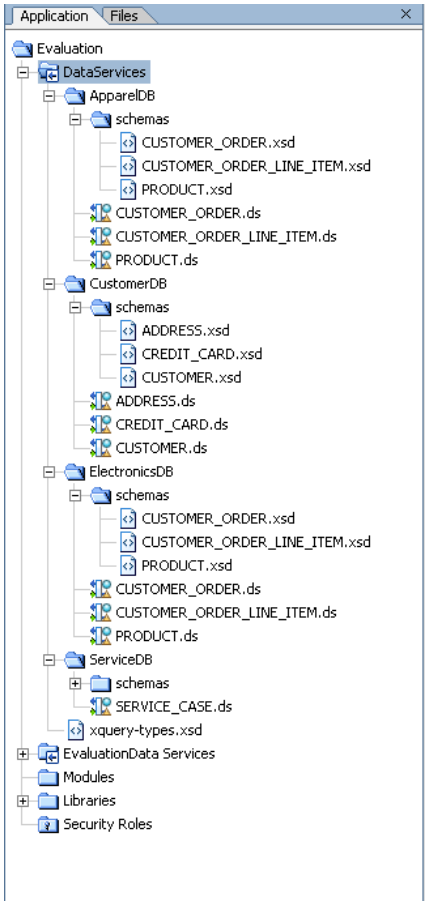


Figure 2-9 New Data Services

Lab 2.5 Building a Project

Building a project simply means that the project's source code is compiled into machine-readable instructions. Each project produces a particular type of file when the project is built. For example, a Java project produces a JAR file.

Objectives

In this lab, you will:

Build the DataServices project.

Review the results in the Build window.

Instructions

1. Right-click the DataServices project folder.
2. Choose Build DataServices. It may take a few moments for the project to be built. When complete, you will see a message in the Build window, similar to that displayed in Figure 2-10. (If the Build window is not open, choose View → Windows → Build or press Alt+5.)

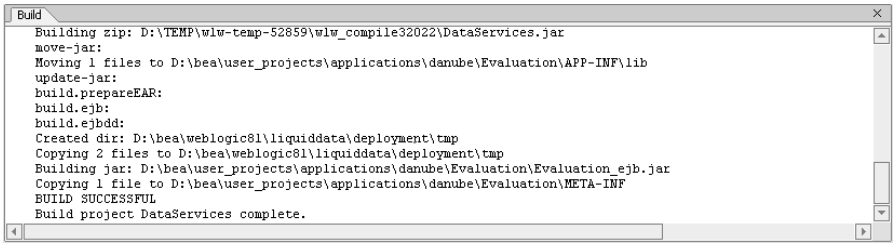


Figure 2-10 Build Project Information

3. Scroll through the Build window. As part of the Build process, DSP generates a number of files, including the following:

   Data service (`.ds`) files for each table within the underlying data source.

   Miscellaneous JAR and EJB files.

   Figure 2-11 displays the complete Build information for the DataServices project.

Figure 2-11 Complete Build Information for the DataServices Project

4. (*Optional*) Expand the Libraries folder. You should see the `DataServices.jar` file.

Lab 2.6 Viewing Physical Data Service Information

A physical data service is automatically generated when you import source metadata and build the associated project. Each generated physical data service represents a single data source that can be integrated with other physical or logical data services.

When DSP generates a physical data service, it also generates XML data types, an XML Schema Definition (`.xsd` file), default query and navigation functions, and pragma information.

Objectives

In this lab, you will:

View XML type, native data types, XML schema definition, generated functions, and metadata.

Use Design View and Source View to obtain information about a data service.

Viewing XML type

An *XML type*, which derives from the data service's XML Schema Definition (XSD), is a structured XML document that classifies each element within the data service as a particular form of information, according to its allowable contents and units of data. For example, the XML type for the CUSTOMER data service is CUSTOMER, whose elements include:

CUSTOMER_ID, whose xs:string classification indicates the element's return data will be formatted as a sequence of alphabetic, numeric, and/or special characters.

CUSTOMER_SINCE, whose xs:date classification indicates the element's return data will be formatted as numeric characters presented in a *YYYY-MM-DD* format.

Multiple data services can use a single XML type. DSP uses the XML type as the default superset of data elements that will be returned by a set of queries. This superset XML type, known as the *Return type*, models and normalizes data retrieved from the underlying data source, thereby transforming disparate data into a unified view.

Instructions

1. In the Application pane, expand the CustomerDB folder.
2. Double-click the `CUSTOMER.ds` file. The data service opens in Design View.

   Note: The data service automatically opens in the View workspace last used; if Design View is not currently open, click the Design View tab.
3. In the middle of the data service representation you should see the CUSTOMER XML (also known as schemas) type for the data service, plus the XML classification for each element in the data service. Items marked with a question mark (?) are optional elements, which indicates: 1) if there is no data in the underlying data source, that element will not display in the data set returned by the data service and 2) a query function can succeed without providing any value for that particular element.

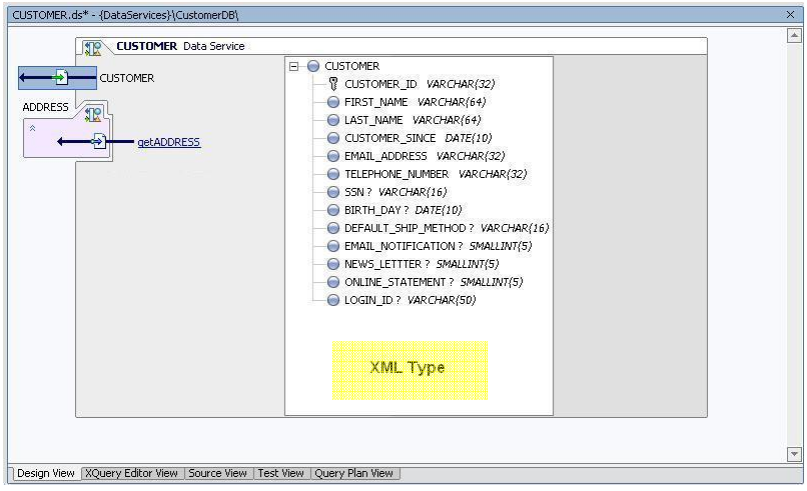


Figure 2-12 Design View of XML Type

Viewing Native Data Type

A *Native Data Type* classifies each data element according to the definitions specified in the underlying data source. For relational data sources, DSP generates Native Data Type definitions based on the underlying database's table structure and column data definitions.

Instructions

1. Right-click the CUSTOMER Data Service header on the Design View tab. (You can also right-click any empty space within the data service diagram.)
2. Select Display Native Type. This will display the original data type for each element in the underlying data source.
3. In the middle of the data service representation, you should see Native Types for each data element in the data service.

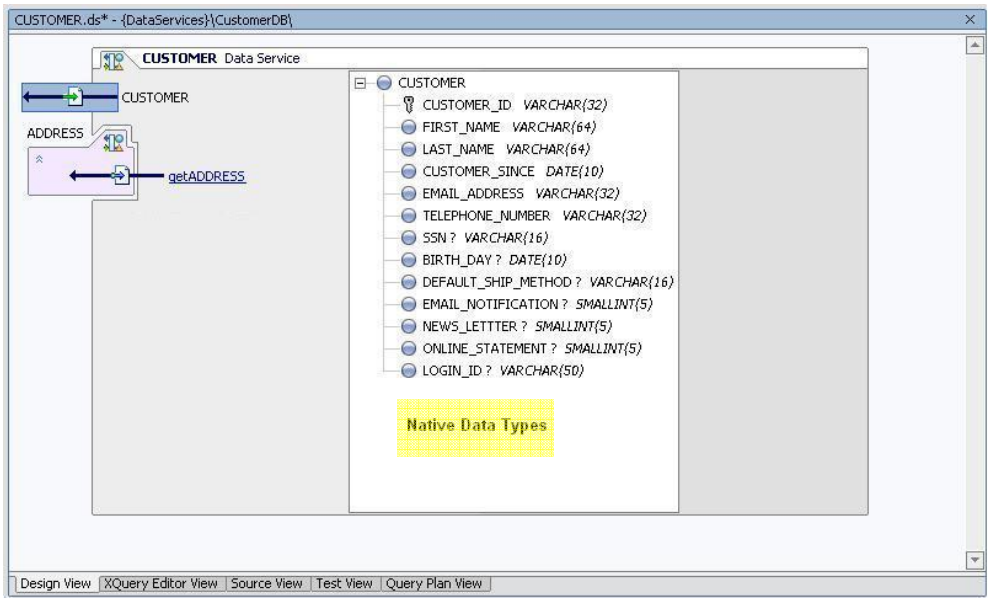


Figure 2-13 Design View of Native Type

Viewing XML Schema Definition

An *XML Schema Definition file* (`.xsd`) corresponds exactly to the XML type of a data service. It defines the structure and content of an XML document, such as the XML type document. In other words, it defines the vocabulary, rules, and conventions for representing information in a system.

A `.xsd` file is organized as a flat catalog of complex elements, any attributes, and any child elements. For physical data services, DSP automatically generates a `.xsd` file from underlying data when the underlying data source's metadata is imported. Generated `.xsd` files are placed in the appropriate data service's schema directory.

Note: For logical data services, you must create a schema. You can use XQuery Editor View, discussed in Lesson 3, to create such schemas (XSD files).

Instructions

1. Right-click the CUSTOMER element, located in the XML type pane. A pop-up menu opens.
2. Choose Go to Source to view the underlying schema information.

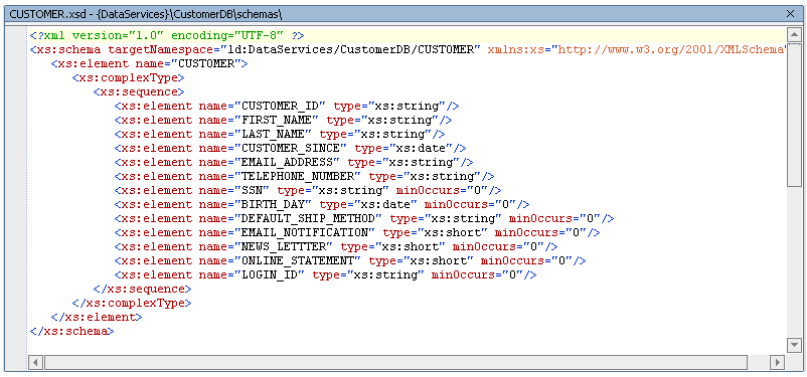


Figure 2-14 XML Schema Definition

3. After reviewing the XSD, click the Close box (X) in the upper-right corner of the source pane to return to Design View of your data service.

   Note: Clicking the large red X will close WebLogic Workshop.

Viewing Generated Functions

The data service interface consists of public functions of the data service, which can be of several types:

One or more read functions, which typically return data in the form of the data service XML type.

One or more navigation functions, which return data from related data services. The navigation functions are based on any relationships defined within the underlying data source. Relationships enhance the flexibility of data services by enabling the return of data in the shape of another data service.

One submit() function, which allows users to persist changes to the original data source. The submit() function does not appear in Design View.

In addition to public functions, a data service can include private functions and side effect functions. Private functions are only used within the data service. They generally contain common processing logic that can be used by more than one data service function. Side effect functions can be invoked from the client side. For example, a side effect function can contain code to update a non-rdbms data source, such as xml, flat files, and Web services, and clients can invoke this function to perform updates. (For more information, see the *Data Service Developer's Guide*.)

Instructions

1. In Design View, notice the public functions displayed in the left pane of the diagram. These functions, which were generated for the data service, include the following:

   CUSTOMER(), a read function that retrieves data from the underlying RTLCUSTOMER database.

   getADDRESS(), a navigate function that retrieves data from the ADDRESS data service. This function is based on a relationship between the CUSTOMER and ADDRESS tables, which are defined in the RTLCUSTOMER database.

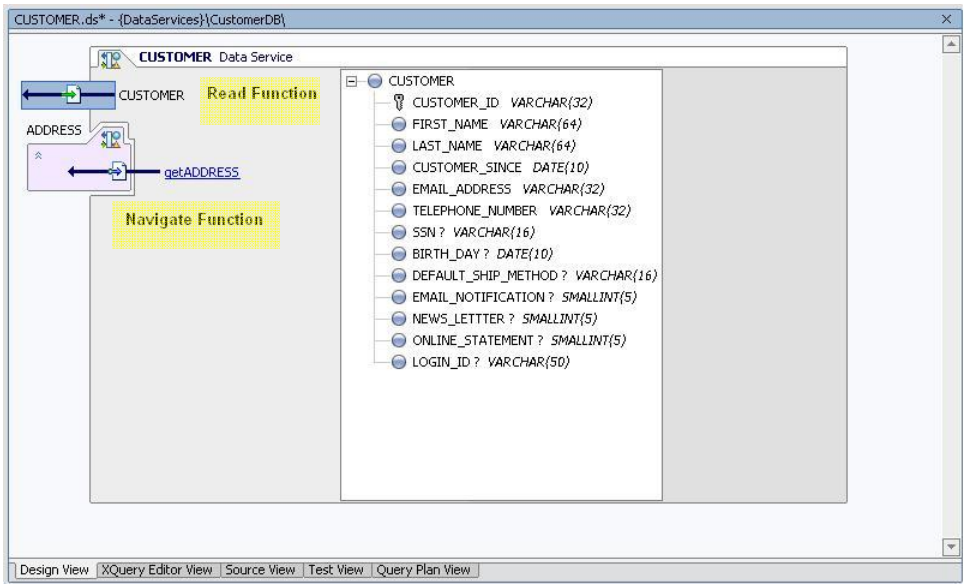


Figure 2-15 Design View: Generated Functions

2. (Optional) Right-click the CUSTOMER Data Service header and choose Display XML type from the pop-up menu. (You can also right-click any empty space within the data service diagram.)

Viewing Data Service Metadata

Metadata is simply information about the structure of data; it provides facts about the data service's data, format, meaning, and lineage. For example, a list of tables and columns within a database is metadata. DSP uses metadata to describe a data service: what information is provided by the data service and the information's lineage (that is, the source for the information.)

In addition to documenting data services for potential consumers, metadata helps you determine what data services are affected when inevitable changes occur in the underlying data source layer. Of course in the case of physical data services, the metadata primarily describes metadata extracted from the physical data source.

Metadata information is contained in the data service's META-INF folder. Normally you should not need to refer to the contents of this folder.

Instructions

1. Select the Source View tab. The metadata information used by the Customer data service appears. (Also available in Source View are data service namespace, schema namespace, and XQuery functions; these items are not displayed in Figure 2-16.)
2. Click the + icon to display all metadata information.
3. Notice the following:

   The date the data service was created.

   The data source from which the metadata was imported.

   The XML type, XPath, Native Data Type, and native XPath for each element within the data service.

   The relationship target, role name, role number, XDS, and relationship parameters for each data service associated with the active data service.

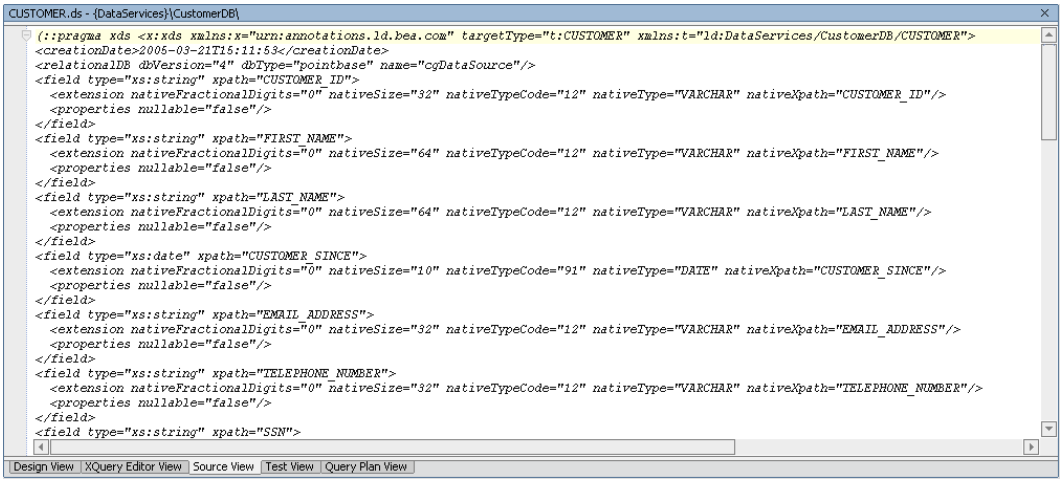


Figure 2-16 Source View of Metadata

Note: Before you test any function or data service, you should ideally clean and redeploy the application, so that the data is updated on the WebLogic server also.

4. To clean the application, right-click Evaluation and select Clean Application.
5. To redeploy the application, right-click Evaluation and select Deployment→Redeploy.

Lab 2.7 Testing Physical Data Service Functions

Testing a data service's functionality within Test View lets you determine whether the data service is able to return the expected data results.

Objectives

In this lab, you will:

Test the CUSTOMER() function.

Review the results in Test View.

Review the results in the Output window to confirm that the data is pulled from the correct data source.

Instructions

1. Select the Test View tab.
2. Select CUSTOMER() from the function drop-down list.
3. Click Execute. You should see data returned from the RTLCUSTOMER database, formatted according to the CUSTOMER data service's Return type, which is defined by each element's XML type.

Note: At times the WebLogic server may not get updated automatically. In that case, you may get some validation errors when you execute the function. To fix this, try cleaning and redeploying the application.

4. Expand the nodes and notice the following:

Each element defined by the XML type returns specific data retrieved from the RTLCUSTOMER database. For example, the <FIRST_NAME> element returns “Jack” as an xs:string, while the <CUSTOMER_SINCE> element returns "2001-10-01" as an xs:date.

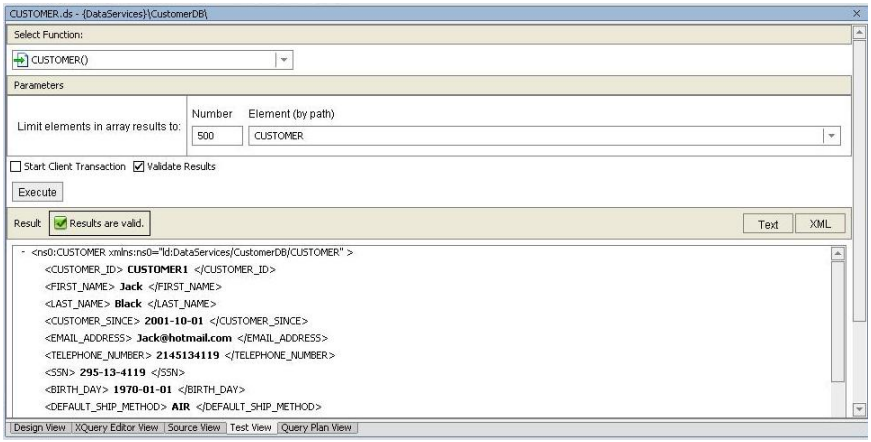


Figure 2-17 Physical Data Service Test Results

5. To view the results in the Output window, you need to enable auditing in the ALDSP console. To enable auditing:

   a. Open the ALDSP console, typically located at http://localhost:7001/ldconsole.

   b. Log on using the following credentials:

      User = weblogic

      Password = weblogic

   c. Expand ldplatform in the left-hand menu and click Evaluation.

   d. Click the Audit tab.

   e. Select all the options in the Global Settings section as shown in Figure 1-1.

   f. Select the At Default Level option from the Configure all Properties list in Audit Properties.

   g. Click Apply.

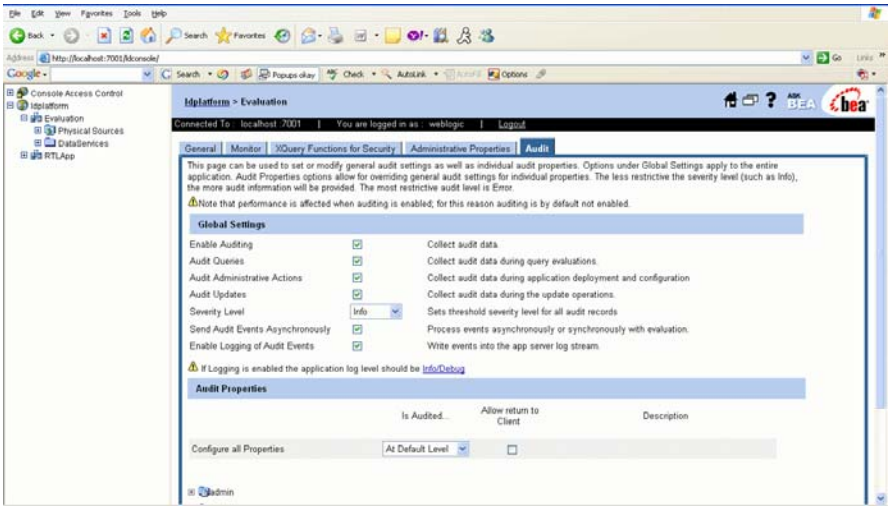


Figure 2-18 Audit Tab in the ALDSP Console

h. In the left-hand menu, expand Evaluation, DataServices, and then CustomerDB as shown in Figure 2-19.

i. Click Customer and select the Admin tab.

j. Click the Audit tab.

k. Select the check box in the Enable Audit column for the CUSTOMER function.

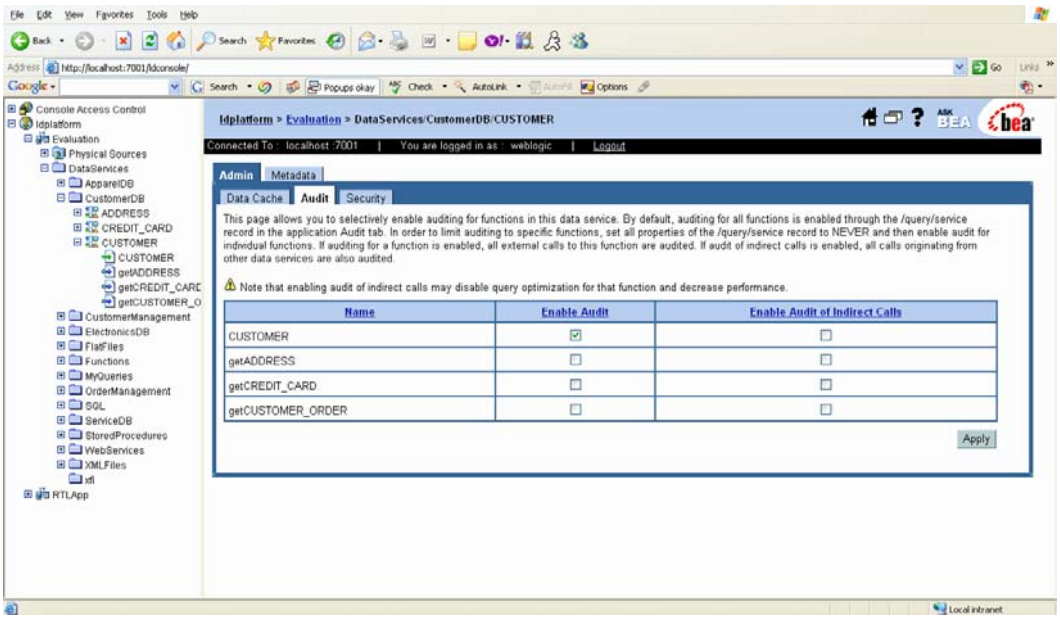


Figure 2-19 Enabling Function-Level Auditing

l. Click Apply. This enables auditing for the CUSTOMER () function.

Note:

To enable auditing for any other function in this tutorial, repeat the steps h to l.

Ensure that you keep auditing enabled in the ALDSP console throughout this tutorial. For details about auditing, refer to http://edocs.bea.com/aldsp/docs21/admin/monitor.html.

6. In WebLogic Workshop→Test View, click Execute again.
7. Open the Output window (View → Windows → Output).
8. Confirm that the output is similar to that displayed in Figure 2-20

Note: You can use the Output window to verify that each element in the data service is pulling data from the correct data source. In this example, the return results are pulled from the RTLCUSTOMER database, CUSTOMER table 1, and a specific column (c1, c2, c3, and so on) for each element.

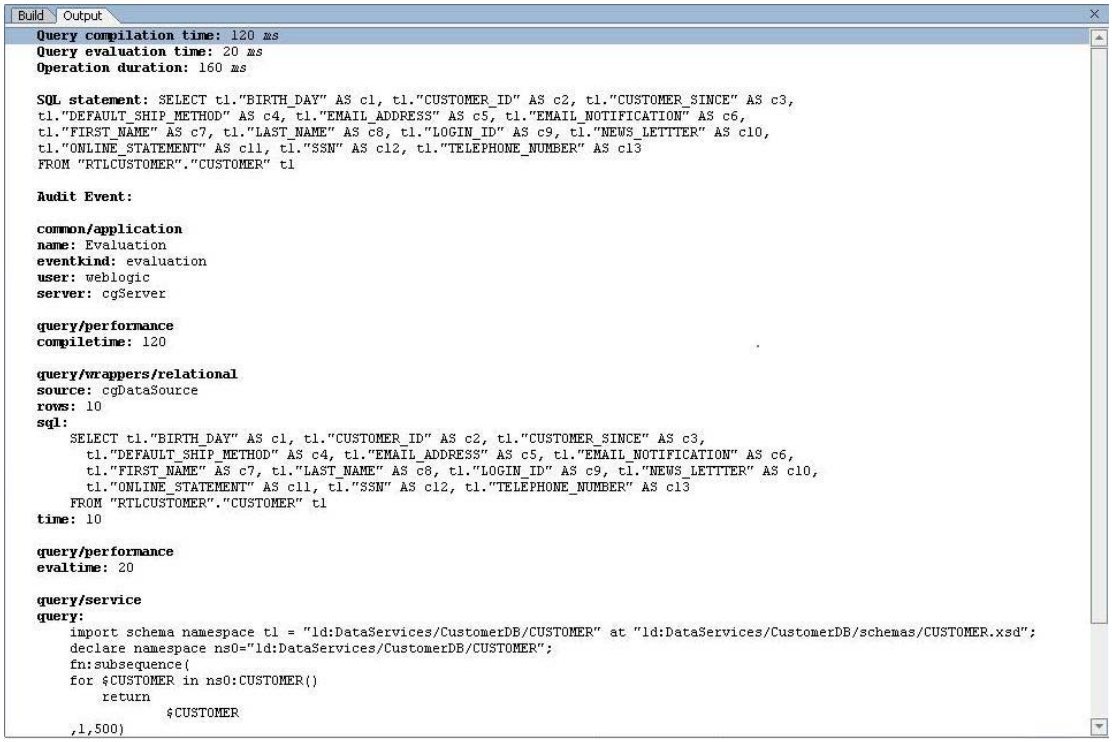


Figure 2-20 Test Results Output

Lesson Summary

In this lesson, you learned how to:

Create a DSP application and project.

Create project sub-folders to group data services.

Import relational tables to create a simple physical data services.

Build a project and review the build information.

Examine a physical data service's shape/schema definition, data types, functions, and source code.

Test a data service function.

Lesson 3 Creating a Logical Data Service

As noted in Lesson 2, there are two types of data services: *physical* and *logical*. Physical data services model a *single* physical data source residing in a relational database, Web service, flat file, XML file, or Java function.

To enable the integration of data from multiple sources through Data Services Platform (DSP), you define a logical data service. In this lesson you will create a logical data service that integrates data from the CUSTOMER data service.

Objectives

After completing this lesson, you will be able to:

- Create a simple logical data service, define its shape, and specify its query conditions
- Test the logical data service's read, write, and limit functions

Overview

A logical data service integrates data from two or more physical or logical data services. Its *shape* is defined by an XML type schema that classifies a data element as a particular form of information, according to its allowable contents and units of data. For example, an xs:string type can be a sequence of alphabetic, numeric, and/or special characters, while an xs:date type can only be numeric characters presented in a YYYY-MM-DD format.

The data service interface consists of *public functions* that enable client-based consuming applications to retrieve data from the modeled data source. A data service's functions can be of several types:

- One or more read functions, which typically return data in the form of the XML type.
- One or more navigate functions, which return data from related data services. Within a logical data service, you must define relationships through modeling. Although similar to relationships in the RDBMS context, a logical data service lets you establish relationships between data from any source. This gives you the ability to, for example, relate an ADDRESS relational table with a -STATE look-up Web service.
- One submit() function, which allow users to persist changes to the back-end storage

In addition to public functions, a data service can include private functions and side effect functions. Private functions are only used within the data service. They generally contain common processing logic that can be used by more than one data service function. Side effect functions can be invoked from the client side. For example, a side effect function can contain code to update a non-rdbms data source, such as xml, flat files, and Web services, and clients can invoke this function to perform updates. (For more information, see the *Data Service Developer's Guide*.)

Every function within a logical data service also includes source-to-target mappings that define what results will be returned by that function. There are four types of mappings:

- A *simple mapping* means that you are mapping simple source node elements to simple elements in the Return type one at a time. You can create a simple mapping by dragging and dropping any element from the source node to its corresponding target element in the Return type. Optional Return type elements do not need to be mapped; otherwise elements in the Return type need to be mapped to run your query.

An *induced mapping* means that a complex element is mapped to a complex element in the Return type. In this gesture, the top level complex element in the Return type is ignored (source node name need not match). The editor then automatically maps any child elements (complex or simple) that are an exact match for source node elements.

An *overwrite mapping* replaces a Result type element and all its children (if any) with the source node elements. As an example of the general steps needed to create an overwrite mapping, you would press <Ctrl>, then drag and drop the source node's complex element onto the corresponding element in the Result type. The entire source node's complex element is brought to the Result type, where it completely replaces the target element with the source element.

An *append mapping* adds a simple or complex element (and any children or attributes) as a child of the specified element in the Return type. To create an append mapping, select the source element, then press <Ctrl>+<Shift> while dragging and dropping the source node's element onto the element in the Return type that you want to be the parent of the new element(s).

Alternatively, if you simply want to add a child element to a Return type, you can drag a source element to a complex element in your Return type. The element will be added as a child of the complex element and mapped accordingly.

In addition to the mappings, each function can also include parameters and variations on the basic XQuery FLWOR (for-let-where-order by-return) statements that further define the data retrieval results.

In Figure 3-1, what you see in Design View is a logical data service that:

Uses the getAllCustomers(), getCustomer(), getPaymentList(), and getLatePaymentList() functions to retrieve data.

Uses the `customer.xsd` schema definition to define its XML type, and thus its Return type.

Integrates data from the ApparelDB and CustomerDB physical data services, plus a CreditRating Web service.

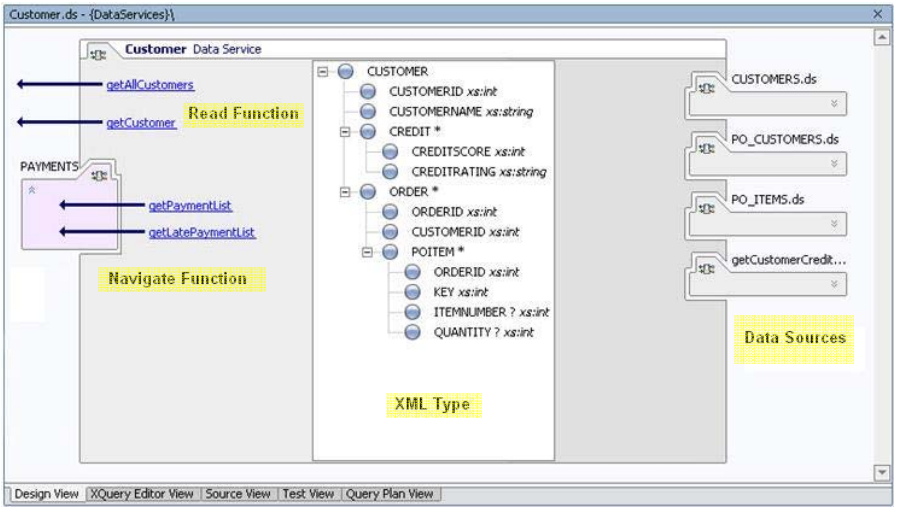


Figure 3-1 Design View of a Logical Data Service

If you open XQuery Editor View for a particular function, you would see the function's source-to-target mappings.

If you open Source View, you would see each function's parameters and FLWOR statements.

Lab 3.1 Creating a Simple Logical Data Service

A logical data service integrates and transforms data from multiple physical and logical data services.

Objectives

In this lab, you will:

Create a new folder for the logical data service.

Create an empty data service that can be built into a logical data service.

Import a pre-defined XML schema definition that you will associate as the logical data service's XML type.

Define functions and their mappings, parameters, and FLWOR statements.

Instructions

1. Create a new folder within the DataServices project and name it CustomerManagement.
2. Create a new data service within the CustomerManagement folder by completing the following steps:
   a. Right-click the CustomerManagement folder.
   b. Choose New → Data Service. The New File dialog box opens.
   c. Confirm that Data Service → Data Service are selected.
   d. Enter CustomerProfile in the Name field.
   e. Click Create.

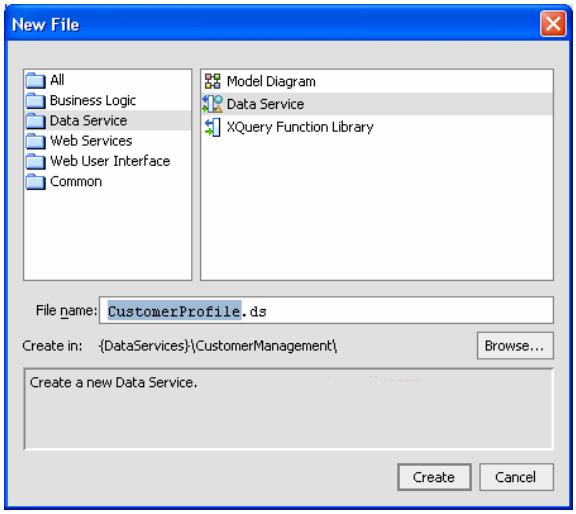


Figure 3-2 New Data Service

A new data service is generated, but without any associated data services or XML type.

Lab 3.2 Defining the Logical Data Service Shape

A data service transforms received data into the shape defined by its *Return* type. Pragmatically, the Return type is the "R" in a FLWOR (for-let-where-order by-return) query. A Return type, which describes the structure or shape of data returned by the data service's queries, serves two main purposes:

Provides a superset of data elements that can be returned by an XQuery.

Defines the unified structure, and order of the data returned by an XQuery.

The Return type is generated from the data service's XML type. An *XML type* classifies a data element as a particular form of information, according to its allowable contents and units of data. For example, an xs:string type can be a sequence of alphabetic, numeric, and/or special characters, while an xs:date type can only be numeric characters presented in a *YYYY-MM-DD* format.

Objectives

In this lab, you will:

Import a schema file, which you will associate with the data service's XML type.

Review the results.

Instructions

Note: Although you can use DSP to graphically build a schema file, in this lab you will import a pre-defined schema file to save time. For more information on using WebLogic Workshop to create the XML types, see the Data Services Platform *Data Services Developer's Guide*.

1. Create a new folder in the CustomerManagement folder and name it `schemas`.
2. Import a schema file into the schema folder by completing the following steps:
   a. Right-click the schema folder, located in the CustomerManagement folder.
   b. Choose Import.
   c. Navigate to `<beahome>\weblogic81\samples\LiquidData\EvalGuide`.
   d. Select the CustomerProfile.xsd file.
   e. Click Import.

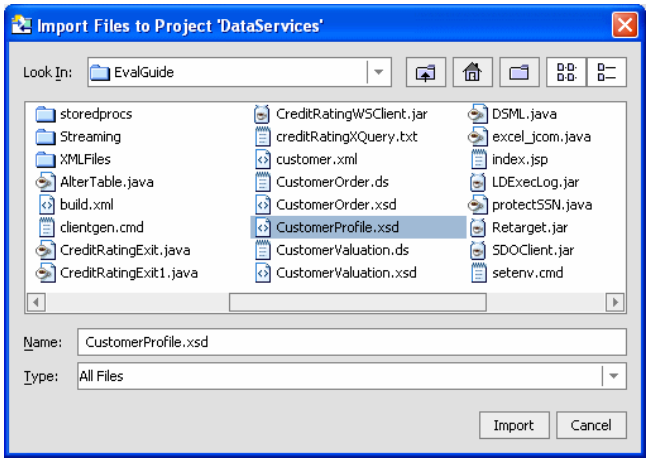


Figure 3-3 Import XML Schema Definition File

3. Right-click the CustomerProfile Data Service header on the Design View tab.
4. Choose Associate XML Type.
5. Select the `CustomerProfile.xsd` file, located in `CustomerManagement\schemas`.
6. Click Select.

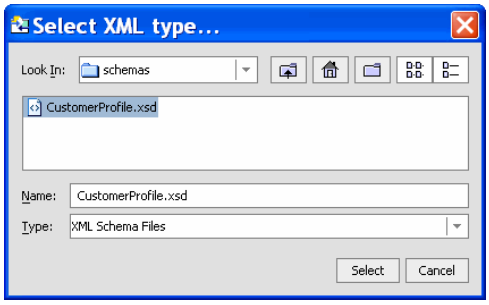


Figure 3-4 Associating XML type with XSD

You should see that the CustomerProfile data service is now shaped by the `CustomerProfile.xsd` file.

You should also see that several of the elements are identified with a question (?) mark. This indicates that these elements are optional. Because the schema file identifies these elements as optional, DSP will not require the mapping of these elements to the Return type; however, if mapped to the Return type *and* there is no corresponding data in the underlying data source, then the result set will not include the empty elements.

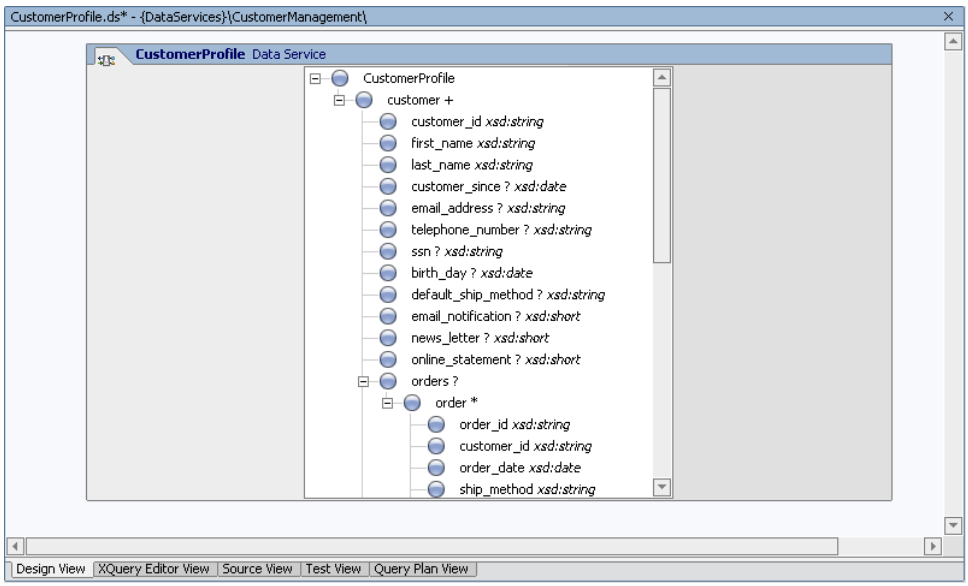


Figure 3-5 Logical Data Service XML type

Lab 3.3 Adding a Function to a Logical Data Service

A data service consumer—a client application or another data service—uses the data service's function calls to retrieve information. A logical data service includes the same types of functions that are found in a physical data service:

One or more read functions that form the data service's external interface, which is exposed to consuming applications requesting data. These read functions typically return data in the form of the data service's XML type.

