

Oracle® Fusion Middleware

Understanding Oracle SOA Suite



12c Release (12.2.1.3.0)

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Oracle Fusion Middleware Understanding Oracle SOA Suite, 12c Release (12.2.1.3.0)

E96879-04

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Preface

Understanding Oracle SOA Suite provides a high-level introduction to Oracle SOA Suite concepts and components, highlighting business challenges that can be addressed by Oracle SOA Suite components.

Documentation Accessibility

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Related Documents

Refer to the [Oracle Fusion Middleware library on the Oracle Help Center](#) for additional information.

- For Oracle SOA Suite information, see Oracle SOA Suite.
- For adapters information, see On-Premises Integration Adapters.
- For Oracle BAM information, see Oracle Business Activity Monitoring.
- For Oracle B2B information, see Oracle B2B.
- For Oracle Business Process Management information, see Oracle Business Process Management.
- For Oracle Enterprise Scheduler information, see Oracle Enterprise Scheduler.
- For Oracle Managed File Transfer information, see Oracle Managed File Transfer.
- For Oracle Service Bus information, see Oracle Service Bus.

- For Oracle SOA Suite for healthcare integration information, see Oracle SOA Suite for Healthcare Integration.
- For versions of platforms and related software for which Oracle products are certified and supported, review the [Certification Matrix on OTN](#).
- For cloud adapters information, see:
 - *Using Ariba Adapter*
 - *Using Oracle Eloqua Cloud Adapter*
 - *Using Oracle ERP Cloud Adapter*
 - *Using the NetSuite Adapter*
 - *Using Oracle RightNow Cloud Adapter*
 - *Using Salesforce Adapter*
 - *Using Oracle Sales Cloud Adapter*
 - *Using ServiceNow Adapter*
 - *Using SuccessFactors Adapter*

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.
<i>italic</i>	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.

Part I

Introduction to Oracle SOA Suite

This part includes the following chapter:

- [Overview of Oracle SOA Suite](#)

1

Overview of Oracle SOA Suite

This chapter provides a high-level overview of Oracle SOA Suite architecture, including key concepts, components, management tools and processes, and process flows.

For more information about:

- Oracle SOA Suite architecture and building applications, see *Developing SOA Applications with Oracle SOA Suite*
- Oracle SOA Suite infrastructure and administration, see *Administering Oracle SOA Suite and Oracle Business Process Management Suite*

This chapter includes the following sections:

- [About Oracle SOA Suite](#)
- [Key Concepts](#)
- [Key Components](#)
- [Key Management Tools and Processes](#)
- [Overview of an Oracle SOA Suite Process Flow](#)

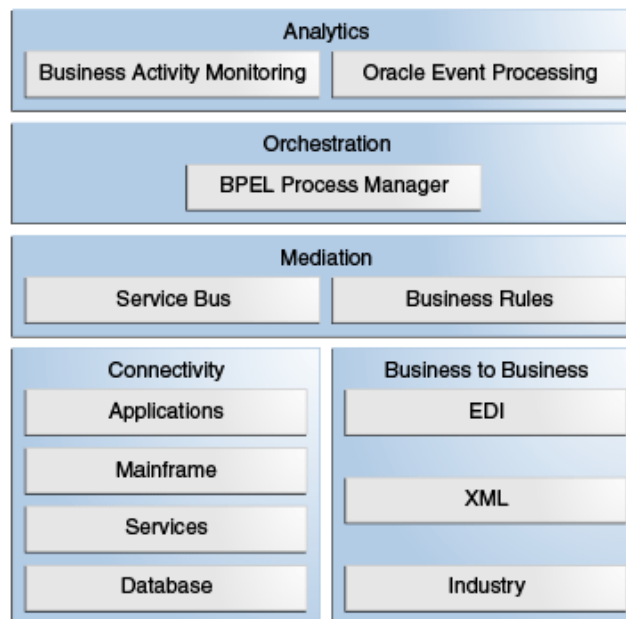
1.1 About Oracle SOA Suite

Oracle SOA Suite is a comprehensive, hot-pluggable software suite that enables you to build, deploy, and manage integrations using service-oriented architecture (SOA). Oracle SOA Suite provide the following capabilities:

- Consistent tooling
- A single deployment and management model
- End-to-end security
- Unified metadata management

Oracle SOA Suite enables you to transform complex application integrations into agile and reusable service-based applications to shorten the time to market, respond faster to business requirements, and lower costs. Critical business services, such as customer, financial, ordering information, and others that were previously accessible only in packaged application user interfaces can now be rapidly modeled for mobile devices such as smart phones and tablets.

[Figure 1-1](#) provides an overview of Oracle SOA Suite architecture.

Figure 1-1 Oracle SOA Suite Architecture

1.2 Key Concepts

Oracle SOA Suite's hot-pluggable architecture enables businesses to reduce costs through reuse of existing IT investments and assets, regardless of the operating system on which they run or the technology on which they are built. Oracle SOA Suite provides easy-to-use, reusable, and unified application development tooling and life cycle management support to further reduce development and maintenance costs and complexity. Businesses can improve efficiency and agility through rules-driven, business process automation with Oracle SOA Suite. Oracle SOA Suite's ability to deliver real-time trending and analysis, visualization, and life cycle visibility enables businesses to anticipate and respond to change when it matters. Oracle SOA Suite provides the following capabilities:

- Unifies cloud applications with on-premises applications to minimize complexity.
- Leverages existing functionality for rapid mobile enabling with representational state transfer (REST) support.
- Designs SOA composite applications from disparate services and applications.
- Connects to virtually any data source technology (messaging, database, and so on), application, or trading partner through a unified connectivity framework, including adapters and B2B gateways, and preintegration with Oracle Data Integration Suite.
- Routes, transforms, and virtualizes services through the highly scalable Oracle Service Bus.
- Orchestrates and builds process automation with Oracle BPEL Process Manager.
- Builds agility by externalizing specific blocks of logic using Oracle Business Rules.

- Gains real-time visibility into operation and performance of business processes, including the ability to respond to specific situations, through Oracle Business Activity Monitoring.
- Consistently and easily secures all services through a policy-driven integrated security framework and the global policy manager in Oracle Enterprise Manager Fusion Middleware Control.
- Executes SOA composite applications through a unified, optimized infrastructure. The SOA service infrastructure is built on top of Oracle WebLogic Server, JRockit, and Oracle Coherence.
- Manages and monitors the previously-mentioned components through a single console natively integrated with Oracle Enterprise Manager Fusion Middleware Control.

1.3 Key Components

Oracle SOA Suite includes the following key components.

- Oracle Service Bus

Oracle Service Bus is a configuration-based, policy-driven enterprise service bus designed for SOA life cycle management. Oracle Service Bus provides the following capabilities:

- Service discovery and intermediation
- Rapid service provisioning and deployment
- Highly-scalable and reliable service-oriented integration, service management, and traditional message brokering across heterogeneous IT environments
- Intelligent message brokering with routing and transformation of messages, along with service monitoring and administration in a unified software product

For more information, see *Developing Services with Oracle Service Bus* and *Administering Oracle Service Bus*.

- Oracle Business Process Execution Language (BPEL) Process Manager

Oracle BPEL Process Manager provides a comprehensive, standards-based, and easy-to-use solution for assembling a set of discrete services into an end-to-end process flow to reduce the cost and complexity of process integration. The BPEL process service engine is a mature, scalable, and robust BPEL server. It executes standard BPEL processes and provides dehydration capability. This enables the state of long-running business flow instances to be automatically maintained in a database, enabling clustering for both failover and scalability. Built-in human workflow services such as task, notification, and worklist management are provided to enable the integration of people and manual tasks into BPEL business flow instances. Oracle BPEL Process Manager can integrate applications and legacy systems, composing coarse-grained services from finer-grained services, building process-centric composite applications, and automating business processes and workflow applications, including routing and escalation.

For more information, see *Developing SOA Applications with Oracle SOA Suite* and *Administering Oracle SOA Suite and Oracle Business Process Management Suite*.

- Oracle Business Activity Monitoring (BAM)

Oracle BAM monitors business processes in real time to enable you to make informed tactical and strategic business decisions. Unlike traditional reporting systems, Oracle BAM offers *right-time* operational intelligence for mission critical business processes. Oracle BAM analyzes data before, during, and after business events.

For more information, see *Monitoring Business Activity with Oracle BAM*.

- Oracle Business Rules

Oracle Business Rules enable dynamic business decisions at runtime, enabling you to automate policies, computations, and reasoning while separating rule logic from underlying application code. This provides for agile rule maintenance and enables business analysts to modify rule logic without programmer assistance and without interrupting business processes.

For more information, see *Designing Business Rules with Oracle Business Process Management*.

- Oracle Java EE Connector Architecture (JCA) adapters

Oracle JCA adapters enable connectivity to virtually any data source inside the enterprise. Oracle JCA adapters are standards-based and support both web services and JCA technologies. Oracle JCA Adapters are available for the following:

- Packaged applications
- Legacy and mainframe applications, including Tuxedo, Virtual Storage Access Method (VSAM), and Customer Information Control System (CICS)
- Cloud applications
- Technologies and protocols, including FTP, files, databases, AQ, JMS, MQSeries, Coherence, LDAP, User Messaging Service, and Oracle E-Business Suite

For more information, see *Understanding Technology Adapters*.

- Oracle B2B

Oracle B2B enables an enterprise to exchange information electronically with a trading partners. Oracle B2B supports a set of industry standards, including Electronic Data Interchange (EDI), UCCnet, RosettaNet, Chemical Industry Data Exchange (CIDX), Petroleum Industry Data Exchange (PIDX), Voluntary Interindustry Commerce Solutions (VICS), ebXML, and Universal Business Language (UBL).

For more information, see *Using Oracle B2B*.

- Oracle SOA for Healthcare

Oracle SOA Suite for Healthcare enables you to design, create, and manage applications that process health care data. Oracle SOA Suite for Healthcare integration provides a web-based user interface in which to create and configure health care integration applications, and monitor and manage the messages processed through those applications. You can also use the Oracle Document Editor to create and configure document definitions that define message structures.

For more information, see *Using Oracle SOA Suite for Healthcare Integration*.

- Oracle Web Services Manager (OWSM)

OWSM provides the policy manager for securing web services, including authentication and authorization. OWSM is installed by default when you install Oracle Fusion Middleware Infrastructure. It is licensed only through Oracle SOA Suite; a standalone license is not available.

For more information, see *Enabling Security with Policies and Message Encryption in Developing SOA Applications with Oracle SOA Suite*.

Oracle SOA Suite can be integrated with the following additional components:

- Oracle Enterprise Scheduler

Enterprise applications require the ability to off-load large transactions to run at a future time or automate the running of application maintenance work based on a defined schedule. Oracle Enterprise Scheduler enables you to run different job types, including Java, PL/SQL, binary scripts, web services, and Enterprise JavaBeans (EJBs) distributed across the nodes in an Oracle WebLogic Server cluster. Oracle Enterprise Scheduler runs jobs securely, with high availability, scalability, and load balancing. Oracle Enterprise Scheduler runs are monitored and managed through Oracle Enterprise Manager Fusion Middleware Control.

For more information, see *Developing Applications for Oracle Enterprise Scheduler* and *Administering Oracle Enterprise Scheduler*.

- Oracle Managed File Transfer

Oracle Managed File Transfer is a high performance, standards-based, end-to-end managed file gateway. It features design, deployment, and monitoring of file transfers using a lightweight, web-based, design-time console that includes file encryption, scheduling, and embedded FTP and SFTP servers.

For more information, see *Using Oracle Managed File Transfer*.

1.4 Key Management Tools and Processes

Oracle SOA Suite provides a number of development, monitoring, and management tools.

1.4.1 Oracle JDeveloper

Oracle JDeveloper is the integrated development environment used by Oracle SOA Suite for building service-oriented applications with the latest industry standards for Java, XML, web services, SQL, REST, and SCA. Oracle JDeveloper supports the complete development life cycle with integrated features for modeling, coding, debugging, testing, profiling, tuning, and deploying applications. Oracle JDeveloper features a SOA Composite Editor for quickly and graphically assembling the various components and technologies used in a SOA project. User friendly wizards are provided to simplify many common tasks such as connecting to IT systems.

1.4.2 Oracle Enterprise Manager Fusion Middleware Control

Oracle Enterprise Manager Fusion Middleware Control is a web-based tool for managing and monitoring SOA composite applications at runtime. Administrators perform tasks such as tracking business flow instances, attaching security policies, identifying a specific message by searching on specific data, identifying and repairing errors in the Error Hospital, and so on. Oracle Enterprise Manager Fusion Middleware Control also provides visibility into the execution of processes, showing a complete end-to-end graphical representation of the business flow followed by a given message across all the components traversed.

1.4.3 Additional Design and Runtime Tools

Oracle SOA Suite provides additional design and runtime tools for some components, as described in [Table 1-1](#).

Table 1-1 Additional Design and Runtime Tools

Runtime Tools	Description
Oracle BAM Composer	Provides a user interface for creating dashboards, alerts, business views, key performance indicators (KPIs), alerts, and parameters.
Oracle B2B Console	Provides a user interface for creating B2B transactions, including trading partners and trading partner agreements.
Oracle Managed File Transfer Console	Provides a lightweight, web-based, design-time console for defining the following artifacts: <ul style="list-style-type: none"> • The origin of files to transfer (known as sources) • The destination of files (known as targets) • A transfer that associates a source with targets
Oracle Service Bus Console	Provides configuration tools for creating service level agreement alerts, pipeline alerts, messaging reporting actions, alert destinations, and throttling groups for business service endpoints. You can also update environmental values, either individually or in bulk.
Oracle SOA Composer	Provides a runtime environment for creating domain value maps, approval management extensions, business rules, and composite sensors in deployed composites.
Oracle Healthcare for Healthcare Integration Console	Provides support for messaging protocols and creating and managing endpoints, managing documents, creating map sets, and creating Java callouts.

1.5 Overview of an Oracle SOA Suite Process Flow

The remaining chapters of this guide provide an overview of how Oracle SOA Suite components work together in a process flow from design time through runtime to address the business challenges faced by a company.

For more information, see [Business Challenges of Company X](#).

Part II

Business Challenges and Oracle SOA Suite

This part describes a business challenge and how the components of Oracle SOA Suite address these challenges from design time through runtime.

- [Business Challenges of Company X](#)
- [Creating a Credit Validation System](#)
- [Creating an Order Processing System](#)
- [Adding New Ordering Channels with Oracle Service Bus](#)
- [Packing and Shipping Orders](#)
- [Fulfilling Orders](#)
- [Scheduling Composite Execution](#)
- [Managing File Transfers](#)
- [Accepting B2B Orders](#)
- [Adding Fraud Detection](#)
- [Gaining Business Insights with Oracle Business Activity Monitoring](#)

2

Business Challenges of Company X

This chapter describes the business challenges faced by Company X and how Oracle SOA Suite provides a business solution for these challenges.

This chapter includes the following sections:

- [Business Challenges of Company X](#)
- [Solutions](#)

2.1 Business Challenges of Company X

Company X must improve their order processing system to accommodate multichannel growth with online business partners. In addition, an aggressive store expansion is planned. Overlapping systems must be consolidated to provide better end-to-end visibility from order to fulfillment.

Requirements for improving the order processing system are as follows:

- The order processing system must be accessible through multiple protocols, data formats, and client types, including mobile devices:
 - Business trends indicate that Company X must launch a mobile application soon and the new order processing service must support access through RESTful APIs.
 - In addition to the existing online direct store, Company X plans to launch a service in which orders are received through a different channel (as batch comma-separated value (CSV) files over FTP). They must eventually be processed and fulfilled using the same new order provisioning infrastructure.
 - Company X must interface with trading partners and provide electronic data interface (EDI) support.
- For large orders, a customer's credit history must be checked before sending the order for fulfillment. Otherwise, the order is rejected. Initially, credit is checked by internal departments, but later must be integrated with PayPal. Changing credit providers must not disrupt order processing operations.
- The order processing system must provide direct integration with the packaging department to ship orders with preferred shipping providers based on the type of shipping service (2 day, 5-7 day shipping, and so on).
- The bulk fulfillment process must run according to a predefined pick-up schedule.
- Upon fulfillment processing and orders being sent to the packaging department, a message must be communicated to the customer (either bulk or on-demand).

2.2 Solutions

The chapters of this guide describe how Company X uses the capabilities of Oracle SOA Suite to address their business challenges. [Table 2-1](#) provides an overview.

Table 2-1 Addressing Business Challenges

Challenge Addressed	See...
Company X designs a credit card validation composite to validate payments and return payment status. If a payment is denied, an order is not processed. Oracle Service Bus is integrated with the composite to provide registration and security benefits.	Creating a Credit Validation System
Company X designs a SOA composite application to accept new purchase orders, authorize or deny them, and forward the authorized orders to an order fulfillment composite designed in Fulfilling Orders . Oracle Service Bus makes the order processing composite available over many protocols and data formats, and validates the order.	Creating an Order Processing System
Company X designs an Oracle Service Bus pipeline to connect a proxy service to a file ordering channel. The proxy handles incoming customer orders by file.	Adding New Ordering Channels with
Company X designs a BPEL process that sets the status of an order to shipped, notifies the customer that the order has shipped, and updates the order status in the database. This process is connected to an inbound REST interface service that defines a shipping resource.	Packing and Shipping Orders
Company X designs an order fulfillment composite to listen for orders to process, selects a shipping provider, and invokes the packing and shipping service designed in Packing and Shipping Orders .	Fulfilling Orders
Company X designs a query inventory composite to identify the total number of items for each product ordered daily for a given category. Oracle Enterprise Scheduler is used to define a web service job for the query inventory composite and then submit the job with a schedule to run at a specified time.	Scheduling Composite Execution
Company X designs an Oracle Managed File Transfer flow to receive files and write them to a file system using the Managed File Transfer embedded FTP server. Oracle Managed File Transfer invokes a Managed File Transfer service in a composite and dynamically decides based on file size whether to pass the content inline or by reference.	Managing File Transfers
Company X uses the Oracle B2B Console to build a document flow that accepts an EDI XML order from a remote trading partner.	Accepting B2B Orders

Table 2-1 (Cont.) Addressing Business Challenges

Challenge Addressed	See...
Company X designs an Oracle Event Processing application to provide real-time, time-based analysis of orders (events) placed by customers recognized specifically by an associated email address. As each order (event) is passed to the Oracle Event Processing server, it is dynamically accessed for possible fraudulent activity by observing event patterns with an aggregated order dollar amount that exceeds \$1000 in any 24 hour period.	Adding Fraud Detection
Company X designs BPEL process analytic measurements and business indicators on activities in a BPEL process. Oracle BAM Composer is used to create a dashboard of these analytics to gain business insights into customer order requests.	Gaining Business Insights with Oracle Business Activity Monitoring

3

Creating a Credit Validation System

This chapter describes how Oracle SOA Suite addresses the business challenge of creating a credit validation system. Overviews of how key SOA composite application components are created and address this challenge are provided, including BPEL process invoke, assign, and transformation activities; database adapters; SOA templates; and composite sensors. The role of Oracle Service Bus in this business solution is also described.

This chapter includes the following sections:

- [Business Challenge](#)
- [Business Solution](#)
- [Related Documentation](#)

3.1 Business Challenge

Company X has embarked upon a project to improve customer satisfaction. A key area for improvement is the need to streamline the ordering process to provide better order tracking visibility through the following parts of the ordering life cycle:

- Credit approvals
- Fulfillment
- Shipment
- Delivery

A key issue in their current system is that credit card payments are often denied for minor reasons. Since the process to correct these issues varies across Company X's order entry systems, there is no consistent follow-up and resolution to customers. Orders become lost and delayed in the system, causing customer dissatisfaction.

Company X has determined that a new credit card fraud detection system must also be in place at year's end to eliminate credit card abuses. A consistent fraud mechanism requires the credit validation process to be consolidated across all order entry systems.

The first step is to provide a consistent interface for all order entry applications for credit validation. The consolidated credit validation service is to be initially hosted in-house to control quality. However, once the interface is stabilized, this service is to be outsourced to a third party provider. In the future, when Company X decides to outsource credit validation to an external provider, this can be accomplished without impacting existing applications.

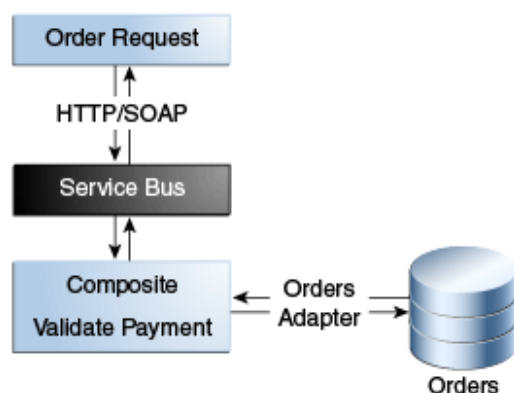
3.2 Business Solution

To address this business challenge, Company X designs a business solution that uses the components described in [Table 3-1](#).

