Oracle® Banking Platform

Extensibility Guide

Release 2.3.0.0.0

E56276-01

July 2014

ORACLE®

Oracle Banking Platform Extensibility Guide, Release 2.3.0.0.0

E56276-01

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Preface

The Oracle Banking Platform Extensibility guide explains customization and extension of Oracle Banking Platform.

This preface contains the following topics:

- Audience
- Documentation Accessibility
- Related Documents
- Conventions

Audience

This guide is intended for the users of Oracle Banking Platform.

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at `http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc`.

Access to Oracle Support

Oracle customers have access to electronic support through My Oracle Support. For information, visit `http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info` or visit `http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs` if you are hearing impaired.

Related Documents

For more information, see the following documentation:

- For installation and configuration information, see the Oracle Banking Installation Guide - Silent Installation
- For a comprehensive overview of security for Oracle Banking, see the Oracle Banking Security Guide
- For the complete list of Oracle Banking licensed products and the Third Party licenses included with the license, see the Oracle Banking Licensing Guide
- For information related to setting up a bank or a branch, and other operational and administrative functions, see the Oracle Banking Administrator's Guide

- For information on the functionality and features of the Oracle Banking product licenses, see the respective Oracle Banking Functional Overview documents

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

1 Objective and Scope

This chapter defines the objective and scope of this document.

1.1 Overview

Oracle Banking Platform (OBP) is designed to help banks respond strategically to today's business challenges, while also transforming their business models and processes to reduce operating costs and improve productivity across both front and back offices. It is a one-stop solution for a bank that seeks to leverage Oracle Fusion experience across its core banking operations across its retail and corporate offerings.

OBP provides a unified yet scalable IT solution for a bank to manage its data and end-to-end business operations with an enriched user experience. It comprises pre-integrated enterprise applications leveraging and relying on the underlying Oracle Technology Stack to help reduce in-house integration and testing efforts.

1.2 Objective and Scope

While most product development can be accomplished using highly flexible system parameters and business rules, further competitive differentiation can be achieved through IT configuration and extension support. Time consuming, custom coding to enable region specific, site specific or bank specific customizations can be minimized by offering extension points and customization support which can be implemented by the bank and / or by partners.

1.2.1 Extensibility Objective

OBP when extended and customized by the Bank and / or Partners results in reduced dependence on Oracle. As a result of this, the Bank does not have to align plans with Oracle's release plans for getting certain customizations or product upgrades. The bank has the flexibility to choose and do the customizations themselves or have them done by partners.

One of the key considerations towards enabling extensibility in OBP has been to ensure that the developed software can respond to future growth. This has been achieved by disciplined software development leading to clearer dependencies, well-defined interfaces and abstractions with corresponding reduction in high cohesion and coupling. Hence, the extensions are kept separate from Core. Bank can take advantage of OBP Core solution upgrades as most extensions done for a previous release can be placed directly on top of the upgraded version. This reduces testing effort thereby reducing overall costs of planning and taking up an upgrade. This can also improve TTM significantly as the bank enjoys the advantage of getting universal features through upgrades.

The broad guiding principles with respect to providing extensibility in OBP are summarized below:

- Strategic intent for enabling customers and partners to extend the application.
- Internal development uses the same principles for client specific customizations.
- Localization packs
- Extensions by Oracle Consultants, Oracle Partners, Banks or Bank Partners.
- Extensions through the addition of new functionality or modification of existing functionality.
- Planned focus on this area of the application. Hence, separate budgets specifically for this.
- Standards based - OBP leverages standard tools and technology
- Leverage large development pool for standards based technology.
- Developer tool sets provided as part of JDeveloper and Eclipse for productivity.

1.2.2 Document Scope

The scope of this document is to explain the customization and extension of OBP for the following use cases:

- Customizing OBP UI
- Adding an ADF screen side validation to an existing field
- Adding a new field or a table on the screen
- Removing fields from the UI
- Customizing OBP application services and implementing composite application services
- Adding pre-processing or post processing validations in the application services extension
- Altering the product behavior at customizations hooks provided as adapter calls in functional areas that are prone to change (for example, loan schedule generation) and in between modules that can be replaced (for example, alerts, content management)
- Adding new fields to the OBP domain model and including it on the corresponding screen.
- Adding a new report
- Adding a new batch program
- Customizing SOA based BPEL process with adding a partner link or a human task to an existing process.
- Adding new steps as a sub-process
- Adding or customizing facts and business rules in the application and configuring them for different modules
- Adding or customizing ID generation logic with options of automated, manual or custom generation
- Processing of the uploaded files data
- Printing of receipt once the transaction is over

- Defining the security related access and authorization policies
- Defining different security related rules, validator and processing logics
- Customizing different functionalities like user search, role evaluation and limit exclusion in the application related to security

This document is a useful tool for Oracle Consulting, bank IT and partners for customizing and extending the product.

1.3 Complementary Documentation

The document is a developer's extensibility guide and does not intend to work as a replacement of the functional specification which would be the primary resource covering the following:

1. OBP installation and configuration
2. OBP parameterization as part of implementation
3. Functional solution and product user guide

1.4 Out of Scope

The scope of extensibility does not intend to suggest that OBP is forward compatible.

2 Overview of Use Cases

The use cases that are covered in this document shall enable the developer in applying the discipline of extensibility to OBP. While the overall support for customizations is complete in most respects, the same is not a replacement for implementing a disciplined, thoughtful and well-designed approach towards implementing extensions and customizations to the product.

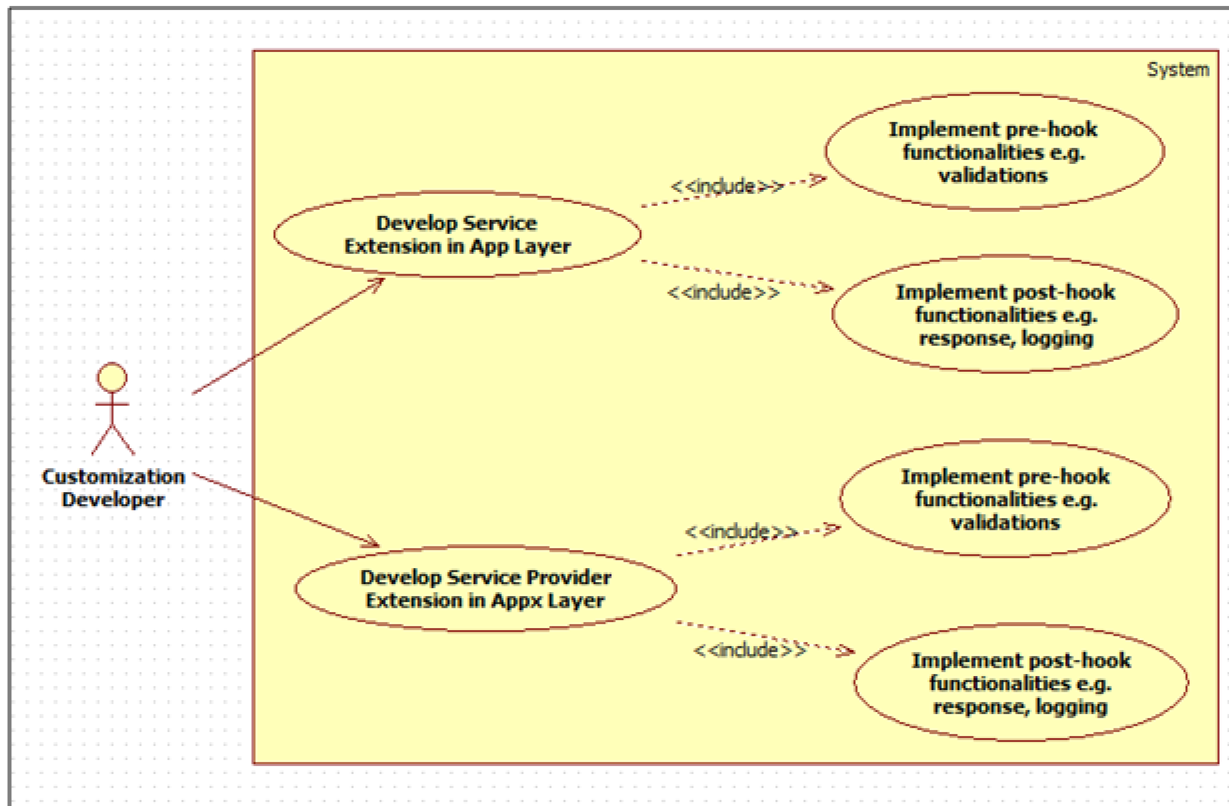
2.1 Extensibility Use Cases

This section gives an overview of the extensibility topics and customization use cases to be covered in this document. Each of these topics is detailed in the further sections.

2.1.1 Extending Service Execution

In OBP, additional business logic might be required for certain services. This additional logic is not part of the core product functionality but could be a client requirement. For these purposes, hooks have been provided in the application code wherein additional business logic can be added or overridden with custom business logic.

Figure 2–1 Extending Service Execution



Following are the two hooks provided:

- **Service Extensions**

  This hook resides in the app layer of the application service. This hook is present for, before as well after the actual service execution. The additional business logic has to implement the interface *I<service_name>ApplicationServiceExt* and extend and override the default implementation *Void<service_name>ApplicationServiceExt* provided for the service. Multiple implementations can be defined for a particular service. The service extensions executor invokes all the implementations defined for the particular service both before and after the actual service executes.

- **Service Provider Extension**

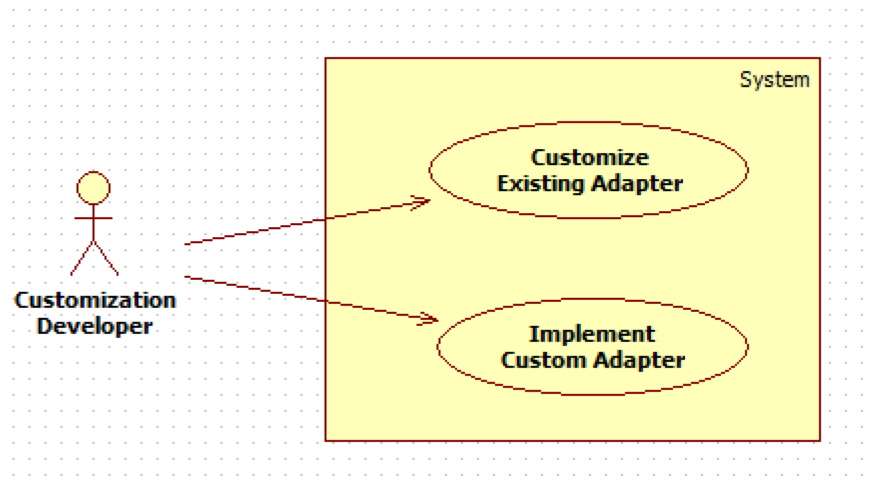
  This hook resides in the appx layer of the application service. This hook, too, is present for before as well after the actual service execution. The additional business logic has to implement the interface *I<service_name>ApplicationServiceSpiExt* and extend and override the default implementation *Void<service_name>ApplicationServiceExt* provided for the service. Multiple implementations can be defined for a particular service. The service extensions executor invokes all the implementations defined for the particular service both before and after the actual service executes.

2.1.2 OBP Application Adapters

In OBP, adapters are used for helping two different modules or systems to communicate with each other. It helps in the consuming side adapters to any incompatibility of the invoked interface to work together. This is done to achieve cleaner build time separation of different functional product processor modules.

Hence, when Loan Module needs to invoke services of Party Module or Demand Deposit module then an adapter class owned by the Loans module will be used to ensure that functions such as defaulting of values, mocking of an interface, and so on, are implemented in the adapter layer thereby relieving the core module functionality from getting corrupted.

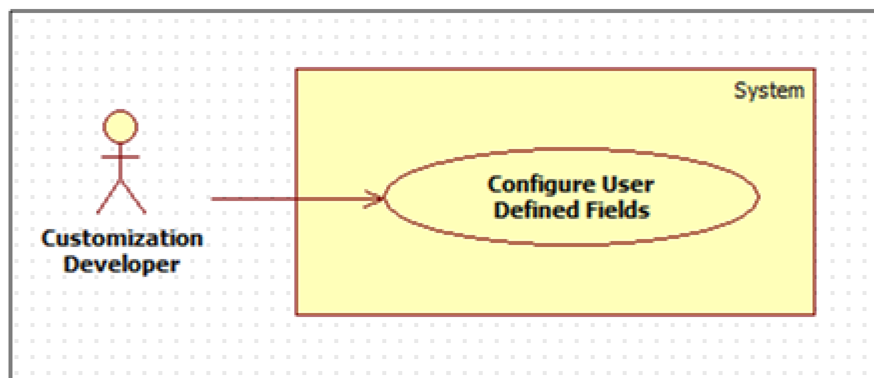
Figure 2–2 OBP Application Adapters



2.1.3 User Defined Fields

There may be a requirement to capture additional data for certain objects/entities from the product screens. These additional attributes are not a part of the core product functionality but could be a client requirement.

Figure 2–3 Configure User Defined Fields



There are two ways in which additional data can be captured. These are:

- **User Defined Fields (UDF) Task-flow**

  The application provides a UDF task-flow which can be used for adding user defined fields on a screen. UDF are useful for capturing and displaying additional data. However, it is difficult to use this additional data in the business logic. Hence, UDF are ideal for capturing data and reporting purposes. When using this

way for additional capture, simple changes on client side and minimal changes (or no changes) on host side are required.

Client: The UDF task-flow needs to be incorporated in the screen for which the additional fields need to be added. After adding the task-flow, you can add additional fields and specify various attributes for it like label for the field, mandatory field, and so on.

Host: The Appx layer needs to be enabled for the service. This layer contains the required call to the UDFApplicationService. However, once this layer has been enabled, you can add more fields without any need for modification on the host side.

- **Custom Entities**:

  Additional fields can be added to objects / entities from the very base level (ORM / POJO layer) to the front end (View layer) level. This way is more costly since it requires changes at all layers of the application. However, it has an advantage of the ability to use the additional data in the business logic of the application.

  Client: The UI of the screen in which the additional data needs to be captured has to be modified for the additional fields. The view-service linkage also needs to be modified for transferring the additional data.

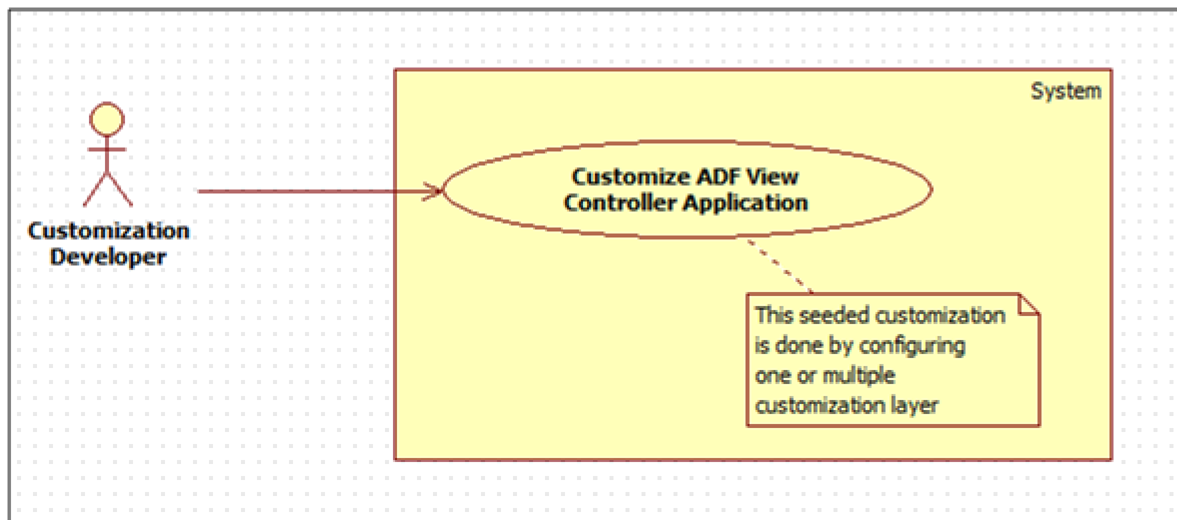
  Host: On the host side, the ORM and POJO for the entity have to be modified to save the additional field's data. The service layer has to be modified for any business logic that is affected by the additional fields.

2.1.4 ADF Screen Customization

OBP application may need to be customized for certain additional requirements. However, since these additional requirements differ from client to client, and the base application functionality remains the same, the code to handle the additional requirements is kept separate from the code of the base application. For this purpose, ***Seeded Customizations*** (built using Oracle Meta-data Services framework) can be used to customize an application.

When designing seeded customizations for an application, one or more customization layers need to be specified. A customization layer is used to hold a set of customizations. A customization layer supports one or more customization layer value which specifies the set of customizations to apply at runtime.

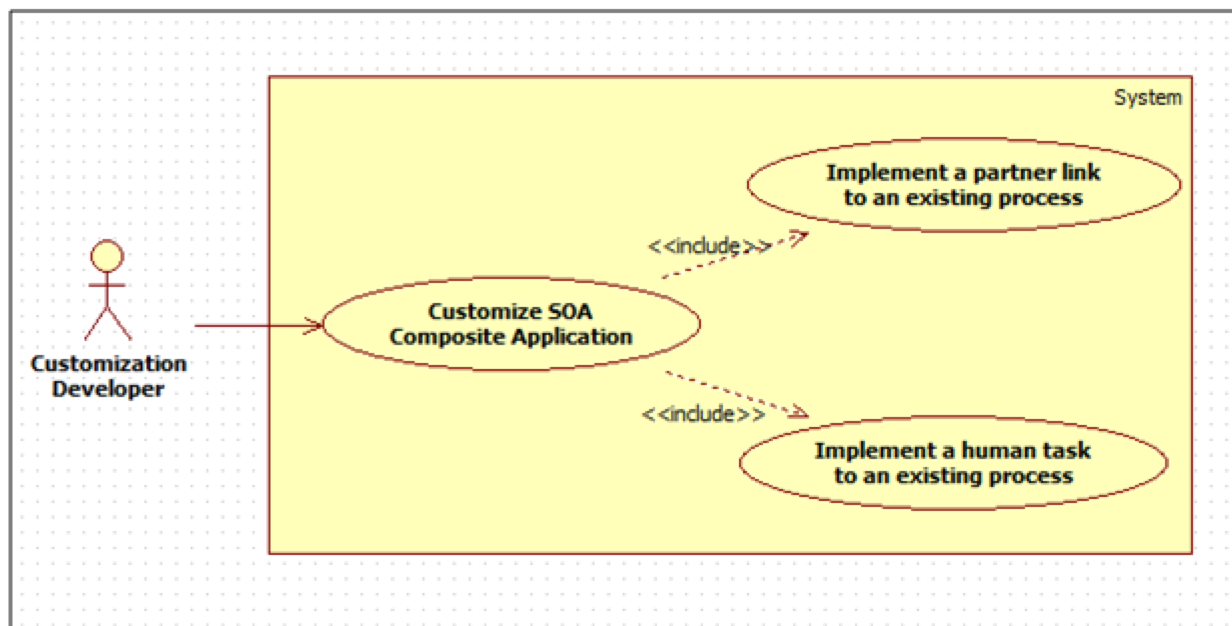
Figure 2–4 ADF Screen Customization



2.1.5 SOA Customization

OBP Application provides the feature for customizing SOA composite applications based on the additional requirements which may vary from client to client. It includes implementing the partner link to an existing process or implementing human tasks or sub processes which can be hooked into an existing product process.

Figure 2–5 SOA Customization

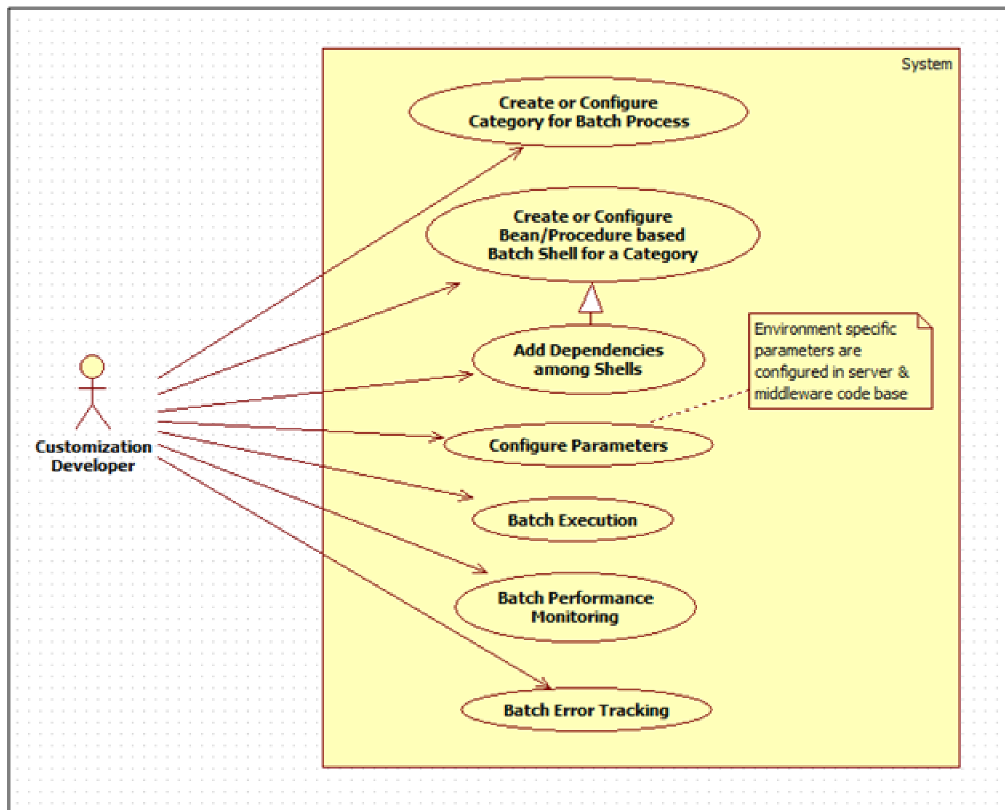


2.1.6 Batch Framework Extension

This extensibility feature is provided because most of the enterprise applications require the bulk processing of records to perform business operations in real-time environments. These business operations include complex processing of large volumes of information that is most efficiently processed with minimal or no user interaction. Such operations includes time-based events (For example, month-end calculations, notices or correspondence), periodic application of complex business rules processed repetitively across very large data sets (For example, rate adjustments).

All such scenarios form a part of batch processing for multiple records. Thus, Batch processing is used to process billions of records for enterprise applications. There are many categories in OBP Batch Processes like Beginning of Day (BOD), End of Day (EOD), and Statement Generation, and so on, for which the batch execution is performed.

Figure 2–6 Batch Framework Extension

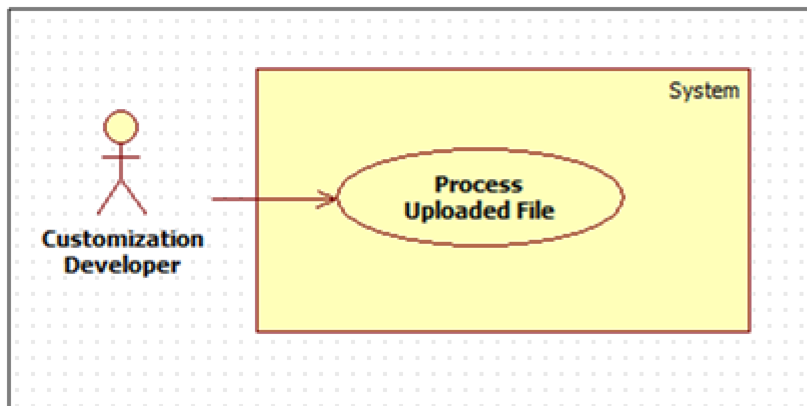


2.1.7 Uploaded File Processing

File processing is an independent process and is done separately after file upload. Every upload provides a unique field for the uploaded file. The processing is then done for each upload as per the required functionality. The final status is provided at the end of the processing in the form of ProcessStatus.

An example can be salary credit processing. Once the employer account details (in header records) and the multiple employee account details (in detail records) are uploaded through the file upload, the salary credit processing can be done in which the employer account will be debited and the multiple accounts of the employees will be credited.

Figure 2–7 Upload File Processing

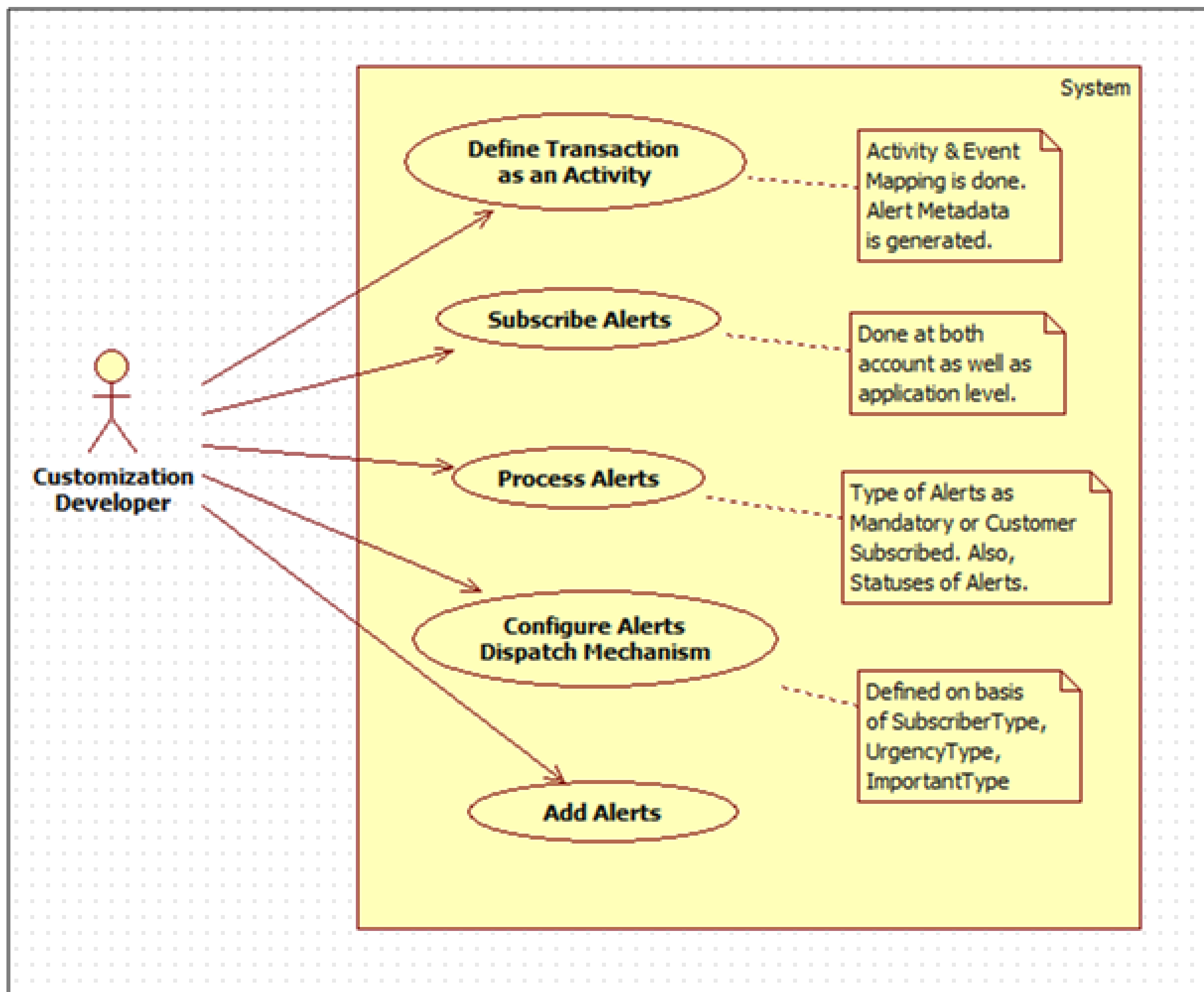


2.1.8 Alert Extension

OBP has to interface with various systems to transfer data which is generated during business activities that take place during teller operations or processing. The system requires a framework which can support on-line data transfer to interfacing systems.

This extension of event processing module of OBP provides a framework for identifying executing host services as activities and generating / raising events that are configured against the same. Generation of these events results in certain actions that can vary from dispatching data to subscribers (customers or external systems) to execution of additional logic. The action whereby data is dispatched to subscribers is termed as Alert. In OBP application, these Alerts can be customized and configured.

Figure 2–8 Alerts Extension

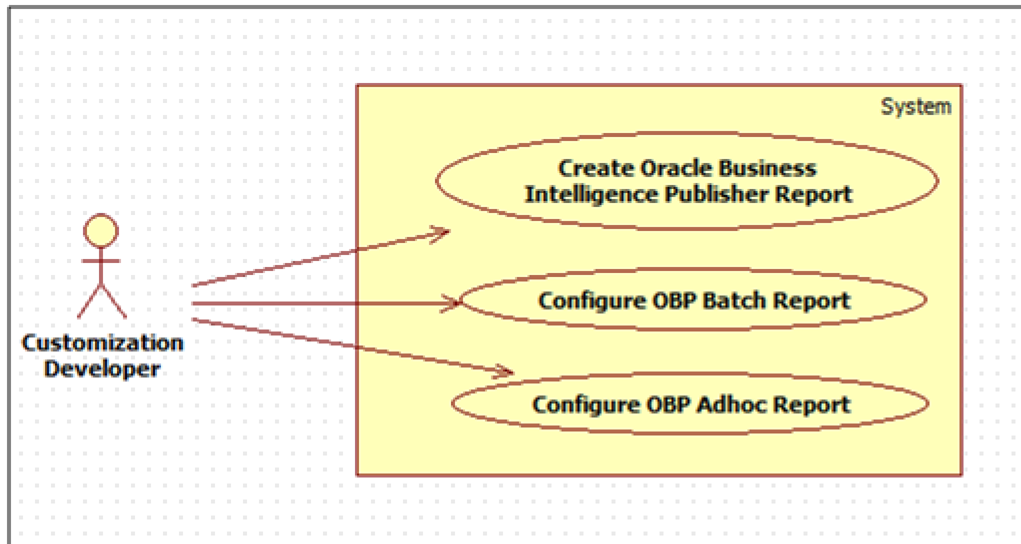


2.1.9 New Reports Creation

OBP application provides functionality for configuring multiple reports through integrated Oracle's Business Intelligence Publisher Enterprise. It is a standalone reporting and document output management solution that allows companies to lower the cost of ownership for separate reporting solutions. The developer can add and configure an Adhoc report to OBP using the BI Publisher.

The OBP application also has a batch framework using which a developer can easily add batch processes, also known as batch shells, to the application. The batch framework executes all the batch shells defined in the system as per their configuration. The results of these batch shell executions are stored in the database. In OBP, the user can create and customize the batch reports based on the requirements which can vary from client to client.

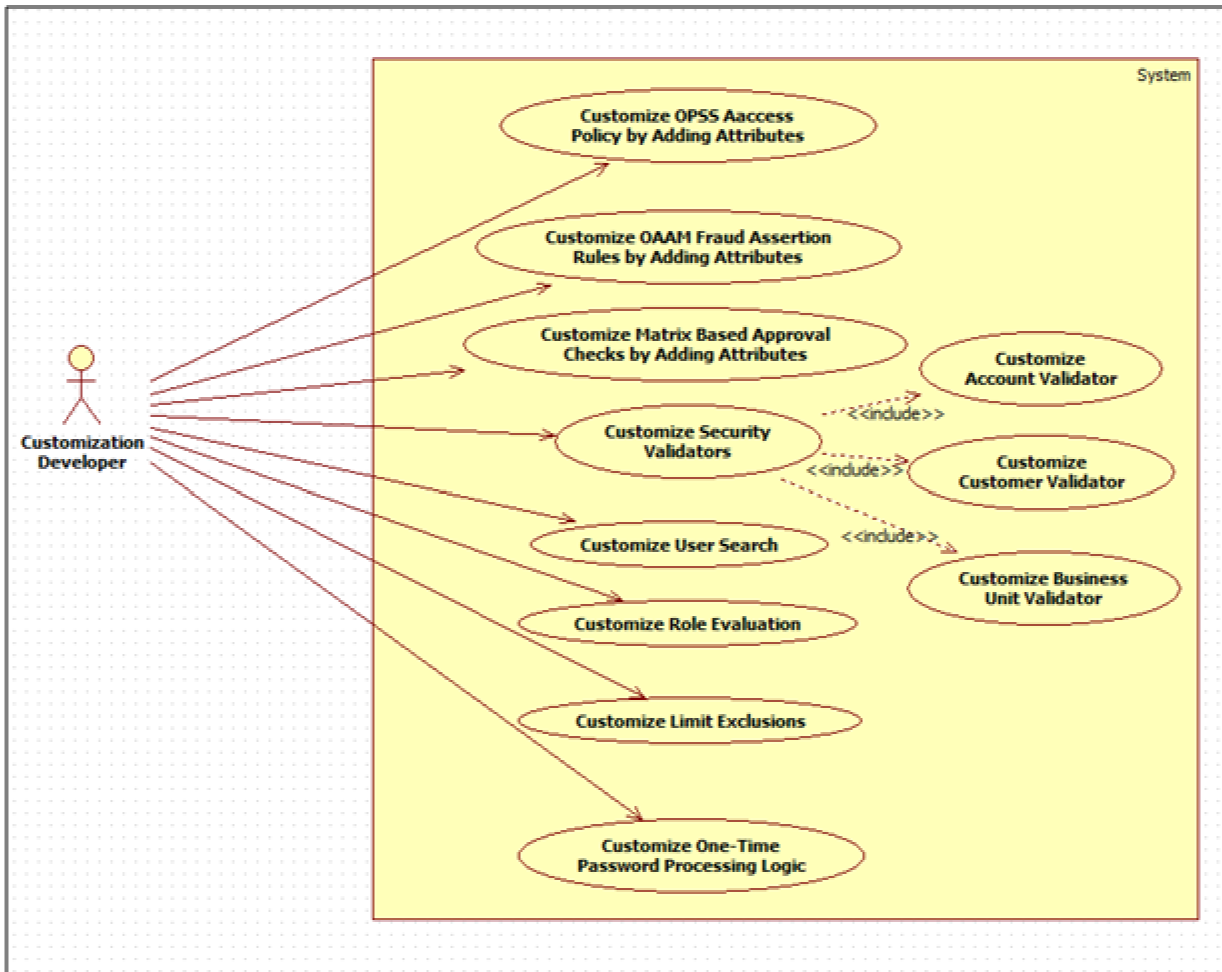
Figure 2–9 Creating New Reports



2.1.10 Security Customization

OBP application comprises of several modules which have to interface with various systems in an enterprise to transfer/share data. This data is generated during business activity that takes place during teller operations or processing. While managing the transactions that are within OBP's domain, it also needs to consider security and identity management and the uniform way in which these services need to be consumed by all applications in the enterprise. This is possible if these capabilities can be externalized from the application itself and are implemented within products that are specialized to handle such services.

Figure 2–10 Security Customization



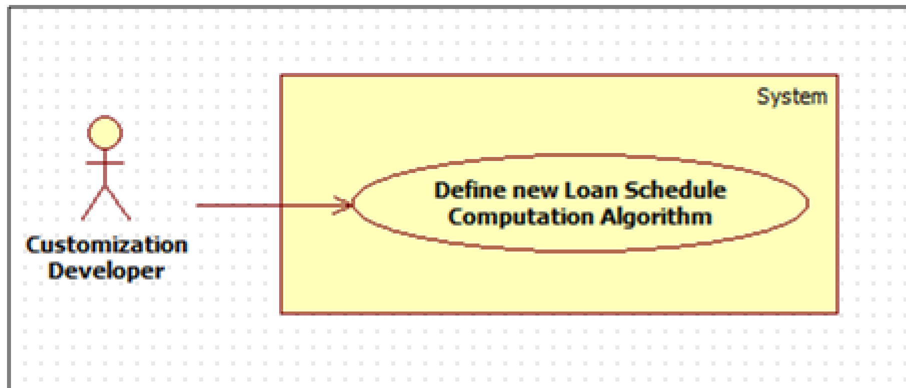
OBP application therefore provides functionality where there is a provision for customizing the security attributes or functions. For example:

- Attributes participating in access policy rules
- Attributes participating in fraud assertion rules
- Attributes participating in matrix based approval checks
- Account validator
- Customer validator
- Business unit validator
- Adding validators
- Customizing user search
- Customizing 2FA 'Send OTP | Validate OTP' logic
- Customizing Role Evaluation
- Customizing Limit Exclusions

2.1.11 Loan Schedule Computation Algorithm

OBP application provides the extensibility by which the additional loan schedule computation algorithm can be customized based on client's requirement.

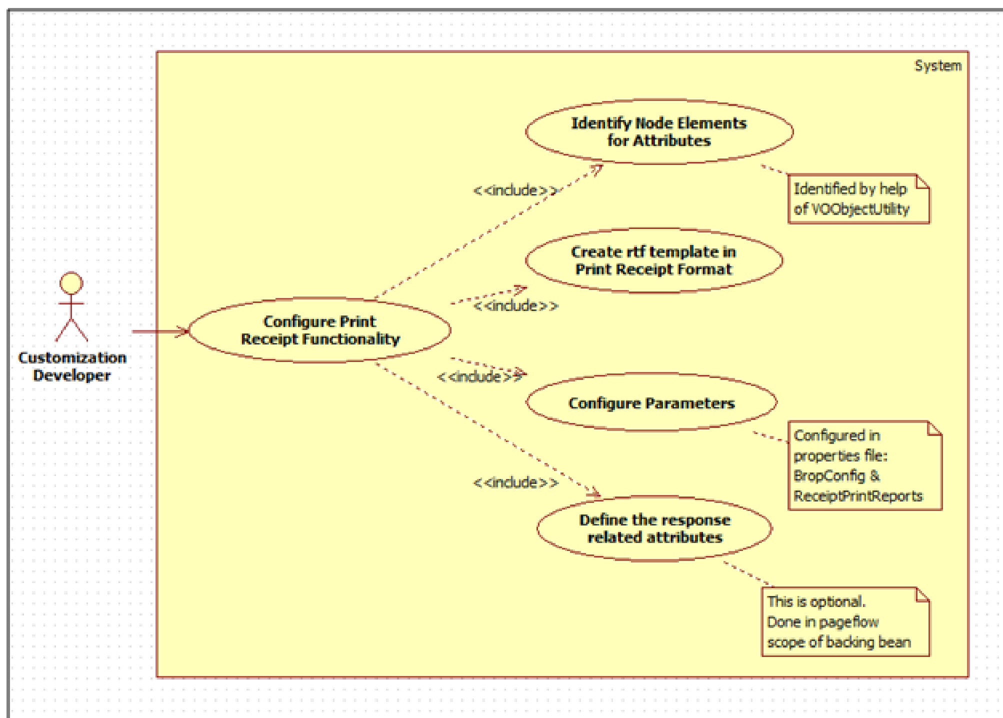
Figure 2–11 Loan Schedule Computation Algorithm



2.1.12 Print Receipt Functionality

OBP has many transaction screens in different modules where it is desired to print the receipt with different details about the transaction. This functionality provides the print receipt button on the top right corner of the screen which gets enabled on the completion of the transaction and can be used for printing of receipt of the transaction details.

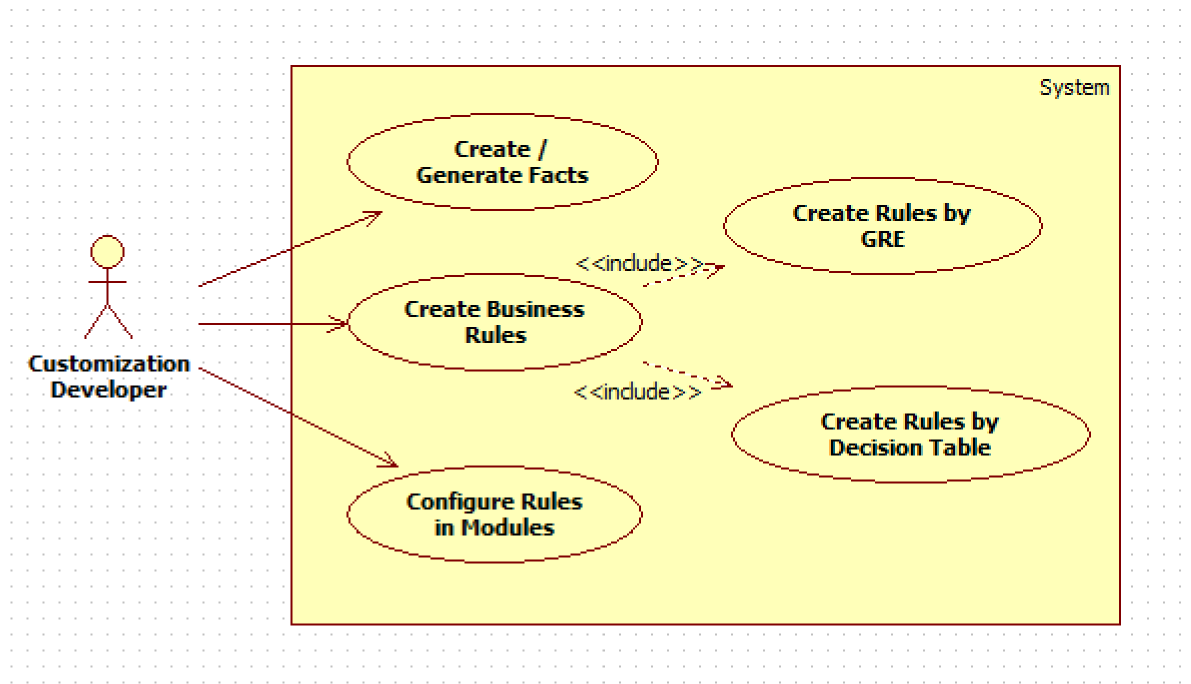
Figure 2–12 Print Receipt Functionality



2.1.13 Facts and Business Rules

Fact (in an abstract way) is something which is a reality or which holds true at a given point of time. Business rules are made up of facts. Business Rules are defined for improving agility and for implementing business policy changes. This agility, meaning fast time to market, is realized by reducing the latency from approved business policy changes to production deployment to near zero time. In addition to agility improvements, Business Rules development also requires far fewer resources for implementing business policy changes. This means that Business Rules not only provides agility, it also provides the bonus reduced cost of development.

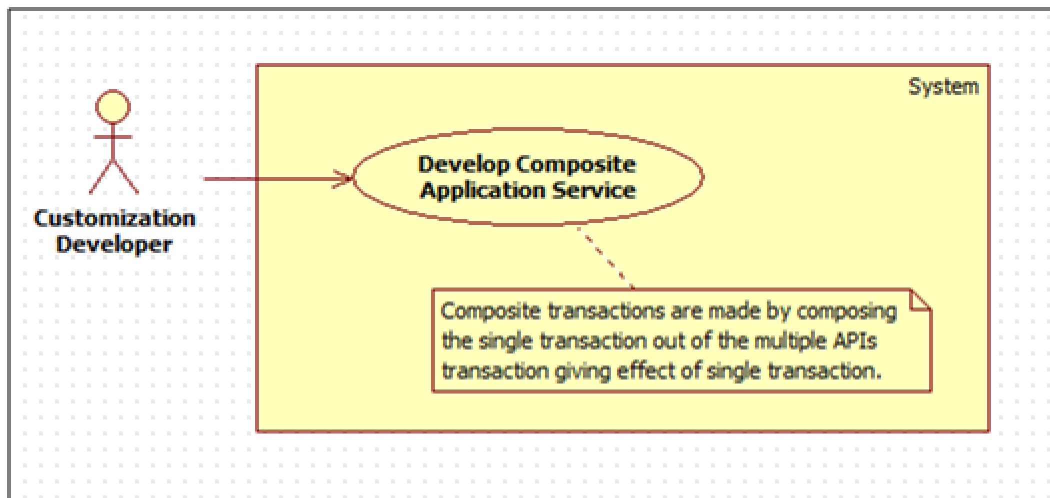
Figure 2–13 Facts and Business Rules



2.1.14 Composite Application Service

OBP provides the extensibility feature by which developer can write the composite service in which multiple service calls can be made as part of single call. Transactions in composite application service are made by composing the single transaction out of the multiple APIs transaction that gives the effect of single transaction.

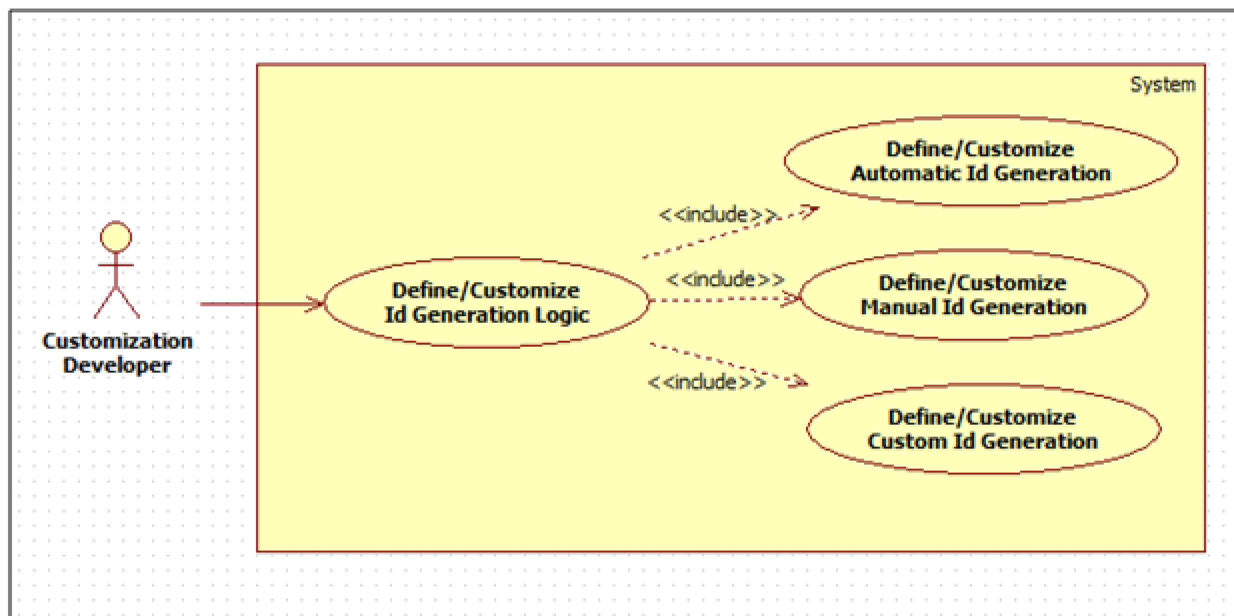
Figure 2–14 Composite Application Service



2.1.15 ID Generation

OBP is shipped with the functionality of ID generation in three ways that is, Automatic, Manual and Custom. These three configurations can be defined by the banks as per their requirements and IDs can be generated accordingly.

Figure 2–15 ID Generation

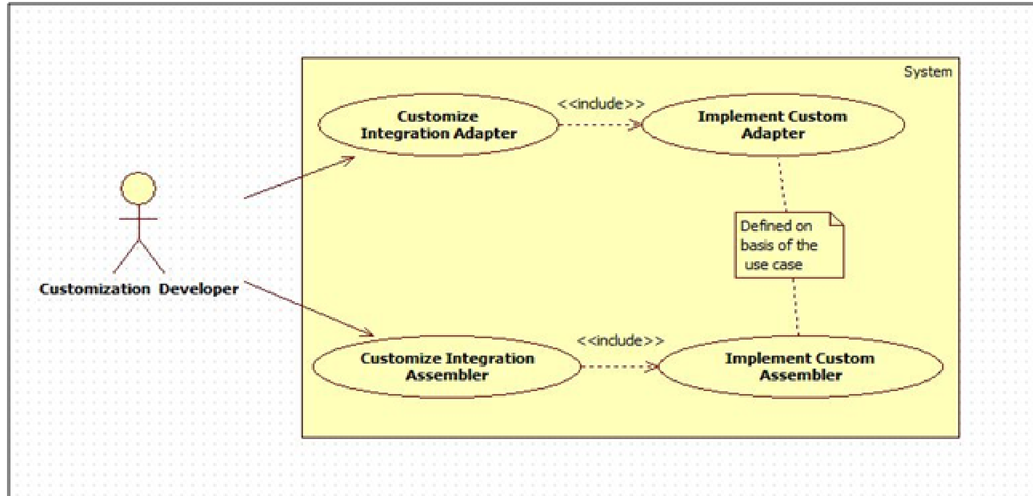


2.1.16 OCH Integration

OBP provides various integration adapters and assemblers which are used to publish customer information to OCH. These adapters and assemblers can be customized for publishing details to OCH.

Customization developer can extend the existing integration adapters to fetch or gather more information about the customer and customize integration assembler to add new mappings.

Figure 2–16 OCH Integration



3 Extending Service Executions

This chapter describes how additional business logic can be added prior to execution (pre hook) and/or post the execution (post hook) of particular application service business logic on the host side. Extension prior to a service execution can be required for the purposes of additional input validation, input manipulation, custom logging and so on.

An application service extension in the form of a pre hook can be important in the following scenarios:

- Additional input validations
- Execution of business logic, which necessarily has to happen before going ahead with normal service execution.

An application service extension in the form of a post hook can be important in the following scenarios:

- Output response manipulation
- Third party system calls in the form of web service invocation, JMS interface and so on.
- Custom data logging for subsequent processing or reporting.

The OBP application provides two layers where the pre and post extension hooks for extending service execution can be implemented. These places are:

- Application Service – referred to as the “app” layer extension.
- Extended Application Service – referred to as the “appx” layer extension.

There are few differences in the extensions of the app and appx layer:

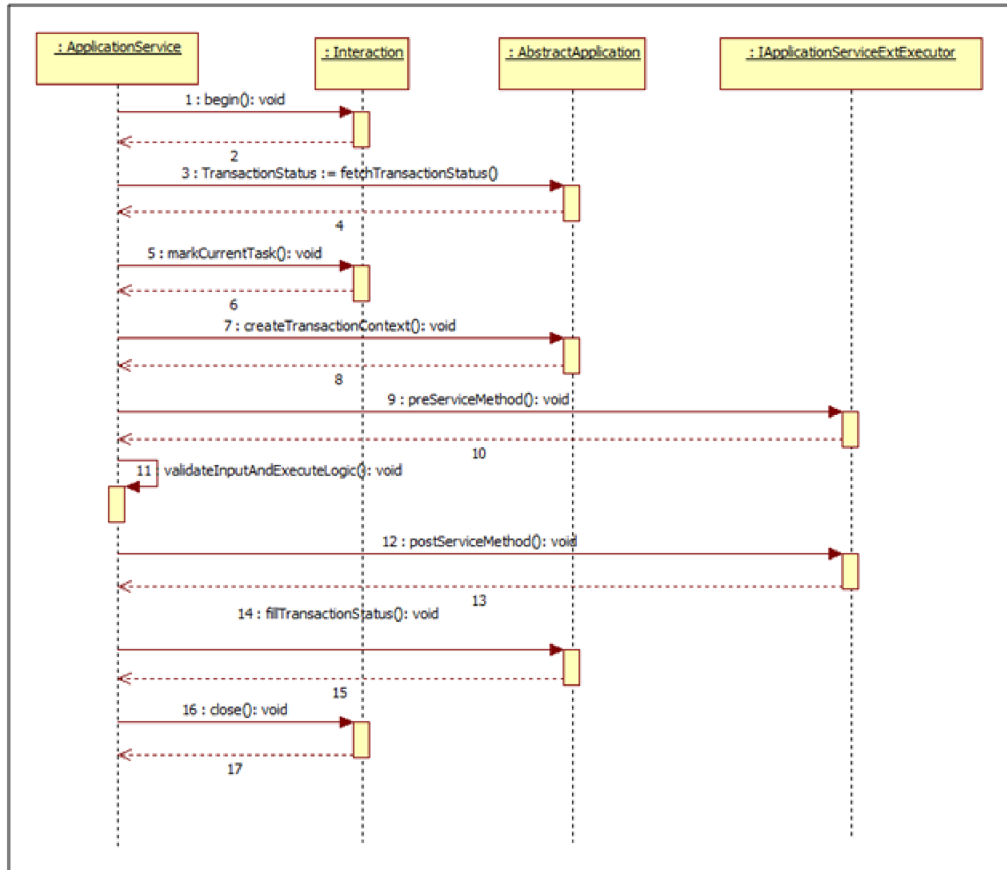
- In the appx layer extension, the validations can be added against the user defined fields which is not possible in case of the app layer.
- In the appx layer extension, the service response can be passed when the return type is not transaction status. This response can be validated or updated which is not available in case of app layer.
- In the appx layer, the approvals can be incorporated and can be validated in the appx layer extension which is not possible in app layer.

3.1 Service Extension – Extending the “app” Layer

The "app" layer is referred to as the application service layer. It denotes the business logic that executes as part of a service method exposed by OBP middleware host. Extension points provided as pre and post hooks are present in this layer at the same

points in the service. Every application service method has a standard set of framework method calls as shown in the sequence diagram below:

Figure 3–1 Standard Set of Framework Method Calls



The pre hook is provided after the invocation of createTransactionContext call inside the application service. At this step, the transaction context is set and the host application core framework is aware of the executing service with respect to the authenticated subject or the user who has posted the transaction, transaction inputs, financial dates, different determinant types applicable for the executing service, an initialized status and has the ability to track the same against a unique reference number. At this step, the database session is also initialized and accessible enabling the user to use the same in the pre hook for any database access which needs to be made.

The post hook is provided after the business logic corresponding to the application service invoked has executed and before the successful execution of the entire service is marked in the status object. This ensures that the status marking takes into consideration any execution failures of post hook prior to reporting the result to the calling source. Both, the pre and the post hooks accept the service input parameters as the inputs.

The following sections explain important concepts, which should be understood for extending in this service layer.

3.1.1 Application Service Extension Interface

The OBP plug-in for eclipse generates an interface for the extension of a particular service. The interface name is in the form I<Service_Name>ApplicationServiceExt. This interface has a pair of pre and post method definitions for each application service method of the present. The signatures of these methods are:

```
public void pre<Method_Name>(<Method_Parameters>) throws FatalException;
public void post<Method_Name>(<Method_Parameters>) throws FatalException;
```

A service extension class has to implement this interface. The pre method of the extension is executed before the actual service method and the post method of the extension is executed after the service method.

Figure 3–2 Extension Hook for DocumentTypeApplicationService

```
package com.ofss.fc.app.content.service.ext;

import com.ofss.fc.app.content.dto.DocumentTypeDTO;

/**
 * <p>
 * Extension hook for DocumentTypeApplicationService. The default implementation for this interface
 * is the generated VoidDocumentTypeApplicationServiceExt. Extensions should extend the VoidDocumentTypeApplicationServiceExt
 * instead of implementing this interface.
 * </p>
 * @see com.ofss.fc.app.content.service.VoidDocumentTypeApplicationServiceExt
 */
public interface IDocumentTypeApplicationServiceExt {

    /**
     * This is the extension point for DocumentTypeApplicationService.addDocumentType.
     * The SessionContext object is not passed but the rest of the parameters are the same.
     * The javadoc for the original method and the params can be seen from the See Also link.
     * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#addDocumentType
     */
    public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
        throws FatalException;

    /**
     * This is the extension point for DocumentTypeApplicationService.addDocumentType.
     * The SessionContext object is not passed but the rest of the parameters are the same.
     * The javadoc for the original method and the params can be seen from the See Also link.
     * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#addDocumentType
     */
    public void postAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
        throws FatalException;

    /**
     * This is the extension point for DocumentTypeApplicationService.updateDocumentType.
     * The SessionContext object is not passed but the rest of the parameters are the same.
     * The javadoc for the original method and the params can be seen from the See Also link.
     * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#updateDocumentType
     */
    public void preUpdateDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
        throws FatalException;

    /**
     * This is the extension point for DocumentTypeApplicationService.updateDocumentType.
     * The SessionContext object is not passed but the rest of the parameters are the same.
     * The javadoc for the original method and the params can be seen from the See Also link.
     * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#updateDocumentType
     */
    public void postUpdateDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
```

3.1.2 Default Application Service Extension

The OBP plug-in for eclipse generates a default extension for a particular service in the form of the class Void<Service_Name>ApplicationServiceExt. This class implements the aforementioned service extension interface without any business logic if the implemented methods are empty.

The default extension is a useful and convenient mechanism to implement the pre and / or post extension hooks for specific methods of an application service. Instead of implementing the entire interface, one should extend the default extension class and override only required methods with the additional business logic. Product developers DO NOT implement any logic, including product extension logic, inside the default

extension classes. This is because the classes are auto-generated and reserved for product use and get overwritten as part of a bulk generation process.

Figure 3–3 Default Application Service Extension

```
package com.ofss.fc.app.content.service.ext;

import com.ofss.fc.app.content.dto.DocumentTypeDTO;

/**
 * <p>
 * Extension hook for DocumentTypeApplicationService. The default for the extension points.
 * Each application service method for DocumentTypeApplicationService has corresponding pre
 * and post methods. This default implementation returns and does nothing.
 * Extenders are encouraged to extned this class instead of implementing
 * the interface as they would have to then implement all methods. This class
 * is provided for easing the writing of the extensions.
 * </p>
 * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService
 */
public class VoidDocumentTypeApplicationServiceExt implements IDocumentTypeApplicationServiceExt {

    /**
     * This is the extension point for DocumentTypeApplicationService.addDocumentType.
     * The SessionContext object is not passed but the rest of the parameters are the same.
     * The javadoc for the original method and the params can be seen from the See Also link.
     * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#addDocumentType
     */
    public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
        throws FatalException {
        return;
    }

    /**
     * This is the extension point for DocumentTypeApplicationService.addDocumentType.
     * The SessionContext object is not passed but the rest of the parameters are the same.
     * The javadoc for the original method and the params can be seen from the See Also link.
     * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#addDocumentType
     */
    public void postAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
        throws FatalException {
        return;
    }

    /**
     * This is the extension point for DocumentTypeApplicationService.updateDocumentType.
     * The SessionContext object is not passed but the rest of the parameters are the same.
     * The javadoc for the original method and the params can be seen from the See Also link.
     * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#updateDocumentType
     */
    public void preUpdateDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
        throws FatalException {
        return;
```

3.1.3 Application Service Extension Executor

The OBP plug-in for eclipse generates a service extension executor interface and an implementation for the executor interface. The naming convention for the generated executor classes which enable 'extension chaining' is as shown below:

```
Interface : I<Application Service Qualifier>ApplicationServiceExtExecutor
Implementation : <Application Service Qualifier>ApplicationServiceExtExecutor
```

The service extension executor class, on load, creates an instance each of all the extensions defined in the service extensions configuration file. If no extensions are defined for a particular service, the executor creates an instance of the default extension for the service. The executor also has a pair of pre and post methods for each method of the actual service. These methods in turn call the corresponding methods of all the extension classes defined for the service.

Figure 3–4 Application Service Extension Executor

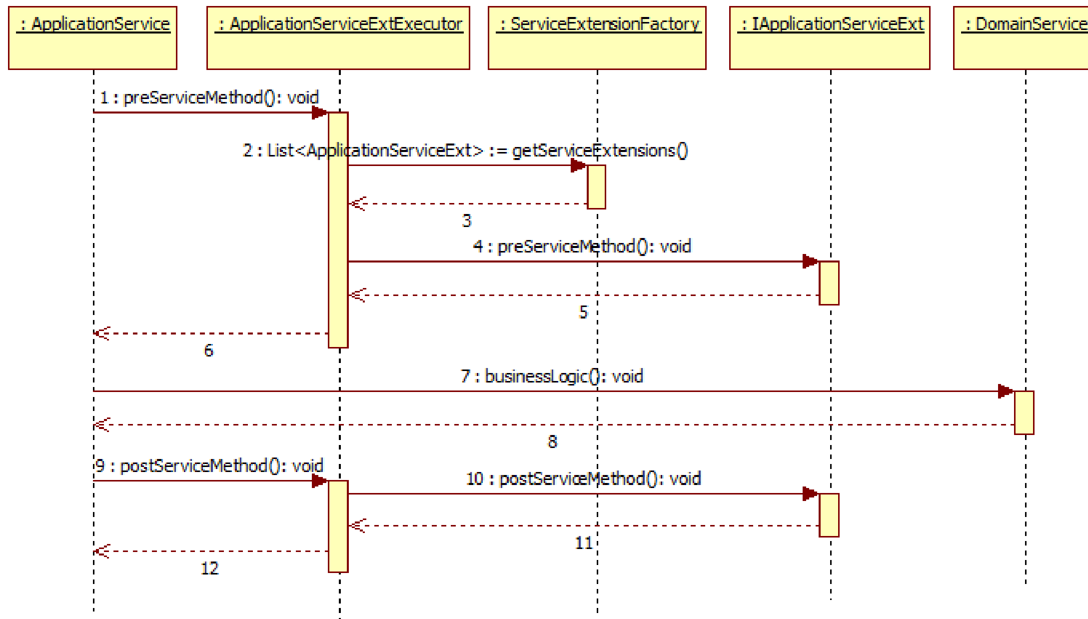


Figure 3–5 ExtensionFactory Hook for DocumentTypeApplicationService

```
com.ofss.fc.module.content/src/com/ofss/fc/app/content/service/ext/IDocumentTypeApplicationServiceExtExecutor.java - Eclipse
File  Edit  Source  Refactor  Navigate  Search  Project  Run  Window  Help
Quick Access   Java   SVN Repository Exploring   Team Synchronizing   Debug
DocumentTypeApplicationService.java   DocumentTypeApplicationServiceExtExecutor.jav   IDocumentTypeApplicationServiceExtExecutor.ja

 1 package com.ofss.fc.app.content.service.ext;
 2
 3 import com.ofss.fc.app.content.dto.DocumentTypeDTO;
 9
10 /**
11  * <p>
12  * ExtensionFactory hook for DocumentTypeApplicationService. Extension Factories should extend
13  * the IDocumentTypeApplicationServiceExtExecutor
14  * </p>
15  */
16 public interface IDocumentTypeApplicationServiceExtExecutor {
17
18     /**
19      * This is the extension point for DocumentTypeApplicationService.addDocumentType.
20      * The SessionContext object is not passed but the rest of the parameters are the same.
21      * The javadoc for the original method and the params can be seen from the See Also link.
22      * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#addDocumentType
23      */
24     public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
25         throws FatalException;
26
27     /**
28      * This is the extension point for DocumentTypeApplicationService.addDocumentType.
29      * The SessionContext object is not passed but the rest of the parameters are the same.
30      * The javadoc for the original method and the params can be seen from the See Also link.
31      * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#addDocumentType
32      */
33     public void postAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
34         throws FatalException;
35
36     /**
37      * This is the extension point for DocumentTypeApplicationService.updateDocumentType.
38      * The SessionContext object is not passed but the rest of the parameters are the same.
39      * The javadoc for the original method and the params can be seen from the See Also link.
40      * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#updateDocumentType
41      */
42     public void preUpdateDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
43         throws FatalException;
44
45     /**
46      * This is the extension point for DocumentTypeApplicationService.updateDocumentType.
47      * The SessionContext object is not passed but the rest of the parameters are the same.
48      * The javadoc for the original method and the params can be seen from the See Also link.
49      * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#updateDocumentType
50      */
51     public void postUpdateDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
52         throws FatalException;
53
```

Figure 3–6 Factory Implementation of Extension Hook for DocumentTypeApplicationService

```
package com.ofss.fc.app.content.service.ext;

import com.ofss.fc.app.content.dto.DocumentTypeDTO;

/**
 * <p>
 * Factory Implementation of Extension hook for DocumentTypeApplicationService. The default
 * for the extension points.
 * The methods in this class when invoked, will internally call the pre/post
 * methods present in the classes returned by the ServiceExtensionFactory
 * </p>
 * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService
 */
public class DocumentTypeApplicationServiceExtExecutor implements IDocumentTypeApplicationServiceExtExecutor {

private static IDocumentTypeApplicationServiceExtExecutor uniqueInstance = new DocumentTypeApplicationServiceExtExecutor();
private static String THIS_COMPONENT_NAME = DocumentTypeApplicationServiceExtExecutor.class.getName();

    private List<IDocumentTypeApplicationServiceExt> extensions = null;

    public DocumentTypeApplicationServiceExtExecutor(){
        extensions =
            (List<IDocumentTypeApplicationServiceExt>) ServiceExtensionFactory
                    .getServiceExtensions(DocumentTypeApplicationService.class.getName());
    }

    public static IDocumentTypeApplicationServiceExtExecutor getInstance() {
            synchronized (DocumentTypeApplicationServiceExtExecutor.class) {
                if (uniqueInstance == null) {
                    uniqueInstance = new DocumentTypeApplicationServiceExtExecutor();
                }
            }
            return uniqueInstance;
    }

    /**
     * This is the extension point for DocumentTypeApplicationService.addDocumentType.
     * The javadoc for the original method and the params can be seen from the See Also link.
     * @see com.ofss.fc.app.content.service.DocumentTypeApplicationService#addDocumentType
     */
    public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
        throws FatalException {
        for (IDocumentTypeApplicationServiceExt extension : extensions) {
                extension.preAddDocumentType(sessionContext, documentTypeDTO);
        }
    }

    /**
```

3.1.4 Extension Configuration

The extension classes that implement the extension interface are mapped to the application service class with the help of a property file mapping inside serviceextensions.properties. The mapping convention to be specified is a service's fully qualified class name to comma separated extensions' fully qualified class name in the following format:

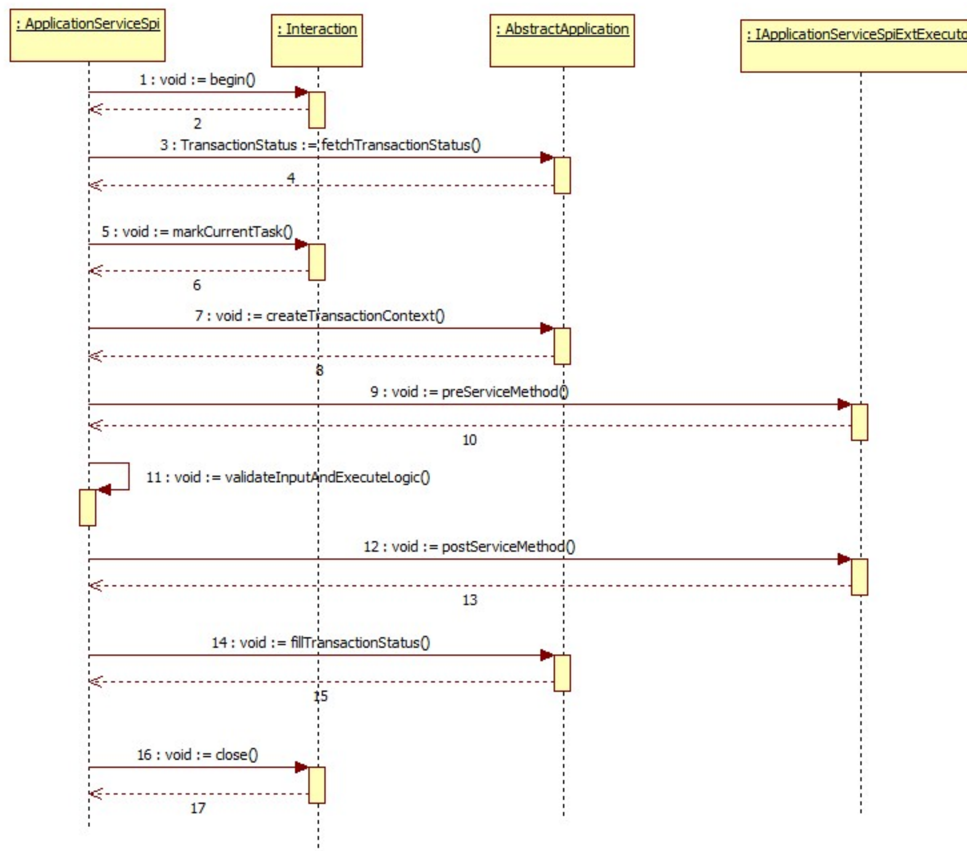
```
<service_class_name>=<extension_class_name>,<extension_class_name>...
Example Mapping : config/properties/serviceextensions.properties
Single extension configuration
com.ofss.fc.app.content.service.DocumentTypeApplicationService=
com.ofss.fc.app.content.service.ext.DocumentTypeApplicationServiceExt
Multiple extension configuration
com.ofss.fc.app.content.service.DocumentTypeApplicationService=
com.ofss.fc.app.content.service.ext.in.DocumentTypeApplicationServiceExtension,
com.ofss.fc.app.content.service.ext.in.mum.DocumentTypeApplicationServiceExtension
,
com.ofss.fc.app.content.service.ext.in.mum.ExtendedDocumentTypeApplicationService,
com.ofss.fc.app.content.service.ext.in.blr.DocumentTypeApplicationServiceExtension
,
com.ofss.fc.app.content.service.ext.in.blr.ExtendedDocumentTypeApplicationService
```

It is possible to configure multiple implementations of pre / post extensions for an executing service in this layer. This is achieved with the help of the extension executor which has the capability to loop through a set of extension implementations which conform to the extension interface which is supported by the service.

3.2 Extended Application Service Extension – Extending the “appx” Layer

The ’appx’ layer is referred to as the extended application service layer. It represents the business logic that executes as part of a service method exposed by OBP middleware host with additional internal service calls to support extended features such as user defined fields (UDF). The appx layer also provides extension support, on top of and on the lines of the app layer. The implementation of extension support in this layer is similar to the implementation of extension support in the app layer.

Figure 3–7 Extended Application Service Extension



The pre hook is provided before the invocation of actual application service call inside the extended application service layer. At this step, the extended host application core framework is aware of the executing service with respect to the authenticated subject or the user who has posted the transaction and an initialized status. At this step, the database session is also initialized and accessible enabling the user to use the same in the pre hook for any database access which might be required.

The post hook is provided after the primary application service which is extended in the appx layer along with the remaining internal service calls to support extended features like UDF complete execution and before the successful execution of the entire service is marked in the status object. This ensures that the status marking takes into consideration any execution failures of post hook prior to reporting the result to the calling source. Both, the pre and the post hooks accept the service input parameters including UDF data as their inputs. Additionally, if the response type of the object

returned by the primary app layer application service is other TransactionStatus, the same is also accepted as input by the post hook.

The following sections explain the important concepts which should be understood for extending in this appx layer.

Figure 3–8 Extended Application Service Extension - Post and Pre Hook

The following concepts are important for extending in this service provider layer:

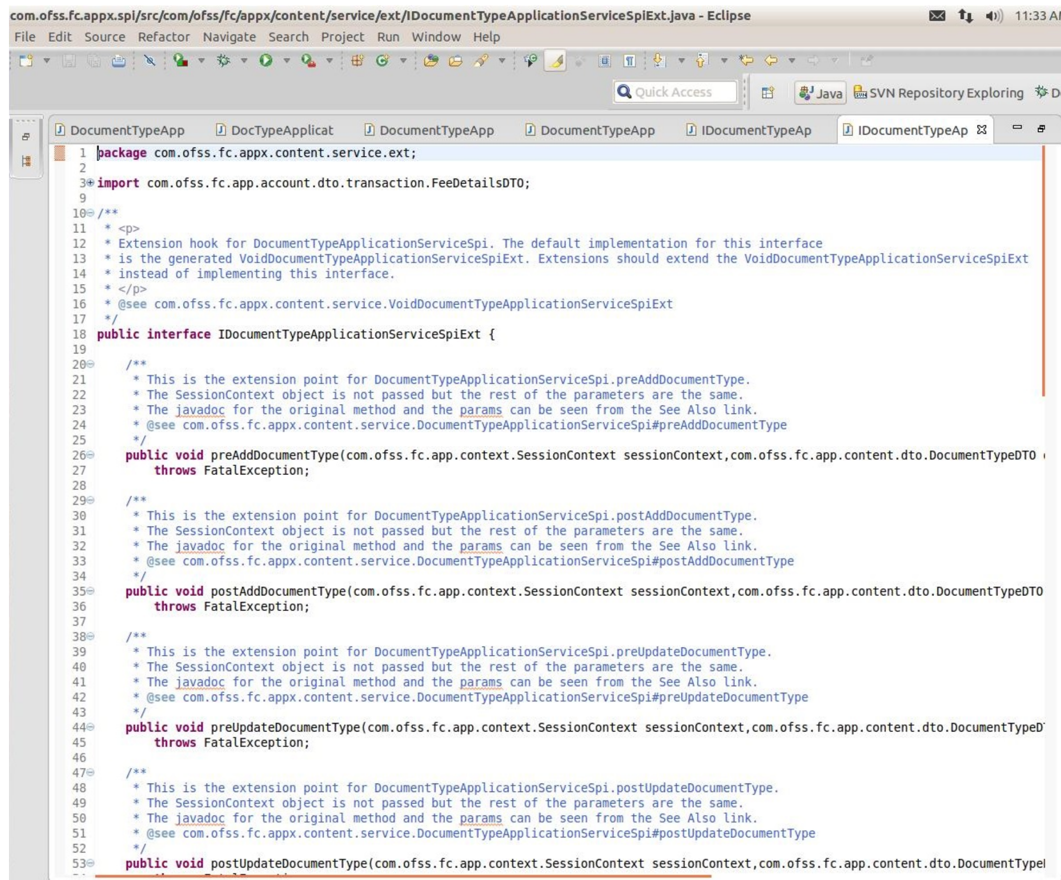
3.2.1 Extended Application Service Extension Interface

The OBP plug-in for eclipse generates an interface for the extension of a particular service. The interface name is in the form I<Service_Name>ApplicationServiceSpiExt. This interface has a pair of method definitions for each method of the present in the actual service. The signatures of these methods are:

```
public void pre<Method_Name>(<Method_Parameters>) throws FatalException;
public void post<Method_Name>(<Method_Parameters>) throws FatalException;
```

An extended application service extension class has to implement this interface. The pre method of the extension is executed before the actual service method and the post method of the extension is executed after the service method.

Figure 3–9 Extension Hook for DocumentTypeApplicationServiceSpi



3.2.2 Default Implementation of Appx Extension

The OBP plug-in for eclipse generates a default service extension for a particular service in the form of the class ***Void<Service_Name>ApplicationServiceSpiExt***. This class implements the aforementioned service provider extension interface without any business logic viz. the implemented methods are empty.

The default extension is a useful and convenient mechanism to implement the pre and / or post extension hooks for specific methods of an application service. Instead of implementing the entire interface, one should extend the default extension class and override only required methods with the additional business logic. Product developers DO NOT implement any logic, including product extension logic, inside the default extension classes. This is because the classes are auto-generated and reserved for product use and may get overwritten as part of a bulk generation process.

Figure 3–10 Default Implementation of Appx Extension

```
com.ofss.fc.appx.spi/src/com/ofss/fc/appx/content/service/ext/VoidDocumentTypeApplicationServiceSpiExt.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access   Java   SVN Repository Exploring   Team Synchronizing   Debug
DocumentTypeApplicationServiceExtExecutor.java   VoidDocumentTypeApplicationServiceSpiExt.java

 2 Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.
 4 package com.ofss.fc.appx.content.service.ext;
 5
 6 import com.ofss.fc.app.account.dto.transaction.FeeDetailsDTO;
 7 import com.ofss.fc.app.content.dto.DocumentTypeInquiryResponse;
 8 import com.ofss.fc.app.content.dto.DocumentTypeInquiryResponseSet;
 9 import com.ofss.fc.app.udf.udfservice.dto.LinkedUDFDTO;
10 import com.ofss.fc.enumeration.content.DocumentClassificationType;
11 import com.ofss.fc.infra.exception.FatalException;
12
14  * VoidDocumentTypeApplicationServiceSpiExt
18 public class VoidDocumentTypeApplicationServiceSpiExt implements IDocumentTypeApplicationServiceSpiExt {
19
20     public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext, com.ofss.fc.app.content.dto.DocumentTypeDTO
21         /*
22         Void extension hook implemented with empty pre and post methods for the ApplicationServiceSpi. Each application
23         service method for the ApplicationServiceSpi has corresponding pre and post methods. This default
24         implementation does nothing. Usage guideline mandates extending this class instead of implementing the
25         interface as they would have to then implement all methods. This class is provided for easing the
26         writing of the extensions. An entry of extended class should be put in serviceextensions.properties.
27         */
28         /*
29         DO NOT ADD ANY CODE IN THESE METHODS AS IT WILL GET OVERWRITTEN WHEN BULK GENERATION OF CODE HAPPENS
30         AND THE PERSON GENERATING DOES A BULK CHECK-IN !!!
31         */
32     }
33
34     public void postAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext, com.ofss.fc.app.content.dto.DocumentTypeDT
35         /*
36         Void extension hook implemented with empty pre and post methods for the ApplicationServiceSpi. Each application
37         service method for the ApplicationServiceSpi has corresponding pre and post methods. This default
38         implementation does nothing. Usage guideline mandates extending this class instead of implementing the
39         interface as they would have to then implement all methods. This class is provided for easing the
40         writing of the extensions. An entry of extended class should be put in serviceextensions.properties.
41         */
42         /*
43         DO NOT ADD ANY CODE IN THESE METHODS AS IT WILL GET OVERWRITTEN WHEN BULK GENERATION OF CODE HAPPENS
44         AND THE PERSON GENERATING DOES A BULK CHECK-IN !!!
45         */
46     }
47
48     public void preUpdateDocumentType(com.ofss.fc.app.context.SessionContext sessionContext, com.ofss.fc.app.content.dto.DocumentTypeI
61
62     public void postUpdateDocumentType(com.ofss.fc.app.context.SessionContext sessionContext, com.ofss.fc.app.content.dto.DocumentTyp
75
76     public void preFetchDocumentType(com.ofss.fc.app.context.SessionContext sessionContext, com.ofss.fc.app.content.dto.DocumentTypeD
89
90     public void postFetchDocumentType(com.ofss.fc.app.context.SessionContext sessionContext, com.ofss.fc.app.content.dto.DocumentTypeI
```

3.2.3 Configuration

The service provider extension class to the service class mapping is defined in a property file *ServiceProviderExtensions.properties* under "config/properties". Multiple extensions can be defined for a particular service provider with the help of the extension executor. The pre and post extensions are defined in the service layer.

The mapping is specified for a service provider extension interface's fully qualified class name to service provider extension class's fully qualified class name in the following format:

```
<service_provider_interface_name>=<service_provider_extension_class_
name>,<service_provider_extesion_class_name>
Example Mapping : config/properties/ServiceProviderExtensions.properties
Single extension configuration
com.ofss.fc.appx.content.service.ext.DocumentTypeApplicationServiceSpi=
com.ofss.fc.appx.content.service.ext.DocumentTypeApplicationServiceSpiExt
Multiple extension configuration
com.ofss.fc.appx.content.service.ext.DocumentTypeApplicationServiceSpi=
com.ofss.fc.appx.content.service.ext.in.DocumentTypeApplicationServiceExt,
com.ofss.fc.appx.content.service.ext.in.mum.DocumentTypeApplicationServiceExt,
com.ofss.fc.appx.content.service.ext.in.mum.ExtendedDocumentTypeApplicationService
, com.ofss.fc.appx.content.service.ext.in.blr.DocumentTypeApplicationServiceExt,
com.ofss.fc.appx.content.service.ext.in.blr.ExtendedDocumentTypeApplicationService
```

3.2.4 Extended Application Service Extension Executor

The OBP plug-in for eclipse generates a service provider extensions executor interface and an implementation class in the form of the following naming convention.

```
I<ApplicationServiceQualifier>ApplicationServiceSpiExtExecutor
<ApplicationServiceQualifier>ApplicationServiceSpiExtExecutor
```

The extended application service extension executor class, on load, creates an instance each of all the extensions defined in the service provider extensions configuration file. If no extensions are defined for a particular service provider, the executor creates an instance of the default extension for the appx service. The executor also has a pair of pre and post methods for each method of the actual appx service. These methods in turn delegate the call to the corresponding methods of all the extension classes configured inside the properties file for the service provider.

Figure 3–11 Extended Application Service Extension Executor

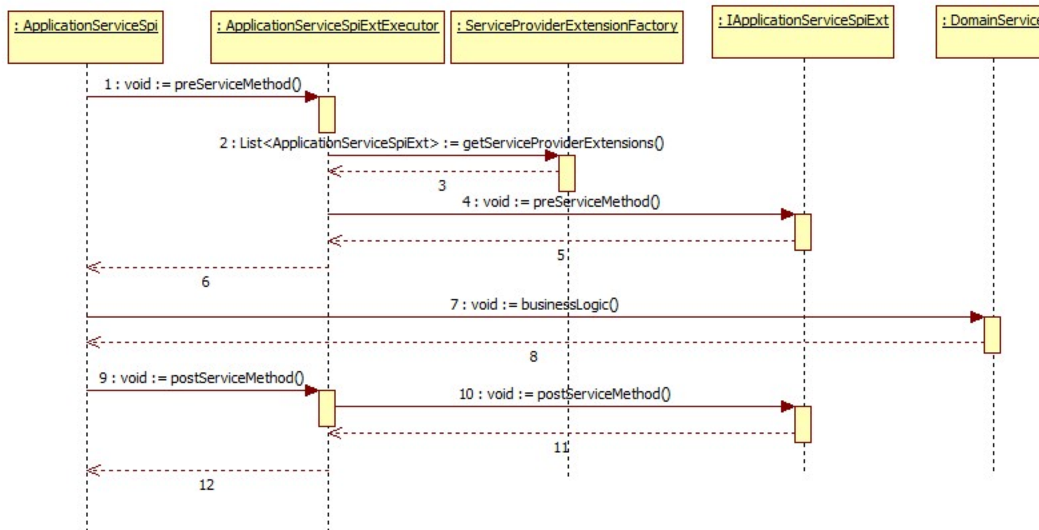


Figure 3–12 ExtensionFactory Hook for DocumentTypeApplicationServiceSpi

```
com.ofss.fc.appx.spi/src/com/ofss/fc/appx/content/service/ext/IDocumentTypeApplicationServiceSpiExtExecutor.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help

1  package com.ofss.fc.appx.content.service.ext;
2
3  import com.ofss.fc.app.account.dto.transaction.FeeDetailsDTO;
9
10 /**
11  * <p>
12  * ExtensionFactory hook for DocumentTypeApplicationServiceSpi. Extension Factories should implement
13  * the IDocumentTypeApplicationServiceSpiExtExecutor
14  * </p>
15  */
16 public interface IDocumentTypeApplicationServiceSpiExtExecutor {
17
18     /**
19      * This is the extension point for DocumentTypeApplicationServiceSpi.preAddDocumentType.
20      * The javadoc for the original method and the params can be seen from the See Also link.
21      * @see com.ofss.fc.appx.content.service.DocumentTypeApplicationServiceSpi#preAddDocumentType
22      */
23     public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,com.ofss.fc.app.content.dto.DocumentTypeDTO
24         throws FatalException;
25
26     /**
27      * This is the extension point for DocumentTypeApplicationServiceSpi.postAddDocumentType.
28      * The javadoc for the original method and the params can be seen from the See Also link.
29      * @see com.ofss.fc.appx.content.service.DocumentTypeApplicationServiceSpi#postAddDocumentType
30      */
31     public void postAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,com.ofss.fc.app.content.dto.DocumentTypeDTO
32         throws FatalException;
33
34     /**
35      * This is the extension point for DocumentTypeApplicationServiceSpi.preUpdateDocumentType.
36      * The javadoc for the original method and the params can be seen from the See Also link.
37      * @see com.ofss.fc.appx.content.service.DocumentTypeApplicationServiceSpi#preUpdateDocumentType
38      */
39     public void preUpdateDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,com.ofss.fc.app.content.dto.DocumentTypeD
40         throws FatalException;
41
42     /**
43      * This is the extension point for DocumentTypeApplicationServiceSpi.postUpdateDocumentType.
44      * The javadoc for the original method and the params can be seen from the See Also link.
45      * @see com.ofss.fc.appx.content.service.DocumentTypeApplicationServiceSpi#postUpdateDocumentType
46      */
47     public void postUpdateDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,com.ofss.fc.app.content.dto.DocumentType
48         throws FatalException;
49
50     /**
51      * This is the extension point for DocumentTypeApplicationServiceSpi.preFetchDocumentType.
52      * The javadoc for the original method and the params can be seen from the See Also link.
53      * @see com.ofss.fc.appx.content.service.DocumentTypeApplicationServiceSpi#preFetchDocumentType
```

Figure 3–13 Factory Implementation of Extension Hook for DocumentTypeApplicationServiceSpi

```
com.ofss.fc.appx.spi/src/com/ofss/fc/appx/content/service/ext/DocumentTypeApplicationServiceSpiExtExecutor.java - Eclipse
1  package com.ofss.fc.appx.content.service.ext;
2
3⊕ import com.ofss.fc.app.account.dto.transaction.FeeDetailsDTO;
12
13⊖ /**
14   * <p>
15   * Factory Implementation of Extension hook for DocumentTypeApplicationServiceSpi. The default
16   * for the extension points.
17   * The methods in this class when invoked, will internally call the pre/post
18   * methods present in the classes returned by the ServiceProviderExtensionFactory
19   * which implement the extension interface.
20   * </p>
21   * @see com.ofss.fc.appx.content.service.DocumentTypeApplicationServiceSpi
22   */
23 public class DocumentTypeApplicationServiceSpiExtExecutor implements IDocumentTypeApplicationServiceSpiExtExecutor {
24
25     private static IDocumentTypeApplicationServiceSpiExtExecutor uniqueInstance = new DocumentTypeApplicationServiceSpiExtExecutor();
26     private static String THIS_COMPONENT_NAME = DocumentTypeApplicationServiceSpiExtExecutor.class.getName();
27
28     private List<IDocumentTypeApplicationServiceSpiExt> extensions = null;
29
30⊖    public DocumentTypeApplicationServiceSpiExtExecutor(){
31         extensions =
32             (List<IDocumentTypeApplicationServiceSpiExt>) ServiceProviderExtensionFactory
33                 .getServiceProviderExtensions(DocumentTypeApplicationServiceSpi.class.getName());
34     }
35
36⊖    public static IDocumentTypeApplicationServiceSpiExtExecutor getInstance() {
37         if (uniqueInstance == null) {
38             synchronized (DocumentTypeApplicationServiceSpiExtExecutor.class) {
39                 if (uniqueInstance == null) {
40                     uniqueInstance = new DocumentTypeApplicationServiceSpiExtExecutor();
41                 }
42             }
43         }
44         return uniqueInstance;
45     }
46
48⊕     * This is the extension point for DocumentTypeApplicationServiceSpi.preAddDocumentType.
54⊖    public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,com.ofss.fc.app.content.dto.DocumentTypeDTO
55         throws FatalException {
56         for (IDocumentTypeApplicationServiceSpiExt extension : extensions) {
57             extension.preAddDocumentType(sessionContext, documentTypeDTO, feeDetails, linkedUDFDTO);
58         }
59     }
60
62⊕     * This is the extension point for DocumentTypeApplicationServiceSpi.postAddDocumentType.
68⊕    public void postAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,com.ofss.fc.app.content.dto.DocumentTypeDTO
```

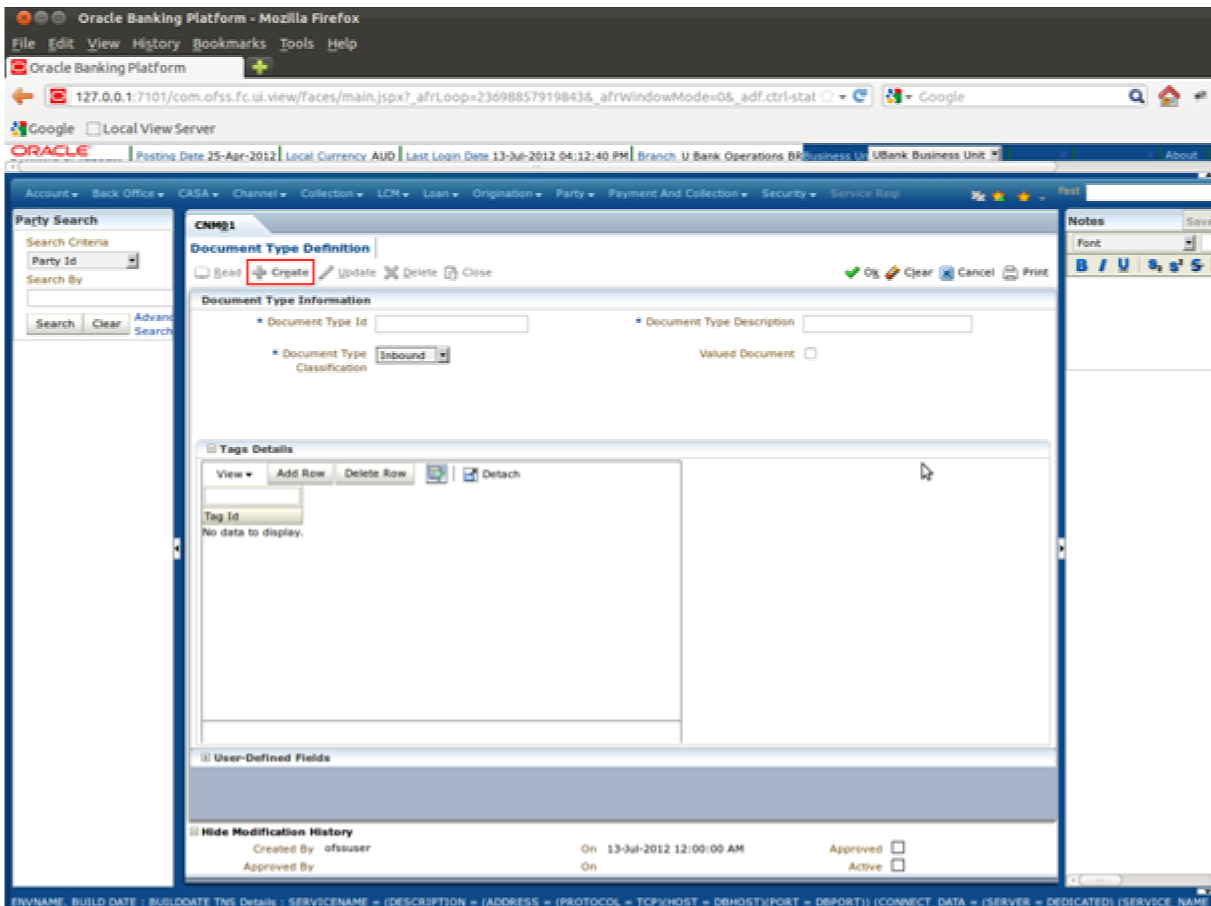
3.3 End-to-End Example of an Extension

This section gives an end-to-end example of extensions written in the appx layer using the extended application service extensions as well as app layer application service extensions. The example shall implement this by extending the default implementation of the appx extension class ***Void<ApplicationServiceQualifier>ApplicationServiceSpiExt*** class and app extension class ***Void<ApplicationServiceQualifier>ApplicationServiceExt.***

For example, Back Office -> Content -> Document Type Definition screen of the application.

This screen is used for the maintenance of Document Types defined in the application.

Figure 3–14 Maintenance of Document Types



The Create tab of the screen allows a user to create document types in the application. On click of Ok, and after successful validation of the input entered by the user, the screen extracts the values. It calls the DocumentTypeApplicationServiceSpi (in appx layer) and DocumentTypeApplicationService (in app layer) on the host application to save the document type in the system.

In this example, we have added multiple extensions to this service of the appx layer through the extension executor where the update of the description is done in one of the extension and check the length of name in another in the pre extension method.

Figure 3–15 DocumentTypeApplicationServiceSpiExt - Appx Layer

com.ofss.fc.appx.spi.executor/src/com/ofss/fc/appx/content/service/ext/DocumentTypeApplicationServiceSpiExt.java - Eclipse

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DocumentTypeApplicationServiceSpiExt.java | DocTypeApplicationServiceSpiExt.java

```
2⊕Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.
4 package com.ofss.fc.appx.content.service.ext;
5
6⊕import java.util.ArrayList;
18
19⊖/**
20  * DocumentTypeApplicationServiceSpiExt
21  * @author VishalA
22  * @version 1.0
23  */
24 public class DocumentTypeApplicationServiceSpiExt extends VoidDocumentTypeApplicationServiceSpiExt
25     implements IDocumentTypeApplicationServiceSpiExt{
26
27     private static String THIS_COMPONENT_NAME = DocumentTypeApplicationServiceSpiExt.class.getName();
28     private transient Logger logger = MultiEntityLogger.getUniqueInstance().getLogger(THIS_COMPONENT_NAME);
29     private List<ValidationError> errorList = new ArrayList<ValidationError>();
30     private final static int NAME_MAX_LENGTH = 20;
31
32⊖    public DocumentTypeApplicationServiceSpiExt() {
33         super();
34     }
35
36⊖    public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,
37             com.ofss.fc.app.content.dto.DocumentTypeDTO documentTypeDTO, FeeDetailsDTO feeDetails, LinkedUDFDTO linkedUDFDTO)
38                 throws ValidationException {
39         logger.log(Level.FINE, "Pre add document type service spi ext started.");
40
41         if (documentTypeDTO!=null && documentTypeDTO.getName()!=null  && documentTypeDTO.getKeyDTO()!=null) {
42             if(documentTypeDTO.getName().length()>NAME_MAX_LENGTH) {
43                 logger.log(Level.WARNING, "Name exceeds the prescribed length.");
44                 ValidationError error = new ValidationError("DocumentTypeDTO", "name", "null",
45                         CMErrorConstants.INVALID_LENGTH,
46                         "The name exceeds the prescribed length.");
47                 errorList.add(error);
48             }
49         } else {
50             logger.log(Level.WARNING, "Null Parameters");
51             ValidationError error = new ValidationError("DocumentTypeDTO", "name", "null",
52                     CMErrorConstants.NULL_NAME,
53                     "The named attribute value should not be null");
54             errorList.add(error);
55         }
56         if (errorList != null && errorList.size() > 0) {
57             throw new ValidationException(CMErrorConstants.NULL_DESCRIPTION, errorList);
58         }
59         logger.log(Level.FINE, "Pre add document type service spi ext ended.");
60     }
61 }
```

Figure 3–16 DocTypeApplicationServiceSpiExt - Appx Layer

```
com.ofss.fc.appx.spi.executor/src/com/ofss/fc/appx/content/service/ext/DocTypeApplicationServiceSpiExt.java - Eclipse

DocumentTypeApplicationServiceSpiExt.java    DocTypeApplicationServiceSpiExt.java

 2⊕Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.
 4 package com.ofss.fc.appx.content.service.ext;
 5
 6⊕import java.util.ArrayList;
18
19⊖/**
20  * DocTypeApplicationServiceSpiExt
21  * @author VishalA
22  * @version 1.0
23  */
24 public class DocTypeApplicationServiceSpiExt extends VoidDocumentTypeApplicationServiceSpiExt
25         implements IDocumentTypeApplicationServiceSpiExt{
26
27     private static String THIS_COMPONENT_NAME = DocTypeApplicationServiceSpiExt.class.getName();
28     private transient Logger logger = MultiEntityLogger.getUniqueInstance().getLogger(THIS_COMPONENT_NAME);
29     private List<ValidationError> errorList = new ArrayList<ValidationError>();
30
31⊖    public DocTypeApplicationServiceSpiExt() {
32         super();
33     }
34
35⊖    public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,
36             com.ofss.fc.app.content.dto.DocumentTypeDTO documentTypeDTO, FeeDetailsDTO feeDetails, LinkedUDFDTO linkedUDFDTO)
37                 throws ValidationException {
38         logger.log(Level.FINE, "Pre add document type service spi ext started.");
39
40         if (documentTypeDTO!=null && documentTypeDTO.getDescription()!=null) {
41             String newDescription = documentTypeDTO.getDescription().
42                 concat("This sample description is appended to the earlier description.");
43             documentTypeDTO.setDescription(newDescription);
44         } else {
45             logger.log(Level.WARNING, "Null Parameters");
46             ValidationError error = new ValidationError("DocumentTypeDTO", "description", "null",
47                 CMErrorConstants.NULL_DESCRIPTION,
48                 "The description attribute value should not be null");
49             errorList.add(error);
50             if (errorList != null && errorList.size() > 0) {
51                 throw new ValidationException(CMErrorConstants.NULL_DESCRIPTION, errorList);
52             }
53         }
54         logger.log(Level.FINE, "Pre add document type service spi ext ended.");
55     }
56 }
57
```

In this example, we have added multiple extensions to the service of the app layer through the extension executor and implemented a not null and size check on the document tags in pre hook of the app layer to validate that document tags are sent as input in the application service.

Figure 3–17 DocumentTypeApplicationServiceSpiExt - App Layer

com.ofss.fc.app.content.service.ext/src/com/ofss/fc/app/content/service/ext/DocumentTypeApplicationServiceExt.java - Eclipse

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DocTypeApplicationServiceExt.java | DocumentTypeApplicationServiceExt.java

```
2⊕Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.
4 package com.ofss.fc.app.content.service.ext;
5
6⊕import java.util.ArrayList;
17
18⊖/**
19  * DocumentTypeApplicationServiceExt
20  * @author VishalA
21  * @version 1.0
22  */
23 public class DocumentTypeApplicationServiceExt extends VoidDocumentTypeApplicationServiceExt
24         implements IDocumentTypeApplicationServiceExt{
25
26     private static String THIS_COMPONENT_NAME = DocumentTypeApplicationServiceExt.class.getName();
27     private transient Logger logger = MultiEntityLogger.getUniqueInstance().getLogger(THIS_COMPONENT_NAME);
28     private List<ValidationError> errorList = new ArrayList<ValidationError>();
29     private final static int NAME_MAX_LENGTH = 20;
30
31⊖    public DocumentTypeApplicationServiceExt() {
32         super();
33     }
34
35⊖    public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
36                 throws FatalException {
37         logger.log(Level.FINE, "Pre add document type service spi ext started.");
38
39         if (documentTypeDTO!=null && documentTypeDTO.getName()!=null  && documentTypeDTO.getKeyDTO()!=null) {
40             if(documentTypeDTO.getName().length()>NAME_MAX_LENGTH) {
41                 logger.log(Level.WARNING, "Name exceeds the prescribed length.");
42                 ValidationError error = new ValidationError("DocumentTypeDTO", "name", "null",
43                         CMErrorConstants.INVALID_LENGTH,
44                         "The name exceeds the prescribed length.");
45                 errorList.add(error);
46             }
47         } else {
48             logger.log(Level.WARNING, "Null Parameters");
49             ValidationError error = new ValidationError("DocumentTypeDTO", "name", "null",
50                     CMErrorConstants.NULL_NAME,
51                     "The named attribute value should not be null");
52             errorList.add(error);
53         }
54         if (errorList != null && errorList.size() > 0) {
55             throw new ValidationException(CMErrorConstants.NULL_DESCRIPTION, errorList);
56         }
57         logger.log(Level.FINE, "Pre add document type service spi ext ended.");
58     }
59 }
```

Figure 3–18 DocTypeApplicationServiceSpiExt - App Layer

```
com.ofss.fc.app.content.service.ext/src/com/ofss/fc/app/content/service/ext/DocTypeApplicationServiceExt.java - Eclipse

DocTypeApplicationServiceExt.java    DocumentTypeApplicationServiceExt.java

 2 Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.
 4 package com.ofss.fc.app.content.service.ext;
 5
 6 import java.util.ArrayList;
17
18 /**
19  * DocTypeApplicationServiceExt
20  * @author VishalA
21  * @version 1.0
22  */
23 public class DocTypeApplicationServiceExt extends VoidDocumentTypeApplicationServiceExt
24         implements IDocumentTypeApplicationServiceExt{
25
26     private static String THIS_COMPONENT_NAME = DocTypeApplicationServiceExt.class.getName();
27     private transient Logger logger = MultiEntityLogger.getUniqueInstance().getLogger(THIS_COMPONENT_NAME);
28     private List<ValidationError> errorList = new ArrayList<ValidationError>();
29
30     public DocTypeApplicationServiceExt() {
31         super();
32     }
33
34     public void preAddDocumentType(com.ofss.fc.app.context.SessionContext sessionContext,DocumentTypeDTO documentTypeDTO)
35             throws FatalException {
36         logger.log(Level.FINE, "Pre add document type service spi ext started.");
37
38         if (documentTypeDTO!=null && documentTypeDTO.getDescription()!=null) {
39             String newDescription = documentTypeDTO.getDescription().
40                     concat("This sample description is appended to the earlier description.");
41             documentTypeDTO.setDescription(newDescription);
42         } else {
43             logger.log(Level.WARNING, "Null Parameters");
44             ValidationError error = new ValidationError("DocumentTypeDTO", "description", "null",
45                     CMErrorConstants.NULL_DESCRIPTION,
46                     "The description attribute value should not be null");
47             errorList.add(error);
48             if (errorList != null && errorList.size() > 0) {
49                 throw new ValidationException(CMErrorConstants.NULL_DESCRIPTION, errorList);
50             }
51         }
52         logger.log(Level.FINE, "Pre add document type service spi ext ended.");
53     }
54 }
55
```

4 OBP Proxy Extension

OBP Proxy Extension functionality is driven by a preference named "ProxyFacadeExtension" whose key-value properties are provided by a java class - **com.ofss.fc.common.ProxyFacadeExtensionConfig**. This java class will have fully qualified name (replacing '.' With '_') of a proxy as a variable name and fully qualified name of a target proxy as a variable value.

For example,

```
public final String com_ofss_fc_xyz_ProductProxyFacade =
"com.ofss.fc.osb.xyz.ProductProxyFacade"; // notice usage of '_' in place of '.'
in variable name.
```

Sample Existing Code:

```
public TransactionStatus addReferenceObject(SessionContext sessionContext,
ReferenceObjectDTO referenceObjectDTO) throws FatalException, ServiceException {
        if (logger.isLoggable(Level.FINE)) {
            logger.log(Level.FINE, THIS_COMPONENT_NAME + " addReferenceObject()
Entry");
            logger.log(Level.FINE, logAppServiceMessage(sessionContext));
            logger.log(Level.FINE, logAppServiceMessage(referenceObjectDTO));
        }
        TransactionStatus returnObj = null;
        try {

this.overrideProtocol("ReferenceObjectApplicationServiceProxy.addReferenceObject")
;
            this.populateDictionaryData(referenceObjectDTO);
            if ("JSON".equals(protocol) && "APP".equals(hostApplicationLayer)) {

com.ofss.fc.app.me.service.referencedata.service.json.client.ReferenceObjectApplic
ationServiceJSONClient jsonStub = new
com.ofss.fc.app.me.service.referencedata.service.json.client.ReferenceObjectApplic
ationServiceJSONClient(jsonServiceUrl);
                returnObj = jsonStub.addReferenceObject(sessionContext,
referenceObjectDTO);
            } else if ("LOCAL".equals(protocol) &&
"APP".equals(hostApplicationLayer)) {
                try {
                    Object[] args = new Object[] { sessionContext,
referenceObjectDTO };
                    String stringToCompleteClassName =
"com.ofss.fc.app.me.service.referencedata.ReferenceObjectApplicationService";
                    Object obj =
ReflectionHelper.getInstance().getClass(stringToCompleteClassName).newInstance();
```

```
                    returnObj = (TransactionStatus)
ReflectionHelper.getInstance().invokeMethod(obj, "addReferenceObject", args);
                } catch (Exception e) {
                    throw new ServiceException(SERVICE_NOT_AVAILABLE, e);
                }
            } else {
                logger.log(Level.SEVERE, THIS_COMPONENT_NAME, "No valid protocol
and hostApplicationLayer combination found");
                logger.log(Level.SEVERE, THIS_COMPONENT_NAME, SERVICE_NOT_
AVAILABLE);
            }
            this.populateTransactionStatus(returnObj);
        } catch (IOException e) {
            logger.log(Level.SEVERE, THIS_COMPONENT_NAME, e);
            throw new ServiceException(SERVICE_NOT_AVAILABLE, e);
        }
        if (logger.isLoggable(Level.FINE)) {
            logger.log(Level.FINE, THIS_COMPONENT_NAME + " addReferenceObject()
Exit");
            logger.log(Level.FINE, logAppServiceMessage(returnObj));
        }
        return returnObj;
    }
```

Sample Existing Code will be changed to:

```
public TransactionStatus addReferenceObject(SessionContext sessionContext,
ReferenceObjectDTO referenceObjectDTO) throws FatalException, ServiceException {

              if (logger.isLoggable(Level.FINE)) {
                     logger.log(Level.FINE, THIS_COMPONENT_NAME + "
addReferenceObject() Entry");
                     logger.log(Level.FINE, logAppServiceMessage(sessionContext));
                     logger.log(Level.FINE,
logAppServiceMessage(referenceObjectDTO));
              }
              TransactionStatus returnObj = null;
              try {
                     if (isProxyExtended(this)) {
                           Serializable overriddenResponse =
invokeExtendedProxy(this, sessionContext, "addReferenceObject",
referenceObjectDTO);
                           if (overriddenResponse != null) {
                                  if (overriddenResponse instanceof
TransactionStatus) {
                                         return (TransactionStatus)
overriddenResponse;
                                  } else {
                                         logger.log(Level.SEVERE,
                                                THIS_COMPONENT_NAME,
                                                "Invalid response returned
from the overridden proxy. Response expected is an instance of
TransactionStatus.");
                                         throw new
ServiceException(BranchErrorConstants.FC_OVR_RESP_INV);
                                  }
                           } else {
                                  logger.log(Level.SEVERE,
                                         THIS_COMPONENT_NAME,
                                         "Null response returned from the
```

```
overridden proxy. Response expected is an instance of TransactionStatus.");
                                    throw new
ServiceException(BranchErrorConstants.FC_OVR_RESP_NULL);
                            }
                      } else {
                            this.populateDictionaryData(referenceObjectDTO);
                            if ("JSON".equals(protocol) &&
"APP".equals(hostApplicationLayer)) {

com.ofss.fc.app.me.service.referencedata.service.json.client.ReferenceObjectApplic
ationServiceJSONClient jsonStub = new
com.ofss.fc.app.me.service.referencedata.service.json.client.ReferenceObjectApplic
ationServiceJSONClient(jsonServiceUrl);
                                    returnObj =
jsonStub.addReferenceObject(sessionContext, referenceObjectDTO);
                            } else if ("LOCAL".equals(protocol) &&
"APP".equals(hostApplicationLayer)) {
                                    try {
                                          Object[] args = new Object[] {
sessionContext, referenceObjectDTO };
                                          String stringToCompleteClassName =
"com.ofss.fc.app.me.service.referencedata.ReferenceObjectApplicationService";
                                          Object obj =
ReflectionHelper.getInstance().getClass(stringToCompleteClassName).newInstance();
                                          returnObj = (TransactionStatus)
ReflectionHelper.getInstance().invokeMethod(obj, "addReferenceObject", args);
                                    } catch (Exception e) {
                                          throw new ServiceException(SERVICE_NOT_
AVAILABLE, e);
                                    }
                            } else {
                                    logger.log(Level.SEVERE, THIS_COMPONENT_NAME,
"No valid protocol and hostApplicationLayer combination found");
                                    logger.log(Level.SEVERE, THIS_COMPONENT_NAME,
SERVICE_NOT_AVAILABLE);
                            }
                            this.populateTransactionStatus(returnObj);
                      }
              } catch (Throwable e) {
                      logger.log(Level.SEVERE, THIS_COMPONENT_NAME, e);
                      throw new ServiceException(SERVICE_NOT_AVAILABLE, e);
              }
              if (logger.isLoggable(Level.FINE)) {
                      logger.log(Level.FINE, THIS_COMPONENT_NAME + "
addReferenceObject() Exit");
                      logger.log(Level.FINE, logAppServiceMessage(returnObj));
              }
              return returnObj;
       }
```

5 OBP Application Adapters

An adapter, by definition, helps the interfacing or integrating components to adapt. In software it represents a coding discipline that helps two different modules or systems to communicate with each other and helps the consuming side to adapt to any incompatibility of the invoked interface to work together. Incompatibility could be in the form of input data elements which the consumer does not have and hence might require defaulting or the invoked interface might be a third party interface with a different message format requiring message translation. Such functions, which do not form part of the consumer functionality, can be implemented in the adapter layer.

In OBP, adapters are used for the above purposes as well as to achieve cleaner build time separation of different functional product processor modules. Hence, when Loan Module needs to invoke services of Party Module or Demand Deposit module then an adapter class owned by the Loans module will be used to ensure that functions such as defaulting of values, mocking of an interface, and so on, are implemented in the adapter layer thereby relieving the core module functionality from getting corrupted.

The design of the adapter layer is based on the Separated Interface design pattern and the access mechanism of the adapters by modules is implemented using an Abstract Factory design pattern. The adapter implementation is explained in the sections below as it exists in OBP.

5.1 Adapter Implementation Architecture

This section provides a detailed explanation of the adapter implementation architecture.

5.1.1 Package Diagram

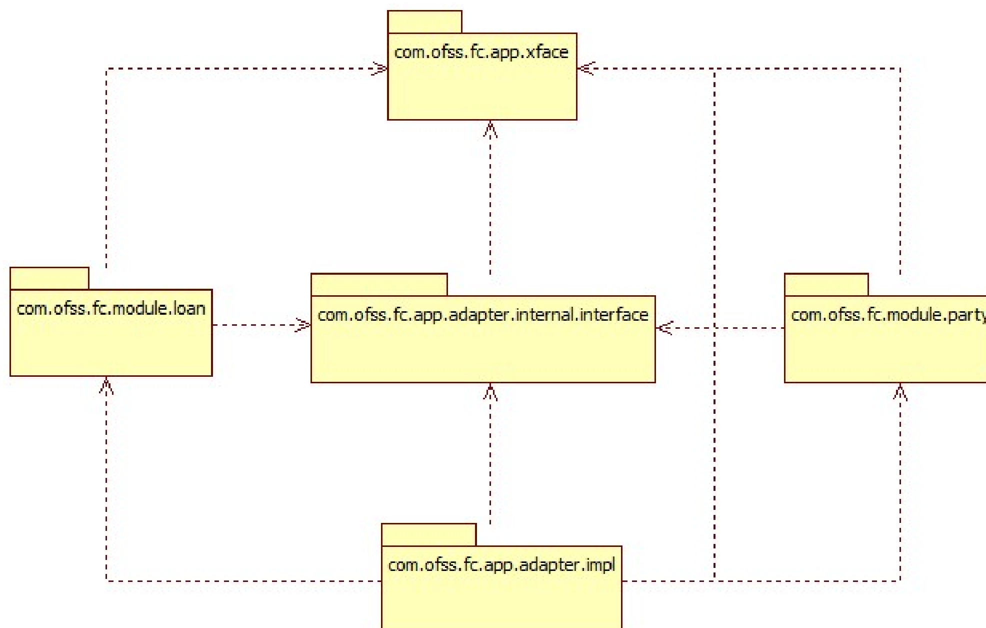
The components of adapter implementation in OBP are structurally placed in separate projects to enable OBP to achieve build time independence between functional modules of the product. The way this is achieved is detailed in the table below and depicted with package diagram, class diagrams and an example usage mechanism.

Table 5–1 Components of Adapter Implementation

Sr.	Project Name	Description	Example
1	com.ofss.fc.app.xface	DTO project. Holds all DTOs that are used in the module application services request and response DTOs.	
2	com.ofss.fc.app.adapte r.internal.interface	Package contains adapter interfaces for all modules and the abstract factory implementation (i.e. factory of adapter factories).	com.ofss.fc.app.adapter.ep.IEventProcess ingAdapter Abstract Factory com.ofss.fc.app.adapter.AdapterFactory
3	com.ofss.fc.app.adapte r.impl	This project has the **implementation** of adapter interfaces and corresponding adapter factories.	com.ofss.fc.app.adapter.ep.**impl**.EventPr ocessingAdapter com.ofss.fc.app.adapter.ep.**impl**.EventPr ocessingAdapterFactory

Hence, if Loans module (that is, com.ofss.fc.module.loan) and Party module (that is, com.ofss.fc.module.party) are any two modules that need to communicate, the package dependency diagram is depicted below:

Figure 5–1 Package Diagram



The dependencies among the packages are:

- Package com.ofss.fc.app.adapter.internal.interface only depends on DTO's.
- Any module package depends on the Adapter interfaces and DTO's to communicate with another module.
- Package com.ofss.fc.app.adapter.impl depends on all the packages.

In this manner, the loans module is developed into a functional module which is structurally modular and independent in terms of development and build from the party module and vice versa. Same is true for all modules developed in OBP.

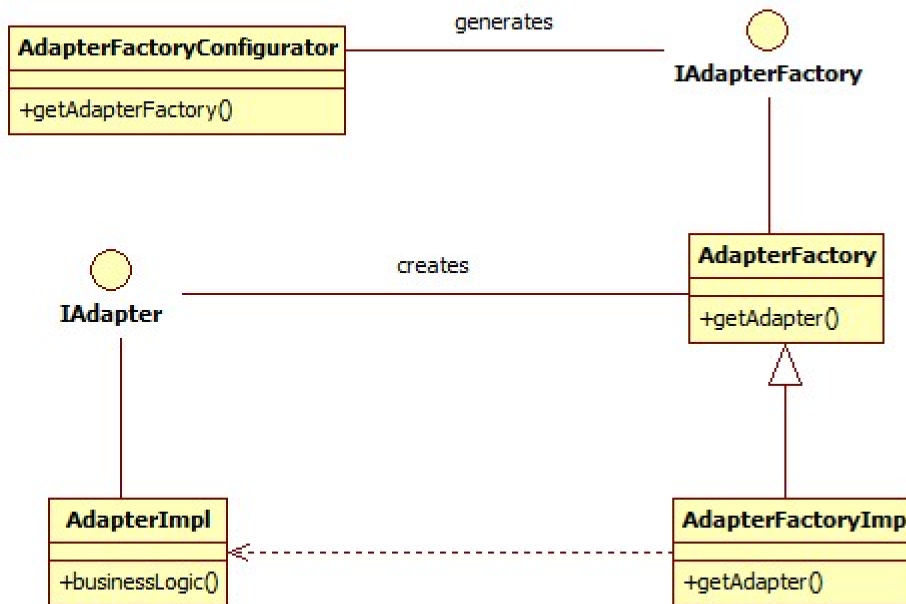
5.1.2 Adapter Mechanism Class Diagram

An Application Service in calling module calls the getAdapterFactory() method of class AdapterFactoryConfigurator which returns an instance of an implementation of the abstract class AdapterFactory. The class of instance is decided by the string parameter passed to the method.

The getAdapter() method in the AdapterFactory returns an adapter instance. The class of instance is decided by the string parameter passed to the method.

The Application Service then uses this adapter instance to access any data from an application service within another module.

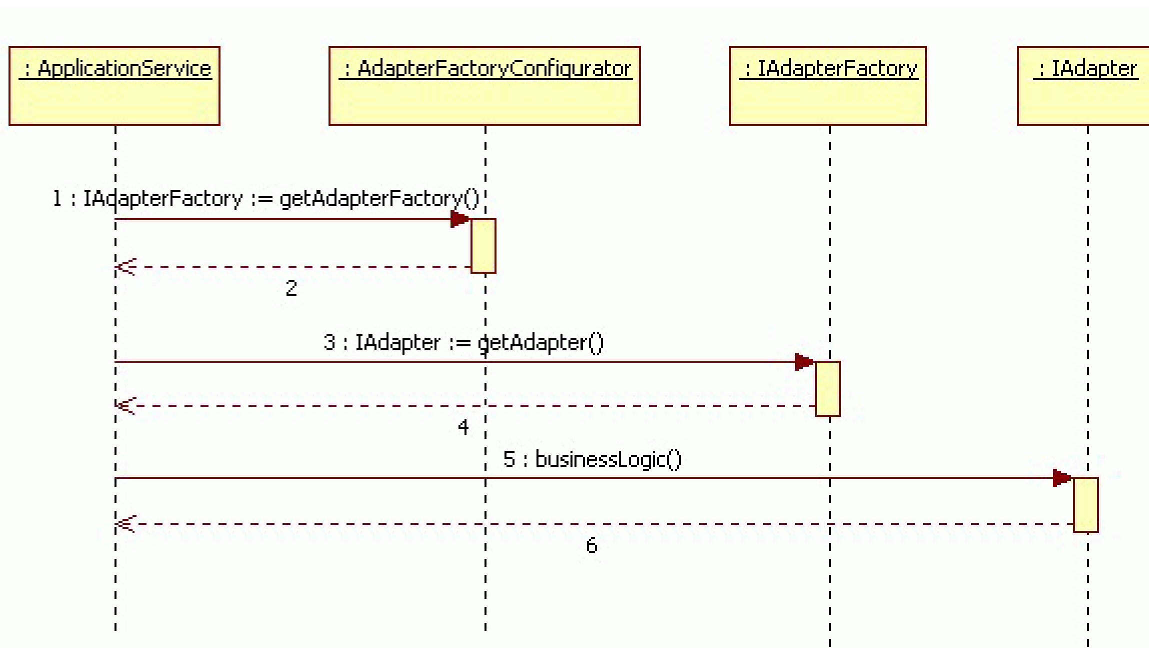
Figure 5–2 Adapter Mechanism Class Diagram



5.1.3 Adapter Mechanism Sequence Diagram

A method in an application service gets an instance of a desired adapter factory by calling getAdapterFactory() method of AdapterFactoryConfigurator class. The instance of the adapter factory obtained is used to call getAdapter() method to get an instance of the adapter. This adapter instance has all the methods to communicate to the service in another module.

Figure 5–3 Adapter Mechanism Sequence Diagram



5.2 Examples of Adapter Implementation

This section provides multiple adapter usage scenarios with code snippets. The section also has examples describing the steps for implementing custom adapters and their factory implementation. The same mechanism applies to all adapters which are provided by different modules in OBP. The adapter factory additionally supports mocking of the adapter. OBP depends on the DI feature function supported by Jmock to enable mocking of adapters.

The custom adapter, adapter factory and corresponding constants are depicted in code samples below:

5.2.1 Example 1 – EventProcessingAdapter

Code snippet to invoke a method *processActivityEvents()* in alerts module from a different module:

```
… Constants definition …
public static final String EVENT_PROCESSING = "EVENT_PROCESSING";
public static final String MODULE_TO_ACTIVITY = "ModuleToActivityAdapter";
… Adapter usage …
com.ofss.fc.app.adapter.IAdapterFactory adapterFactory =
AdapterFactoryConfigurator.getInstance().getAdapterFactory(ModuleConstant.EVENT_
PROCESSING);
IEventProcessingAdapter adapter = (IEventProcessingAdapter)
adapterFactory.getAdapter (EventProcessingAdapterConstant.MODULE_TO_ACTIVITY);
adapter.processActivityEvents();
```

The parameters passed in the **getAdapterFactory()** and **getAdapter()** methods are String constants denoting instance of which class has to be returned. These string values are maintained as constants. In the example given below, the string constant is created in a constants file (in this example, it the constants file is ModuleConstant).

```
public static final String EVENT_PROCESSING = "EVENT_PROCESSING";
```

An entry is made in AdapterFactories.properties corresponding to the string constant. This entry specifies the adapter factory class corresponding to the above constant which should be instantiated and returned. The adapter factory has the intelligence of all adapters along with adapter methods which are mocked as and where required.

```
EVENT_PROCESSING=com.ofss.fc.app.adapter.impl.ep.EventProcessingAdapterFactory
```

While implementing the adapter factory, developers can choose to have a separate factory specific constants on the basis of which to manage multiple adapters from the same factory. Alternatively, developers can choose to create an adapter factory each for an adapter and its interface. The constants form the basis for instantiating and returning of respective adapters by the factory.

The respective adapter constant and corresponding usage in the **getAdapter** method of the adapter factory class is shown in a sample below.

```
… Adapter Factory Method …
public IEventProcessingAdapter getAdapter(String adapter, NameValuePair[]
nameValues) {
EventProcessingAdapter eventProcessingAdapter = null;
If (adapter.equalsIgnoreCase(EventProcessingAdapterConstant.MODULE_TO_ACTIVITY)) {
eventProcessingAdapter = new EventProcessingAdapter();
}
return eventProcessingAdapter;
}
```

The adapter implementation (that is, *EventProcessingAdapter*) can have implementation of the methods defined in the adapter interface it implements. This implementation is typically delegated calls to services of the module which is invoked by the consuming module. For example, the *EventProcessingAdapter* can implement the method *processActivityEvents()*.

```
public void processActivityEvents(ApplicationContext applicationContext,
HashMap<String, String> activityMap) throws FatalException {
EventProcessorApplicationService eventApplicationService =
new EventProcessorApplicationService();
eventApplicationService.processActivityEvents(AdapterContextHelper.fetchSessionCon
text(), key, activityDataId);
}
```

5.2.2 Example 2 – DispatchAdapter

Similar to the implementation of *EventProcessingAdapter*, an adapter implementation is provided by product for dispatch of an SMS alert. This adapter will always get customized during implementation depending on the SMS gateway used by the customer at their end.

The code snippet to invoke a method *dispatchSMS()* in alerts module by using the adapter interface is depicted below.

```
… Constants definition …
public static final String EVENT_PROCESSING_DISPATCH = "EVENT_PROCESSING_
DISPATCH";
public static final String EP_TO_DISPATCH = "EpToDispatchAdapter";

… Adapter usage …
com.ofss.fc.app.adapter.IAdapterFactory adapterFactory =
```

```
AdapterFactoryConfigurator.getInstance().getAdapterFactory(ModuleConstant. EVENT_
PROCESSING_DISPATCH);

adapter = (IDispatchAdapter) adapterFactory.getAdapter
(EventProcessingAdapterConstant.EP_TO_DISPATCH);
adapter.dispatchSMS();
```

An entry in *AdapterFactories.properties* corresponding to the *DispatchAdapterFactory* would look as below. This entry specifies the adapter factory class corresponding to the above constant which should be instantiated and returned.

```
EVENT_PROCESSING_DISPATCH=com.ofss.fc.app.adapter.impl.ep.DispatchAdapterFactory
```

The adapter *DispatchAdapter* is used in the alerts module to dispatch a message to an SMS destination endpoint. It has a method called *dispatchSMS(…)* and the default implementation is currently to write the SMS text generated as part of alert processing into a file called SMS.txt.

```
public boolean dispatchSMS(String recipientId, String dispatchMessage) throws
FatalException {
return writeToFile(recipientId, dispatchMessage);
}
```

The customization developer can override this method by supplying a customized implementation of the adapter. Such custom implementation of the *dispatchSMS(…)* method invokes the APIs provided by the gateway client. A sample implementation which overrides the default implementation of *dispatchSMS* could look like the one below:

```
public boolean dispatchSMS(String recipientId, String dispatchMessage) throws
FatalException {
NewGatewayAPI newGateway =  new NewGatewayAPI();
newGateway.sendMessage(recipientId,dispatchMessage);
}
```

5.3 Customizing Existing Adapters

If an added functionality or replacement functionality is required for an existing adapter or existing method in an adapter, the customization developer has to develop a new adapter and corresponding adapter factory and override the method in a new custom adapter class. The custom adapter would have to override and implement the methods which need changes.

5.3.1 Custom Adapter Example 1 – DispatchAdapter

Depending on the client the SMS gateway they use and thus the corresponding interface to communicate with the gateway will differ. Also, OBP by default does not support interfacing with any SMS gateway. Hence, customization of DispatchAdapter is essential. The following steps can be followed for implementation of a custom *DispatchAdapter*.

Develop a *CustomDispatchAdapter* and *CustomDispatchAdapterFactory*. As a guideline, the custom adapter should extend the existing adapter and override the methods which need to be replaced with new functionality. Given below are examples of customizing the adapters which are detailed above.

The custom adapter, adapter factory and corresponding constant are depicted as a sample below:

```
… CustomDispatchAdapterFactory Method …
public IDispatchAdapter getAdapter(String adapter, NameValuePair[] nameValues) {
IDispatchAdapter adapter = null;
If (adapter.equalsIgnoreCase(EventProcessingAdapterConstant.EP_TO_DISPATCH)) {
adapter = new CustomDispatchAdapter();
}
return adapter;
}
```

The custom adapter implementation (that is, *CustomDispatchAdapter*) has the implementation of the methods defined in the adapter interface it implements. For example, the *CustomDispatchAdapter* would implement the method *dispatchSMS()* to reflect the desired functionality.

The entry in *AdapterFactories.properties* corresponding to the *DispatchAdapterFactory* can be modified to instantiate and return the *CustomDispatchAdapterFactory*. The same is shown below.

```
Original entry
EVENT_PROCESSING_DISPATCH=com.ofss.fc.app.adapter.impl.ep.DispatchAdapterFactory
Changed entry
EVENT_PROCESSING_
DISPATCH=com.ofss.fc.app.adapter.impl.ep.CustomDispatchAdapterFactory
```

This changed entry specifies the custom adapter factory class corresponding to the constant which is referred to in the product. The new entry shall ensure that the *AbstractFactory* instantiates and returns an instance of *CustomDispatchAdapterFactory* instead of the original *DispatchAdapterFactory* supplied with product.

5.3.2 Custom Adapter Example 2 – PartyKYCCheckAdapter

OBP ships an adapter implementation for KYC check of a party. The adapter implements to the interface shown below. The interface method *performOnlineKYCCheck* can be overridden by the customization developer while supplying the actual implementation of the desired functionality.

```
public interface IPartyKYCCheckAdapter {
@External(name = "KYC", info = "Perform Online KYC Check")
public abstract KYCHistoryDTO performOnlineKYCCheck(KYCHistoryDTO kycCheckDTO)
throws FatalException;
}
```

This adapter is integrated in product and the default implementation of the KYC check returns a successful KYC check as shown below. This is depicted in the code snippets below.

Figure 5–4 Party KYC Status Check Adapter Interface

```
/*
Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.
*/
package com.ofss.fc.app.adapter.party;

import com.ofss.fc.app.party.dto.core.KYCHistoryDTO;

/**
 * This interface represents the Party KYC status check adapter interface.  Default implementation of <br>
 * this interface would return the KYCHistoryDTO with a KYC status indicating successful completion of<br>
 * the KYC for party.
 *
 * @author OBPDev
 * @version 1.0
 */
public interface IPartyKYCCheckAdapter {

    @External(name = "KYC", info = "Perform Online KYC Check")
    public abstract KYCHistoryDTO performOnlineKYCCheck(KYCHistoryDTO kycCheckDTO) throws FatalException;
}
```

Figure 5–5 Default Implementation of IPartyKYCCheckAdapter Interface

```
 * Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.

package com.ofss.fc.app.adapter.impl.party;

import java.util.logging.Level;

/**
 * Default implementation of IPartyKYCCheckAdapter interface. This would complement the adapter mocking<br>
 * done in the corresponding adapter factory.
 * @author shravank
 */
public class PartyKYCCheckAdapter implements IPartyKYCCheckAdapter {

    private static final String THIS_COMPONENT_NAME = PartyKYCCheckAdapter.class.getName();
    private Logger logger = MultiEntityLogger.getUniqueInstance().getLogger(THIS_COMPONENT_NAME);
    private MultiEntityLogger formatter = MultiEntityLogger.getUniqueInstance();

    /**
     * This method would return the KYCHistoryDTO with a KYC status indicating successful completion of<br>
     * the KYC for party.
     */
    @Override
    public KYCHistoryDTO performOnlineKYCCheck(KYCHistoryDTO kycCheckDTO) throws FatalException {
        if (logger.isLoggable(Level.FINE)) {
            logger.log(Level.FINE, formatter.formatMessage("Entered performOnlineKYCCheck."));
        }
        kycCheckDTO.getAutomaticKYCDetails().setKycStatus(KYCStatus.CONFIRMED);
        kycCheckDTO.getAutomaticKYCDetails().setKycProcessStage(KYCProcessStage.Complete);
        kycCheckDTO.getAutomaticKYCDetails().setKycComments("KYC Staus maintained by Party");
        String bankCode = (String) FCRThreadAttribute.get(FCRThreadAttribute.USER_BANK);
        Date postingDate = new CoreService().fetchBankDates(bankCode).getCurrentDate();
        kycCheckDTO.getAutomaticKYCDetails().setKycDate(postingDate);
        if (logger.isLoggable(Level.FINE)) {
            logger.log(Level.FINE, formatter.formatMessage("Exit performOnlineKYCCheck with KYCStatus:UNCONFIRMED and KYCProcessStage:Pending "));
        }
        return kycCheckDTO;
    }
}
```

```
… PartyKYCCheckAdapter performOnlineKYCCheck Method …
public KYCHistoryDTO performOnlineKYCCheck(KYCHistoryDTO kycCheckDTO) throws
FatalException {
kycCheckDTO.getAutomaticKYCDetails().setKycStatus(KYCStatus.CONFIRMED);
kycCheckDTO.getAutomaticKYCDetails().setKycProcessStage(KYCProcessStage.Complete);
kycCheckDTO.getAutomaticKYCDetails().setKycComments("KYC Status maintained by
Party");
…
kycCheckDTO.getAutomaticKYCDetails().setKycDate(postingDate);
return kycCheckDTO;
}
```

In actual product implemented in production at the customer site, this is replaced with an online KYC status check against a third-party system or the appropriate KYC

agency external system interface. Hence, this would always be a customization point during an implementation.

Depending on the client the KYC system uses, the corresponding interface to communicate will differ. Hence, customization of the party KYC status check adapter implementation is essential. The following steps would have to be followed for implementation of a custom *PartyKYCStatusCheckAdapter*.

The implementation of *getAdapter* method of KYC adapter factory with mocking support is given in the sample below for reference.

Figure 5–6 KYC Adapter Factory with Mocking Support

```
/**
 * This method returns instance of the KYC Adapter. If mocking is enabled, the method would return a mocked<br>
 * instance of the adapter. Mocking helps in cases where the interface undergoes a change and the same has<br>
 * to be handled with minor code changes at the adapter level.
 * @return Object Instance of the adapter
 */
public Object getAdapter(String adapter) {
    if (CommonAdapterConstants.PARTY_KYC_ADAPTER.equals(adapter)) {
        if ( !isMockEnabled) {
            return new PartyKYCCheckAdapter();
        } else {
            Mockery context = new Mockery();
            final IPartyKYCCheckAdapter mockPartyKYCCheckAdapter = context.mock(IPartyKYCCheckAdapter.class);
            try {
                context.checking(new Expectations() {
                    {
                        allowing(mockPartyKYCCheckAdapter).performOnlineKYCCheck(with(any(KYCHistoryDTO.class)));
                        final KYCHistoryDTO kycCheckDTO = new KYCHistoryDTO();
                        KYCDetailsDTO automaticKYCDetails = new KYCDetailsDTO();
                        automaticKYCDetails.setKycStatus(KYCStatus.CONFIRMED);
                        automaticKYCDetails.setKycProcessStage(KYCProcessStage.Complete);
                        automaticKYCDetails.setKycComments("KYC Staus maintained by Party");
                        String bankCode = (String) FCRThreadAttribute.get(FCRThreadAttribute.USER_BANK);
                        Date postingDate = new CoreService().fetchBankDates(bankCode).getCurrentDate();
                        automaticKYCDetails.setKycDate(postingDate);
                        kycCheckDTO.setAutomaticKYCDetails(automaticKYCDetails);
                        will(returnValue(kycCheckDTO));
                    }
                });
            } catch (Exception e) {
                throw new MockAdapterException(InfraErrorConstants.MOCK_METHOD_NOT_CONFGD, e, PartyKYCCheckAdapterFactory.class.getName());
            }
            return mockPartyKYCCheckAdapter;
        }
    } else {
        throw new ConfigurationInitializationException(InfraErrorConstants.ADAPTER_NOT_FOUND, PartyKYCCheckAdapterFactory.class.getName());
    }
}
```

```
… Constants definition …
public static final String PARTY_KYC_ADAPTER_FACTORY = "PARTY_KYC_ADAPTER_
FACTORY";
public static final String PARTY_KYC_ADAPTER = "PartyKYCCheckAdapter";
… PartyKYCStatusCheckAdapterFactory getAdapter Method …
if (AdapterConstants.PARTY_KYC_ADAPTER.equals(adapter)) {
if ( !isMockEnabled) {
return new PartyKYCCheckAdapter();
 else {
// 1. Creation of Mockery Object
Mockery context = new Mockery();
final IPartyKYCCheckAdapter mockPartyKYCCheckAdapter =
context.mock(IPartyKYCCheckAdapter.class);
try {
context.checking(new Expectations() {
{
allowing(mockPartyKYCCheckAdapter).performOnlineKYCCheck(with(any(KYCHistoryDTO.cl
ass)));
final KYCHistoryDTO kycCheckDTO = new KYCHistoryDTO();
KYCDetailsDTO automaticKYCDetails = new KYCDetailsDTO();
automaticKYCDetails.setKycStatus(KYCStatus.CONFIRMED);
automaticKYCDetails.setKycProcessStage(KYCProcessStage.Complete);
automaticKYCDetails.setKycComments("KYC Status maintained by Party");
String bankCode = (String) FCRThreadAttribute.get(FCRThreadAttribute.USER_BANK);
Date postingDate = new CoreService().fetchBankDates(bankCode).getCurrentDate();
```

```
automaticKYCDetails.setKycDate(postingDate);
kycCheckDTO.setAutomaticKYCDetails(automaticKYCDetails);
will(returnValue(kycCheckDTO));
}
);
} catch (Exception e) {
throw new
 MockAdapterException(InfraErrorConstants.MOCK_METHOD_NOT_CONFGD,
e, PartyKYCCheckAdapterFactory.class.getName());
}
return mockPartyKYCCheckAdapter;
}
}
```

To override the default implementation of the KYC check, the customization developer has to implement a custom adapter and its corresponding adapter factory. Assume the same are named as *CustomPartyKYCStatusCheckAdapter* which conforms to the interface of the product KYC check adapter and *CustomPartyKYCStatusCheckAdapterFactory* which would return an instance of the custom adapter. As a guideline, the custom adapter should extend the existing adapter and override the methods which need to be replaced with new functionality.

Therefore, *CustomPartyKYCStatusCheckAdapter* can override and provide an actual implementation of the methods defined in the default product adapter interface. For example, the adapter implements the method *performOnlineKYCCheck()* to reflect the desired functionality.

The entry in *AdapterFactories.properties* corresponding to the *PartyKYCCheckAdapterFactory* can to be modified to instantiate and return the *CustomPartyKYCCheckAdapterFactory*. The same is shown below.

```
Original entry
PARTY_KYC_ADAPTER_
FACTORY=com.ofss.fc.app.adapter.impl.party.PartyKYCCheckAdapterFactory
Changed entry
PARTY_KYC_ADAPTER_FACTORY=
com.ofss.fc.app.adapter.impl.party.CustomPartyKYCCheckAdapterFactory
```

This changed entry specifies the custom adapter factory class corresponding to the constant which is referred to in the product. The new entry shall ensure that the *AbstractFactory* instantiates and returns an instance of *CustomPartyKYCCheckAdapterFactory* instead of the original *PartyKYCCheckAdapterFactory* supplied by the product.

6 User Defined Fields

OBP application is shipped with the additional functionality where the additional data items can be added for certain objects/entities. These additional attributes needs not be part of the core product but could be the client's requirement.

For this provision of adding the user defined fields, the application is provided with the UDF task-flow fields on a screen, the UDF are useful for capturing and displaying additional data. However, it is difficult to use this additional data in the business logic. Hence, UDF are ideal for capturing data and reporting purposes. When using this way for additional capture, simple changes on client side and minimal changes (or no changes) on host side are required.

The following sections describe the changes to be done to enable the UDF for a particular screen.

6.1 Enabling UDF for a Particular Screen

This section provides a detailed explanation on enabling UDF for a particular screen.

6.1.1 UDF Metadata

Metadata for UDF are maintained in a table FLX_MD_SCREEN_BINDING. There is a facility to generate this data for the screens using a utility, but considering the complexity involved, in some cases the utility fails to generate the actual data and the metadata needs to be entered manually.

The Utility for assisting generation of the metadata are:

- **DomainObjectParser:**

  This utility gets the data of the middleware entities and creates a mapping between the DTO and the Entity fields and populates the same in a data source.

- **ScreenComponentDTOMapping:**

  This utility uses the data generated above, and by parsing the UI related files around the area where the VO Object is getting set from the DTO, and tries to arrive at the mapping between the vo attribute and the associated entity attribute.

  The accuracy of this utility process isn't 100 percent as it depends directly on the different flavours/fashion of the code written and also on the way the screen has been designed. As 100 percent accuracy is not achievable using this, the generated data needs to be verified and corrected wherever necessary.