One or more navigate functions that return data from other data services. Within a logical data service, you must define relationships through modeling. Although similar to relationships in the RDBMS context, a logical data service lets you establish relationships between data from any source. This gives you the ability, for example, to relate an ADDRESS relational table with a STATE lookup Web service.

One submit() function, which allows users to persist changes to the back-end storage.

Objectives

In this lab, you will:

Add a new read function, getAllCustomers(), to the logical data service.

View the results in XQuery Editor View.

Instructions

1. Right-click the CustomerProfile Data Service header.
2. Choose Add Function. A new function displays in the left pane of the data service model.
3. Enter getAllCustomers() as the function name.

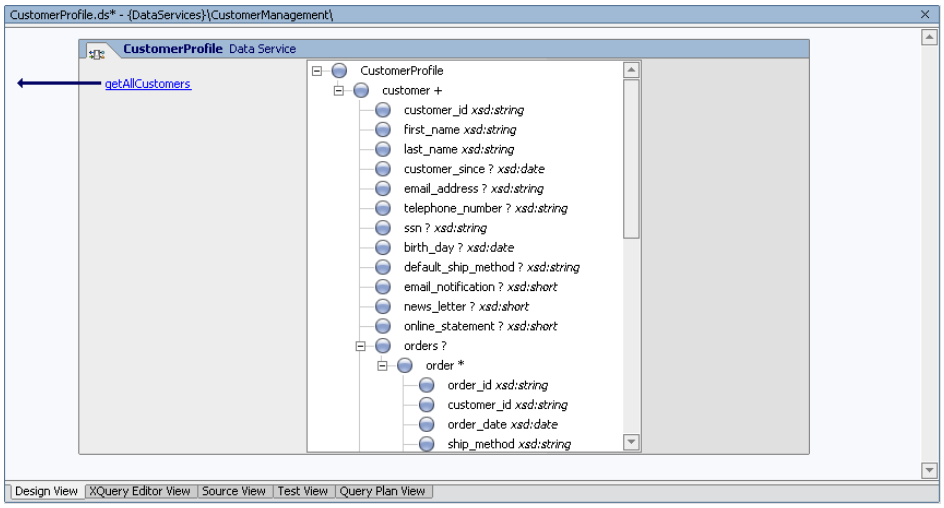


Figure 3-6 Design View of New Function

Lab 3.4 Mapping Source and Target Elements

In the previous lab, you associated a logical data service with an XML Schema Definition (`.xsd` file), which generated a Return type that includes all data elements defined within the schema. However, there are no conditions associated with the Return type; *conditions* specify which source data will be returned.

You can define conditions by mapping source and target (Return) elements.

Objectives

Add a physical data service function as a data source for the logical data service.

Create a simple map between the source node and the Result type.

Instructions

1. Click the getAllCustomers() function to open XQuery Editor View. You should see a *Return* type populated with the CustomerProfile schema definition. The Return type determines what data can be made available to consuming applications, as well as the shape (string, data, integer, and so on) that the data will take. The Return type was automatically populated when you associated the logical data service with the `CustomerProfile.xsd`.

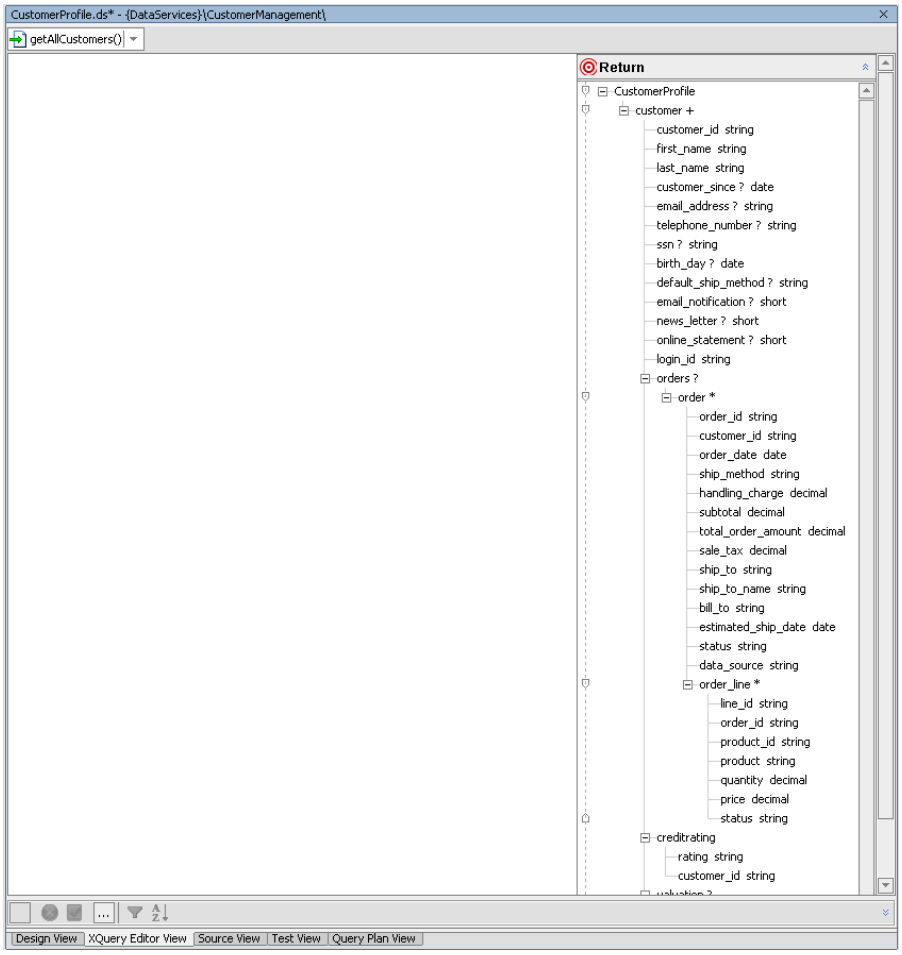


Figure 3-7 XQuery Editor View of Function Return Type

2. In the Data Services Palette, expand `CustomerDB\CUSTOMER.ds`. If the Data Services Palette is not open, choose View → Windows → Data Services Palette.

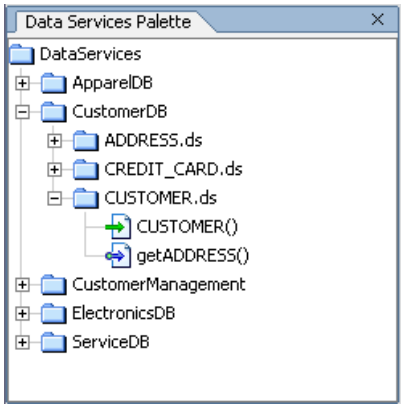


Figure 3-8 Data Services Palette

3. Drag and drop CUSTOMER() into XQuery Editor View. This method call represents a root or global element within the CUSTOMER physical data service (see Lesson 2). A for node for that element is automatically generated and assigned a variable, such as For: $CUSTOMER. Within the XQuery Editor View, this for node is a graphical representation of a for clause, which is an integral part of an XQuery FLWOR expression (for-let-where-order by-return).

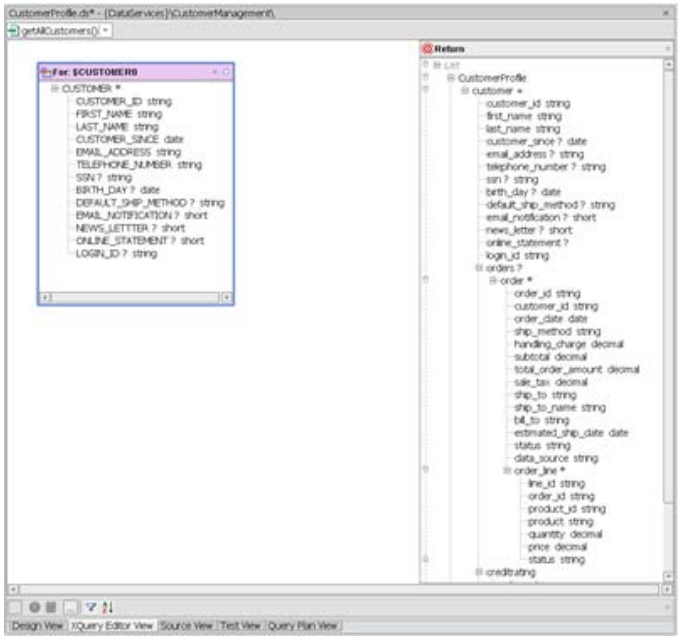


Figure 3-9 Source Node and Return Type

4. Create a *simple* map by dragging and dropping individual elements from the $CUSTOMER source node onto the corresponding elements in the Return type. The logical data service CustomerProfile should now be similar to what is shown in Figure 3-10.

Note: There are alternatives to mapping elements instead of using the slow simple mapping technique. Faster mapping techniques are described in labs that follow.

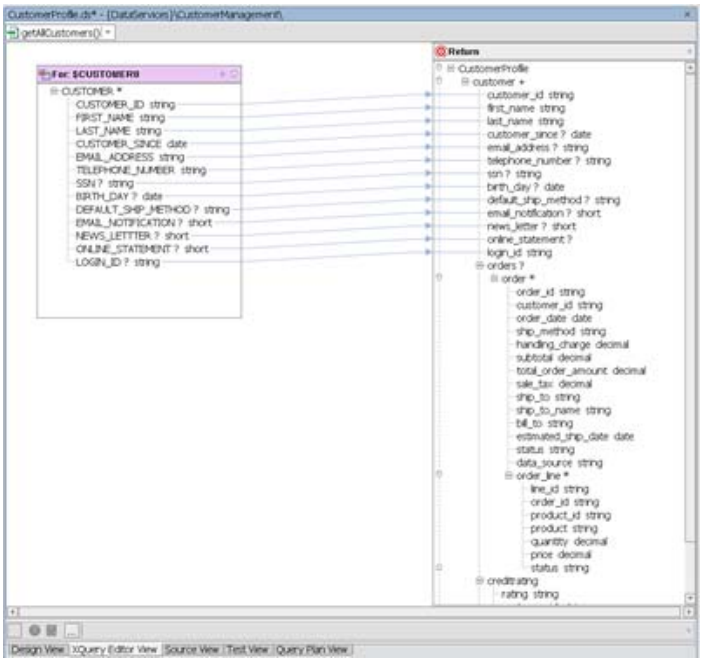


Figure 3-10 Simple Mapping Between Source Node and Return Type

Lab 3.5 Viewing XQuery Source Code

When you use XQuery Editor View to construct an XQuery, source code in XQuery syntax is automatically generated. You can view this generated source code in Source View and, if needed, modify the code. Any changes made in Source View will be reflected in XQuery Editor View.

Objectives

In this lab, you will:

View generated XQuery source code in Source View.

Review the for and return clauses of the getAllCustomers() query function.

Instructions

1. Select the Source View tab. A portion of the generated XQuery source code is displayed in Figure 3-11.
2. Notice the for clause, which references the CUSTOMER() function.
3. Notice the return clause, which reflects the simple mapping between the $CUSTOMER source node and the Return type. All optional elements are identified with a question mark in the field description, as shown (emphasis added):

   ```
   <TelephoneNumber?> {fn:data($x0/TELEPHONE_NUMBER)}</Telephone number
   ```

4. Also, notice that the <orders> elements are empty because order information has not yet been mapped to the Return type. This means that a consuming application, using this query, will only see customer information, not order information.

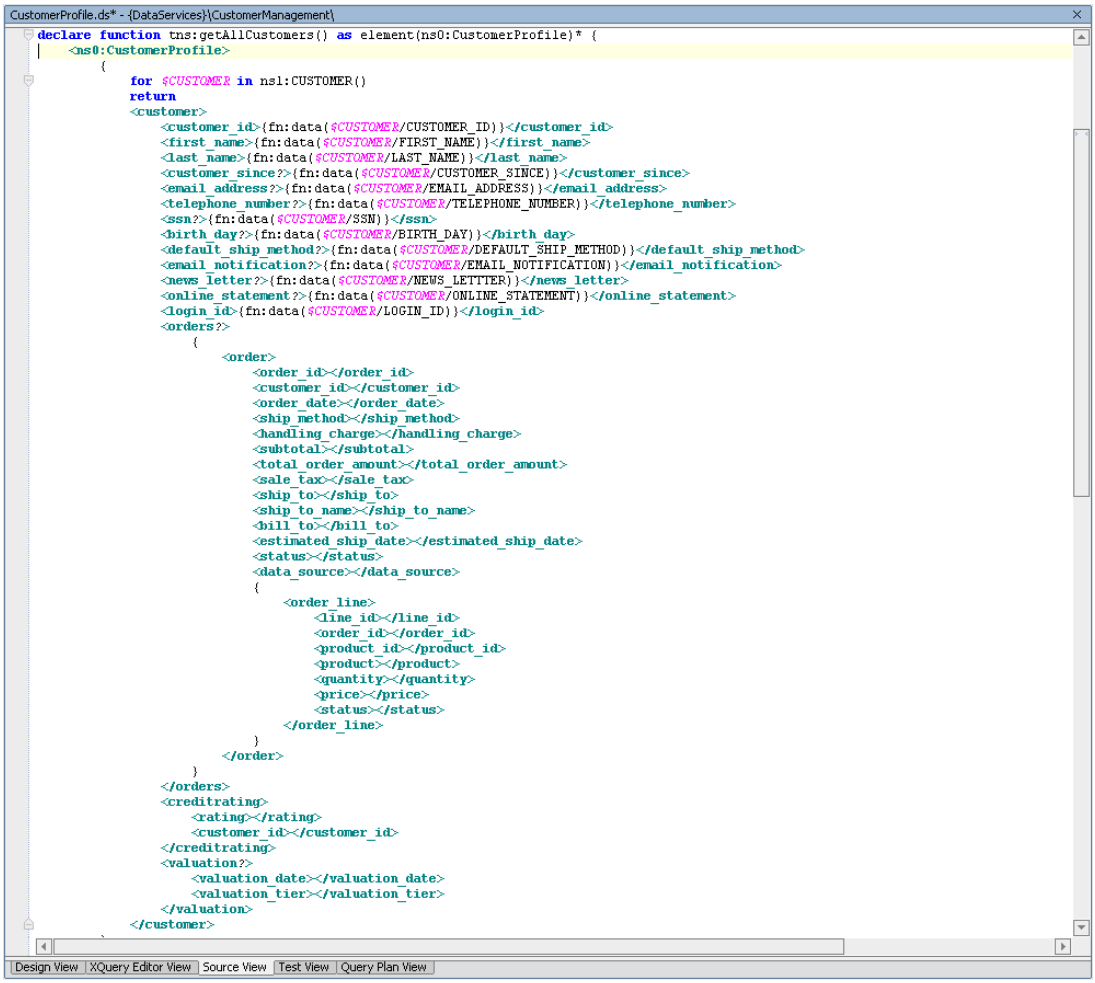


Figure 3-11 Source View of XQuery Code for CUSTOMER() Node

Lab 3.6 Testing a Logical Data Service Function

You can use Test View to validate the functionality of a logical data service.

Objectives

In this lab, you will:

Build the DataServices project.

Test the function's retrieve and limit result capabilities.

Instructions

1. Build the DataServices project by right-clicking the DataServices folder and choosing Build DataServices from the pop-up menu.
2. After the build completes successfully, select the Test View tab.
3. Select getAllCustomers() from the function drop-down list.

Test the ability to specify the number of tuples returned by completing the following steps:

a. Clear the Validate Result option. This feature is not mandatory to complete this lab.

b. Enter CustomerProfile/customer in the Parameter field. This specifies the XPath expression for the element whose return results you want to limit to a set number of occurrences such as the order_line_items.

c. Enter 5 in the Number field. This will limit the results to the first five customers retrieved.

d. Click Execute.

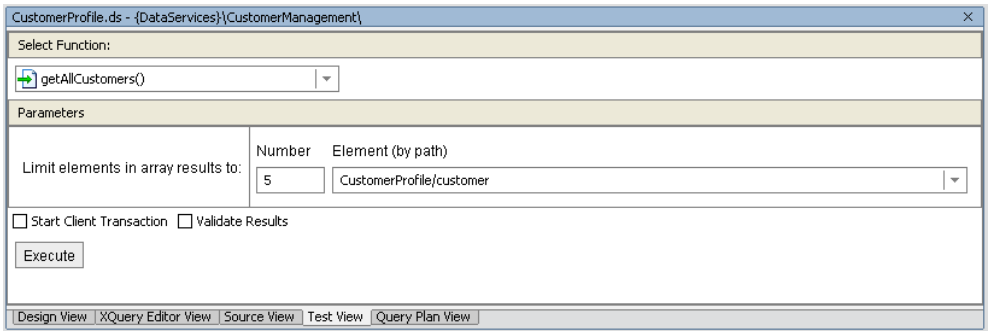


Figure 3-12 Test Truncate Capabilities

4. View the results, which appear in the Result pane.

5. Expand the top-level node. There should be only five Customer Profiles listed.

6. Expand the first <customer> node. You should see a Customer Profile for Jack Black, as displayed in Figure 3-13.

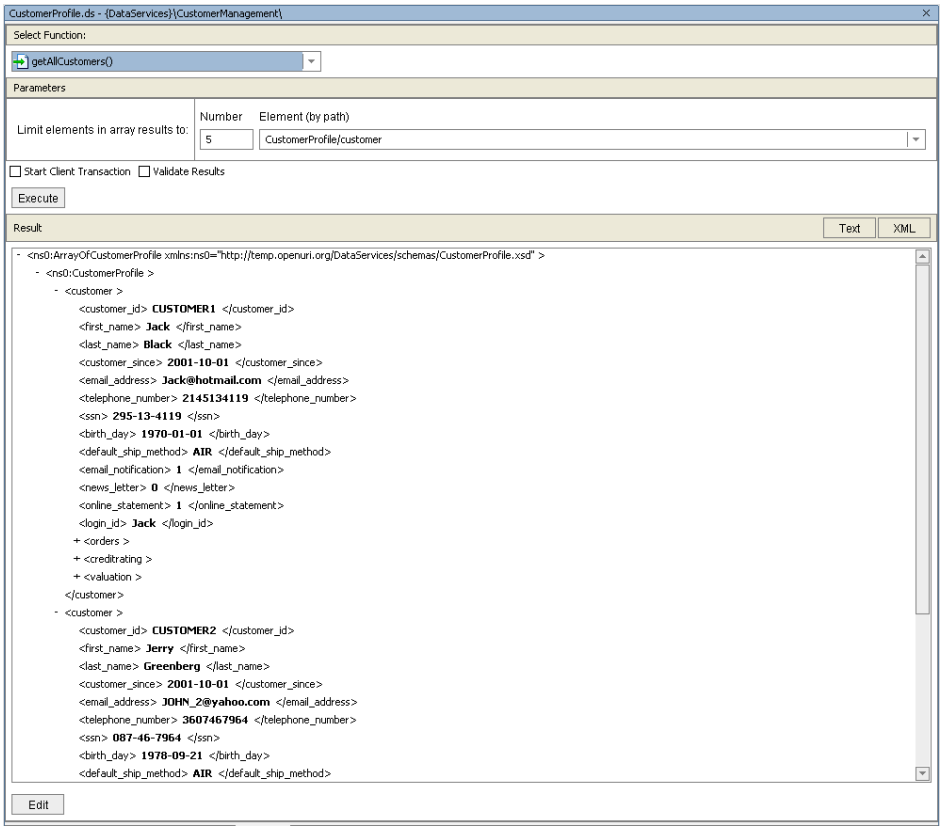


Figure 3-13 Customer Profile Test Results

Lesson Summary

In this lesson, you learned how to:

Create a simple logical data service.

Associate an XML schema definition with the data service.

Create a simple function.

Use XQuery editor view to map elements from the source node to the return type.

Use Source View to examine an XQuery function's source code.

Use Test View to test a logical data service query capabilities, limit the number of data set results returned as part of the query, and test data service editing capabilities.

Lesson 4 Integrating Data from Multiple Data Services

The power of logical data services in Data Services Platform (DSP) is the ability to integrate and transform data from multiple physical and logical data services.

In the previous lesson, you created a simple logical data service that mapped to a single physical data service. In this lesson, you will further develop the logical data service to enable data retrieval from multiple data services.

Objectives

After completing this lesson, you will be able to:

Use the Data Services Palette to add physical and logical data service functions to a logical data service, thereby accessing data from multiple sources.

Join data services by connecting source elements, thereby integrating data from multiple sources.

Use the Expression Builder to define a parameterized where clause.

Set the context for nested elements in the source node.

Create a complex override mapping.

Test parameterized data services to verify the return of integrated data results.

Overview

How is data integration different from process integration? Most applications involve a combination of *informational interactions* and *transactional interactions*. Examples of informational interaction include: get customer info, review order status, get customer profile, and get customer's case history. Examples of transactional interactions include: place order, update customer address, and create customer.

Informational interactions involve efficiently aggregating discrete pieces of data that are potentially resident in multiple data sources, and potentially in multiple data formats. Developers can end up spending inordinate amounts of time writing custom code to handle the various interface protocols and data formats, and integrate disparate data into manageable, business-relevant information. DSP simplifies this activity by providing a simple, declarative approach to aggregating data from heterogeneous data sources.

Transactional interactions involve taking a piece of data (say a purchase order) and orchestrating its propagation to the various underlying applications. This involves coordinating a business process through a formal or informal workflow, managing long-running processes, managing human interactions (such as a supervisor approval to an order), handling applications that have indeterminate response times (such as batch systems), maintaining transactional integrity across applications, etc.

Both data integration and process integration are essential elements when building applications that handle information from across multiple data sources. For functions of interest across data services, you can use function libraries. A function library (.xfl file) contains operations that return simple types (not the XML data type of a standard data service) that can be called from various data services. Read functions on a data service can be defined to return information in various ways. For example, the data service may define read functions for getting all customers, customers by region, or customers with a minimum order amount.

Lab 4.1 Joining Multiple Physical Data Services within a Logical Data Service

In the previous lab, you mapped a single physical data service to the Return type. In this lab, you will enable data retrieval from both the CUSTOMER and CUSTOMER_ORDER physical data services.

Objectives

In this lab, you will:

Create a second for node, by adding the CUSTOMER_ORDER() function to the XQuery Editor View.

Create a simple map between the new for node and the Return type.

Create an automatically-generated where clause, by joining the two for nodes.

Review source code.

Test the results (read and write capability)

Instructions

1. Open `CustomerProfile.ds` in XQuery Editor View.
2. In the Data Services Palette, expand `ApparelDB\CUSTOMER_ORDER` data service.
3. Drag and drop CUSTOMER_ORDER() into XQuery Editor View to create a second for node, For:$CUSTOMER_ORDER.
4. Create a simple map: Drag and drop the individual elements from the $CUSTOMER_ORDER source node onto their corresponding elements in the Return type.

   Note: Do not map the TRACKING_NUMBER and DATE_INT elements.
5. Create a join: Drag and drop the CUSTOMER_ID element from the $CUSTOMER source node onto the C_ID element in the $CUSTOMER_ORDER source node. This action joins the two for nodes. By joining these two nodes, you automatically create a where clause within the FLWOR statement.

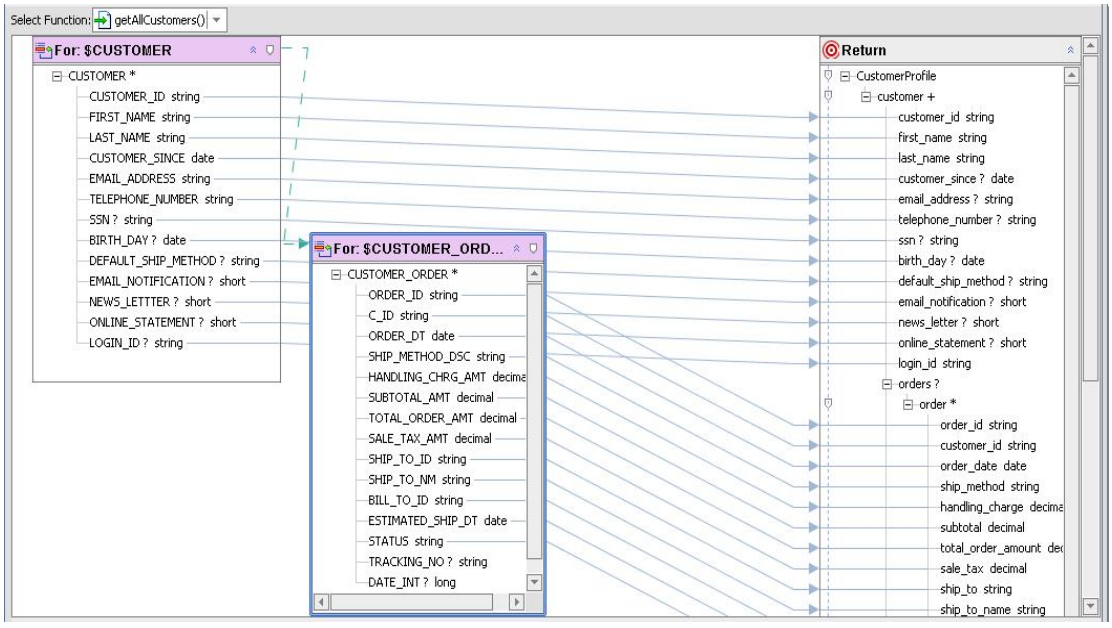


Figure 4-1 Joined Data Services

6. Select the Source View tab to view the XQuery code. You should see a where clause joining $CUSTOMER and $CUSTOMER_ORDER, using the CUSTOMER_ID element. In Figure 4-2, the where clause is:

```
where $CUSTOMER/CUSTOMER_ID eq $CUSTOMER_ORDER/C_ID
```

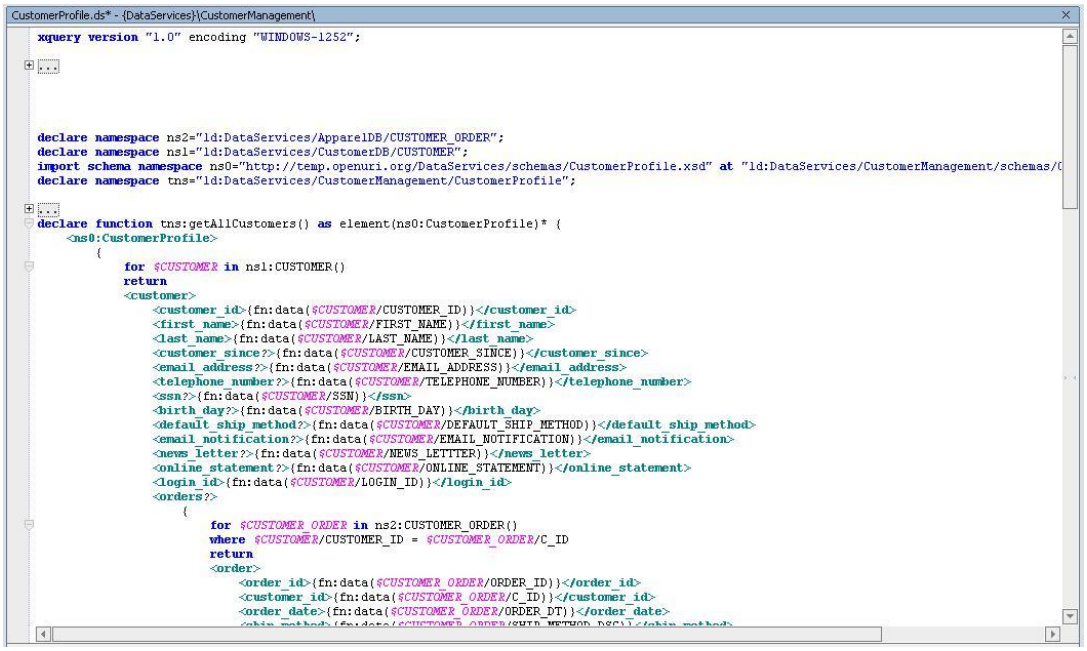


Figure 4-2 Source View of Joined Data Services

7. Build the DataServices project. Right-click the DataServices project folder and choose Build DataServices.

8. After the build is successful, select the Test View tab and determine whether you can retrieve order information integrated with the customer information, by completing the following steps:

a. Select getAllCustomers() from the function drop-down list.

b. Click Execute. (You don't need any parameters, because you are not testing the limit returned tuples feature.)

c. Expand the nodes. The results should include order information for each customer, as displayed in Figure 4-3.

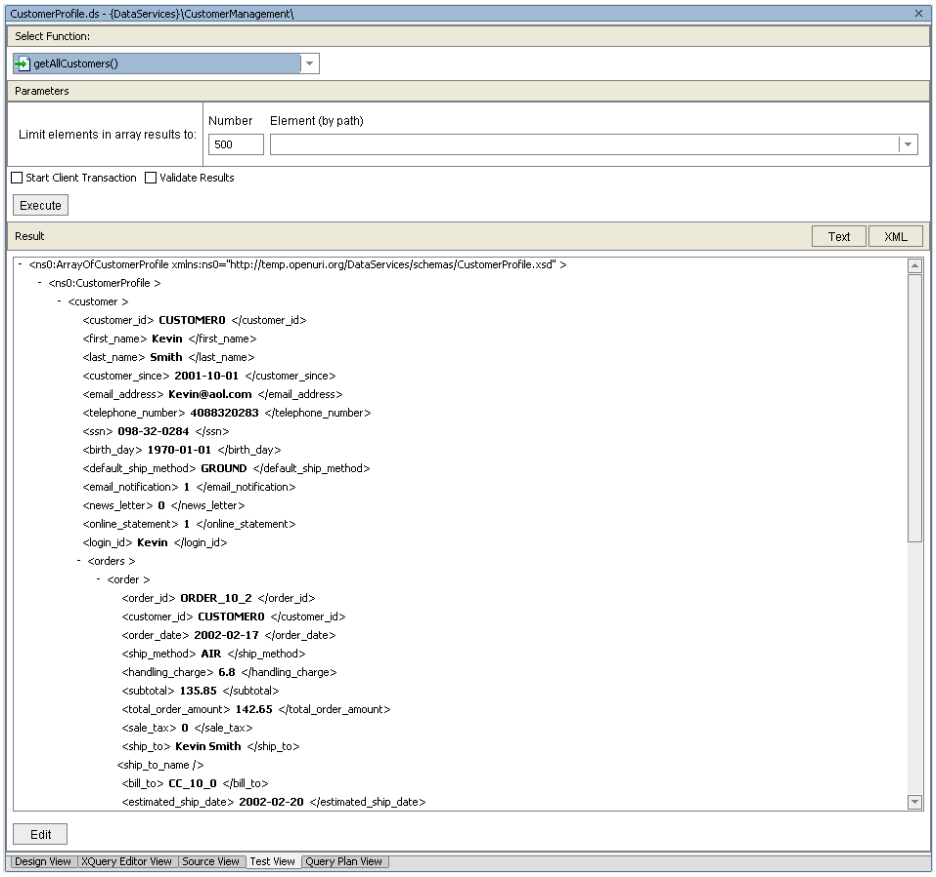


Figure 4-3 Integrated Customer and Order Data Results

Lab 4.2 Defining a Where Clause to Join Multiple Physical Data Services

In the previous lab, you joined the CUSTOMER and CUSTOMER_ORDER data services, thereby automatically generating a where clause. In this lab, you will manually define the where clause that joins multiple data services.

Objectives

In this lab, you will:

Add a third for node, by adding the CUSTOMER_ORDER_LINE_ITEM() function.

Define a where clause, using the Expression Editor.

View the results in Design View and Source View.

Test the results.

Instructions

1. Open XQuery Editor View for the getAllCustomers() function.
2. In the Data Services Palette, expand `ApparelDB\CUSTOMER_ORDER_LINE_ITEM` data services.
3. Drag and drop CUSTOMER_ORDER_LINE_ITEM() into XQuery Editor View. This creates a third for node: `For: $CUSTOMER_ORDER_LINE_ITEM`.

4. Create simple mappings by dragging and dropping the individual elements from the $CUSTOMER_ORDER_LINE_ITEM source node onto the corresponding elements in the Return type.

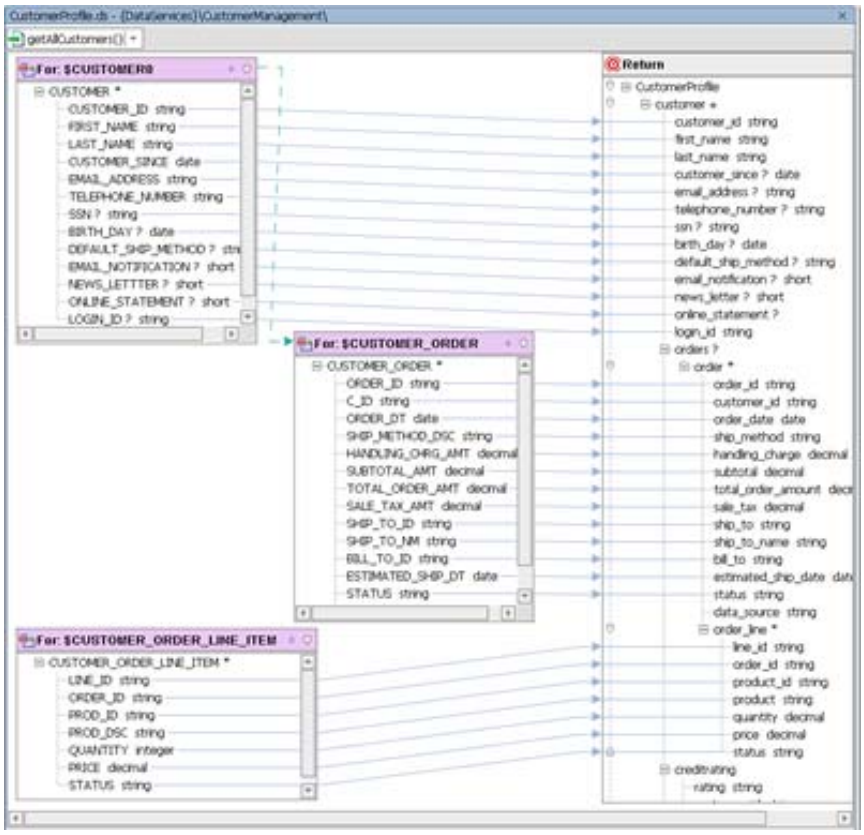


Figure 4-4 Three Data Service Functions Mapped to the Return Type

5. Define a where clause that joins two data services, by completing the following steps:

   a. Select the node header for $CUSTOMER_ORDER_LINE_ITEM to activate the expression editor for that node. (Note: Do not select the CUSTOMER_ORDER_LINE_ITEM* element.)

   b. Click the Add Where Clause icon  .

   c. Click the ORDER_ID element in the $CUSTOMER_ORDER_LINE_ITEM source node. You should see the following in the WHERE field (the variable name may be different, in your case):

      ```
      $CUSTOMER_ORDER_LINE_ITEM/ORDER_ID
      ```

   d. Select eq: Compare Single Values from the operator list ("…" icon). You should see the following in the Where field:

      ```
      $CUSTOMER_ORDER_LINE_ITEM/ORDER_ID eq
      ```

   e. Click the ORDER_ID element in the CUSTOMER_ORDER source node. You should see the following in the where field (the variable name may be different, in your case):

      ```
      $CUSTOMER_ORDER_LINE_ITEM/ORDER_ID eq
      $CUSTOMER_ORDER/ORDER_ID
      ```

   f. Click the green check box  to add the parameterized WHERE clause to the getAllCustomers() function.

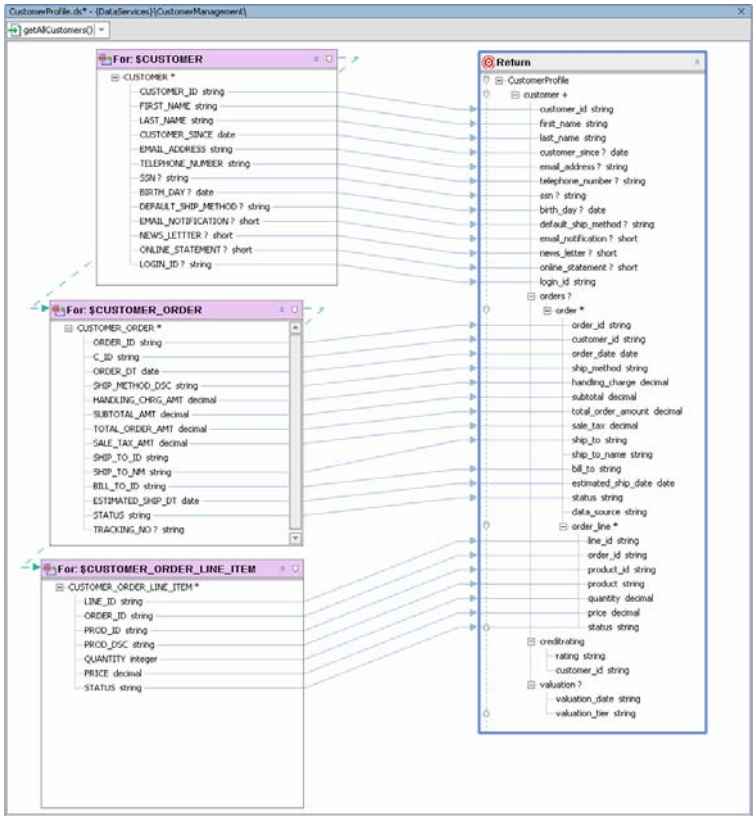


Figure 4-5 Where Clause Joining Two Data Services

6. Verify the joins you created and view the results, by completing the following steps:

    a. Open `CustomerProfile.ds` in Design View. The physical data services associated with the three functions that you dropped into XQuery Editor View as for nodes are displayed in the right pane as data sources for the logical data service.

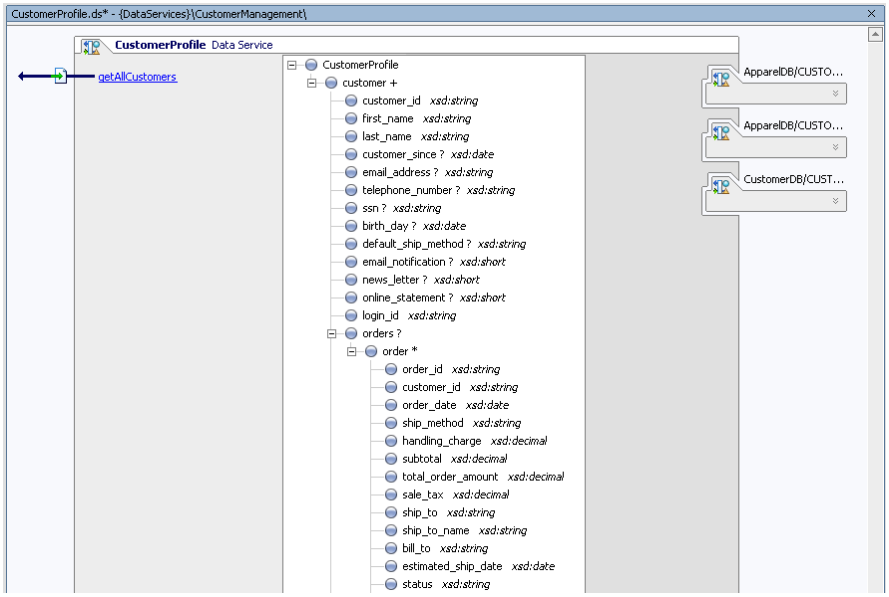


Figure 4-6 Design View of Integrated and Parameterized Data Service

b. Open `CustomerProfile.ds` in Source View. The XQuery code for the logical data service is displayed.