Table 3-1 Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
SOA composite application	<p>A SOA composite application is designed to validate payments and return status. If payment is denied, an order is not processed. The composite consists of the following components, each of which is briefly described below:</p> <ul style="list-style-type: none"> • BPEL process service component • Database adapter • SOA template • Composite sensor 	<p>SOA composite applications consist of the following:</p> <ul style="list-style-type: none"> • Service binding components: Provide the outside world with an entry point to the SOA composite application. • Service components Implement the business logic or processing rules of the application. • Reference binding components: Enable messages to be sent from the SOA composite application to external services in the outside world.
<ul style="list-style-type: none"> • BPEL process service component 	<p>The BPEL process (and its activities) orchestrates the validation of credit card payments and returns a payment status (invokes a database adapter).</p>	<p>BPEL processes provide a comprehensive and easy-to-use infrastructure for creating, deploying, and managing business processes. BPEL is the standard for assembling discrete services into an end-to-end process flow. BPEL processes orchestrate and build process automation.</p>
<ul style="list-style-type: none"> • Database adapter 	<p>The database adapter stores and retrieves credit card payment information from the database, including payment type, card number, expiration date, card name, and daily limit. If the credit card number is not available in the database, payment is denied.</p>	<p>The database adapter enables Oracle SOA Suite and Oracle Fusion Middleware to communicate with database endpoints. These include Oracle database servers and any relational databases that follow the ANSI SQL standard and provide JDBC drivers.</p>
<ul style="list-style-type: none"> • SOA template 	<p>A BPEL scope activity template is imported that includes a transformation activity that determines the payment status (authorized or denied) based on the daily limit and total order amount.</p>	<p>A SOA template is a reusable part of an Oracle SOA Suite project that you use to create new projects. There are three types of templates:</p> <ul style="list-style-type: none"> • SOA project • Service component • Custom BPEL scope activity
<ul style="list-style-type: none"> • Composite sensor 	<p>The composite sensor tracks credit card payment status.</p>	<p>Composite sensors provide a method for implementing trackable fields on messages.</p>
Oracle Service Bus	<p>Oracle Service Bus provides the following composite registration and security benefits:</p> <ul style="list-style-type: none"> • A business service registers the composite URI of the SOA composite application. • A pipeline validates the SOA composite application before invocation. • A proxy enables customers to invoke the composite through a proxy instead of connecting directly to the composite. 	<p>Oracle Service Bus is a configuration-based, policy-driven enterprise service bus. It provides highly scalable and reliable service-oriented integration, service management, and traditional message brokering across heterogeneous IT environments.</p>

Figure 3-1 provides an overview of how this business solution is implemented.

Figure 3-1 Payment Validation Overview

Subsequent sections of this chapter provide more specific details about how the components in [Table 3-1](#) are used to address the credit validation business challenge.

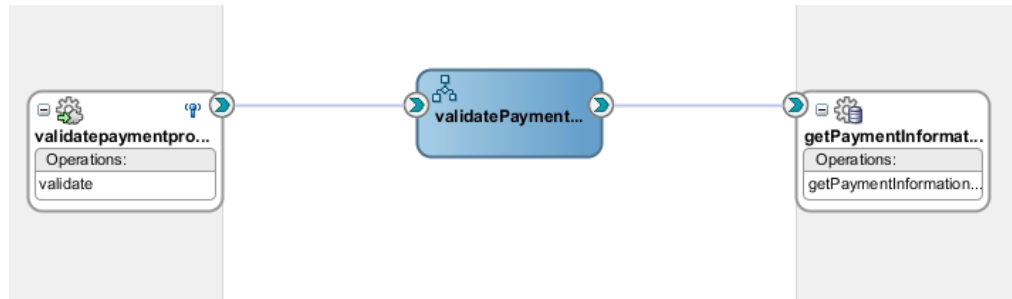
- [Creating a Credit Validation Composite](#)
- [Retrieving Credit Card Payment Information from the Database](#)
- [Invoking the Database Adapter from the BPEL Process](#)
- [Calculating Payment Status with XSLT Transformations](#)
- [Tracking Payment Status with Composite Sensors](#)
- [Deploying the validatePayment Composite](#)
- [Registering SOA Composite Applications with](#)
- [Deploying and Testing](#)

3.2.1 Creating a Credit Validation Composite

The business solution is designed in a SOA composite application that validates a credit card payment and returns a payment status. If the payment is denied, the order is not processed. The implementation of this service uses a BPEL process to invoke a database adapter to retrieve the credit card data from the database and perform the validation. The service returns a payment status of either authorized or denied.

[Figure 3-2](#) provides an overview of the credit validation composite. Customer requests come through the **validatepaymentprocess** service. The SOA composite application (named **validatePayment**) takes these requests and invokes a database adapter reference named **getPaymentInformation** to retrieve credit card information from the database. The database adapter is configured with the Adapter Configuration Wizard.

Figure 3-2 Credit Validation Process



The following example shows the content of an inbound order message. The customer provides their credit card number, expiration date, card type, and billing address.

```
<soas:Billing >
  <soas:CardPaymentType>1</soas:CardPaymentType>
  <soas:CardNum>1234123412341234</soas:CardNum>
  <soas:ExpireDate>0316</soas:ExpireDate>
  <soas:CardName>AMEX</soas:CardName>
  <soas:BillingAddress>
    <soas:FirstName>Joe</soas:FirstName>
    <soas:LastName>Smith</soas:LastName>
    <soas:AddressLine>555 Beverly Lane</soas:AddressLine>
    <soas:City>Hollywood</soas:City>
    <soas:State>CA</soas:State>
    <soas:ZipCode>12345</soas:ZipCode>
    <soas:PhoneNumber>5127691108</soas:PhoneNumber>
  </soas:BillingAddress>
</soas:Billing>
```

3.2.2 Retrieving Credit Card Payment Information from the Database

All available credit card details are stored in a database, including payment type, card number, expiry date, card name, and daily limit. The database adapter retrieves credit card payment information from the database, using the customer's credit card number as the key.

The validation process includes three steps:

- The payment information is first retrieved from the database, using the credit card number quoted in the order message as the key. If there is no data available with this credit card number, payment is denied.
- If data for the credit card number is available, the expiration date in the database record is compared to the expiration date in the order message. If they are not the same, the payment is also denied.
- The last check compares if the total order amount is less than the daily limit on the credit card in the database.

If all tests are successful, payment is authorized. Otherwise, payment is denied.

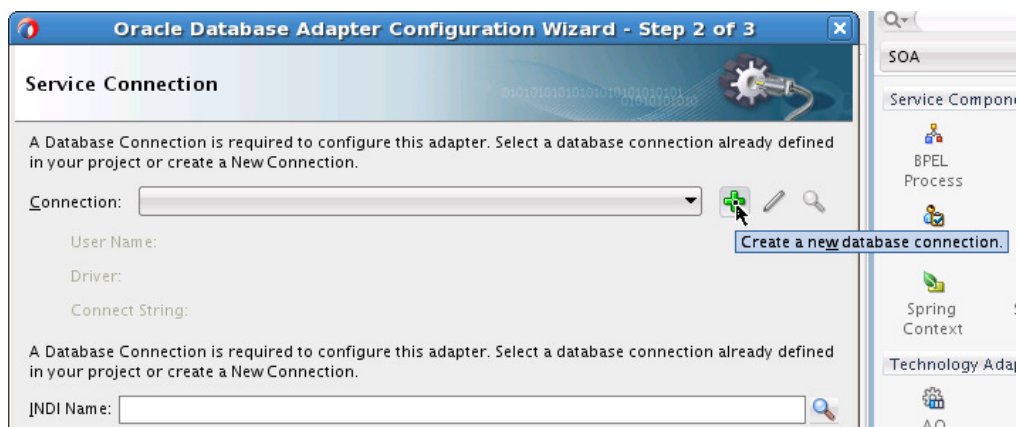
To invoke the Adapter Configuration wizard, the database adapter is dragged from the Components window into the **External References** swimlane of the SOA Composite Editor. This action invokes the Adapter Configuration Wizard for configuring the database adapter.

3.2.2.1 Configuring the Database Adapter with the Adapter Configuration Wizard

The following database adapter configuration tasks are performed during execution of the Adapter Configuration Wizard.

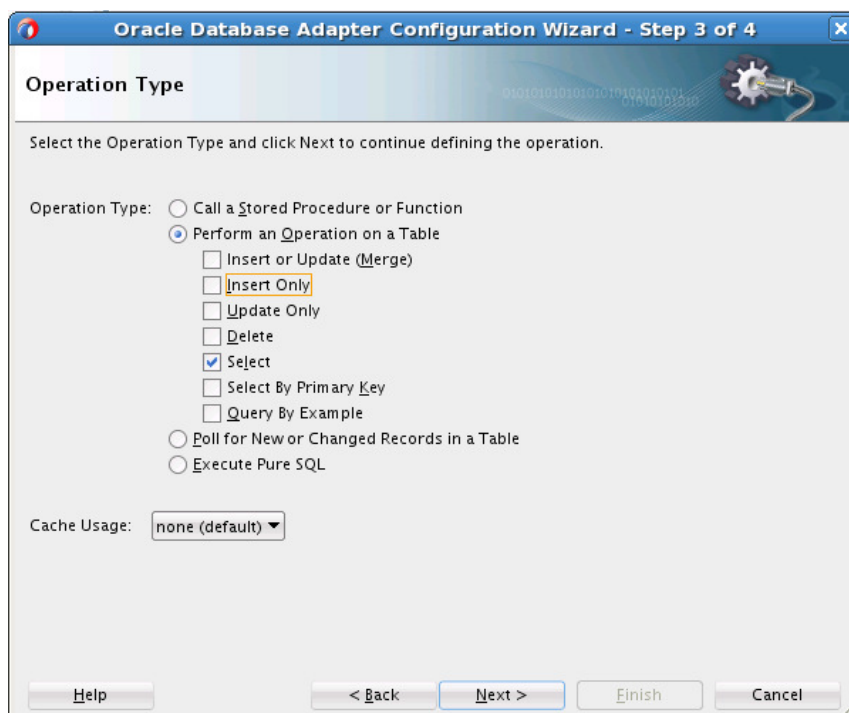
- The option to create a connection to the database in which the credit card information is stored is selected, as shown in [Figure 3-3](#). This enables the database adapter to access the database and retrieve the appropriate credit card information.

Figure 3-3 Database Connection



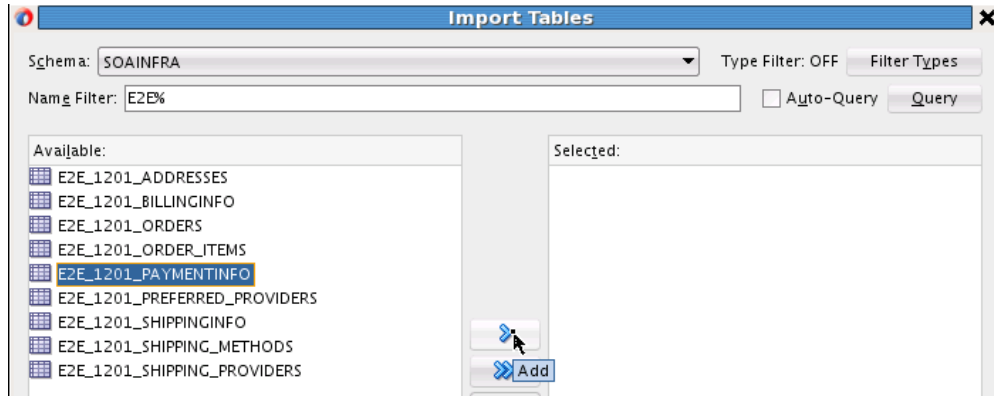
- The **Select** database option is chosen to create a database query, as shown in [Figure 3-4](#).

Figure 3-4 Database Operation Type



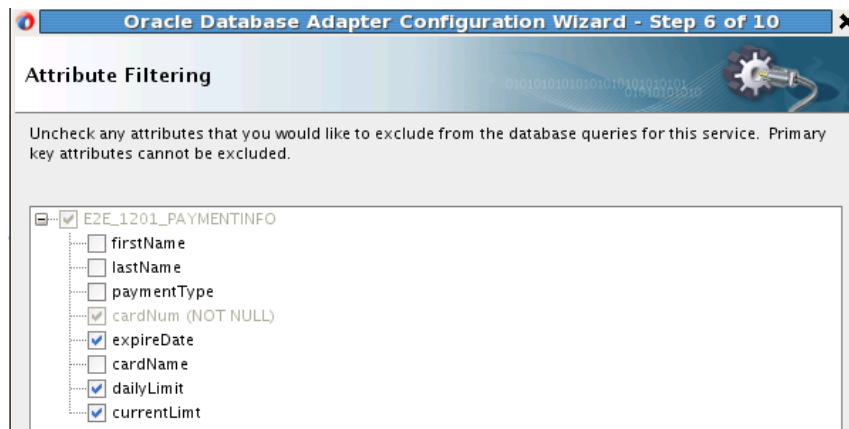
- The appropriate credit card information table is imported from the database, as shown in [Figure 3-5](#).

Figure 3-5 Table with Credit Card Information Imported



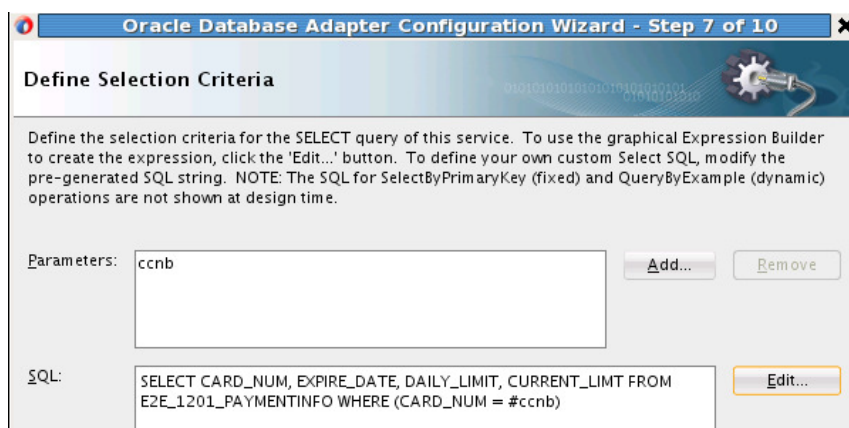
- The appropriate credit card filtering information to use in creating the **Select** operation database query is enabled, as shown in [Figure 3-6](#).
 - Expiration date
 - Daily limit
 - Current limit

Figure 3-6 Credit Card Filtering



- The appropriate credit card criteria for the **Select** operation is specified, as shown in [Figure 3-7](#). The **ccnb** parameter is provided for the customer's credit card number that is specified in the inbound message (`CardNum`), as shown in [Creating a Credit Validation Composite](#). The database adapter retrieves credit card payment information from the database, using the credit card number as the key.

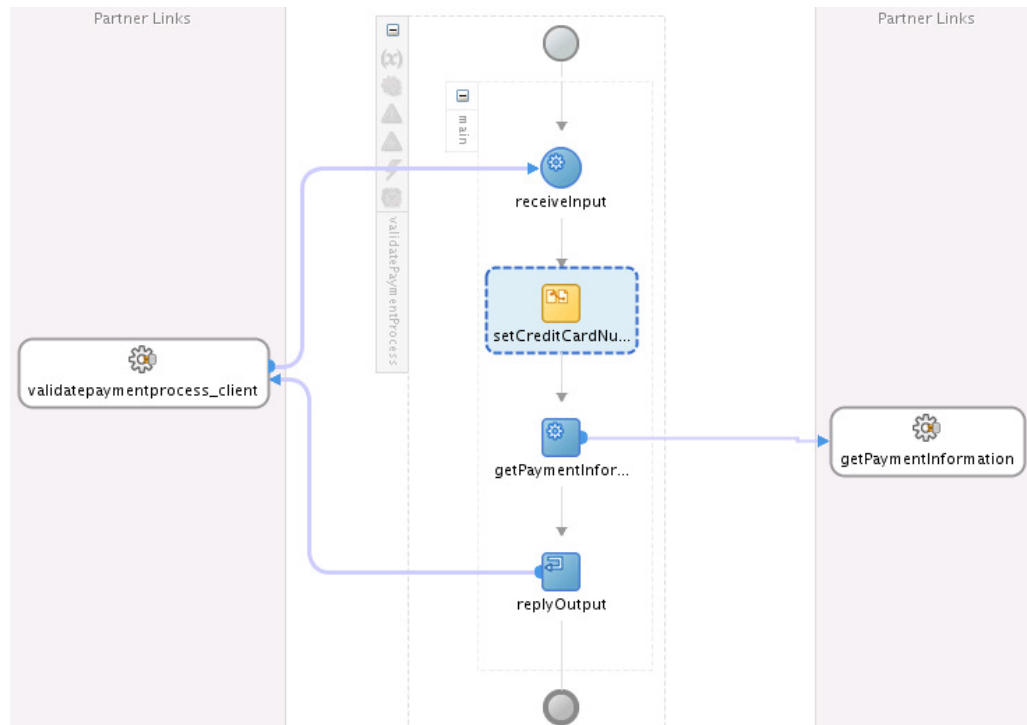
Figure 3-7 Define Selection Criteria



The database adapter processes the selections and generates a reference that implements the operation specified. The SOA composite application now contains the WSDL file to represent the database adapter reference: **getPaymentInformation.wsdl**. The composite diagram shown in [Figure 3-2](#) shows the **getPaymentInformation** reference.

3.2.3 Invoking the Database Adapter from the BPEL Process

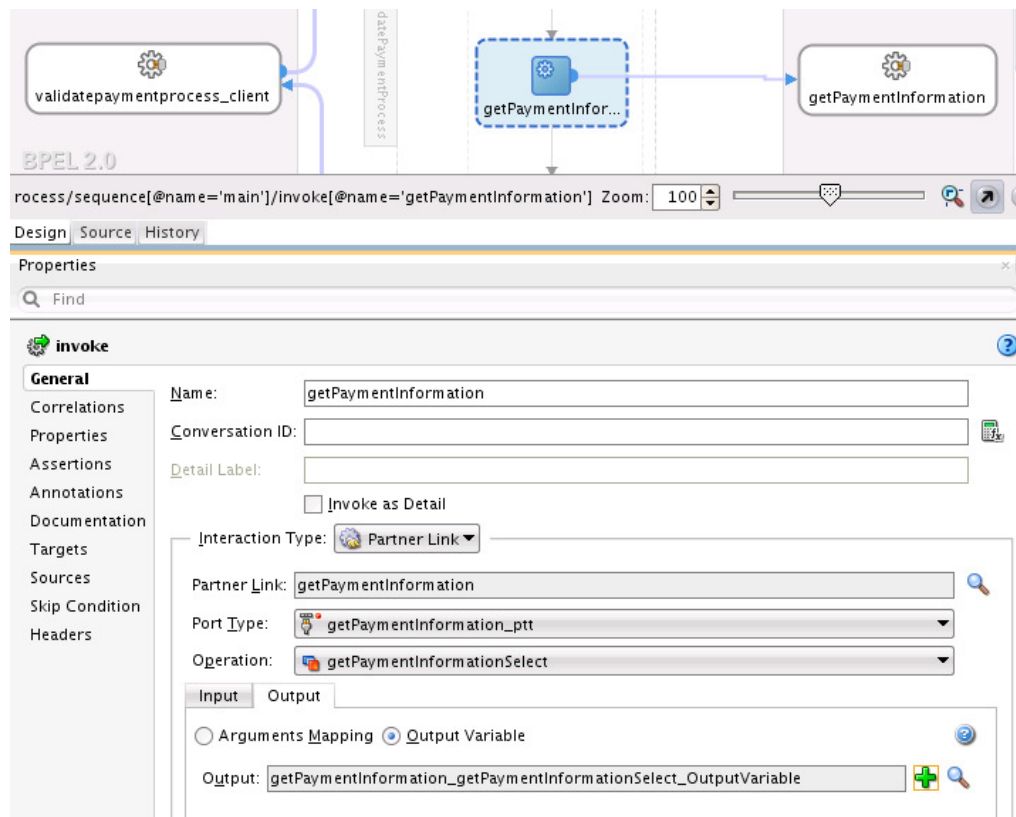
Company X creates a BPEL process service component in the SOA composite application. The BPEL process orchestrates the logic of the business solution. An invoke activity in the BPEL process invokes the database adapter as a partner link to retrieve credit card information from the database. [Figure 3-8](#) provides details.

Figure 3-8 BPEL Process Invocation of the getPaymentInformation Reference

Within the BPEL process, the invoke activity calls the database adapter (named **getPaymentInformation**), as shown in [Figure 3-9](#). You can create and edit invoke activities details from the Property Inspector below the designer or by double-clicking the invoke activity.

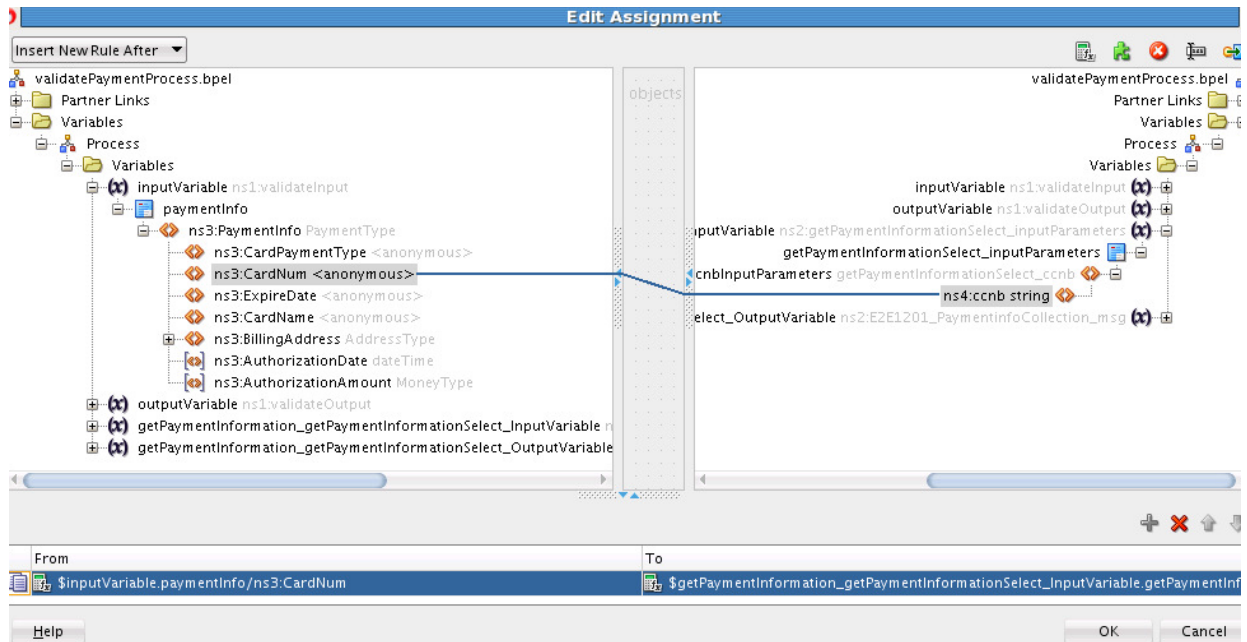
- Name
- Partner link to invoke (for this example, the database adapter)
- Port type
- Operation to perform
- Input variable under the **Input** tab (contains the credit card number to send to the database adapter)
- Output variable under the **Output** tab (returns the results from the database adapter)

Figure 3-9 Invoke Activity Invoking the Database Adapter



An assign activity is used to populate the input variable in the invoke activity. In the **Copy Rules** tab of the assign activity (named **setCreditCardNumber**), the credit card number passed into the BPEL process as **CardNum** is assigned to the **ccnb** parameter of the **getPaymentInformation** database adapter. [Figure 3-10](#) provides details.