  In case, the required data does not come out of this utility, the same need to be manually supplied in the table.

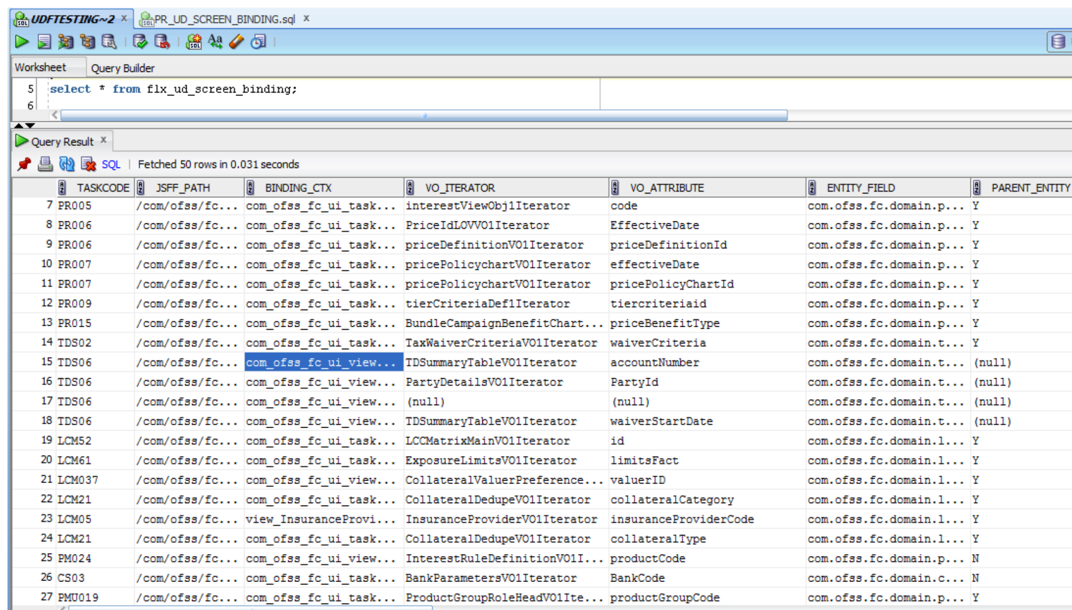
The above mentioned utility populates FLX_MD_SCREEN_BINDING, however, as there would be quite some cases where the utility will not supply the values when run, currently the UDF processing logic is based on another table with the same structure, which is FLX_UD_SCREEN_BINDING. The data in this table will be checked in as seed data.

The columns in this table are explained as follows:

Table 6–1 FLX_UD_SCREEN_BINDING

S.No	Column Name	Explanation
1	TASK_CODE	This is the task code of the screen.
2	JSFF_PATH	This is the path for the jsff relative to the root folder.
3	BINDING_CTX	There is a row in this table for every relevant UI attribute. Among these rows only the key fields are of interest in the case of UDF. This shows the page definition where this field figures. for example, com_ofss_fc_ui_taskflows_ priceDefinitionMaintenancePageDef. And if the field happens to be inside an inner task flow, then it will be a concatenation of the wrapper jsff pagedef with the inner task flow definition id and then the inner task flow definition pageDef. (as given below). com_ofss_fc_ui_view_taxation_taxWaiverPageDef#partyDetailsTaskFlowDefn1#com_ ofss_fc_ui_taskflows_partyDetailsPageDef.
4	VO_ITERATOR	The Iterator name for the attribute.
5	VO_ ATTRIBUTE	The UI attribute name. This should be the attribute name inside the vo.
6	ENTITY_FIELD	This is the fully qualified entity name for the corresponding Entity.
7	PARENT_ ENTITY	If there are multiple entities mapped to the screen, then one of the entities will be the parent entity, and the same needs to be marked as 'Y'.

Figure 6–1 UDF Metadata



	TASKCODE	JSFF_PATH	BINDING_CTX	VO_ITERATOR	VO_ATTRIBUTE	ENTITY_FIELD	PARENT_ENTITY
7	PR005	/com/ofss/fc...	com_ofss_fc_ui_task...	interestViewObj1Iterator	code	com.ofss.fc.domain.p...	Y
8	PR006	/com/ofss/fc...	com_ofss_fc_ui_task...	PriceIdLOVVO1Iterator	EffectiveDate	com.ofss.fc.domain.p...	Y
9	PR006	/com/ofss/fc...	com_ofss_fc_ui_task...	priceDefinitionVO1Iterator	priceDefinitionId	com.ofss.fc.domain.p...	Y
10	PR007	/com/ofss/fc...	com_ofss_fc_ui_task...	pricePolicychartVO1Iterator	effectiveDate	com.ofss.fc.domain.p...	Y
11	PR007	/com/ofss/fc...	com_ofss_fc_ui_task...	pricePolicychartVO1Iterator	pricePolicyChartId	com.ofss.fc.domain.p...	Y
12	PR009	/com/ofss/fc...	com_ofss_fc_ui_task...	tierCriteriaDef1Iterator	tiercriteriaid	com.ofss.fc.domain.p...	Y
13	PR015	/com/ofss/fc...	com_ofss_fc_ui_task...	BundleCampaignBenefitChart...	priceBenefitType	com.ofss.fc.domain.p...	Y
14	TDS02	/com/ofss/fc...	com_ofss_fc_ui_task...	TaxWaiverCriteriaVO1Iterator	waiverCriteria	com.ofss.fc.domain.t...	Y
15	TDS06	/com/ofss/fc...	com_ofss_fc_ui_view...	TDSummaryTableVO1Iterator	accountNumber	com.ofss.fc.domain.t...	(null)
16	TDS06	/com/ofss/fc...	com_ofss_fc_ui_view...	PartyDetailsVO1Iterator	PartyId	com.ofss.fc.domain.t...	(null)
17	TDS06	/com/ofss/fc...	com_ofss_fc_ui_view...	(null)	(null)	com.ofss.fc.domain.t...	(null)
18	TDS06	/com/ofss/fc...	com_ofss_fc_ui_view...	TDSummaryTableVO1Iterator	waiverStartDate	com.ofss.fc.domain.t...	(null)
19	LCM52	/com/ofss/fc...	com_ofss_fc_ui_task...	LCCMatrixMainVO1Iterator	id	com.ofss.fc.domain.l...	Y
20	LCM61	/com/ofss/fc...	com_ofss_fc_ui_task...	ExposureLimitsVO1Iterator	limitsFact	com.ofss.fc.domain.l...	Y
21	LCM037	/com/ofss/fc...	com_ofss_fc_ui_view...	CollateralValuerPreference...	valuerID	com.ofss.fc.domain.l...	Y
22	LCM21	/com/ofss/fc...	com_ofss_fc_ui_task...	CollateralDedupeVO1Iterator	collateralCategory	com.ofss.fc.domain.l...	Y
23	LCM05	/com/ofss/fc...	view_InsuranceProvi...	InsuranceProviderVO1Iterator	insuranceProviderCode	com.ofss.fc.domain.l...	Y
24	LCM21	/com/ofss/fc...	com_ofss_fc_ui_task...	CollateralDedupeVO1Iterator	collateralType	com.ofss.fc.domain.l...	Y
25	PM024	/com/ofss/fc...	com_ofss_fc_ui_view...	InterestRuleDefinitionVO1I...	productCode	com.ofss.fc.domain.p...	N
26	CS03	/com/ofss/fc...	com_ofss_fc_ui_task...	BankParametersVO1Iterator	BankCode	com.ofss.fc.domain.c...	N
27	PMU019	/com/ofss/fc...	com_ofss_fc_ui_task...	ProductGroupRoleHeadVO1Ite...	productGroupCode	com.ofss.fc.domain.p...	Y

6.1.2 Seed Data for the Task Codes

The UDF linkage to different services is done through the screen task flow codes.

The Task Flow code and a meaningful description need to be populated in FLX_UD_AVLBL_TASK_CODES table.

Task Code LOV in the UDF Linkage screen shows the values from this table, in order to attach the different UDF codes to this.

6.1.3 Screen Changes for Incorporating UDF

The following changes should be taken care of to incorporate UDF functionality to a screen.

Changes to the UI/Middleware

There are no changes to be done to the UI/Middleware to enable UDF, except in a few special cases.

In case of a transaction screen, the screen type will be taken as input by default. If a screen happens to be an enquiry screen, then the parameter ("TransactionScreenType") should be passed accordingly. There are some other special cases which are explained in a subsequent section.

Changes to the Middleware

The design is in such a way that a transaction service saved will use the Transaction Reference number (SessionContext.internalReferenceNumber) for saving the UDF Details. This has been done because it will be difficult to link the transaction services to a single Entity. A Transaction spans multiple Entities.

Typically a Maintenance Service (domain layer) will extend "MaintenanceDomainService". Hence, the code has been put inside create(),update() and merge() to extract the key fields from the Entity instance using reflection.

```
MaintenanceDomainService. extractKeyFromDomainObject(AbstractDomainObject)
```

The above method does the following:

1. Take the data from flx_md_key_fields for the Entity and extract the Key values from the entity instance. (keyvalue1#keyvalue2#keyvalue3)
2. Form the key attributes in a similar fashion (keyattr1#keyattr2#keyattr3)
3. Take the fully qualified Entity name from the entity passed and store the same.

Finally the data is stored into the FCRThreadAttribute as shown below:

Figure 6–2 Data Stored into the FCRThreadAttribute

```
    }
    if(FCRThreadAttribute.get(FCRThreadAttribute.UDF_KEY)==null){
    HashMap<String, String> udfMap = new HashMap<String, String>();
    udfMap.put(UDFKeyThreadAttributeMapConstants.KEY_VALUE, keyAttrData);
    udfMap.put(UDFKeyThreadAttributeMapConstants.KEY_ATTRIBUTES, sbAttribute.toString());
    udfMap.put(UDFKeyThreadAttributeMapConstants.ENTITY_NAME, fullyQualifiedName);
    if (logger.isLoggable(Level.FINE)) {
        logger.log(Level.FINE, formatter.formatMessage("Inside %s.setEntityKeyForUDF().Setting udfKey map into FC
                THIS_COMPONENT_NAME));
    }
    FCRThreadAttribute.set(FCRThreadAttribute.UDF_KEY, udfMap);
    }
}
```

When the UDF service is called to persist the UDF data, the following checks happen:

1. If the UDFDTO contains the key in it, then it is taken to save the UDF.
2. If not, the FCRThreadAttribute is accessed and the key is taken from there.
3. If step#2 also does not yield the key, then it saves with the internalReferenceNo from SessionContext. Transaction Services typically should not extend "MaintenanceDomainService", and hence will fall under this option to get the key.

6.1.4 Linking of UDF to a Screen (Taskflow Code)

UDF can be linked to a particular task flow code in three simple steps.

1. Create the Required User Defined Fields using the UserDefinedFields Definition Screen (UDF01).
2. Link the Fields to the TaskFlow Code using the User Defined Fields Linkage Screen (UDF02).

(Optional) If there is a requirement to use the Associated UDF functionality, Link the Associated UDF's in this screen (UDF03). If the Associated UDF's are not required, the steps 1 and 2 will suffice.

6.2 Control Flow for UDF

This section describes the control flow of UDF.

6.2.1 Initial Screen Load

UDF task flow has been put on the template (maintenance and transaction) and it will be enabled for the screens using these templates, with an exception of a few because of the way the screen and/or service has been done.

When the screen loads the template page, Definition is initialized, and as a part of it the UDF region is initialized.

When the UDF region is initialized, the 'LinkedUDFsBean' is initialized, and from the constructor of which, the LinkedUDFsHelper is initialized.

As part of the helper initialization, UDF metadata is fetched, UDF VO is initialized and the related UDF fields (the ones linked to the task code) are shown on the screen.

6.2.2 Extracting UDF Values on Submission

The following steps are involved in extracting UDF values on Submission:

Step 1

Appx Layer is enabled for the Services that need to enable UDF. Enabling the appx for the service can be done as follows.

Step 2

From the First Layer (Proxy Façade), the data details for the UDF are extracted, with a call to **com.ofss.fc.ui.core.adfhelper.ADFProxyLayerHelper.**

Step 3

The data thus obtained into the UDF DTO is passed to the subsequent layer json client till the Service Spi, if the host application layer is APPX.

Figure 6–3 LinkedUDFDTO

```
public LinkedUDFDTO extractUDFData(SessionContext sessionContext,
                                   WorkItemViewObjectDTO[] workItemViewObjectDTO) throws FatalException,ServiceException {
    LinkedUDFDTO[] dtoArray= null;
    ILinkedUDFsHelper helper= LinkedUDFsRegionHelper.getLinkedUDFsHelper();
    if(helper!= null && helper.isTaskCodeLinked())
    {dtoArray =helper.populateLinkedDTOs();
     }

    return dtoArray !=null?dtoArray[0]:null;
```

Step 4

LinkedUDFsRegionHelper.getLinkedUDFsHelper() is get the instance of the LinkedUDFsHelper from the respective container, using which it the UDF DTO can be extracted.

Figure 6–4 Extracting UDF DTO using instance of the LinkedUDFsHelper

```
public static ILinkedUDFsHelper getLinkedUDFsHelper()
{ ILinkedUDFsHelper helper=null;
   try{
    JUFormBinding template = getTemplateBindingContainer();
    DCTaskFlowBinding udftf = (DCTaskFlowBinding)template.findExecutableBinding("udftaskflowdefinition1");
    PageFlowScope pf= getPageFlowScope(udftf.getFullName());
    helper = (ILinkedUDFsHelper)pf.get("LinkedUDFsHelper");
    }
    catch (Exception e) {

                return null;
            }

    return helper;
}
```

Step 5

From the ServiceSpi, the call to the actual service is made along with a call to the UDF Service.

A new property will be available in the UIConfig.properties. This is being added to get around the circular dependency which could otherwise come into existence.

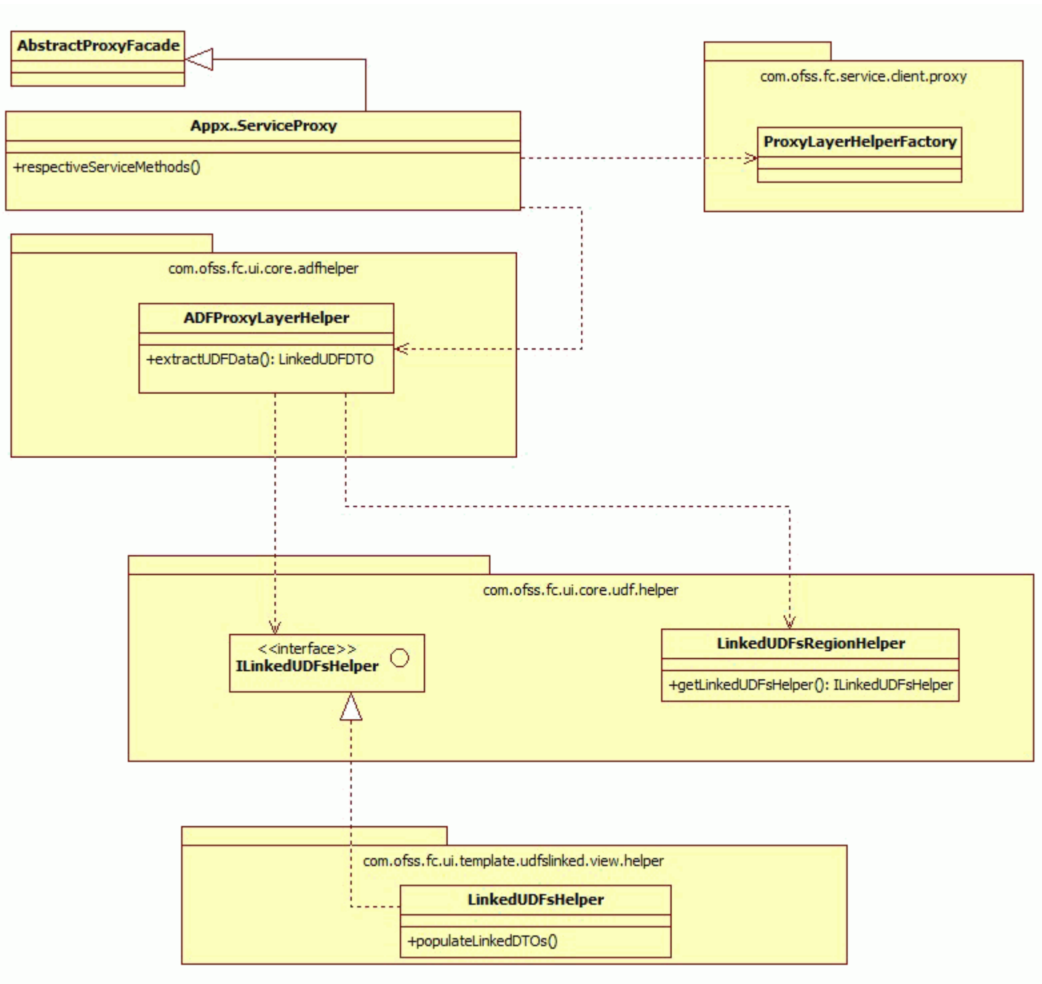
Figure 6–5 UIConfig.properties

```
50 # Time interval for Common Enumeration loading
51 ENUM.RELOAD.INTERVAL=3600000
52
53 # Proxy layer helper class for client dependent method implementations
54 # like fetching UDF data in appx layer.  We can add methods for supporting
55 # other input parameters also in this helper.
56 adf.proxy.layer.helper= com.ofss.fc.ui.core.adfhelper.ADFProxyLayerHelper
57
58 # Property added for temporary location for creating pdf file
59 EXPORT.LOCATION=/oracle/deployables/config/temp/
60
```

Package Level Interactions

The following diagram presents the package level interaction for the Extraction of UDF Data:

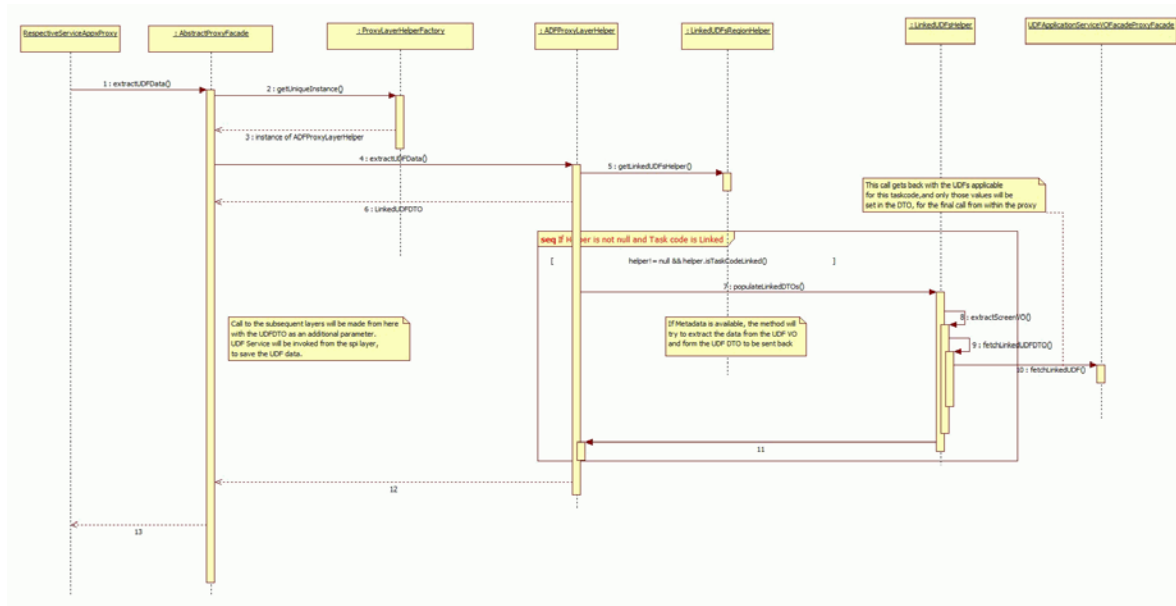
Figure 6–6 Package Level Interactions



Sequence Diagram

Following is the Sequence Diagram for UDF DTO Extraction.

Figure 6–7 Sequence Diagram for UDF DTO



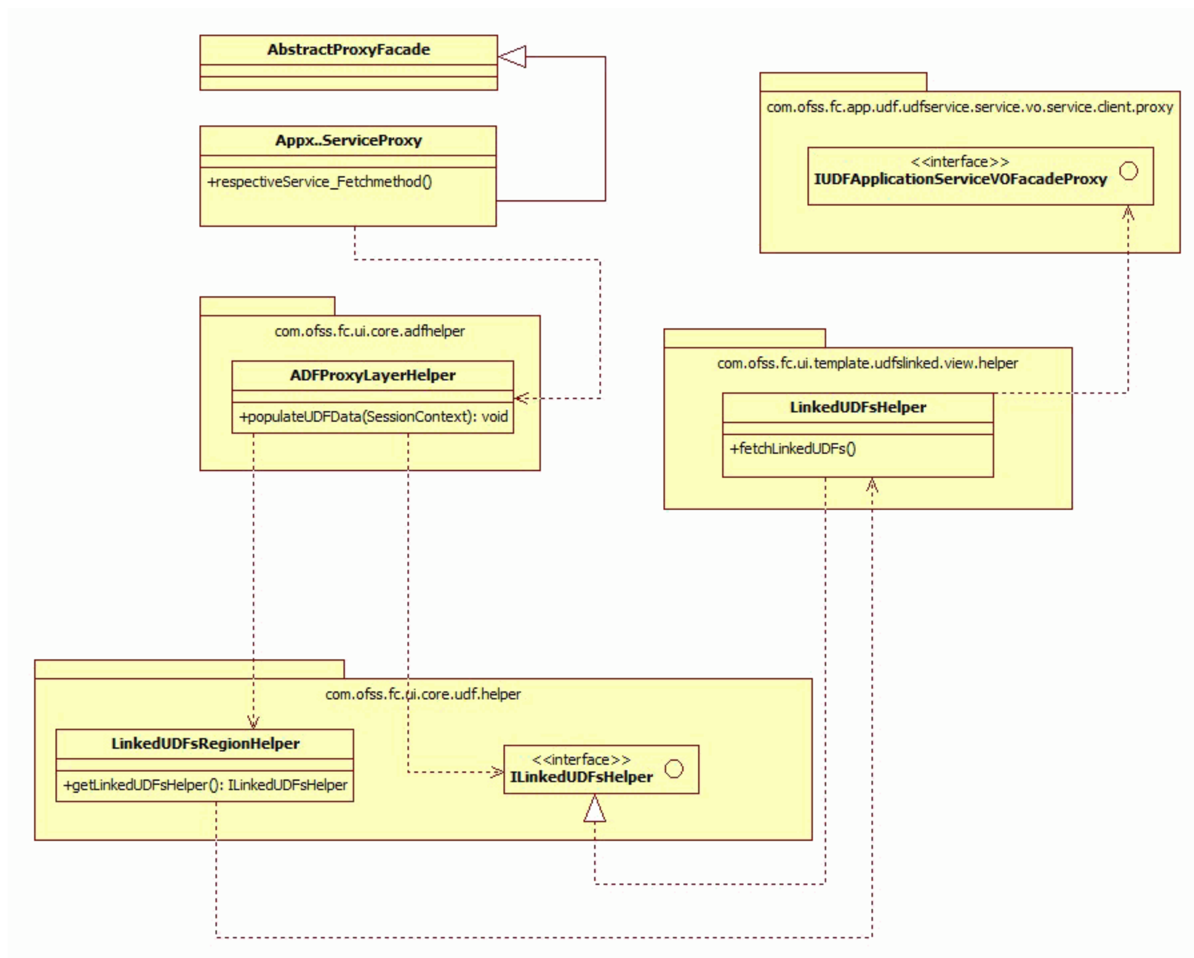
6.2.3 Handling the Fetch of UDF Values

UDF Values linked to a key in the screen is done through a call in the Proxy layer to fetch and hence render the values on to the screen.

Package Level Interactions

The following figure explains the package level interactions.

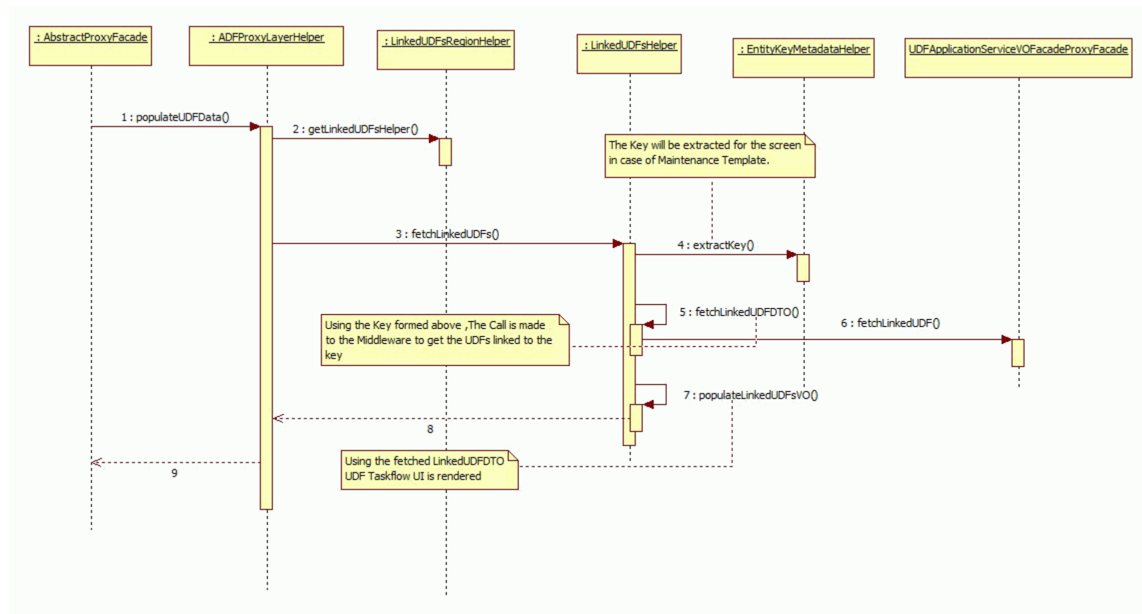
Figure 6–8 Package Level Interactions



Sequence Diagram

The following sequence diagram explains the code flow:

Figure 6–9 Sequence Diagram



The fetch is dependent on the fact that the Key values are populated on the screen (whether Visible on the screen or not), and the attribute name as well as the VO Iterator name and PageDef name is part of the Seed Data.

6.2.4 UDF Enabling Special Cases

Because of the screen/service design, it is possible that some of the cases will need to be handled differently. These cases revolve around either the extraction of key values in the middleware for any service, or about obtaining the key (with which the UDF had been saved for the current task code (record)).

The cases as identified now are provided below:

Fetch

During fetch of the UDF, there could be situations due to which the key cannot be extracted from the screen, using the metadata provided in the FLX_UD_SCREEN_BINDING table:

- In the case of a composite Key if one of the attributes involved in the key is not available in the UI View object. The cases in which this would happen are different.
  - An 'if' condition based on which a value is set into the DTO at the time of save from a Enum or a constant, where as the screen displays the value as something else.
  - One of the key attributes is taken from the session context in the middleware, just before the fetch happens, and that attribute is not available anywhere in the UI.

  Solution:

  The above two cases needs to be handled by raising an event from the screen, after setting the key value into TaskFlow.udf_key. Event Consumer class will consume this event and make a call to the middleware with this key to fetch the LinkedUDFDTO.

- In some cases, the screen is designed to list the multiple records maintained from that screen in a single grid. In this case there are multiple keys (record) available on the screen at the same time

  Solution:

  Same as the above. Raising an event from the screen during the process of fetch, after setting the key value into TaskFlow.udf_key. Event Consumer class will consume this event and make a call to the middleware with this key to fetch the LinkedUDFDTO.

Save

During Extraction of the key in the middleware, there could be the following cases:

- A Maintenance Service calling multiple services within itself. In this case, there are multiple entries into MaintenanceDomainService, and in all cases the code to extract they key from the entity will be executed. Now, we don't know the right entity from which the key needs to be extracted.

  Solution:

  A new mapping table (new metadata) has been put in place to maintain a mapping between Fully Qualified (FQ) Spi name and the Fully Qualified EntityName. When the call enters the key extraction method it will check if there is an entry in this table, and if yes, it will process only if it comes in with the right Entity. If there is no entry in this table, then it takes the key details from the first Entry into the key extraction method and stores it against the FCRThreadAttribute.udf_Key. Subsequently, there is a check to see if it is already available, and skip if yes.

6.2.5 Tips for Trouble Shooting

UDF panel is not appearing on the screen:

If the UDF panel is not appearing on the screen, you can perform the following checks:

- Check correct key entry is there in FLX_UD_LINKED_UDF, the taskcode linkage table.
- Check if the table (FLX_UD_SCREEN_BINDING) has rows for the task code. The rows in here are required only if it is maintenance template.
- If the screen is using transaction template, check if the TransactionType is input or inquiry.
- If it is input, then check if there are UDF's linked to the taskcode.
- If it is inquiry, then see if the event is getting raised from the grid. If the event is there, then on the grid task flow, check if MultiTabCtx is being passed as a parameter into this task flow. The event is raised after setting the UDF key is set into the respective attribute inside the TaskFlow.
- Check if the page has template binding in its page definition.

UDF field values are not persisting in to DB:

If the UDF field values are not persisting in to DB, you can perform the following checks:

- Check if Appx is enabled in HostApplicationLayer.properties
- Debug inside the extractUDF method of the ADFProxyLayerHelper, it extracts UDF fields from UDF view object, creates linkedUDFDTO and returns the same to

the proxy layer. This can be checked at the service Spi level if the UDFDTO is coming in with values.

- The case could also be that, the UDF values are saved with the user reference number, that is, in the case where the key extraction from MaintenanceDomainService has not happened fine. In this case, even though the UDF is persisted, it does not look like it has, and as a result this would seem like a persistence issue.

UDF field values are not populated in fetch:

If the UDF field values are not populated in fetch:, you can perform the following checks:

- Check if the screen has some special handling to populate the UDF by raising events.
- To raise the event, the keyvalue for the screen needs to be set in "TaskFlow" instance, and this is possible only if MultiTabContext is available in the pageflowscope where the event is getting raised.
- If not, check the call from the Proxyfacade, if the call has to AbstractProxyFacade. populateUDFData(SessionContext sessionContext)
- Check if the screen is a transaction template screen, and it happens to be a pure enquiry screen. If yes, the parameter "transactionScreenType" needs to be passed from the taskcode jsff appropriately.

UDF Data getting saved with the wrong key:

If the UDF data is getting saved with the wrong key, you can perform the following checks:

- If the metadata related to an entity is not available in FLX_MD_KEY_FIELDS, the actual maintenance service key cannot be used to save the UDF, and it by default gets saved with the SessionContext.internalReferenceNumber, and make it look like the UDF values were not saved.
- Similarly, in case of a transaction service, the design is to save the UDF with the transaction reference number (SessionContext.internalReferenceNumber). However, if the service (or one of the component Services happens to extend "MaintenanceDomainService"), the key will be extracted from the entity that is passed into this. This can be handled by passing the screentype parameter properly.

6.3 Limitations and Special Cases

Following is the list of the limitations and special cases:

- There are multiple records getting maintained at one time, that is during one save. There is only one instance of the UDFDTO available in the service signatures for the App services.
- UDF Panel has been added to the template. Currently, it supports Maintenance and Transaction template. UDF cannot be enabled for Dashboard type of screen where there is a collage of information fed by different services, as it is UI (taskcode) dependent rendering for the UDF. This will require coding specifically to be done on the screen where it needs to be rendered.
- Extraction of the UDF Key is dependent on the metadata generated on the Entities, and using a linkage that needs to be maintained with the UI (Vo) attributes and

the service attributes. If the UI attributes or Entity attributes change, the metadata has to be brought in sync.

- Fetching of UDF requires the task code to be supplied along with the Key value, currently though the domain entity name is also captured.
- If there is a grid on the screen, the call to render the UDF for the different keys on the grid needs to happen through an Event raising.
- Multiple fetch Calls might happen from the UI. UI might not be able to differentiate between the main fetch calls and the others when it comes to fetching the UDF values.

7 ADF Screen Customizations

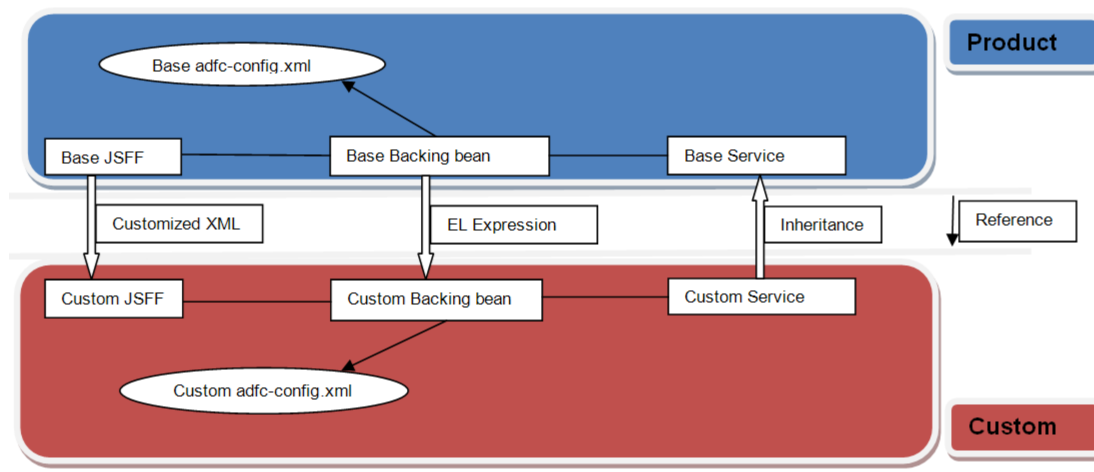
OBP provides the extensibility to an application for customizing certain additional requirements of a client. However, since these additional requirements differ from client to client, and the base application functionality remains the same, the code to handle the additional requirements should be kept separate from the code of the base application. For this purpose, **Seeded Customizations** (built on the Oracle Metadata Services framework) can be used to customize an application.

7.1 Seeded Customization Concepts

When designing seeded customizations for an application, one or more customization layers need to be specified. A customization layer is used to hold a set of customizations. A customization layer supports one or more customization layer value which specifies which set of customizations to apply at runtime.

Custom Application View can be represented as follows:

Figure 7–1 Customization Application View



Oracle JDeveloper 11g includes a special role for designing customizations for each customization layer and layer value called the Customization Developer Role.

The following section explains the details about the Oracle JDeveloper customization mode as well as customizing and extending of the ADF application artifact. The detailed documentation for customizing and extending ADF Application Artifacts is also available at the Oracle website:

http://docs.oracle.com/cd/E25178_01/fusionapps.1111/e16691/ext_busobjedit.htm

7.2 Customization Layer

To customize an application, you must specify the customization layers and their values in the CustomizationLayerValues.xml file, so that they are recognized by JDeveloper.

For example, you can create a customization layer with the name **option** and values **demo** and ***another bank name***.

To create the customization layer, follow these steps:

1. From the main menu, choose the **File -> open** option. Locate and open the file
2. CustomizationLayerValues.xml which is found in the <JDEVELOPER_HOME>/jdeveloper/jdev directory. In the XML editor, add the entry for a new customization layer and values as shown in the following image.

Figure 7–2 CustomizationLayerValues.xml

3. Save and close the file.

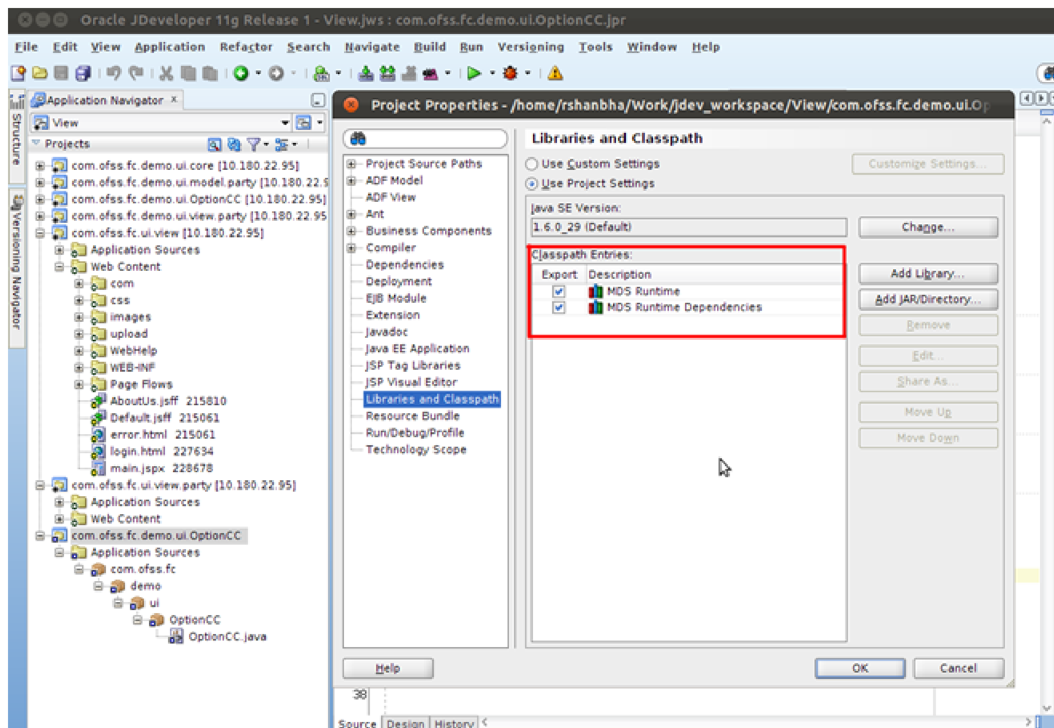
7.3 Customization Class

Before customizing an application, a customization class needs to be created. This class represents the interface that the *Oracle Metadata Services* framework uses to identify the customization layer that should be applied to the application's base metadata.

To create a customization class, follow these steps:

1. From the main menu, choose **File -> New**.
2. Create a generic project and give a name *(com.ofss.fc.demo.ui.OptionCC)* to the project.
3. Go to **Project Properties** for this project and add the required **MDS** libraries in the classpath of the project.

Figure 7–3 Customization Class



4. Create the customization class in this project. The customization class **must** extend the *oracle.mds.cust.CustomizationClass* abstract class.

   Following are the abstract methods of the CustomizationClass:

   - getCacheHint() - This method will return the information about whether the customization layer is applicable to all users, a set of users, a specific HTTP request or a single user.
   - getName() - This method will return the name of the customization layer.
   - getValue() - This method will return the customization layer value at runtime.

     The screenshot below depicts an implementation for the methods:

Figure 7–4 Implementation for the abstract methods of CustomizationClass

```
package com.ofss.fc.demo.ui.OptionCC;

import oracle.mds.core.MetadataObject;
import oracle.mds.core.RestrictedSession;
import oracle.mds.cust.CacheHint;
import oracle.mds.cust.CustomizationClass;

public class OptionCC extends CustomizationClass {

    private static final String LAYER_NAME = "option";
    private static final String DEFAULT_LAYER = "demo";

    public OptionCC() {
        super();
    }

    public CacheHint getCacheHint() {
        return CacheHint.REQUEST;
    }

    public String getName() {
        return LAYER_NAME;
    }

    public String[] getValue(RestrictedSession restrictedSession,
                             MetadataObject metadataObject) {
        String[] layerValues = null;

        try {
            //Add Code to fetch layer values from property resources
        } catch(Exception e) {
            layerValues = new String[]{DEFAULT_LAYER};
        }

        return layerValues;
    }
}
```

5. Build this class and deploy the project as a JAR file (com.ofss.fc.demo.ui.OptionCC.jar). This JAR file should only contain the customization class.

6. Place this JAR file in the location <JDEVELOPER_HOME>/jdeveloper/jdev/lib/patches so that the customization class is available in the classpath of JDeveloper.

7.4 Enabling Application for Seeded Customization

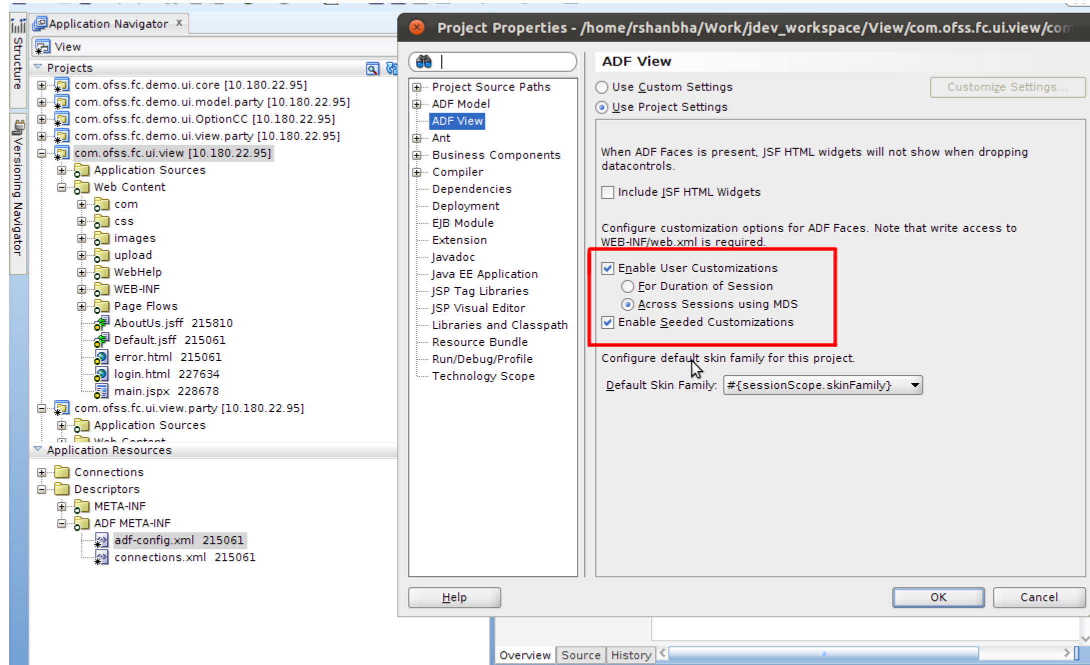
Seeded customization of an application is the process of taking a generalized application and making modifications to suit the needs of a particular group. The generalized application first needs to be enabled for seeded customization before any customizations can be done on the application.

To enable seeded customization for the application, follow these steps:

1. Go to the **Project Properties** of the application's project.

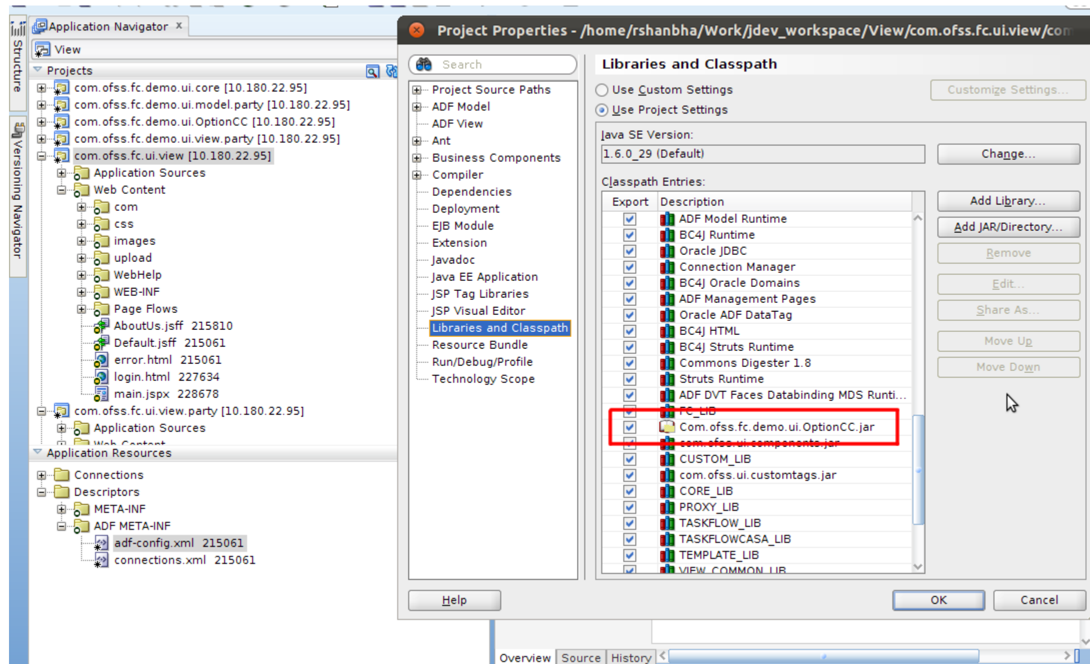
2. In the **ADF Views** section, check the **Enable Seeded Customizations** option.

Figure 7–5 Enable Seeded Customizations



3. In the Libraries and Classpath section, add the previously deployed com.ofss.fc.demo.ui.OptionCC.jar which contains the customization class.

Figure 7–6 Adding com.ofss.fc.demo.ui.OptionCC.jar



4. In the Application Resources tab, open the adf-config.xml present in the Descriptors/ADF META-INF folder. In the list of Customization Classes, remove

all the entries and add the com.ofss.fc.demo.ui.OptionCC.OptionCC class to this list.

Figure 7–7 Adding com.ofss.fc.demo.ui.OptionCC.OptionCC

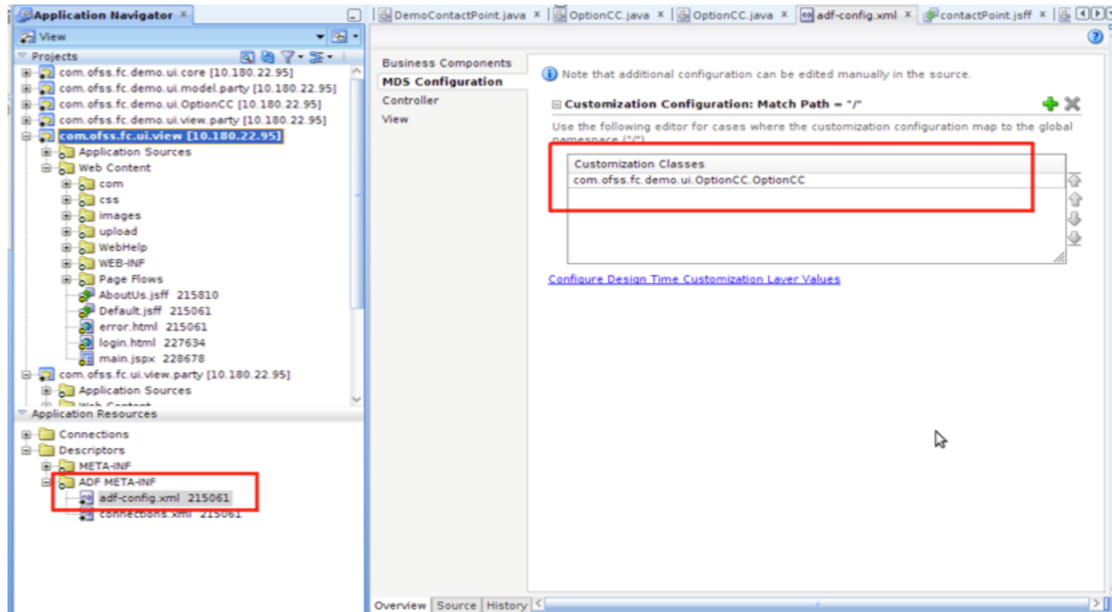


Figure 7–8 Adf-config.xml

7.5 Customization Project

After creating the Customization Layer and the Customization Class and enabling the application for Seeded Customizations, the next step is to create a project which will hold the customizations for the application.

To create the customization project, follow these steps:

1. From the main menu, choose **File -> New**. Create a new Web Project with the following technologies:
   - ADF Business Components
   - Java
   - JSF
   - JSP and Servlets
2. Go to the **Project Properties** of the project and in the classpath of the project, add the following jars:
   - Customization class JAR (com.ofss.fc.demo.ui.OptionCC.jar)
   - The project JAR which contains the screen / component to be customized. For example, if you want to customize the *Party -> Contact Information -> Contact Point* screen, the related project JAR is com.ofss.fc.ui.view.party.jar.
   - All the dependent JARS / libraries for the project JAR.
   - Enable this project for **Seeded Customizations.**

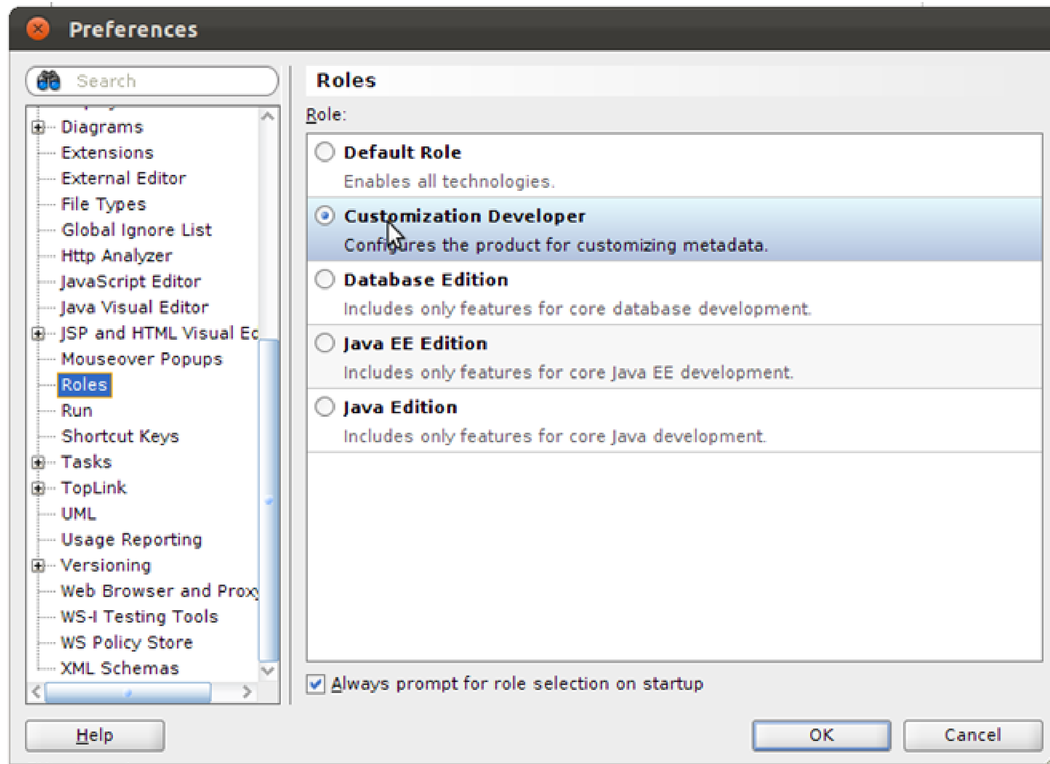
7.6 Customization Role and Context

Oracle JDeveloper 11g includes a specific role called Customization Developer Role that is used for editing seeded customizations.

To edit customizations to an application, you will need to switch JDeveloper to that role, follow these steps:

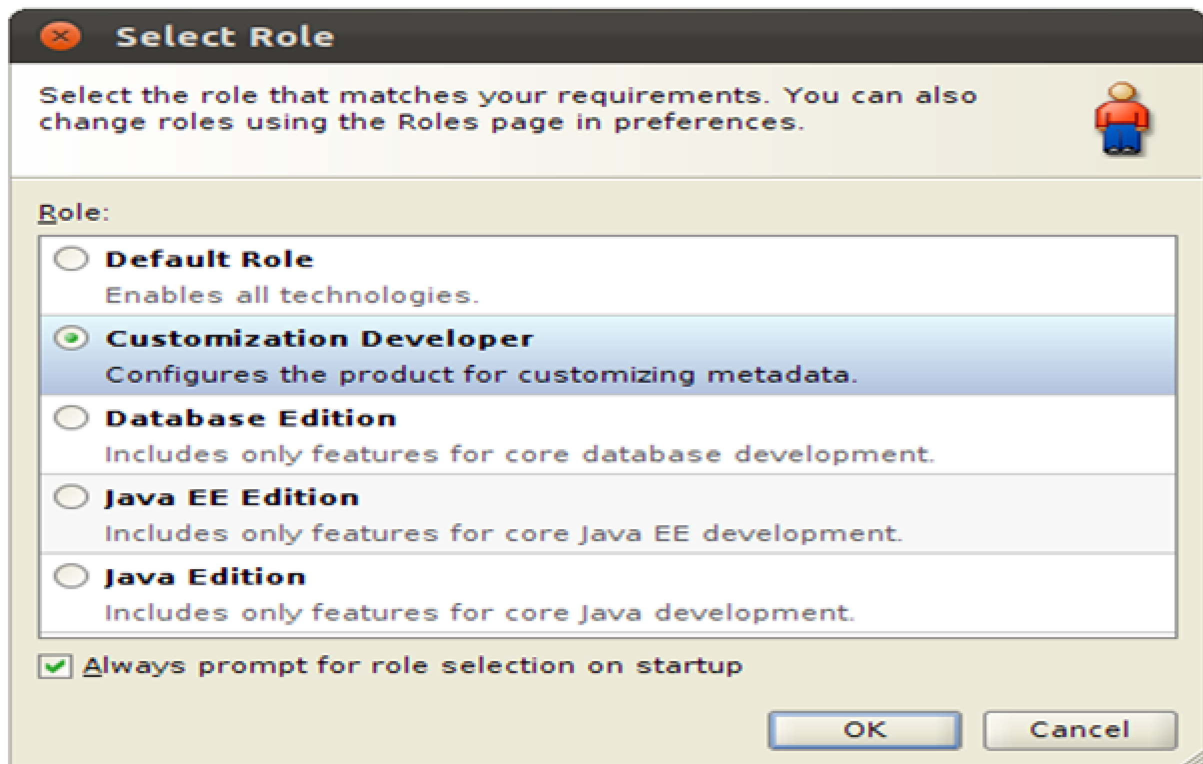
1. In **Tools -> Preferences -> Roles**, select the Customization Developer Role.

Figure 7–9 Customization Developer



2. Select the "Always prompt for role selection on start up" option.

Figure 7–10 Selecting Always Prompt for Role Selection on Start Up



3. On restarting JDeveloper, you will be prompted for role selection. Select *Customization Developer Role.*

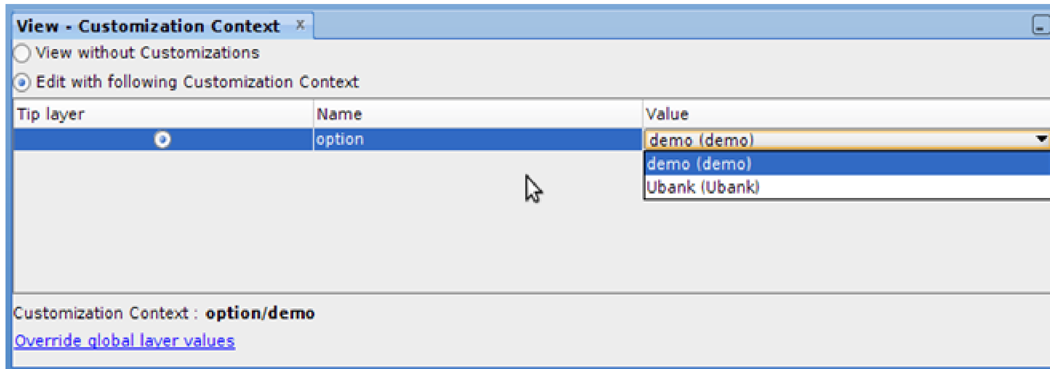
   Once Oracle JDeveloper 11g has restarted, ensure that the application to be customized is selected in the Application Navigator and have a look around the integrated development environment. You will notice a few changes from the Default Role. The first change you might notice is that files (such as Java classes), that are not customizable, are now read only. The Customization Developer Role can only be used for editing seeded customizations. Anything that is not related to seeded customizations will be disabled. The second major difference you might notice is the *MDS - Customization Context* window that is displayed.

4. Check the *Edit with following Customization Context* option.

   You will see a list of customization layer name and customization layer values which were defined in the *CustomizationLayerValues.xml* file.

5. Select the Customization Context for which, the customizations you edit should be applicable.

Figure 7–11 View Customization Context



All the customizations which are done to the application are now stored for the selected Customization Context.

7.7 Customization Examples

This section describes the customization examples.

7.7.1 Adding a Validator to Input Text Component

In this first example of customization, we will be adding a Validator to an Input Text Component present in a screen.

Use Case Description: The **Party -> Contact Information -> Contact Point** screen is used to store the various contact point details for a party. In the Contact Point Details tab, the user can select a Contact Point Type. For certain types, the Telephone Details tab is enabled in which the user can enter the telephone details. A custom component numericCode is used for getting the user's input for Telephone Number. We will be adding a Validator to this component which will validate the user's input against a regular expression.

Figure 7–12 Contact Point

To create the customization as mentioned in this use case, follow these steps:

Step 1 Create Customization Project

1. Create a project *(com.ofss.fc.demo.ui.view.party)* to hold the customization, as mentioned in the section **Customization Project**.
2. Add the required libraries and JARS along with JAR which contains the above screen *(com.ofss.fc.ui.view.party.jar)*.
3. Enable the project for seeded customizations.

Step 2 Create Validator Class

All the files which are not customizable *(for example - Java Classes)*, are read only in the *Customization Developer Role*. Hence, you have to create the Validator Class in the Default Role itself. Create the class with following features:

1. To get a handle on the *numericCode* component of the *Telephone Number*, include a private member in this class of type *ContactPoint* which is the backing bean for this screen.
2. Add a validator method with the following signature - public void methodName (FacesContext facesContext, UIComponent uiComponent, Object object).

Figure 7–13 DemoValidator.java

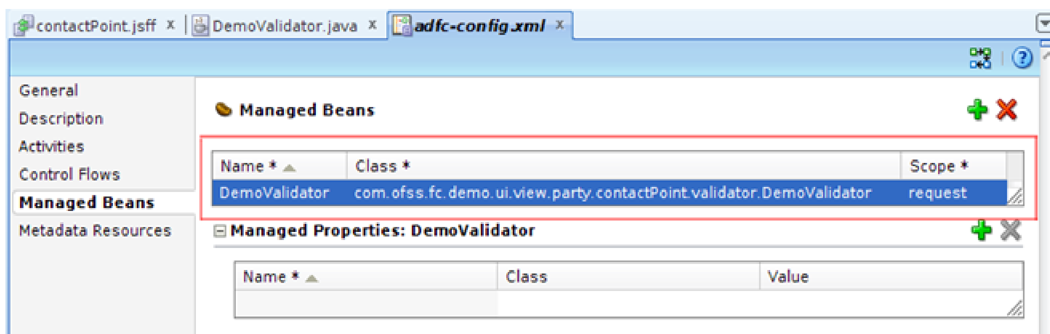
```java
package com.ofss.fc.demo.ui.view.party.contactPoint.validator;

import com.ofss.fc.ui.common.el.ELHandler;
import com.ofss.fc.ui.common.handler.MessageHandler;
import com.ofss.fc.ui.view.party.contactPoint.backing.ContactPoint;

import java.util.regex.Matcher;
import java.util.regex.Pattern;


import javax.faces.component.UIComponent;
import javax.faces.context.FacesContext;

public class DemoValidator {

    private ContactPoint contactPoint = null;

    public DemoValidator() {
        super();
        contactPoint = (ContactPoint)ELHandler.get("#{ContactPoint}");
    }

    public void telNumberValidator(FacesContext facesContext,
                                   UIComponent uiComponent, Object object) {
        String regex = "\\d{10}?";
        String telNumber = object.toString();
        Matcher matcher = Pattern.compile(regex).matcher(telNumber);
        if (!matcher.matches()) {
            MessageHandler.addErrorMessage(contactPoint.getTelNumber().getClientId(),
                                           "Improper Mobile Number",
                                           "Mobile Number should be 10 digits long.");
        }
    }
}
```

Step 3 Create Managed Bean

After creating the validator class, you have to switch to the *Customization Developer Role*.

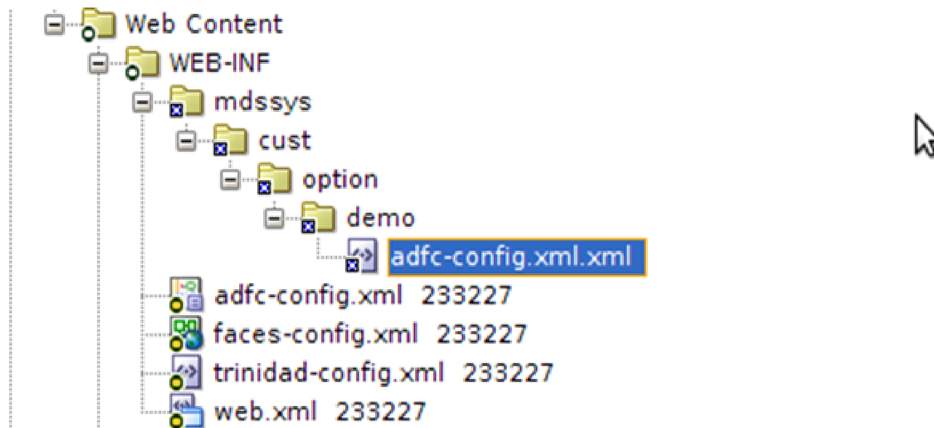
1. Select the required customization context (for example - demo).
2. Open the customization project's *adfc-config.xml* which is present in the *WEB-INF* folder.
3. In the **Managed Beans** tab, add the validator class as a managed bean with request scope as follows.

Figure 7–14 Managed Beans



When you save the changes, JDeveloper creates a customization XML to store the changes. For the above change, JDeveloper creates the XML *adfc-config.xml* in the *WEB-INF/mdssys/cust/option/demo* folder where option is the Customization Layer Name and demo is the Customization Layer Value.

Figure 7–15 Creating Managed Bean - Customization XML

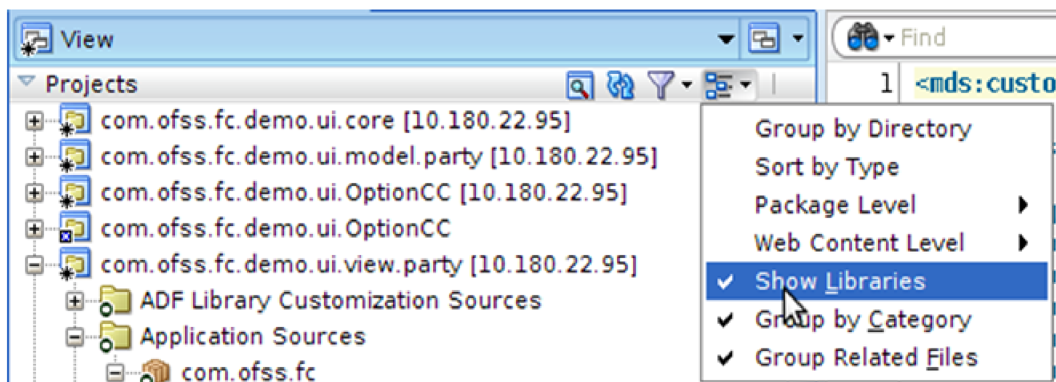


Step 4 Open Screen JSFF

After adding the Validator class as a managed bean, open the JSFF for the screen and perform the below mentioned steps:

1. In the *Application Navigator*, open the *Navigator Display Options* for *Projects* tab.
2. Select the *Show Libraries* option.

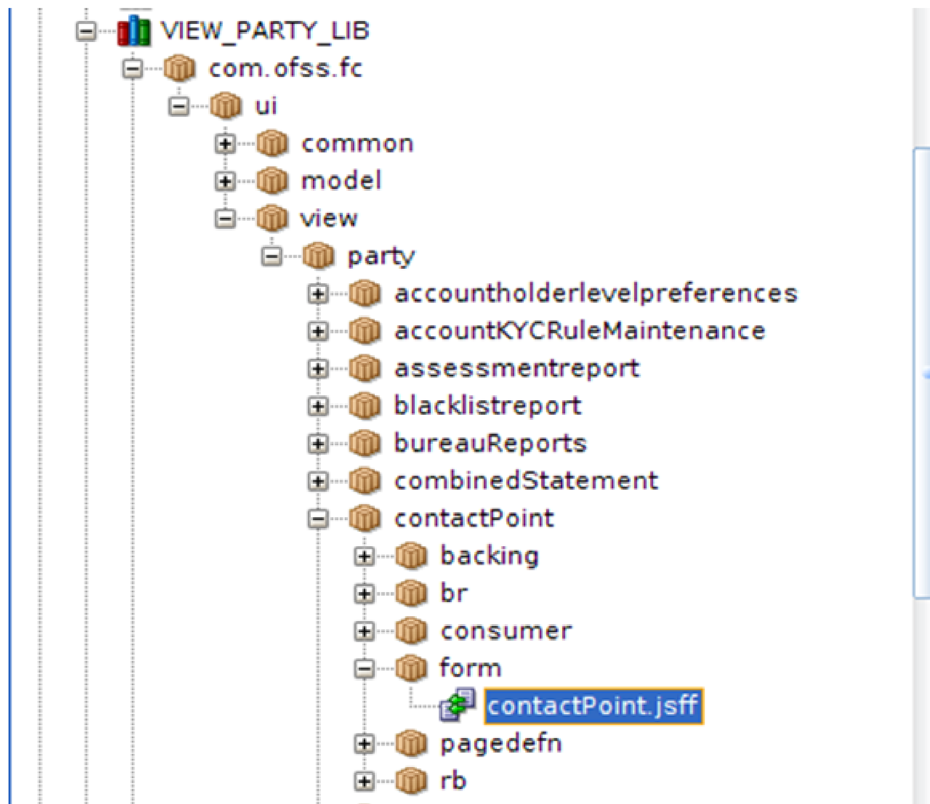
Figure 7–16 Opening JSFF Screen - Show Libraries



3. In the navigator tree, locate the JAR that contains the screen *(com.ofss.fc.ui.view.party.jar)*.
4. Inside this JAR, locate the screen JSFF (com.ofss.fc.ui.view.party.contactPoint.form.contactPoint.jsff) and open it.

   You will notice that you cannot modify this JSFF in the editor.
5. Locate the *<fc:numericCode>* component for the Telephone Number.

Figure 7–17 Opening JSFF Screen - contactPoint.Jsff



Step 5 Bind Validator to Component

1. Select the aforementioned component and open the *Property Inspector* tab.
2. For the property *Validator*, select the *Method Expression Builder*.
3. In the pop-up, locate the *Validator Class Method* under the *ADF Managed Beans*.

   When you select this method and save, the component is bound to the validator.

Figure 7–18 Bind Validator to Component - Validator Property

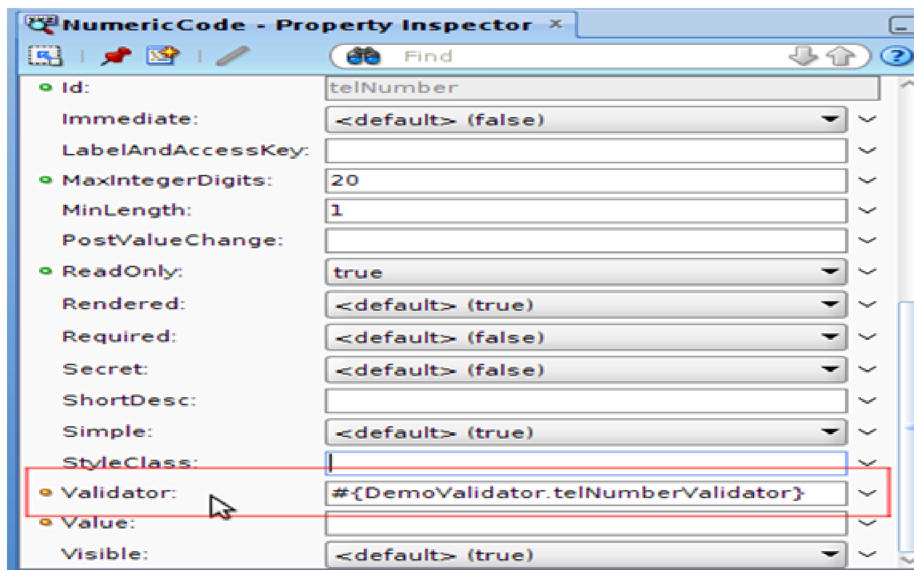
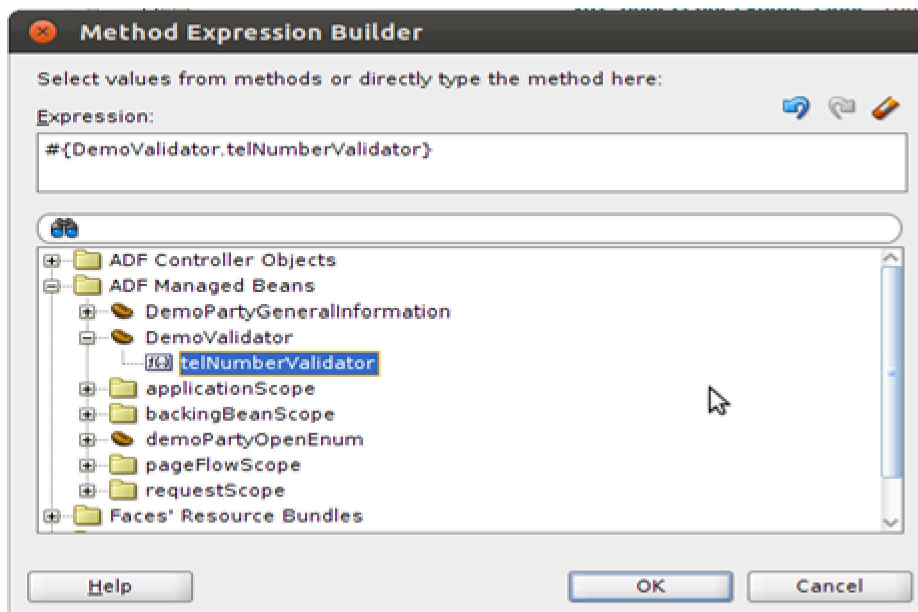


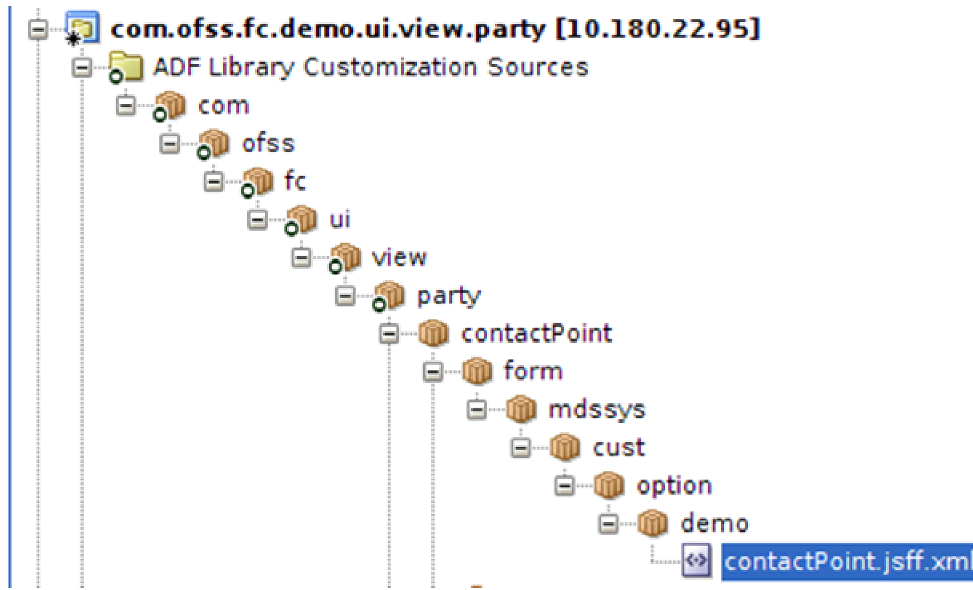
Figure 7–19 Bind Validator to Component - telNumberValidator



4. When you save the changes, JDeveloper creates a customization XML to store the changes.

   For the above change, JDeveloper creates the XML *contactPoint.jsff.xml* in the *com/ofss/fc/ui/view/party/contactPoint/cust/option/demo* folder where option is the Customization Layer Name and demo is the Customization Layer Value.

Figure 7–20 Bind Validator to Component - contactPoint.jsff.xml



Step 6 Deploy Customization Project

After finishing the customization changes, exit the *Customization Developer Role* and start JDeveloper in *Default Role*. Deploy the customization project as an ADF Library JAR *(com.ofss.fc.demo.ui.view.party.jar)*.

1. Go to the **Project Properties** of the main application project and in the *Libraries* and *Classpath*, add the following JARS:

    1. Customization Project JAR (com.ofss.fc.demo.ui.view.party.jar)

    2. Customization Class JAR (com.ofss.fc.demo.ui.OptionCC.jar)

    3. All dependency libraries and JARS for the project.

2. Start the application and navigate to the *Party -> Contact Information -> Contact Point* screen.

3. Input a *Party Id*.

4. Select a *Contact Point Type* and provide input in the *Telephone Number* input box.

    If the input is invalid as per the *Validator Class Method*, an error message is displayed to the user.

Figure 7–21 Contact Point screen

7.7.2 Adding a UI Table Component to the Screen

In this second example of customization, we will be adding a table *UI Component*, which displays data to a screen.

Use Case Description: The Advanced Search screen is used to display the related accounts and their details for a party. The *Party -> On-Boarding -> Related Party* screen displays the related parties for a party. We will be adding the table UI component used for displaying the related parties on the *Related Party* screen to the *Advanced Search* screen and populate data in this table on search and selection of a party.

Figure 7–22 Adding a UI Table Component - Party Search screen

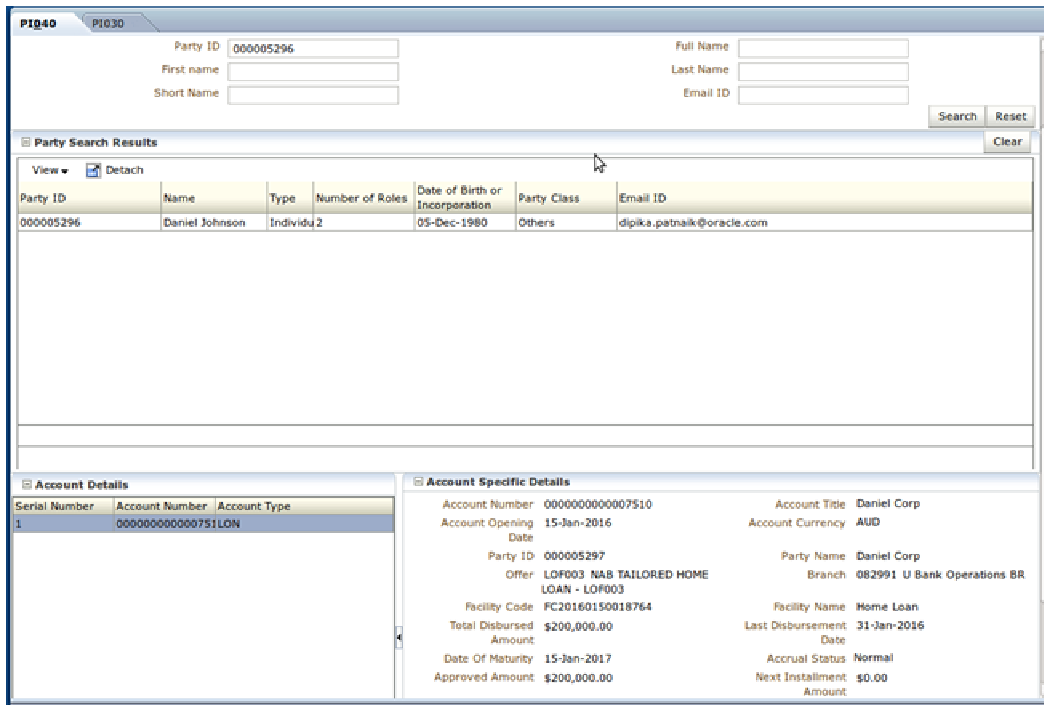
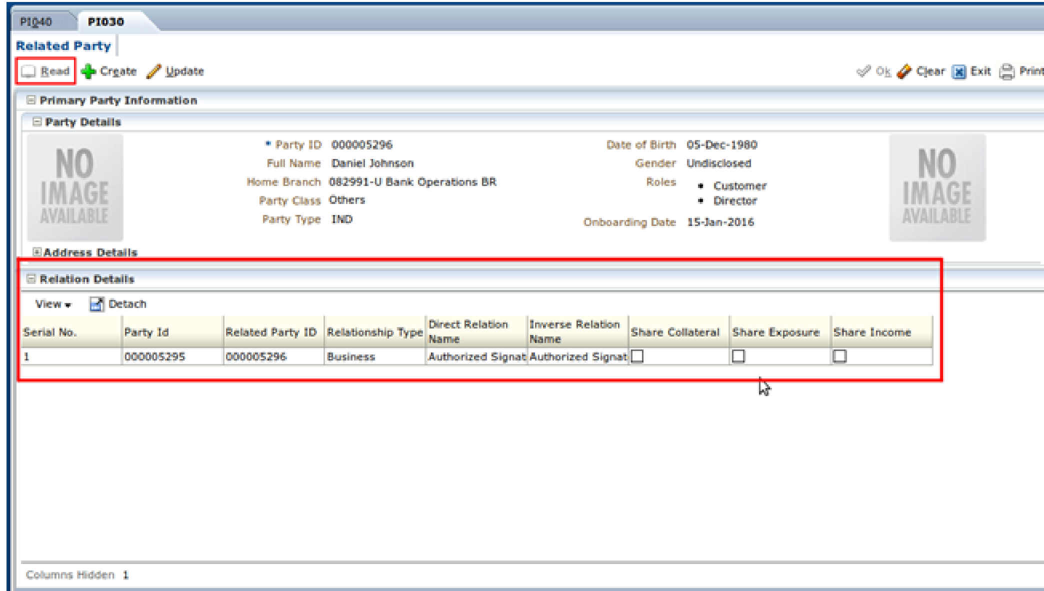


Figure 7–23 Adding a UI Table Component - Related Party screen



To create the customization as mentioned in this use case, start JDeveloper in the *Default Role* and follow these steps:

Step 1 Create Customization Project

1. As mentioned in the section **Customization Project**, create a project *(com.ofss.fc.demo.ui.view.party)* to hold the customization.

2. Add the required libraries and JARS along with JAR which contains the above screen *(com.ofss.fc.ui.view.party.jar)*.
3. Enable the project for seeded customizations.

Step 2 Create Binding Bean Class

You will need to create a class which will contain the binding for the *UI Components* which will be added to the screen during customization. Create the class with the following features:

- Private members for the UI Components and public accessors for the same.
- Private member for the backing bean of the screen *(PartySearchMaintenance)* which is initialized in the constructor of this class.
- Private member for the parent UI Component of the newly added UI components and public accessors which returns the corresponding component of the backing bean.

Figure 7–24 Creating Binding Bean Class

```
DemoPartySearchMaintenance.java
package com.ofss.fc.demo.ui.view.party.partySearch.backing;

import ...;

public class DemoPartySearchMaintenance {

    public static final String PARTY_RELATIONSHIP_TABLE_VO = "RelatedPartiesAndDetailsTableVO1Iterator";
    public static final String PARTY_SEARCH_MAINTENANCE_PAGE_DEFN = "com_ofss_fc_ui_view_party_PartySearchMaintenancePageDef1";

    private RichPanelGroupLayout pgl1;
    private RichPanelBox olpbl;
    private RichPanelCollection olpcl;
    private RichTable oltl;
    private RichOutputText olotl;
    private PartySearchMaintenance partySearchMaintenance;

    public DemoPartySearchMaintenance() {
        super();
        partySearchMaintenance = (PartySearchMaintenance) ELHandler.get(PartyProxyConstants.BACKING_BEAN_PARTY_SEARCH);
    }

    public void setPgl1(RichPanelGroupLayout pgl1) {
        this.pgl1 = pgl1;
    }

    public RichPanelGroupLayout getPgl1() {
        this.pgl1 = partySearchMaintenance.getPgl1();
        return pgl1;
    }

    public void setOlpbl(RichPanelBox olpbl) {
        this.olpbl = olpbl;
    }

    public RichPanelBox getOlpbl() {
        return olpbl;
    }

    public void setOlpcl(RichPanelCollection olpcl) {
        this.olpcl = olpcl;
    }
```

Step 3 Create Event Consumer Class

You will need to create a class which contains the business logic for populating the table UI component with the related parties' data. The search and selection of a party in the *Advanced Search* screen raises an event. By binding this event consumer class to the party's selection event, the business logic for populating the related party's data will be executed automatically on selection of a party by the user.

The original event consumer class bound to this event contains the business logic for populating the accounts data. Since your event consumer class would be over-riding the original binding, you will need to incorporate the original business logic for populating the accounts data in your event consumer class.

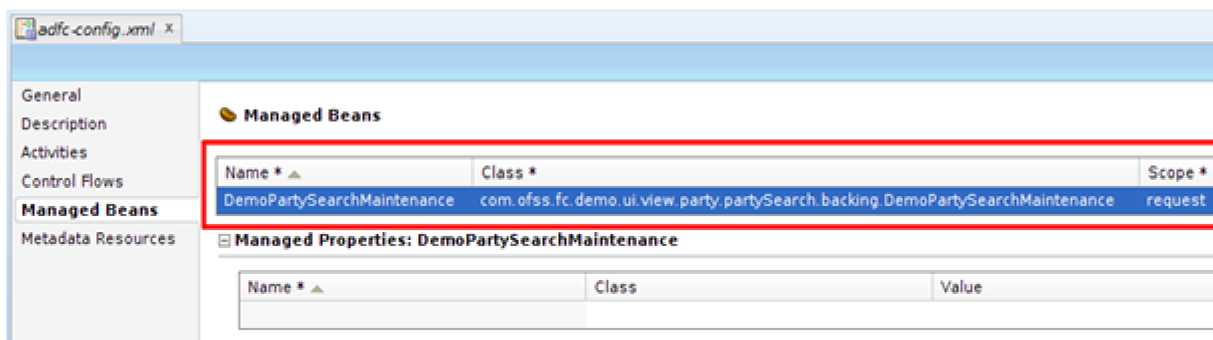
Figure 7–25 Create Event Consumer Class

```
DemoPartySearchMaintenance.java    DemoPartySearchConsumer.java

package com.ofss.fc.demo.ui.view.party.partySearch.event;

import ...;

public class DemoPartySearchConsumer {

    private static final String THIS_COMPONENT_NAME = DemoPartySearchConsumer.class.getName();
    private final Logger logger = MultiEntityLogger.getUniqueInstance().getLogger(this.getClass().getName());

    public DemoPartySearchConsumer() {
        super();
    }

    public void handleAccountTaskCodeAndPartyRelationshipEvent(Object object) {

        PartySearchTaskFlowHelper helper = (PartySearchTaskFlowHelper)object;      Original Logic for Accounts
        String partyId = helper.getSelectedPartyId();

        fillAccountsTable(partyId);

        fillPartyRelationshipTable(partyId);      New Logic for Party Relationships
    }

    private void fillPartyRelationshipTable(String partyId) {
        DemoPartySearchMaintenance demoPartySearchMaintenance = (DemoPartySearchMaintenance)ELHandler.get("#{requestScope.DemoP
        demoPartySearchMaintenance.getOlpbl().setVisible(true);

        PartyRelationshipResponse response = null;

        ViewObject partyRelationshipTableVO = IteratorHandler.getViewObject(DemoPartySearchMaintenance.PARTY_SEARCH_MAINTENANCE
        partyRelationshipTableVO.clearCache();

        try {
            IPartyRelationshipApplicationServiceProxy client =
                    (IPartyRelationshipApplicationServiceProxy)ProxyFactory.getInstance().getProxy(com.ofss.fc.ui.common.consta
            SessionContext sessionContext = SessionContextFactory.getSessionContextFactory().getSessionContextInstance();
            sessionContext.setServiceCode(RelatedPartyConstants.Task_Code);

            response = client.fetchAllRelatedPartiesAndRelationships(sessionContext, partyId);

            if (response != null && response.getStatus() != null && response.getStatus().getErrorCode().equals("0")) {
                if (response.getPartyRelationshipsDTO().length > 0) {
```

Step 4 Create Managed Bean

You will need to register the binding bean class as a managed bean. Open the project's adfc-config.xml which is present in the WEB-INF folder. In the Managed Beans tab, add the binding bean class as a managed bean with request scope as follows:

Figure 7–26 Creating Managed Bean



Step 5 Create Data Control

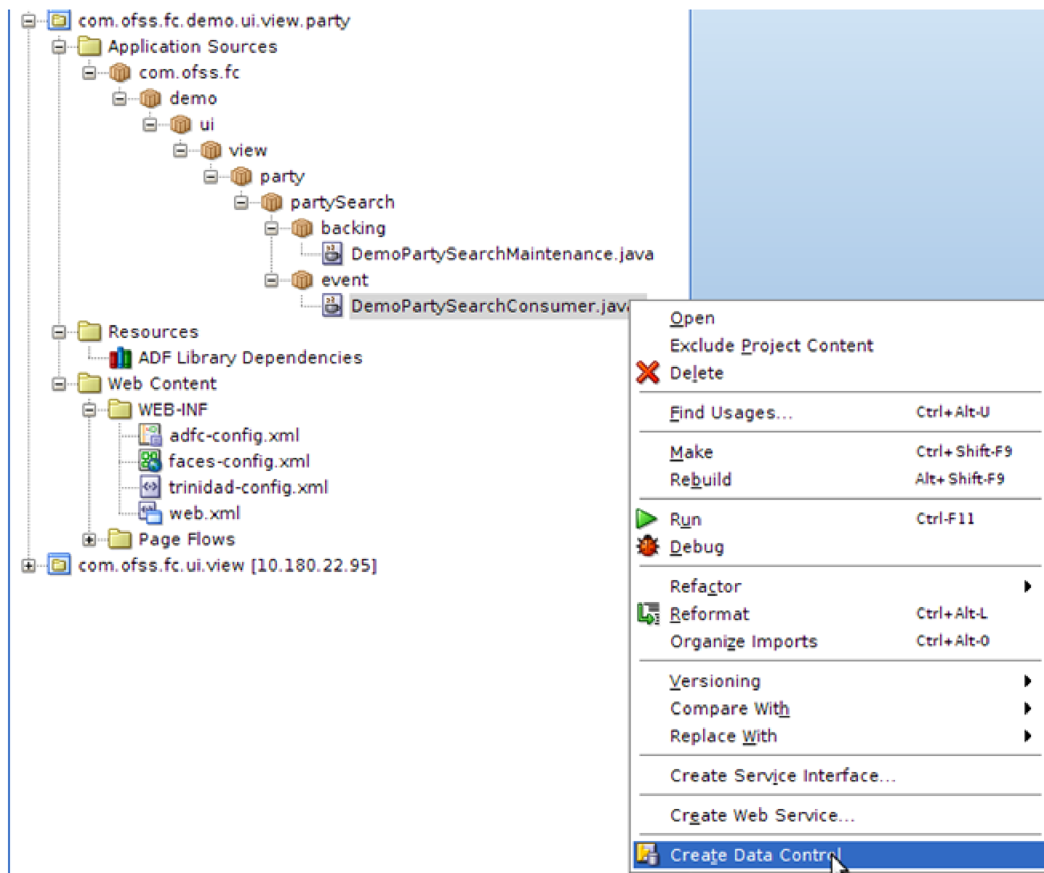
For the event consumer class's method to be exposed as an event handler, you will need to create a *data control* for this class.

1. In the *Application Navigator*, right-click the event consumer Java file and create data control.

2. On creation of data control, an XML file is generated for the class and a *DataControls.dcx* file is generated containing the information about the data controls present in the project.

   You will be able to see the event consumer data control in the *Data Controls* tab.

Figure 7–27 Create Data Control



3. Restart JDeveloper in the *Customization Developer Role* to edit the customizations.

4. Ensure that the appropriate *Customization Context* is selected.

Step 6 Add View Object Binding to Page

You will need to add the view object binding to the page definition of the screen. To open the page definition of the screen, follow these steps:

1. In the Application Navigator, open the Navigator Display Options for Projects tab and check the Show Libraries option.

2. In the navigator tree, locate the JAR that contains the screen (*com.ofss.fc.ui.view.party.jar*).

3. Inside this JAR, locate and open the page definition XML (*com.ofss.fc.ui.view.party.partySearch.pageDefn.PartySearchMaintenancePageDef.xml*)

4. After opening the page definition XML, add a tree binding for the view object (RelatedPartiesAndDetailsTableVO1) as follows:

Figure 7–28 Adding View Object Binding to Page Definition - Add Tree Binding

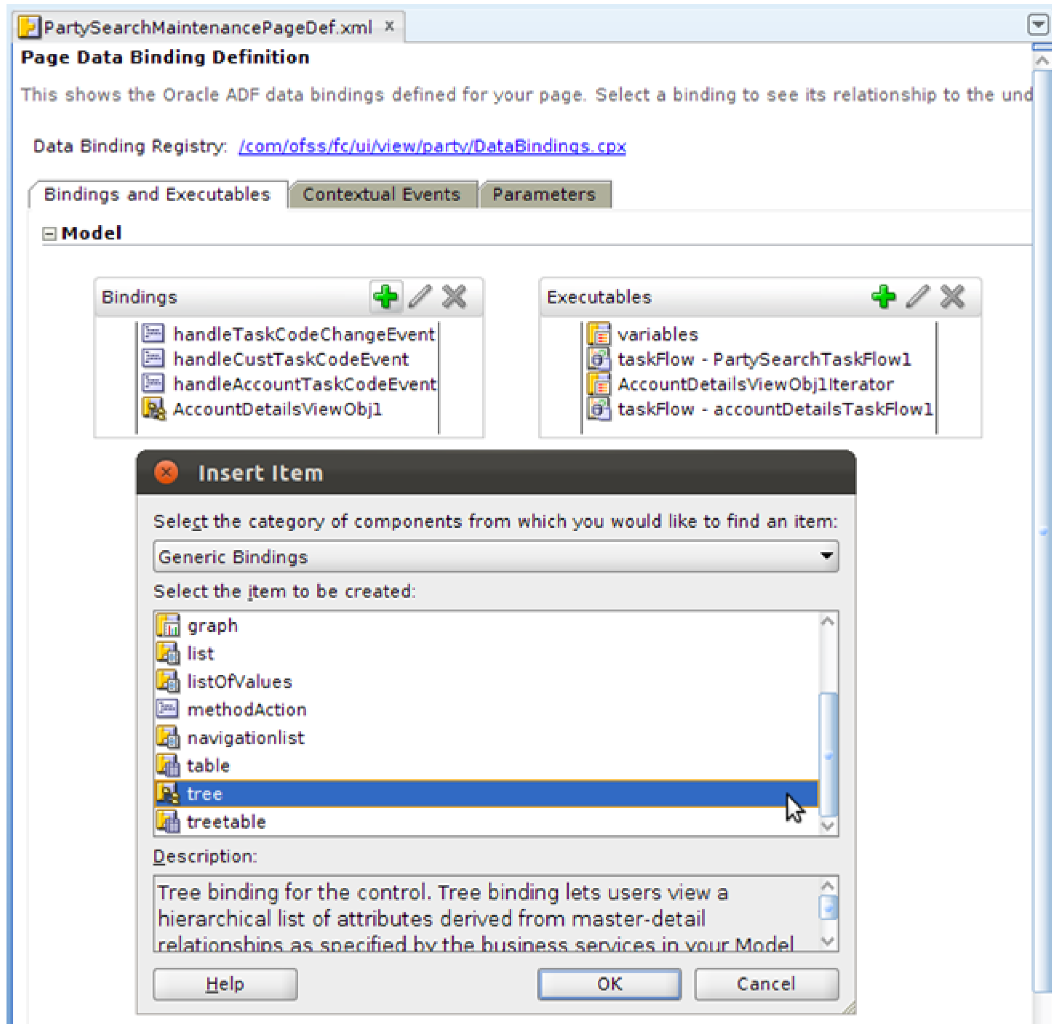
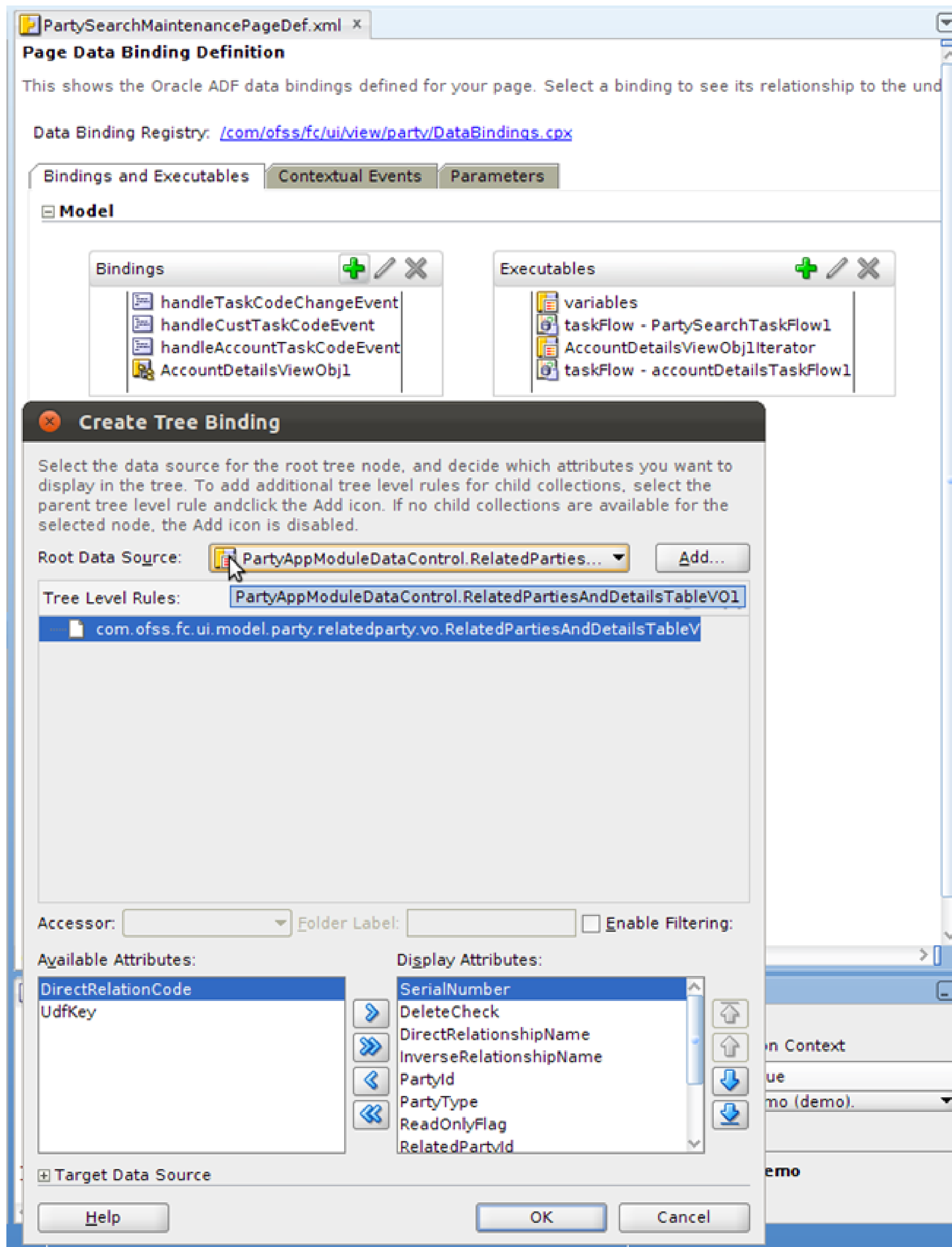


Figure 7–29 Adding View Object Binding to Page Definition - Update Root Data Source



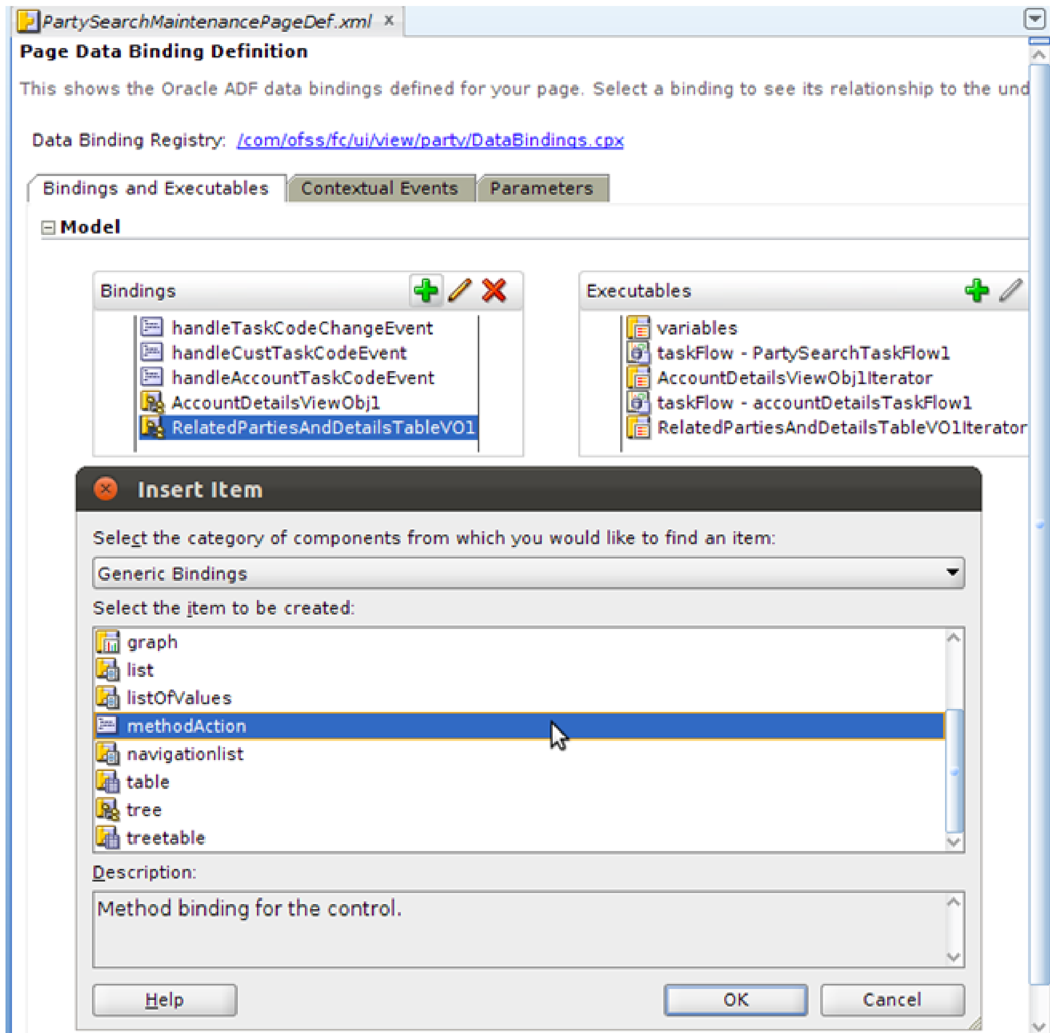
5. In Root Data Source, locate the view object which is present in the *PartyAppModuleDataControl*. Select the required display attributes and click **OK**.

Step 7 Add Method Action Binding to the Page Definition

You will need to add the method action binding for the event consumer data control to the page definition of the screen.

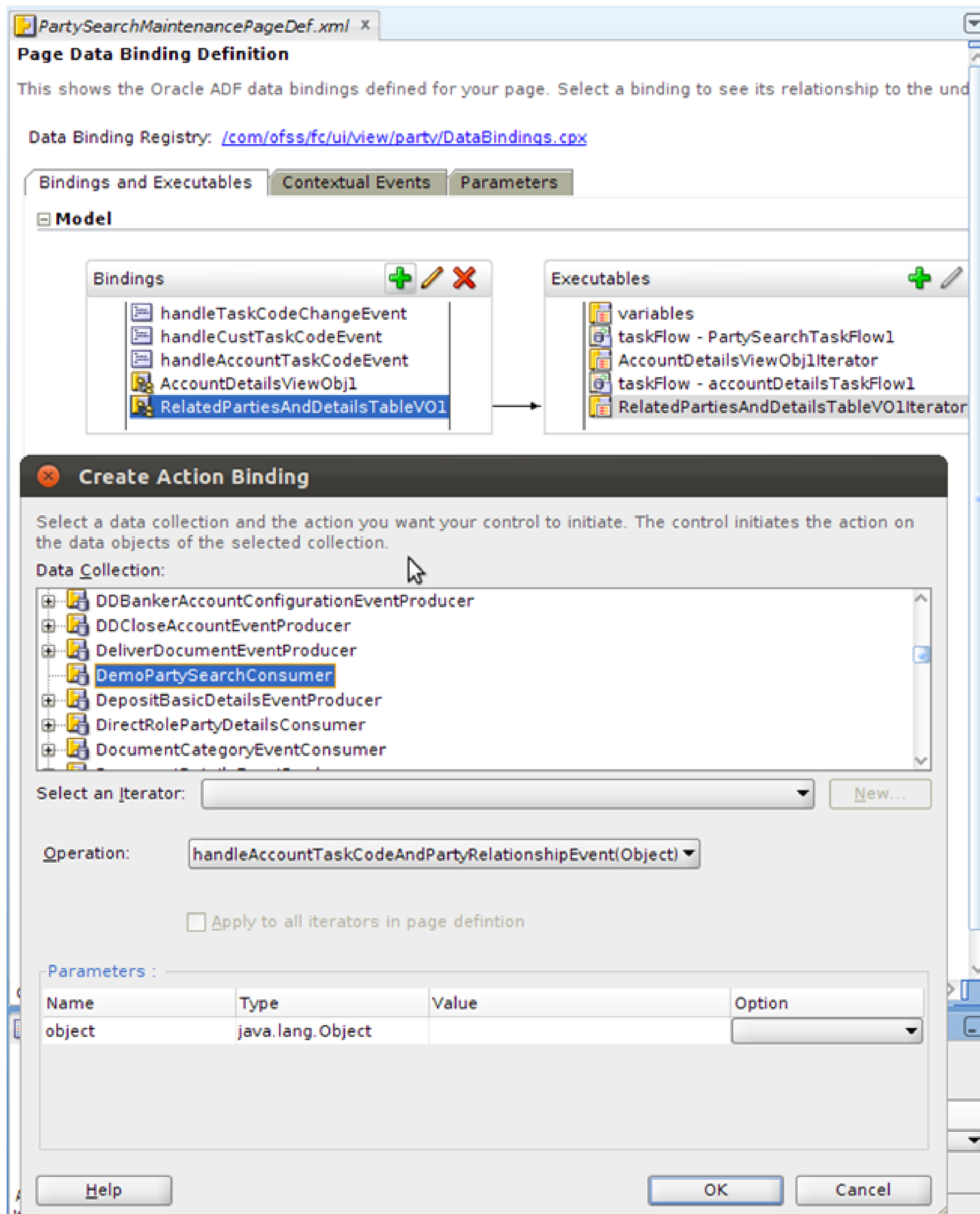
1. After opening the page definition XML, add the method action binding for the *DemoPartySearchConsumer* data control to the page definition as follows:

Figure 7–30 Page Data Binding Definition - Insert Item



2. Browse and locate the data control and click **OK**.

Figure 7–31 Page Data Binding Definition - Create Action Binding

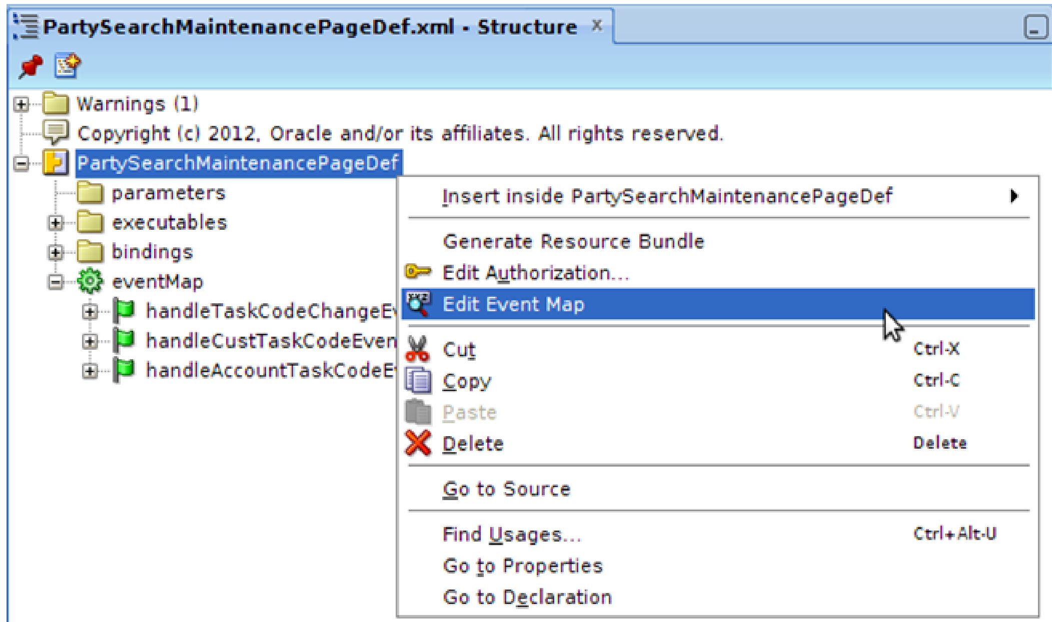


Step 8 Edit Event Map

You will need to map the *Event Producer* for the party selection event to the **Event Consumer** defined by you in the page definition.

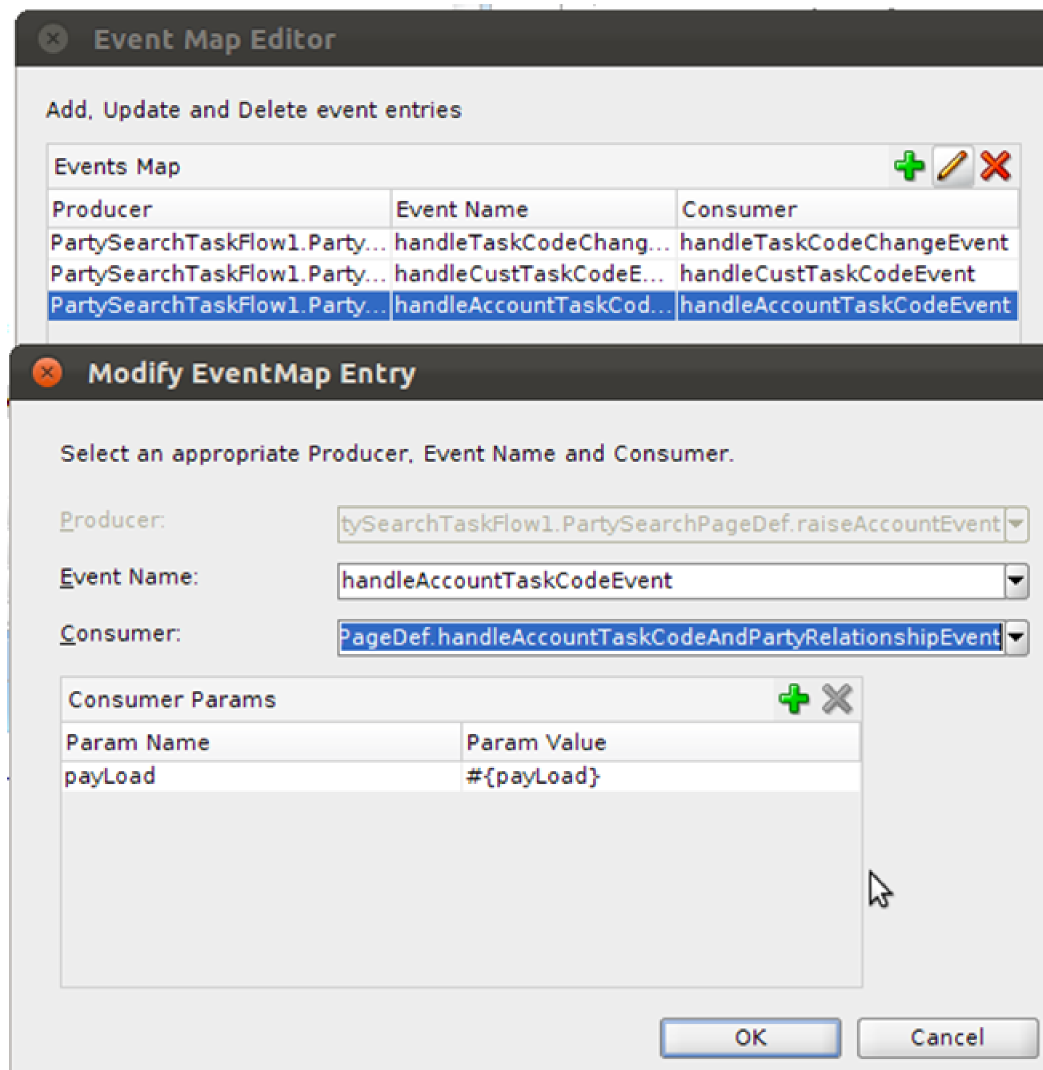
1. In the *Application Navigator*, select the page definition XML file.
2. In the *Structure panel* of JDeveloper, right-click the page definition XML and select *Edit Event Map*.

Figure 7–32 Edit Event Map



3. In the **Event Map Editor** panel, edit the mapping for the required event.
4. Select the newly added Event Consumer's method.

Figure 7–33 Event Map Editor



Step 9 Add UI Components to Screen

After making the required changes to page definition of the screen, you will need to add the UI components to the screen JSFF. After opening the JSFF for the screen *(com.ofss.fc.ui.view.party.partySearch.PartySearchMaintenance.jsff)*, follow these steps:

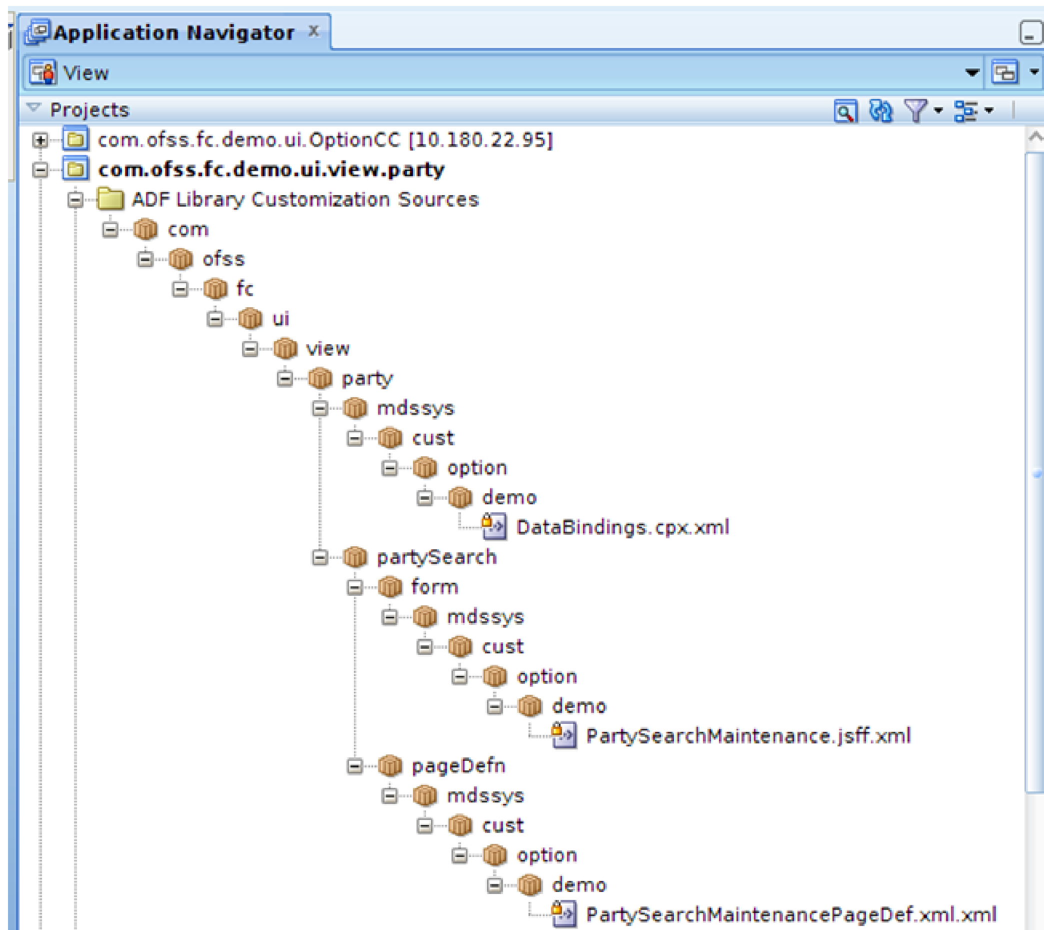
1. Drag and drop the *Panel Box*, *Panel Collection* and *Table* components onto the screen.
2. Set the required columns for the *Table* component.
3. Drag and drop the *Output Text* or *Check Box* components as required inside the columns.
4. For each component, set the required attributes using the *Property Inspector* panel of JDeveloper.
5. Add the binding for required components to the binding bean members.
6. Add the view object binding to the *Table* component.
7. Save changes made to the JSFF.

Figure 7–34 Add UI Components to Screen

After saving all these changes, you will notice that JDeveloper has created a customization XML for each of the customized entities in the *ADF Library Customizations Sources* folder packaged as per the corresponding base document's package and customization context *(Customization Layer Name & Customization Layer Value)*. These XML's store the difference between the base and customized entity. In our customization, you can see the following generated XML's:

- PartySearchMaintenancePageDef.xml for the page definition customizations.
- DataBindings.cpx.xml for the data binding (view object binding) customizations.
- PartySearchMaintenance.jsff.xml for the UI customization to the screen JSFF.

Figure 7–35 Application Navigator



Step 10 Deploy Customization Project

After finishing the customization changes, exit the *Customization Developer Role* and start JDeveloper in *Default Role*. Deploy the customization project as an ADF Library JAR *(com.ofss.fc.demo.ui.view.party.jar)*.

1. Go to the **Project Properties** of the main application project and in the *Libraries* and *Classpath*, add the following JARS:
   - Customization Project JAR (com.ofss.fc.demo.ui.view.party.jar)
   - Customization Class JAR (com.ofss.fc.demo.ui.OptionCC.jar)
   - All dependency libraries and JARS for the project.
2. Start the application and navigate to the *Advanced Search* screen.
3. Search for a party ID and select a party from the *Party Search Results* table.
4. On selection of a party, the *Relation Details* panel containing the related party's data is displayed.

Figure 7–36 Party Search

7.7.3 Adding a Date Component to a Screen

In this third example of customization, we will be adding a Date Component to an existing screen to capture date input from the input. This input will be saved in the database.

Use Case Description: The *Party -> Contact Information -> Contact Point* screen is used to store the various contact point details for a party. In the *Contact Point Details* tab, the user can select a *Contact Point Type* and a *Contact Preference Type* and provide details for the same. We will be adding a field *Expiry Date* as a date component to this tab. We will be adding a table to the database to save the user input for this field and services for this screen will be added/modified.

Figure 7–37 Adding a Date Component

To create the customization as mentioned in this use case, follow these steps:

Step 1 Host Application Changes

In this use case, we need to save the input data in the database of the application, we need to do certain modifications on the host application before creating the customizations on the client application. Following are the changes that need to be done to the host application.

Step 2 Create Table in Application Database

To save the input data for the *Expiry Date* field, create a table in the application database. The table will also need to have the *Key* columns for this field and the columns needed to store information about the record. Create appropriate primary and foreign keys for the table as well.

Figure 7–38 Create Table in Application Database

```
CREATE TABLE "FLX_PI_CONTACT_EXPIRY"
(
  "PARTY_ID"                VARCHAR2(40 BYTE) NOT NULL ENABLE,
  "CONTACT_POINT_TYPE"      VARCHAR2(3 BYTE) NOT NULL ENABLE,
  "CONTACT_PREF_TYPE"       VARCHAR2(4 BYTE) NOT NULL ENABLE,
  "EXPIRY_DATE"             DATE,
  "CREATED_BY"              VARCHAR2(254 BYTE) NOT NULL ENABLE,
  "CREATION_DATE"           TIMESTAMP (6) NOT NULL ENABLE,
  "LAST_UPDATED_BY"         VARCHAR2(254 BYTE) NOT NULL ENABLE,
  "LAST_UPDATE_DATE"        TIMESTAMP (6) NOT NULL ENABLE,
  "OBJECT_VERSION_NUMBER"   NUMBER(9,0) NOT NULL ENABLE,
  "OBJECT_STATUS_FLAG"      CHAR(1 BYTE) NOT NULL ENABLE,

  CONSTRAINT "FLX_PI_CONTACT_EXPIRY_PK" PRIMARY KEY ("PARTY_ID", "CONTACT_POINT_TYPE", "CONTACT_PREF_TYPE") ENABLE,
  CONSTRAINT "FLX_PI_CONTACT_EXPIRY_FK1" FOREIGN KEY ("PARTY_ID") REFERENCES "FLX_PI_PARTIES_B" ("PARTY_ID") ENABLE
);
```

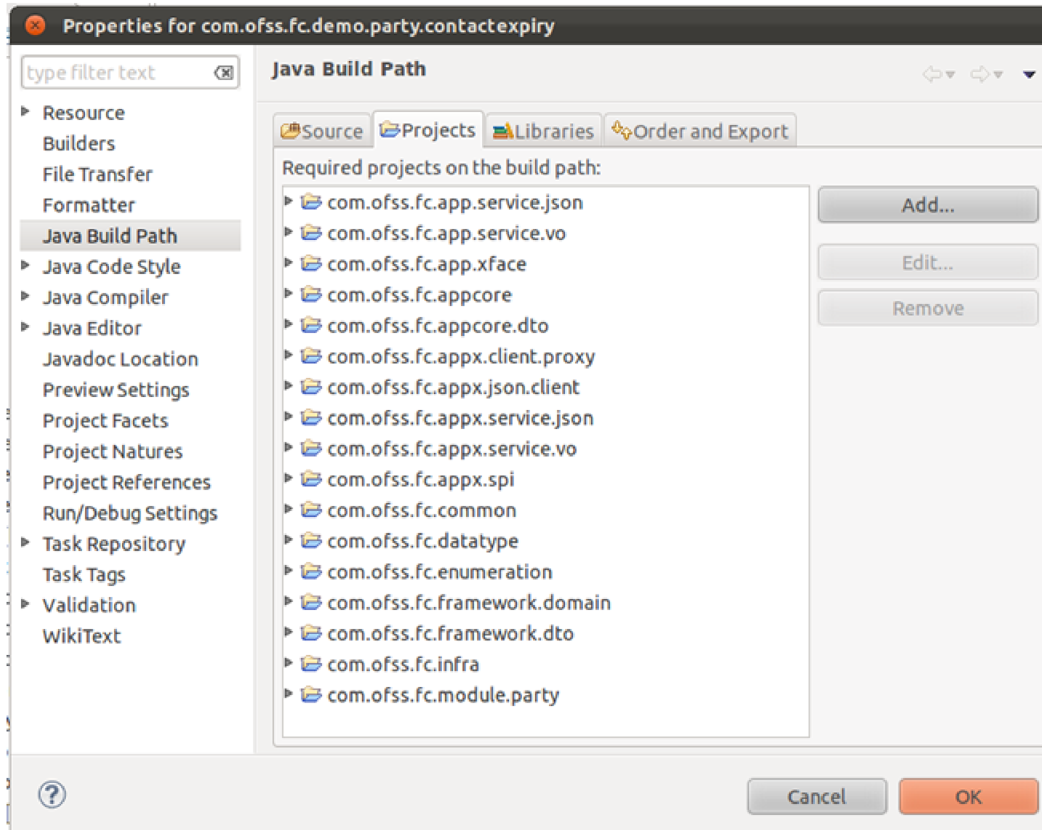
Key Columns
Expiry Date Field
Record Information Columns

After creating the table, we will need to create the domain object and service layers. To create these entities, follow these steps:

Step 3 Create Java Project

To contain the domain object and service layer classes, create a Java Project in eclipse. Give a title to the project (com.ofss.fc.demo.party.contactexpiry) and add the required projects to the classpath of the project.

Figure 7–39 Create Java Project

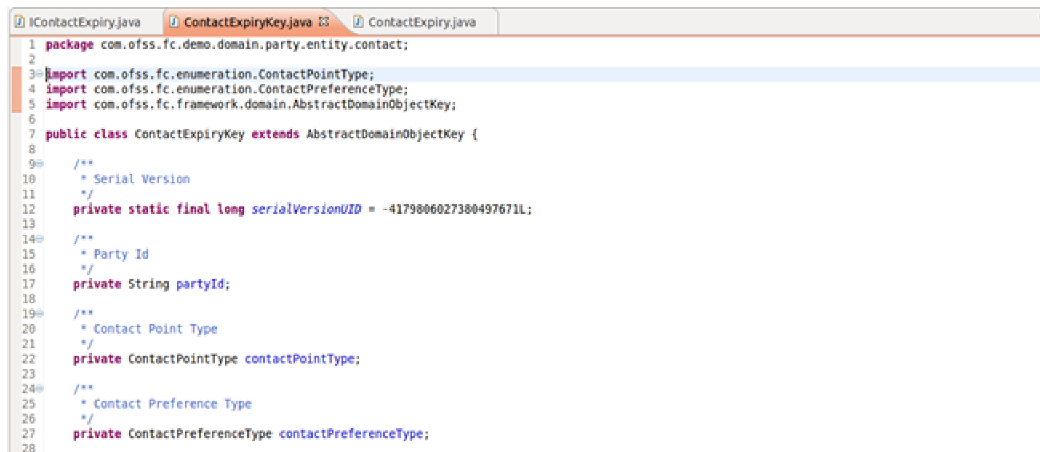


Step 4 Create Domain Objects

We will need to create the domain objects for the newly added table. As per the structure and package conventions of OBP, create the domain objects as follows:

1. Create class (*com.ofss.fc.demo.domain.party.entity.contact.ContactExpiryKey)* for the key columns of the table. This class must extend the *com.ofss.fc.framework.domain.AbstractDomainObject* abstract class.
2. Add the properties, getters and setters for the key columns of the table in this class.
3. Implement the abstract methods of the superclass.

Figure 7–40 Create Domain Objects



4. Create interface *(com.ofss.fc.demo.domain.party.entity.contact.IContactExpiry)* for the domain object class with getters and setters abstract methods for the *Key* domain object and the field *Expiry Date*.

   This interface must extend the interface *com.ofss.fc.framework.domain.AbstractDomainObject*.

Figure 7–41 Create Interface

5. Create class *(com.ofss.fc.demo.domain.party.entity.contact.ContactExpiry)* for the domain object. This class must implement the previously created interface and extend *com.ofss.fc.framework.domain.AbstractDomainObject* abstract class.
6. Add the properties, getters and setters for *Key* object and *Expiry Date* field.
7. Implement the abstract methods of the superclass.

Figure 7–42 Create Class

```
IContactExpiry.java   ContactExpiryKey.java   ContactExpiry.java
1  package com.ofss.fc.demo.domain.party.entity.contact;
2
3  import com.ofss.fc.datatype.Date;
4  import com.ofss.fc.framework.domain.AbstractDomainObject;
5  import com.ofss.fc.framework.domain.AbstractDomainObjectKey;
6
7  public class ContactExpiry extends AbstractDomainObject implements IContactExpiry {
8
9      /**
10      * Serial Version
11      */
12     private static final long serialVersionUID = -4179806027380497671L;
13
14     /**
15      * Contact Expiry Key
16      */
17     private ContactExpiryKey key;
18
19     /**
20      * Expiry Date
21      */
22     private Date expiryDate;
23
```

8. After creating the domain objects, build the project. We will be using the OBP development eclipse plug-in to generate the service layers.

Step 5 Set OBP Plugin Preferences

Before using the plug-in for generating service layer classes, you will need to set the required preferences for the plug-in. In eclipse, go to *Windows -> Preferences -> OBP Development* and the set the preferences as follows.

Figure 7–43 Preferences - Service Publisher

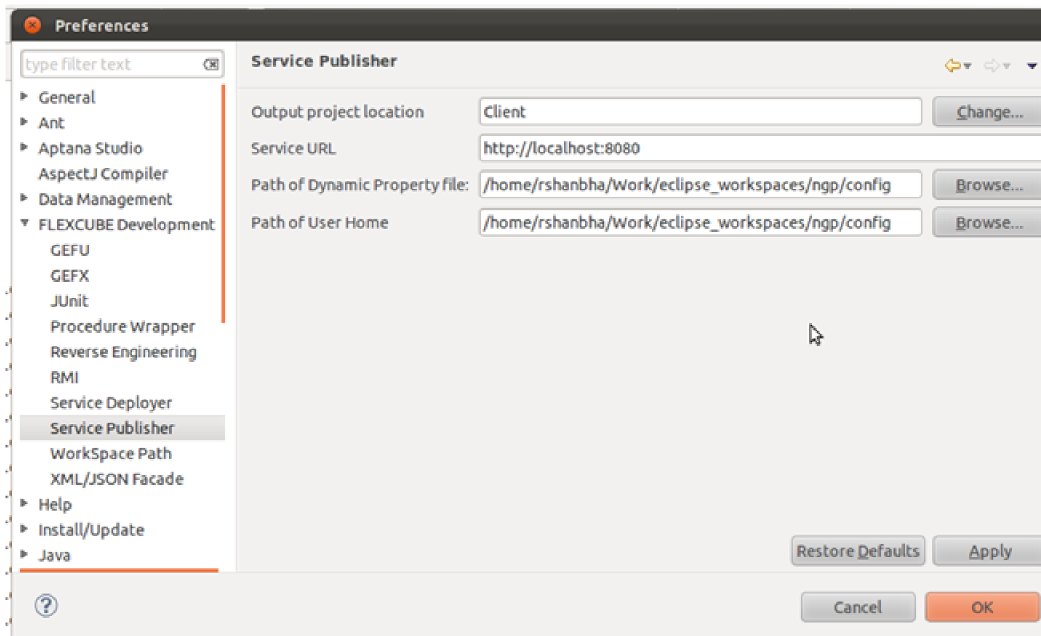


Figure 7–44 Preferences - WorkSpacePath

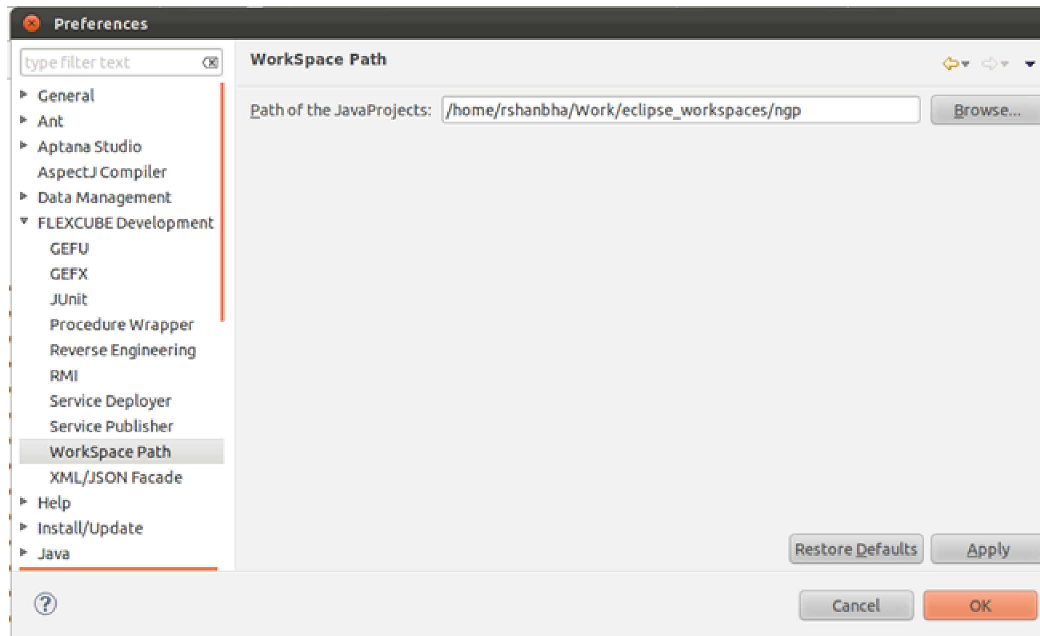
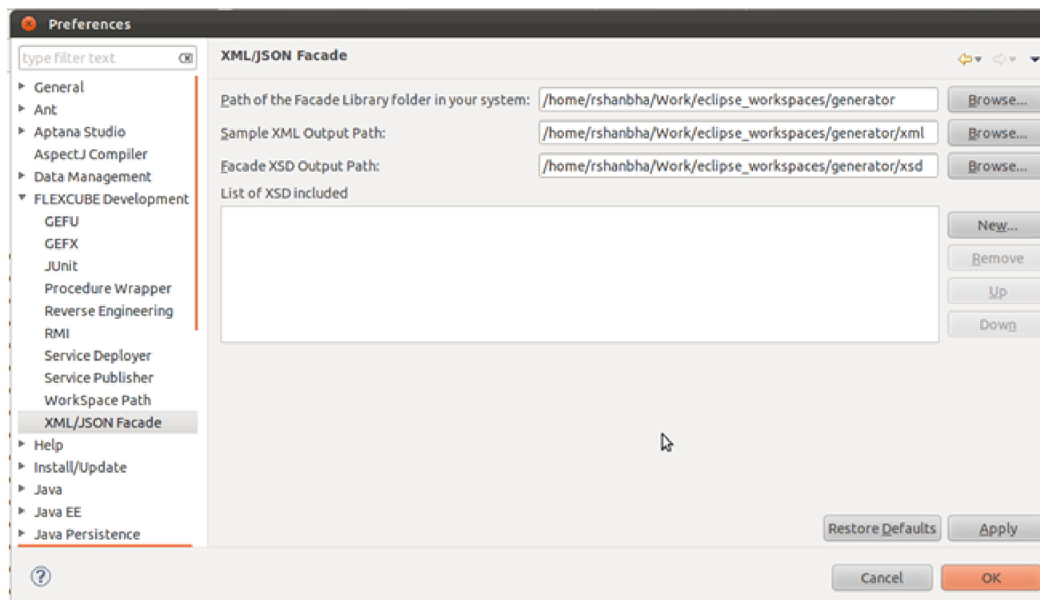


Figure 7–45 Preferences - XML/JSON Facade



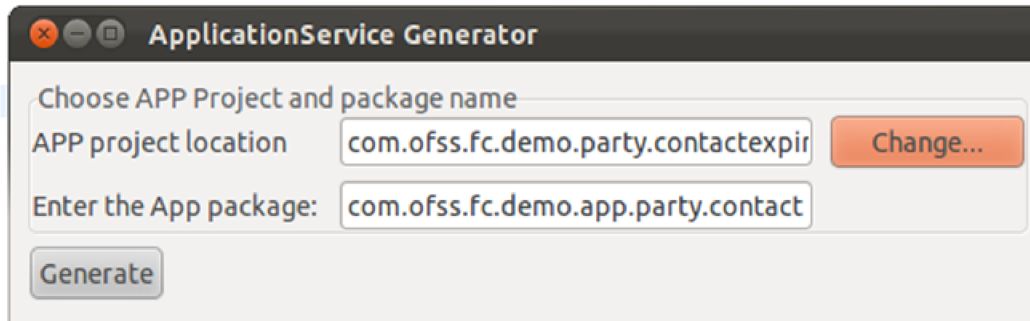
Step 6 Create Application Service

You will need to generate the application service layer classes using the OBP development plugin. Follow these steps:

1. Open the domain object class (*ContactExpiry*)
2. On the getter method of the *Key* object, add a javadoc comment **@PK**.
3. Right-click the editor window and from context menu that opens, choose *OBP Development -> Generate Application Service*.

4. In the dialog that opens, select the Java project for generated classes. You can use the project previously created by you.

Figure 7–46 ApplicationService Generator



5. Click *Generate*. Application Service classes will be generated in the project.

The Java source might contain some compilation errors due to syntax. Fix these errors and build the project. The following classes should have been generated in the project.

Figure 7–47 List of Classes Generated in the Project

Step 7 Generate Service and Facade Layer Sources

Before generating the service and facade layer sources, you will need to modify the *Data Transfer Object* (DTO). When a service call is made from the client application for a transaction related to *Contact Point*, the *Contact Expiry* transaction for the newly added *Expiry Date* field should be done in addition to the *Contact Point* transaction. Hence, the DTO for this transaction should also contain the DTO for the *Contact Point* transaction.

1. Open the *ContactExpiryDTO* class.
2. Delete the member *ContactExpiryKey* member and add *ContactPoint* member.
3. Re-factor references of the deleted member with the added member.

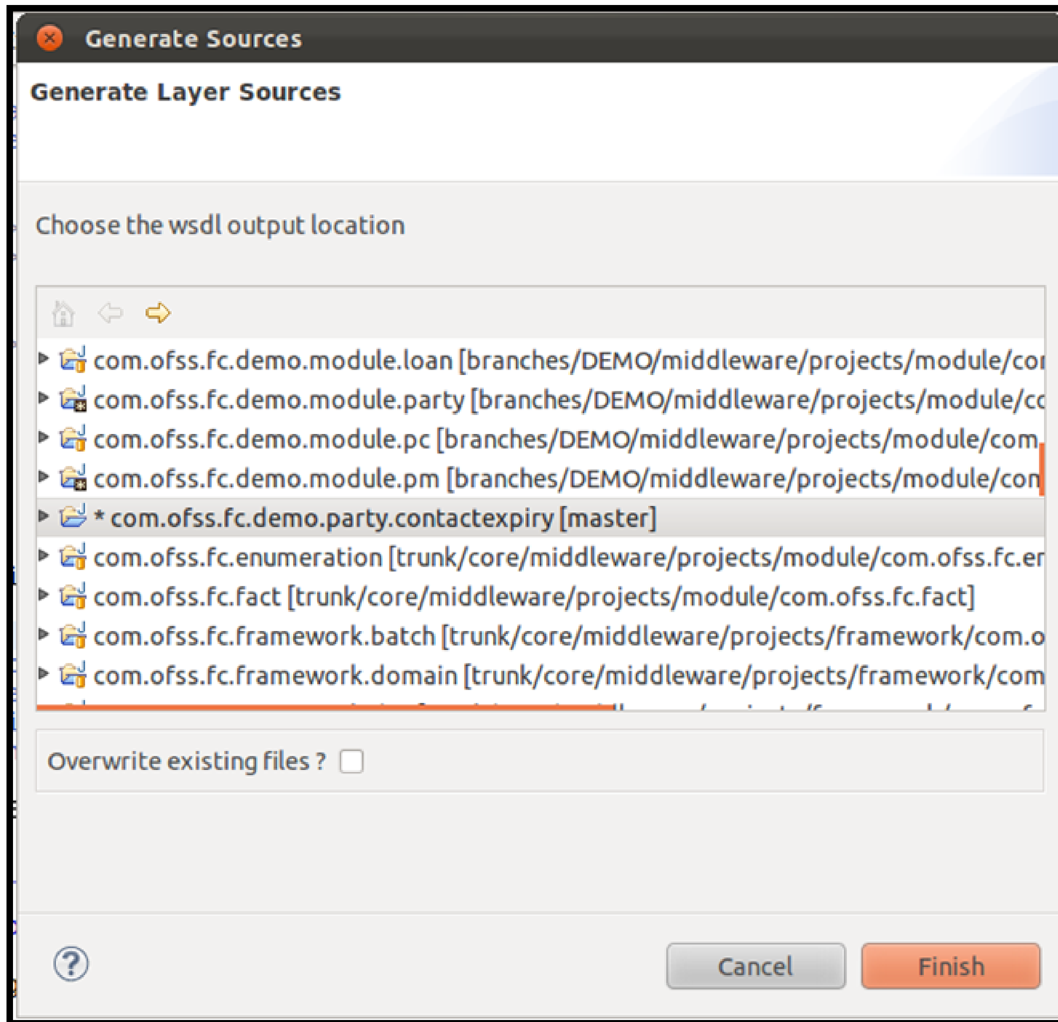
Figure 7–48 ContactExpiryDTO. java file

```
ContactExpiryKey.jav | ContactExpiryAssembl | ContactExpiryDTO.jav | ContactExpiryKeyDTO. | ContactExpiryFactory

37  * This class represents the DTO for the ContactExpiry entity.
38  * TODO: Auto generated comment: Please write detailed description for this class here.
39  * @author rshanbha
40  * @version 1.0
41  */
42 public class ContactExpiryDTO extends DomainObjectDTO {
43
44     private static final long serialVersionUID = 1L;
45
46     /**
47      * Contact Point DTO which has the key for Contact Expiry DTO
48      */
49     private ContactPointDTO contactPointDTO;
50
51     /**
52      * This indicates the expiryDate attribute
53      */
54     private Date expiryDate;
55
56     /**
57      * This represents the constructor for the class.
58     * @fcb.param MI Date expiryDate  This indicates the expiryDate attribute
59     * @fcb.param MI ContactPreferenceType contactPreferenceType  This indicates the contactPreferenceType attribute
60     * @fcb.param MI ContactPointType contactPointType  This indicates the contactPointType attribute
61     * @fcb.param MI String partyId  This indicates the partyId attribute
62      */
63     public ContactExpiryDTO(Date expiryDate, ContactPointDTO contactPointDTO)  {
64         setContactPointDTO(contactPointDTO);
65         setExpiryDate(expiryDate);
66     }
67
68     /**
69      * This represents the constructor for the class.
70     * @fcb.param MI
71      */
72     public ContactExpiryDTO()  {
73     }
74
75     /**
76      * This method returns PartyId
77      * @return partyId
78      */
79     public ContactPointDTO getContactPointDTO(){
80         return contactPointDTO;
81     }
82
```

To generate the service and facade layer sources, follow these steps:

1. Open the application service class (*ContactExpiryApplicationService)*
2. Right-click the editor window and from the context menu that opens, choose *OBP Development -> Generate Service and Facade Layer Sources*
3. In the dialog box that opens, select the Java project for the generated classes. You can use the project previously created by you. Deselect the *Overwrite Existing Files* option.