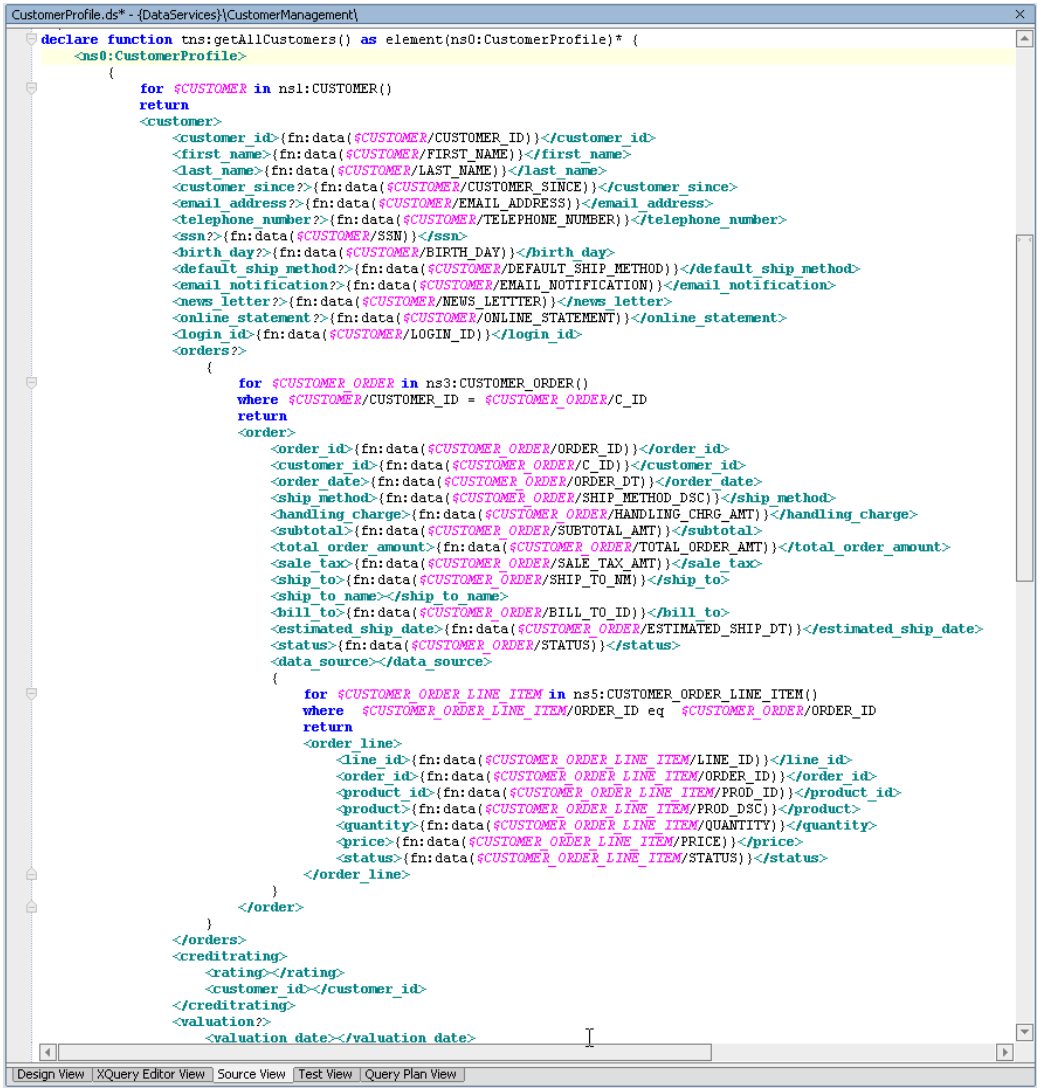


Figure 4-7 Source Code for Data Integrated with WHERE Clauses and Parameters

7. Test the results, by completing the following steps:

   a. Build the DataServices project.

   b. Open `CustomerProfile.ds` in Test View.

   c. Select getAllCustomers() from the function drop-down list.

   d. Set the element (by path) option to CustomerProfile/customer.

   e. Click Execute. (You do not need any parameters.)

   f. Expand the nodes and confirm that you can retrieve order line information integrated with order information, similar to that displayed in Figure 4-8. (You can use customer_id = CUSTOMER3 to verify this information).

   g. Click Edit.

   h. Navigate to the Orders node for CUSTOMER3 and update handling_charge information by double clicking the element content (the 6.8 value).

i. Confirm changes by pressing Submit button.

j. Verify that the update was done successfully by re-executing getAllCustomers() function and navigating to order information for CUSTOMER3.

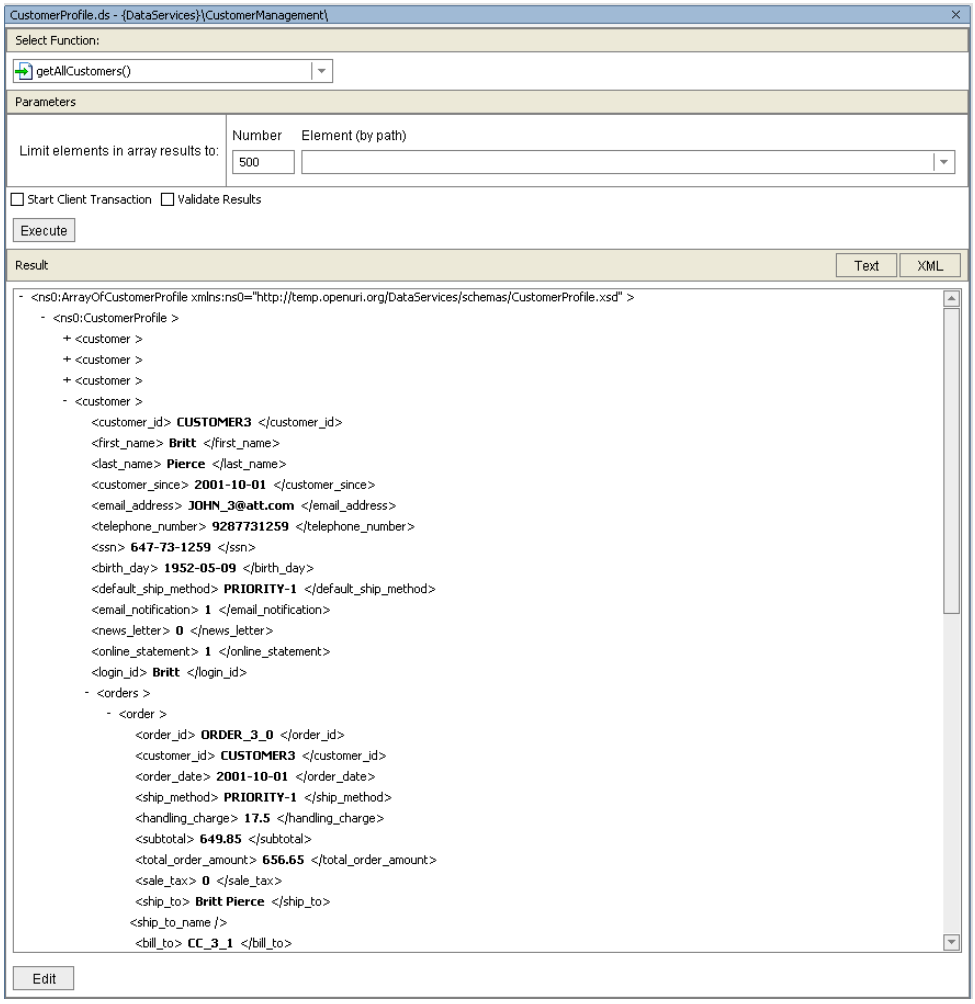


Figure 4-8 Order Line Data Integrated Within Order Information

Lab 4.3 Creating a Parameterized Function

Adding a parameter to a function ensures that the consuming application can access specific user-defined data, such as an individual customer's profile information.

Objectives

In this lab, you will:

Add a new function, getCustomerProfile().

Add a for node based on the getAllCustomers() function.

Set the context for nested elements within the logical data service.

Instructions

1. In Design View, create a new function for the CustomerProfile data service, and name it getCustomerProfile().
2. Click getCustomerProfile() to open XQuery Editor View for that function.
3. In the Data Services Palette, expand `CustomerManagement\CustomerProfile` data service.
4. Drag and drop getAllCustomers() into the XQuery Editor View. You should see a new for node. For: $CustomerProfile, with its shape defined by the CustomerProfile logical data service's getAllCustomers() function.

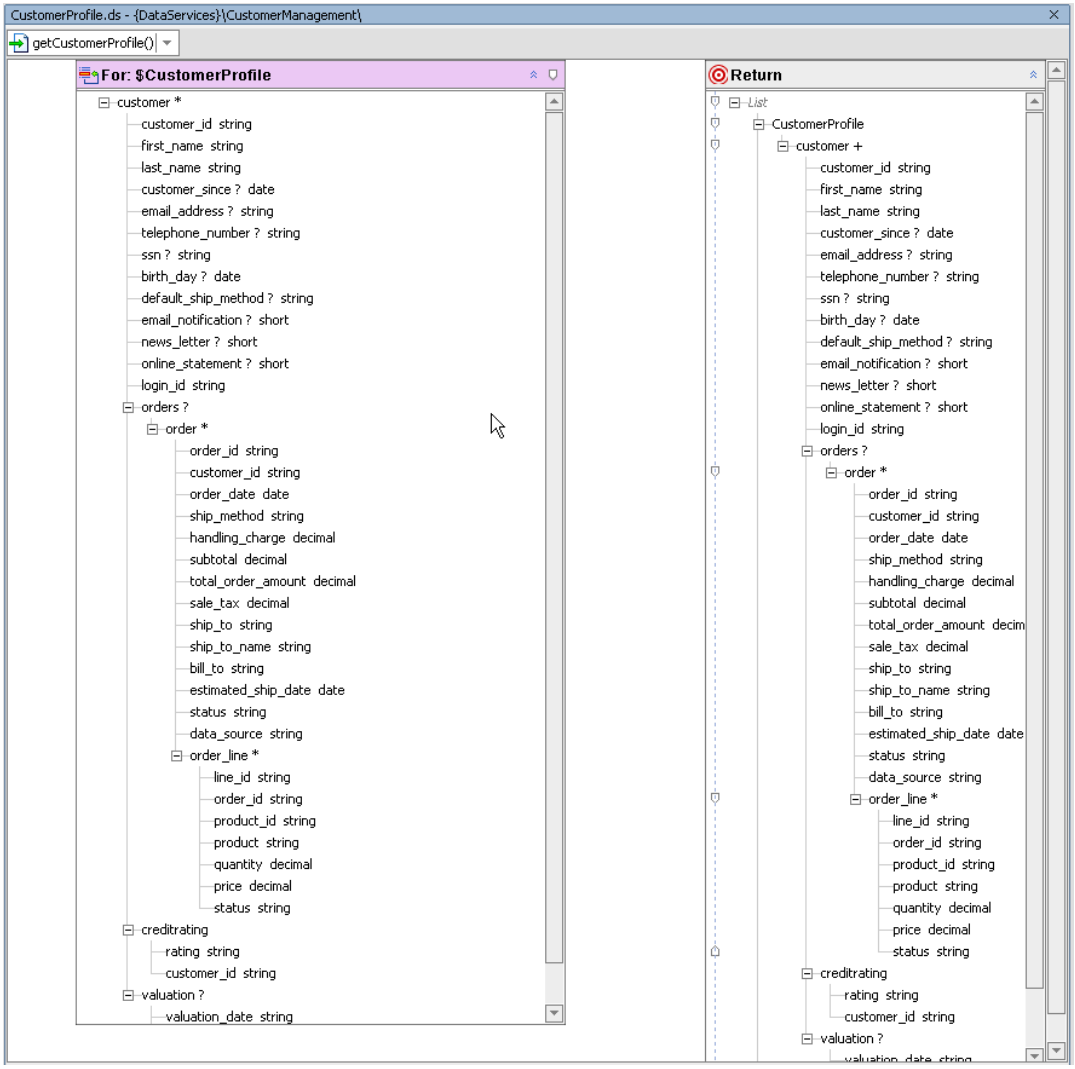


Figure 4-9 Complex Element Node

Note: In a previous lab, you defined getAllCustomers() to include a complex, nested customer element associated with the customer_id element of the $CUSTOMER_ORDER_LINE_ITEM source. You must set the context of the $CustomerProfile source node to point to the customer element because customer_id uses a string parameter for filtering.

5. Create a parameter by completing the following steps:
   a. Right-click an empty space in XQuery Editor View.
   b. Select Add Parameter.

c. Enter CustomerID in the Parameter Name field.

d. Select xs:string from the Primitive Type drop-down list.

e. Click OK.

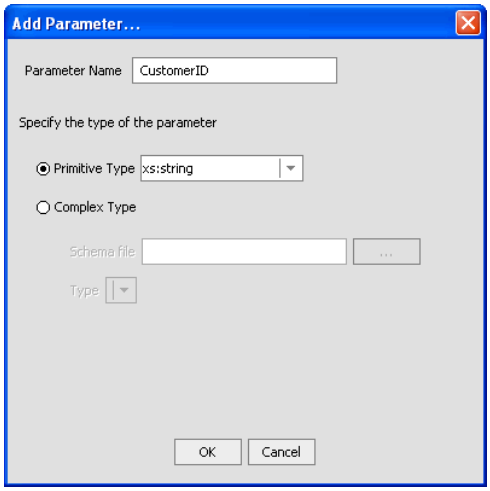


Figure 4-10 Add Parameter

Note: You may need to move the $CustomerProfile node to make the parameter node visible.

6. Create a complex, overwrite mapping, by completing the following steps:

   a. Press Ctrl.

   b. Drag and drop the $CustomerProfile customer* element onto the customer+ element in the Return type. (The Return type will change.)

7. Create a join: Drag and drop the parameter's string element onto the customer_id element of the $CustomerProfile source node. This joins the string parameter to the $CustomerProfile source node and creates a function that will return data based on the user-specified parameter. (You will see this in action in the next lab.)

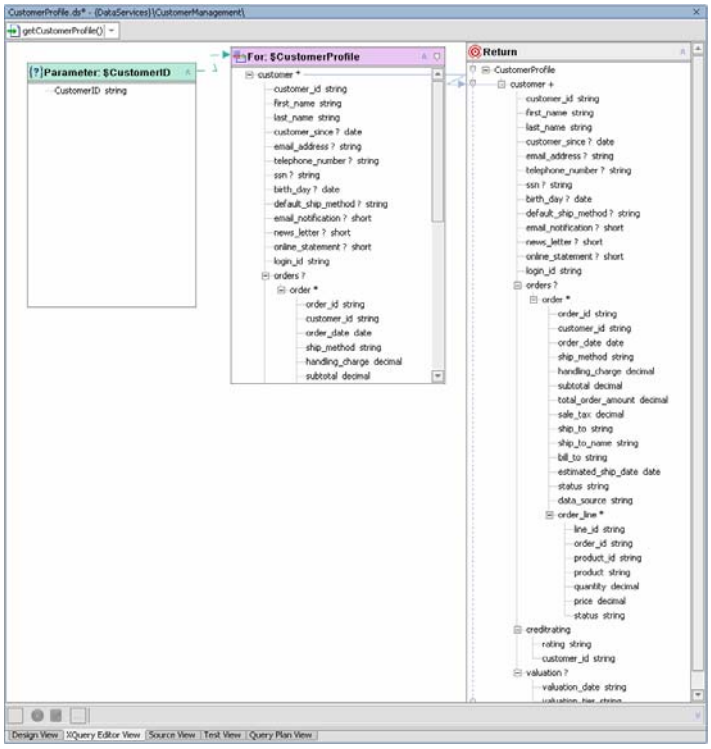


Figure 4-11 Data Source Node and Parameter Joined

8. Select the Source View tab and confirm that the XQuery code for the getCustomerProfile() function is as follows:

```
declare function tns:getCustomerProfile($CustomerID as xs:string) as
element(ns0:CustomerProfile)* {
    <ns0:CustomerProfile>
        {
            for $CustomerProfile in tns:getAllCustomers()/customer
            where $CustomerID = $CustomerProfile/customer_id
            return
            $CustomerProfile
        }
    </ns0:CustomerProfile>
```

9. Remove the asterisk * from the return type element(ns0:CustomerProfile)*, because this function, as currently written, will return all customer profiles. Your source code should be similar to that displayed in Figure 4-12.

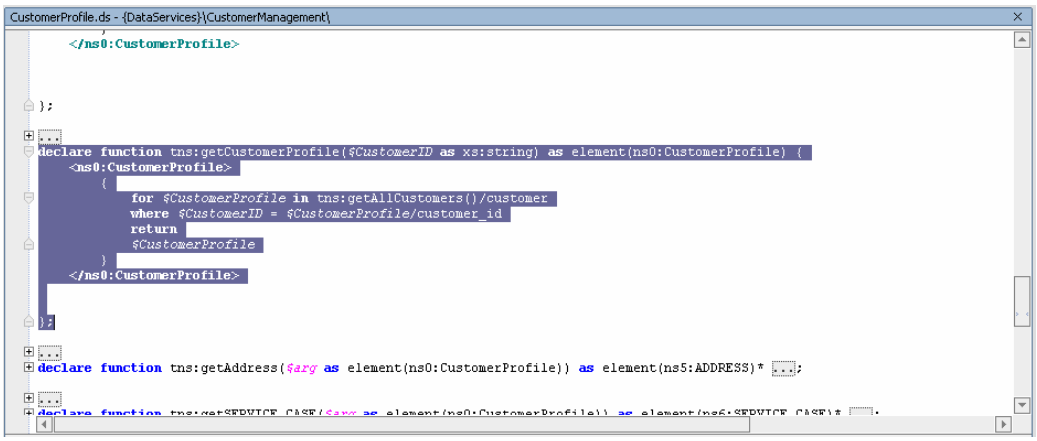


Figure 4-12 Source Code for a Parameterized and Complex Overwrite Mapped Function

10. Test the function, by completing the following steps:

    a. Build your project.

    b. Open `CustomerProfile.ds` in Test View.

    c. Select getCustomerProfile(CustomerID) from the function drop-down list.

    d. Enter CUSTOMER3 in the xs:string CustomerID Parameter field. (Note: The parameter is case-sensitive.)

    e. Confirm that you retrieved the requested information — customer, orders, and order line items for Britt Pierce.

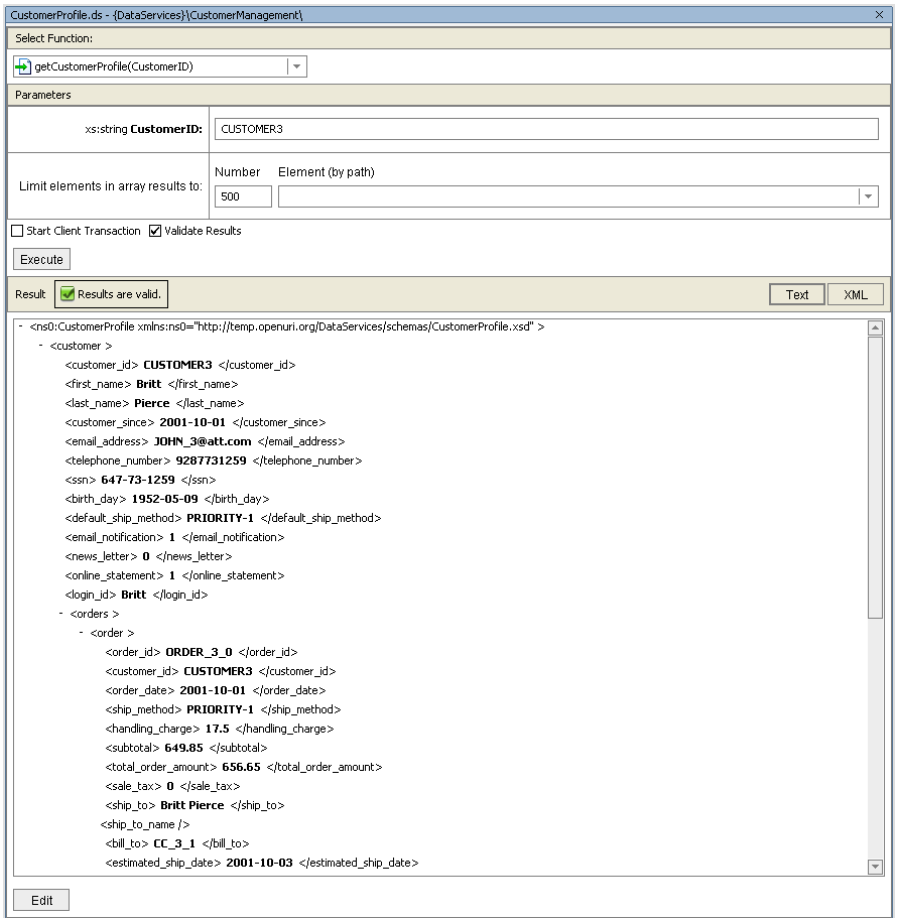


Figure 4-13 Integrated Data Results

Lesson Summary

In this lesson, you learned how to:

Use the Data Services Palette to add physical and logical data service functions to a logical data service, thereby accessing data from multiple sources.

Join data services by connecting source elements, thereby integrating data from multiple sources.

Use the Expression Builder to define a parameterized where clause.

Set the context for nested elements in the source node.

Create a complex override mapping.

Test parameterized data services to verify the return of integrated data results.

Lesson 5 Modeling Data Services

Any data service — physical or logical — can be placed in a model diagram. Model diagrams show:

The basic structure of data returned by each data service within the model.

Any functions associated with that data service.

Any relationships between data services.

The main purpose of the diagram is to help you envision meaningful subsets of the model, but it can also be used to define new artifacts or edit existing artifacts.

Objectives

After completing this lesson, you will be able to:

Create model diagrams and add data source nodes to the diagram.

Confirm relationships inferred during the Import Source Metadata process.

Define new relationships between data services and modify relationship properties.

Overview

Model diagrams show how various data services are related. Models can represent physical data services, logical data services, or a combination.

Each *physical model entity* represents a single data source. In the case of relational sources, you can automatically generate physical models that are representative of data sources. After being generated, physical data services can be integrated with other physical or logical sources in the same or new models. Physical model types use a key icon to identify primary keys.

Logical data model entities, which are discussed in detail in the *Data Service Developer's Guide,* represent composite views of physical and/or logical models.

Within the model diagram, data services appear as boxes. Relationships are represented by annotated lines between two data services. Each side of the relationship line represents the *role* played by the nearest data service. The annotations for each relationship include the following:

Target Role Name. By default, the target role name reflects the name of its adjacent data service. You can modify the target role name to better express the relationship, which is particularly useful when there are multiple relationships between two data services.

Cardinality. A relationship can be zero-to-one (0:1 or 1:0), one-to-one (1:1), one-to-many (1:*n*) or many-to-many *(n:n*). For example, a customer can have multiple orders, therefore, the relationship should be *1*:*n* (customer:orders).

Directionality. A relationship can be either unidirectional or bidirectional. If unidirectional, data service *a* can navigate to data service *b* but *b* does not navigate to *a*. If bidirectional, data service *a* can navigate to *b* and *b* can navigate to *a*.

A data service's navigation functions determine the relationship's cardinality and directionality. Arrowheads indicate possible navigation paths.

DSP model diagrams are very flexible; they can be based on existing data services (and corresponding underlying data sources), planned data services, or a combination. Using models you can easily manage multiple data services as well as identify needs for new data services. You can also create and modify data service types directly in the modeler and inspect data services.

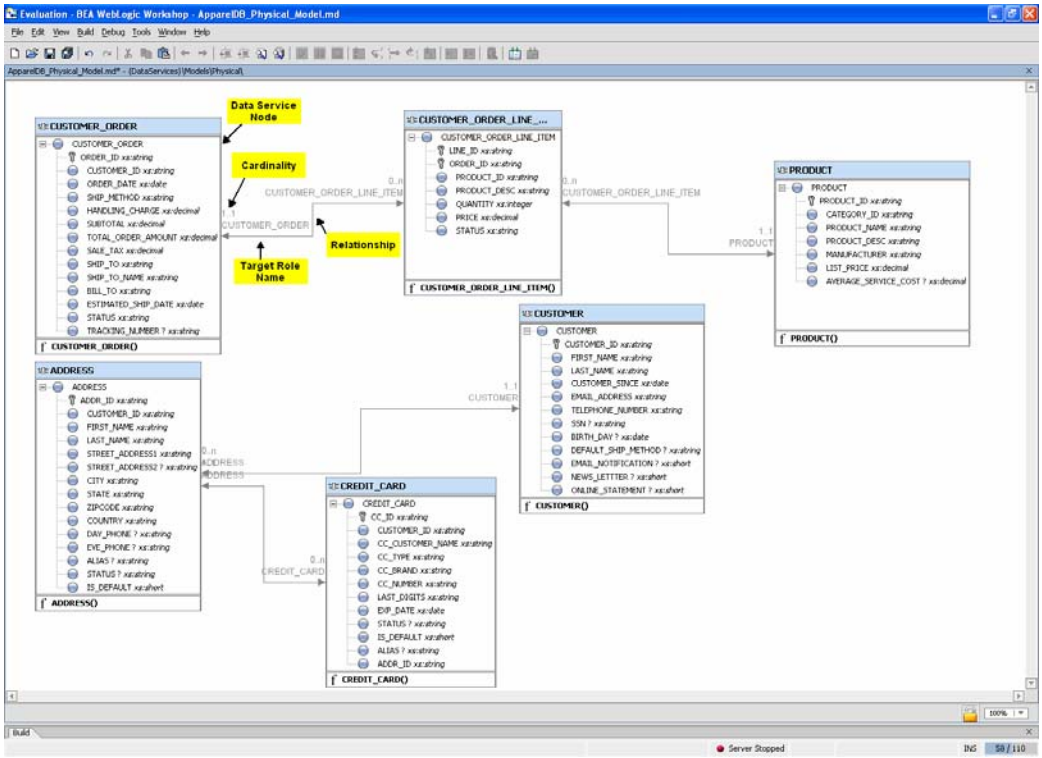


Figure 5-1 Model Diagram for Physical Data Services

Lab 5.1 Creating a Basic Model Diagram for Physical Data Services

Modeling data services begins by adding individual data services to a diagram.

Objectives

In this lab, you will:

Create a diagram that you will use to model relationships between physical data services.

Add the ApparelDB and CustomerDB physical data services to the model diagram.

Confirm relationships "captured" during the Import Source Metadata process.

Instructions

1. Create a new folder in the DataServices project and name it Models.
2. Create a new folder in the Models folder and name it Physical.
3. Create a blank model diagram, by completing the following steps:
   a. Right-click the Physical folder.
   b. Choose New → Model Diagram.
   c. Select Data Service → Model Diagram as shown in Figure 5-2.

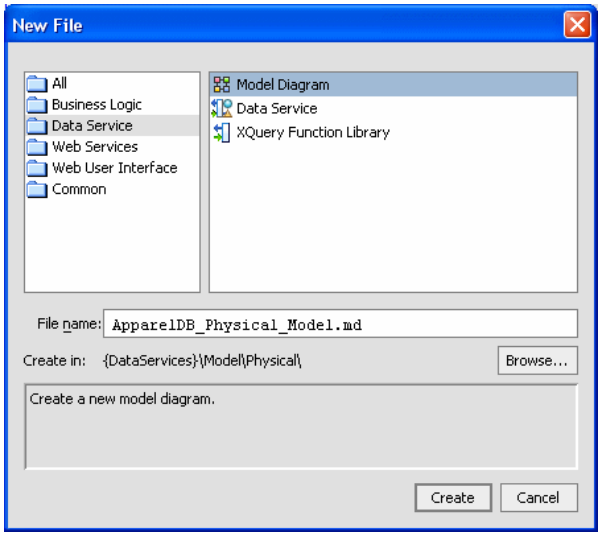


Figure 5-2 Create Model Diagram

d. Enter `ApparelDB_Physical_Model` in the File name field.

e. Click Create. A blank workspace opens, which you can used to construct the model diagram.

4. Add the ApparelDB and CustomerDB physical data services to the model by dragging and dropping the following data service files from the Application pane into the model:

Data Service File	Located In:
`CUSTOMER_ORDER.ds`	`DataServices\ApparelDB`
`CUSTOMER_ORDER-LINE_ITEM.ds`	`DataServices\ApparelDB`
`PRODUCT.ds`	`DataServices\ApparelDB`
`ADDRESS.ds`	`DataServices\CustomerDB`
`CREDITCARD.ds`	`DataServices\CustomerDB`
`CUSTOMER.ds`	`DataServices\CustomerDB`

Notice that relationships between some data services already exist. These relationships were automatically generated during the Import Source Metadata process, and are based on the foreign key relationships defined in the underlying database.

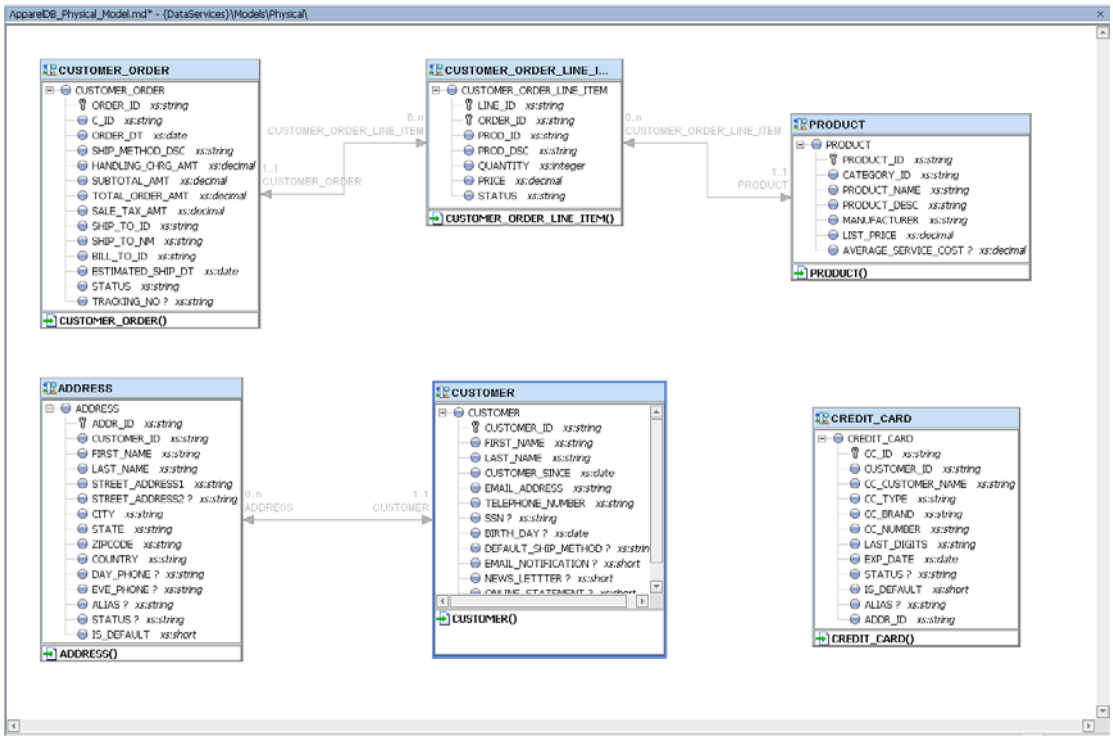


Figure 5-3 Model Diagram for a Physical Data Service

Lab 5.2 Modeling Relationships Between Physical Data Sources

The next step in data service modeling is to define additional relationships, beyond any relationship that was automatically generated during the import source metadata process.

A *relationship* is a logical connection between two data services, such as the CUSTOMER and CUSTOMER_ORDER data services. A relationship exists when one data service retrieves data from another, by invoking one or more of the other data service's functions.

A data service's navigation functions determine the relationship's cardinality and directionality. Arrowheads indicate possible navigation paths. Directionality can be either one directional or bidirectional.

Objectives

In this lab, you will:

Define a relationship between the CUSTOMER and CUSTOMER_ORDER nodes, thereby creating a navigational function between the two nodes.

Modify the relationship properties to enable a "1:0 or many" relationship.

Instructions

1. Drag and drop the top-level CUSTOMER element onto the top-level CUSTOMER_ORDER element. The Relationship Properties dialog box opens.
2. In the Relationship Properties dialog box, modify the cardinality properties of the CUSTOMER and CUSTOMER_ORDER data services, by completing the following steps:
   a. Select 0 from the Min occurs drop-down list.

b. Select n from the Max occurs drop-down list.

The relationship cardinality is now "1:0 or many" between the CUSTOMER and CUSTOMER_ORDER data services. In other words, one customer can have none, one, or any number of orders.

3. Click Finish.

Note: In subsequent lessons, you will use additional features of the Relationship Properties dialog box to customize relationship properties.

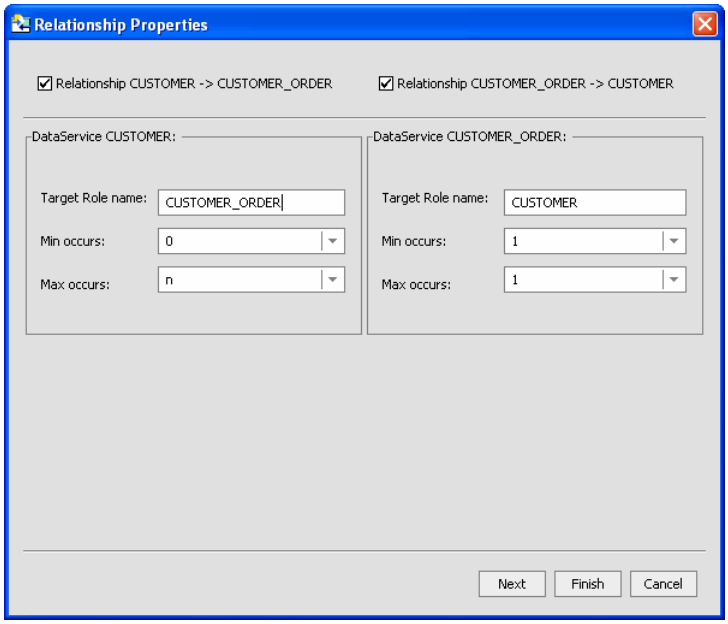


Figure 5-4 Relationship Properties — Cardinality

Note: It may take a few seconds to generate the relationship line.

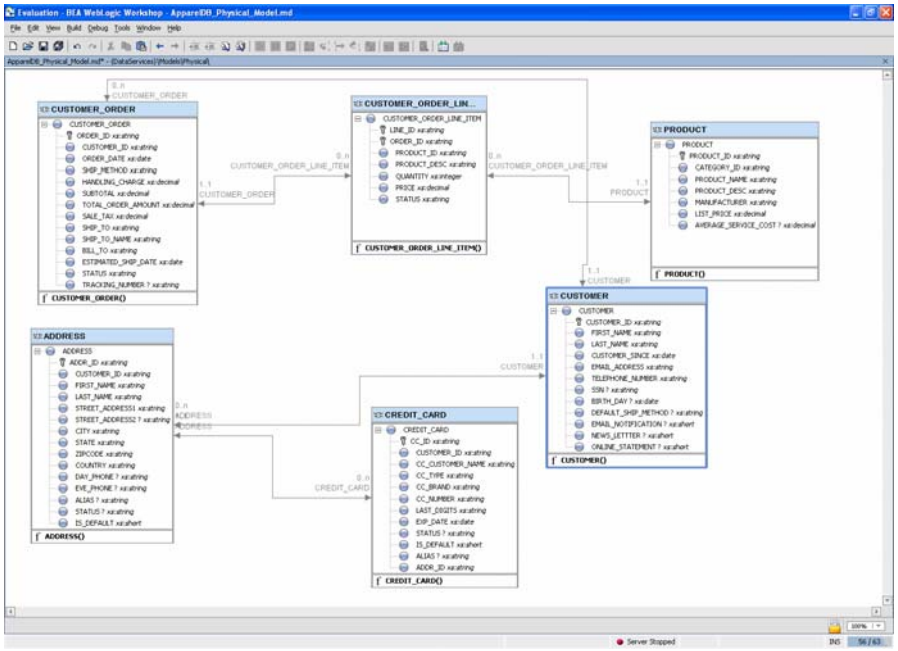


Figure 5-5 New Customer: Customer_Order Relationship Defined

4. Save all files.
5. Open `CUSTOMER.ds` in Design View. The file is located in the `DataServices\CustomerDB` folder.
6. Confirm that the CUSTOMER data service includes a new relationship with the CUSTOMER_ORDER data service, using the getCustomer_Order() function.

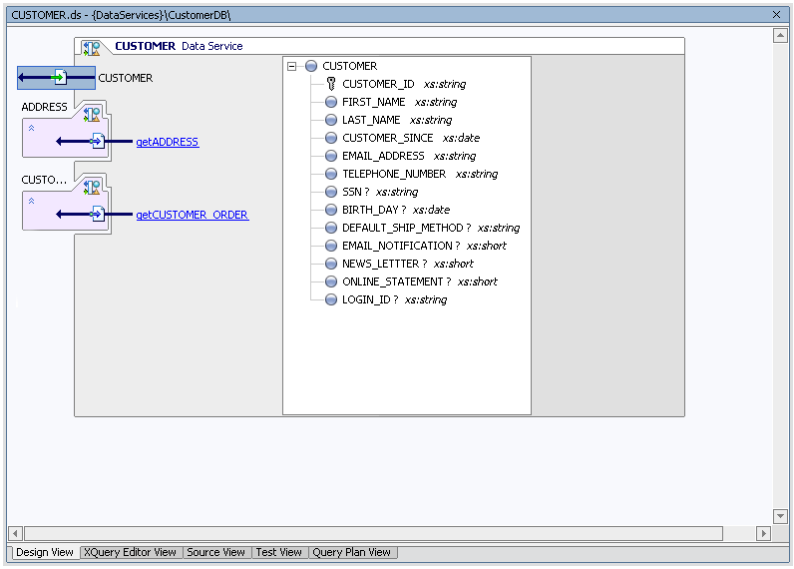


Figure 5-6 Design View of Added Relationship Function

7. Open `CUSTOMER_ORDER.ds` in Design View. The file is located in `DataServices\ApparelDB`.
8. Confirm that the CUSTOMER_ORDER data service includes a new relationship with the CUSTOMER data service, using the getCustomer() function.