Figure 3-10 Credit Card Number Assigned to the Input Variable



An XSLT map determines if the payment is valid based on the information returned by the database adapter.

3.2.4 Calculating Payment Status with XSLT Transformations

Company X requires a mechanism for determining if payment status is authorized or denied. To address this requirement, an XSLT transform activity determines if the payment is valid based on the following information returned by the database adapter.

- The daily limit (retrieved from the database)
- The total order amount (authorization amount in the order message, which has been calculated in the process order project by multiplying the price and amount of every order item and adding them). The total amount of the order must be smaller than the daily limit on the credit card.

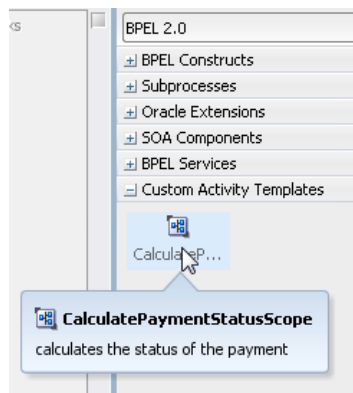
XSLT transformation design can be packaged in the following ways:

- Within an individual transform activity in a BPEL process
- As part of a template. Templates enable you to share common code between applications, composites, and processes. You create a template once, then share it as needed. The template can be reused multiple times. Three types of templates are supported:
 - Project templates that provide a complete project with all components and resources.
 - Service component templates such as a BPEL process with all references and components.
 - Custom activity templates that consist of a BPEL process scope activity.

Company X decides to use a template. For this example, a custom activity template is created and then imported that consists of a scope activity with a transform activity.

You create and design templates in Oracle JDeveloper. After creation, templates are displayed in the Components window for selection and use, as shown in [Figure 3-11](#). The custom activity template can be dragged into a BPEL process, as needed.

Figure 3-11 Custom Activity Template

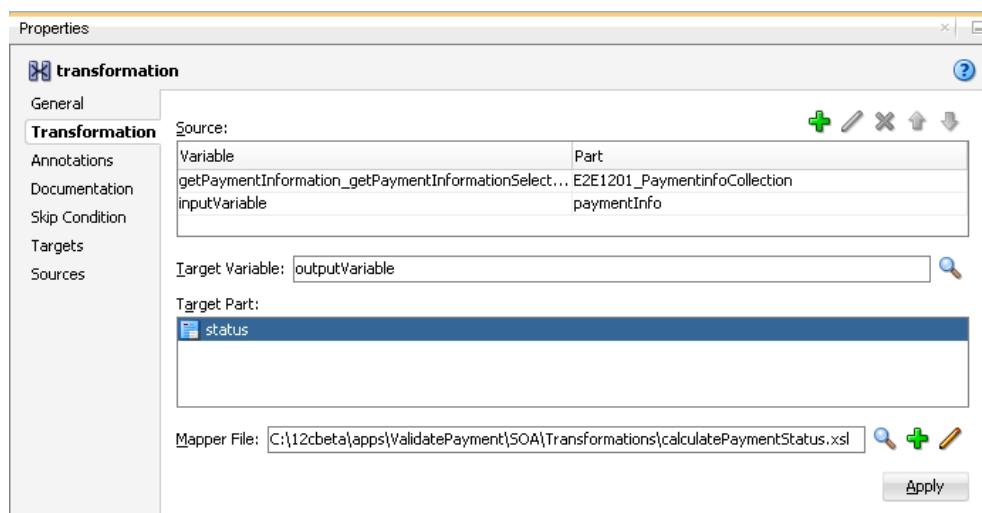


The custom scope activity consists of the transform activity. The transformation for this example expects two input variables, as shown in the **Sources** section of [Figure 3-12](#).

- An output variable of the database adapter, which includes the payment information stored in the database.
- An input variable of the BPEL process, which includes the total order amount.

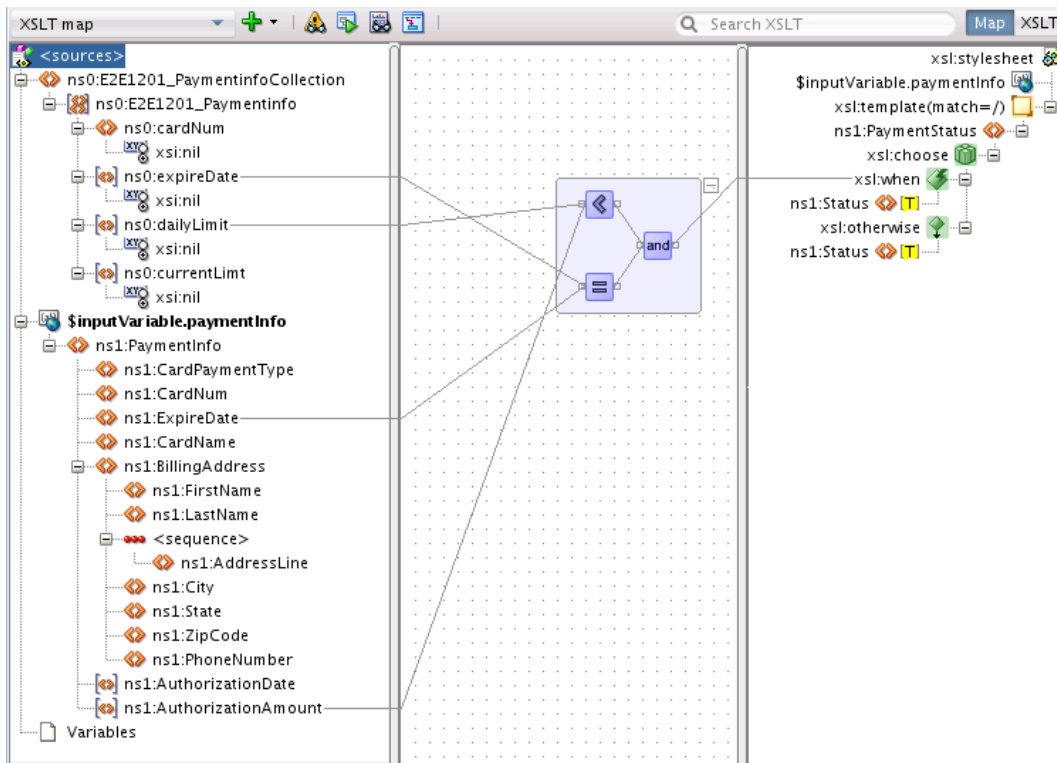
The output is in the **status** field of the output message, as shown in the **Target Part** section of [Figure 3-12](#). This field is either set to **Denied** or **Authorized**.

Figure 3-12 Transformation Variables



The mapping in the XSLT Map Editor is shown in [Figure 3-13](#).

Figure 3-13 Transformation in the XSLT Map Editor



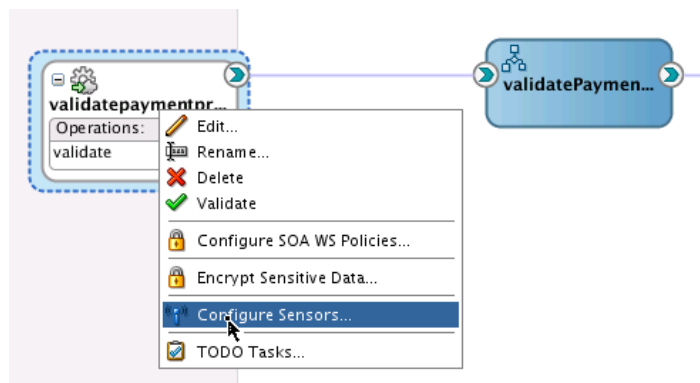
3.2.5 Tracking Payment Status with Composite Sensors

Company X must be able to track the status of order payments (either authorized or denied). To address this requirement, composite sensors are used. Composite sensors provide a method for implementing trackable fields on messages. Composite sensor data is persisted in the database during runtime, enabling you to search for all authorized or denied payments.

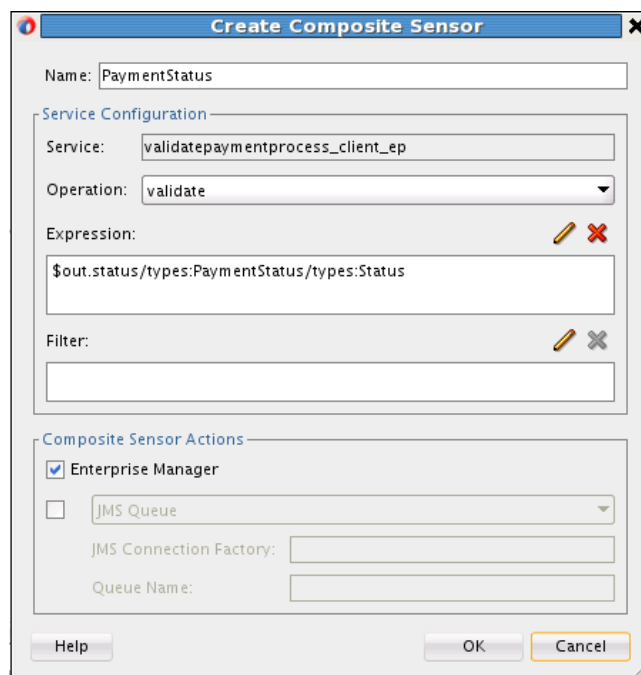
Composite sensors enable you to perform the following tasks:

- Monitor incoming and outgoing messages.
- Locate particular instances by searching for specific sensor details in Oracle Enterprise Manager Fusion Middleware Control.
- Publish JMS data computed from incoming and outgoing messages.
- Track composite instances initiated through business event subscriptions.

The composite sensor is defined on the inbound SOAP web service binding component, as shown in [Figure 3-14](#). You can also define composite sensors on reference binding components and service components that have business event subscriptions.

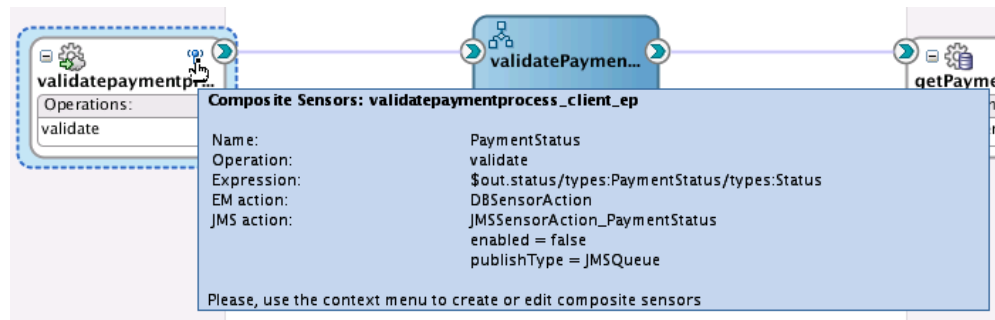
Figure 3-14 Composite Sensor Definition on a SOAP Service Binding Component

The Create Composite Sensor dialog shown in [Figure 3-15](#) shows that an XPath expression is defined to track the payment status (authorized or denied). The **Enterprise Manager** check box is also selected. This enables you to view composite sensor names and values (for example, **Status=Authorized**) in the Flow Instances page of Oracle Enterprise Manager Fusion Middleware Control.

Figure 3-15 Composite Sensors

The sensor is displayed as an icon on the **validatepaymentprocess** SOAP web service binding component. When you place your cursor over the icon, the composite sensor definition is displayed. [Figure 3-16](#) provides details.

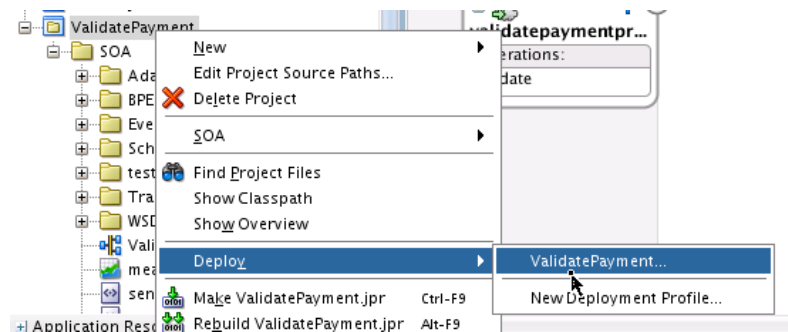
Figure 3-16 Composite Sensor Details



3.2.6 Deploying the validatePayment Composite

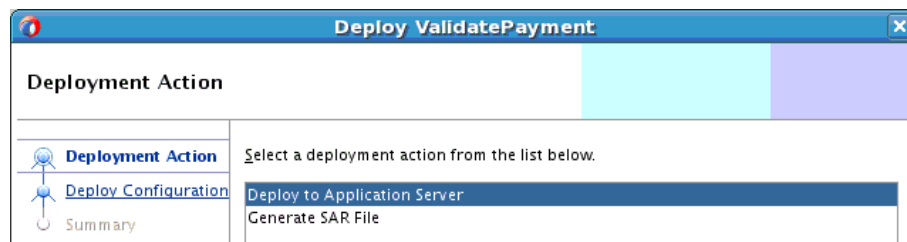
Company X deploys the **validatePayment** composite in Oracle JDeveloper, as shown in [Figure 3-17](#).

Figure 3-17 validatePayment Composite Deployment

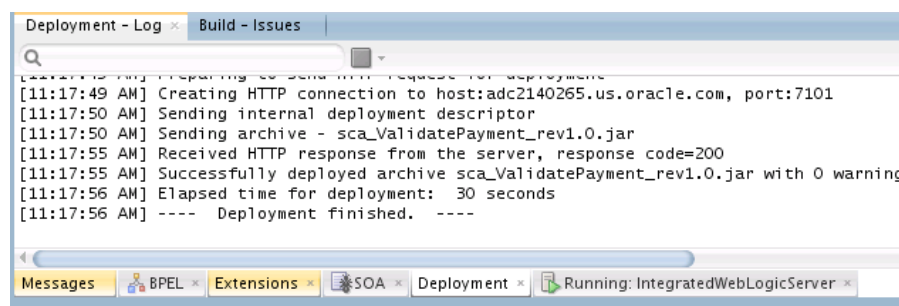


During the deployment process, the composite is deployed to the server on which an application server connection was created in [Configuring the Database Adapter with the Adapter Configuration Wizard](#). [Figure 3-18](#) provides details.

Figure 3-18 Deployment to the Application Server



If there are no compilation errors, the build is successful and deployment starts. [Figure 3-19](#) provides details.

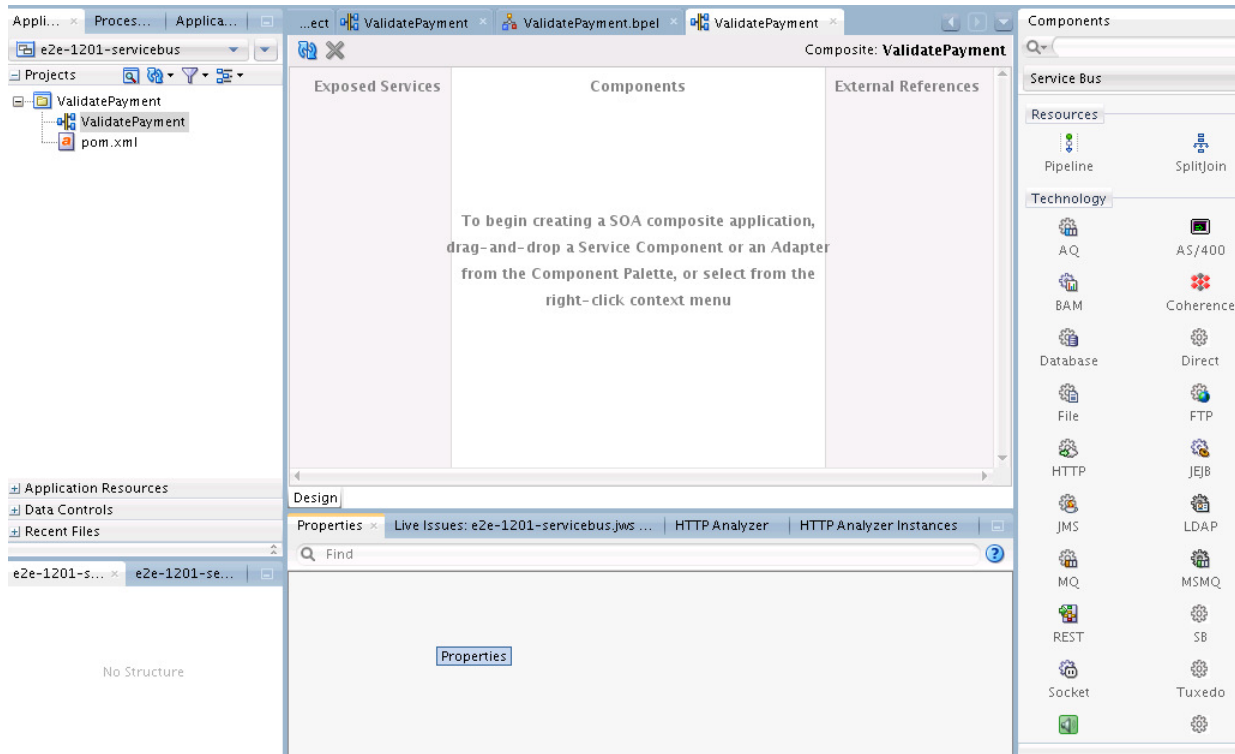
Figure 3-19 Deployment Success Message in Oracle JDeveloper Log Window

3.2.7 Registering SOA Composite Applications with Oracle Service Bus

Company X must be able to protect **validatePayment** composite users from routine changes such as deployment location and implementation updates. To address this requirement, Company X registers the **validatePayment** composite with Oracle Service Bus. Oracle Service Bus scales the service to handle higher volumes of requests and provides resiliency for the service if it is taken down for routine maintenance.

Company X begins by creating an Oracle Service Bus application in which to perform registration. [Figure 3-20](#) provides details. Company X can create proxies, pipelines, and business services by dragging icons from the Components window on the right into the designer. In the Components window, pipeline and split-join icons are displayed. In Release 12c, the pipeline is separated from the proxy to enable it to be a reusable component. Adapters and transports are also displayed for building business services (in the **External References** swimlane) and proxies (in the **Exposed Services** swimlane).

Figure 3-20 Oracle Service Bus Application Ready for Design Registration



When design registration is complete, the business solution looks as shown in [Figure 3-21](#).

Figure 3-21 Oracle Service Bus Application Registration



The following sections provide an overview of Oracle Service Bus application registration:

- [Sharing Resources with Folders](#)
- [Registering the Composite URI of the SOA Composite Application](#)
- [Configuring Pipelines and Proxies](#)

3.2.7.1 Sharing Resources with Folders

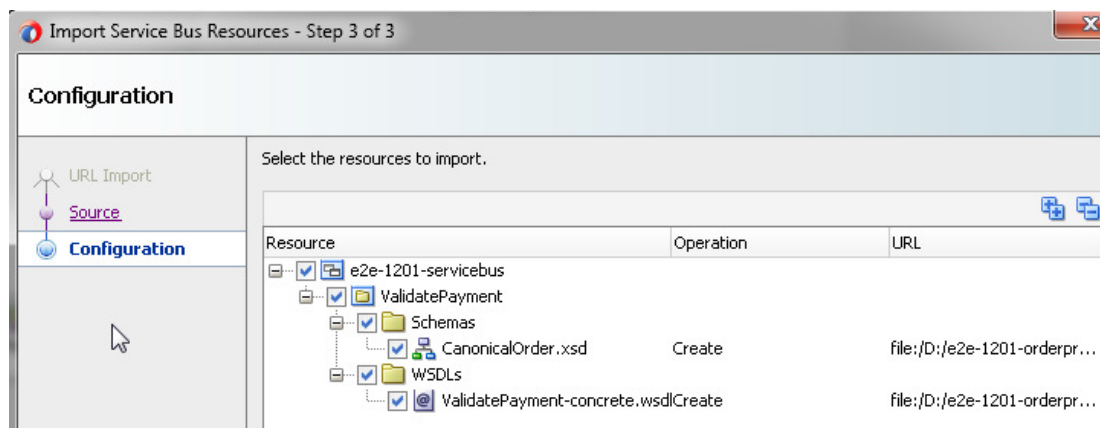
Company X creates folders into which resources such as XSD and WSDL files are imported. This action is performed by right-clicking the Oracle Service Bus application and selecting **New > From Gallery > Folder** to invoke the Create Folder wizard.

Oracle Service Bus folders categorize resources and are aligned with the default **Schema** and **WSDL** folders that are displayed in the Applications window for the SOA

composite application. Folders provide a way to share resources between Oracle Service Bus and the SOA composite application.

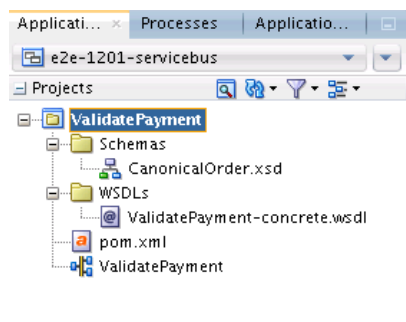
After folder creation, Company X imports the artifacts from the file system for building services by selecting **File > Import > Service Bus Resources** to invoke the Import Service Bus Resources wizard. When artifact selection is complete, the wizard looks as shown in [Figure 3-22](#).