Figure 7–49 Generate Service and Facade Layer Sources



4. Click *Finish*. Service and facade layer sources will be generated in the project.
5. Certain classes might be generated twice. Delete the newly created copy of the classes and keep the original.
6. Certain compilation errors might be present in the generated classes due to erroneous syntax. Fix these compilation errors.

You will need to include a corresponding call to the *Contact Point Application Service* in the *add*, *update* and *fetch* transactions of the *Contact Expiry Application Service*.

Open *ContactExpiryApplicationServiceSpi* and modify the code as shown below.

Figure 7–50 ContactExpiryApplicationServiceSpi.java file before Modification

```
ContactExpiryApplicationServiceSpi.java
72              .getName();
73
74      private transient Logger logger = MultiEntityLogger.getUniqueInstance()
75              .getLogger(THIS_COMPONENT_NAME);
76
77      public TransactionStatus addContactExpiry(
78              com.ofss.fc.app.context.SessionContext sessionContext,
79              ContactExpiryDTO contactExpiryDTO, FeeDetailsDTO feeDetails,
80              LinkedUDFDTO linkedUDFDTO) throws FatalException {
81
82          com.ofss.fc.demo.app.party.service.contact.ContactExpiryApplicationService manager = new com.ofss.fc.demo.app.party.service.contact.Contac
83
84          Interaction.begin(sessionContext);
85
86          com.ofss.fc.demo.appx.party.service.contact.ext.IContactExpiryApplicationServiceSpiExt helper = (com.ofss.fc.demo.appx.party.service.conta
87                  .getInstance()
88                  .getServiceProviderExtension(
89                          "com.ofss.fc.demo.appx.party.service.contact.ext.IContactExpiryApplicationServiceSpiExt",
90                          "com.ofss.fc.demo.appx.party.service.contact.ext.ContactExpiryApplicationServiceSpiExt");
91
92          TransactionStatus transactionStatus = fetchTransactionStatus();
93          String taskCode = null;
94          try {
95              helper.preAddContactExpiry(sessionContext, contactExpiryDTO,
96                      feeDetails, linkedUDFDTO);
97
98              /* Code added for Contact Point transaction */
99              ContactPointApplicationServiceSpi cpServiceSpi = new ContactPointApplicationServiceSpi();
100             transactionStatus = cpServiceSpi.createContactPoint(sessionContext,
101                     contactExpiryDTO.getContactPointDTO(), feeDetails,
102                     linkedUDFDTO);
103             /* Code added for Contact Point transaction */
104
105             transactionStatus = manager.addContactExpiry(sessionContext,
106                     contactExpiryDTO);
107             taskCode = Interaction.fetchCurrentTask();
108             transactionStatus = applyServiceCharge(sessionContext, feeDetails,
109                     taskCode);
110             fillTransactionStatus(transactionStatus);
111             Map<String, Object> parentDTOMap = new HashMap<String, Object>();
112             transactionStatus = addUDF(sessionContext, linkedUDFDTO,
113                     parentDTOMap);
114             fillTransactionStatus(transactionStatus);
115
116             helper.postAddContactExpiry(sessionContext, contactExpiryDTO,
117                     feeDetails, linkedUDFDTO);
118
```

Figure 7–51 ContactExpiryApplicationServiceSpi.java file after Modification

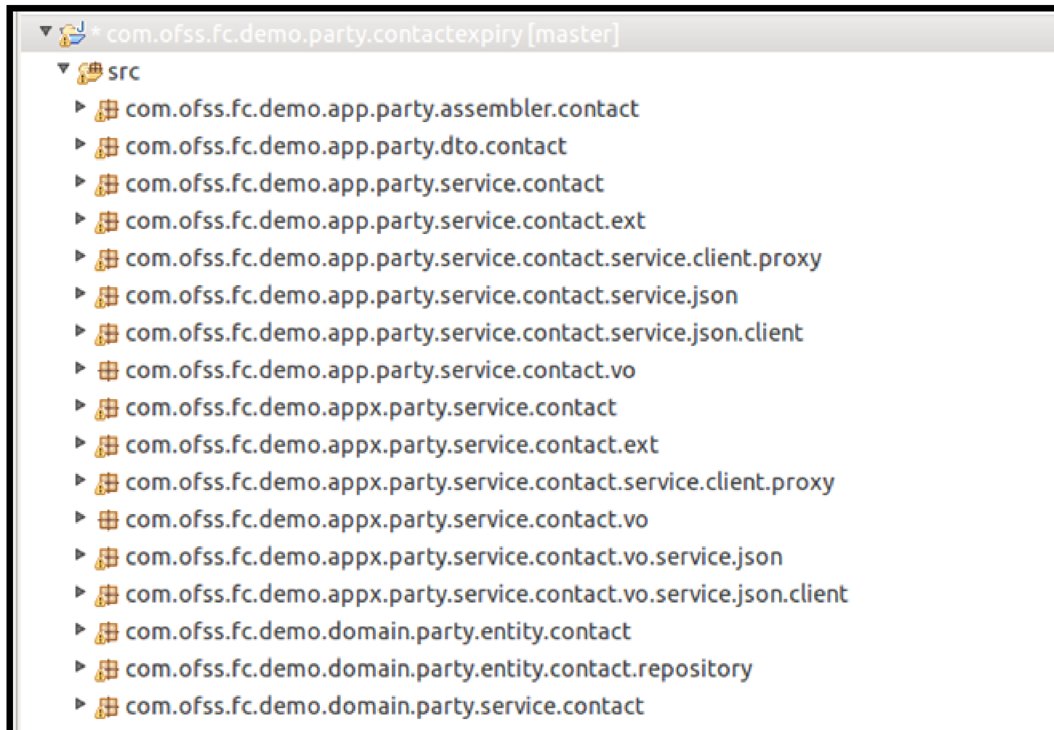
```
ContactExpiryApplicationServiceSpi.java
128         }
129         return transactionStatus;
130     }
131
132     public TransactionStatus updateContactExpiry(
133             com.ofss.fc.app.context.SessionContext sessionContext,
134             ContactExpiryDTO contactExpiryDTO, FeeDetailsDTO feeDetails,
135             LinkedUDFDTO linkedUDFDTO) throws FatalException {
136
137         com.ofss.fc.demo.app.party.service.contact.ContactExpiryApplicationService manager = new com.ofss.fc.demo.app.party.service.contact.Contac
138
139         Interaction.begin(sessionContext);
140
141         com.ofss.fc.demo.appx.party.service.contact.ext.IContactExpiryApplicationServiceSpiExt helper = (com.ofss.fc.demo.appx.party.service.conta
142                 .getInstance()
143                 .getServiceProviderExtension(
144                         "com.ofss.fc.demo.appx.party.service.contact.ext.IContactExpiryApplicationServiceSpiExt",
145                         "com.ofss.fc.demo.appx.party.service.contact.ext.ContactExpiryApplicationServiceSpiExt");
146
147         TransactionStatus transactionStatus = fetchTransactionStatus();
148         String taskCode = null;
149         try {
150             helper.preUpdateContactExpiry(sessionContext, contactExpiryDTO,
151                     feeDetails, linkedUDFDTO);
152
153             /* Code added for Contact Point transaction */
154             ContactPointApplicationServiceSpi cpServiceSpi = new ContactPointApplicationServiceSpi();
155             transactionStatus = cpServiceSpi.updateContactPoint(sessionContext,
156                     contactExpiryDTO.getContactPointDTO(), feeDetails,
157                     linkedUDFDTO);
158             /* Code added for Contact Point transaction */
159
160             transactionStatus = manager.updateContactExpiry(sessionContext,
161                     contactExpiryDTO);
162             taskCode = Interaction.fetchCurrentTask();
163             transactionStatus = applyServiceCharge(sessionContext, feeDetails,
164                     taskCode);
165             fillTransactionStatus(transactionStatus);
166             Map<String, Object> parentDTOMap = new HashMap<String, Object>();
167             transactionStatus = updateUDF(sessionContext, linkedUDFDTO,
168                     parentDTOMap);
169             fillTransactionStatus(transactionStatus);
170
171             helper.postUpdateContactExpiry(sessionContext, contactExpiryDTO,
172                     feeDetails, linkedUDFDTO);
173
174             fillTransactionStatus(transactionStatus);
```

Figure 7–52 Contact Expiry Application Service - Contact Point Transaction

```
ContactExpiryApplicationServiceSpi.java
182             Interaction.close();
183         }
184         return transactionStatus;
185     }
186 
187     public ContactExpiryInquiryResponse fetchContactExpiry(
188             com.ofss.fc.app.context.SessionContext sessionContext,
189             ContactExpiryDTO contactExpiryDTO, FeeDetailsDTO feeDetails,
190             LinkedUDFDTO linkedUDFDTO) throws FatalException {
191 
192         com.ofss.fc.demo.app.party.service.contact.ContactExpiryApplicationService manager = new com.ofss.fc.demo.app.party.service.contact.Contac
193 
194         Interaction.begin(sessionContext);
195 
196         com.ofss.fc.demo.appx.party.service.contact.ext.IContactExpiryApplicationServiceSpiExt helper = (com.ofss.fc.demo.appx.party.service.conta
197                 .getInstance()
198                 .getServiceProviderExtension(
199                         "com.ofss.fc.demo.appx.party.service.contact.ext.IContactExpiryApplicationServiceSpiExt",
200                         "com.ofss.fc.demo.appx.party.service.contact.ext.ContactExpiryApplicationServiceSpiExt");
201 
202         ContactExpiryInquiryResponse response = null;
203         TransactionStatus transactionStatus = fetchTransactionStatus();
204         String taskCode = null;
205         try {
206             helper.preFetchContactExpiry(sessionContext, contactExpiryDTO,
207                     feeDetails, linkedUDFDTO);
208 
209             response = manager.fetchContactExpiry(sessionContext,
210                     contactExpiryDTO);
211 
212             /* Code added for Contact Point transaction */
213             ContactPointApplicationServiceSpi cpServiceSpi = new ContactPointApplicationServiceSpi();
214             ContactPointResponse cpResponse = cpServiceSpi.fetchContactPoint(
215                     sessionContext, contactExpiryDTO.getContactPointDTO(),
216                     feeDetails, linkedUDFDTO);
217             if (cpResponse.getContactPoints() != null
218                     && cpResponse.getContactPoints().length != 0) {
219                 response.getContactExpiryDTO().setContactPointDTO(
220                         cpResponse.getContactPoints()[0]);
221             }
222             /* Code added for Contact Point transaction */
223 
224             taskCode = Interaction.fetchCurrentTask();
225             transactionStatus = applyServiceCharge(sessionContext, feeDetails,
226                     taskCode);
227             fillTransactionStatus(transactionStatus);
228             Map<String, Object> parentDTOMap = new HashMap<String, Object>();
```

The project should contain the Java packages as shown below:

Figure 7–53 Java Packages

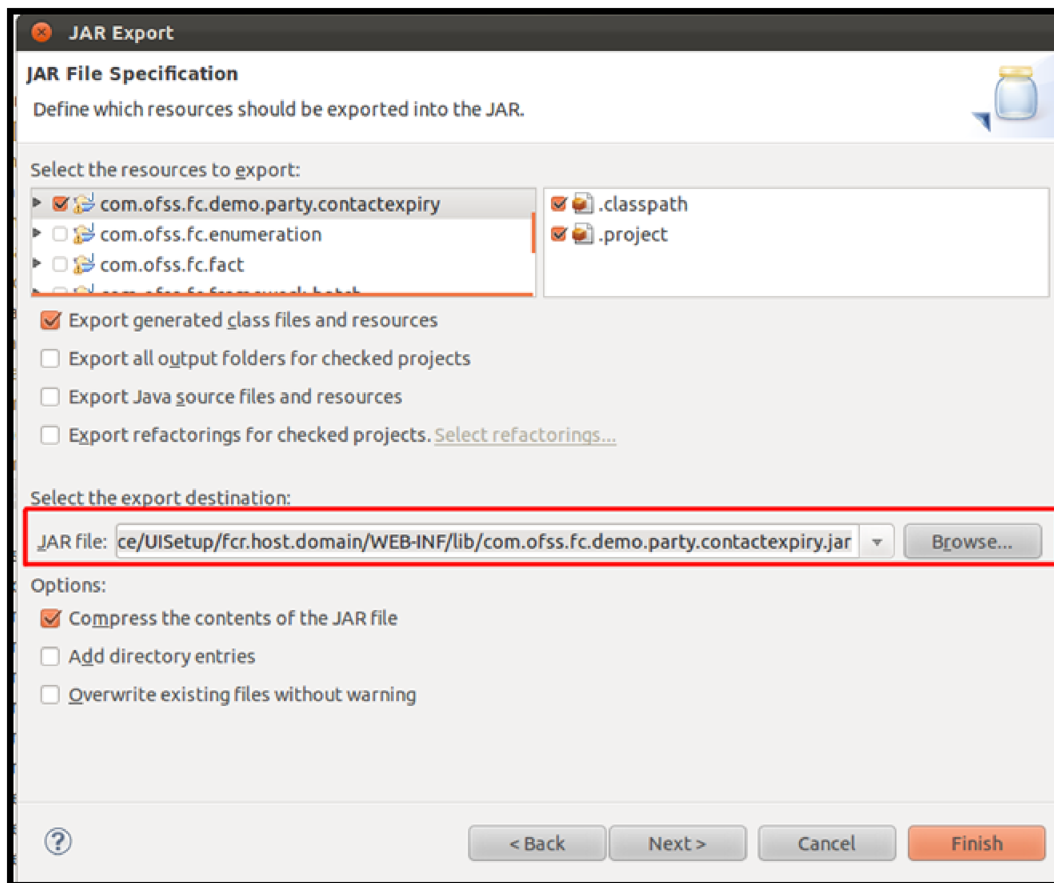


Step 8 Export Project as a JAR

You will need to export the Java project containing the domain object, application service and facade layer source as a *JAR*.

1. Right-click the project and choose *Export*.
2. Choose *JAR File* in the export options.
3. Provide an export path and name *(com.ofss.fc.demo.party.contactexpiry.jar)* for the JAR file and click Finish.

Figure 7–54 Export Project as a Jar



Step 9 Create Hibernate Mapping

You will need to create a hibernate mapping to map the database table to the domain object. Follow these steps:

1. Create *ContactExpiry.hbm.xml* file in the *orm/hibernate/hbm* folder of the *config* project of the host application.
2. Add the entry for this XML in the *orm/hibernate/cfg/party-mapping.cfg.xml* hibernate configuration XML.
3. Add the mapping in *ContactExpiry.hbm.xml* as shown below.

Figure 7–55 Create Hybernate Mapping

ContactExpiry.hbm.xml

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!-- Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved. -->
<!DOCTYPE hibernate-mapping PUBLIC "-//Hibernate/Hibernate Mapping DTD//EN" "http://www.hibernate.org/dtd/hibernate-mapping-3.0.dtd">
<hibernate-mapping auto-import="true" default-access="field" default-cascade="none" default-lazy="false">
    <class dynamic-insert="true" dynamic-update="true" lazy="false" mutable="true"
        name="com.ofss.fc.demo.domain.party.entity.contact.ContactExpiry" optimistic-lock="version" polymorphism="implicit"
        select-before-update="false" table="FLX_PI_CONTACT_EXPIRY">
        <composite-id class="com.ofss.fc.demo.domain.party.entity.contact.ContactExpiryKey" mapped="false" name="key" unsaved-value="undefined">
            <key-property column="party_id" name="partyId" type="string"/>
            <key-property column="contact_point_type" name="contactPointType">
                <type name="com.ofss.fc.infra.enumeration.EnumUserType">
                    <param name="Enum">com.ofss.fc.enumeration.ContactPointType</param>
                </type>
            </key-property>
            <key-property column="contact_pref_type" name="contactPreferenceType">
                <type name="com.ofss.fc.infra.enumeration.EnumUserType">
                    <param name="Enum">com.ofss.fc.enumeration.ContactPreferenceType</param>
                </type>
            </key-property>
        </composite-id>
        <version column="OBJECT_VERSION_NUMBER" generated="never" name="version" type="java.lang.Integer" unsaved-value="undefined"/>
        <property column="EXPIRY_DATE" generated="never" lazy="false" name="expiryDate" optimistic-lock="true"
            type="com.ofss.fc.datatype.Date" unique="false"/>
        <property column="created_by" generated="never" lazy="false" name="createdBy" optimistic-lock="true" type="string" unique="false"/>
        <property column="creation_date" generated="never" lazy="false" name="creationDate" optimistic-lock="true"
            type="com.ofss.fc.datatype.Date" unique="false"/>
        <property column="last_updated_by" generated="never" lazy="false" name="lastUpdatedBy" optimistic-lock="true"
            type="string" unique="false"/>
        <property column="last_update_date" generated="never" lazy="false" name="lastUpdatedDate" optimistic-lock="true"
            type="com.ofss.fc.datatype.Date" unique="false"/>
        <property column="object_status_flag" generated="never" lazy="false" name="entityStatus" optimistic-lock="true"
            type="EntityStatus" unique="false"/>
    </class>
</hibernate-mapping>
```

Step 10 Configure Host Application Project

You will need to configure the *Contact Expiry Application Service* and *Facade Layer* in the host application. To configure, follow these steps:

1. Configure *APPX layer* as the service layer for *Contact Expiry* service.
2. Open *properties/hostapplicationlayer.properties* present in the configuration project and add an entry as shown below.

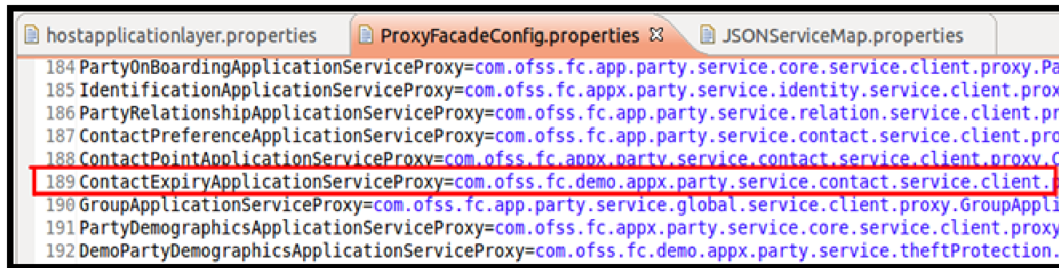
Figure 7–56 Adding an Entry in hostapplicationlayer.properties file

hostapplicationlayer.properties | ProxyFacadeConfig.properties | JSONServiceMap.properties

```
6 PartyAddressApplicationServiceProxy=APPX
7 CreditAssessmentApplicationServiceProxy=APPX
8 PartyNameApplicationServiceProxy=APPX
9 IdentificationApplicationServiceProxy=APPX
10 EmploymentHistoryApplicationServiceProxy=APPX
11 ContactPointApplicationServiceProxy=APPX
12 ContactExpiryApplicationServiceProxy=APPX
13 PartyDemographicsApplicationServiceProxy=APPX
14 PartyAccountRelationshipApplicationServiceProxy=APPX
15 CommentApplicationServiceProxy=APPX
16 BlacklistReportApplicationServiceProxy=APPX
```

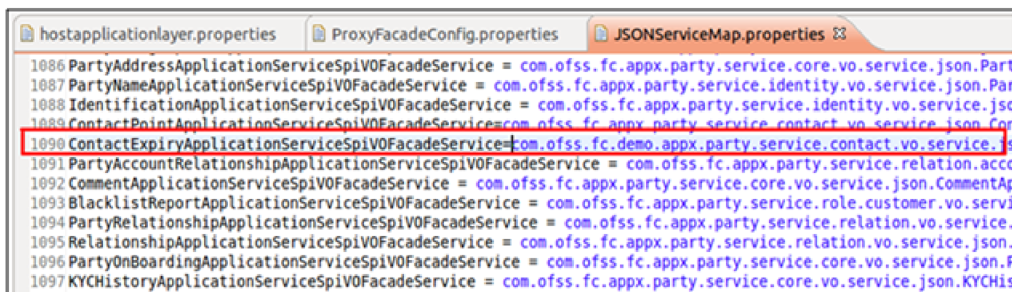
3. Configure *APPX* layer proxy as the proxy for *Contact Expiry* service.
4. Open *properties/ProxyFacadeConfig.properties* present in the configuration project and add an entry as shown below.

Figure 7–57 Adding an entry in ProxyFacadeConfig.properties file



5. Configure the JSON and Facade layer mapping for *Contact Expiry* service.
6. Open *properties/JSONServiceMap.properties* present in the configuration project and add the two entries as shown below.

Figure 7–58 Adding an entry in JSONServiceMap.properties file



Step 11 Deploy Project

After performing all the above mentioned changes, deploy the project as follows:

1. Add this project (*com.ofss.fc.demo.party.contactexpiry)* to the classpath of the branch application project.
2. Open the launch configuration of the *Tomcat Server*. Add this project to the classpath of the server as well.
3. Deploy the branch application project on the server and start it.

Client Application Changes

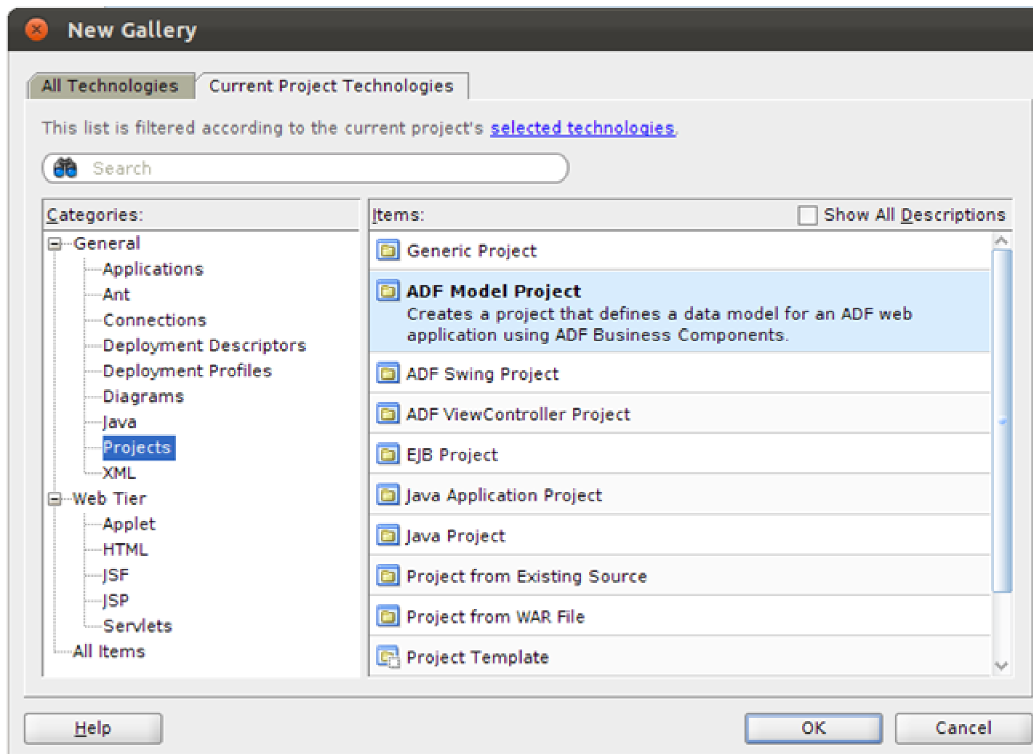
After creating database table to hold the input data and after creating the related domain objects and service and facade layers, we can customize the user interface. The customizations to the application have to be done on the client application. To customize the UI, follow these steps.

Step 1 Create Model Project

You will need to create a model project to hold the required view objects and application module. To create the model project, follow these steps:

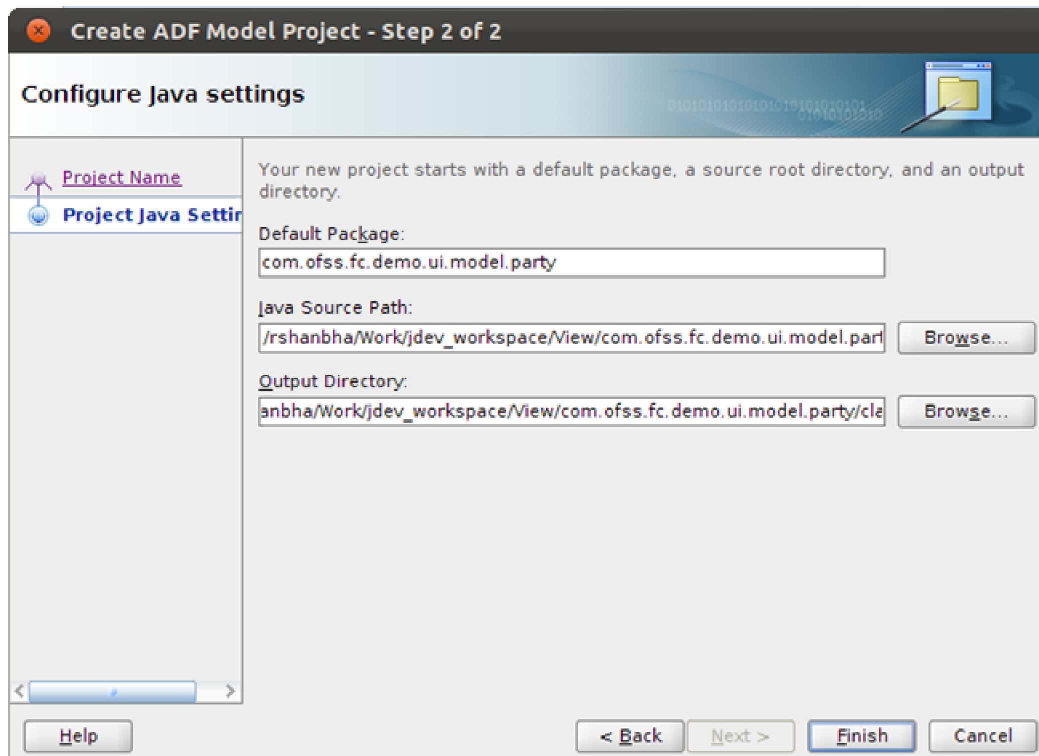
1. In the client application, create a new project of the type *ADF Model* Project.

Figure 7–59 Create Model Project - ADF Model



2. Give the project a title *(com.ofss.fc.demo.ui.model.party)* and set the default package as the same.
3. Click *Finish* to create the project.

Figure 7–60 Create Model Project - Click Finish

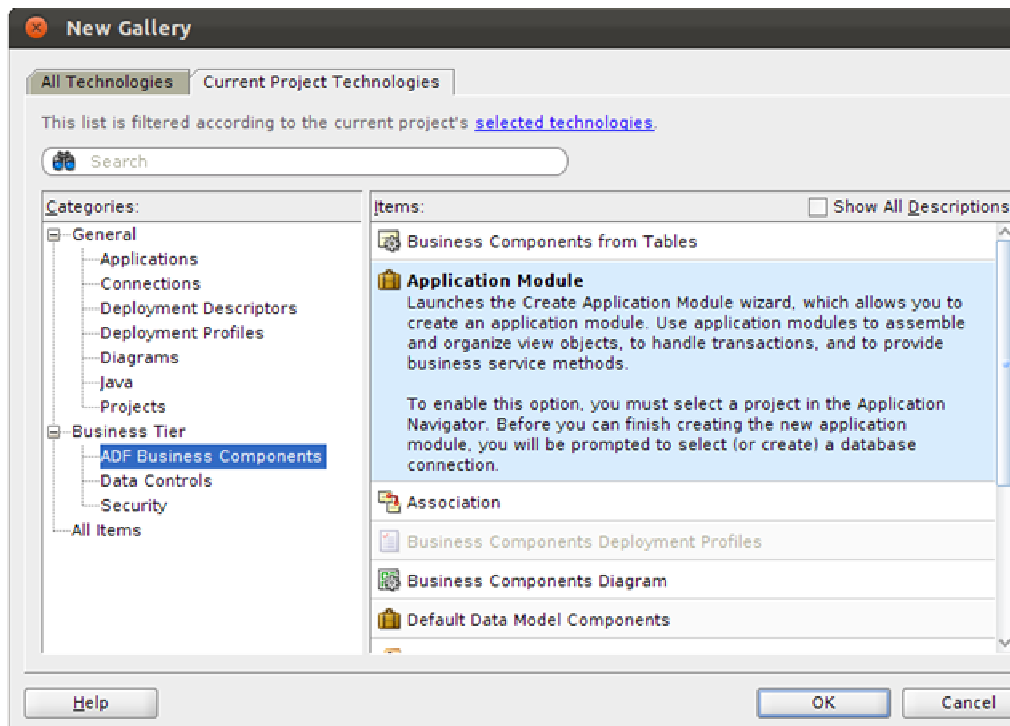


Step 2 Create Application Module

You will need to create an application module to contain the information of all the view objects that you need to create. To create an application module, follow these steps:

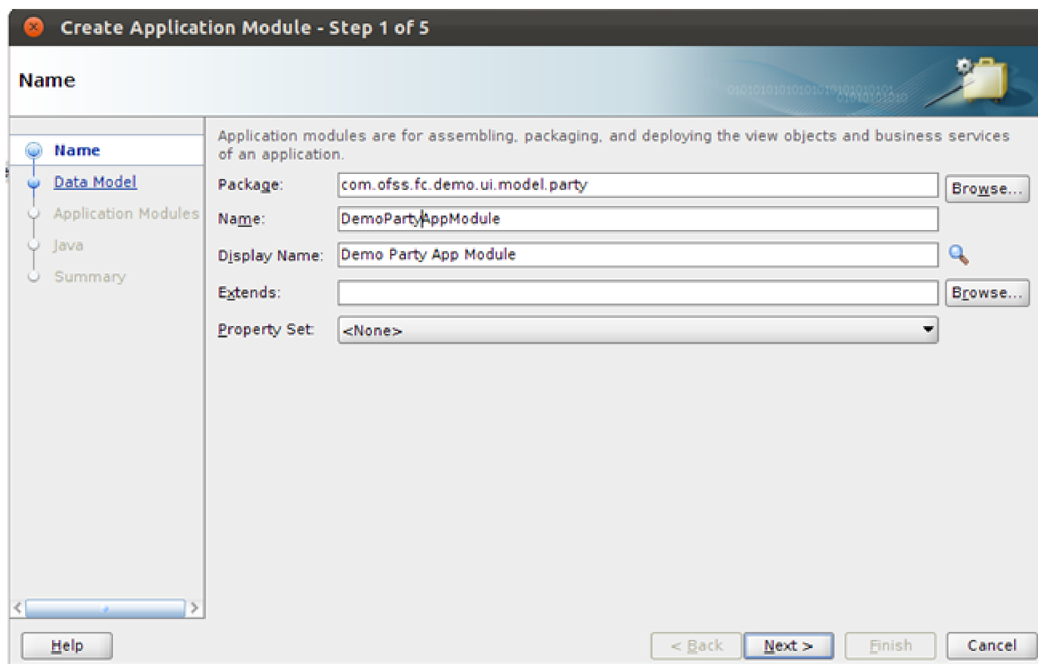
1. Right-click the model project and select *New*.
2. Choose *Application Module* from the dialog box that opens.

Figure 7–61 Create Application Module - ADF Business Components



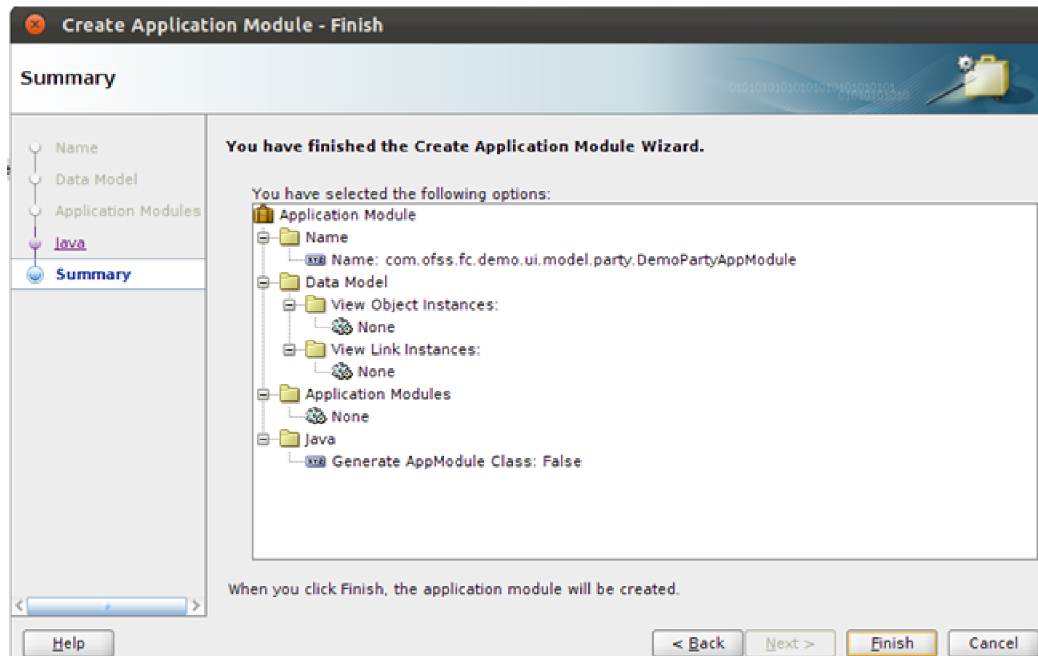
3. Set the package of the application module to the default package *(com.ofss.fc.demo.ui.model.party)*
4. Provide a name to the application module *(DemoPartyAppModule)*

Figure 7–62 Create Application Module - Set Package and Provide Name



5. Click *Next* and let the rest of the options be set to the default options.
6. You will see a summary screen for the application module. Click *Finish* to create the application module.

Figure 7–63 Create Application Module - Summary

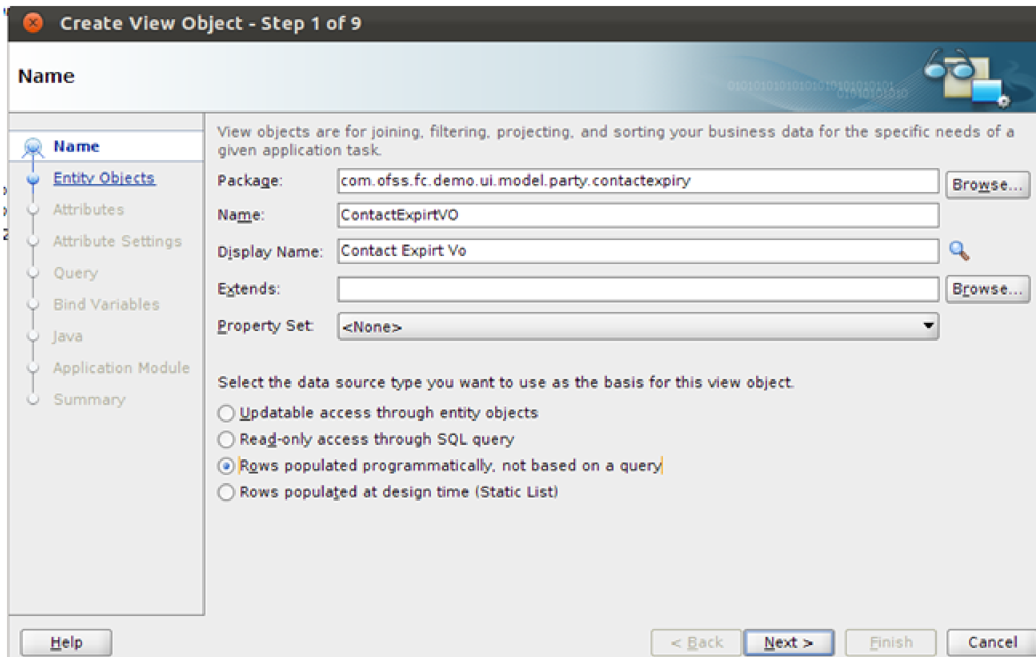


Step 3 Create View Object

You will need to create a view object for the newly added *Expiry Date* field. This view object will be used on the screen to display the value of the field as well as to take the input for the field. To create the view object, follow these steps:

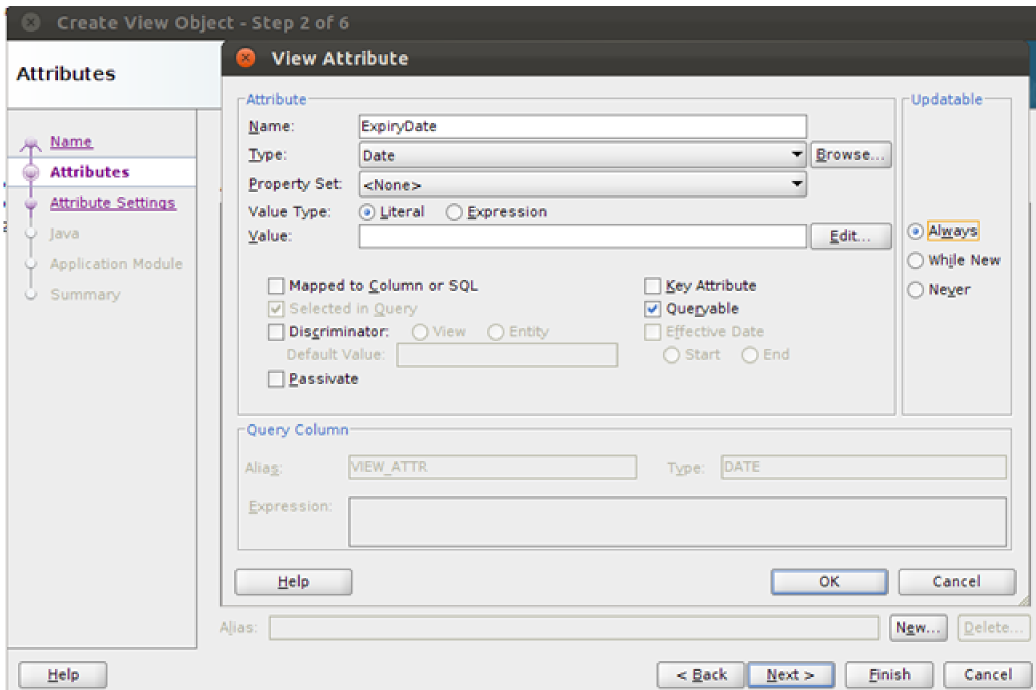
1. Right-click the Java package com.ofss.fc.demo.ui.model.party and select New View Object.
2. In the dialog box that opens, provide a name (*ContactExpiryVO*) for the view object.
3. Provide a package (com.ofss.fc.demo.ui.model.party.contactexpiry) for the view object.
4. For the Data Source Type option, select Rows populated programmatically, not based on a query.
5. Click *Next*.

Figure 7–64 Create View Object - Provide Name



6. In the *Attributes* dialog, create a new attribute for *Expiry Date* field.
7. Provide a name (*ExpiryDate*) and type (*Date*) for the attribute.
8. For the *Updatable* option, select *Always*.

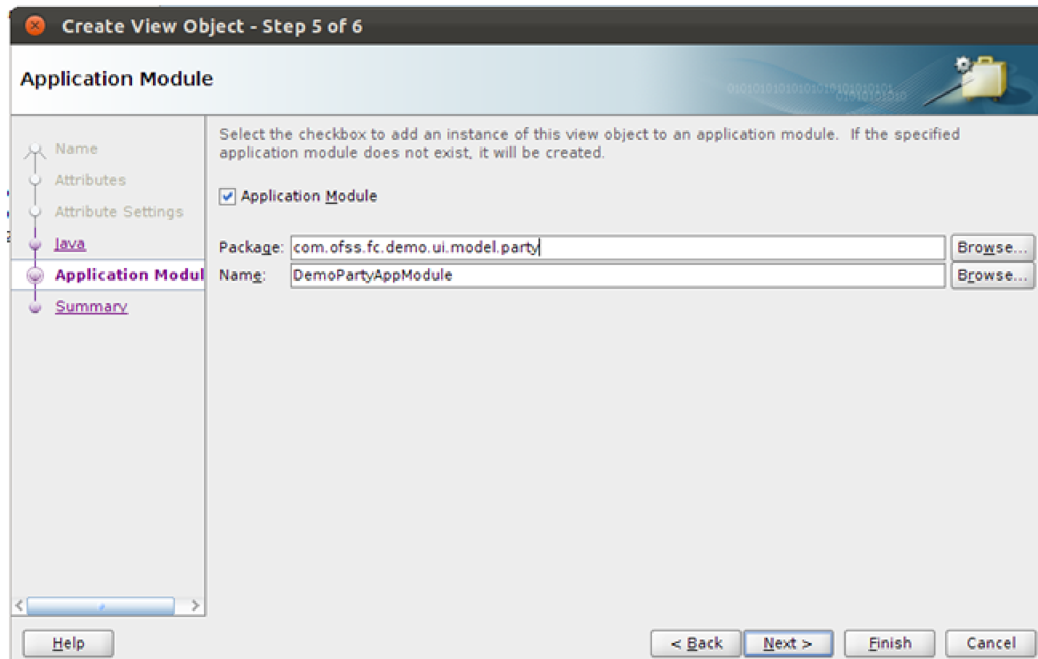
Figure 7–65 Create View Object - View Attribute



9. Click *Next*.

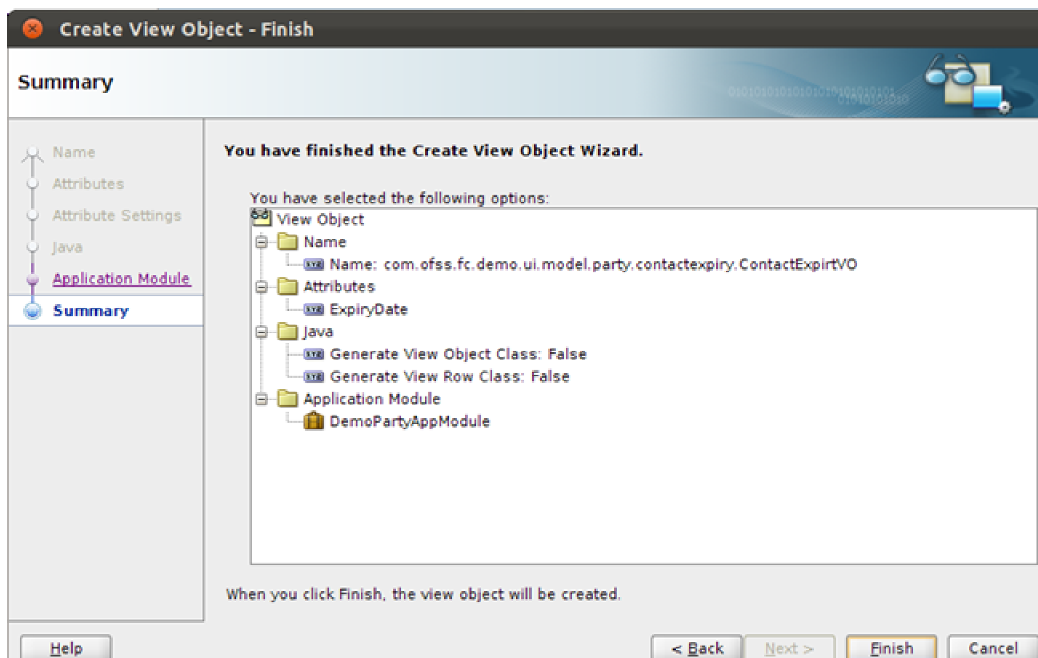
10. On the *Application Module* dialog, browse for the previously created *DemoPartyAppModule*.

Figure 7–66 Create View Object - Application Module



11. For all other dialogs, keep the default options. Click *Next* till you reach the summary screen as shown below.
12. Click *Finish* to create the view object.

Figure 7–67 Create View Object - Click Finish

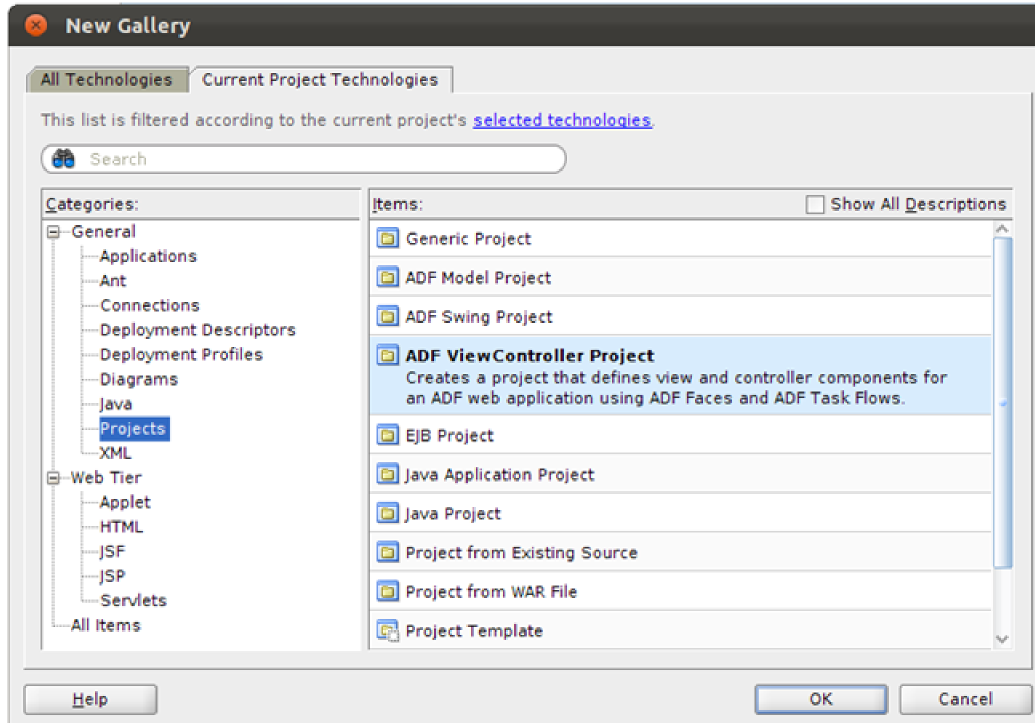


Step 4 Create View Controller Project

You will need to create a view controller project to contain the UI elements. This project will also hold the customizations to the application. To create the view controller project, follow these steps:

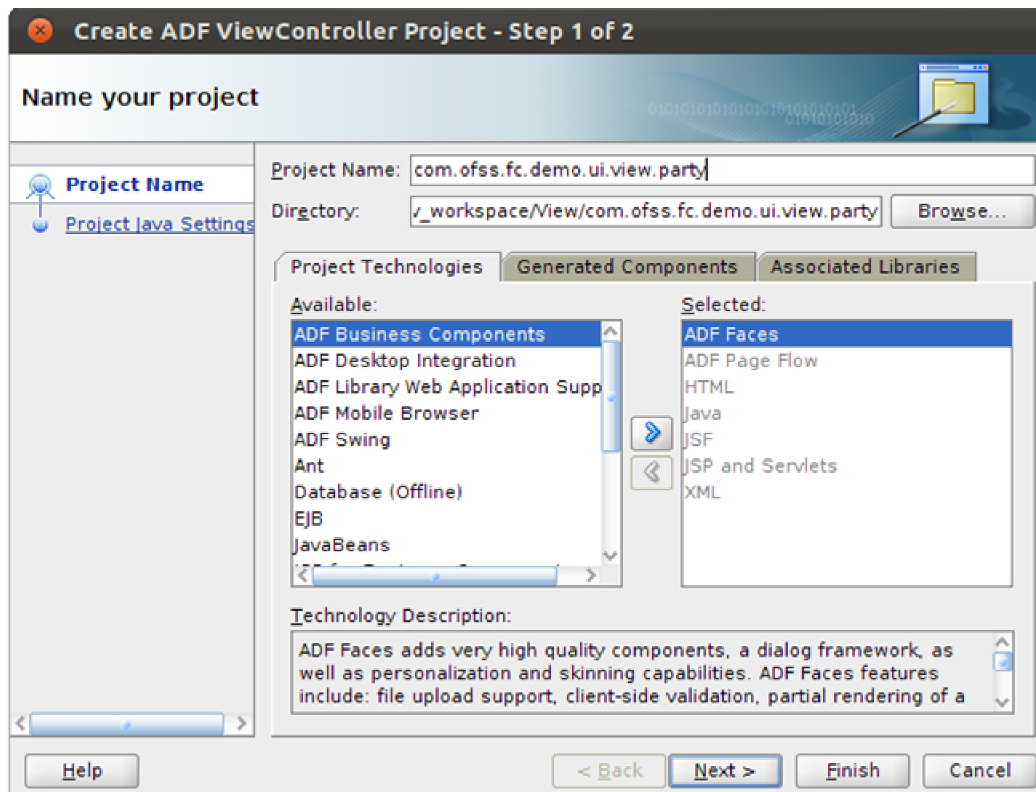
1. In the client application, create new project of the type *ADF View Controller Project*.

Figure 7–68 Create View Controller Project - ADF View Controller Project



2. Give the project a title *(com.ofss.fc.demo.ui.view.party)* and set the defaults package to the same.
3. Click *Finish* to finish creating the project.

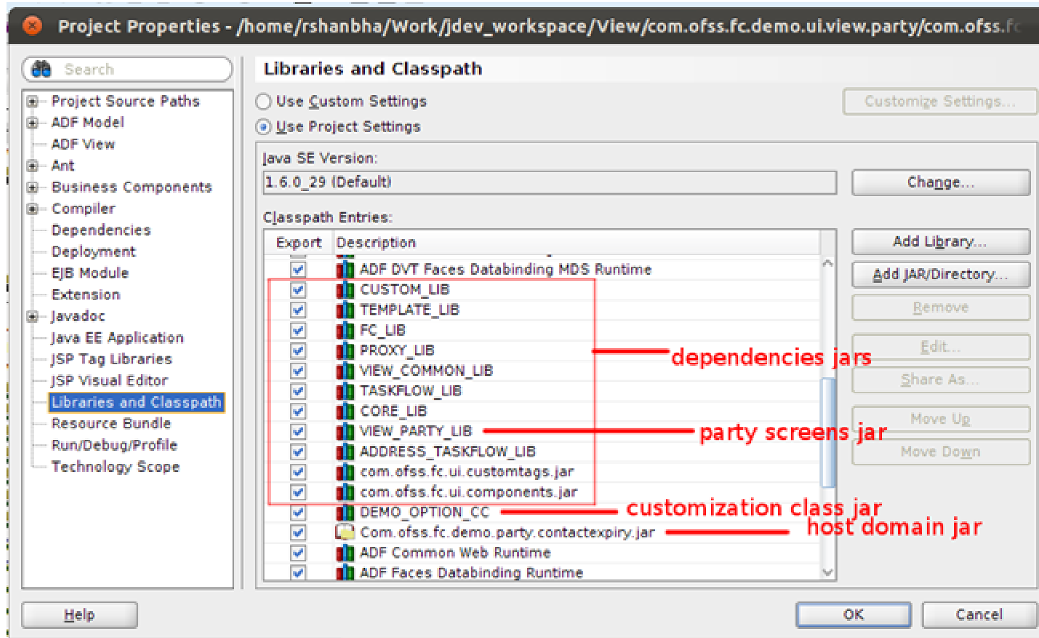
Figure 7–69 Create View Controller Project - Project Title



4. Right-click the project and go to *Project Properties*. In the *Libraries* and *Classpath* tab, add the following:

   - The Jar containing the screen to be customized *(com.ofss.fc.ui.view.party.jar)*
   - The Jar containing the domain objects and services for Contact Expiry *(com.ofss.fc.demo.party.contactexpiry.jar)* as created in host application project.
   - All the required dependent Jars for the above Jars.
   - The Jar containing the customization class *(com.ofss.fc.demo.ui.OptionCC.jar)*

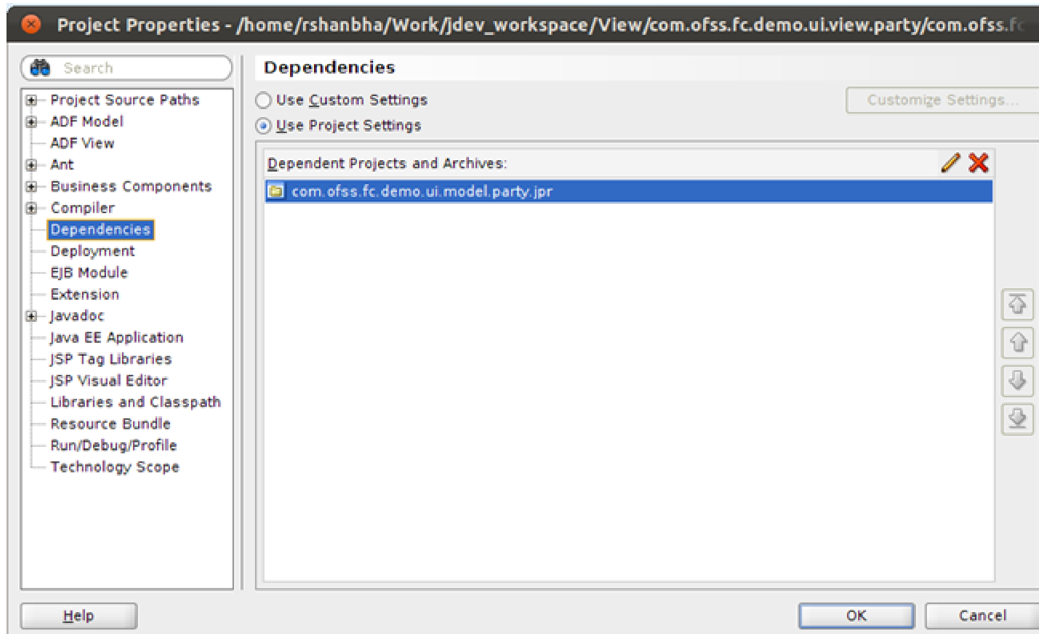
Figure 7–70 Create View Controller Project - Libraries and Classpath tab



5. In the Dependencies tab, browse for and add the previously created adf model project *(com.ofss.fc.demo.ui.model.party)*

6. In the *ADF View* tab, check the *Enable Seeded Customizations* option to enable this project for customizations.

Figure 7–71 Create View Controller Project - Dependencies Tab

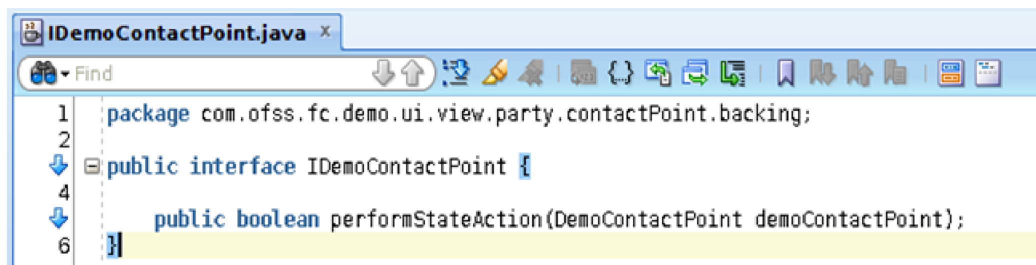


7. Save the changes by clicking *OK* and rebuild the project.

Step 5 Create Maintenance State Action Interface

Create an interface containing the method definition for a maintenance action. This interface will be implemented by the required maintenance state actions classes for the screen to be customized. The state action method will take the instance of the backing bean as a parameter.

Figure 7–72 Create an Interface



Step 6 Create State Action Class

You will need to create a class which will contain the business logic for the create transaction for this screen. This class should have following features:

- Implements the previously created state action interface.
- Creates the *Contact Point DTO* from the users input.
- Creates an instance of the *Contact Point* service proxy.
- Calls the add method of the service passing the DTO.

Step 7 Create Update State Action Class

You will need to create a class which will contain the business logic for the update transaction for this screen. This class should have following features:

- Implements the previously created state action interface.
- Creates the *Contact Point DTO* from the users input.
- Creates an instance of the *Contact Point* service proxy.
- Calls the update method of the service passing the DTO.

Figure 7–73 Create Update State Action Class

```
DemoCreateContactPoint.java
    public class DemoCreateContactPoint implements IDemoContactPoint {
22
23      private final Logger logger = MultiEntityLogger.getUniqueInstance().getLogger(DemoCreateContactPoint.class.getName());
24
        public boolean performStateAction(DemoContactPoint demoContactPoint) {
26          // Create the DTO from the screen and call proxy.
27          boolean status = false;
28
29          SessionContext context = SessionContextFactory.getSessionContextFactory().getSessionContextInstance();
30          context.setServiceCode(Constants.SERVICE_CODE);
31          TransactionStatus transactionStatus = null;
32
33          ContactExpiryDTO contactExpDTO = demoContactPoint.createContactExpDTO();
34          IContactExpiryApplicationServiceProxy contactExpProxy = null;
35
36          try {
37              contactExpProxy = (IContactExpiryApplicationServiceProxy) ProxyFactory.getInstance().getProxy(
38                      DemoContactPoint.CONTACT_EXPIRY_PROXY);
39              if (logger.isLoggable(Level.FINE)) {
40                  logger.log(Level.FINE, "Calling addContactExpiry service");
41              }
42              transactionStatus = contactExpProxy.addContactExpiry(SessionContextFactory.getSessionContextFactory()
43                      .getSessionContextInstance(), contactExpDTO);
44              status = true;
45              if (transactionStatus != null && (transactionStatus.getErrorCode().equals("0"))) {
46                  MessageHandler.addMessage(transactionStatus);
47              }
48          } catch (FatalException e) {
49                  MessageHandler.addMessage(e);
50                  logger.log(Level.SEVERE, MultiEntityLogger.getUniqueInstance().formatMessage(
51                      "Exception while creating contact point", e));
52          } catch (ServiceException e) {
53                  MessageHandler.addMessage(e);
54                  logger.log(Level.SEVERE, MultiEntityLogger.getUniqueInstance().formatMessage(
55                      "Service exception while creating contact point", e));
56          } catch (Throwable e) {
57                  MessageHandler.addErrorMessage("Internal error occured. Please contact system administrator");
58          }
59          return status;
```

Figure 7–74 Create Update State Action Class - Service Exception

```
DemoUpdateContactPoint.java
    public class DemoUpdateContactPoint implements IDemoContactPoint {
20
21      private final Logger logger = MultiEntityLogger.getUniqueInstance().getLogger(DemoUpdateContactPoint.class.getName());
22
        public boolean performStateAction(DemoContactPoint demoContactPoint) {
24          // Create the DTO from the screen and call proxy.
25          boolean status = false;
26
27          SessionContext context = SessionContextFactory.getSessionContextFactory().getSessionContextInstance();
28          context.setServiceCode(Constants.SERVICE_CODE);
29          TransactionStatus transactionStatus = null;
30
31          ContactExpiryDTO contactExpDTO = demoContactPoint.createContactExpDTO();
32          IContactExpiryApplicationServiceProxy contactExpProxy = null;
33
34          try {
35              contactExpProxy = (IContactExpiryApplicationServiceProxy) ProxyFactory.getInstance().getProxy(
36                      DemoContactPoint.CONTACT_EXPIRY_PROXY);
37              if (logger.isLoggable(Level.FINE)) {
38                  logger.log(Level.FINE, "Calling addContactExpiry service");
39              }
40              transactionStatus = contactExpProxy.updateContactExpiry(SessionContextFactory.getSessionContextFactory()
41                      .getSessionContextInstance(), contactExpDTO);
42              status = true;
43              if (transactionStatus != null && (transactionStatus.getErrorCode().equals("0"))) {
44                  MessageHandler.addMessage(transactionStatus);
45              }
46          } catch (FatalException e) {
47                  MessageHandler.addMessage(e);
48                  logger.log(Level.SEVERE, MultiEntityLogger.getUniqueInstance().formatMessage(
49                      "Exception while updating contact point", e));
50          } catch (ServiceException e) {
51                  MessageHandler.addMessage(e);
52                  logger.log(Level.SEVERE, MultiEntityLogger.getUniqueInstance().formatMessage(
53                      "Service exception while updating contact point", e));
54          } catch (Throwable e) {
55                  MessageHandler.addErrorMessage("Internal error occured. Please contact system administrator");
56          }
57          return status;
```

Step 8 Create Backing Bean

You will need to create a backing bean class for the screen to be customized. This class should have the following features:

- Should implement the interface *ICoreMaintenance*.
- Private members to be added UI Components in customization and public accessors for the same.
- Private member for the backing bean of the original backing bean of the screen (*ContactPoint*) which is initialized in the constructor of this class.
- Private member for the parent UI Component of the newly added UI components and public accessors which returns the corresponding component of the backing bean.
- Private member for the newly added view object (*ContactExpiryVO*) and the current view objects present on the screen.

Figure 7–75 Create Backing Bean

```
DemoContactPoint.java
45  public class DemoContactPoint implements ICoreMaintenance {
46
47      private static final String VO_CONTACT_EXP = "ContactExpiryVO1Iterator";
48      private static final String EXPIRY_DATE = "ExpiryDate";
49
50      protected static final String CONTACT_EXPIRY_PROXY = "ContactExpiryApplicationServiceProxy";
51
52      private UIXGroup formData;
53      private ContactPoint contactPoint;
54      private ViewObject contactPointVO = IteratorHandler.getViewObject(Constants.PAGE_DEF, Constants.VO_CONTACT_POINT);
55
56      ContactPointBusinessRules contactPointBR = new ContactPointBusinessRules();
57      private RichPanelLabelAndMessage plam18;
58      private DateComponent expiryDate;
59      private ViewObject contactExpVO = IteratorHandler.getViewObject(Constants.PAGE_DEF, VO_CONTACT_EXP);
60
61      private transient Logger logger = MultiEntityLogger.getUniqueInstance().getLogger(DemoContactPoint.class.getName());
62
63
64      public DemoContactPoint() {
65          super();
66          contactPoint = (ContactPoint)ELHandler.get("#{ContactPoint}");
67      }
68
69      public void setFormData(UIXGroup formData) {
70          this.formData = formData;
71      }
72
73      public UIXGroup getFormData() {
74          this.formData = contactPoint.getFormData();
75          return formData;
76      }
```

- *clear()* method which handles the user action *Clear*.
- *save()* method which handles the maintenance state actions *Create* and *Update*.
- Depending on the current state action, the *save()* method should instantiate either *DemoCreateContactPoint* or *DemoUpdateContactPoint* and perform the corresponding state action methods.

Figure 7–76 Create Backing Bean - Save and Clear Method

```
public boolean save() {
    boolean status = false;
    boolean flag = contactPoint.validateAllInputs();
    if (flag) {
        IDemoContactPoint demoContactPointAction = null;
        if (MaintenanceHelper.getCurrentState().equals(MaintenanceHelper.CREATE)) {
            demoContactPointAction = new DemoCreateContactPoint();
        } else if (MaintenanceHelper.getCurrentState().equals(MaintenanceHelper.UPDATE)) {
            demoContactPointAction = new DemoUpdateContactPoint();
        }
        status = demoContactPointAction.performStateAction(this);
    }
    return status;
}

public boolean clear() {
    if(contactPoint.clear()) {
        contactExpVO.clearCache();

        this.getExpiryDate().reset();
        this.getExpiryDate().setReadOnly(true);

        initializeContactExpVO();

        return true;
    }
    return false;
}
```

- A public method to create the *Contact Expiry DTO* from the user's input on the screen.

Figure 7–77 Create Backing Bean - Contact Expiry DTO Method

```
public ContactExpiryDTO createContactExpDTO() {
    Date expiryDate = null;
    if (contactExpVO.getCurrentRow().getAttribute(EXPIRY_DATE) != null) {
        expiryDate = new Date(((oracle.jbo.domain.Date)contactExpVO.getCurrentRow().getAttribute(EXPIRY_DATE)).dateValue());
    }

    ContactPointDTO contactPointDTO = contactPoint.createContactPointDTO();

    ContactExpiryDTO contactExpDTO = new ContactExpiryDTO();
    contactExpDTO.setContactPointDTO(contactPointDTO);
    contactExpDTO.setExpiryDate(expiryDate);

    return contactExpDTO;
}
```

- A value change event handler for the *Expiry Date UI* Component.

Figure 7–78 Create Backing Bean - OnExpiryDateChange

```
public void onExpiryDateChange(ValueChangeEvent valueChangeEvent) {
    if (logger.isLoggable(Level.FINE)) {
        logger.log(Level.FINE,
                   MultiEntityLogger.getUniqueInstance().formatMessage("Entering onExpiryDateChange method."));
    }
    Date processdate =
        new com.ofss.fc.datatype.Date(((oracle.jbo.domain.Date)ELHandler.get("#{pageFlowScope.defaultValues.postingDate}")
    if (valueChangeEvent.getNewValue() != null) {
        Date expDate =
            new Date(((oracle.jbo.domain.Date)valueChangeEvent.getNewValue()).dateValue());
        //TODO: fix the process date error
        if (!expDate.isBefore(processdate)) {
            MessageHandler.addErrorMessage(getExpiryDate().getClientId(),
                                           "Expiry date should not be less than the current date",
                                           null);
            contactExpVO.getCurrentRow().setAttribute(EXPIRY_DATE,
                                                      null);
            this.getExpiryDate().reset();
            AdfFacesContext.getCurrentInstance().addPartialTarget(expiryDate);
        }
    } else if (valueChangeEvent.getNewValue() == null) {
        MessageHandler.addErrorMessage(getExpiryDate().getClientId(),
                                       "Select Expiry Date", null);
    }
}
```

- Value change event handlers for the existing UI Components on change of which the screen data is to be fetched.

Figure 7–79 Create Backing Bean - Value Change Event Handler

```
public void onContactPreferenceChange(ValueChangeEvent valueChangeEvent) {
    if (MaintenanceHelper.getCurrentState().equals(MaintenanceHelper.READ)) {
        clearContactExpiryDetails();
        initializeContactExpVO();
        if (contactPointVO.getCurrentRow().getAttribute(Constants.PARTYID) != null
            && contactPointVO.getCurrentRow().getAttribute(Constants.CONTACT_POINT_TYPE) != null) {
            contactPointVO.getCurrentRow().setAttribute(Constants.CONTACT_PREF_TYPE,
                                                         valueChangeEvent.getNewValue().toString());
            ContactExpiryDTO contactExpDTO = fetchContactExp();
            if(contactExpDTO != null) {
                setContactExpDetails(contactExpDTO);
            }
        }
    }

    contactPoint.onContactPreferenceChange(valueChangeEvent);
}

public void onContactPointTypeChange(ValueChangeEvent valueChangeEvent) {
    if (MaintenanceHelper.getCurrentState().equals(MaintenanceHelper.READ)
         || MaintenanceHelper.getCurrentState().equals(MaintenanceHelper.CREATE)) {
        clearContactExpiryDetails();
        if (MaintenanceHelper.getCurrentState().equals(MaintenanceHelper.READ)) {
            initializeContactExpVO();
        }
    }

    contactPoint.onContactPointTypeChange(valueChangeEvent);
}
```

- Method containing the business logic to fetch screen data using *Contact Expiry* proxy service.

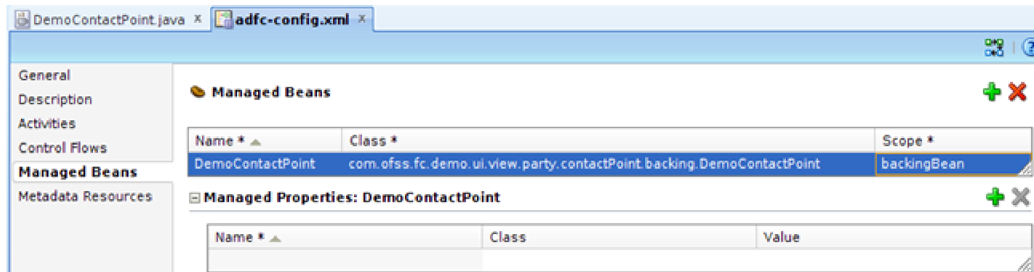
Figure 7–80 Create Backing Bean - Contact Expiry Proxy Service

```
private ContactExpiryDTO fetchContactExp() {
    ContactPointType cpType = null;
    if (contactPointVO.getCurrentRow().getAttribute(Constants.CONTACT_POINT_TYPE) != null) {
        cpType = (ContactPointType)EnumerationHelper.getInstance().fromValue(ContactPointType.class,
                          (String)contactPointVO.getCurrentRow().getAttribute(Constants.CONTACT_POINT_TYPE));
    }
    ContactPreferenceType contactPrefType = null;
    if (contactPointVO.getCurrentRow().getAttribute(Constants.CONTACT_PREF_TYPE) != null) {
        contactPrefType = (ContactPreferenceType)EnumerationHelper.getInstance().fromValue(ContactPreferenceType.class,
                          (String)contactPointVO.getCurrentRow().getAttribute(Constants.CONTACT_PREF_TYPE));
    }
    String partyId = (String)contactPointVO.getCurrentRow().getAttribute(Constants.PARTYID);

    ContactExpiryDTO contactExpDTO = new ContactExpiryDTO();

    ContactPointDTO contactPointDTO = new ContactPointDTO();
    contactPointDTO.setContactPoint(cpType);
    contactPointDTO.setPreferenceType(contactPrefType);
    contactPointDTO.setPartyId(partyId);

    contactExpDTO.setContactPointDTO(contactPointDTO);

    SessionContext context = SessionContextFactory.getSessionContextFactory().getSessionContextInstance();
    context.setServiceCode(Constants.SERVICE_CODE);

    IContactExpiryApplicationServiceProxy contactExpProxy = null;
    ContactExpiryInquiryResponse response = null;

    try {
        contactExpProxy = (IContactExpiryApplicationServiceProxy) ProxyFactory.getInstance().getProxy(CONTACT_EXPIRY_PROXY);
        if (logger.isLoggable(Level.FINE)) {
            logger.log(Level.FINE, "Calling fetchContactExp service");
        }

        response = contactExpProxy.fetchContactExpiry(SessionContextFactory.getSessionContextFactory()
                                                      .getSessionContextInstance(), contactExpDTO);
        if (response != null &&
            (response.getStatus().getErrorCode().equals("0"))) {
            contactExpDTO = response.getContactExpiryDTO();
        }
    } catch (FatalException e) {
```

- **Create Managed Bean** - You will need to register the *DemoContactPoint* backing bean as a managed bean with a *backing bean* scope. Open the project's

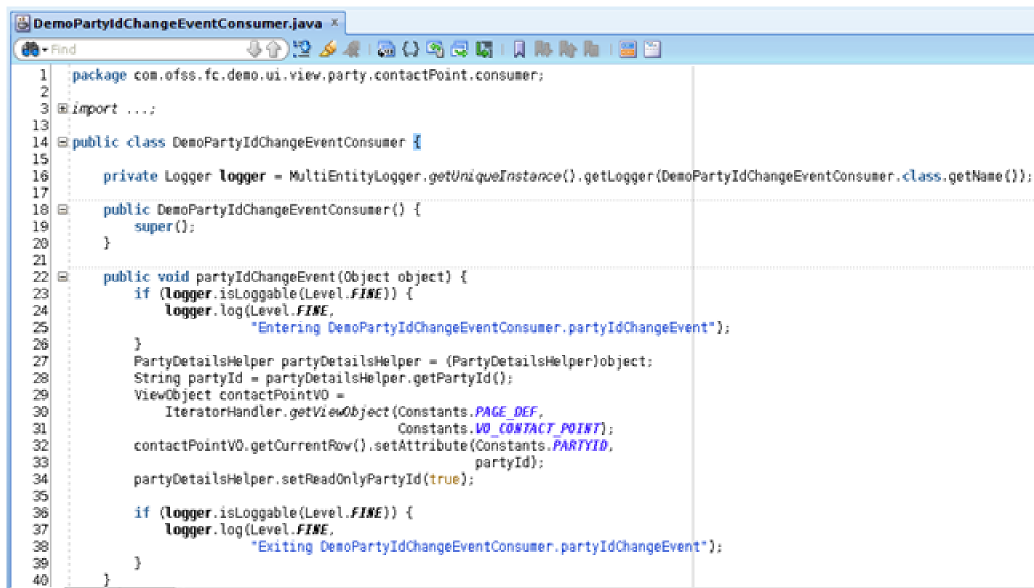
adfc-config.xml which is present in the *WEB-INF* folder. In the Managed Beans tab, add the binding bean class as a managed bean with backing bean scope as follows:

Figure 7–81 Create Managed Bean - Register Demo Contact Point



- **Create Event Consumer Class** - You will need to create an event consumer class to consume the *Party Id Change* event. When the user inputs a party id on the screen, the business logic in this event consumer class will be executed automatically.

Figure 7–82 Create Event Consumer Class



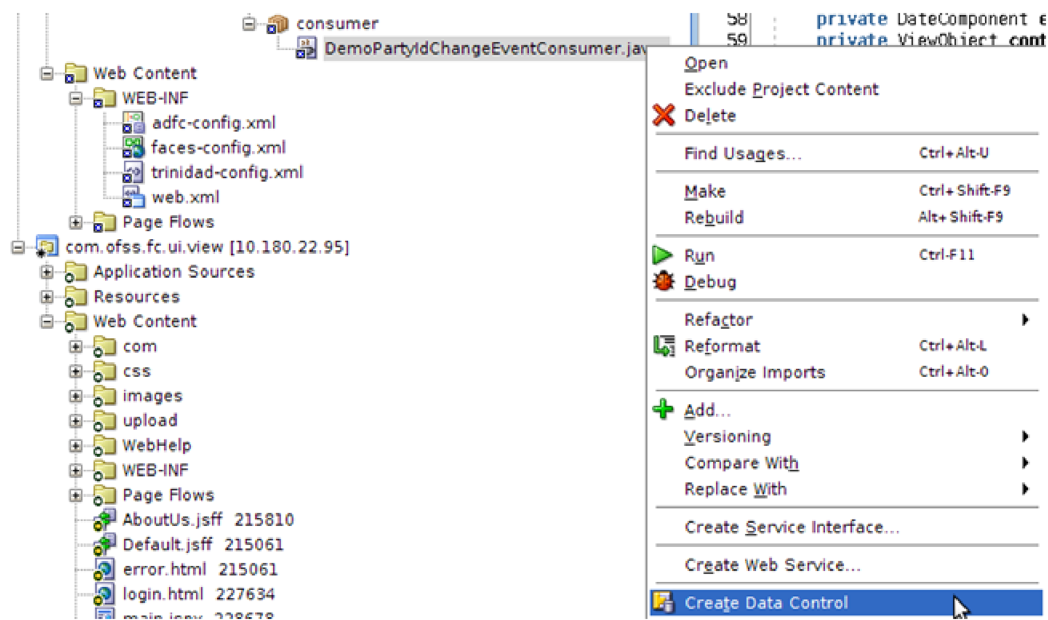
Step 9 Create Data Control

For the event consumer class's method to be exposed as an event handler, you will need to create a data control for this class.

1. In the *Application Navigator*, right-click the event consumer Java file and create data control.

   On creation of data control, an XML file is generated for the class and a *DataControls.dcx* file is generated containing the information about the data controls present in the project. You will be able to see the event consumer data control in the *Data Controls* tab.

Figure 7–83 Create Data Control



2. Restart JDeveloper in the *Customization Developer Role* to edit the customizations. Ensure that the appropriate *Customization Context* is selected.

Step 10 Add UI Components to Screen

Browse and locate the JSFF for the screen to be customized *(com.ofss.fc.ui.view.party.contactPoint.contactPoint.jsff)* inside the JAR *(com.ofss.fc.ui.view.party.jar)*. Open the JSFF and do the required changes as follows:

1. Drag and drop the *Panel Label & Message* and *Date UI* components at the required position on the screen.
2. For each component, set the required attributes using the *Property Inspector* panel of JDeveloper.
3. Modify the containing *Panel's width* and number of columns attributes as required.
4. For each component, add the binding to the *DemoContactPoint* backing bean's corresponding members.
5. Add the value change event binding for the *Expiry Date* UI component to the backing bean's corresponding method.
6. Change the value change event binding for the existing UI component on change of which the screen data is fetched.
7. Change the backing bean attribute of the screen to the previously created *DemoContactPoint* backing bean.
8. Save the changes. You will notice that JDeveloper has created a customization XML in the ADF *Library Customizations* folder to save the differences between the base JSFF and the customized JSFF. The generated *contactPoint.jsff.xml* should look similar to as shown below.

Figure 7–84 Adding UI to Screens

contactPoint.jsff.xml

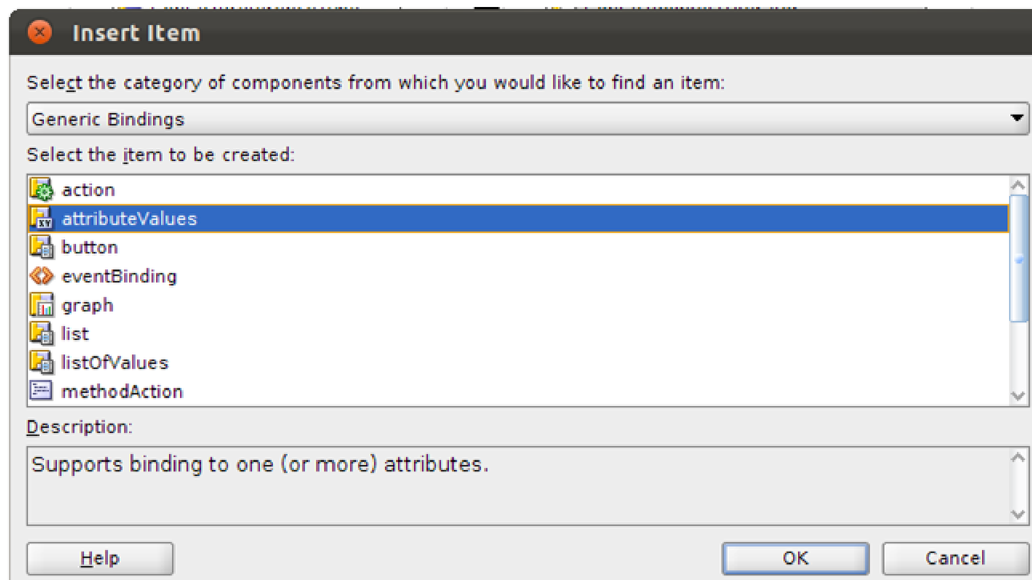
```
<mds:customization version="11.1.1.61.92" xmlns:mds="http://xmlns.oracle.com/mds">
  <mds:insert parent="formData" after="smcAllowedpurpose" xmlns:af="http://xmlns.oracle.com/adf/faces/rich" xmlns:fc="/com/ofss/fc/ui/components">
    <af:panelLabelAndMessage xmlns:af="http://xmlns.oracle.com/adf/faces/rich" label="Expiry Date" id="plam18" binding="#{DemoContactPoint.plam18}">
      <fc:date xmlns:fc="/com/ofss/fc/ui/components" label="Expiry Date" id="expiryDate" binding="#{DemoContactPoint.expiryDate}"
               value="#{bindings.ExpiryDate.inputValue}" autoSubmit="true" readOnly="true" postValueChange="#{DemoContactPoint.onExpiryDateChange}"/>
    </af:panelLabelAndMessage>
  </mds:insert>
  <mds:modify element="pt1(xmlns(f=http://java.sun.com/jsf/core))/f:attribute[@name='BackingBeanClass']">
    <mds:attribute name="value" value="com.ofss.fc.demo.ui.view.party.contactPoint.backing.DemoContactPoint"/>
  </mds:modify>
  <mds:modify element="pfl3">
    <mds:attribute name="maxColumns" value="2"/>
    <mds:attribute name="fieldWidth" value="60%"/>
    <mds:attribute name="labelWidth" value="40%"/>
  </mds:modify>
  <mds:modify element="socContactPointType">
    <mds:attribute name="valueChangeListener" value="#{DemoContactPoint.onContactPointTypeChange}"/>
  </mds:modify>
  <mds:modify element="socContactPref">
    <mds:attribute name="valueChangeListener" value="#{DemoContactPoint.onContactPreferenceChange}"/>
  </mds:modify>
</mds:customization>
```

Step 11 Add View Object Binding to Page Definition

You will need to add the view object binding for the previously created *ContactExpiryVO* view object to the page definition of the screen to be customized.

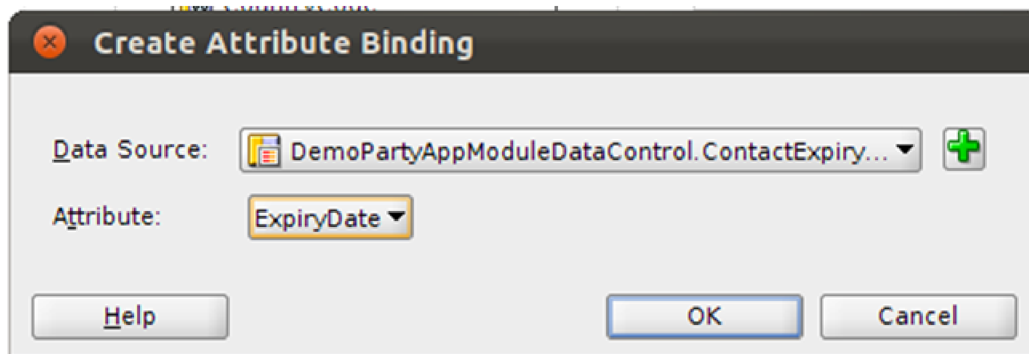
1. Browse and locate the page definition for the screen to be customized *(com.ofss.fc.ui.view.party.contactPoint.pageDef.ContactPointPageDef.xml)* and open it.
2. Add an *attributeValues* binding as shown below.

Figure 7–85 Adding View Object Binding to Page Definition



3. For *Data Source* option, locate the previously created *ContactExpiryVO* view object present in the *DemoPartyAppModule*.
4. For *Attribute* option, choose the *ExpiryDate* attribute present in the view object.

Figure 7–86 Create Attribute Binding



Step 12 Add Method Action Binding to Page Definition

You will need to add the method action binding for the previously created *DemoPartyIdEventChangeConsumer* event consumer class to the page definition of the screen to be customized.

1. Add a *methodAction* binding as shown below.
2. For the *Data Collection* option, locate the previously created *DemoPartyIdChangeEventConsumer* data control.

Figure 7–87 Adding Method Action Binding

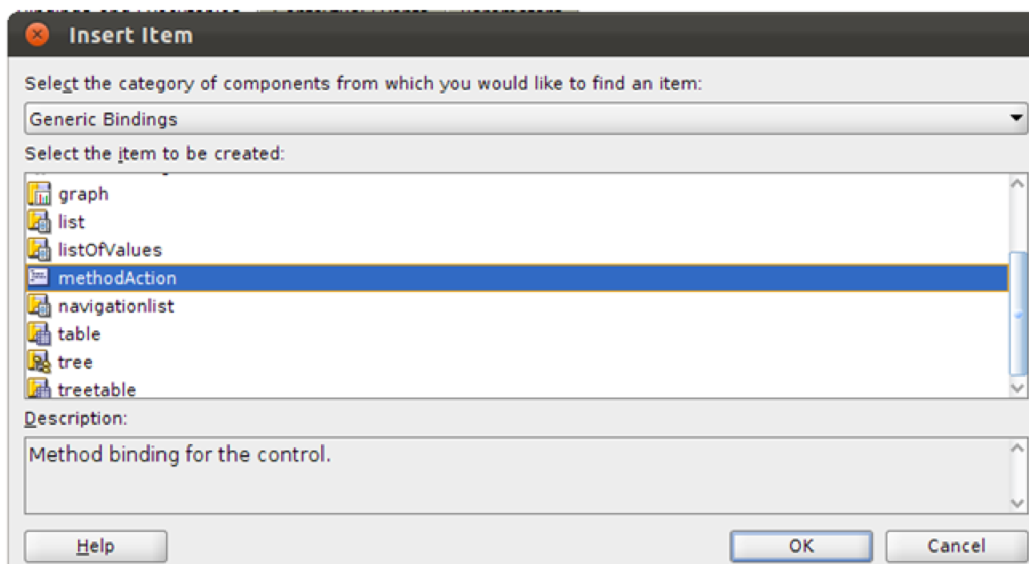
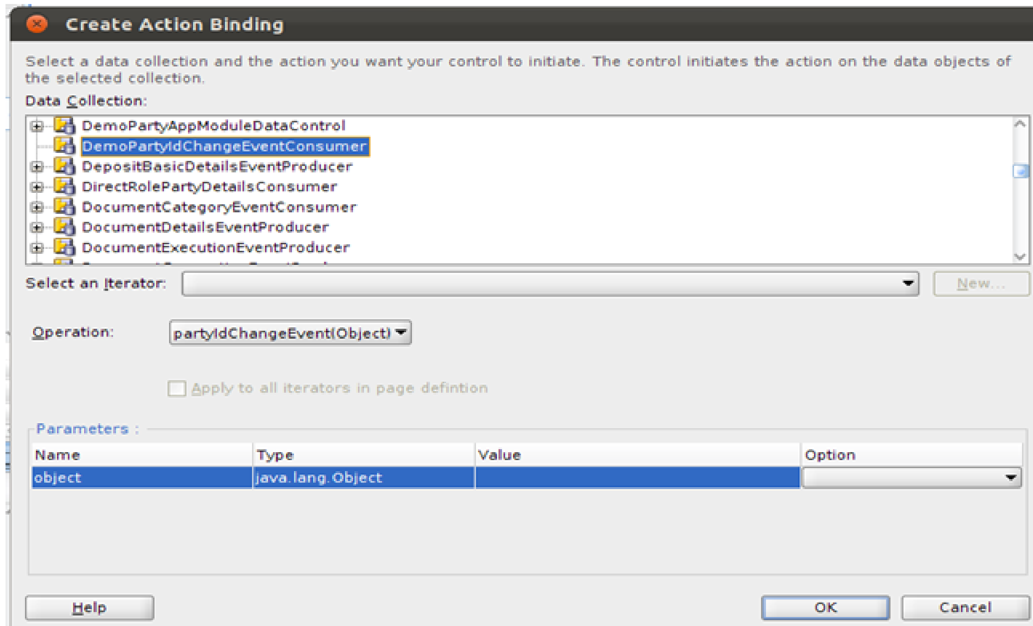


Figure 7–88 Adding Method Action Binding - Demo Party Change Event Consumer

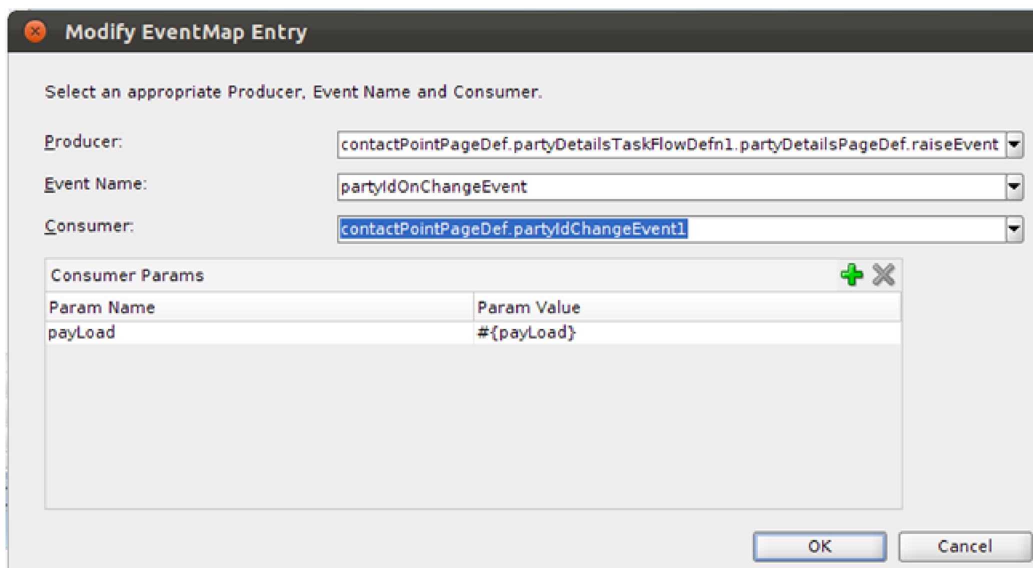


Step 13 Edit Event Map of Page Definition

You will need to map the *Event Producer* for the party id change event to the previously created *Event Consumer*.

1. In the *Structure* panel of JDeveloper, right-click the page definition and select *Edit Event Map*.
2. In the *Event Map Editor* dialog that opens, edit the mapping for the party id change event. Select the previously created *Event Consumer's* method.

Figure 7–89 Edit Event Map of Page Definition - Edit Mapping



Step 14 Edit Event Map of Page Definition

Save the changes. You will notice that JDeveloper has created a customization XML in the *ADF Library Customizations* folder to save the differences between the base JSFF and the customized JSFF. The generated *contactPoint.jsff.xml* should look similar to as shown below.

Figure 7–90   Edit Event Map of Page Definition - ContactPoint.jsff.xml

```
contactPointPageDef.xml.xml

<mds:customization version="11.1.1.61.92" xmlns:mds="http://xmlns.oracle.com/mds">
  <mds:insert parent="contactPointPageDef(xmlns(mds_ns1=http://xmlns.oracle.com/adfm/uimodel))/mds_ns1:executables" position="last">
    <iterator Binds="ContactExpiryVO1" RangeSize="10" DataControl="DemoPartyAppModuleDataControl"
              id="ContactExpiryVO1Iterator" xmlns="http://xmlns.oracle.com/adfm/uimodel"/>
  </mds:insert>
  <mds:insert parent="contactPointPageDef(xmlns(mds_ns1=http://xmlns.oracle.com/adfm/uimodel))/mds_ns1:bindings" position="last">
    <attributeValues IterBinding="ContactExpiryVO1Iterator" id="ExpiryDate" xmlns="http://xmlns.oracle.com/adfm/uimodel">
      <AttrNames>
        <Item Value="ExpiryDate"/>
      </AttrNames>
    </attributeValues>
  </mds:insert>
  <mds:insert parent="contactPointPageDef(xmlns(mds_ns1=http://xmlns.oracle.com/adfm/uimodel))/mds_ns1:bindings" position="last">
    <methodAction id="partyIdChangeEvent1" InstanceName="DemoPartyIdChangeEventConsumer.dataProvider" DataControl="DemoPartyIdChangeEventConsumer"
                  RequiresUpdateModel="true" Action="invokeMethod" MethodName="partyIdChangeEvent" IsViewObjectMethod="false" xmlns="http://xmlns.oracle.com/adfm/uimodel">
      <NamedData NDName="object" NDType="java.lang.Object"/>
    </methodAction>
  </mds:insert>
  <mds:replace node="contactPointPageDef(xmlns(mds_ns1=http://xmlns.oracle.com/adfm/contextualEvent))/mds_ns1:eventMap"/>
  <mds:insert parent="contactPointPageDef" position="last">
    <eventMap xmlns="http://xmlns.oracle.com/adfm/contextualEvent">
      <event name="partyIdOnChangeEvent">
        <producer region="partyDetailsTaskFlowDefn1.partyDetailsPageDef.raiseEvent">
          <consumer region="" handler="partyIdChangeEvent1">
            <parameters>
              <parameter name="payLoad" value="#{payLoad}"/>
            </parameters>
          </consumer>
        </producer>
      </event>
    </eventMap>
  </mds:insert>
</mds:customization>
```

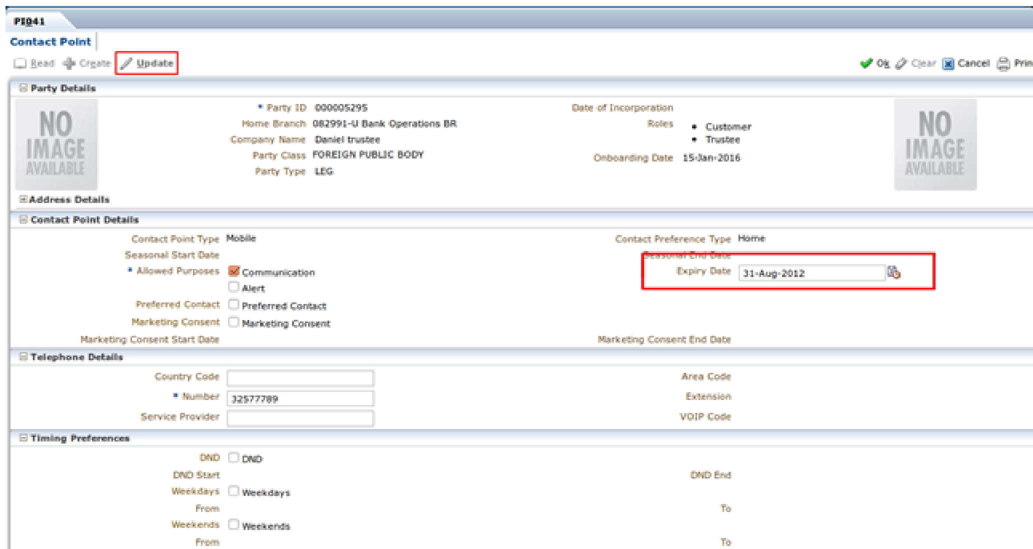
Step 15 Deploy Customization Project

After finishing the customization changes, exit the *Customization Developer Role* and start JDeveloper in *Default Role*. Deploy the view controller project as an *ADF Library Jar (com.ofss.fc.demo.ui.view.party.jar)*

1. Go to *Project Properties* of the main application project and in the *Libraries* and *Classpath*, add the following:

   - View controller project Jar (com.ofss.fc.demo.ui.view.party.jar)
   - Host domain Jar (com.ofss.fc.demo.party.contactexpiry.jar)
   - Customization Class Jar (com.ofss.fc.demo.ui.OptionCC.jar)
   - All dependency libraries and Jars for the project
   - Start the application and navigate to *Party* -> *Contact Information* -> *Contact Point* screen. Input a party id on the screen and perform the *read*, *create* and *update* actions on *Contact Point*. You will be able to input data and fetch value for the newly added *Expiry Date* field.

Figure 7–91 Contact Point screen with Expiry Date field

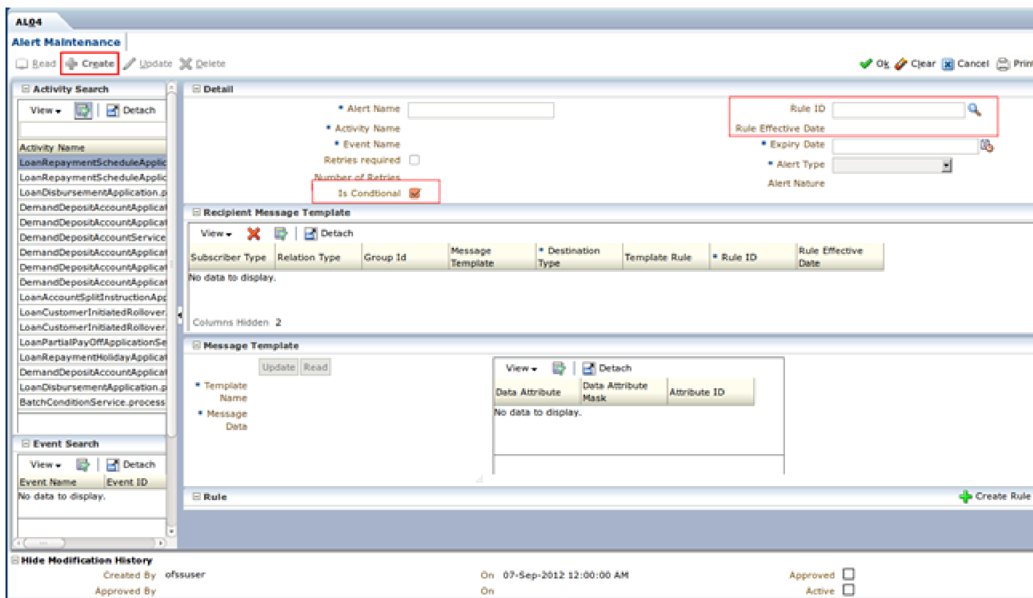


7.7.4 Removing existing UI components from a screen

In this fourth example of customization, we will be removing some existing UI components present in a screen.

Use Case Description: The *Back Office -> Events -> Alert Maintenance* screen is used to define *Alerts* in the system for different types of events / activities. In this screen, there is a check box field Is *Conditional* for specifying whether there is a *Rule* to be associated with this alert and the *Effective Date* for the rule. If the check box is unchecked, the *Rule* and *Expiry Date* fields are disabled. If the check box is checked, the *Rule* and *Expiry Date* fields are enabled. We will remove these 3 fields in customization.

Figure 7–92 Remove UI Components from Alert Maintenance screen



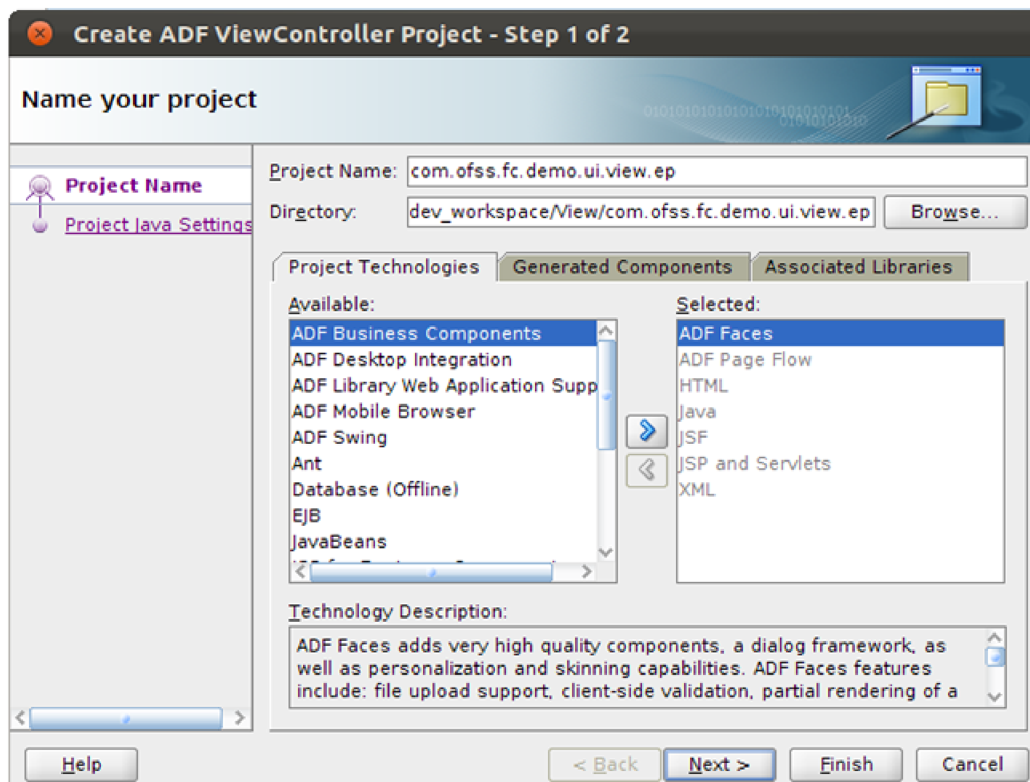
To create customizations as mentioned in this use case, follow these steps:

Step 1 Create View Controller Project

You will need to create a view controller project to hold the customizations that need to be done on the screen. To create a view controller project, follow these steps:

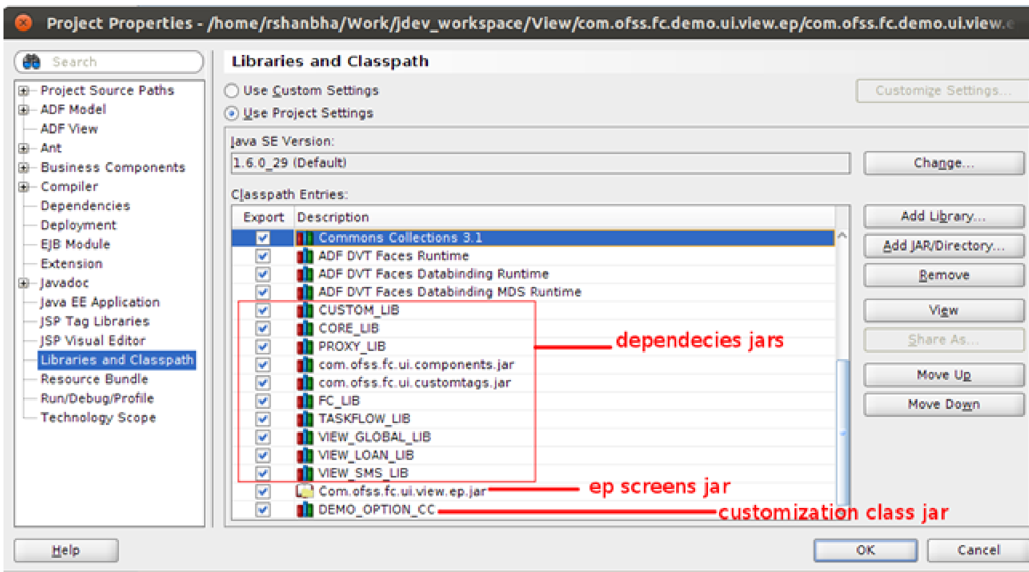
1. In the client application, create a new project of the type *ADF View Controller Project*.
2. Give the project a title (*com.ofss.fc.demo.ui.view.ep)* and set the default package to the same.
3. Click *Finish* to finish creating the project.

Figure 7–93 Create ADF View Controller Project - Project Technologies



4. Right-click the project and go to *Project Properties*. In the *Libraries* and *Classpath* tab, add the following:
   - The Jar containing the screen to be customized *(com.ofss.fc.ui.view.ep.jar)*
   - All the required dependent Jars for the above Jar.
   - The Jar containing the customization class (com.ofss.fc.demo.ui.OptionCC.jar)
5. In the *ADF View* tab, check the *Enable Seeded Customizations* option to enable seeded customizations for this project.

Figure 7–94 Create View Controller Project - Libraries and Class Path



6. Restart JDeveloper in the *Customization Developer Role* to edit the customizations. Ensure that the appropriate *Customization Context* is selected.

Step 2 Remove UI Components from Screen

Browse and locate the JSFF for the screen to be customized *(com.ofss.fc.ui.view.ep.activityEventAction.form.ActivityEventActionMaintenance.jsff)*. Open the JSFF and do the required changes as follows:

1. Select the *Is Conditional* check box component. In the *Property Inspector* panel, set the *Rendered* property to *false*.
2. Select the *Rule Id* custom component. In the *Property Inspector* panel, set the *Rendered* property to false.
3. Select the *Rule Effective Date* component. In the *Property Inspector* panel, set the *Rendered* property to false.
4. Set the *Rendered* property to *false* is better than completely deleting the component to avoid binding errors.
5. Save the changes. You will notice that JDeveloper has created a customization XML in the ADF Library Customizations folder to save the differences between the base JSFF and the customized JSFF. The generated

   ActivityEventActionMaintenance.jsff.xml should look similar to as shown below.

Figure 7–95 Modifications in the ActivityEventActionMaintenance.jsff.xml

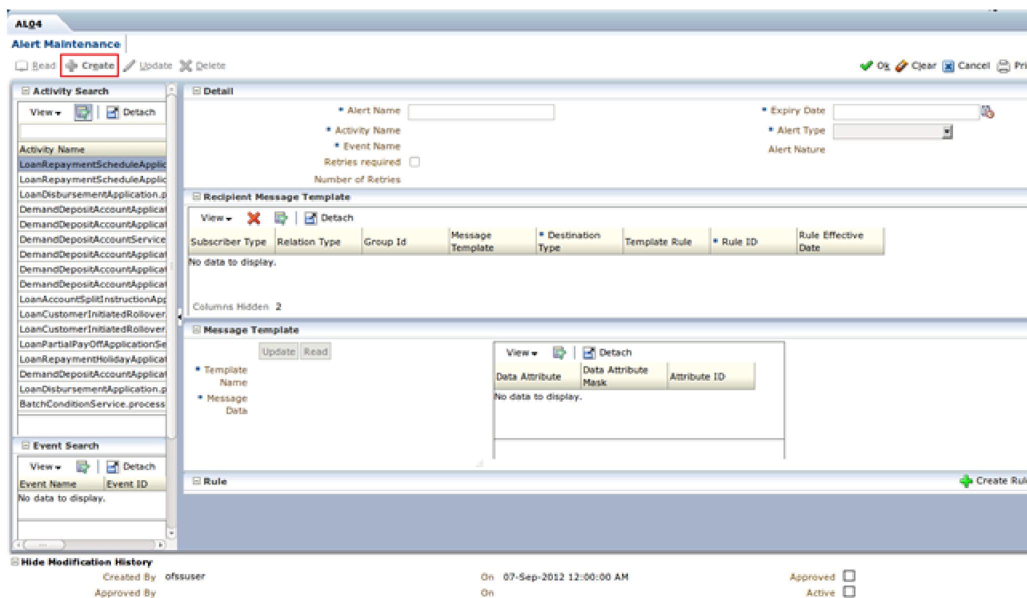
```
<mds:customization version="11.1.1.61.92"
                   xmlns:mds="http://xmlns.oracle.com/mds">
  <mds:modify element="sbc3">
    <mds:attribute name="rendered" value="false"/>
  </mds:modify>
  <mds:modify element="plam5">
    <mds:attribute name="rendered" value="false"/>
  </mds:modify>
  <mds:modify element="plam3">
    <mds:attribute name="rendered" value="false"/>
  </mds:modify>
</mds:customization>
```

Step 3 Deploy Customization Project

After finishing customization changes, exit *Customization Developer Role* and start JDeveloper in *Default Role*. Deploy the view controller project as an *ADF Library Jar (com.ofss.fc.demo.ui.view.ep.jar)*.

1. Add this Jar and customization class jar to the classpath of the main application project.
2. Start the application and navigate to B*ack Office -> Events -> Alert Maintenance* screen. You will notice that the fields *Is Conditional*, *Rule Id* and *Rule Effective Date* are not present on the screen.

Figure 7–96 Modified Alert Maintenance Screen



8 SOA Customizations

OBP provides the functionality for customizing the SOA composite applications. The steps to customize a SOA composite application are similar to those of customizing an ADF View Controller application with a few differences. The similarities and differences would be apparent in the examples demonstrated in the following sections.

The following section provides details about the SOA Components Customization. The detailed documentation for customizing and extending the SOA Components is also available at the Oracle website:

http://docs.oracle.com/cd/E25178_01/fusionapps.1111/e16691/ext_soaedit.htm

8.1 Customization Layer

To customize an application, you must specify the customization layers and their values in the *CustomizationLayerValues.xml* file, so that they are recognized by JDeveloper.

We need to create a customization layer with name ***option*** and values ***demo*** and ***another bank name***.

To create this customization layer, follow these steps:

1. From the main menu, choose the **File** -> ***Open*** option.
2. Locate and open the file *CustomizationLayerValues.xml* which is found in the *<JDEVELOPER_HOME>/jdeveloper/jdev* directory.
3. In the XML editor, add the entry for a new customization layer and values as shown in the following image.

Figure 8–1 Add an entry for new Customization Layer

```
CustomizationLayerValues.xml
94  generation.
95  -->
96
97  <cust-layers  xmlns="http://xmlns.oracle.com/mds/dt">
98    <cust-layer name="site" id-prefix="s">
99        <!-- Generated id-prefix would be "s1" and "s2" for values
100         "site1" and "site2".-->
101       <cust-layer-value value="site1" display-name="Site One" id-prefix="1" />
102       <cust-layer-value value="site2" display-name="Site Two" id-prefix="2" />
103       <!-- Generated id-prefix would be "s" for value "site"
104            since no prefix was specified on the value -->
105       <!-- ADF SiteCC always returns the value as "site" -->
106       <cust-layer-value value="site" display-name="Site"/>
107     </cust-layer>
108
109 <cust-layer name="option" prefix="o">
110         <cust-layer-value value="demo" display-name="demo" id-prefix="o1"/>
111         <cust-layer-value value="Ubank" display-name="Ubank" id-prefix="o2"/>
112 </cust-layer>
113
114     <!-- Customization layers that are only meant for runtime usage can
115     be excluded in design time by defining size as "no_values"-->
116     <cust-layer name="runtime_only_layer" value-set-size="no_values"/>
117
118     <cust-layer name="user" value-set-size="large">
119      <!-- Generated id-prefix would be "us1" and "us2" for values "user1"
120           and "user2" since no prefix was defined per-name level -->
121       <cust-layer-value value="user1" display-name="First User" id-prefix="us1" />
122       <cust-layer-value value="user2" display-name="Second User" id-prefix="us2" />
123      <!-- Generated id-prefix would be "useradmin" and "userguest" for
124           values "admin" and "guest" since no prefix was defined at both
125           layer level and name level -->
126       <cust-layer-value value="admin" display-name="Administrator"/>
127       <cust-layer-value value="guest"/>
128     </cust-layer>
129 </cust-layers>
130
Source
```

4. Save and close the file.

8.2 Customization Class

Before customizing an application, a *customization* class needs to be created which is the interface that the *Oracle Meta-data Services* framework uses to define which customization layer should be applied to the application's base meta-data.

To create a customization class, follow these steps:

1. From the main menu, choose **File** -> **New**.
2. Create a generic project and give a name *(com.ofss.fc.demo.ui.OptionCC)* to the project.
3. Go to **Project Properties** for this project and add the required **MDS** libraries in the classpath of the project.
4. Create the customization class in this project. The customization class **must** extend the *oracle.mds.cust.CustomizationClass* abstract class.

   Implement the following abstract methods of the *CustomizationClass* as follows:

   1. **getCacheHint()** - This method will return the information about whether the customization layer is applicable to all users, a set of users, a specific HTTP request or a single user.
   2. **getName()** - This method will return the name of the customization layer.
   3. **getValue()** - This method will return the customization layer value at runtime.

   The screenshot below depicts a sample implementation of the above methods.

Figure 8–2 Create Customization Class

```
package com.ofss.fc.demo.ui.OptionCC;

import oracle.mds.core.MetadataObject;
import oracle.mds.core.RestrictedSession;
import oracle.mds.cust.CacheHint;
import oracle.mds.cust.CustomizationClass;

public class OptionCC extends CustomizationClass {

    private static final String LAYER_NAME = "option";
    private static final String DEFAULT_LAYER = "demo";

    public OptionCC() {
        super();
    }

    public CacheHint getCacheHint() {
        return CacheHint.REQUEST;
    }

    public String getName() {
        return LAYER_NAME;
    }

    public String[] getValue(RestrictedSession restrictedSession,
                             MetadataObject metadataObject) {
        String[] layerValues = null;

        try {
            //Add Code to fetch layer values from property resources
        } catch(Exception e) {
            layerValues = new String[]{DEFAULT_LAYER};
        }