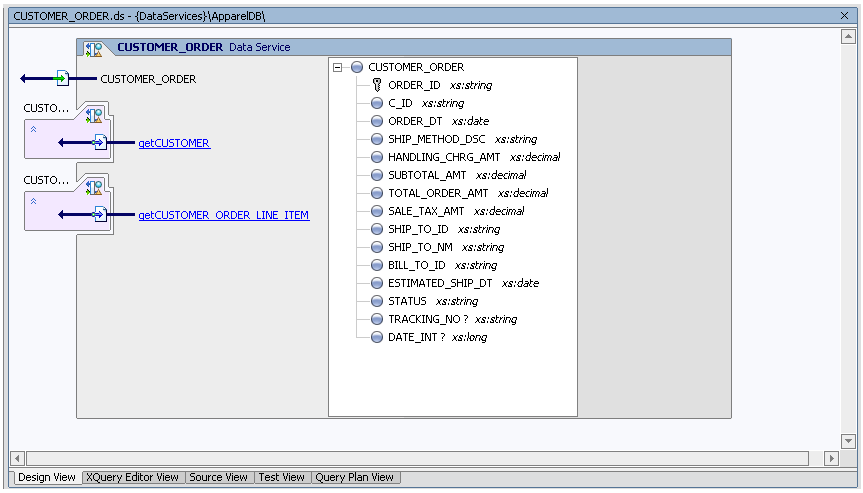


Figure 5-7 Design View of Added Relationship Function

9. (*Optional*) Create a relationship between CUSTOMER and CREDIT_CARD data services.
10. (*Optional*) Close all open files.

Lesson Summary

In this lesson, you learned how to:

Create model diagrams and add data source nodes to the diagram.

Confirm relationships inferred during the Import Source Metadata process.

Define relationships between data services.

Lesson 6 Accessing Data in Web Services

One of the data sources available with the samples installed with DSP is a Web service that provides customer credit rating information. In this lesson, you will generate a physical data service that can be integrated into the CustomerProfile logical data service.

The process for creating a data service based on a Web service is similar to importing relational database source metadata. The difference is that DSP uses the WSDL (Web services description language) metadata to introspect the Web service's operation and generate the data service.

Objectives

After completing this lesson, you will be able to:

Import a WSDL.

Use the WSDL to generate a data service.

Test the Web service by passing a SOAP request body as a query parameter.

Use a logical data service to invoke the Web service and retrieve data.

Overview

A Web service is a self-contained, platform-independent unit of business logic that is accessible to other systems on a network. The network can be a corporate intranet or the Internet. Other systems can call the Web services' functions to request data or perform an operation.

Web services are increasingly important resources for global business information. Web services can facilitate application-to-application communication and are a useful way to provide data, like stock quotes and weather reports, to an array of consumers over a corporate intranet or the Internet. But they take on additional new power in the enterprise, where they offer a flexible solution for integrating distributed systems, whether legacy systems or new technology.

WSDLs are generally publicly accessible and provide enough detail so that potential clients can figure out how to operate the service solely from reading the WSDL file. If a Web service translates English sentences into French, the WSDL file will explain how the English sentences should be sent to the Web service, and how the French translation will be returned to the requesting client.

Lab 6.1 Importing a Web Service Project into the Application

When you want to use an external Web service from within WebLogic Workshop, you should first obtain that service's WSDL file. In this lab, you will use the WSDL for a Web service project that was created in WebLogic Workshop.

Objectives

In this lab, you will:

Import the CreditRatingWS Web service into your sample application. This Web service provides getCreditRating() and setCreditRating() functions for retrieving and updating a customer's credit rating.

Run the Web service to test whether you can retrieve credit rating information.

Instructions

1. Import a Web service into the DSP-enabled application, by completing the following steps:

   a. Choose File → Import Project. The Import Project → New Project dialog box opens.

   b. Select Web Service Project.

   Caution: Make sure that you select a project of type Web service. If you select another project type, then the CreditRatingWS application may not work correctly.

   c. In the directory field, click Browse.

   d. Navigate to `<beahome>\weblogic81\samples\LiquidData\EvalGuide`.

   e. Select CreditRatingWS and click Open.

   f. Make sure that the Copy into Application directory checkbox is selected.

   g. Click Import and then click Yes when the confirmation message to update your project appears.

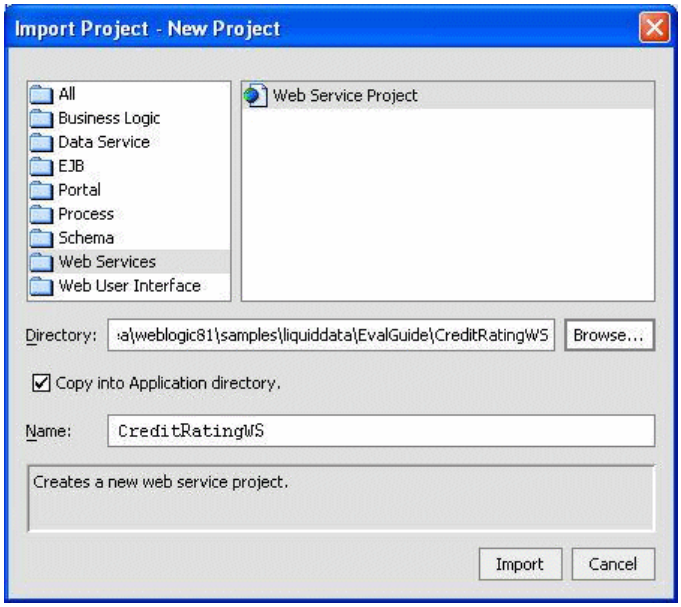


Figure 6-1 Import Web Services Project

2. In the Application pane, verify that the following items were imported:

   A CreditRatingWS project folder containing:

   A controls folder, within which are the `CreditRatingDB.jcx` control and `CreditratingDBTest.jws` Web service.

   A credit rating folder, within which is the Web service folder that contains the `CreditRating.java` file.

   A WEB-INF folder.

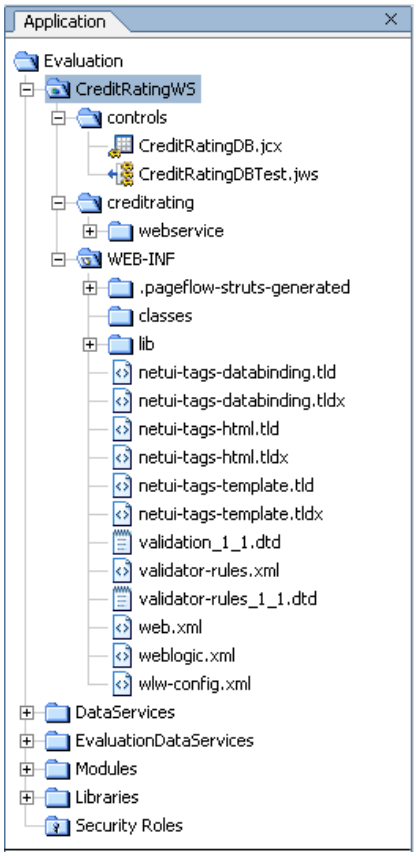


Figure 6-2 Web Service Project

3. Open CreditRatingDBTest.jws in Design View. This file is located in `CreditRatingWS\controls`. The Web service diagram should be as displayed in Figure 6-3.

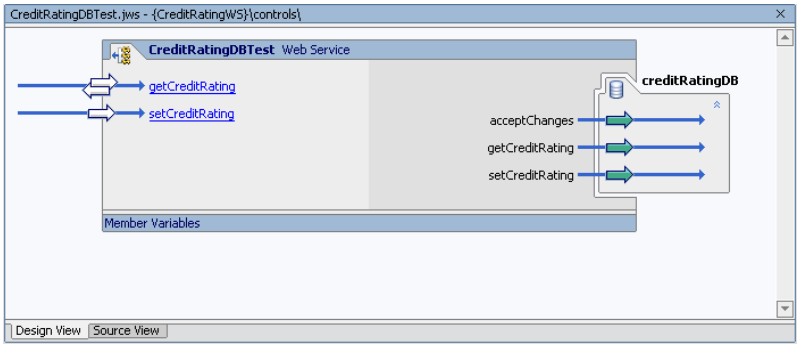


Figure 6-3 Design View of Credit Rating Web Service

4. Test the imported Web service, by completing the following steps:

   a. Click the Start icon , or press Ctrl + F5, to open Workshop Test Browser.

   b. Enter CUSTOMER3 in the customer_id field.

   c. Click getCreditRating. The requested information displays in Workshop Test Browser.

Figure 6-4 Workshop Test Browser

d. Scroll down to the Service Response section and confirm that you can retrieve credit rating information for CUSTOMER3.

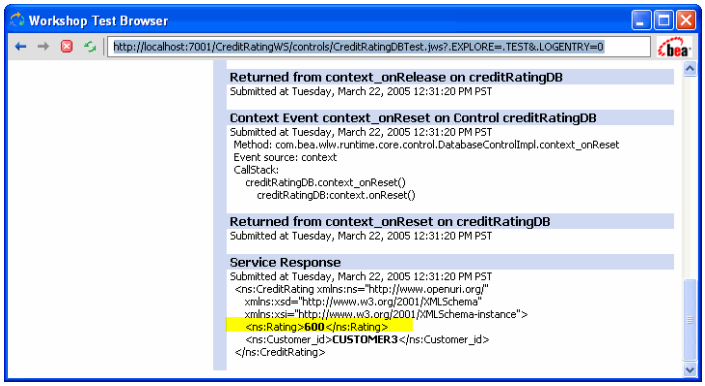


Figure 6-5 Web Service Results

Lab 6.2 Importing Web Service Metadata into a Project

WSDL is a standard XML document type for describing an associated Web service so that other software applications can interface with the Web service. Files with the .wsdl extension contain Web service interfaces expressed in the Web Service Description Language (WSDL).

A WSDL file contains all the information necessary for a client to invoke the methods of a Web service:

The data types used as method parameters or return values.

The individual method names and signatures (WSDL refers to methods as *operations*).

The protocols and message formats allowed for each method.

The URLs used to access the Web service.

Objectives

In this lab, you will:

Import the CreditRatingWS source metadata via its WSDL, into the DataServices project, thereby generating a new data service (`getCreditRatingResponse.ds`).

Confirm that the new data service includes the getCreditRating() function that you tested in the previous lab.

Instructions

1. In Workshop Test Browser, scroll to the top of the window.
2. Click the Overview tab.

Figure 6-6 Workshop Test Browser Overview

3. Click Complete WSDL.
4. Copy the WSDL URI, located in the Address field. The URI is typically: **http://localhost:7001/CreditRatingWS/controls/CreditRatingDBTest.jws?WSDL=**

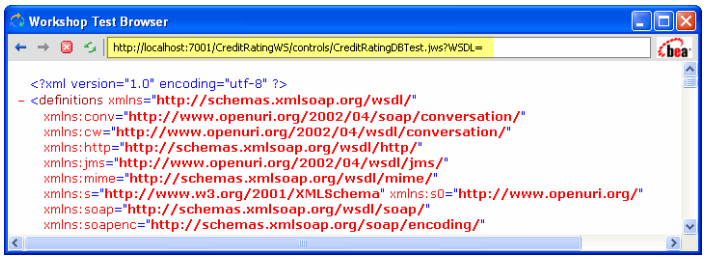


Figure 6-7 WSDL URI

5. Close Workshop Test Browser.
6. In Workshop: Close all open files.
7. Create a new folder within the DataServices project folder, and name it WebServices.
8. Import Web service source metadata into the WebServices folder, by completing the following steps:
    a. Right-click the WebServices folder.
    b. Choose Import Source Metadata.
    c. Choose Web Service from the Data Source Type drop-down list. Then click Next.

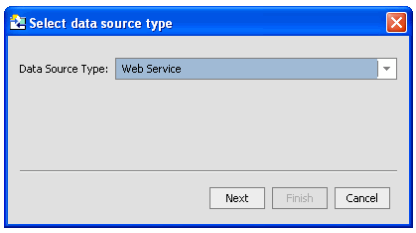
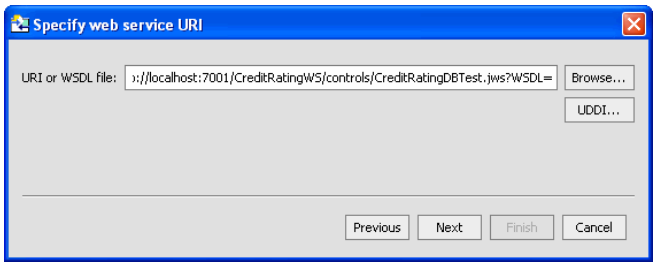


Figure 6-8 Web Service Data Source Type

d. Paste the copied WSDL URI into the URI or WSDL File box and click Next.



e. Expand the CreditRatingDBTestSoap and Operations folders.

f. Select getCreditRating operation, and click Add to populate the Selected Web Service Operations pane.

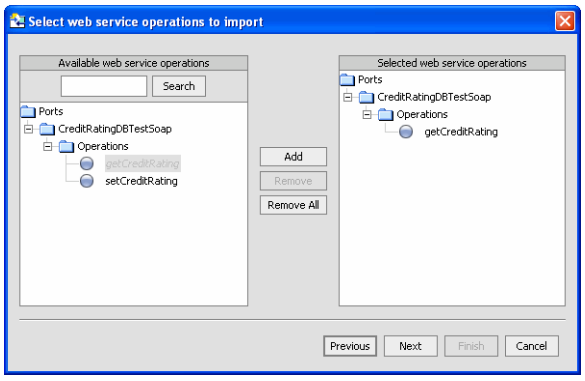


Figure 6-9 Selected Web Service Operations

g. Do not select the getCreditRating procedure as the side effect procedure in the Select Side Effect Procedures dialog box, and click Next.

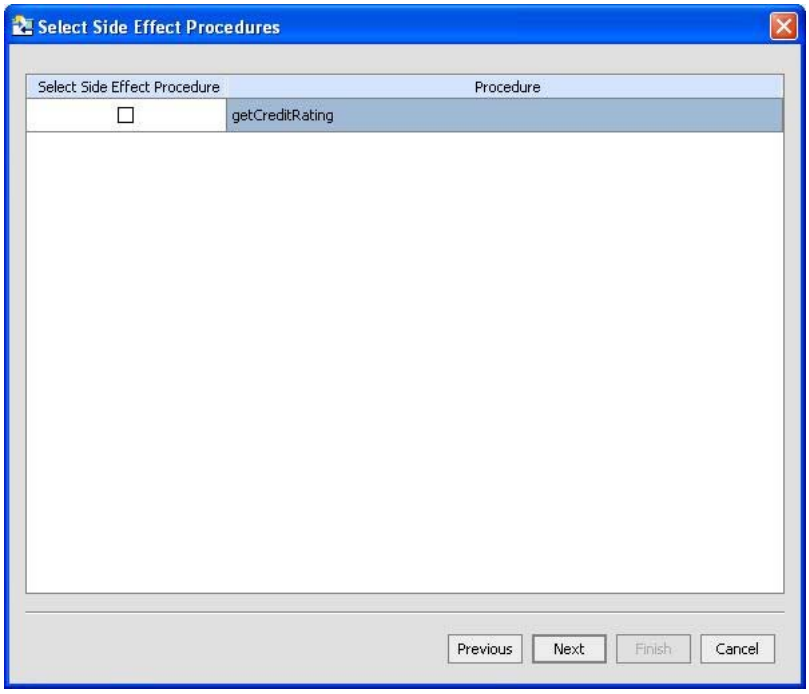


Figure 6-10 Select Side Effect Procedures

h. Review the Summary information, which includes

Function name.

XML type, for Web service objects whose source metadata will be imported.

Name, for each data service that will be generated from the source metadata. (Any name conflicts appear in red and must be resolved before proceeding. However, you can modify any data service name.)

Add to Existing Data Service, to add the function to an existing data service.

Location, where the generated data service(s) will reside.

i. Click Finish.

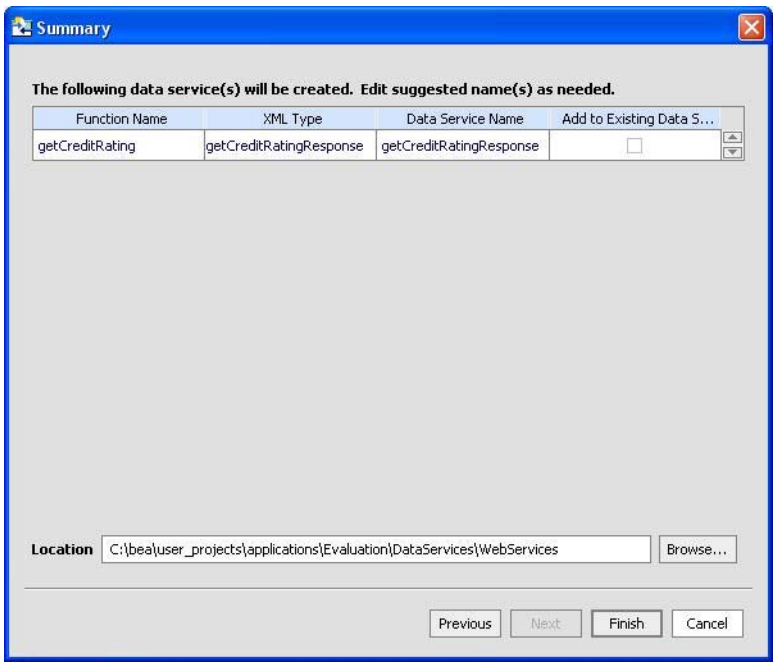


Figure 6-11 Web Services Summary

9. Open `getCreditRatingResponse.ds` in Design View. This file is located in `DataServices\WebServices`.

10. Confirm that there is a function called getCreditRating().

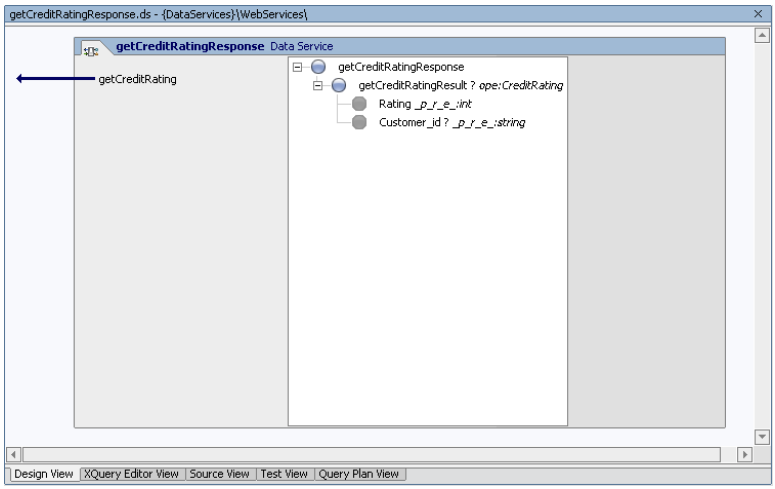


Figure 6-12 Web Service Function Added

Lab 6.3 Testing the Web Service via a SOAP Request

Extensible Markup Language (XML) messages provide a common language by which different applications can talk to one another over a network. Most Web services communicate via XML. A client sends an XML message containing a request to the Web service, and the Web service responds with an XML message containing the results of the operation. In most cases these XML messages are formatted according to Simple Object Access Protocol (SOAP) syntax. SOAP specifies a standard format for applications to call each other's methods and pass data to one another.

Note: Web services may communicate with XML messages that are not SOAP-formatted. The types of messages supported by a particular Web service are described in the service's WSDL file.

Objectives

In this lab, you will:

Use the getCreditRating() function and a SOAP parameter to test `getCreditRatingResponse.ds`.

Review the results.

Instructions

1. Build the DataServices project.
2. Open `getCreditRatingResponse.ds` in Test View. (This file is located in `DataServices\WebServices`.)
3. Select getCreditRating(x1) from the Function drop-down list.
4. Enter the following SOAP body in the Parameter field:

```
<getCreditRating xmlns="http://www.openuri.org/">
  <customer_id>CUSTOMER3</customer_id>
</getCreditRating>
```

Note: An alternative to adding the SOAP body in the parameter field is to create a template for the input parameter by clicking Insert Template.

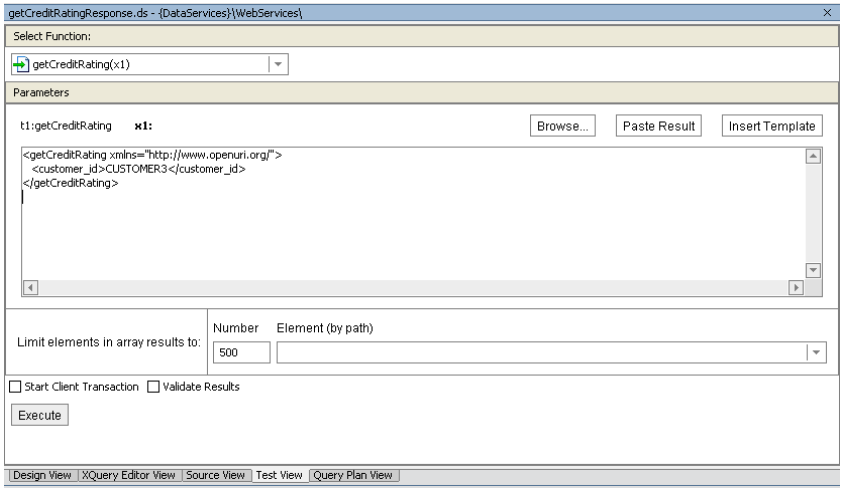


Figure 6-13 SOAP Parameter

5. Click Execute.

6. Review the results, which should be similar to those displayed in Figure 6-14. Notice that only two data elements are returned: the customer ID and the credit rating for that customer.

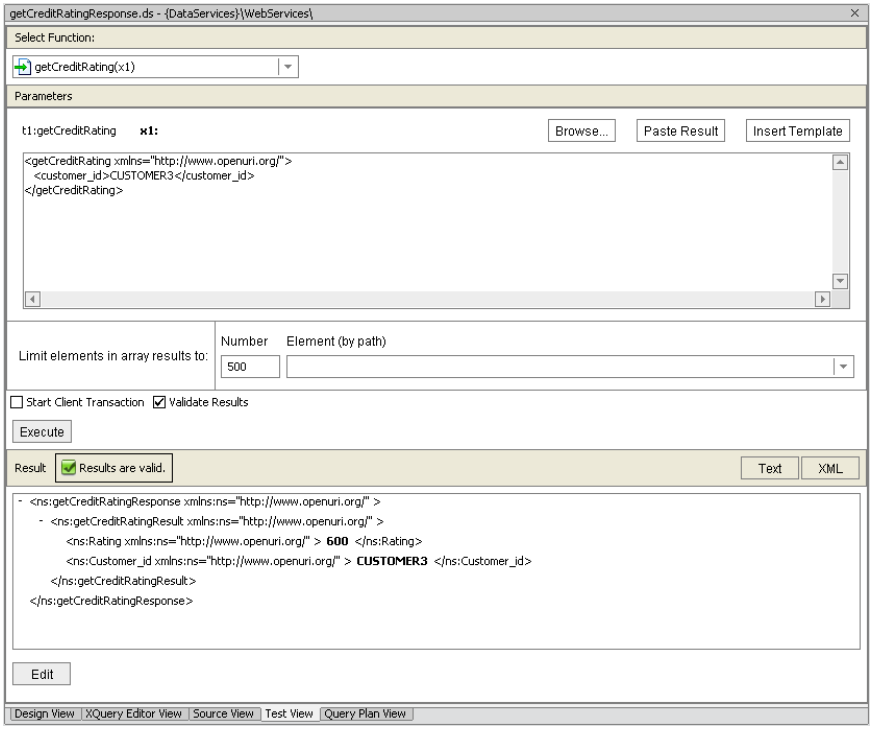


Figure 6-14 Web Service Results

Lab 6.4 Invoking a Web Service in a Data Service

You are now ready to use the Web service to provide the data that populates the CustomerProfile logical data service.

Objectives

In this lab, you will:

Use the getCreditRatingResponse data service to populate the credit rating element in the CustomerProfile data service.

Test the invocation.

Review the results.

Instructions

1. Open `CustomerProfile.ds` file in Source View. The file is located in `DataServices\CustomerManagement`.

2. In the Source View, add the following namespace definitions, in addition to the ones already defined for the CustomerProfile data service:

```
declare namespace
ws1="ld:DataServices/WebServices/getCreditRatingResponse";

declare namespace ws2 = "http://www.openuri.org/";
```

3. Open the `creditRatingXQuery.txt` file, located in `<beahome>\weblogic81\samples\LiquidData\EvalGuide` in a text editor.
4. Copy the following code from the `creditRatingXQuery.txt` file:

```
{
   for $rating  in ws1:getCreditRating(
   <ws2:getCreditRating>

 <ws2:customer_id>{data($CUSTOMER/CUSTOMER_ID)}</ws2:customer_id>
   </ws2:getCreditRating> )
   return
   <creditrating>

 <rating>{data($rating/ws2:getCreditRatingResult/ws2:Rating)}</rating>

<customer_id>{data($rating/ws2:getCreditRatingResult/ws2:Customer_id)
}</customer_id>
   </creditrating>
 }
```

5. In the `CustomerProfile.ds` file, expand the getAllCustomers() function.
6. Insert the copied text into the section where the empty CreditRating complex element is located. The empty complex element is as follows:

```
 <creditrating>
   <rating/>
   <customer_id/>
</creditrating>
```

7. Confirm that the <creditrating> code is as displayed in Figure 6-15.

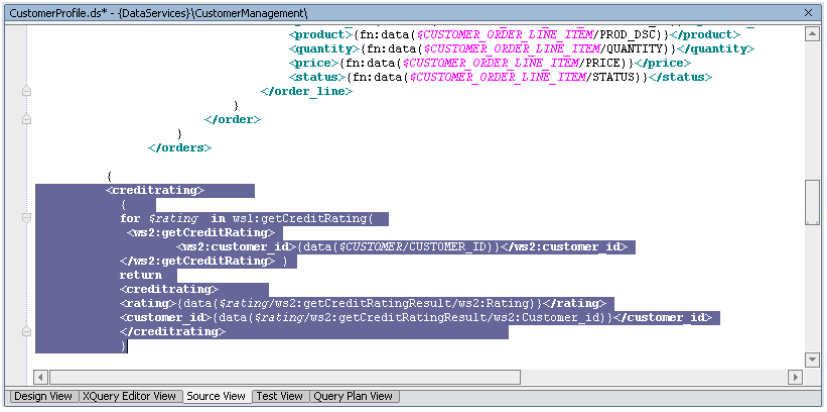


Figure 6-15 Credit Rating Source Code

8. View the results, by completing the following steps:
   a. Open `CustomerProfile.ds` in XQuery Editor View.
   b. Select getAllCustomers() from the Function dropdown list. The function should be similar to that displayed in Figure 6-16.

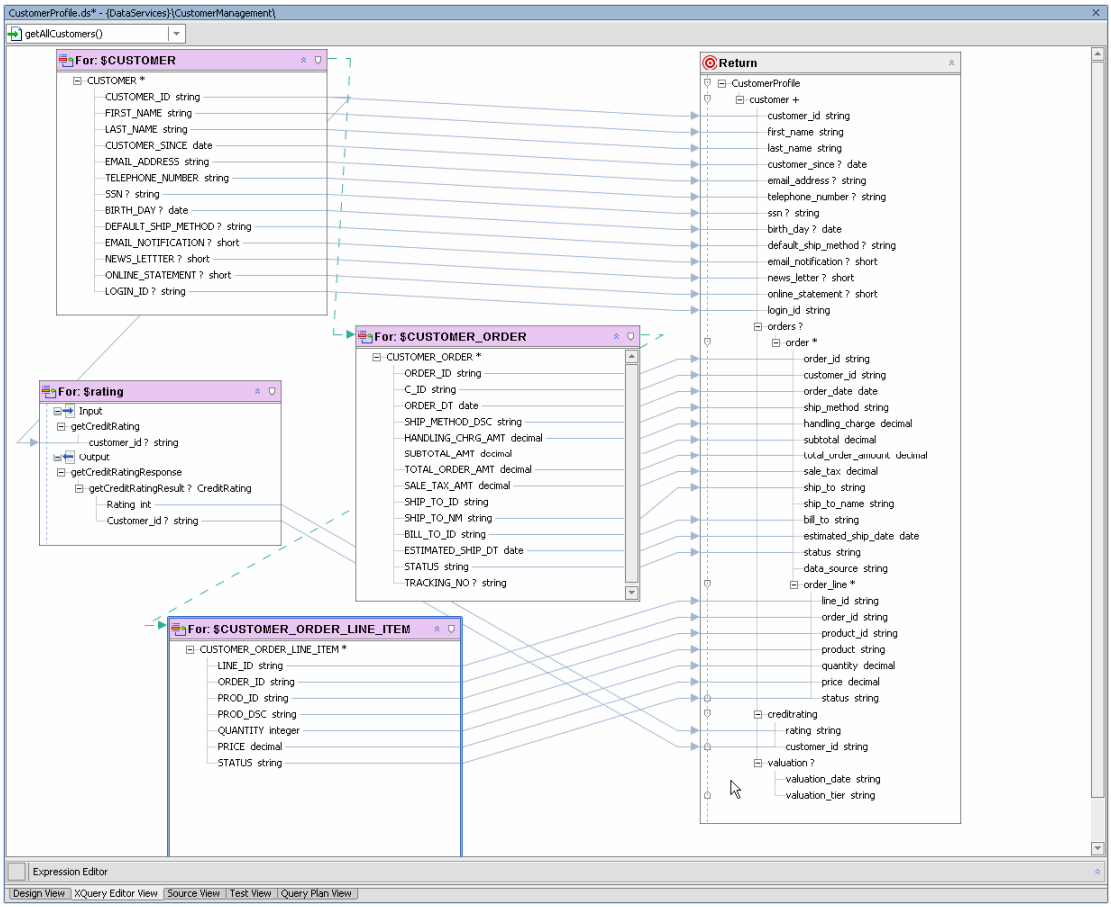


Figure 6-16 XQuery Editor View of a Web Service Being Invoked

c. Open `CustomerProfile.ds` in `Design` View. The Web service is listed as a data source, in the right pane of the diagram.

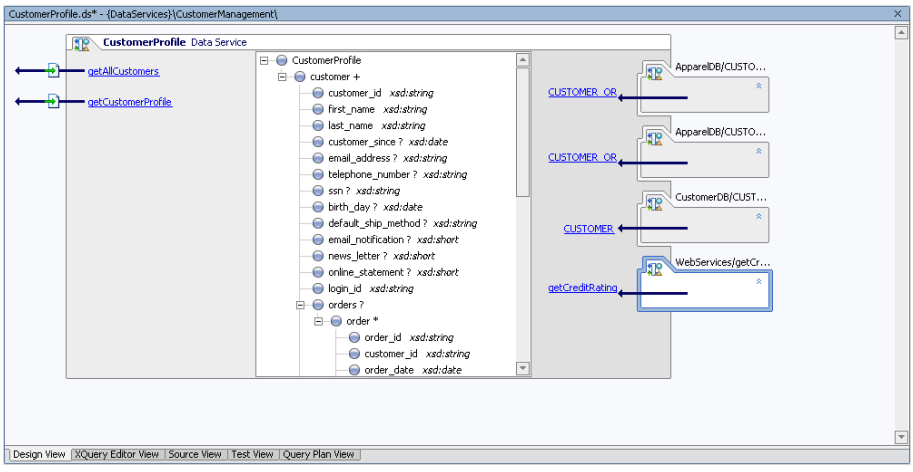


Figure 6-17 Design View of a Web Service Invoked in a Data Service

9. Test the data service by completing the following steps:

   a. Build the DataServices project.

   b. Open `CustomerProfile.ds` in Test View.

   c. Select getCustomerProfile(CustomerID) from the Function drop-down list.

d. Enter CUSTOMER3 in the xs:string CustomerID field.

e. Click Execute.

f. Confirm that you can retrieve the credit rating for Customer 3.

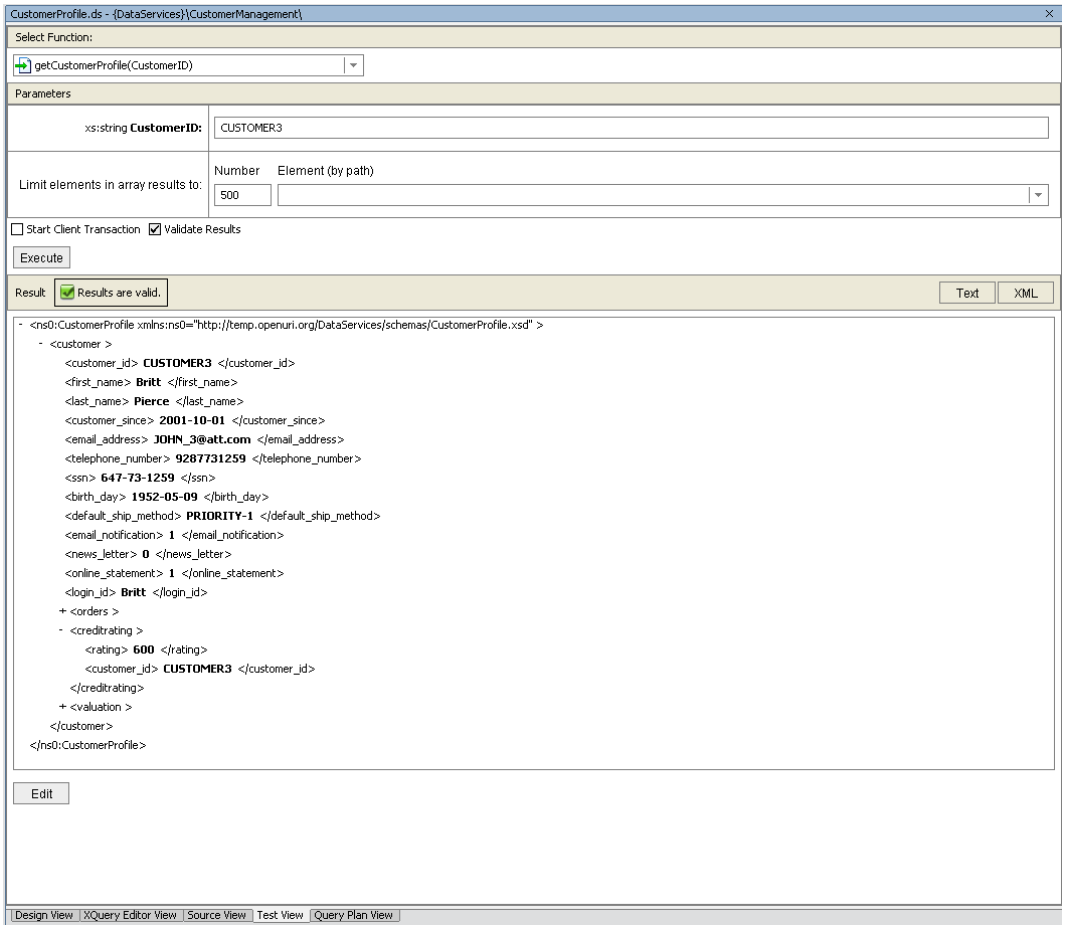


Figure 6-18 Customer Profile Data Integrated with Web Service Credit Rating Data

10. Import the `CreditRatingExit1.java` file from the EvalGuide folder:

    a. Right-click the WebServices folder.

    b. Select Import option.

    c. Navigate to `<beahome>\weblogic81\samples\LiquidData\EvalGuide` and select file `CreditRatingExit1.java` for import. Click Import.

    d. Build the DataServices project.

    e. Open `getCreditRatingResponse.ds`; click on the header and change the UpdateOverride Class property in the Property Editor to WebServices.CreditRatingExit1. (If the Property Editor is not open, you can select it using the View menu Property Editor option.

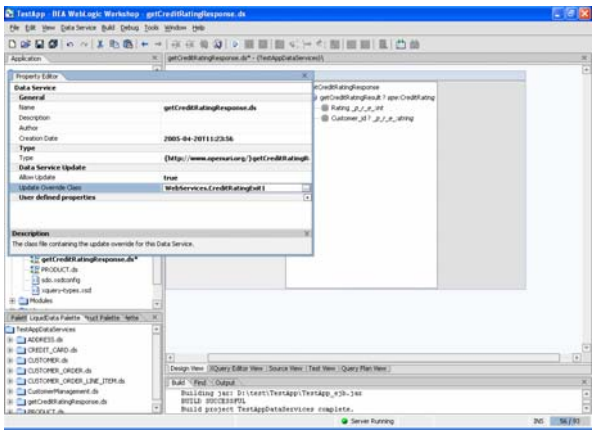


Figure 6-19 Selecting the Update Override Class

11. (*Optional*) Open the Output window to view the data sources used to generate the Test View results. You should see the following statement, which indicates that data was pulled from the invoked Web service:

    Note: To perform this step, you need to enable auditing in the DSP Console.

Figure 6-20 Viewing the Data Sources in the Output Window

Lesson Summary

In this lesson, you learned how to:

Import a Web service project, locate its WSDL, and use that WSDL to generate a data source.

Test the Web service by passing a SOAP request body as a query parameter.

Use a logical data service to invoke a Web service and retrieve data.

Lesson 7 Consuming Data Services Using Java

After a Data Services Platform (DSP) application is deployed to a WebLogic Server, clients can use it to access real-time data. DSP supports a services-oriented approach to data access, using several technologies:

Mediator API. The Java-based Mediator API instantiates DSP information as data objects, which are defined by the Service Data Objects (SDO) specification. *SDO* is a proposed standard that defines a language and architecture intended to simplify and unify the way applications handle data.

Data Services Workshop Control. The Data Services Workshop control is a wizard-generated Java file that exposes a user-specified data service function to WebLogic Workshop client applications (such as page flows, portals, or Web services). You can add functions to the control from data services deployed on any WebLogic server that is accessible to the client application, whether it is on the same WebLogic Server as the client application or on a remote WebLogic Server.

WSDL. WSDL-based Web services can act as wrappers for data services.

SQL. The Data Services Platform JDBC driver gives SQL clients (such as reporting and database tools) and JDBC applications a traditional, database-oriented view of the data layer. To users of the JDBC driver, the set of data served by DSP appears as a single virtual database, with each service appearing as a table.

In this lesson, you will enable DSP to consume data through the SDO Mediator API.

Objectives

After completing this lesson, you will be able to:

Use SDO in a Java application.

Invoke a data service function using the untyped SDO Mediator API interface.

Access data services from Java, using the typed SDO Mediator API.

Overview

SDO is a joint specification of BEA and IBM that defines a Java-based programming architecture and API for data access. A central goal of SDO is to provide client applications with a unified interface for accessing and updating data, regardless of its physical source or format.

SDO has similarities with other data access technologies, such as JDBC, Java Data Objects (JDO), and XMLBeans. However, what distinguishes SDO from other technologies is that SDO gives applications both static programming and a dynamic API for accessing data, along with a disconnected model for accessing externally persisted data. Disconnected data access means that when DSP gets data from a source, such as a database, it opens a connection to the source only long enough to retrieve the data. The connection is closed while the client operates on the data locally. When the client submits changes to apply to the source, the connection is reopened.

DSP implements the SDO specification as its client programming model. In concrete terms, this means that when a client application invokes a read function on a data service residing on a server, any data is returned as a *data object*. A data object is a fundamental component of the SDO programming model. It represents a unit of structured information, with static and dynamic interfaces for getting and setting its properties.

In addition to static calls, SDO, like RowSets in JDBC, has a dynamic Mediator API for accessing data through untyped calls (for example, getString("CUSTOMER_NAME")). An *untyped Mediator API* is useful if you do not know the data service to run at development time.

The Mediator API gives client applications full access to data services deployed on a WebLogic server. The application can invoke read functions, get the results as Service Data Objects, and pass changes back to the source. To use the Mediator API, a client program must first establish an initial context with the server that hosts the data services. The client can then invoke data service queries and operate on the results as Service Data Objects.

Lab 7.1 Running a Java Program Using the Untyped Mediator API

An untyped Mediator API is useful if, at development time, you do not know the data service to run.