Figure 3-22 Import Service Bus Resources Wizard - Configuration Page



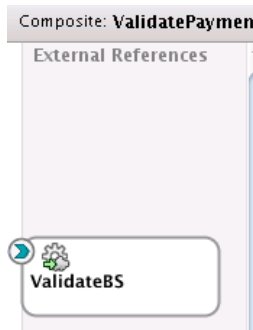
When wizard configuration is complete, [Figure 3-23](#) shows the artifacts in the Applications window.

Figure 3-23 Oracle Service Bus Imported WSDL and Schema File Resources



3.2.7.2 Registering the Composite URI of the SOA Composite Application

A business service (named **ValidateBS** in [Figure 3-21](#)) registers the composite URI of the SOA composite application and provides a representation of the **validatePayment** composite. Configuration is performed by dragging an **HTTP** icon from the Components window into the **External References** swimlane of the Oracle Service Bus application, as shown in [Figure 3-24](#).

Figure 3-24 ValidateBS Business Service

This action invokes the Create Business Service wizard for configuring the following:

- HTTP as the transport type
- WSDL as the service type
- The WSDL file
- The endpoint URI is set to the **validatePayment** composite. The endpoint URI format is based on the transport protocol you selected (HTTP). For example:

```
http://localhost:7101/soainfra/services/default/ValidatePayment/  
validatepaymentprocess_client_ep
```

Company X double-clicks the **ValidateBS** business service to review the general, transport, performance (result caching), and security policy settings.

3.2.7.3 Configuring Pipelines and Proxies

A pipeline (named **ValidatePP** in [Figure 3-21](#)) contains actions performed on the service bus such as error handling reporting, data transformation, and validation before invoking the composite.

Users invoke the **validatePayment** composite through a proxy (named **ValidatePS** in [Figure 3-21](#)) rather than connecting directly to the composite. This provides for more agility and flexibility in managing changes. The proxy is the interface to the service from external consumers.

Pipeline and proxy configuration is performed by dragging a **Pipeline** icon from the Components window into the **Components** section of the Oracle Service Bus application. This action invokes the Create Pipeline Service wizard for pipeline and proxy configuration. During configuration, Company X selects the WSDL file, as shown in [Figure 3-25](#).

Figure 3-25 WSDL Selection for Proxy

The **Expose as Proxy Service** check box is also selected on subsequent pages of the wizard. [Figure 3-26](#) provides details.

Figure 3-26 Expose as a Proxy Service Check Box

Expose as a Proxy Service

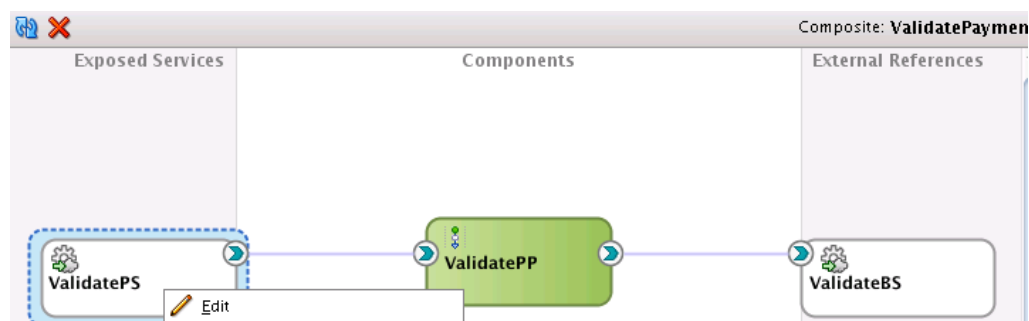
Proxy Name:

Proxy Location:

Proxy Transport:

[Figure 3-27](#) shows the **ValidatePP** pipeline in the **Components** section and the **ValidatePS** proxy in the **Exposed Services** swimlane.

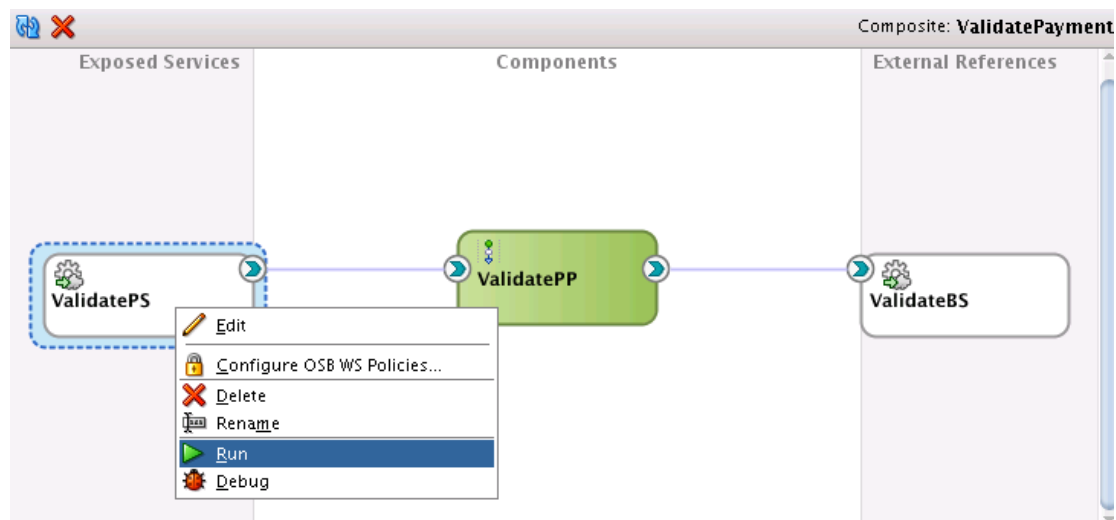
Figure 3-27 Proxy and Pipeline Configuration in the Components Section



3.2.8 Deploying and Testing

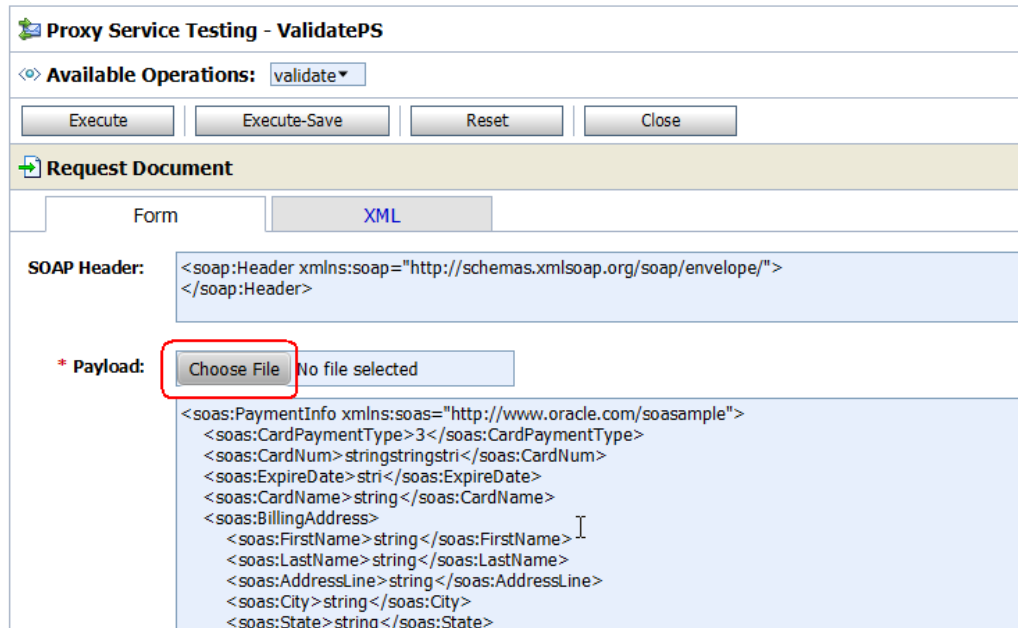
After application design is complete, Company X deploys and tests the application end-to-end by right-clicking the **ValidatePS** proxy and selecting **Run**. [Figure 3-28](#) provides details.

Figure 3-28 Application Invocation



The Test Console is displayed from which you can select a payload for testing. A sample payload is generated for you. [Figure 3-29](#) provides details.

Figure 3-29 Test Console



Company X tests with a sample authorize payment file, as shown in the following example:

```
<ns1:PaymentInfo xmlns:ns1="http://www.oracle.com/soasample">
  <ns1:CardPaymentType>0</ns1:CardPaymentType>
  <ns1:CardNum>1234123412341234</ns1:CardNum>
  <ns1:ExpireDate>0316</ns1:ExpireDate>
  <ns1:CardName>AMEX</ns1:CardName>
  <ns1:BillingAddress>
    <ns1:FirstName>Joe</ns1:FirstName>
    <ns1:LastName>Smith</ns1:LastName>
    <ns1:AddressLine>555 Beverly Lane</ns1:AddressLine>
    <ns1:City>Hollywood</ns1:City>
    <ns1:State>CA</ns1:State>
    <ns1:ZipCode>12345</ns1:ZipCode>
    <ns1:PhoneNumber>5127691108</ns1:PhoneNumber>
  </ns1:BillingAddress>
  <ns1:AuthorizationAmount>100</ns1:AuthorizationAmount>
</ns1:PaymentInfo>
```

After importing the sample file, Company X clicks **Execute**.

Credit validation design and testing is now complete.

3.3 Related Documentation

[Table 3-2](#) provides references to documentation that more specifically describes the components and features described in this chapter.

Table 3-2 Related Topics

For Information About...	See...
Creating a SOA composite application	"Creating a SOA Application" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Creating a database connection	"Creating an Application Server Connection for Oracle JCA Adapters" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Configuring a database adapter with the Adapter Configuration wizard	"Defining an Oracle Database Adapter" of <i>Understanding Technology Adapters</i> .
Designing transformations with the XSLT Map Editor	"Creating Transformations with the XSLT Map Editor" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Creating composite sensors	"Defining Composite Sensors" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Creating Oracle SOA Suite templates	"Oracle SOA Suite Templates and Reusable Subprocesses" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Creating a business service in Oracle Service Bus	"How to Create a Business Service" of <i>Developing Services with Oracle Service Bus</i> <ul style="list-style-type: none">• Create folders• Import resources• Add business services• Create pipelines and proxies
Adding a pipeline	"How to Add a Pipeline" of <i>Developing Services with Oracle Service Bus</i>
Creating a proxy	"How to Create a Proxy Service" of <i>Developing Services with Oracle Service Bus</i>

4

Creating an Order Processing System

This chapter describes how Oracle SOA Suite addresses the business challenge of creating an order processing system. Overviews of how key SOA composite application components are created and address this challenge are provided, including SOA composite templates, inline BPEL subprocesses, composite sensors, and Oracle Service Bus proxy services, pipelines, and business services.

This chapter includes the following sections:

- [Business Challenge](#)
- [Business Solution](#)
- [Related Documentation](#)

4.1 Business Challenge

Company X must design an order processing system that addresses the following business challenges:

- Many different types of clients access the system over different protocols and in different data formats, including mobile devices.
- The new order processing system must support access through REST interfaces (to prepare for a transition to an in-development mobile application).
- Existing systems must be able to place orders using XML and comma-separated value (CSV) files. These must be processed and fulfilled using the same new order provisioning system.
- The system must interface with trading partners and provide electronic data interchange (EDI) support.

4.2 Business Solution

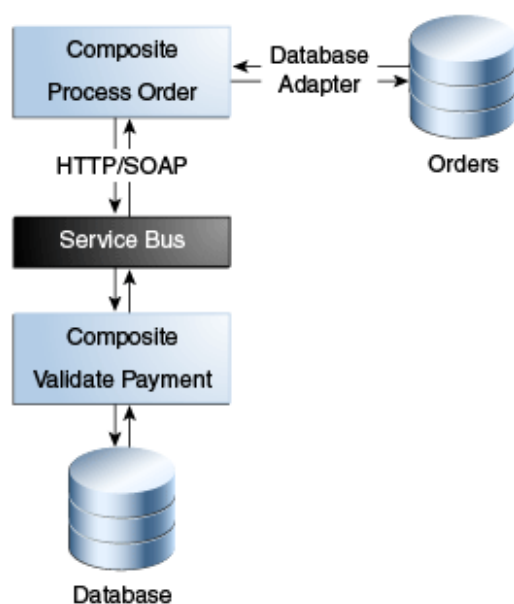
To address these business challenges, Company X designs a business solution that uses the components described in [Table 4-1](#).

Table 4-1 Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
SOA composite application	<p>A SOA composite application is designed to accept new purchase orders, authorize or deny them, and forward the authorized orders to an order fulfillment system. The composite consists of the following components, each of which is briefly described below:</p> <ul style="list-style-type: none"> • SOA project template • Inline BPEL subprocess • Composite sensor 	See Table 3-1 for a description of SOA composite applications.
SOA project template	<p>A SOA project template is imported. The template is used to create the SOA composite application. The predefined components in the composite implement the basic scenario:</p> <ul style="list-style-type: none"> • Receive an order from a web service call • Create an order number and status • Calculate the amount • Save the order in the database • Return an acknowledgement and order number to the customer <p>The following occurs:</p> <ul style="list-style-type: none"> • If the payment is denied, the order status is set to Denied and processing is stopped. • If the payment is authorized, the order status is set to Authorized and the order is sent to an order fulfillment system for processing. (Described in Fulfilling Orders .). When processing is finished, the order status is set to ReadyForShip. 	See Table 3-1 for a description of SOA project templates.
Inline BPEL subprocess	<p>The inline BPEL process (through use of a call activity) invokes the payment validation system in Creating a Credit Validation System to update the order status in the database based on the outcome of the payment validation.</p>	<p>A subprocess is a fragment of BPEL code that can be reused within a composite by separate processes. The subprocess extension provides the following benefits:</p> <ul style="list-style-type: none"> • BPEL process code reusability, which reduces the need to create the same activities multiple times to perform the same tasks. • Code modularity. • Code maintenance (changes are propagated, which eliminates the need to implement updates in multiple places every time a change is necessary). • Memory footprint reduction, which can be considerable in a complex process.
Composite sensor	A composite sensor tracks the order number.	See Table 3-1 for a description of SOA composite sensors.
Oracle Service Bus proxy service, pipeline, and business service	An Oracle Service Bus makes the order processing composite available over many protocols and data formats, and validates the order.	See Table 3-1 for a description of Oracle Service Bus.

Figure 4-1 provides an overview of how this business solution is implemented.

Figure 4-1 Order Process Overview



Subsequent sections of this chapter provide more specific details about how the components in [Table 4-1](#) are used to address the order processing business challenge.

- [Creating a SOA Composite Application From a SOA Project Template](#)
- [Customizing the Contents of the SOA Project Template](#)
- [Updating Order Status with an Inline BPEL Subprocess](#)
- [Tracking the Order Number with Composite Sensors](#)
- [Updating Order Status After Payment Authorization](#)
- [Deploying and Testing in](#)
- [Registering the ProcessOrder Composite on](#)
- [Testing the Pipeline Template](#)

4.2.1 Creating a SOA Composite Application From a SOA Project Template

As described in [Calculating Payment Status with XSLT Transformations](#), templates enable you to reuse existing composites, service components, and custom activities. Company X frequently has business requirements for designing SOA composite applications that accept new purchase orders, approve them, and forward them to an order fulfillment system. For this reason, Company X created a project template named **ProcessOrderTemplate** with these capabilities that can be imported into multiple applications in Oracle JDeveloper, as necessary. The template can then be customized for the business requirements of that specific project. Changes made to that specific imported template are not propagated to projects previously created using this template.

The **ProcessOrderTemplate** project template is registered in Oracle JDeveloper by selecting **Tools > Preferences > SOA > Templates**, and specifying the template storage location. The

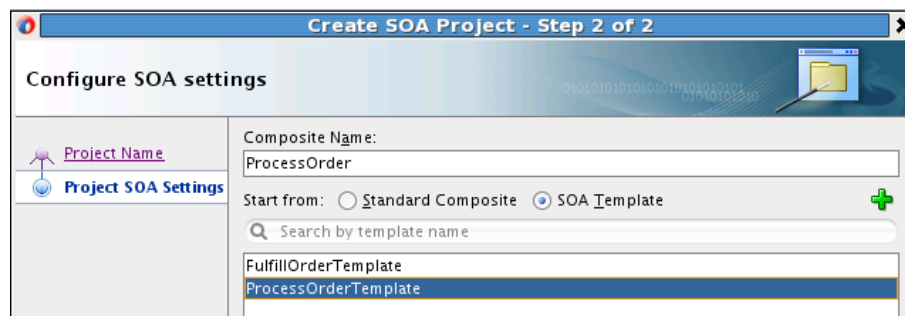
template is provided as a JAR file. This makes the template visible for selection in Oracle JDeveloper.

The project template consists of a number of predefined components and provides the following functionality:

- Receives an order from a SOAP web service.
- Creates an order number, sets the order date to the current date, and sets the order status to a value of **New**.
- Calculates the total order amount.
- Saves the order in the database with a status value of **New**.
- Returns an acknowledgement to the client with the order number.

Company X invokes the Create SOA Project wizard to create a new SOA project. While running the wizard, Company X selects to create a project based on a template. The project template is imported into the new application by selecting **SOA Template** in the Create SOA Project wizard, which refreshes the dialog to display existing templates for selection. **ProcessOrderTemplate** is selected, then the project name is shortened to **ProcessOrder**. Figure 4-2 provides details.

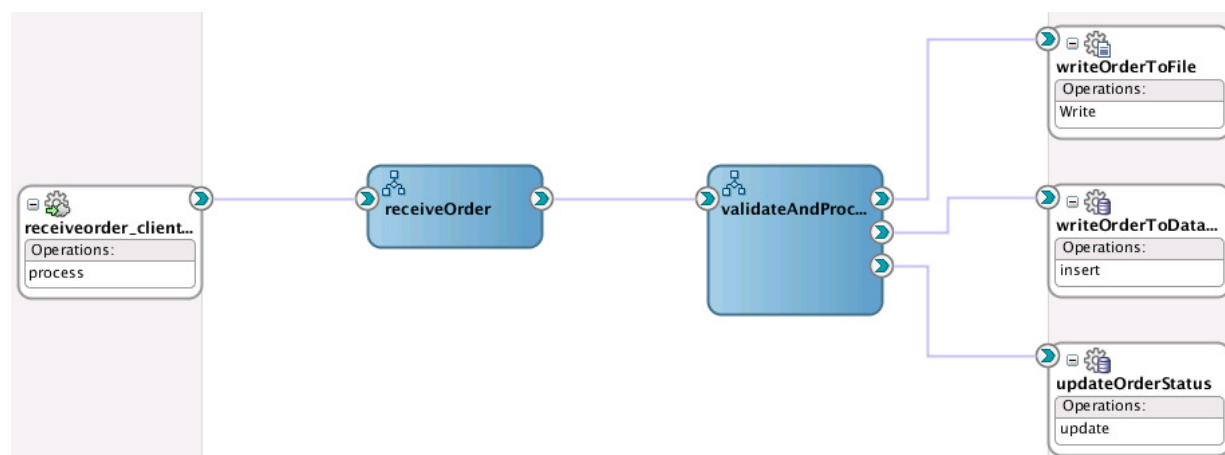
Figure 4-2 Selection of SOA Composite Template in the Create SOA Project Dialog



When imported, the project and its predefined components looks as shown in Figure 4-3.

- The **receiveOrder_client** service receives an order from a customer.
- The **receiveOrder** BPEL process service component sets an order number (which is provided back to the client) and order date, and calls the **validateAndProcessOrder** BPEL process service component.
- The **validateAndProcessOrder** BPEL process service component assigns an order to a variable and calculates the total amount of the order used to validate the payment. It invokes three partner links as part of validating and processing the order.
 - The **writeOrderToFile** file adapter reference writes the order to a file using a file adapter.
 - The **writeOrderToDatabase** reference writes the order to the database using a database adapter.
 - The **updateOrderStatus** reference updates the order status to **Denied** or **Authorized** in the database according to the value returned.

Figure 4-3 Imported Template of a SOA Composite Application



4.2.2 Customizing the Contents of the SOA Project Template

The **validateAndProcessOrder** BPEL process of the template assigns the order to a variable and calculates the total order amount used to validate the payment. The activities in the process shown in Figure 4-4 perform the following tasks:

- An XSLT transform activity calculates the total order amount.
- An assign activity adds the total order amount to the order message.
- A scope activity (collapsed below) includes all activities involved in updating the order status in the database and in a file.

Figure 4-4 Key Activities of the validateAndProcessOrder BPEL Process



- If the payment is denied, the order is cancelled and the order status is updated in the database.
- If the payment is authorized, the order status is updated in the database and file, and the order is processed. When processing is complete, the status is updated to **ReadyForShip**.

An order only requires processing if payment has first been validated. The **ProcessOrder** composite does not include this functionality. However, Company X created the **validatePayment** composite in [Creating a Credit Validation System](#). Company X customizes the imported composite template to invoke the **validatePayment** composite to validate the payment. If the payment is authorized, the **ProcessOrder** composite then processes the order. This customization to the imported template is not propagated to users of this template in other projects.

Company X customizes the **ProcessOrder** composite by dragging a SOAP web service into the **External References** swimlane to invoke the Create Web Service dialog. From this dialog, Oracle SOA Suite enables you to browse services deployed in an Oracle SOA Suite or Oracle Service Bus project on the integrated server in Oracle JDeveloper or on a remote application server. You can browse for the following:

- Select WSDL URLs.
- Read WSDLs from a file system, Oracle Metadata Services Repository (MDS Repository), UDDI registry, or web services inspection language (WSIL) file.