        return layerValues;
    }
}
```

5. Build this class and deploy the project as a JAR file *(com.ofss.fc.demo.ui.OptionCC.jar)*.

   This JAR file should only contain the customization class.

6. Place this JAR file in the location *<JDEVELOPER_HOME>/jdeveloper/jdev/lib/patches* so that the customization class is available in the classpath of Jdeveloper.

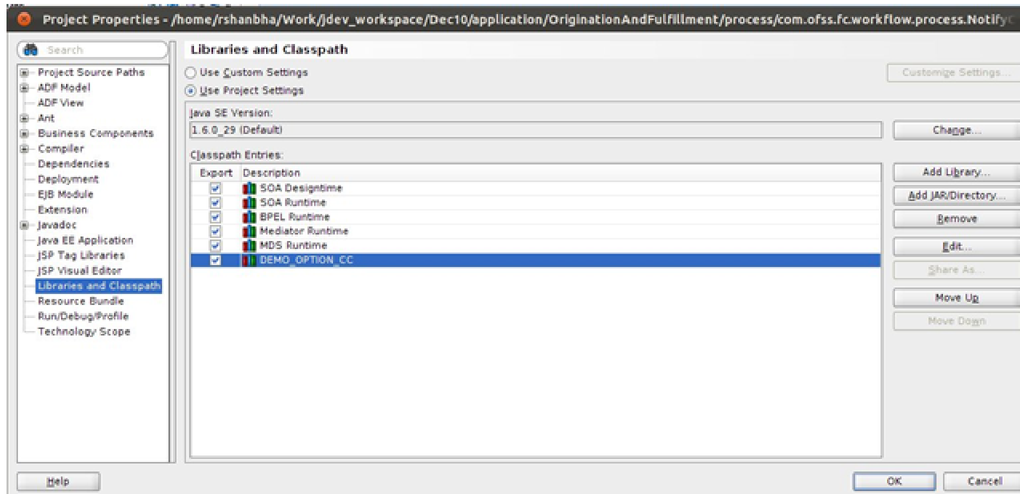
8.3 Enabling Application for Seeded Customization

Seeded customization of an application is the process of taking a generalized application and making modifications to suit the needs of a particular group. The generalized application first needs to be enabled for seeded customization before any customizations can be done on the application.

To enable seeded customization for the application, follow these steps:

1. Go to the **Project Properties** of the application's project.
2. In the *ADF View* section, check the *Enable Seeded Customizations* option.
3. In the *Libraries* and *Classpath* section, add the previously deployed which contains the customization class.

Figure 8–3 Enabling Application for Seeded Customization



4. In the **Application Resources** tab, open the *adf-config.xml* present in the *Descriptors/ADF META-INF* folder.

5. In the list of *Customization Classes*, remove all the entries and add the *com.ofss.fc.demo.ui.OptionCC.OptionCC* class to this list. The sections below will elaborate in detail the actual customization of a SOA process with examples.

8.4 SOA Customization Example Use Cases

This section describes the examples use cases of SOA customization.

8.4.1 Add a Partner Link to an Existing Process

In this example of SOA customization, we will be adding a Partner Link call to an Echo Service to an existing SOA process. The Echo Service will take a string input and respond with the same string as output.

The following section will explain how to create a SOA project and process with the example of Echo Service.

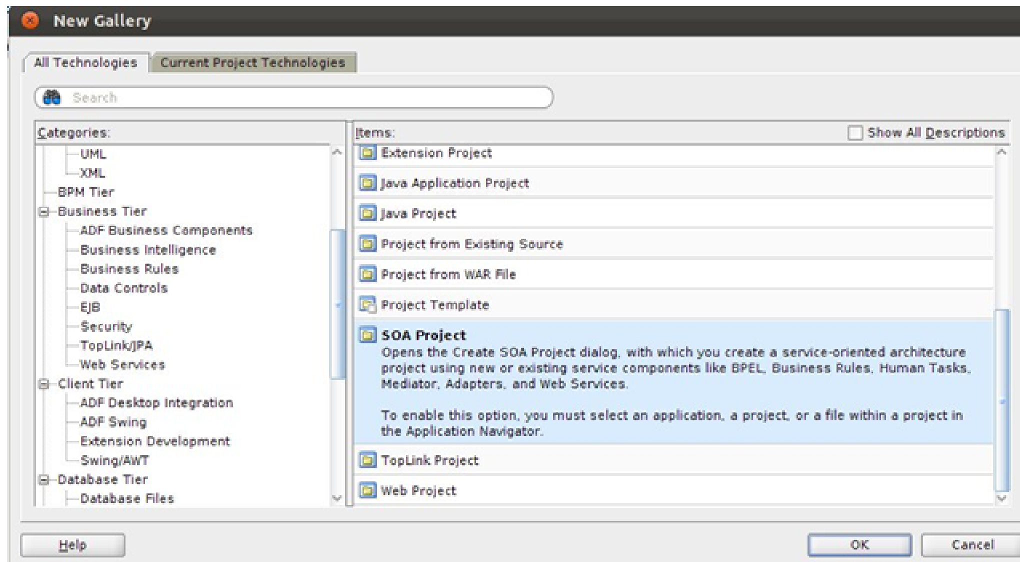
Step 1 Create SOA Project

You will need to create a SOA project to contain the Echo Service process. To create the SOA project, follow these steps:

1. In the Main Menu, go to **File** -> **New**.

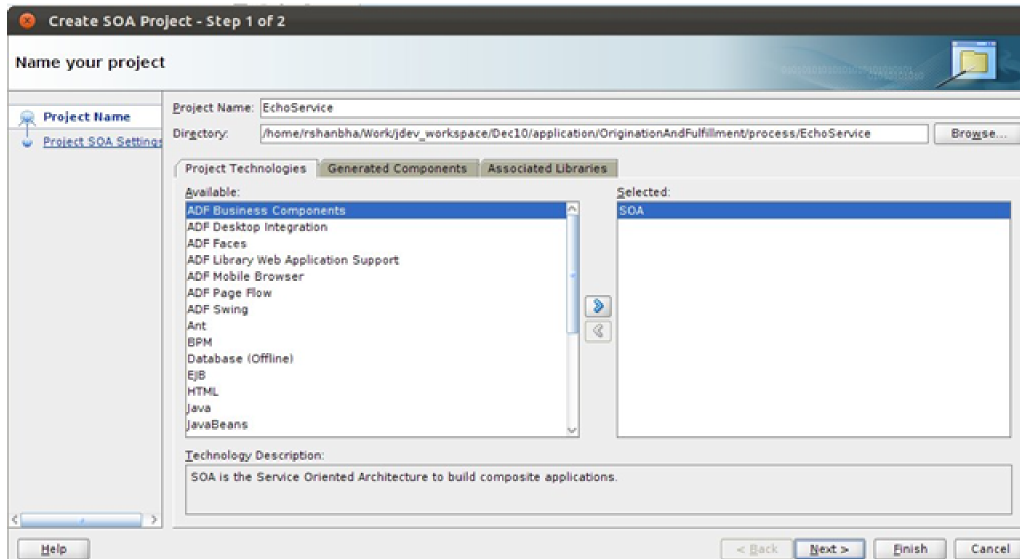
2. In the Project Gallery that opens, select *SOA Project* and click **OK**.

Figure 8–4 Select SOA Project



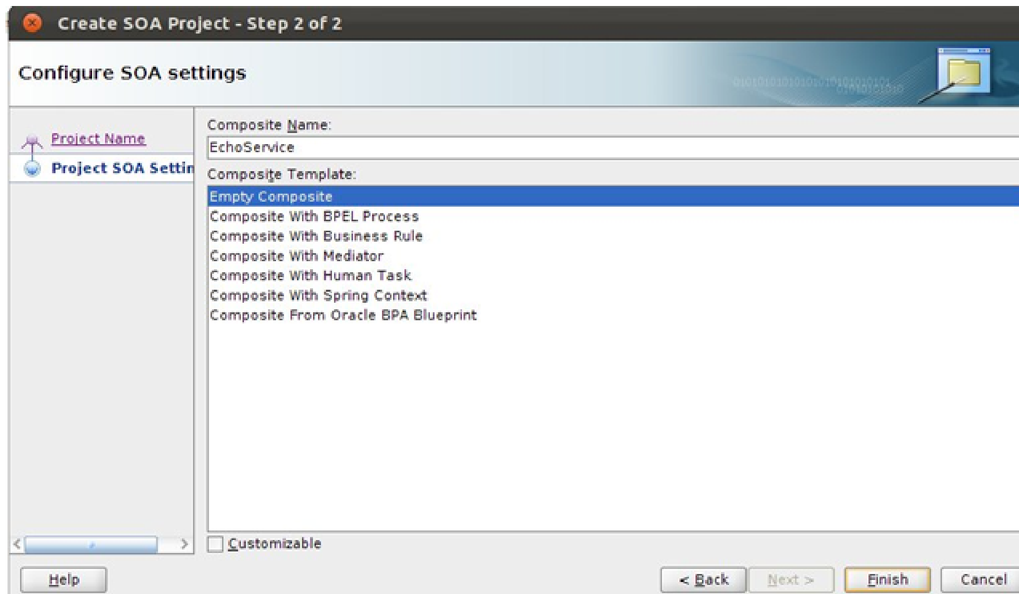
3. In the **Create SOA Project** wizard, enter appropriate project name (EchoService) and location for the project.
4. Click **Next**.

Figure 8–5 Enter SOA Project Name



5. In the next dialogue of the wizard, enter appropriate name (EchoService) for the SOA composite.
6. Select *Empty Composite* from the drop-down menu.
7. Click **Finish**.

Figure 8–6 Configure SOA Settings



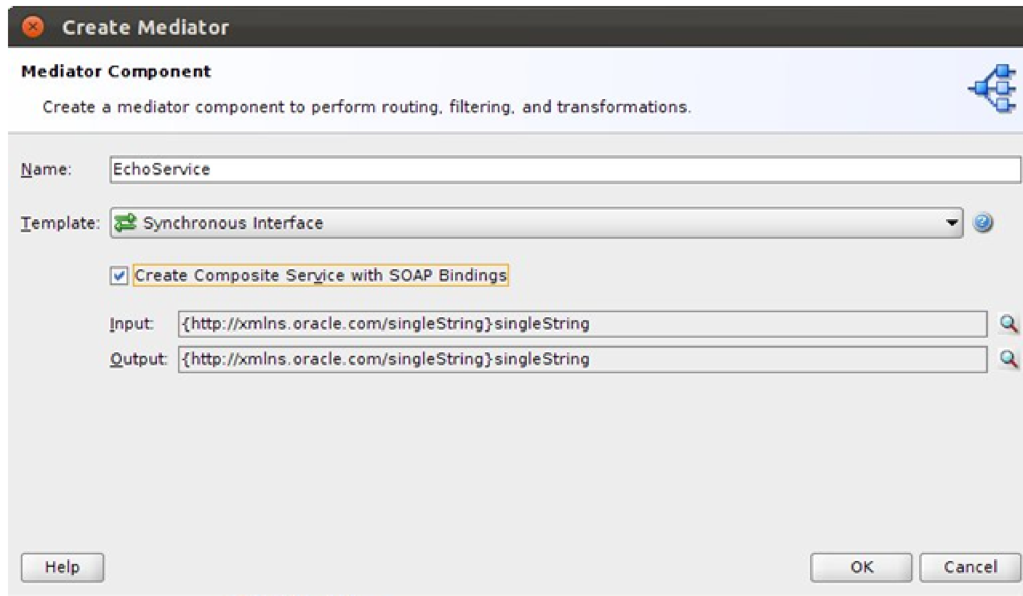
Step 2 Add Mediator Component

You will need to add a *Mediator* component to the BPEL process to process the input to the SOA process and generate an output.

To add the *Mediator*, follow these steps:

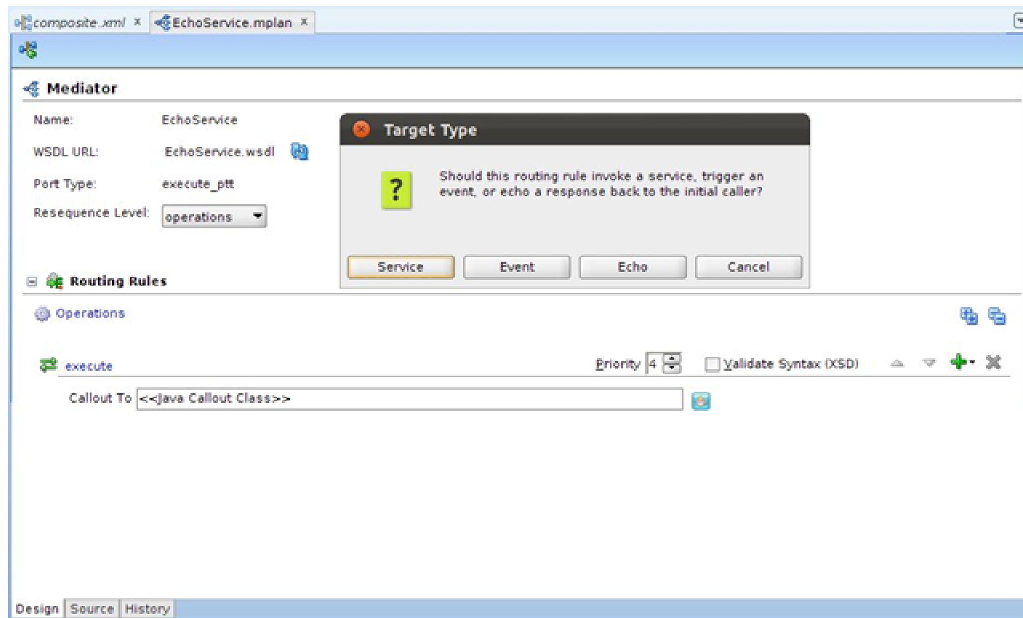
1. From the **Project Navigator** tab, select and open *EchoService.bpel* in the *Design* mode.
2. From the **Component Palette** tab, in *SOA Components* section, select the *Mediator* component.
3. Drag and drop it onto the *bpel* process.
4. In the **Create Mediator** dialogue that opens, enter appropriate name (EchoService).
5. From the **Templates** drop-down, select *Synchronous* Interface.
6. Check the *Create Composite Service with SOAP Bindings* option.
7. Click **OK**.

Figure 8–7 Create Mediator



8. An *EchoService.mplan* file will be created. Open this file in **Design** mode.
9. In the *Routing Rules* section, click the icon for *Add*.
10. Select *Static Routing Rule* from pop-up menu.
11. In the **Target Type** dialogue that opens, click **Echo**.

Figure 8–8 Select Target Type

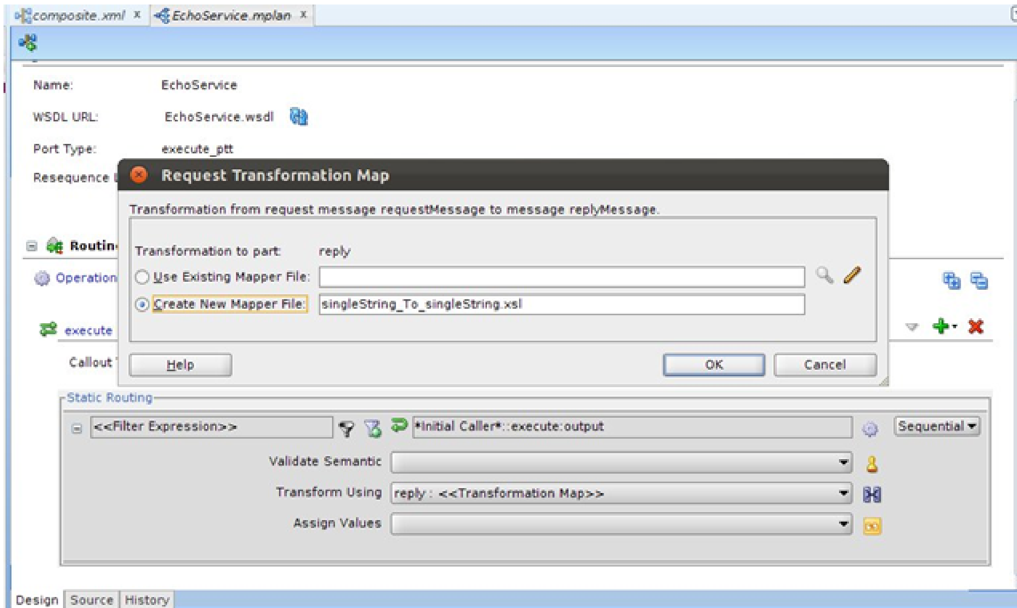


A *Static Routing* section will be added to the screen.

12. Click the icon next to the *Transform Using* drop-down.

13. In the **Request Transformation Map** dialogue that opens, select the option **Create New Mapper File**.
14. Click **OK**.

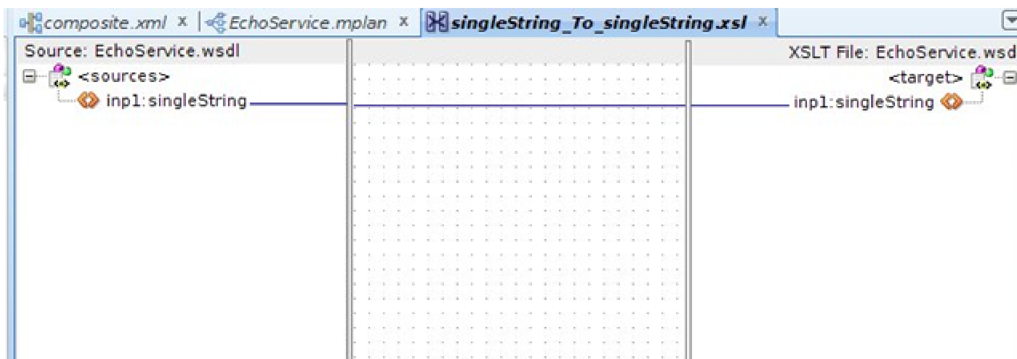
Figure 8–9 Request Transformation Map to create new mapper file



15. This will create a *singleString_to_singleString.xsl* file. Open this file in **Design** mode.

    You will see the input parameters in tree format on the left hand side and the output parameters on the right hand side of the screen.
16. In our case, the input and output contain a single *string*.
17. Select the input string from the left hand side and drag and drop it to the output string on the right hand side. This will create a mapping between input and output parameters.

Figure 8–10 Mapping Input and Output string



18. Save all files and build the project.

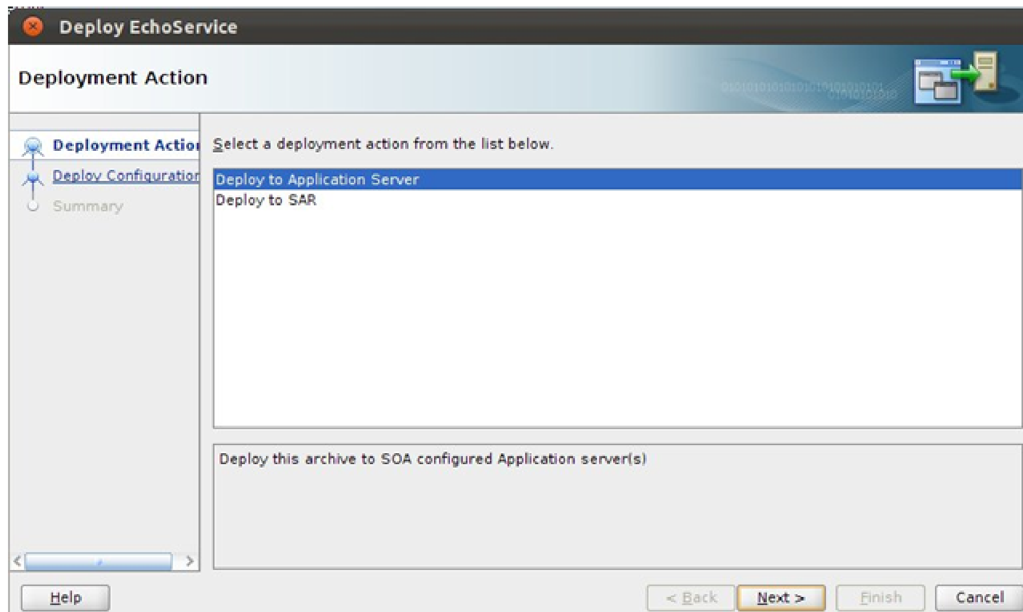
Step 3 Deploy Project to SOA Server

You will need to deploy this project to a SOA Server. From the *Admin* team, get details of the SOA Server and configure it in your JDeveloper.

After adding the SOA Server to your JDeveloper, follow these steps to deploy the *EchoService* composite to the server:

1. In the **Project Navigator** tab, right click the project and select *Deploy*.
2. In the **Deploy EchoService** dialogue that opens, select *Deploy* to *Application Server* from the list.
3. Click **Next**.

Figure 8–11 Select Deployment Action



4. In the Deploy Configuration dialogue, check the option *Overwrite any existing composites with the same revision ID*.
5. Click **Next**.

Figure 8–12 Deploy Configuration Settings

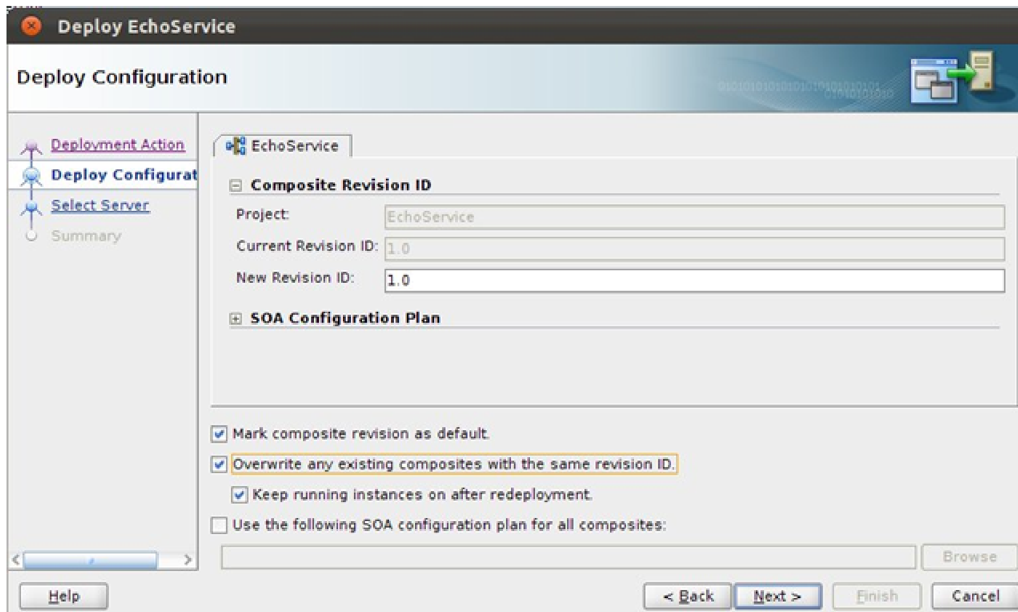
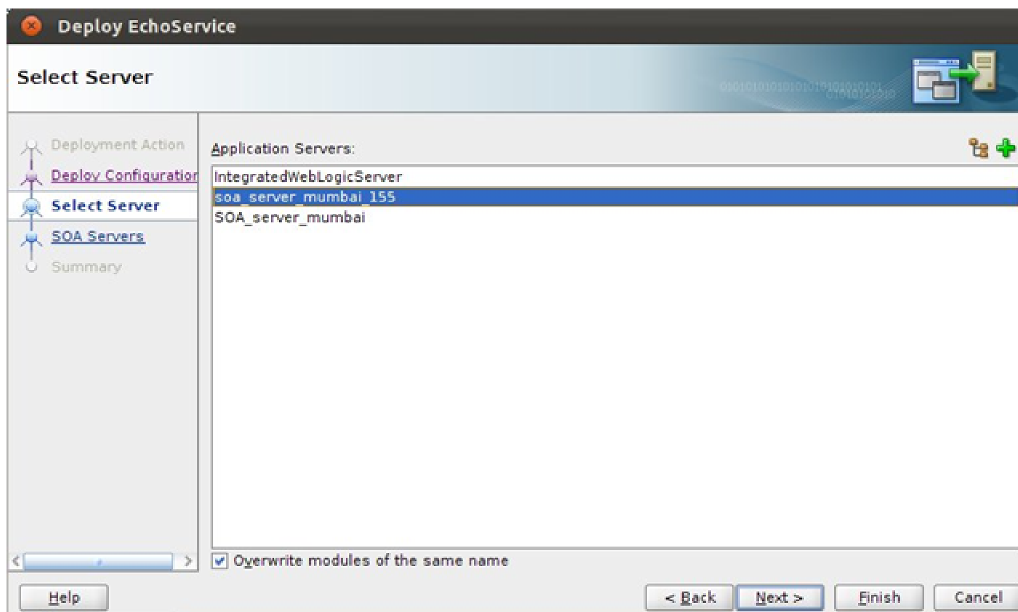
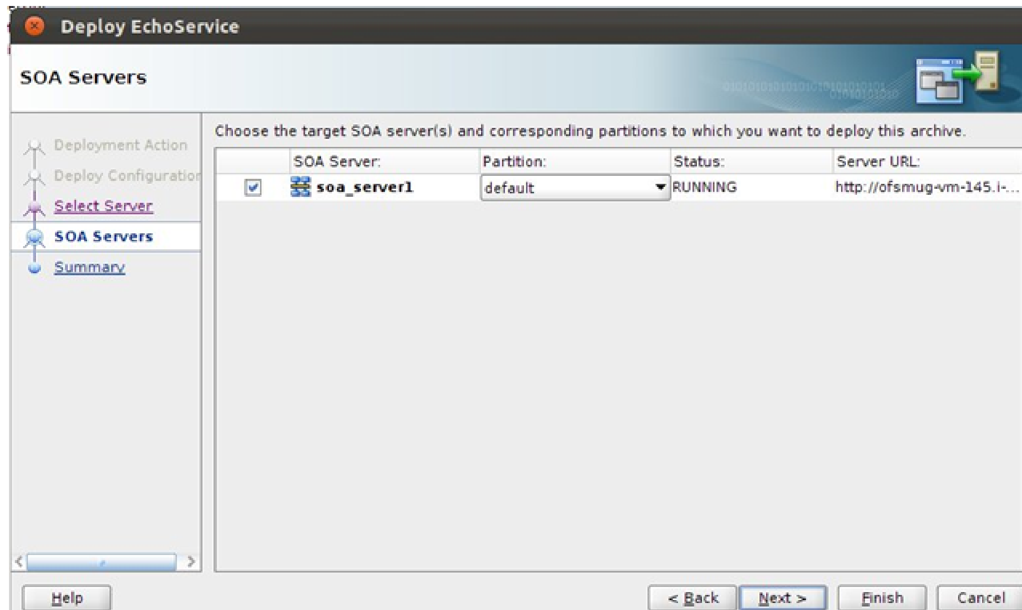


Figure 8–13 Select Deployment Server



6. Select the appropriate *Partition* of the SOA Server where the composite should be deployed.
7. Click **Finish**.

Figure 8–14 Select Target SOA Server

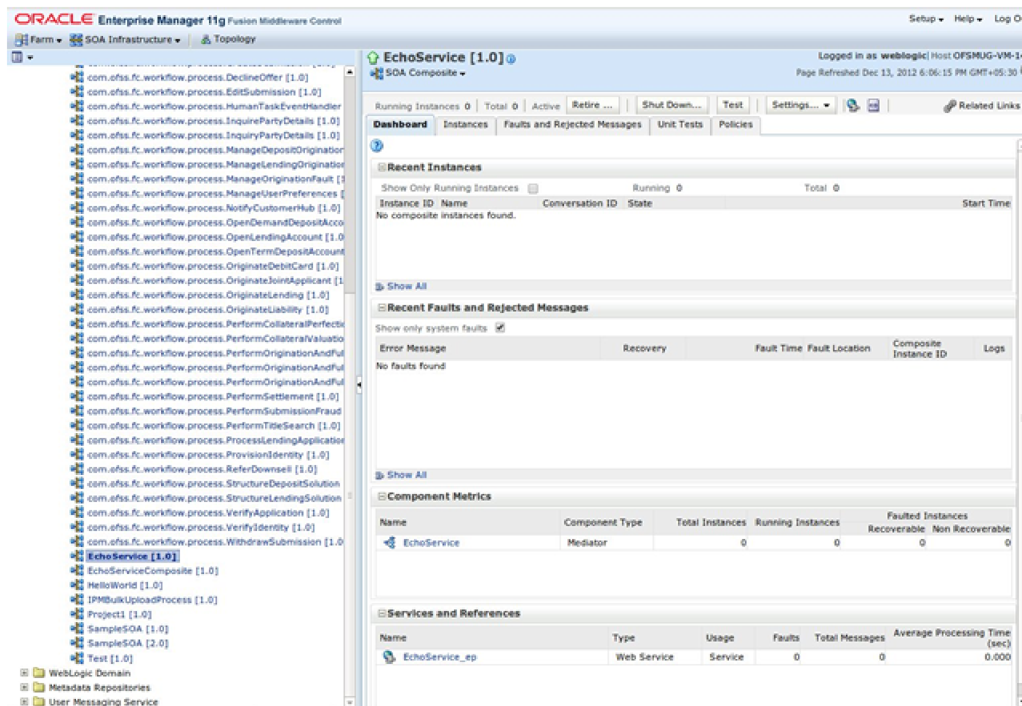


Step 4 Test Echo Service

After deploying the *EchoService* composite to a SOA Server, you can test it through the EM console:

1. Log in to *em* console of the SOA Server to which the composite is deployed.
2. From the *SOA Domain* select the *EchoService* composite.

Figure 8–15 Select SOA Domain



3. On the right hand side panel, you can see the *Dashboard* which lists the instances of SOA requests to that composite and many other options.
4. Click the **Test** button to test the composite.

Figure 8–16 Test Web Service

5. In the *Input Arguments* section, enter input and click *Test Web Service*.
6. You will be able to see the response in the *Response* section.

Step 5 Add Customizable Scope to SOA Application

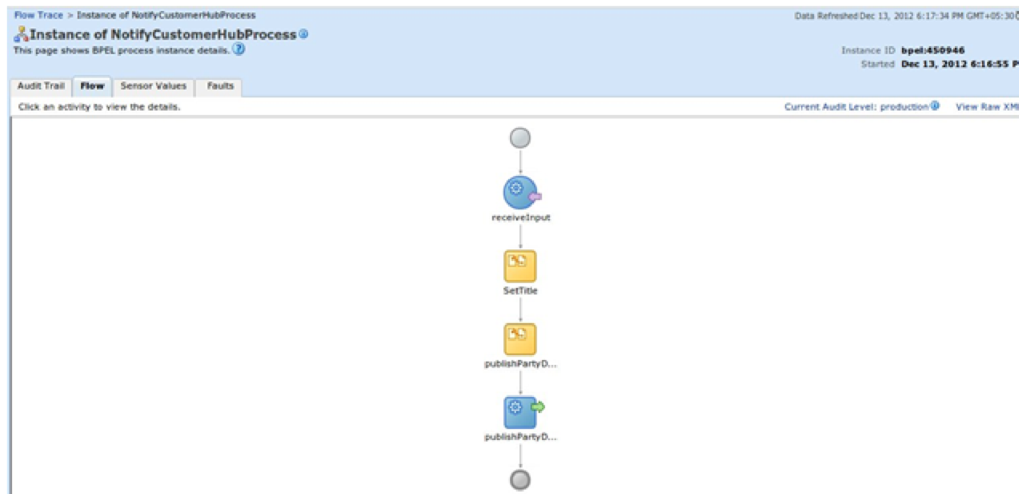
By default, a BPEL process in itself is not customizable. In addition to the steps followed to enable customizations in a SOA application, you will need to add a *Scope* component to the BPEL process and enable it for customizations.

To demonstrate customizations of a SOA process, we will be using the BPEL process *NotifyCustomerHubProcess* present in the composite *com.ofss.fc.workflow.process.NotifyCustomerHub*.

To see the flow of the *NotifyCustomerHubProcess* before customizations:

1. Deploy the composite to a SOA Server.
2. Log in to the *em* console and select the process from *SOA Domain*.
3. From the *Dashboard*, click **Test**.
4. Enter appropriate input and click *Test Web Service*.
5. From the *Dashboard*, click an *Instance* of the composite request.
6. Select the **Flow** tab to see the flow of the process.

Figure 8–17 Customization of SOA Application - Flow

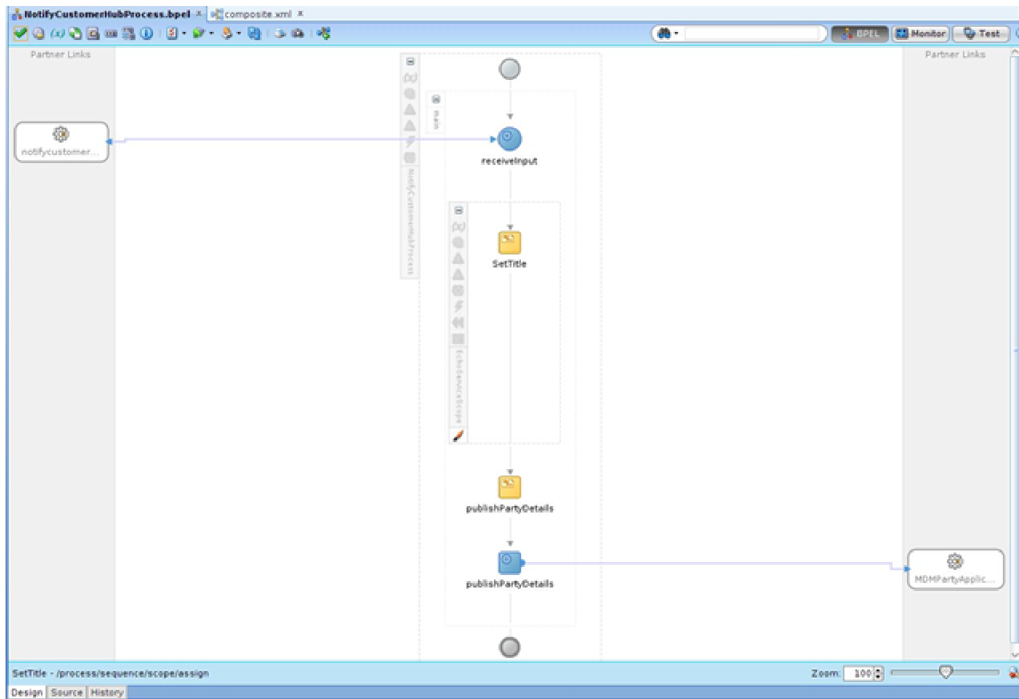


7. Open the SOA application which contains the base composite which will be customizing. The aforementioned process is present in the *OriginationAndFulfillment* application inside the *com.ofss.fc.workflow.NotifyCustomerHub project*.

To add a customizable scope to the BPEL process, follow these steps:

1. Open the *NotifyCustomerHubProcess.bpel* file in **Design** mode.
2. From the *Component Palette* panel on the right side, in the *BPEL Constructs* section, drag the *Scope* component and drop it on to the BPEL process as shown in the figure.
3. Double-click the component and enter appropriate name (EchoServiceScope) for the component.
4. Drag and drop the existing *Assign* component labeled *setTitle* on to the newly added *EchoServiceScope* component.

Figure 8–18 Customization of SOA Application - Notify Customer



5. Right click the *Scope* component and select *Customizable* from the context menu.
6. Save all the changes and restart JDeveloper in *Customization Developer Role*.

Step 6 Customize the SOA Composite

After adding a *Customizable Scope* to the base composite, you can start performing customizations in JDeveloper's *Customization Developer Role*.

When you open the *NotifyCustomerHubProcess.bpel* file in *Design* mode, you will notice that all other components in the process, except the customizable *EchoServiceScope* component, are disabled. This means that your customizations are limited to that scope.

In the following sections, we will be adding a *Partner Link* call to the previously created *EchoService* BPEL process and other required components in the *customization* mode.

Step 7 Add Partner Link Component

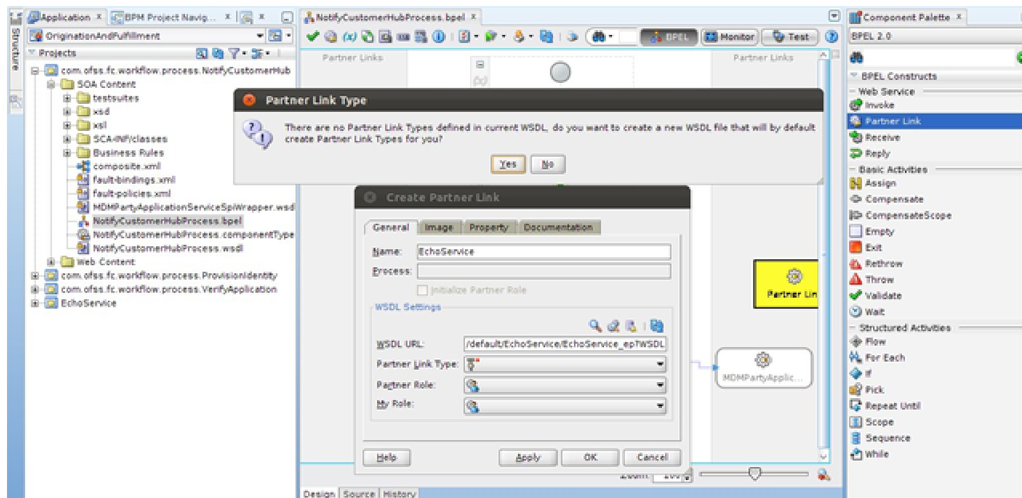
To add a *Partner Link* to the BPEL process, follow these steps:

1. From the Project Navigator, open the NotifyCustomerHubProcess.bpel file in Design mode.
2. From the *Component Palette* panel on the right side, in the *BPEL Constructs* section, drag the *Partner Link* component and drop it on to the *Partner Links* section of the BPEL process.
3. In the *Create Partner Link* dialogue that opens, enter appropriate name (EchoService) for the partner link.
4. In the *WSDL Settings* section of the dialogue, enter the URL for the previously created *EchoService* composite.

5. You will get alert notifying that there are no Partner Links defined in the current WSDL with an option to create a wrapper WSDL file with partner links defined for specified WSDL.
6. Click **Yes**.

   A new *EchoServiceWrapper.wsdl* file will be created which contains the partner links.
7. Select the newly defined partner link type and partner role in the *Partner Link Type* and **Partner Role** drop-down.
8. Select *Not Specified* option in the **My Role** drop-down.

Figure 8–19 Add Partner Link Component



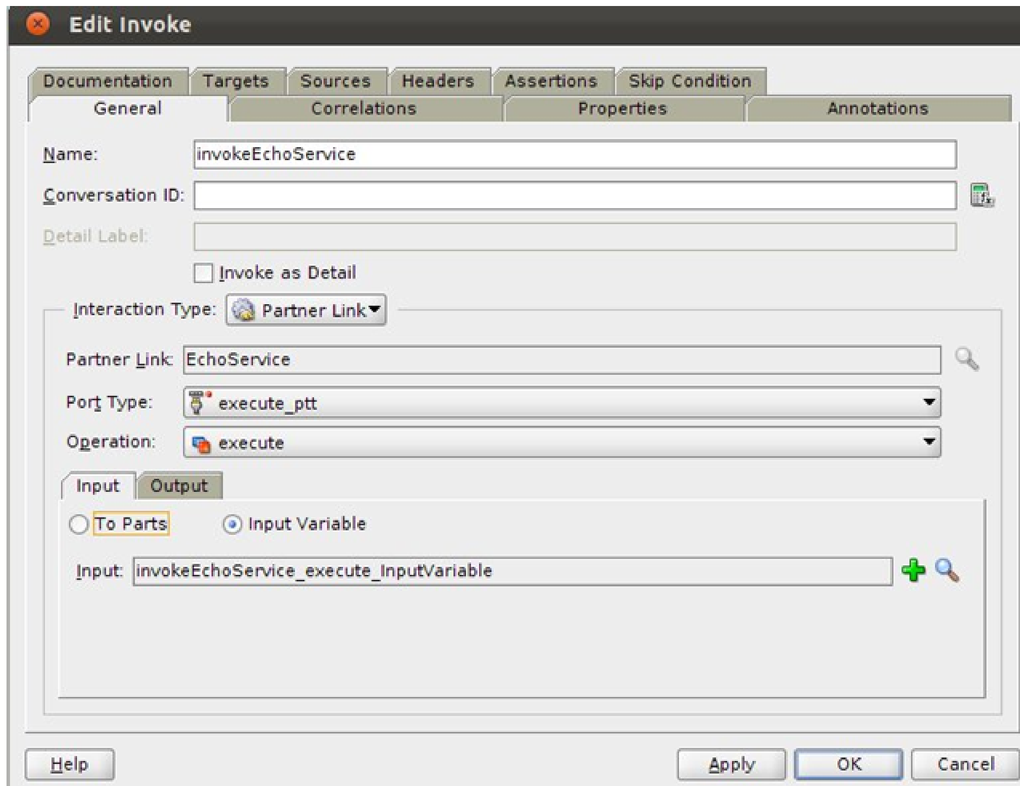
Step 8 Add Invoke Component

You will need to add an *Invoke* component to invoke the previously added partner link call to *EchoService*.

To add *Invoke component*, follow these steps:

1. From the *Component Palette* panel on the right side, in the *BPEL Constructs* section, drag the *Invoke* component and drop it on the BPEL process inside the *EchoServiceScope* component.
2. Click the *Invoke* component and drag it to the previously added *EchoService* partner link.
3. Double-click the *Invoke* component.
4. In the *Edit Invoke* dialogue that opens, enter an appropriate name (invokeEchoService) for the component.
5. Click the icon for adding a new variable in the *Input Variable* and *Output Variable* sections.
6. Click **OK** to save the changes.

Figure 8–20 Add Invoke Component



Step 9 Add Assign Components

An *Assign* component is used to assign values to a variable. These values can be directly assigned from one variable to another or modified using BPEL functions available.

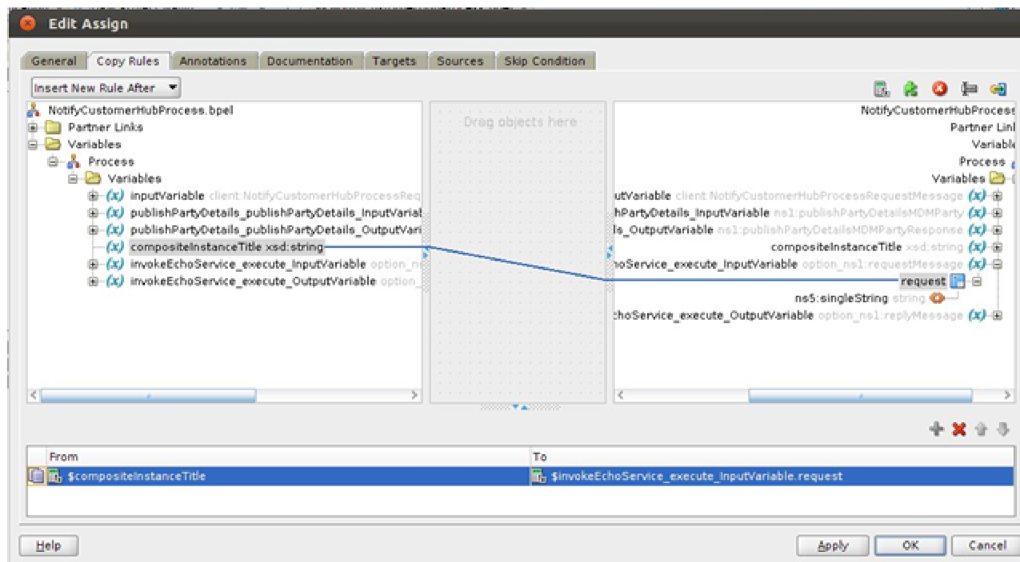
The *EchoService* accepts a single string as an input and gives a single string as an output. The *Input Variable* and *Output Variable* defined in the previously created *invokeEchoService* component will be used to hold the input value for the *EchoService* and the output returned respectively.

In our case, we will need to add two *Assign* components for following purposes:

- To populate the *Input Variable* of the *invokeEchoService* component with the value returned by the existing *setTitle* component.
- To populate the *setTitle* component with the value returned in the *Output Variable* of the *invokeEchoService* component.
- To add the *Assign* components, follow these steps:
  1. From the *Component Palette* panel on the right side, in the *BPEL Constructs* section, drag the *Assign* component and drop it on the BPEL process inside the *EchoServiceScope* component between the *setTitle* and *invokeEchoService* components.
  2. Double-click the *Assign* component.
  3. In the *Edit Assign* dialogue that opens, enter appropriate name (copyToEchoServiceInput) for the component.

4. In the **Copy Rules** tab, select the *compositeInstanceTitle* from the left hand side tree and drag it to the *invokeEchoService_inputVariable* on the right hand side screen as shown in the figure.
5. Click **OK**.

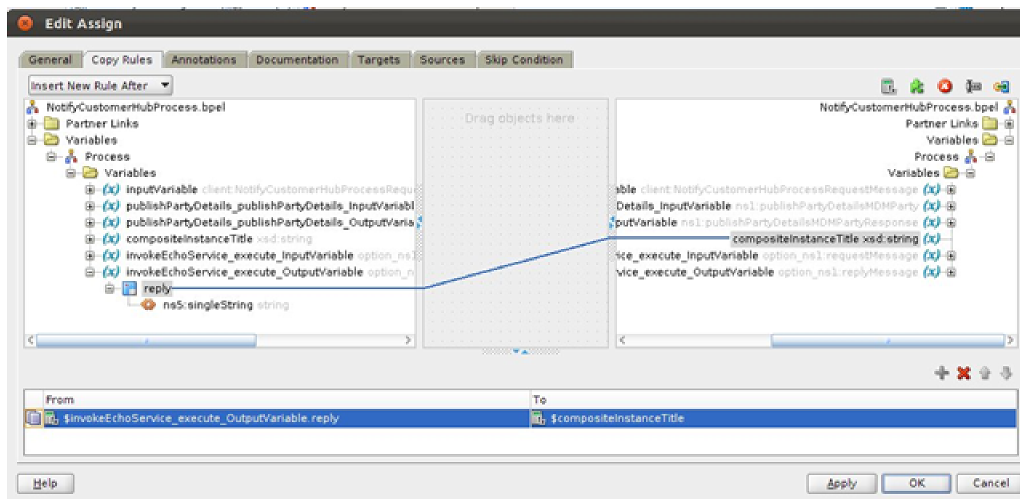
Figure 8–21 Edit Copy Rules Variable



6. Repeat the above steps for another *Assign* component labeled *copyFromEchoServiceOutput*. This component should be present after the *invokeEchoService* component.

   The *Copy Rules* for this component should be as shown in the figure below.

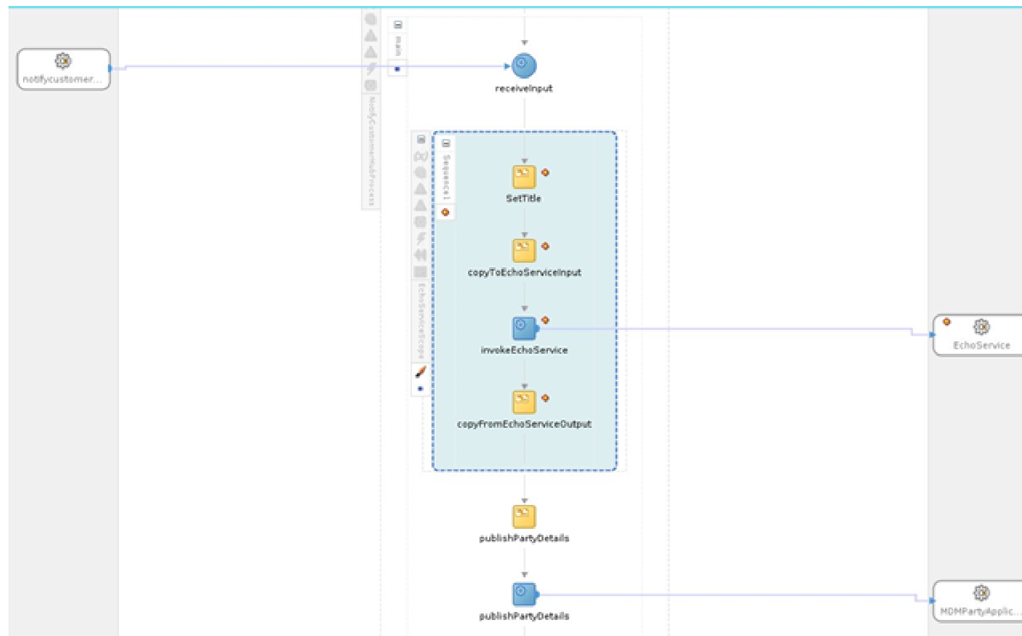
Figure 8–22 Add Assign Components - Reply



7. Save all the changes.

   The **Design** view of the BPEL process should look as shown in the figure below:

Figure 8–23 Design View of the BPEL Process



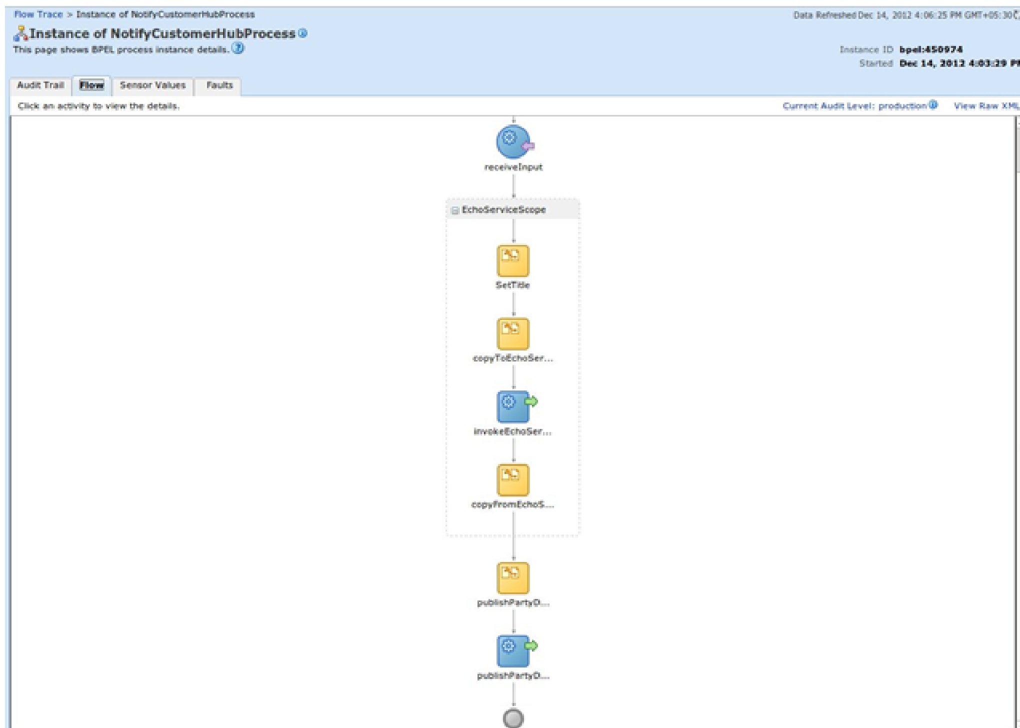
Step 10 Test the Customized Composite

After performing the customizations, build the project and deploy it to a SOA Server. You will need to include the *Customization Class JAR* in the runtime classpath of the deployed application.

To test the customized composite, follow these steps:

1. Log in to the *em* console and select the composite from the *SOA Domain*.
2. Click **Test** and enter appropriate input.
3. On the *Dashboard* panel, click the composite *Instance*. In the *Flow* panel of the screen, you will be able to see the flow of the customized composite.

Figure 8–24 Test Customized Composite - Flow



4. Click the *invokeEchoService* component from the flow to see the request and response XML for the invoke operation to the partner link.

Figure 8–25 Test Customized Composite - invokeEchoService

InvokeEchoService

[2012/12/14 16:03:45]
Started invocation of operation "execute" on partner "EchoService".

[2012/12/14 16:03:45]
Invoked 2-way operation "execute" on partner "EchoService".

```
- <messages>
  - <invokeEchoService_execute_InputVariable>
    - <part xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" name="request">
        <singleString xmlns="http://xmlns.oracle.com/singleString">000007918</singleString>
      </part>
    </invokeEchoService_execute_InputVariable>
  - <invokeEchoService_execute_OutputVariable>
    - <part xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" name="reply">
        <inp1:singleString xmlns:inp1="http://xmlns.oracle.com/singleString">000007918</inp1:singleString>
      </part>
    </invokeEchoService_execute_OutputVariable>
  </messages>
```

Copy details to clipboard

8.4.2 Add a Human Task to an Existing Process

In this example, we will demonstrate how to add a *Human Task* component mode.

In this example of SOA customization, we will be adding a *Human Task* to a BPEL process. Instead of adding the *Human Task* in customization mode, we will build a

separate BPEL process with the human task and then customize the base composite to include a *Partner Link* call to that BPEL process.

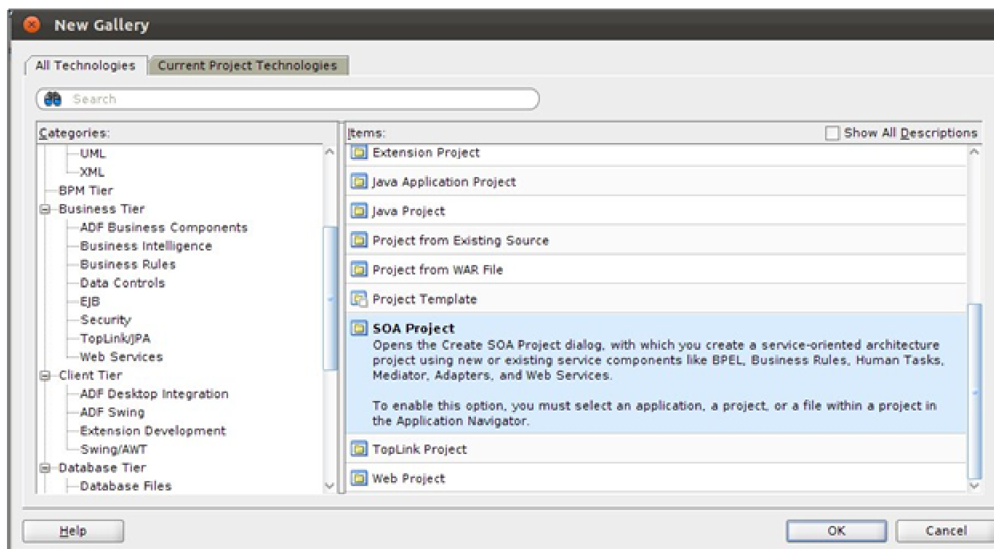
The following section will demonstrate how to create a BPEL process with *Human Task*. The human task will take the title as a *string* input and will have the outcomes *REJECT* and *APPROVE*. The BPEL process will invoke the human task passing the title as input. Based on the outcome of the human task, the title will be suitably modified and returned by the BPEL process.

Step 1 Create SOA Project

You will need to create a SOA project to contain the Echo Service process. To create the SOA project, follow these steps:

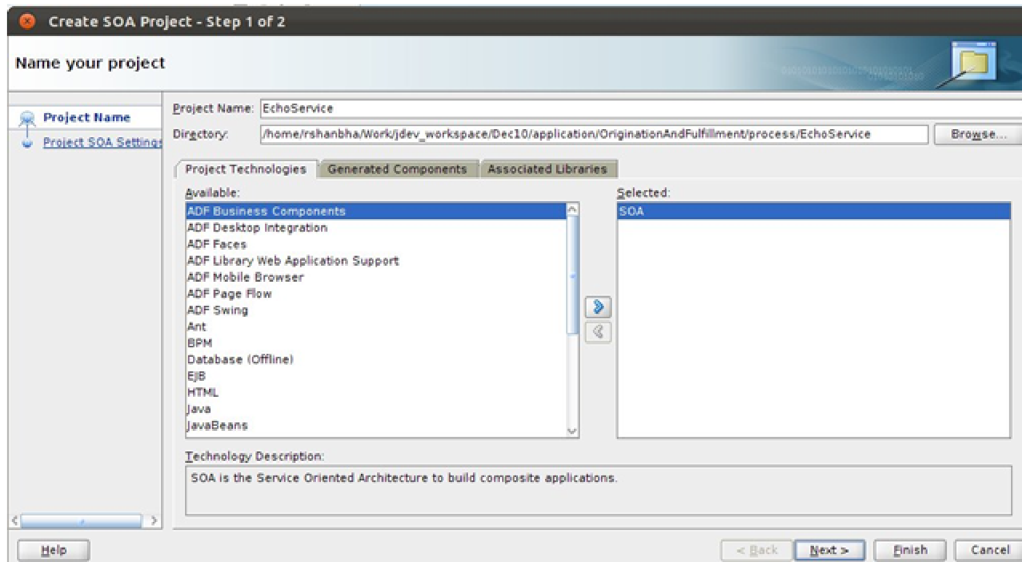
1. In the Main Menu, go to **File** -> **New**.
2. In the Project Gallery that opens, select *SOA Project*.
3. Click **Ok**.

Figure 8–26 Select SOA Project



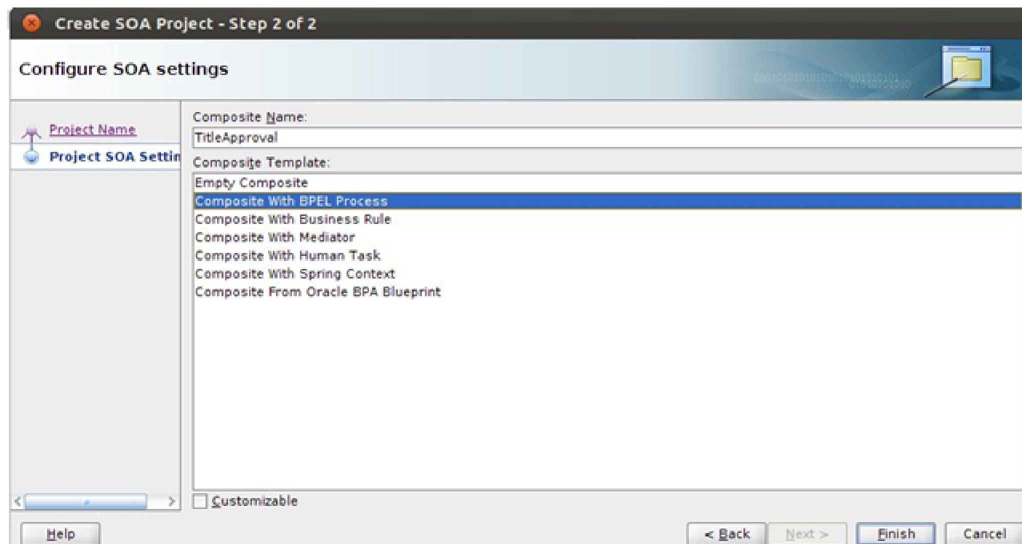
4. In the **Create SOA Project** wizard, enter appropriate project name (TitleApproval) and location for the project and click **Next**.

Figure 8–27 Create SOA Project Name



5. In the next dialogue of the wizard, enter appropriate name (TitleApproval) for the SOA composite.
6. Select *Composite With BPEL Process* from the drop-down menu.
7. Click **Finish**.

Figure 8–28 Configure SOA Settings



8. The dialog *Create BPEL Process* will open. Enter a name (TitleApprovalProcess) for the process and select *Asynchronous BPEL Process* from the templates drop-down.

Figure 8–29 Configure BPEL Process Settings

Step 2 Create Human Task

After defining the BPEL process, you will need to add the *Human Task* component to the process. To add the *Human Task*, follow these steps:

1. From the **Project Navigator** tab, select and open *composite.xml* in the *Design* mode.
2. From the **Component Palette** tab, in *SOA Components* section, select the *Human Task* component and drag and drop it onto the *components* section of the *composite.xml*.
3. In the **Create Human Task** dialog that opens, enter a name (TitleApprovalHumanTask) for the human task.
4. Click **OK**.

Figure 8–30 Enter Human Task Name

5. From *Project Navigator*, select and open *TitleApprovalHumanTask.task* file in **Design** mode. This file has the human task definition.
6. In the *General* section, specify a **Task Title** and **Description** for the human task.

Figure 8–31 Create Human Task - General Tab

7. In the *Data* section, click the icon for add task parameter.

8. In the **Add Task Parameter** dialog, specify the parameter type and name for the input to the human task. In our case, the input task parameter would be a string title.

Figure 8–32 Add Human Task Parameter

Figure 8–33 Create Human Task - Data Tab

The *Assignment* section is used to define the *Users* or *User Groups* to which the human task should be assigned.

9. Double-click **Edit Participant**.
10. In the **Add Participant Type** dialog, check the Value-based option for **Specify Attributes Using**.
11. Click the icon for adding a value.
12. Select the *User By Name* option and enter the name of your user (weblogic).

Figure 8–34 Add Participant Type Details

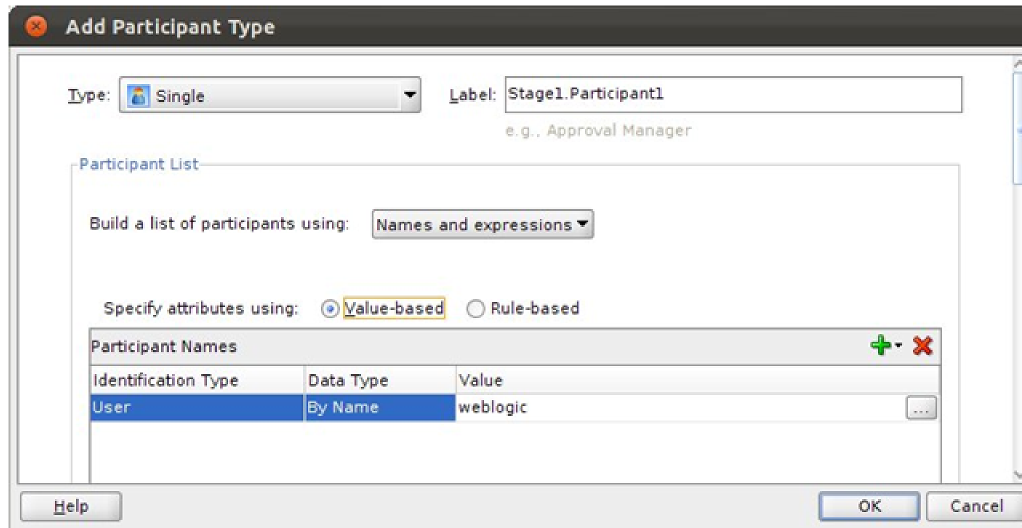
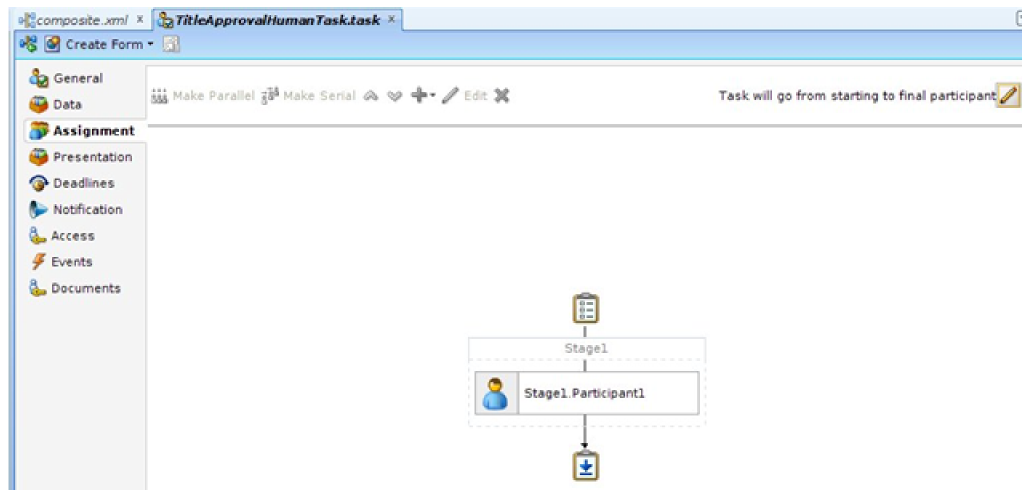
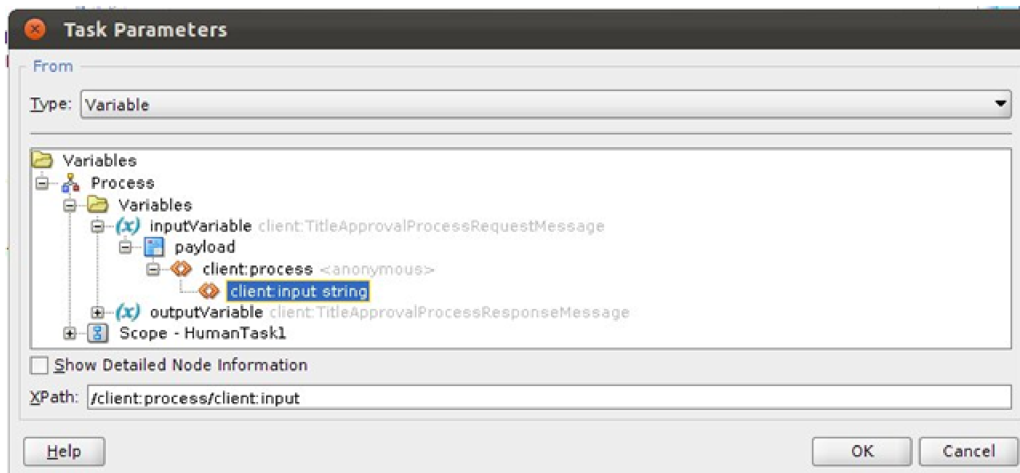


Figure 8–35 Create Human Task - Assignment Tab



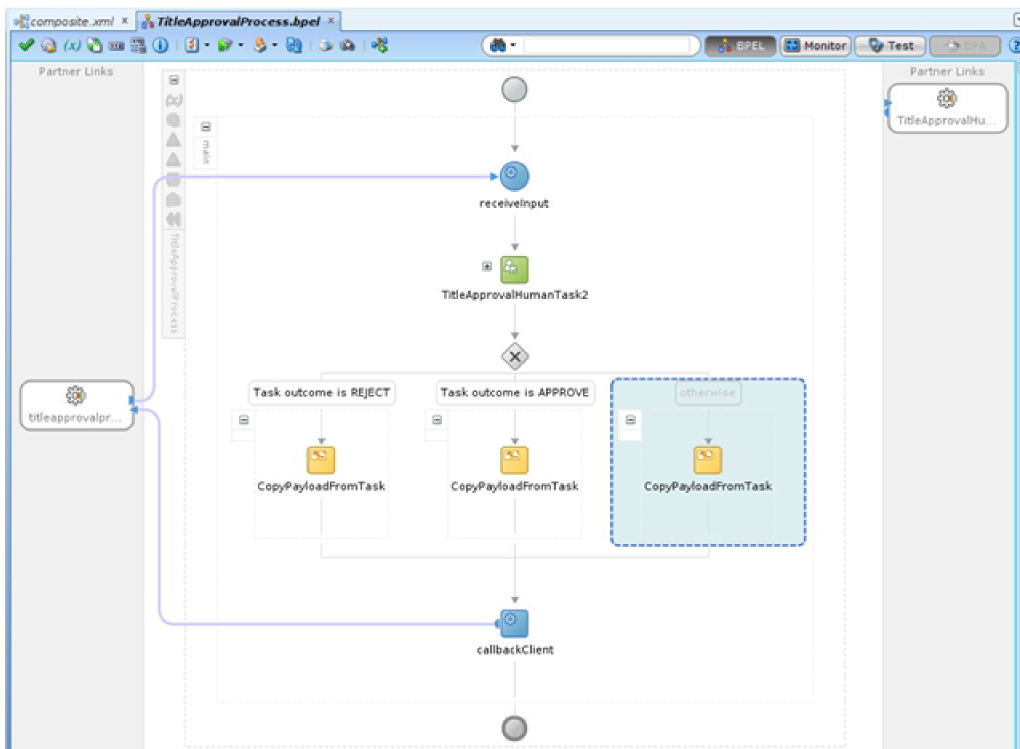
13. From the Project Navigator, open the *TitleApprovalProcess.bpel* file in **Design** mode.
14. From the **Component Palette**, select the component *Human Task* and drag-drop it on to the BPEL process.
15. Click the icon to add task parameter.
16. In the **Task Parameters** dialog, select the *string* input to the BPEL process.

Figure 8–36 Select Human Task Parameters



17. In the task outcomes *Switch* in the BPEL process, delete the condition for *otherwise*.

Figure 8–37 Create Human Task - Delete Condition



18. From the **Component Palette**, select the *Assign* component and drag-drop it to the *REJECT* outcome of the switch.
19. Enter a *name* (rejectTitle) for the component.
20. In the *Copy Rules* section of the assign, use the *Expression Builder* to set the output *string variable* of the BPEL process to '<title> - Rejected'.

Figure 8–38 Create Human Task - Expression Builder

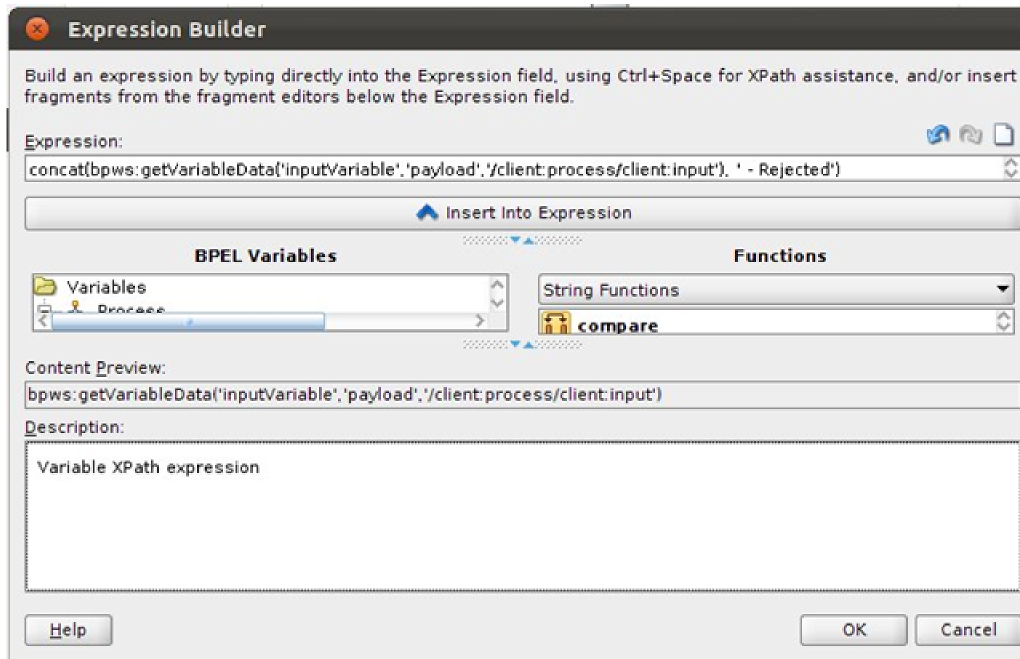
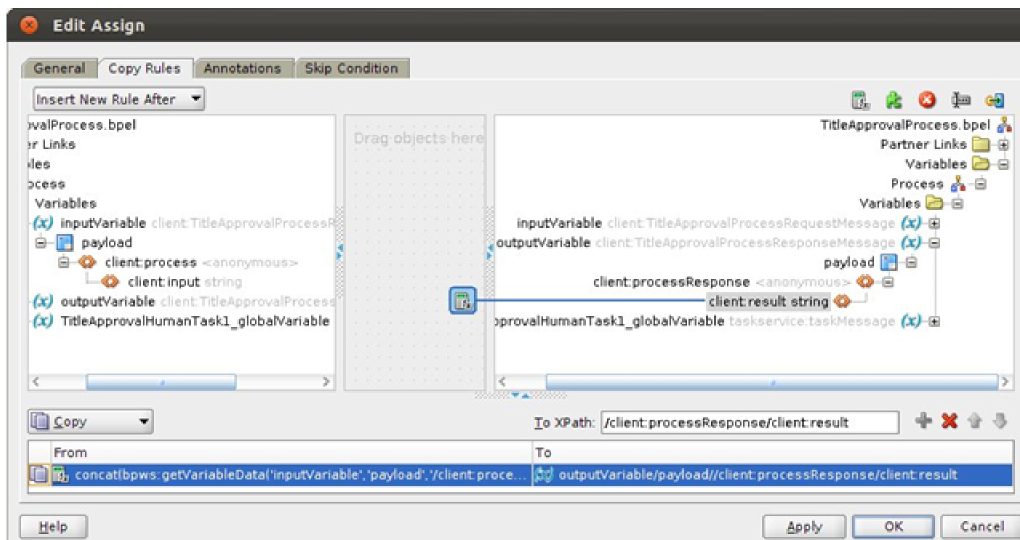
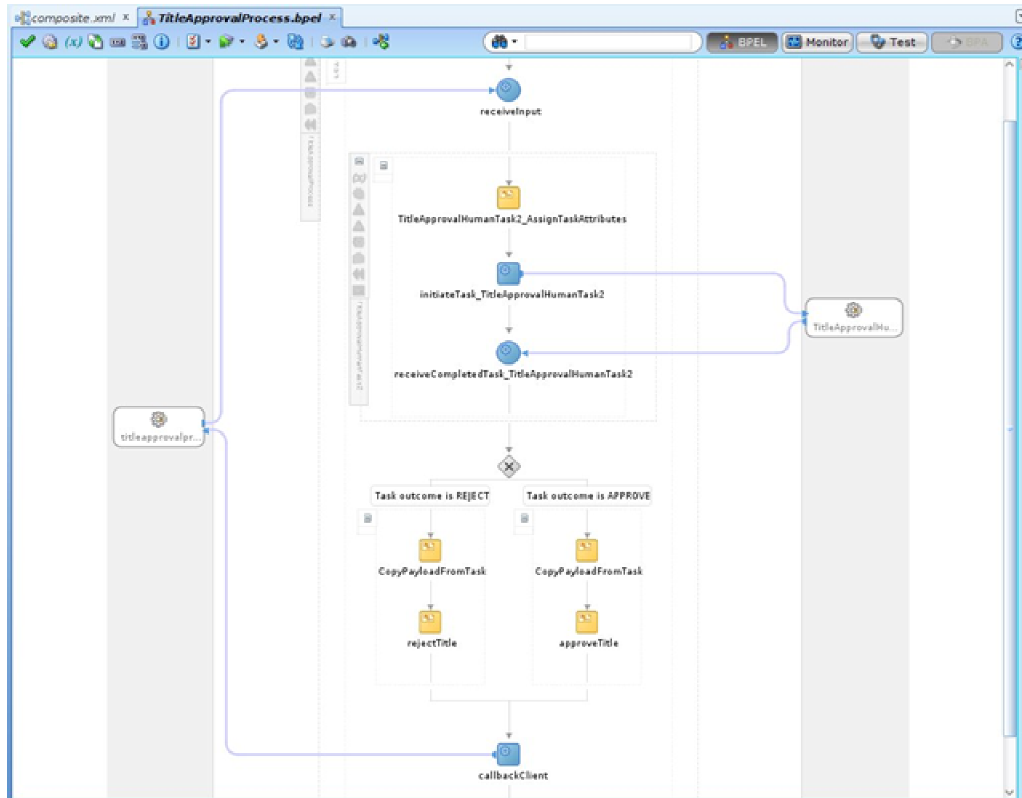


Figure 8–39 Create Human Task - Copy Rules



21. Save all changes to the human task. The BPEL process should look as shown in the figure below.

Figure 8–40 Create Human Task - BPEL Process



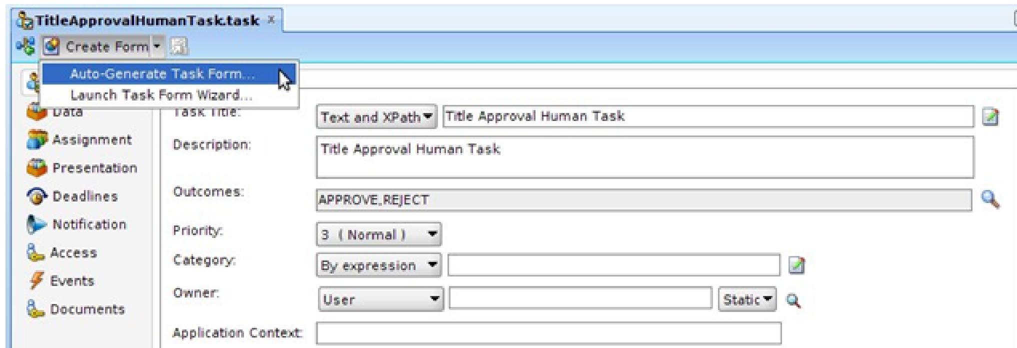
22. Deploy the SOA process to the server as mentioned in the previous example.

Step 3 Create Human Task Form

The *Human Task* is visible to assigned users in the *BPM Worklist* application. To display the task parameters and the payload for the task, you will need to create a *task-flow* with the *Human Task* Form. This task form can be auto generated through the process. Follow these steps:

1. From the Project Navigator, open the *TitleApprovalHumanTask.task* file in **Design** mode.
2. Click the button for *Create Task Form*.
3. Select the *Auto-generate Task Form* option from the context menu.

Figure 8–41 Select Human Task Form



4. Enter a name (TitleApprovalHumanTask) and *location* for the human task form project.
5. Click **Finish**.

The generated human task form project will have default file names. Re-Factor file names for form and page definition using appropriate naming conventions.

Step 4 Deploy Human Task Form Project

You will need to deploy the human task form project on the UI server for the previously deployed SOA process. To deploy, follow these steps:

1. Clean and build the project.
2. Right-click the project and select *Deploy* from the context menu.
3. In the **Deploy** dialog that opens, select the *Deploy to Application* Server option from the list and click *Next*.
4. Select the appropriate UI server for the SOA server.
5. Click **Finish**.

Figure 8–42 Select Human Task Form Deployment Action

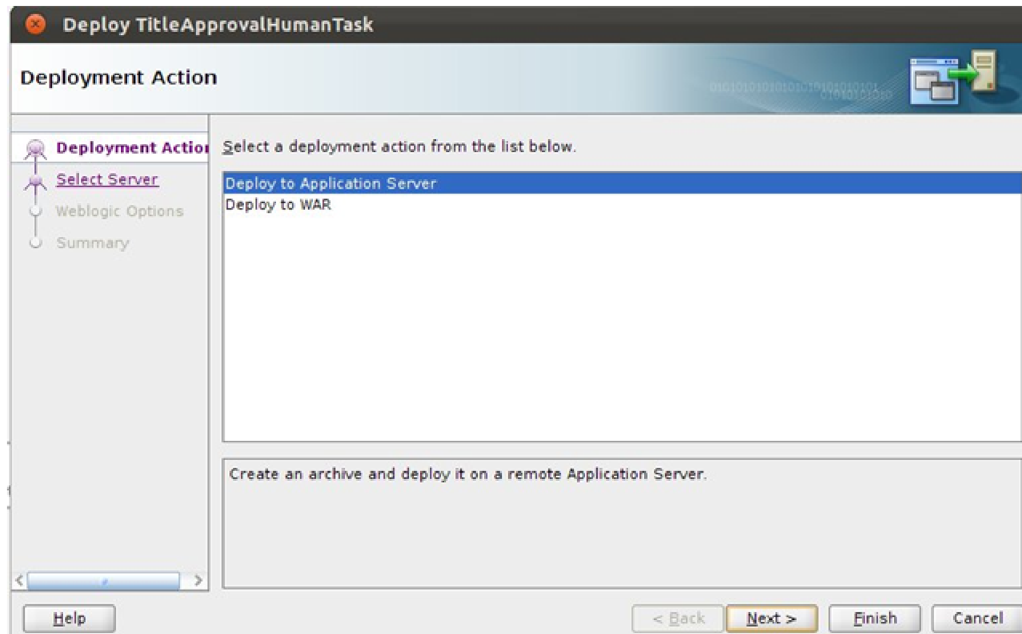
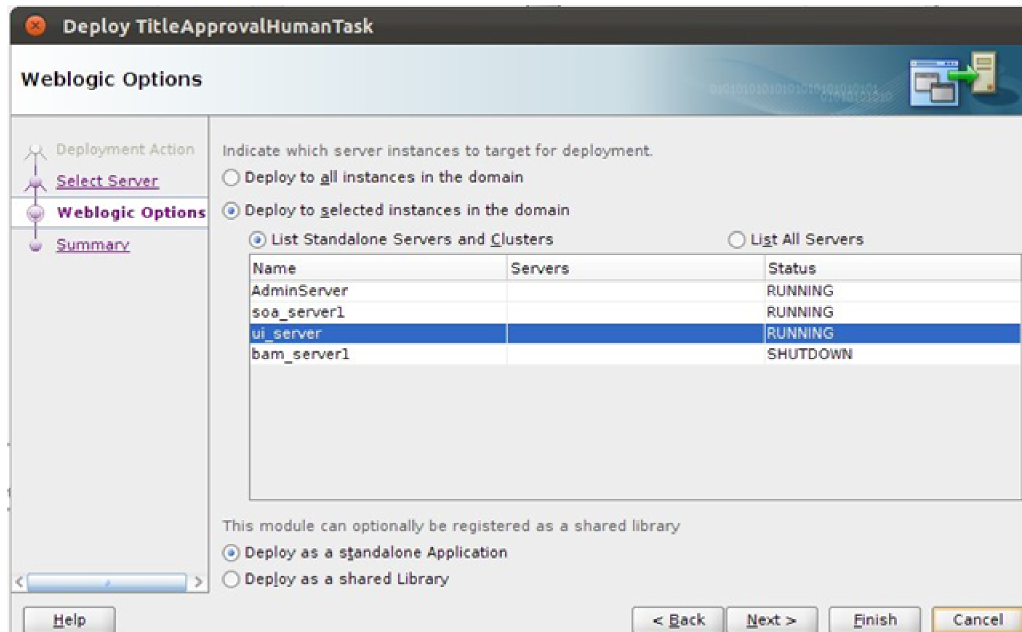


Figure 8–43 Select Human Task Form - Weblogic Options



Step 5 Add Customizable Scope to SOA Application

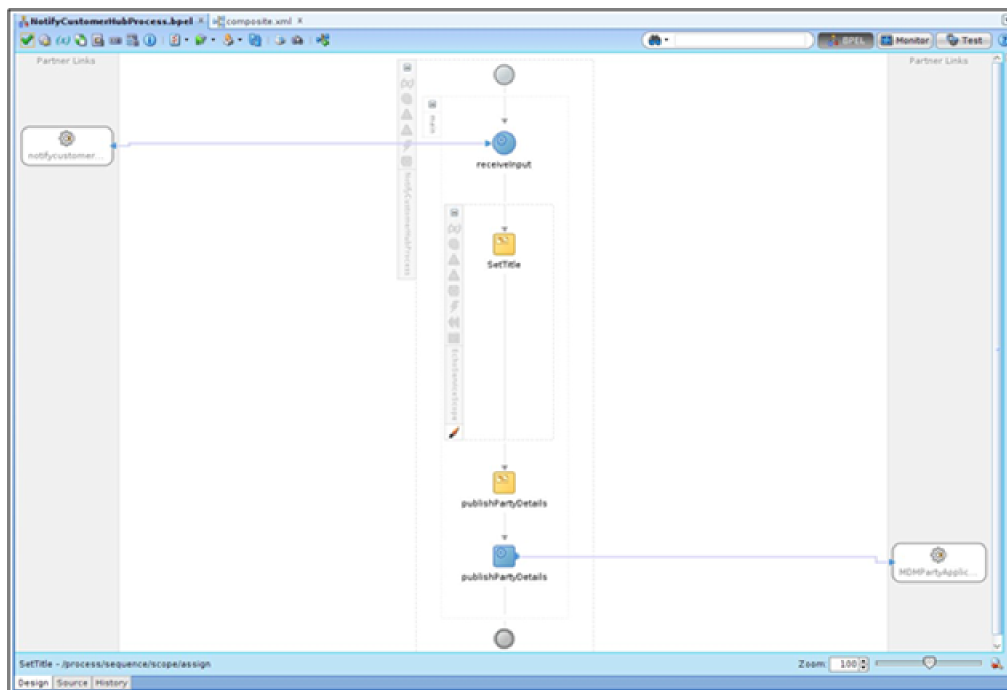
To demonstrate customizations of a SOA process, we will be using the BPEL process *NotifyCustomerHubProcess* present in the composite *com.ofss.fc.workflow.process.NotifyCustomerHub*.

Open the SOA application which contains the base composite which will be customizing. The aforementioned process is present in the *OriginationAndFulfillment* application inside the *com.ofss.fc.workflow.NotifyCustomerHub project*.

To add a customizable scope to the BPEL process, follow these steps:

1. Open the *NotifyCustomerHubProcess.bpel* file in **Design** mode.
2. From the *Component Palette* panel on the right side, in the *BPEL Constructs* section, drag the *Scope* component and drop it on to the BPEL process as shown in the figure.
3. Double click the component and enter appropriate name for the component.
4. Drag and drop the existing *Assign* component labeled *setTitle* on to the newly added *Scope* component.

Figure 8–44 Add Customization Scope to SOA Application



5. Right-click the *Scope* component and select *Customizable* from the context menu.
6. Save all the changes and restart JDeveloper in *Customization Developer Role*.

Step 6 Customize the SOA Composite

After adding a *Customizable Scope* to the base composite, you can start performing customizations in JDeveloper's *Customization Developer Role*.

When you open the *NotifyCustomerHubProcess.bpelf* ile in Design mode, you will notice that all other components in the process, except the customizable Scope component, are disabled. This means that your customizations are limited to that scope.

In the following sections, we will be adding a *Partner Link* call to the previously created *TitleApproval BPEL* process and other required components in the customization mode.

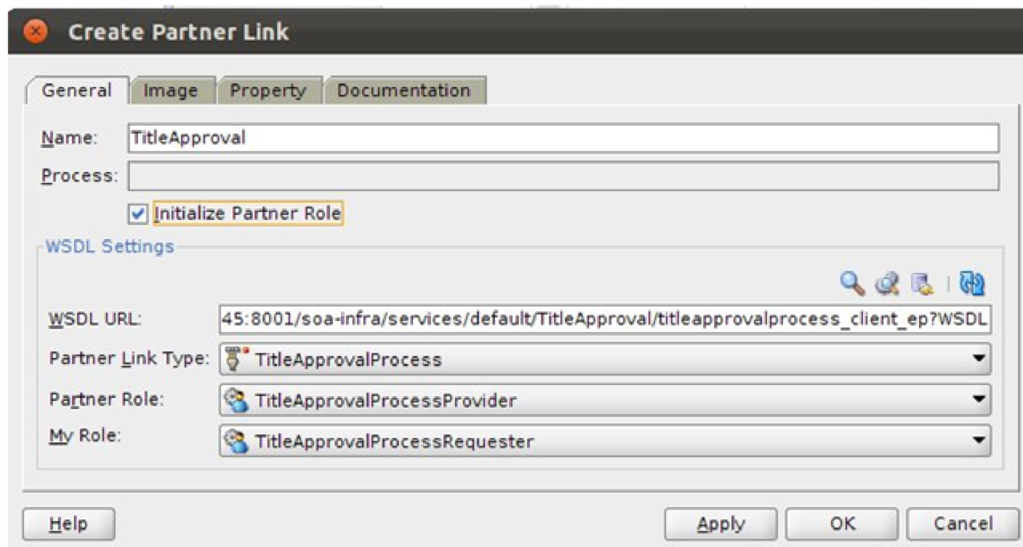
Step 7 Add Partner Link Component

To add a *Partner Link* to the BPEL process, follow these steps:

1. From the Project Navigator, open the NotifyCustomerHubProcess.bpel file in Design mode.

2. From the *Component Palette* panel on the right side, in the *BPEL Constructs* section, drag the Partner Link component and drop it on to the *Partner Links* section of the BPEL process.
3. In the *Create Partner Link* dialogue that opens, enter appropriate name (TitleApproval) for the partner link.
4. Select the following options:
    1. **TitleApprovalProcess** as the Partner Link Type.
    2. **TitleApprovalProcessProvider** as the Partner Role.
    3. **TitleApprovalProcessRequester** as the My Role.

Figure 8–45 Add Partner Link Component

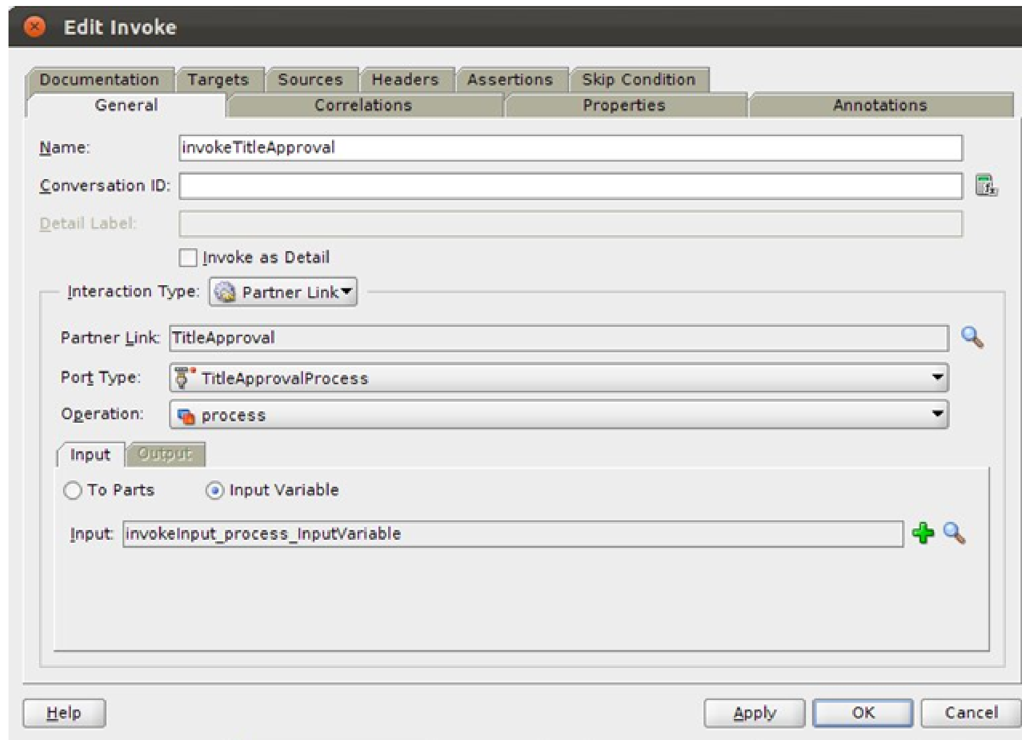


Step 8 Add Invoke Component

You will need to add an *Invoke* component to invoke the previously added partner link call to *TitleApproval*. To add *Invoke component*, follow these steps:

1. From the *Component Palette* panel on the right side, in the *BPEL Constructs* section, drag the *Invoke* component and drop it on the BPEL process inside the *Scope* component.
2. Click the *Invoke* component and drag it to the previously added *TitleApproval* partner link.
3. Double-click the *Invoke* component.
4. In the *Edit Invoke* dialogue that opens, enter an appropriate name (invokeTitleApproval) for the component.
5. Click the icon for adding a new variable in the *Input Variable* section.
6. Click **OK** to save the changes.

Figure 8–46 Add Invoke Component

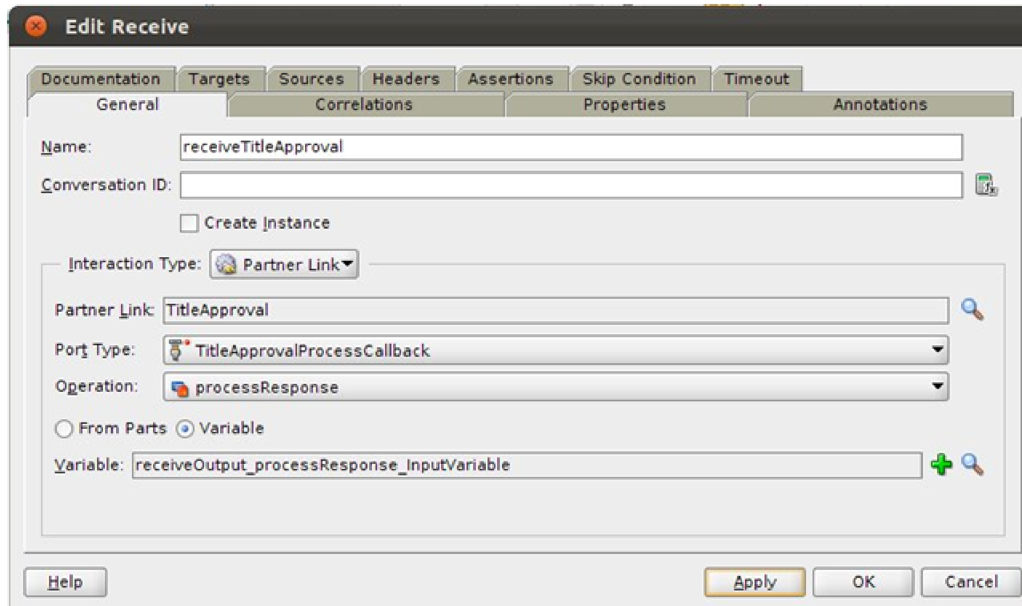


Step 9 Add Receive Component

You will need to add a *Receive* component to receive output from the previously added partner link call to *TitleApproval*. To add *Receive* component, follow these steps:

1. From the *Component Palette* panel on the right side, in the *BPEL Constructs* section, drag the *Invoke* component and drop it on the BPEL process inside the *Scope* component.
2. Click the *Receive* component and drag it to the previously added *TitleApproval* partner link.
3. Double-click the *Receive* component.
4. In the *Edit Receive* dialogue that opens, enter an appropriate name (receiveTitleApproval) for the component.
5. Click the icon for adding a new variable in the *Output Variable* section.
6. Click **OK** to save the changes.

Figure 8–47 Add Receive Component using BPEL functions



Step 10 Add Assign Components

An *Assign* component is used to assign values to a variable. These values can be directly assigned from one variable to another or modified using BPEL functions available.

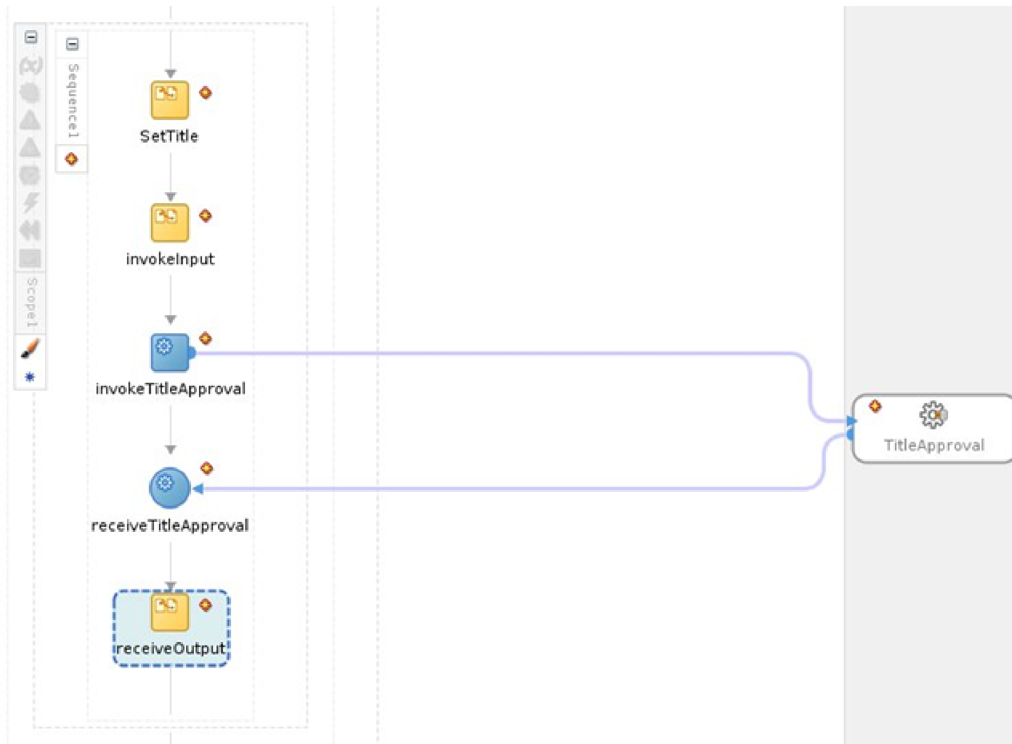
The *TitleApproval* accepts a single *string* as an input and gives a single *string* as an output. The *Input Variable* and *Output Variable* defined in the previously created *invokeTitleApproval* and *receiveTitleApproval* components will be used to hold the input value for the *TitleApproval* and the output returned respectively.

In our case, we will need to add two *Assign* components for following purposes:

- To populate the *Input Variable* of the *invokeTitleApproval* component with the value returned by the existing *setTitle* component.
- To populate the *setTitle* component with the value returned in the *Output Variable* of the *receiveTitleApproval* component.
- Add the two required *Assign* components and save all changes.

  The customized process should look as shown in the figure below.

Figure 8–48 Add Assign Component



Step 11 Deploy and Test Customized SOA Composite

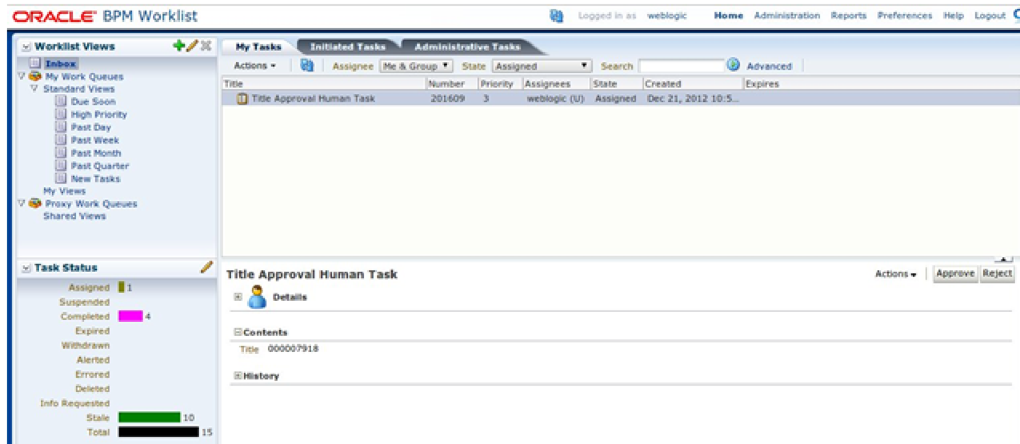
After performing the customizations, build the project and deploy it to a SOA Server. You will need to include the *Customization Class JAR* in the runtime classpath of the deployed application.

To test the customized composite, follow these steps:

1. Log in to the *em* console and select the composite from the *SOA Domain*.
2. Click **Test** and enter appropriate input.
3. A *Human Task* will be created and assigned to the user as specified in the human task definition.
4. Log in to the *BPM Worklist* application with the appropriate user.

   You will be able to see the previously created task on the dashboard.
5. Select the task from the list and click *Approve* or *Reject* button to perform approve or reject action on the task.

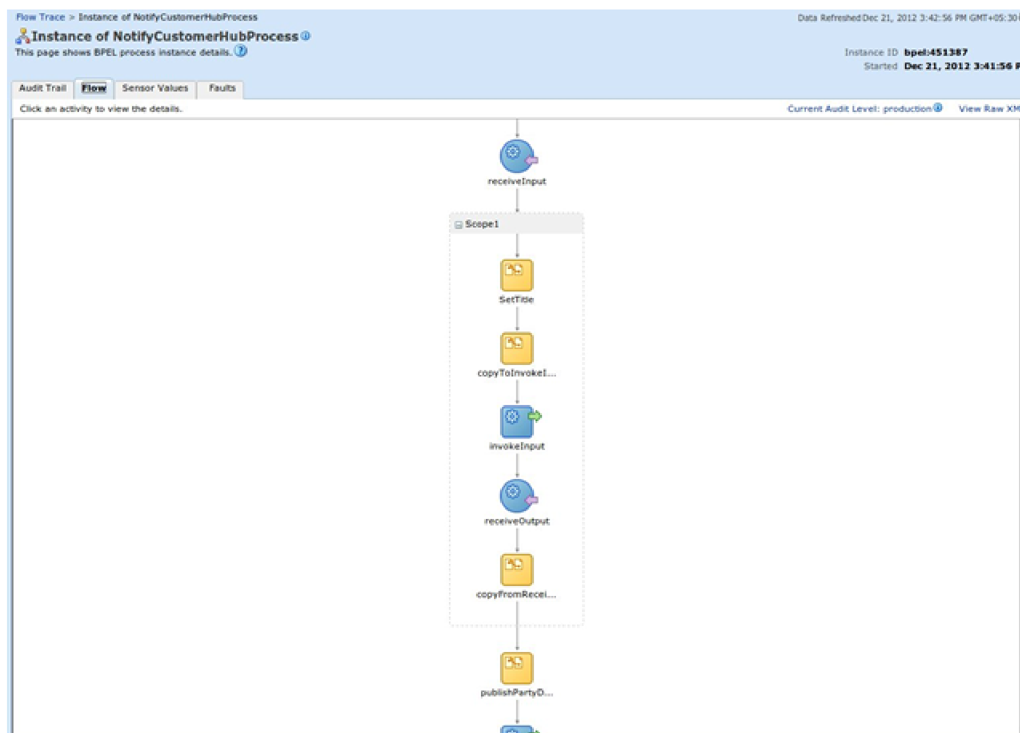
Figure 8–49 Deploy and Test Customized SOA Composite - My Tasks Tab



6. On the *Dashboard* panel of the *em*, click the composite *Instance*.

   In the *Flow* panel of the screen, you will be able to see the flow of the customized composite.

Figure 8–50 Deploy and Test Customized SOA Composite - Flow



7. Click the *invokeTitleApproval* component to see the request xml for the partner link call to *TitleApproval* process.

Figure 8–51 Deploy and Test Customized SOA Composite - Invoke Input

invokeInput

[2012/12/21 15:42:10]
Started invocation of operation "process" on partner "TitleApproval".

[2012/12/21 15:42:11]
Invoked 1-way operation "process" on partner "TitleApproval".


```
- <invokeInput_process_InputVariable>
  - <part xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" name="payload">
    - <process
      xmlns="http://xmlns.oracle.com/OriginationAndFulfillment/TitleApproval/TitleApprovalProcess">
        <input>000007918</input>
      </process>
    </part>
  </invokeInput_process_InputVariable>
```


Copy details to clipboard

8. Click the *receiveTitleApproval* component to see the response xml for the partner link call to *TitleApproval* process.

Figure 8–52 Deploy and Test Customized SOA Composite - Receive Output

receiveOutput

[2012/12/21 15:42:11]
Waiting for "processResponse" from "TitleApproval". Asynchronous callback.

[2012/12/21 15:42:42]
Received "processResponse" callback from partner "TitleApproval"


```
- <receiveOutput_processResponse_InputVariable>
  - <part xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" name="payload">
    - <processResponse
      xmlns="http://xmlns.oracle.com/OriginationAndFulfillment/TitleApproval/TitleApprovalProcess">
        <result>000007918 - Approved</result>
      </processResponse>
    </part>
  </receiveOutput_processResponse_InputVariable>
```


Copy details to clipboard

9 Batch Framework Extensions

Most of the enterprise applications require bulk processing of records to perform business operations in real-time environments. These business operations include complex processing of large volumes of information that are most efficiently processed with minimal or no user interaction. Such operations would typically include time-based events (for example, month-end calculations, notices or correspondence), periodic application of complex business rules processed repetitively across very large data sets (for example, rate adjustments). All such scenarios form a part of batch processing. Thus, batch processing is used to process billions of records for enterprise applications.

There are few primary categories in OBP Batch Processes:

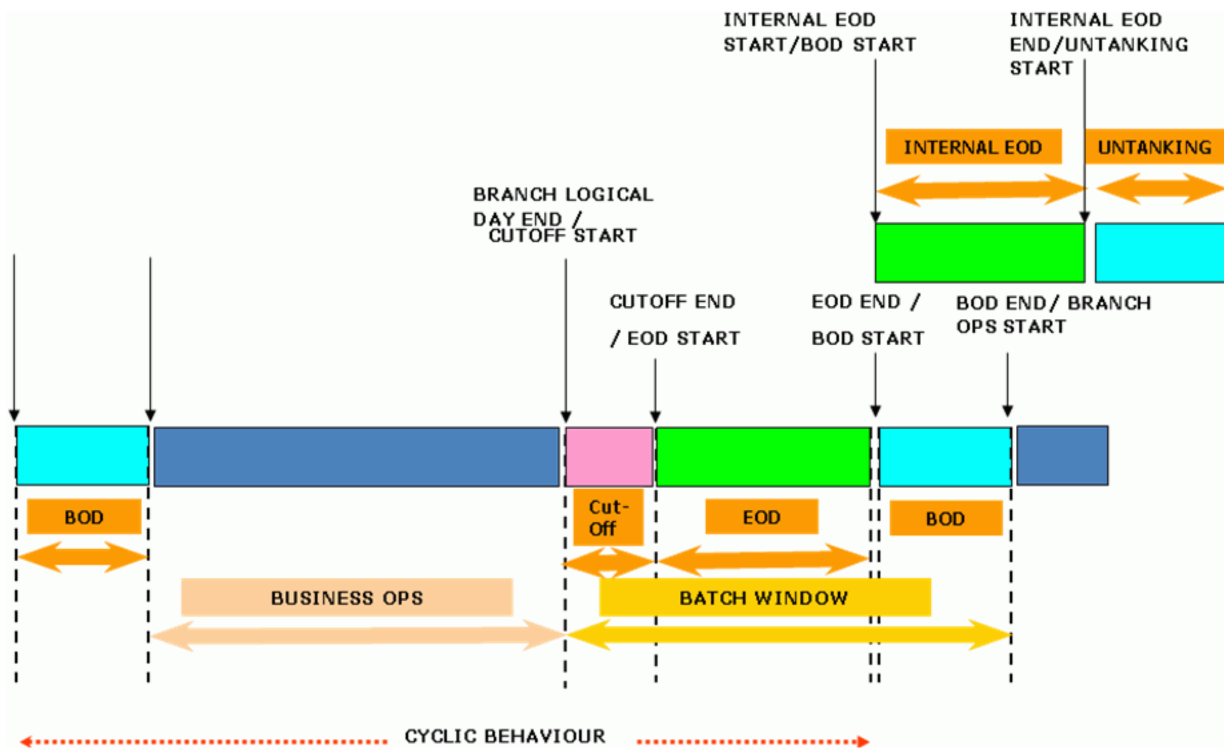
- Beginning of Day (BOD)
- Cut-off
- End of Day (EOD)
- Internal EOD
- Statement Generation
- Customer Communication

Additional categories can also be configured as per the requirement.

9.1 Typical Business Day in OBP

The following graphic describes a typical business day in OBP:

Figure 9–1 Business Day in OBP



9.2 Overview of Categories

This topic describes the categories in OBP Batch Processes.

9.2.1 Beginning of Day (BOD)

The activities for a new day of the bank / branch begin with the BOD (beginning of day). This is a batch process which executes a group of shells (programs) which are required to be performed before the normal day-to-day operations at the branch can be started. The BOD typically includes

- TD Maturity and Interest Processing
- Standing instructions execution (Based on setup)
- Loan Charging, Drawdown and Auto-Disbursement
- Value date processing of cheques (Based on the setup)
- Reports Generation

9.2.2 Cut-off

Cut-off is a process that sets the trigger for modules to start logging transactions with a new date.

It also marks cut-off for the channel transactions.

9.2.3 End of Day (EOD)

Once all the operations for the current working date of the branch are completed and all the transactions are posted the Branch EOD batch is started. This batch executes a

group of shells (programs) which are required to be performed before the Business Date of the branch is changed to the next working date. It marks the end of a business day. The EOD typically includes:

- DDA Sweep-Out Instruction
- Loan Rate Change
- Term Deposit Lien Expiry and Interest Capitalization
- DDA Balance Change, Rate Change, Interest Capitalization and Settlement
- Account and Party Asset Classification
- Loan Interest Computation
- Accounting Verification

9.2.4 Internal EOD

This category performs all the activities which do not affect the customer account but are related to bank internal processing. Internal EOD typically includes:

- Interest Accrual and Compounding
- Deferred Ledger Balance Update
- Balance Period Creation
- Financial Closure

9.2.5 Statement Generation

This category performs different statement generation activities on the monthly or yearly basis. It typically includes:

- Periodic PL balance history Generation
- CASA Statement Generation
- Loan Statement Generation
- TD Statement Generation

9.2.6 Customer Communication

This category performs different communications which needs to be done with the customer on the regular basis. It typically includes:

- Regular Account Balance Notification On Specified Date

9.3 Batch Framework Architecture

This section describes the architecture of the Batch Framework.

9.3.1 Static View

The static view of batch framework shows the architecturally significant classes included in the batch framework being developed. It is in line with the overall design and development guidelines and principles. This section shows the class diagrams representing the static model of the batch framework emphasizing the static structure of the system using objects, attributes and relationships.

Class Diagram

The following diagram depict details about the different classes of the code which are involved in the batch execution.

Figure 9–2 Batch Framework Architecture - Static View

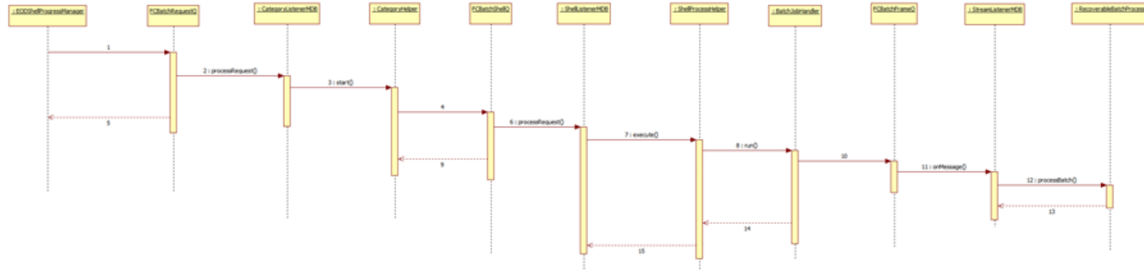
9.3.2 Dynamic View

This section emphasizes the dynamic behavior of the system by showing collaborations among objects and changes to the internal states of objects.

Sequence Diagram

The following diagram depicts the sequence diagram for Batch framework. It provides details about the flow of control during the batch execution.

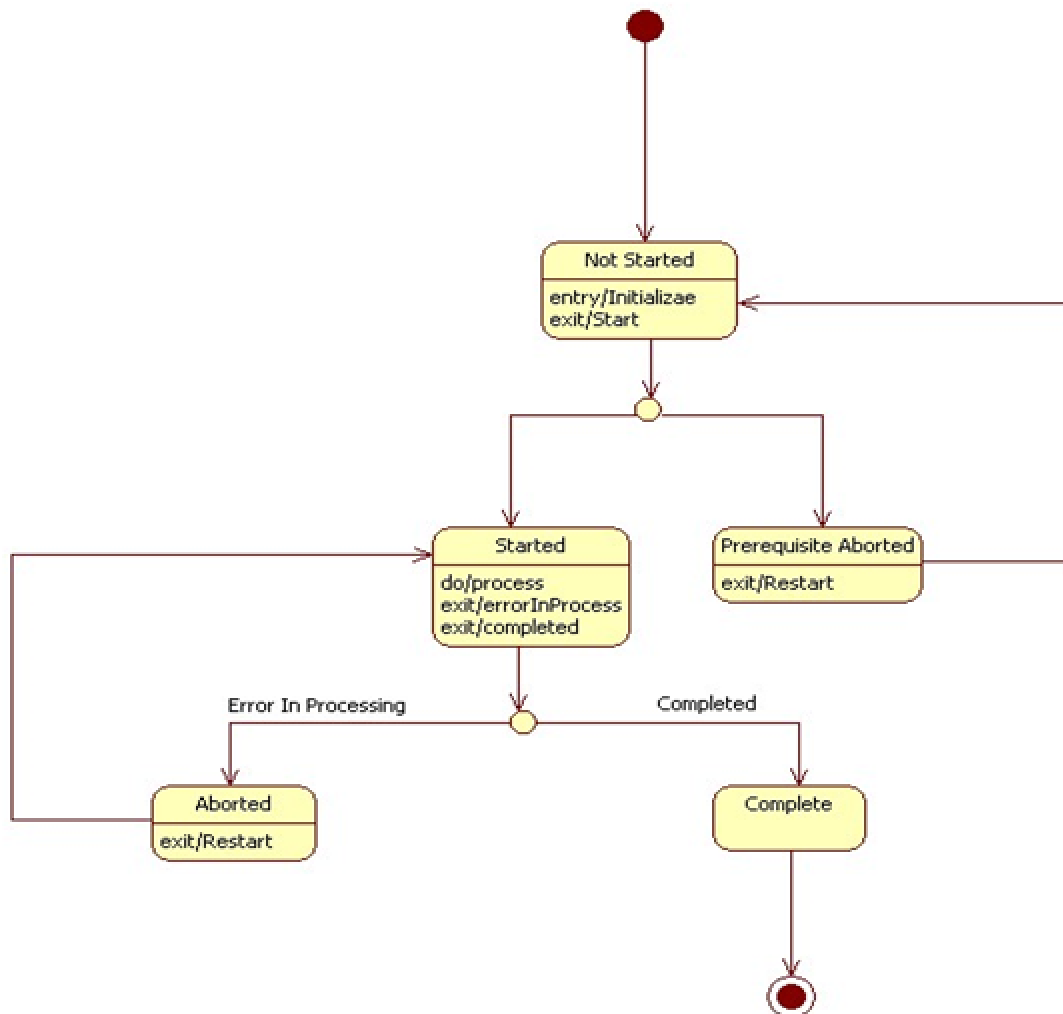
Figure 9–3 Dynamic View Sequence Diagram



State Diagram of a Shell

When the end of day batch starts, every shell is reset to Not Started. During the course of the batch, the shell status will change till the shell is completed. The transitions of shell execution are explained in the state diagram below:

Figure 9–4 State Diagram of a Shell



9.4 Batch Framework Components

This section describes the batch framework components.

9.4.1 Category Components

This section describes the category components.

CategoryListenerMDB

This MDB listens to the FCBBatchRequestQ and delegate to CategoryHelper for further processing.

CategoryHelper

This class starts or restarts a category depending upon the request received.

It will validate the input xml Request, validate the prerequisites for starting/restarting a category, get the list of shells that can be initiated on a category start/shell

completion, prepare the Batch XML Message for each of the shell and send a message to FCBBatchShellQ for each Shell to be started.

It also services requests initiation of the next shell after a shell has been successfully completed.

9.4.2 Shell Components

This section describes the shell components.

ShellListenerMDB

This MDB listens on ShellRequestQ and delegate to ShellProcessHelper for processing.

ShellProcessHelper

This class validates the input request and calls appropriate batch handler to start the shell. It will call:

- BatchFrameworkShellHelper for non-report Java Bean Based Shell
- ProcedureShellHelper for Procedure based shell
- BatchReportShellBean for report shells
- BatchReportRestartShellBean for report epilogue shells

After successful completion of shell, it sends an 'InitiateNext' request to the CategoryHelper to initiate subsequent shells. If the shell is aborted, this class will mark the shell as aborted.

ShellRootHelper

This is the base class which is required for each shell processing. It Implements the IBatchHandler Interface. All the batch handlers extend this class.

This class contains the common methods which need to invoked for processing each shell for example, method to parse the request, methods used to acquire and release lock for shell, method to initiate the shell and mark the shell as complete upon successful completion.

BatchFrameworkShellHelper

This SSB extends ShellRootHelper. It is responsible for executing non report Java Bean based shells. This class will validate the process date of the request, prepare a BatchContext entity encapsulating the batch run details and call BatchJobHandler to run the shell.

BatchJobHandler

This class is responsible for putting the stream requests in queue. It will get the Batch Processes (1 Batch Process per stream) by calling BatchProcessManager and post them to the Stream Queue.

After posting the stream requests, it will start polling on the status of the streams till either all streams are completed or any one of the streams is aborted. If the streams are completed, it will return 'Success' as the status else it will return the status as 'Failure'.

BatchProcessManager

This component acts as a manager for the complete batch process. The functionalities include finding the pending batch processes and creating batch processes and returning the list of batch processes to be initiated.

If the shell is being restarted, this class will fetch the aborted batch processes, reset them and return list of reset Batch Processes to be re-initiated.

If the shell is being started, it will call BatchJobHelper to populate the driver table and create the batch processes and return the list of batch processes to be initiated.

BatchJobHelper

This class is responsible for populating the driver table and creating the Batch Processes.

ProcedureShellHelper

This class is used to process DB procedure based shells. This class will fetch the procedure to be executed from the 'flx_batch_job_shell_master' table and execute it.

BatchReportShellBean

This class is responsible initiating the generation of reports. It will call ReportJobRequestor to fetch the reports to be generated, prepare the generation request and post the requests to the Report Queue.

After the successful posting of requests, the report shell will be marked as complete. The report generation will be done in parallel to the execution of subsequent shells.

BatchReportRestartShellBean

This class is used for the epilogue shell in each category which has reports generation.

This class will check whether all the reports have been generated or not. This class will call ReportJobRequestor which will poll on the status of the reports till all the reports are completed or aborted.

If the aborted reports are to be regenerated, it will also post the messages to regenerate aborted reports.

9.4.3 Stream Components

This section describes the stream components.

StreamListenerMDB

This MDB is responsible for listening to the stream queue. It delegates the processing to StreamProcessHelper.

StreamProcessHelper

This class is responsible for starting the batch process. It calls RecoverableBatchProcess to start the process.

BatchProcess

This component is the base class for processing the batch process. The StreamProcessHelper calls this class for starting the batch process. This class will initialize the BatchShellResult, clear the StaticCacheRegistry (if the BatchProcess is the first BatchProcess of a category), process the BatchProcess, retry the processing of the BatchProcess (if the earlier failure was due to StaleState or PKDuplication) and finalize the BatchShellResult status depending on success/failure.

The call to process a batch request is routed through this class to the subclass.

RecoverableBatchProcess

This component processes the batch data and inherits the BatchProcess class. This class will process all the records in the sequence number range specified in the BatchShellResult.

This class will fetch the records from the driver table and process them sequentially.

To execute each record, it will call service method of the service class stored in the BatchShellDetails table using reflection. If there is any exception, it will call the exception handler method of the service class if the service class implements the IBatchExceptionHandler interface.

It will commit the transaction at the end of commit size. If all the records are executed successfully, the stream is marked as complete. If any record fails, the stream is marked as aborted.

Recoverable Batch Process can handle the failure of a record in the following ways depending upon the set up.

- Recoverable Batch Process with Recovery Mode ON

  When a record fails, the previous records in the commit size will be committed and marked as success, the failed record will be marked as failed and the execution of batch process resumes from the record after the failed record. Hence in this mode all the successful records are committed and the failed records are marked as failed.

- Recoverable Batch Process with Recovery Mode OFF

  In this mode, when a record fails the earlier records in the commit size are marked as skipped for the current run, the failed record is marked as failed and execution of batch process resumes from the record after the failed record.

Simple Batch Process

While executing the shell as a Simple Batch Process, the stream will be executed till the first failed record. When a record fails, the previous records in the commit size will be committed and the shell will be aborted. The records after the failed record will be skipped in the current run.

SimpleBatchProcess class is no longer used

The functionality of SimpleBatchProcess is executed through RecoverableBatchProcess by specifying the FLG_PROCESS_TYPE as "SBP" in the flx_batch_job_shell_dtls table. In the flx_batch_job_shell_dtls table:

- FLG_PROCESS_TYPE column indicates whether it is RecoverableBatchProcess (RBP) or SimpleBatchProcess (SBP).
- FLG_RECOVERY_MODE column indicates whether the Recovery mode is ON or OFF
- Simple Batch Process should have Recovery Mode as ON.

Example 9–1

```
Total Number of records =20;
Commit Frequency = 10
Failed Records = 5, 18
```

The shell will be executed as follows:

- Recoverable Batch Process with Recovery Mode ON:

- Records 5 and 18 will be skipped and rest all the records will be committed successfully

- Recoverable Batch Process with Recovery Mode OFF:
  - Records 1 - 5 will be skipped.
  - Records 6 - 15 will be committed successfully.
  - Records 16-18 will be skipped
  - Records 19 - 20 will be committed successfully
- Simple Batch Process:
  - Records 1- 4 will be committed successfully. Rest of the records will be skipped.

9.4.4 Database Components

The Database Server houses the following components:

Table 9–1 Database Server Components

Batch Framework Tables	Description
flx_batch_job_category_master	This table contains details of each of the category per branch group. This table contains the description, last run date and the multi run flag for the category. The status, state flag and the last Run Date for each category is maintained and validated from this table during batch run.
flx_batch_job_grp_category	This table contains the previous, current and the next run date for each category per branch group.
flx_batch_job_category_depend	This table contains the category dependencies.
flx_batch_job_shell_master	This table contains details of each shell per branch group. Shell wise status, Last Run Date, process category and frequency of shell execution are the critical attributes of this table. This table will also specify whether the shell is Java Bean based shell or Procedure Based shell.
flx_batch_job_shell_depend	This table contains the dependencies of and for each shell in flx_batch_job_shell_master.
flx_batch_job_shell_dtls	This table will contain the details for executing Java Bean Based shell.
flx_<module>_drv_<action>	This driver table contains the batch execution details for the particular action
flx_<module>_actions_b	This table defines the action type, action name and action executor which gets mapped to the driver table. The action type value is populated as action sequence in the driver table.
flx_batch_job_shell_results	This table contains execution details of each stream of each shell for each batch run per branch group.
flx_batch_job_brn_grp_mapping	This table will contain the mapping between the branch group and the branches
flx_batch_job_grp_brn_xref	This table will contain the list of branches for which a category is being run. This table will be used only when a category is running.

9.5 Batch Configuration

The following section defines the configuration which needs to be done in order to create a new category or add a new batch shell for batch execution using the batch framework.

9.5.1 Creation of New Category

The following steps explain the creation of new category:

1. Create an entry in **flx_batch_job_category_master**:

   This contains the new category name and category code along with branch group code to be defined here.

Table 9–2 FLX_BATCH_JOB_CATEGORY_MASTER

Columns	Description
DAT_EOD_RUN	This column specifies the date on which the category was last run
COD_EOD_STATUS	This column specifies the Status of the last category run. 0 - Successful Completion ; 1 - The process was aborted after start
COD_PROC_CATEGORY	This column specifies the category code. 1 - EOD, 2 - BOD etc. Any number of process categories can be defined
FLG_MULTI_RUN	This column specifies whether this category can be run multiple times. 0 - Multi-Run is disabled; 1 - Multi-Run is enabled.
FLG_EOD_STATE	This column specifies the flag indicating the state of the category. R - Running ; C - Completed (i.e. not running)
TXT_CATEGORY	This column specifies the category description
COD_BRANCH_ GROUP_CODE	This column specifies the code of the Branch Group of the category
OBJECT_VERSION_ NUMBER	This column specifies the version number of the category
NAM_PROD_REP_DB	This column mentions about the database repository

2. Create an entry in **flx_batch_job_grp_category**:

   This contains branch group code, new category code, bank code and dates relating to run the category.

Table 9–3 FLX_BATCH_JOB_GRP_CATEGORY

Columns	Description
BRANCH_GROUP_ CODE	This column specifies the Branch Group Code
COD_PROC_CATEGORY	This column specifies the procedure category
DAT_LAST_PROCESS	This column specifies the date on which the category was last run
DAT_PROCESS	This column specifies the current date of the category
DAT_NEXT_PROCESS	This column specifies the next date of the category

3. Create an entry in **flx_batch_job_category_depend** (if required):

   This table will contain the category dependency. If the category does not depend on any other category, no entry in this table is required.

Table 9–4 FLX_BATCH_JOB_CATEGORY_DEPEND

Columns	Description
COD_PROC_CATEGORY	This column specifies the procedure category
COD_BRANCH_ GROUP_CODE	This column specifies the branch group code
COD_PROC_REQD_ CATEGORY	This column specifies the dependency of the required procedure category which needs to be run before this category
COD_PROC_ VALIDATION_DATE	This column defines the validation time. It can be Current/Previous.

4. Create bean or procedure based shells:

   New shells (bean/procedure based, as shown in the section below) are created and linked to the category by populating the cod_proc_category column in those tables with the new category code created in the flx_batch_job_category_master.

5. Add enumeration:

   In the middleware code, add an enum value in the ProcessCategoryType.java for the category.

6. Add category code in the property file:

   In the middleware code, add the entry for the category in the ProcessCategoryType_en.properties file.

7. Middleware Changes

   If any validations required or any dependency on other categories we can make changes in EODShellProgressManager.java file accordingly.

Figure 9–5 Creation of New Category

Java - com.ofss.fc.module.global/src/com/ofss/fc/app/batch/EODShellProgressManager.java - Eclipse

```
568                 // "1" Eod Category
569                 if (validateDependancy(dependCategory, dateLastProcess)) {
570                     ErrorManager.throwFatalException(FCRJConstants.MID_EEC_EOD_NOT_DONE, null);
571                 }
572             }
573             /* For Internal System EOD to start, Eod for that day should have been run */
574             if (processCategory.equals(ProcessCategoryType.INTERNAL_SYSTEM_EOD.getValue())) {
575                 // "16" Internal system EOD Category
576                 dependCategory = ProcessCategoryType.END_OF_DAY.getValue();
577                 // "1" Eod Category
578                 if (validateDependancy(dependCategory, dateProcess)) {
579                     ErrorManager.throwFatalException(FCRJConstants.MID_EEC_CURR_EOD_NOT_DONE, null);
580                 }
581             }
582             /* For UnTanking to start, Internal System EOD for that day should have been run */
583             if (processCategory.equals(ProcessCategoryType.UNTANKING.getValue())) {
584                 // "20" UnTanking Category
585                 dependCategory = ProcessCategoryType.INTERNAL_SYSTEM_EOD.getValue();
586                 // "16" Internal system EOD Category
587                 if (validateDependancy(dependCategory, dateProcess)) {
588                     ErrorManager.throwFatalException(FCRJConstants.MID_EEC_INTERNAL_EOD_NOT_DONE, null);
589                 }
590             }
591             /* For Automatic EFS to start, cutoff for that day should not have been run */
592             if (processCategory.equals(ProcessCategoryType.AUTOMATIC_EFS.getValue())) {
593                 // "13" Automatic EFS
594                 dependCategory = ProcessCategoryType.CUTOFF.getValue();
595                 // "1" Eod Category
596                 if (validateDependancy(dependCategory, dateLastProcess)) {
597                     ErrorManager.throwFatalException(FCRJConstants.MID_EEC_CUTOFF_NOT_DONE, null);
598                 }
599             }
600             /* For Automatic Mark write off to start, Automatic write off should run once before */
601             if (processCategory.equals(ProcessCategoryType.MARK_FOR_WRITE_OFF.getValue())) {
602                 // "14" Mark write off
603                 dependCategory = ProcessCategoryType.AUTOMATIC_WRITE_OFF.getValue();
604                 // "15" Automatic write off
605                 if (validateDependancy(dependCategory, dateLastProcess)) {
606                     ErrorManager.throwFatalException(FCRJConstants.MID_ACC_MARK_WRIT_OFF, null);
607                 }
608             }
609             // date to be considered
610             eodStatusConsolidatedResponse = getCategoryStatus(processCategory, jobCode, null);
611             eodStatusConsolidatedResponse.setProcessDate(dateProcess);
612             eodStatusConsolidatedResponse.setNextProcessDate(dateNextProcess);
613             eodStatusConsolidatedResponse.setStatus(status);
614             extension.postValidateProcessFlow(sessionContext, processCategory, jobCode);
615             fillTransactionStatus(status);
616         } catch (FatalException e) {
```

9.5.2 Creation of Bean Based Shell

In this batch execution (Type "B"), the business logic is provided in the service method of the java class.

1. Create an entry for Shell Parameters in the table **FLX_BATCH_JOB_SHELL_MASTER**.

Table 9–5 FLX_BATCH_JOB_SHELL_MASTER

Columns	Description
COD_EOD_PROCESS	Process code. This is the name of the program module that will be started as a process by the EOD monitor.
TXT_ PROCESS	Process name to be displayed in the new UI screen
FRQ_PROC	Frequency at which this process is to be run. 1 - Daily 2 - Weekly 3 - Fortnightly 4 - Monthly 5 - Bi-monthly 6 - Quarterly 7 - Half-yearly 8 - Yearly.
COD_PROC_STATUS	Process Status Code 0 - Complete 1 - Started 2 - Not Started 3 - Aborted 4 - Prerequisite Aborted 5 - Prerequisite Absent
NUM_PROC_ERROR	Last error returned by this process
FLG_RUN_TODAY	Flag indicating whether process to be run today Y/N
COD_PROC_CATEGORY	Category code to which this shell belongs to e.g.: 1 - EOD, 2 - BOD and so on.

Table 9–5 (Cont.) FLX_BATCH_JOB_SHELL_MASTER

Columns	Description
SERVICE_KEY	Service method to be executed
NAM_COMPONENT	Name of the Procedure (if procedure based batch execution) or fully qualified class name of the Batch Handler (if bean based). 1. com.ofss.fc.bh.batch.BatchFrameworkShellHelper - java bean based shell 2. com.ofss.fc.bh.batch.BatchReportShellBean - procedure based shell for reports 3. com.ofss.fc.bh.batch.BatchReportRestartShellBean - procedure based for report epilogue shell
TYPE_COMPONENT	This indicates whether the specified nam_component is Java class or Function. P stands for Function and B Stand for the Java Class.
NAM_DBINSTANCE	The DB instance for PROD or REP(reports)
COD_BRANCH_GROUP_CODE	Specifies the branch group code that a branch is part of.
OBJECT_VERSION_NUMBER	This column specifies the version number of the category

2. Create an entry for Shell Details in the table **FLX_BATCH_JOB_SHELL_DTLS**.

   This table contains the following parameters;

Table 9–6 FLX_BATCH_JOB_SHELL_DTLS

Columns	Description
COD_SHELL	A unique code for batch shell.
SHELL_NAME	Provide a name to batch shell
SHELL_DESCRIPTION	Description about the batch shell
COMMIT_FREQUENCY	Provide the commit frequency thus, after every this no of records have been processed the framework would commit those set of records
FLG_RECOVERY_MODE	Flag indicating whether recovery mode is ON or OFF. Possible values are 'Y' and 'N' only. This would be only used by Batch Processes which support recovery mode functionality but there might be batch processes which would ignore this flag (e.g.: SBP)
FLG_STREAM_TYP	Define the type of stream for the batch shell. This would have three possible values ('S' - fixed no of streams, 'R' - fixed no of rows, 'N' - no streams)
STREAM_COUNT	Define the no of streams to be created for the batch shell. This is only applicable if the StreamType is marked as 'S' or 'R'
INPUT_DRV_NAME	Define the fully classified class name mapped to the driver table
INPUT_SHELL_PARAM	Define the name for the shell parameter
SERVICE_CLASS_NAME	Define the fully classified class name for the service class. This class is the starting point of the business logic execution. In case of service class name as ActionSetProcessor, the action sequence column is populated in the driver table. The execution is done corresponding to those actions
SERVICE_METHOD_NAME	Define only method name of the service. The service method should have input parameter as driver table entity
DRV_POP_PROC_NAME	Defines the name procedure used for driver table population. The procedure should have three input parameters branch group code, process date and next process date. Use only procedures instead of packages for data population. Because db2 will not support Package

Table 9–6 (Cont.) FLX_BATCH_JOB_SHELL_DTLS

Columns	Description
FLG_PROCESS_TYPE	It defines the type of process RBP or SBP. In RBP (Recoverable Batch Process) if any records fails in batch it will continue and execute rest of the records in the stream. But in case of SBP (Simple Batch process) it will abort the stream
HELPER_CLASS_NAME	It defines the helper class for caching big queries
BATCH_NO	Indicates the batch number for the shell

3. Create an entry for Shell Execution Order in the table **FLX_BATCH_JOB_SHELL_DEPEND**.

Table 9–7 FLX_BATCH_JOB_SHELL_DEPEND

Columns	Description
COD_EOD_PROCESS	Process code This is the name of the program module that will be started as a process by the EOD monitor
COD_REQD_PROCESS	Required process code after which the framework will run process code
COD_PROC_CATEGORY	Category of the Process Code. 1 - EOD, 2 - BOD and so on.
COD_REQD_PROC_CAT	Category of the required process code. 1 - EOD, 2 - BOD and so on.
COD_BRANCH_GROUP_CODE	This column specifies the branch group code

If the shell is not dependent on any other shell or category then no need to keep an entry in this table.

4. Create a new driver table (the name of the table prefix by **FLX_<ModuleCode>_drv_<>)** for the Batch Shell. This is the table from which the data will be picked up for processing by the defined batch process. This table should be populated by the procedure written for population of the driver table. This table would contain the following parameters:

Table 9–8 Driver Table

Column	Description
DATE_RUN	Defines the date on which the batch job was run (process date).Value in this column needs to be populated by the driver table population procedure.
SEQ	Sequence no for the data present in the table i.e. simple sequence from 1 to maximum number of records present in table. Value in this column needs to be populated by the driver table population procedure.
PROCESS_RESULT	Define the column which would contain the result of processing of each record of this table. This column would be updated the framework with values 0,1, 2,3 or 4 indicating not processed, processing of record successful, failed with business exception , failed with framework exception or failed with SQL exception respectively.
ERROR_CODE	Define the column for error code. This would be updated the framework with the error code returned by the processing logic (currently updating the exception if any occurred).
BRANCH_CODE	Attribute specifies the branch code in which the shell is executed
BRANCH_GROUP_CODE	Attribute specifies the branch group code that a branch is part of.

Table 9–8 (Cont.) Driver Table

Column	Description
ERROR_DESC	Attribute specifies error description. This will populated by the batch framework in case the record aborts
ACTION_SEQUENCE (Optional)	In case of service action as ActionSetProcessor, the batch execution is done through the executor framework defined in the action table of the module. The details of this action table in mentioned below. If user want to execute multiple actions, then the comma separated action_type can be defined in this column. They will be executed based on the defined priorities.
<Custom_Columns>	Define the other columns required which would contain the data required by the processing logic. Typical examples would be a column containing accountNo (if the main logic is per account) or customerId or txnRefNo etc. We can have multiple such columns which are used for per record processing for e.g. we can have two columns branchCode, accountNo.

Note: DATE_RUN, SEQ, BRANCH_GROUP_CODE columns are part of the Unique key. e.g.: flx_in_drv_eod_actions

5. Add the entry of the action in the actions table (FLX_<ModuleCode>_actions_b) for the shell where the service method is defined as ActionSetProcessor in the details table. This table would contain the following parameters, for example, flx_td_actions_b

Table 9–9 Actions Table

Column	Description
ACTION_TYPE	Stores the type of action to be performed. The defined action type is populated in the action sequence column of the driver table.
ACTION_LEVEL	Stores the action level of the action as 0,1,2 based on the execution status.
PRIORITY	Stores the priority of the action.
ENTITY_STATUS	Stores the status of the entity.
ACTION_NAME	User friendly name of the action.
ACTION_DESC	Stores the description of the action.
ACTION_EXECUTOR	Stores the name of the action executor which needs to be executed when the service action is populated as ActionSetProcessor.
HOLIDAY_TREATMENT	Stores the holiday treatment of the action.
HOLIDAY_EPOCH_TYPE	Stores the holiday epoch type of the action.

6. Create a procedure (the name of the proc prefixed with **ap_<Module Code>_pop_drv)** which would populate the data in the driver table, created above. This procedure would be called at the first time when the Batch shell is run. The procedure will have only three arguments branch group code, process date and next process date. e.g.: ap_in_pop_drv_eod_actions
7. Create an entity which extends **AbstractBatchData** and map this entity to the driver table. This entity name would be the one which will carry the data to be processed for batch processing. This should be provided in the InputDataName column of flx_batch_job_shell_dtls table. e.g.: InterestEODActionSetBatchData

8. Map the entity to the driver table in the hbm. The entity attributes should represent only Extra columns added in the driver table. They shouldn't be mapped to the seq, date_run, error_code, process_result columns. For example, InterestEODActionSet.hbm.xml
9. Make additions in **batch-mapping.cfg** file for the new hbm entities created for BatchData. For example, account-mapping.cfg.xml
10. Create **Helper Class** for caching big queries in Application layer. The fully qualified class name of the helper class needs to be defined in the **HELPER_CLASS_NAME** column of the FLX_BATCH_JOB_SHELL_DTLS table. For example, InterestEODActionSetBatchDataHelper.java
11. Create a **service processor class** with the **service method** which processes the batch application. For example, ActionSetProcessor

    The fully qualified class name of this service processor class need to be defined in the **SERVICE_CLASS_NAME** column of the FLX_BATCH_JOB_SHELL_DTLS table.

    This processing method defined in this class should be specified in the **SERVICE_METHOD_NAME** column of the FLX_BATCH_JOB_SHELL_DTLS table.

    The service method should have two input arguments - ApplicationContext and AbstractBatchData.

    If the shell needs to handle the batch exceptions, the service processor class should implement IBatchHandler interface.

> **Note:** The above steps would suffice for creating a batch shell to be run using the new Batch Framework. The Results of the shell will be present in the FLX_BATCH_JOB_SHELL_RESULTS table.

9.5.3 Creation of Procedure Based Shell

In this batch execution (Type "P"), the business logic is provided in the Stored Procedures.

1. Create an entry for **Shell Parameters** in the table **FLX_BATCH_JOB_SHELL_MASTER**. Same as described in the above section.
2. Create an entry for **Shell Execution Order** in the table **FLX_BATCH_JOB_SHELL_DEPEND**. Same as briefed in the above section if there is any dependency with any other shell.
3. Create a **function** in Database which contains the Business logic. This function will be used for batch procedure based execution and the signature of the function must have the arguments as shown in the example:

```
CREATE OR REPLACE FUNCTION ap_as_batch_verify
                     (var_pi_cod_brn_grp_code  VARCHAR2,
                      var_pi_cod_user_no       NUMBER,
                      var_pi_cod_user_id       VARCHAR2,
                      var_pi_dat_process       DATE,
                      var_pi_nam_bank          VARCHAR2,
                      var_pi_cod_stream_id     NUMBER,
                      var_pi_cod_eod_process   VARCHAR2,
                      var_pi_cod_proc_category NUMBER)  RETURN NUMBER AS
VAR_L_RETCODE NUMBER;
BEGIN
  VAR_L_RETCODE := 0;
```

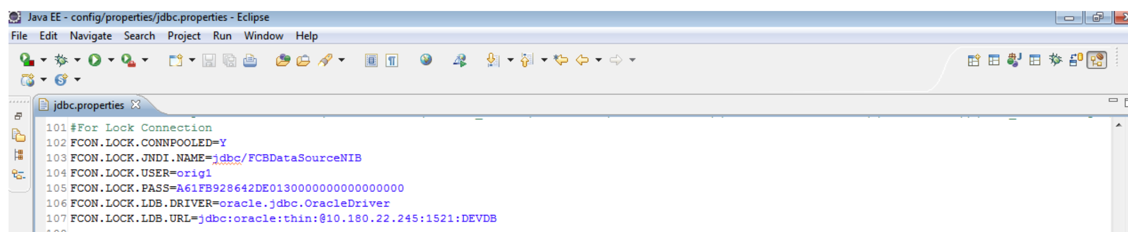
```
-----------------------------1. Init Restart---------------------------
  BEGIN
    plog.error('var_pi_dat_process :  ' || var_pi_dat_process);
    var_l_ret_code := ap_ba_init_restart(var_pi_cod_eod_process,
                                         var_pi_cod_brn_grp_code,
                                         var_pi_cod_proc_category);
    IF (var_l_ret_code != 0) THEN
      BEGIN
        IF (var_l_ret_code = -2) THEN
          RETURN var_l_ret_code;
        ELSE
          ora_raiserror(SQLCODE, 'Error in executing Init Restart ', 53);
          RETURN 95;
        END IF;
      END;
    END IF;
  END;
-------------------------------2.Bisuness Logic-------------------------
...we can write a piece of code …or a new proc which contain all the business
logic...
---------------------------------3.Finish Restart-----------------------
  BEGIN
    var_l_ret_code := ap_ba_finish_restart(var_pi_cod_eod_process,
                                           var_pi_cod_brn_grp_code,
                                           var_pi_cod_proc_category,
                                           var_pi_dat_process);
    IF (var_l_ret_code != 0) THEN
      ora_raiserror(SQLCODE, 'Error in executing Finish Restart ', 76);
      RETURN 95;
    END IF;
  END;
 --------------------------------------------------------------------------
  return 0;
EXCEPTION
  WHEN OTHERS THEN
    ora_raiserror(SQLCODE,
                  'Execution of ap_as_batch_verify Failed',
                  37);
    RETURN 95;
END;/
```

9.5.4 Population of Other Parameters

The following procedures describe the population of other parameters:

1. Create database credential details for Lock Connection in the jdbc.properties file

Figure 9–6 Population of Other Parameters



2. Create datasource on the host server where the batch needs to be executed

Figure 9–7 Population of Other Parameters - General Tab

Home >Summary of Deployments >Summary of JDBC Data Sources >**LockDatasource**

Settings for LockDatasource

Configuration | Targets | Monitoring | Control | Security | Notes

General | Connection Pool | Oracle | ONS | Transaction | Diagnostics | Identity Options

Save

Applications get a database connection from a data source by looking up the data source on the Java Naming and Directory Interface (JNDI) tree and then requesting a connection. The data source provides the connection to the application from its pool of database connections.

This page enables you to define general configuration options for this JDBC data source.

Name:	LockDatasource	A unique name that identifies this data source in the WebLogic domain. More Info...
JNDI Name: jdbc/FCBDataSourceNIB		The JNDI path to where this data source is bound. By default, the JNDI name is the name of the data source. More Info...
Row Prefetch Enabled		Enables multiple rows to be "prefetched" (that is, sent from the server to the client) in one server access. More Info...
Row Prefetch Size:	48	If row prefetching is enabled, specifies the number of result set rows to prefetch for a client. More Info...
Stream Chunk Size:	256	Specifies the data chunk size for steaming data types. More Info...

Save

Figure 9–8 Population of Other Parameters - Connection Pool

10.180.25.93:7001/console/console.portal?_nfpb=true&_pageLabel=JdbcDatasourcesJDBCDataSourceConfigConnectionPoolTabPage&handle=com.bea.console.h...

Jira | Grok | UI | IUT 1 | ST1 | ST2 | INT | INT Console | OBP22IUT | OBPBMARK | NGP Design Debt | Est Tracker | Dev Tracker | Other bookmarks

ORACLE WebLogic Server® Administration Console

Home Log Out Preferences Record Help | Welcome, weblogic | Connected to: host_domain

Change Center

View changes and restarts

No pending changes exist. Click the Release Configuration button to allow others to edit the domain.

Lock & Edit

Release Configuration

Domain Structure

host_domain
- Environment
- Deployments
- Services
- Security Realms
- Interoperability
- Diagnostics

How do I...

- Configure testing options for a JDBC data source
- Configure the statement cache for a JDBC connection pool
- Configure credential mapping for a JDBC data source

System Status

Health of Running Servers

Failed (0)
Critical (0)
Overloaded (0)
Warning (0)

Home >Summary of Deployments >Summary of JDBC Data Sources >**LockDatasource**

Settings for LockDatasource

Configuration | Targets | Monitoring | Control | Security | Notes

General | **Connection Pool** | Oracle | ONS | Transaction | Diagnostics | Identity Options

Save

The connection pool within a JDBC data source contains a group of JDBC connections that applications reserve, use, and then return to the pool. The connection pool and the connections within it are created when the connection pool is registered, usually when starting up WebLogic Server or when deploying the data source to a new target.

Use this page to define the configuration for this data source's connection pool.

URL:	jdbc:oracle:thin:@10.180.22.245:1521:DEVDB	The URL of the database to connect to. The format of the URL varies by JDBC driver. More Info...
Driver Class Name:	oracle.jdbc.xa.client.OracleXADataSource	The full package name of JDBC driver class used to create the physical database connections in the connection pool. (Note that this driver class must be in the classpath of any server to which it is deployed.) More Info...
Properties: user=orig1		The list of properties passed to the JDBC driver that are used to create physical database connections. For example: server=dbserver1. List each property=value pair on a separate line. More Info...
System Properties:		The list of System Properties names passed to the JDBC driver that are used to create physical database connections. For example: server=dbserver1. List each property=value pair on a separate line. More Info...
Password:	••••••••••••••••••	The password attribute passed to the JDBC driver when creating physical database connections. More Info...

3. Enable Node Affinity for Batch Processing (Optional)

   This feature can be used for Clustered Database environment. In this feature connections taken by threads are pinned to a particular database node explicitly in order to reduce Cluster Wait events.

4. To enable this feature, set IS_DB_RAC = true in jdbc.properties file and specify the number of DB nodes.

Figure 9–9 Population of Other Parameters - Set IS_DB_RAC

```
41 #Denotes if the data base is running in cluster mode.
42 IS_DB_RAC=true
43 #Denotes the number of nodes in the db cluster.
44 NO_OF_DB_NODES=2
45
```

5. Create a separate data for each node in the cluster. Each of these connections will have the IP of an individual node instead of the SCAN-IP. Specify the data source configuration per node in the cluster in jdbc.properties.

Figure 9–10 Population of Other Parameters - Specify Data