Objectives

In this lab, you will:

Add a Java project to your application.

Add the method calls necessary to use the Mediator API.

Review the results in the Output window and a standalone Java application.

Instructions

1. Add a Java project to your application by completing the following steps:
   a. Right-click the Evaluation application folder.
   b. Select Import Project.
   c. Select Java Project.
   d. Click Browse and navigate to `<beahome>\weblogic81\samples\liquiddata\EvalGuide`.
   e. Select DataServiceClient, click Open, and then click Import.

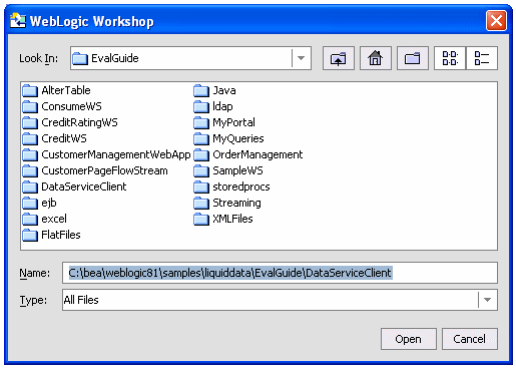


Figure 7-1 Importing Java Project

The Java project is added to the application, in the DataServiceClient folder. To use the Mediator API, you need to add the method calls to instantiate the data service, invoke the getCustomerProfile() method and assign the return value of the function to the CustomerProfileDocument SDO/XML bean.

2. Open the `DataServiceClient.java` file, located in the DataServiceClient folder.

3. Insert the method calls necessary to use the Mediator API, by completing the following steps:

Note: The `com.bea.ld.dsmediator.client` API has been deprecated for the Data Service and Data Service Factory functions. To work with Data Service and Data Service Factory functions, you may need to change the import statement in Source View to import the `com.bea.dsp.dsmediator.client.DataService` and `com.bea.dsp.dsmediator.client.DataServiceFactory` APIs.

a. Locate the main method. You will see a declaration of the data service, a String params [ ], plus the CustomerProfileDocument variable.

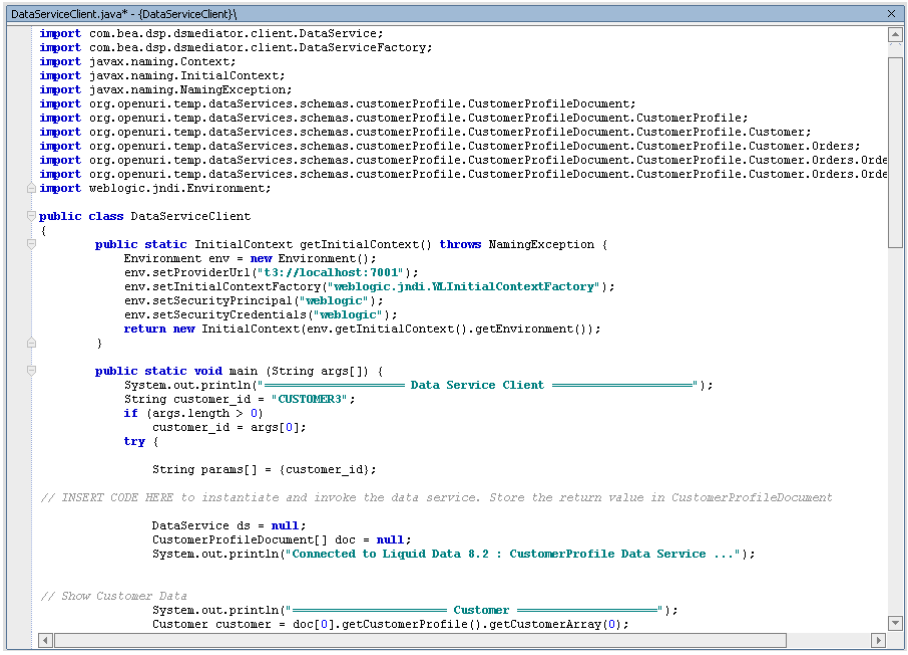


Figure 7-2 Java Source Code

b. Confirm that the String params [ ], which is an object array consisting of arguments to be passed to the function, is set as follows:

```
String params[] = {customer_id};
```

c. Construct a new data service instance, by modifying the DataService ds = null line. The Mediator API provides a class called DataServiceFactory, which can be used to construct the new data service instance. Using the newDataService method, you can pass in the initial JNDI context, the application name, and the data service name as parameters. For example:

```
DataService ds = DataServiceFactory.newDataService(
  getInitialContext(),                                    // Initial Context
  "Evaluation",                                           // Application Name
  "ld:DataServices/CustomerManagement/CustomerProfile" // Data Service Name
);
```

Note: You may need to remove "*" in the return type in the getCustomerProfile() function inside the CustomerProfile data service.

d. Invoke the data service, by modifying the CustomerProfileDocument doc = null line, as shown in the following code:

```
CustomerProfileDocument[] doc = (CustomerProfileDocument[])
ds.invoke("getCustomerProfile",params);
```

e. Specify the first element of the customer profile array by changing the following code:

```
Customer customer = doc.getCustomerProfile().getCustomerArray(0);
```

to

```
Customer customer = doc[0].getCustomerProfile().getCustomerArray(0);
```

Note: In AquaLogic Data Services Platform 2.1, the automatic creation of Arrayof functions has been deprecated. Ensure that you change the code line in the //Show Customer Data section as follows:

```
Customer customer = doc[0].getCustomerProfile().getCustomerArray(0);
```

f. Review the inserted code and verify that it is similar to that displayed in Figure 7-3.

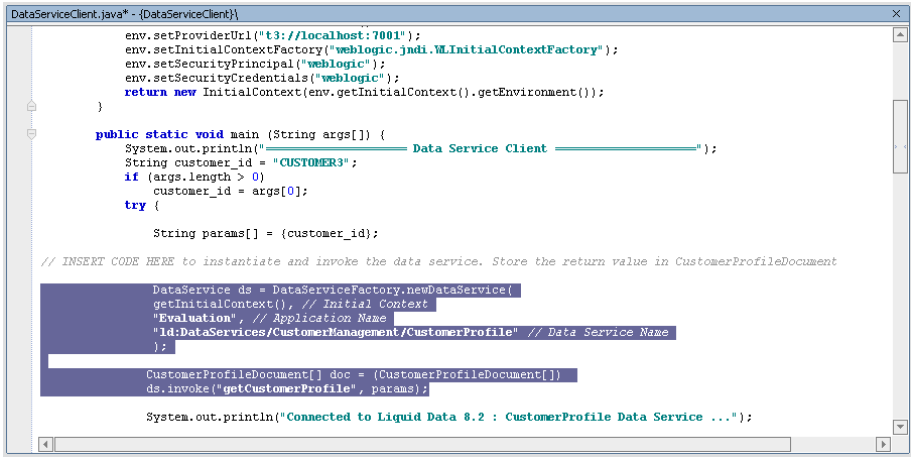


Figure 7-3 Untyped Mediator API Code Added

4. Review the code included in the //Show Customer Data and //Show Order Data sections. This code will be used to retrieve customer information, all orders of that customer (order ID, order date, and total amount) and the line items of each order (product ID, price and quantity). The code should be similar to that displayed in Figure 7-4.

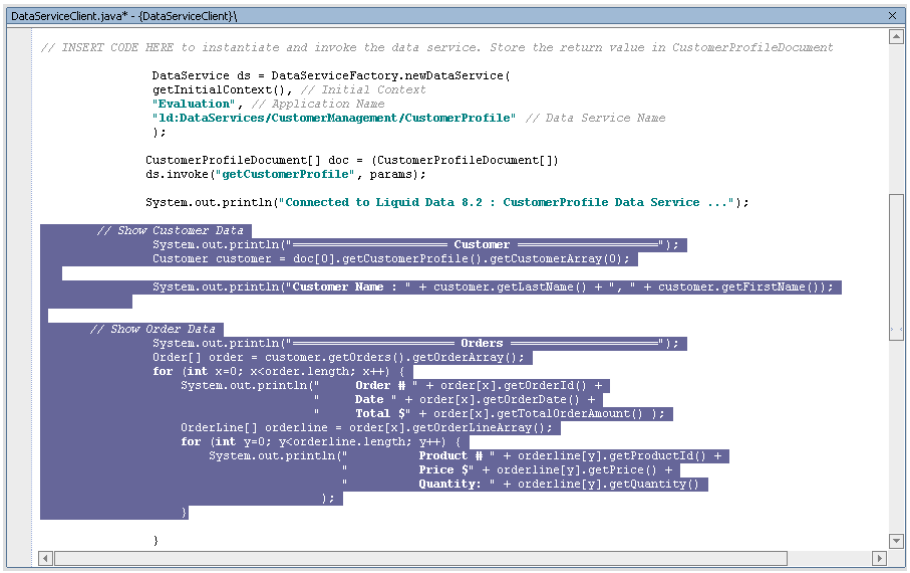


Figure 7-4 Customer and Order Code

5. Click the Start icon (or press Ctrl + F5) to compile your program (if a Confirmation message regarding debugging properties appears, then click OK). It may take a few moments to compile the program.

   Note: WebLogic Server must be running. Confirm that the program returns the specified results by viewing the results in the Output window (if the Output window is not open, choose View → Windows → Output).

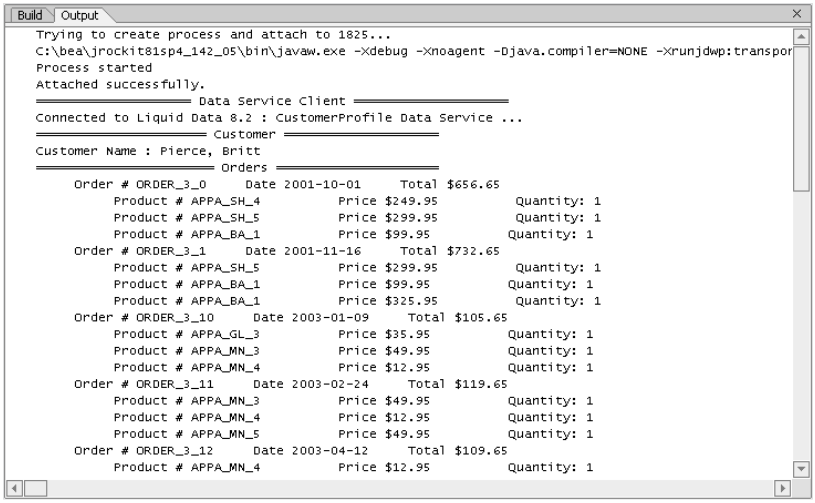


Figure 7-5 Results: Output Window

6. (*Optional*) View the results in a standalone Java environment of your choice.

   Note: To use the Mediator API outside of WebLogic Workshop, you need to add the following files to your classpath:

   WebLogic Libraries:

   ```
   %\bea\weblogic81\server\lib\weblogic.jar
   ```

   XML Bean:

   ```
   %\bea\weblogic81\server\lib\xbean.jar
   ```

CustomerProfile classes:

```
%\bea\user_projects\applications\Evaluation\APP-
INF\lib\DataServices.jar
```

DSP Server Libraries:

```
%\bea\weblogic81\liquiddata\lib\ld-server-core.jar
```

DSP Client Libraries (including Mediator API):

```
%\bea\weblogic81\liquiddata\lib\ld-client.jar
```

Service Data Object:

```
%\bea\weblogic81\liquiddata\lib\wlsdo.jar
```

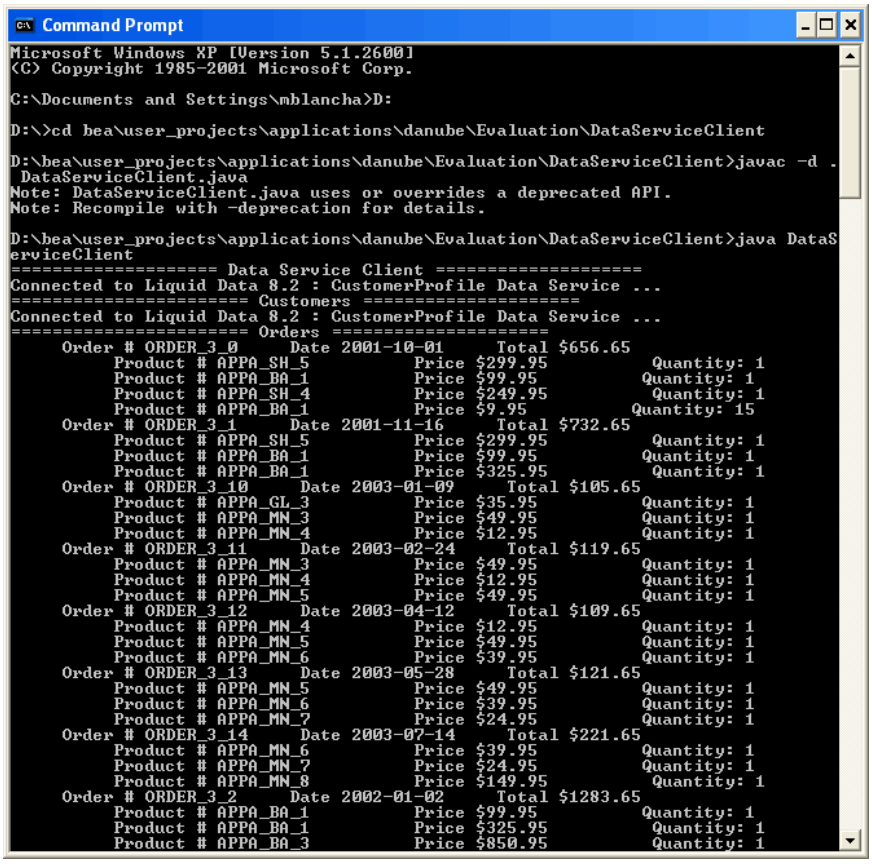


Figure 7-6 Results: Standalone Java Environment

Lab 7.2 Running a Java Program Using the Typed Mediator API

With the typed mediator interface, you instantiate a typed data service proxy in the client, instead of using the generic data service interface. The typed data service interface may be easier to program and it improves code readability.

In this lab, you will access data services from a Java client, using the typed SDO Mediator API. You will be provided with a generated API for your data service, which lets you directly invoke the actual functions as methods (for example, ds.getCustomerProfile(customer_id).

Objectives

In this lab, you will:

Build your application as an EAR file.

Build the SDO mediator client.

Add the SDO mediator client's generated JAR file to your libraries folder.

Construct a DataServices instance and invoke the data service.

View the results in the Output window.

View the results in a standalone Java application.

Instructions

1. Build your application as an EAR file by completing the following steps:

a. Choose Tools → Application Properties and click Build.

b. In the Project build order section, place DataServices as the first project.

c. Clear the Project: DataServiceClient checkbox, because this is not required for the EAR file.

d. Click OK.

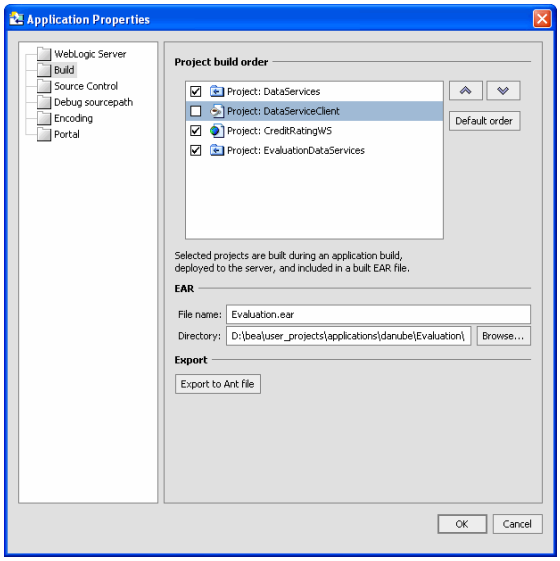


Figure 7-7 Project Build Order

2. Build the SDO Mediator Client, by completing the following steps:

a. Right-click the Evaluation application and select Build Application from the pop-up menu.

b. Right-click the Evaluation application again and select Build SDO Mediator Client. A message displays notifying you that an EAR file will be created.

c. Click Yes when asked whether you want to build an EAR file.

Note: This confirmation box appears only the first time you build the SDO Mediator Client. However, to ensure that the latest EAR file is used while building the SDO Mediator Client, you must build the EAR before you build the SDO Mediator Client.

d. Confirm that you see the following text in the Build window (if not open, choose View → Windows → Build):

```
Generating SDO client API jar...

clean:

de-ear:

build:

[delete] Deleting: C:\bea\user_projects\applications\Evaluation\Evaluation-ld-
client.jar

[mkdir] Created dir: C:\Documents and Settings\jsmith\Local Settings\Temp\wlw-
temp-53911\sdo_compile42918\client\src

[java] May 2, 2006 6:41:26 PM com.bea.ld.context.MetadataContext getRepositoryRoot

[java] INFO: 30 (ms)

[java] May 2, 2006 6:41:27 PM com.bea.ld.wrappers.ws.JAXRPCWebserviceAdapter
<clinit>

[java] WARNING: Unable to instantiate ServiceFactory. Please ensure that
javax.xml.rpc.ServiceFactory property has been properly set.

[mkdir] Created dir: C:\Documents and Settings\jsmith\Local Settings\Temp\wlw-
temp-53911\sdo_compile42918\client\classes

[javac] Compiling 12 source files to C:\Documents and Settings\jsmith\Local
Settings\Temp\wlw-temp-53911\sdo_compile42918\client\classes

[jar] Updating jar: C:\bea\user_projects\applications\Evaluation\Evaluation-ld-
client.jar

all:

Importing SDO client API jar into application...

SDO client API jar available as
C:\bea\user_projects\applications\Evaluation\Evaluation-ld-client.jar
```

Note: The drive information may be different for your application.

3. Construct a new data service instance and invoke the data service, by completing the following steps:

   a. Open the `DataServiceClient.java` file.

   b. Replace the declaration of the DataService and CustomerProfileDocument objects with the following (modified code is displayed in boldface type):

```
CustomerProfile ds = CustomerProfile.getInstance(
getInitialContext(),          // Initial Context
"Evaluation"                  // Application Name
);
CustomerProfileDocument[] doc = ds.getCustomerProfile(customer_id);
```

Note: In the case of typed mediator APIs, you specify whether you are retrieving a single object or an array based on the data service function declaration. In the preceding example, to retrieve a single object in the output, the `doc` object is used instead of `doc[0]`.

c. Click Alt + Enter and select dataservices.customermanagement.CustomerProfile. This imports the specified element.

d. Edit getInitialContext () to suit your environment. Typically no changes are needed when working through the tutorial on your local computer.

4. View the results in the Output window, by completing the following steps:

   a. Click the Start icon (or press Ctrl + F5) to compile your program.

   b. Click OK if a confirmation message asking if you would like to run DataServiceClient.

   c. Confirm that the program return the specified results by viewing the results in the Output window (if not open, choose View → Windows → Output).

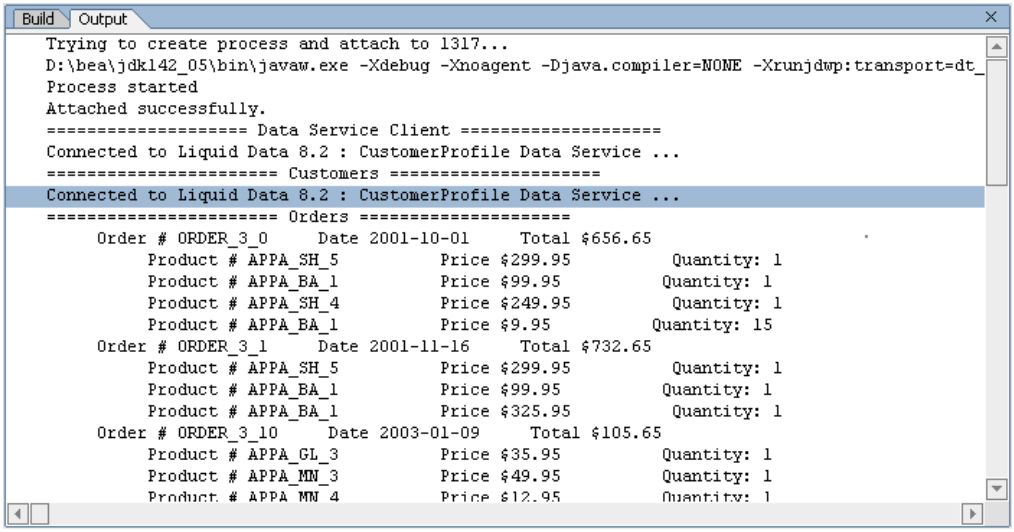


Figure 7-8 Results—Output Window

5. (*Optional*) Run your program in a standalone Java application to list customer orders. Note that you must add the generated file (the typed data-service proxy, Evaluation-ld-client.jar) to the classpath, along with the other libraries listed for Lab 7.1, (optional) step 7.

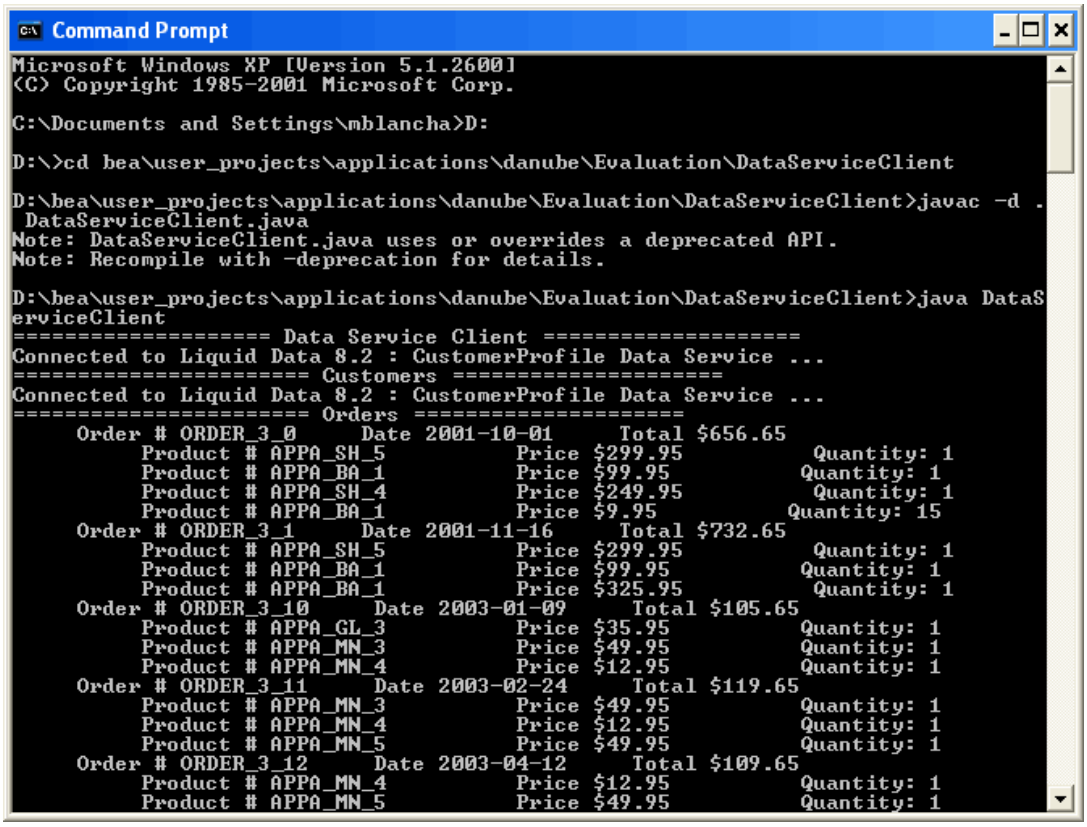


Figure 7-9 Results—Standalone Java Application

Lab 7.3 Resetting the Mediator API

After Lab 7.2, you must remove the `Evaluation_ld-client.jar` file from your Libraries folder because this JAR file will create inconsistencies in future lessons. You must also revert the method calls to use the Untyped Mediator API.

Objectives

In this lab, you will:

Remove the `Evaluation_ld-client.jar` file from the Libraries folder.

Revert the method calls to use the untyped Mediator API.

Instructions

1. Delete the `Evaluation-ld-client.jar` file by completing the following steps:
    a. Expand the Libraries folder.
    b. Right-click the `Evaluation-ld-client.jar` file.
    c. Choose Delete from the pop-up menu.
    d. Click Yes, when the confirmation message displays.
2. Revert the method calls to use the untyped mediator API, by completing the following steps:
    a. Open the `DataServiceClient.java` file.

b. Replace the declaration of the `DataService` and `CustomerProfileDocument` objects with the following (modified code is displayed in bold):

```
DataService ds = DataServiceFactory.newDataService(
getInitialContext(),                                    // Initial Context
"Evaluation",                                           // Application Name
"ld:DataServices/CustomerManagement/CustomerProfile"    // Data Service Name
);
CustomerProfileDocument[] doc = (CustomerProfileDocument[])
ds.invoke("getCustomerProfile", params);;
System.out.println("Connected to Liquid Data 8.2 : CustomerProfile Data Service
...");
```

Note: If your application name is different from Evaluation, locate "Evaluation" in the newDataService() call and rename it to reflect the name of your application.

c. Remove the import CustomerProfile statement.

d. Save your work.

Lesson Summary

In this lesson, you learned how to:

Set the classpath environment to use the SDO Mediator API.

Use the untyped and typed SDO Mediator API to access data services from Java.

Generate the specific client-side Mediator API for your data service.

Lesson 8 Consuming Data Services Using WebLogic Workshop Data Service Controls

A Data Service control provides WebLogic Workshop applications with easy access to data service functions.

Objectives

After completing this lesson, you will be able to:

Install the Data Service Control in your application.

Create a Java page flow (`.jpf`) Web application file, using WebLogic Workshop.

Overview

A convenient way to quickly access DSP from a WebLogic Workshop application, such as page flows, process definitions, portals, or Web services, is through the Data Service control.

The Data Service control is a wizard-generated Java file that exposes to WebLogic Workshop client applications only those data service function that you choose. You can add functions to a control from data services deployed on any WebLogic Server that is accessible to the client application, whether it is on the same WebLogic Server as the client application or on a remote WebLogic Server.

If accessing data services on a remote server, information regarding the information that the service functions return (in the form of XML schema files) are first downloaded from the remote server into the current application. The schema files are placed in a schema project named after the remote application. The directory structure within the project mirrors the directory structure of the remote server.

When you create a Data Service control, WebLogic Workshop generates interface files for the target schemas associated with the queries and then a Java Control Extension (.jcx) file. The .jcx file contains the methods included from the data services when the control was created and a commented method that, when uncommented, allows you to pass any XQuery statement to the server in the form of an ad-hoc query.

Lab 8.1 Installing a Data Service Control

Data Service controls let you easily access data from page flows, process definitions, portals, or Web services.

Objectives

In this lab, you will:

Import a Web project that will be used to demonstrate Data Service control capabilities.

Install a Data Service control.

Instructions

1. Right-click the Evaluation application folder.
2. Choose Import Project.

3. Choose Web Project.
4. Navigate to `<beahome>\weblogic81\samples\LiquidData\EvalGuide`.
5. Select the CustomerManagementWebApp project and click Open.
6. Click Import, and then click Yes when asked whether you want to install project files.
7. Right-click the Evaluation application folder.
8. Choose Install → Controls → Data Service.

   Note: The Data Service option will not display if you previously installed a Data Service control.
9. Expand the Libraries folder and confirm that the `LiquidDataControl.jar` file is installed.

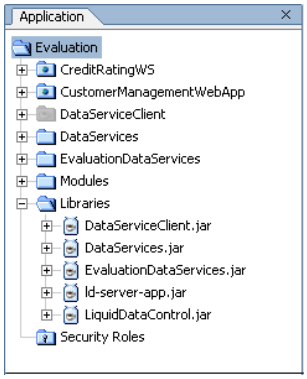


Figure 8-1 Data Service Control

Lab 8.2 Defining the Data Service Control

1. Create a new folder in the CustomerManagementWebApp Web project, and name it *controls*.
2. Define a new Java control as a Data Service control by completing the following steps:

a. Right-click the controls folder.

b. Choose New → Java Control.

c. Select Data Service.

d. Enter CustomerData in the File name field.

e. Click Next.

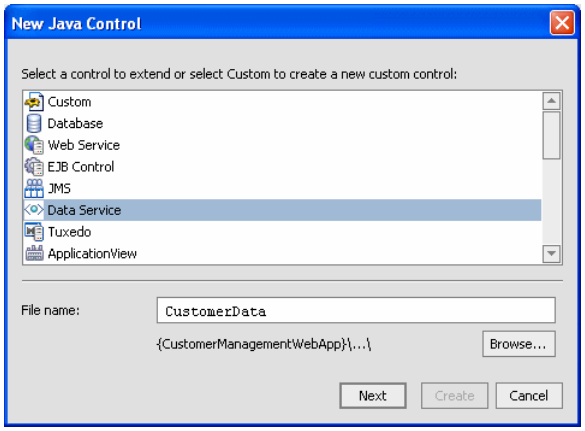


Figure 8-2 Creating a New Java Control

f. In the New Java Control – Data Service dialog box, click Create.

Note: Do not change any default settings.

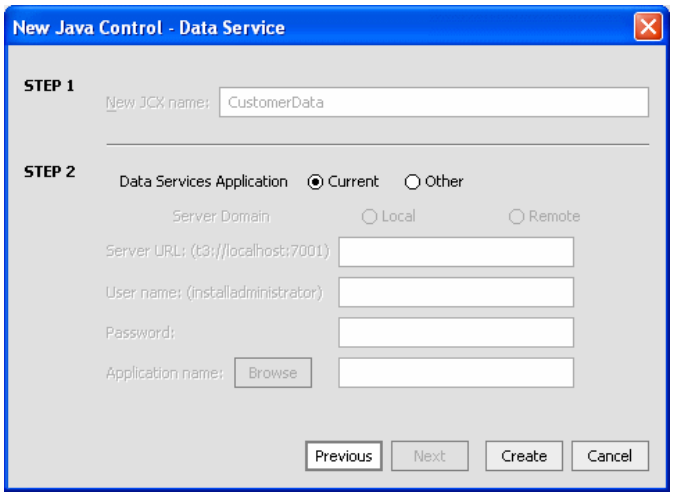


Figure 8-3 Creating a New Data Service Control

g. In the Select Data Service Functions box, expand the CustomerManagement and then the CustomerProfile.ds folders.

h. Select getCustomerProfile().

i. Press Ctrl.

j. Select submitCustomerProfile().

k. Click Add and then click Finish.

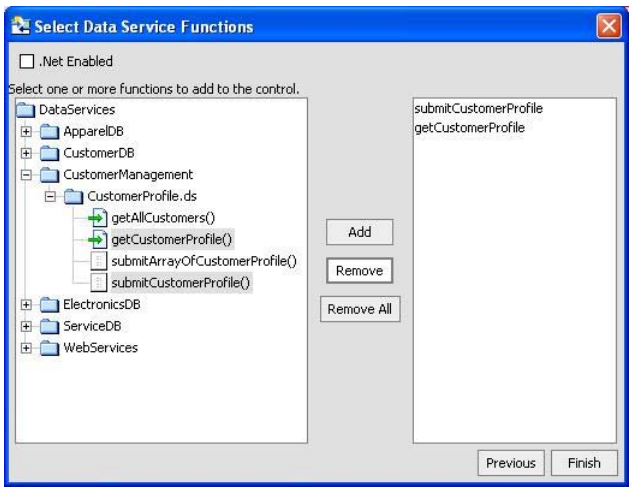


Figure 8-4 Selecting Functions for the Data Service Control

It will take a few moments for the project to compile. After compilation, you should see a Java-based Data Service Control called `CustomerData.jcx`, with the following signatures:

getCustomerProfile() is a data service read function.

submitCustomerProfile() is a submit function for all the changes (inserts, updates, and deletes) done to the customer profile and persisting the data to the data sources involved.

Note: You can use the data service control that you define as any WebLogic Workshop control in a workflow, a JPF, or a portal.

Lesson Summary

In this lesson, you learned how to:

Install the Data Service Control in your application.

Create a Data Service Control for a Web project, and then add functions from your data service into the Data Service Control.

Lesson 9 Accessing Data Service Functions Through Web Services

A Data Service Control can be used to access data through a page flow, Web service, or business logic. In the previous lesson, you created a Data Service Control and used it within a Web application's page flow. In this lesson, you will use that same Data Service Control to generate a .wsdl for a Web service that can invoke data service functions.

Objectives

After completing this lesson, you will be able to:

Use a Data Service Control to generate a Web service for a data service.

Test the generated Web service and invoke data service functions through the Web service interface.

Generate a .wsdl file for Web service clients.

Overview

A Web service is a set of functions packaged into a single entity that is available to other systems on a network. The network can be a corporate intranet or the Internet. Other systems can call these functions to request data or perform an operation.

Web services are a useful way to provide data to an array of consumers over the Internet, like stock quotes and weather reports. But they take on a new power in the enterprise, where they offer a flexible solution for integrating distributed systems, whether legacy systems or new technology.

Lab 9.1 Generating a Web Service from a Data Service Control

In the previous lesson, you created a Data Service Control, which enabled WebLogic Workshop to generate a Java Control Extension (.jcx) file. This file contains the underlying data service's method calls. In this lab, you will use that Data Service Control to generate a Web service.

Objectives

In this lab, you will:

Generate a stateless Web service interface, through which you can access the Data Service Control.

Test the Web service to determine that it returns customer profile and order information.

Instructions

1. Expand the CustomerManagementWebApp and controls folders.
2. Right-click the CustomerData.jcx control.
3. Choose Generate Test JWS (Stateless). A new file, CustomerDataTest.jws, is generated. With this Java Web Service (.jws) file, the Data Service Control methods are now available through a Web service interface.

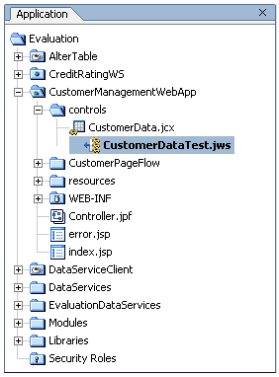


Figure 9-1 Java Web Service File

4. Open the CustomerDataTest.jws file in Source View.
5. Click the Start icon (or press Ctrl+F5). Workshop Test Browser opens.
6. Enter CUSTOMER3 in the string CUSTOMER ID field.

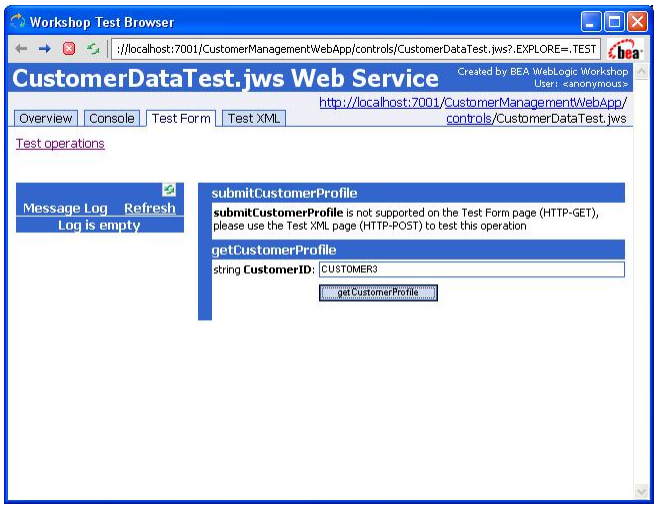


Figure 9-2 Workshop Test Browser: Web Service

7. Click getCustomerProfile. The customer profile and order information for Customer 3 is retrieved.
8. View both the "Returned from" and "Service Response" results, which should be similar to that displayed in Figure 9-3.

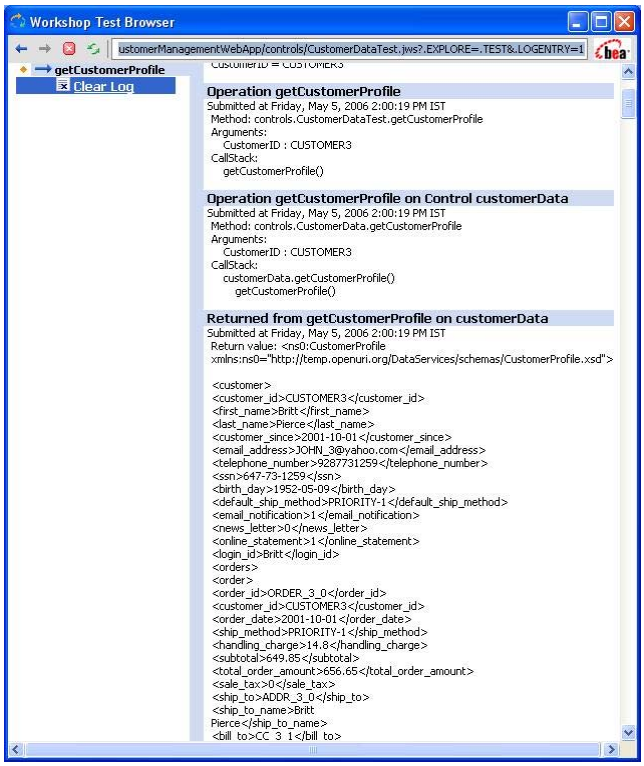


Figure 9-3 Web Service Test Results

9. Close Workshop Test Browser.

Lab 9.2 Using a Data Service Control to Generate a WSDL for a Web Service

You can use the Java Web Service file to generate a WSDL. A WSDL file contains all of the information necessary for a client to invoke the methods of a Web service:

The data types used as method parameters or return values.

The individual methods names and signatures (WSDL refers to methods as *operations)*.

The protocols and message formats allowed for each method.

The URLs used to access the Web service.

Objectives

In this lab, you will:

Generate a .wsdl file, based on the Data Service Control.

(*Optional*) View the .wsdl file's structure and source code.

Instructions

1. Right-click the CustomerDataTest.jws control.
2. Choose Generate WSDL File. The CustomerDataTestContract.wsdl is generated, which can be used by other Web service clients.

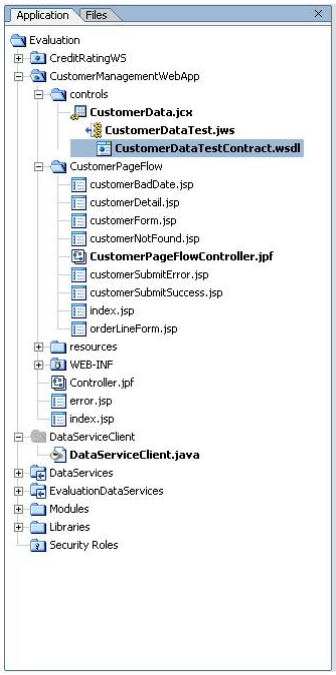


Figure 9-4 New WSDL File

3. (*Optional*) Open the CustomerDataTestContract.wsdl file and explore the document structure and source code.

Figure 9-5 Document Structure

Lesson Summary

In this lesson, you learned how to:

- Use a Data Service Control to generate a Web service for a data service.
- Test the generated Web service and invoke data service functions through the Web service interface.
- Generate a .wsdl file for Web service clients.

Lesson 10 Updating Data Services Using Java

One of the features introduced with Data Services Platform (DSP) is the ability to write data back to the underlying data sources. This write service is built on top of the Service Data Object (SDO) specification, and provides the ability to update, insert, and delete results returned by a data service. It also provides the ability to submit all changes to the SDO (inserts, deletes, and updates) to the underlying data sources for persisting.