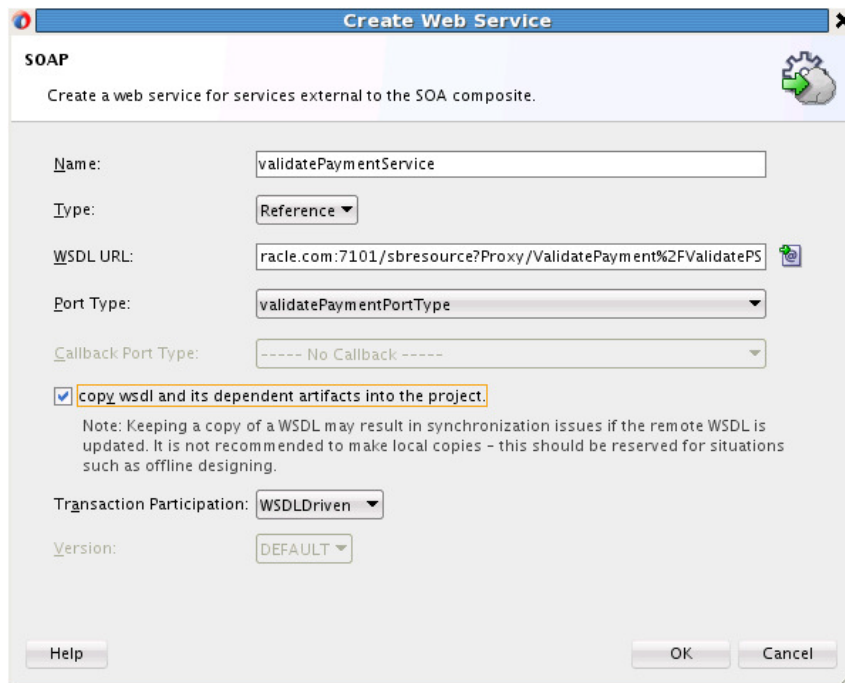
The Oracle Service Bus proxy service for **validatePayment** is selected by clicking the icon to the right of the **WSDL URL** field. Selecting this icon enables you to browse for services. The **ValidatePS** proxy service created in [Registering SOA Composite Applications with](#) is selected, as shown in [Figure 4-5](#).

Figure 4-5 Selection of ValidatePS Proxy in the WSDL Chooser Dialog



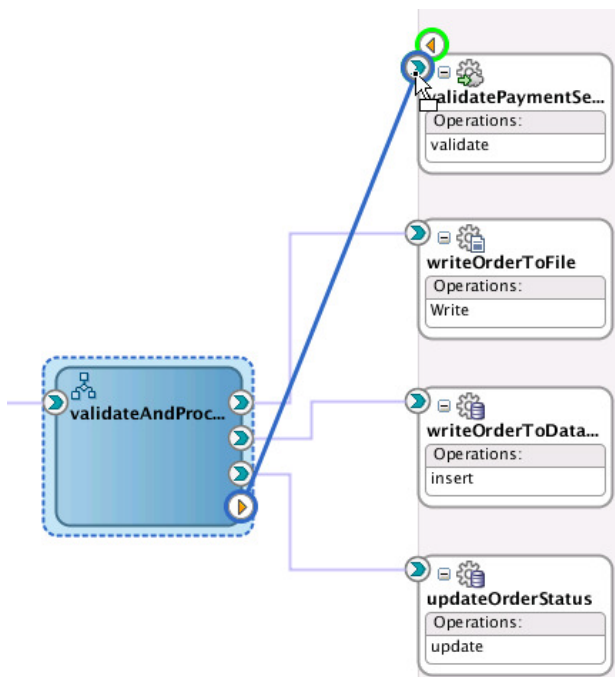
The new web service (named **validatePaymentService**) invokes the **validatePayment** proxy service defined in [Registering SOA Composite Applications with](#). The port type is automatically added. [Figure 4-6](#) provides details.

Figure 4-6 Call of validatePayment Proxy WSDL File



The **validateAndProcessOrder** BPEL process is then wired to the new **validatePaymentService** SOAP web service in the SOA Composite Editor, as shown in [Figure 4-7](#).

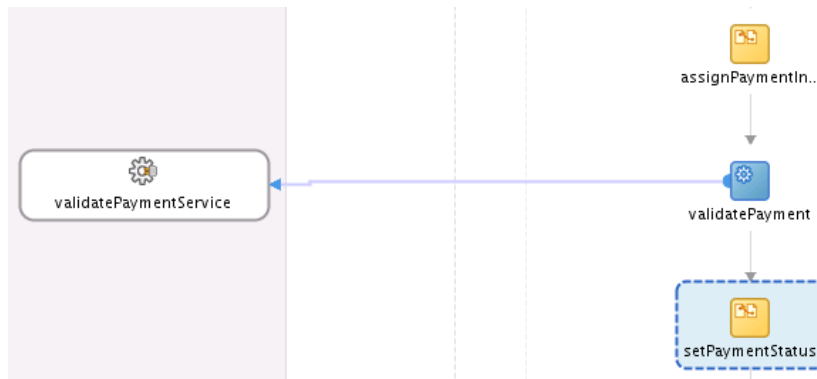
Figure 4-7 Invocation of validatePaymentService SOAP Web Service



Company X further customizes the **validateAndProcessOrder** BPEL process by adding the following:

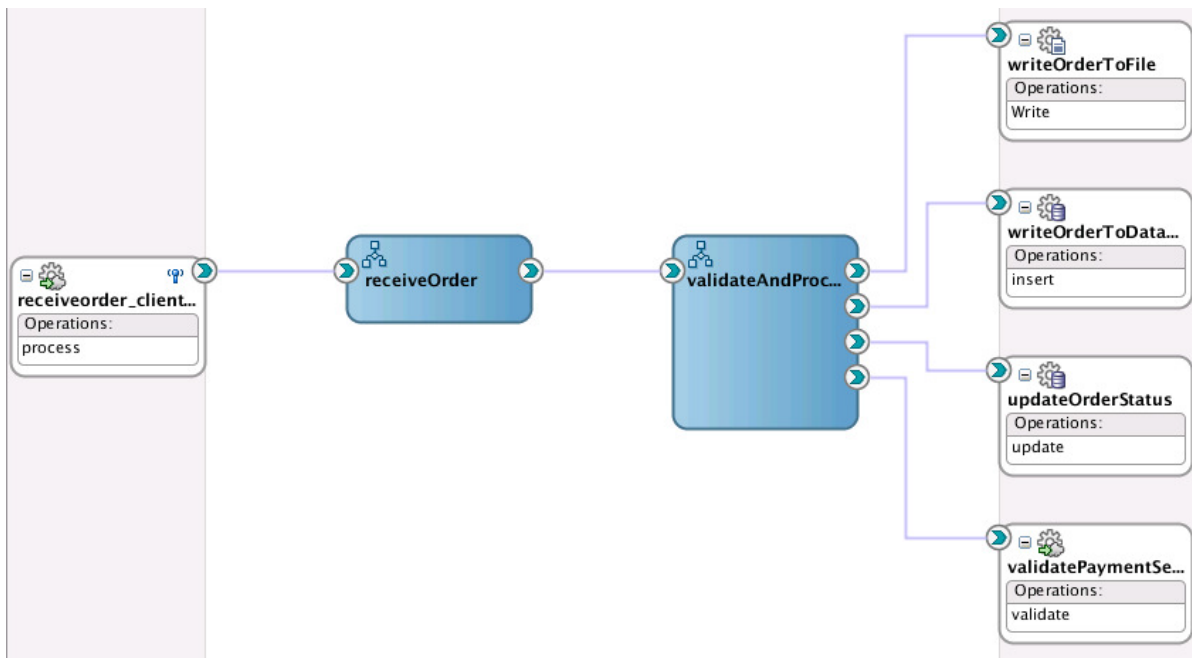
- An invoke activity (named **validatePayment**) to invoke the **validatePaymentService** partner link.
- An assign activity before the **validatePayment** invoke activity for assigning the correct values to the input variable for the web service call.
- An assign activity after the invoke activity to assign the payment status reply from the web service call to the order message. [Figure 4-8](#) provides details.

Figure 4-8 Customizations to the validateAndProcessOrder BPEL Process of the Composite Template



The completed composite is shown in [Figure 4-9](#).

Figure 4-9 Completed Composite



4.2.3 Updating Order Status with an Inline BPEL Subprocess

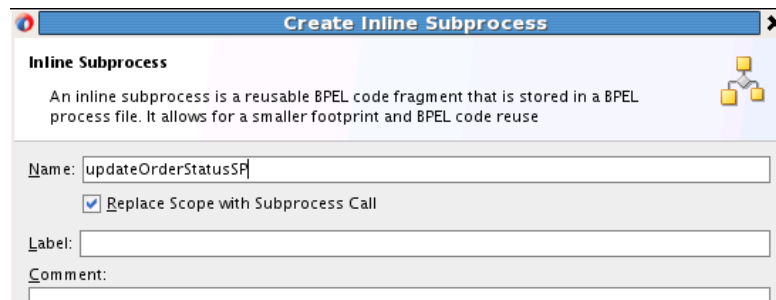
Company X has a requirement to use the order status update part of the **validateAndProcessOrder** BPEL process at least once more in the same BPEL process. One method is to create the same assign and invoke activities already used. However, this is an error prone process and every time a change is necessary, it must be made in all those places. To avoid this, Company X uses a BPEL subprocesses. There are two types:

- **Standalone:** A fragment of a BPEL process, which includes a number of activities to reuse. Standalone subprocess do not have an interface and are only called from another BPEL process. A standalone process can have partner links across a number of other BPEL processes.
- **Inline:** For groups of activities that are reused within a single BPEL process. An inline process is part of the parent BPEL process code and is not visible in the composite view. You use a call activity for inline subprocesses.

The inline subprocess is ideal for Company X's business requirements.

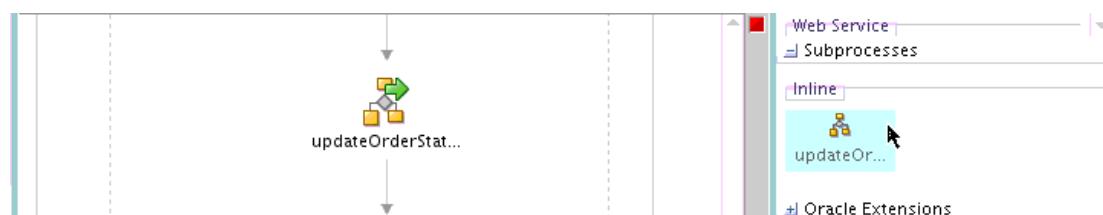
Within the **validateAndProcessOrder** BPEL process, the scope activity responsible for updating the order status, named **updateOrderStatusScope**, is right-clicked, and **Convert to a Subprocess** is selected. This invokes the Create Inline Subprocess dialog. Company X renames the subprocess and selects to automatically replace the scope activity with a subprocess call activity. [Figure 4-10](#) provides details.

Figure 4-10 Create Inline Subprocess



This converts the scope activity into a call activity. A call activity executes referenced subprocess code in standalone and inline subprocesses. The call activity is also added to the **Subprocesses** part of the Components window. You can drag and drop this call activity as needed into other locations in the BPEL process. [Figure 4-11](#) provides details.

Figure 4-11 Call Activity in the BPEL Process and in the Components Window

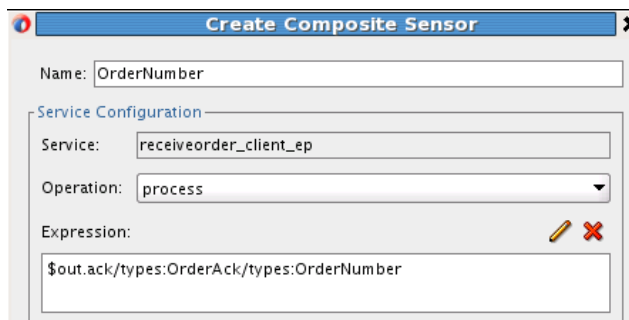


4.2.4 Tracking the Order Number with Composite Sensors

Company X added a composite sensor for tracking the status of order payments in [Tracking Payment Status with Composite Sensors](#).

Company X now has an additional requirement for a composite sensor to track the order number. The SOAP web service **receiveorder_client** included in the imported composite template shown in [Figure 4-3](#) returns the **orderNumber** in the order acknowledgement message. Company X defines a composite sensor on this service that includes an XPath expression to track the order number, as shown in the Create Composite Sensor dialog in [Figure 4-12](#).

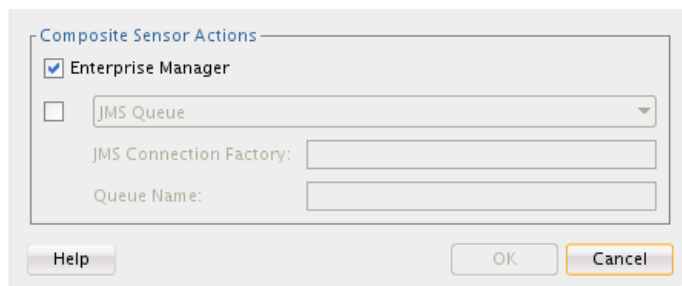
Figure 4-12 Expression Defined on Composite Sensor



The screenshot shows a dialog box titled "Create Composite Sensor". It has a "Name" field containing "OrderNumber". Below this is a "Service Configuration" section with a "Service" dropdown set to "receiveorder_client_ep", an "Operation" dropdown set to "process", and an "Expression" text area containing the XPath expression "\$out.ack/types:OrderAck/types:OrderNumber". There are edit and delete icons next to the expression field.

The **Enterprise Manager** check box of the Create Composite Sensor dialog is also selected, as shown in [Figure 4-13](#). This enables you to track composite sensor names and values (for example, **OrderNumber=1234**) on the Flow Instances page or the Flow Trace page for a specific business flow instance in Oracle Enterprise Manager Fusion Middleware Control. Oracle Enterprise Manager Fusion Middleware Control is a web browser-based, graphical user interface that you use to monitor and administer your deployed composites.

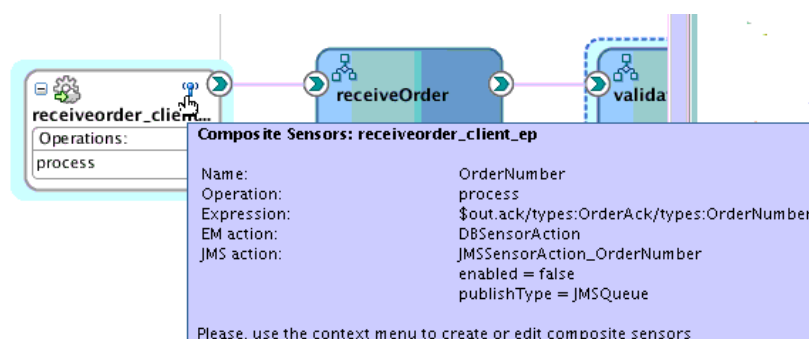
Figure 4-13 Enterprise Manager Check Box for Composite Sensors



The screenshot shows a dialog box titled "Composite Sensor Actions". It features a checked "Enterprise Manager" checkbox. Below it is a "JMS Queue" dropdown menu, followed by "JMS Connection Factory" and "Queue Name" text input fields. At the bottom are "Help", "OK", and "Cancel" buttons.

The composite sensor definition is displayed by placing the cursor over the icon on the **receiveorder_client** SOAP web service binding component. [Figure 4-14](#) provides details.

Figure 4-14 Composite Sensor Definition



4.2.5 Updating Order Status After Payment Authorization

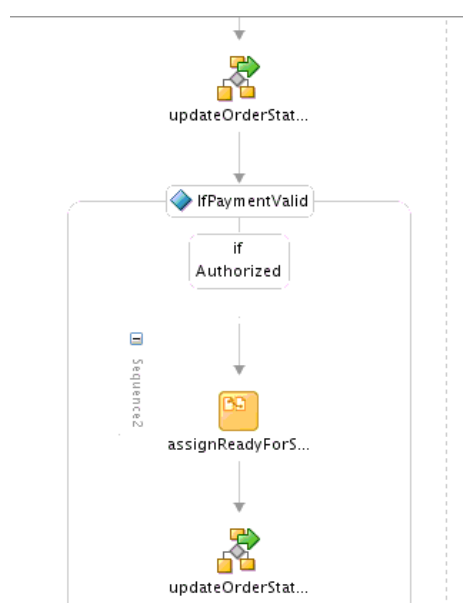
If the payment is valid, the order status is set to **ReadyForShip** in the database. This status update triggers the order fulfillment process described in [Fulfilling Orders](#).

Company X further customizes the **validateAndProcessOrder** BPEL process by adding an if activity. An if activity defines conditional behavior for specific activities to decide between the execution of two or more branches. Only one activity is selected for execution from a set of branches. The if activity for this business scenario consists of the following branches:

- If the payment is authorized, the order continues. An assign activity in the if branch updates the order status to **ReadyForShip** in the database.
- If the payment is denied, processing ends and an email is sent to the customer informing them about the unauthorized payment.

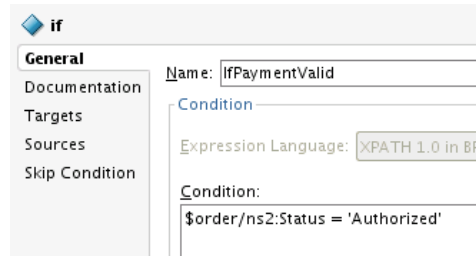
Figure 4-15 provides details. The if activity is added below the **updateOrderStatusSP** call activity that was created in [Updating Order Status with an Inline BPEL Subprocess](#).

Figure 4-15 If Activity



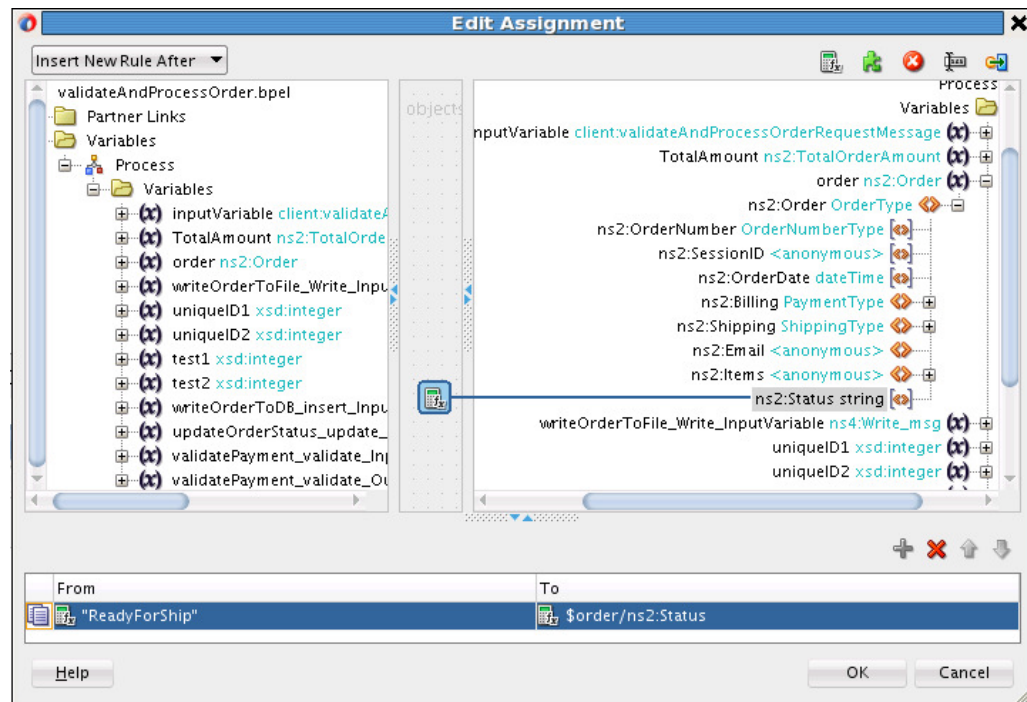
An expression is defined on the **if** branch if the payment is authorized, as shown in Figure 4-16.

Figure 4-16 If Branch Authorizes Payment

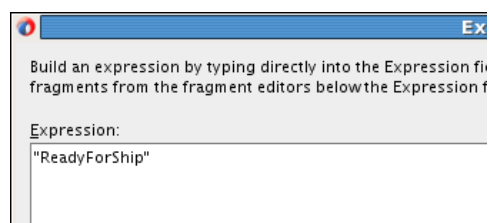


If payment is authorized, the processing of the order is complete. An assign activity is added to the **if** branch to update the order status to **ReadyForShip** in the database. The contents of the copy rule in the assign activity are shown in Figure 4-17.

Figure 4-17 Assign Activity



The XPath expression contents in the copy rule assign activity are shown in Figure 4-18.

Figure 4-18 ReadyForShip Expression

An **else** branch is not necessary and is deleted because order processing stops if the payment has been denied.

4.2.6 Deploying and Testing in Oracle Enterprise Manager Fusion Middleware Control

Company X deploys and creates a business flow instance of the project. In the Flow Trace page in Oracle Enterprise Manager Fusion Middleware Control, the two composite sensor names and values are displayed. Payment has been authorized, and the project is sent to the order fulfillment system. [Figure 4-19](#) provides details.

Figure 4-19 Composite Sensor Names and Values on Flow Trace Page

Sensor Name	Value	Location	Composite
OrderNumber	201342093899	receiveorder_client_e	ProcessOrder [1.0]
PaymentStatus	Authorized	validatepaymentproci	ValidatePayment [1.0]

Trace						
Instance	Type	Usage	State	Time	Composite	
receiveorder_client_ep	Service	Service	Completed	Apr 20, 2013 9:38:09 AM	ProcessOrder [1.0]	
receiveOrder	BPEL		Completed	Apr 20, 2013 9:38:09 AM	ProcessOrder [1.0]	
validateAndProcessOrder	BPEL		Completed	Apr 20, 2013 9:38:09 AM	ProcessOrder [1.0]	
writeOrderToDatabase	Reference	Reference	Completed	Apr 20, 2013 9:38:10 AM	ProcessOrder [1.0]	
writeOrderToFile	Reference	Reference	Completed	Apr 20, 2013 9:38:11 AM	ProcessOrder [1.0]	
validatePaymentService	Reference	Reference	Completed	Apr 20, 2013 9:38:11 AM	ProcessOrder [1.0]	
OSB	OSB			Apr 20, 2013 9:38:13 AM		
validatepaymentprocess_client_ep	Service	Service	Completed	Apr 20, 2013 9:38:13 AM	ValidatePayment [1.0]	
validatePaymentProcess	BPEL		Completed	Apr 20, 2013 9:38:13 AM	ValidatePayment [1.0]	
getPaymentInformation	Reference	Reference	Completed	Apr 20, 2013 9:38:13 AM	ValidatePayment [1.0]	
updateOrderStatus	Reference	Reference	Completed	Apr 20, 2013 9:38:14 AM	ProcessOrder [1.0]	
updateOrderStatus	Reference	Reference	Completed	Apr 20, 2013 9:38:14 AM	ProcessOrder [1.0]	

The audit trail indicates that the order is marked as **Authorized** and **ReadyForShip**. [Figure 4-20](#) provides details.