```
109 #Used in Clustered env for pinning connection to stream
110 FCON.BATCH1.CONNPOOLED=Y
111 FCON.BATCH1.JNDI.NAME=jdbc/FCBDataSourceN1
112 FCON.LOCK.USER=orig1
113 FCON.LOCK.PASS=A61FB928642DE0130000000000000000
114 FCON.LOCK.LDB.DRIVER=oracle.jdbc.OracleDriver
115 FCON.LOCK.LDB.URL=jdbc:oracle:thin:@10.180.22.245:1521:DEVDB
116 #Used in Clustered env for pinning connection to stream
117 FCON.BATCH2.CONNPOOLED=Y
118 FCON.BATCH2.JNDI.NAME=jdbc/FCBDataSourceN2
119 FCON.LOCK.USER=orig1
120 FCON.LOCK.PASS=A61FB928642DE0130000000000000000
121 FCON.LOCK.LDB.DRIVER=oracle.jdbc.OracleDriver
122 FCON.LOCK.LDB.URL=jdbc:oracle:thin:@10.180.22.245:1521:DEVDB
123
```

9.6 Batch Execution

The user can execute the batch process from the task code EOD10 screen. User needs to select the process category, job type and job code. The corresponding shells get populated in the table below which can be started by clicking on the start/restart button.

User can also monitor the performance by clicking on the Refresh button available in the Category Details section. The execution of the batch takes care of shell dependencies and the dependent shells are run once their dependencies are executed.

Figure 9–11 Batch Execution

10 Uploaded File Data Processing

In Banks, there are multiple times when the bulk load of data is available in the form of files which needs to be uploaded and processed in the banking application. An example for the same can be salary credit processing. The salary credit data is provided by the organizations in the form of files where employer account needs to be debited and the multiple accounts of the employees needs to be credited for the provided data in the files.

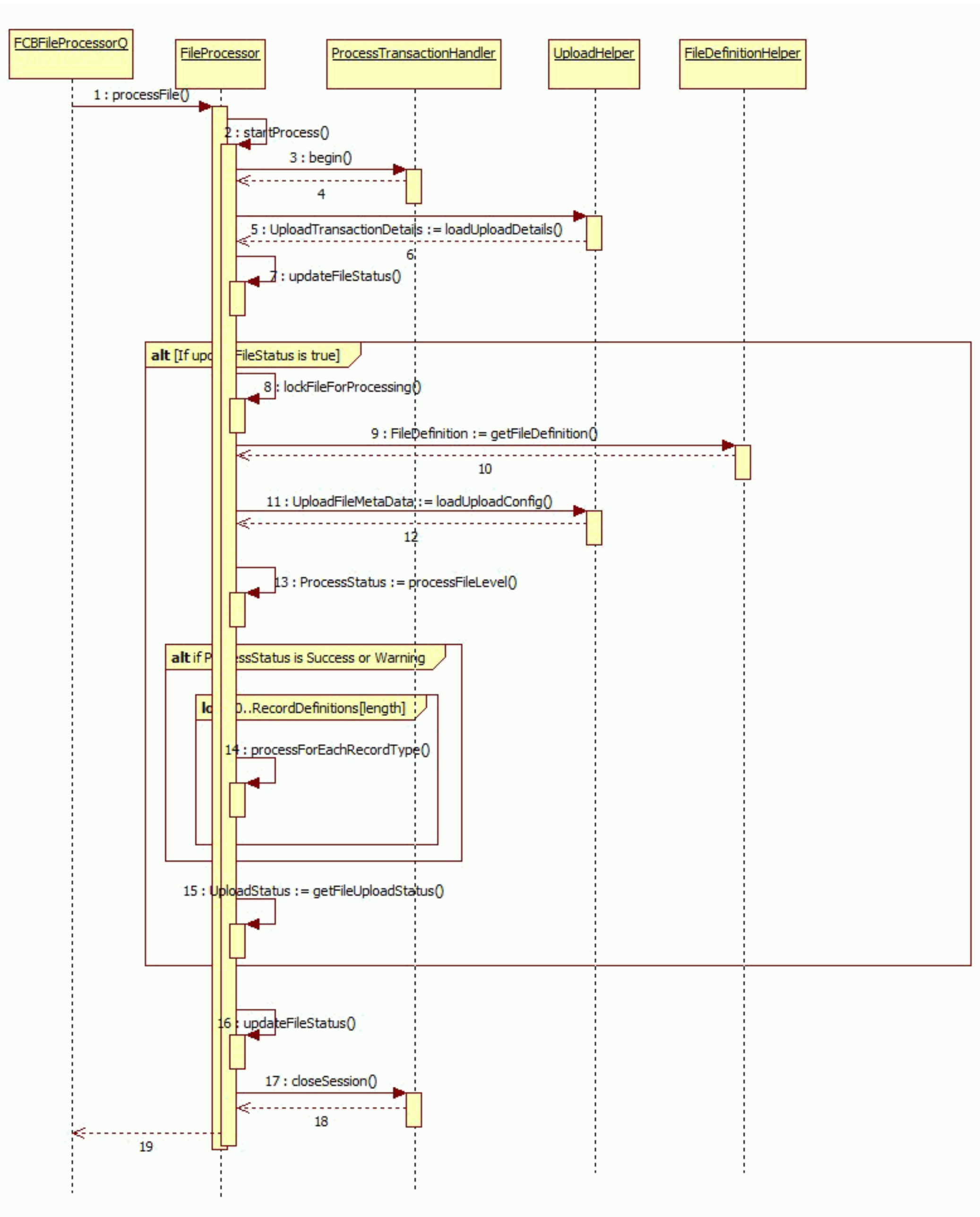
In OBP, file upload and file processing are two independent processes where the upload of file is done as one process and the processing on the uploaded data is done as another process. Every upload provides a unique field for the uploaded file. The processing is then done for each uploaded file and the final status is then provided at the end of the processing in the form of ProcessStatus.

The below section, from the extensibility perspective, provides the detailed understanding of the steps involved in the business logic processing of the files once the files are uploaded from the upload services. After the upload of the data, the data gets populated in the temporary tables in the database with the unique file id, which is then used for the processing of the uploaded file for the required business logic.

In the above mentioned salary credit example, the employer account details (in the form of header records) and the multiple employee account details (in the form of detail records) can be uploaded in OBP through the file upload, functionality which can then be processed for debiting the employer account and crediting the multiple salary accounts of the employees.

The framework of the uploaded file processing is shown in the sequence diagram below:

Figure 10–1 Uploaded Data File Processing Framework



From the implementation perspective, the following sections describe the configuration and processing of uploaded file.

10.1 Configuration

The configuration part of the uploaded file processing requires definition of the following components.

10.1.1 Database Tables and Setup

In case of file processing, there is one master table and individual record process tables for the recordType.

- FLX_EXT_FILE_UPLOAD_MAST

Table 10–1 FLX_EXT_FILE_UPLOAD_MAST

Column Name	Description
COD_FILE_ID	This defines the primary key identifier as file id for each specific file.
COD_XF_SYSTEM	This identifies the system to which the file type is associated. This indicates that the file is received from or sent to the particular system indicated by the system code.
FILE_TYPE	This identifies the type of file that is being uploaded. For every file type the format is defined. The file type can be like TXN
NAM_HOFF_FILE	Name of the uploaded file.
TXT_NRRTV	File Narration for the uploaded file.
COD_ORG_BRN	This stores the originating branch code from where the file is uploaded.
CTR_BATCH_NO	This identifies the batch number of the file upload. This is generated internally.
DAT_FILE_PROCESS	The process date as specified while uploading a file.
COD_FILE_STATUS	Indicates the current status of the file.
DAT_FILE_UPLOAD	Indicates when the file was uploaded.
DAT_TIM_PROC_START	The start time indicates the time the processing starts.
DAT_TIM_PROC_END	The end time indicates the time the processing ends.
DAT_FILE_REVERSE	Indicates when the file was reversed.
CTR_TOTAL_REC	This value indicates the total records in the file.
CTR_PROCESS_REC	This Value indicates the number of records processed for a file.
CTR_REJECT_REC	This Value indicates the number of records rejected for a file.
FILE_SIZE	This value indicates the size of the file in bytes.
COMMENTS	The file Comments for the uploaded file if the processing fails
FILE_CHECK_SUM	This column is used to store check sum of the file
FROM_ODI	This flag is used to indicate whether upload is happening from ODI
CURR_RECORD_TYPE	This column denotes the current record type being processed, updated after every recordType is successfully processed

- FLX_EXT_<<Process>>_HEADERRECDTO e.g. FLX_EXT_SALCREDIT_HEADERRECDTO
- FLX_EXT_<<Process>>_DETAILRECDTO e.g. FLX_EXT_SALCREDIT_DETAILRECDTO

  The field and record Id together as the key forms the record identifier in the record tables. The mandatory fields in the record tables are mentioned below. The additional required fields should be defined as the additional columns in the record tables.

Table 10–2 Mandatory Fields in Record Tables

Column Name	Description
RECORDID	This defines the primary key identifier as record id in the table. This is generated for every record.
FILEID	This is the primary key identifier as file id for the specific file.
RECORDTYPE	The type of record; possible values 'H', 'D' and 'F'
RECORDNAME	Name of the record type; possible values 'Header', 'Detail' and 'Footer'
DATA	Stores the complete data of each row of the file. This is populated for inquiry purposes that the user can view the contents of the record as it was read from the file.
LENGTH	Total length of DATA. This value is populated after the record is parsed.
COMMENTS	Comment update at the time of GEFU Upload and Processing of record
RECORDSTATUS	List of Record Status : 1-UPLOADED, 2-FAILED_UPLOAD, 3-CANCELLED, 4-INPROGRESS, 5-PROCESSED, 6-FAILED_PROCESS, 7-REVERSED, 8-FAILED_REVERSED, 9-ABORTED, 10-MARKED_FOR_PROCESS
DATE_RUN	This column holds the value of batch job's run date
SEQ	This column holds the value of batch job's sequence number
PROCESS_RESULT	This column holds the value of batch job process result
ERROR_CODE	This column holds the value of batch job's error code
ERROR_DESC	This column indicates the Error Description
BRANCH_CODE	This column holds the branch code of the branch
BRANCH_GROUP_CODE	This column holds the value of branch Group code

- FLX_EXT_FILE_PARAMS

  This table contains the information about the file definition template which is used to define the handlers, DTO and other details required for the processing of the uploaded file.

Table 10–3 FLX_EXT_FILE_PARAMS

Column Name	Description
COD_XF_SYSTEM	This identifies the system to which the file type is associated. This indicates that the file is received from or sent to the particular system indicated by the system code.
FILE_TYPE	This identifies the type of file that is being uploaded. For every file type the format is defined. The file type can be like TXN
NAM_XF_SYSTEM	Name of the system to which the file type is associated. This indicates that the file is received from or sent to the particular system indicated by the system code.
NAM_FILE_TYPE	This is name of the type of file that is being uploaded. For every file type the format is defined. The file type would be like PYMT (Payment File) or SAL (Salary Upload).
NAM_UPLOAD_TMPL	XFF file definition template name
FLG_OUTPUT_REQD	Once the processing of all the records is complete, a check is made if its value is 'Y' and then the response file is generated accordingly.
FLG_FILE_TRANSACTIONAL	Used to decide, whether File level validation is required or not.
CTR_COMMIT_SIZE	Used to commit records in batch while processing, so it's the batch size.

Table 10–3 (Cont.) FLX_EXT_FILE_PARAMS

Column Name	Description
RELATIVE_PATH	If provided, this searches for xff file in the path: base_folder/folder_name_ mentioned_here.
COD_ADHOC_ REQUEST_CLASS	Adhoc request class name
CTR_UPLOAD_ COMMIT_SIZE	Used to commit records in batch while validation, so it's the batch size.
FLAG_DUPLICATE_ FILE_CHECK	This flag is used to indicate whether duplicate file check is required or not
FLAG_FROM_ODI	This flag is used to indicate whether upload is happening from ODI

- FLX_BATCH_JOB_SHELL_DTLS

  This table contains the information about the batch processing with bean based shell mechanism as described in the 'Batch Framework Extension' section. The sample values are provided below:

Table 10–4 FLX_BATCH_JOB_SHELL_DTLS

Columns	Description	Sample Values
COD_SHELL	A unique code for batch shell. For example, 'upld_batch_shell_ <ProcessType>'	upld_batch_shell_SalCredit
SHELL_NAME	Name for batch shell	GEFU Processing Shell For Salary Credit
SHELL_ DESCRIPTION	Description about the batch shell.	GEFU Processing Shell For Salary Credit
COMMIT_ FREQUENCY	Commit frequency	100
FLG_RECOVERY_ MODE	Recovery mode - ON / OFF	Y
FLG_STREAM_TYP	Type of stream : 'S' - fixed no of streams, 'R' - fixed no of rows, 'N' - no streams	S
STREAM_COUNT	No of streams for the batch shell. Applicable only for StreamType as 'S' or 'R'	2
INPUT_DRV_NAME	Fully classified class name mapped to the driver table	com.ofss.fc.entity.upload.AbstractRecordDT O
INPUT_SHELL_ PARAM	Name for the shell parameter	AbstractRecordDTO
SERVICE_CLASS_ NAME	Fully classified class name - starting point of the business logic execution	com.ofss.fc.upload.processor.batch.BatchReco rdProcessor
SERVICE_ METHOD_NAME	Method name of the service	processRecord
DRV_POP_PROC_ NAME	Defines the name procedure used for driver table population	ap_gefu_pop_drv_gefu_rec

Table 10–4 (Cont.) FLX_BATCH_JOB_SHELL_DTLS

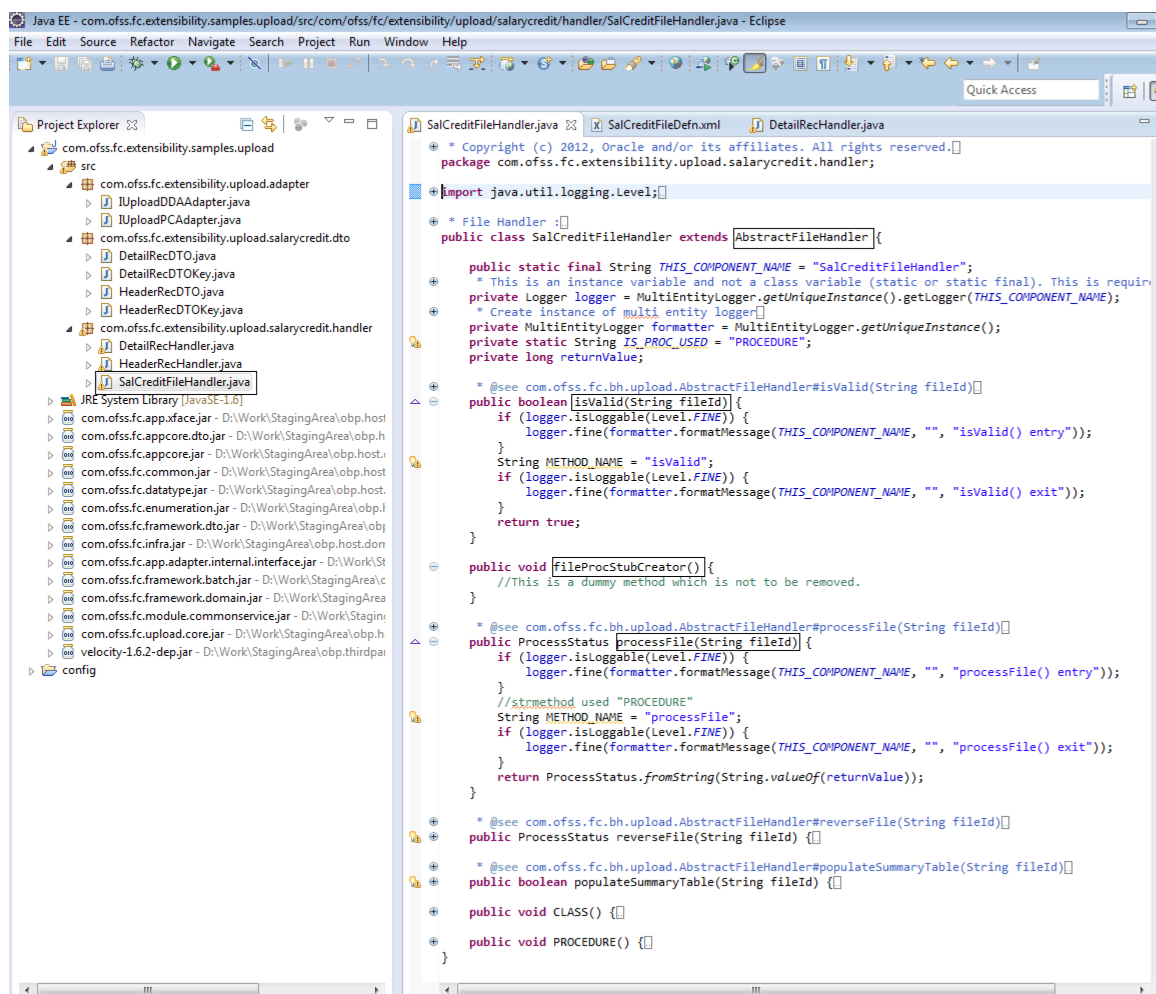
Columns	Description	Sample Values
FLG_PROCESS_TYPE	RBP (Recoverable Batch Process) if any records fails in batch, it will continue and execute rest of the records in the stream or SBP (Simple Batch process) it will abort the stream	RBP
HELPER_CLASS_NAME	Helper class for caching big queries	com.ofss.fc.upload.processor.batch.GEFUBatchJobHelper
BATCH_NO	Batch number for the shell	1

10.1.2 File Handlers

File Handler class is written for processing of the uploaded file and should extend the AbstractFileHandler. The class name of the File Handler is mentioned in the File Definition XML. In this class, the following abstract methods should be implemented:

- isValid() : To check if the particular uploaded file is valid. Validations such as, is the file uploaded duplicate or not, or are the header details valid or not are done as part of file level validations.
- processFile() : To write the actual processing business logic where the functionality is implemented, if required, or else a default blank implementation is executed.

Figure 10–2 File Handlers

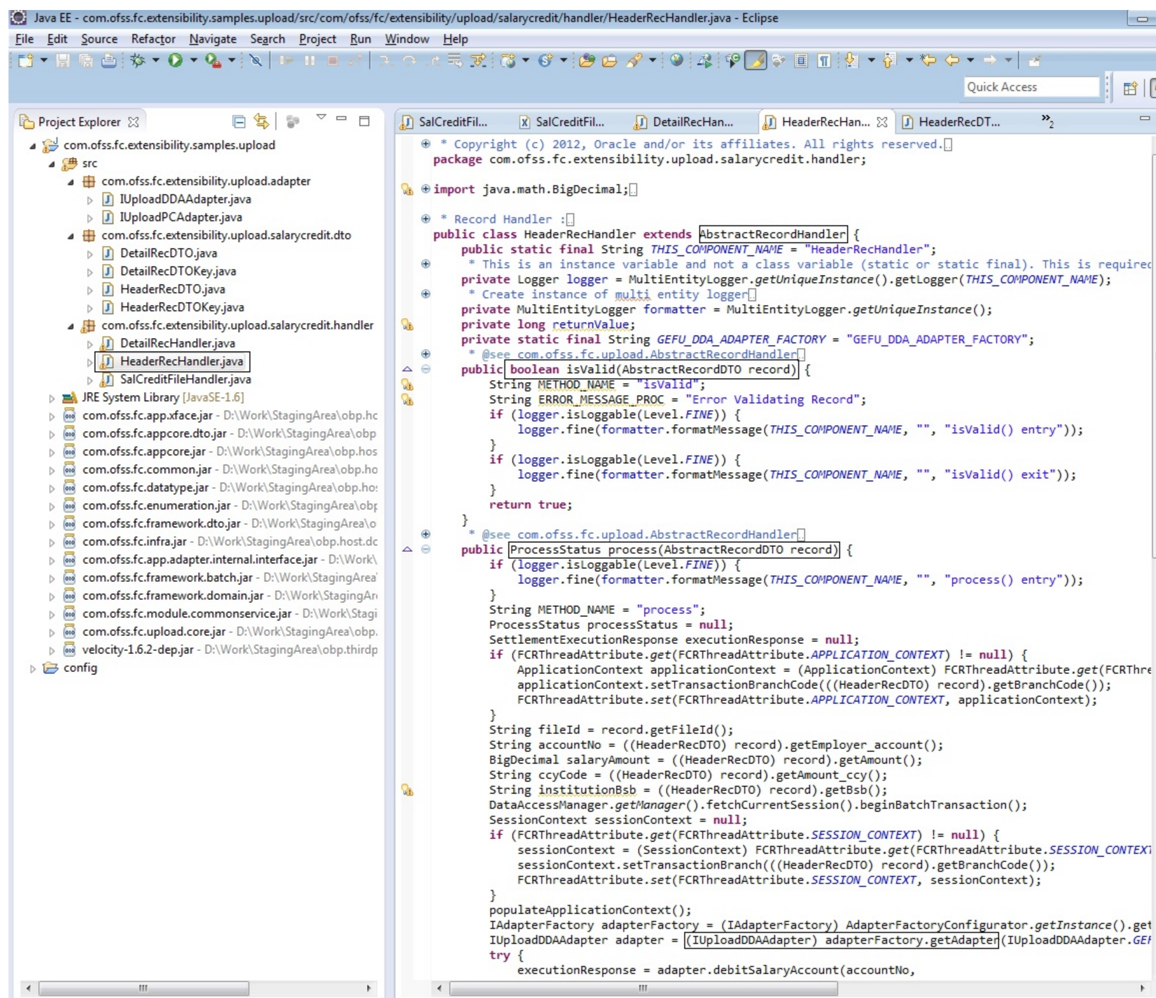


10.1.3 Record Handlers for Both Header and Details

This class provides the methods for record level validations and processing. It should extend the AbstractRecordHandler. The class name of the Record Handlers are also mentioned in the File Definition XML. The following abstract method needs to be implemented in this class:

- isValid() : To check if the particular uploaded record is valid for the processing purpose
- process() : To write the actual processing business logic where the functionality is implemented. It is called once the file is successfully validated.

Figure 10–3 Record Handlers for Both Header and Details



10.1.4 DTO and Keys Classes for Both Header and Details

This is a persistent class for the particular process. This class provides the fields which represents the characteristics of the record data. This class is defined for each record type of a file.

Figure 10–4 DTO and Keys Classes for Both Header and Details - HeaderRecDTOKey

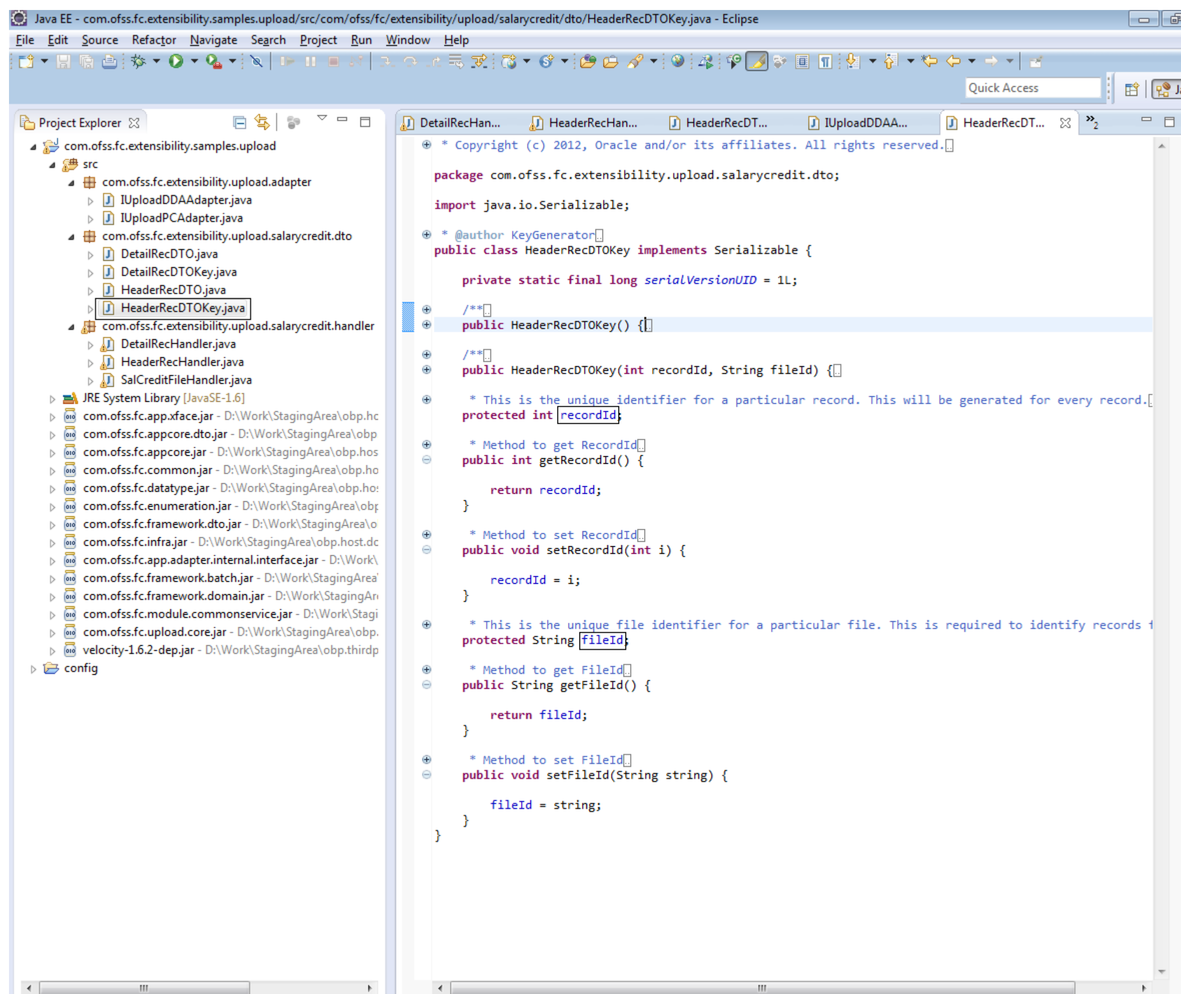
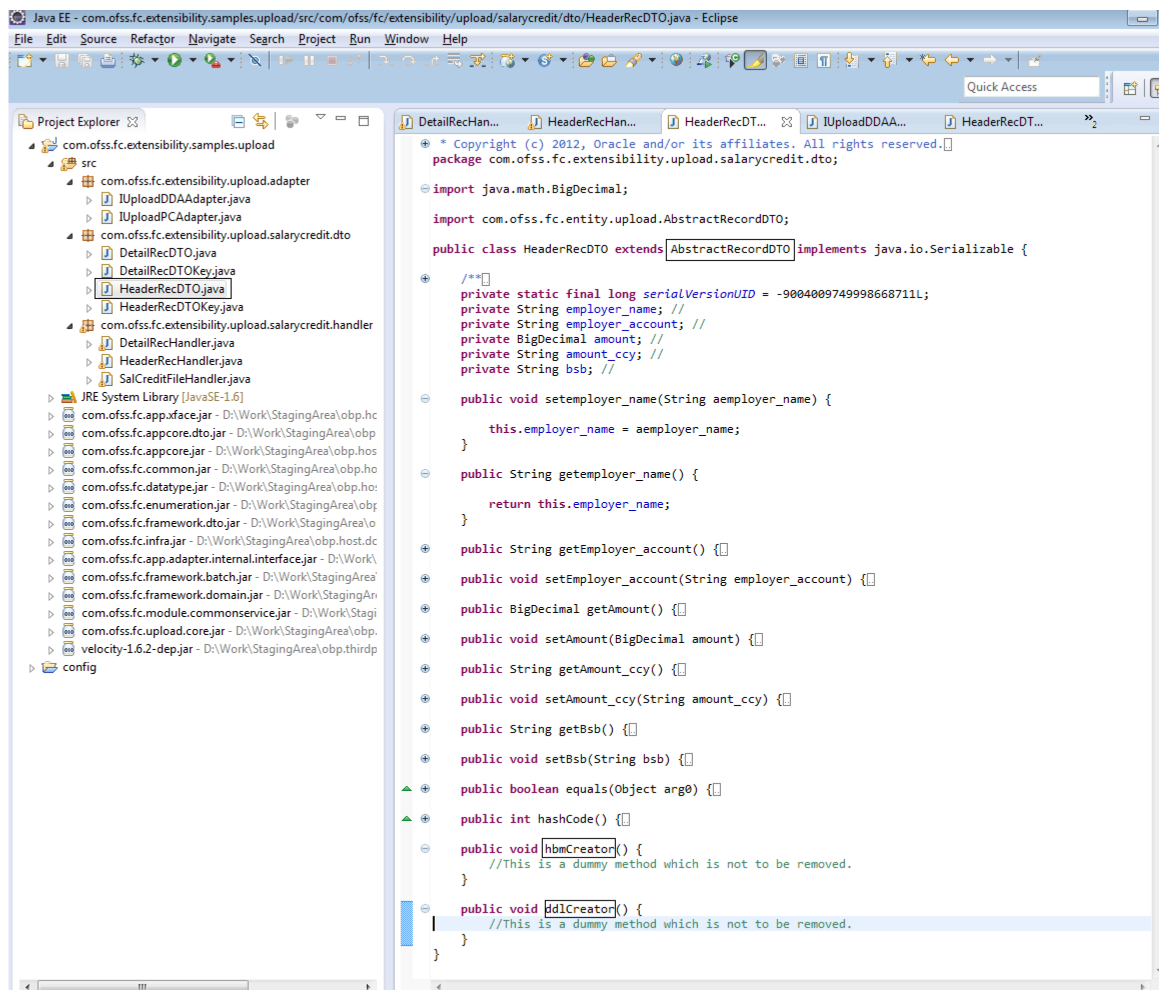


Figure 10–5 DTO and Keys Classes for Both Header and Details - AbstractDTORec



10.1.5 XFF File Definition XML

The xff file contains all the information about the different record type DTOs, the fields in those DTOs and the handlers pertaining to the uploaded file. The name of the xff file is mentioned in the FLX_EXT_FILE_PARAMS table. The file details are read from each tag in xff file and interpreted as described below in the table. The record element can occur N number of times based on number of record types present, for example if a particular upload has three record types Header, Detail and Trailer then there will be three elements for Record, each describing the three record types.

There are two one-to-many relationship in the file definition xml file:

- One 'File' element can have many 'Record' elements, depending upon the number of recordType present for this upload.
- One 'Record' element can have many 'Field' elements, depending upon the number of fields present for this recordType of upload.

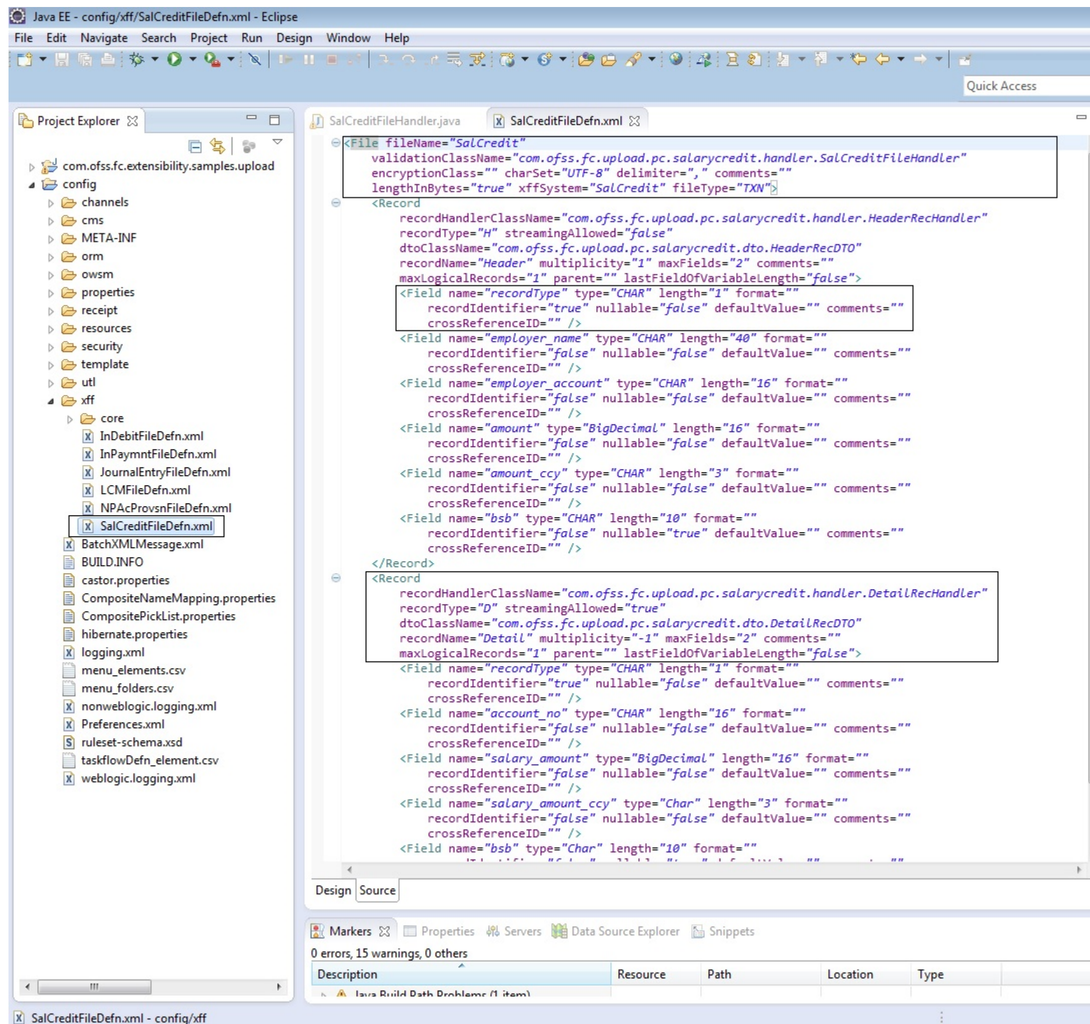
Table 10–5 XXF File Definition XML

Elements	Attributes	Description
File		Contains all details about the FileHandler, there is only once occurrence of this element.
	fileName	This denotes logical name of the file
	validationClassName	Fully qualified name of the FileHandler class
	encryptionClass	This denotes the name of the class that is used for encryption (optional).
	charSet	This denotes the Charset of the file.
	delimiter	This denotes delimiter coming in the file.(optional)
	comments	This is used to store comment on the file.(optional)
	lengthInBytes	This Boolean variable is used to denote whether the file's length has to be calculated in bytes.
	xffSystem	Name of xff file system, name should be same as mentioned in COD_XF_SYSTEM in table FLX_EXT_FILE_PARAMS
	fileType	Name of file type, name should be same as mentioned in FILE_TYPE in table FLX_EXT_FILE_PARAMS
Record		Child element of "File" can have any number of occurrences depending upon number of RecordType for a particular Upload.
	recordHandlerClassName	Fully qualified name of the Handler class for this RecordType
	recordType	This denotes record type which can be "Header", "Detail" or "Trailer"
	streamingAllowed	Indicates if the streaming is allowed for the record; Possible values are true or false
	dtoClassName	Name of DTO for this particular recordType
	recordName	Name of this record.
	multiplicity	This denotes whether this record type will appear only once in the file or multiple times. Value of this field will be either 1 (for only once) or -1 (for multiple times)
	maxFields	This denotes the maximum number of fields coming in the record type.
	comments	This stores comments.(optional)
	maxLogicalRecords	This denotes maximum number of records that may come of this record type.
	parent	
	lastFieldOfVariableLength	This denotes whether the last field of the record is variable or not. This value can be either "true" or "false"
Field		Child element of "Record" can have as many occurrences as the number of fields in a particular recordType
	name	Name of the field
	type	This denotes field type. E.g.:- 'CHAR', 'NUMBER' and so on.
	length	Length of field
	format	This denotes format of the field
	recordIdentifier	This denotes whether this field is used to identify the record. Value of this field can be either true or false.
	nullable	This denotes whether this field can be null or not

Table 10–5 (Cont.) XXF File Definition XML

Elements	Attributes	Description
	defaultValue	Default value of this field if any.
	comments	This stores the comment on the field. (optional)
	crossReferenceID	If another field wants to refer to this field then this id will be used.

Figure 10–6 XXF File Definition XML



10.2 Processing

Processing of an uploaded file is done on two levels, one on file level and the other on Record level. The processing is initially triggered when a message is sent on to a JMS Queue. The message is then picked up by an MDB which parses the message into a key value pair, and then passes it on to the FileProcessor by passing the processor type as an input. Based on the processor type, that is, header or detail record, the file processor initiates respective processing by invoking specific business logic written as file or record level handlers.

The processing of the business logic to different Service APIs of different modules are carried in the handler classes of the records. The processForRecordType() method of

the FileProcessor invokes the respective handler classes that is, if the Header section is being processed, it invokes the HeaderHandler class.

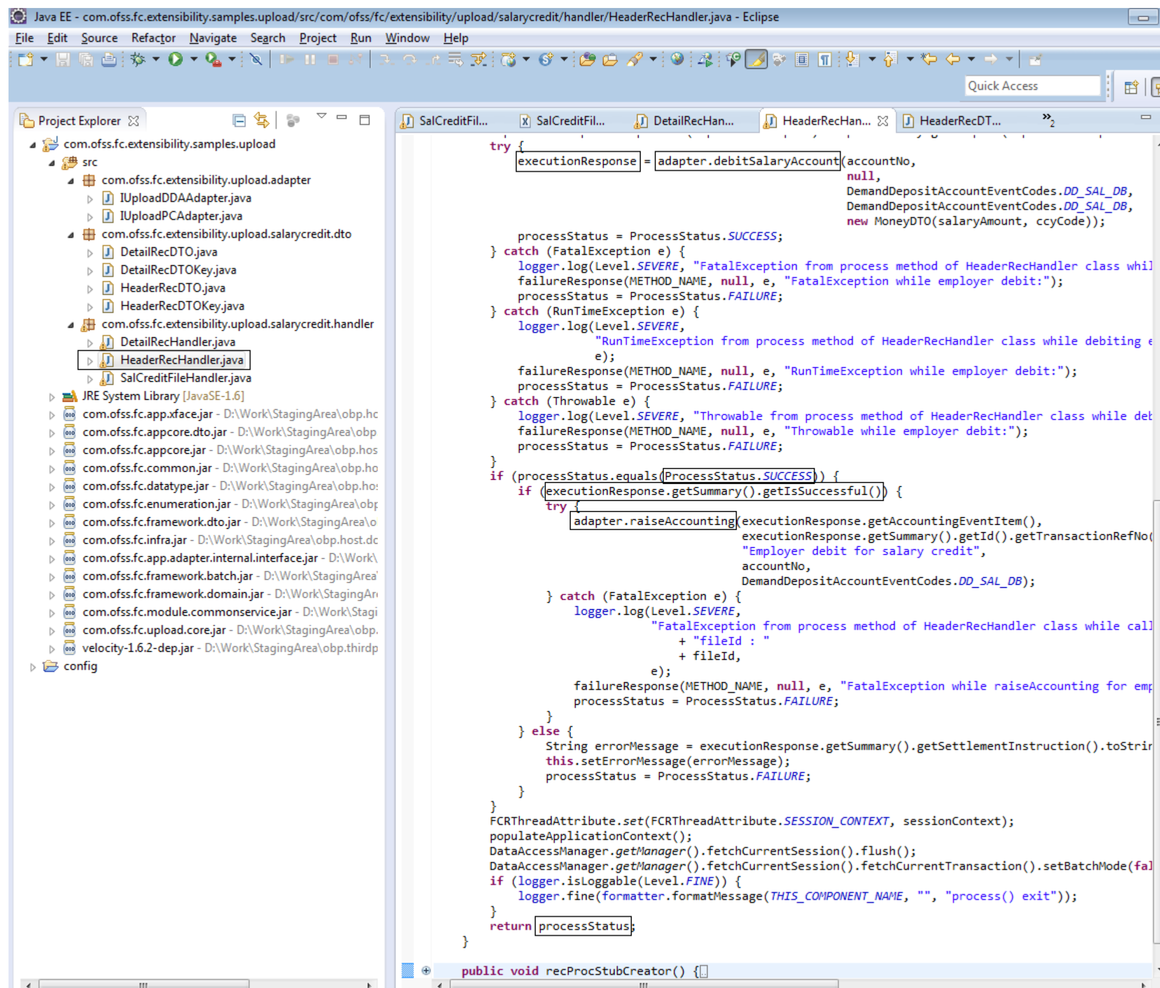
As per the process, the headers are processed first and then the details records. Each and every record is processed individually. As soon as a file is picked for processing, its status is changed to InProgress so that the same file is not picked by any other process for processing. Individual records are processed based on its record type.

10.2.1 API Calls in the Handlers

The API calls of different exposed application services are called from the handlers. The respective method call from the adapter will return the response object which can be further used for another adapter call as the input value or for the validation purpose. In the following example, it is shown that the salary account is debited for the user and then the returned response summary is used for validation purpose before raising the accounting for that account.

```
<Response1>=Adapter1.<method call>(<method parameters>)
If(<Validation on Response1>) {
<Response2>=Adapter2.<method call>(<method parameters containing Response1>) }
Example:
executionResponse = adapter.debitSalaryAccount()
if(executionResponse.getSummary().getIsSuccessful()) {
adapter.raiseAccounting(); }
```

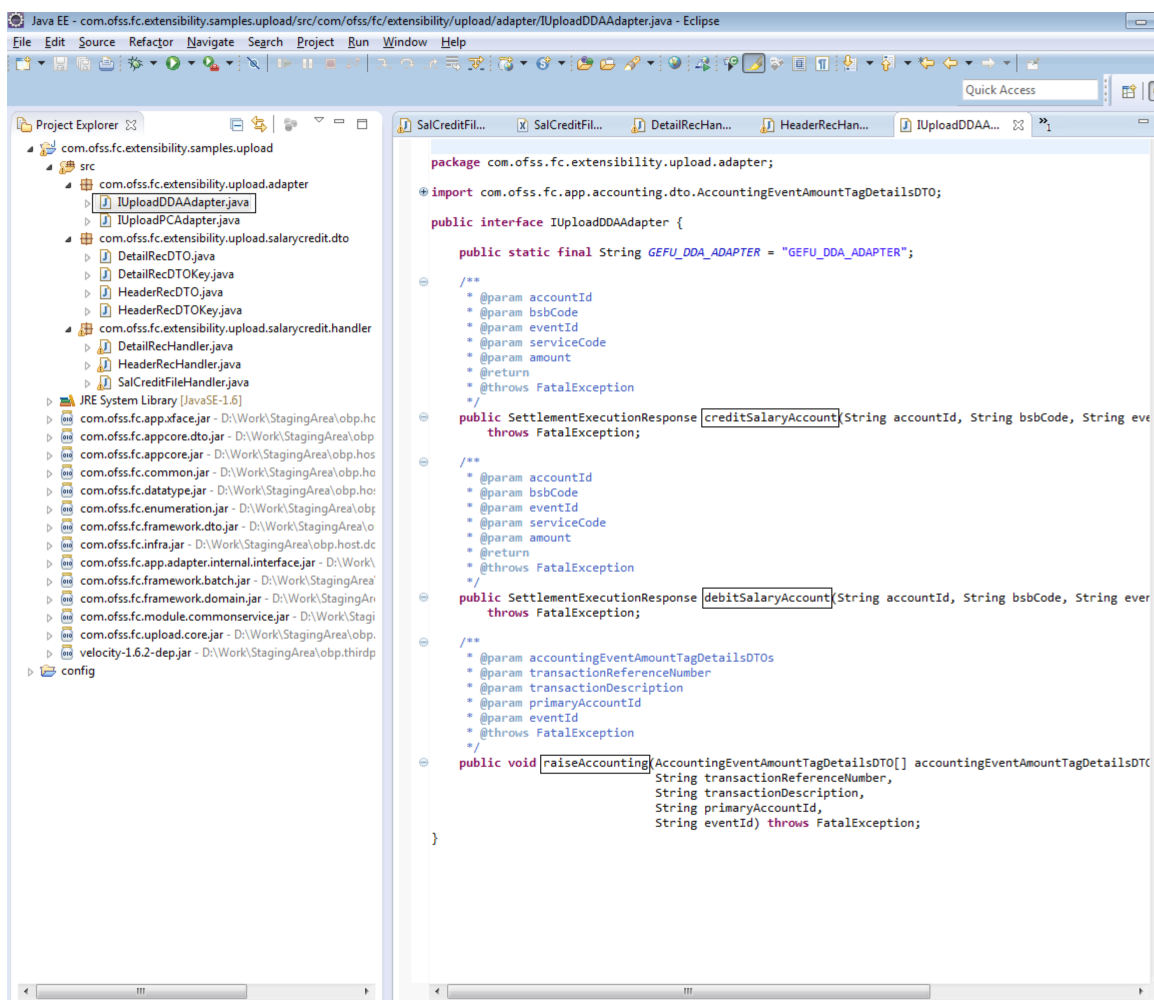
Figure 10–7 API Calls in Adapters



10.2.2 Processing Adapter

The processing adapters needs to be implemented for invoking the required application service API. In the example, the new methods as creditSalaryAccount(), debitSalaryAccount() and raiseAccounting() are implemented by the user based on their requirements.

Figure 10–8 Processing Adapter



10.3 Outcome

In case of header or footer, there is only one Record for these record types, hence based on Record Level Status returned, the processing status is set, if RecordLevelStatusType is SUCCESS or WARNING, the PROCESSING_STATUS will be marked as SUCCESS else FAILURE.

In case of detail records, processing status is decided based on the criteria that is, if NumberOfRecords with record processing status as FAILED is equal to totalNoOfRecords then overall ProcessStatus is FAILED or if less than totalNoOfRecords then overall ProcessStatus is WARNING and if zero then overall ProcessStatus is SUCCESS. Also, in case there is error in insertion of any record to the working table then overall ProcessStatus is FAILED.

Each record on processing can have any one of the three process status. If process status is success it moves to the next record. If process status is warning then it moves to the next record but marks the record as failed. If process status is failure then an Exception is raised and the file is marked as Failed.

Table 10–6 Process Status

Status Name	Value	Description
SUCCESS	0	Processing of this record is a success. Further record processing should continue.
FAILURE	1	Processing of this record has failed. Further record processing should not continue.
WARNING	2	Processing of this record has failed. Further record processing should continue.

On successful processing, the record will get persisted into the respective table and return a status of '5' to the invoked method.

But, in case of failure, the status is returned as '6' for that particular record and it continues with the next record for processing. Also the exceptions raised during a failure can be appended into the "comments" column of the respective table.

10.4 Failure/Exception Handling

There can be processing failure in case of any validations failure caused by the service. In case of any exceptions raised, it will be handled in the handler class.

While invoking an API when the SessionContext variables are not passed properly it would result in null. 'Invalid user id' will be added in the comments column and the processing will not happen.

The exceptions raised during processing can be logged into the comments column of the respective table by calling the setErrorMessage() method. In case of process failure in file handling, this method can also be invoked from inside the catch block of the processFile() method:

```
this.setErrorMessage(errorMessage);
processStatus = ProcessStatus.FAILURE;
```

11 Alerts Extension

OBP has to interface with various systems to transfer data which is generated during business activities that take place during teller operations or processing. OBP Application is, therefore, provided with the framework which can support on-line data transfer to interfacing systems.

The event processing module of OBP provides a mechanism for identifying executing host services as activities and generating or raising events that are configured against the same. Generation of these events results in certain actions that can vary from dispatching data to subscribers (customers or external systems) to execution of additional logic. The action whereby data is dispatched to subscribers is termed as *Alert*.

The following sections provides an overview of what the developer needs to do in order to add a new *Activity* and an *Event* which will be raised on execution of the said that activity. We will be using a sample activity and event to illustrate the steps.

Use Case: In the *Party -> Contact Information -> Contact Info* screen, user can create or update the contact details for a party. This screen has many attributes like *telephone number*, *email*, *do not disturb info* and so on. We will be registering this *update* transaction as an *Activity* and creating *Events* which will be raised on this activity.

11.1 Transaction as an Activity

This section describes how existing or new online transactions can be supported and recognized as activity for the events that are setup in the system with action, subscriber and dispatch configuration already in place. A transaction can be either financial or maintenance executing in the application server middleware host environment. This kind of setup is particularly useful when we have external systems like CEP, BAM to which data needs to be dispatched online.

The procedure for creating activities and events for a *financial* transaction is a subset of the same for a *maintenance* transaction. The aforementioned use case describes a maintenance transaction.

11.1.1 Activity Record

You will need to create a record for the activity in the table FLX_EP_ACT_B which stores all the recognized activities. This table has the following columns:

Table 11–1 FLX_EP_ACT_B

Column Name	Use	Example
COD_ACT_ID	The unique activity id for the activity. This id will be used in the activity - event mapping as well	'com.ofss.fc.app.party.service.contact.ContactPointApplicationService.updateContactPoint.dndInfo'
TXT_ACT_NAME	Activity name	'ContactPointApplicationService.updateContactPoint.dndInfo'
TXT_ACT_DESC	Meaningful description of the activity	'DND Info Change'
MODULE_TYPE	Module code for the module of which the transaction is a part off	'PI'
CREATED_BY	User id of the user creating this record	'SYSTELLER'
CREATION_DATE	Creation date of this record	to_date('20110310', 'YYYYMMDD')
LAST_UPDATED_BY	User id of the user last updating this record	'SYSTELLER'
LAST_UPDATE_DATE	Last update date of this record	to_date('20110310', 'YYYYMMDD')
OBJECT_VERSION_NUMBER	Version number of this record	1
OBJECT_STATUS	Status of this record	'A'

Sample script for Activity Record:

Figure 11–1 Sample script for Activity Record

```
--for insertion of activity record
DELETE FROM FLX_EP_ACT_B WHERE COD_ACT_ID =
'com.ofss.fc.app.party.service.contact.ContactPointApplicationService.updateContactPoint.dndInfo';
INSERT INTO FLX_EP_ACT_B (COD_ACT_ID, TXT_ACT_NAME, TXT_ACT_DESC, MODULE_TYPE, FLG_IP_REQD, FLG_OP_REQD, FLG_LOG_REQD, TXT_LOG_CLASS,
CREATED_BY, CREATION_DATE, LAST_UPDATED_BY, LAST_UPDATE_DATE, OBJECT_VERSION_NUMBER, OBJECT_STATUS)
VALUES ('com.ofss.fc.app.party.service.contact.ContactPointApplicationService.updateContactPoint.dndInfo',
'ContactPointApplicationService.updateContactPoint.dndInfo', 'DND Info Change', 'PI', null, null, null, null, 'SYSTELLER', to_date
('20110310', 'YYYYMMDD'), 'SYSTELLER', to_date('20110310', 'YYYYMMDD'), 1, 'A');
```

11.1.2 Attaching Events to Activity

Recognized events can be attached to recognized activities. The mapping in this case can be many-to-many viz., an activity can raise multiple events and an event can be raised by multiple activities.

11.1.3 Event Record

You will need to create an event record in the table FLX_EP_EVT_B which stores all the recognized events. This table has the following columns:

Table 11–2 FLX_EP_EVT_B

Column Name	Use	Example
COD_EVENT_ID	The unique event id for this event. This id will be used in the activity - event mapping as well	'PI_UPD_DND_INFO'
TXT_EVENT_TYP	The type of event	'ONLINE'
TXT_EVENT_DESC	Meaningful description for the event	'DND Info Updated'
EVENT_CATEGORY_ID	The category code for this event	2

Sample script for Event Record:

Figure 11–2 Sample script for Event Record

```
--for insertion of event record
DELETE FROM FLX_EP_EVT_B WHERE COD_EVENT_ID = 'PI_UPD_DND_INFO';
INSERT INTO FLX_EP_EVT_B (COD_EVENT_ID, TXT_EVENT_TYP, TXT_EVENT_DESC, EVENT_CATEGORY_ID)
VALUES ('PI_UPD_DND_INFO', 'ONLINE', 'DND Info Updated', 2);
```

11.1.4 Activity Event Mapping Record

You will need to create an activity event mapping record in the table FLX_EP_ACT_EVT_B which stores the mapping between all activities and events. This table has the following columns:

Table 11–3 FLX_EP_ACT_EVT_B

Column Name	Use	Example
COD_ACT_ID	The unique activity id as specified in the activity table	'com.ofss.fc.app.party.service.contact.ContactPointApplicationService.updateContactPoint.dndInfo'
COD_EVENT_ID	The unique event id as specified in the event table	'PI_UPD_DND_INFO'
TXT_ACT_EVT_DESC	Meaningful description for the activity event mapping	'DND Info Updated'
TXT_EVT_TYP	The type of event	'OTHER'
TXT_ACT_EVT_TYP	The type of activity event mapping	'ONLINE'

Sample script for Activity Event Mapping Record:

Figure 11–3 Activity Event Mapping Record

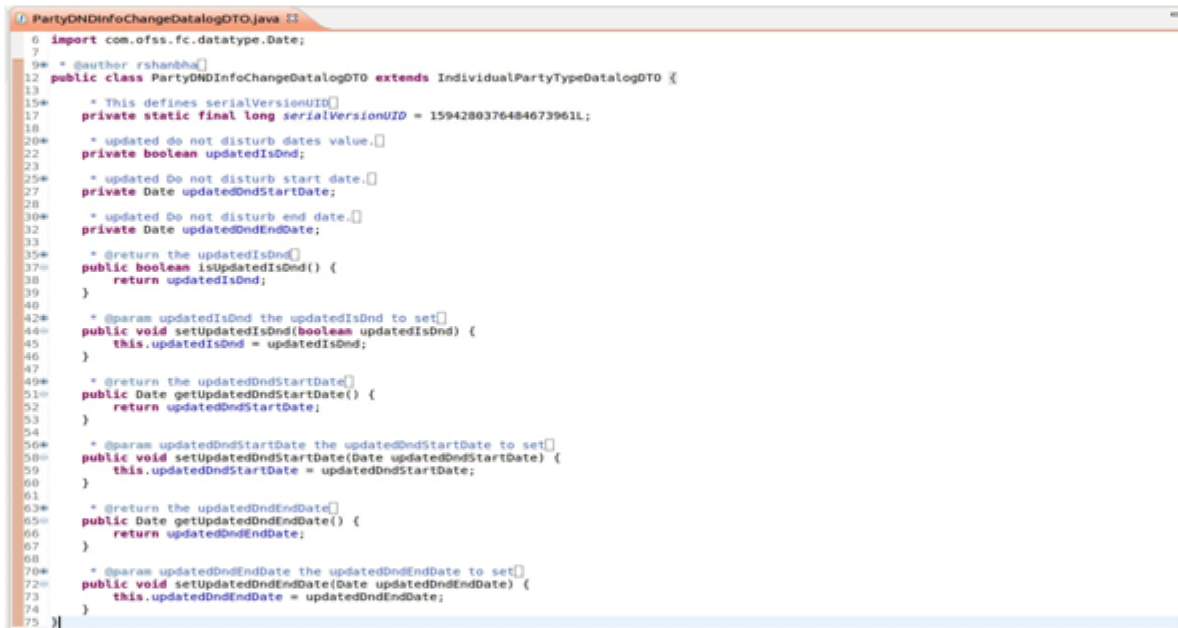
```
--for insertion of activity - event mapping
DELETE FROM FLX_EP_ACT_EVT_B WHERE COD_ACT_ID =
'com.ofss.fc.app.party.service.contact.ContactPointApplicationService.updateContactPoint.dndInfo' AND COD_EVENT_ID = 'PI_UPD_DND_INFO';
INSERT INTO FLX_EP_ACT_EVT_B (COD_ACT_ID, COD_EVENT_ID, TXT_ACT_EVT_DESC, TXT_EVT_TYP, TXT_ACT_EVT_TYP)
VALUES ('com.ofss.fc.app.party.service.contact.ContactPointApplicationService.updateContactPoint.dndInfo', 'PI_UPD_DND_INFO', 'DND Info
Updated', 'OTHER', 'ONLINE');
```

11.1.5 Activity Log DTO

In order to transfer activity data to the actions defined for the event, you need to develop data objects to contain the activity data. The DTO should implement the interface *com.ofss.fc.xface.ep.dto.IActivityLog*. Module specific activity log DTO's which already implement the *IActivityLog* interface are present. These DTO's contain the application specific and module specific activity data. You can extend the module's DTO class and add the transaction specific activity data.

For party module, the class *com.ofss.fc.app.party.dto.alert.IndividualPartyTypeDatalogDTO* is one of the classes that implement the *IActivityLog* interface. For the aforementioned activity, the activity log DTO can be as follows:

Figure 11–4 Activity Log DTO



11.1.6 Alert Metadata Generation

This section describes the different types of alert metadata generation.

Metadata Generation

To generate metadata for alerts you need to have plugin.

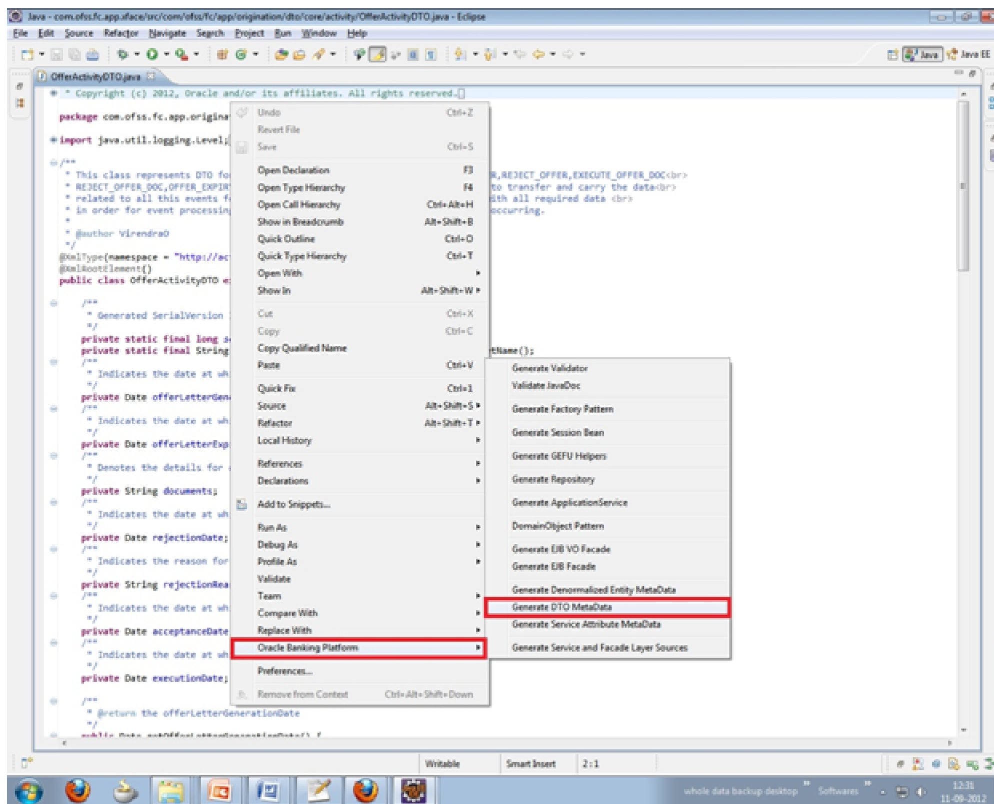
Once you have plugin you need to set properties in preferences in windows tab for Service Publisher, Service Deployer and Workspace Path.

1. Go to your DTO class and right-click that class and click the following : *Oracle Banking Platform -> Generate DTO Metadata*.
2. This will generate the insert scripts for following two tables:
   - FLX_MD_DATA_DEFN
   - FLX_MD_FIELDS_DEFN

   These scripts will be generated in your config folder by default. The path of this script is :

   WorkspaceDirectory -> config -> meta-data-scripts -> incr-meta-data.log

Figure 11–5 Metadata Generation



Service Data Attribute Generation

After generating metadata, we need to generate service attribute which will be mapped with facts which will be used in data bindings in Alert Maintenance screen AL04.

To generate we need to activity ID class for specific event, DTO is used for this activity ID.

1. Right-click that service and select *Oracle Banking Platform -> Generate Service Attribute Metadata*.

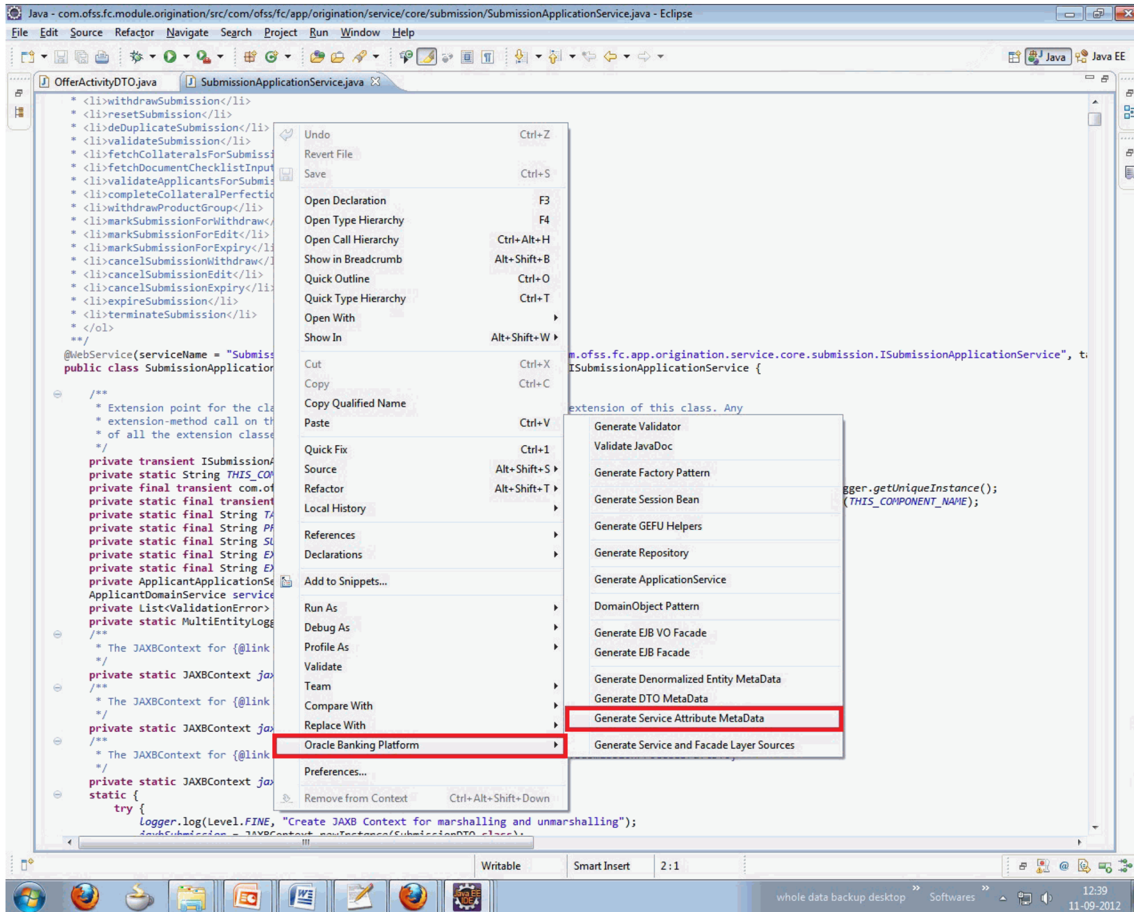
   In this case also insert scripts will be generate in same location as metadata attributes.

2. This will generate the insert scripts for following tables:

   - FLX_MD_SERVICE_INPUTS
   - FLX_MD_SERVICE_OUTPUT
   - FLX_MD_SERVICE_ATTR

There are some steps in generating of service attribute which are as follows:

Figure 11–6 Service Data Attribute Generation



FLX_MD_SERVICE_ATTR is used to map the alert activity attribute with the fact code and to map the alert activity attribute with the DTO field to extract the data from.

As an example, the key fields in FLX_MD_SERVICE_ATTR for an alert activity attribute have been listed below:

Table 11–4 Key Fields in FLX_MD_SERVICE_ATTR

Column	Description
COD_SERVICE_ATTR_ID	The Unique ID for the Attribute of any Activity configured for an alert. For example, com.ofss.fc.app.account.service.accountaddresslinkage.AccountAddressLinkageApplicationService.createAccountAddressLinkage.Alert.Party.Address.City.DTO
TYP_DATA_SRC	Indicates the Data Source(entity/input/DTO) for the Attribute of the Resource

Table 11–4 (Cont.) Key Fields in FLX_MD_SERVICE_ATTR

Column	Description
COD_ATTR_ID	This field indicates the Fact Code. For example, Alert.Party.Address.City
COD_SERVICE_ID	This field indicates the Activity ID. For example, com.ofss.fc.app.account.service.accountaddresslinkage.AccountAddressLinkageApplicationService.createAccountAddressLinkage
REF_FIELD_DEFN_ID	This field indicates the DTO leaf field from which the data is extracted. For e.g.: com.ofss.fc.app.dda.dto.alert.AccountAddressLinkageAlertDTO.Address,com.ofss.fc.datatype.PostalAddress.City Data for this column is interpreted /extracted as follows. com.ofss.fc.datatype.PostalAddress address = com.ofss.fc.app.dda.dto.alert.AccountAddressLinkageAlertDTO.getAddress(); String city = address.getCity()

11.1.7 Alert Message Template Maintenance

User will maintain template format and template ID to be used for the alerts definition.

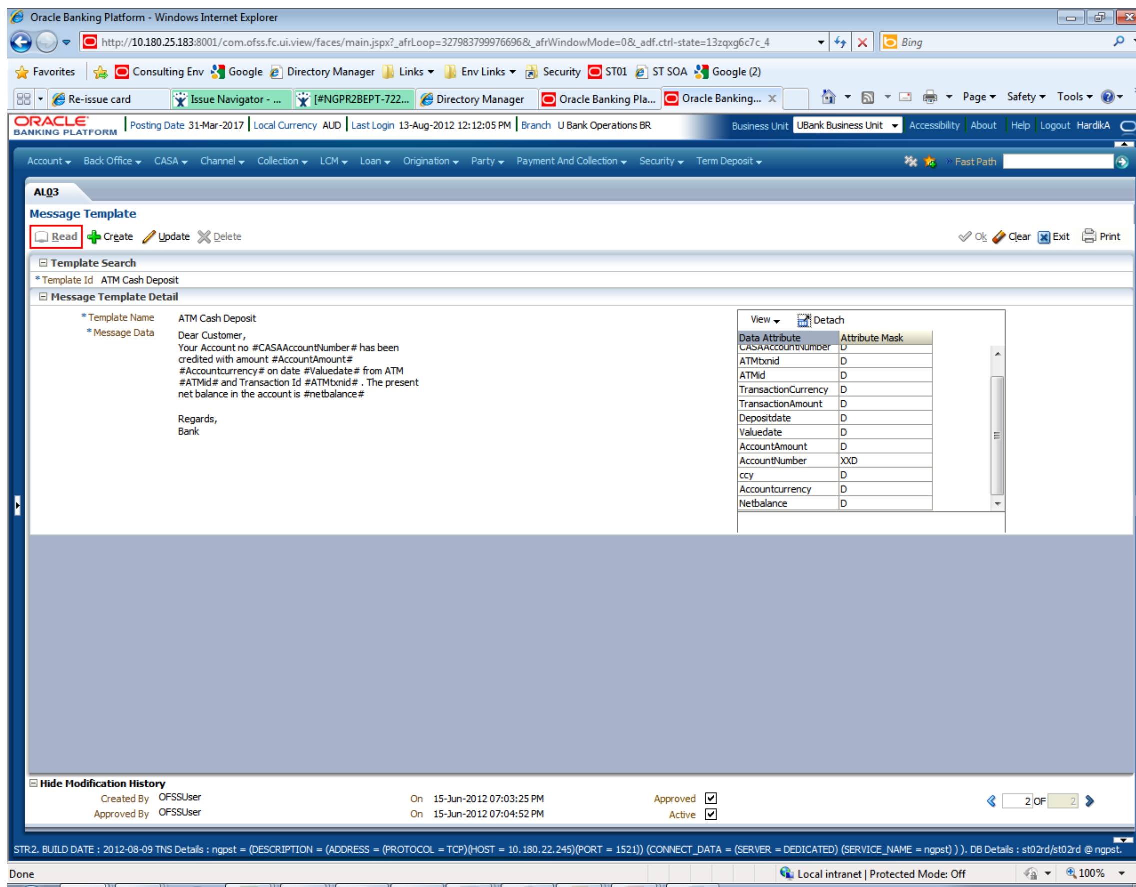
These messages need to be defined only if the same template is going to be used for multiple events. Else there is a provision to define the message template during the definition of the alert itself.

All data elements defined within the '#' symbol will be defaulted in the panel below as data attribute.

For example, your account Number #Acct No# has been credited with #currency# #transaction amount# being cash deposited

The user can Mask certain digits in data elements that are preceded with '#' under the 'Attribute Mask' column.

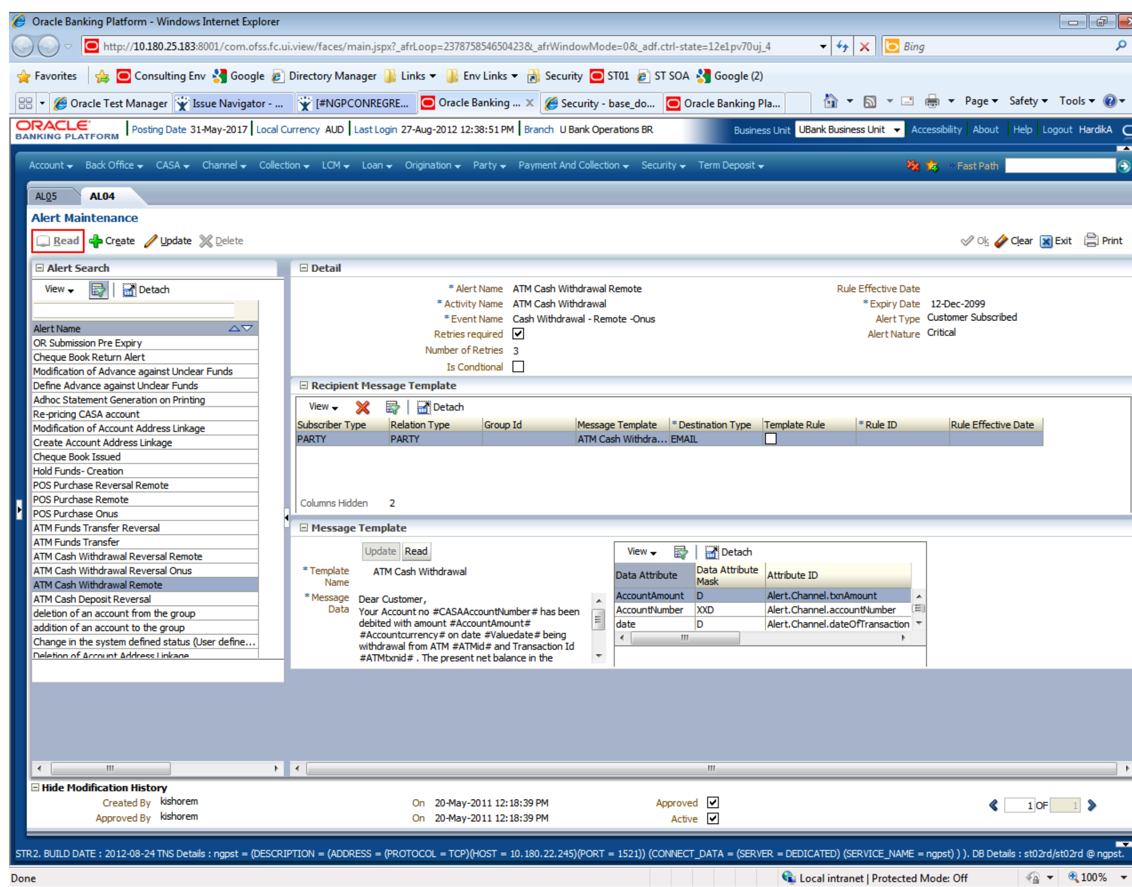
Figure 11–7 Alert Message Template Maintenance



11.1.8 Alert Maintenance

Given below is the Alert Maintenance screen.

Figure 11–8 Alert Maintenance



We can define the alert name, expiry date, alert type (Customer Subscribed/ Mandatory) and link this with predefined activity and event. These entries are fed to table "flx_ep_act_evt_acn_b".

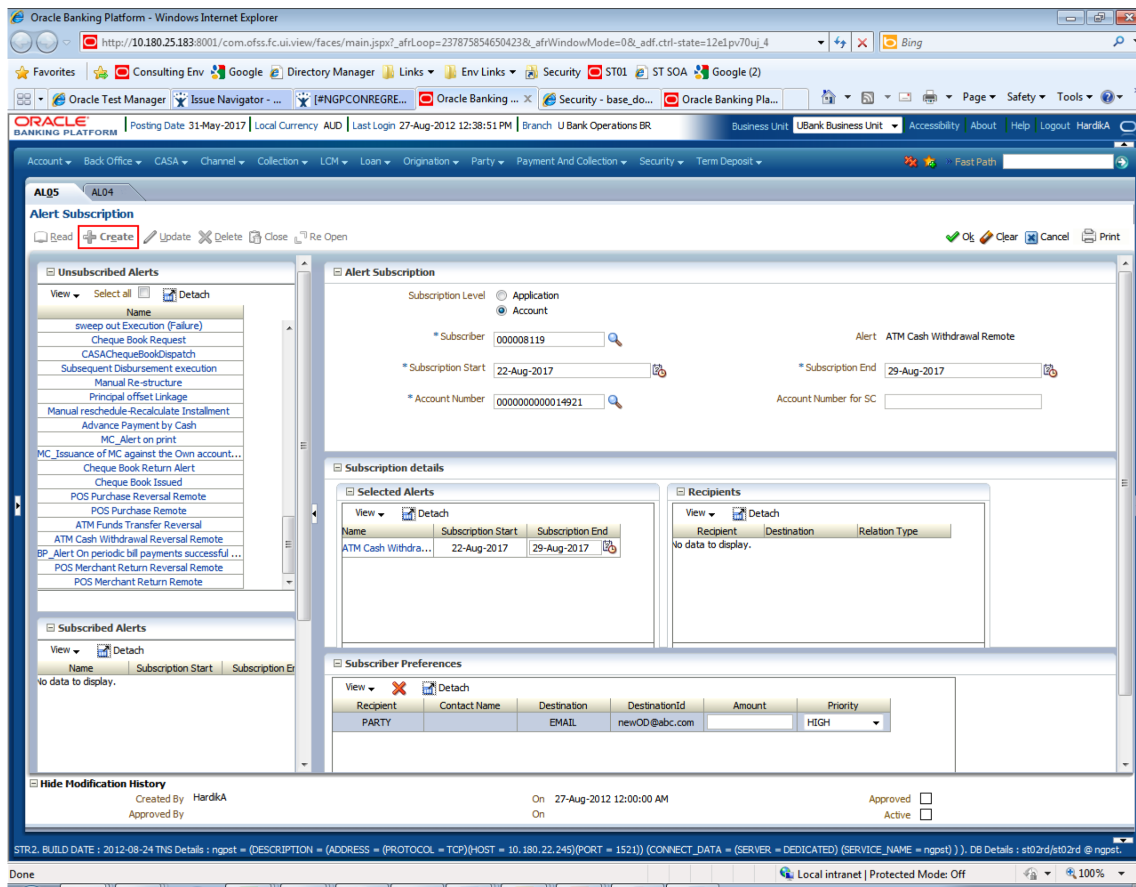
Now, we need to link a Recipient Message Template/s with this alert. For this we drag recipients from the Recipient Panel on to the Recipient Message Template Panel. In this setup, we define the kind of recipient and link this to predefined Message Template and Destination Types. The entry for this goes to table "flx_ep_evt_rec_b".

Finally, we need to complete the Message Template Mapping Configuration for each Recipient Message Template. For this, we map each data attribute of each Recipient Message Template with a corresponding attribute (Fact Code) from the drop down. This drop down populates fact codes configured for this activity id in the metadata table FLX_MD_SERVICE_ATTRIBUTE. The entry for this goes to table "flx_ep_msg_src_b"

11.2 Alert Subscription

Subscription can be done for alerts at **account level** or at **application level** (called as subscription level)

Figure 11–9 Alert Subscription



11.2.1 Transaction API Changes

You will need to modify the transaction API to support the newly registered activities. This section gives an overview of how the developer needs to modify the transaction API.

The entry point for activity business logic would be the service call for the transaction. In the aforementioned use case, the service call would be *com.ofss.fc.app.party.service.contact.ContactPointApplicationService.updateContactPoint(...)*.

Figure 11–10 Transaction API Changes - Service Call

```
public TransactionStatus updateContactPoint(SessionContext sessionContext, ContactPointDTO dto) throws FatalException {

    super.checkAccess("com.ofss.fc.app.party.service.contact.ContactPointApplicationService.updateContactPoint", sessionContext, dto);
    if (logger.isLoggable(Level.FINE)) {
        logger.log(Level.FINE,
                MultiEntityLogger.getUniqueInstance()
                                .formatMessage("Entered method updateContactPoint with partyId as '%s', contact point type as '%s' an
                                        dto.getPartyId(),
                                        dto.getContactPoint() == null ? "null" : dto.getContactPoint().toString(),
                                        dto.getPreferenceType() == null ? "null" : dto.getPreferenceType().toString()));
    }
    Interaction.begin(sessionContext);
    TransactionStatus transactionStatus = fetchTransactionStatus();
    try {
        Interaction.markCurrentTask(PartyTaskConstants.CONTACT_PREFERENCE);
        createTransactionContext(sessionContext, MaintenanceType.MODIFICATION);
```

If the activity needs to be conditional, then the logic for evaluating the conditions should be present inside the service call. This should be followed by the invocation of the routine to register the activity. In the aforementioned use case, the activity should

be registered only if the *update* transaction updates the attributes associated with *DND Information*. Following code snippet shows the conditional evaluation and invocation of the call to register activity.

Figure 11–11 Transaction API Changes - Conditional Evaluation

```
} else if(dto.isDnd() != telephoneNumberExisting.isDnd()
        || (dto.getDndStartDate() != null && !dto.getDndStartDate().equals(telephoneNumberExisting.getDndStartDate()))
        || (dto.getDndEndDate() != null && !dto.getDndEndDate().equals(telephoneNumberExisting.getDndEndDate()))) {
    if (logger.isLoggable(Level.FINE)) {
        logger.log(Level.FINE, MultiEntityLogger.getUniqueInstance()
                                       .formatMessage("Registering activity for alerts on change of dnd details for party '%s'",
                                               dto.getPartyId()));
    }
    partyAlertHelper.persistActivityLog(CONTACTPOINT_UPDATECONTACTPOINT_DNDINFO,
                              dto,
                              sessionContext,
                              partyName.getFullName(),
                              EVENTCODE_DNDINFO_CHANGE);
}
```

The *persistActivityLog(..)* routine primarily takes the *Activity Id*, *Event Id* and *Activity Log DTO*. This routine first calls a helper routine to populate the activity log DTO with the activity data and then passes on the DTO to the appropriate *Event Processing Adapter* which will register the activity and generate associated events.

Figure 11–12 Transaction API Changes - persistActivityLog(..)

```
/**
 * This method logs/registers the activity log DTO
 *
 * @fcb.param MI,String,activityId, The ActivityId for which we need to log the data for the further processing of
 *            alerts.
 * @fcb.param MI,Object,object, holds the new data, sent as DTO's.
 * @fcb.param MI,SessionContext,sessionContext, holds the session data, used for creating the ApplicationContext.
 * @fcb.param MI,String,partyName, holds the Party Name.
 * @fcb.param MI,String,eventId, holds the event Id.
 * @throws FatalException
 */
public void persistActivityLog(String activityId, Object object, SessionContext sessionContext, String partyName, String eventId)
        throws FatalException {

    IActivityLog activityLog = populateActivityLog(activityId, object, partyName);
    if (activityLog != null) {
        com.ofss.fc.app.adapter.IAdapterFactory adapterFactory = AdapterFactoryConfigurator.getInstance()
                                                                  .getAdapterFactory(ModuleConstant.EVENT_PROCESSING);
        IEventProcessingAdapter adapter = (IEventProcessingAdapter) adapterFactory.getAdapter(EventProcessingAdapterConstant.MODULE_TO_ACTIVITY);
        adapter.registerActivityAndGenerateEvent(createApplicationContext(sessionContext), activityId, eventId, new Date(), activityLog);
    } else {
        if (logger.isLoggable(Level.FINE)) {
            logger.log(Level.FINE, "PartyAlertHelper.persistActivityLog  :  ActivityLog is null");
        }
    }
}
```

You will need to add the business logic to populate the activity log DTO with the data specific to the transaction and the activity. This logic can be present inside the activity helper class for the module. Module specific activity attributes can also be populated in this logic. Following code snippet shows the activity log DTO population with activity data for the aforementioned activity.

Figure 11–13 Transaction API Changes - Activity Log

```
private IActivityLog populateActivityLogForDNDInfoChange(Object object, String partyName) {

    ContactPointDTO contactPointDTO = (ContactPointDTO) object;
    PartyDNDInfoChangeDatalogDTO activityLog = new PartyDNDInfoChangeDatalogDTO();
    activityLog.setCustomerId(contactPointDTO.getPartyId());
    activityLog.setPartyId(contactPointDTO.getPartyId());
    activityLog.setFullName(partyName);
    activityLog.setUpdatedIsDnd(contactPointDTO.isDnd());
    activityLog.setUpdatedDndStartDate(contactPointDTO.getDndStartDate());
    activityLog.setUpdatedDndEndDate(contactPointDTO.getDndEndDate());
    activityLog.setCriticalNotification(true);
    return activityLog;
}
```

Figure 11–14 Transaction API Changes - Register Activity

```
/**
 * Used to register an Activity with an associated Event
 *
 * @param activityID
 * @param eventID
 * @param eventProcessingDate
 * @param activityLog
 * @return
 * @throws FatalException
 */
public String registerActivityAndGenerateEvent(ApplicationContext applicationContext,
                                               String activityID,
                                               String eventID,
                                               Date eventProcessingDate,
                                               Object logObject) throws FatalException {

    ActivityLog activityLog = (ActivityLog) logObject;
    ActivityRegistrationApplicationService activityManager = new ActivityRegistrationApplicationService();
    SessionContext sessionContext = AdapterContextHelper.fetchSessionContext();
    if (sessionContext == null) {
        sessionContext = AdapterContextHelper.fetchBasicSessionContext(applicationContext);
    }
    ActivityEventKeyDTO activityEventKeyDTO = new ActivityEventKeyDTO();
    activityEventKeyDTO.setActivityId(activityID);
    activityEventKeyDTO.setEventId(eventID);
    ActivityRegistrationResponse response = activityManager.registerActivityAndGenerateEvent(sessionContext,
                                                                                              activityEventKeyDTO,
                                                                                              eventProcessingDate,
                                                                                              activityLog);

    return response.getActivityDataId();
}
```

The *Event Processing Adapter* contains the logic to register the activity and generate events. You can use the existing adapter class *com.ofss.fc.app.adapter.impl.ep.EventProcessingAdapter* or write your own custom adapter which must implement the interface *com.ofss.fc.app.adapter.impl.ep.IEventProcessingAdapter*.

All the above steps would suffice to support a transaction as an activity and raise events on the activity.

On successful completion of the transaction and the activity registration and event generation, you can view the activity log in the table FLX_EP_ACT_LOG_B and the generated events log in the table FLX_EP_EVT_LOG_B.

Actions associated with the activity events would pick up the activity and event data from these tables for processing.

11.3 Alert Processing Steps

For any modules the starting point is EventProcessingAdapter method named 'registerActivityAndGenerateEvent'.

Through this we call 'registerActivityAndGenerateEvent' method of ActivityRegistrationApplicationService which marks actually registration of your activities and events.

During this activity the entries are made in table FLX_EP_ACT_LOG_B and FLX_EP_EVT_LOG_B with appropriate comments depending on type of Alerts whether it is Mandatory (M) or Customer Subscribed (S).

There is one flag maintained in FLX_EP_EVT_LOG_B viz. FLG_PROCESS_STAT, which specifies status of event.

In this step various validations are also performed such as checking if email Id of recipient is mentioned and so on.

However, the final processing of alerts is managed in 'Interaction.java' when it is about to close that is, call is made in 'manageLastInteraction'.

Figure 11–15 Alert Processing Steps

EventProcessStatusType

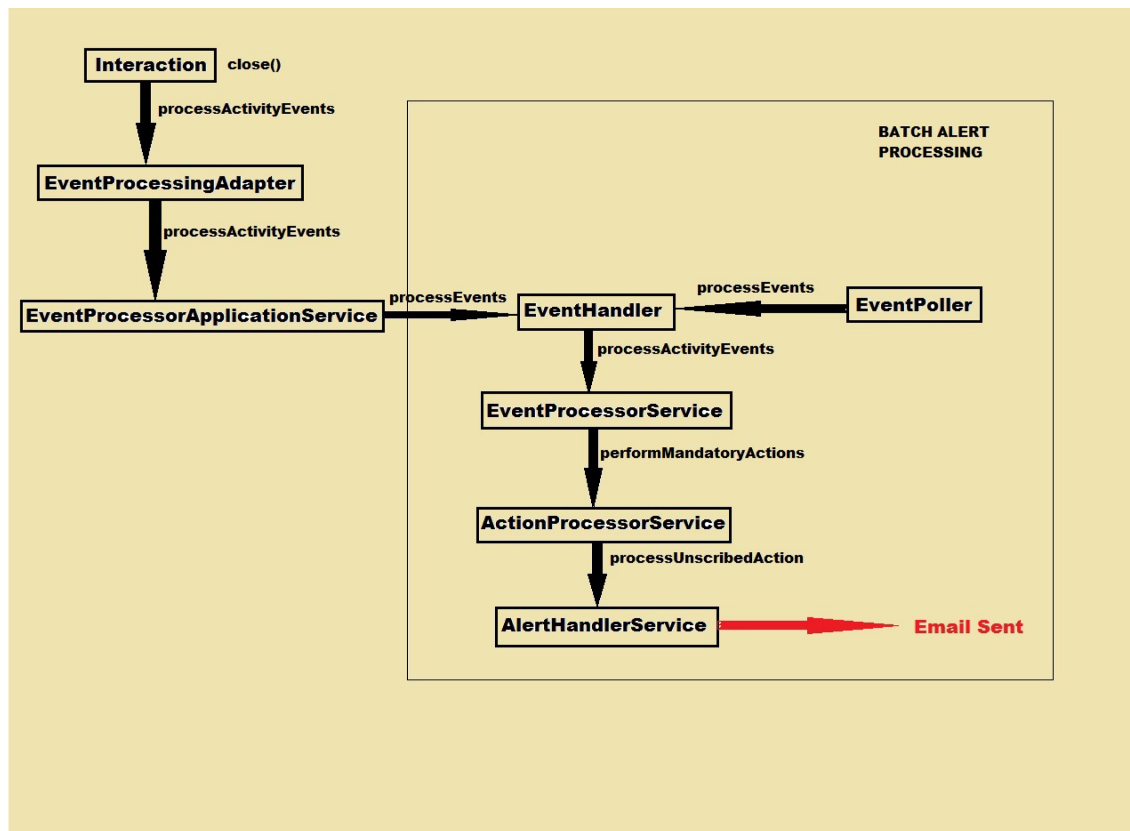
This shows status of event throughout cycle of event processing from Registration of event to Dispatch of Alert. (It is maintained in FLX_EP_EVT_LOG_B table as "flg_process_stat").

The various statuses of events are as follows:

- GENERATED("G")
- COMPLETED("C")
- NO_SUBSCRIPTION("N")
- ABORTED("A")
- INITIATED("I")
- REINITIATED("R")

For any event online or batch, when it is logged for first time it is marked as Generated "G" in flx_ep_evt_log_b table.

Figure 11–16 Event Processing Status Type

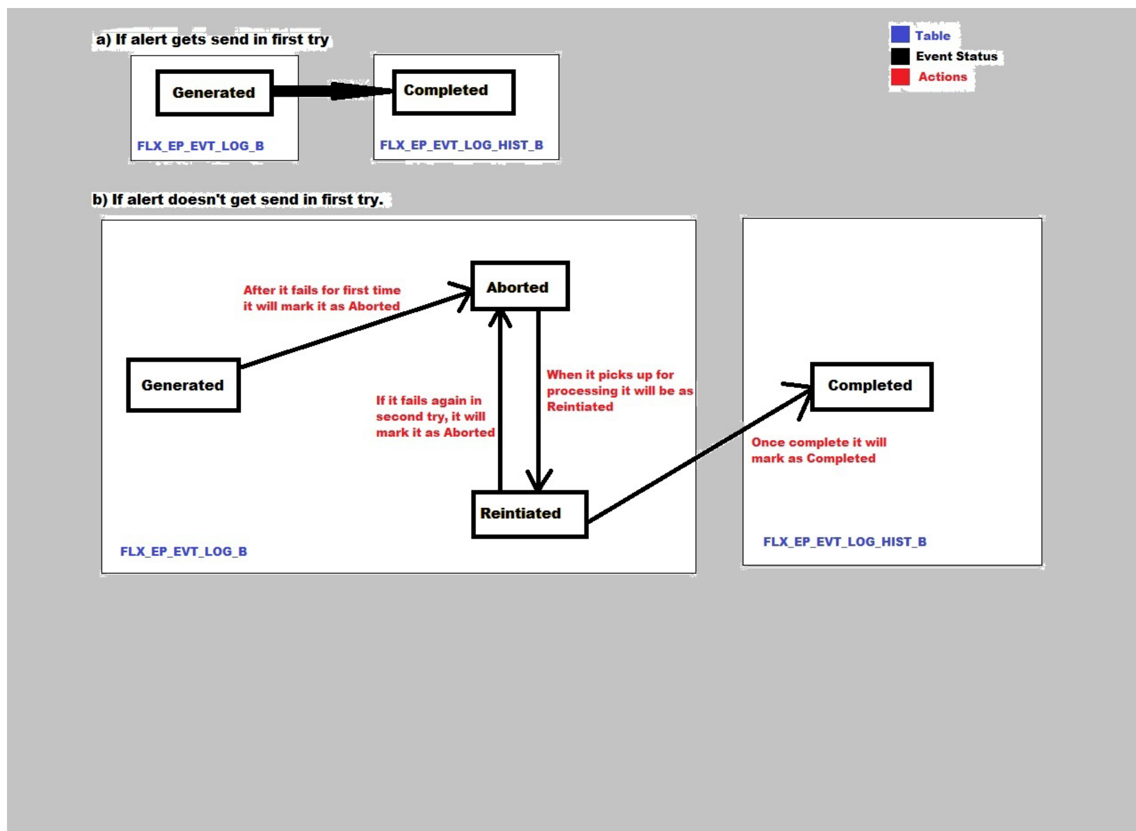


JMS (Java Messaging Service) is used for dispatch of alerts.

For Online Alerts:

- **Direct Approach**: If alert gets send in first try, flg_process_stat is as "G" in FLX_EP_EVT_LOG_B and alert is dispatched through JMS, and then entry for that event record is moved to FLX_EP_EVT_LOG_HIST_B and flg_process_stat is marked as "C".
- **EventPoller**: If alert gets failed in first retry it will mark status as "R". In this case EventPoller will pick the failed event and complete its processing and mark status as "A" and then entry for that event record is moved to FLX_EP_EVT_LOG_HIST_B and flg_process_stat is marked as "C".
- **For Batch Alerts**: In case of batch alerts as no Interaction.close() is called, the direct approach is not used in Batch Alerts. In this case only EventPoller approach is used.

Figure 11–17 Batch Alerts



11.4 Alert Dispatch Mechanism

The dispatch mechanism is triggered by the *AlertHandlerService* for dispatching subscribed actions of type *Alert*. The processing is implemented as part of the respective handlers. The handler services delegate the call to the *Dispatcher* based on the type of *DestinationType* configured in the *Recipient* at the time of *ActivityEventAction* maintenance which involves *RecipientMessageTemplate* setup.

The module provides definition of multiple dispatch detail configurations on the basis of *SubscriberType* and various configuration parameters like *UrgencyType*, *ImportantType* in the AlertTemplate.

The dispatcher uses the *DispatchDataConverter* to convert the data captured as part of activity registered in the system into data which can be dispatched to the target subscriber.

Figure 11–18 Alert Dispatch Mechanism

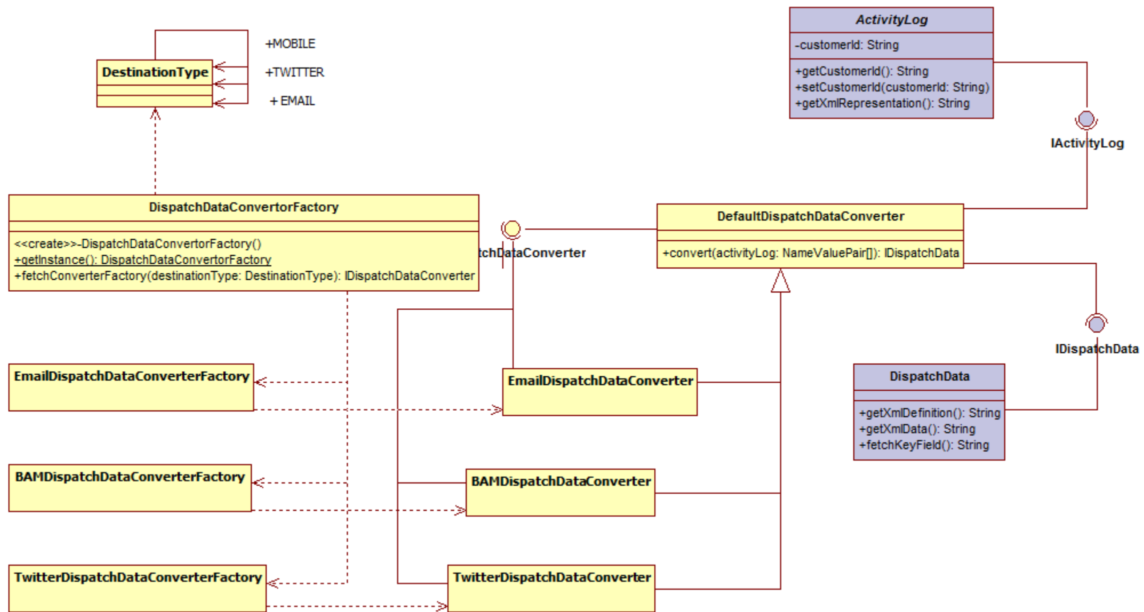


Figure 11–19 Alert Dispatch Mechanism - Dispatcher Factory

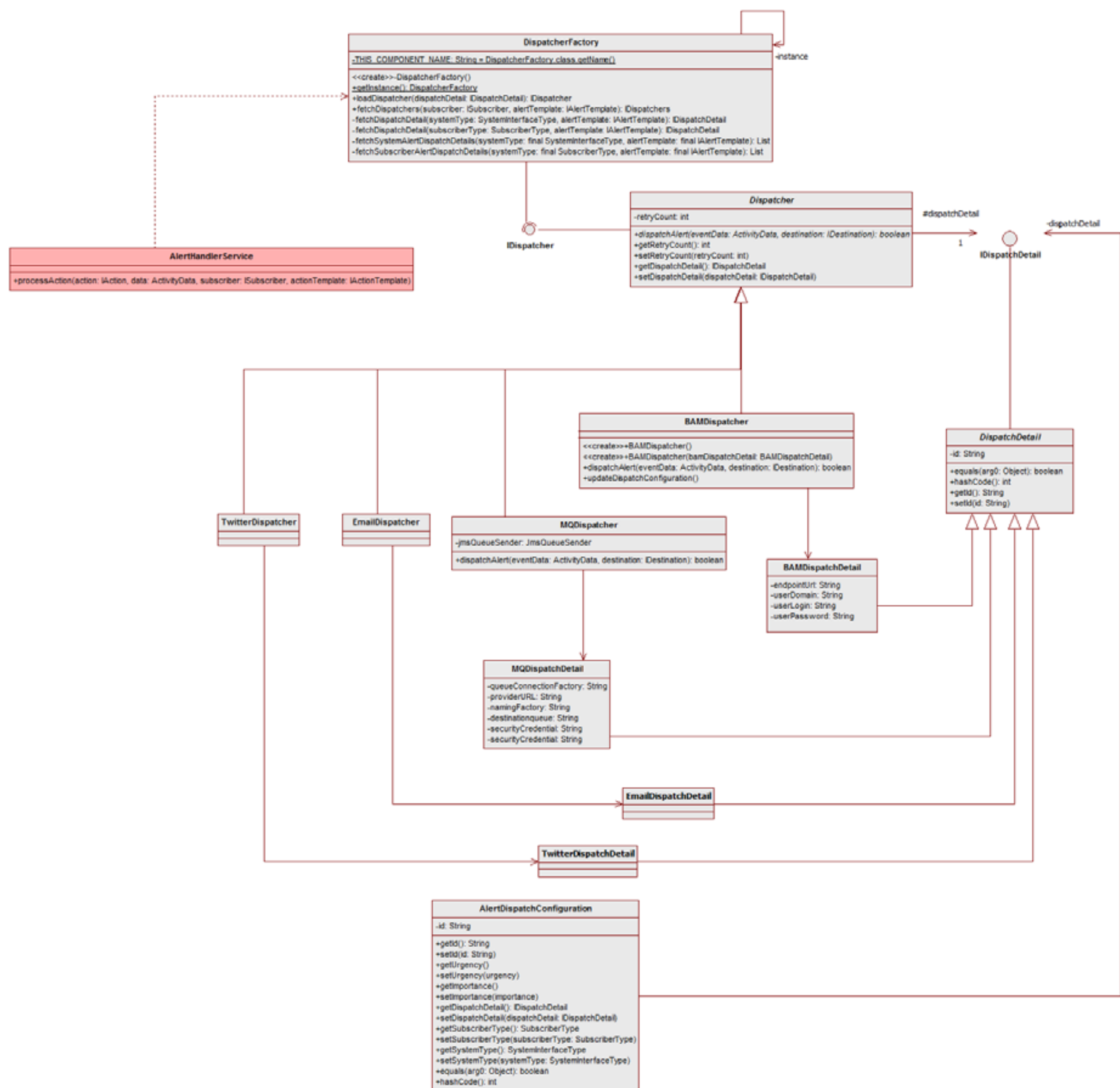
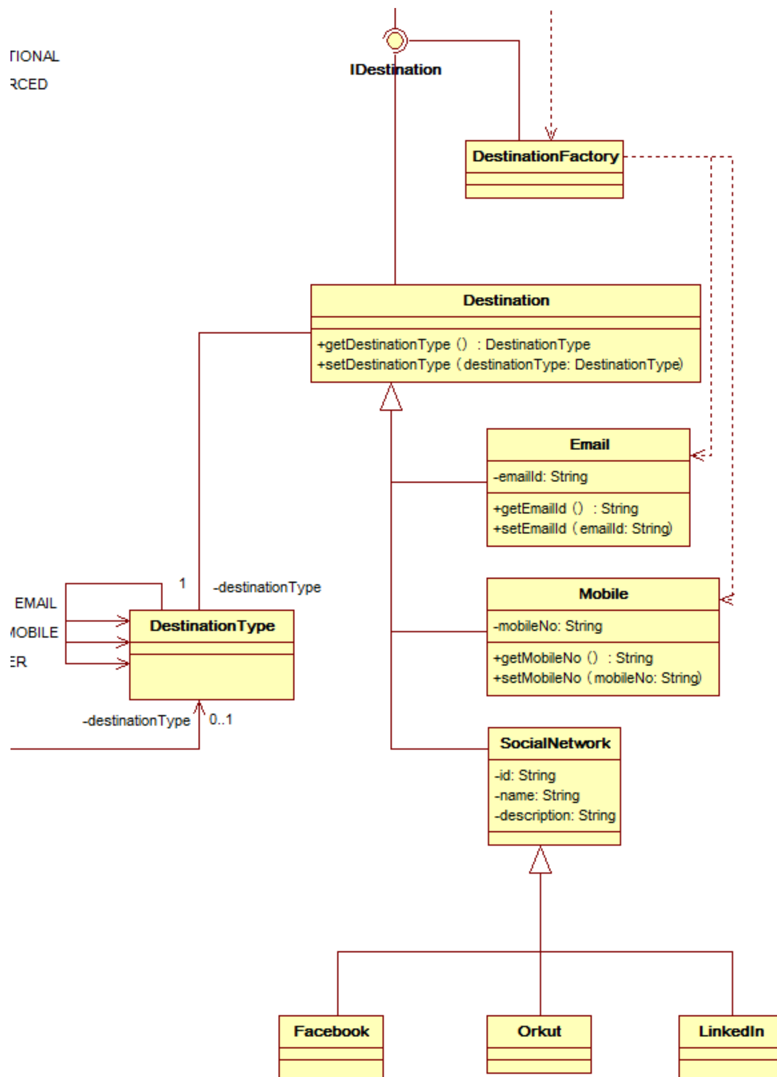


Figure 11–20 Alert Dispatch Mechanism - Destination



The various Destination Types are coded as per the above diagram. This existing framework makes it further extensible as per the requirements that is, you can add more destination types.

11.5 Adding New Alerts

To add a new alert:

1. Implement the Service Extension Interface for the application service of the method for which alert is to be raised.
2. Use either the preServiceMethod() or postServiceMethod() hook for the method in the implemented service extension class depending on the requirement.
3. The method should call the registerActivityAndGenerateEvent() of the EventProcessingAdapter class. In case a custom adapter is required the custom adapter method should call registerActivityAndGenerateEvent() of ActivityRegistrationApplicationService.

4. New Activity ID, Event ID and implementation of IActivityLogDTO have to be created.

11.5.1 New Alert Example

This example will explain the above points in detail.

Use Case: A new alert has to be added after updating a party name.

The class PartyNameApplicationService has a method updateIndividualName() that does this activity.

Create the extension class, say PartyNameApplicationServiceExt, for this application service by implementing its extension interface IPartyNameApplicationServiceExt. Since the alert should be raised after updation of party name we will use the postUpdateIndividualName() method.

Within the method a call to registerActivityAndGenerateEvent() in EventProcessingAdapter should be made.

Code snippet for the call:

```
com.ofss.fc.app.adapter.IAdapterFactory adapterFactory =
AdapterFactoryConfigurator.getInstance().getAdapterFactory(ModuleConstant.EVENT_
PROCESSING);
IEventProcessingAdapter adapter = (IEventProcessingAdapter)
adapterFactory.getAdapter(EventProcessingAdapterConstant.MODULE_TO_ACTIVITY);
adapter.registerActivityAndGenerateEvent(applicationContext, activityId, eventId,
new Date(), activityLog);
```

In case a new customer adapter has to be used, a call to registerActivityAndGenerateEvent() in ActivityRegistrationApplicationService should be made from within the adapter. A class called ActivityEventKeyDTO is used which captures the event ID and activity ID.

Code snippet for the call:

```
ActivityRegistrationApplicationService activityManager = new
ActivityRegistrationApplicationService();
ActivityEventKeyDTO activityEventKeyDTO = new ActivityEventKeyDTO();
activityEventKeyDTO.setActivityId(activityID);
activityEventKeyDTO.setEventId(eventID);
ActivityRegistrationResponse response =
activityManager.registerActivityAndGenerateEvent(sessionContext,activityEventKeyDT
O,eventProcessingDate, activityLog);
```

The signature for the method is:

```
public String registerActivityAndGenerateEvent(ApplicationContext
applicationContext,
                                            String activityID,
                                            String eventID,
                                            Date eventProcessingDate,
                                            Object logObject) throws
FatalException;
```

Create new activityID, eventID and logObject to be passed to this method.

ActivityID and EventID as explained in detail in the above section have to be added in the following database tables. If data is not added in the tables, a runtime exception will occur while displaying the alert.

FLX_EP_ACT_B stores all the recognized activities.

FLX_EP_EVT_B stores all the recognized events.

FLX_EP_ACT_EVT_B which stores the mapping between all activities and events.

The Activity ID denotes the actual action that should raise the event within the application service and hence for ease of understanding it should ideally be the fully qualified name of the method.

Eg.com.ofss.fc.app.party.service.contact.PartyNameApplicationService.updateIndividualName

The Event ID can be anything that denotes the event

For example, UPDATED_PARTY_NAME

The logObject is an implementation of IActivityLogDTO. For the new alert a new implementation has to be created. The DTO should have fields mapped to the placeholders in the new alert to be added

For example, for the alert "Your name has been updated from #previous_Name# to #new_Name# successfully."

the following DTO has to be made. The variables have to map to the placeholders in the alert template.

```
public class PartyNameChangeLogDTO implements IActivityLogDTO {
     private static final long serialVersionUID = -3492413059506052931L;
     private String updatedName;
     private String registeredOldName;
     //getters and setters for the variables
}
The DTO has to be populated with relevant data
E.g.:. private IActivityLog populateActivityLogForIndividualPartyNameChange() {
     PartyNameChangeLogDTO activityLog = new PartyNameChangeLogDTO();
     activityLog.setUpdatedName("Andrew Matthew");
     activityLog.setRegisteredOldName("Andy Matthew");
     return activityLog;
}
```

11.5.2 Testing New Alert

JUnit test cases can be used to test the alert created by supplying sample input data. The example below shows how the above new alert can be tested.

```
public void testPartyUpdateName() throws IOException {
    String testCase = "PartyUpdateName";
    ActivityRegistrationApplicationService activityRegistrationApplicationService
          = new ActivityRegistrationApplicationService();
    ActivityEventKeyDTO activityEventKeyDTO = new
ActivityEventKeyDTO("com.ofss.fc.app.party.service.contact.
     PartyNameApplicationService.updateIndividualName "," UPDATED_PARTY_NAME");
    Date date = new Date();
    SessionContext sessionContext = getSessionContext();
    com.ofss.fc.app.party.dto.alert.PartyNameChangeLogDTO activityLog
          = new com.ofss.fc.app.party.dto.alert.PartyNameChangeLogDTO ();
    activityLog.setUpdatedName("Andrew Matthew");
    activityLog.setRegisteredOldName("Andy Matthew");
    try{
          ActivityRegistrationResponse response
                    =
activityRegistrationApplicationService.registerActivityAndGenerateEvent(
```

```
          sessionContext, activityEventKeyDTO, date, activityLog);
          TransactionStatus result= response.getStatus();
          dumpTransactionStatus("ActivityRegistrationApplicationService", "
testPartyUpdateName ", result);
          logger.log(Level.FINER, "The ErrorCode is: "+ result.getErrorCode());
        } catch (FatalException e) {
          logger.log(Level.SEVERE,"FatalException from"+THIS_COMPONENT_NAME+".
testPartyUpdateName ",e);
          fail("Unexpected failure from " + THIS_COMPONENT_NAME + ".
testPartyUpdateName ");
        }
}
```

For testing with the JUnit test cases we need to update the PoolType property in the AlertPollerPool.properties as follows:

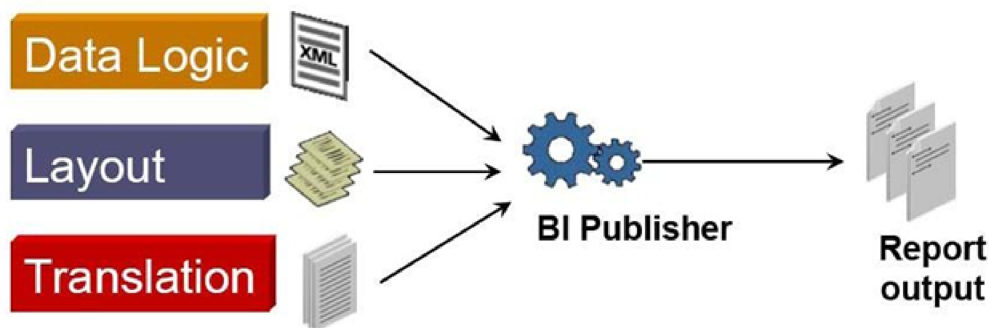
```
PoolType=JDK
```

The value should be JDK for testing with JUnit (standalone application) and JMS if the application is run on WebLogic server.

12 Creating New Reports

Oracle's Business Intelligence Publisher Enterprise is a standalone reporting and document output management solution that allows companies to lower the cost of ownership for reporting solutions. BI Publisher Enterprise's (hereafter known as BIP) strength is that it separates the data model from the actual report formatting/layout. BIP relies on 2 fundamental components to create reports, XML data and a template that represents the look and feel of the report. The XML data can be generated from any number of sources and BIP makes accessing data in the proper format easy. Templates can be created in Microsoft Word and Adobe Acrobat allowing almost anyone familiar with these desktop applications the ability to create reports.

Figure 12–1 Creating New Reports



The following sections will give an overview of Oracle's *BI Publisher*. The developer will be able to add and configure an *Adhoc* report to OBP using the BI Publisher.

Use Case: The OBP application has a batch framework using which a developer can easily add batch processes, also known as *batch shells*, to the application. The batch framework executes all the batch shells defined in the system as per their configuration. The results of these batch shell executions are stored in the database. We will be adding a report using BIP for the execution results summary for batch shells.

12.1 Data Objects for the Report

The *Data Model* of the report invokes the database to fetch the data for the report through certain data objects that we will need to create. The primary data objects needed for the reports are as follows:

Global Temporary Table

You will need to create a *Global Temporary Table* based on the fields required for the report data. This table should mandatory have the field *SESSION_ID* of *NUMBER* type. The naming convention followed in OBP for the global temporary table's name is *RPT_<Module_Code>_R<Report_Number>*.

For the aforementioned use case, the script for creating the global temporary table would be as shown below.

Figure 12–2 Global Temporary Table

```
-- Global temporary table for the report
DROP TABLE RPT_PI_R007;
CREATE GLOBAL TEMPORARY TABLE RPT_PI_R007
(
  COD_SHELL                 VARCHAR2(30),
  TXT_PROCESS_NAME          VARCHAR2(120),
  COD_PROC_CATEGORY         NUMBER(3),
  TXT_CATEGORY              VARCHAR2(20),
  DATE_RUN                  CHAR(8),
  STREAM_START_TIME         DATE,
  STREAM_END_TIME           DATE,
  PROCESSED_COUNT           NUMBER(38),
  COD_BRANCH_GROUP_CODE     VARCHAR2(10),
  EXECUTION_DURATION        NUMBER,
  SESSION_ID                NUMBER
)
on commit preserve rows;
```

Report Record Type

You will need to create a *Type* object with the fields present in the global temporary table. This type will represent a single row of data for the report. The naming convention followed in OBP for the report record type's name is *REP_REC_<Report_Id>*.

For the aforementioned use case, the script for creating the report record type would be as shown below.

Figure 12–3 Report Record Type

```
-- Record type for the report
CREATE OR REPLACE TYPE REP_REC_PI007 AS OBJECT
(
  COD_SHELL                 VARCHAR2(30),
  TXT_PROCESS_NAME          VARCHAR2(120),
  COD_PROC_CATEGORY         NUMBER(3),
  TXT_CATEGORY              VARCHAR2(20),
  DATE_RUN                  CHAR(8),
  STREAM_START_TIME         DATE,
  STREAM_END_TIME           DATE,
  PROCESSED_COUNT           NUMBER(38),
  COD_BRANCH_GROUP_CODE     VARCHAR2(10),
  EXECUTION_DURATION        NUMBER,
  SESSION_ID                NUMBER
);
```

Report Table Type

You will need to create a *Type* object which will be a table of the previously created report record type. This type will represent the set of rows of data for the report. The naming convention followed in OBP for the report table type's name is *REC_TAB_<Report_Id>*.

For the aforementioned use case, the script for creating the report table type would be as shown below.

Figure 12–4 Report Table Type

```
-- Table type for the report
CREATE OR REPLACE TYPE REP_TAB_PI007 AS TABLE OF REP_REC_PI007;
```

Report DML Function

You will need to create a DML function which will be invoked to populate the previously created global temporary table with the data required to be displayed in the report. This function can have parameters as per the developer's requirements with filtering the data or inserting additional data. The naming convention followed in OBP for the report DML function's name is *AP_DML_<Report_Id>.*

For the aforementioned use case, the script for the report DML function would be as shown below.

Figure 12–5 Report DML Function

```
-- DML function for the report
CREATE OR REPLACE FUNCTION AP_DML_PI007(var_l_session_id  IN NUMBER,
                                       var_bank_code      IN VARCHAR2,
                                       var_cod_shell      IN VARCHAR2)
RETURN NUMBER AS

var_l_cod_shell VARCHAR2(30);
PRAGMA AUTONOMOUS_TRANSACTION;

BEGIN

  -- input parameter
  IF (var_cod_shell IS NULL or length(trim(var_cod_shell)) = 0) THEN
    var_l_cod_shell := '%';
  ELSE
    var_l_cod_shell := var_cod_shell;
  END IF;

  --delete existing data for the session
  DELETE FROM RPT_PI_R007 WHERE SESSION_ID = var_l_session_id;

  --insert data into the table
  INSERT INTO RPT_PI_R007
  (COD_SHELL, TXT_PROCESS_NAME, COD_PROC_CATEGORY, TXT_CATEGORY, DATE_RUN, STREAM_START_TIME,
   STREAM_END_TIME, PROCESSED_COUNT, COD_BRANCH_GROUP_CODE, EXECUTION_DURATION, SESSION_ID)
  SELECT DISTINCT
    BJSR.COD_SHELL, BJSM.TXT_PROCESS_NAME, BJSM.COD_PROC_CATEGORY, BJCM.TXT_CATEGORY, BJSR.DATE_RUN, BJSR.STREAM_START_TIME,
    BJSR.STREAM_END_TIME, BJSR.PROCESSED_COUNT, BJSR.COD_BRANCH_GROUP_CODE, BJSR.EXECUTION_DURATION, var_l_session_id
  FROM
    FLX_BATCH_JOB_SHELL_RESULTS BJSR, FLX_BATCH_JOB_SHELL_MASTER BJSM,
    FLX_BATCH_JOB_CATEGORY_MASTER BJCM, FLX_BATCH_JOB_BRN_GRP_MAPPING BJBGM
  WHERE
    BJSR.COD_SHELL = BJSM.COD_EOD_PROCESS AND BJSR.COD_SHELL LIKE var_l_cod_shell AND
    BJSM.COD_PROC_CATEGORY = BJCM.COD_PROC_CATEGORY AND BJSM.COD_BRANCH_GROUP_CODE = BJBGM.BRANCH_GROUP_CODE AND
    BJBGM.BANK_CODE = var_bank_code
  ORDER BY DATE_RUN;

  --commit
  COMMIT;
  RETURN 0;

  EXCEPTION
    WHEN OTHERS THEN ORA_RAISERROR(SQLCODE, 'Execution of AP_DML_PI007 failed', 500);

END;
```

Report DDL Function

You will need to create a DDL function which will be invoked to fetch data required to be displayed in the report from the global temporary table and wrap it in the previously created report table type. The naming convention followed in OBP for the report DDL function's name is *AP_DDL_<Report_Id>*.

For the aforementioned use case, the script for creating report DDL function would be as shown below.

Figure 12–6 Report DDL Function

```
-- DDL function for creating the report
CREATE OR REPLACE FUNCTION AP_DDL_PI007(var_bank_code IN VARCHAR2,
                                        var_cod_shell IN VARCHAR2)
RETURN REP_TAB_PI007 AS

v_ret                   REP_TAB_PI007;
var_l_session_id        NUMBER;
dml_function_result     NUMBER;

BEGIN
  var_l_session_id    := USERENV('SESSIONID');
  dml_function_result := AP_DML_PI007(var_l_session_id, var_bank_code, var_cod_shell);

  SELECT
    CAST
    (
      MULTISET
      (
        SELECT
          COD_SHELL, TXT_PROCESS_NAME, COD_PROC_CATEGORY, TXT_CATEGORY, DATE_RUN, STREAM_START_TIME,
          STREAM_END_TIME, PROCESSED_COUNT, COD_BRANCH_GROUP_CODE, EXECUTION_DURATION, SESSION_ID
        FROM RPT_PI_R007
        WHERE SESSION_ID = var_l_session_id
        ORDER BY DATE_RUN
      )
      AS REP_TAB_PI007
    )
    INTO v_ret
    FROM DUAL;

  RETURN v_ret;

  EXCEPTION
    WHEN OTHERS THEN ORA_RAISERROR(SQLCODE, 'Execution of AP_DDL_PI007 failed', 500);

END;
```

Data Model for the Report

Once you have created the data objects for the report in the database, you can start adding and configuring the report using BIP. Log in to the BIP application and follow these steps.

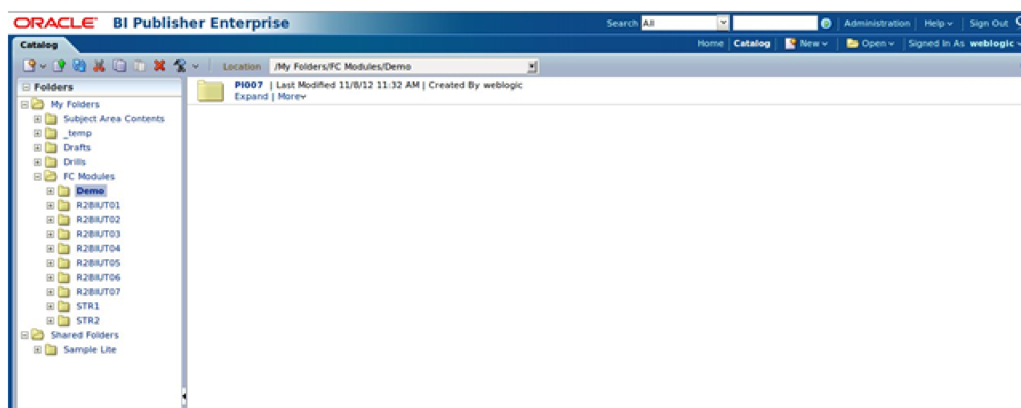
You can log in to the BIP application deployed on http: //<IP ADDRESS><PORT>/xmlpserver/ with the credentials *weblogic/weblogic1*.

12.2 Catalog Folder

Before creating the data model or the layout for the report, you should create a folder to save the model and layout. You can find the link for the Catalog tab on the home screen. Click it and create a folder for your report at an appropriate location.

For the aforementioned use case, you can create a folder *PI007* at the location */My Folders/FC Module/Demo* as shown below.

Figure 12–7 Catalog Folder

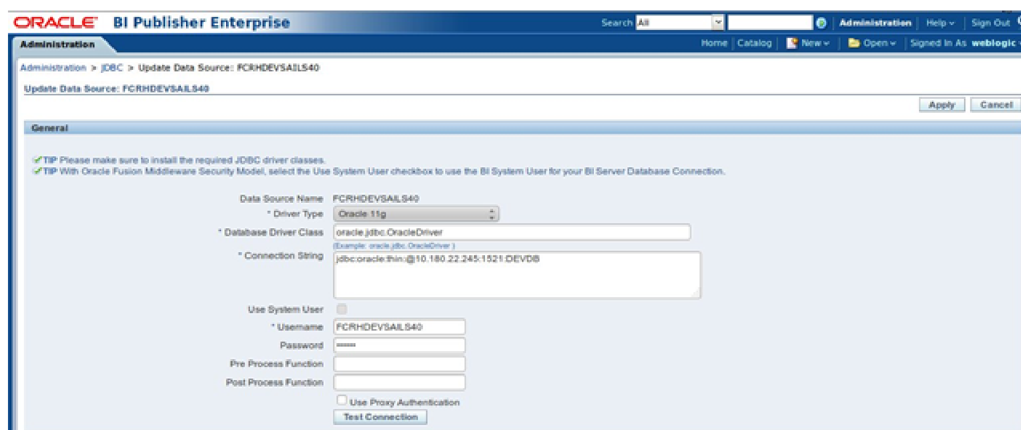


12.3 Data Source

You will need to add the data source from which the data will be fetched to be displayed in the report. The data source can be a *JDBC Connection*, *JNDI Connection*, *File*, *LDAP Connection* and so on. You can find the link for the *Administration* tab on the home screen. Click it and choose the appropriate data source connection type. Enter the required parameter values and validate the connection. Save the data source with an appropriate name.

For the aforementioned use case, you can add the JDBC Connection data source as show below.

Figure 12–8 Data Source



12.4 Data Model

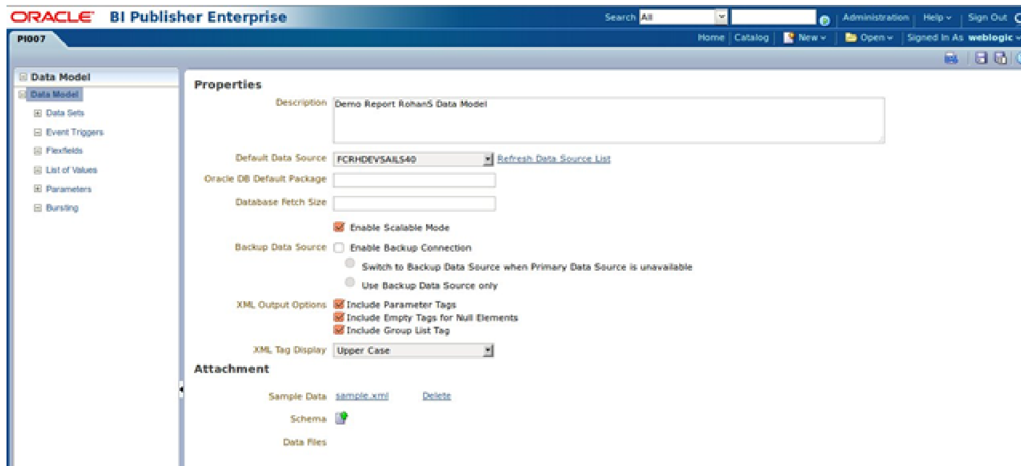
You will need to create a data model to back the report. This data model represents the report data fetched using the data objects and formatted into XML data. You can find the link to *Create Data Model* on the home screen of BIP. Click it and follow these steps:

1. Enter an appropriate *description* for the data model.
2. Choose the previously created *data source* from the list displayed.
3. Check the Enable Scalable Model option.

4. Check the Include Parameter Tags option.
5. Check the Include Empty Tags for Null Elements option.
6. Check the Include Group List Tags option.
7. You can leave the rest of the options to default.

   For the aforementioned use case, you can create data model as shown below.

Figure 12–9 Data Model



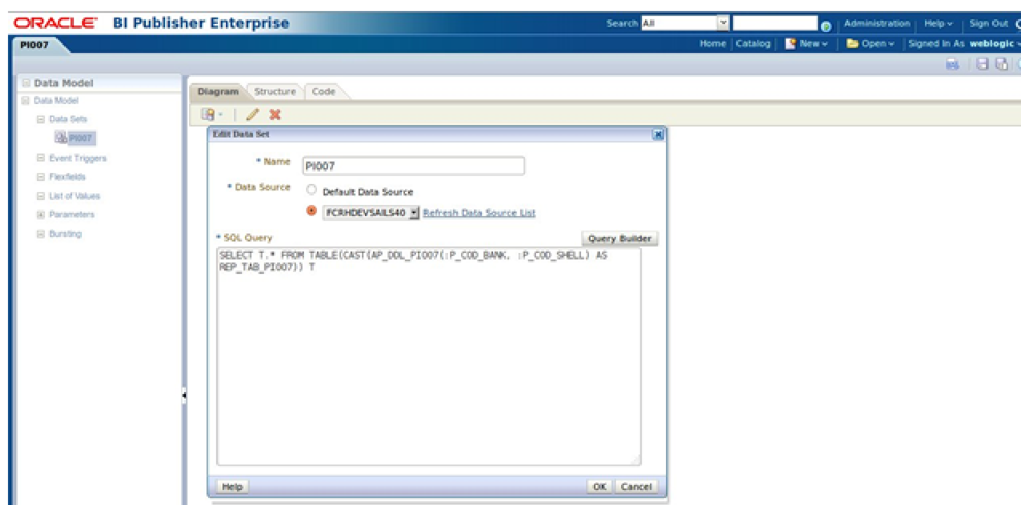
Data Set

After creating the data model, you will need to create a data set of the fields required to be displayed in the report. You can find the link for *Data Sets* on the left side pane of the screen. To create the data set, follow these steps:

1. In the Create Data Set icon, choose the option Create Data Set from SQL Query.
2. Enter an appropriate *name* for the data set.
3. Choose the previously created *data source* from the list displayed.
4. Enter the SQL query which will be used to fetch the data for the report. The results returned should be of the *Report Table Type* previously created.

For the aforementioned use case, you can create the data set as shown below.

Figure 12–10 Data Set



On click of OK, a data set will be created with all the fields as defined in the previously created *Report Record Type*.

You can group the fields as per the requirements of the report:

1. Select the field on which you want to group and choose *Group By.*
2. After creating a group, you can move fields between the groups.
3. You can also set field which will be used to sort the data displayed in a group.

For the aforementioned use case, you can group the fields as shown below.

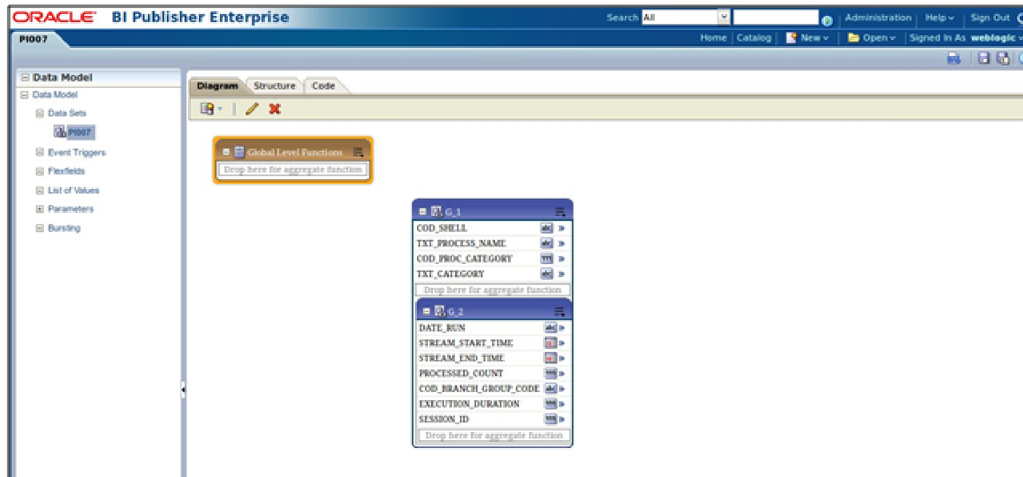
Figure 12–11 Group Fields

	XML View			Business View	
Data Source	XML Tag Name	Sorting	Value If Null	Display Name	Data Type
Report Data					
Data Structure	PI007				
PI007	G_1			G_1	
COD_SHELL	COD_SHELL			COD_SHELL	
TXT_PROCESS_NAME	TXT_PROCESS_NAME			TXT_PROCESS_NAME	
COD_PROC_CATEGORY	COD_PROC_CATEGORY			COD_PROC_CATEGORY	
TXT_CATEGORY	TXT_CATEGORY			TXT_CATEGORY	
PI007	G_2			G_2	
DATE_RUN	DATE_RUN			DATE_RUN	
STREAM_START_TIME	STREAM_START_TIME			STREAM_START_TIME	
STREAM_END_TIME	STREAM_END_TIME			STREAM_END_TIME	
PROCESSED_COUNT	PROCESSED_COUNT			PROCESSED_COUNT	
COD_BRANCH_GROUP_CODE	COD_BRANCH_GROUP_CODE			COD_BRANCH_GROUP_CODE	
EXECUTION_DURATION	EXECUTION_DURATION			EXECUTION_DURATION	
SESSION_ID	SESSION_ID			SESSION_ID	

You can view and edit the XML structure and labels of the report data in the *Structure* tab in a tabular format.

For the aforementioned use case, the structure would be as shown below:

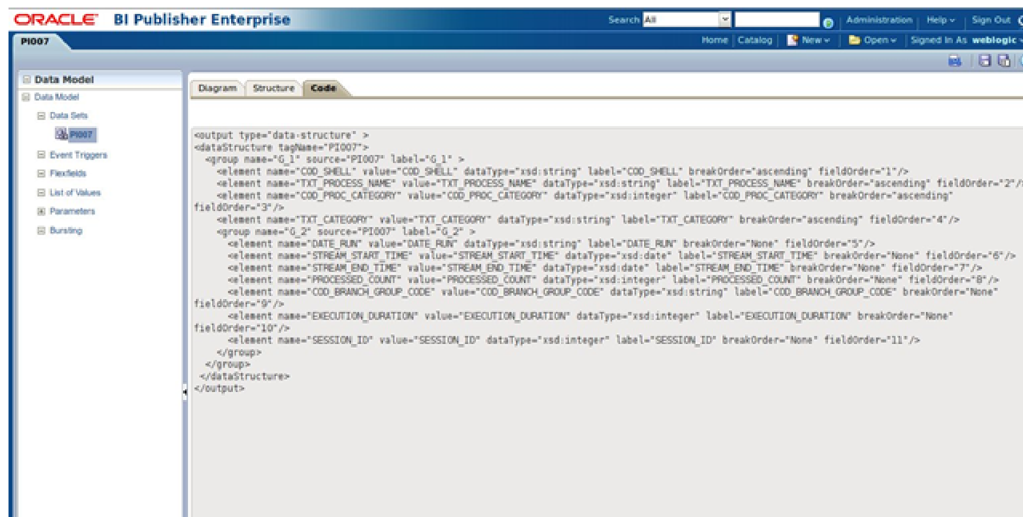
Figure 12–12 XML Structure and Labels



You can view the actual XML code in the *Code* tab.

For the aforementioned use case, the XML code would be as shown below.

Figure 12–13 XML Code



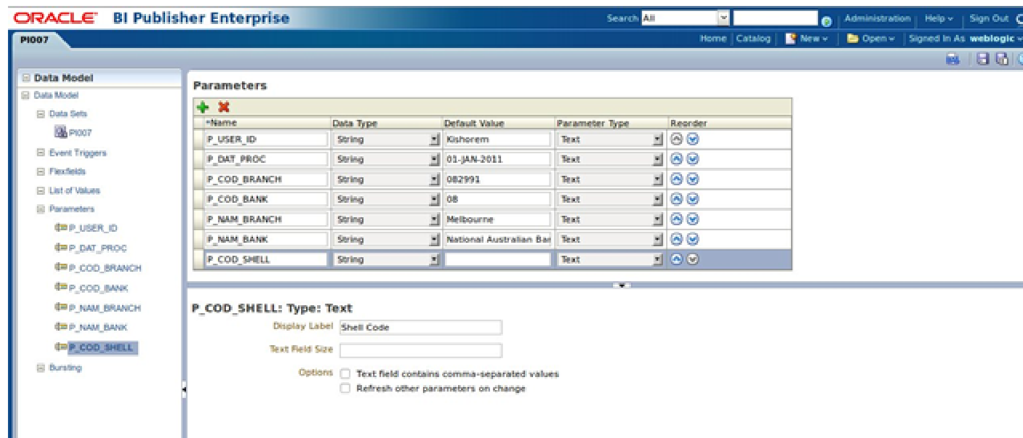
Input Parameters

You can define the *Input Parameters* required by the report in the *Parameters* tab present on the left hand side pane of the screen. To define input parameters, follow these steps:

1. In the **Parameters** tab, click the icon for *Add Parameter*.
2. Enter the name, type, display label and default value for the parameter.
3. Repeat the above steps to define as many parameters as required.

For the aforementioned use case, you can add parameters as shown below:

Figure 12–14 Add Input Parameters



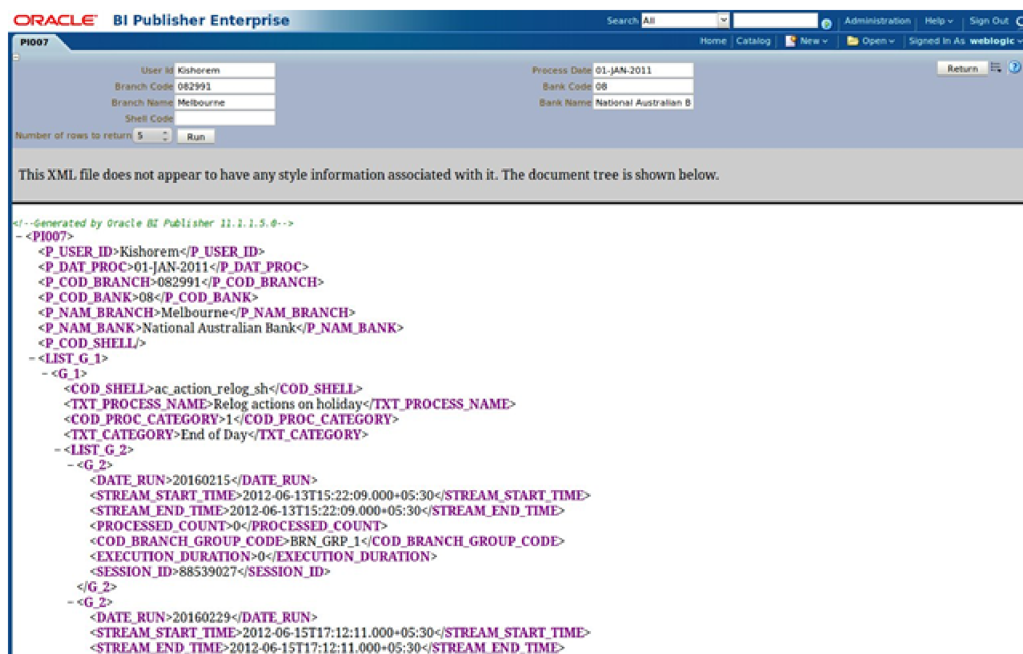
12.5 XML View of Report

After following the above steps, save the data model in the previously created catalog folder with an appropriate name. You can view the report without the layout in the XML form by clicking on the icon for *XML View*.

In the XML view, you will see input fields for the previously defined *input parameters*. Enter appropriate values in those fields and click *Run*. You will be able to see the XML representation of the report data.

For the aforementioned use case, the XML representation of the report data would be as shown below.

Figure 12–15 XML View of Report



12.6 Layout of the Report

A report needs to be presented in an appropriate format. The format can vary from report to report and client to client. BIP separates the data model from the layout making it convenient for the developer.

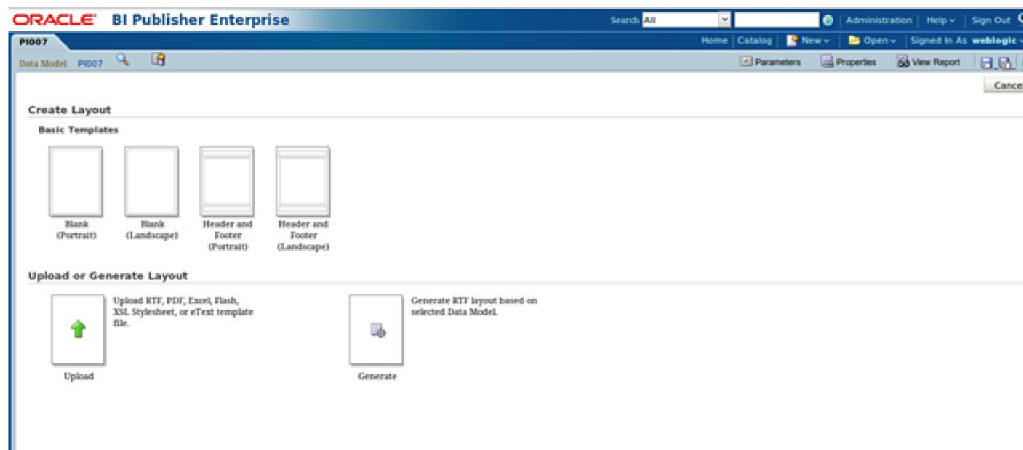
Anybody familiar with using Microsoft Word or Adobe Acrobat can use the corresponding plug-ins for these tools to create a layout for a report. You can create a rich layout using these standalone applications with BIP plug-ins and then upload them to the BIP application for use in your report.

The BIP application can generate a very basic layout for your report from the data set. You can download the generated layout, modify it as per your layout requirements and upload it to the BIP application for use in your report.

The BIP application also allows the user to create a layout on the web. It has a rich set of tools to with drag and drop features and a ready link to the data set fields. You can create a layout in this fashion and use it in your report.

You can find the link to *Add New Layout* on the right side of the screen. Click it to get the options to *create*, *generate* or *upload* a layout.

Figure 12–16 Layout of the Report - Create Layout

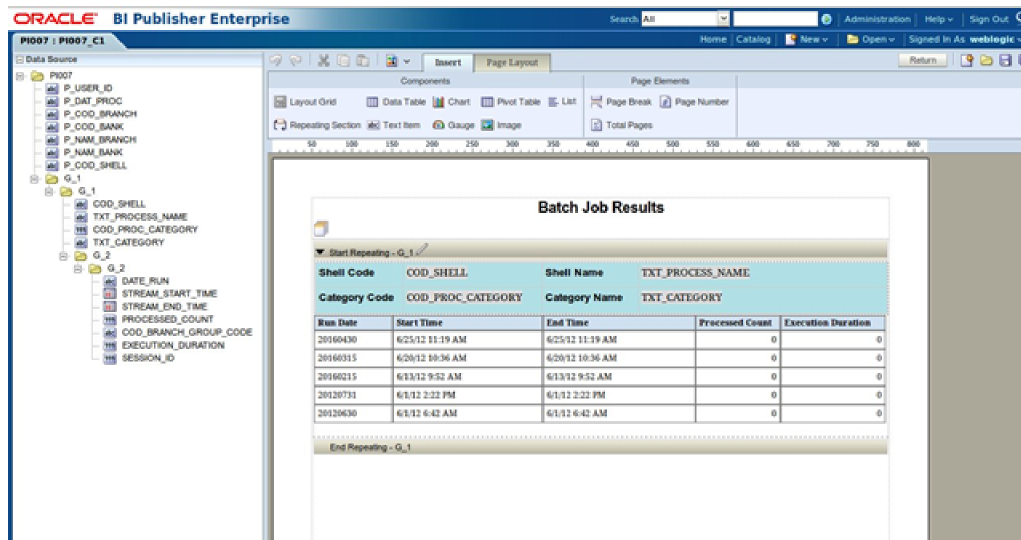


Choose from the *Basic Templates* to create a layout from a template. The layout editor screen will open. The previously created data set fields are present on the left pane of the screen. The toolbar present on top of the layout has tools to insert *Layout Grid, Data Table, Repeating Section, Text Item, List, Image, Page Break, Page Number,* elements.

You can drag and drop the layout and data set elements on to the layout as per your requirements. After making the required modifications, save the layout and return to the previous screen.

For the aforementioned use case, the layout for the report would be as shown below.

Figure 12–17 Layout of the Report - Batch Job Results



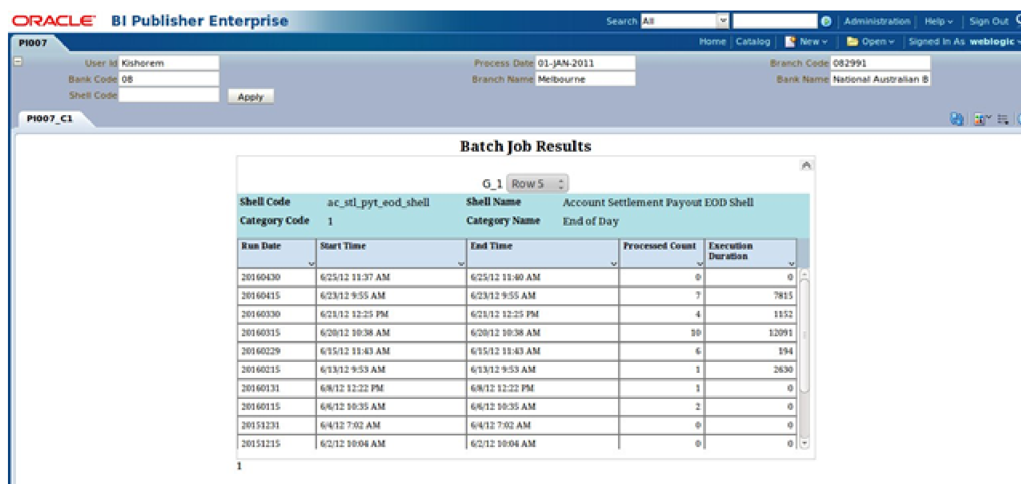
12.7 View Report in BIP

After saving the *Data Model* and *Layout*, you can view the report in BIP. Click the **View Report** link on the top right corner of the screen to open the report screen.

You will be able to see the input fields for the input parameters defined for the report. Enter appropriate values in these fields and click **Apply**. The report will be generated and displayed on the screen with the applicable data returned by the previously created *Data Model* and formatted as per the previously created *Layout*.

For the aforementioned use case, the final report would be as shown below.

Figure 12–18 View Report in BIP



You can export the report in *HTML, PDF, Excel, RTF* or *PowerPoint* formats by clicking on the icon for *Export* on the right top corner of the screen and choosing the corresponding export option.

12.8 OBP Batch Report Configuration - Define the Batch Reports

Entries are required in three tables as given below to generate reports during EOD.

```
insert into FLX_BATCH_JOB_SHELL_MASTER (COD_EOD_PROCESS, TXT_PROCESS, TXT_PROCESS_
NAME, FRQ_PROC, DAT_LAST_RUN, DAT_SCHEDULED_RUN, TXT_PROC_PARAM, COD_PROC_STATUS,
NUM_PROC_ERROR, FLG_RUN_TODAY, COD_PROC_CATEGORY, FLG_MONTH_END, FLG_MNT_STATUS,
COD_MNT_ACTION, COD_LAST_MNT_MAKERID, COD_LAST_MNT_CHKRID, DAT_LAST_MNT, CTR_
UPDAT_SRLNO, COD_MODULE, DAT_PROC_START, DAT_PROC_END, TXN_KEY, SERVICE_KEY, NAM_
COMPONENT, TYPE_COMPONENT, NAM_DBINSTANCE, RETRY_COUNTER, NON_RETRY_COUNTER, COD_
UNSTREAMED_PROCESS, COD_BRANCH_GROUP_CODE)
values ('ch_eod_report_shell', 'CASA EOD Reports', 'CASA EOD Reports', '1', to_
date('15-02-2012', 'dd-mm-yyyy'), to_date('15-12-2007', 'dd-mm-yyyy'), '99', 0, 0,
'Y', 1, 0, 'A', ' ', 'SETUP1', 'SETUP2', to_date('09-02-2002', 'dd-mm-yyyy'), 2,
'CH', to_date('21-08-2008 09:54:57', 'dd-mm-yyyy hh24:mi:ss'), to_date('28-02-2011
05:02:41', 'dd-mm-yyyy hh24:mi:ss'), 'DUMMY', 'execute',
'com.ofss.fc.bh.batch.BatchReportShellBean', 'B', 'PROD', 0, 0, 'ch_eod_report_
shell', 'BRN_GRP_1');
```

Cod_proc_category = **1**, for EOD; 2, for BOD and 16 for Internal System EOD

Nam_component is the same for all report shells.

Also we are using Branch_Group_Category ='BRN_GRP_1' for all these report shells.

12.9 OBP Batch Report Configuration - Define the Batch Report Shell

```
Insert into FLX_BATCH_JOB_SHELL_DEPEND (COD_EOD_PROCESS, COD_REQD_PROCESS, COD_
PROC_CATEGORY, COD_REQD_PROC_CAT, FLG_MNT_STATUS, COD_MNT_ACTION, COD_LAST_MNT_
MAKERID, COD_LAST_MNT_CHKRID, DAT_LAST_MNT, CTR_UPDAT_SRLNO, COD_BRANCH_GROUP_
CODE)
Values ('ch_eod_report_shell', 'dd_eod_action', 1, 1, 'A', ' ', 'SETUP', 'SETUP',
to_date('30-06-1995', 'dd-mm-yyyy'),2, 'BRN_GRP_1');
```

Here, in the first column is the report shell name and second is the name of the shell after which this shell should run. So 'ch_bod_report_shell' runs after 'dd_bod_action'. The remaining columns are self explanatory.