Objectives

After completing this lesson, you will be able to:

Update, add to, and delete data from data service objects.

Submit changes to the underlying data sources, using the Mediator API.

Overview

When you update, add, or delete from data service objects, all changes are logged in the SDO's change summary. When the change is submitted, items indicated in the Change Summary log are applied in a transactionally-safe manner, and then persisted to the underlying data source. Changes to relational data sources are automatically applied, while changes to other data services, such as Web services and portals, are applied using a DSP update framework.

Lab 10.1 Modifying and Saving Changes to the Underlying Data Source

Although the steps in the next three labs are different, the underlying principle is the same: When you update, add, or delete from data service objects, all changes are logged in the SDO's change summary. When the change is submitted, items indicated in the Change Summary log are applied in a transactionally-safe manner, and then persisted to the underlying data source. Changes to relational data sources are automatically applied, while changes to other data services, such as Web services and portals, are applied using a DSP update framework.

Objectives

In this lab, you will:

Modify customer data and save the changes to the SDO Change Summary log.

View the results in the Output window.

Invoke the submit() method of the Mediator API to save the changes to the underlying data source.

Verify the results in Test View.

Instructions

1. Open the `DataServiceClient.java` file, located in the DataServiceClient project folder.
2. Change the first and last name of CUSTOMER3 from Brett Pierce to Joe Smith, by using the set() methods of the Customer data object instance. You do this by adding the set() method to the //Show Customer Data section (new code is displayed in boldface type):

```
Customer customer = doc[0].getCustomerProfile().getCustomerArray(0);
     customer.setLastName("Smith");
     customer.setFirstName("Joe");
System.out.println("Customer Name : " + customer.getLastName() +
", " + customer.getFirstName());
```

Note: The Arrayof function has been deprecated. Ensure that you modify `doc.getCustomerProfile().getCustomerArray(0)` to `doc[0].getCustomerProfile().getCustomerArray(0)`:

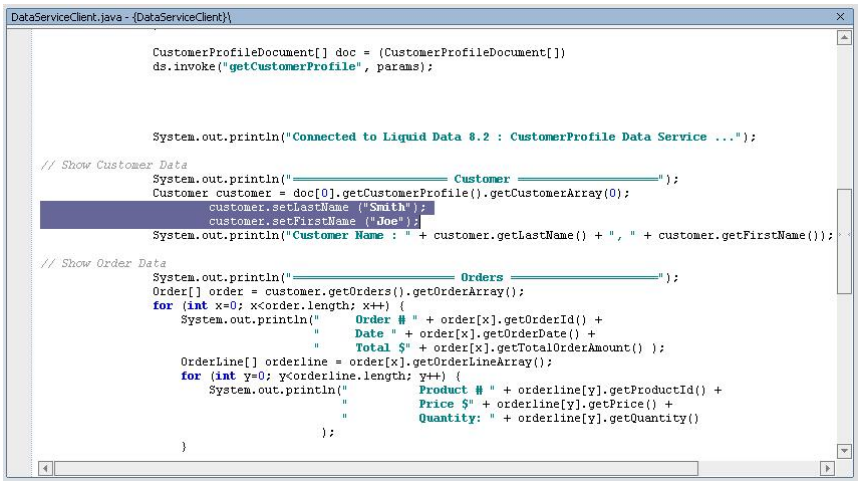


Figure 10-1set() Method Specified

3. Save your work.
4. Right-click the DataServiceClient project folder and choose Build DataServiceClient.
5. Click the `DataServiceClient.java` file's Start icon (or press Ctrl + F5).
6. Confirm that the changes were submitted, by viewing the results in the Output window. (If the window is not open, choose View → Windows → Output.)

Note: At this point, the changes only exist as entries in the SDO Change Summary Log, not in the data source. You must complete the remaining steps in this lab to ensure that the underlying data source is updated.

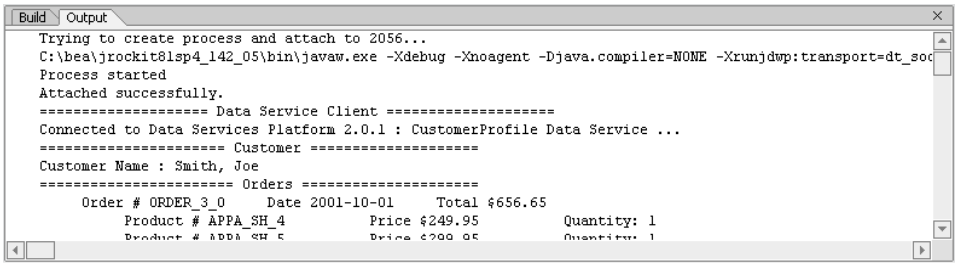


Figure 10-2 Change Results in Output Window

7. Invoke the Mediator API's submit() method and save the changes to the data source, by using the data service instance. The submit() method takes two parameters: the document to submit and the data service name. You do this by adding the following code into the //Show Customer Data section of the file:

```
ds.submit(doc);
```

8. Change the output code, as follows:

```
System.out.println("Change Submitted");
```

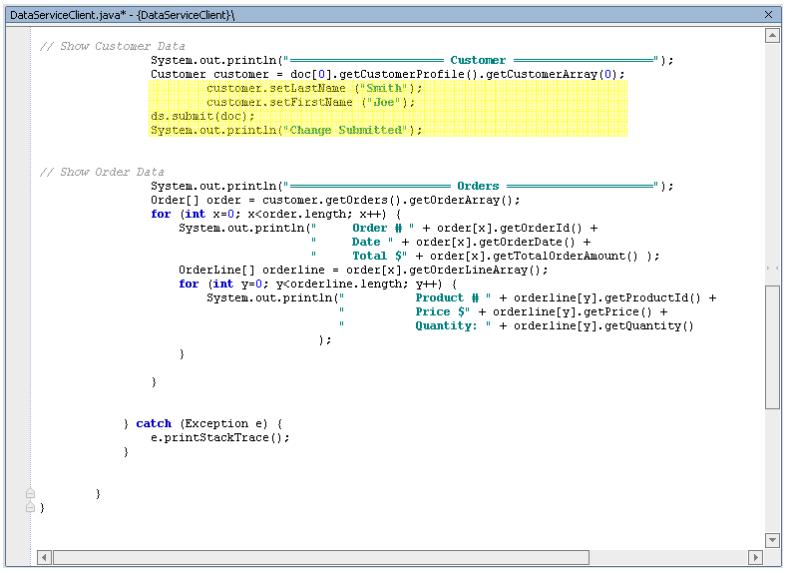


Figure 10-3 submit() and Output Method Specified

9. Open `DataServices\CustomerManagement\ CustomerProfile.ds` in TestView.
10. Enter CUSTOMER3 in the xs:string CustomerID field.
11. Click Execute. The result should change the customer name to Smith Joe.

Lab 10.2 Inserting New Data to the Underlying Data Source Using Java

You can use the Mediator API to add new information to the underlying data source, thereby reducing the need to know a variety of data source APIs.

Objectives

In this lab, you will:

Add new data and save the changes to the SDO Change Summary log.

Invoke the submit() method of the Mediator API to save the changes to the underlying data source.

Verify the results in Test View.

Instructions

1. In WebLogic Workshop open the `DataServiceClient.java` file.
2. Add a new item to ORDER_3_0 (the first order placed by CUSTOMER3), by using the addNewOrderLine()method of the Order Item data object instance. You do this by inserting the following code into the //Show Customer Data section, after System.out.println("Change Submitted"):

```
// Get the order
      Order myorder = customer.getOrders().getOrderArray(0);
// Create a new order item
      OrderLine newitem = myorder.addNewOrderLine();
```

3. Set the values of the new order item, including values for all required columns. (You can check the physical or logical `.xsd` file to determine what elements are required.) All foreign keys must be valid; therefore, use APPA_GL_3 as the Product ID.

   You do not need to setOrderID(); the SDO update will automatically set the foreign key to match its parent because the item will be added as a child of ORDER_3_0.

   To set the values, insert the following code above the //Show Order Data section of the Java file:

```
// Fill the values of the new order item
      newitem.setLineId("8");
      newitem.setProductId("APPA_GL_3");
      newitem.setProduct("Shirt");
      newitem.setQuantity(new BigDecimal(10));
      newitem.setPrice(new BigDecimal(10));
      newitem.setStatus("OPEN");
```

4. Press Alt + Enter to enable java.math.BigDecimal.
5. Invoke the Mediator API's submit method and save the changes to the data source, by using the data service instance. (The submit() method takes: the document to submit as a parameter)

   You do this by inserting the following code before the //Show Order Data section of the java file:

```
// Submit new order item
      ds.submit(doc, "ld:DataServices/CustomerManagement/CustomerProfile.ds");
      System.out.println("Change Submitted");
```

6. Comment out the code where customer first name and last name were set, including call to submit method
7. Confirm that the //Show Customer Data section of your java file is as displayed in Figure 10-4.

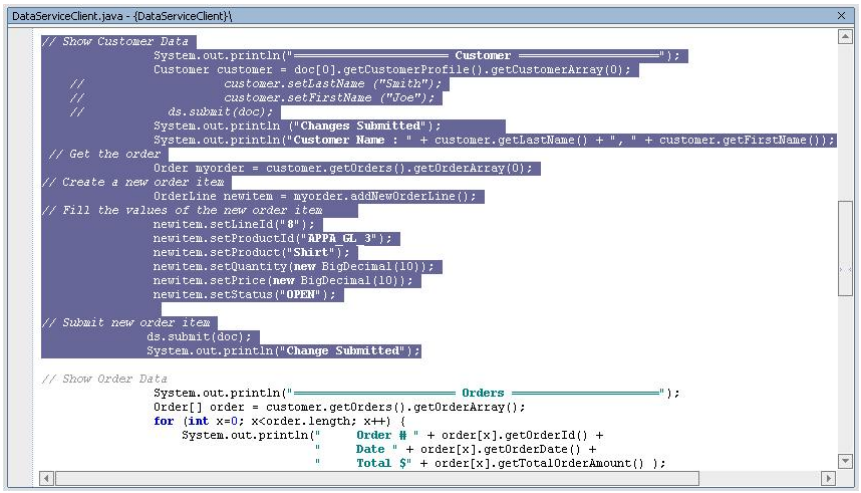


Figure 10-4Java Code to Add Line Item

8. Open `DataServices\CustomerManagement\ CustomerProfile.ds` in TestView.
9. Enter CUSTOMER3 in the xs:string CustomerID field.
10. Click Execute. The result should contain the new order information.

Lab 10.3 Deleting Data from the Underlying Data Source Using Java

You can use the Mediator API to delete information to the underlying data source, thereby reducing the need to know a variety of data source APIs.

Objectives

In this lab, you will:

Delete data and save the changes to the SDO Change Summary log.

Invoke the submit() method of the Mediator API to save the changes to the underlying data source.

Verify the results in Test View.

Instructions

1. In Workshop Test Browser, determine the new item's placement in the array and subtract 1. For example, if line item with line_id = 8 is the fifth item for ORDER_3_0, its order placement is 4.
2. Close Workshop Test Browser.
3. In the `DataServicesClient.java` file delete or comment out the code that added a new order line item.
4. Add an instance of the item that you want to delete, by inserting the following code file:

```
// Get the order item
     OrderLine myItem = customer.getOrders().getOrderArray(0).getOrderLineArray(4);
```

   Note: The getOrderLineArray() is based on the item's placement in the array. In this case, 8 is the fifth item, making the variable 4. You should use the variable that is correct for your situation.

5. Call the delete method by inserting the following code:

```
 // Delete the order item
```

```
myItem.delete();
```

6. Submit the changes, using the Mediator API's submit() method.

```
// Submit delete order item
        " ds.submit(doc,);
        System.out.println("Change Submitted");
```

7. Confirm that the code is as displayed in Figure 10-5.

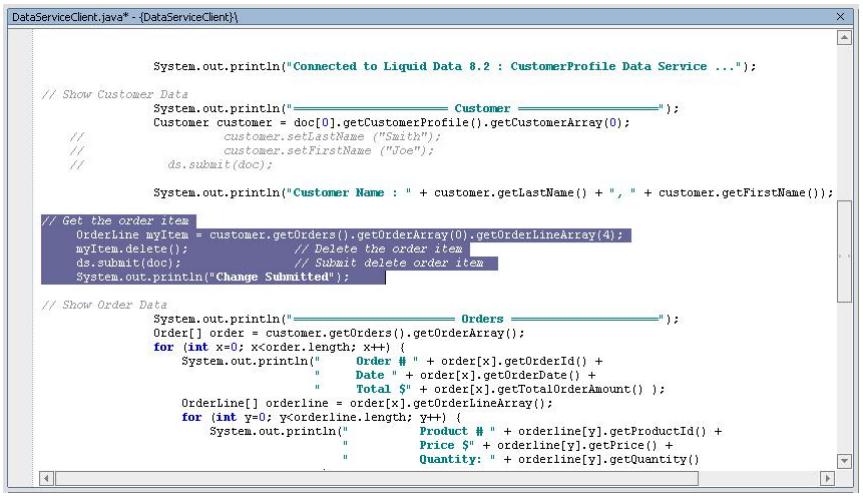


Figure 10-5 Java Code to Delete Line Item

8. Build the DataServiceClient project.
9. Open `DataServices\CustomerManagement\ CustomerProfile.ds` in TestView.
10. Enter CUSTOMER3 in the xs:string CustomerID field.
11. Click Execute. Note that the fourth order item has been deleted.

Lesson Summary

In this lesson, you learned how to:

Update, add to, and delete data from data service objects.

Submit changes to the underlying data sources, using the Mediator API.

Lesson 11 Filtering, Sorting, and Truncating XML Data

When designing your data service, you can specify read functions that filter data service return values. However, instead of trying to create a read function for every possible client requirement, you can create generalized read functions to which client applications can apply custom filtering or ordering criteria at runtime.

Objectives

After completing this lesson, you will be able to:

Use the FilterXQuery class to create dynamic filter, sort, and truncate data service results.

Apply the FilterXQuery class to a data service, using the Mediator API or Data Service Control.

Overview

Data users often want to access information in ways that are not anticipated in the design of a data service. The filtering and ordering API allow client applications to control what data is returned by a data service read function call based on conditions specified at runtime.

Although you can specify read functions that filter data service return values, it may be difficult to anticipate all the ways that client applications may want to filter return values. To deal with this contingency, DSP lets client applications specify dynamic filtering, sorting, and truncating criteria against the data service. These criteria are evaluated on the Server, before being transmitted on the network, thereby reducing the data set results to items matching the criteria. Where possible, these instances are "pushed down" to the underlying data source, thereby reducing the data set returned to the user.

The advantage of the FilterXQuery class is that you can define client-side filtering operations, without modifying or re-deploying your data services.

Lab 11.1 Filtering Data Service Results

With the FilterXQuery class addFilter() method, filtering criteria are specified as Boolean condition statements (for example, ORDER_AMOUNT > 1000). Only items that meet the condition are included in the return set.

The addFilter() method also lets you create compound filters that provide significant flexibility, given the hierarchical structure of the data service return type. In other words, given a condition on a nested element, compound filters let you control the effects of the condition in relation to the parent element.

For example, consider a multi-level data hierarchy for CUSTOMERS/CUSTOMER/ORDER, in which CUSTOMERS is the top level document element, and CUSTOMER and ORDER are sequences within CUSTOMERS and CUSTOMER respectively. Finally, ORDER_AMOUNT is an element within ORDER.

An ORDER_AMOUNT condition (for example, CUSTOMER/ORDER/ORDER_AMOUNT > 1000) can affect what values are returned in several ways:

It can cause all CUSTOMER objects to be returned, but filter ORDERS that have an amount less than 1000.

It can cause only CUSTOMER objects to be returned that have at least one large order. All ORDER objects are returned for every CUSTOMER.

It can cause only CUSTOMER objects to be returned that have at least one large order along with only large ORDER objects.

It can cause only CUSTOMER objects to be returned for which every ORDER is greater than 1000.

Instead of writing XQuery functions for each case, you just pass the filter object as a parameter when executing a data service function, either using the Data Service Control or Mediator API.

Objectives

In this lab, you will:

Import the FilterXQuery class, which enables filtering, truncating, and sorting of data.

Add a condition filter.

View the results through the Mediator API.

Instructions

1. Open the `DataServiceClient.java` file.
2. Delete the code that removed the line item with line_id = 8 order item delete code.
3. Delete the invoke and println code from the //Insert Code section:

```
CustomerProfileDocument[] doc = (CustomerProfileDocument[])
ds.invoke("getCustomerProfile",params);

System.out.println("Connected to Liquid Data 8.2 : CustomerProfile
Data Service ...");
```

4. Import the FilterXQuery class by adding the following code:

```
import com.bea.ld.filter.FilterXQuery;
```

5. Create a filter instance of the FilterXQuery, plus specify a condition to filter orders greater than $1,000, by adding the following code:

```
//Create a filter and condition
    FilterXQuery filter = new FilterXQuery();
    filter.addFilter(
    "CustomerProfile/customer/orders/order",
    "CustomerProfile/customer/orders/order/total_order_amount",
    ">", "1000");
```

6. Apply the filter to the data service, by adding the following code:

```
// Apply the filter


    RequestConfig config = new RequestConfig();
     config.setFilter(filter);
     CustomerProfileDocument doc[] = (CustomerProfileDocument[])
ds.invoke("getCustomerProfile",params, config);
```

7. Change the //Show Customer Data code so that it is as follows:

```
// Show Customer Data

    System.out.println("======================== Customers ====================");

    Customer customer = doc[0].getCustomerProfile().getCustomerArray(0);

    System.out.println("Connected to Liquid Data 8.2 : CustomerProfile Data
Service ...");
```

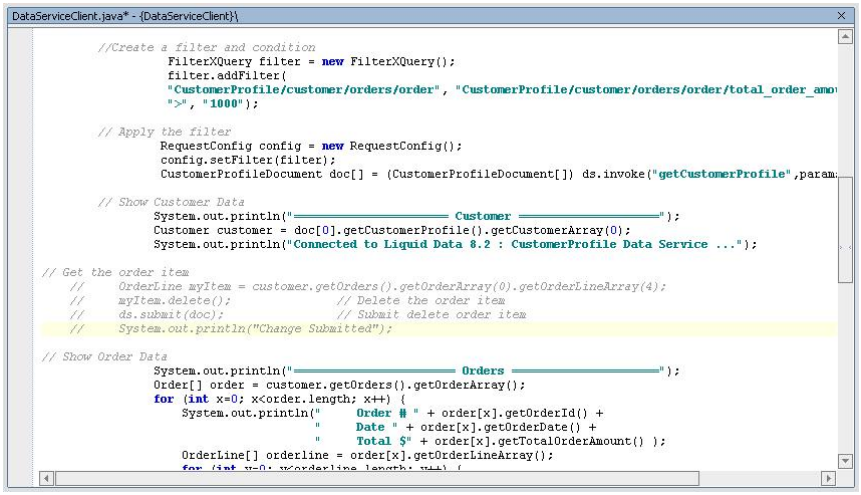


Figure 11-1 Filter Code

8. Click the `DataServiceClient.java` file's Start icon (or press Ctrl + F5).
9. Use the Mediator API to view the results in the Output window and/or a standalone Java environment. The return results should be similar to those displayed in Figure 11-2.

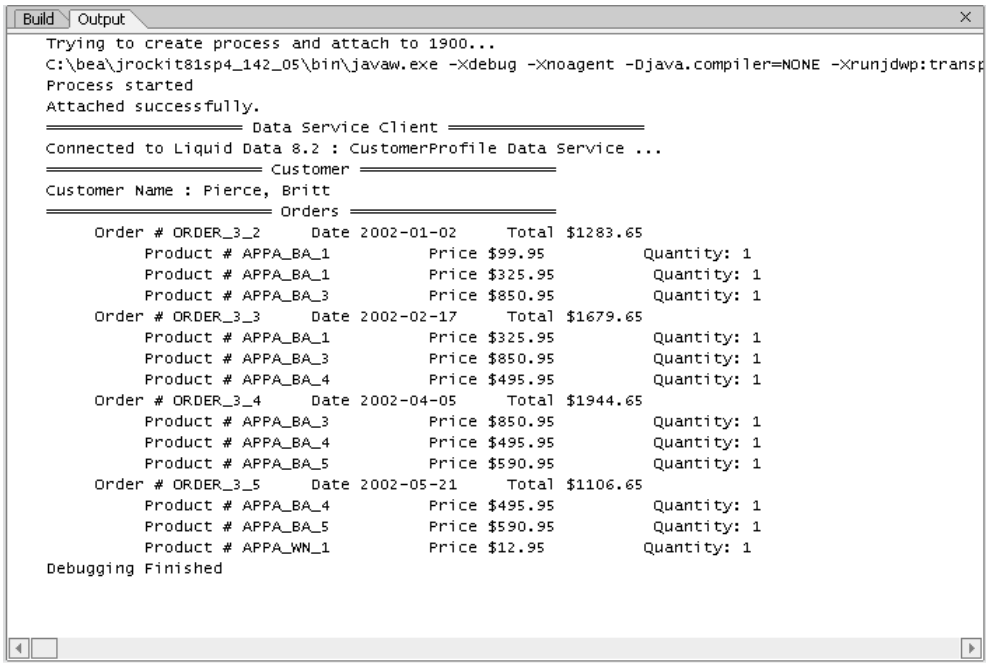


Figure 11-2 Filtered Data Results

Lab 11.2 Sorting Data Service Results

With the FilterXQuery class sortfilter.addOrderBy() method, you can specify criteria for organizing the data service return results. For example, to sort the order amount results in ascending order, you would use a sort condition similar to the following:

```
("CustomerProfile/customer/orders/order","total_order_amount",
    FilterXQuery.ASCENDING);
```

Objectives

In this lab, you will:

Add a sort condition.

View the results using the Mediator API.

Instructions

1. Open the `DataServiceClient.java` file.
2. Create a sort instance of the FilterXQuery, by adding the following code before the //Apply Filter section:

```
// Create a sort
    FilterXQuery sortfilter = new FilterXQuery();
```

3. Add a sort condition, using the addOrderBy() method, to sort orders based on total_order_amount (ascending) as shown:

```
    sortfilter.addOrderBy(
        "CustomerProfile/customer/orders/order",
        "total_order_amount",
     FilterXQuery.ASCENDING);
```

4. Apply the sort filter to the data service by adding the following code:

```
// Apply the sort
    filter.setOrderByList(sortfilter.getOrderByList());
```

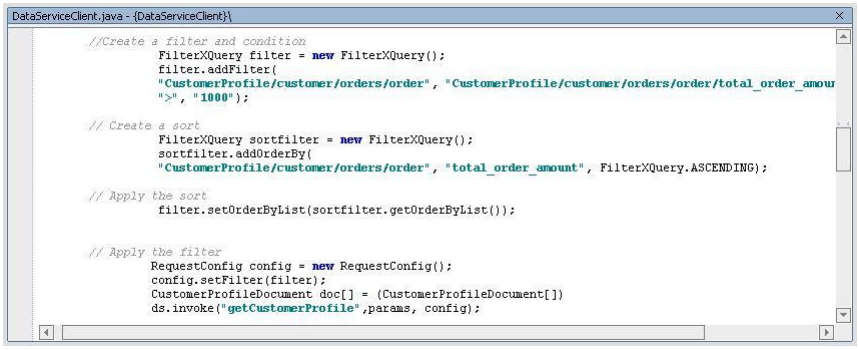


Figure 11-3Sort Code

5. Click the Start icon (or press Ctrl + F5) for the `DataServiceClient.java` file.

6. Use the Mediator API to view the results in the Output window and/or a standalone Java environment. The data results should be similar to those displayed in Figure 11-4.

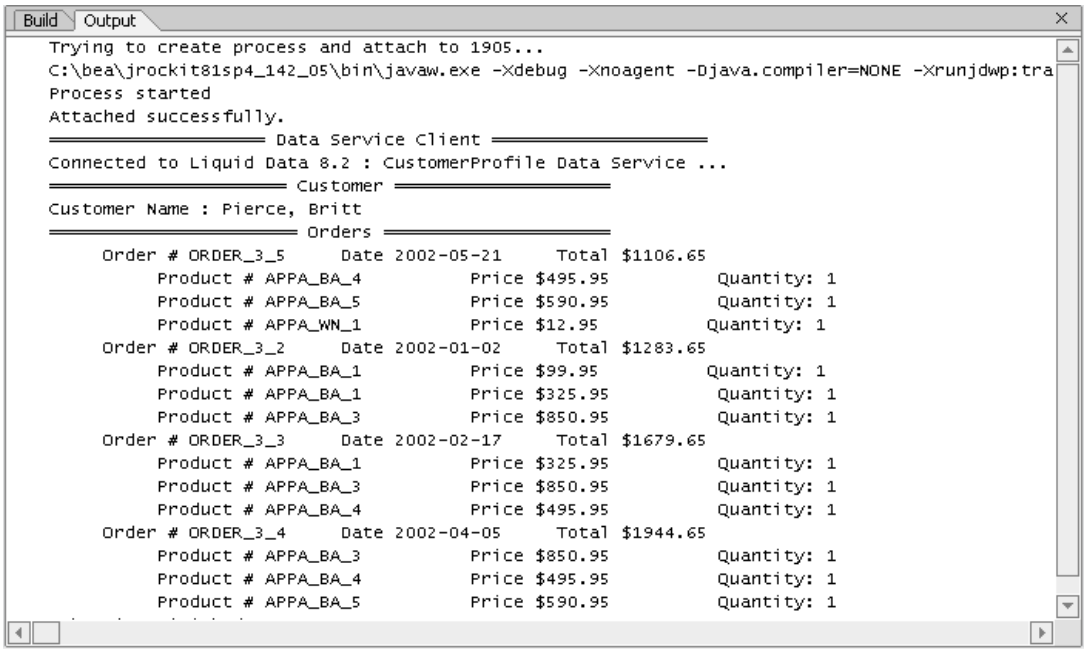


Figure 11-4 Filtered and Sorted Data Results

Lab 11.3 Truncating Data Service Results

The FilterXQuery class also provides the filter.setLimit() method, which lets you limit the number of return results. For example, to limit the return results to two line items, you would use a truncate condition similar to the following:

```
("CustomerProfile/customer/orders/order/order_line","2");
```

The filter.setLimit method is based on the following:

```
public void setLimit(java.lang.String appliesTo, String max)
```

Objectives

In this lab, you will:

Truncate the data result set.

View the results using the Mediator API.

Instructions

1. Open the `DataServiceClient.java` file.
2. Add a truncate condition, using the setLimit() method to limit the result set to a maximum of two order lines for each order, as shown:

```
// Truncate result set
    filter.setLimit("CustomerProfile/customer/orders/order/order_line","2");
```

Figure 11-5 Truncate Code

3. Click the Start icon (or press Ctrl + F5) for the `DataServiceClient.java` file.
4. Use the Mediator API to view the results in the Output window and/or a standalone Java environment. The data results should be similar to those displayed in Figure 11-6.

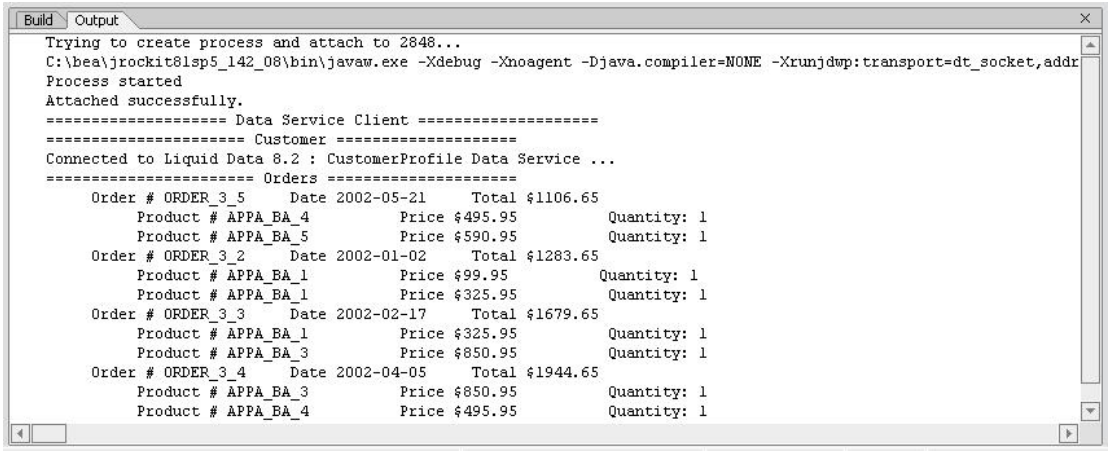


Figure 11-6 Truncated Result Set

Lesson Summary

In this lesson, you learned how to:

Use the FilterXQuery class to filter, sort, and truncate data service results.

Apply the FilterXQuery class to a data service, using the Mediator API or Data Service Control.

Lesson 12 Consuming Data Services through JDBC/SQL

Data Services Platform JDBC driver gives JDBC clients read-only access to the information supplied by data services. With the Data Services Platform JDBC driver, DSP acts as a virtual database. The driver allows you to invoke data service functions from any JDBC client, from custom Java applications to database, and from reporting tools, including Crystal Reports.

Objectives

After completing this lesson, you will be able to:

Access DSP via JDBC.

Integrate a Crystal Report file, populated by DSP, into your Web application.

Overview

Data services built into DSP can be accessed using a Data Services Platform JDBC driver, which provides access to the DSP-enabled Server via JDBC APIs. With this functionality, JDBC clients—including business intelligence and reporting tools such as Business Objects and Crystal Reports—are granted read-only access to the information supplied by DSP services. The main features of the Data Services Platform JDBC driver are:

Supports most SQL-92 SELECT statements.

Provides error handling; if an error is detected in SQL query, then the error will be reported along with an error code.

Performs metadata validation; the translator checks SQL syntax and validates it against the data service schema.

When communicating with DSP via a JDBC/ODBC interface, standard SQL-92 query language is supported. The Data Services Platform JDBC driver implements components of the java.sql.* interface, as specified in JDK 1.4x.

Note: The Data Services Platform JDBC driver needs to be in your computer's CLASSPATH variable within System variables:

```
$BEA_HOME\weblogic81\liquiddata\lib\ldjdbc.jar
```

Lab 12.1 Running DBVisualizer

WebLogic Platform includes DBVisualizer, which is a third-party database tool designed to simplify database development and management.

Before you start:

The Data Services Platform JDBC driver needs to be in your computer's CLASSPATH variable:

```
$BEA_HOME\weblogic81\liquiddata\lib\ldjdbc.jar
```

The WebLogic Server needs to be running.

Make sure that your Evaluation application is deployed correctly to WebLogic Server.

Objectives

In this lab, you will:

Create a database connection that enables DBVisualizer to access your Evaluation application as if it were a database.

Use DBVisualizer to explore your Evaluation application.

Instructions

1. Choose Start → Programs → BEA WebLogic Platform8.1 → Other Development Tools → DBVisualizer. The DBVisualizer tool opens.

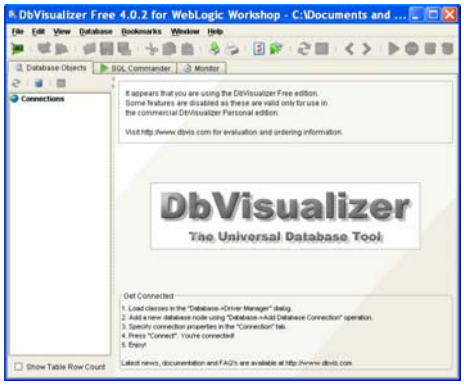


Figure 12-1 DBVisualizer Interface

2. Choose Database → Add Database Connection.
3. Select the JDBC Driver tab from the Connection Data section.
4. Enter the following parameters:

   Connection Alias: LD

   JDBC Driver: com.bea.ld.jdbc.LiquidDataJDBCDriver

   Database URL: jdbc:ld@localhost:7001:Evaluation

   Userid: weblogic

   Password: weblogic

5. Click Connect.

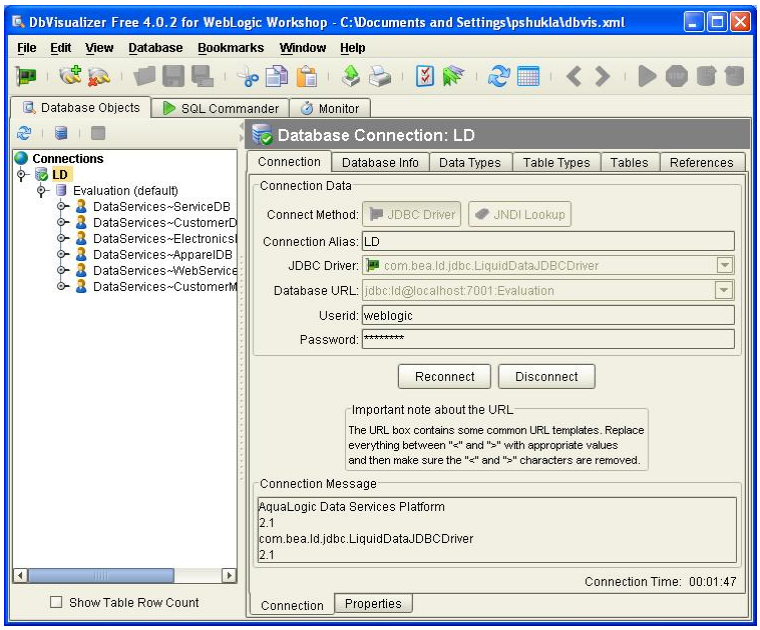


Figure 12-2 New Database Connection Parameters

6. Use DBVisualizer to explore your DSP application as if it were a database. Data service projects display as database schemas. Functions within a project display as a database view; functions with parameters display as database functions.

7. Select a tab (Database Info, Data Types, Table Types, Tables, and References) to view that category of information for all data services within your application. For example, selecting the Tables tab displays each data service as a table.

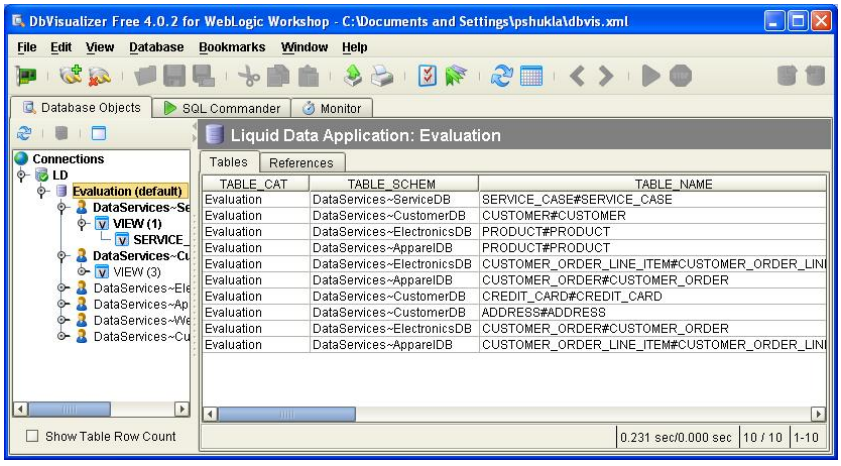


Figure 12-3 Tables

8. Double-click an element to view the values for a specific data service. For example, double-clicking the DataServices~CustomerDB element from the Table Schema column displays that data services values.

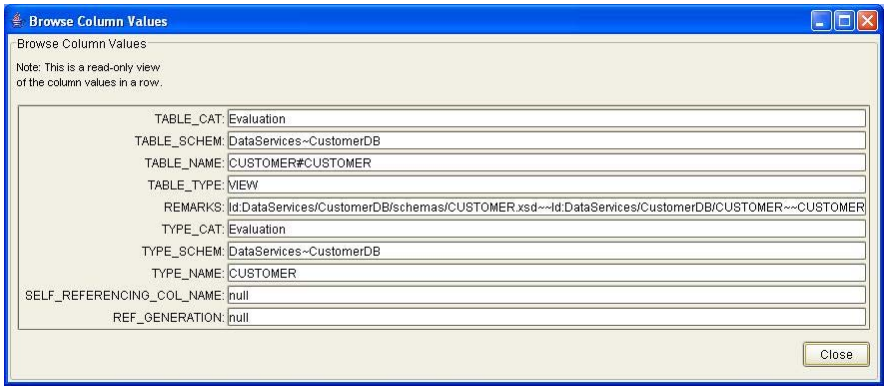


Figure 12-4 Table Column Values

Lab 12.2 Integrating Crystal Reports and Data Services Platform

The Data Services Platform JDBC driver makes data services accessible from business intelligence and reporting tools, such as Crystal Reports, Business Objects, Cognos, and so on. In this lab, you will learn how to use the Date Service Platform JDBC driver in conjunction with Crystal Reports. (For ODBC applications, you can use JDBC to ODBC Bridge Drivers provided by vendors such as OpenLink, available as of this writing at http://www.openlinksw.com.)

Objectives

In this lab, you will:

Install Crystal Reports View in a Web application.

Import a saved Crystal Report file and JSP into the Web application.

View the report from the Web application.

Instructions

1. Install Crystal Reports Viewer in the CustomerManagementWebApp by completing the following steps:
    a. Right-click CustomerManagementWebApp.
    b. Choose Install → Crystal Reports.
2. Import a saved Crystal Reports file and JSP that displays the report by completing the following steps:
    a. Right-click CustomerManagementWebApp.
    b. Choose Import.
    c. Navigate to `<beahome>\weblogic81\samples\LiquidData\EvalGuide` and select the `SpendByCustomers.rpt` and `showCrystal.jsp` files:
    d. Click Import. You should see `showCrystal.jsp` and `SpendByCustomers.rpt` files within CustomerManagementWebApp.
    e. Right-click the CustomerPageFlow folder.
    f. Choose Import.
    g. Select `index.jsp`, located in `<beahome>\weblogic81\samples\LiquidData\EvalGuide`.

h. Click Import and choose Yes when asked if you want to overwrite the existing `index.jsp` file.

3. Open `CustomerPageFlowController.jpf`, located in `CustomerManagementWebApp\CustomerPageFlow`.
4. Click the Start icon (or press Ctrl + F5) to run Workshop Test Browser.
5. In Workshop Test Browser, click Customer Report to test the report. The first invocation may take time to display.

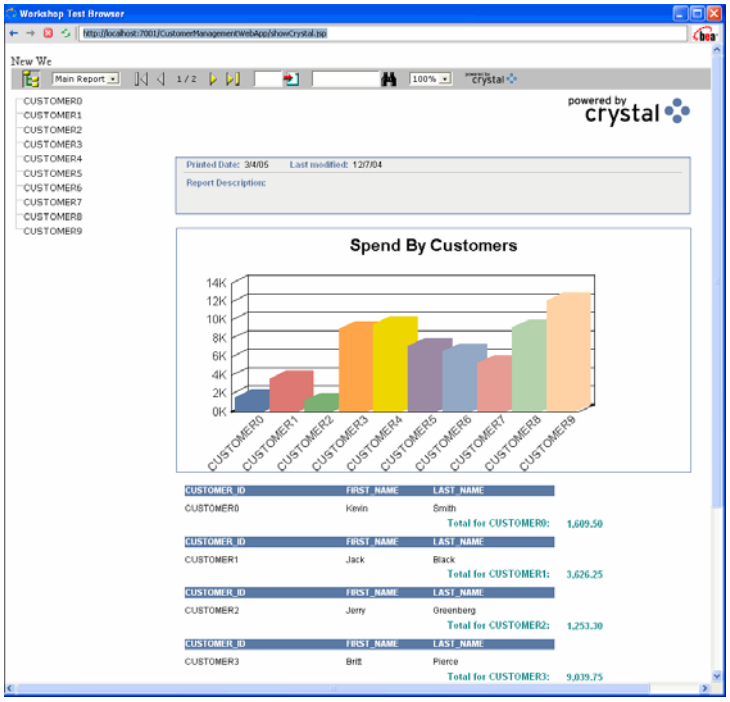


Figure 12-5 Crystal Report

Lab 12.3 (Optional) Configuring JDBC Access through Crystal Reports

Crystal Reports 10.0 comes with a direct JDBC interface, which can be used to interact with the Data Services Platform JDBC driver.