Figure 4-20 Flow of Business Flow Instance

▼ updateOrderStatus	
Jul 10, 2013 3:35:56 PM	bpelx:call execution started
Jul 10, 2013 3:35:57 PM	bpelx:call execution completed
▼ <process>	
▼ <Sequence1 (38)>	
▼ assignOrderStatus	
Jul 10, 2013 3:35:56 PM	Updated variable "updateOrderStatus_update_InputVariable"
Jul 10, 2013 3:35:56 PM	Updated variable "updateOrderStatus_update_InputVariable"
Jul 10, 2013 3:35:56 PM	Completed assign
▼ updateOrderStatus	
Jul 10, 2013 3:35:56 PM	Started invocation of operation "update" on partner "updateOrderStatus".
▼ Jul 10, 2013 3:35:56 PM	Invoked 1-way operation "update" on partner "updateOrderStatus".
	View Payload
▼ <IfPaymentValid (189)>	
▼ IfPaymentValid	
Jul 10, 2013 3:35:57 PM	If is selected. Condition is "\$order/hs2:Status = 'Authorized'".
▼ <Sequence1 (194)>	
▼ assignReadyForShipStatus	
Jul 10, 2013 3:35:57 PM	Updated variable "order"
Jul 10, 2013 3:35:57 PM	Completed assign
▼ updateOrderStatusToReadyForShip	
Jul 10, 2013 3:35:57 PM	bpelx:call execution started
Jul 10, 2013 3:35:57 PM	bpelx:call execution completed
▼ <process>	
▼ <Sequence1 (38)>	
▼ assignOrderStatus	
Jul 10, 2013 3:35:57 PM	Updated variable "updateOrderStatus_update_InputVariable"
Jul 10, 2013 3:35:57 PM	Updated variable "updateOrderStatus_update_InputVariable"
Jul 10, 2013 3:35:57 PM	Completed assign
▼ updateOrderStatus	
Jul 10, 2013 3:35:57 PM	Started invocation of operation "update" on partner "updateOrderStatus".
▼ Jul 10, 2013 3:35:57 PM	Invoked 1-way operation "update" on partner "updateOrderStatus".
	View Payload

4.2.7 Registering the ProcessOrder Composite on Oracle Service Bus

As with the **validatePayment** composite in [Creating a Credit Validation System](#), Company X uses Oracle Service Bus to register the **ProcessOrder** composite to make it available to external customers.

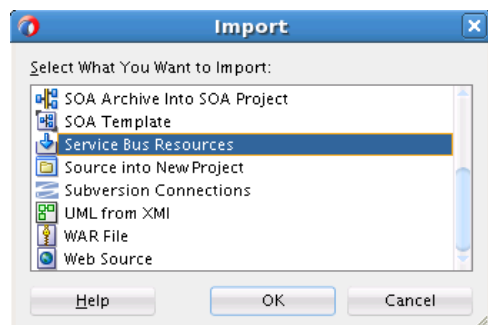
Oracle Service Bus makes the **ProcessOrder** composite available over different protocols and data formats without disrupting the core business logic in the composite. Oracle Service Bus also validates the order data and performs auditing.

Company X updates the Oracle Service Bus application created in [Registering SOA Composite Applications with](#) to include additional projects. These projects use a pipeline template.

Pipeline templates are used to design prototype message flows for proxy services. A pipeline template defines the general shape or pattern of the message flow. Concrete pipelines can then be generated out of the pipeline template. All concrete pipelines use the message flow defined by the pipeline template with designated places where custom logic can be inserted.

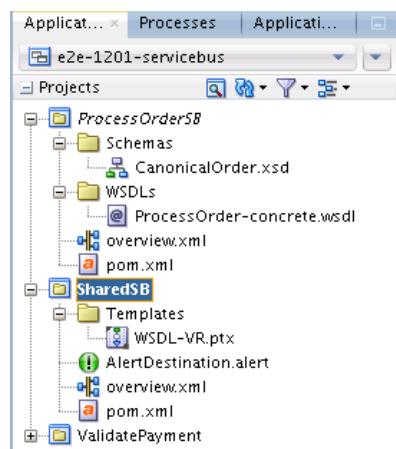
Company X imports the template by right-clicking the Oracle Service Bus application, selecting **Import**, and selecting **Service Bus Resources**. [Figure 4-21](#) provides details.

Figure 4-21 Oracle Service Bus Resources Selection



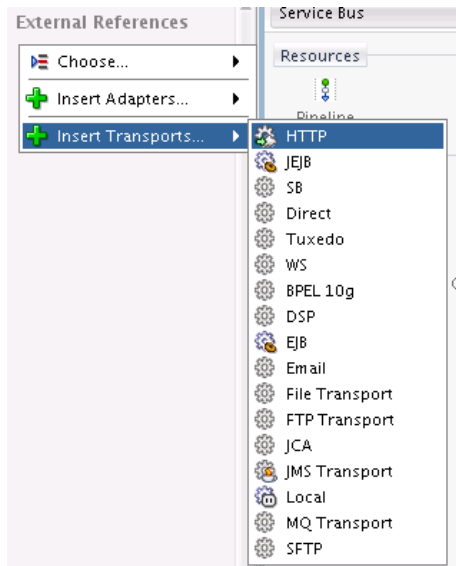
This invokes the Import Service Bus Resources dialog for selecting the pipeline template to use. When complete, the imported template is displayed in the Applications window, as shown in [Figure 4-22](#).

Figure 4-22 Imported Oracle Service Bus Pipeline Template in Applications Window



4.2.7.1 Registering the ProcessOrder Composite as a Business Service

Company X registers the composite as a business service by right-clicking in the **External References** column and selecting **Insert Transports > HTTP**, as shown in [Figure 4-23](#).

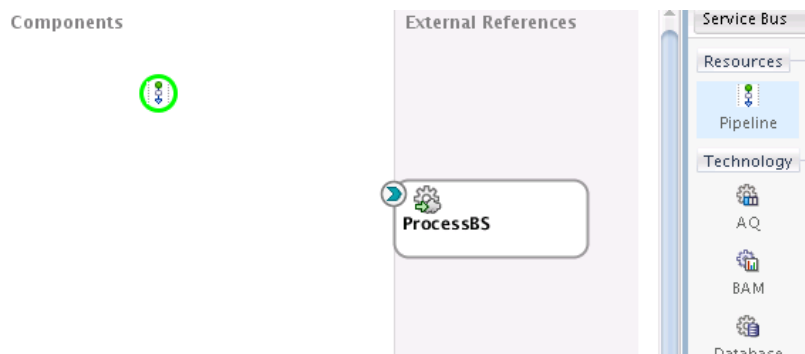
Figure 4-23 Business Service Creation

This action invokes the Create Business Service wizard in which Company X sets the following:

- HTTP as the transport type
- **ProcessOrder** concrete WSDL as the service type
- The WSDL file
- The composite as the endpoint URI. Oracle Service Bus also enables you to have multiple endpoints for your business service to support application load balancing and failover.

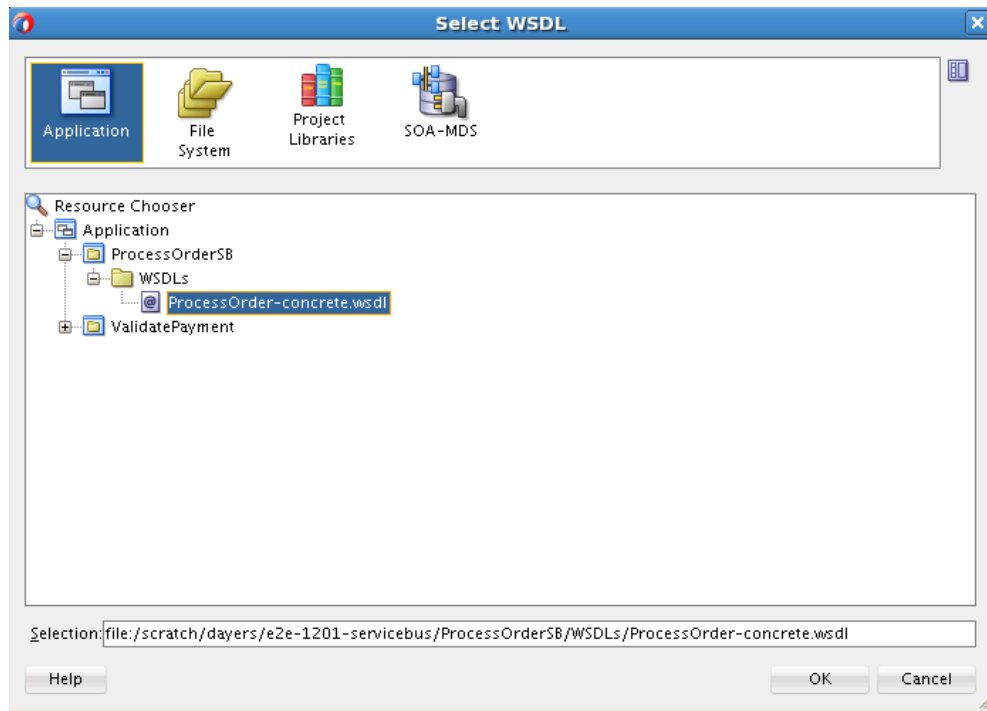
4.2.7.2 Creating a New Pipeline with a Proxy Using the Pipeline Template

Company X then creates a pipeline template (**SharedSB**) by dragging a **Pipeline** icon from the Component window into the **Components** section of Oracle JDeveloper, as shown in [Figure 4-24](#).

Figure 4-24 Pipeline Template

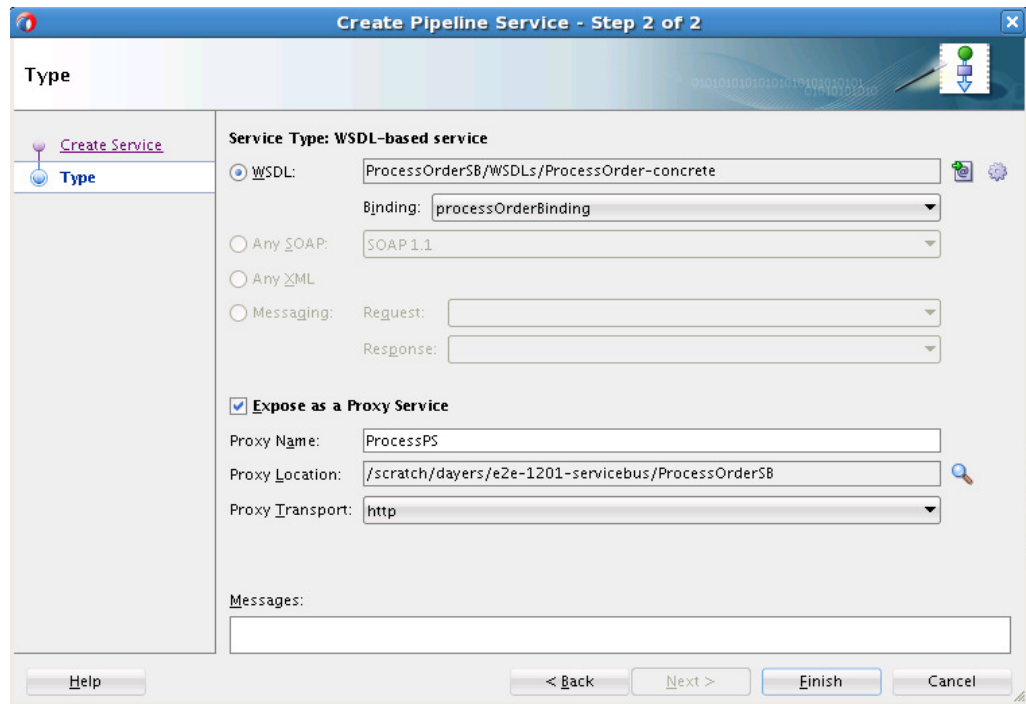
This invokes the Create Pipeline Service dialog for selecting the imported pipeline template to use. During configuration, you select the template for WSDL-based services, the specific WSDL to use for the pipeline (shown in [Figure 4-25](#)), and to expose the pipeline as a proxy service.

Figure 4-25 Select WSDL Dialog



When configuration is complete, the Create Pipeline Service dialog looks as shown in [Figure 4-26](#).

Figure 4-26 Completed Create Pipeline Service Dialog

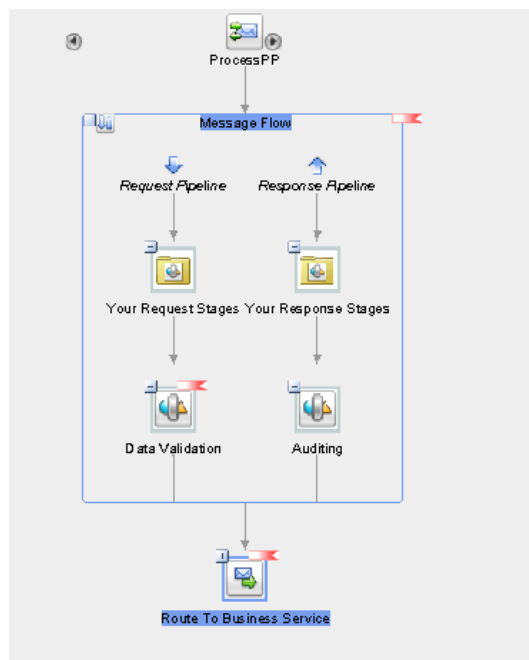


The pipeline is displayed in the application, as shown in [Figure 4-27](#). The yellow icon in the pipeline indicates that it requires additional configuration before it is fully implemented.

Figure 4-27 Pipeline in Application



Double-clicking **ProcessPP** displays it for editing, and includes some features partially preconfigured (for example, data validation, routing, reporting, error condition alerts, and error handling). Red flags indicate areas that require additional configuration. The **Your Request Stages** message indicates areas in which the pipeline provides placeholder information for Company X to customize (such as transformations and message enrichment). [Figure 4-28](#) provides details.

Figure 4-28 Preconfigured Pipeline Template

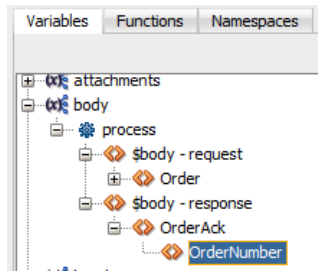
The template also enables you to define an error handler for pipelines, as shown in [Figure 4-29](#). The predefined error handler reports error back to the caller with details and send an alert to Oracle Enterprise Manager Fusion Middleware Control indicating that something is wrong with processing.

Figure 4-29 Error Handling in the Pipelines Template

Company X configures data validation by opening the **Data Validation** stage and selecting the **Validate** action. This part enables Company X to validate the incoming payload against the **Order** schema element type expected by the **ProcessOrder** composite. Validating in Oracle Service Bus saves resources in the back end that are processing good orders. Company X only needs to select the **Order** type against which to validate, since all other details are preconfigured.

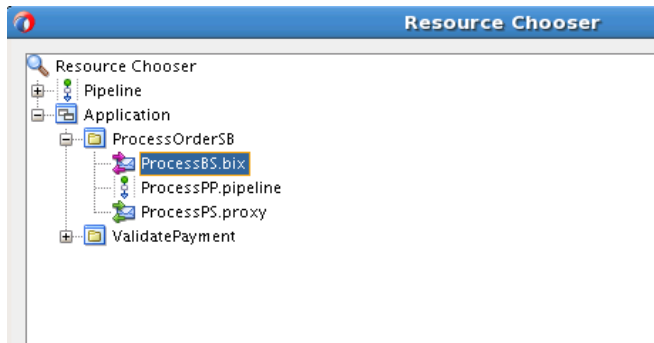
Company X configures the **Report** action in the **Auditing** stage of the response flow shown in [Figure 4-28](#) to report on the **Order** number returned from the composite, as shown in [Figure 4-30](#). The template already saves a copy of the incoming order in case of an error and reports it to Oracle Enterprise Manager Fusion Middleware Control.

Figure 4-30 OrderNumber Selection



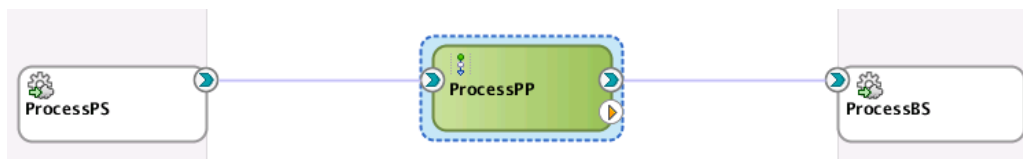
Company X also configures the routing node by double-clicking the **Routing** icon in the template in [Figure 4-28](#), selecting the **Routing** tab in the Property Inspector, and selecting the **ProcessBS** business service. [Figure 4-31](#) provides details.

Figure 4-31 Business Service Selection



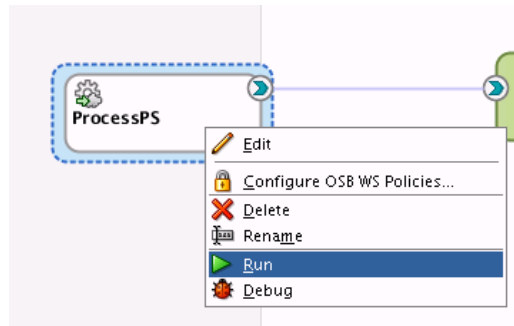
When configuration is complete, the Oracle Service Bus application looks as shown in [Figure 4-32](#).

Figure 4-32 Oracle Service Bus Application



4.2.8 Testing the Pipeline Template

Company X tests by right-clicking the **ProcessPS** service in the left swim lane and selecting **Run**, as shown in [Figure 4-33](#). Good and bad orders are sent during the test phase.

Figure 4-33 Testing the Pipeline Template

4.3 Related Documentation

Table 4-2 provides references to documentation that more specifically describes the components and features described in this chapter.

Table 4-2 Related Documentation

For Information About...	See...
Creating a SOA composite application	"Creating a SOA Application" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Creating and using composite templates and inline subprocesses	"Oracle SOA Suite Templates and Reusable Subprocesses" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Creating composite sensors	"Defining Composite Sensors" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Creating a business service in Oracle Service Bus	"Creating and Configuring Business Services" of <i>Developing Services with Oracle Service Bus</i>
Using pipeline templates	"Working with Pipeline Templates" of <i>Developing Services with Oracle Service Bus</i>

5

Adding New Ordering Channels with Oracle Service Bus

This chapter describes how Oracle SOA Suite addresses the business challenge of adding new ordering channels. Overviews of how key components are used to address this challenge are provided, including file-based proxies in Oracle Service Bus, the Native Format Builder Wizard, Oracle Enterprise Manager Fusion Middleware Control, and the Oracle Service Bus debugger.

This chapter includes the following sections:

- [Business Challenge](#)
- [Business Solution](#)
- [Related Documentation](#)

5.1 Business Challenge

Company X has a requirement for legacy systems to place orders in common delimited formats without impacting the back end application. Protocol and data translation must be provided to minimize disruptions to the back end business logic of the **ProcessOrder** composite designed in [Creating an Order Processing System](#).

5.2 Business Solution

To address these business challenges, Company X designs a business solution that uses the components described in [Table 5-1](#).

Table 5-1 Components That Provide the Business Solution

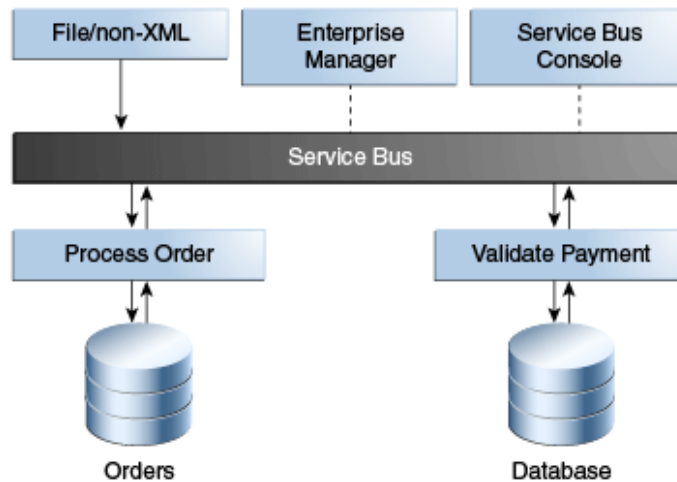
Component	How This Component Addresses The Business Challenge	Component Description
Oracle Service Bus file-based proxy	An Oracle Service Bus pipeline connects a proxy service to a file ordering channel. The proxy handles incoming customer orders by file.	A pipeline validates the application before invocation. A proxy enables customers to invoke the composite through a proxy instead of connecting directly to the composite.
Native Format Builder Wizard	The file adapter transforms a comma-delimited order to an XML schema file for the order processing composite to use.	The Native Format Builder Wizard enables you to create a native schema file from a variety of file formats, such as delimited, fixed-length, complex type, data type description (DTD), and Cobol Copybook.
Oracle Service Bus Debugger	A breakpoint debugger set on the Oracle Service Bus pipeline tests and debugs the end-to-end application.	The Oracle Service Bus debugger enables you to set breakpoints directly in Oracle JDeveloper for troubleshooting on pipelines and split-joins.

Table 5-1 (Cont.) Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
Oracle Enterprise Manager Fusion Middleware Control	Oracle Enterprise Manager enables you to monitor and administer an Oracle Service Bus application.	Oracle Enterprise Manager Fusion Middleware Control provides a web browser-based, graphical user interface for monitoring and administering deployed applications.