```
COD_PROC_CATEGORY=1 , for EOD; 2, for BOD and 16 for Internal System EOD
COD_REQD_PROC_CAT=1, for EOD; 2, for BOD and 16 for Internal System EOD
```

Also we are using Branch_Group_Category = 'BRN_GRP_1' for all these report shells.

12.10 OBP Batch Report Configuration - Define the Batch Report Shell Dependencies

```
Insert into flx_ba_report_ctrl (COD_REPORT_ID, FLG_REP_ADV, COD_MODULE, NAM_
REPORT, TYP_REPORT, FRQ_REPORT, FLG_PRINT, FLG_DELETE, CTR_REP_COPIES, COD_
PRIORITY, COD_ACCESS_LVL, COD_FILEID, BUF_INV_VAR1, BUF_INV_VAR2, BUF_INV_VAR3,
BUF_INV_VAR4, BUF_INV_VAR5, FLG_MNT_STATUS, COD_MNT_ACTION, COD_LAST_MNT_MAKERID,
COD_LAST_MNT_CHKRID, DAT_LAST_MNT, CTR_UPDAT_SRLNO, FLG_SOURCE, FLG_SPLIT, FLG_
PROD_REP, COD_REPORT_DB_PREFIX, FLG_APPLY_SC, REF_UDF_NO, XPATH, FLG_REPORT_
SERVER)
values ('CH318', 'R', 'CH', 'CASA BALANCE LISTING', 'E', '1', '1', '0', 1, 0, 0,
10047, ' ', ' ', ' ', ' ', ' ', 'A', ' ', 'PHASE_2', 'PHASE_2', to_
date('01-11-1999', 'dd-mm-yyyy'), 2, 'P', 'Y', 'P', 'PROD', '', '', '', 'B');
```

Entry for each report should be here with typ_report = 'I' for Internal System EOD; 'E' for EOD and 'B' for BOD.

Currently, for EOD and BOD eod_report_shell and bod_report_shell will take care of all non CASA and TD EOD and BOD reports respectively.

No separate module specific shell is required during EOD and BOD. That is to mention Entry 3 alone is sufficient during EOD and BOD categories for any module. However, entries are needed for all three entries for batch report generation during any other category.

12.11 OBP Batch Report Configuration

This section describes the OBP batch report configuration.

12.11.1 Batch Report Generation for a Branch Group Code

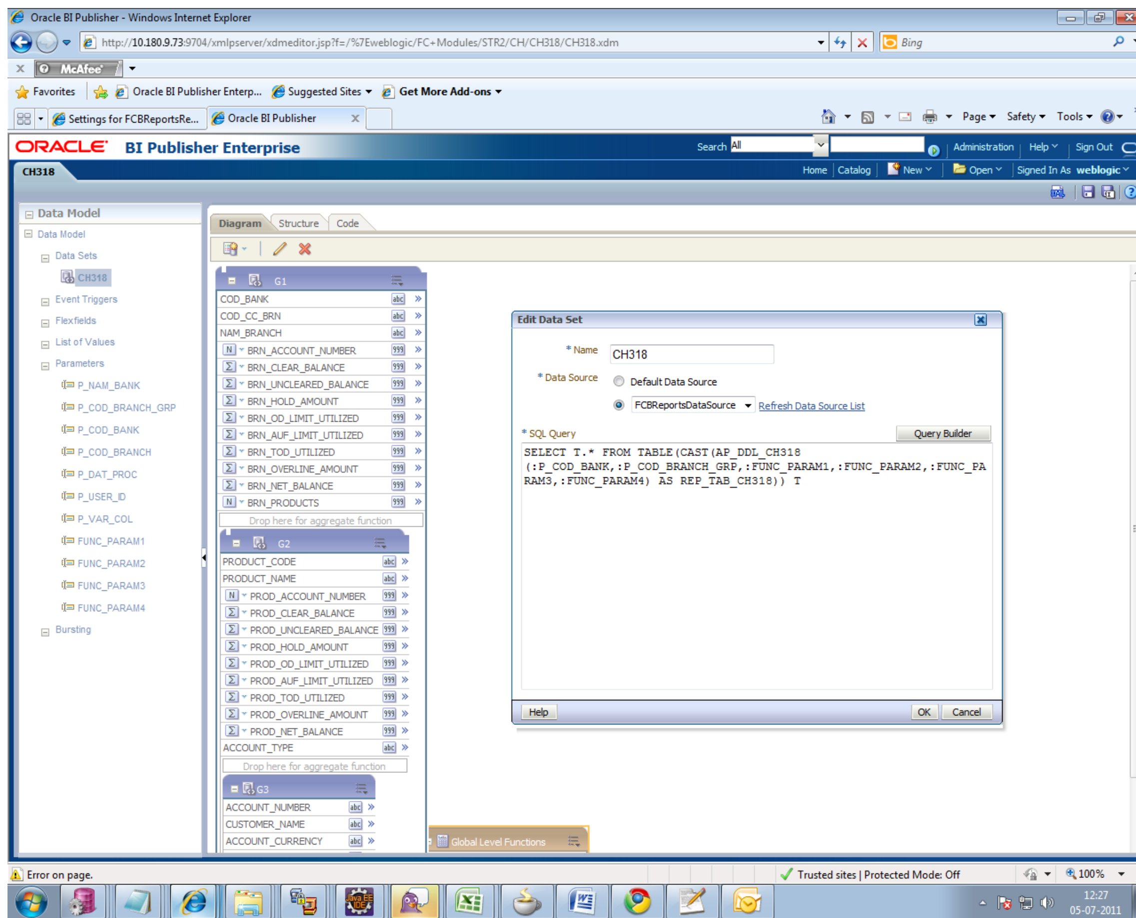
During Batch Process, a report should be generated for all branches linked to the respective Branch Group Code.

For any Batch Report to make use of the Branch Group Code getting passed by the application, a parameter 'P_COD_BRANCH_GRP' has to be defined in the Data Model.

The Data Model should pass this parameter to the Report Related DDL Function.

The Report Related DML Function filters all branch codes from FLX_BATCH_JOB_RESULTS_FILTERED that belong to the same Branch Group Code.

Figure 12–19 Batch Report Generation for a Branch Group Code



12.11.2 Batch Report Generation Status

At the end of all batch processes BA_REPORT_RESTART gets logged with the generated report status as D -> Done or F->Failed.

12.11.3 Batch Report Generation Path

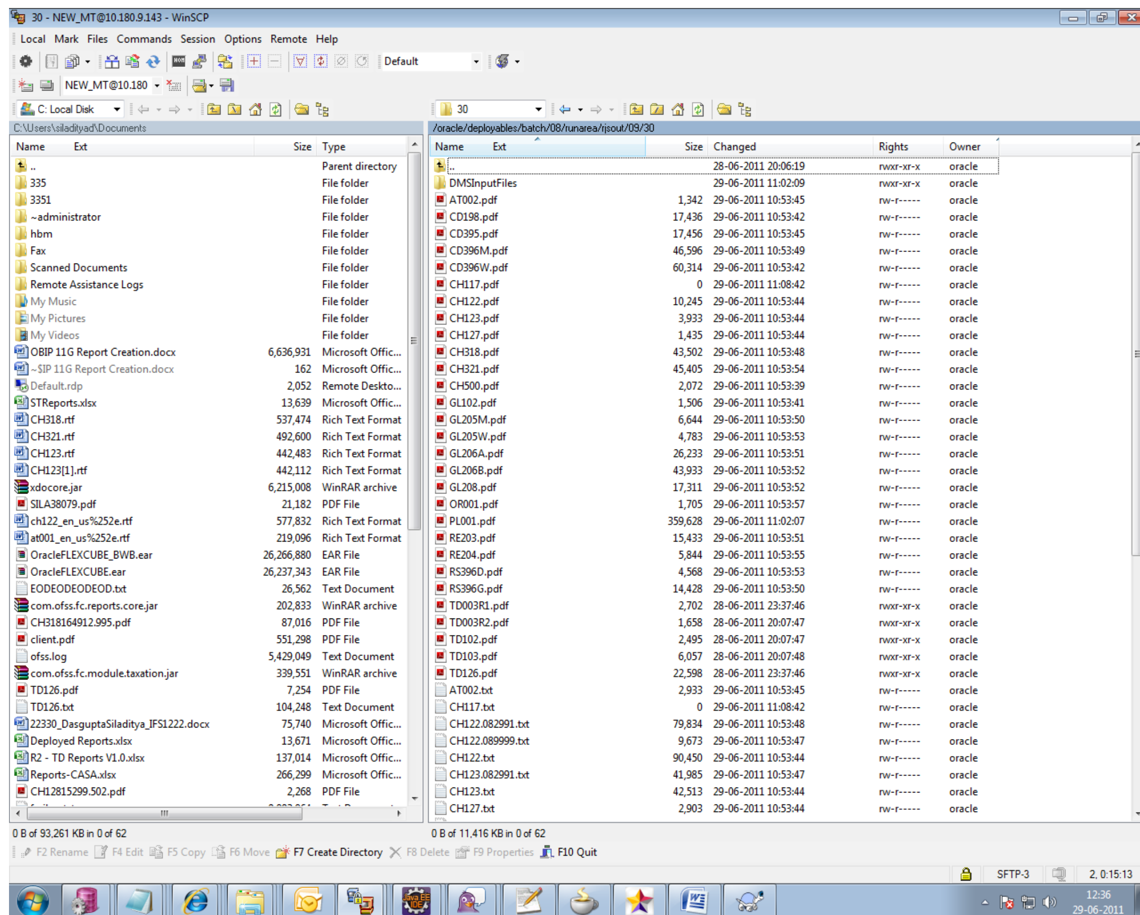
The reports (for example, 30th September 2008) will be generated as shown in the host side screen-shot.

Locate these reports at this location in the host server.

/oracle/deployables/batch/08/runarea/rjsout/09/30 which actually is of the format

/config/../<BankCode>/runarea/rjsout/<MM>/<DD>

Figure 12–20 Batch Report Generation Path



12.12 OBP Adhoc Report Configuration

This section describes the OBP adhoc report configuration.

12.12.1 Define the Adhoc Reports

Define the adhoc reports as follows:

```
Insert into flx_ba_report_ctrl (COD_REPORT_ID, FLG_REP_ADV, COD_MODULE, NAM_
REPORT, TYP_REPORT, FRQ_REPORT, FLG_PRINT, FLG_DELETE, CTR_REP_COPIES, COD_
PRIORITY, COD_ACCESS_LVL, COD_FILEID, BUF_INV_VAR1, BUF_INV_VAR2, BUF_INV_VAR3,
BUF_INV_VAR4, BUF_INV_VAR5, FLG_MNT_STATUS, COD_MNT_ACTION, COD_LAST_MNT_MAKERID,
COD_LAST_MNT_CHKRID, DAT_LAST_MNT, CTR_UPDAT_SRLNO, FLG_SOURCE, FLG_SPLIT, FLG_
PROD_REP, COD_REPORT_DB_PREFIX, FLG_APPLY_SC, REF_UDF_NO, XPATH, FILE_DESC, FLG_
REPORT_SERVER)
values ('CH318', 'R', 'CH', 'CASA BALANCE LISTING', 'A', '1', '1', '0', 1, 0, 0,
10047, ' ', ' ', ' ', ' ', ' ', 'A', ' ', 'PHASE_2', 'PHASE_2', to_
date('01-11-1999', 'dd-mm-yyyy'), 2, 'P', 'Y', 'P', 'PROD', '', '', '', 'Savings
Listing Reports', 'B');
```

12.12.2 Define the Adhoc Report Parameters

Define the adhoc report parameters as follows:

```
INSERT INTO flx_ba_report_params (COD_REPORT_ID,FLG_REP_ADV,COD_SERIAL,NAM_PROMPT,
```

```
COD_FLD_TYP,LEN_FLD,FLG_DELETE,DAT_LAST_MNT,NAM_VAL_ROUTINE,REQD_DESC) VALUES
('CH318','R',1,'Branch Code',0,0,'N','01-NOV-99','','Y')
/
INSERT INTO flx_ba_report_params (COD_REPORT_ID,FLG_REP_ADV,COD_SERIAL,NAM_PROMPT,
COD_FLD_TYP,LEN_FLD,FLG_DELETE,DAT_LAST_MNT,NAM_VAL_ROUTINE,REQD_DESC) VALUES
('CH318','R',2,'Product Code',0,0,'N','01-NOV-99','','Y')
/
INSERT INTO flx_ba_report_params (COD_REPORT_ID,FLG_REP_ADV,COD_SERIAL,NAM_PROMPT,
COD_FLD_TYP,LEN_FLD,FLG_DELETE,DAT_LAST_MNT,NAM_VAL_ROUTINE,REQD_DESC) VALUES
('CH318','R',3,'From Date(DD-MMM-YYYY)',8,0,'N','01-NOV-99','','Y')
/
```

Also COD_FLD_TYP = 8 will ensures the host side date format validations.

COD_FLD_TYP = 0 is for string type parameters.

Corresponding to each of the above sequence of parameters appearing in screen, a mandatory parameter 'FUNC_PARAM<Parameter Sequence Number>' should be defined in BIP Data Model. So the input parameter 'FUNC_PARAM2' defined in data model should correspond to Product Code as defined above.

12.12.3 Define the Adhoc Reports to be listed in Screen

Define the group name as follows:

For Adhoc Report, column FILE_DESC of report master table FLX_BA_REPORT_CTRL contains the name of the group under which the report will be listed in 7775 screen.

12.12.4 Adding Screen Tab for Report Module

For adding a Screen Tab do the following:

```
com.ofss.fc.ui.view.brop.jar@
public_html/com/ofss/fc/ui/view/brop/reportRequest/form/ReportRequest.jsff
   <af:commandNavigationItem partialSubmit="true"  text="#{rb7775.LBL_
Reconciliation}"
                 binding="#{ReportRequest.cni11}" id="cni11" immediate="true"
                 actionListener="#{ReportRequest.processMode}" selected="false">
                           <f:attribute name="mode" value="Reconciliation"/>
   </af:commandNavigationItem>
```

```
com.ofss.fc.ui.view.brop.jar@
/com/ofss/fc/ui/view/brop/reportRequest/backing/ReportRequest.java
private RichCommandNavigationItem cni11;
    Add following accessors:-
    public void setCni11(RichCommandNavigationItem cni11) {
        this.cni11 = cni11;
    }
    public RichCommandNavigationItem getCni11() {
        return cni11;
    }
```

Also modify the selection tab highlighting portion of the code.

com.ofss.fc.ui.view.brop.jar@

/com/ofss/fc/ui/view/brop/reportRequest/rb/ReportRequest_en.properties

LBL_Reconciliation = Reconciliation

12.13 Adhoc Report Generation – Screen 7775

The adhoc report can be generated using the following screen:

Figure 12–21 Adhoc Report Generation - Report Request

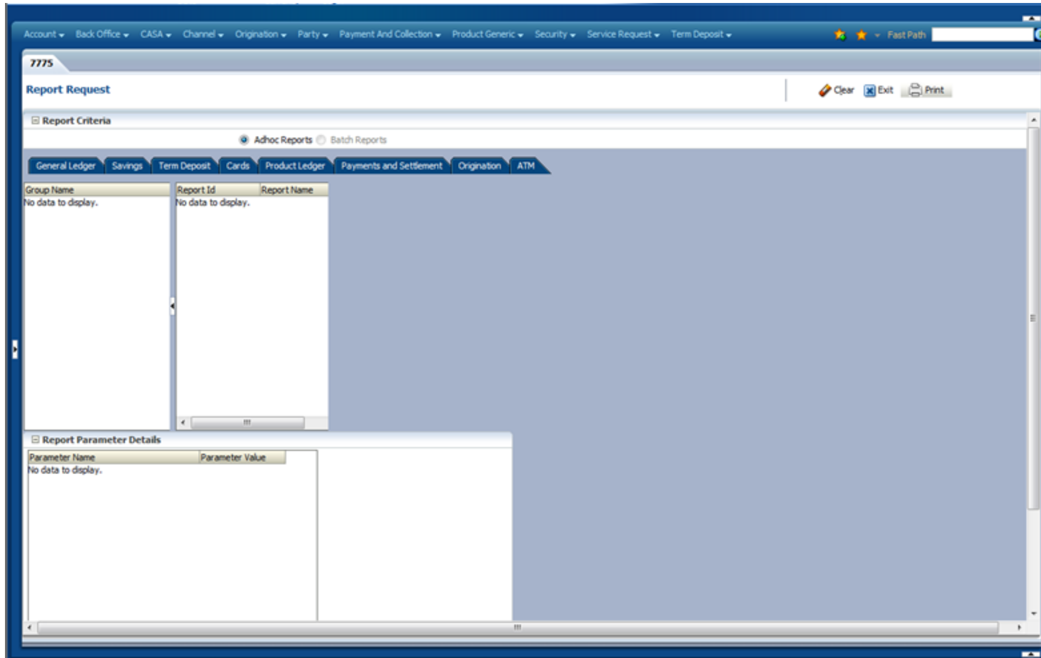
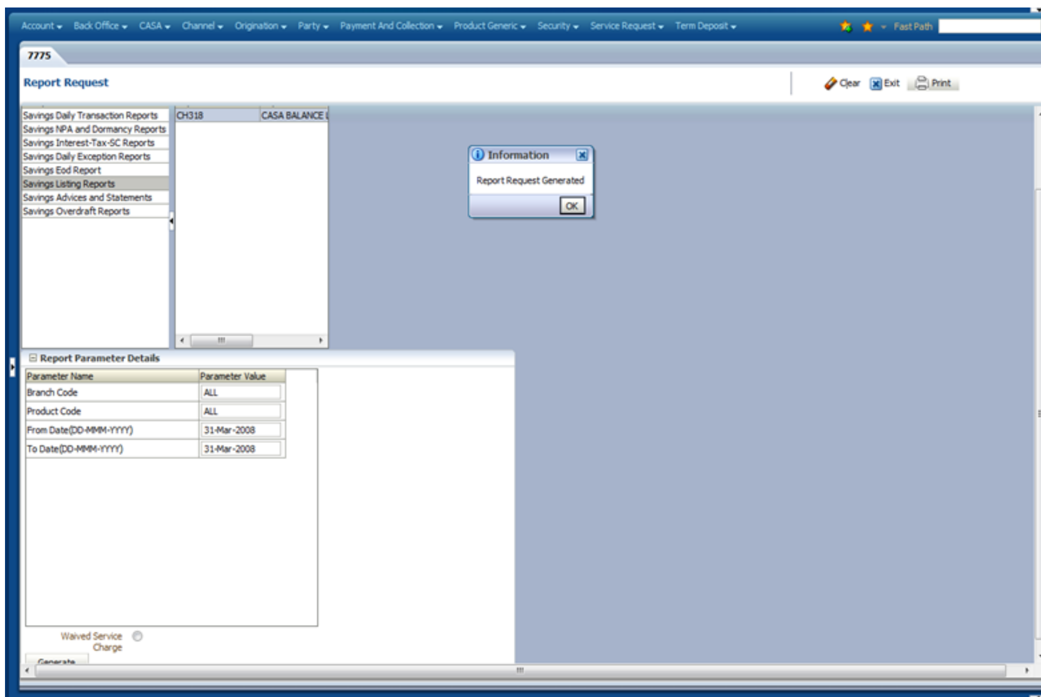


Figure 12–22 Adhoc Report Generation - Report Generated



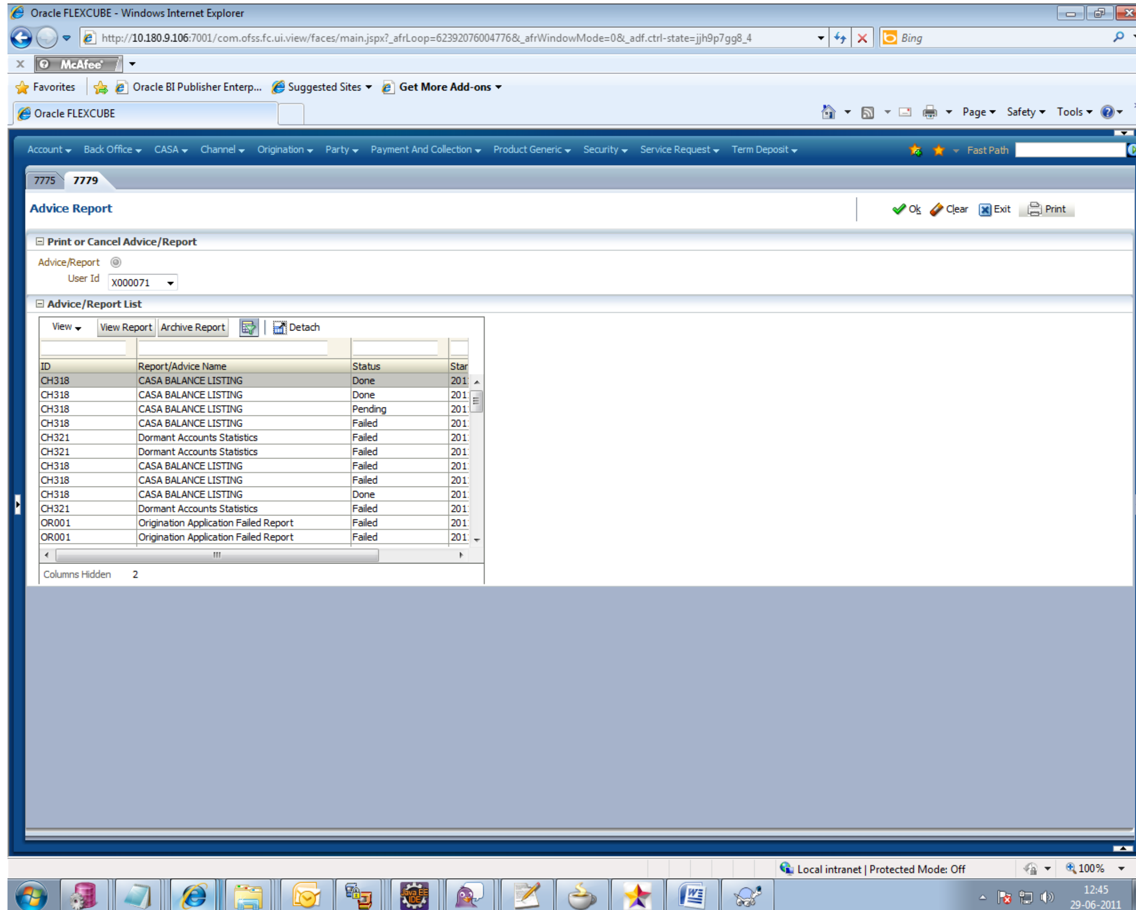
On filling the parameters and clicking on 'Generate' the report request gets successfully posted.

At the end of Adhoc report generation, RJS_REQUESTS gets logged with the generated report status as D -> Done, F-> Failed.

12.14 Adhoc Report Viewing – Screen 7779

The adhoc report can be viewed using the following screen:

Figure 12–23 Advice Report



On selecting the correct user id that generated the report we get the reports generated by that user.

Now sort the Transaction Number (right most column) in the descending order.

Select the top record and click 'View Report'.

Figure 12–24 View Generated Adhoc Report

Bank : 08 National Australia Bank

FLEXCUBE
CASA BALANCE LISTING

Branch : 082991 U Bank Operations BR
Op. Id : X000071
Module : CASA

For:29-Feb-2008

Account Number	Customer Name	Account Currency	Account Status	Clear Balance	Uncleared Balance	Hol
Product Code : CS100		Product Name:U Saver		Account Type:ASSET		
000047845	Keith Watson	AUD	Inactive	54.21	0.00	
000047861	franklin joseph	AUD	Regular	420.00	20.00	
000047896	franklin joseph	AUD	Regular	712.74	0.00	
000024125	Brad Pitt	AUD	Regular	0.00	0.00	
000024176	Randy Orton	AUD	Regular	0.00	0.00	
000024192	John GGG Cena	AUD	Regular	22,189.61	0.00	
000024205	Atul KKK Sinha	AUD	Regular	0.00	0.00	
000024256	Kanh Do	AUD	Regular	993,838.02	0.00	
000024301	Andy Flower	AUD	Regular	26,810.07	0.00	
000024408	Shane Watson	AUD	Regular	3,016.62	0.00	
000024491	Aaron Lo	AUD	Regular	10,079.18	0.00	
000024504	JJJJJJJJJJ RRRRRRRR	AUD	Regular	0.00	0.00	
000024627	jay more	AUD	Regular	110,263.88	0.00	
000024686	Harry Jonto	AUD	Regular	0.00	0.00	
000024889	Shane Watson	AUD	Regular	5,021.16	0.00	
000024897	Shane Watson	AUD	Regular	14,063.40	0.00	
000024918	Shane Watson	AUD	Regular	41,169.39	50,000.00	
000025013	John GGG Cena	AUD	Regular	25,227.97	0.00	
000025144	franklin pearl	AUD	Regular	2,322.47	2,795.00	
000025179	ansdnn asnasnsn	AUD	Regular	0.00	0.00	
000025320	brad hopes	AUD	Regular	1,108.71	0.00	
000025347	HHHHHHHH MMMMMMM	AUD	Regular	0.00	0.00	
000025363	adam gilchrist	AUD	Regular	0.00	0.00	
000025435	Charlotte Collins	AUD	Regular	0.00	0.00	
000025443	Charlotte Collins	AUD	Regular	100,491.50	0.00	
000048098	Darryl Molley	AUD	Regular	102,275,320.27	0.00	1,
000048100	ice ice	AUD	Regular	0.00	0.00	
000048119	ice 1	AUD	Regular	50,000.00	0.00	
000048127	iceice ice	AUD	Regular	0.00	0.00	
000048135	Aishwarya ram	AUD	Regular	100,008.81	0.00	
000048151	ice ice	AUD	Regular	0.00	0.00	
000048207	Martin Berchmans	AUD	Regular	95,680.26	0.00	

The report is rendered in the front end.

13 Security Customizations

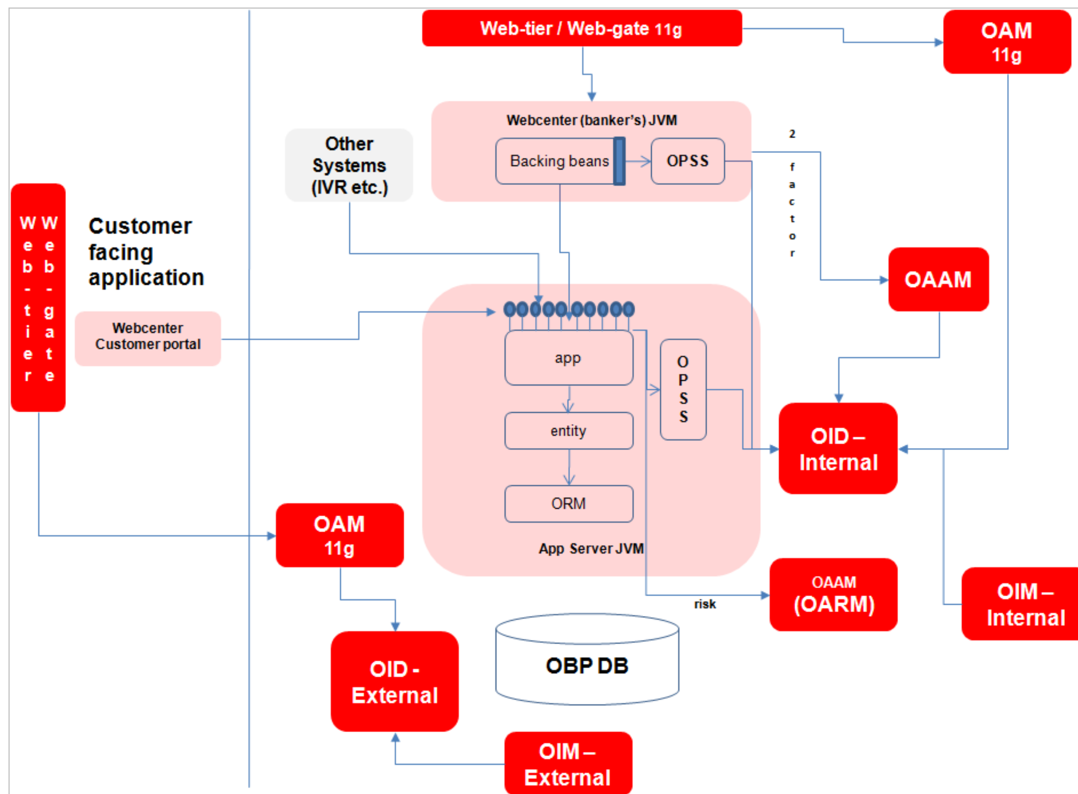
OBP comprising of several modules has to interface with various systems in an enterprise to transfer or share data which is generated during business activity that takes place during teller operations or processing. While managing the transactions that are within OBP's domain, it is needed to consider security and identity management and the uniform way in which these services need to be consumed by all applications in the enterprise.

This is possible if these capabilities can be externalized from the application itself and are implemented within products that are specialized to handle such services. Examples of these services include authentication against an enterprise identity-store, creating permissions and role-based authorization model that controls access to not only the components of the application, but also the data that is visible to the user based on fine-grained entitlements.

The following security functions are provided with the extensibility features:

- Attributes participating in access policy rules
- Attributes participating in fraud assertion rules
- Attributes participating in matrix-based approval checks
- Account validator
- Customer validator
- Business unit validator
- Adding validators
- Customizing user search
- Customizing of a 'Send OTP | Validate OTP' logic
- Customizing Role Evaluation
- Customizing Limit Exclusions
- Adding approval checks

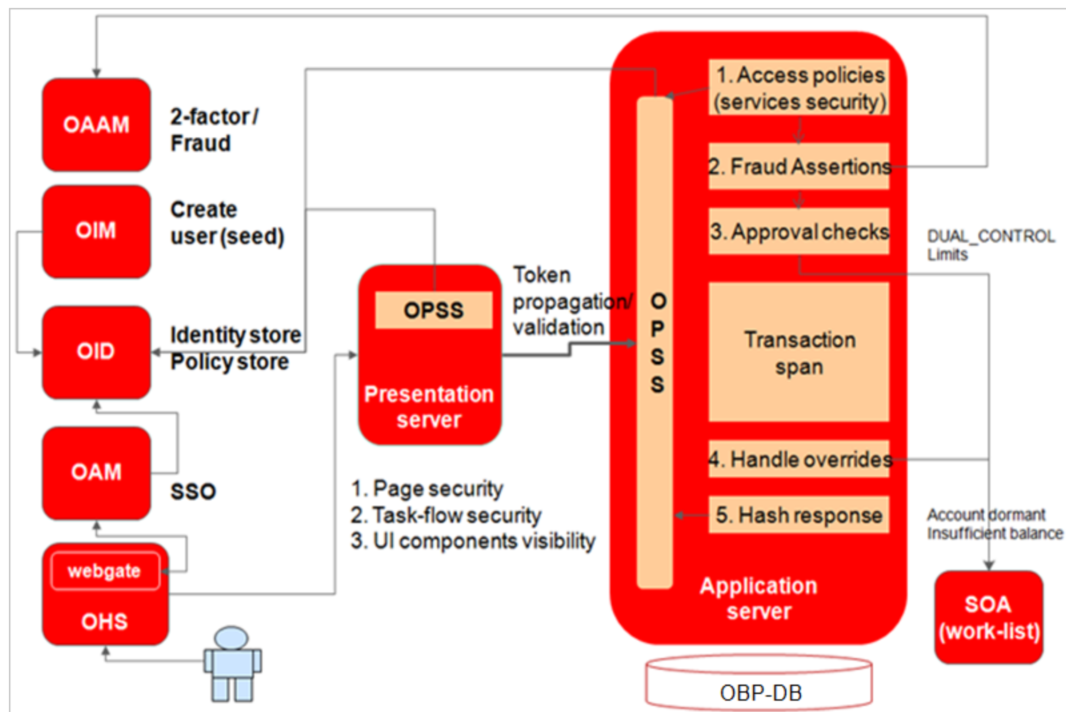
Figure 13–1 Security Customizations Interface



- Oracle Identity Manager (OIM) is used for managing user provisioning.
- Oracle Access Manager (OAM) is used for managing declarative authentication and SSO.
- Oracle Platform Security Services (OPSS) is used for runtime evaluation of authn / authz.
- Oracle Adaptive Access Manager (OAAM)/Oracle Adaptive Risk Manager (OARM) is used for step-up authentication and fraud management.
- Authorization Policy Manager (APM) is used to manage access policy definitions.
- Oracle Internet Directory (OID) is used as the identity/policy store.

A high-level security use case has the following access checks and assertions.

Figure 13–2 Security Use Case with Access Checks and Assertions



13.1 OPSS Access Policies – Adding Attributes

OBP uses OPSS to assert role-based access policies. Access policies are rules-based to give more flexibility.

Example of an access policy rule:

```
Grant
Role = RetailBranchOperationsExecutive
Service=com.ofss.fc.app.dda.service.transaction.DemandDepositCashTransactionServic
e.depositCash
Action = perform
IF DepositCash_IsEmployeeAccount=false AND DepositCash_IsRestrictedAccount=false
```

In the above example, the following facts (attributes) make up the access policy rule:

```
DepositCash_IsEmployeeAccount
DepositCash_IsRestrictedAccount
```

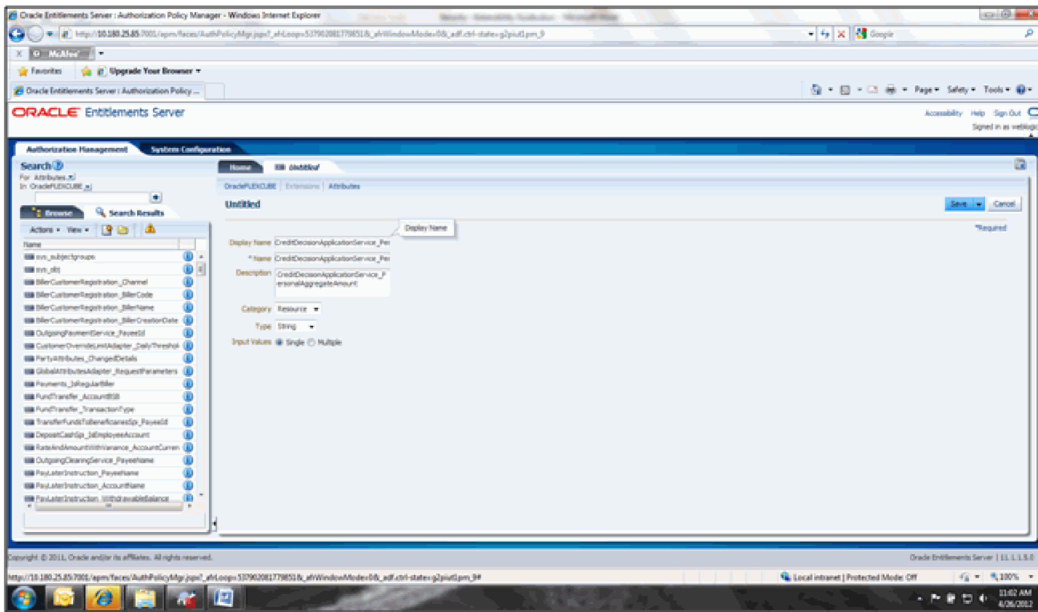
The security framework allows for addition to the facts that can be used in rules. The steps to do this are mentioned in the next section.

13.1.1 Steps

Following steps are needed to add an extra attribute to an access policy rule.

1. Add attribute in OID under the 'Attributes' entry.

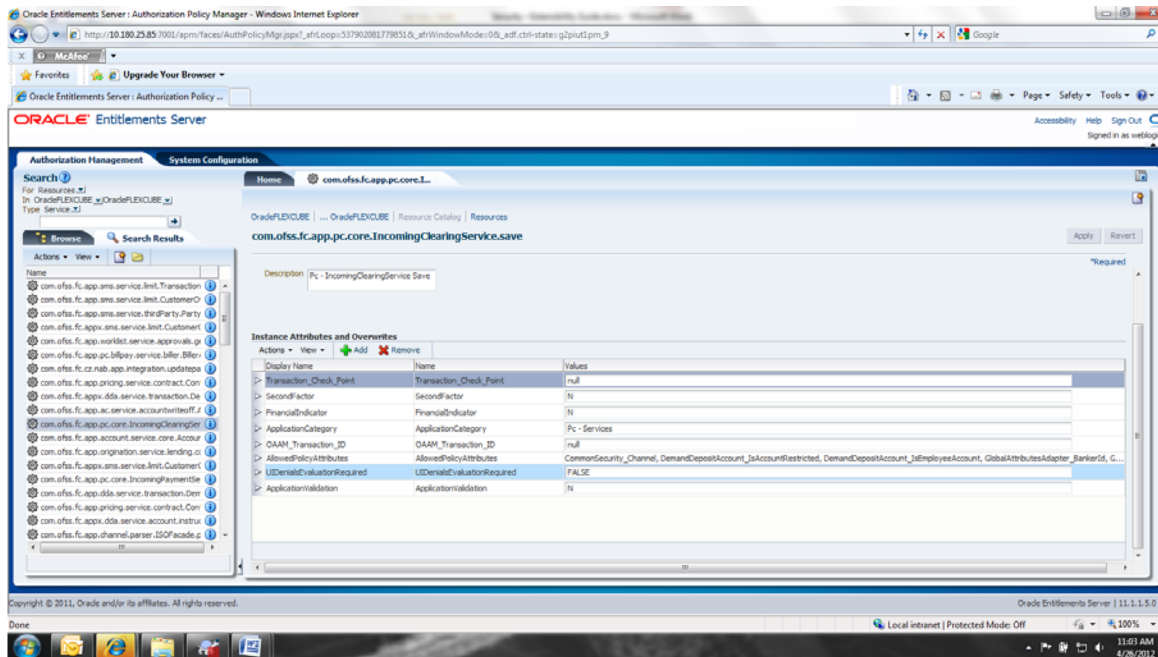
Figure 13–3 Add Attributes to Access Policy Rule



This can be done directly in OID or by using APM, as shown above.

2. Add the attribute under 'AllowedPolicyAttributes' against the particular resource.

Figure 13–4 Attribute to Access Policy Rule - Authorization Management



This can be done directly in OID or by using APM, as shown above. Adding this attribute under 'AllowedPolicyAttributes' ensures that the security framework executes a specified adapter to fetch the attribute value and make it available to the execution context.

3. Develop custom adapter to retrieve attribute value. Attribute should be structured along similar lines as the other adapters used for the same purpose.

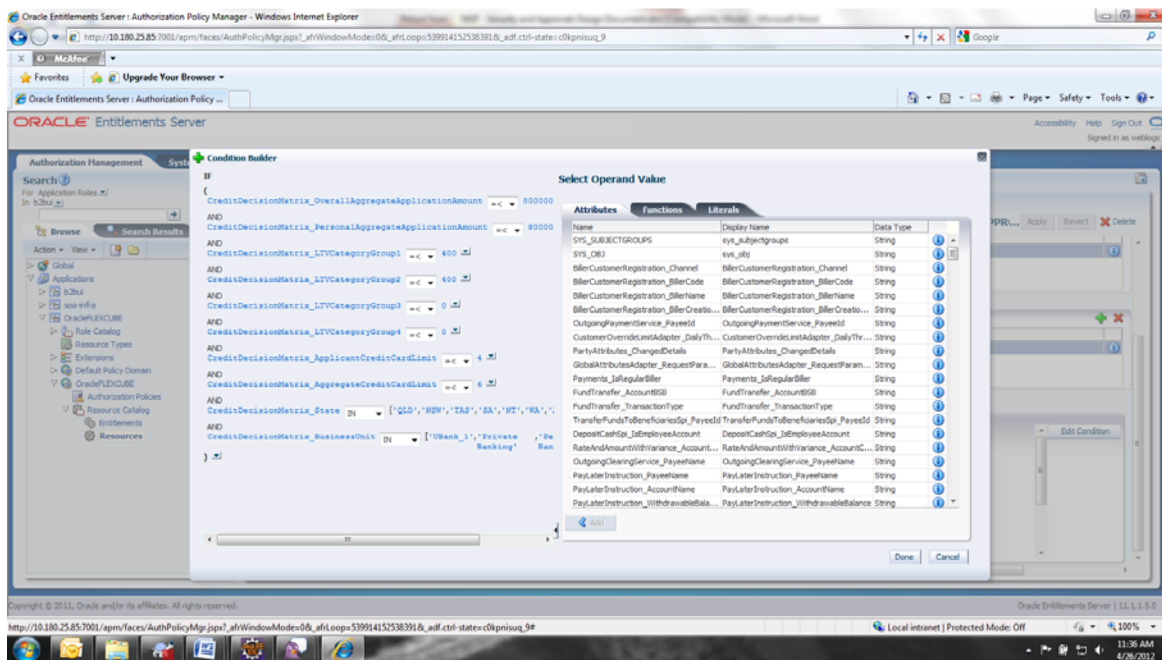
```
Example -
Attribute - CreditDecisionMatrix_OverallAggregateApplicationAmount
Adapter -
public com.ofss.fc.app.adapter.impl.sms.CreditDecisionAttributesAdapter {
      public String getOverallAggregateApplicationAmount () {
             //Logic to fetch overall aggregate amount
     }
}
```

> **Note:** The naming convention of the attribute should be as follows:
>
> The first part of the attribute till the '-' delimiter identifies the transaction. The remaining part with CamelCase is prefixed with a 'get' to form the method in the adapter.

4. Add entry in ConstraintAttributeHelper.properties to link the attribute to the adapter.

   ```
   CreditDecisionMatrix_OverallAggregateApplicationAmount=
   com.ofss.fc.app.adapter.impl.sms.CreditDecisionAttributesAdapter
   ```
5. Add/Modify access policy/rule in APM to use the extra attribute.

Figure 13–5 Add or Modify Access Policy Rule



13.2 OAAM Fraud Assertions – Adding Attributes

OBP uses OAAM to assert fraud policies consisting of rules to identify potentially fraudulent transactions.

Attributes used in fraud identification rules:

`payee_id, account_number`

The security framework allows for addition to this list of facts. The steps to do this are mentioned in the next section.

13.2.1 Steps

Following steps are needed to add an attribute to an existing OAAM transaction:

1. Add the attribute under 'AllowedPolicyAttributes' against the particular resource.
2. Add attribute in OID under the 'Attributes' entry.
3. Develop custom adapter to retrieve attribute value.
4. Add entry in ConstraintAttributeHelper.properties to link the attribute to the adapter.

The above steps are exactly the same as mentioned in the previous section.

1. Add seed data in the following tables to persist the mapping between OID attributes and OAAM attributes.
   - flx_sm_fraud_txn_attributes (stores OAAM transaction key to OAAM attribute mapping) and
   - flx_sm_fraud_assert_attributes (stores OBP attributeName - oaamAttributeName mapping.

   ```
   Example -
   insert into Flx_Sm_Fraud_Txn_Attributes (TRANSACTION_KEY, ATTRIBUTE_NAME)
   values ('payment', 'is_2fa_completed')
   /
   insert into flx_sm_fraud_assert_attributes (ATTRIBUTE_KEY, FRAUD_ATTRIBUTE_
   NAME)
   values (OutgoiOBPaymentService_Is2FACompleted', 'is_2fa_completed')
   /
   ```
2. Add/Modify fraud rules in OAAM to use the extra attribute

Figure 13–6 Add or Modify Fraud Rules in OAAM - Data Tab

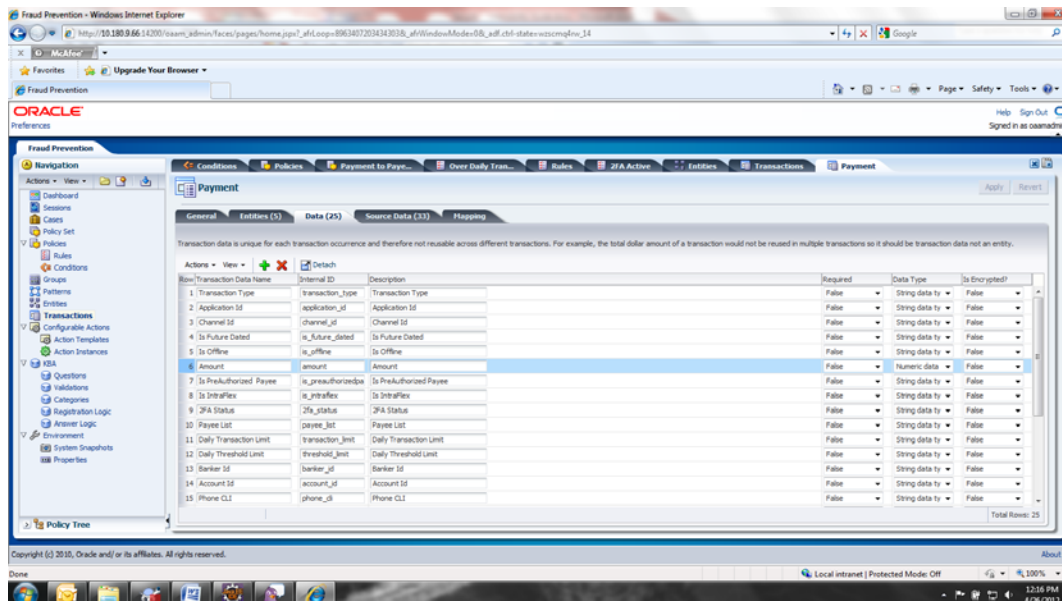
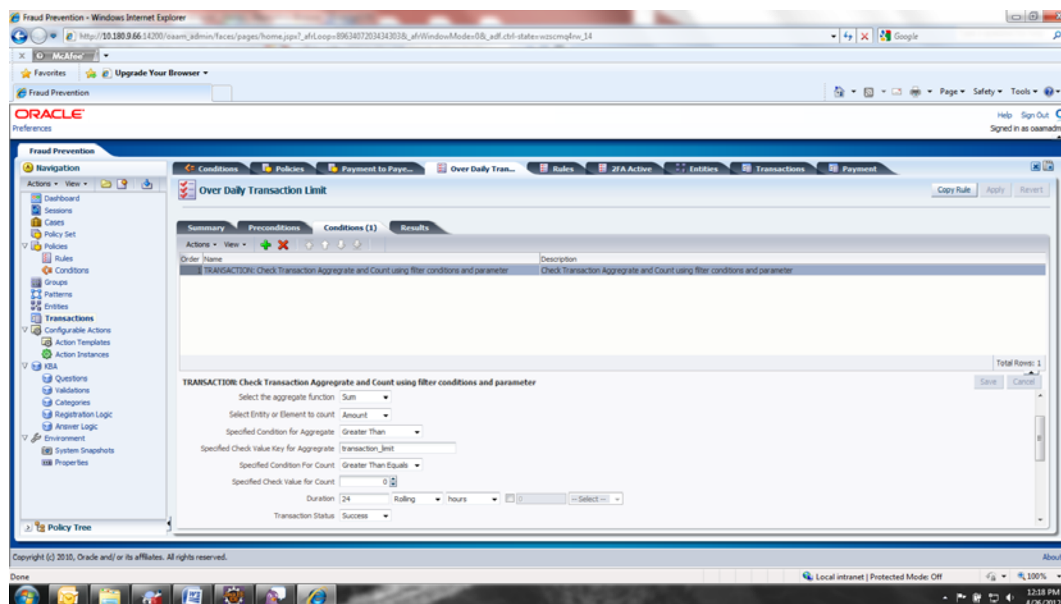


Figure 13–7 Add or Modify Fraud Rules in OAAM - Conditions Tab



13.3 Matrix Based Approvals – Adding Attributes

OBP uses OPSS to assert matrix-based approvals. The matrix comprises of various facts.

Example of a matrix-based rule:

```
Grant
Role = CreditAnalyst
Service=com.ofss.fc.app.origination.service.lending.core.credit.decision.CreditDec
isionApplicationService.approveDecision
Action = performWithoutApprovals
IF CreditDecisionMatrix_Margin > 1
AND CreditDecisionMatrix_CustomerExposure > 10000000
```

In the above example, the following facts (attributes) make up the access policy rule:

```
CreditDecisionMatrix_Margin
CreditDecisionMatrix_CustomerExposure
```

The security framework allows for addition to the facts that can be used in rules.

The steps to add facts are same as described in above section.

Note: The only difference between the policy semantics in the example mentioned under this and last action is the 'Action'. ['perform' versus 'performWithoutApprovals']

13.4 Security Validators

In addition to OPSS access policies, there are additional validators that perform security checks. The sole purpose of these validators was to give hooks to enable site

specific security logic that would be complicated enough and hence cannot be provisioned as rules.

Note: These additional validators come into effect only when the following property is set.

```
APPLICATION_SECURITY_VALIDATOR=true
```

The role, channel, service and the attributes available in the execution context are passed to the validators.

The validators implement the interface com.ofss.fc.app.adapter.impl.sms.validator.IExtendableApplicationValidator

There are three types of security-validation categories:

- Customer validators
- Account validators
- Business unit validators

There can be multiple validator classes contributing to each individual category.

The package structure of the validators is required to be:

```
'com.ofss.fc.app.adapter.impl.sms.validator'
```

13.4.1 Customer Validators

This validator returns a Boolean signifying whether the logged-in user can perform a transaction on the customer.

Step 1

Add property in ApplicationValidators.properties

```
com.ofss.fc.app.dda.service.account.core.DDAInquiryApplicationService.fetchBasicDe
tails.CustomerValidators=RestrictedAccountApplicationValidator,EmployeeAccountAppl
icationValidator
```

Step 2

Develop custom validator along the lines of existing adapters.

13.4.2 Account Validators

This validator returns a Boolean signifying whether the logged-in user can perform a transaction on the account.

Step 1

Add property in ApplicationValidators.properties

```
com.ofss.fc.app.dda.service.account.core.DDAInquiryApplicationService.fetchBasicDe
tails.AccountValidators=RestrictedAccountApplicationValidator,EmployeeAccountAppli
cationValidator
```

Step 2

Develop custom validator along the lines of existing adapters.

13.4.3 Business Unit Validators

This validator returns a Boolean signifying whether the logged-in user can perform a transaction on the business unit.

Step 1

Add property in ApplicationValidators.properties

```
APPLY_BUSINESS_UNIT_VALIDATION_TO_ALL_SERVICES=false
com.ofss.fc.app.dda.service.account.core.DDAInquiryApplicationService.fetchBasicDe
tails.BusinessUnitValidators=BusinessUnitApplicationValidator
BusinessUnitValidators=GlobalBusinessUnitApplicationValidator
```

Step 2

Develop custom validator along the lines of existing adapters.

> **Note:** BusinessUnit validation can be global, in which case the following property is set.
>
> ```
> APPLY_BUSINESS_UNIT_VALIDATION_TO_ALL_SERVICES=true
> ```

13.5 Customizing User Search

OBP application services use SessionContext as an input parameter to set the context of the user interacting with the system. The session-context is populated out of the user's details in OID. Across implementations, the user metadata (objectclasses, attributes) is expected to be different resulting in the requirements to have a custom user search capability.

The security framework provides an extension point to inject a custom search. The steps are given in the next section.

13.5.1 Steps

SecurityConstants.properties contains attributes that enable custom user searches.

Step 1

Add properties in SecurityConstants.properties.

```
CUSTOM_SEARCH_
CLASS=com.ofss.fc.domain.ixface.sms.service.utils.CustomUserSearchAdapter.retrieve
UserUsingExtendableAttributes
CUSTOM_SEARCH_PARAM=nagactualaccessid
```

Step 2

Develop custom user search adapter.

13.6 Customizing One-Time-Password (OTP) Processing Logic

OBP uses OAAM for step-up authentication and fraud assertions. Customer is asked to enter a one-time password (OTP) if OAAM suspects the transaction to be fraudulent. The logic to send or validate an OTP is implemented using a custom hook. Details of the extension are given in the next section.

13.6.1 Steps

OAAM.properties contains a property that provides an extension for second factor password generation / dispatch.

Steps:

1. Add property for the class implementing 2FA in OAAM.properties

   ```
   TWO_FACTOR_AUTH_SERVICE=com.ofss.fc.domain.ixface.oaam.TwoFactorAuthService
   ```

2. Develop custom class.

13.7 Customizing Role Evaluation

OPSS can be configured to add a user in multiple groups (enterprise roles), as a result of which a user can have multiple application roles. OBP uses the most significant role amongst this list to query the user's severity configuration.

The default role-evaluator can be overridden to provide custom role evaluation logic. The steps to do this are given in the next section.

13.7.1 Steps

SecurityConstants.properties contains an attribute that provides an extension for a custom role evaluator.

Step 1

Replace property value in SecurityConstants.properties

```
ROLE_
EVALUATOR=com.ofss.fc.domain.sms.entity.user.roleEvaluationCriteria.SimpleRoleEval
uator
```

Step 2

Develop custom role evaluator.

Currently, the default role evaluator returns the role that has the maximum limits for the service.

13.8 Customizing Limits Exclusions

OBP application services evaluate transaction limits for various services. The assertion logic excludes limits checks for certain conditions. Example, if the customer is transferring funds to his own accounts. Banks have site-specific requirements to exclude transactions from limits checks. The security framework provides an extension point to inject a custom limits exclusions adapter. The steps are given in the next section.

13.8.1 Steps

LimitsExclusions.properties contains a property that enables custom limit exclusions logic for a particular service.

Step 1

Add properties in LimitsExclusions.properties

```
EXCLUSION_PACKAGE_NAME=com.ofss.fc.app.adapter.impl.sms.exclusions
com.ofss.fc.app.dda.service.transaction.DemandDepositFundsTransferService.transfer
FundsToBeneficiaries=TransferFundsExclusionValidator
```

Step 2

Develop custom limits exclusions adapter.

13.9 Customizing Business Rules

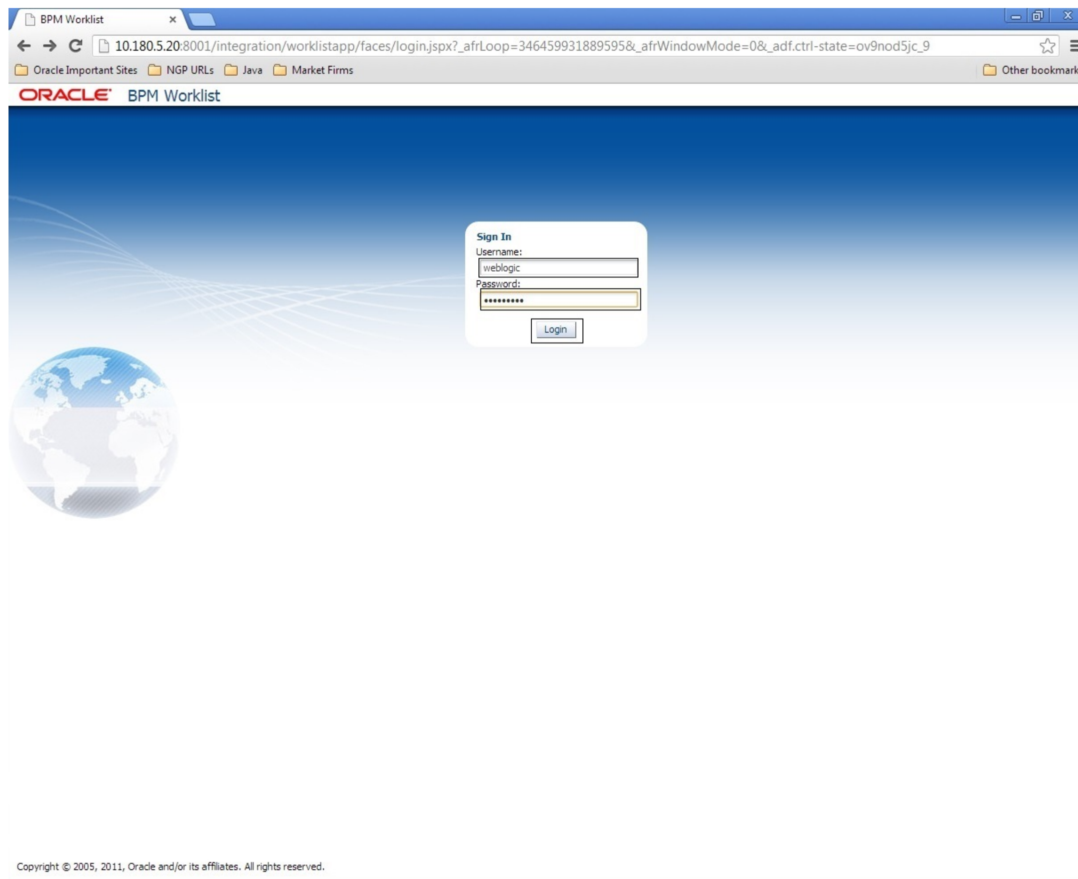
BPEL approval process business rules can be configured and it is based on input authorizations raised during transaction processing at OBP host. The steps for configuring the business rules of the approvals are given in the below section.

13.9.1 Steps to Update the Business Rules by Browser

Following are the steps to update the business rules by browser.

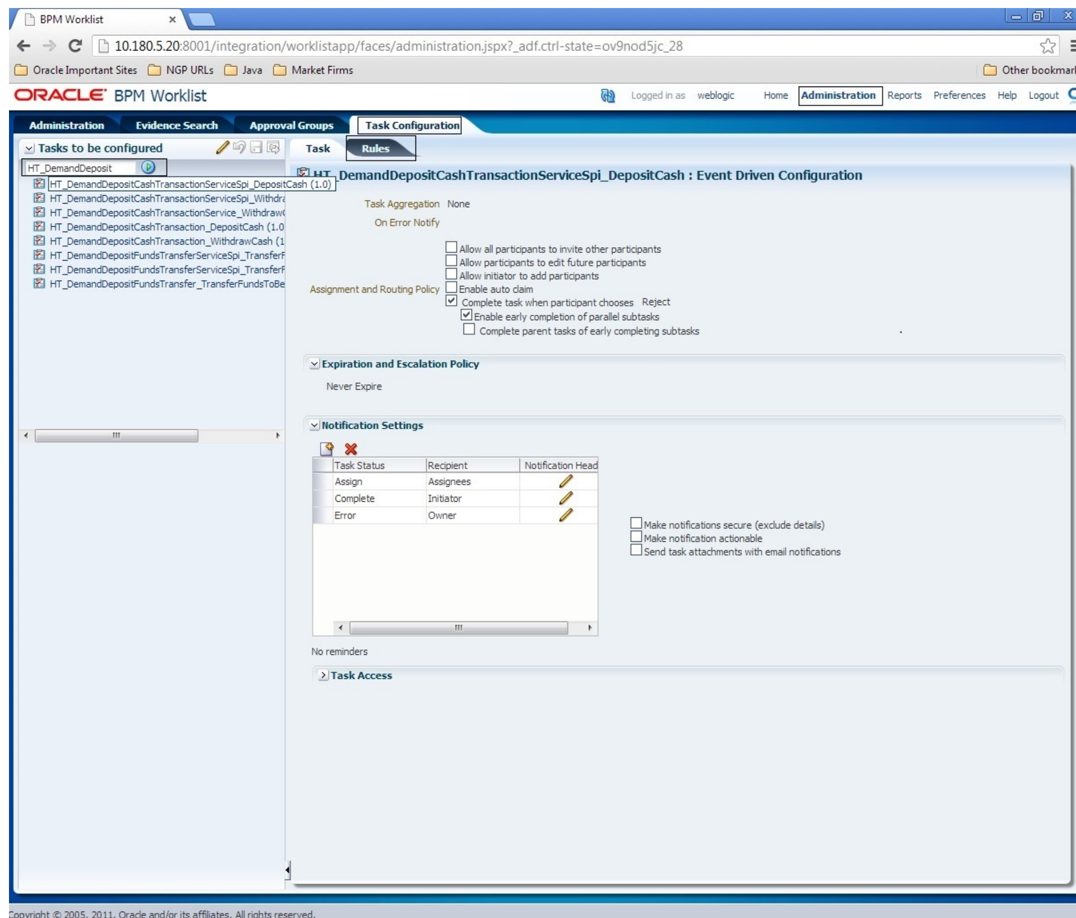
1. Log in to BPM Worklist application of the OBP.

Figure 13–8 Log in to BPM Worklist Application screen



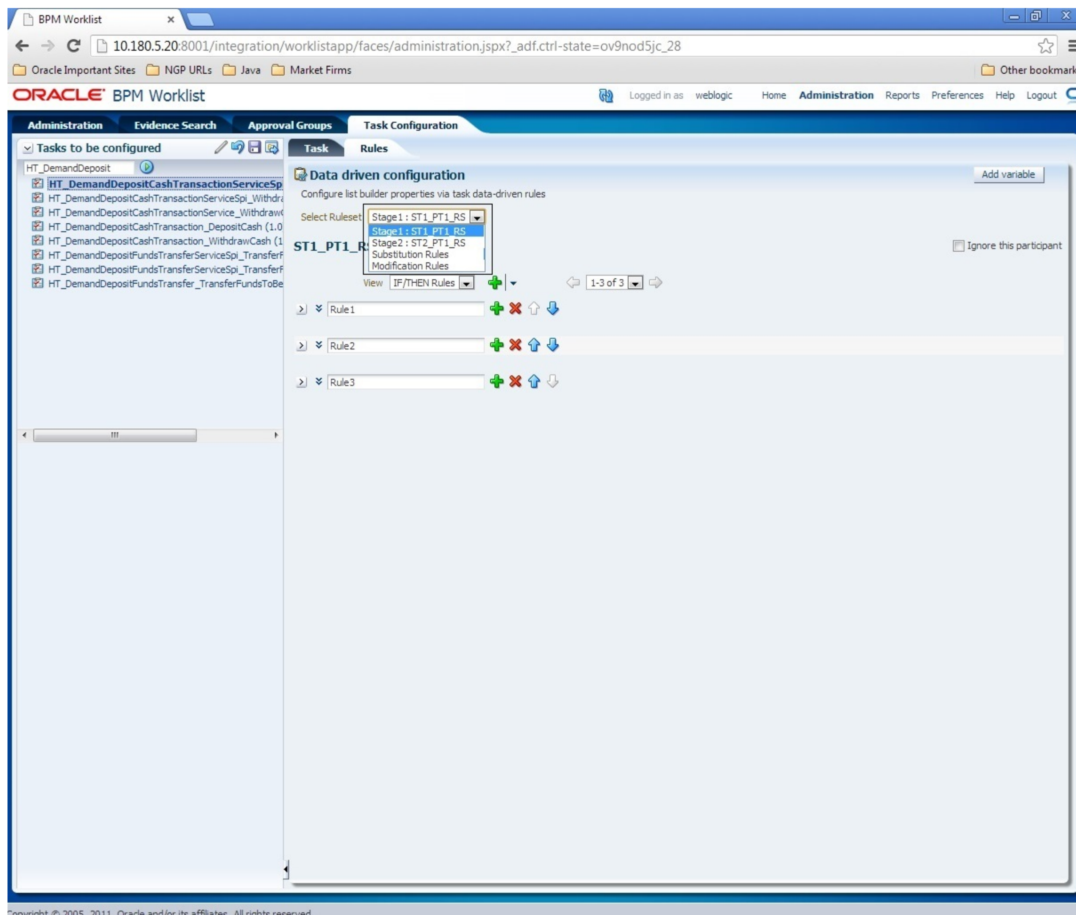
2. Select the 'Task' in the select box from the 'Task Configuration' tab in 'Administration'.

Figure 13–9 Task Configuration tab



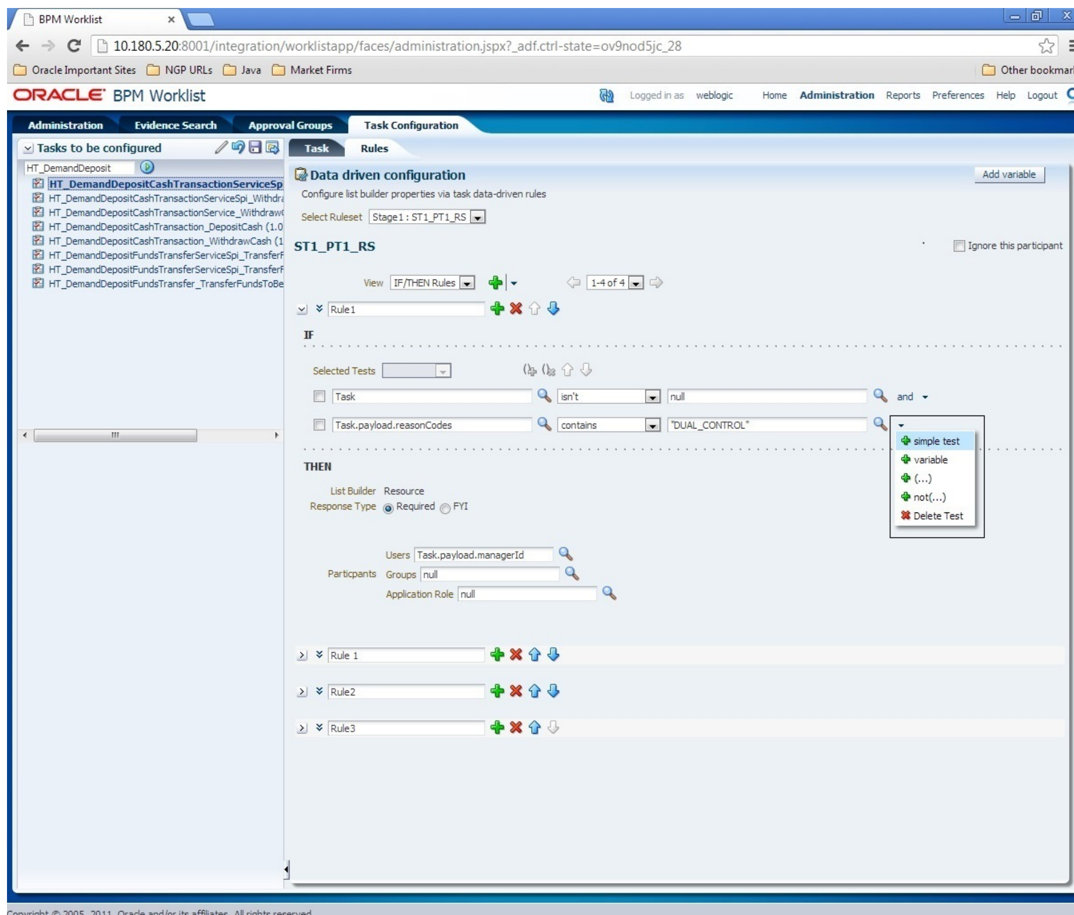
3. In the 'Rules' tab of the 'Task Configuration' screen, select the stages of approval where the condition in rule is required to be updated.

Figure 13–10 Stages of Approval



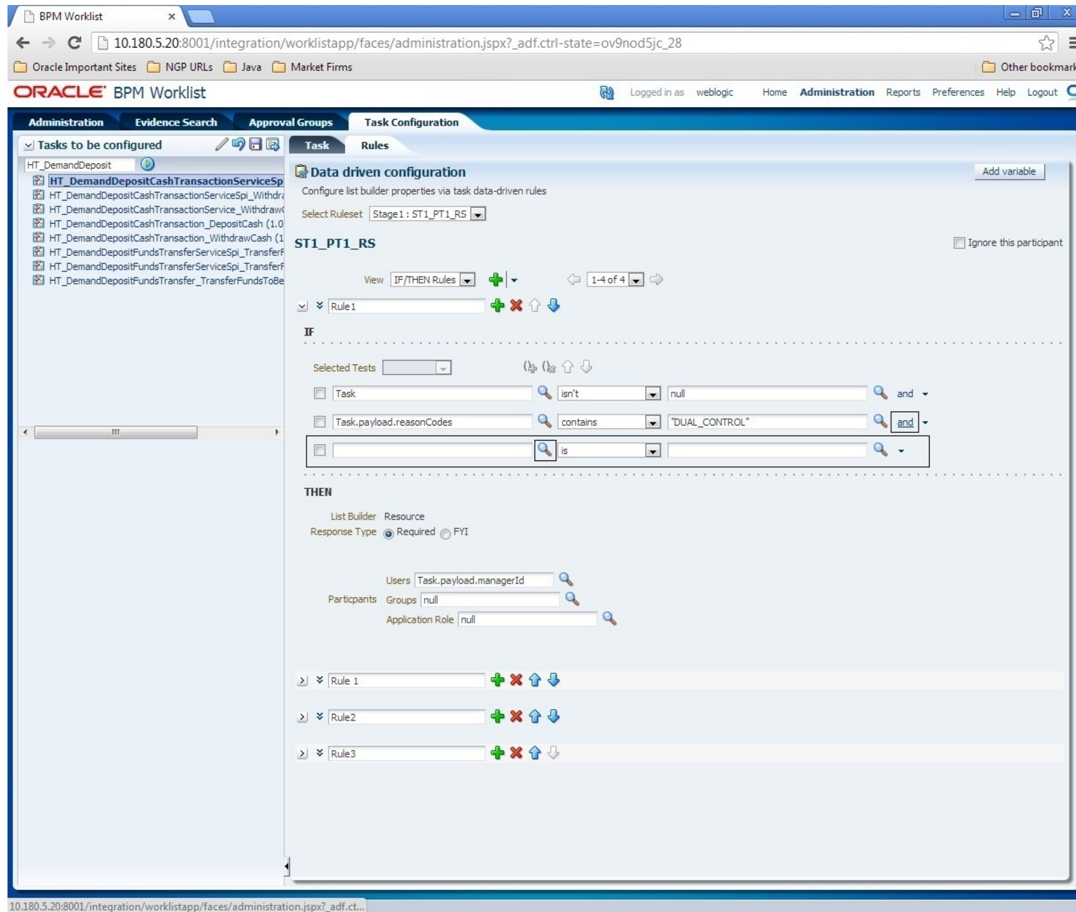
4. After stage selection, select the specific rule where the condition needs to be updated. The existing condition can be updated or the new test condition (simple/variable) can be added.

Figure 13–11 Select Test Condition



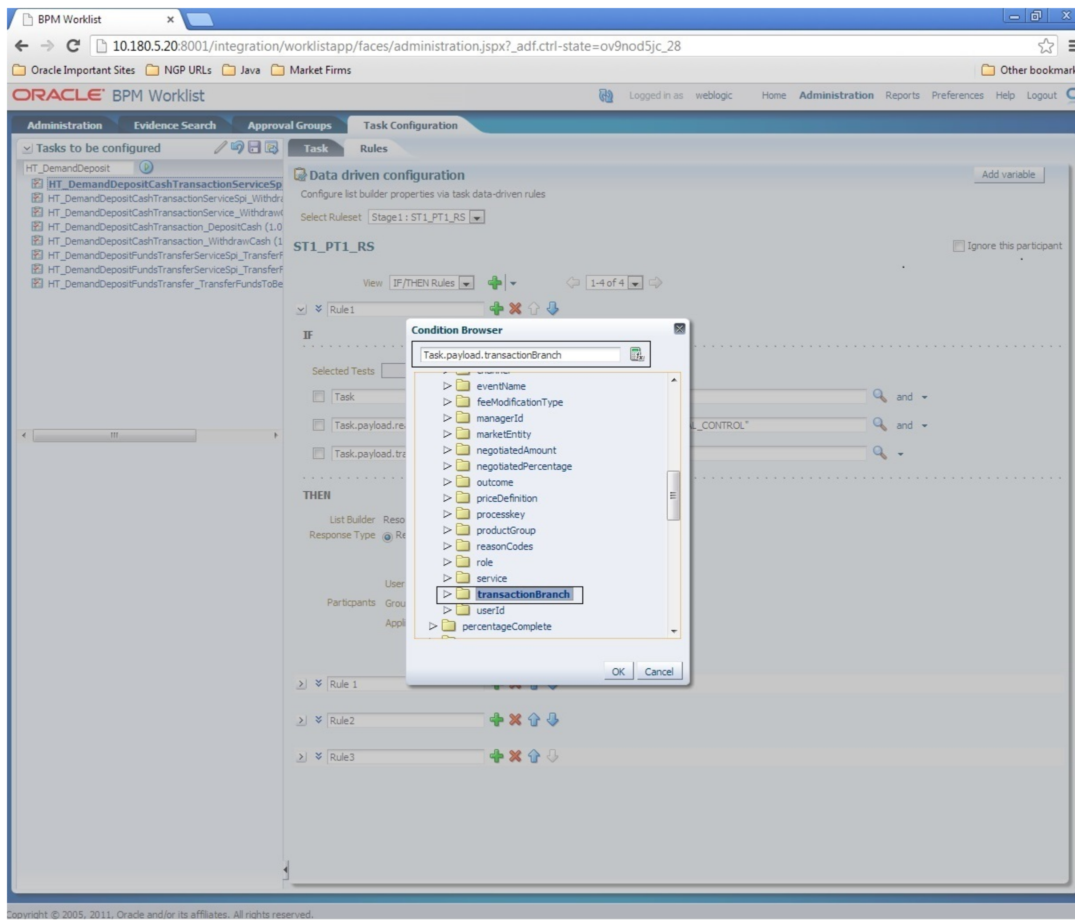
5. After selection of the test condition, the new expression row appears where the variable, the operator and the expression value can be selected.

Figure 13–12 Select Values



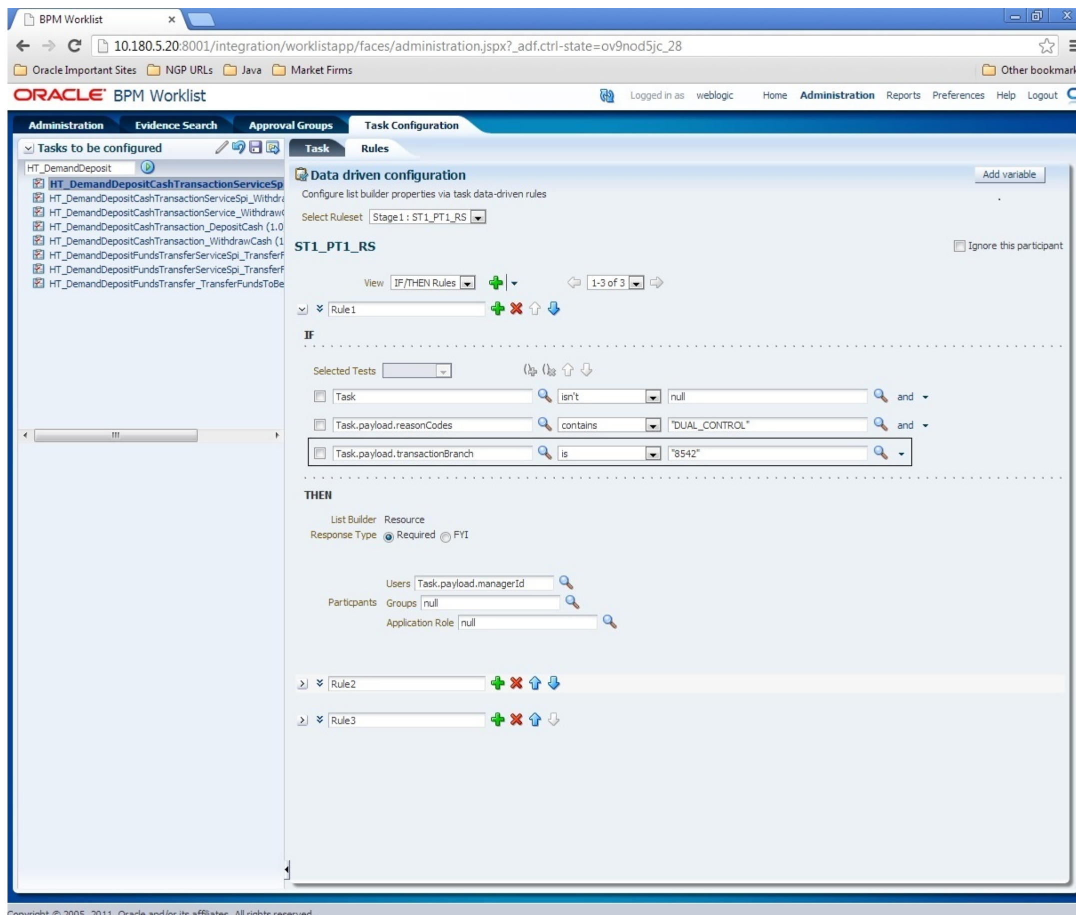
6. On selection of the search button next to the variable select box, the condition browser opens where the specific task can be selected.

Figure 13–13 Select Specific Task



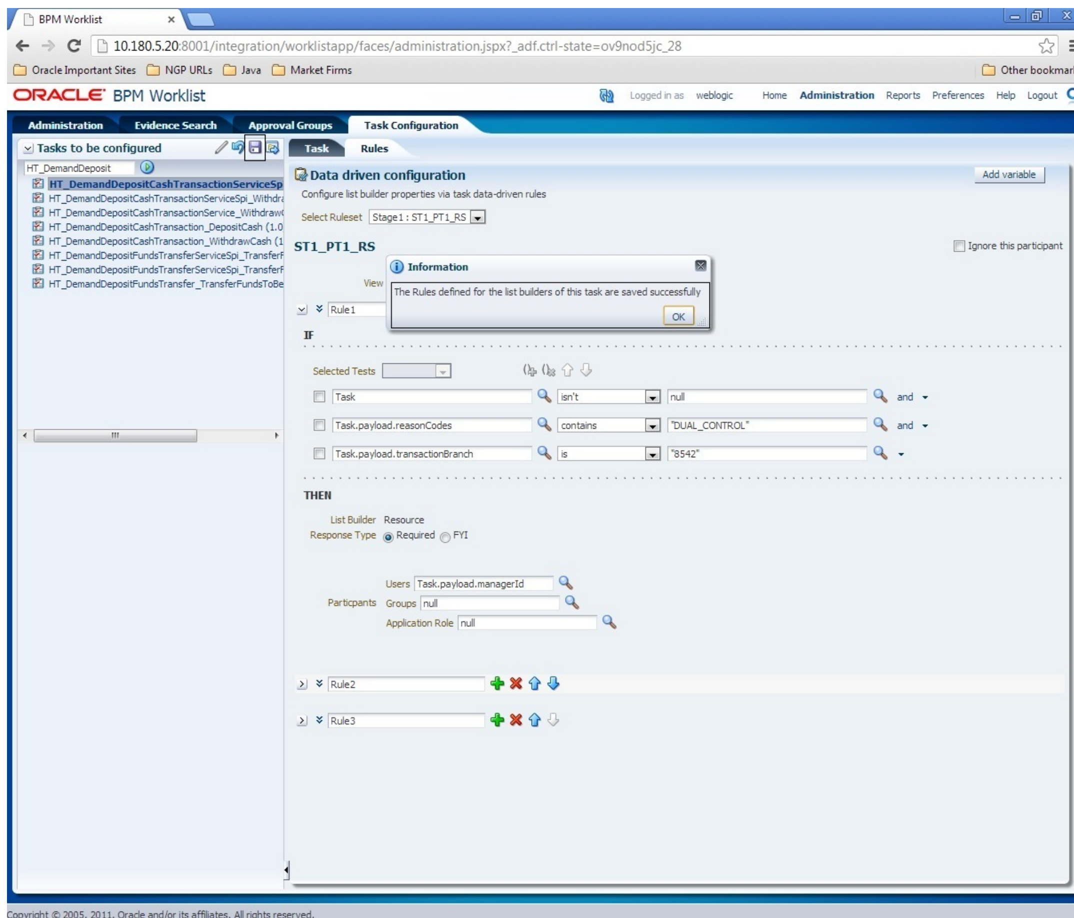
7. Update the variable, operator and value of the expression in a row.

Figure 13–14 Update Values



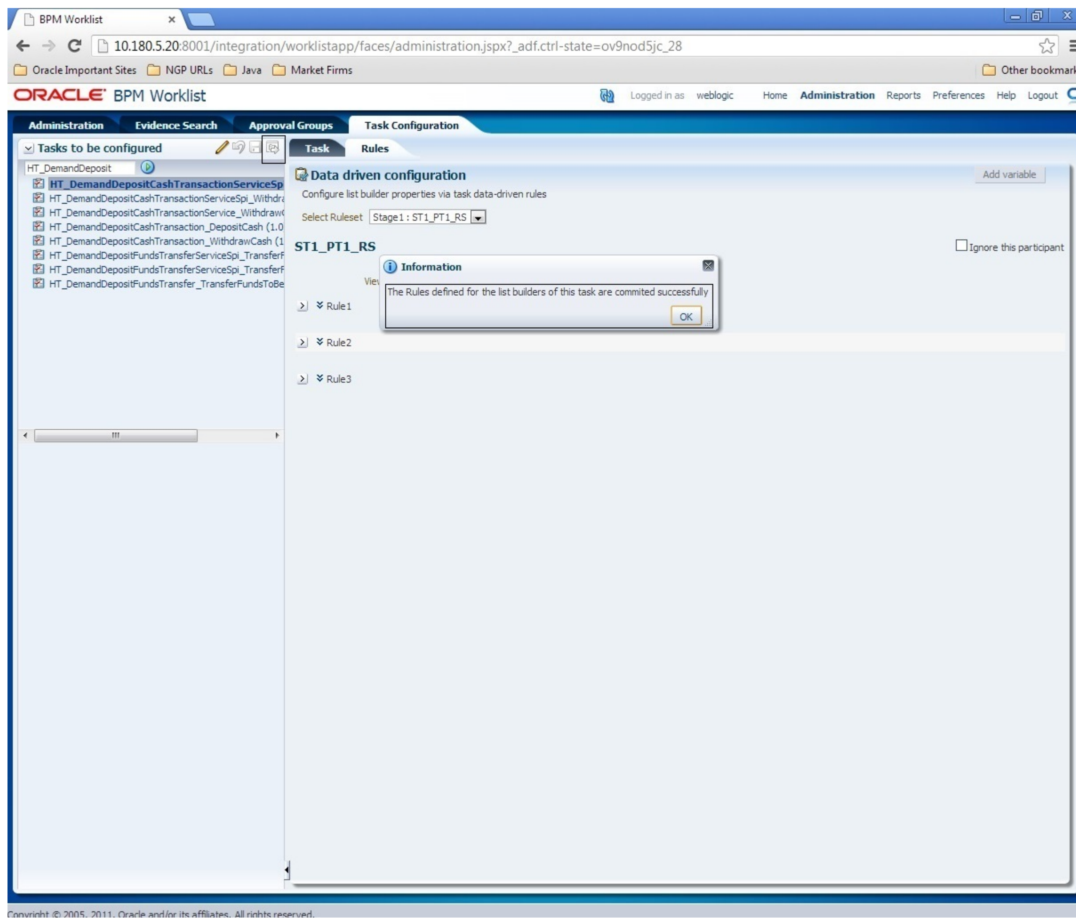
8. Save the updated rule using the save button in the left side menu.

Figure 13–15 Save the Updated Rule



9. Commit the changes in the rule by clicking the commit button.

Figure 13–16 Commit the Changes



Note: 'Ignore this participant' check box is available on the screen for ignoring the specific stage. The particular stage is then ignored while consideration of the rules implementation in the approval process.

13.9.2 Steps to Update the Business Rules in JDeveloper

Following are the steps to update the business rules in JDeveloper.

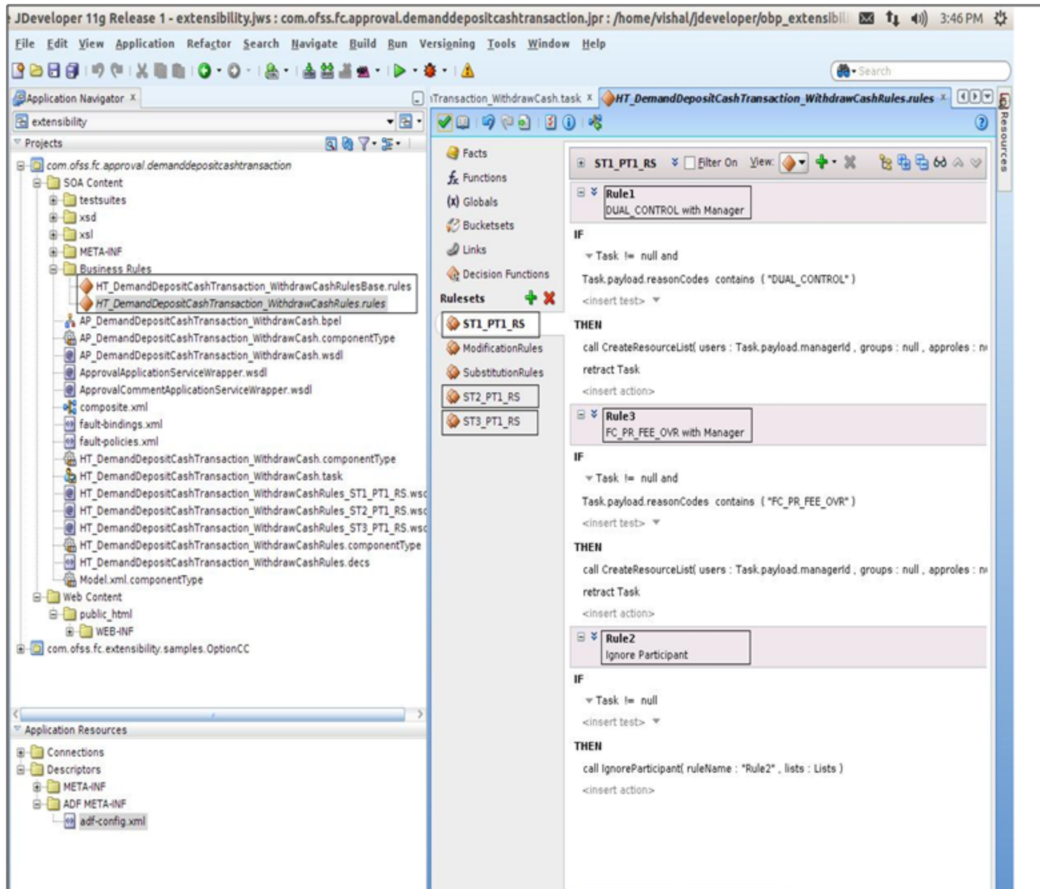
Step 1

Configure the JDeveloper in the customization option and the particular process jar import as the SOA project in the customizable mode. The details of this step are explained in this document in the section SOA customization.

Step 2

Expand the Business Rules folder of your project. You will see two .rules files in it. One will be <<HumanTaskName>>Rules.rules file and the other will be <<HumanTaskName>>RulesBase.rules file. Double Click and open the <<HumanTaskName>>Rules.rules file. The existing approval stages and rulesets will be available in the file.

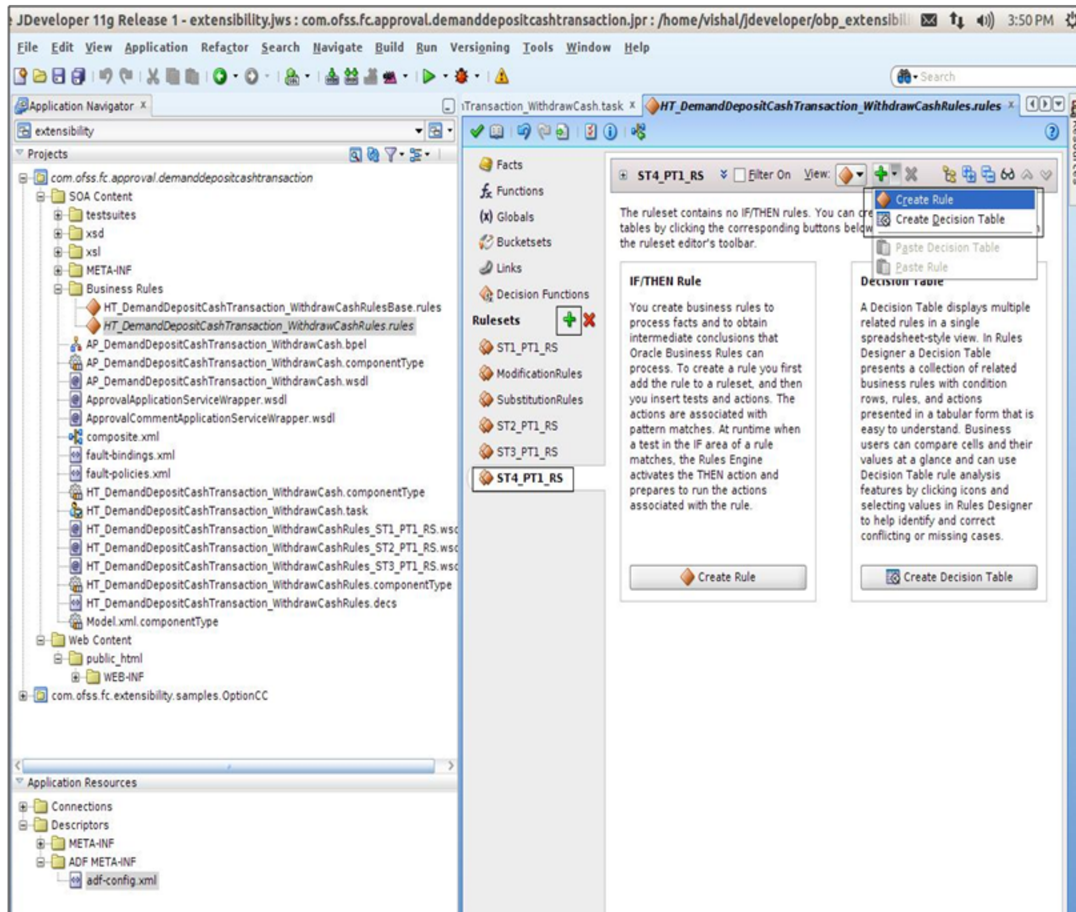
Figure 13–17 Expand Business Rules



Step 3

Create a new stage in the format 'ST<Stage Number>_PT1_RS' by clicking the '+' button in the Rulesets. The new rules/decision table can be added to a stage.

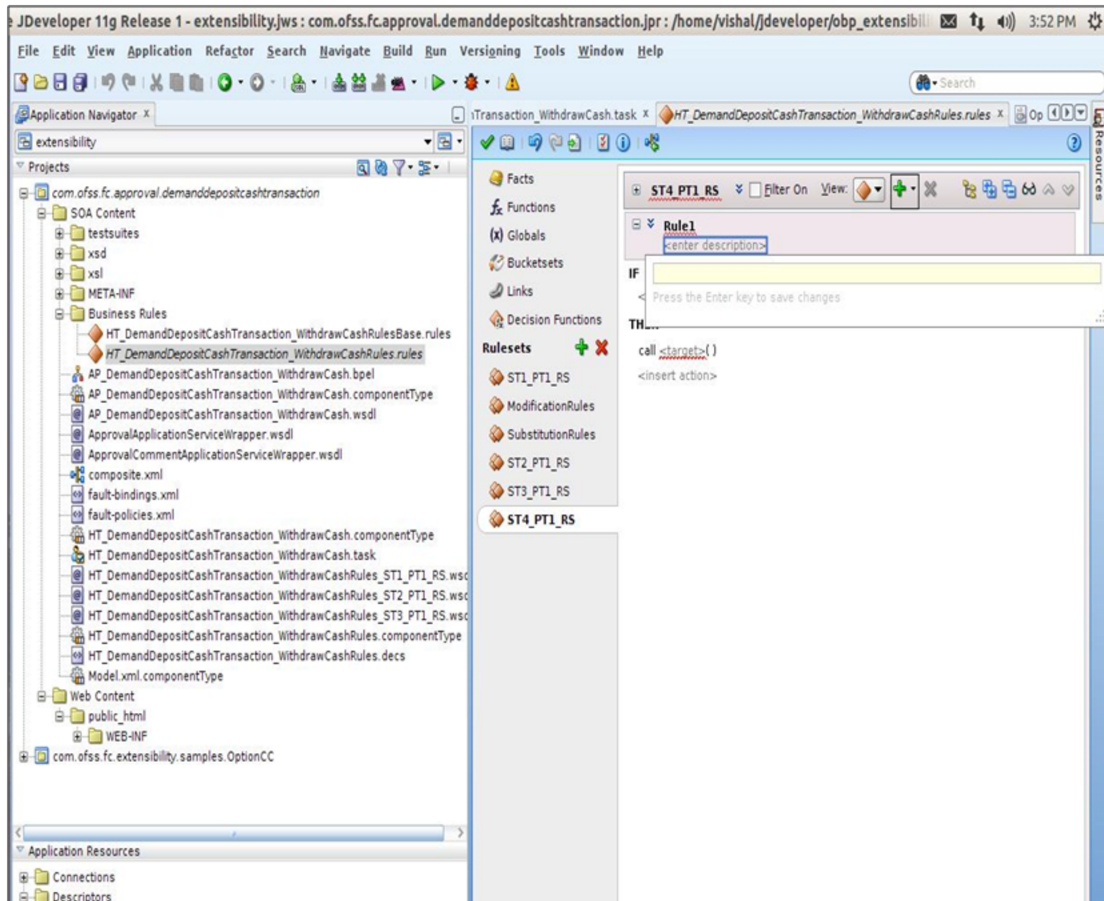
Figure 13–18 Create New Stage



Step 4

Add the new rule by clicking the '+' button on the stage. The existing rule can also be added/modified in the existing stage.

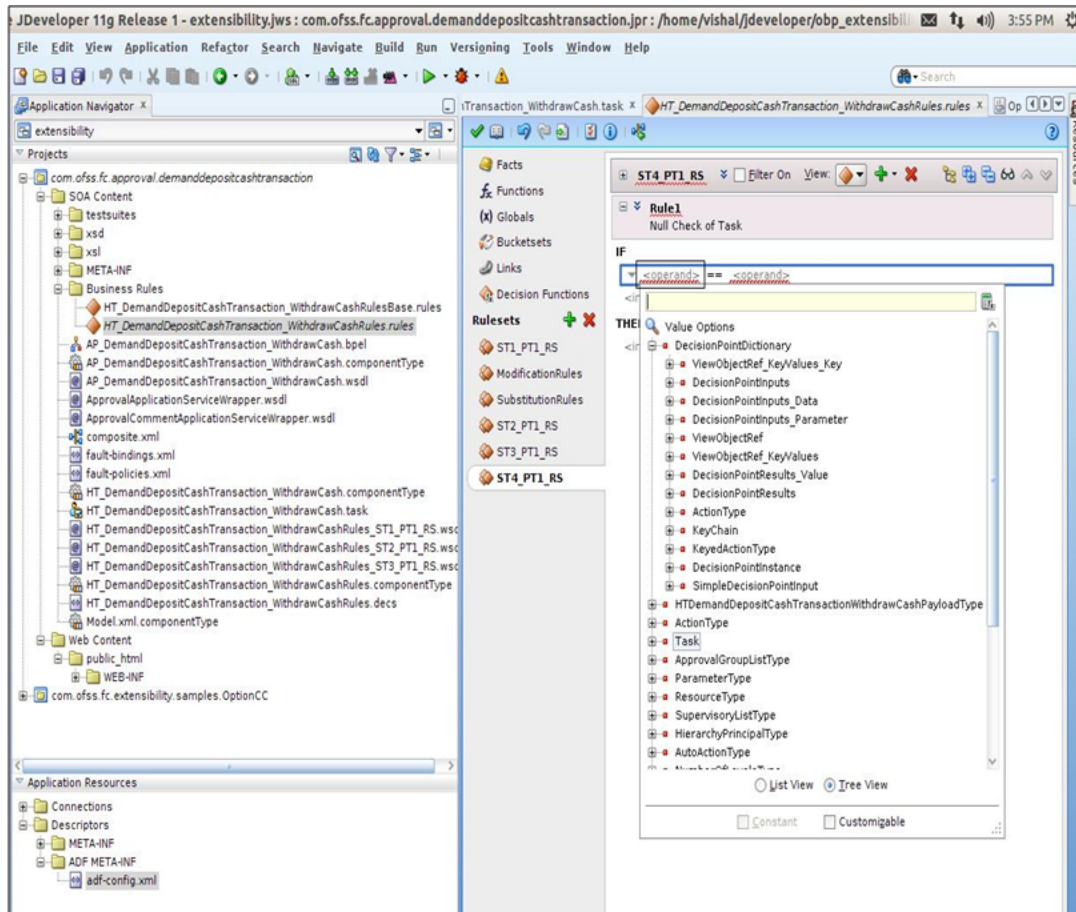
Figure 13–19 Add New Rule



Step 5

Populate the rule with the conditions in 'if' and 'then' block.

Figure 13–20 Populate the New Rule

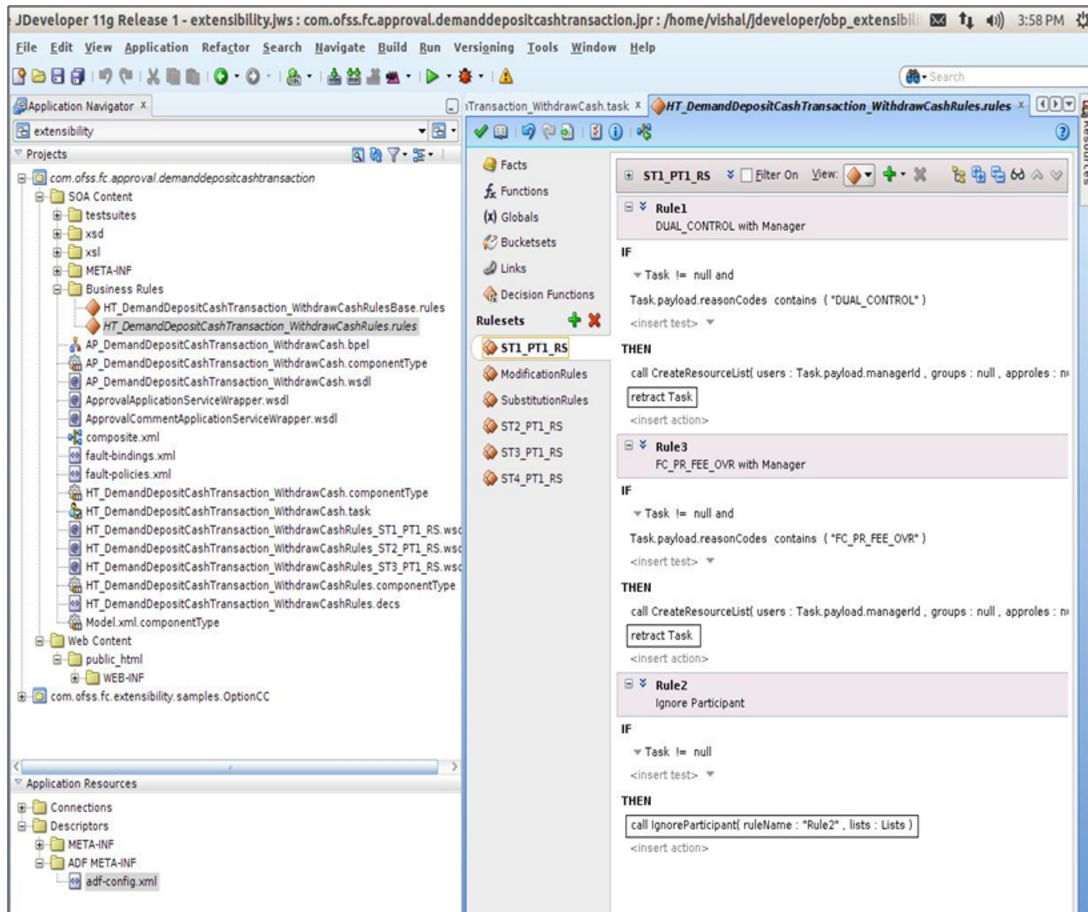


Step 6

Deploy the project jar as explained in this document in the section SOA customization.

Note: All the rules should have the final 'THEN' statement with the return type as 'retract Task'. 'retract Task' makes sure that if the condition of the rule is satisfied then the second rule should not be evaluated else the flow will execute the entire ruleset. It is also mandatory to have the last rule with the final 'THEN' statement as 'call IgnoreParticipant'. This is done to bring the control out of the ruleset.

Figure 13–21 Deploy Project Jar



14 Loan Schedule Computation Algorithm

OBP application provides the extensibility by which the additional loan schedule computation algorithm can be added or customized based on client's requirement.

14.1 Adding a New Algorithm

For adding a new algorithm following additions need to be done.

LoanCalculationMethodType.properties contains list of available loan stage algorithms in the system in the form of key-value pairs. For example, ARM=ARM

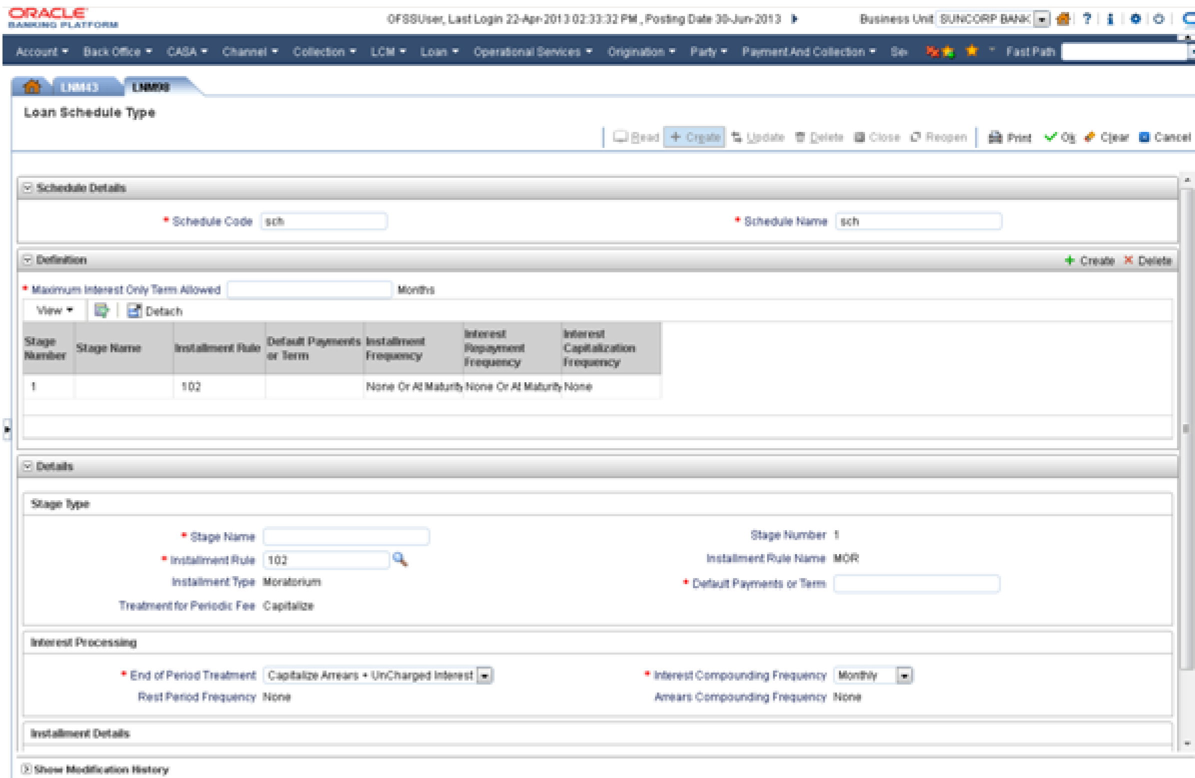
This list is used as part of screen LNM43 to populate a drop down called Computation Formula.

An entry has to be made in this file to appear as a choice in the drop-down list.

Figure 14–1 Add New Algorithm

This screen is used to create a new Installment Rule. For example: ABC. We can choose the new algorithm for the new rule.

Figure 14–2 Create New Installment



Screen LNM98 is used to create new schedule codes from existing instalment rules. A new schedule code can be made using the new instalment rule created above.

A schedule generator class is created to implement a schedule code. The property file **ScheduleCalculator.properties** stores this relation in the form:

Schedule_Type_Code=Schedule_Calculator_Class

If a new schedule generator class is created for the new schedule code above, an entry in this file has to be made.

```
Example: IOI-EIPI-PMI_IntOnly-Month_Pr-Month_Ann=
com.ofss.fc.domain.schedule.loan.generator.NewPrincipalRepaymentScheduleGenerator;
```

The key is the SCHEDULE_CODE column in the table FLX_SH_SCHEDULE_TYPE_B.

The **PrincipalRepaymentScheduleGeneratorFactory** reads this property file and creates an instance of the schedule generator class associated with the schedule type code passed. The following code snippet shows how it is done

```
IPrincipalRepaymentScheduleGenerator calculator = null;
String calculatorClassName = calculators.get(scheduleTypeCode);
calculator = (IPrincipalRepaymentScheduleGenerator) ReflectionHelper.getInstance()
.getClassInstance(calculatorClassName);
```

// If schedule calculator is not found then do nothing

```
if (calculator == null) {
```

```
calculator = new PrincipalRepaymentScheduleGenerator();
}
```

Currently, in the application this property file is empty and hence an instance of PrincipalRepaymentScheduleGenerator is returned by default.

The new schedule generator class has to implement the interface IPrincipalRepaymentScheduleGenerator which is the base for all schedule generators.

The important methods in it are:

```
public SortedMap<Integer, PrincipalRepaymentPeriod>
defineStages(SortedMap<Integer, PrincipalRepaymentPeriod> repaymentStages,
AccountScheduleAttributesDTO accountParameters, Money amountForScheduleGeneration,
Date onDate);
public LoanScheduleCalculatorOutputData defineSchedule(Date definitionDate,
SortedMap<Integer, PrincipalRepaymentPeriod> repaymentStages,
AccountScheduleAttributesDTO accountParameters, SortedMap<LoanInterestType,
List<NetRateDTO>> interestRates, Money mountForScheduleGeneration);
public LoanScheduleCalculatorOutputData generateRepaymentRecords(Date
generationDate, SortedMap<Integer, PrincipalRepaymentPeriod> repaymentSchedule,
AccountScheduleAttributesDTO accountParameters, Money totalPrincipalToRepay,
SortedMap<LoanInterestType, List<NetRateDTO>> interestRates,
List<PrincipalScheduleTransaction> scheduleTransactionHistory, SortedMap<Date,
PrincipalScheduleInterestBase> interestBaseHistory, SortedMap<Date, Money>
feeDetails);
```

The method generateAndSavePrincipalSchedule() of ScheduleApplicationService creates and processes the instance of a schedule generator as follows:

```
IPrincipalRepaymentScheduleGenerator scheduleGenerator =
PrincipalRepaymentScheduleGeneratorFactory.getInstance().createScheduleGeneratorIn
stance(accountParameters.getScheduleTypeCode());
```

The methods in the schedule generator call the business logic for the instalment rules (stage algorithms) part of the schedule code. This logic is written in a Stage generator class. New Stage generator class has to be created for the new algorithm created above.

```
For example, EPIARMRepaymentStageGenerator.class is created for EPI and ARM.
```

This class has to implement interface **IPrincipalRepaymentPeriodGenerator** which is the base for all stage generators. The important methods in it are:

```
public void defineStage(LoanRepaymentStageDTO repaymentStage);
public void define(LoanRepaymentStageDTO
repaymentStage,AccountScheduleAttributesDTO accountParameters,Date definitionDate,
List<NetRateDTO> interestRates, SortedMap<Integer, LoanRepaymentStageDTO>
allRepaymentStages, SortedMap<Date, PrincipalScheduleInterestBase>
interestBaseHistory, List<PrincipalScheduleTransaction>
scheduleTransactionHistory);
public SortedMap<Date, LoanRepaymentRecordDTO> generate(LoanRepaymentStageDTO
repaymentStageToBeGenerated, AccountScheduleAttributesDTO accountParameters, Date
generationDate, List<NetRateDTO> interestRates, SortedMap<Integer,
LoanRepaymentStageDTO> allRepaymentStages, SortedMap<Date, RepaymentDate>
repaymentDates, SortedMap<Date, LoanRepaymentRecordDTO> allRepaymentRecords,
SortedMap<Date, PrincipalScheduleInterestBase> interestBaseHistory,
List<PrincipalScheduleTransaction> scheduleTransactionHistory, SortedMap<Date,
Money> feeDetails);
```

The entry for the new Stage generator class has to be made in **StageCalculator.properties**.

```
For example,
ARM=com.ofss.fc.domain.schedule.loan.generator.EPIARMRepaymentStageGenerator
```

The **PrincipalScheduleRepaymentPeriodGeneratorFactory** class reads this property file and based on the installment rule passed as parameter creates an instance of its corresponding stage generator class. The following code snippet shows it

```
IPrincipalRepaymentPeriodGenerator stageGenerator =
PrincipalScheduleRepaymentPeriodGeneratorFactory.getInstance()
.createStageGeneratorInstance(repaymentStage.getInstallmentRule())
```

14.2 Consuming Third Party Schedules

As mentioned above the PrincipalRepaymentScheduleGeneratorFactory reads the property file ScheduleCalculator.properties which has entry for the schedule generator class to be used for a schedule code. For using third party schedule algorithms, an entry in this file has to be made against the required schedule codes.

```
IOI-EIPI-PMI_IntOnly-Month_Pr-Month_Ann=
com.ofss.external.ScheduleAlgoExt.XYZScheduleGenerator;
```

15 Receipt Printing

OBP has many transaction screens in different modules where it is desired to print the receipt with different details about the transaction. This functionality provides the print receipt button on the top right corner of the screen which gets enabled on the completion of the transaction and can be used for printing of receipt of the transaction details.

For example, if the customer is funding his term deposit account, the print receipt option will print the receipt with the details like Payin Amount, Deposit Term etc at the end of the transaction. The steps to configure this option in the OBP application are given in the following section.

15.1 Prerequisite

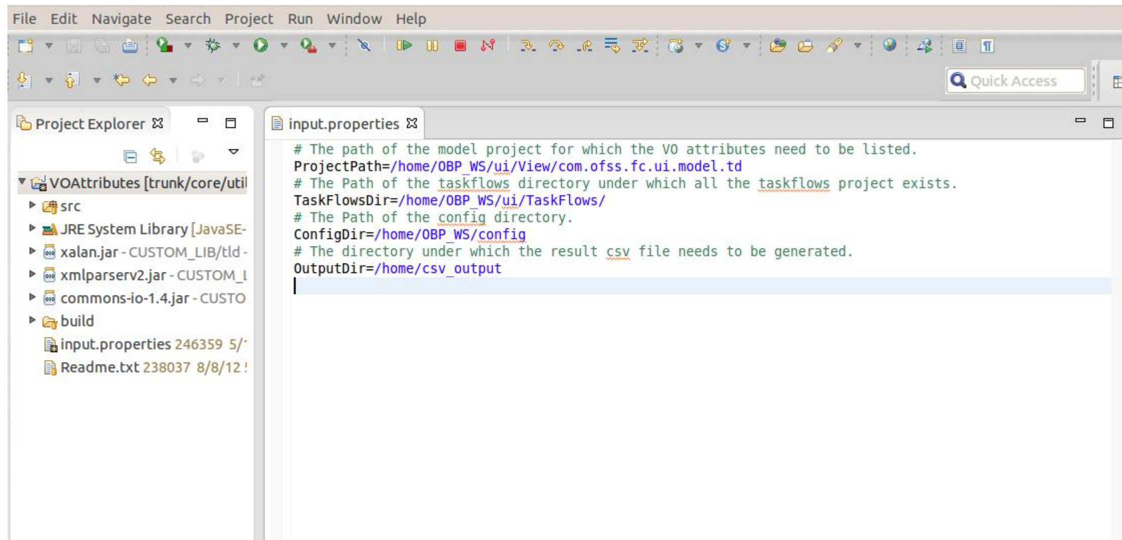
Following are the prerequisites for receipt printing.

15.1.1 Identify Node Element for Attributes in Print Receipt Template

The list of all the elements that are present in the particular task code screen and need to be displayed in the printed receipt can be identified with the help of the VO object utility. This utility helps in identifying all the node elements which are available on the screen and can be used in the print receipt template. This utility VOObjectUtility can be used to generate the data required for the functionality to work.

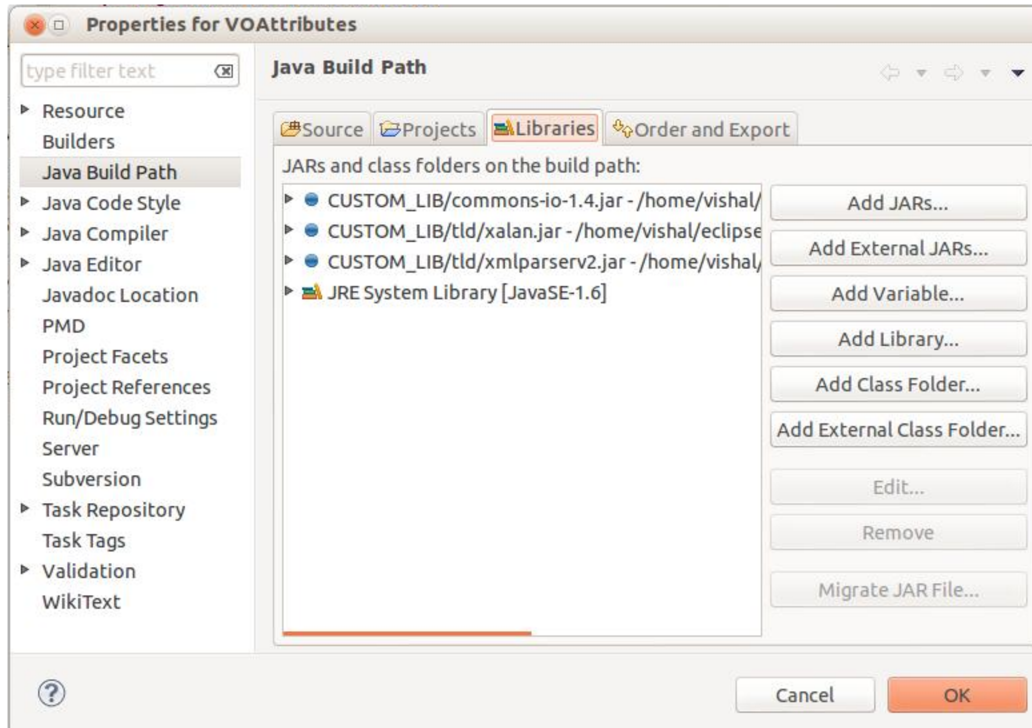
Once the utility is imported in the workspace, the input.properties file needs to be updated with the location of module's UI, location of task flow directory, location of config directory and the output directory where you want the output of the utility.

Figure 15–1 Input Property Files



In the build path of the utility, three libraries (commons-io, xalan and xmlparserv2) need to be added as they are required for execution of the utility.

Figure 15–2 Build Path of Utility



Then the main method of the VOAttributesFinder.java class in the utility is executed.

Figure 15–3 Utility Execution

```
package com.ofss.fc.voattribute;

import java.io.File;

public class VoAttributesFinder {

    * Represents the properties object to read the properties file.
    private Properties prop;
    private String outputFile;
    private StringBuilder voAttributes = new StringBuilder();
    private Map<String, String> taskCodeMap = new HashMap<String, String>();
    private Map<String, String> taskFlowVisitedMap =
    private Map<String, String> taskFlowVoAttributes =
    private static final String LINE_SEPARATOR =
    private static final String FILE_SEPARATOR =
    private static final String STARTING_STR = "<?";
    private static final String ENDING_STR = "?>";

    public static void main(String[] args) throws IOException {

        new VoAttributesFinder().getVoAttributes();
    }

    public VoAttributesFinder() {

        init();
    }

    public void getVoAttributes() throws IOException {

        getAllVoAttributes();
    }

    private void getAllVoAttributes() throws IOException {

        String projectPath = prop.getProperty("ProjectPath");
        voAttributes.append("Task Code").append(",").append("View Object").append(",")
                .append("Attribute Name").append(",").append("Attribute Type")
                .append(",").append("RTF Node").append(LINE_SEPARATOR);
        System.out.println("Generating . . . ");
        populateTaskFlowVoAttributes();
```

On the execution of the utility, the Excel file is generated. The task codes can be filtered in the Excel file for viewing different RTF node value of different attributes available on the particular screen.

Figure 15–4 Excel Generation

	A	B	C	D	E
1	Task Code	View Object	Attribute Name	Attribute Type	RTF Node
15	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	accountNo	java.lang.String	<?FundTermDepositVO_accountNo?>
16	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	principalBalance	java.math.BigDecimal	<?FundTermDepositVO_principalBalance?>
17	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	payinAmount	java.math.BigDecimal	<?FundTermDepositVO_payinAmount?>
18	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	transactionRefNo	java.lang.String	<?FundTermDepositVO_transactionRefNo?>
19	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	userRefNo	java.lang.String	<?FundTermDepositVO_userRefNo?>
20	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	acctCCY	java.lang.String	<?FundTermDepositVO_acctCCY?>
21	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	productCode	java.lang.String	<?FundTermDepositVO_productCode?>
22	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	partyId	java.lang.String	<?FundTermDepositVO_partyId?>
23	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	branchId	java.lang.String	<?FundTermDepositVO_branchId?>
24	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	primaryReason	java.lang.String	<?FundTermDepositVO_primaryReason?>
25	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	secondaryReason	java.lang.String	<?FundTermDepositVO_secondaryReason?>
26	TD002	com.ofss.fc.ui.model.td.mixedpayin.vo.FundTermDepositVO.xml	narrative	java.lang.String	<?FundTermDepositVO_narrative?>

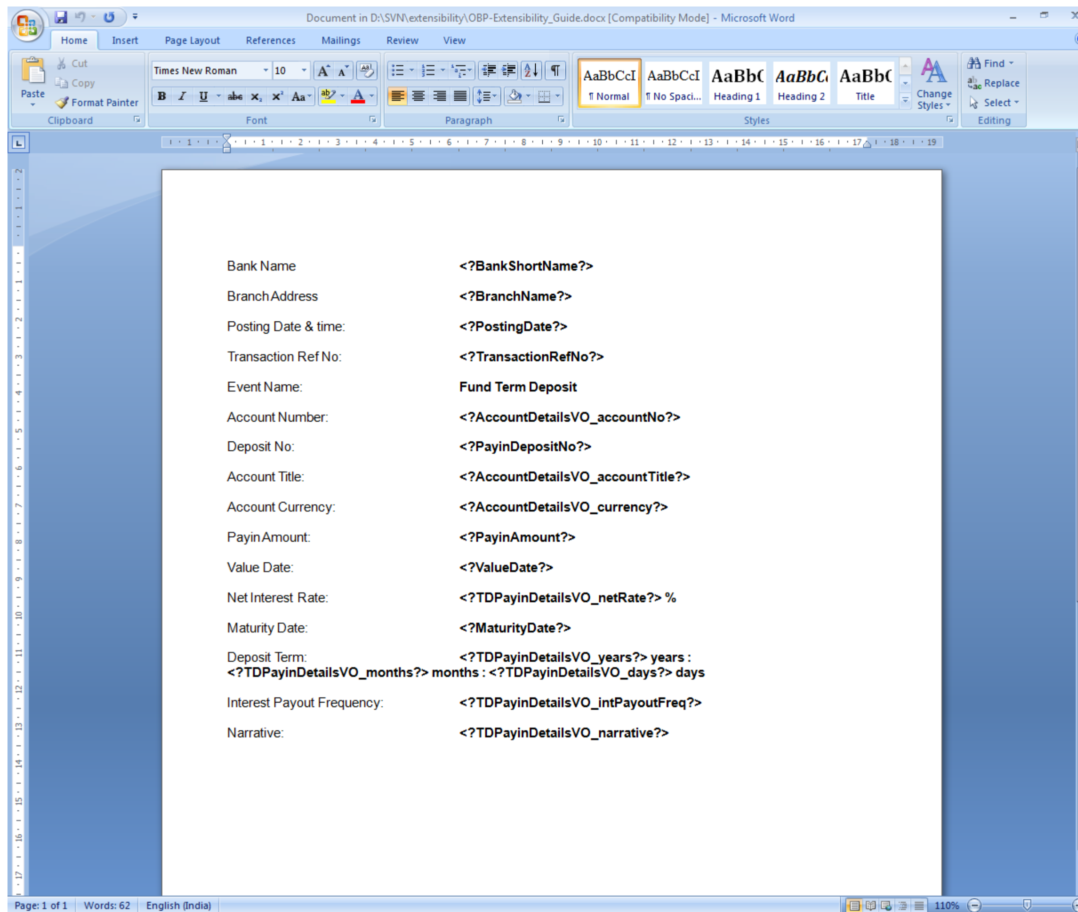
Task Code — View Object Path (Screen/taskflow) — VO Attribute Name — Attribute Type — Reference in RTF template

15.1.2 Receipt Format Template (.rtf)

This template is used for defining the format of the output receipt. Different data elements which need to be shown in the output receipt are mentioned in this RTF report format template. The node will be taken from the above generated Excel file from 'RTF Node' column for specifying the output value in the final output RTF.

The sample rtf template is shown below:

Figure 15–5 Receipt Format Template



15.2 Configuration

This section describes the configuration details.

15.2.1 Parameter Configuration in the BROPConfig.properties

Following configuration parameters are required to be set in the BROPConfig.properties file.

- receipt.print.copy: Set to ‘S’ (default) if Single receipt is required. Else, set to ‘M’ for multiple receipts. The receipt will be stored in current posting date ‘month/date’ folder structure.
- receipt.base.in.location: Location for the RTF templates, which is configured as ‘config\receipt\basein\template\’ structure on the UI server. (For RTF development purpose this location will also have the XML generated while processing receipt.)
- receipt.base.out.location: Location for generated receipt, which is configured as ‘config\receipt\baseout\’ structure on the UI server.
- ui.service.url : UI URL http://IP:port format.

15.2.2 Configuration in the ReceiptPrintReports.properties

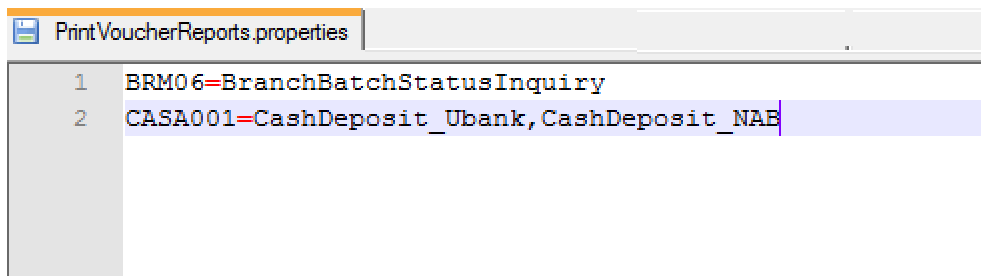
This file contains the key value pair of the Task Code of the screen and the corresponding template names, comma separated if more than 1 template is referred by screen.

TaskCode=RTF Filename

Where TaskCode: task code of screen for which receipt print will be enabled and RTF Filename: name of the RTF template which will be used for the creation of the output with the same filename.

For example, TD002=FundTermDeposit

Figure 15–6 Receipt Print Reports



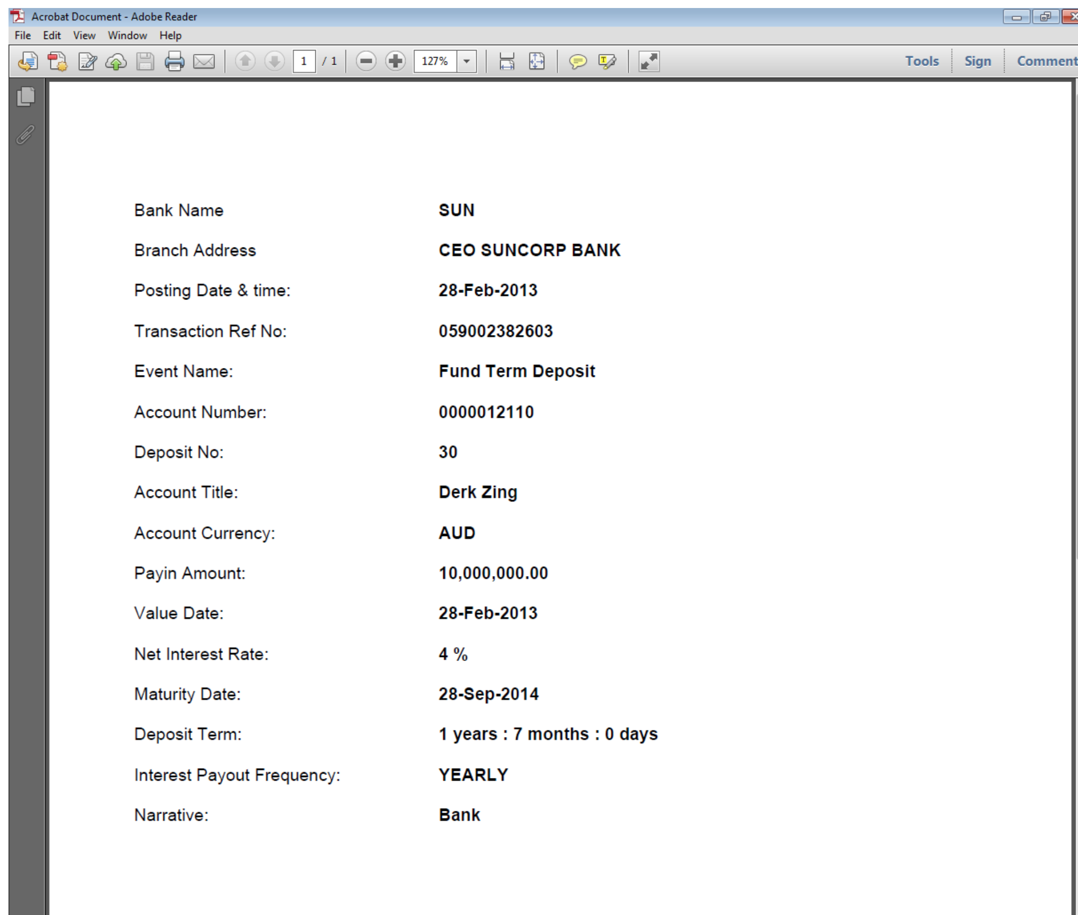
15.3 Implementation

The implementation for the print receipt functionality is explained in the following steps:

1. Once the screen is opened, Template checks '*ReceiptPrintReports.properties*' file if the Task code of the opened screen is present in the property file. The 'Receipt Print' button will be rendered in a disabled state.
2. On successful completion of transaction (successful Ok click), Receipt Print button gets enabled.
3. On click of Receipt Print button, all the VO's on current screen are fetched and created as a XML with data (for RTF development reference, this XML is not deleted at the moment but on environments these will be deleted). The RTF and XML merge up to create and open the receipt in the pdf format.
4. Receipt will be stored with the file name as <Logged in userId_TemplateName>

The sample output receipt in the PDF form is shown below:

Figure 15–7 Sample of Print Receipt



15.3.1 Default Nodes

As per the functional specification requirement, some default nodes are already added in the generated XML. The list of those nodes are as follows:

- BankCode
- BankShortName
- BranchName
- PostingDate
- UserName
- BankAddress
- BranchAddress
- LocalDateTimeText

15.4 Special Scenarios

There are some cases, where some of the attributes are not available in the VOs of the screen and the value needs to be picked from the response of the transaction. There are also some data values which need to be formatted first and then published in the PDF.

These values can be added to the pageFlowScope Map variable 'receiptPrintOtherDetailsMap'.

The population of those values needs to be done in the Backing Bean, after getting the response of the transaction in the following manner:

```
MessageHandler.addMessage(payinResponse.getStatus());
receiptDetails.put("TransactionRefNo",payinResponse.getStatus().getInternalReferen
ceNumber());
SimpleDateFormat receiptTimeFormat = new SimpleDateFormat("hh:mm:ss a");
SimpleDateFormat receiptDateFormat = new SimpleDateFormat("dd-MMM-yyyy");
HashMap<String,String> receiptDetails = new HashMap<String, String>();
Date date=new Date(getSessionContext().getLocalDateTimeText());
receiptDetails.put("PostingTime",
receiptTimeFormat.format(date.getSQLTimestamp()));
if(payinResponse!=null && payinResponse.getValueDate()!=null) {
receiptDetails.put("ValueDate",receiptDateFormat.format(payinResponse.getValueDate
().getSqlDate()));
}
ELHandler.set("#{pageFlowScope.receiptPrintOtherDetailsMap}", receiptDetails);
```

Internally, the functionality adds all the details in map variable, other than VO's data. While receipt printing, template checks the Map variable and if not null, it gets all the key-value from the map and show them in XML which is used later on for generation of receipt.

16 Facts and Rules Configuration

This chapter explains the facts and rules configuration details.

16.1 Facts

Fact (in an abstract way) is something which is a reality or which holds true at a given point of time. Business rules are made up of facts.

A fact can be classified in two ways:

- ***Literal Fact*** - Any number, text or other information that represents a value. It is a fixed value. For example, 100, 2.95, "Mumbai"
- ***Variable Fact*** - A fact whose value keeps changing over a period of time For example, Account Balance, Product Type.

For example, If a customer maintains an Average Quarterly Balance of Rs.10,000 then waive off his quarterly account maintenance fees. Here, the Average Quarterly Balance is a variable fact while the Rs.10, 000 is a literal fact.

16.1.1 Type of Facts

There are two types of facts:

- Direct Facts with input name value pair
- Derived Facts

Services will be exposed for various operations on the facts. These services are broadly classified into two types:

- Fact Inquiry Service
- Fact Derivation Service

For deriving the fact value, different type of datasource can be used:

- Java DataSource - Derivation from Java class
- HQL DataSource - HQL Query column
- JDBC DataSource - SQL Query column
- DbFunction DataSource - Derivation from database function

Fact Definition can be further categorized into:

- **Fact Value Definition** - Definition to Derive Fact Value, It is used mostly in Rule Execution

- **Fact Enum Definition** - Definition to Derive Permissible values for a fact. It is used mostly in Rule Creation.

16.1.2 Facts Vocabulary

Facts Vocabulary is a list or collection of all facts pertaining to a specific field or domain. A standard vocabulary of facts aids users in defining their business rules. For example, the Facts Vocabulary of the Banking domain can contain common and familiar facts such as Account Balance, Customer Type, Product Type, Loan-To-Value Ratio. The Facts Vocabulary of the Cards domain may contain common facts such as Total Credit Limit, Available Credit Limit, Available Cash Limit.

A vocabulary is defined for variable facts. Each fact has a definition and can have source information.

Definition

The fact definition indicates common properties of the fact such as its name, its data type, which domain, domain category and group it belongs to, key for retrieving value and a brief description.

Variable facts would be defined for a domain and a domain category. Domain categories are the sub-systems inside a domain. For example, Lending, Term Deposits, Demand Deposits are the categories of Banking domain. There are some variable facts which would be common across all the categories in a given domain. For example, Customer and Bank data is common for all the categories of Banking domain. Such facts can be classified under a special category called "Global".

The facts are further categorized under various groups. One fact can belong to one or more Groups. For example, In a Banking domain, Customer Type, Birth Date, Gender are Global facts belonging to the group Individual Customer Details. Account Balance, Account Opening Date are facts in Lending category belonging to the group Account Details. Loan-to-value (LTV) ratio, Sanctioned Amount are Facts in Lending category and belong to multiple groups such as Consumer Loan, Home Loan, Agriculture Loan. There are some variable facts which do not really fall into any specific group, such facts are classified under a special group called "Others".

A variable fact value can be received as input from the consumer of eRules in the form of key-value pair, the key here is defined as *RetrievalKey*. The fact will also have a data source for value derivation in case the fact value is not an input.

Some variable facts can have a permissible list of values defined and the rule creator will be restricted to use only those values which are defined in the permissible list of a given fact. All facts will have a *FactValueType* defined as either *Enumerated* (indicates that the fact has a permissible list of values) or *OpenEnded* (indicates that the fact value is a free text). For facts with *FactValueType* as *Enumerated*, data source information will be defined in the vocabulary to derive the list of values.

Variable facts will have a grouping based on BusinessDataType. For example, Variable facts like Transaction Amount, Sanctioned Amount, and Disbursed Amount can be grouped under "Amount". Variable facts like Available Balance, Book Balance belong to "Balance" BusinessType and so on.

These BusinessDataType will in turn have PrimitiveDataType. For example, Amount and Balance will have PrimitiveDataType as double.

With the help of BusinessDataType grouping a list of facts belonging to a particular group can be displayed for user selection while defining rules, rate charts, policies and so on. During actual rule execution the respective *PrimitiveDataType* (that is, int, double, String and so on) of the BusinessDataType will be used.

Literal facts will only have a *PrimitiveDatatype*.

Source

Some facts can be derived, if they are not received as input. Also associated with some facts is a list of permissible values for the fact at the time of rule/policy definition. All these information forms the part of source data. The Fact Derivation layer is responsible for deriving the value of a fact and the list of permissible values for the fact based on source information defined in the vocabulary.

Deriving Enumeration (applicable list of values) for a Fact

A Variable fact can hold any value at a given point of time. But some can have a standard set of applicable values defined and the value held by such facts would be always within the range of this list of values.

For example, Account Balance as a variable fact can hold any value at a given point of time, a set of values cannot be defined for such facts. Hence, no list of permissible values will be defined for Account Balance. However, the variable fact Customer Gender can have only one of two possible values namely - Male or Female.

While defining the rules, the permissible list of values will be derived for such facts and user selection will be restricted to this list.

Deriving Value for a Fact

During rule execution, a set of fact information will be sent by the consumer of eRules in the form of key-value pair. But this might not be a complete set of fact information required for executing pricing rules. Hence some facts will have to be derived if they are not received as input.

During rule execution, the required facts would be determined, value will be fetched from *RetrievalKey* of the fact if received as input else the value will be derived.

16.1.3 Generation of Facts using Eclipse Plug-in

The fact objects can be generated either by populating the database tables directly or by using the eclipse plug-in. This plug-in is created for fact generation purpose in OBP application.

A local host server needs to be configured in eclipse before processing for configuration of the fact plug-in. For fact generation purpose, the following steps need to be followed.

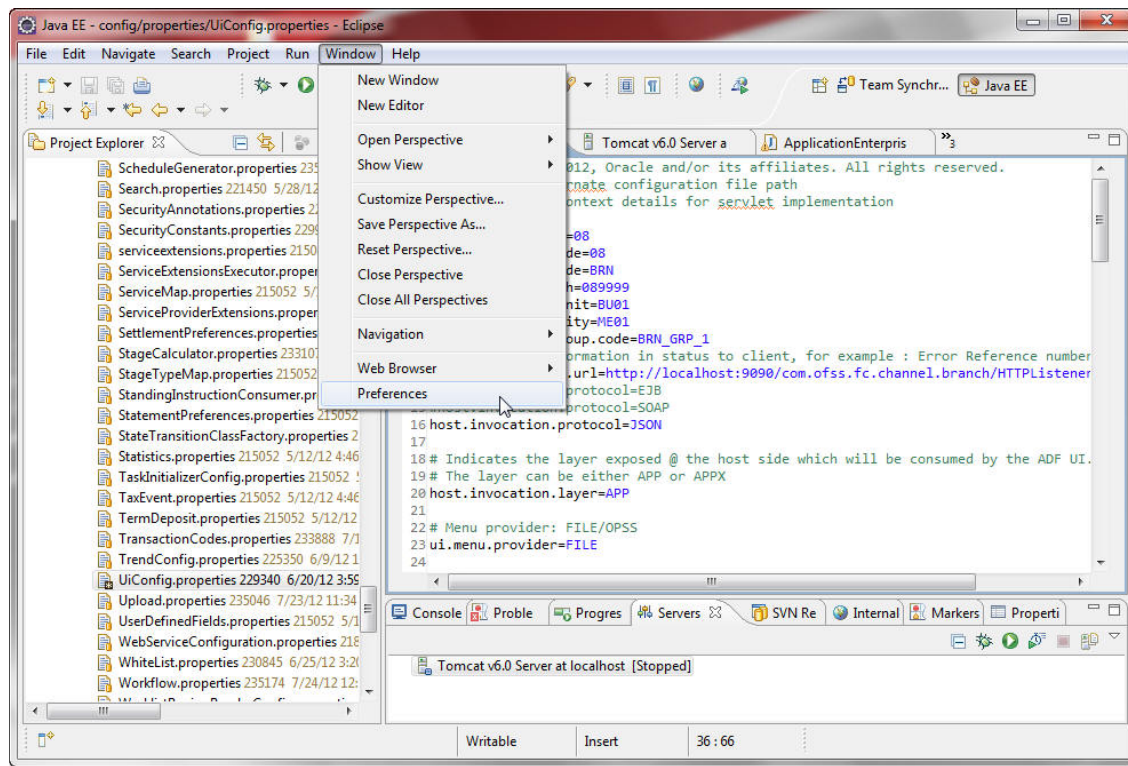
Get the Fact Plugin from the development team.

Put the plugin (**com.ofss.fc.util.plugin.fact_1.0.0.jar**) in the plug-in folder of eclipse.

Restart Eclipse

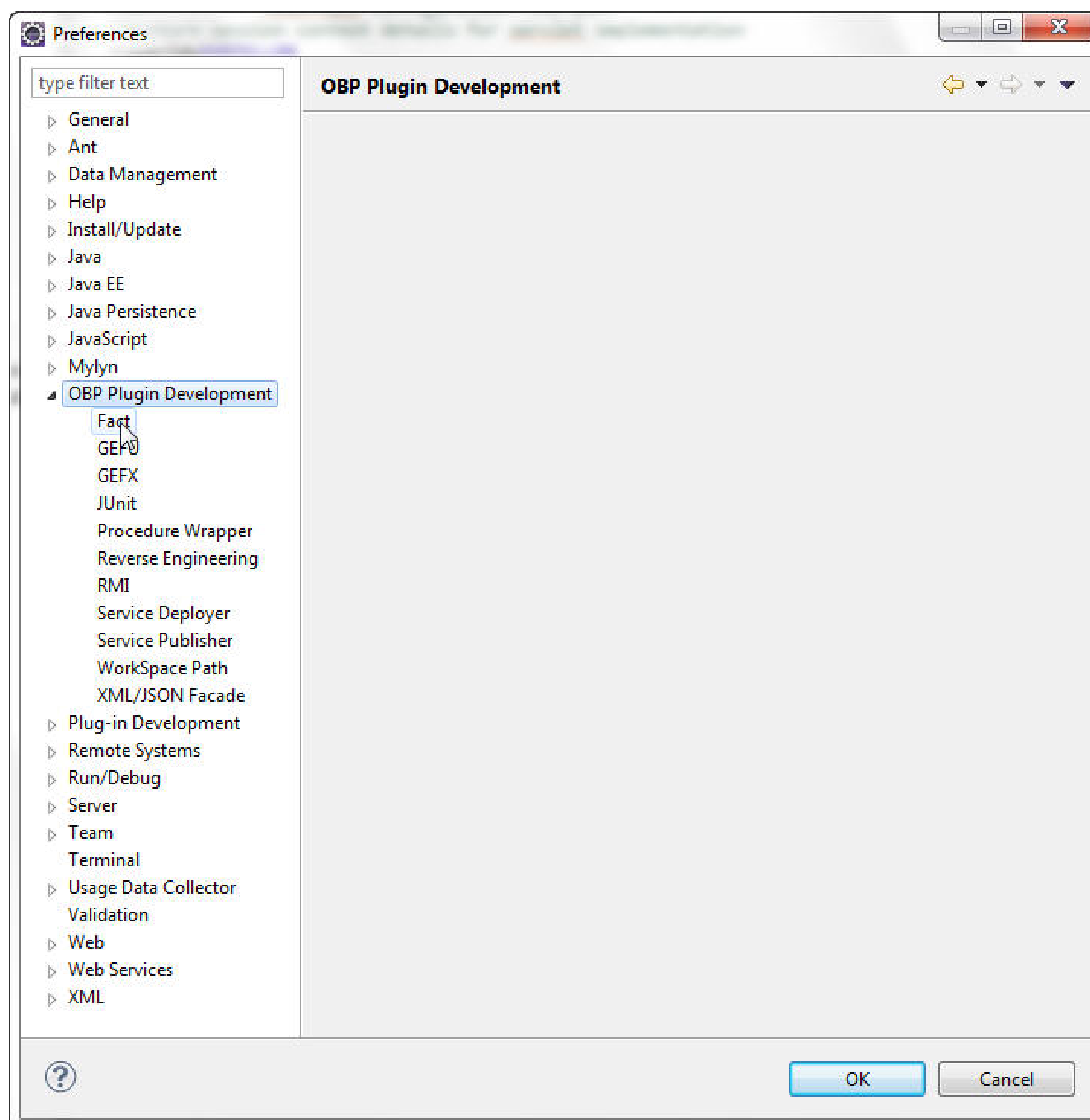
1. In eclipse, go to Window -> Preferences.

Figure 16–1 Select Window Preferences



2. Now in Preferences Window, go to **OBP Plugin Development -> Fact**.

Figure 16–2 Window Preferences - OBP Plugin Development



3. Enter the values as mentioned:

   - **Application Server URL**: Local Host Server Listener URL

     Example: http: //localhost:9090/com.ofss.fc.channel.branch/HTTPListener

   - **Presentation Server URL**: Token Generator Application URL

     Example: http: //127.0.0.1:8001/TokenGenerator/HTTPListener

     If using the plug-in in local eclipse workspace, it will not be used, but a value must be provided, you can use it from example value.

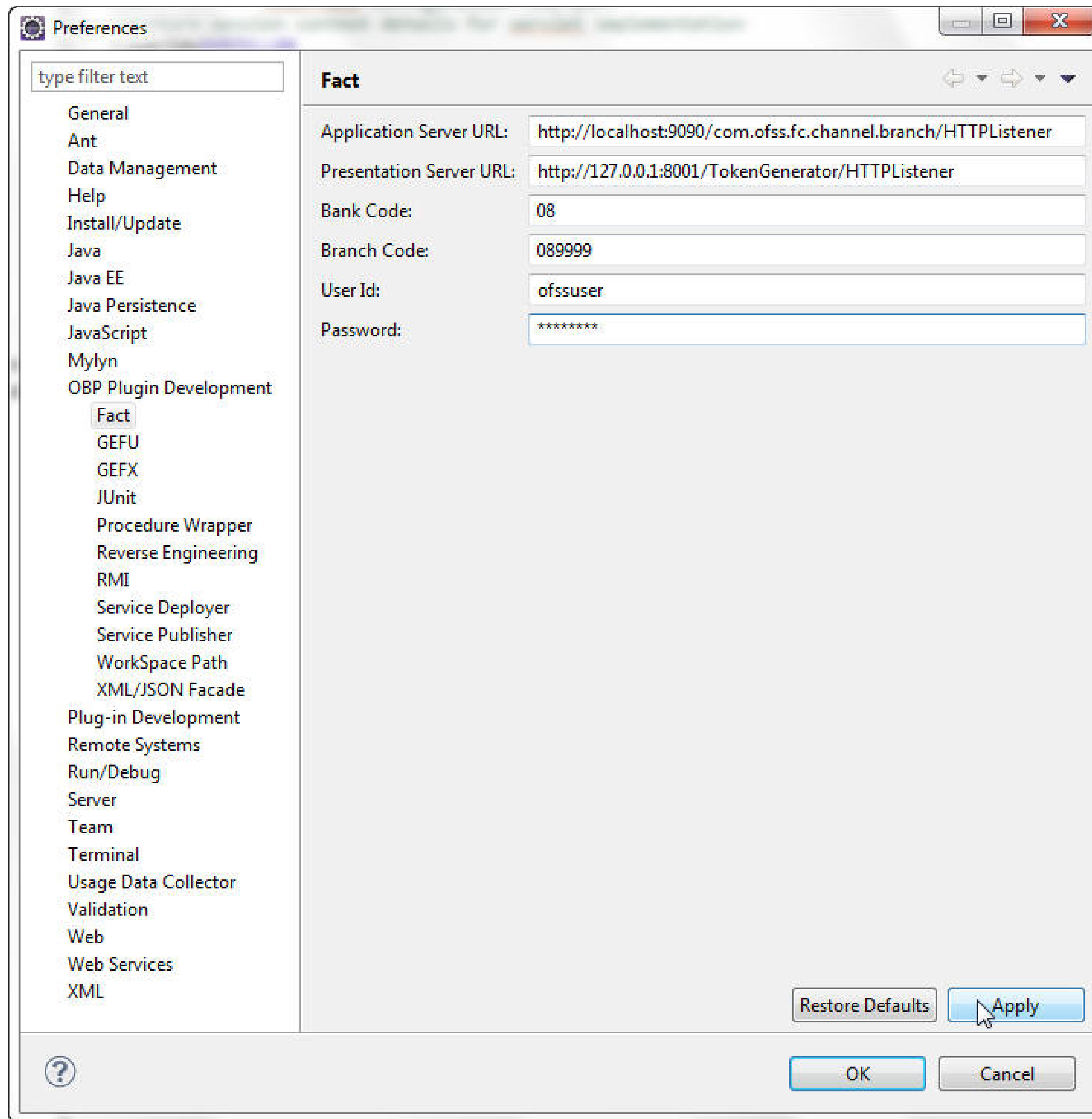
     For security configured environment, it will be used, and then it should be provided properly.

   - **Bank Code**: Bank code (Example: 08)

   - **Branch Code**: Branch Code (Example: 089999)

- **User Id**: username (Example: ofssuser)
- **Password**: Password (Example: welcome1)

Figure 16–3 Enter the Preferences Fact values



4. Now click **Apply**, and then click **Ok**.
5. Open Fact.properties and modify:
   - **aggregateCodeFilePath**: The location of host workspace.
   - **sourceFilePath**: The location of src directory of com.ofss.fc.fact project.

Figure 16–4 Fact Properties - aggregateCodeFilePath

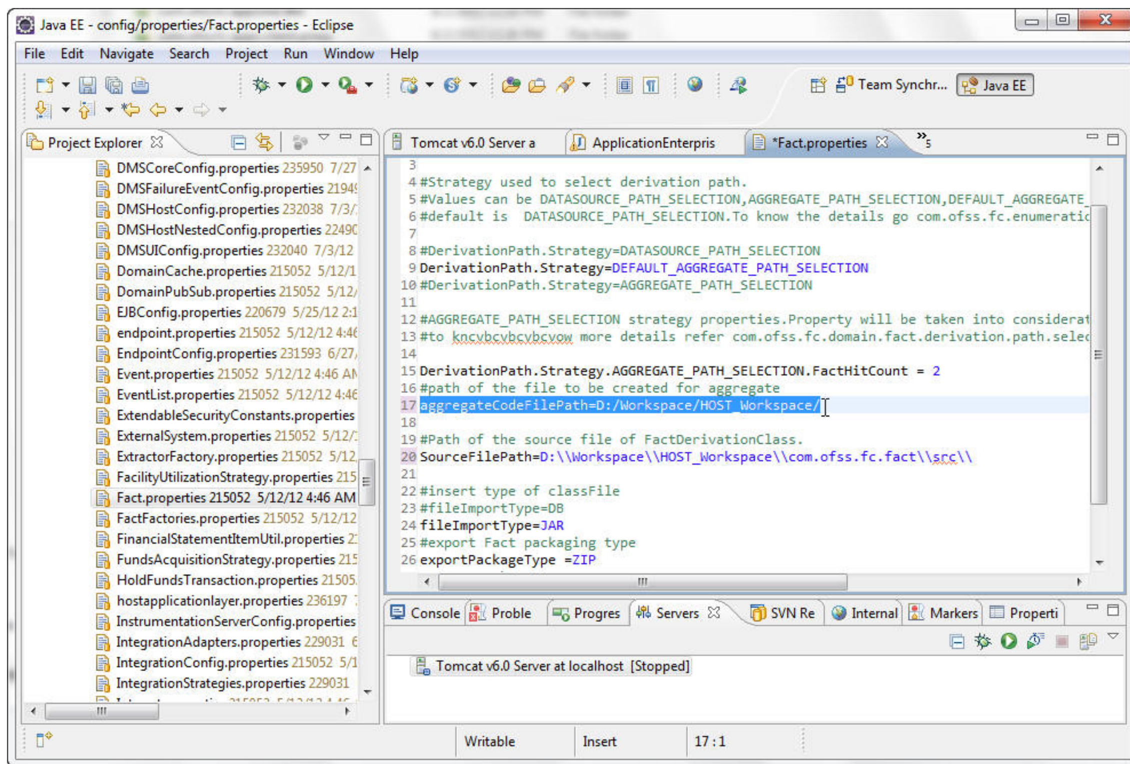
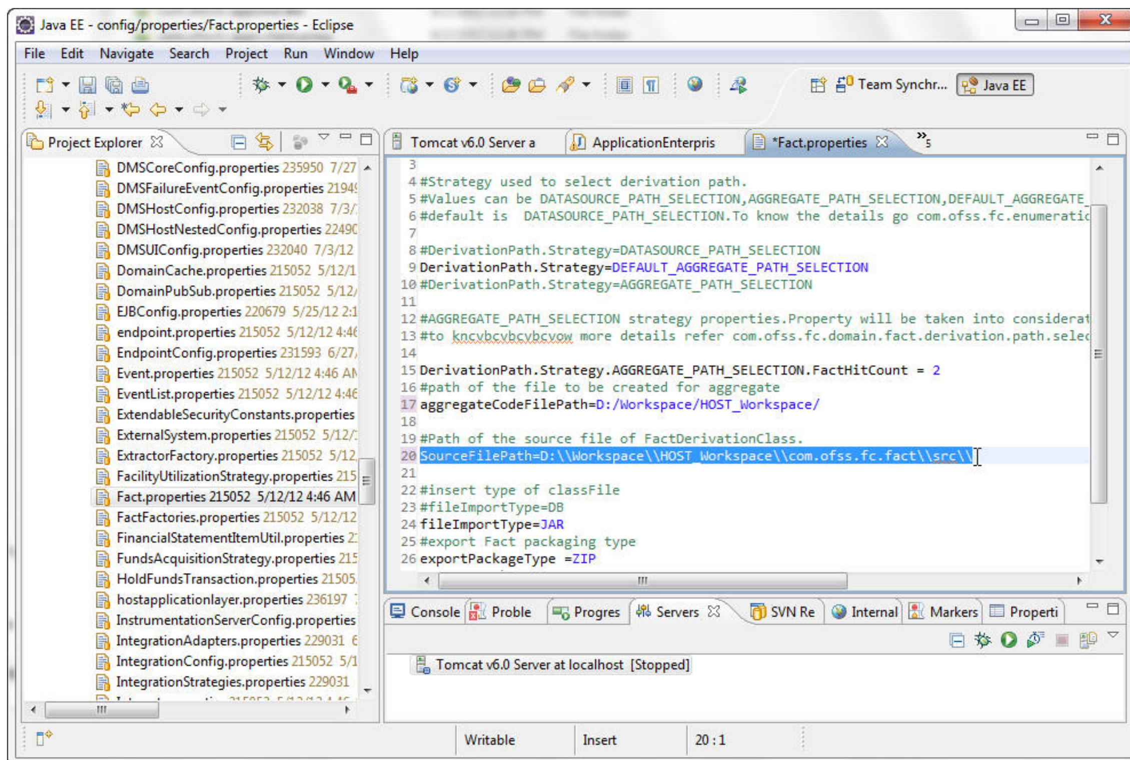


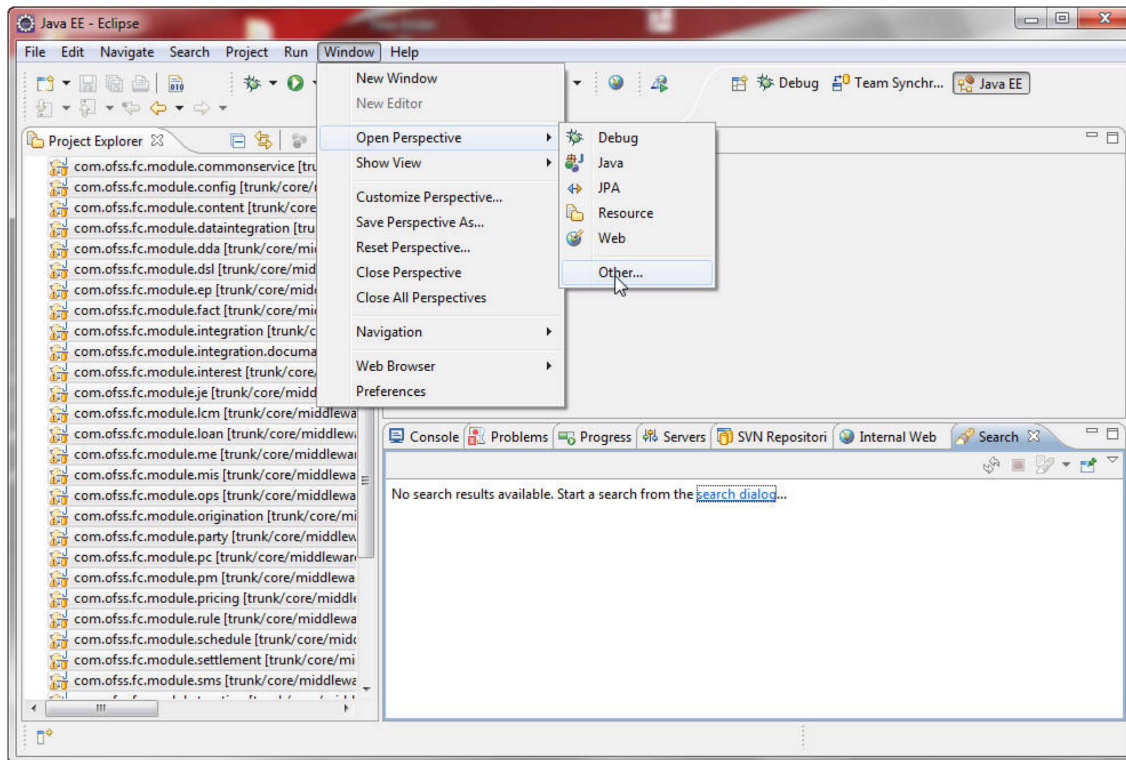
Figure 16–5 Fact Properties - sourceFilePath



6. Now start the Host server.

7. In eclipse, go to Window -> Open Perspective -> Other.

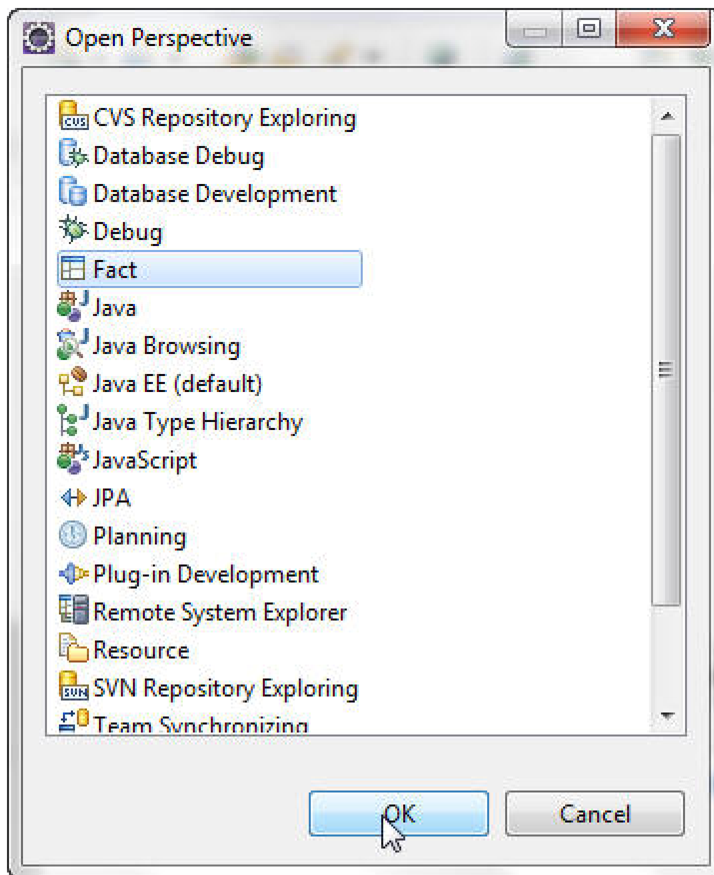
Figure 16–6 Start Host Server



8. Now in Open Perspective window select **Fact**.

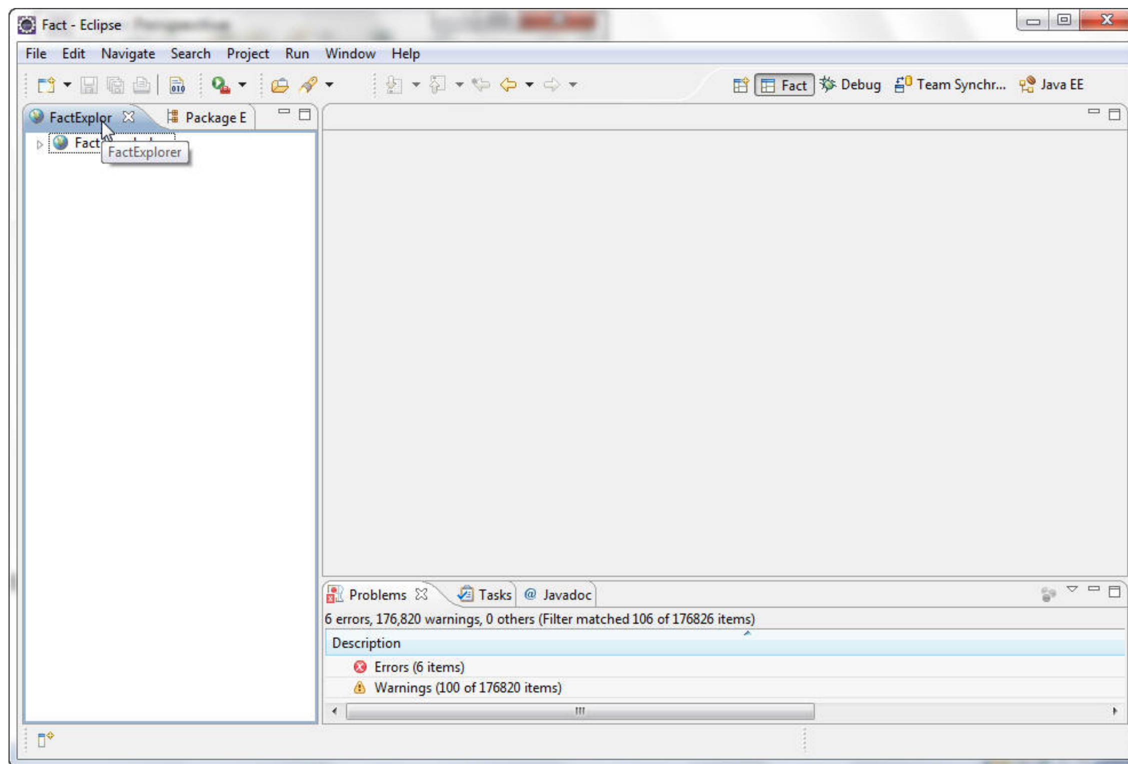
9. Click **Ok**.

Figure 16–7 Select Open Perspective value



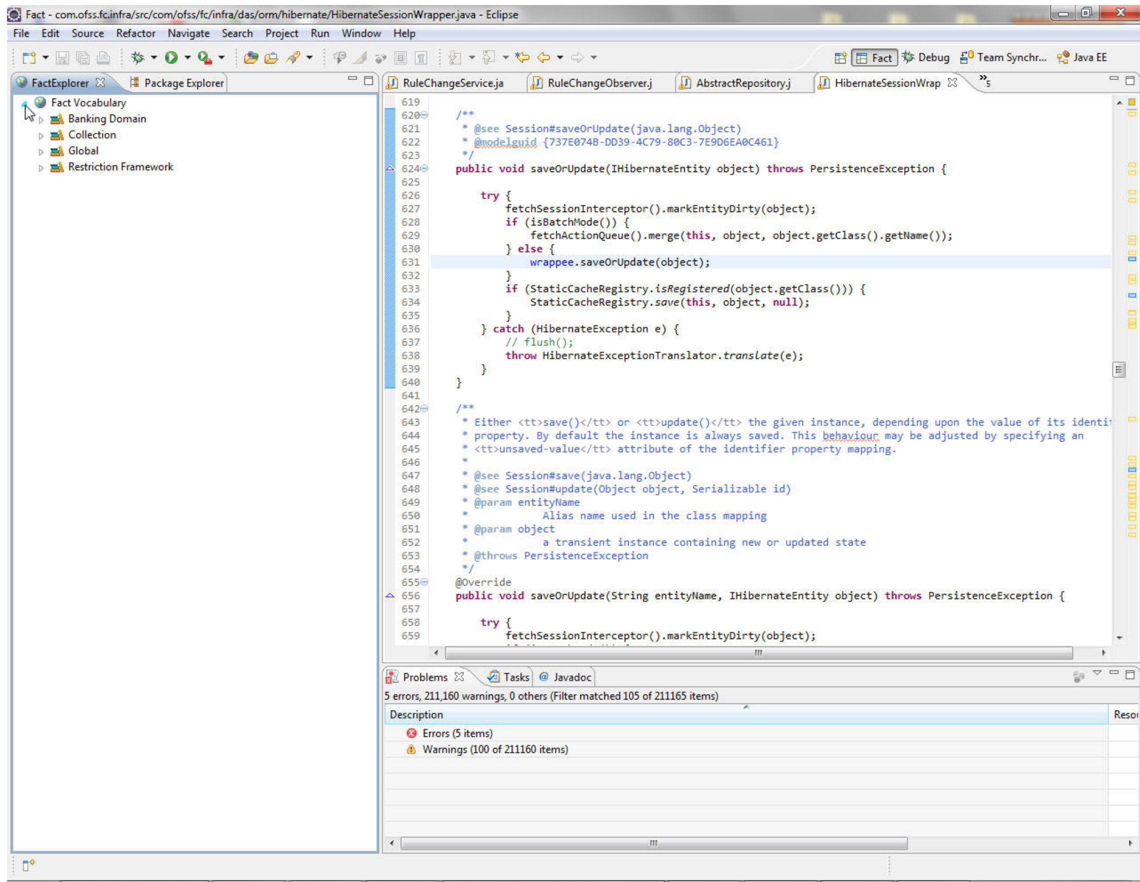
It will open **Fact Explorer** perspective, where **Fact Vocabulary** is available.

Figure 16–8 Fact Explorer



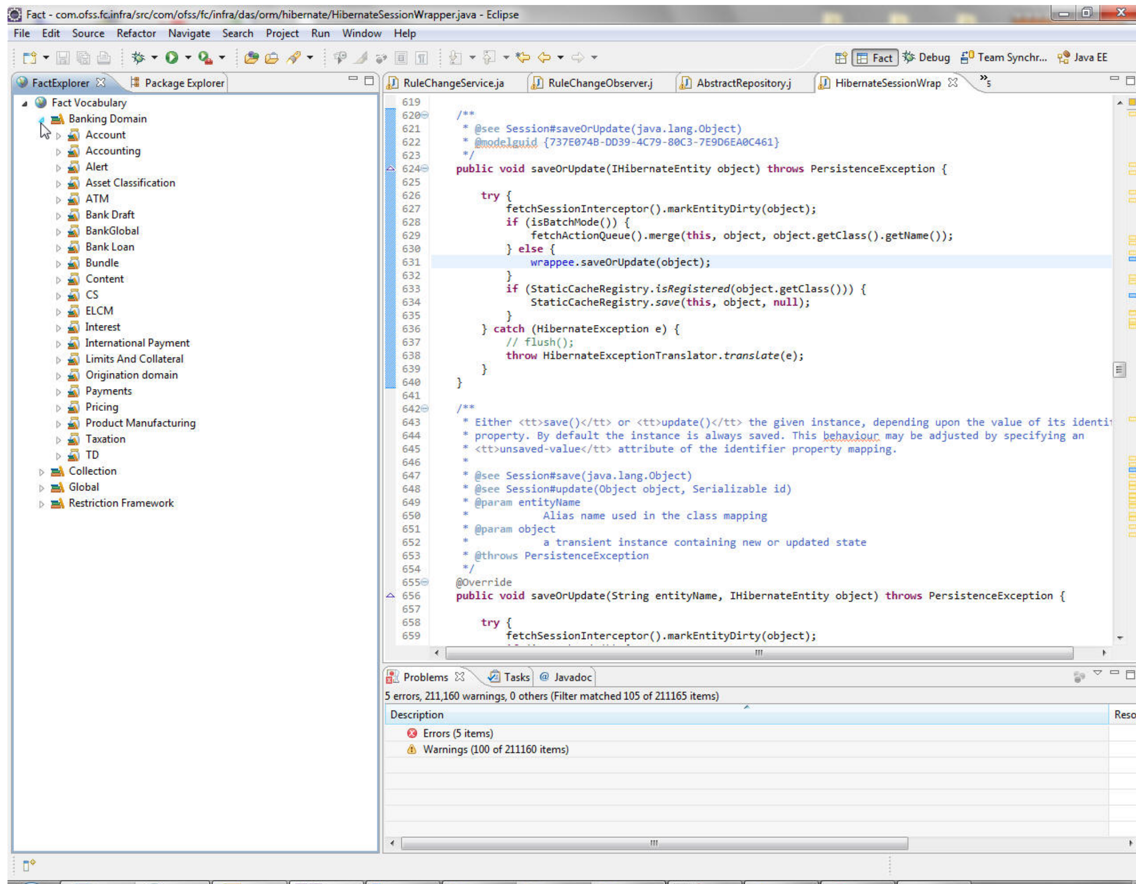
10. Now refresh and expand **Fact Vocabulary**. Expanding Fact Vocabulary will show the **Domain** names.

Figure 16–9 Fact Vocabulary



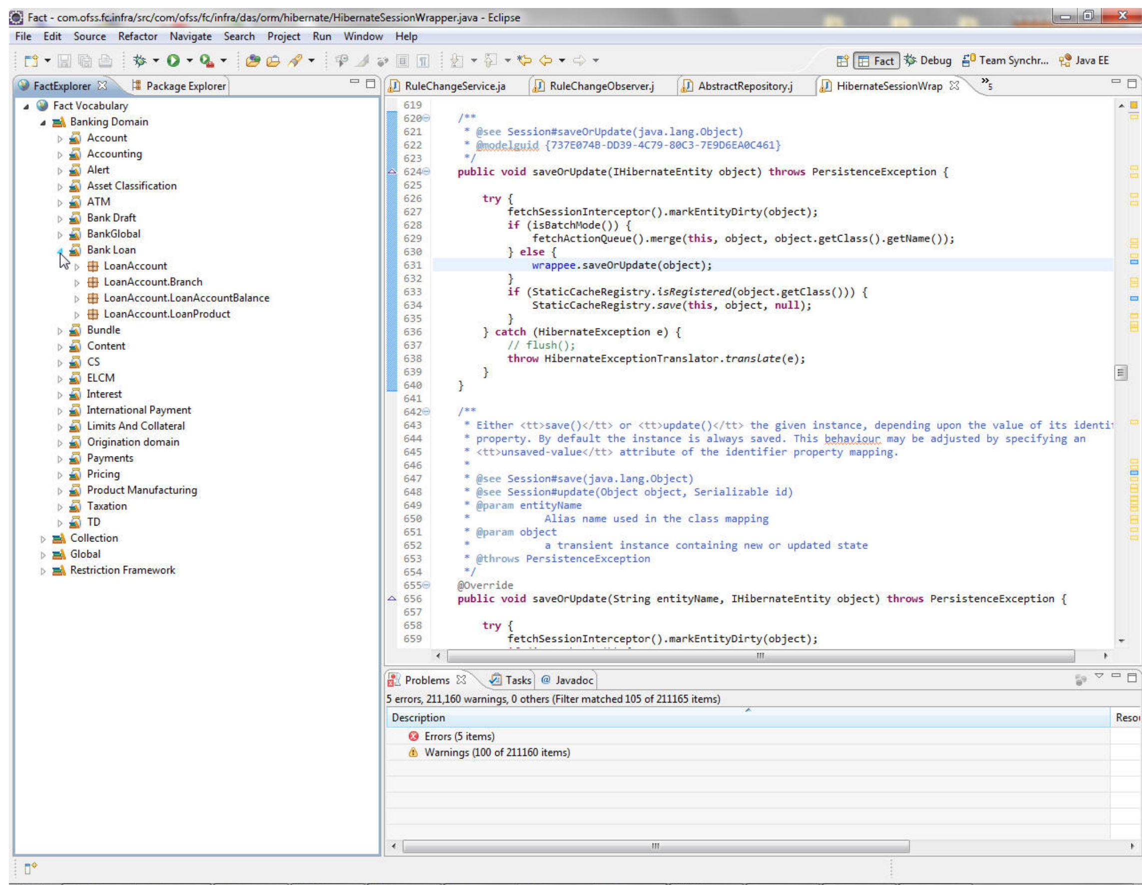
Each Domain contains its **Domain Category** names.

Figure 16–10 Domain Category



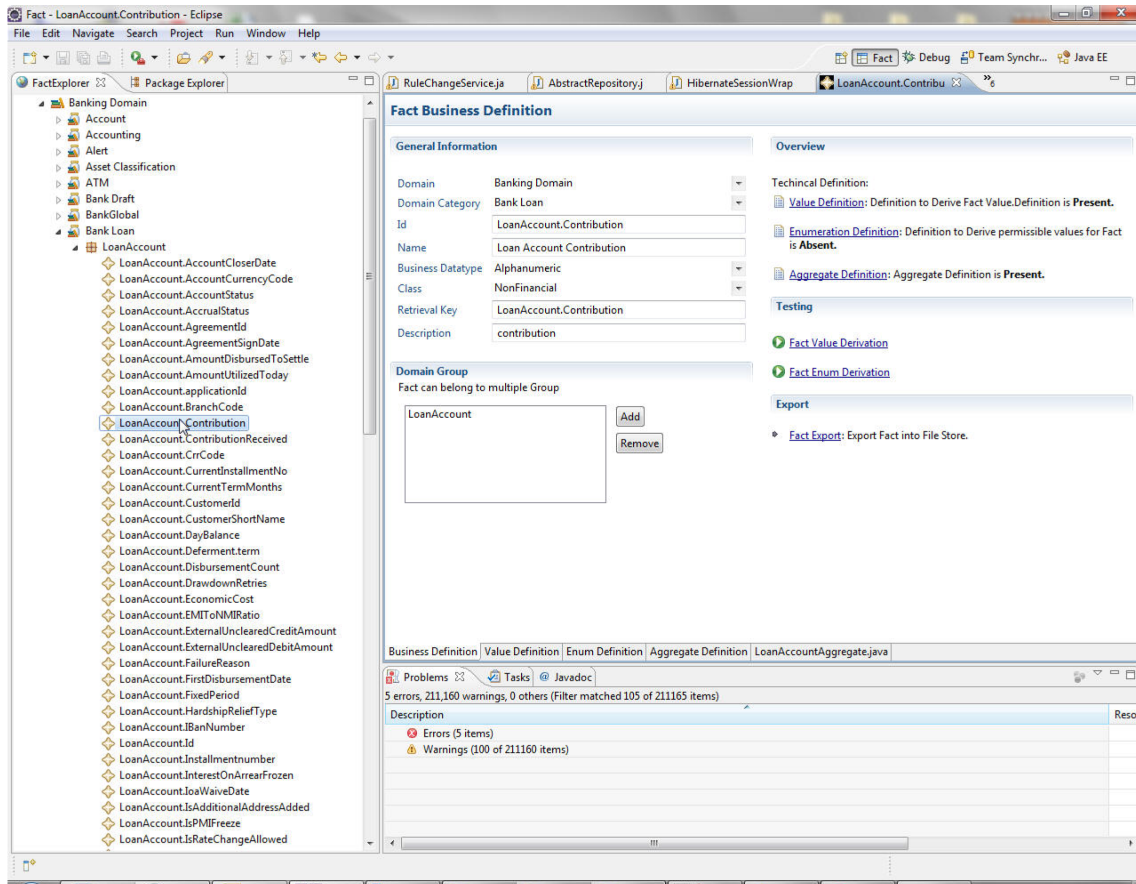
Each Domain category contain its **Fact Groups**

Figure 16–11 Fact Groups



Each Fact Groups contains its **Facts**.

Figure 16–12 Facts



11. To see the details of any fact, just double-click it. The details will be shown in a fact window containing some tabs. Move to each tab to show the details.

Figure 16–13 Business Definition Tab

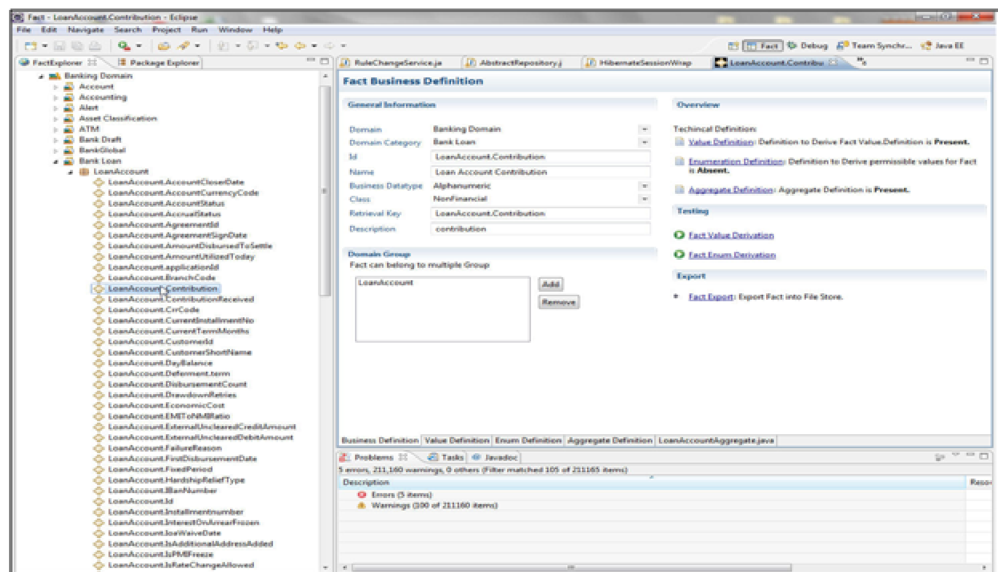


Figure 16–14 Value Definition Tab

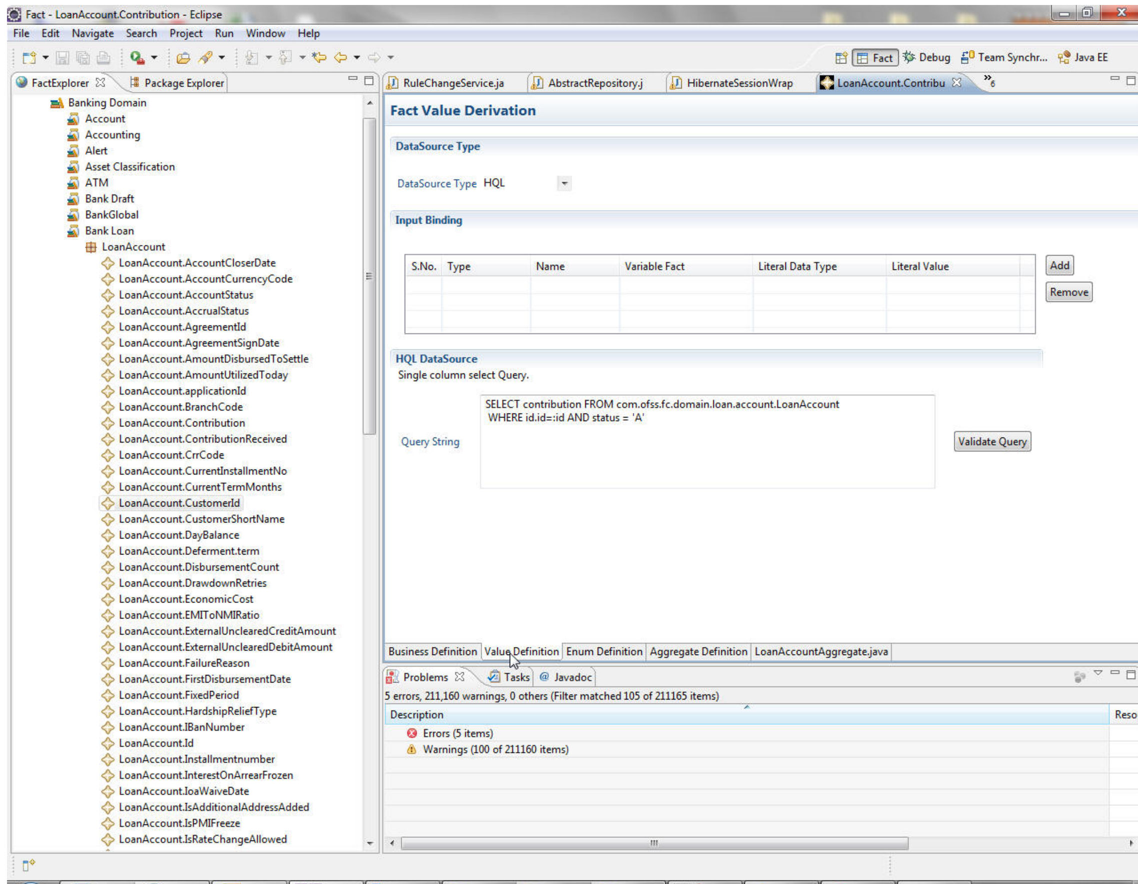


Figure 16–15 Enum Definition Tab

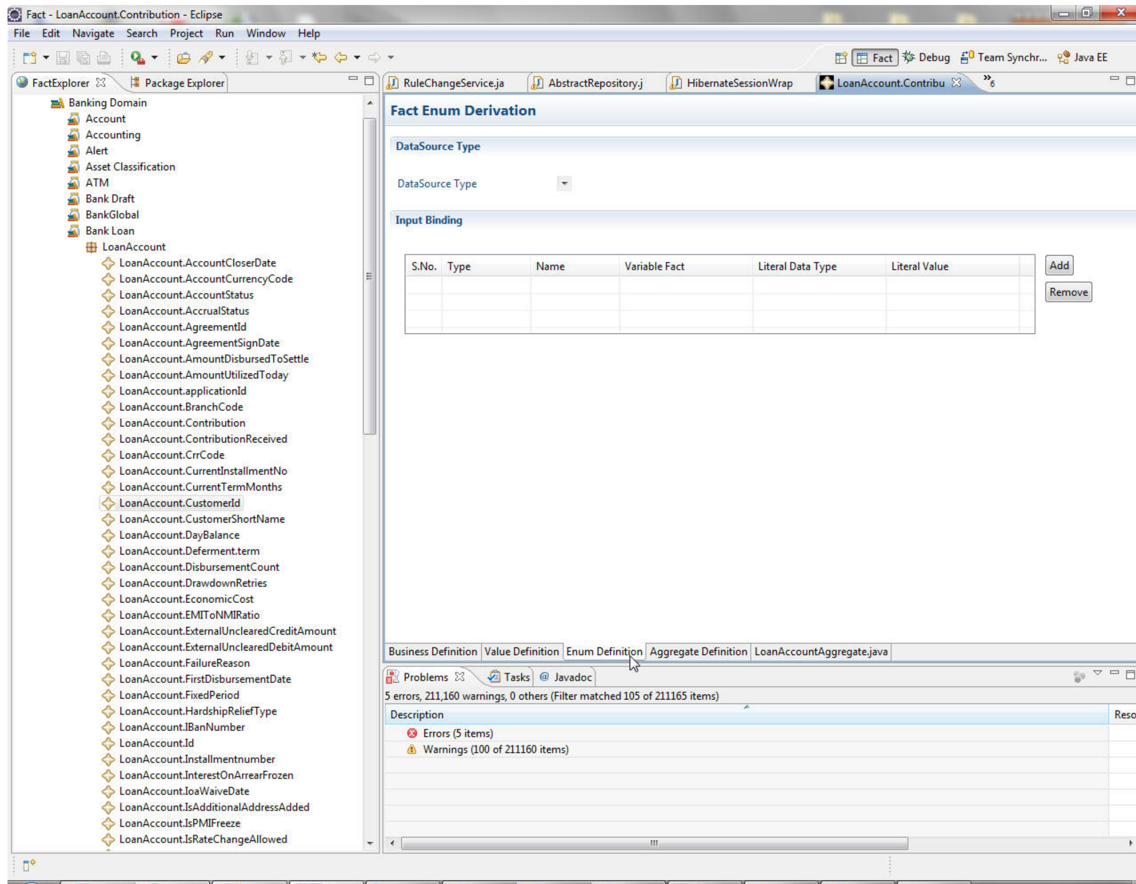


Figure 16–16 Aggregrate Definition Tab

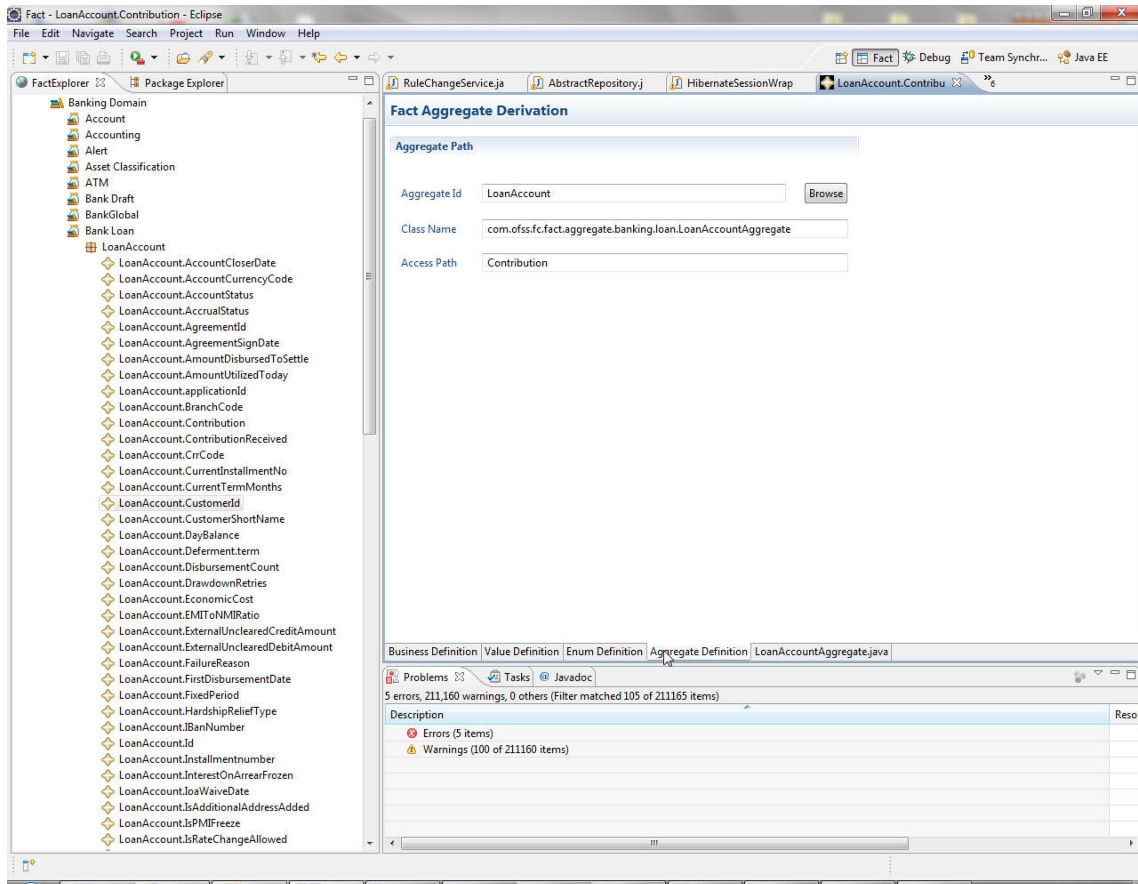
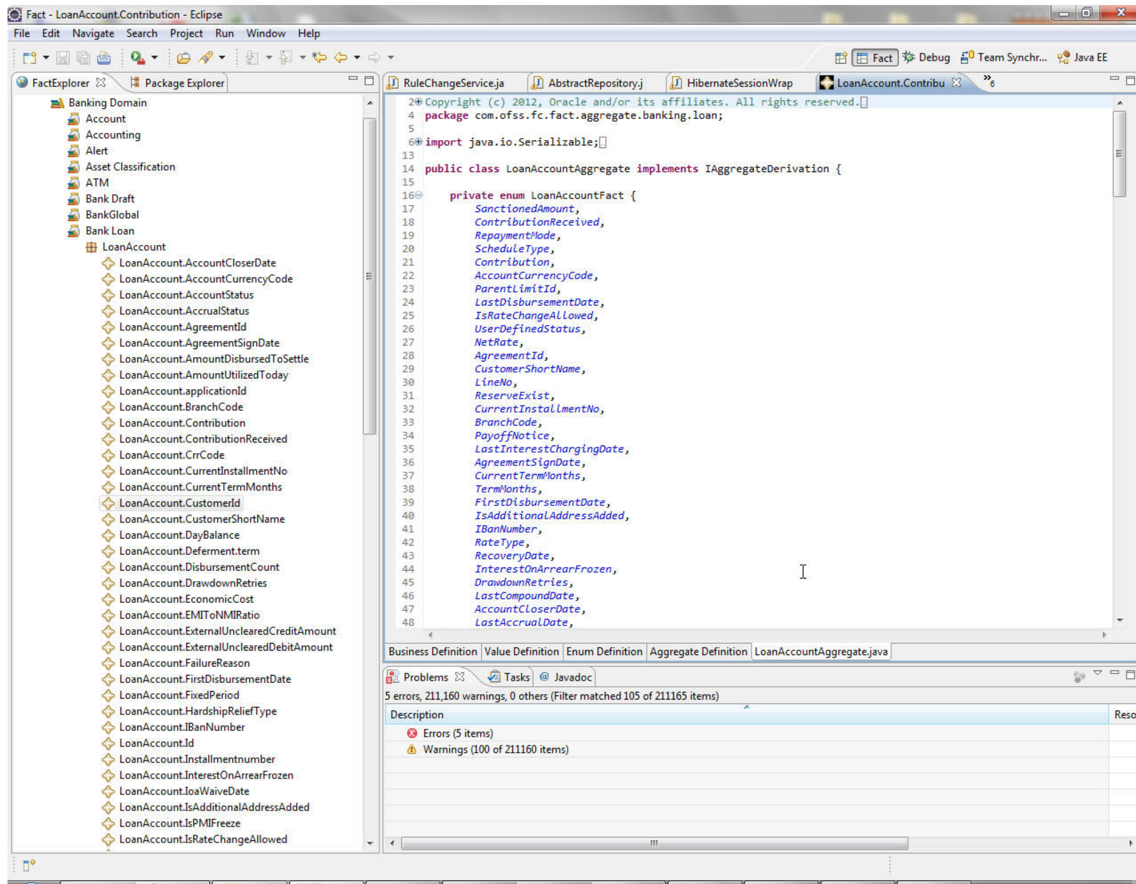
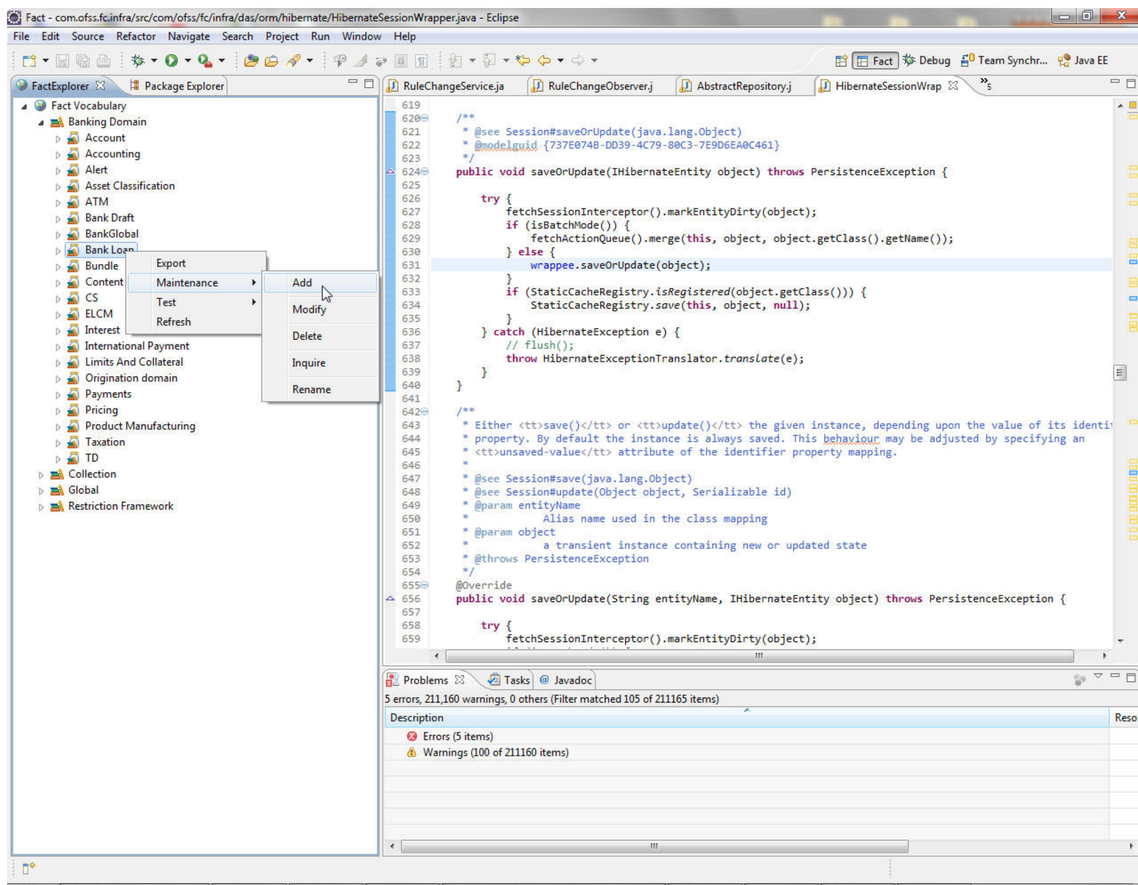


Figure 16–17 Aggregate File Tab



12. Creating **New Fact**: Right-click any domain Category in which Fact is to be created. Go to Maintenance -> Add.

Figure 16–18 Creating New Fact - Add



13. Enter required details for the facts in the new fact window.

All fields of Business definition tab are required for creation of any fact.

Fields of other tabs may be or may not be required. It depends on the fact to be created.

Figure 16–19 Creating New Fact - Fact Business Definition

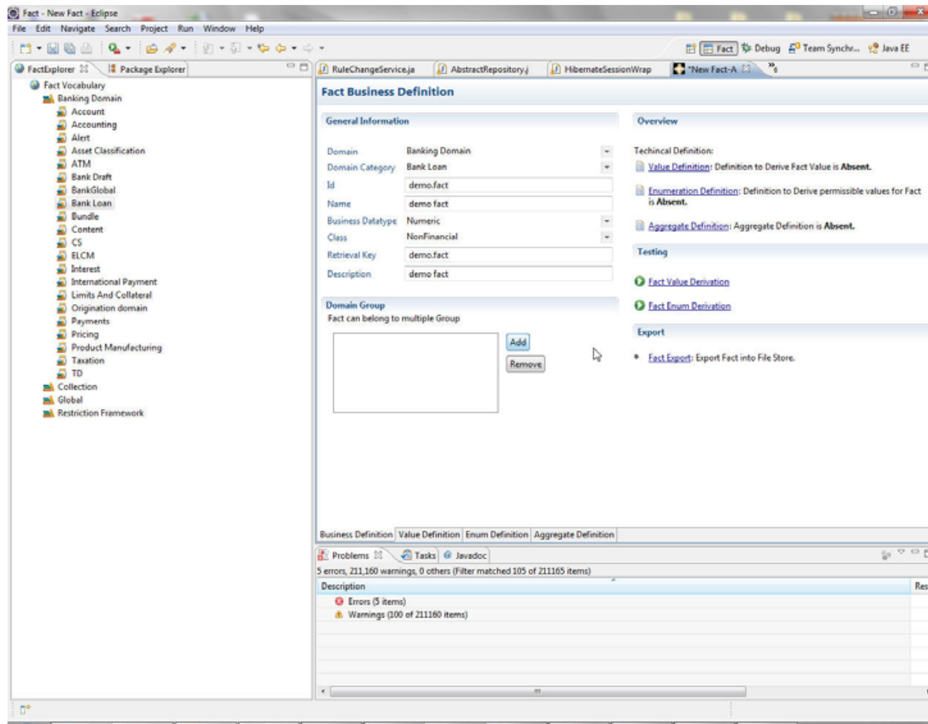
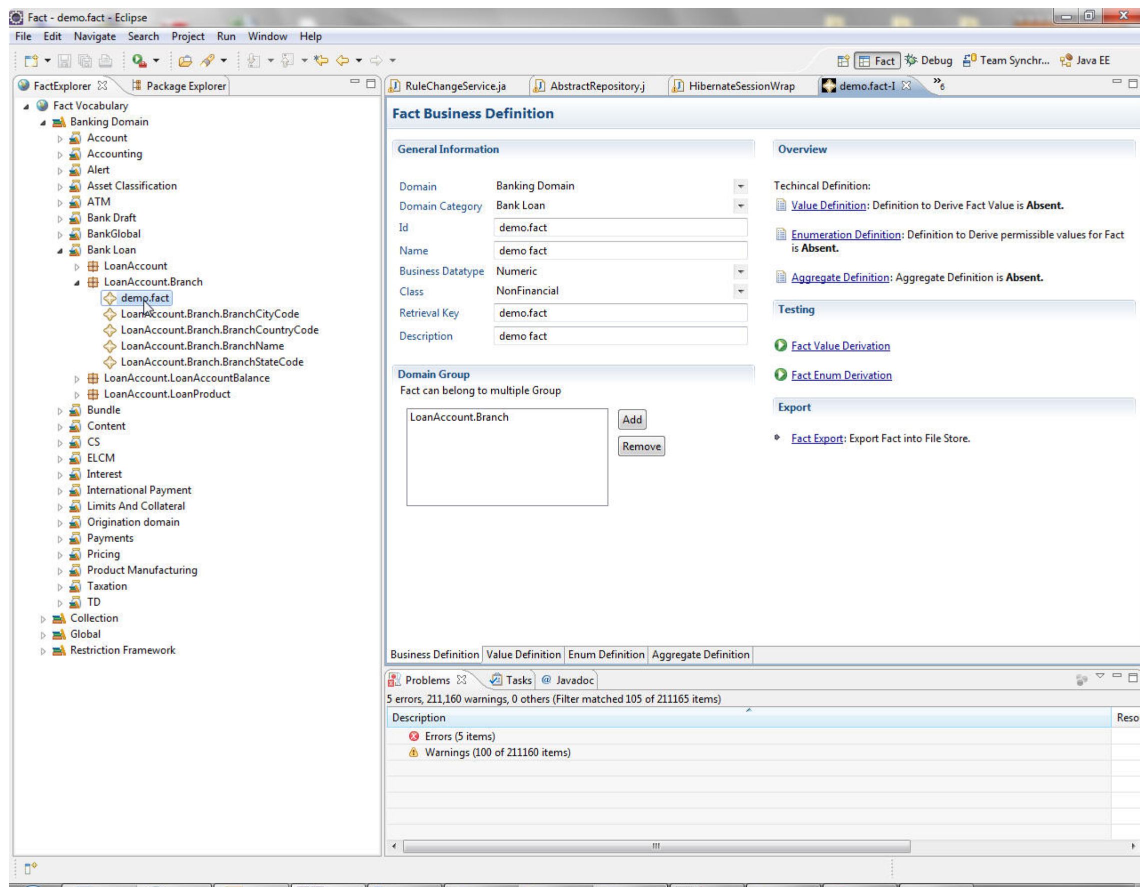


Figure 16–20 Creating New Fact - Domain Group



14. Enter the values in the fields and press CTRL+S, click **Yes** to save and fact will be created.

Figure 16–21 Saving New Fact

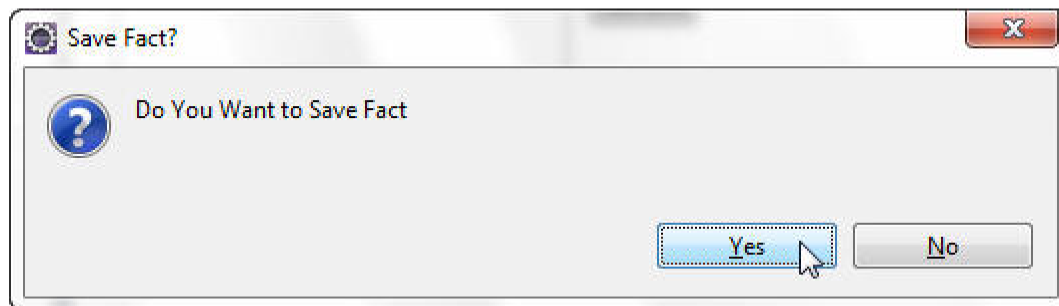
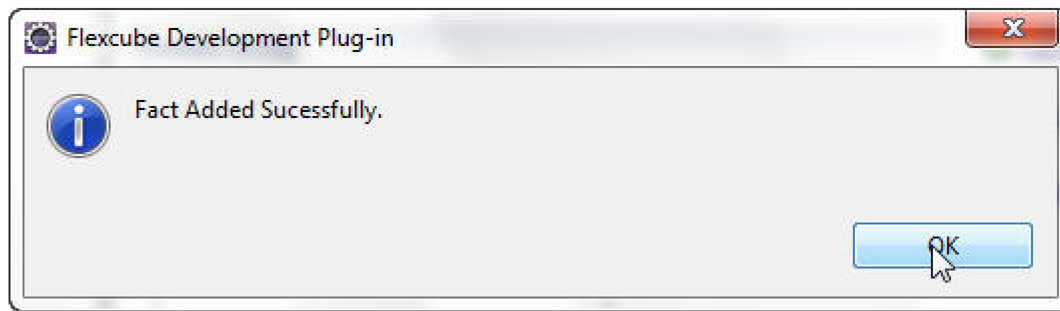


Figure 16–22 Saving New Fact - Fact Added



15. Modification of **Existing Fact**: To modify an existing fact, right-click the fact -> Maintenance -> Modify.

    It opens the fact details in editable mode. Change whatever required and then save it using 'CTLRL+S'.

Fact Perspective also provide following facilities:

- Maintenance Operations on Fact
- Add
- Modify
- Inquire
- Fact Derivation Test
- Fact Value Derivation Test
- Fact Enum Derivation Test
- Fact Import - Import Fact from File Store to Database store
- Fact Export - Export Fact from Database store to File store.

16.2 Business Rules

Business Rules are defined for improving agility and for implementing business policy changes. This agility, meaning fast time to market, is realized by reducing the latency from approved business policy changes to production deployment to near zero time. In addition to agility improvements, Business Rules development also requires far fewer resources for implementing business policy changes. This means that Business Rules not only provides agility, it also provides the bonus of reduced development cost.

16.2.1 Rules Engine

A rule engine is a mechanism for executing 'business rules'. Business rules are simple business-oriented statements that encode business decisions of some kind, often phrased very simply in an if/then conditional form.

For instance, a business rule for a Banking system might be: Given a Customer and his location, if all of the following conditions are met:- The Customer is High Net worth Individual (HNI) - The Location is Metro - The Location is not Delhi{_}. The consequence is a 20% Discount in Application fee for Home loan. These business rules are not new: they are the business logic that is the core of many business software

applications. These rules are expressed as a subset of requirements. They are statements like "give a twenty-percent discount to non-Delhi Metro HNI Customers"

The primary difference with a rule engine is the way these rules are expressed; instead of embedding them within the program, these are encoded in business rule form.

Rule engines are not limited to execution; they often come with other tools to manage rules. Enterprise Rule Engine has all the options such as creation, deployment, storage, versioning and other such administration of rules either individually, or in groups.

16.2.2 Rules Creation by Guided Rule Editor

Any kind of rule can be created using this tool. User can freely enter business rules in text area, throughout the rule creation tool.

Standard Rule created in GRE comprises of following elements:

```
[mandatory]
If
               [condition] {AND/OR [condition]}*
Then
               [Action]+
[optional]*
Else If
              [condition] {AND/OR [condition]}*
Then
              [Action]+
[optional]?
Else
              [Action]+
where
* = 0 or more Occurrence
?= 0 or 1 Occurrence
+= 1 or more Occurrence
```

Features of Guided Rule Editor (GRE)

The features of GRE are:

- The 'if' block is mandatory block at the beginning of the structure.
- If (true) kind of condition is not supported. The condition should be comprised of 'LHS operator RKH'. There is parenthesis support in the UI. But you have to add it manually. Validation of parenthesis is supported.
- Nested 'if' is not supported from UI as of now.
- Conditions and actions are added by clicking the '+' button.
- After adding Condition user can add 'AND/OR Condition' by clicking '+' button at the End of Condition
- Different types of Actions can be added under 'Then'.
- Any number of 'Else if' can be added after 'If'.
- The condition for 'Else if' should differ from its previous 'if' or 'Else if' condition. Warning should be shown to user in this case.
- At most one 'Else' condition can be added to this 'if-else if-else' structure.
- No 'Else if' can be added after 'Else'.
- Real time rule structure preview in the bottom panel.

- Rule template / fragment for re usability.
- Facts will be used to create the rules

16.2.3 Rules Creation By Decision Table

Decision tables are a precise yet compact way to model complicated logic. Decision tables, like if-than-else, associate conditions with actions to perform. But, unlike the control structures found in traditional programming languages, decision tables can associate many independent conditions with several actions in an elegant way.

Example:

Table 16–1 Example of a Decision Table

Conditions & its alternatives			**Actions**
Customer Type	**Location Type**	**Location**	**Discount**
HNI	Metro	Mumbai	20% of App. fee
HNI	Metro	Delhi	No discount
HNI		Jaipur	No discount

The features of Decision Table are:

- The decision table contains rows and columns. Each row is considered to be a rule. In normal circumstances, the decision table is evaluated from top to bottom sequentially evaluating the various rules. It does not stop even if a rule fires. However, there is an option to stop processing of the decision table in case a rule is satisfied. There should be a special fixed column in the decision table (towards the right) which allows the decision table author to stop further evaluation of rules in case the current rule fires.
- Decision table should be expandable, that is, Rows and columns can be added dynamically.

Various functions for column and row manipulation should be available:

- Add Column After
- Add Column Before
- Add Row Above
- Add Row Below
- Delete Column
- Delete Row
- Move Column
- Move Row
- Sort Column Data Ascending
- Sort Column Data Descending
- Column Headers indicate condition / action
- Decision table should be editable to input data/conditions/actions

If a condition or action has range the column should be split in to two columns to accept the minimum and maximum values. Option to automatically fill series of

values. When clicked on row, a brief description about the condition should appear. Decision table will have brief description for the conditions and actions setup. Import and export data between Decision Table and Excel Spread Sheet.

16.2.4 Rules Storage

Rules created are stored in database tables as conditions and actions first, then these database tables are used to create executable rule in java programming language and compiled.

Table 16–2 Actions

ActionID	Outvariable	Expression	Datatype
ACTION1	Discount Fee	0.2*App Fee	Double
ACTION2	Discount Fee	0	Double
ACTION3	Discount Fee	0	Double

Table 16–3 Conditions

ConditionID	LeftExpression	RelationalOperator	RightExpression	LinkedConditionID	LinkedConditionalOperator	ActionId	RuleID	Version
CON1	CustomerType	==	HNI	CON2	&&	ACTION 1	RULE1	1
CON2	LocationType	==	METRO	CON3	&&		RULE1	1
CON3	Location	==	MUMBAI				RULE1	1
CON4	CustomerType	==	HNI	CON5	&&	ACTION 2	RULE1	1
CON5	LocationType	==	METRO	CON6	&&		RULE1	1
CON6	Location	==	DELHI				RULE1	1
CON7	CustomerType	==	HNI	CON8	&&	ACTION 3	RULE1	1
CON8	Location	==	JAIPUR				RULE1	1

16.2.5 Rules Deployment

Rules are put together in compiled java class which are stored in jar file and deployed on the server at runtime. This deployed jar is available for applications which are going to execute the rules.

16.2.6 Rules Versioning

Each time rule is modified new version is created for the rule and stored.

Table 16–4 Rules Versioning

RuleID	Version	Name	Effective Date
RULE1	1	DiscountRule	01/01/2009
RULE1	2	DiscountRule	31/03/2009

16.3 Rules Configuration in Modules

Rules can be configured for multiple modules and multiple screens. The list of screens where the rule definition taskflows are used is mentioned below:

- Facts are used by configuring the fact context. Fact Context contains information about interacting Module. This need to be set to interact with Fact layer. Fact Context has been categorized at Domain Level.

  For example, BankingFactContext will be used in Banking domain. This context has setters method for Facts which are generic in that domain. For example, BankingFactContext has *setAcountId* method. Interacting module need to fill maximum information available. These methods are setters for Facts which will always has input like *AccountId*, *PartyId*, *TransactionAmount* and so on.

- It is possible that at the time of interaction, Module already has some derivable Facts which are not going to change in the interaction. For example, *LnAccountProduct* at the time of Interest calculation.
- Module will send such Facts using *addFact* method, *using _retrievalKey* of the Fact referring Fact vocabulary. The benefit of sending such facts is these Facts won't get derived again. At the time of Fact Derivation, if *RetrievalKey* is present in the input FactMap, same value will be returned as a Fact value. If *RetrievalValue* is not present the Fact will be derived.
- Module will send maximum Fact information available at the time of interaction for better performance.

  For example, at the time of Loan Account Opening, Pseudo code will look like:

  ```
  // create fact context.
  BankingFactContext lnFactContext = new BankingFactContext("LN");
  lnFactContext.setPartyId(001);
  // Set max available information
  lnFactContext.addFact("LnAppliedAmount",2000);
  lnFactContext.addFact("LnProductType","Home");
  lnFactContext.addFact("LnRiskCategory",1);
  lnFactContext.addFact("CustType","VIP");
  ```

At the time of CashTransaction Event, code will look like:

```
// create fact context.
BankingFactContext casaFactContext = new BankingFactContext("CASA");
casaFactContext.setPartyId(003);
casaFactContext.setAcountId("111111111111");
casaFactContext.setTransctionAmount(new BigDecimal(122));
casaFactContext.setTransactionCurrency(104);
casaFactContext.setTransactionAmountInAcy(new BigDecimal(122));
// Set max available information
casaFactContext.addFact("CustType", "VIP");
casaFactContext.addFact("CASAAccountType", "Saving");
```

16.3.1 Generic Rules Configuration

Generic Rules can be configured through the screen RL001 where the new rule can be defined or the existing rule can be updated for multiple domains and domain category. The authoring mode of rule creation can be chosen as GRE or Decision Table.

Figure 16–23 Generic Rule Configuration

Account | Back Office | CASA | Channel | Collection | LCM | Loan | Operational Services | Origination | Party | Payment And Collection | Fast Path

RL001

Rule Author

Read | Create | Update | Print | Ok | Clear | Exit

Rule Details

*Domain Id	Banking	Domain Name	Banking Domain
*Domain Category Id	CS	Domain Category Name	CS
*Rule Id	OD_RL_1	*Name	OD Rule
*Effective Date	02-Jan-2013	*Description	OD Rule Desc
Authoring Mode	GRE	Version	1

If
(AssetClassification.Fees.Days greater than 0)
And (AssetClassification.Fees.Days less than equal to 8)
or (AssetClassification.Interest.Days greater than 0)
And (AssetClassification.Interest.Days less than equal to 8)
or (AssetClassification.TOD.Days greater than 0)
And (AssetClassification.TOD.Days less than equal to 8)
or (AssetClassification.Overline.Days greater than 0)
And (AssetClassification.Overline.Days less than equal to 8)
or (AssetClassification.Suspended.Fees.Days greater than 0)
And (AssetClassification.Suspended.Fees.Days less than equal to 8)
or (AssetClassification.Suspended.Interest.Days greater than 0)
And (AssetClassification.Suspended.Interest.Days less than equal to 8)
Then
Classification Code equal to 101
AC.ClassificationReason equal to D

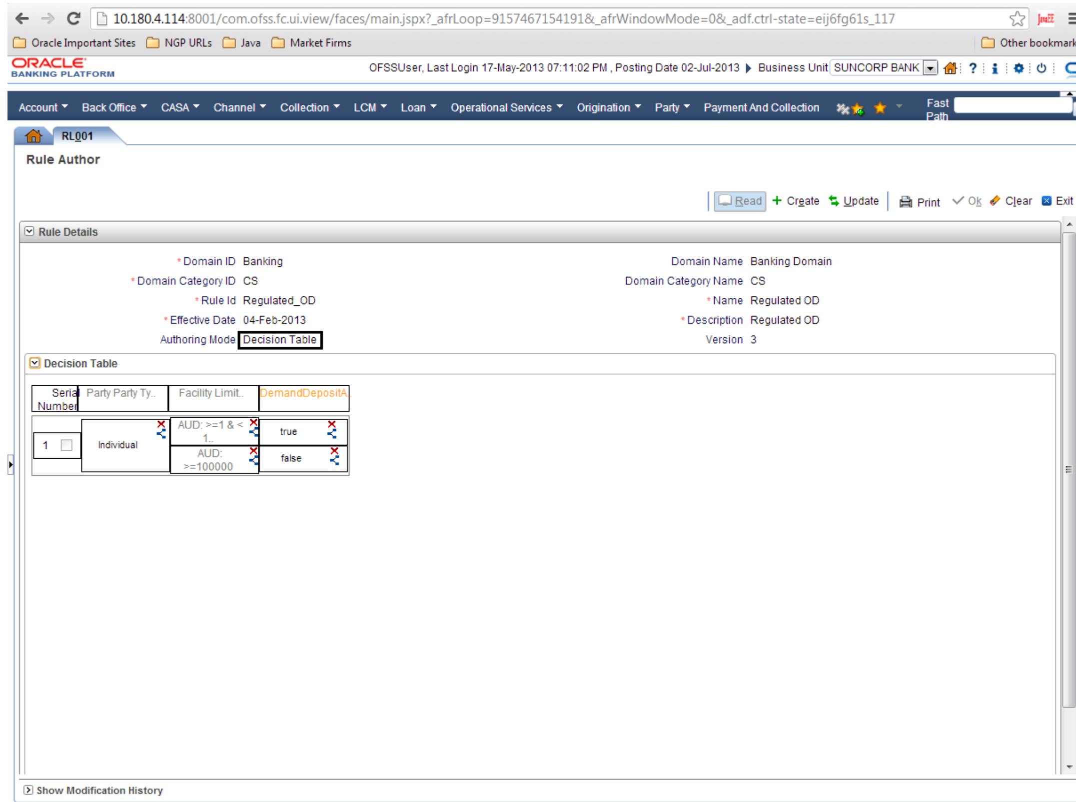
Else If
(AssetClassification.Fees.Days greater than 16)
And (AssetClassification.Fees.Days less than equal to 24)
or (AssetClassification.Interest.Days greater than 16)
And (AssetClassification.Interest.Days less than equal to 24)
or (AssetClassification.TOD.Days greater than 16)
And (AssetClassification.TOD.Days less than equal to 24)
or (AssetClassification.Overline.Days greater than 16)
And (AssetClassification.Overline.Days less than equal to 24)
or (AssetClassification.Suspended.Fees.Days greater than 16)
And (AssetClassification.Suspended.Fees.Days less than equal to 24)
or (AssetClassification.Suspended.Interest.Days greater than 16)
And (AssetClassification.Suspended.Interest.Days less than equal to 24)
Then
Classification Code equal to 103
AC.ClassificationReason equal to D

Else If
(AssetClassification.Fees.Days greater than 24)
or (AssetClassification.Interest.Days greater than 24)
or (AssetClassification.TOD.Days greater than 24)
or (AssetClassification.Overline.Days greater than 24)
or (AssetClassification.Suspended.Fees.Days greater than 24)
or (AssetClassification.Suspended.Interest.Days greater than 24)
Then
Classification Code equal to 104
AC.ClassificationReason equal to D

Hide Modification History

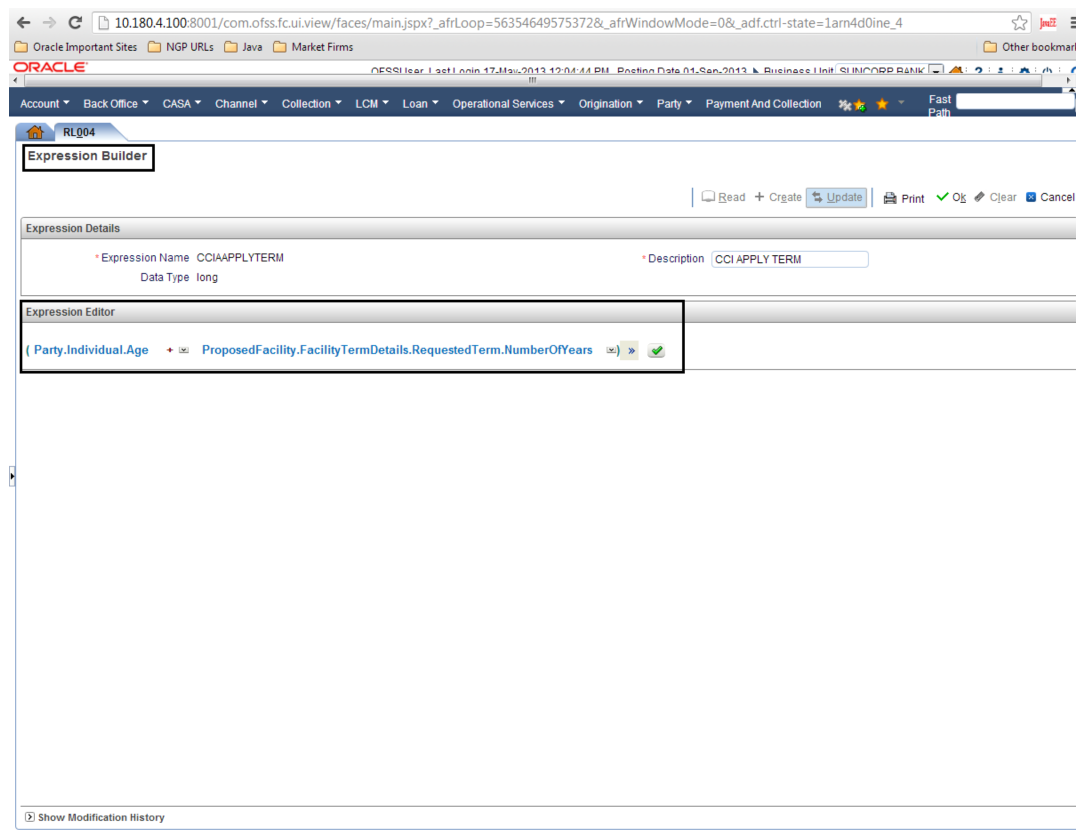
Created By	OFSSUser	On	22-Feb-2013 12:17:46 PM	Approved	☑
Approved By	OFSSUser	On	22-Feb-2013 12:17:46 PM	Active	☑

Figure 16–24 Rule Author - Decision Table



Different expressions can be defined in the expression builder screen. The expression once defined can also be used as one of the expressions in GRE.

Figure 16–25 Rule Author - Expression Builder



16.4 Rules Migration

This section describes the rules migration.

16.4.1 Rules Configured for Modules

Rule taskflows can be added to different modules. User can set up different rules based on the screen requirements.

Table 16–5 Details of Configured Rules in Modules

Module	Screen	Rule Type	Rule Description
Alerts	AL04 - Alert Maintenance	GRE	User can create the new message template rule or use the existing rule. In this rule, the message template of the alert is selected based on the selected rule criteria. For example, if there is a particular party id, then the specific alert needs to be sent.
Content	CNM03 - Document Policy Definition	Decision Table	There are two types of rules (Inbound Rule and Outbound Rule) defined for each event in the document policies. These rules primarily define the checklist of documents based on different input values. The inbound rule are defined for the scenario of the documents being inputted to the system and the outbound rule are defined for the scenario of the documents being retrieved from the system and displayed to the end user. For example, In document policy of new applications, there is a event for identity verification. The inbound rule can be defined for the category of the documents which are required to be uploaded for the verification purpose on the basis of the Party Agency Type and the Party Type.
Pricing	PR006 - Price Definition	Generic Rule Author	Price can be rule based that is, amount of fee to be charged or price code to be charged comes from rule
Pricing	PR005 - Interest/Margin Index Code Definition	Generic Rule Author	Interest Index can be Rule Based i.e. Interest rate to be applied comes as outcome of rule.
Pricing	PR004 - Rate Chart Maintenance	Generic Rule Author	Rate Chart can be Rule Based i.e. Interest index to be used comes as outcome of rule.
Pricing	PR007 - Price Policy Chart Maintenance	Decision Table	Price policy chart internally gets stored as Rule. It basically defines Prices/RateCharts applicable when criteria is satisfied which is mentioned in rule.
Pricing	PR040 - Fee Computation Analysis	Generic Rule Author	This screen provides analysis as how the fee for particular transaction (happened in past) was computed. In case of Rule Based Fees charged in transaction, this screen displays details of that rule along with input fact values used during rule evaluation.
Pricing	PR017 - Interest Rate Derivation Analysis	Generic Rule Author	This screen provides analysis as how the interest rate for particular account was computed. In case of Rule Based Rate Chart and Rule Based Index, this screen displays details of that rule along with input fact values used during rule evaluation.
Tax	TDS01 - Tax Parameter Maintenance	Decision Table	This rule is used to maintain the exemption limit and that exemption limit will be used at the time of tax computation.

Table 16–5 (Cont.) Details of Configured Rules in Modules

Module	Screen	Rule Type	Rule Description
Product Manufacturing	PM011 - Define Interest Rule	GRE/ Decision Table	In the Rule and Expression task flow is consumed to create Rule or Expression which is used to derived the BaseForInterest for Calculation of Interest. During EOD, module send facts which is used derive the BaseForInterest by executing the Rule or Expression whichever is attached to the IRD.
Asset Classification	RL001 - Rule Author	GRE	This rule is used to derive the Asset Classification code of an account during the Account level classification batch shell. The facts will be the days past due date of various outstanding arrears. The rules will be created under 'LN' and 'CS' and linked to a plan in Asset Classification Plans (NP002). Rule for Facility-level classification: This rule is maintained only if the 'Applicability level' in NP001 is 'Facility'. This rule is used to derive the Classification code for a Facility during the Facility-level batch classification. The rule will be created under the Domain Category 'AC' and is linked via Asset Classification Preference (NP001).
Collections	RULE01 - RuleSet	GRE/Decision Table	Collection module's rules are defined as RuleSet. The RuleSet can be incorporated for the batch processing to filter accounts coming to collection. In RuleSet screen, multiple rules can be combined together as a single object called ruleset. The RuleSet functionality in rule engine provides the user with the facility to design the sequence of execution of rules where multiple rules need to be asserted for the same set of inputs. User would be able to select and wire the already existing rules and their sequence as per his/her requirement. There can be output dependent rules defined. For example, Rule 1 is: If(FACILITY_ID equal to TEST_FACILITY_ID) Then Account Type equal to FIXED Else If (FACILITY_ID equal to AAA) Then Account Type equal to 0 Rule 2 is: If (ACCOUNT_TYPE equal to FIXED) Then ARS_ASSESSED_AMOUNT equal to 70000 In the above case, rule 2 will be executed only if rule 1 satisfies the condition.

17 Composite Application Service

OBP Application provides with the functionality of adding composite application services which call multiple application services in one request. The transactions in these composite application services are called composite transactions and are made by composing the single transaction out of the multiple APIs transaction that gives the effect of single transaction.

Using APIs, single transaction can be composed of multiple transactions using very little effort. However, this cannot be done at run time. Following points have to be taken in to account while making a new composite transaction out of existing API transactions:

- Both the transactions should be passed in the same session context except overridden warnings. Overridden warnings from one transaction are passed as an input to next transaction.
- Decision of whether to commit the transaction or rollback the same must be explicitly handled by the composite transaction. The beginning and closing of interaction should be handled by the composite transactions.

  For the transaction control of the transaction manager, there are two defined patterns:

  – **With Interaction.begin**

    * The interaction begins to ensure that the transaction reference number is maintained same across all participating APIs
    * Required for supporting reversal of composite financial APIs
    * Context information for entire call is maintained and used.
    * Similar to any other API

  – **With TransactionManager**

    * Scope restricted to database transaction
    * All APIs in the composite have the same commit scope
    * Unique transaction reference generated for each API
    * Can be thought of as a workflow with APIs participating in the same DB commit scope
    * The composite transactions can be handled in two scenarios:

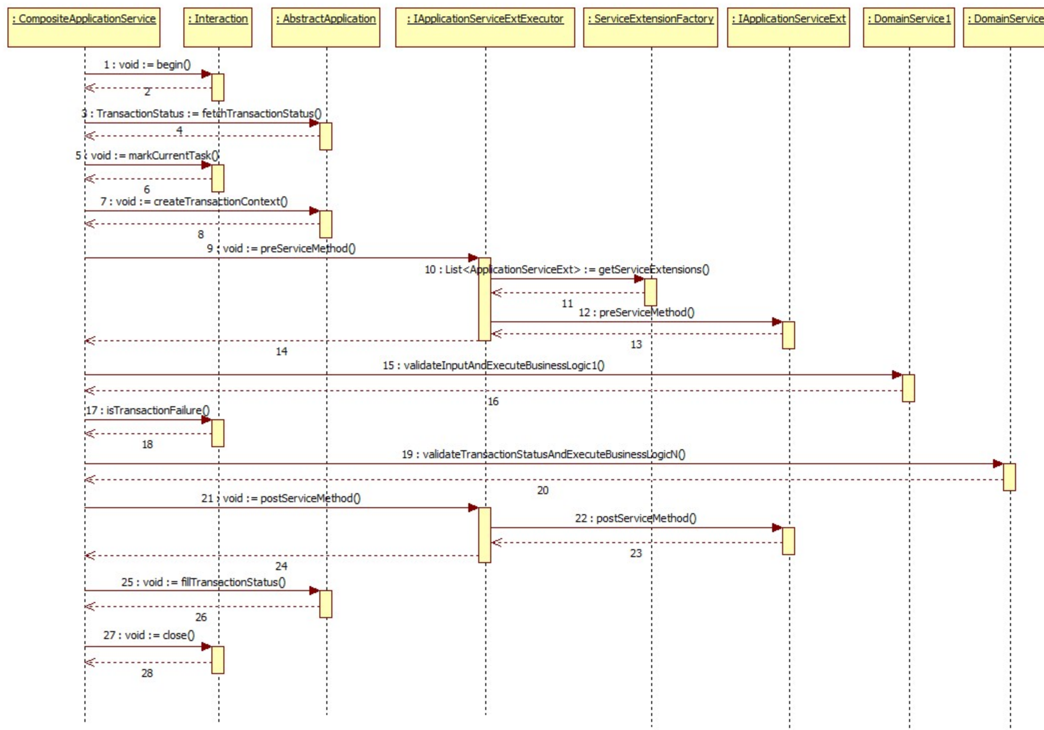
      - Calling multiple APIs in the same module

      - Calling multiple APIs in different modules by making the adapter call

17.1 Composite Application Service Architecture

The following depicts the sequence diagram for the composite transactions where two of the domain service calls are shown which can be extended to multiple domain service (1..N) calls. After every domain service call, 'isTransactionFailure()' call needs to be made to check the transaction status before proceeding for the next domain service call.

Figure 17–1 Composite Application Service Architecture



17.2 Multiple APIs in Single Module

For writing the composite service API which calls multiple services API, the following Java classes are needed with respect to new services as mentioned in the below table:

Table 17–1 Java Classes

Class Name	Description
Composite Service Interface	This provides the method definitions for the composite services.
Composite Service Class	This provides the implementation class for the composite services. In this class, we write methods which make the calls to different service APIs. The response of one service API can be used for making calls in another service APIs. The final response of the composite service is then created with the response objects of other service APIs and then transferred back to the adapter calls.

Table 17–1 (Cont.) Java Classes

Class Name	Description
Executor Interface	This provides the extension pre-hook and post-hook method definitions for the service calls.
Executor Classes	This provides the implementation class for the executor interface.
Composite API Response Object	This provides the final response object which is passed to the adapter calls.

One of the sample composite service method 'TDAccountPayinApplicationService. openAccountWithPayin' is shown below. In this service method, there are two methods of two different services:

- tdAccountApplicationService.openAccount
- tdDepositApplicationService.openDeposit

These service methods are called where the new account is created and then the returned account id from first service is used to do the payin by creating a new deposit for that account.

```
package com.ofss.fc.app.extensibility.td.service.composite;
import java.util.logging.Level;
import java.util.logging.Logger;
import com.ofss.fc.app.AbstractApplication;
import com.ofss.fc.app.Interaction;
import com.ofss.fc.app.agent.dto.agent.AgentArrangementLinkageDTO;
import com.ofss.fc.app.context.SessionContext;
import com.ofss.fc.app.extensibility.td.dto.composite.TDAccountPayinResponse;
import
com.ofss.fc.app.extensibility.td.service.composite.ext.IExtendedTermDepositApplica
tionServiceExtExecutor;
import com.ofss.fc.app.td.dto.account.TermDepositAccountOpenDTO;
import com.ofss.fc.app.td.dto.account.TermDepositAccountResponse;
import com.ofss.fc.app.td.dto.deposit.PayinResponse;
import com.ofss.fc.app.td.dto.transaction.payin.PayinTransactionDTO;

import com.ofss.fc.app.td.service.account.ITermDepositAccountApplicationService;
import com.ofss.fc.app.td.service.account.TermDepositAccountApplicationService;
import com.ofss.fc.app.td.service.deposit.DepositApplicationService;
import com.ofss.fc.app.td.service.deposit.IDepositApplicationService;
import com.ofss.fc.common.td.TermDepositTaskConstants;
import com.ofss.fc.enumeration.MaintenanceType;
import com.ofss.fc.infra.exception.FatalException;
import com.ofss.fc.infra.exception.RunTimeException;
import com.ofss.fc.infra.log.impl.MultiEntityLogger;
import com.ofss.fc.service.response.TransactionStatus;
/**
 * The TDAccountPayinApplicationService class exposes functions/services to
perform the sample of composite operations.  This extensibility sample services
includes: opening account and deposit
 * @author Ofss
 */
public class ExtendedTermDepositApplicationService extends AbstractApplication
implements IExtendedTermDepositApplicationService {
/**
* Extension point for the class. This is the factory implementation for the
extension of this class.
 * Any extension-method call on this factory instance, internally triggers a call
to corresponding
```

```
 * extension methods of all the extension classes returned by the
ServiceExtensionFactory
*/
private transient IExtendedTermDepositApplicationServiceExtExecutor extension;
 // This attribute holds the component name
private final String THIS_COMPONENT_NAME =
ExtendedTermDepositApplicationService.class.getName();
/**
 * This is an instance variable and not a class variable (static or static final).
This is required to
* support multi-entity wide logging.
*/
private transient Logger logger =
MultiEntityLogger.getUniqueInstance().getLogger(THIS_COMPONENT_NAME);
/ Create instance of multi entity logger
private transient MultiEntityLogger formatter =
MultiEntityLogger.getUniqueInstance();
/**
* @param sessionContext
* @param termDepositAccountOpenDTO
 * @return TermDepositAccountResponse
* @throws FatalException
*/
public TDAccountPayinResponse openAccountWithPayin(SessionContext sessionContext,
TermDepositAccountOpenDTO termDepositAccountOpenDTO,
PayinTransactionDTO payinTransactionDTO,
AgentArrangementLinkageDTO agentArrangementLinkageDTO
)  throws FatalException  {
super.checkAccess("com.ofss.fc.app.td.service.composite.TDAccountPayinApplicationS
ervice.openAccountWithPayin", sessionContext, termDepositAccountOpenDTO,
payinTransactionDTO,
agentArrangementLinkageDTO);
if (logger.isLoggable(Level.FINE)) {
logger.log(Level.FINE, formatter.formatMessage("Entered into
openAccountWithPayin(). Input : termDepositAccountOpenDTO %s ",THIS_COMPONENT_
NAME,  termDepositAccountOpenDTO.toString()));
}
Interaction.begin(sessionContext);
TransactionStatus transactionStatus = fetchTransactionStatus();
TermDepositAccountResponse tdAccountResponse = null;
String newAccountId = null;
PayinResponse payinResponse = null;
TDAccountPayinResponse tdAccountPayinResponse = new TDAccountPayinResponse();
ITermDepositAccountApplicationService tdAccountApplicationService
= new TermDepositAccountApplicationService();
IDepositApplicationService tdDepositApplicationService= new
DepositApplicationService();
try {
    Interaction.markCurrentTask(TermDepositTaskConstants.TD_ACCOUNT_ATTRIBUTE);
    createTransactionContext(sessionContext, MaintenanceType.ADDITION);
    extension.preOpenAccountWithPayin(sessionContext, termDepositAccountOpenDTO,
payinTransactionDTO, agentArrangementLinkageDTO);
   termDepositAccountOpenDTO.setBankCode(sessionContext.getBankCode());
    if (logger.isLoggable(Level.FINE)) {
       logger.log(Level.FINE, formatter.formatMessage("Entered into
tdAccountApplicationService.openAccount().
           Input : termDepositAccountOpenDTO %s ",THIS_COMPONENT_NAME,
termDepositAccountOpenDTO.toString()));
    }
    tdAccountResponse = tdAccountApplicationService.openAccount(sessionContext,
```

```
termDepositAccountOpenDTO);
    if (logger.isLoggable(Level.FINE)) {
        logger.log(Level.FINE, formatter.formatMessage("Exiting from
tdAccountApplicationService.openAccount().
Input : termDepositAccountOpenDTO %s ", THIS_COMPONENT_NAME,
termDepositAccountOpenDTO.toString()));
   }
   if(tdAccountResponse!=null && tdAccountResponse.getAccountId()!=null &&
!Interaction.isTransactionFailure(transactionStatus)) {
      newAccountId = tdAccountResponse.getAccountId();
payinTransactionDTO.getAccountTransactionDTO().setAccountId(newAccountId);
      if (logger.isLoggable(Level.FINE)) {
Logger.log(Level.FINE, formatter.formatMessage("Entered into
tdDepositApplicationService.openDeposit().
Input : payinTransactionDTO %s ", THIS_COMPONENT_NAME,
termDepositAccountOpenDTO.toString()));
       }
       payinResponse = tdDepositApplicationService.openDeposit(sessionContext,
payinTransactionDTO, agentArrangementLinkageDTO);
      if (logger.isLoggable(Level.FINE)) {
logger.log(Level.FINE,formatter.formatMessage("Exiting from
tdDepositApplicationService.openDeposit().
Input : payinTransactionDTO %s ",THIS_COMPONENT_NAME,
termDepositAccountOpenDTO.toString()));
      }
      if (payinResponse != null) {
tdAccountPayinResponse.setAccountId(payinResponse.getAccountId());
tdAccountPayinResponse.setDepositId(payinResponse.getDepositId());
tdAccountPayinResponse.setDepositStatus(payinResponse.getDepositStatus());
tdAccountPayinResponse.setNetInterestRate(payinResponse.getNetInterestRate());
tdAccountPayinResponse.setAccountingEventItem(payinResponse.getAccountingEventItem
());
tdAccountPayinResponse.setMaintenanceType(payinResponse.getMaintenanceType());
tdAccountPayinResponse.setMaturityAmount(payinResponse.getMaturityAmount());
tdAccountPayinResponse.setProductCode(payinResponse.getProductCode());
tdAccountPayinResponse.setInterestStartDate(payinResponse.getInterestStartDate());
tdAccountPayinResponse.setValueDate(payinResponse.getValueDate());
tdAccountPayinResponse.setStatus(payinResponse.getStatus());
       }
   }
       extension.postOpenAccountWithPayin(sessionContext,
termDepositAccountOpenDTO, payinTransactionDTO, agentArrangementLinkageDTO);
        fillTransactionStatus(transactionStatus);
        tdAccountPayinResponse.setStatus(transactionStatus);
                 } catch (FatalException fatalException) {
 logger.log(Level.SEVERE, formatter.formatMessage("FatalException from
openAccountWithPayin()"), fatalException);
 fillTransactionStatus(transactionStatus, fatalException);
                } catch (RunTimeException fcrException) {
             logger.log(Level.SEVERE, "RunTimeException from
openAccountWithPayin()", fcrException);
                fillTransactionStatus(transactionStatus, fcrException);
                } catch (Throwable throwable) {
logger.log(Level.SEVERE, "Throwable from openAccountWithPayin()", throwable);
                   fillTransactionStatus(transactionStatus, throwable);
                } finally {
                   Interaction.close();
               }
                  super.checkResponse(sessionContext, payinResponse);
   if (logger.isLoggable(Level.FINE)) {
```

```
                    logger.log(Level.FINE, formatter.formatMessage("Exiting from
openAccountWithPayin()."));
                }
                return tdAccountPayinResponse;
          }
}
```

18 ID Generation

OBP is shipped with the functionality of generation of the IDs in three ways that is, Automatic, Manual and Custom. These three configurations can be defined by the user as per their requirements:

- If the configuration type for the ID generation is set to automatic, the ID is generated as per the defined generation logic for the automated ID generation. You can set the pattern, sequence, weights and check digit modulo and modify the automatic generation logic.
- If the configuration type is set to manual then the ID will be input and it will be checked in the database if it is unique. For the ID, a certain range of serial numbers can be reserved in the range table by the custom developer and the teller can select it from amongst the ranges while doing the manual entry.
- In case the bank's requirement is to have the different ID generation process which can be written or modified, then the extensibility feature is provided in OBP. In this feature, customized ID generation logic can be written and can be plugged in the OBP application by creating the custom ID generation class and doing the required configurations in the database.

The configuration of the ID generation process is shown in the sequence diagram below where the generator is selected based on the set configuration type.

Figure 18–1 Configuration of ID Generation Process

From the implementation perspective, the following sections describe the change in configurations required for customizing the ID generation.

18.1 Database Setup

The configuration part of the ID generation requires the following components which need to be defined in the OBP application. The following tables are involved to store the generation logic details for ID generation:

- FLX_CS_ID_CONFIG_B: This is the main config table where the identifier is defined with the combination of the category and sub category columns. The type of generation logic is determined based on the configuration set in the CONFIG_TYPE column of this table.

Table 18–1 FLX_CS_ID_CONFIG_B

Column Name	Description
CATEGORY_ID	Represents the Category Example: Party,Origination, DDA and so on
SUB_CATEGORY_ID	Represents the Sub Category Example: PartyId, AccountNo and so on
PATTERN_TXT	Represents the pattern in which the ID is generated Example: SSSSSSSSC, NNNBBBBYYYYSSSSSSS
CONFIG_TYP	Represents Generation type values are AUT for Automatic, MAN for Manual, CUS for Custom
GENERATOR_CLASS_NAME	Fully Qualified classname of ID generator for config type Custom
SEQ_VALUE	Running Serial Number
WEIGHT	Comma separated Weight for each character defined in the pattern text Example: '0,0,7,6,5,4,3,2', '3,8,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1'
CHK_DIGIT_MODULO	Check digit modulo
CREATED_BY	Indicates the User who created the row

Table 18–1 (Cont.) FLX_CS_ID_CONFIG_B

Column Name	Description
CREATION_DATE	Indicates the date and time of the creation of the row
LAST_UPDATED_BY	Indicates the User who last updated the row
LAST_UPDATE_DATE	Indicates the date and time of the last update of the row
OBJECT_VERSION_NUMBER	Indicates the version number, Used to implement optimistic locking
OBJECT_STATUS_FLAG	Status Flag Example: A

- FLX_CS_ID_RANGE: This table is used to determine the range of the values which the ID can take.

Table 18–2 FLX_CS_ID_RANGE

Column Name	Description
RANGE_ID	Represents the identifier for the range definition
RANGE_NAME	Represents the name defined for the range Example: Party, DDA
RANGE_START	Defines the beginning value for the range
RANGE_CURRENT	Defines the current value for the range
RANGE_END	Defines the ending value for the range
CATEGORY_ID	Represents the Category defined in FLX_CS_ID_CONFIG_B
SUB_CATEGORY_ID	Represents the Sub Category defined in FLX_CS_ID_CONFIG

- FLX_CS_ID_USF: This table is used to determine the user selected fields for the ID generation logic.

Table 18–3 FLX_CS_ID_USF

Column Name	Description
USF_ID	Represents the identifier for the user selected fields
USF_NAME	Represents the name for the user selected fields
IS_FIXED_FLAG	Defines if the user selected fields are fixed
CATEGORY_ID	Represents the Category defined in FLX_CS_ID_CONFIG_B
SUB_CATEGORY_ID	Represents the Sub Category defined in FLX_CS_ID_CONFIG_B

18.1.1 Database Configuration

In case of existing ID generation logic in the database, end user can update the seed data scripts by modifying configuration type and other parameters (pattern, sequence, weight and check digit modulo). While in case of new type of ID generation logic, an insert sql can be added in the scripts of tables.

18.2 Automated ID Generation

For the configuration type as automatic, user needs to set the CONFIG_TYPE as "AUT" in the FLX_CS_ID_CONFIG_B table. The ID generation logic is determined based on the set values in the config table for the pattern, sequence, weight and check digit modulo. The three attributes 'sequence', 'weights' and 'check digit modulo' are primarily used for calculation of the check digit.

ID Generation with Sequence and Range

ID is picked using the database sequence. This is needed in the case where serial number is used as part of an ID. Database sequence is used to avoid deadlock while trying to update, a sequential value stored and retrieved as part of the configuration in-case where the application is multiple threaded. This might lead to 'gaps' in the sequence of ids generated, if an exception occurs in the Transaction. However, this suffices as the errors related to deadlocks are mitigated.

For the first call to derive the value, the sequence for the specific configuration pattern is created, with names as CATEGORYTYPE_SUBCATEGORYTYPE_SEQ. The creation of this sequence happens only once in the lifecycle of application deployment. For example, TD (category) and AccountId (sub-category), the sequence generated is TD_ ACCOUNTID_SEQ. And, for the successive requests, the already created sequence is used for sequence generation.

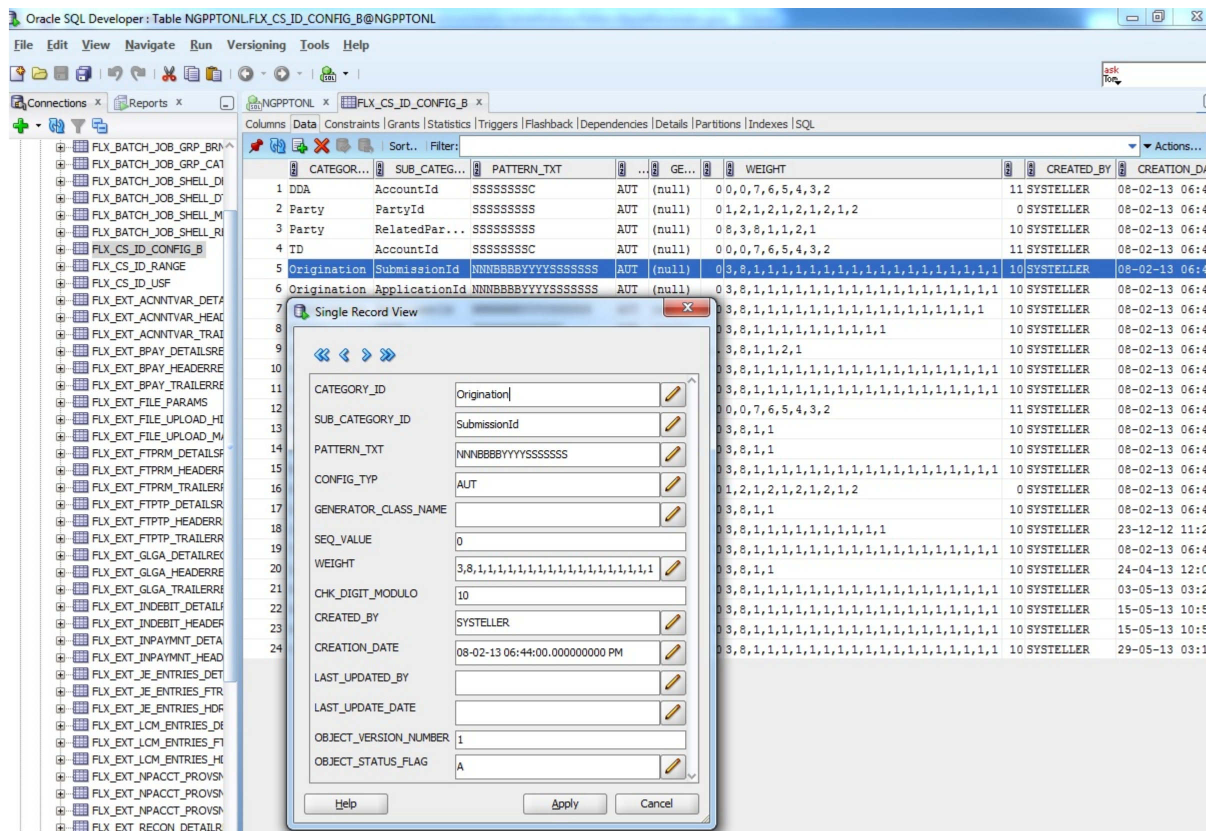
ID Generation with Pattern Text

The pattern text is split and an array is created of the characters. In case of mask ID configuration's pattern, ID configuration's text patterns are split. If the value is found to contain the special character (out of range [65-90]), it will be appended as it is to generated ID. Following are the conditions of ID generation with pattern text:

- If the pattern value is not the special character and the ID value is 'S' that is, SerialNumber, then range is looked upon:
  - If the range is defined, the current position of the range is determined based on category and sub-category. If the current position value's length is greater than pattern length, then characters between [0-length of pattern] will be generated ID, else zeros are prefixed before current position value of range until it's size becomes pattern's length. For example, the pattern is 'SSSSSS' and the generated range gives the value as '2345' then the actual value will become '002345'.
  - If range is not defined, then next value from sequence category_subCategory_ SEQ is picked, it'll also be corrected to the size of pattern's length as mentioned in case of above example.
- If the pattern value contains 'C', that is, check digit. Check digit computation is done and then appended the computed value to the pre computed ID value. The input value, weight and check digit modulo are used for calculation of check-digit. The input value can be sequence ID or can be the ASCII value in case the inputs are characters. The weights will be comma separated string of the digits to be used for the calculation.
- If the pattern value contains 'R', related party identifier is used for that value.
- If the pattern value doesn't match any of the above character, the value is fetched from the pattern map for the pattern's ID and the length is adjusted to the pattern's attribute length. These pattern map characters need to be passed by the caller service for calculation.

  For example, let us take the submissionId with the pattern as NNNYYYYBBBSSSSS in the database.

Figure 18–2 Automated ID Generation - Single Record View



The pattern hashmap 'value' will be populated and passed by the caller with the key value pair as pattern character as key and its corresponding value. As shown below, 'N' will contain name value, 'Y' will contain year value and 'B' will contain branch code.

Figure 18–3 Automated ID Generation - Generate Submission ID

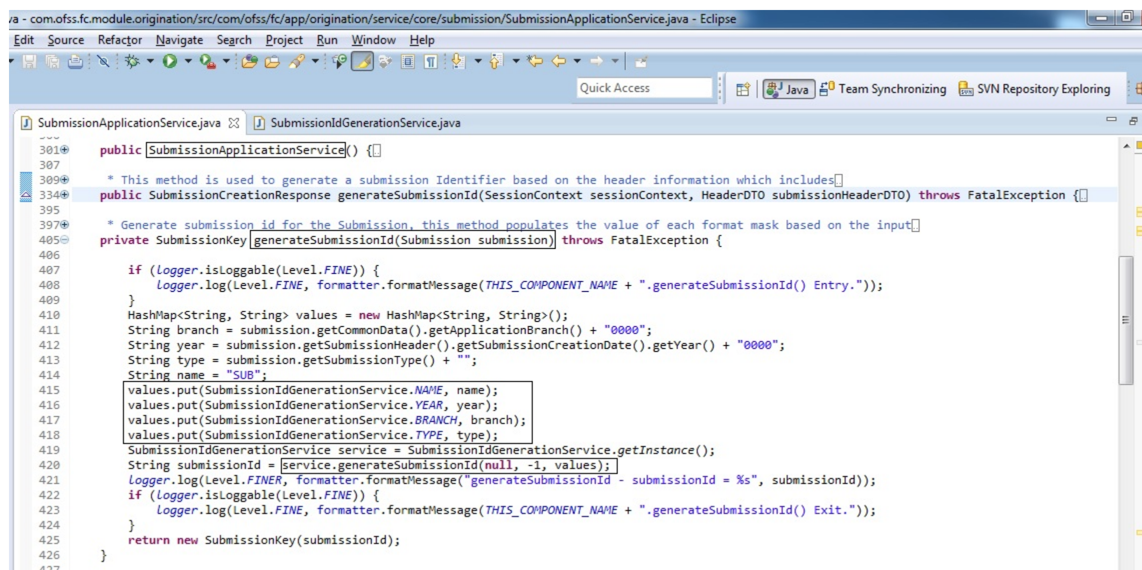


Figure 18–4 Automated ID Generation - Submission ID Generation Service

```
 2 * Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.
 4
 5 package com.ofss.fc.domain.origination.service.core.submission.id.generation;
 6
 7 import java.util.HashMap;
13
15 * This class generates ID for different entities in Submission such as Submission, Application and Applicant.
19 public final class SubmissionIdGenerationService {
20
22     * Constant for Submission_Id
24    private static final String SUBMISSION_ID = "SubmissionId";
26     * Constant for Origination
28    private static final String ORIGINATION = "Origination";
30     * Constant for Application_Id
32    private static final String APPLICATION_ID = "ApplicationId";
34     * Constant for Applicant_Id
36    private static final String APPLICANT_ID = "ApplicantId";
38     * Constant for name
40    public static final String NAME = "N";
42     * constant for type
44    public static final String TYPE = "T";
46     * Constant for branch
48    public static final String BRANCH = "B";
50     * Constant for year
52    public static final String YEAR = "Y";
54     * Constant for channel
56    public static final String CHANNEL = "H";
57
58    /**
59     * Service to generate the submission id based on configurable format mask. The default format mask is <br/>
60     * <b>"SUB"TBrcdYyyyNnnnnn</b>,<br/>
61     * the first three character is constant "SUB", following by one character that indicate the submission type
62     * {@link com.ofss.fc.enumeration.origination.SubmissionType} and combination of Branch Code + Year + Running Serial
63     * Number
64     *
65     * @fcb.param MI,String,submissionId, ,It is used for manual id generation, not applicable for Automatic Id
66     *            generation
67     * @fcb.param MI,String, rangeId, ,The range id for the generator. It is used to generate the sequence in a
68     *            specified range
69     * @fcb.param MI,HashMap,values,,The set of values used to generate the submissio id. The key is the pattern type
70     *            (Name,Type,Branch,Year)
71     * @return The submission id.
72     */
73    public String generateSubmissionId(String submissionId, long rangeId, HashMap<String, String> values) throws FatalException {
74
75        IdGenerator generator = (IdGenerator) AbstractGeneratorFactory.getUniqueInstance().getIdGenerator(ORIGINATION, SUBMISSION_ID);
76        String tempId = null;
77        try {
78            tempId = generator.generateId(submissionId, rangeId, values);
79        } catch (FatalException fatalException) {
80            ErrorManager.throwFatalException(fatalException);
81        }
82        return tempId;
83    }
84
```

The ID will be generated by the automatic generator with first three characters as name, next four digits as year, next three characters of branch and rest with generated sequence as per the mask pattern.

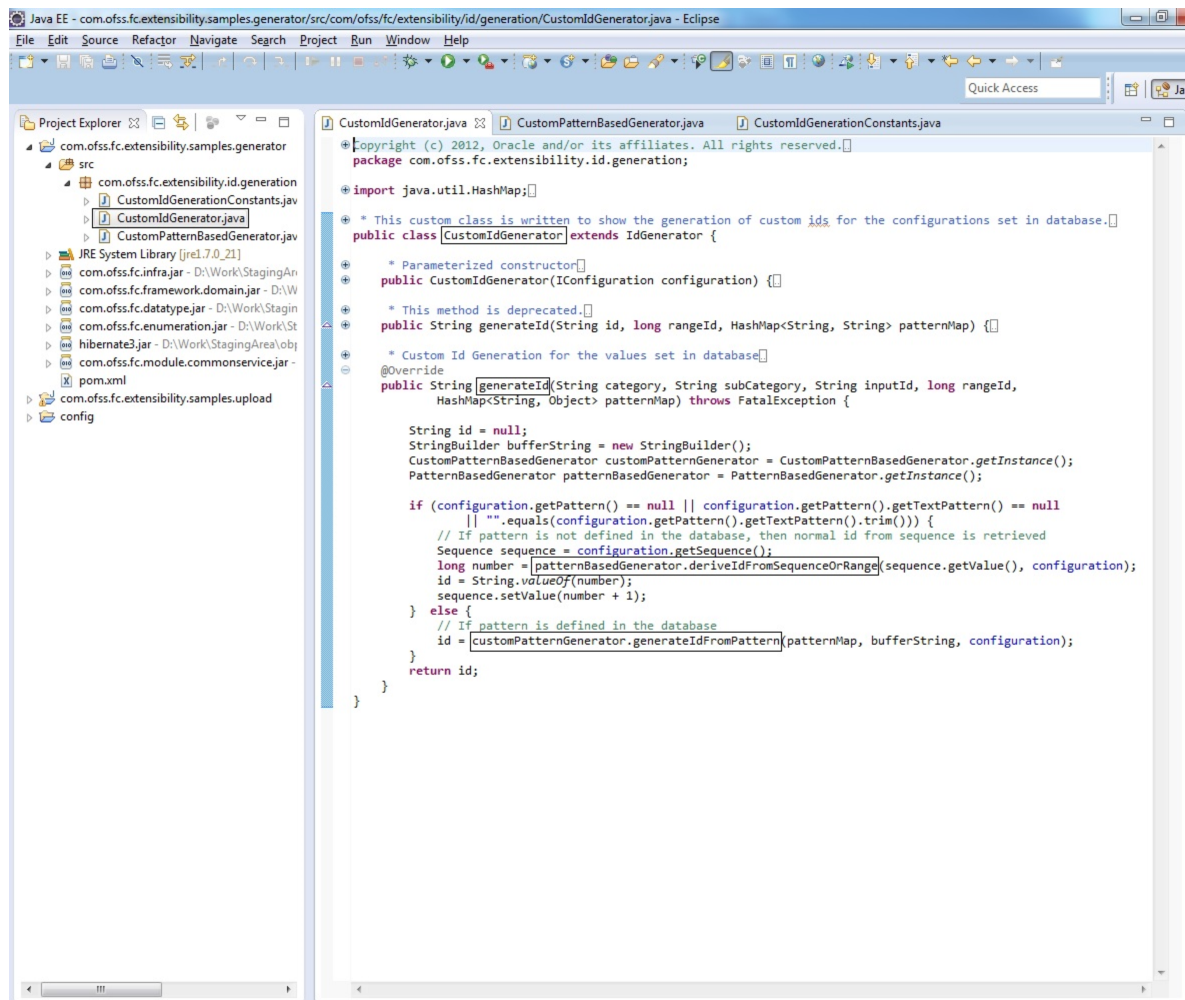
In case of without mask configuration's pattern. If range ID is -1, it means that there is no range defined for the mask configuration, it then picks up the range details with range ID based on the category and sub-category. The generated ID will become the current position of range. If range is not defined in the table, then the sequence needs to be defined and the value is picked based on that. The next value of the sequence will become the generated ID value.

18.3 Custom ID Generation

In case of configuration type as custom, user needs to set the CONFIG_TYPE as 'CUS' in the CONFIG_TYP column in the FLX_CS_ID_CONFIG_B table.

User can customize the ID generator by writing a new custom ID generator class which will need to extend the IdGenerator and write the abstract methods for the ID generation. This class needs to be mentioned in the GENERATOR_CLASS_NAME column of FLX_CS_ID_CONFIG_B table.

Figure 18–5 Custom ID Generation - Custom ID Generator



In case the user want to write the custom generation logic in a specific customized pattern definition, then user can do that by writing the custom constant class and the custom pattern class which can pick the defined pattern from the configuration object set in the PATTERN_TXT column of the FLX_CS_ID_CONFIG_B table of the database. The user will pass the values in the pattern hashmap which will then populate the pattern and generate the ID.

Figure 18–6 Custom ID Generation - Custom ID Generation Constants

```
Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.
package com.ofss.fc.extensibility.id.generation;

public interface CustomIdGenerationConstants {

    /**
     * Custom Year for the Code Generation
     */
    public static final String CUSTOM_YEAR = "M";

    /**
     * Custom Sequence for the Code Generation
     */
    public static final String CUSTOM_SEQ = "Q";

}
```

Figure 18–7 Custom ID Generation - Custom Pattern Based Generator

```
Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved.
package com.ofss.fc.extensibility.id.generation;
import java.util.ArrayList;

 * Class to derive the value of the Id from the configuration defined.
public class CustomPatternBasedGenerator {

     * Represents the Unique Instance of this class per JVM
    private static CustomPatternBasedGenerator uniqueInstance;
     * Private Constructor
    private CustomPatternBasedGenerator() {
     * @return uniqueInstance for ConfigurationRepository
    public static CustomPatternBasedGenerator getInstance() {

    /**
     * @param rangeId , Represents the range Id
     * @param patternMap , HashMap of the pattern attributes defined.
     * @param checkDigitBuffer , StringBuilder holding checkdigit information.
     * @param bufferString
     * @param configuration for which Id is to be generated.
     * @return String, generated Id.\
     * For e.g. M-QQQQ will be 2013-2345 if the sequence value is 2345 in the database.
     */
    public String generateIdFromPattern(HashMap<String, Object> patternMap, StringBuilder bufferString,
            IConfiguration configuration) throws FatalException {
        String generatedId;
        PatternBasedGenerator patternBasedGenerator = PatternBasedGenerator.getInstance();
        ArrayList<PatternAttributeDTO> definition = patternBasedGenerator.split(configuration.getPattern()
                .getTextPattern());

        /* Starting the formation of the String based on Definition that is returned */
        Iterator<PatternAttributeDTO> iterator = definition.iterator();
        while (iterator.hasNext()) {
            PatternAttributeDTO patternAttributeDTO = iterator.next();
            /* If special character then place as it is in the buffer */
            if (patternAttributeDTO.getIsSpecialCharacter()) {
                bufferString.append(patternAttributeDTO.getId());
            } else if (CustomIdGenerationConstants.CUSTOM_YEAR.equals(patternAttributeDTO.getId())) {
                /* In case of the custom year the year is added to the code */
                Calendar localCalendar = Calendar.getInstance(TimeZone.getDefault());
                int currentYear = localCalendar.get(Calendar.YEAR);
                bufferString.append(currentYear);
            } else if (CustomIdGenerationConstants.CUSTOM_SEQ.equals(patternAttributeDTO.getId())) {
                /* In case of the custom sequence the sequence value is checked and updated by 1 */
                Sequence sequence = configuration.getSequence();
                long number = patternBasedGenerator.deriveIdFromSequenceOrRange(sequence.getValue(),
                        configuration);
                String temporaryGeneratedId = String.valueOf(number);
                sequence.setValue(number + 1);
                bufferString.append(temporaryGeneratedId);
            }
        }
        generatedId = bufferString.toString();
        return generatedId;
    }
}
```

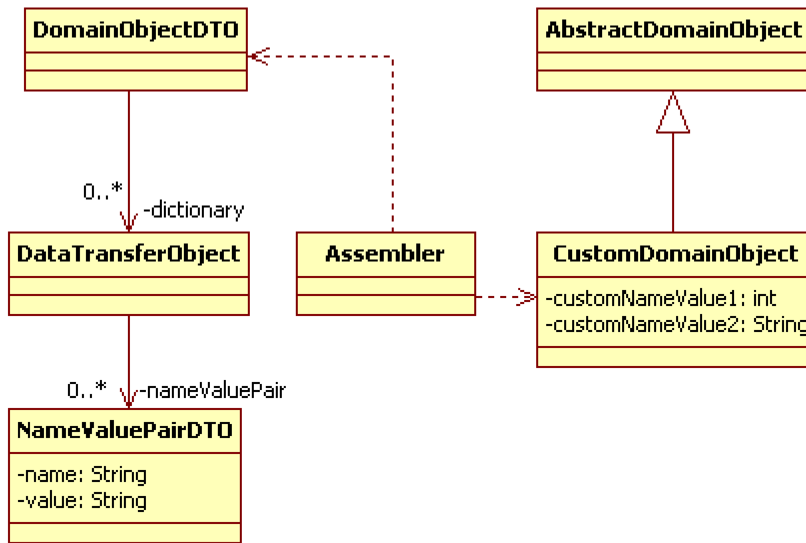
19 Extensibility of Domain Objects - Dictionary Pattern

This chapter describes how consultants or other third parties can extend OBP domain by leveraging the dictionary design pattern to extend any Abstract Domain Object on which a maintenance screen and corresponding services are supported by product and are shipped for a release. This pattern provides true domain model extension capabilities by allowing addition of custom data fields to the underlying domain objects and the database tables mapped to them. Such capability alleviates an important limitation in the earlier approach of using User Defined Fields (UDF) to extend the OBP data model. In the UDF approach, the data model for the custom fields is separate from that of the domain objects itself and hence cannot be consumed in business policies or even rules as facts. The dictionary pattern enables using the custom data fields in the extensions, business rules (as facts) and custom business policies as the domain object load from the database retrieves the extended domain object and not just the product domain object.

The framework related changes to make such support available are supported from release 2.3 of the Oracle Banking Platform. These changes have been made across layers including the UI, JSON, Assembler, ORM and DB layer. The changes required to be made by consulting to support the persistence and usage of the extra attributes by extending the product domain object have been discussed in detail in the sections by taking common domain extensibility use cases as examples. The process in which data is transferred from the UI layer, to the host layer is mentioned briefly as points below:

- The proxy layer provides an extension point wherein the additional data fields on the screen can be populated as name value pairs and set in the input request.
- The custom attribute data gets passed through the JSON layer onto the middleware host as part of the application service invocation.
- These name value pairs are translated into the custom domain object which extends the base OBP domain object.
- The custom fields get persisted into the DB along with the domain object fields as part of ORM mapping.
- Exact opposite flow follows for inquiry services in which the data flows back via output response.

Figure 19–1 Extensibility of Domain Objects - Framework



The dictionary data is passed in the request DTO and is therefore available as part of the pre and post application service extensions. The above process is described in detail in the sections below.

19.1 Customized Domain Object Attribute Placeholders

Data transfer object (DTO) is a design pattern used to transfer data between an external system and the application service. All the information may be wrapped in a single DTO containing all the details and passed as input request as well as returned as an output response. The client can then invoke accessor (or getter) methods on the DTO to get the individual attribute values from the Transfer Object. All request response classes in OBP application services are modelled as data transfer objects. These objects extend a base class DataTransferObject which holds an array of Dictionary object. The Dictionary encapsulates an array of NameValuePairDTO which is used to pass data of custom data fields or attributes from the UI layer to the host middleware. The following is mentioned as points below:

- All DTO classes should extend DomainObjectDTO class.
- The DomainObjectDTO class has been made to extend DataTransferObject class.
- This class has a single attribute which is an array of Dictionary class.
- Dictionary class has a single attribute which is an array of NameValuePairDTO

Using an array of name value pairs inside an array of dictionary allows for supporting two dimensional grid structures in the UI layer.

At present whenever any third party requires support for additional attributes in a Domain Object, the information regarding the corresponding Customized Domain Object name and attribute name-value pair is required to be populated as an array of NameValuePairDTO which in turn is set in the Dictionary class as the first and only element of the 'dictionaryArray' attribute of the DataTransferObject. This is shown in the following code extract.

Figure 19–2 Code Extract

```
1  com.ofss.fc.framework.domain.common.dto.NameValuePairDTO nameValuePairDTO1= new com.ofss.fc.framework.domain.common.dto.NameValuePairDTO();
2  nameValuePairDTO1.setGenericName("com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate.CustomValue1");
3  nameValuePairDTO1.setValue("Y");
4  com.ofss.fc.framework.domain.common.dto.NameValuePairDTO nameValuePairDTO2= new com.ofss.fc.framework.domain.common.dto.NameValuePairDTO();
5  nameValuePairDTO2.setGenericName("com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate.CustomValue2");
6  nameValuePairDTO2.setValue("Y");
7  com.ofss.fc.framework.domain.common.dto.NameValuePairDTO[] nameValuePairDTOArray= new com.ofss.fc.framework.domain.common.dto.NameValuePairDTO[2];
8  nameValuePairDTOArray[0]=nameValuePairDTO1;
9  nameValuePairDTOArray[1]=nameValuePairDTO2;
10 com.ofss.fc.framework.domain.common.dto.Dictionary dictionary= new com.ofss.fc.framework.domain.common.dto.Dictionary();
11 dictionary.setNameValuePairDTOArray(nameValuePairDTOArray);
12 com.ofss.fc.framework.domain.common.dto.Dictionary[] dictionaryArray = new com.ofss.fc.framework.domain.common.dto.Dictionary[1];
13 dictionaryArray[0]=dictionary;
```

19.2 Customized Domain Object DTO Interceptor in UI Layer

All DTO classes should extend DomainObjectDTO in case maintenance fields are required.

For example, 'MessageDataAttributeDTO' Class which extends 'DomainObjectDTO' is used to transfer data between an external system and the application service and persist data for Domain Object 'MessageDataAttribute'.

'CustomizedMessageDataAttribute' is a subclass of this Customizable Maintenance Domain Object called 'MessageDataAttribute' which is extended by the partners or consulting teams to include and subsequently persist extra attributes along with those of 'MessageDataAttribute'.

This information can be mapped as input and output to the application services with the help of dictionaryArray attribute of MessageDataAttributeDTO inherited from DataTransferObject.

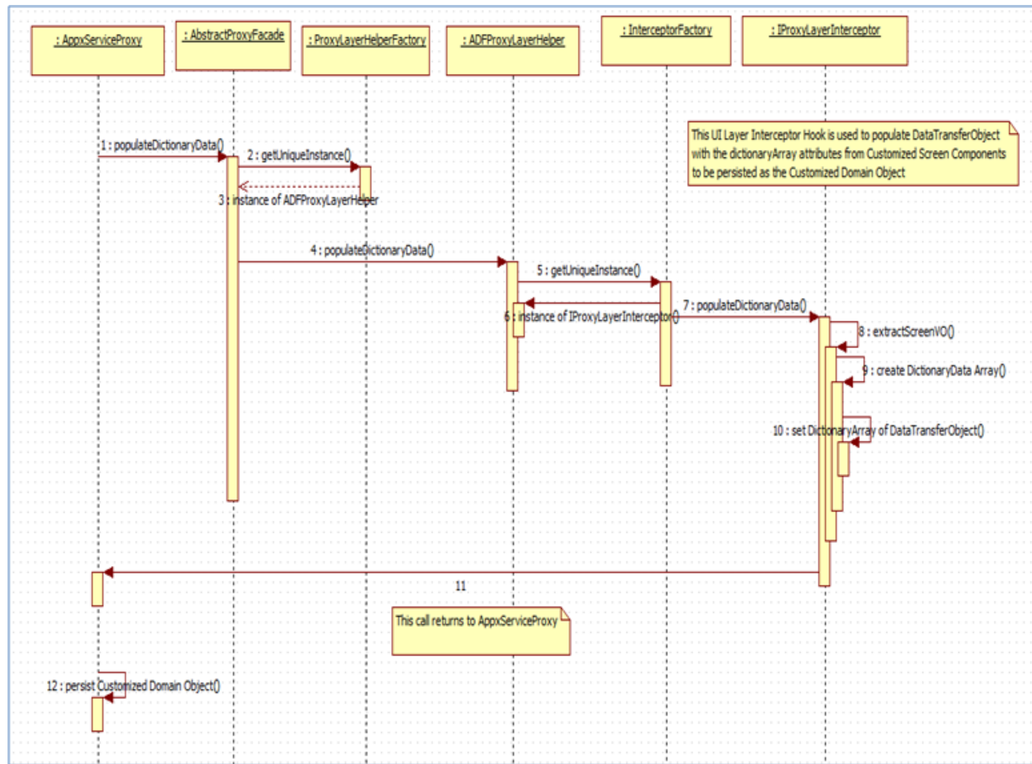
19.2.1 Interceptor Hook to Persist Customized Domain Object Attributes

This UI Layer Interceptor Hook is used during Create or Update mode to populate DataTransferObject with the dictionaryArray attributes from customized Screen Components to be persisted as the Customized Domain Object.

In the UI Layer, the ApplicationServiceProxyFacade is used to send the DataTransferObject on to the Host to be persisted. Before it does so, it uses the InterceptorFactory to instantiate the appropriate IProxyLayerInterceptor defined in the DictionaryInterceptor.properties corresponding to the key for this application service or task code. Thereafter it invokes the 'populateDictionaryArray' method of this IProxyLayerInterceptor to populate DataTransferObject with the dictionaryArray attributes from customized Screen Components. Thereafter, it sends the entire DataTransferObject on to the Host for persistence as the Customized Domain Object.

The following figure provides the details of Interceptor Hook to populate and persist Customized Domain Object.

Figure 19–3 Interceptor Hook to Persist Customized Domain Object



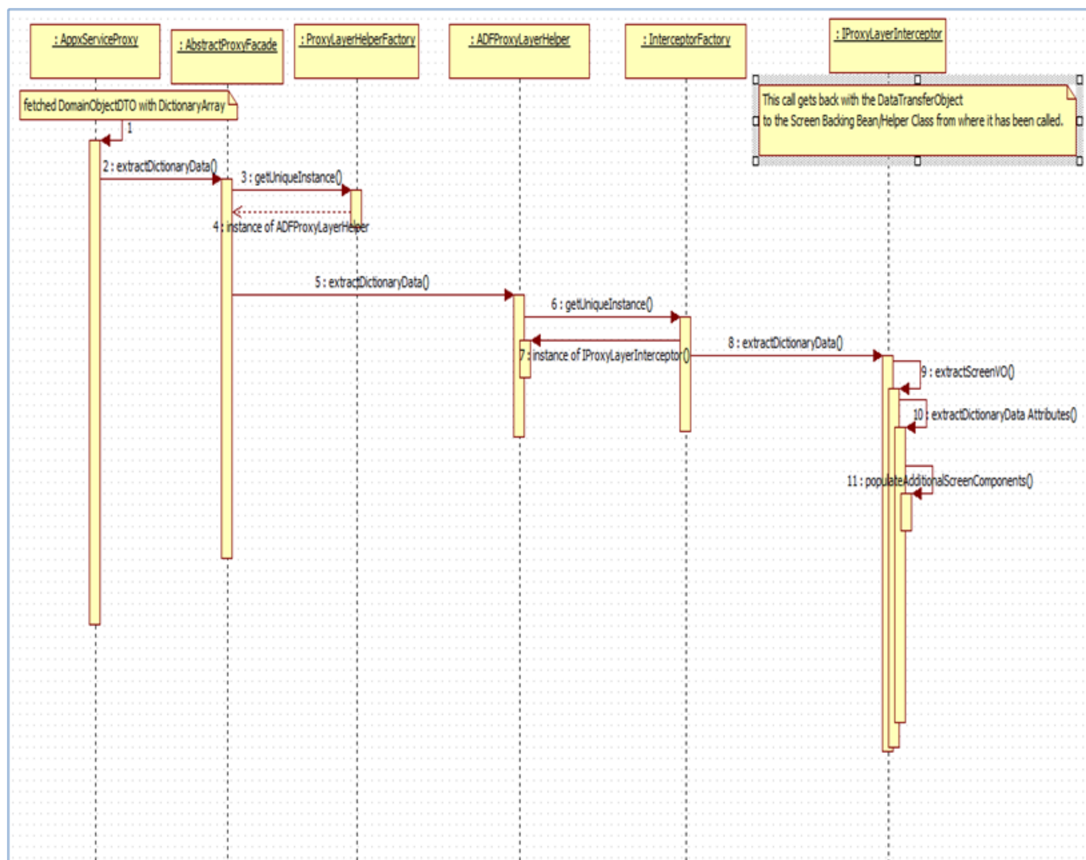
19.2.2 Interceptor Hook to Fetch Customized Domain Object Attributes

This UI Layer Interceptor Hook is used during read mode to extract the dictionaryArray attributes from the DataTransferObject and populate the customized Screen Components with the help of the screen view object.

In the UI Layer, the ApplicationServiceProxyFacade is used to receive the DataTransferObject from the Host. After it does so, it uses the InterceptorFactory to instantiate the appropriate IProxyLayerInterceptor defined in the DictionaryInterceptor.properties corresponding to the key for this application service or task code. Thereafter, it invokes the 'extractDictionaryArray' method of this IProxyLayerInterceptor to extract the dictionaryArray attributes from the DataTransferObject and populate the customized Screen Components with the help of the screen view object. Thereafter, it returns the entire DataTransferObject on to the Screen Backing Bean or Helper Class from where the proxy fetch call was invoked.

The following figure provides the details of Interceptor Hook to fetch Customized Domain Object and populate extra Screen Components.

Figure 19–4 Interceptor Hook to Fetch Customized Domain Object



InterceptorFactory instantiates the appropriate IProxyLayerInterceptor defined in the DictionaryInterceptor.properties corresponding to the key.

Examples of such key value pair is:-

com.ofss.fc.appx.ep.service.dispatch.message.service.client.proxy.MessageTemplateApplicationServiceProxyFacade=com.ofss.fc.ui.taskflows.ep.messageTemplateUI.view.interceptor.MessageTemplateUIInterceptor

com.ofss.fc.appx.party.service.contact.service.client.proxy.ContactPointApplicationServiceProxyFacade=com.ofss.fc.ui.view.party.contactPoint.interceptor.ContactPointUIInterceptor

19.3 Dictionary Data Transfer from UI to Host

The section describes the dictionary data transfer from UI to Host.

19.3.1 Customized Domain Object DTO Transfer from UI to Host

In UI server <ApplicationService>JSONClient constructs the JSON Object for <DomainObjectDTO> which includes the dictionaryArray of the DataTransferObject.

For example, in UI server MessageTemplateApplicationServiceJSONClient constructs the JSON Object for MessageTemplateDTO which includes MessageTemplateAttributeDTO and the dictionaryArray of DataTransferObject as shown below.

Figure 19–5 JSONClient constructs the JSON Object

```
private JSONArray serializeMessageDataAttributeDTOArray(com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO[] objInputVals)
    throws JSONException {

    JSONArray lMessageDataAttributeDTOJSONArray = null;
    if (objInputVals != null) {
        lMessageDataAttributeDTOJSONArray = new JSONArray();
        for (int inumobjInputValArray = 0; inumobjInputValArray < objInputVals.length; inumobjInputValArray++) {
            JSONObject lObjInputValJSONObject = null;
            com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO objObjInputVal = objInputVals[inumobjInputValArray];
            if (objObjInputVal != null) {
                lObjInputValJSONObject = new JSONObject();
                lObjInputValJSONObject.put("_type", (objObjInputVal.getClass().getName()));
                com.ofss.fc.framework.domain.common.dto.Dictionary[] arr_objObjInputVal_dictionaryArray = objObjInputVal.getDictionaryArray();
                JSONArray llObjInputValJSONObjectdictionaryArrayArray = serializeDictionaryArray(arr_objObjInputVal_dictionaryArray);
                try {
                    lObjInputValJSONObject.put("DictionaryArray", llObjInputValJSONObjectdictionaryArrayArray);
                } catch (Throwable t) {
                    ErrorManager.overrideError(null, t);
                }
            }
            lMessageDataAttributeDTOJSONArray.put(lObjInputValJSONObject);
        }
    }
    return lMessageDataAttributeDTOJSONArray;
}
```

<ApplicationService>JSONClient constructs the JSON Object for <DomainObjectDTO> which includes the dictionaryArray of the DataTransferObject

The above process uses AbstractJSONBindingStub class' serializeDictionaryArray to include 'genericName' and 'value' attributes of NameValuePairDTOArray which was inside dictionaryArray attribute of MessageTemplateAttributeDTO.

Figure 19–6 SerializeDictionaryArray to include GenericName and Value attributes

```
/**
 * 1D Array of Dictionary representing the set of Union Subclasses of the corresponding Customized
 * AbstractDomainObject is serialized into a JSONArray
 *
 * @param objInputVal
 * @return
 * @throws JSONException
 */
protected JSONArray serializeDictionaryArray(Dictionary[] extendedDomainObjectDTOArray) throws JSONException {

    JSONArray lDictionaryJSONArray = new JSONArray();
    if (extendedDomainObjectDTOArray != null) {
        for (int i = 0; i < extendedDomainObjectDTOArray.length; i++) {
            JSONArray lCustomizedNameValuePairDTOJSONArray = new JSONArray();
            NameValuePairDTO[] nameValuePairDTOArray = extendedDomainObjectDTOArray[i].getNameValuePairDTOArray();
            for (int j = 0; j < nameValuePairDTOArray.length; j++) {
                JSONObject lCustomizedNameValuePairDTOJSONObject = new JSONObject();
                lCustomizedNameValuePairDTOJSONObject.putOpt("FactName", nameValuePairDTOArray[j].getGenericName());
                lCustomizedNameValuePairDTOJSONObject.putOpt("FactValue", nameValuePairDTOArray[j].getValue());
                lCustomizedNameValuePairDTOJSONArray.put(lCustomizedNameValuePairDTOJSONObject);
            }
            lDictionaryJSONArray.put(lCustomizedNameValuePairDTOJSONArray);
        }
    }
    return lDictionaryJSONArray;
}
```

AbstractJSONBindingStub class's serializeDictionaryArray to include "genericName" and "value" attributes of NameValuePairDTOArray

In the Host Server <ApplicationService>JSONFacade extracts the 'DictionaryArray' attribute of JSON Object and sets it as <DomainObjectDTO>'s dictionaryArray attribute.

For example, in the Host Server, MessageTemplateApplicationServiceJSONFacade extracts the 'DictionaryArray' attribute of JSON Object and sets it as MessageDataAttributeDTO's dictionaryArray attribute.

Figure 19–7 Host Server JSONFacade extracts the attribute of JSON Object

```
private com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO[] getMessageDataAttributeDTOArray(JSONObject jsonObject, String strName
    throws JSONException {

    com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO[] lMessageDataAttributeDTOs = null;
    JSONArray lMessageDataAttributeDTOJSONArray = jsonObject.optJSONArray(strName);
    if (lMessageDataAttributeDTOJSONArray != null) {
        int numobjInputValArray = lMessageDataAttributeDTOJSONArray.length();
        lMessageDataAttributeDTOs = new com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO[numobjInputValArray];
        JSONObject lobjInputValJSONObject = null;
        for (int iobjInputVal = 0; iobjInputVal < numobjInputValArray; iobjInputVal++) {
            com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO lstrName_MessageDataAttributeDTO = null;
            lobjInputValJSONObject = lMessageDataAttributeDTOJSONArray.optJSONObject(iobjInputVal);
            if (lobjInputValJSONObject != null) {
                lstrName_MessageDataAttributeDTO = new com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO();
                String strMessageDataAttributeDTOType = lobjInputValJSONObject.optString("_type");
                com.ofss.fc.framework.domain.common.dto.Dictionary[] llstrName_MessageDataAttributeDTO_dictionaryArrays
                                                        = getDictionaryArray(lobjInputValJSONObject,"DictionaryArray");
                lstrName_MessageDataAttributeDTO.setDictionaryArray(llstrName_MessageDataAttributeDTO_dictionaryArrays);
            }
            lMessageDataAttributeDTOs[iobjInputVal] = lstrName_MessageDataAttributeDTO;
        }
    }
    return lMessageDataAttributeDTOs;
}
```

In the Host Server <ApplicationService>JSONFacade extracts the "DictionaryArray" attribute of JSON Object and sets it as <DomainObjectDTO>'s dictionaryArray attribute

The above process uses AbstractJSONFacade's getDictionaryArray method that unmarshalls the 'genericName' and 'value' from JSON Object to get the dictionaryArray attribute.

Figure 19–8 AbstractJSONFacade's getDictionaryArray method

```
/**
 * JSONObject is deserialized to get 1D Array of Dictionary representing the set of Union Subclasses of the corresponding
 * Customized AbstractDomainObject
 * @param jsonObject
 * @param strName
 * @return
 */
public Dictionary[] getDictionaryArray(JSONObject jsonObject, String strName) {
    Dictionary[] extendedDomainObjectDTOArray = null;
    NameValuePairDTO[] nameValuePairDTOArray = null;
    try {
        JSONArray inputJSONObj = jsonObject.getJSONArray(strName);
        int rows=inputJSONObj.length();
        if(rows>0){
            extendedDomainObjectDTOArray = new Dictionary[rows];
            JSONArray jsonArray = (JSONArray)inputJSONObj.get(0);
            for (int i = 0; i < rows; i++) {
                jsonArray = (JSONArray)inputJSONObj.get(i);
                int cols=jsonArray.length();
                nameValuePairDTOArray=new NameValuePairDTO[cols];
                for (int j = 0; j < cols; j++) {
                    JSONObject arrayObject = (JSONObject)jsonArray.get(j);
                    nameValuePairDTOArray[j]= new NameValuePairDTO();
                    nameValuePairDTOArray[j].setGenericName(arrayObject.getString("FactName"));
                    nameValuePairDTOArray[j].setValue(arrayObject.getString("FactValue"));
                }
                extendedDomainObjectDTOArray[i] = new Dictionary();
                extendedDomainObjectDTOArray[i].setNameValuePairDTOArray(nameValuePairDTOArray);
            }

        }
    } catch (Exception e) {
        return null;
    }
```

AbstractJSONFacade's getDictionaryArray method that unmarshalls the "genericName" and "value" from JSON Object to get the dictionaryArray attribute

19.3.2 Customized Domain Object DTO transfer from Host to UI

In the Host Server <ApplicationService>JSONFacade constructs the JSON Object for <DomainObjectDTO> and the dictionaryArray of DataTransferObject

MessageTemplateApplicationServiceJSONFacade's method serializeMessageDataAttributeDTOArray in Host Server constructs the JSON Object for MessageTemplateDTO which includes MessageTemplateAttributeDTO and the dictionaryArray of DataTransferObject as shown below:

Figure 19–9 Host Server JSONFacade constructs the JSON Object

```
private JSONArray serializeMessageDataAttributeDTOArray(com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO[] objInputVals)
    throws JSONException {

    JSONArray lMessageDataAttributeDTOJSONArray = null;
    if (objInputVals != null) {
        lMessageDataAttributeDTOJSONArray = new JSONArray();
        for (int inumobjInputValArray = 0; inumobjInputValArray < objInputVals.length; inumobjInputValArray++) {
            JSONObject lObjInputValJSONObject = null;
            com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO objObjInputVal = objInputVals[inumobjInputValArray];
            if (objObjInputVal != null) {
                lObjInputValJSONObject = new JSONObject();
                lObjInputValJSONObject.put("_type", (objObjInputVal.getClass().getName()));

                com.ofss.fc.framework.domain.common.dto.Dictionary[] arr_objObjInputVal_dictionaryArray = objObjInputVal.getDictionaryArray();
                JSONArray llObjInputValJSONObjectdictionaryArrayArray = serializeDictionaryArray(arr_objObjInputVal_dictionaryArray);
                try {
                    lObjInputValJSONObject.put("DictionaryArray", llObjInputValJSONObjectdictionaryArrayArray);
                } catch (Throwable t) {
                    ErrorManager.overrideError(null, t);
                }
            }
            lMessageDataAttributeDTOJSONArray.put(lObjInputValJSONObject);
        }
    }
    return lMessageDataAttributeDTOJSONArray;
}
```

In the Host Server <ApplicationService>JSONFacade constructs the JSON Object for <DomainObjectDTO> and the dictionaryArray of DataTransferObject

The above process uses AbstractJSONFacade's serializeDictionaryArray to include 'genericName' and 'value' attributes of NameValuePairDTOArray which was inside dictionaryArray attribute of MessageTemplateAttributeDTO.

Figure 19–10 AbstractJSONFacade's serializeDictionaryArray to include Generic Name and Value attributes