Objectives

In this lab, you will:

Install Crystal Reports software, JDBC driver, and Java server files.

Add environment variables.

Create a new JDBC data source in Crystal Reports.

Instructions

1. Install the Crystal Reports software, per the vendor's installation instructions.
2. Install the JDBC driver files and Java Server, available from Crystal Reports.

You can download the files from:
http://www.businessobjects.com/products/downloadcenter/ceprofessional.asp

3. Select Windows JDBC, XML and DB@ Unicode—all languages.
4. Navigate to where you installed the driver and server files.
5. Add the JAVA_HOME variable to your environment variable. For example:

   ```
   JAVA_HOME=C:\j2sdk1.4.2_06
   ```

   where

   ```
   C:\j2sdk1.4.2_06
   ```

   identifies the Java SDK location on your computer.
6. Make sure that the jvm.dll is in the path variable for your computer. For example:

   ```
   $BEA_HOME\jdk142_04\jre\bin\server
   ```
7. Open CRDB_JavaServer.ini and make the following changes:

   Move $classpath to the beginning of the line. It should be like this:

   ```
   CLASSPATH = ${CLASSPATH};C:\Program Files\Common Files\Crystal
   Decisions\2.5\bin\CRDBJavaServer.jar;C:\Program Files\Common
   Files\Crystal Decisions\2.5\java\lib\external\CRDBXMLExternal.jar
   ```

   Modify the following entries:

   JDBCUserName = weblogic

   JDBCDriverName = com.bea.ld.jdbc.LiquidDataJDBCDriver

   GenericJDBCDriverBehavior = SQLServer
8. Create a new JDBC data source in Crystal Reports, by providing the following parameters:

   JDBC Driver: com.bea.ld.jdbc.LiquidDataJDBCDriver

   URL string: jdbc:ld@localhost:7001:Evaluation

   Provide a user name and password
9. Login to Crystal Reports. Once authenticated, Crystal Reports will show you a view of the Evaluation application.

Lesson Summary

In this lesson, you learned how to:

Access DSP via JDBC.

Integrate a Crystal Reports file, populated by DSP, into your Web application.

Lesson 13 Consuming Data via Streaming API

Streaming API allows developers to retrieve Data Services Platform (DSP) results in a streaming fashion.

Objectives

After completing this lesson, you will be able to:

Stream results returned from AquaLogic Data Services Platform into a flat file.

Test the results.

Overview

There are situations where you need to extract large amounts of data from operational systems using DSP. For those cases, DSP provides a data streaming API. Large data sets can be retrieved to application in a streaming fashion or be streamed directly to a file on server. All security enforcements previously defined will still be relevant in case of the streaming API.

When working with streaming API keep the following things in mind:

The ability to get results as streams will be only available on the Server; there will not be any client-server support for this API.

Only the Generic Data Service Interface is available for getting streaming results.

Lab 13.1 Stream results into a flat file

Objectives

In this lab, you will:

Create a new function that streams CustomerProfile information into a flat file.

Import a new jsp file to access a streaming function.

Test streaming data into a file.

Instructions

1. Import new index page into your application
   a. Right-click CustomerPageFlow located in CustomerManagementWebApp.
   b. Choose Import.
   c. Navigate to `<beahome>\weblogic81\samples\LiquidData\EvalGuide\Streaming`.
   d. Select `index.jsp` as the page to be imported.
   e. Click on Import button.
   f. Open `index.jsp` and verify that you have a new link called “Export All Data”.
2. Insert streaming function into your page flow

a. Open `CustomerPageFlowController.jpf` located in `CustomerManagementWebApp\ CustomerPageFlow`

b. Go to Source View.

c. Add two additional methods into the page flow.

d. Open `Streaming.txt` file located in `<beahome>\weblogic81\samples\LiquidData\EvalGuide\Streaming`.

e. Copy and paste both functions found in `Streaming.txt` file immediately after method submitChanges() in the `CustomerPageFlowController.jpf` java page flow.

f. Press four times the key combination of Alt + Enter keys to import missing packages or type the following in import section of page flow:

```
import com.bea.ld.dsmediator.client.StreamingDataService;
import javax.naming.InitialContext;
import javax.naming.NamingException;
import com.bea.ld.dsmediator.client.DataServiceFactory;
import weblogic.jndi.Environment;
```

Note: If your application name is different from "Evaluation", locate "Evaluation" in newStreamingDataService method and rename it to reflect the name of your application.

g. Save your changes.

3. Start your `CustomerPageFlowController.jpf`
4. Once the `application` is started, click the Export All Data link
5. `Verify` that data is exported successfully by opening `customerexport.txt`, located in:

`<BEAHOME>\weblogic81\samples\domains\ldplatform`

Lab 13.2 Consume data in streaming fashion

Objectives

In this lab, you will:

Import a new version of CustomerPageFlow.

Instantiate a new Streaming Data Service.

Retrieve results into XMLInputStream object by calling getCustomerProfile function.

Test fetching data from DSP in a streaming fashion.

Instructions

1) Import a new folder into your application

a. Right-click CustomerManagementWebApp located in your Evaluation application.

b. Choose Import.

c. Navigate to `<beahome>\weblogic81\samples\LiquidData\EvalGuide`.

d. Select CustomerPageFlowStream folder to be imported.

e. Click Import.

f. Open `CustomerPageFlowController.jpf` file in Source View.

g. Locate stream method and the following comments:

```
//instantiate and initialize your streaming data service here
```

h. Add the following code:

```
com.bea.dsp.dsmediator.client.StreamingDataService sds = null;

    //instantiate and initialize your streaming data service here

    sds =
com.bea.dsp.dsmediator.client.DataServiceFactory.newStreamingData
Service(getInitialContext(), "Evaluation",
"ld:DataServices/CustomerManagement/CustomerProfile");
```

i. The DataServiceFactory class contains a method to create a streaming data service.

j. Replace stream = null with following code:

```
stream = sds.invoke("getCustomerProfile", new String[]{"CUSTOMER3"});
```

For reference, your code should look similar to that shown below:

Figure 13-1 Instantiating and Initializing Streaming Data

k. Test running your `CustomerPageFlowController.jpf`. You can use CUSTOMER3 as a parameter to retrieve results. This time, data is fetched in streaming fashion as shown in Figure 13-2.

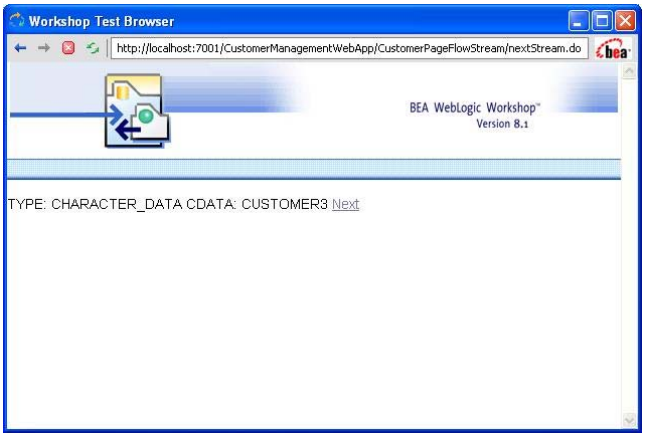


Figure 13-2 Data in Streaming Format

Lesson Summary

In this lesson, you learned to:

Stream results returned from AquaLogic Data Services Platform into a flat file.

Test the results.

Lesson 14 Managing Data Service Metadata

DSP uses a set of descriptors (or metadata) to provide information about data services. The metadata describes the data services: what information they provide and where the information derives from (that is, its *lineage*). In addition to documenting services for potential consumers, metadata helps administrators determine what services are affected when inevitable changes occur in the data source layer. If a database changes, you can easily tell which data services are affected by the change.

Objectives

After completing this lesson, you will be able to:

Synchronize physical data service metadata with changes made to the physical data source.

Analyze impacts and dependencies.

Create custom metadata for a logical data service.

Overview

DSP metadata information is stored as annotations at the data service and function levels. The metadata is openly structured as XML fragments for easy export and import. At deployment time, the metadata is incorporated into a compiled data service, and then deployed as part of the data service application in WebLogic Server.

Stored metadata includes:

Physical data service metadata:

- Relational data source, type, and version
- Column names, native data types, size, and scale
- XML schema types
- Web service WSDL URI

User-defined metadata:

- Description
- Custom properties at the data service level
- Custom properties at the function level
- Relationships created through data modeling

The Data Services Platform Console lets you access metadata stored within the DSP metadata repository. The DSP Console supports the following functionality:

- Searching the metadata repository
- Exploring where and how a given data service or function is consumed
- Analyzing data service lineage and dependencies (all data service objects dependent on a given data service)

Imported physical data service metadata can be re-synchronized to capture changes at the data source.

Lab 14.1 Defining Customized Metadata for a Logical Data Service

There may be times when you need to modify the generated metadata descriptions to provide more detailed information to others who will be working with the data service.

Objectives

In this lab, you will:

Create customized metadata for the CustomerProfile logical data service, at both the data service and function levels.

Build the DataServices project to enable persistence of the new metadata.

Instructions

1. Add customized metadata at the data service level, by completing the following steps:

   a. Open `CustomerProfile.ds` in Design View. The file is located in the `DataServices\CustomerManagement`.

   b. Click the data service header to open the Property Editor at the data service level. If the Property Editor is not open, choose View → Windows → Property Editor, or press Alt + 6.

   c. In Property Editor, click the Description field, located in the General section. This activates the Description field.

   d. Click the "…" icon for the Description field. The Property Text Editor opens.

   e. In Property Text Editor, enter the following text:

      Unified Customer Profile View – contains CRM, order information, credit rating, and valuation information.

   f. Click OK. The specified text is added to the Description field.

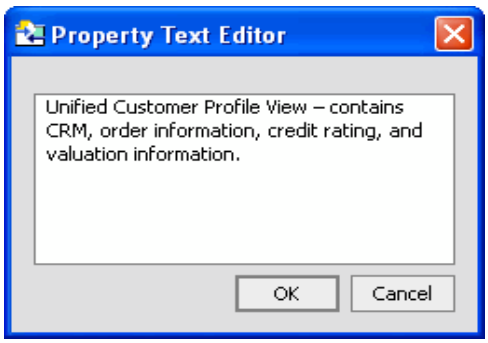


Figure 14-1 Property Text Editor

   g. In Property Editor, click the + icon for the User-Defined Properties section.

   h. Click the + icon for the Property(1) field. This activates the Property(1) field.

   i. Add a user-defined property, using the following values:

      Name = Owner

      Value = <your name>

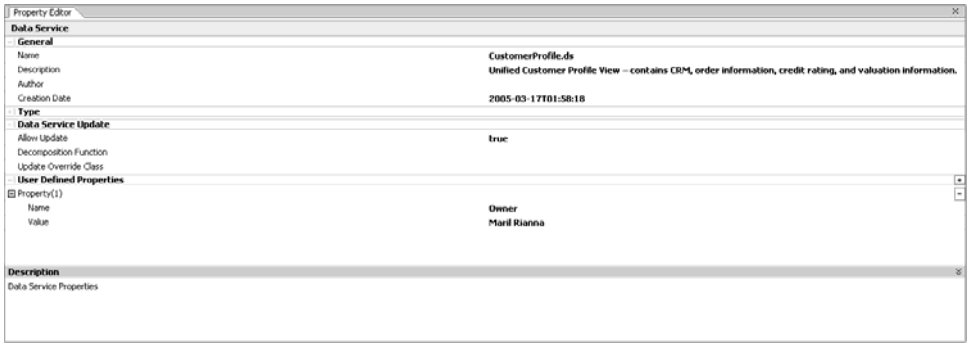


Figure 14-2 User-Defined Property for a Logical Data Service

2. Add customized metadata at the function level, by completing the following steps:

   a. In Design View, click the getCustomerProfile() function arrow to open that function's Property Editor.

   Note: Do not click the function, which will open XQuery Editor View.

   b. In Property Editor, click the + icon, located in the User-Defined Properties section.

   c. Add a user-defined property, using the following values:

      Name = Notes

      Value = This function is consumed by the Customer Management Portal.

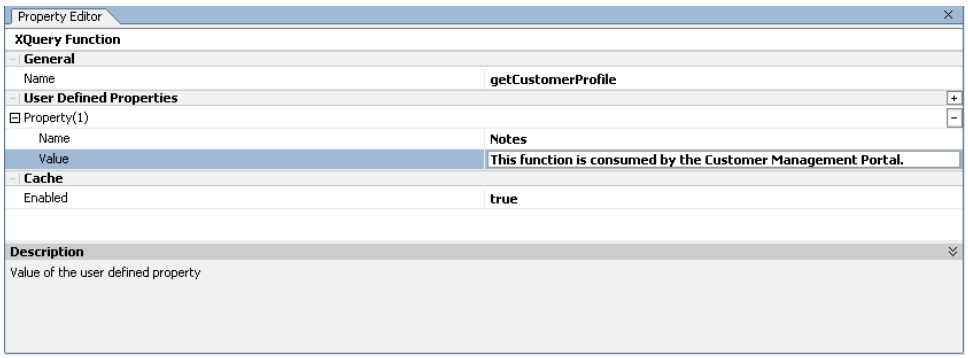


Figure 14-3 User-Defined Property for a Function

3. Save the file.

4. Build the DataServices project.

Lab 14.2 Viewing Data Service Metadata Using the DSP Console

All data service metadata, whether automatically generated or user-defined, can be viewed using the DSP Console.

Objectives

In this lab, you will:

Use the DSP Console to view both generated and customized metadata.

Use the console's Search feature to locate metadata for a specific data service.

Instructions

1. Open the DSP Console, typically located at http://localhost:7001/ldconsole/.

   Note: WebLogic Server must be running.

2. Log in using the following credentials:

   User = weblogic

   Password = weblogic

3. Open the CustomerProfile data service, located in `ldplatform\Evaluation\DataServices\CustomerManagement` using the left-hand menu.

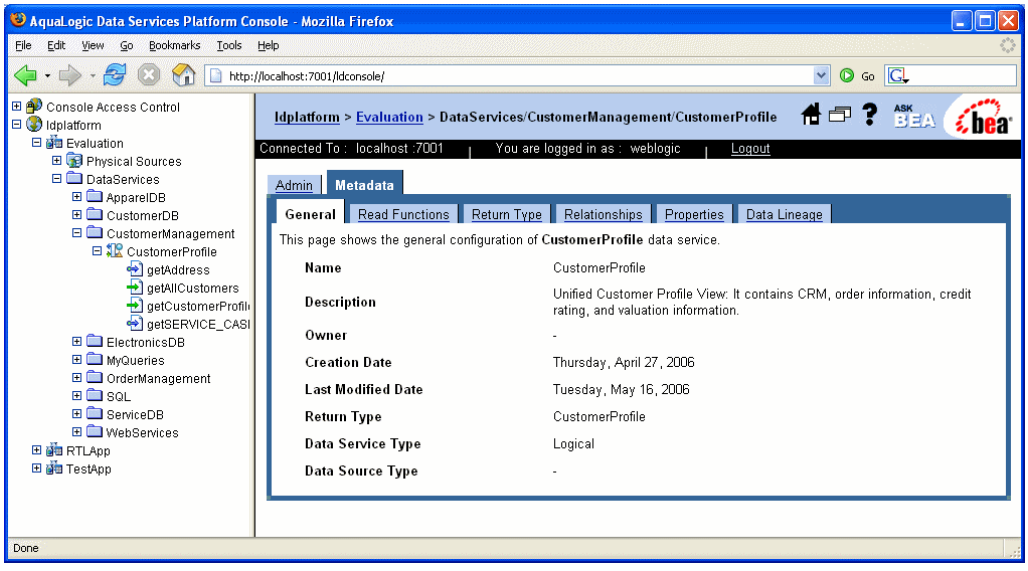


Figure 14-4 DSP Console

4. Click the Properties tab and verify that user-defined properties for the data service display. The property should be similar to that displayed in Figure 14-5, except that it will be your name in the Value field.

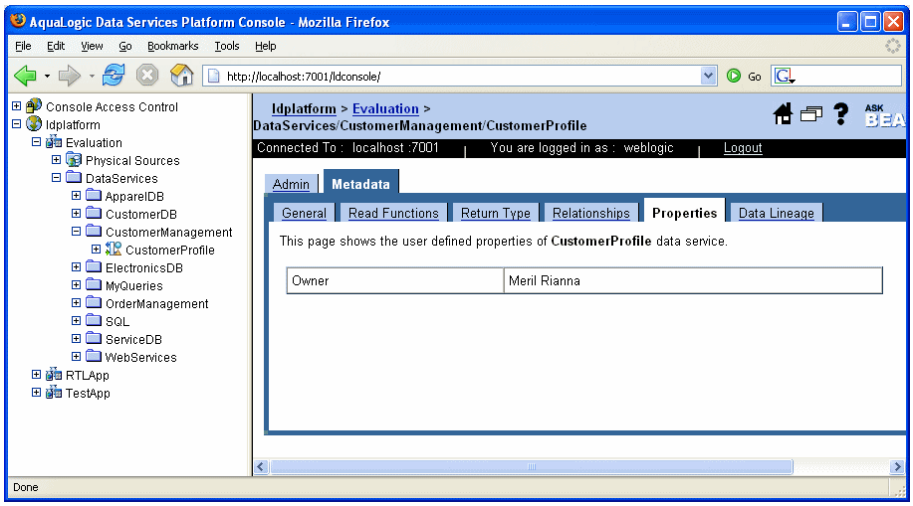


Figure 14-5 CustomerProfile Properties Metadata

5. Explore the CustomerProfile data service metadata by completing the following steps:

    a. Select the Read Functions tab.

    b. Click getCustomerProfile().

    c. Click the Properties tab. The Note that you created for getCustomerProfile() should be visible.

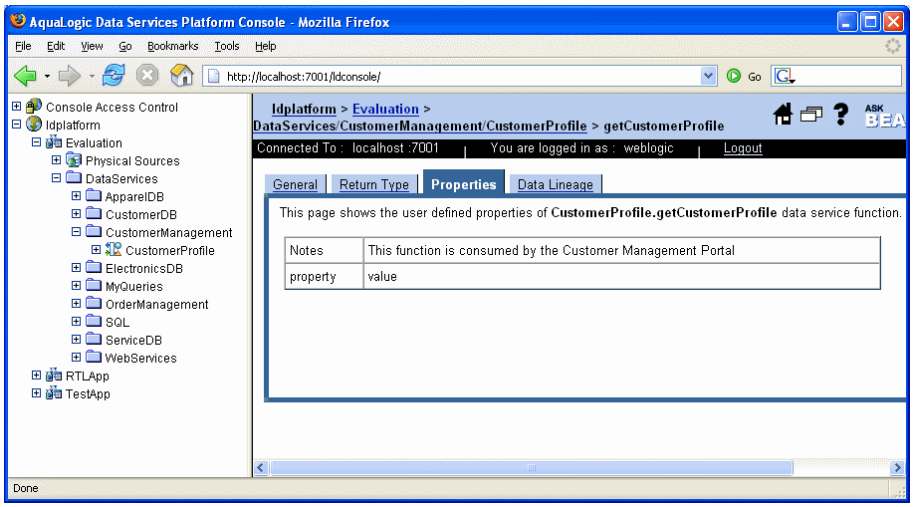


Figure 14-6 Metadata—Read Function Properties

    d. *(Optional)* Select the Return Type, Relationships, Properties, and Where Used tabs to view other metadata.

6. Search the DataServices folder for metadata by completing the following steps:

    a. Right-click the Evaluation folder and click Search (A search can be on data service name, function name, description, or return type.)

    b.

    c. Enter CustomerProfile in the Data Service Name search box and click Search. The data service name, path, and type of data service are displayed for the CustomerProfile data service. Clicking the data service name displays the Admin page for the data service.

Figure 14-7 Search Results

Lab 14.3 Synching a Data Service with Underlying Data Source Tables

Sometimes the underlying data source changes; for example, a new table is added to a database. For those inevitable situations, DSP provides an easy way to update a data service.

Objectives

In this lab, you will:

Import a Java project that contains additional CUSTOMER_ORDER database columns.

Synchronize the information in the Java project with the CUSTOMER_ORDER data service.

Confirm the addition of a new element in the CUSTOMER_ORDER data service schema.

Instructions

1. In WebLogic Workshop, choose File → Import Project.
2. Select Java Project.
3. Navigate to `<beahome>\weblogic81\samples\LiquidData\EvalGuide`.
4. Select the AlterTable folder, click Open, and then click Import.

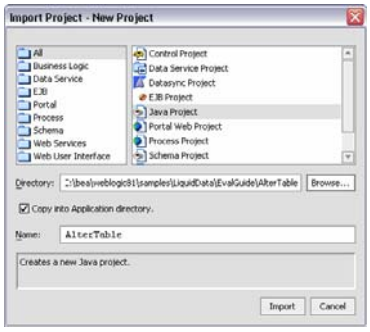


Figure 14-8 Importing Java Project

5. Open `AlterTable.java`. (The file is located in the AlterTable project folder).
6. Click the Start icon, and then click OK when a Confirmation message displays. Compiling the file adds a new column to the CUSTOMER_ORDER table.
7. Open the Output window and confirm that you see the CUSTOMER_ORDER_TABLE altered message.

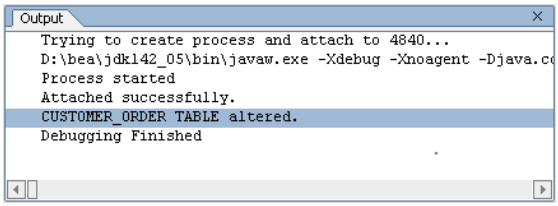


Figure 14-9 Altered Table Message

8. Right-click the ElectronicsDB folder, located in the DataServices project folder.
9. Select Update Source Metadata. The Metadata Update Targets wizard opens, displaying a list of all new columns.

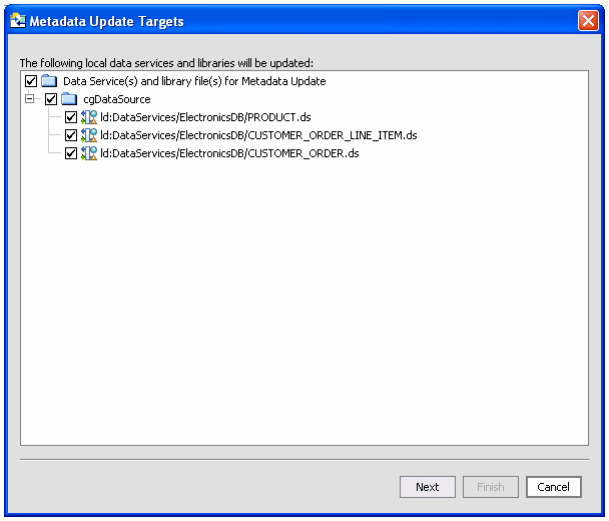


Figure 14-10 Physical Data Sources

10. Click Next. The Metadata Update Preview dialog box opens, which provides details on the data to be synchronized.

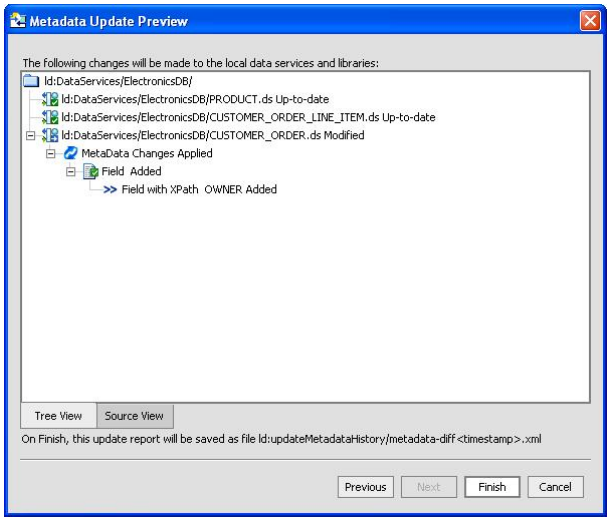


Figure 14-11 Synchronization Preview

11. Click Finish.
12. Open `CUSTOMER_ORDER.ds` in Source View. The file is located in the ElectronicsDB.

13. Expand the data service annotation, located on the first line of the file, to view the captured metadata for the relational data source (type, version, column names, native data types, size, scale, and XML schema types).

14. Scroll down until you locate the following code, which represents the customized metadata that you define in Lab 14.1:

```
<field type="xs:string" xpath="OWNER">
  <extension nativeFractionalDigits="0" nativeSize="50"
nativeTypeCode="12" nativeType="VARCHAR" nativeXpath="OWNER"/>
  <properties nullable="true"/>
</field>
```

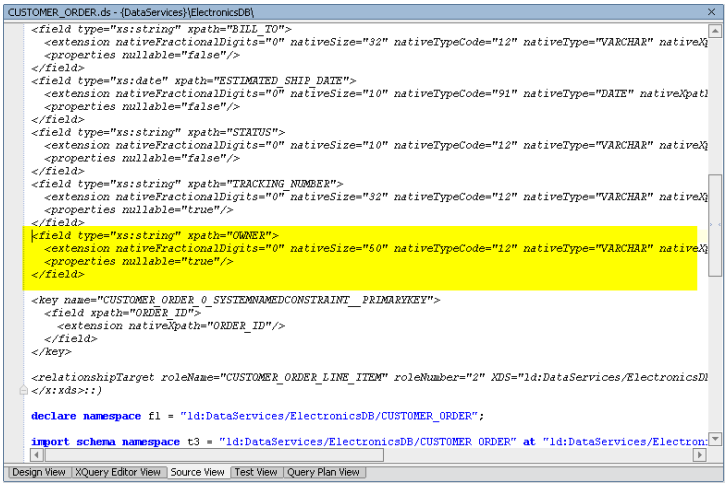


Figure 14-12 Source View of Updated Metadata

15. Select the Design View tab, and verify that an Owner element exists in the XML type for the `CUSTOMER_ORDER` data service.

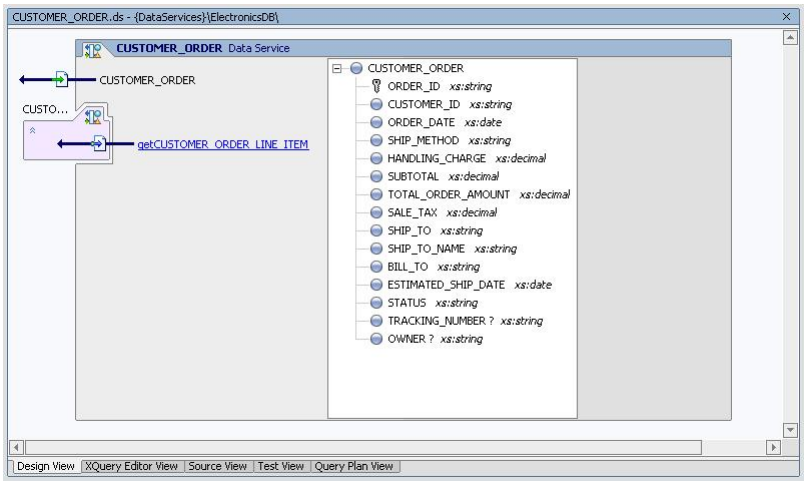


Figure 14-13 Design View

16. Right-click the CUSTOMER_ORDER Data Service header and select Display Native Type. Confirm that there is a new element, called OWNER VARCHAR(50).

Lesson Summary

In this lesson, you learned how to:

Synchronize physical data service metadata with changes made to the physical data source.

Analyze impacts and dependencies.

Create custom metadata for a logical data service.

Lesson 15 Managing Data Service Caching

Caching enables the use of previously obtained results for queries that are repeatedly executed with the same parameters. This helps reduce processing time and enhance overall system performance.

Objectives

After completing this lesson, you will be able to:

Use the DSP Console to configure a DSP cache.

Enable the cache for a data service function and define its time-to-live (TTL).

Check the database to verify whether a cache is used.

Determine the performance impact of the cache, by checking the query response time.

Overview

When DSP executes a query, it returns to the client the data that resulted from the query execution. If DSP caching is enabled, then DSP saves its results into a *query results cache* the first time a query is executed. The next time the query is run with the same parameters, DSP checks the cache configuration and, if the results are not expired, quickly retrieves the results from the cache, rather than re-running the query. Using the previously obtained results for queries that are repeatedly executed with the same parameters reduces processing time and enhances overall system performance.

By default, the query results cache is disabled. Once enabled, you can configure the cache for individual stored queries as needed, specifying how long query results are stored in the cache before they expire (time out), and explicitly flushing the query cache.

In general, the results cache should be periodically refreshed to reflect data changes in the underlying data stores. The more dynamic the underlying data, the more frequently the cache should expire. For queries on static data (data that never changes), you can configure the results cache so that it never expires. For extremely dynamic data, you would never enable caching.

If the cache policy expires for a particular query, DSP automatically flushes the cache result on the next invocation. In the event of a Server shutdown, the contents of the results cache are retained. On the server restart, the Server resumes caching as before. On the first invocation of a cached query, DSP checks the results cache to determine whether the cached results for that query are valid or expired, and then proceeds accordingly.

Lab 15.1 Determining the Non-Cache Query Execution Time

To understand whether caching improves query execution time, you first need to know how long it takes to execute a non-cached query.

Objectives

In this lab, you will:

Execute a query function.

Determine the query execution time.

Instructions

1. Open `CustomerProfile.ds` in Test View.
2. Select getCustomerProfile(CustomerID) from the function drop-down menu.
3. Enter CUSTOMER3 in the Parameter field.
4. Click Execute. The Output window displays the cache's execution time.

Note: Ensure that auditing is enabled in the ALDSP console, to view results in the Output window. For details about auditing, refer to http://edocs.bea.com/aldsp/docs21/admin/monitor.html.

5. Open the Output window.
6. Search for query/performance evaltime for the value of query execution time.

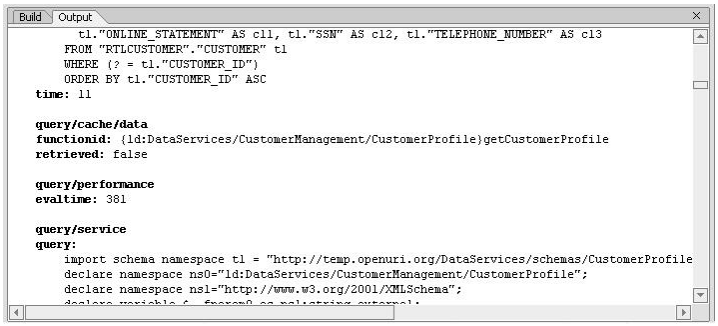


Figure 15-1 Query Execution Time

Lab 15.2 Configuring a Caching Policy Through the DSP Console

By default, DSP results caching is disabled. You must explicitly enable caching. In this lab, you will learn how to enable caching.

Objectives

In this lab, you will:

Enable caching at the application level.

Enable caching at the function level.

Instructions

1. In the DSP Console (`http://localhost:7001/ldconsole/`), using the + icon, expand the ldplatform directory. (Note: If you click the ldplatform name, the Application List page opens. You do *not* want this page for this lesson.)
2. Enable caching at the application level, by completing the following steps:
   a. Click Evaluation. The DSP Console's General page opens.
   b. In the Data Cache section, select Enable Data Cache.
   c. Select cgDataSource from the Data Cache data source name drop-down list.
   d. Enter MYLDCACHE in the Data Cache table name field.
   e. Click Apply.

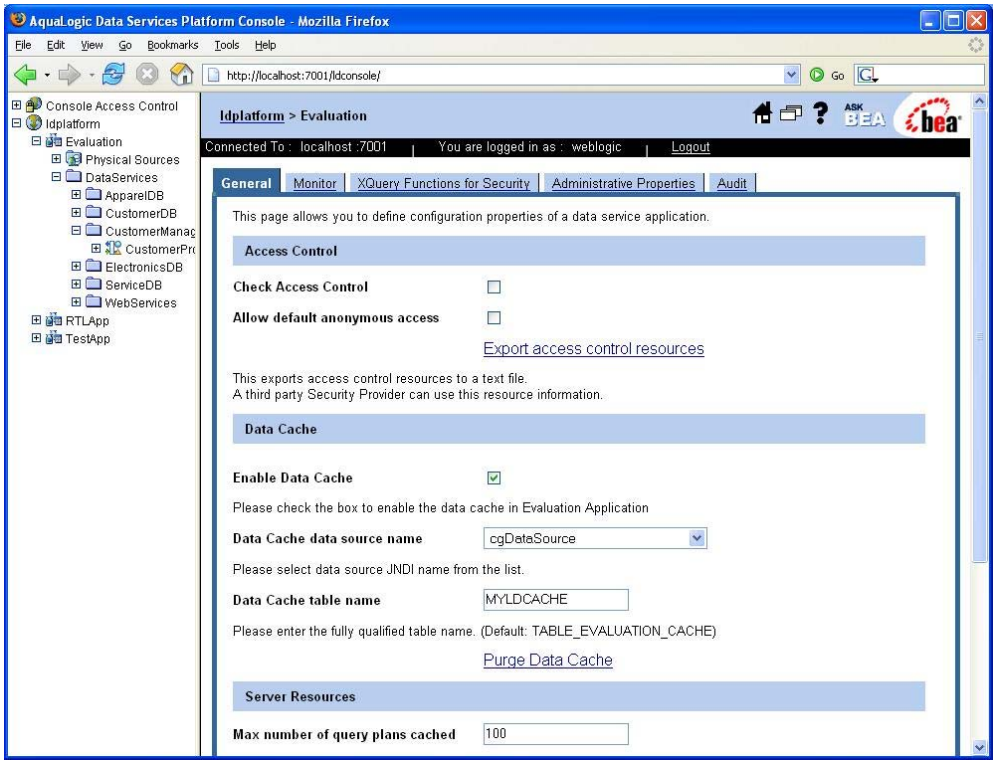


Figure 15-2 DSP Console General Page

3. Enable caching at the function level, by completing the following steps (you can cache both logical and physical data service functions):
   a. Open the CustomerProfile folder, located in `Evaluation\DataServices\CustomerManagement`. The list of data service functions page opens.
   b. For the getCustomerProfile() function, select Enable Cache.
   c. Enter 300 in the TTL (sec) field.
   d. Click Apply.

   Note: Application level cache should be enabled.

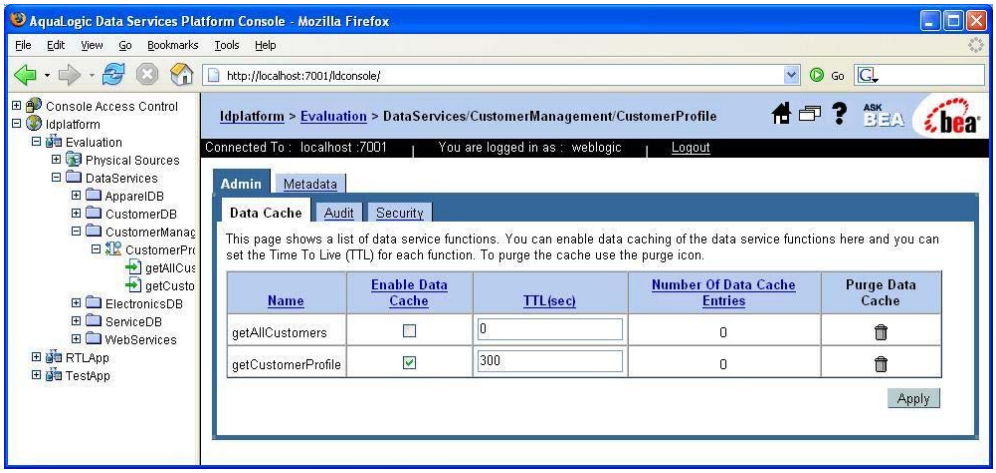


Figure 15-3 Setting TTL

Lab 15.3 Testing the Caching Policy

Testing the caching policy helps you determine whether the specified query results are being cached.

Objectives

In this lab, you will:

Use WebLogic Workshop to test the caching policy for the getCustomerProfile() function.

Use the DSP Console to verify that the cache is populated.

Instructions

1. In WebLogic Workshop, open the CustomerProfile data service in Test View.
2. Select getCustomerProfile(CustomerID) from the Function drop-down list.
3. Enter CUSTOMER3 in the Parameter field.
4. Click Execute.
5. In the DSP Console, verify that the cache is populated by completing the following steps:
   a. Go to the CustomerProfile folder.
   b. Confirm that there are entries in the Number of Cache Entries field for the getCustomerProfile() function.

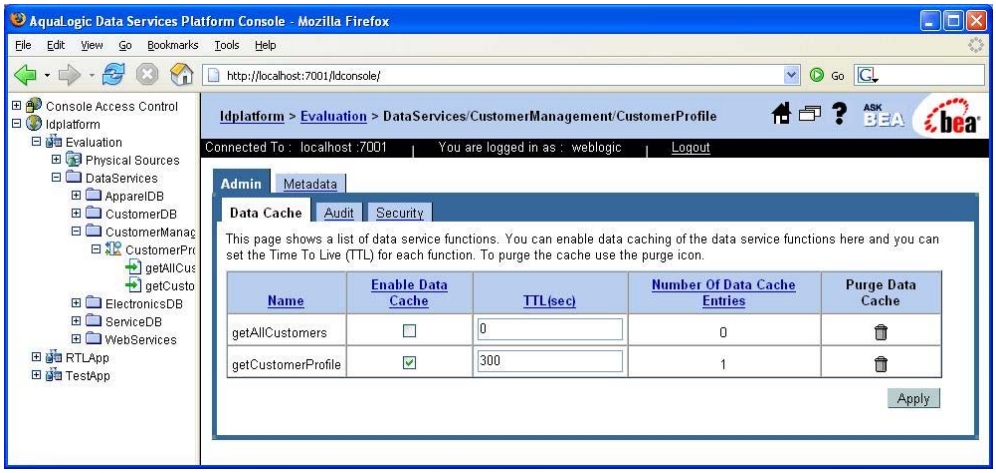


Figure 15-4 Cache Test Results in the Metadata Browser

Lab 15.4 Determining Performance Impact of the Caching Policy

A caching policy can reduces processing time and enhance overall system performance.

Objectives

In this lab, you will:

Use the PointBase Console to confirm that the cache was populated.

Use WebLogic Workshop to determine caching performance.