Figure 5-1 provides an overview of how this business solution is implemented.

Figure 5-1 Ordering Channels



Subsequent sections of this chapter provide more specific details about how the components in Table 5-1 are used to address the new order channel business challenge.

- [Adding a File-Based Proxy to the Pipeline](#)
- [Debugging Components with the Debugger](#)
- [Monitoring in](#)

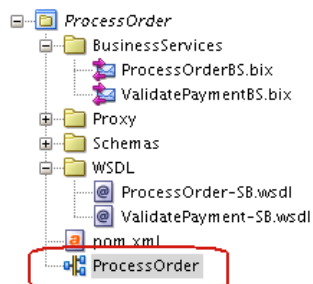
5.2.1 Adding a File-Based Proxy to the Oracle Service Bus Pipeline

Company X's customer base includes legacy companies that are unable to submit their orders in XML format. They instead use a comma-delimited format. Company X must be able to transform these comma-delimited orders into a valid XML format.

Oracle SOA Suite includes an Adapter Configuration Wizard that guides you through integrating applications with file systems, database tables, database queues, FTP servers, Java Message Services (JMS), IBM WebSphere MQ, and other systems. In 12c, the Adapter Configuration Wizard is available in both Oracle SOA Suite and Oracle Service Bus.

Company X opens the **ProcessOrder** project in the Oracle Service Bus application in the Applications window in Oracle JDeveloper. [Figure 5-2](#) provides details.

Figure 5-2 File Adapter Icon in Components Window

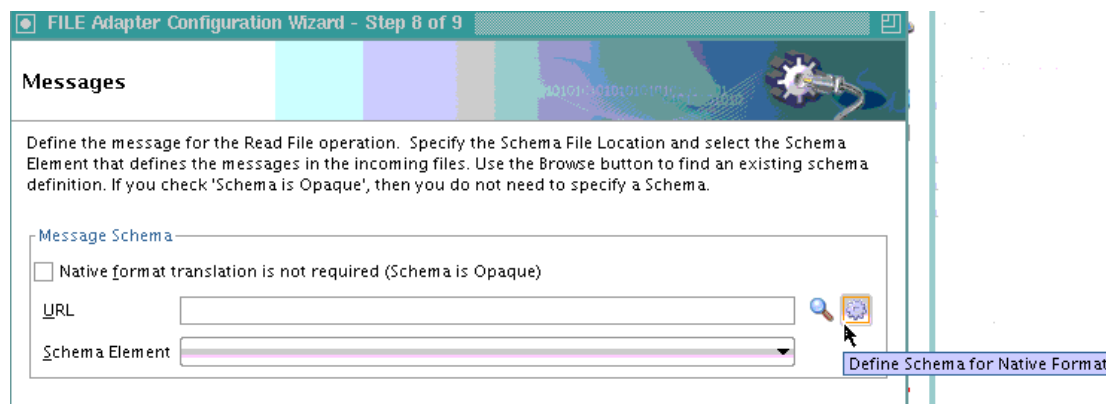


Company X then drags a **File** icon from the Components window to the **Exposed Services** swimlane. This invokes the Adapter Configuration Wizard for adding a new file-based proxy for the **ProcessOrder** composite.

The file adapter lets Oracle Service Bus business and proxy services exchange (read and write) files on local file systems. The file contents can be in both XML and non-XML data formats. For this scenario, the file adapter is configured to read comma-separated value (.csv) files from a specified directory that is polled every minute. On the last page of the wizard, Company X selects the option to create a valid XML schema file from the native comma-delimited format submitted by customers. This selection invokes the Native Format Builder Wizard. [Figure 5-3](#) provides details.

The Native Format Builder Wizard enables you to create a native schema file from a variety of file formats, such as delimited, fixed-length, complex type, data type description (DTD), and Cobol Copybook. Native schema is an XML schema definition with annotations and additional attributes that can be used to translate native format files to XML, and vice versa. This native schema enables the Adapter Configuration Wizard to create a WSDL file for the adapter to communicate with the application.

Figure 5-3 Selection of Option to Define a Schema for a Native Format

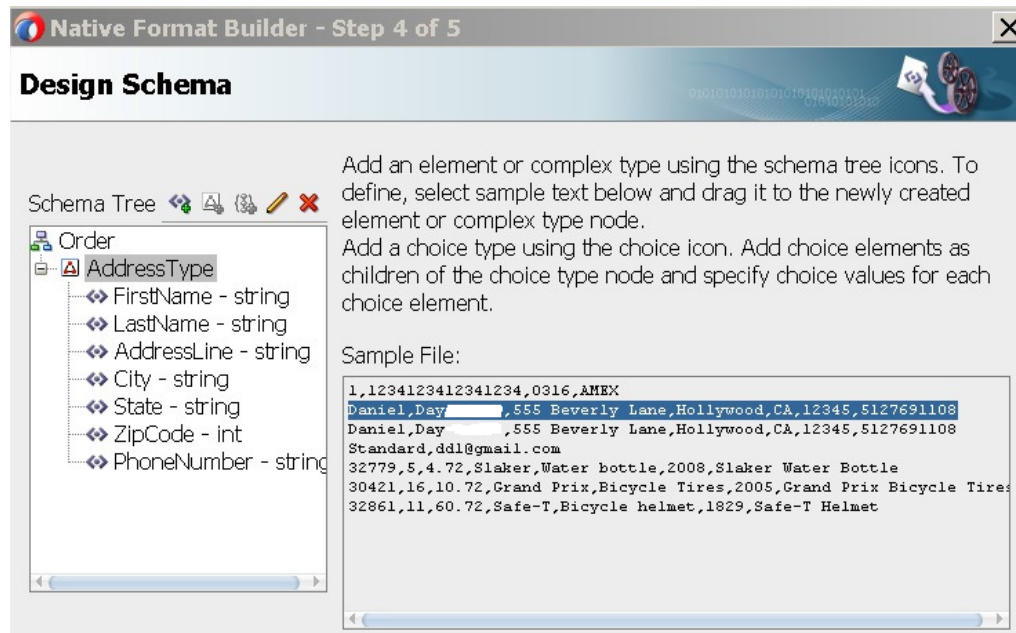


For this scenario, Company X configures the Native Format Builder Wizard pages as follows:

- Selects **Complex Type (Contains records whose fields may themselves be records having multiple delimiter types)** as the native message format from which to create a schema.
- Specifies the native format file and the root element (*Order*).
- Specifies the complex types for data corresponding to address, billing, shipping, and item.
- Specifies the delimiter for data (comma).
- Specifies the schema elements corresponding to the fields in the data file.
- Renames the automatically generated elements C1,C2.....C7 to element names that are expected in the generated XML file.

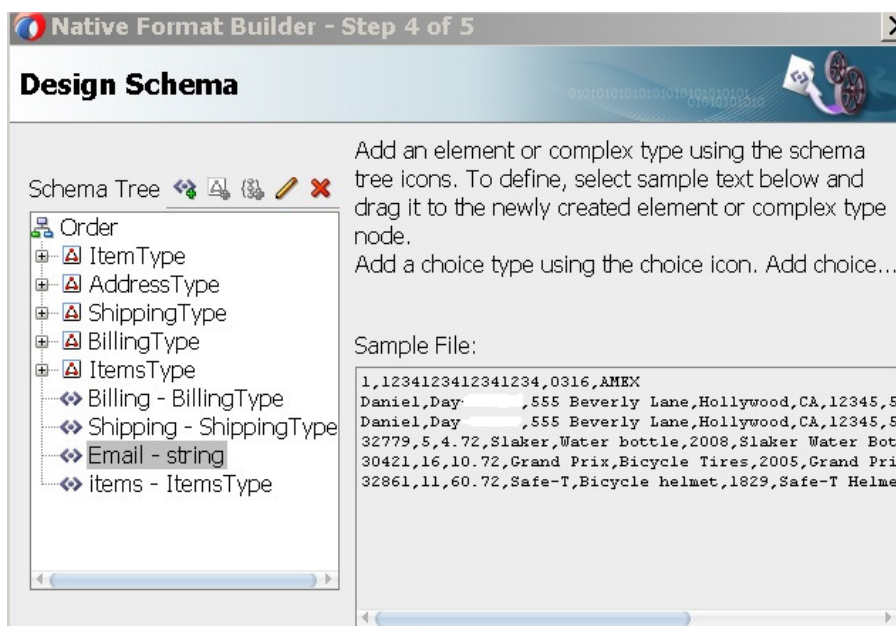
Figure 5-4 shows the complex type **AddressType** with defined schema elements for **FirstName**, **LastName**, **AddressLine**, **City**, **State**, **ZipCode**, and **PhoneNumber**. The comma-delimited file is shown on the right side of the page.

Figure 5-4 Designing of Complex Types in the Schema File



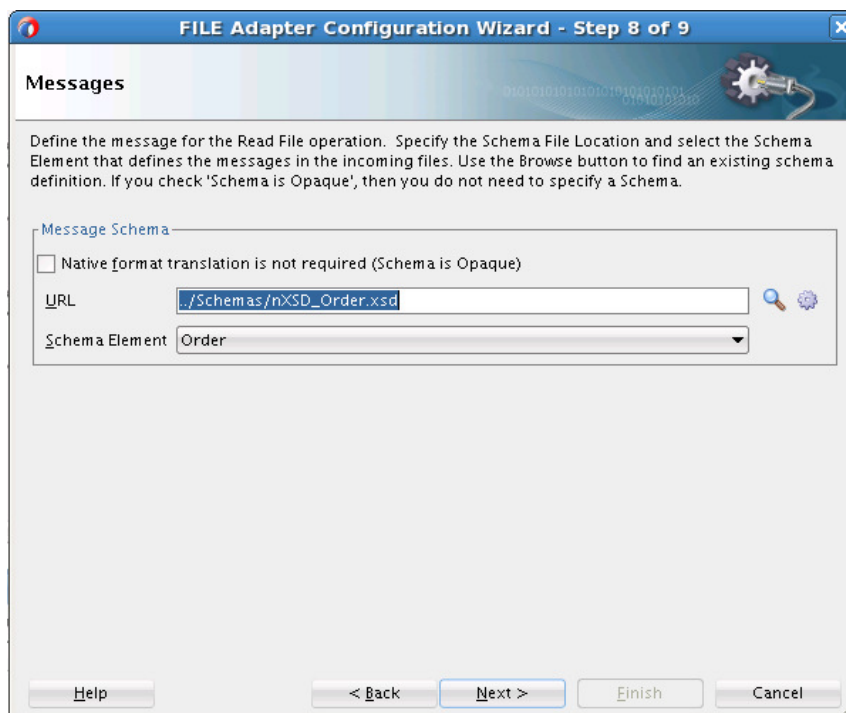
The configuration process is repeated for all required complex types, as shown in Figure 5-5.

Figure 5-5 Completion of Design of Complex Types in the Schema File



When complete, a schema file is created. [Figure 5-6](#) provides details.

Figure 5-6 Schema File and Schema Element Creation



Company X then wires the newly created **ProcessPS_File** proxy to the **ProcessPP** pipeline. [Figure 5-7](#) provides details.

Figure 5-7 File Proxy Wired to ProcessPP Pipeline



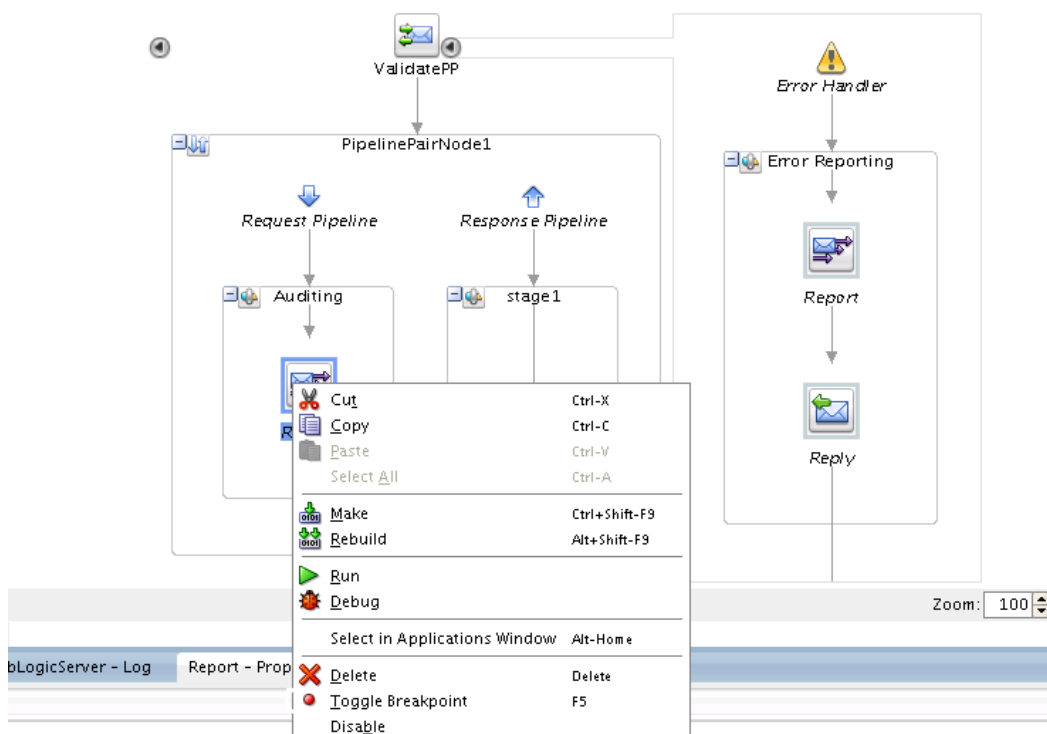
5.2.2 Debugging Components with the Oracle Service Bus Debugger

Oracle JDeveloper provides a comprehensive debugger for assessing and repairing Oracle Service Bus project components. The debugger reduces the development cycle by providing a troubleshooting environment directly in Oracle JDeveloper. This means you do not need to build an Oracle Service Bus application in Oracle JDeveloper, run it, launch a console to test or view audit trails and flow traces, and then return to Oracle JDeveloper to fix any issues and repeat these steps. Instead, you can set breakpoints directly in Oracle JDeveloper for troubleshooting on pipelines and split-joins.

Company X navigates to the **validatePayment** pipeline to debug the pipeline in Oracle JDeveloper. Company X selects the **Reporting** action in the pipeline editor and right-clicks and selects **Toggle Breakpoint** from the menu.

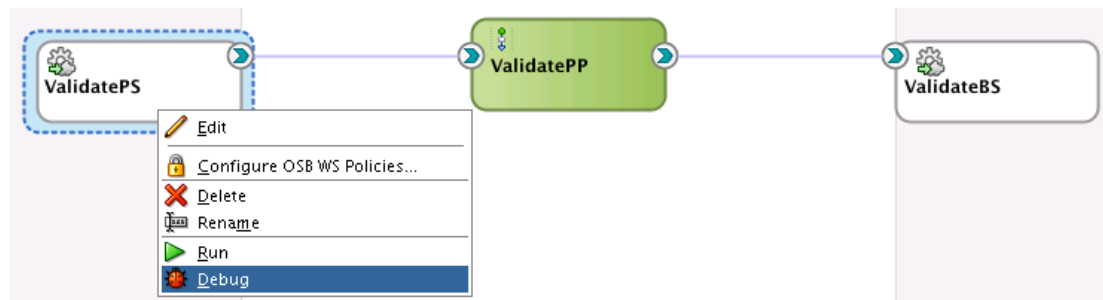
Figure 5-8 provides details.

Figure 5-8 Set Breakpoints



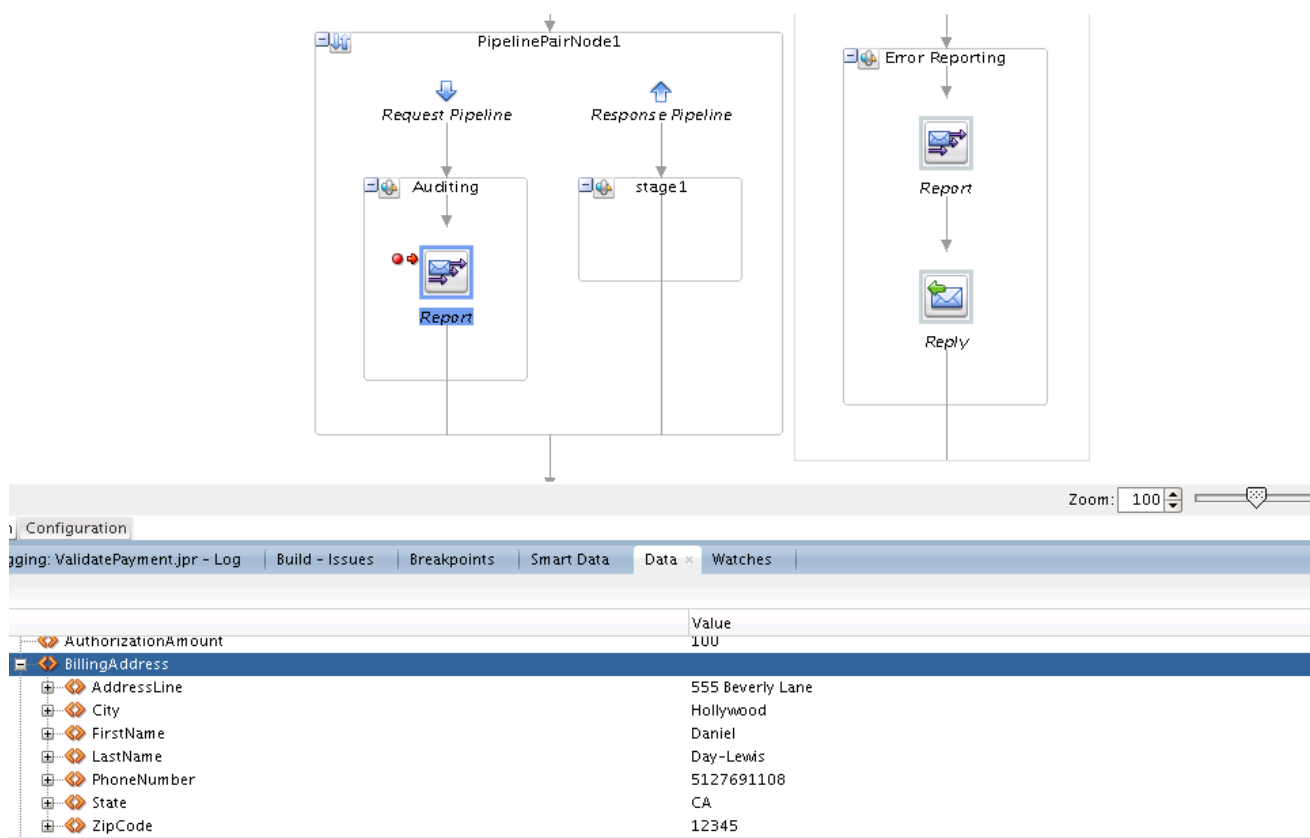
With a breakpoint set, Company X invokes the debugger by right-clicking the proxy and selecting **Run**. Figure 5-9 provides details.

Figure 5-9 Start Debugging of the Oracle Service Bus Proxy



This enables Company X to enter sample data in the test console, review the variables, step through the pipeline in debug mode, and change data, as necessary. Figure 5-10 provides details.

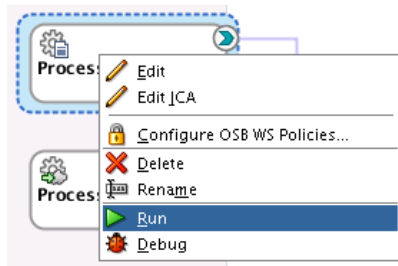
Figure 5-10 Debug of Oracle Service Bus Pipeline



5.2.3 Monitoring Oracle Service Bus in Oracle Enterprise Manager Fusion Middleware Control

Company X deploys the Oracle Service Bus application, as shown in [Figure 5-11](#).

Figure 5-11 Deployment of Oracle Service Bus Application



Company X monitors Oracle Service Bus from Oracle Enterprise Manager Fusion Middleware Control. Oracle Enterprise Manager Fusion Middleware Control is a web browser-based, graphical user interface that you use to monitor and administer deployed applications.

Starting with 12c, the administration of Oracle Service Bus and Oracle SOA Suite is performed from a single, unified Oracle Enterprise Manager Fusion Middleware Control.

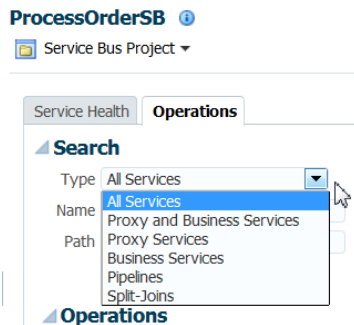
Services are not displayed by default to optimize performance. Therefore, Company X selects **ProcessOrderSB** in the navigator, clicks the **Operations** tab, and clicks **Search** to display all the services in **ProcessOrderSB**. [Figure 5-12](#) provides details.