```
            }
        } catch (Exception e) {
            return null;
        }
        return extendedDomainObjectDTOArray;
    }
    /**
     * 1D Array of Dictionary representing the set of Union Subclasses of the corresponding Customized AbstractDomainObject is
     * serialized into a JSONArray
     * @param objInputVal
     * @return
     * @throws JSONException
     */
    public JSONArray serializeDictionaryArray(Dictionary[] extendedDomainObjectDTOArray) throws JSONException {
        JSONArray lDictionaryJSONArray = new JSONArray();
        if(extendedDomainObjectDTOArray!=null){
            for (int i = 0; i < extendedDomainObjectDTOArray.length; i++) {
                JSONArray lCustomizedNameValuePairDTOJSONArray = new JSONArray();
                NameValuePairDTO[] nameValuePairDTOArray = extendedDomainObjectDTOArray[i].getNameValuePairDTOArray();
                for (int j = 0; j < nameValuePairDTOArray.length; j++) {
                    JSONObject lCustomizedNameValuePairDTOJSONObject = new JSONObject();
                    lCustomizedNameValuePairDTOJSONObject.putOpt("FactName", nameValuePairDTOArray[j].getGenericName());
                    lCustomizedNameValuePairDTOJSONObject.putOpt("FactValue", nameValuePairDTOArray[j].getValue());
                    lCustomizedNameValuePairDTOJSONArray.put(lCustomizedNameValuePairDTOJSONObject);
                }
                lDictionaryJSONArray.put(lCustomizedNameValuePairDTOJSONArray);
            }
        }
        return lDictionaryJSONArray;
    }

}
```

AbstractJSONFacade's serializeDictionaryArray to include "genericName" and "value" attributes of NameValuePairDTOArray

In the UI Server, <ApplicationService>JSONClient extracts the 'DictionaryArray' attribute of JSON Object and sets it as <DomainObjectDTO>DTO's dictionaryArray attribute.

In the UI Server, MessageTemplateApplicationServiceJSONClient extracts the 'DictionaryArray' attribute of JSON Object and sets it as MessageDataAttributeDTO's dictionaryArray attribute.

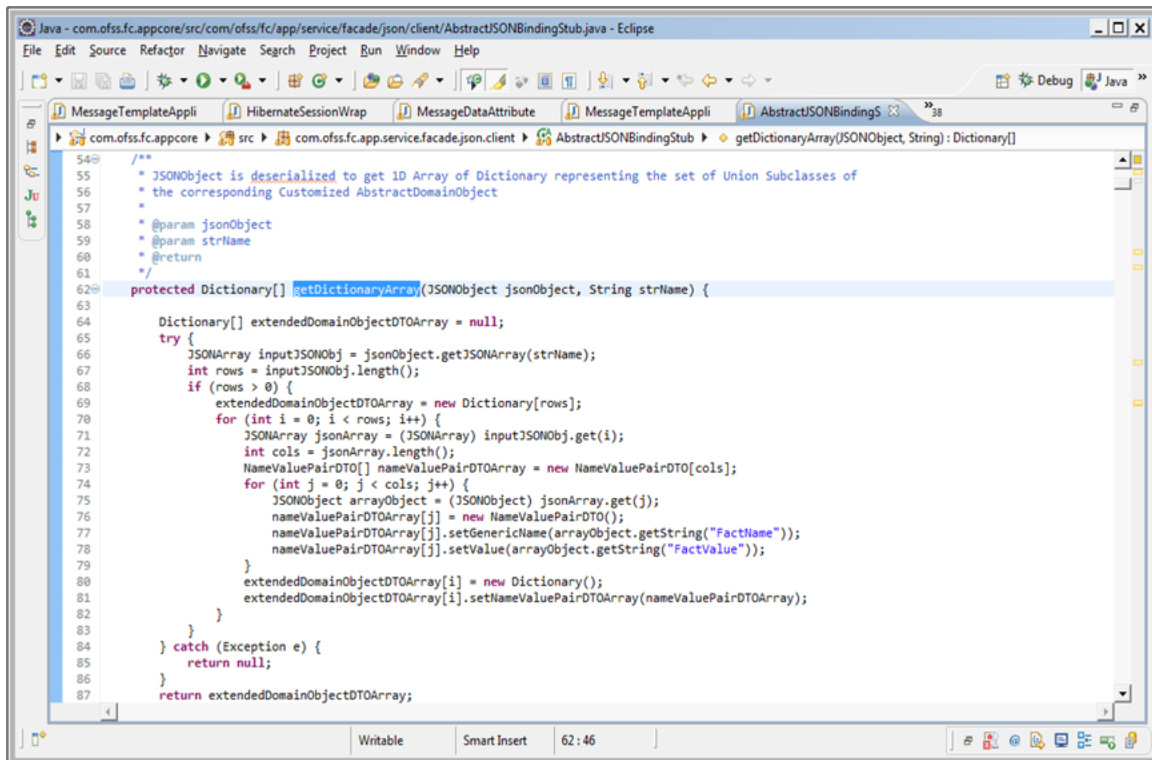
Figure 19–11 UI Server JSONClient extracts the DictionaryArray attribute

```
private com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO[] getMessageDataAttributeDTOArray(JSONObject jsonObject, String strNa
    throws JSONException {

    com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO[] lMessageDataAttributeDTOs = null;
    JSONArray lMessageDataAttributeDTOJSONArray = jsonObject.optJSONArray(strName);
    if (lMessageDataAttributeDTOJSONArray != null) {
        int numobjInputValArray = lMessageDataAttributeDTOJSONArray.length();
        lMessageDataAttributeDTOs = new com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO[numobjInputValArray];
        JSONObject lobjInputValJSONObject = null;
        for (int iobjInputVal = 0; iobjInputVal < numobjInputValArray; iobjInputVal++) {
            com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO lstrName_MessageDataAttributeDTO = null;
            lobjInputValJSONObject = lMessageDataAttributeDTOJSONArray.optJSONObject(iobjInputVal);
            if (lobjInputValJSONObject != null) {
                lstrName_MessageDataAttributeDTO = new com.ofss.fc.app.ep.dto.dispatch.message.MessageDataAttributeDTO();
                String strMessageDataAttributeDTOType = lobjInputValJSONObject.optString("_type");
                com.ofss.fc.framework.domain.common.dto.Dictionary[] llstrName_MessageDataAttributeDTO_dictionaryArrays
                                                = getDictionaryArray(lobjInputValJSONObject, "DictionaryArray");
                lstrName_MessageDataAttributeDTO.setDictionaryArray(llstrName_MessageDataAttributeDTO_dictionaryArrays);
            }
            lMessageDataAttributeDTOs[iobjInputVal] = lstrName_MessageDataAttributeDTO;
        }
    }
    return lMessageDataAttributeDTOs;
}
```

In the UI Server, <ApplicationService>JSONClient extracts the "DictionaryArray" attribute of JSON Object and sets it as <DomainObjectDTO>DTO's dictionaryArray attribute

The above process uses AbstractJSONBindingStub's getDictionaryArray method that unmarshalls the 'genericName' and 'value' from JSON Object to get the dictionaryArray attribute.

Figure 19–12 AbstractJSONBindingStub's getDictionaryArray method



AbstractJSONBindingStub's getDictionaryArray method that unmarshalls the "genericName" and "value" from JSON Object

The provision of marshalling and un-marshalling of 'dictionaryArray' attribute of all DataTransferObjects has been included in the JSON layer for all application services.

19.4 Translating Dictionary Data into Custom Domain Object

This section describes the details of translating dictionary data into custom domain object.

19.4.1 Instantiation and Persistence of Custom Domain Objects

If a method has an input parameter that is a DataTransferObject, the first line of the method in the assembler will be of the form:

(populateDataTransferObjectDTOMap('Fully Qualified Name of this DataTransferObject>', dataTransferObject);

This method is defined in AbstractAssembler.java which newly instantiates referenceDataTransferObjectDTOMap if required and populates the map with the above entry.

This map is used as a set of globally available DataTransferObject's which can be retrieved by invoking another method defined in AbstractAssembler.java which is of the form:

```
retrieveDataTransferObjectDTOMapElement('<Fully Qualified Name of this
DataTransferObject >');
```

Whenever any AbstractDomainObject is instantiated, the Customized AbstractDomainObject should be instantiated instead of the original AbstractDomainObject wherever applicable.

The AbstractDomainObject is instantiated with the help of the below code fragment:

```
IAbstractDomainObject domainObject=null;
        try {
            if (retrieveDataTransferObjectDTOMapElement("
<Fully Qualified Name of DataTransferObject from Naming Convention Rules
>").getDictionaryArray() == null) {
                domainObject =  <Current Process Of Instantiation>;
            } else {
           domainObject=(IAbstractDomainObject)
                    getCustomizedDomainObject (
retrieveDataTransferObjectDTOMapElement (
                                               "<Fully Qualified Name of
DataTransferObject from Naming Convention Rules >"));

/********* In AbstractAssembler.java, we have defined the method
public IAbstractDomainObject getCustomizedDomainObject(DataTransferObject
dataTransferObjectDTO)

This method instantiates the Customized AbstractDomainObject based on the value of
the attribute  "dictionaryArray" of the DataTransferObject passed as the only
parameter. The method also populates this customized domain object with the extra
attribute values also from the "dictionaryArray"  attribute and finally returns
this instance of the Customized Domain Object.
*********/
            }
        } catch (Exception e) {
            domainObject =  <Current Process Of Instantiation>;
        }
```

19.4.2 Fetching of Customized Domain Objects

If a method has an input parameter that is an IAbstractDomainObject, the first line of the method in the assembler will be of the form:

```
populateAbstractDomainObjectMap("<Fully_Qualified_Name_
IAbstractDomainObject>", abstractDomainObject);
```

This method is defined in AbstractAssembler.java which newly instantiates referenceAbstractDomainObjectMap if required and populates the map with the above entry.

This map is used as a set of globally available IAbstractDomainObject's which can be retrieved by invoking another method defined in AbstractAssembler.java which is of the form:

```
retrieveDataTransferObjectDTOMapElement("<Fully_Qualified_Name_
IAbstractDomainObject>");
```

Whenever any DataTransferObject is instantiated, we populate its ’dictionaryArray’ attribute immediately after it's instantiation.

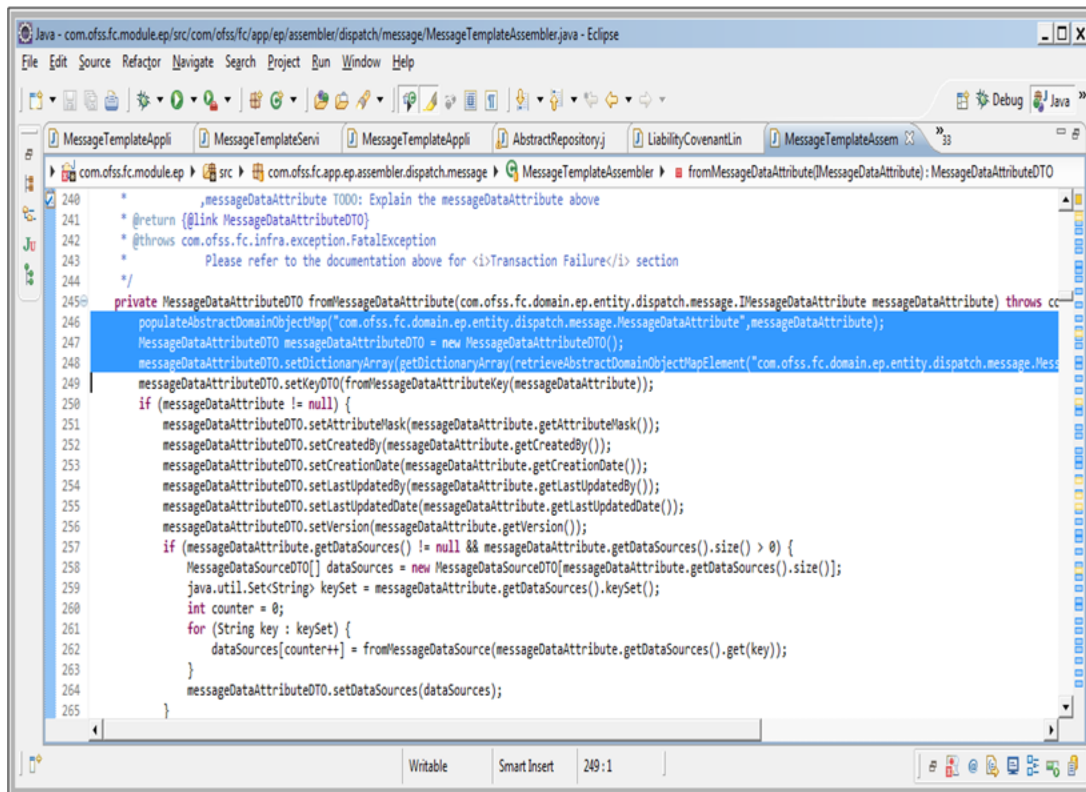
In AbstractAssembler.java, we have defined the method à

```
public Dictionary[] getDictionaryArray(IAbstractDomainObject obj)
```

This method creates and returns a dictionary array from the IAbstractDomainObject passed to it as input parameter.

Example of final piece of code:

Figure 19–13 Instantiation of DataTransferObjects



19.5 Customized Domain Object ORM Configuration

This section describes the details of customized domain object ORM configuration.

19.5.1 Case 1 - Non-Inheritance based mapping

Non-inheritance based mapping refers to those domain objects that are not mapped as a Hibernate Subclass or Union-Subclass or Joined-Subclass. Let us take the example of the class MessageDataAttribute. The fully qualified class name is 'com.ofss.fc.domain.ep.entity.dispatch.message.MessageDataAttribute'. This class has been mapped in ep.messagetemplate.hbm.xml.

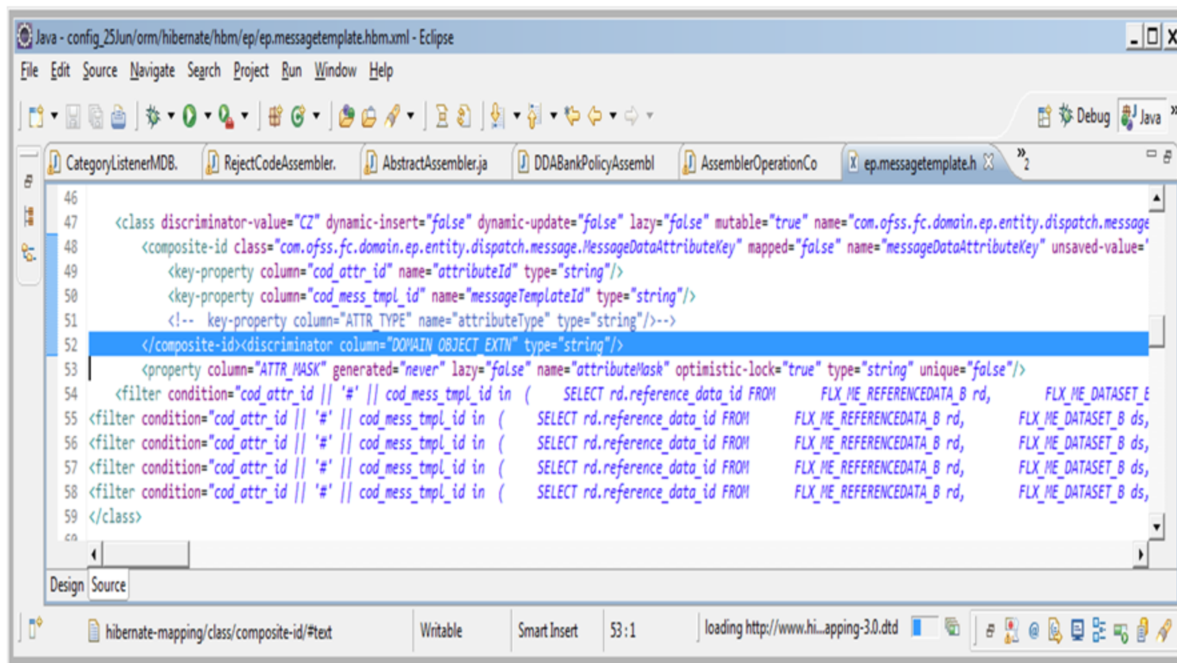
Adding Discriminator column mapping in existing HBM file

Add the discriminator as:- <discriminator column=" DOMAIN_OBJECT_EXTN" type="string"/>

For the purpose of identifying the extended domain object in the corresponding table, add a 'discriminator column' in the corresponding table and update the hibernate file. The name of the discriminator column used is DOMAIN_OBJECT_EXTN and the default discriminator value defined is 'CZ'

So any normal Create or Update operation will have a value 'CZ' for DOMAIN_OBJECT_EXTN column.

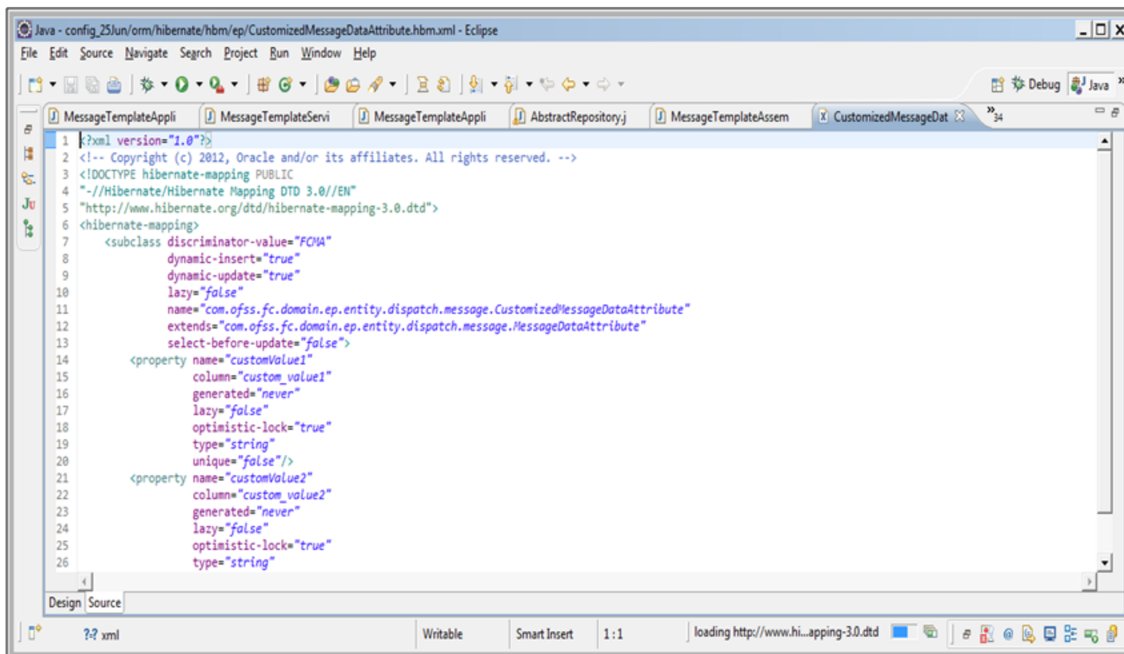
Figure 19–14 Adding Discriminator Column Mapping in Existing HBM file



A new HBM file mapping to Customized Domain Object is added

The following figure explains adding a new HBM file mapping to Customized Domain Object.

Figure 19–15 HBM File Mapping to Customized Domain Object



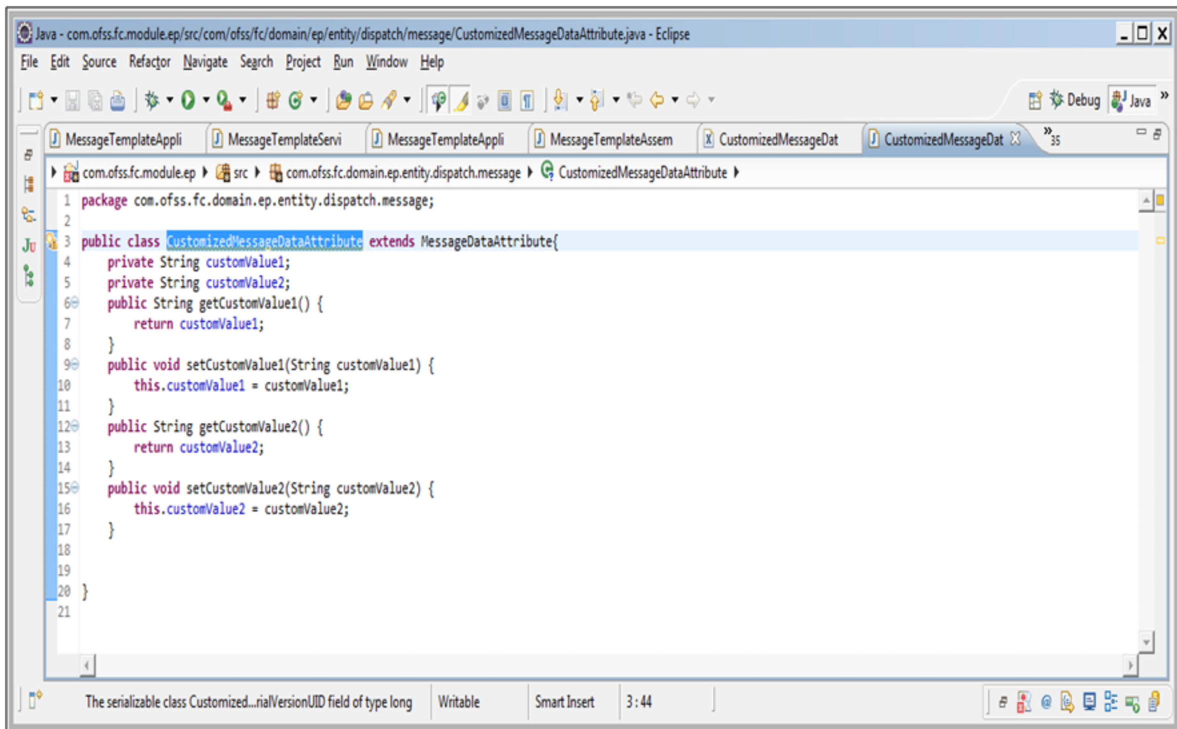
For example a new file CustomizedMessageDataAttribute.hbm.xml is introduced to include the extra attributes added by consulting or any other third party along with

the discriminator value. This file will map to the new customized domain object and will be extending the existing Abstract Domain Object.

Adding new Java File corresponding to the Customized Domain Object

The following figure explains adding new Java file corresponding to the Customized Domain Object.

Figure 19–16 Adding New Java File to the Customized Domain Object

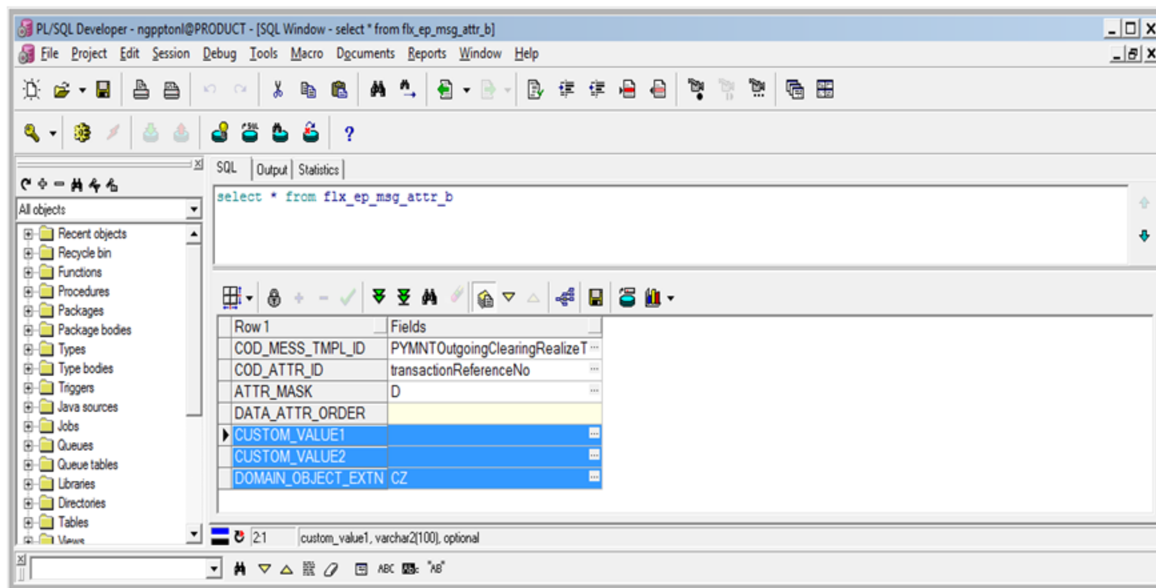


A Java File is added corresponding to the existing Abstract Domain Object. This will be extending the Abstract Domain Object that we are extending.

Adding extra columns along with the discriminator column to the domain object table

The following figure explains adding a new Java file corresponding to the Customized Domain Object.

Figure 19–17 Adding Extra Columns along with the Discriminator Column



The extra columns along with the discriminator column have to be added to the domain object table of this domain object.

In case of Creation or Updation of 'CustomizedMessageDataAttribute' instead of 'MessageDataAttribute' the new discriminator column 'DOMAIN_OBJECT_EXTN' has the value of 'FCMA' instead of 'CZ' and an additional value in columns 'CUSTOM_VALUE1' and 'CUSTOM_VALUE2' in table FLX_EP_MSG_ATTR_B.

In case of Creation or Updation of 'MessageDataAttribute' the new discriminator column 'DOMAIN_OBJECT_EXTN' has the value of 'CZ' and NULL values in columns 'CUSTOM_VALUE1' and 'CUSTOM_VALUE2' in table FLX_EP_MSG_ATTR_B.

19.5.2 Case 2 - Mapped as a Hibernate Subclass

The maintenance domain objects which are mapped as a Hibernate Subclass already have an existing discriminator. For the purpose of identifying the extended domain object in the same table, we shall be using the existing discriminator.

Let us take the example of 'com.ofss.fc.domain.party.entity.contact.Cellular'. This is mapped as a subclass in ContactPoint.hbm.xml.

A new HBM file mapping to Customized Domain Object is added

The following figure explains adding a new HBM file mapping to Customized Domain Object.

Figure 19–18 Adding a New HBM File Mapping to Customized Domain Object

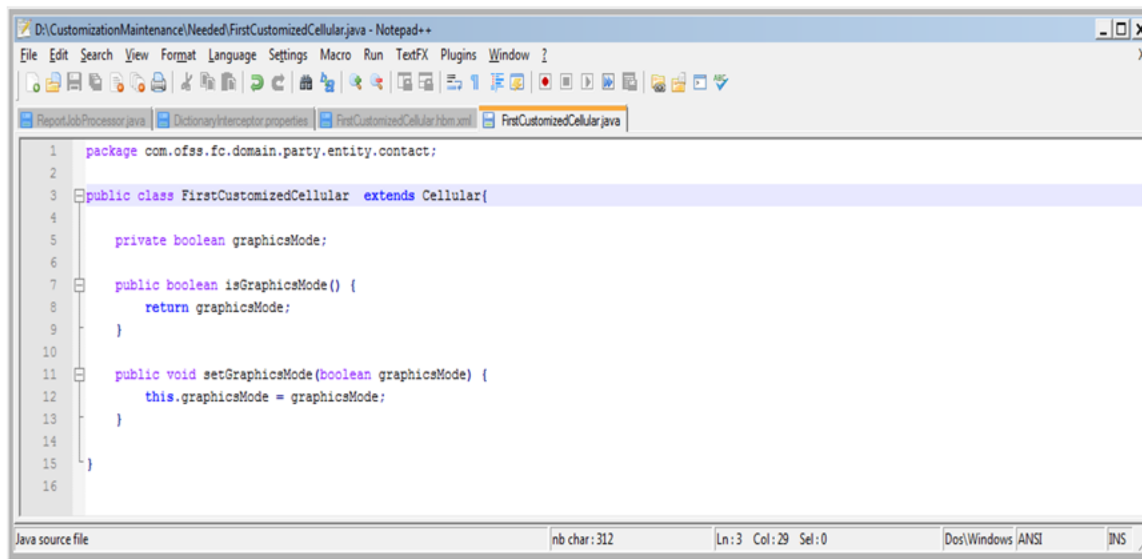
```xml
<?xml version="1.0"?>
<!-- Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved. -->
<!DOCTYPE hibernate-mapping PUBLIC
"-//Hibernate/Hibernate Mapping DTD 3.0//EN"
"http://www.hibernate.org/dtd/hibernate-mapping-3.0.dtd">
<hibernate-mapping>
    <subclass discriminator-value="FCLR"
              dynamic-insert="true"
              dynamic-update="true"
              lazy="false"
              name="com.ofss.fc.domain.party.entity.contact.FirstCustomizedCellular"
              extends="com.ofss.fc.domain.party.entity.contact.Cellular"
              select-before-update="false">
        <property name="graphicsMode"
                  column="graphics_mode"
                  generated="never"
                  lazy="false"
                  optimistic-lock="true"
                  type="yes_no"
                  unique="false"/>
    </subclass>
</hibernate-mapping>
```

A new file FirstCustomizedCellular.hbm.xml is introduced to include the extra attributes added by consulting or any other third party along with the discriminator value 'FCLR'. This file will map to the new customized domain object 'com.ofss.fc.domain.party.entity.contact.FirstCustomizedCellular' and will be extending the existing Abstract Domain Object which is 'com.ofss.fc.domain.party.entity.contact.Cellular'.

Adding new Java File corresponding to the Customized Domain Object

The following figure explains adding a new Java File corresponding to the Customized Domain Object.

Figure 19–19 Adding New Java File to Customized Domain Object



A Java File 'com.ofss.fc.domain.party.entity.contact.FirstCustomizedCellular' is added corresponding to the existing Abstract Domain Object. This will be extending the Abstract Domain Object that we are extending.

Adding Extra Columns to the Domain Object Table

The extra columns have to be added to the domain object table of this domain object.

In this case GRAPHICS_MODE column is added to FLX_PI_CONTACT_POINT table.

So in case of Creation or Updation of 'FirstCustomizedCellular' instead of 'Cellular' the existing discriminator column 'CONTACT_POINT_TYPE' has the value of 'FCLR' instead of 'CLR' and an additional value in column 'GRAPHICS_MODE' in table FLX_PI_CONTACT_POINT.

And in case of Creation or Updation of 'Cellular' the existing discriminator column 'CONTACT_POINT_TYPE' has the value of 'CLR' and NULL values in column 'GRAPHICS_MODE' in table FLX_PI_CONTACT_POINT.

19.5.3 Case 3 - Mapped as a Hibernate Union-Subclass or Joined-Subclass

Let us take the example of 'com.ofss.fc.domain.lcm.entity.limits.facility.proposedFacility.ProposedFacility'. This class has been mapped in Facility.hbm.xml as a union subclass.

Use the customized entity 'com.ofss.fc.cz.nab.domain.lcm.entity.limits.facility.proposedFacility.CustomizedProposedFacility' for the purpose of extensibility of this domain object.

Adding Discriminator in HBM file where base class has been mapped is not required

The existing Facility.hbm.xml file which contains the mapping for "com.ofss.fc.domain.lcm.entity.limits.facility.proposedFacility.ProposedFacility" is not required to be altered.

A new HBM file mapping to Customized Domain Object is added

The following figure explains adding a new HBM file mapped to new Customized Domain Object.

Figure 19–20 New HBM File Mapping

```
1  <?xml version="1.0"?>
2  <!-- Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved. -->
3  <!DOCTYPE hibernate-mapping PUBLIC "-//Hibernate/Hibernate Mapping DTD 3.0//EN"
4  "http://www.hibernate.org/dtd/hibernate-mapping-3.0.dtd">
5
6  <hibernate-mapping>
7    <union-subclass dynamic-insert="true"
8                    dynamic-update="true"
9                    lazy="false"
10                   name="com.ofss.fc.cz.nab.domain.lcm.entity.limits.facility.proposedFacility.CustomizedProposedFacility"
11                   extends="com.ofss.fc.domain.lcm.entity.limits.facility.proposedFacility.ProposedFacility"
12                   table="CZ_NAB_LM_PROPOSED_FACILITY">
13                         <property column="ASSOCIATED_CONSUMER_LENDING" name="associatedConsumerLending" type="string"/>
14                         <property column="ASSOCIATED_BUSINESS_LENDING" name="associatedBusinessLending" type="string"/>
15   </union-subclass>
16 </hibernate-mapping>
17
```

For example, a new file CustomizedProposedFacility.hbm.xml is introduced to include the extra attributes added by consulting or any other third party. This file will map to the new customized domain object and will be extending the existing Abstract Domain Object.

Adding new Java File corresponding to the Customized Domain Object

Figure 19–21 Adding New Java File

```
package com.ofss.fc.cz.nab.domain.lcm.entity.limits.facility.proposedFacility;

import com.ofss.fc.domain.lcm.entity.limits.facility.proposedFacility.ProposedFacility;

public class CustomizedProposedFacility extends ProposedFacility {

    /**
     * Default serial version UID.
     */
    private static final long serialVersionUID = 1L;
    private String associatedConsumerLending;
    private String associatedBusinessLending;
    private String feeNegotiateApprovalCode;

    public String getFeeNegotiateApprovalCode() {

        return feeNegotiateApprovalCode;
    }

    public void setFeeNegotiateApprovalCode(String feeNegotiateApprovalCode) {

        this.feeNegotiateApprovalCode = feeNegotiateApprovalCode;
    }

    public String getAssociatedConsumerLending() {

        return associatedConsumerLending;
    }

    public void setAssociatedConsumerLending(String associatedConsumerLending) {

        this.associatedConsumerLending = associatedConsumerLending;
    }

    public String getAssociatedBusinessLending() {

        return associatedBusinessLending;
```

A Java File 'CustomizedProposedFacility.java' is added. This extends the Abstract Domain Object that we are extending.

Create a new table CZ_NAB_LM_PROPOSED_FACILITY similar to the Domain Object Table

We are extending that is,FLX_LM_PROPOSED_FACILITY_B and add the extra columns to the new table.

Figure 19–22 Create a New Table CZ_NAB_LM_PROPOSED_FACILITY

```
1   create  table CZ_NAB_LM_PROPOSED_FACILITY as
2   select * from FLX_LM_PROPOSED_FACILITY_B where 1=2;
3
4
5   ALTER TABLE  CZ_NAB_LM_PROPOSED_FACILITY ADD ASSOCIATED_CONSUMER_LENDING VARCHAR2(20)
6   /
7   ALTER TABLE  CZ_NAB_LM_PROPOSED_FACILITY ADD ASSOCIATED_BUSINESS_LENDING VARCHAR2(20)
8   /
9
.0  ALTER TABLE  CZ_NAB_LM_PROPOSED_FACILITY add FEE_NEGOTIATE_APPROVAL_CODE VARCHAR2(50)
.1  /
```

Adding Customized HQL Queries whenever the Domain Object is Referred

The following file has the attribute 'CustomizedHibernateQueriesConfig' to fire the Customized HQL if required: Preferences.xml.

The attribute is as follows:

```
<Preference name="CustomizedHibernateQueriesConfig"

PreferencesProvider="com.ofss.fc.infra.config.impl.JavaConstantsConfigProvider"
        overriddenBy="CustomizedHibernateQueriesConfigOverride"
        parent="jdbcpreference"

propertyFileName="com.ofss.fc.common.CustomizedHibernateQueriesConfig"
         syncTimeInterval="600000" />
```

The following files have also been changed to fire the Customized HQL if required.

com.ofss.fc.framework.domain@/com/ofss/fc/framework/repository/AbstractRepos itory.java

com.ofss.fc.common.jar@/src/com/ofss/fc/common/CustomizedHibernateQueriesC onfig.java

The following file has the attribute 'CustomizedHibernateQueriesConfigOverride' to fire the Customized HQL if required.

<lzn>/au/config/Preferences.xml

```
<Preference name="CustomizedHibernateQueriesConfigOverride"

PreferencesProvider="com.ofss.fc.infra.config.impl.JavaConstantsConfigProvider"
        parent=""
propertyFileName="com.ofss.fc.lz.au.common.CustomizedHibernateQueriesConfig"
       syncTimeInterval="600000"/>
```

Therefore, com.ofss.fc.lz.au.common.CustomizedHibernateQueriesConfig.java file needs to have the old HQL query name mapped to the customized HQL query name for this domain object.

Similarly, extensibility of domain objects mapped as joined-subclass can also be done.

19.5.4 Case 4 - Mapped as a Hibernate Component

This relates to only those component classes that implements IAbstractDomainObject and should be extensible.

The Java Class corresponding to this component class has to be extended and this new Java Class along with the additional attributes have to be mapped in the hibernate file.

The corresponding additional columns have to be added in the domain object table in question.

19.6 Extensibility using Dictionary in Origination Application

In this section, the Application Form screen (Fast path: OR097) of the Oracle Banking Platform is taken as an example.

19.6.1 ICustomDataHandler's as DictionaryArray Interceptor

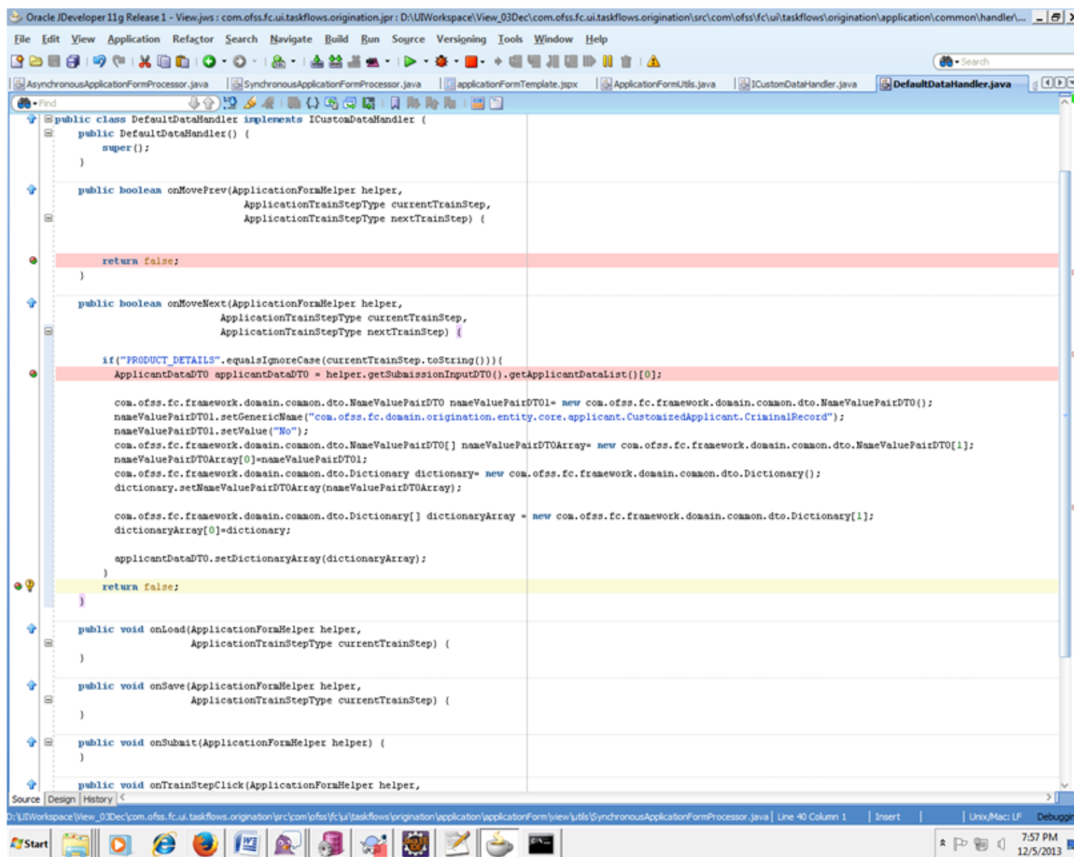
The backing bean method of OR097 - Application Form 'com.ofss.fc.ui.taskflows.origination.application.applicationForm.view.backing.Applic

ationForm.moveNext()' calls implementation of com.ofss.fc.ui.taskflows.origination.application.common.handler.ICustomDataHandler.

Implementation of com.ofss.fc.ui.taskflows.origination.application.common.handler.ICustomDataHandler can be configured in OriginationConfiguration.properties. Property name is **customDataHandler**

ApplicationFormHelper.getSubmissionInputDTO() will give the master DTO for the application form.

Figure 19–23 CustomDataHandler's as DictionaryArray Interceptor

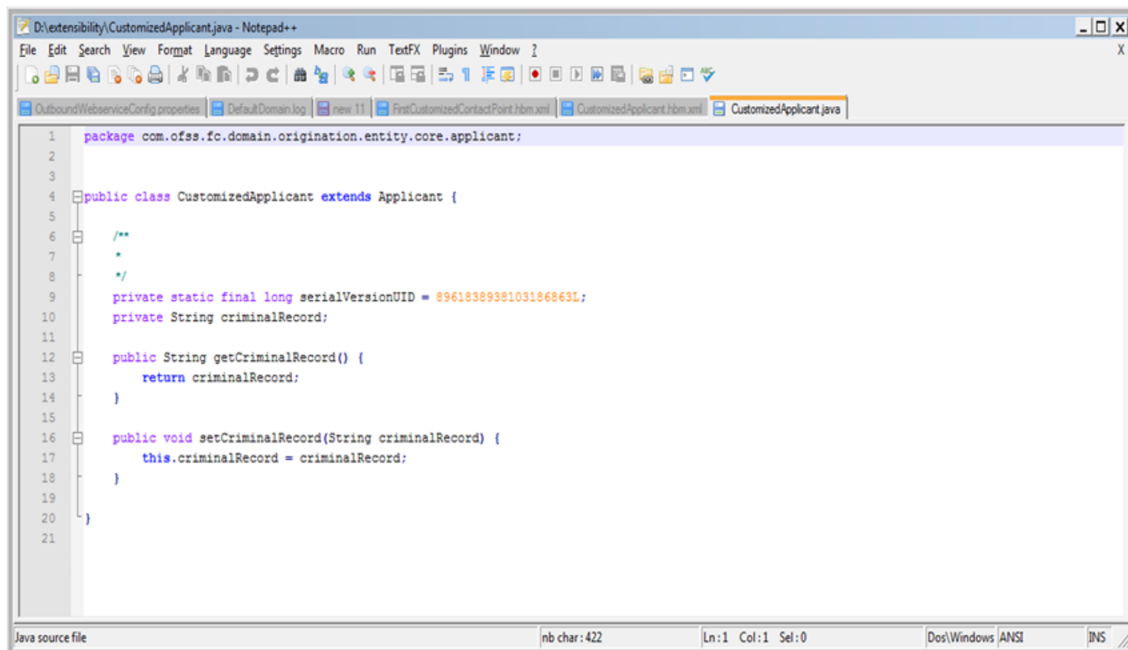


This hook should be used to populate the dictionary array of the concerned DTO at the correct stage of application form entry.

19.6.2 Create Customized Abstract Domain Object Class

A new Java File is added corresponding to the existing Abstract Domain Object. This extends the Abstract Domain Object that we are extending.

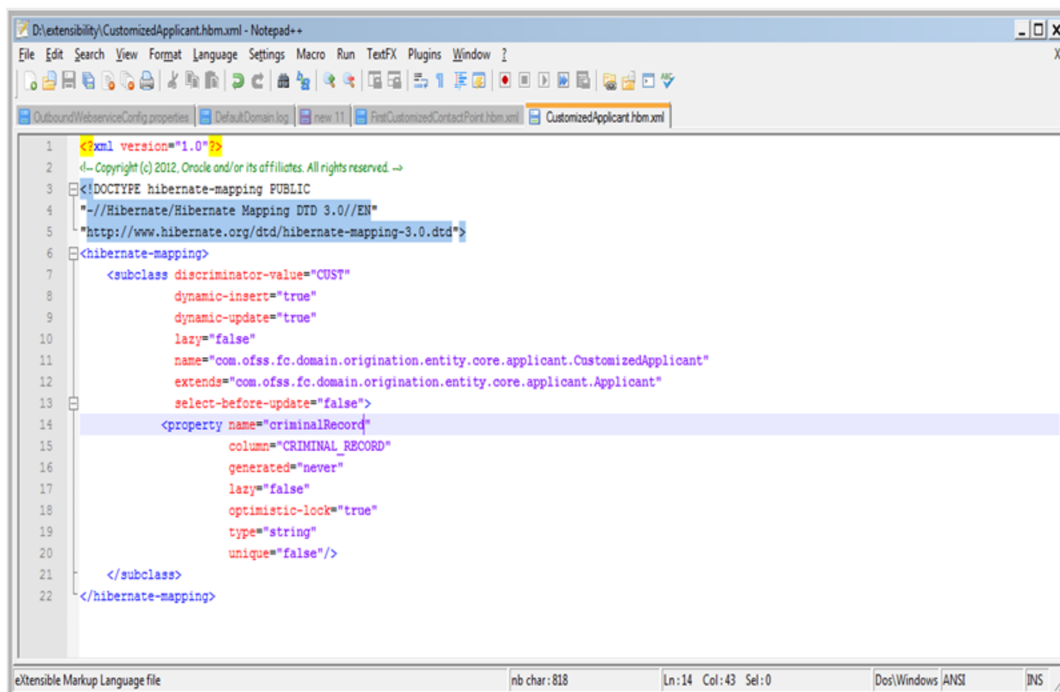
Figure 19–24 Create Customized Abstract Domain Object Class



19.6.3 Create Customized Abstract Domain Object Hibernate Mapping File

A new file hbm.xml is introduced to include the extra attributes added by consulting or any other third party along with the discriminator value. This file maps to the new customized domain object and extends the existing Abstract Domain Object.

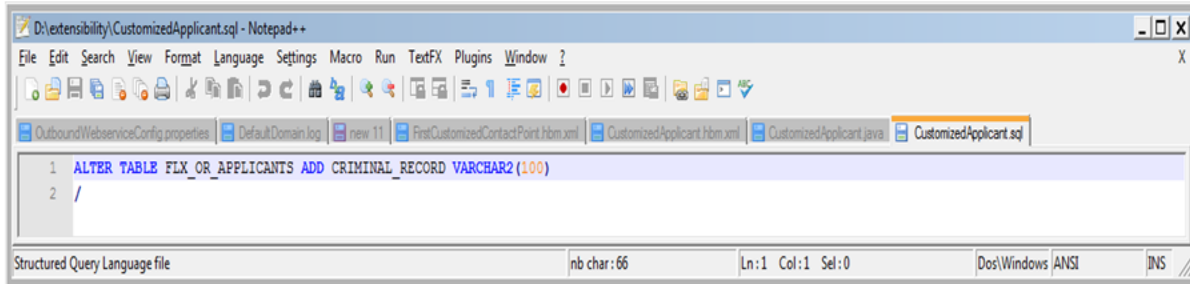
Figure 19–25 Create Customized Abstract Domain Object Hibernate Mapping File



19.6.4 Create Customized Abstract Domain Object Attribute Columns

The extra columns have to be added to the domain object table of this domain object.

Figure 19–26 Create Customized Abstract Domain Object Attribute Columns



In case of Creation or Updation of 'CustomizedApplicant' instead of 'Applicant' the existing discriminator column 'DOMAIN_OBJECT_EXTN' has the value of 'CUST' instead of 'CZ' and an additional value in column 'CRIMINAL_RECORD' in table FLX_OR_APPLICANTS.

In case of Creation or Updation of 'Applicant' the existing discriminator column 'DOMAIN_OBJECT_EXTN' has the value of 'CZ' and NULL values in column 'CRIMINAL_RECORD' in table FLX_OR_APPLICANTS.

Similarly, other DomainObjectDTO's can have their dictionary arrays populated in the ICustomDataHandler class being used and the corresponding customized domain object will get persisted instead of the usual domain object.

19.7 Extensibility using Attributes of Various Supported Datatypes

Extensibility of maintenance domain objects now supports extended attributes with all data types that have a public constructor with a single argument of data-type "String".

This includes attributes of data-type"com.ofss.fc.datatype.Date" whose "toString()" method should be invoked to set its value in NameValuePairDTO array element of Dictionary array. The value set is of the format given in root.properties file.

Additionally extensibility of maintenance domain objects is now also supporting extended attributes with enumeration data types defined in "com.ofss.fc.enumeration" project.

Here is an example of extensibility of "com.ofss.fc.domain.ep.entity.dispatch.message.MessageTemplate" using attributes of different supported datatypes.

The following customized class is created that contains the additional attributes.

Figure 19–27 Customized Message Template Class

```
package com.ofss.fc.domain.ep.entity.dispatch.message;

import com.ofss.fc.datatype.Date;
import com.ofss.fc.enumeration.ep.DestinationType;

public class CustomizedMessageTemplate extends MessageTemplate{

    private static final long serialVersionUID = 376283690240542791L;

    private Integer attributeInteger;

    private Boolean attributeBoolean;

    private String attributeString;

    private Date attributeDate;

    private DestinationType attributeEnum;

    public Integer getAttributeInteger() {
        return attributeInteger;
    }

    public void setAttributeInteger(Integer attributeInteger) {
        this.attributeInteger = attributeInteger;
    }

    public Boolean getAttributeBoolean() {
        return attributeBoolean;
    }

    public void setAttributeBoolean(Boolean attributeBoolean) {
        this.attributeBoolean = attributeBoolean;
    }

    public String getAttributeString() {
        return attributeString;
    }

    public void setAttributeString(String attributeString) {
        this.attributeString = attributeString;
    }

    public Date getAttributeDate() {
```

The following extra columns have been added in the domain object table "flx_ep_msg_tmpl_b".

Figure 19–28 Domain Object Table

Name	Type	Nullable	Default	Storage	Comments
COD_TMPL_ID	VARCHAR2(100)	☐			Indicates unique message template id
DESTINATION_TYPE	VARCHAR2(20)	☑			Indicates destination type like SMS,Email..
MSG_TMPL_NAME	VARCHAR2(100)	☑			Indicates message template name
MSG_TMPL_DESC	VARCHAR2(100)	☑			Indicates message template description
TXT_MSG_TMPL	CLOB	☑			Indicates message template buffer
CREATED_BY	VARCHAR2(64)	☑			Indicates the creator
CREATION_DATE	DATE	☑			Indicates the creation Date
LAST_UPDATED_BY	VARCHAR2(64)	☑			Indicates the approver of the transaction
LAST_UPDATE_DATE	DATE	☑			Indicates the last updated date
OBJECT_VERSION_NUMBER	NUMBER(9)	☑			Indicates the version number. Defaults to 1 for new instances.
OBJECT_STATUS	VARCHAR2(5)	☑			Indicates current status of the entity.
TXT_SUBJECT_TMPL	CLOB	☑			Indicates message for subject Buffer
DOMAIN_OBJECT_EXTN	VARCHAR2(100)	☑			
CUST_INTEGER	NUMBER(9)	☑			
CUST_BOOLEAN	VARCHAR2(5)	☑			
CUST_DATE	DATE	☑			
CUST_STRING	VARCHAR2(100)	☑			
CUST_ENUM	VARCHAR2(100)	☑			

The following hibernate file maps the customized class attributes with the table columns.

Figure 19–29 Hibernate File

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!-- Copyright (c) 2012, Oracle and/or its affiliates. All rights reserved. --><!DOCTYPE hibernate-mapping PUBLIC "-//Hibernate/Hibernate 

<hibernate-mapping auto-import="false" default-access="property" default-cascade="none" default-lazy="true">
    <subclass discriminator-value="CUST"
              dynamic-insert="true"
              dynamic-update="true"
              lazy="false"
              name="com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate"
              extends="com.ofss.fc.domain.ep.entity.dispatch.message.MessageTemplate"
              select-before-update="false">
        <property name="attributeInteger"
                  column="CUST_INTEGER"
                  generated="never"
                  lazy="false"
                  optimistic-lock="true"
                  type="int"
                  unique="false"/>
        <property name="attributeBoolean"
                  column="CUST_BOOLEAN"
                  generated="never"
                  lazy="false"
                  optimistic-lock="true"
                  type="boolean"
                  unique="false"/>
        <property name="attributeString"
                  column="CUST_STRING"
                  generated="never"
                  lazy="false"
                  optimistic-lock="true"
                  type="string"
                  unique="false"/>
        <property name="attributeDate"
                  column="CUST_DATE"
                  generated="never"
                  lazy="false"
                  optimistic-lock="true"
                  type="com.ofss.fc.datatype.Date"
                  unique="false"/>
        <property name="attributeEnum"
                  column="CUST_ENUM"
                  generated="never"
                  lazy="false"
                  optimistic-lock="true"
                  type="DestinationType"
                  unique="false"/>
    </subclass>
</hibernate-mapping>
```

The following JUnit test case has been used to test a "create" operation.

Figure 19–30 JUnit Test Case

```
@Test
public void testAddMessageTemplate() {
    String testCase = "testAdd.messageTemplateDTO.";
    MessageTemplateApplicationService applicationService = new MessageTemplateApplicationService();
    SessionContext sessionContext = getSessionContext();
    MessageTemplateDTO messageTemplateDTO = populateMessageTemplateDTO(testCase);
    try {
        deleteMessageTemplate(testCase);

        com.ofss.fc.framework.domain.common.dto.Dictionary[] dictionaryArray= new com.ofss.fc.framework.domain.common.dto.Dictionary[1];
        com.ofss.fc.framework.domain.common.dto.Dictionary dictionaryObject = new com.ofss.fc.framework.domain.common.dto.Dictionary();

        com.ofss.fc.framework.domain.common.dto.NameValuePairDTO[] nameValuePairDTOArray= new com.ofss.fc.framework.domain.common.dto.NameValuePairDTO[5];

        com.ofss.fc.framework.domain.common.dto.NameValuePairDTO nameValuePairDTO0= new com.ofss.fc.framework.domain.common.dto.NameValuePairDTO();
        nameValuePairDTO0.setGenericName("com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate.AttributeInteger");
        nameValuePairDTO0.setValue("100");
        nameValuePairDTOArray[0]=nameValuePairDTO0;

        com.ofss.fc.framework.domain.common.dto.NameValuePairDTO nameValuePairDTO1= new com.ofss.fc.framework.domain.common.dto.NameValuePairDTO();
        nameValuePairDTO1.setGenericName("com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate.AttributeBoolean");
        nameValuePairDTO1.setValue("false");
        nameValuePairDTOArray[1]=nameValuePairDTO1;

        com.ofss.fc.framework.domain.common.dto.NameValuePairDTO nameValuePairDTO2= new com.ofss.fc.framework.domain.common.dto.NameValuePairDTO();
        nameValuePairDTO2.setGenericName("com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate.AttributeString");
        nameValuePairDTO2.setValue("ABCDEFR");
        nameValuePairDTOArray[2]=nameValuePairDTO2;

        com.ofss.fc.framework.domain.common.dto.NameValuePairDTO nameValuePairDTO3= new com.ofss.fc.framework.domain.common.dto.NameValuePairDTO();
        nameValuePairDTO3.setGenericName("com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate.AttributeDate");
        Date newDate =  new Date();
        nameValuePairDTO3.setValue(newDate.toString());
        nameValuePairDTOArray[3]=nameValuePairDTO3;

        com.ofss.fc.framework.domain.common.dto.NameValuePairDTO nameValuePairDTO4= new com.ofss.fc.framework.domain.common.dto.NameValuePairDTO();
        nameValuePairDTO4.setGenericName("com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate.AttributeEnum");
        nameValuePairDTO4.setValue(com.ofss.fc.enumeration.ep.DestinationType.EMAIL.getEnumValue());
        nameValuePairDTOArray[4]=nameValuePairDTO4;

        dictionaryObject.setNameValuePairDTOArray(nameValuePairDTOArray);
        dictionaryArray[0]=dictionaryObject;
        messageTemplateDTO.setDictionaryArray(dictionaryArray);

        TransactionStatus result = applicationService.addMessageTemplate(sessionContext, messageTemplateDTO);
        assertEquals(result.getErrorCode(), FAPIErrorConstants.MID_SUCCESS);
        dumpTransactionStatus("MessageTemplateApplicationService", "testAddMessageTemplate", result);
    } catch (FatalException e) {
        dumpFatalException("MessageTemplateApplicationService", "testAddMessageTemplate", e);
        fail("Unexpected failture from " + THIS_COMPONENT_NAME + ".testAddMessageTemplate");
    }
}
```

The above JUnit runs to add the following record in the table.

Figure 19–31 JUnit Adds Table Record

Row 1	Fields
COD_TMPL_ID	Junit_Message
DESTINATION_TYPE	
MSG_TMPL_NAME	Junit message template
MSG_TMPL_DESC	Message template description via junit test cas
TXT_MSG_TMPL	<CLOB>
CREATED_BY	ofssuser
CREATION_DATE	7/8/2014 6:40:34 PM
LAST_UPDATED_BY	ofssuser
LAST_UPDATE_DATE	7/8/2014 6:40:34 PM
OBJECT_VERSION_NUMBER	1
OBJECT_STATUS	A
TXT_SUBJECT_TMPL	<CLOB>
DOMAIN_OBJECT_EXTN	CUST
CUST_INTEGER	100
CUST_BOOLEAN	0
CUST_DATE	7/8/2014 6:40:24 PM
CUST_STRING	ABCDEFR
CUST_ENUM	EMAIL

Similarly, a JUnit is run to do "fetch" operation. This fetches the customized record whose dictionary array values have been shown below.

Figure 19–32 Dictionary Array Values

```
@Test
public void testInquireMessageTemplate() {

    /*
     * Test inquiring existing Message Template.
     */
    String testCase = "testInquire.messageTemplateDTO.";
    testAddMessageTemplate();
    MessageTemplateApplicationService applicationService = new MessageTemplateApplicationService();
    SessionContext sessionContext = getSessionContext();
    MessageTemplateDTO messageTemplateDTO = populateMessageTemplateDTO(testCase);
    try {
        MessageTemplateInquiryResponse result = applicationService.fetchMessageTemplate(sessionContext, messageTemplateDTO);
        assertEquals(result.getStatus(
        dumpTransactionStatus("Message
        logger.log(Level.FINER, "The M
    } catch (FatalException e) {
        dumpFatalException("MessageTem
        fail("Unexpected failture from
    }
}

@Test
public void testUpdateforinvalidMessag
```

```
dictionaryArray= Dictionary[1]  (id=246)
  [0]= Dictionary  (id=252)
    nameValuePairDTOArray= NameValuePairDTO[5]  (id=253)
      [0]= NameValuePairDTO  (id=254)
      [1]= NameValuePairDTO  (id=255)
        datatype= null
        genericName= "com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate.AttributeBoolean" (id=265)
        name= null
        value= "false" (id=266)
      [2]= NameValuePairDTO  (id=256)
      [3]= NameValuePairDTO  (id=257)
        datatype= null
        genericName= "com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate.AttributeDate" (id=261)
        name= null
        value= "20140708184024" (id=262)
      [4]= NameValuePairDTO  (id=258)
        datatype= null
        genericName= "com.ofss.fc.domain.ep.entity.dispatch.message.CustomizedMessageTemplate.AttributeEnum" (id=259)
        name= null
        value= "EMAIL" (id=260)
com.ofss.fc.app.ep.dto.dispatch.message.MessageTemplateInquiryResponse@2afacf55
```

```
ort declarations
sageTemplateApplicationServiceTest
  THIS_COMPONENT_NAME : String
  logger : Logger
  deleteMessageTemplate(String) : voi
  generateMessageTemplateDTO(Strir
  populateMessageTemplateDTO(Strir
  populateDataAttributeDTO(String, in
  populateDataAttributeSourceDTO(St
```

```
sole  Tasks  JUnit  History  Progre
eReportServiceTest.testInquireAdhocReportParameters [J
   transactio0_.channel_id as channel16_700_
   transactio0_.service_id as service17_700_
rom
   flx_cs_ext_txn_xref transactio0_
here
   transactio0_.REF_TXN_NO=?
nate:
nsert
nto
   flx_cs_ext_txn_xref
   (DAT_POST, DAT_LOG, ref_usr_no, DAT_TXN,
alues
```

20 Deployment Guideline

This chapter explains the deployment guidelines.

20.1 Customized Project Jars

The customized extension projects are to be bundled in the different extensibility jars which are required to be added in the extensibility.

20.2 Database Objects

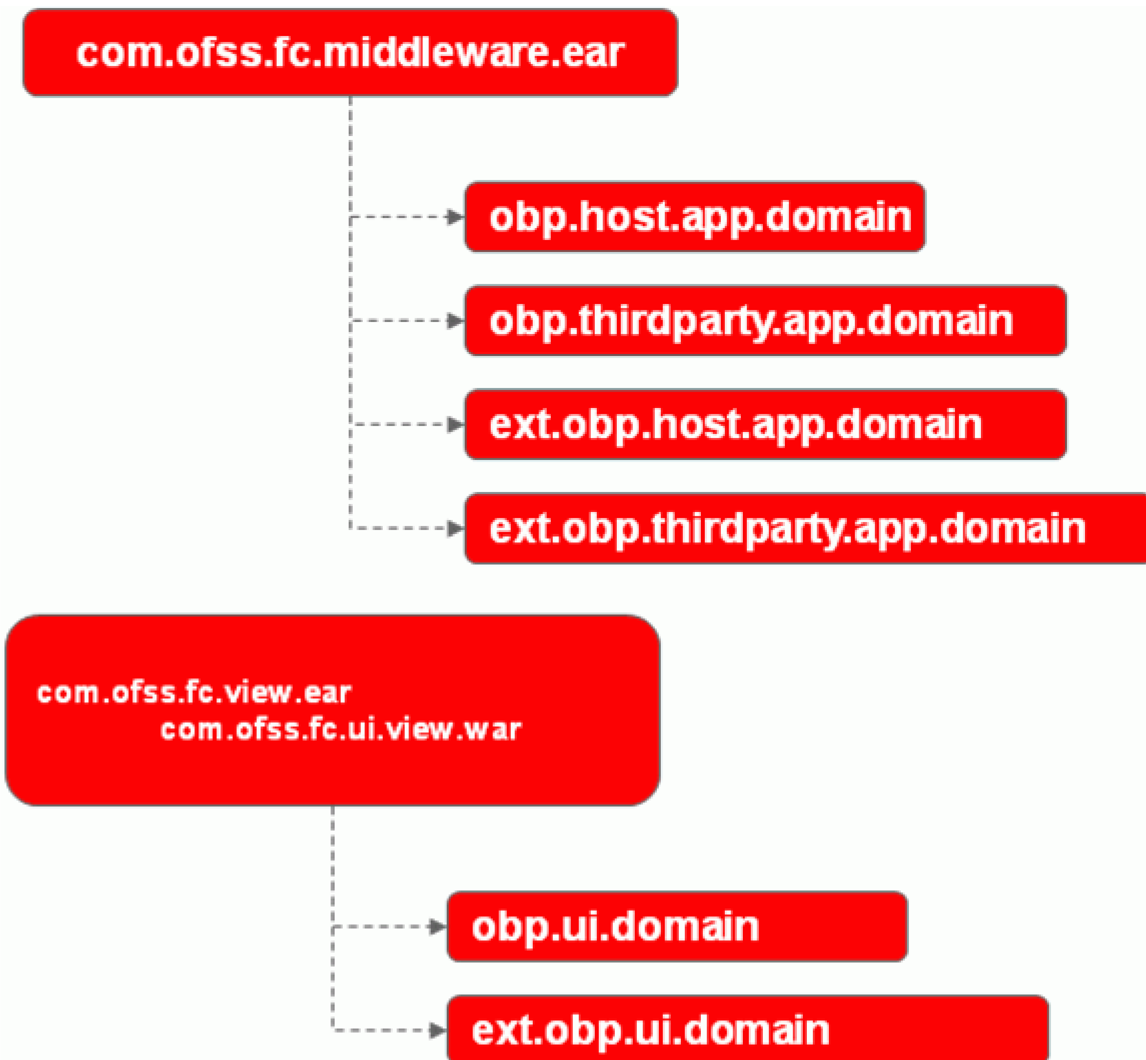
User has to update the corresponding seed data for the implementation of different extensibility features.

20.3 Extensibility Deployment

The new customized extensibility jars will be added in the extensibility libraries as ext.obp.host.domain for the host middleware layer, ext.obp.ui.domain for UI or presentation layer and ext.obp.soa.domain for the SOA layer. These extensibility application libraries will be packaged and shipped as the separate library folders along with the original library folders so that the extensibility feature can be added.

The OBP deployed applications shall reference these libraries so that customization jars included into these get automatically referenced in the corresponding EAR and WAR files.

Figure 20–1 Extensibility Deployment



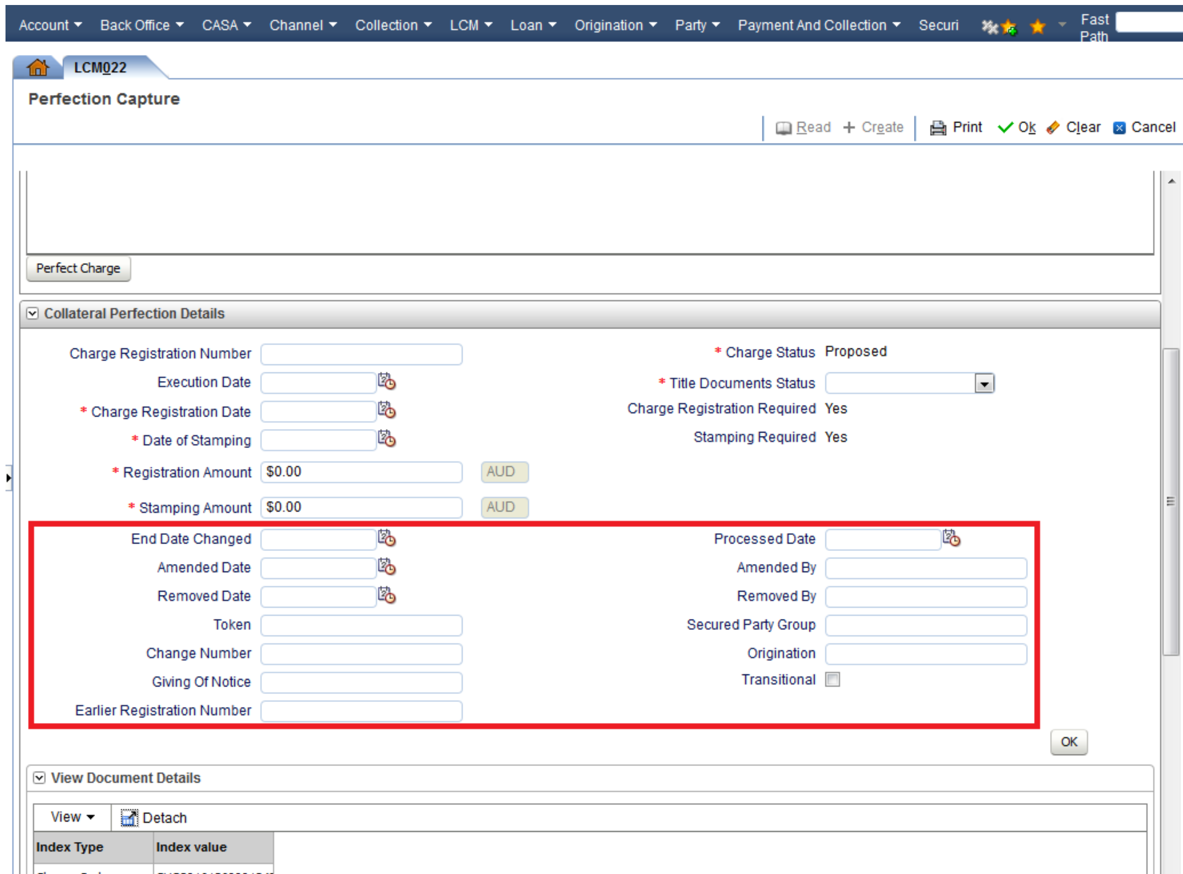
21 Extensibility Usage – OBP Localization Pack

OBP shall be releasing localization pack which ensures an optimized implementation period by adapting the product to different regions by implementing common region specific features pre-built and shipped. Every bank in different regions have different tax laws, different financial policies and so on. The policies in US will be different from those in Australia.

The localization packs leverage OBP extensibility to incorporate regional features and requirements by implementing different extension hooks for host and / or different JDeveloper customization functionalities for UI layer. This section presents a use case from OBP localization pack as implemented using the extensibility guidelines as a sample which can be referred to and followed as a guideline. Customization developers can implement bank's specific requirements on similar lines.

For example, in LCM022 'Perfection Capture' screen, the details section is shown with the additional fields which are defined for a particular location.

Figure 21–1 Perfection Capture Screen



21.1 Localization Implementation Architectural Change

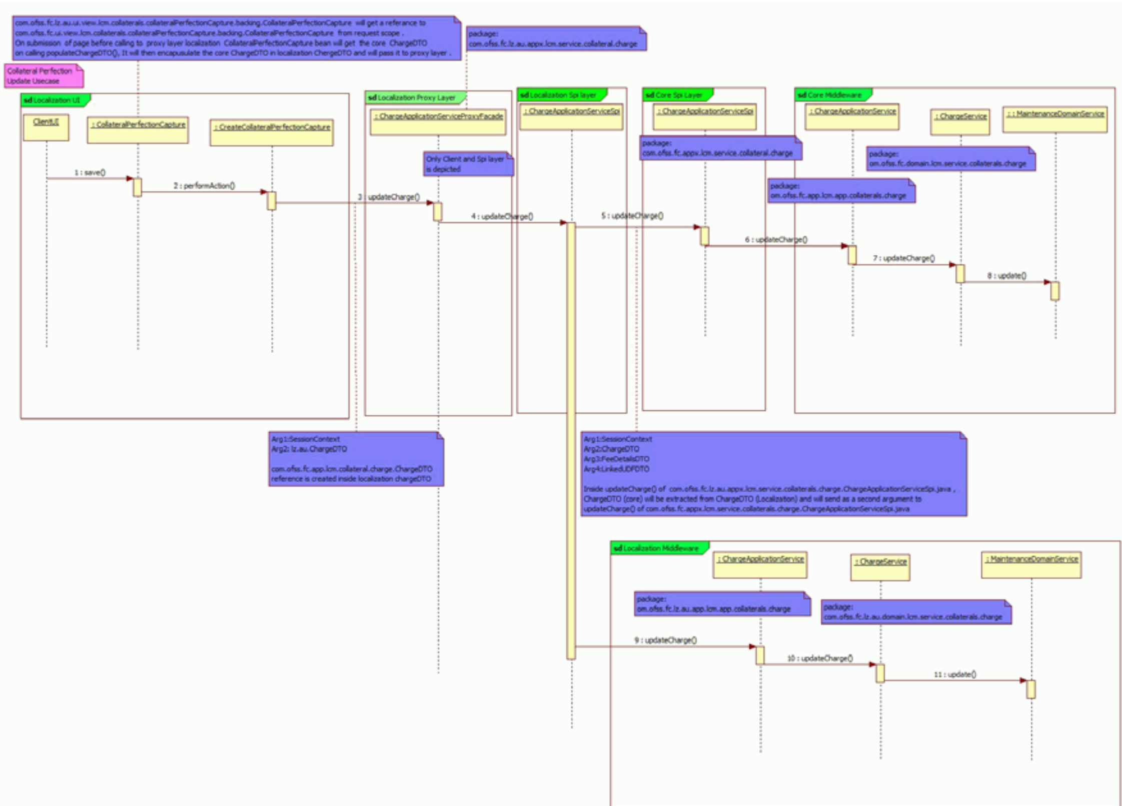
Architecturally, the following points are considered:

- Localization package will be over and above the product
- Customization packages will be over the Localization and the Product.
- Any changes done for Localization should ensure that future product changes as well as customization changes will work seamlessly without any impact.

The additional fields which get identified and developed as part of localization requirements are in its own project, package, configuration, constant files and tables.

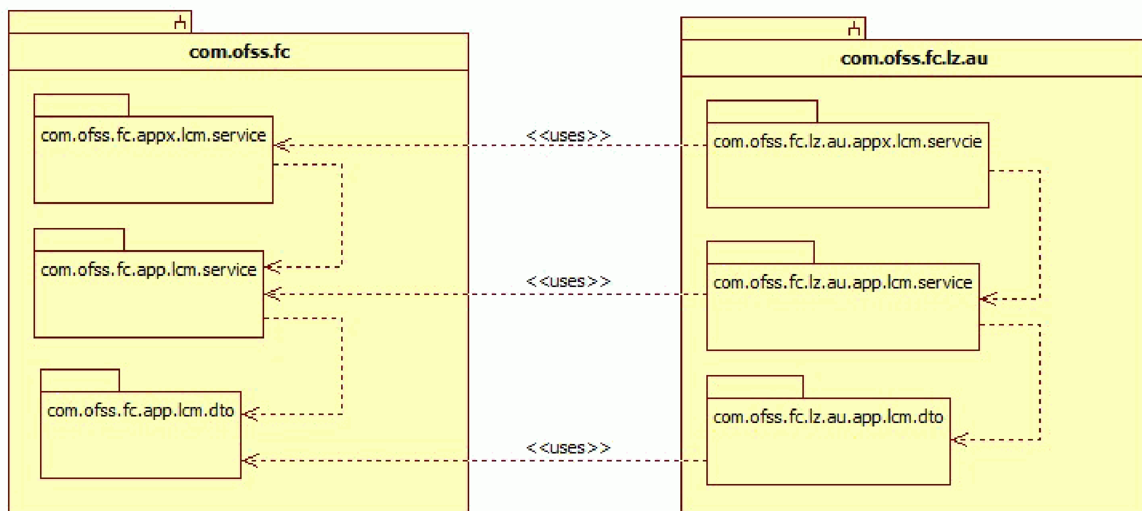
For example, the typical flow of the above mentioned perfection attributes added as part of localization requirement is shown below:

Figure 21–2 Localization Implementation Architectural Change



The Package structure for the implementation is shown below:

Figure 21–3 Package Structure



21.2 Customizing UI Layer

This section explains the customization of UI layer.

21.2.1 JDeveloper and Project Customization

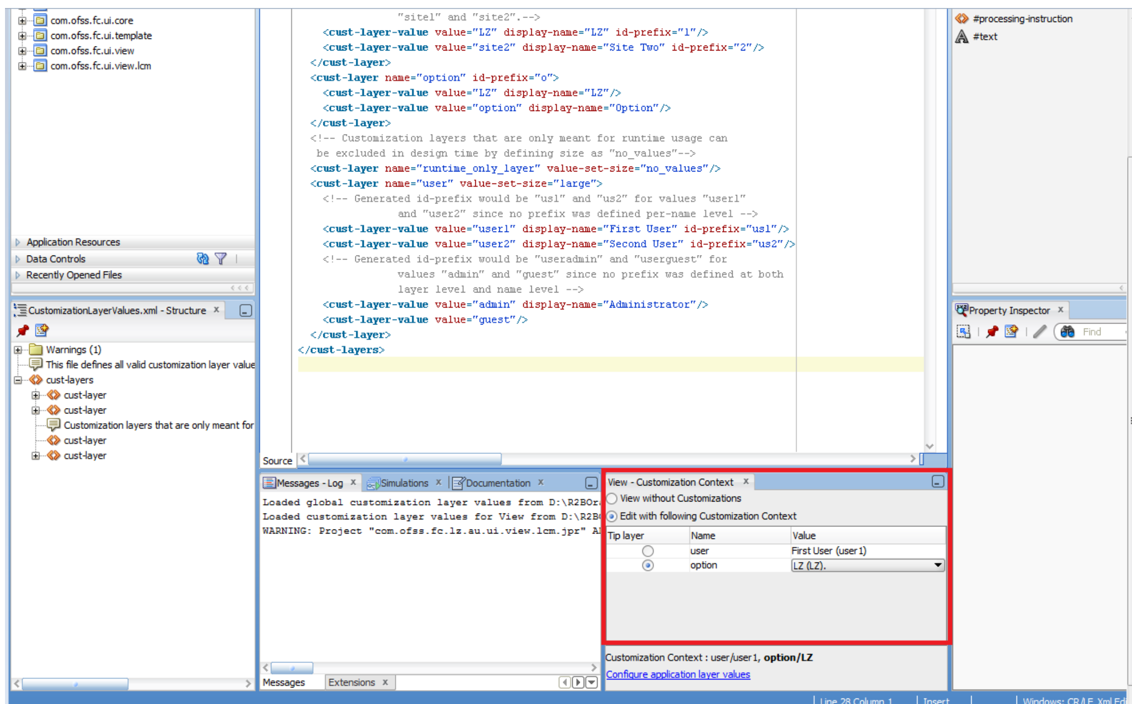
For the customization of the UI layer, JDeveloper needs to be configured in the customizable mode as explained in the ADF Screen Customization Sections.

The example for the customization of the JDeveloper is described below:

Figure 21–4 Customization of the JDeveloper

```
<!--This file defines all valid customization layer values for use in Customization Role for this application. This file completely overrides layer values configured at glo
<cust-layers xmlns="http://xmlns.oracle.com/mds/dt">
  <cust-layer name="site" id-prefix="s">
    <!-- Generated id-prefix would be "s1" and "s2" for values
              "site1" and "site2".-->
    <cust-layer-value value="LZ" display-name="LZ" id-prefix="1"/>
    <cust-layer-value value="site2" display-name="Site Two" id-prefix="2"/>
  </cust-layer>
  <cust-layer name="option" id-prefix="o">
    <cust-layer-value value="LZ" display-name="LZ"/>
    <cust-layer-value value="option" display-name="Option"/>
  </cust-layer>
   be excluded in design time by defining size as "no_values"-->
  <cust-layer name="runtime_only_layer" value-set-size="no_values"/>
  <cust-layer name="user" value-set-size="large">
    <!-- Generated id-prefix would be "us1" and "us2" for values "user1"
              and "user2" since no prefix was defined per-name level -->
    <cust-layer-value value="user1" display-name="First User" id-prefix="us1"/>
    <cust-layer-value value="user2" display-name="Second User" id-prefix="us2"/>
    <!-- Generated id-prefix would be "useradmin" and "userguest" for
              values "admin" and "guest" since no prefix was defined at both
              layer level and name level -->
    <cust-layer-value value="admin" display-name="Administrator"/>
    <cust-layer-value value="guest"/>
  </cust-layer>
</cust-layers>
```

Figure 21–5 Customization Context in Customization Developer Role



adf-config.xml

If the changes are not reflecting, adf-config.xml needs to be opened from the application resources and *Configure Design Time Customization layer values* highlighted in the below image needs to be clicked. It will create a CustomizationLayerValues.xml inside MDS DT folder in application resources. All the content from *<JDEVELOPER_HOME>/jdeveloper/jdev/CustomizationLayerValues.xml* needs to be copied to this CustomizationLayerValues.xml. This is to ensure that the changes are reflected at the application level.

Figure 21–6 Configure Design Time Customization layer

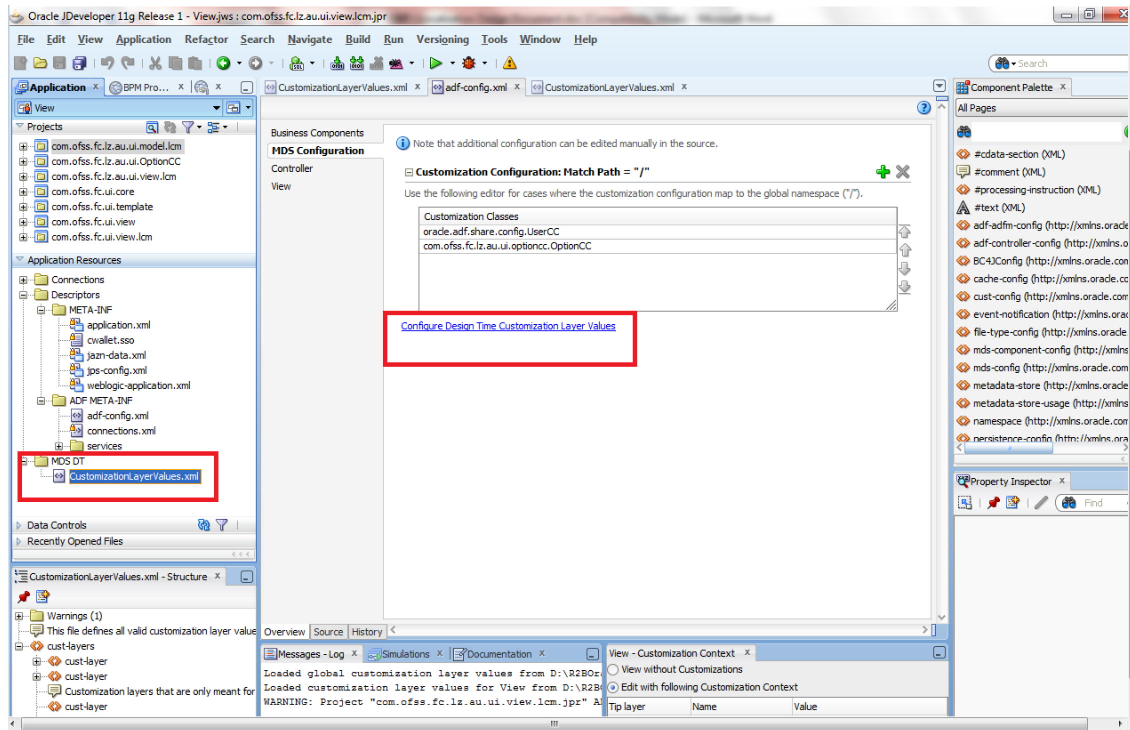
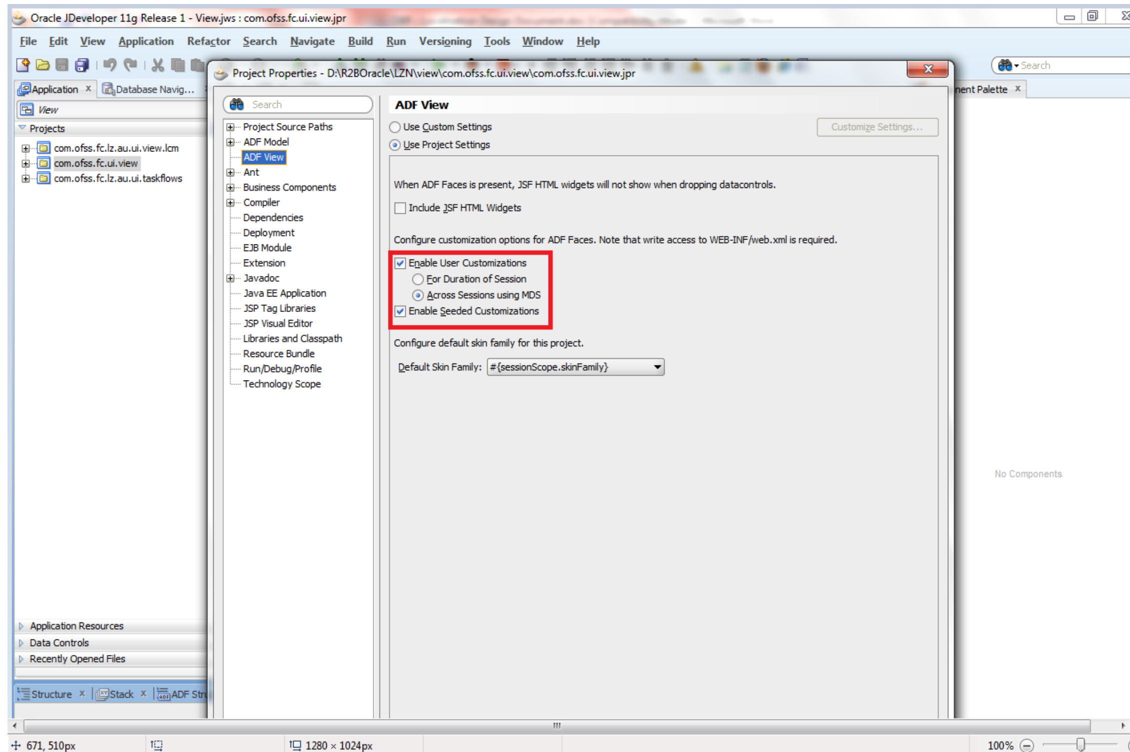


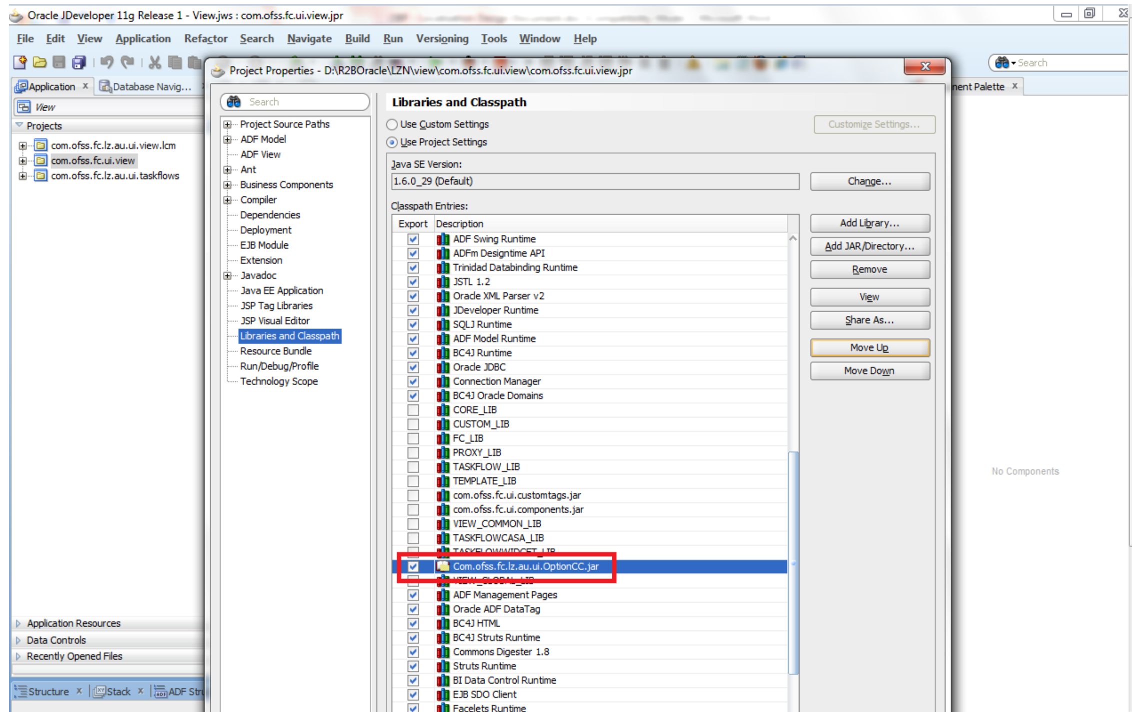
Figure 21–7 Enabling Seeded Customization



Libraries and Classpath

In the "*Libraries and Classpath*" section, the previously deployed *com.ofss.fc.lz.au.ui.OptionCC.jar* containing the customization class then needs to be added.

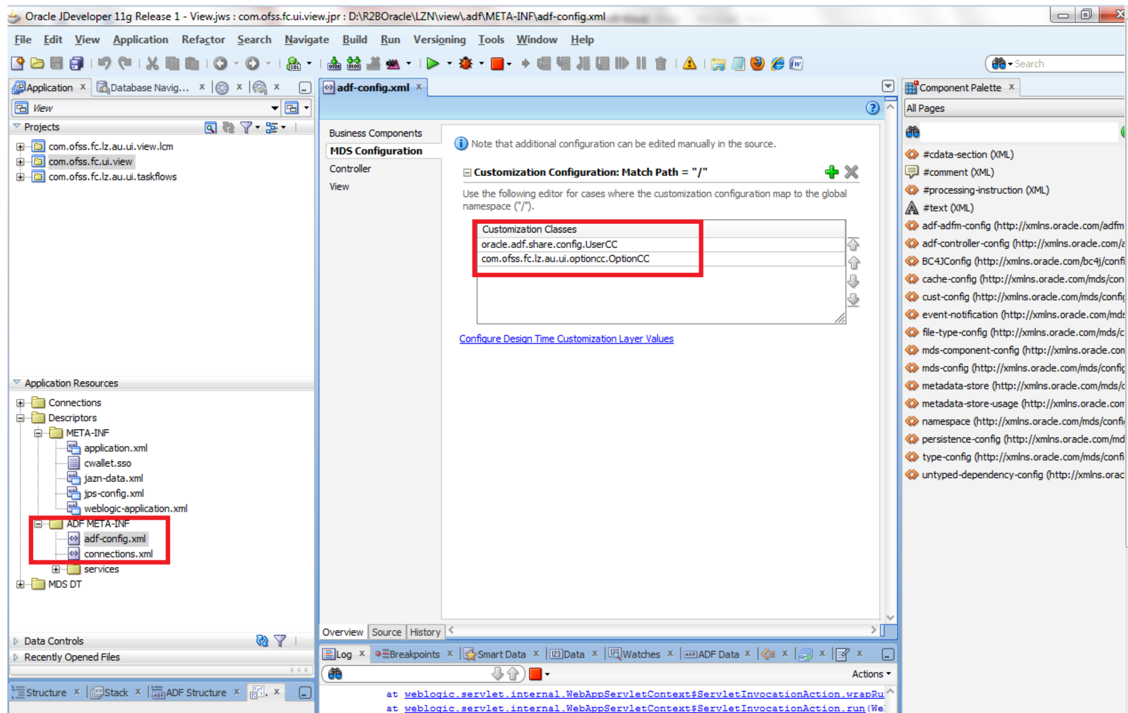
Figure 21–8 Library and Class Path



adf-config.xml

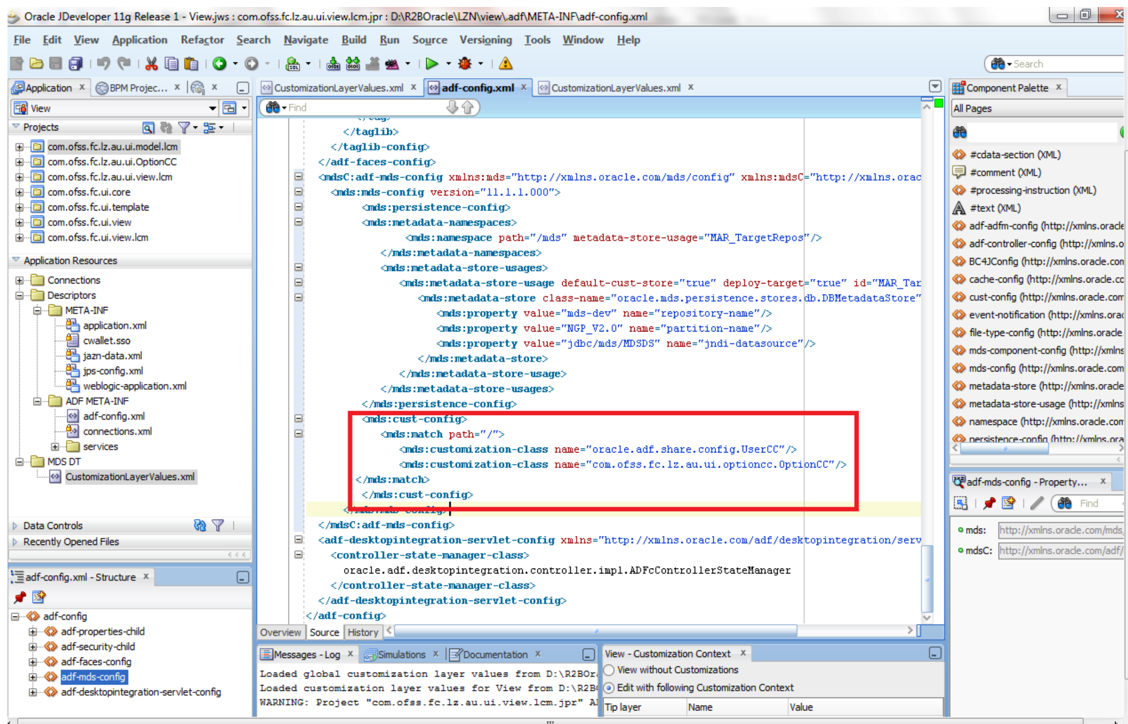
In the *Application Resources* tab, the *adf-config.xml* present in the *Descriptors/ADF META-INF* folder needs to be opened. In the list of *Customization Classes*, all the entries should not be removed and the *com.ofss.fc.lz.au.ui.OptionCC.OptionCC* class to this list needs to be added.

Figure 21–9 MDS Configuration



Jdeveloper is then restarted and the entry needs to be checked for *com.ofss.fc.lz.au.ui.OptionCC*. If the jar entry is not reflecting, then source needs to be clicked and the entry as highlighted and shown in the below image needs to be manually added.

Figure 21–10 Manually Add entries



21.2.2 Generic Project Creation

After creating the Customization Layer, Customization Class and enabling the application for Seeded Customizations, the next step is to create a project which will hold the customizations for the application. Generic project is then created with the following technologies:

- ADF Business Components
- Java
- JSF
- JSP and Servlets

Following jars must then be added to the Project Properties and in the classpath:

- Customization class JAR (com.ofss.fc.lz.au.ui.OptionCC.jar)
- The project JAR which contains the screen / component to be customized. For example, if you want to customize the Collateral Perfection Capture screen, the related project JAR is *com.ofss.fc.ui.view.lcm.jar.*
- All the dependent JARS / libraries for the project needs to added.
- Finally newly created project (example: *'com.ofss.fc.lz.au.view.lcm'*) needs to be enabled for Seeded Customizations.

21.2.3 MAR Creation

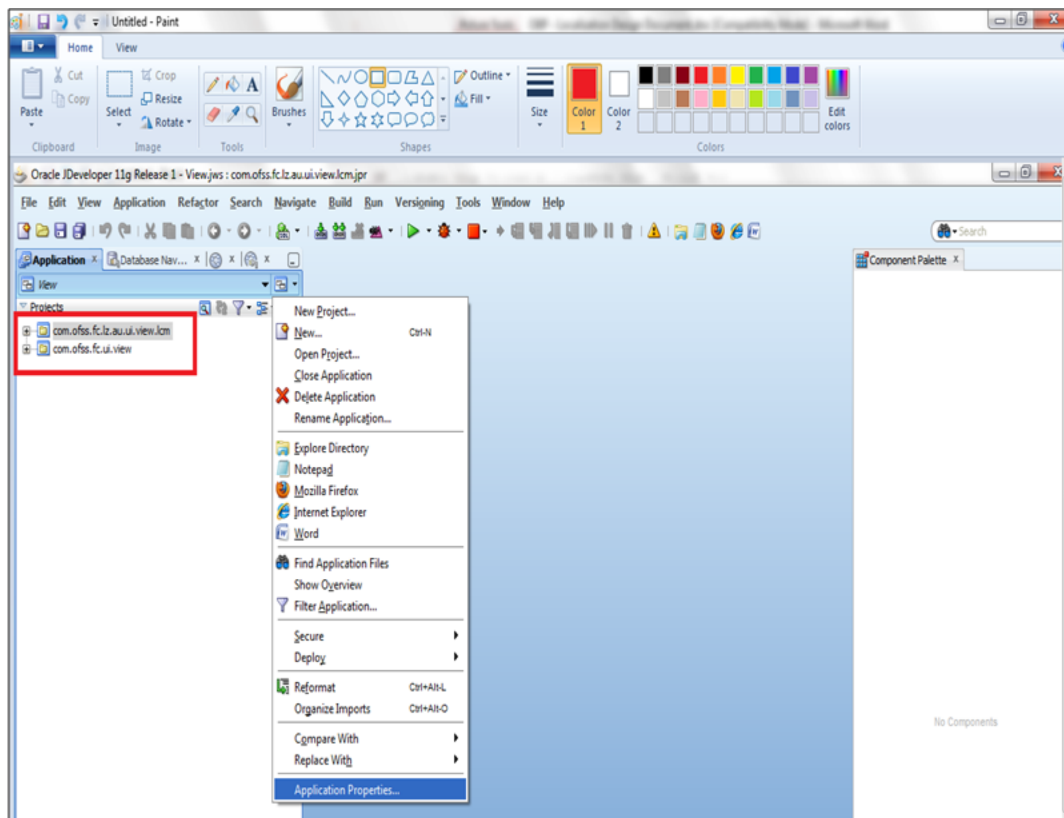
After implementing customizations on objects from an ADF library, the customization metadata is stored by default in a subdirectory of the project called *libraryCustomizations*. Although ADF library customizations at the project level is created and merged together during packaging to be available at the application level at runtime. Essentially, ADF libraries are JARs that are added at the project level, which map to library customizations being created at the project level. However, although projects map to web applications at runtime, the MAR (which contains the library customizations) is at the EAR level, so the library customizations are seen from all web applications.

Therefore, an ADF library artifact are customized in only one place in an application for a given customization context (customization layer and layer value). Customizing the same library content in different projects for the same customization context would result in duplication in MAR packaging. To avoid duplicates that would cause packaging to fail, customizations are implemented for a given library in only one project in your application.

Step 1

Select the Application Properties.

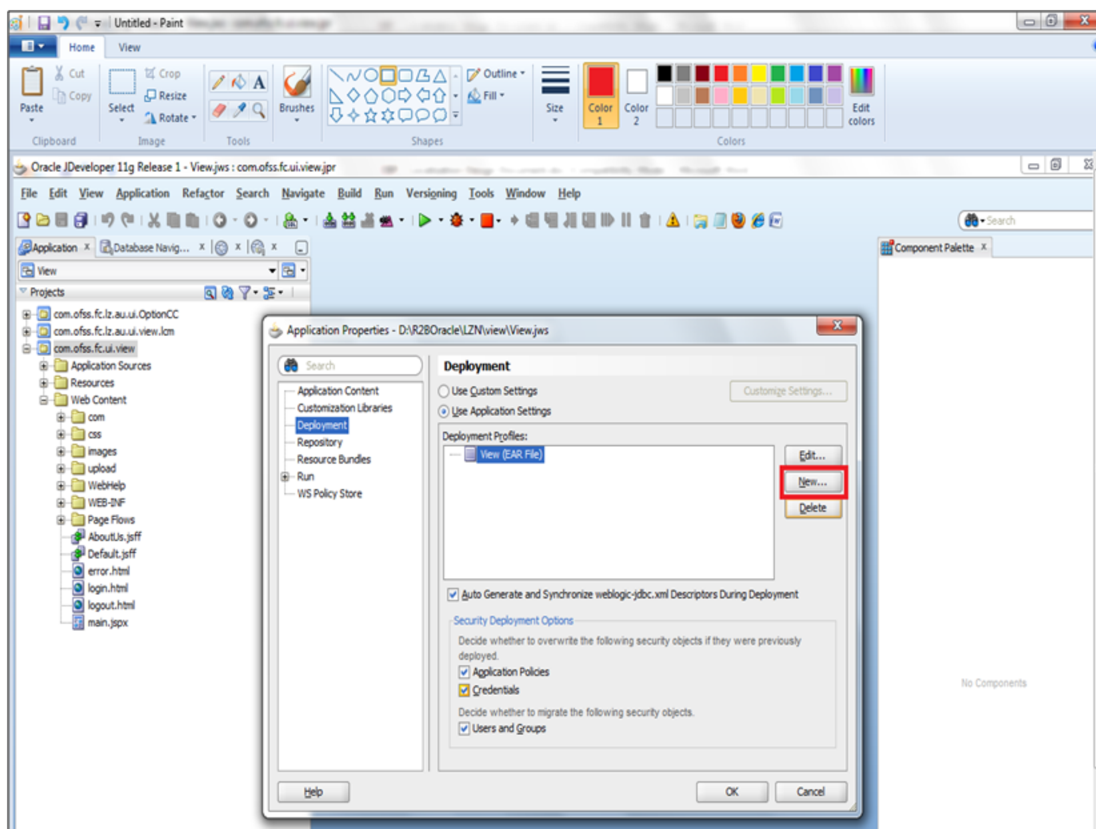
Figure 21–11 MAR Creation



Step 2

Import com.ofss.fc.lz.au.ui.view.lcm project into application. Click Application Menu and select Application Properties.

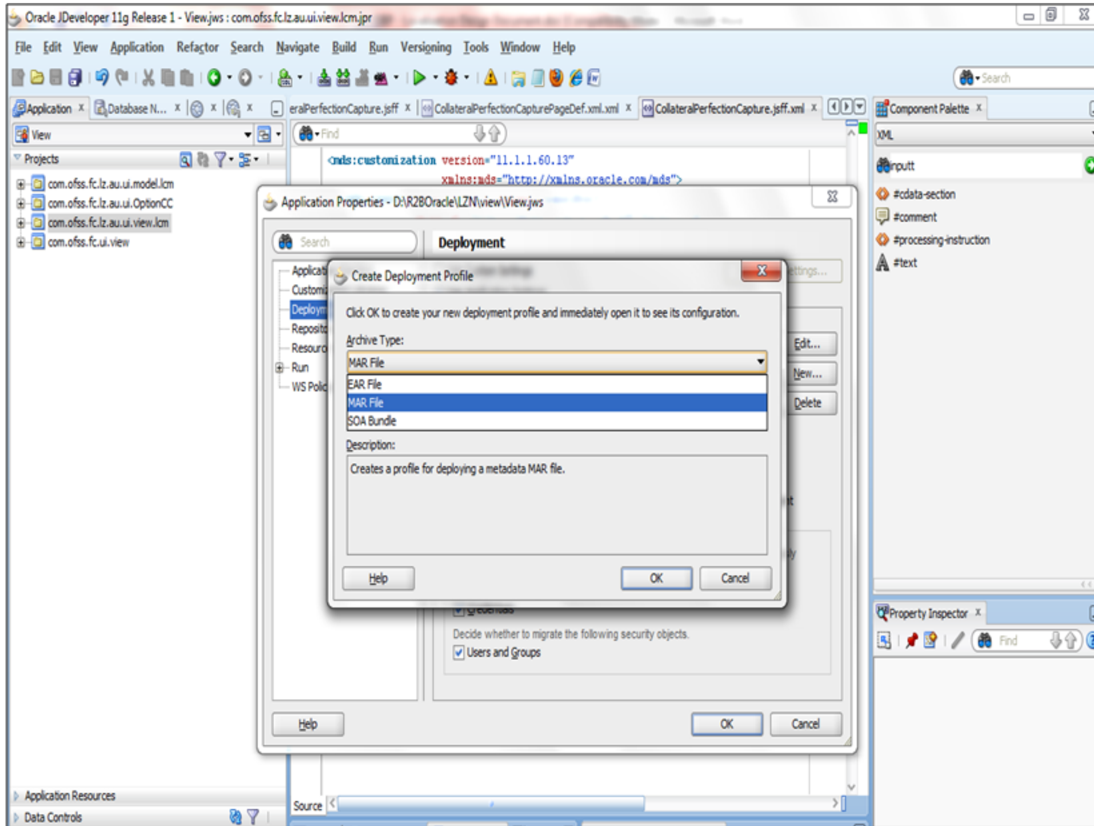
Figure 21–12 MAR Creation - Application Properties



Step 3

Select Deployment and click **New**.

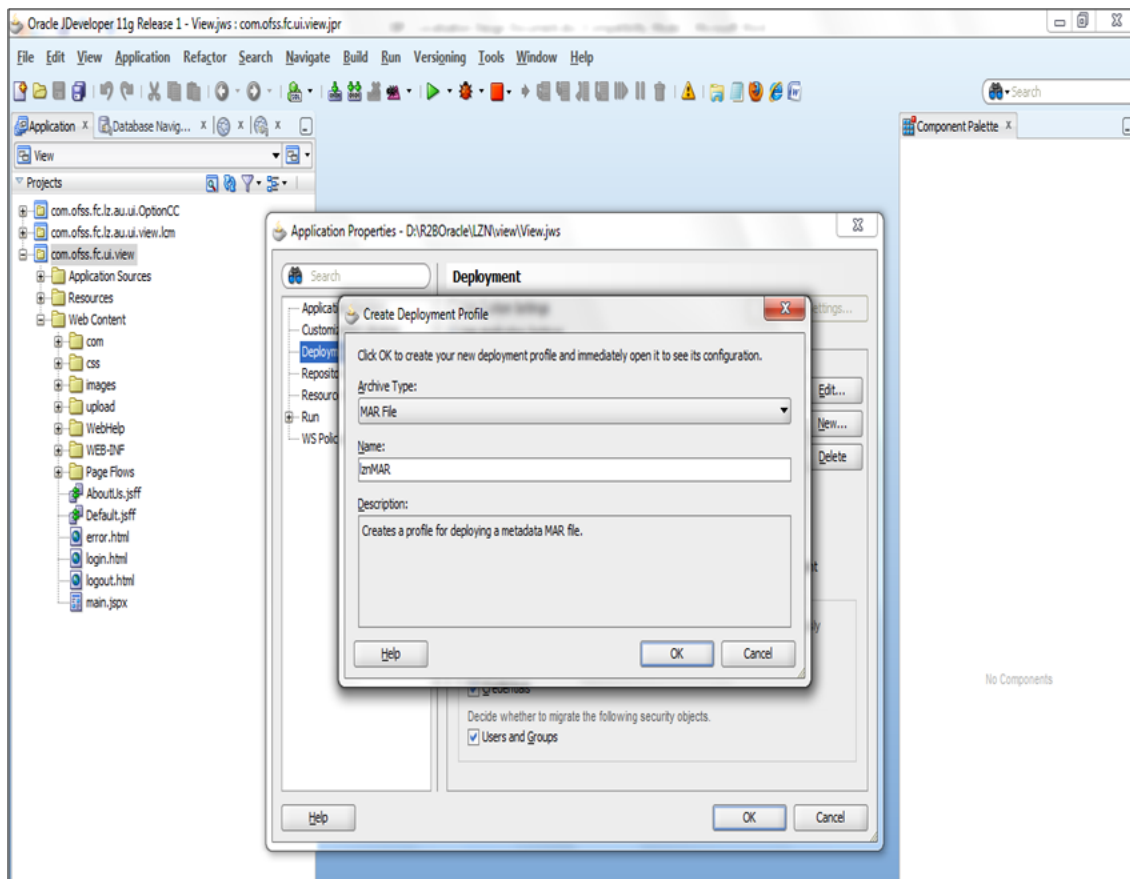
Figure 21–13 MAR Creation - Create Deployment Profile



Step 4

Select the MAR File option.

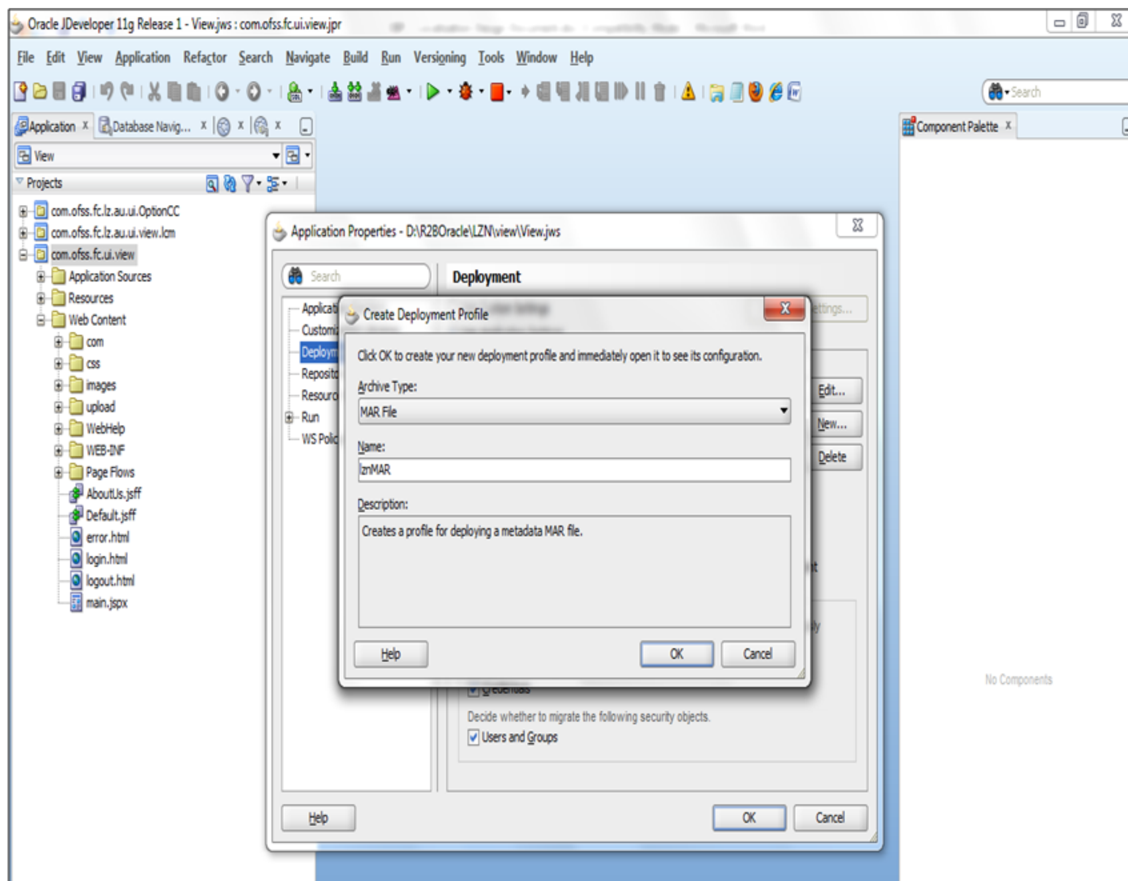
Figure 21–14 MAR Creation - MAR File Selection



Step 5

Select MAR from Archive Type and give a name ending with MAR and click **Ok**.

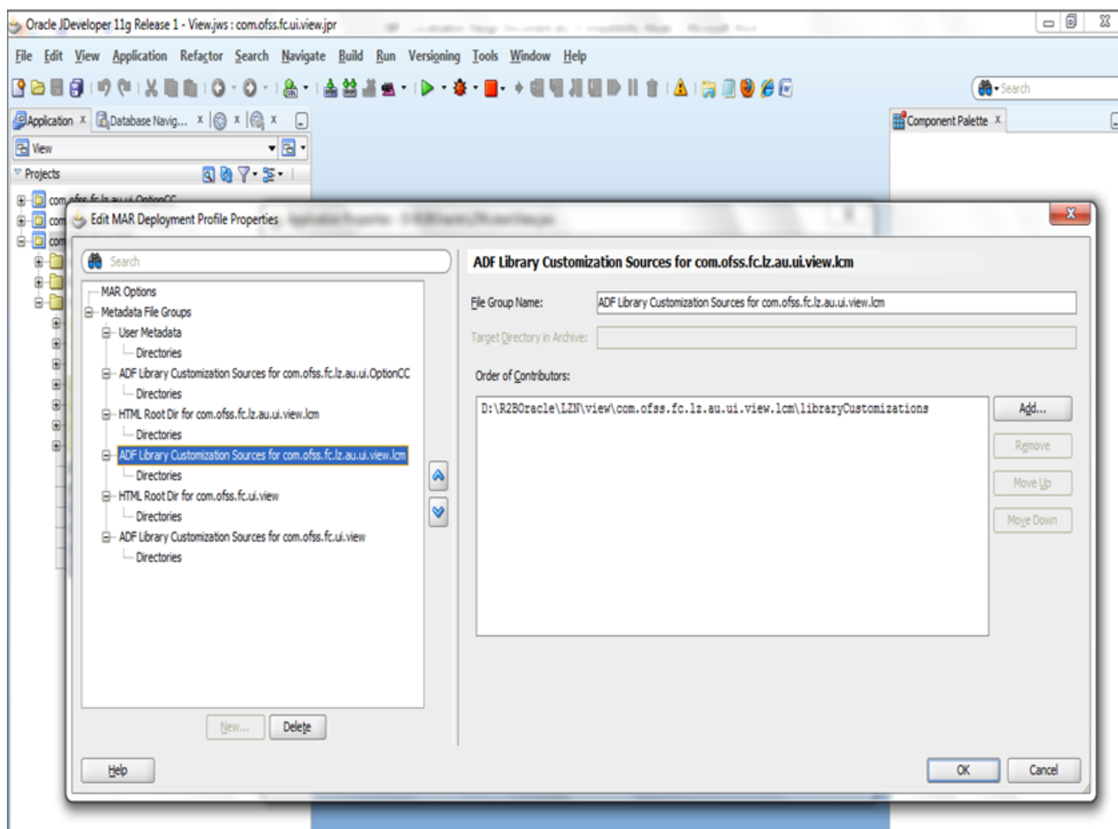
Figure 21–15 MAR Creation - Enter Details



Step 6

Select the ADF Library Customization for com.ofss.fc.lz.au.ui.view.lcm.

Figure 21–16 MAR Creation - ADF Library Customization



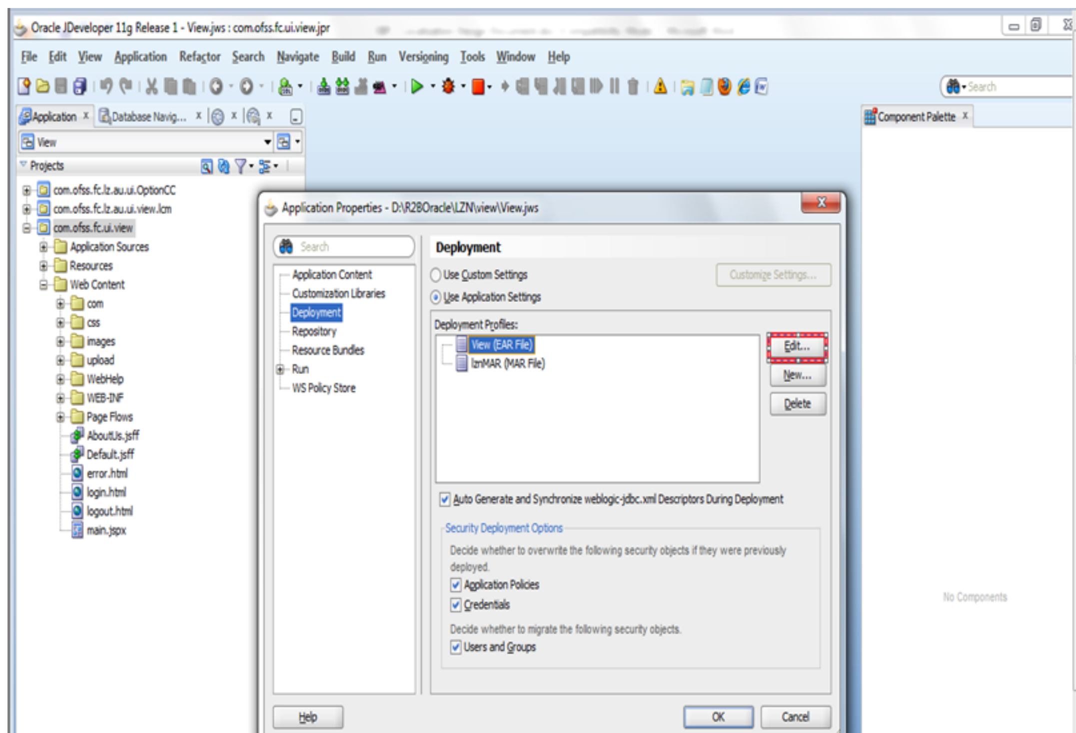
Step 7

Select the project for which Library Customization will be included in MAR (com.ofss.fc.lz.au.ui.view.lcm) and click **OK.**

Step 8

Select View (EAR File) and click Edit.

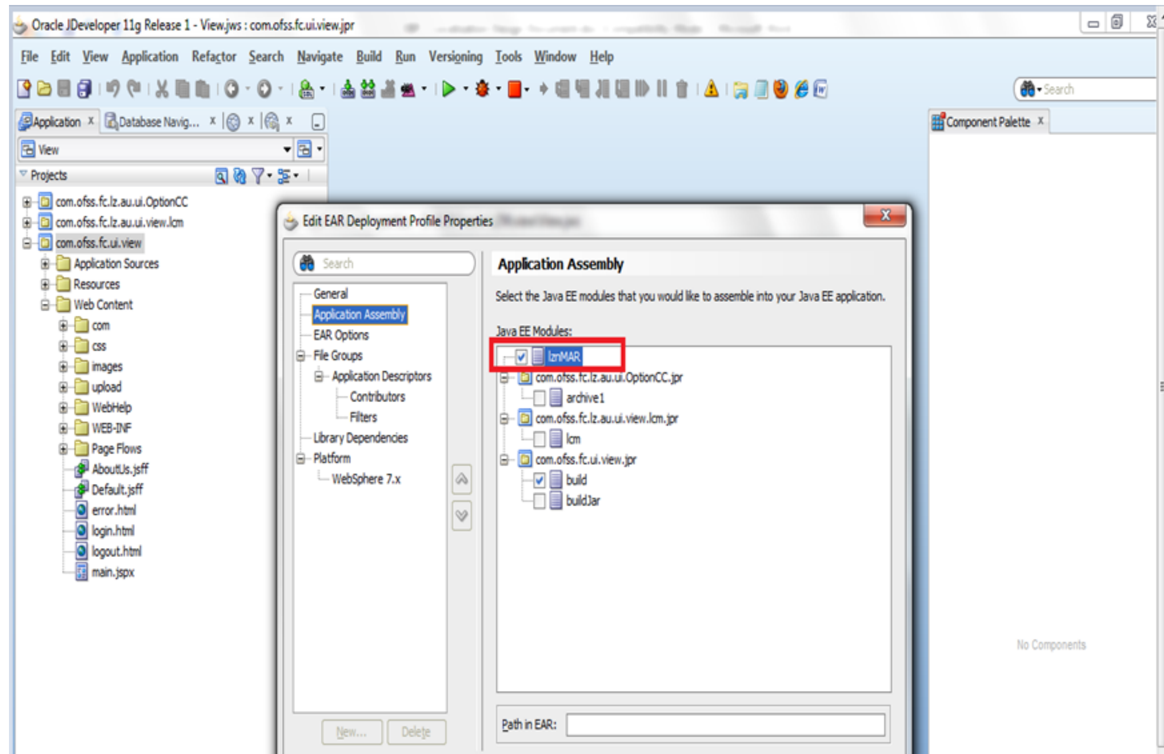
Figure 21–17 MAR Creation - Edit File



Step 9

Select Application Assembly and check the created MAR (lznMAR) and click ok on defaults.

Figure 21–18 MAR Creation - Application Assembly



21.3 Source Maintenance and Build

This section describes the source maintenance and build details.

21.3.1 Source Check-ins to SVN

Along with UI and middleware source maintenance, there is a set of metadata files required to be packaged in the deployable packages in order for customization. When performing any changes to a product screen in "customization mode" the corresponding <screen filename>.xml gets generated. In case of taskflows, the metadata file is <page definition filename>.xml. The path structure is provided in the below table.

Table 21–1 Path Structure

For page definition	
File name (with path)	adfmsrc/com/ofss/fc/ui/view/lcm/collaterals/collateralPerfectionCapture/pageDefn/CollateralPerfectionCapturePageDef.xml
Meta-data file name (with path)	com\ofss\fc\ui\view\lcm\collaterals\collateralPerfectionCapture\pageDefn\mdssys\cust\option\LZ\CollateralPerfectionCapturePageDef.xml.xml
For Screens	
File name (with path)	com/ofss/fc/ui/view/lcm/collaterals/collateralPerfectionCapture/form/CollateralPerfectionCapture.jsff
Meta-data file name (with path)	com\ofss\fc\ui\view\lcm\collaterals\collateralPerfectionCapture\form\mdssys\cust\option\LZ\CollateralPerfectionCapture.jsff.xml

These meta-data sources are checked into the METADATA folder in the product SVN under the localization path. During deployment, the EAR implementing these customizations must include these above mentioned sources in a .mar file.

21.3.2 .mar files Generated during Build

The localization specific build will include a last step, which is creation of .mar (metadata archive) file from the files checked-in the METADATA folder. This step will create separate .mar files, based on the modules which these represent. These MAR files are then packaged inside the deployable application EAR (com.ofss.fc.ui.view.ear).

Typical mar files generated during build will follow the naming convention com.ofss.fc.lz.au.ui.view.<module>.mar. Example, com.ofss.fc.lz.au.ui.view.pc.mar

21.3.3 adf-config.xml

adf-config.xml stores design time configuration information. The cust-config section (under mds-config) in the file contains a reference to the customization class. As part of the build activity, this file needs to be placed in the path com.ofss.fc.ui.view.ear@/adf/META-INF/. Also the customization class should be available in the classpath during deployment.

21.4 Packaging and Deployment of Localization Pack

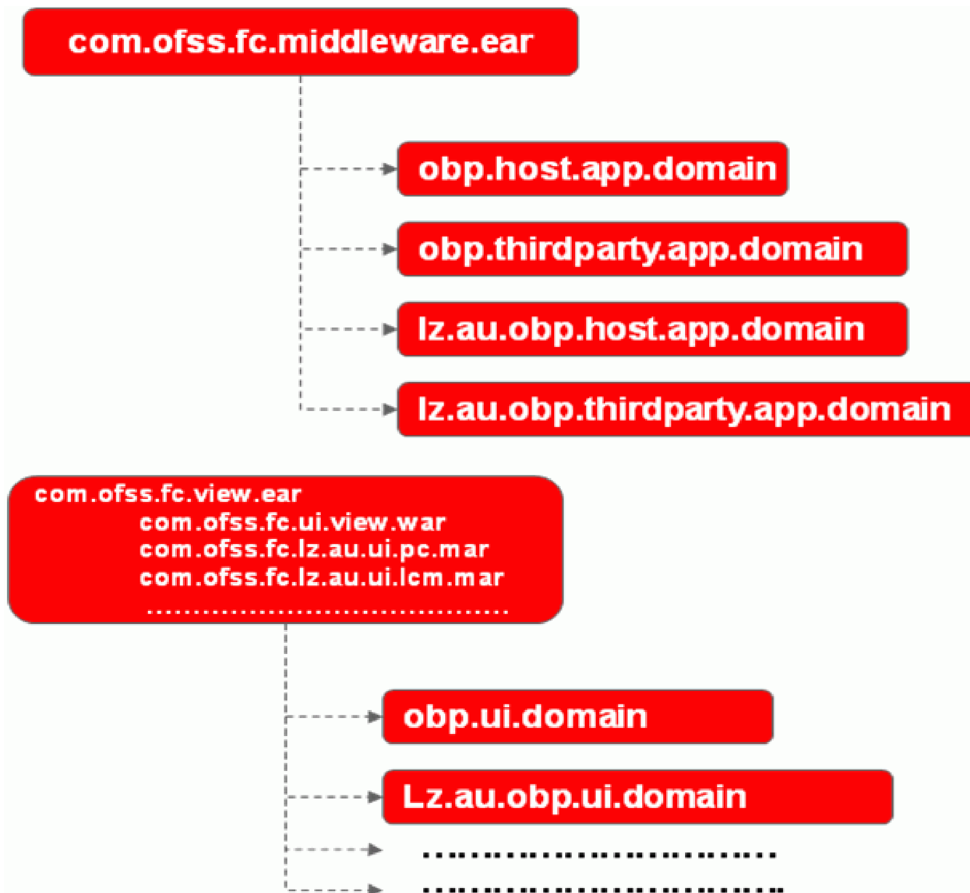
In the OBP application, different projects will be shipped in the form of library jars which can be customized and the new localization-specific application libraries can be created. In the application, the assembly has been specifically modularized to take care of multiple localizations by prevention of mix-up of jars. The naming convention for the jars can be defined for different clients differently.

The new customized jars for hosts and UI needs to be packed with the original jars in the EAR files which will be deployed on the server. Let's say, we are creating the extension hooks of 'obp.host.app.domain' jar, then the separate jars can be defined as 'lz.au.obp.host.app.domain' and 'lz.us.obp.host.app.domain' for Australia and US respectively.

The similar structure can also be maintained for the other applications across UI and SOA channels. 'lz.au.obp.ui.domain' can be defined for the customized jar of the project 'obp.ui.domain'.

The new customized jars for hosts and UI are packed below with the original jars in the EAR files which will be deployed on the servers.

Figure 21–19 Package Deployment



22 OCH Integration

This chapter describes how additional information can be added to an Oracle Customer Hub (henceforth mentioned as OCH) publish request. Publishing additional information can be required base on the client requirements, and hence OBP Integration adapters and assemblers need to be extended for such additional informations. Integration adapters are used for gathering data related to a customer, which is further used by assemblers to map OBP DTO to AIA Enterprise Business Objects (henceforth mentioned as EBOs).

OBP OCH integration involves the following steps:

1. Fetching all the data related to customer depending on the use case
2. Conversion of OBP DTO to AIA EBOs
3. Posting the EBO to AIA queue using Asynch JMS protocol

Integration adapters are invoked from the post hook of application service extensions. After the successful execution of the use case, adapters further call Integration assemblers for conversion of DTO to EBO.

After conversion, adapters post the serialized EBO request to AIA queue using Integration strategy, which is fetched on the basis of use case.

A few examples of Integration strategies are as follows:

- **AsyncFireForgetIntegrationStrategyJMS**: It is used in use cases where a response is not expected from OCH. Integration use cases involving creation/updation of customer information use this strategy.
- **SyncIntegrationStrategy**: It is used where a response is required from OCH. Uses cases, like Party Search or Party Deduplication where customer information is fetched from OCH, use this strategy.

A few examples of Integration adapters are:

- **UpdatepartyAdapter**: It is used for populating customer information.
- **ChangeAccountTitleAdapter**: It is used in use cases where customer's account information is to be published to OCH.

A few examples of Integration assemblers are:

- **UpdatePartyAssembler**: It is invoked from UpdatepartyAdapter and maps customer information to EBO attributes.
- **CreateAccountAssember**: It is invoked from ChangeAccountTitleAdapter and maps customer's account information to respective EBO attribute.

22.1 Integration Adapter Interface

OBP framework contains an interface, IIntegrationAdapter which provides two basic methods for OCH integration.

These two methods must be implemented by any adapter implementing the interface and use them for publishing data to OCH. Signature of these two methods are:

```
void update(SessionContext context, DomainObjectDTO dto, BaseResponse response)
throws FatalException;
Object updateWithResponse(SessionContext context, DomainObjectDTO dto,
BaseResponse response) throws FatalException;
```

Update() method is used in the use cases where response it not expected from OCH.

UpdateWithResponse() method is used when the data is required from OCH.

Figure 22–1 Integration Adapter Interface

```
AbstractAssembler.ja | PartyDeDuplicationAd | ProductLedgerApplica | ProductLedgerApplica | AbstractIntegrationA | IntegrationStrategie | IIntegrationAdapter.

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package com.ofss.fc.app.adapter.integration;

import com.ofss.fc.app.context.SessionContext;
import com.ofss.fc.framework.domain.common.dto.DomainObjectDTO;
import com.ofss.fc.infra.exception.FatalException;
import com.ofss.fc.service.response.BaseResponse;

/**
 * The IAdapter object provides the implementation for propagating changes in the domain objects to appropriate
 * integration end points, using appropriate strategy. NullAdapter is implementation of this interface where integration
 * end points are absent.
 **/
public interface IIntegrationAdapter {

    /**
     * This method uses appropriate Assembler and IntegrationStrategy to invoke appropriate Adaptee method, to propagate
     * the changes done by the FC business method. This will be implemented as part of Async strategies
     *
     * @param dto
     *            - This is the domain DTO which has been changed by the FC business method. This can be aggregation of
     *            DomainDTOs as well.
     * @param dto
     **/
    void update(SessionContext context, DomainObjectDTO dto, BaseResponse response) throws FatalException;

    /**
     * This method uses appropriate Assembler and IntegrationStrategy to invoke appropriate Adaptee method, to propagate
     * the changes done by the FC business method. This will be implemented as part of Sync strategies
     *
     * @param dto
     *            - This is the domain DTO which has been changed by the FC business method. This can be aggregation of
     *            DomainDTOs as well.
     * @param dummy
     *            - This is dummy string used to overload the 'update' method
     **/
    Object updateWithResponse(SessionContext context, DomainObjectDTO dto, BaseResponse response) throws FatalException;
}
```

22.2 Abstract Integration Adapter Class

OBP framework has an abstract class AbstractIntegrationAdapter which provides methods for common data, such as audit information or session context etc. This abstract class implements IIntegrationAdapter interface.

All adapters must extend AbstractIntegrationAdapter and implement the two methods defined in the IIntegrationAdapter interface.

Figure 22–2 Abstract Integration Adapter Class

```
public abstract class AbstractIntegrationAdapter implements IIntegrationAdapter {

    protected SessionContext sessionContext;
    protected String serviceId;
    private static final String ALL_SERVICES = "ALL";

    /**
     * Constructor that validates the service to be integrated.
     */
    public AbstractIntegrationAdapter(SessionContext sessionContext, String serviceId) throws ConfigurationInitializationException {

        this.sessionContext = sessionContext;
        this.serviceId = serviceId;
        boolean isAllowed = isIntegrationAllowed(sessionContext.getChannel(), serviceId);
        if ( !isAllowed) {
            throw new ConfigurationInitializationException(InfraErrorConstants.INTEGRATION_NOT_CONFIGURED);
        }
    }

    @Override
    public abstract void update(SessionContext context, DomainObjectDTO dto, BaseResponse response) throws FatalException;

    @Override
    public abstract Object updateWithResponse(SessionContext context, DomainObjectDTO dto, BaseResponse response) throws FatalException;

    /**
     * @return the sessionContext
     */
    public SessionContext getSessionContext() {

        return sessionContext;
    }

    protected DomainObjectDTO populateCreateAuditInformation(SessionContext sessionContext, DomainObjectDTO dto) {

        dto.setCreatedBy(sessionContext.getUserId());
        dto.setLastUpdatedBy(sessionContext.getUserId());
        return dto;
    }

    protected DomainObjectDTO populateUpdatedAuditInformation(SessionContext sessionContext, DomainObjectDTO dto) {

        dto.setLastUpdatedBy(sessionContext.getUserId());
        return dto;
    }
```

22.3 Sample Integration Adapter

The following figure is a sample adapter for customer information:

Figure 22–3 Sample Integration Adapter

```
public class SampleAdapter extends AbstractIntegrationAdapter {

    public SampleAdapter(SessionContext sessionContext, String serviceId) throws ConfigurationInitializationException, FatalException,
        InvocationTargetException {

        super(sessionContext, serviceId);
        // TODO Auto-generated constructor stub
    }

    @Override
    public void update(SessionContext context, DomainObjectDTO dto, BaseResponse response) throws FatalException {

        // TODO Auto-generated method stub
        if (dto instanceof IndividualDemographicsDTO) {
            PartyKeyDTO partyKeyDTO = new PartyKeyDTO();
            IntegrationPartyOnBoardingDTO integrationOnBoardingDTO = new IntegrationPartyOnBoardingDTO();
            PartyOnBoardingDTO partyOnBoardingDTO = new PartyOnBoardingDTO();
            PartyInquiryResponse partyInquiryResponse = new PartyInquiryResponse();
            PartyApplicationService partyApplicationService = new PartyApplicationService();
            IndividualDTO individualDTO = new IndividualDTO();
            IndividualDemographicsDTO individualDemographicsDTO = (IndividualDemographicsDTO) dto;
            partyKeyDTO.setPartyId(individualDemographicsDTO.getPartyDemographicsKeyDTO().getPartyId());
            partyInquiryResponse = partyApplicationService.fetchPartyDetailsWithoutDemographics(context, individualDemographicsDTO.getPartyDemographicsKeyDTO()
                                                                                                                      .getPartyId());

            individualDTO.setPartyKeyDTO(partyKeyDTO);
            individualDTO.setPartyType(partyInquiryResponse.getPartyType());
            individualDTO.setIndividualDemographicsDTO(individualDemographicsDTO);
            partyOnBoardingDTO.setIndividualDTO(individualDTO);
            integrationOnBoardingDTO.setPartyOnBoardingDTO(partyOnBoardingDTO);
            AbstractAssembler<ICanonicalModel, DomainObjectDTO> updatepartyAssembler =IntegrationAssemblerFactory.getInstance()
                                .fetchAssemblerInstance("com.ofss.fc.app.integration.dto.common.UpdatePartyAdapter.IntegrationPartyOnBoardingDTO");
            SyncCustomerPartyListEBMType customerEBO = (SyncCustomerPartyListEBMType) updatepartyAssembler.toCanonicalModel(integrationOnBoardingDTO);
            IIntegrationStrategy strategy = IntegrationStrategyFactory.getInstance().fetchStrategyInstance("FC-OCH-updateParty");
            strategy.invoke(customerEBO, individualDemographicsDTO.getPartyDemographicsKeyDTO().getPartyId());
        }
    }

    @Override
    public Object updateWithResponse(SessionContext context, DomainObjectDTO dto, BaseResponse response) throws FatalException {

        // TODO Auto-generated method stub
        return null;
    }
}
```


22.4 Integration Abstract Assembler

OBP framework has as abstract class AbstractAssembler which provides design for DTO to EBO conversion. These methods are used while mapping DTO to EBO and vice versa.

Signature of methods are:

```
public abstract T toCanonicalModel(D dto) throws FatalException;
public abstract D  fromCanonicalModel(T domainObject) throws FatalException;
```

toCanonicalModel() is used when DTO is to be converted to EBO and fromCanonicalModel() in the other case.

Figure 22–4 Integration Abstract Assembler

```
public abstract class AbstractAssembler<T extends ICanonicalModel, D extends DomainObjectDTO> {

    /**
     * This method needs to be implemented to convert from a DTO array to a canonical object.
     *
     * @param dto
     *            The input DTO which implements Serializable.
     * @return The canonical object instance.
     */
    public abstract T toCanonicalModel(D dto) throws FatalException;

    /**
     * This method needs to be implemented to convert from a canonical object to a DTO array.
     *
     * @param domainObject
     *            Instance of canonical model.
     * @return Instance of DTO
     */
    public abstract D fromCanonicalModel(T domainObject) throws FatalException;
}
```

All the assemblers must implement these two methods for conversion of DTO to EBO and vice versa.

Assemblers also populate the header of the request which is posted to the queue.

22.5 Sample Assembler

A sample assembler which extends AbstractAssembler should be like:

Figure 22–5 Sample Assembler

```
public class SampleAssember extends AbstractAssembler<SyncCustomerPartyListEBMType, IntegrationPartyOnBoardingDTO> {

    @Override
    public SyncCustomerPartyListEBMType toCanonicalModel(IntegrationPartyOnBoardingDTO dto) throws FatalException {

        //Populate OCH EBO using OBP DTO
        SyncCustomerPartyListEBMType syncCustomerPartyListEBMType = new SyncCustomerPartyListEBMType();
        List<SyncCustomerPartyListDataAreaType> syncCustomerPartyListDataAreaTypes = new ArrayList<SyncCustomerPartyListDataAreaType>();
        SyncCustomerPartyListDataAreaType dataArea = new SyncCustomerPartyListDataAreaType();
        //call to populate details using utility
        dataArea.setSyncCustomerPartyList(PartyAssemblerUtility.CustomerPartyData(dto));
        dataArea.setSync(new SyncType());
        syncCustomerPartyListDataAreaTypes.add(dataArea);
        syncCustomerPartyListEBMType.getDataArea().addAll(syncCustomerPartyListDataAreaTypes);
        //call to populate request header
        syncCustomerPartyListEBMType.setEBMHeader(PartyAssemblerUtility.createUpsert());
        syncCustomerPartyListEBMType.setLanguageCode("English");
        return syncCustomerPartyListEBMType;
    }

    @Override
    public IntegrationPartyOnBoardingDTO fromCanonicalModel(SyncCustomerPartyListEBMType domainObject) throws FatalException {

        // Populate OBP Entity using OCH EBO
        IntegrationPartyOnBoardingDTO integrationPartyOnBoardingDTO = new IntegrationPartyOnBoardingDTO();
        PartyOnBoardingDTO partyOnBoardingDTO = new PartyOnBoardingDTO();
        //fetching value of party type
        String partyTypeStr = domainObject.getDataArea().get(0).getSyncCustomerPartyList().getTypeCode().getValue();
        PartyType partyType = (PartyType) EnumerationHelper.getInstance().fromValue(PartyType.class, partyTypeStr);
        //setting party type in OBP DTO
        partyOnBoardingDTO.setPartyType(partyType);
        integrationPartyOnBoardingDTO.setPartyOnBoardingDTO(partyOnBoardingDTO);
        return integrationPartyOnBoardingDTO;
    }
}
```

User can extend assemblers to add more DTO to EBO mapping.

Note: EBOs are generated from AIA wsdl, and can be extended to add extra fields in the custom tag using the standard AIA extension framework. For each newly added field, customization developer must set that field in the assembler.

A

Appendix

The detailed list of adapters which can be used for extending and customizing the product is present in the Oracle Banking Platform Extensibility Guide - Adapter Usage Details.