Instructions

1. Use the PointBase Console to verify that the cache was populated, by completing the following steps:
   a. Start the PointBase Console, by entering the following command at the command prompt:

      ```
      $BEA_HOME\weblogic81\common\bin\startPointBaseConsole.cmd
      ```

   b. Enter the following configuration parameters to connect to your local PointBase Console:

      Driver: com.pointbase.jdbc.jdbcUniversalDriver

      URL: jdbc:pointbase:server://localhost:9093/workshop

      User: weblogic

      Password: weblogic

   c. Click OK.

   d. Enter the SQL command SELECT * FROM MYLDCACHE to check whether the cache is populated.

   e. Click Execute.

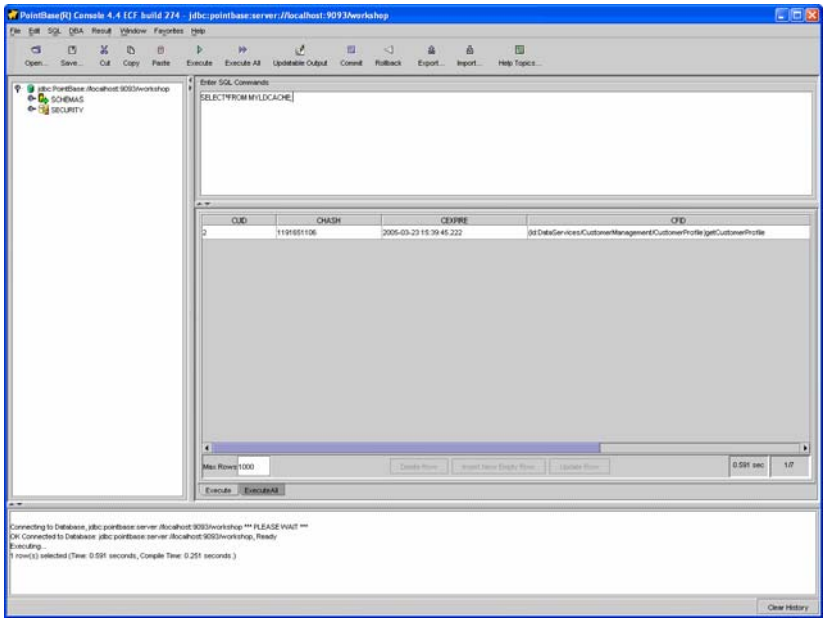


Figure 15-5 PointBase Console

2. In WebLogic Workshop, open the CustomerProfile data service in Test View.
3. Select getCustomerProfile(CustomerID) from the Function drop-down menu.
4. Enter CUSTOMER3 in the Parameter field.
5. Click Execute. The Output window displays the cache's execution time.
6. Use the Output window to determine whether caching helped reduce the query execution time.

Lab 15.5 Disable Caching

Important: For the purposes of the following lessons, you must disable the cache to avoid problems with data updates.

Objectives

In this lab, you will:

Disable caching at the application.

Disable caching at the function level.

Instructions

1. In the DSP Console using the + icon, expand the ldplatform directory. (Note: If you click the ldplatform name, the Application List page opens. You do not want this page for this lab.)
2. Disable application-level caching, by completing the following steps:
   a. Click Evaluation. The DSP Console's General page opens.
   b. In the Data Cache section, clear Enable Data Cache.
   c. Click Apply.

3. Disable function-level caching, by completing the following steps:
   a. Open the CustomerProfile folder, located in

      `Evaluation\DataServices\CustomerManagement`

      The list of data service functions page opens.
   b. For the getCustomerProfile() function, clear Enable Data Cache.
   c. Click Apply.

Lesson Summary

In this lesson, you learned how to:

Use the DSP Console to configure the DSP cache.

Enable the cache for a data service function and define its time-to-live (TTL).

Check the database to verify whether a cache is used.

Determine the performance impact of the cache, by checking the query response time.

Lesson 16 Managing Data Service Security

The Data Services Platform (DSP) leverages the security features of the underlying WebLogic platform. Specifically, it uses resource authorization to control access to DSP resources based on user identity or other information.

Note: WebLogic Server must be running.

Objectives

After completing this lesson, you will be able to:

- Enable application-level security.
- Set function-level read and write access security.
- Set element-level security.

Overview

DSP's security infrastructure extends WebLogic Server's security policies to include DSP objects such as data sources and stored queries, as well as security roles, groups, and users. These security policies allow DSP administrators to set up rules that dynamically determine whether a given user:

- Can access a particular object.
- Holds read/write/execute permissions on a DSP object or a subset of those permissions.

By default data services do not have any security policies configured. Therefore data is generally accessible unless a more restrictive policy for the information is configured. Security policies can apply at various levels of granularity, including:

- **Application level.** The policy applies to all data services within the deployed DSP application.
- **Data service level.** The policy applies to individual data services within the application.
- **Element level.** A policy can apply to individual items of information within a return type, such as a salary node in a customer object. If blocked by insufficient credentials at this level, the rest of the returned information is provided without the blocked element.

Implementing DSP access control involves using the WebLogic Server Console to configure user groups and roles. You can then use the DSP Console to create policies for DSP, including data services and their functions.

Lab 16.1 Creating New User Accounts

The first step in creating data service security policies is to create user accounts and either assign the user account to a default group or configure a new group. There are 12 default authenticator groups.

Objectives

In this lab, you will:

Open the WebLogic Server Console.

Create two user accounts that use a default user group.

View the user list.

Instructions

1. Open the WebLogic Server Console (`http://localhost:7001/console/`), using the following credentials:

   User Name = weblogic

   Password = weblogic

2. Choose Security → Realms → myrealm → Users.

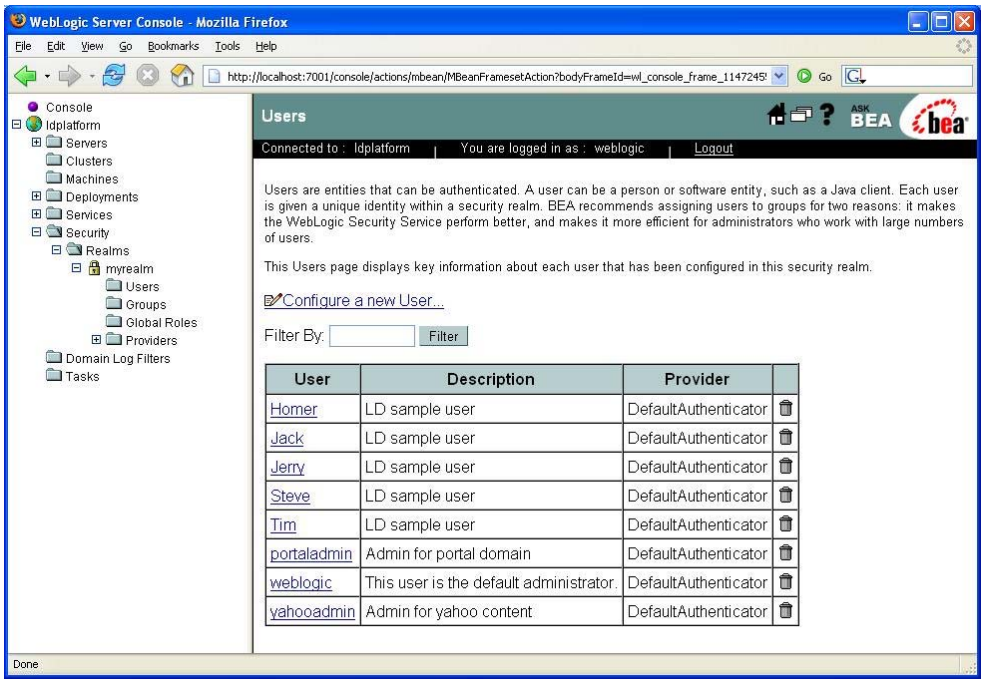


Figure 16-1User Security

3. Select Configure New User.

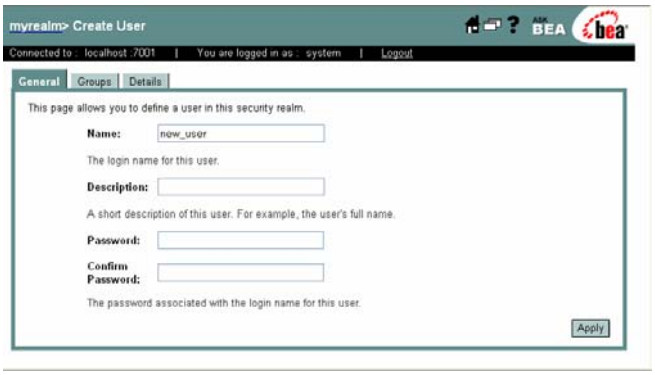


Figure 16-2 Define User in Security Realm

4. Create a new user account by completing the following steps:

    d. Enter `Joe` in the Name field.

    e. Enter `password` in the Password field.

    f. Enter `password` in the Confirm Password field.

    g. Click Apply.

5. Repeat step 3 and step 4, entering Bob in the Name field (step 4a).

6. (*Optional*) Choose Security → Realms → myrealm → Users to view the results.

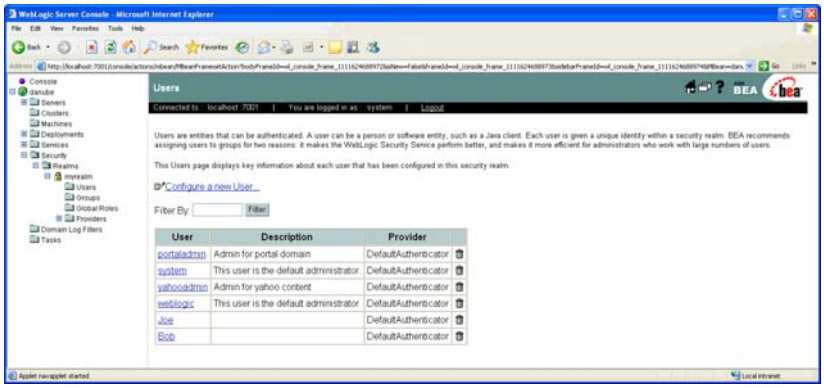


Figure 16-3 New Users Added

Lab 16.2 Setting Application-Level Security

Application-level security applies to all data services within the deployed DSP domain, regardless of user permission or group. By default, when you turn on access control for an application, access to any of its resources is blocked, except for users who comply with policies configured for the resources.

Alternatively, by allowing default anonymous access, you can grant access to its resources by default. You can enable default anonymous access level by navigating to Application level General tab under Access Control (application Name → General). In this case, a resource is restricted only if a more specific security policy for it exists; for example, a security policy at the data service function level.

Objectives

In this lab, you will:

Use the AquaLogic Data Services Platform Console to enable application-level security.

Use WebLogic Workshop to test the security policy.

Instructions

1. In the DSP Console (http://localhost:7001/ldconsole/), using the + icon, expand the ldplatform directory.

   Note: If you click the ldplatform name, the Application List page opens. You do *not* want this page for this lesson.

2. Click Evaluation. The application's General page opens.
3. Select Check Access Control.
4. Click Apply.

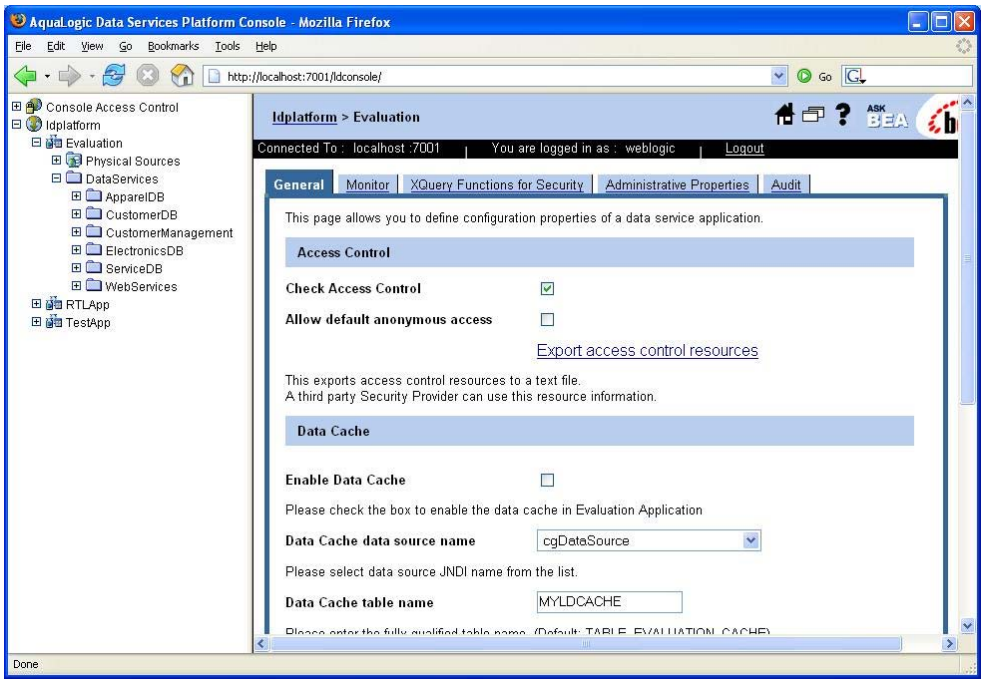


Figure 16-4 Set General Security

5. Test the security policy by completing the following steps:

   a. In WebLogic Workshop, open `CustomerProfile.ds` in Test View.

   b. Select getCustomerProfile() from the Function drop-down list.

   c. Enter CUSTOMER3 in the Parameters field.

   d. Click Execute. The test should return an Access Denied error. With the current security settings, no one can access the application's functions. You must grant user access to read and write functions.

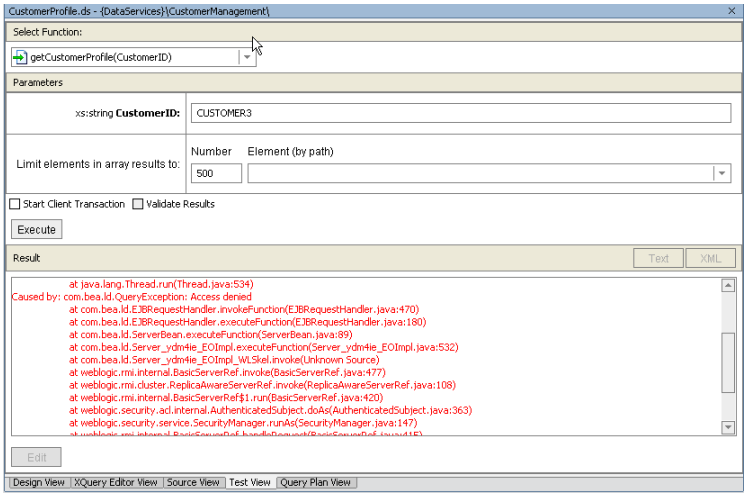


Figure 16-5 Access Denied

Lab 16.3 Granting User Access to Read Functions

DSP security policies can be set at the function level, which applies to specific functions within specific data services. Function-level security can be read and/or write permissions. A policy may include any number of restrictions; for example, limiting access based on the role of the user or on the time of access. Specifically, policies can be based on the following criteria:

User Name of the Caller. Creates a condition for a security policy based on a user name. For example, you might create a condition indicating that only the user John can access the Customer data service.

Caller is a Member of the Group. Creates a condition for a security policy based on a group.

Caller is Granted the Role. Creates a condition based on a security role. A security role is a special type of user group specifically for applying and managing common security needs of a group of users.

Hours of Access are Between. Creates a condition for a security policy based on a specified time period.

Server is in Development Mode. Creates a condition for a security policy based on whether the server is running in development mode.

Objectives

In this lab, you will:

Use the DSP Console to grant Joe read access permissions, based on user name.

Use WebLogic Workshop to test the new security policy.

Instructions

1. In the DSP Console, open the CustomerProfile data service. (The data service is located in `ldplatform\Evaluation\DataServices\CustomerManagement`.)
2. Click the Security tab. The Security Policy tab opens.

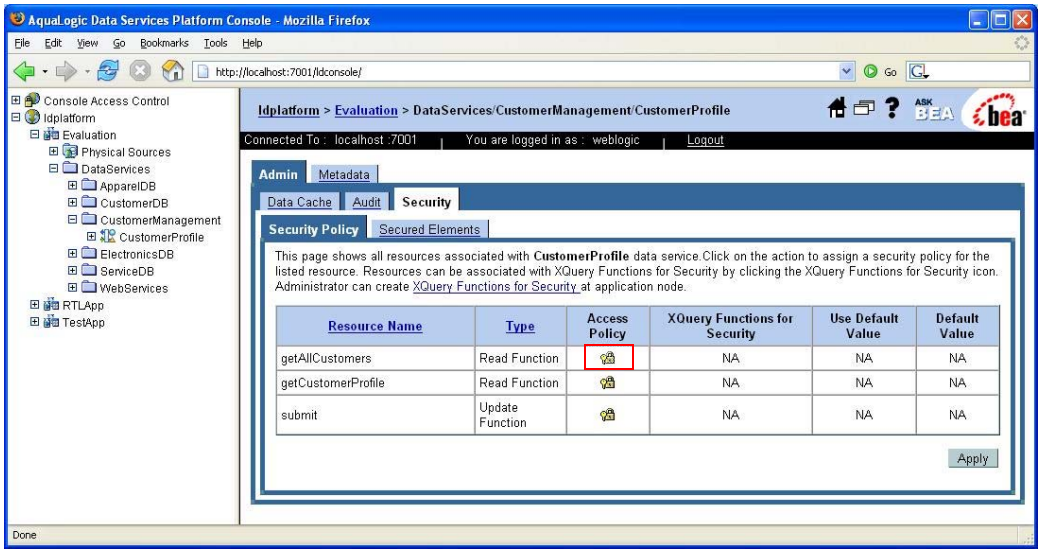


Figure 16-6 Data Service-Level Security Policy

3. Click the Action Policy icon for the getCustomerProfile resource to open the Access Control Policy window.

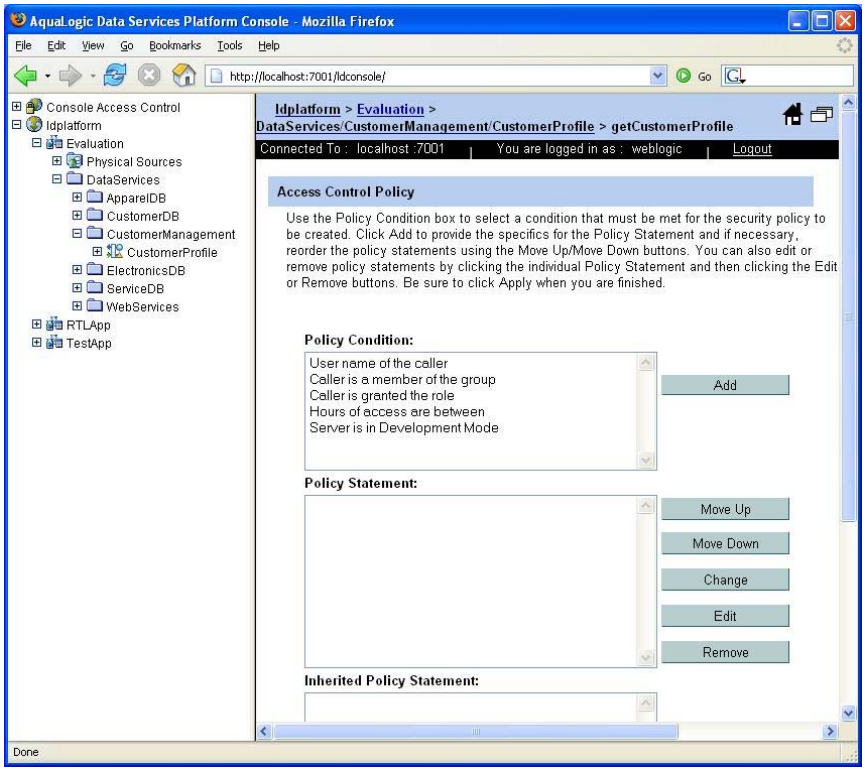


Figure 16-7 Configure Security

4. Set read access for a specific user, by completing the following steps:
    a. Select User name of the caller.

b. Click Add. The Users dialog box opens.

c. Enter Joe in the Name field.

d. Click Add.

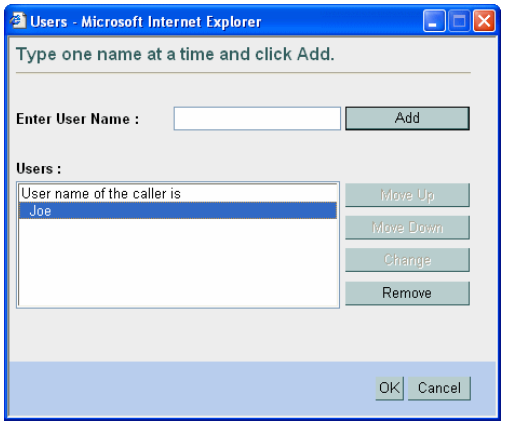


Figure 16-8 Adding User

e. Click OK and move back to the Access Control Policy window.

f. Click Apply.

5. Login to the now-secure application, by completing the following steps:

a. In WebLogic Workshop, choose Tools → Application Properties → WebLogic Server.

b. Select Use Credentials Below.

c. Enter Joe and password in the Use Credentials Below fields.

d. Click OK.

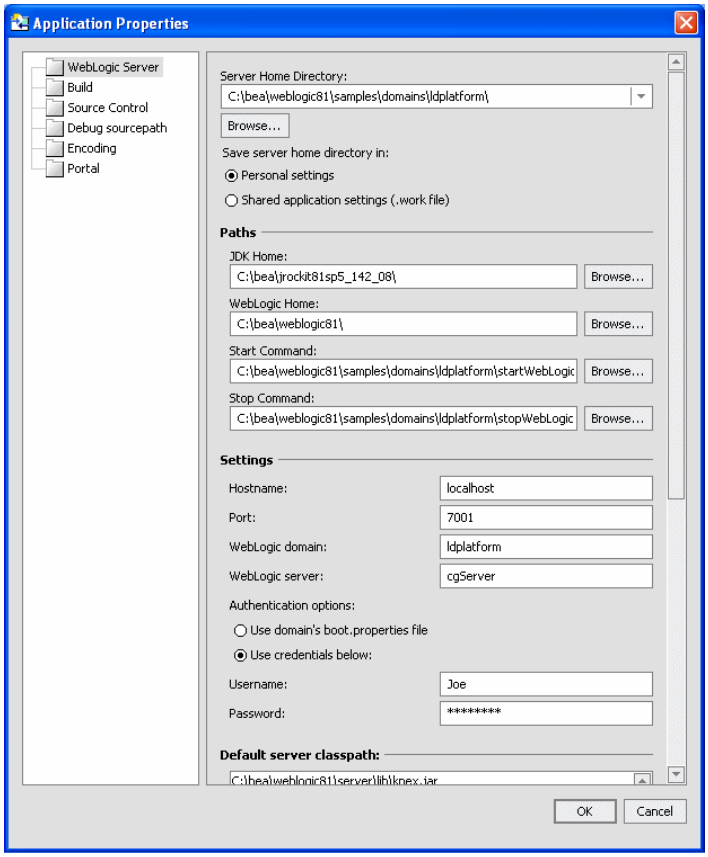


Figure 16-9 Logging Into Secure Application

6. Test the security policy by completing the following steps:

   a. Open `CustomerProfile.ds` in Test View.

   b. Select getCustomerProfile() from the Function drop-down list.

   c. Enter CUSTOMER3 in the Parameters field.

   d. Click Execute. The test should permit access and return the requested data.

   e. Click Edit, modify an item, and then click Submit. An error message will display because Joe is granted only read access.

Lab 16.4 Granting User Access to Write Functions

As noted in the previous lab, security policies at the function level can allow either read and/or write permissions.

Objectives

In this lab, you will:

Use the DSP Console to grant Joe write access permissions.

Use WebLogic Workshop to test the new security policy.

Instructions

1. In the DSP Console, open the CustomerProfile data service.
2. Select the Security tab. The Security Policy tab opens.
3. Click the Action Policy icon for the submit resource. The Access Control Policy window opens.
4. Set write access to a user, by completing the following steps:
    a. Select User name of the caller.
    b. Click Add.
    c. Enter Joe in the Name field.
    d. Click Add.
    e. Click OK.
    f. Click Apply.
5. Test the security policy, by completing the following steps:
    a. In WebLogic Workshop, open `CustomerProfile.ds` in Test View. The file is located in `DataServices\CustomerManagement`.
    b. Select getCustomerProfile() from the Function drop-down list.
    c. Enter CUSTOMER3 in the Parameters field.
    d. Click Execute. The test should permit access and return the specified results.
    e. Click Edit. Because Joe is granted both read and write access, you can now edit the results.

Lab 16.5 Setting Element-Level Data Security

A policy can apply to individual items of information within a return type, such as a salary node in a customer object. If blocked by insufficient credentials at this level, the rest of the returned information is provided without the blocked element.

Objectives

In this lab, you will:

Enable element-level security.

Set a security policy for specific elements.

Instructions

1. In the DSP Console, open the CustomerProfile data service.
2. Select the Security tab.
3. Set element-level security, by completing the following steps:
   a. Select the Secured Elements tab.
   b. Expand the CustomerProfile and customer+ nodes.
   c. Select the checkbox for the ssn simple element.
   d. Expand the orders ? and orders * nodes.
   e. Select the checkbox for the order_line * complex element.
   f. Click Apply.

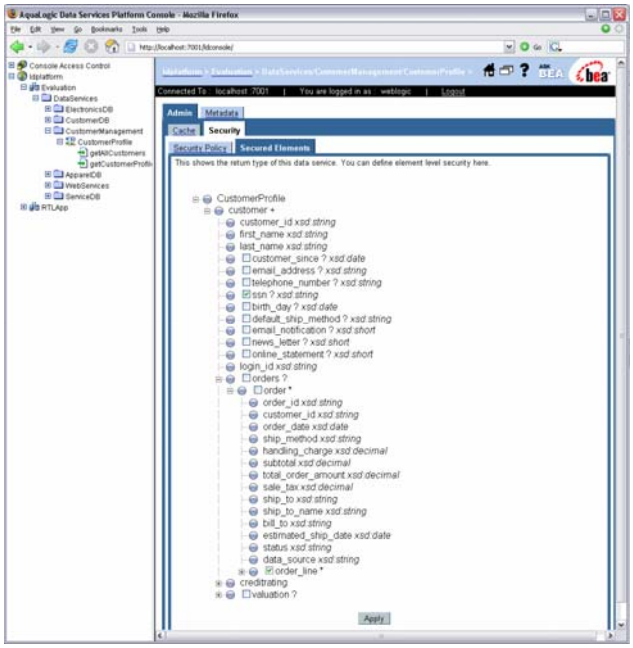


Figure 16-10 Setting Element-Level Security

4. Return to the Security Policy tab for CustomerProfile. You should see two new resources: `CustomerProfile/customer/ssn` and `CustomerProfile/customer/orders/order/order_line`.

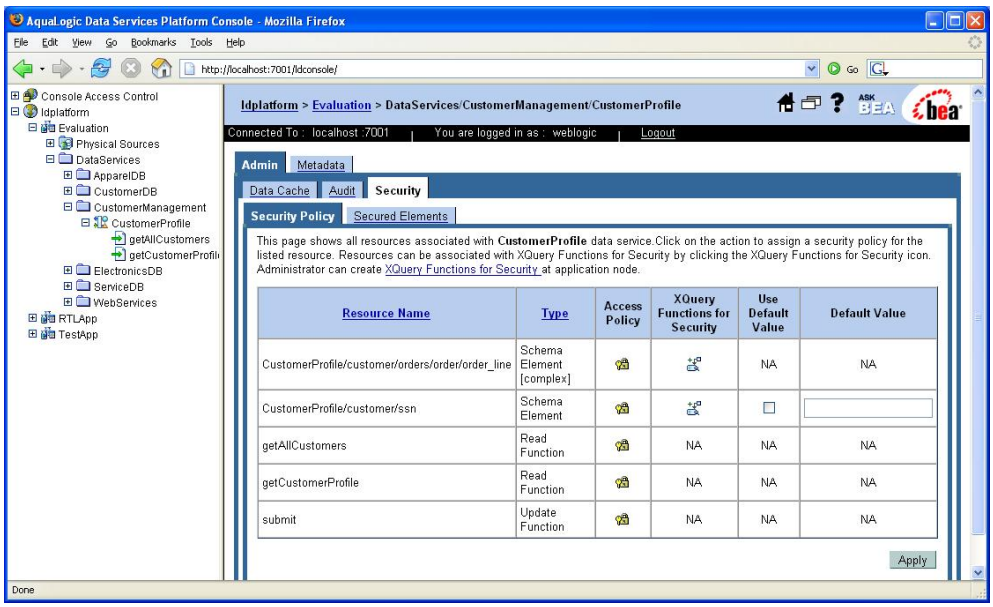


Figure 16-11 New Secured Element Resources

5. Set the security policy for the complex order_line element, by completing the following steps:
    a. Return to the Security Policy tab for CustomerProfile.
    b. Click the Action Policy icon for the `CustomerProfile/customer/orders/order/order_line` resource. The Access Control Policy window opens.
    c. Select User name of the caller.
    d. Click Add.
    e. Enter Joe in the Name field.
    f. Click Add.
    g. Click OK.
    h. Click Apply.
6. Set the security policy for the simple ssn element, by completing the following steps:
    a. Click the Action Policy icon for the `CustomerProfile/customer/ssn` resource. The Access Control Policy window opens.
    b. Select User name of the caller.
    c. Click Add.
    d. Enter Bob in the Name field.
    e. Click Add.
    f. Click OK.
    g. Click Apply.

Lab 16.6 Testing Element-Level Security

At this point, element-level security policies are defined for both Bob and Joe. Testing the policy within WebLogic Workshop lets you determine what data results these two users will be able to access.

Objectives

In this lab, you will:

Test the security policy for Bob and Joe.

Change the security policy for Bob and test the new security policy.

Instructions

1. Test element-level security for Joe, by completing the following steps:
    a. In WebLogic Workshop, open `CustomerProfile.ds` in Test View.
    b. Select getCustomerProfile() from the Function drop-down list.
    c. Enter CUSTOMER3 in the Parameters field.
    d. Click Execute. The test should permit access and return all results except SSN.
    e. Click Edit, modify an order_line value, click Submit, and click OK. The specified change is submitted.
    f. Click Execute to refresh the data set.
    g. Verify that changes have been saved.
2. Test the element-level security policy for Bob, by completing the following steps:
    a. Choose Tools → Application Properties → WebLogic Server.
    b. Select Use Credentials Below.
    c. Enter Bob and password in the Use Credentials Below fields.
    d. Click OK.
    e. Open `CustomerProfile.ds` in Test View.
    f. Select getCustomerProfile(CustomerID) from the Function drop-down list.
    g. Enter CUSTOMER3 in the Parameters field.
    h. Click Execute. The test should fail. Although Bob can access the SSN element, he does not have read access to the getCustomerProfile() function.
3. Change the security policy for Bob, by completing the following steps:
    a. In the DSP Console, open the CustomerProfile data service.
    b. Select the Security tab.
    c. Click the Action Policy icon for the getCustomerProfile resource. The Access Control Policy window opens.
    d. Set read access for Bob, by completing the following steps:
        i. Select User name of the caller.
        ii. Click Add.

iii. Enter Bob in the Name field.

iv. Click Add.

v. Click OK.

vi. Click the "and User name of the caller" line, located in the Policy Statement section of the window.

vii. Click Change, which changes the line to an "or User name of the caller" condition.

viii. Click Apply.

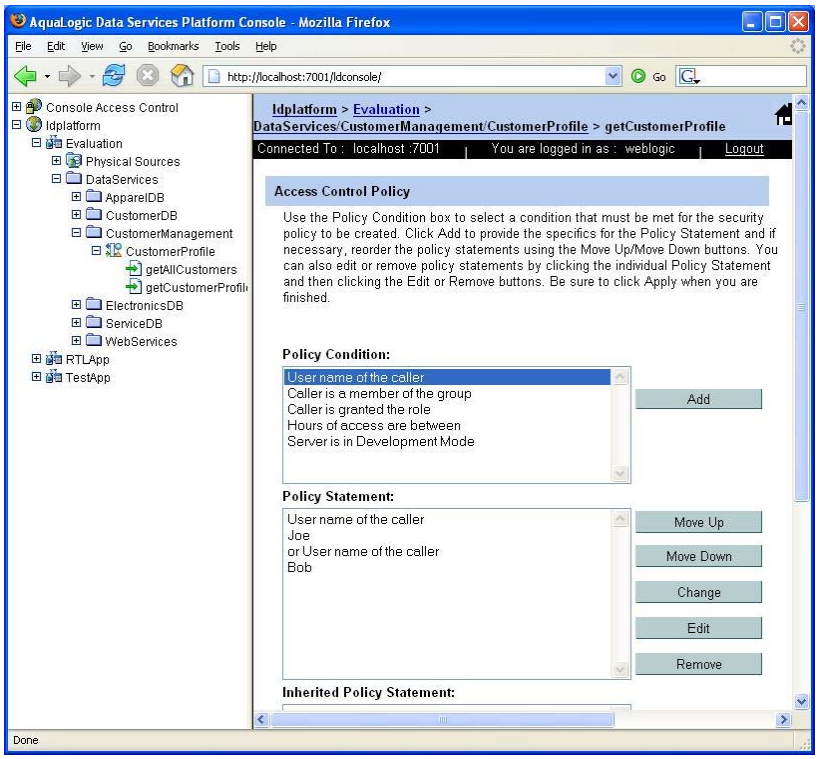


Figure 16-12 Enabling read Access for Two Users

4. In WebLogic Workshop, test the getCustomerProfile() function again. This time, user Bob can view all elements except order_line information.

5. Try modifying data by clicking on Edit button and changing SSN. Submit changes by clicking on Submit button. An error message will display because Bob does not have write privileges.

6. Reset the application-level security, by completing the following steps:

   a. In the DSP Console (http://localhost:7001/ldconsole/), using the + icon, expand the ldplatform directory.

      Note: If you click the ldplatform name, the Application List page opens. You do not want this page for this lesson.

   b. Click Evaluation. The Administration Control's General page opens.

   c. Clear Check Access Control.

   d. Click Apply.

Lesson Summary

In this lesson, you learned how to:

- Activate application level security.
- Set security permissions on both read and write function access.
- Set security permissions on simple and complex elements.

Glossary

ad-hoc query. A hand-coded or generated query that is passes to Data Services Platform on the fly, rather than stored in the DSP repository.

administration console. A Web-based administration tool that an administrator uses to configure and monitor WebLogic Servers. DSP provides a console to help manage instances of Data Services Platform.

application. A collection of all resources and components deployed as a unit to an instance of WebLogic Server. The application contains one or more projects, which in turn contain the folders and files that make up your application. Only one application can be open at a time.

cache. The location where DSP stores information about commonly executed stored queries for subsequent, efficient retrieval, thereby enhancing overall system performance. DSP provides query plan cache and result set cache.

cache policy. In the result set cache, configuration settings determine when the cached results expire for individual stored queries.

data model. A visual representation of data resources.

data object. In SDO, a complex type that holds atomic values and references to other data objects.

data service. A modeled object that describes a data shape and functions used to retrieve and update the data, as well as functions to navigate to other related data services.

data service mediator. The SDO mediator that uses data services to retrieve and update data.

data service update. The engine responsible for handling submits of changes to SDOs

data source. Any structured, semi-structured, or unstructured information that can be queried. The types of data sources that DSP can query include relational databases, Web services, flat files (delimited and fixed width), XML files, Java functions, application views via Web applications (business-level interfaces to the data in packaged applications such as Siebel, PeopleSoft, or SAP), data views (dynamic results of DSP queries).

data source schema. An XML schema that defines the content, semantics, and physical structure of a data source.

function. A uniquely named portion of an XQuery that performs a specific action. In the case of DSP the function would typically query physical or logical data.

Java Server Page (JSP). A J2EE component that extends the Servlet class, and allows for rapid server-side development of HTML interfaces that can be co-mingled with Java.

logical data service. A data service that integrates data from multiple physical and/or logical data services.

mapping. The process of connecting data source schemas to a target (result) schema.

metadata. Descriptors about a data service's information, format, meaning, and lineage.

physical data service. The leaf-level data services that expose external data. For relational sources, this would be a data service representing tables or stored procedures. For functional sources, this would be the functions that are considered to be the initial source of data operated on by XQuery.

project. Groups related files within an application.

query. In the Data Services Platform an XQuery function that retrieves data from a data source. Functions define what tasks the query will perform, while expressions define what data to extract.

query operation. Operation that a query performs, such as a join, aggregation, union, or minus.

query plan. A compiled query. Before a query is run, DSP compiles the XQuery code into an executable query plan. When the query executes, the query plan is sent to the data source for processing.

repository. File-based metadata maintained in a DSP project.

result set. The data returned from an executed query. There are two types of result sets: intermediate result sets are temporary result sets that the query processor generates while processing an analytical query; final result sets are returned to the client application that requested the query in the form of XML data.

return type. A type of XML schema that defines the shape of data returned by a query.

schema. A model for representing the data types, structure, and relationships of data sets and queries.

security. Set of mechanisms available to prevent access to, corruption of, or theft of data. DSP extends the WebLogic Server compatibility security mechanisms to define groups, users, and access control to DSP resources.

service data object (SDO). Defines a Java-based programming architecture and API for data access.

Simple Object Access Protocol (SOAP). An extensible, platform-independent, XML-based protocol that allows disparate applications to exchange messages over the Web. SOAP can be used to invoke methods on servers, Web services, application components, and objects in a distributed, heterogeneous environment. SOAP-based Web services are one of the data sources DSP supports.

source schema. XML schema that describes the shape (structure and legal elements) of the source data — that is, the data to be queried. The DSP-enabled server runs queries against source data and returns query results in the form of the source schema.

stored query. A query that has been saved to the DSP repository. There is a performance benefit to using a stored query because its query plan is always cached in memory, optionally along with query result. With an ad-hoc query, however, the query plan and result are not cached. In addition, caching of query results for a stored query is configurable through the Cache tab on the DSP node in the Administration Console.

Structured Query Language (SQL). The standard, structured language used for communicating with relational databases. Database programmers use SQL queries to retrieve information and modify information in relational databases. In order to be able to access different types of data sources dynamically, DSP employs the XML-based XQuery language as a layer on top of platform-dependent query systems such as SQL.

target schema. See return type.

Weblogic Server. The platform upon which DSP is built.

Weblogic Workshop. The IDE in which DSP runs as an application.

Web service. Business functionality made available by one company, usually through an Internet connection, for use by another company or software program. Web services are a type of service that can be shared by, and used as components of, distributed Web-based applications. Web services communicate with clients (both end-user applications and other Web services) through XML messages that are transmitted by standard Internet protocols, such as HTTP. Web services endorse standards-based distributed computing. Currently, popular Web Service standards are Simple Object Access Protocol (SOAP), Web services description language (WSDL), and Universal Description, Discovery, and Integration (UDDI).

Web Services Description Language (WSDL). Specification for an XML-based grammar that defines and describes a Web service. A WSDL is necessary if two different online systems need to communicate without human intervention.

xml schema. A structured model for describing the structure, content, and semantics of XML documents based on custom rules. Unlike DTDs, XML schemas are written in XML data syntax and provide more support for standard data types and other data-specific features. When metadata about a data source is obtained, it is stored in an XML schema in the DSP repository.

XQuery. An XML query language, which represents a query as an expression which is used to query relational, semi-structured, and structured data.

xsd. An abbreviation for XML Schema Definition. An XSD file describes the contents, semantics, and structure of data within an XML document.