Figure 5-12 ProcessOrderSB Search

Name	Path	Type	State	Monitoring
ProcessBS	ProcessOrderSB	Business Service	✓	✓
ProcessPP	ProcessOrderSB	Pipeline	...	✓ (S)
ProcessPS	ProcessOrderSB	Proxy Service	✓	✓

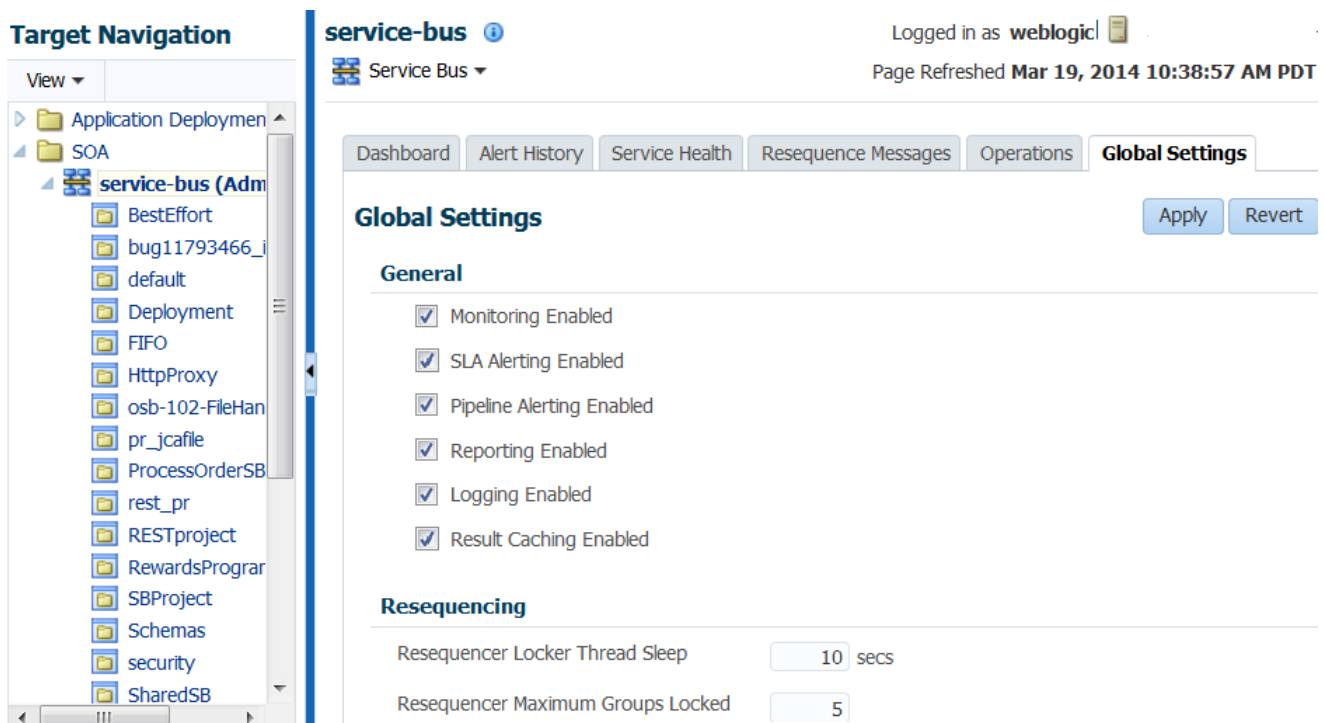
The **Type** list enables you to filter the display of details, as shown in [Figure 5-13](#).

Figure 5-13 Filter Display of Details



Company X uses the Oracle Service Bus home page to monitor additional details under each of the tabs displayed at the top of the page. [Figure 5-14](#) provides details of the **Global Settings** tab.

Figure 5-14 Oracle Service Bus Home Page



5.3 Related Documentation

[Table 5-2](#) provides references to documentation that more specifically describes the components and features described in this chapter.

Table 5-2 Related Documentation

For Information About...	See...
Configuring the file adapter with the Adapter Configuration Wizard	"Oracle JCA Adapter for Files/FTP" of <i>Understanding Technology Adapters</i>
Creating the native schema file with the Native Format Builder Wizard	"Native Format Builder Wizard" of <i>Understanding Technology Adapters</i>
Monitoring Oracle Service Bus in Oracle Enterprise Manager Fusion Middleware Control	"Getting Started with Oracle Service Bus Administration" of <i>Administering Oracle Service Bus</i>
Debugging Oracle Service Bus applications in Oracle JDeveloper	"Debugging Oracle Service Bus Applications" of <i>Developing Services with Oracle Service Bus</i>

6

Packing and Shipping Orders

This chapter describes how Oracle SOA Suite addresses the business challenge of packing and shipping orders. Overviews of how key SOA composite application components address this challenge are provided, including a REST service, BPEL process, HTTP Analyzer, BPEL process component template, standalone BPEL subprocess, composite sensor, and Oracle User Messaging Service adapter.

This chapter includes the following sections:

- [Business Challenge](#)
- [Business Solution](#)
- [Related Documentation](#)

6.1 Business Challenge

Company X has a requirement for assigning preferred shipping providers to a specific shipping method. This method is calculated based on the shipping speed the customer selected when placing the order and the shipping state (in the address). Once the order has been shipped, a notification must be sent to the customer confirming the shipping provider. The order status must also be updated to shipped.

6.2 Business Solution

To address this business challenge, Company X designs a business solution that uses the components described in [Table 6-1](#).

Table 6-1 Components That Provide the Business Solution

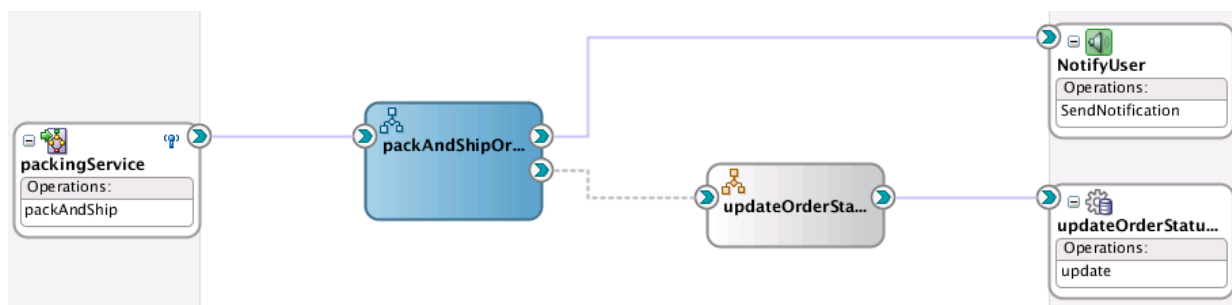
Component	How This Component Addresses the Business Challenge	Component Description
REST service	An inbound REST adapter service defines a shipping resource.	REST is an architecture for designing network applications. RESTful applications use HTTP requests to post data (create and update), get data (for example, make queries), update data, and delete data.
BPEL process	A BPEL process sets the status of the order to shipped, notifies the customer that the order has shipped, and updates the order status in the database. This process is connected to the REST interface, which is exposed as a service.	BPEL processes provide process orchestration and storage of a synchronous or an asynchronous process. You design a business process that integrates a series of business activities and services into an end-to-end process flow.
HTTP Analyzer	The HTTP Analyzer tests the Web Application Description Language (WADL) URL of the REST service to ensure that the service is working properly.	The HTTP Analyzer enables you to examine the content of HTTP request/response package pairs. You can edit the content of a request package, resend it, and observe the response packet returned.

Table 6-1 (Cont.) Components That Provide the Business Solution

Component	How This Component Addresses the Business Challenge	Component Description
BPEL process component template	The component template includes an invoke activity and an assign activity that takes an order number and an order status and assigns it to the input variable of the database adapter.	See Table 3-1 for a description of Oracle SOA Suite templates.
Standalone BPEL subprocess	A standalone BPEL process calls a database adapter reference to update the order status.	A standalone BPEL subprocess is a fragment of a BPEL process, which includes a number of activities to reuse. Standalone subprocess do not have an interface and are only called from another BPEL process.
Composite sensor	A composite sensor tracks all orders of a specific shipping provider.	See Table 3-1 for a description of composite sensors.
Oracle Enterprise Manager Fusion Middleware Control	Oracle Enterprise Manager Fusion Middleware Control monitors the composite sensor in the instance and provides access to a WADL URL used for testing.	Oracle Enterprise Manager Fusion Middleware Control is a web browser-based, graphical user interface that you use to monitor and administer your deployed composites.
Oracle User Messaging Service (UMS) adapter	A UMS adapter sends an email notification to a customer indicating the order was shipped.	UMS is an Oracle Fusion Middleware component that enables communication between users and applications. UMS supports various messaging channels such as email, SMS, and instant messaging (IM). UMS consists of servers, drivers, and applications.

[Figure 6-1](#) provides an overview of how this business solution is implemented.

Figure 6-1 Packing and Shipping Process Overview



Subsequent sections of this chapter provide more specific details about how the components in [Table 6-1](#) are used to address the packing and shipping business challenge.

- [Defining a Shipping Resource with a REST Service](#)
- [Exposing a REST Service with a Packing BPEL Process](#)
- [Testing REST Services with the HTTP Analyzer](#)

- [Using Templates and Standalone Subprocesses to Update the Order Status in the Database](#)
- [Tracking the Shipping Provider with Composite Sensors](#)
- [Sending Email Notifications to Indicate Order Shipments](#)

6.2.1 Defining a Shipping Resource with a REST Service

Company X creates a SOA composite application named **PackAndShipService** to address this business challenge. As an alternative to using a web service, Company X uses a REST service in the composite to define a shipping resource.

REST is an architecture for designing network applications. RESTful applications use HTTP requests to post data (create and update), get data (for example, make queries), update data, and delete data.

Oracle SOA Suite provides the following REST support:

- Support in SOA composite applications:
 - Enable REST support in new or existing services.
 - Integrate with external REST APIs.
 - Orchestrate a set of RESTful state transitions (RPC/Hypermedia as the Engine of Application State (HATEOAS) approach).
 - Support for XML, JavaScript Object Notation (JSON) (with automatic translation to and from XML), URI sample, and URL-encoded GET/POST data.
 - Generation of sample URI for REST service operations.
 - Support for WADL services. The WADL can be provided by a deployed Oracle SOA Suite or Oracle Service Bus service or a non-Oracle SOA Suite or Oracle Service Bus service such as a Jersey REST service.
- Ease of development:
 - Oracle JDeveloper provides a wizard for modeling REST interfaces and WSDL operation bindings.
 - Readable API is provided that publishes each method used upon deployment.
 - Ability to browse and consume Oracle REST endpoints (including Oracle Service Bus) from within Oracle JDeveloper.
- Oracle Web Service Manager (OWSM) policy support for REST security.

Company X drags a REST binding adapter from the Components window into the **Exposed Services** swimlane in Oracle JDeveloper. The packing service expects a shipping resource that includes all necessary information to pack and ship an order. It returns a shipping resource with an updated order status.

Company X defines the following REST service details:

- Creates a REST inbound interface.
- Creates a **shipping** REST resource.
- Creates a **packandShip** operation binding with:
 - A **POST** HTTP verb.
 - A sample request XML payload, as shown in [Figure 6-2](#).

Figure 6-2 Sample XML Payload

Generate sample payload for schema CanonicalOrder.xsd element Shipping

Sample Type: XML
 JSON
 URL-encoded

Sample:

```
<Shipping xmlns="http://www.oracle.com/soasample">
  <OrderNumber>string23</OrderNumber>
  <Address>
    <FirstName>string25</FirstName>
    <LastName>string27</LastName>
    <AddressLine>string29</AddressLine>
    <City>string31</City>
    <State>string33</State>
    <ZipCode>string35</ZipCode>
    <PhoneNumber>string38</PhoneNumber>
  </Address>
  <ShippingSpeed>Twoday</ShippingSpeed>
  <ShippingProvider>
    <Name>string41</Name>
  </ShippingProvider>
  <ShipMethod>43</ShipMethod>
  <Status>Status44</Status>
</Shipping>
```

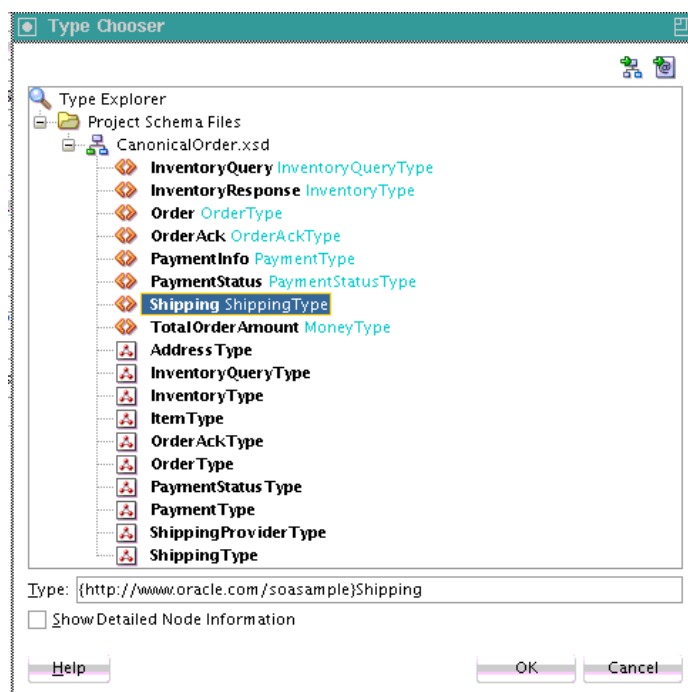
Save to: CanonicalOrder_Shipping.xml

Directory: /home/mlkenned/jdeveloper/mywork/PackAndShipService/Project1/SOA/Adapters

Help OK Cancel

- A request schema file selected from the **ProcessOrder** project created in [Creating a SOA Composite Application From a SOA Project Template](#). The schema file includes the **Shipping** element, as shown in [Figure 6-3](#).

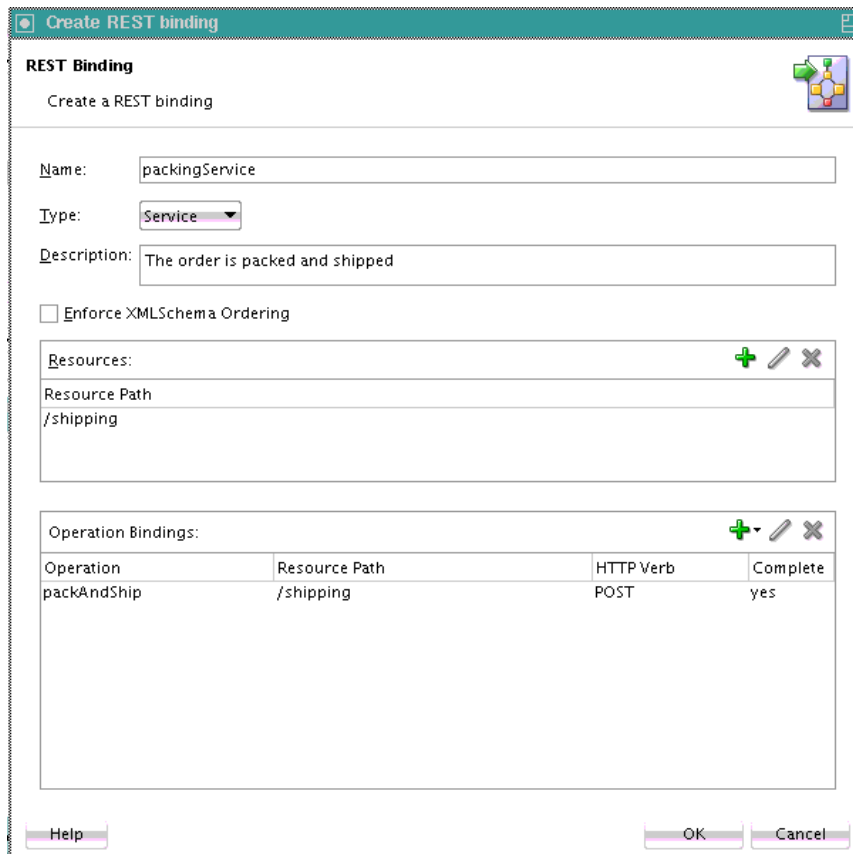
Figure 6-3 Shipping Element in Schema File



- A response schema file selected from the **ProcessOrder** project. The schema file is the same as selected for the request and also includes the **Shipping** element shown in [Figure 6-3](#).

When design is complete, the Create REST Binding dialog looks as shown in [Figure 6-4](#).

Figure 6-4 Create REST Binding Dialog - Design Complete



This creates a REST service binding component in the **Exposed Services** swimlane, as shown in [Figure 6-5](#).

Figure 6-5 REST Service in Exposed Services Swimlane in Oracle JDeveloper



6.2.2 Exposing a REST Service with a Packing BPEL Process

Company X exposes the REST service by connecting it to a BPEL process, as shown in [Figure 6-6](#).

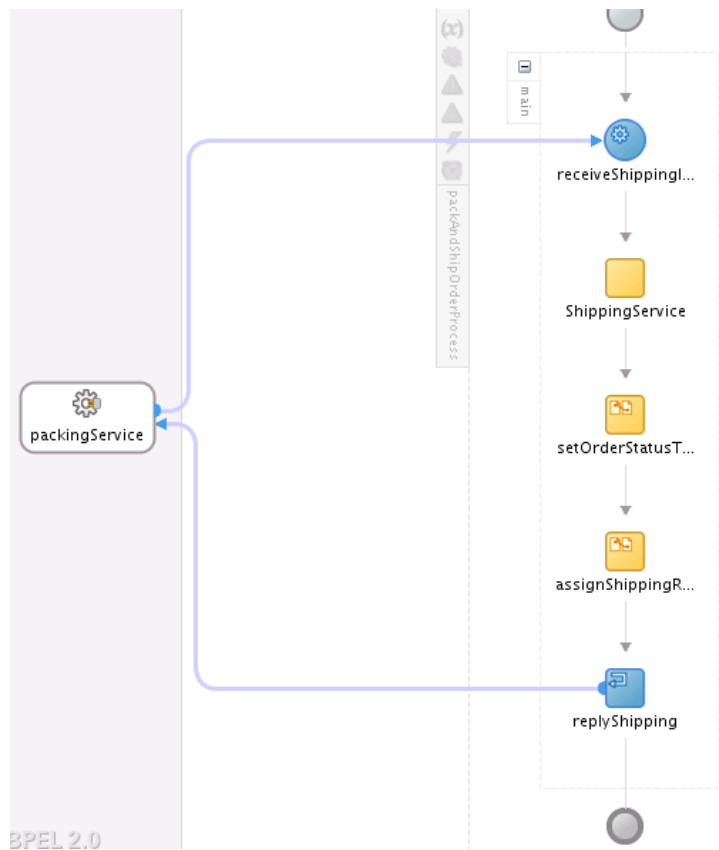
Figure 6-6 REST Service Connected to BPEL Process

This service initiates the packing and shipping based on shipping provider and shipping method, which are both determined by the order fulfillment service in [Fulfilling Orders](#). The BPEL process consists of the following activities:

- A receive activity receives a call from the REST service.
- An empty activity simulates the packing and shipping. After this activity is processed, the order status is updated to **Shipped**.
- An assign activity assigns the order number and status to two variables:
 - **orderNumber** is set from the input variable
 - **orderStatus** is set to **Shipped**
- An assign activity assigns the value of the input variable (with updated status) to the output variable.
- A reply activity returns information to the REST service.

The complete design of the BPEL process is shown in [Figure 6-7](#).

Figure 6-7 REST Service Integration with the BPEL Process



6.2.3 Testing REST Services with the HTTP Analyzer

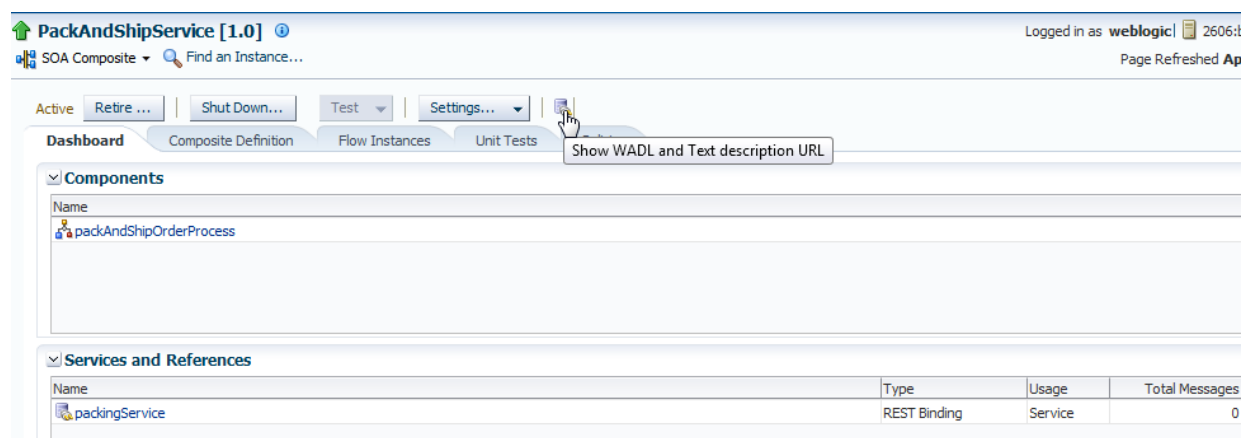
To ensure that the REST service is working properly, Company X first deploys the SOA composite application for testing with the HTTP Analyzer.

Deployment is performed by right-clicking the **PackAndShipService** in the Applications window, selecting **Deploy**, and going through the pages of the Deploy wizard. Deployment is performed to the **IntegratedWebLogicServer**, an embedded, local server in Oracle JDeveloper.

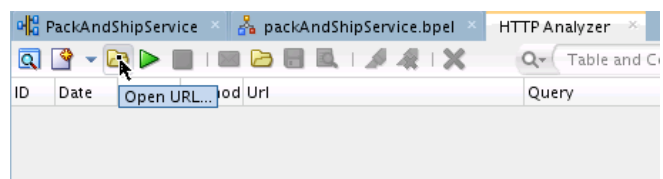
The HTTP Analyzer enables you to examine the content of HTTP request/response package pairs. You can edit the content of a request package, resend it, and observe the response packet returned.

To test the service, Company X first copies the WADL file URL from the home page of the **PackAndShipService** SOA composite application in Oracle Enterprise Manager Fusion Middleware Control, as shown in [Figure 6-8](#).

REST services in Oracle SOA Suite expose WADL files instead of WSDL files to define their interface. WADL provides a readable XML description of HTTP-based web applications (typically REST web services). WADL simplifies the reuse of web services based on the existing HTTP architecture of the web.

Figure 6-8 WADL URL Location in Oracle Enterprise Manager Fusion Middleware Control

Company X then opens the HTTP Analyzer in Oracle JDeveloper by selecting **Tools > HTTP Analyzer**. Company X clicks **Open URL** and enters the WADL URL copied from Oracle Enterprise Manager Fusion Middleware Control, when prompted. [Figure 6-9](#) provides details.

Figure 6-9 HTTP Analyzer

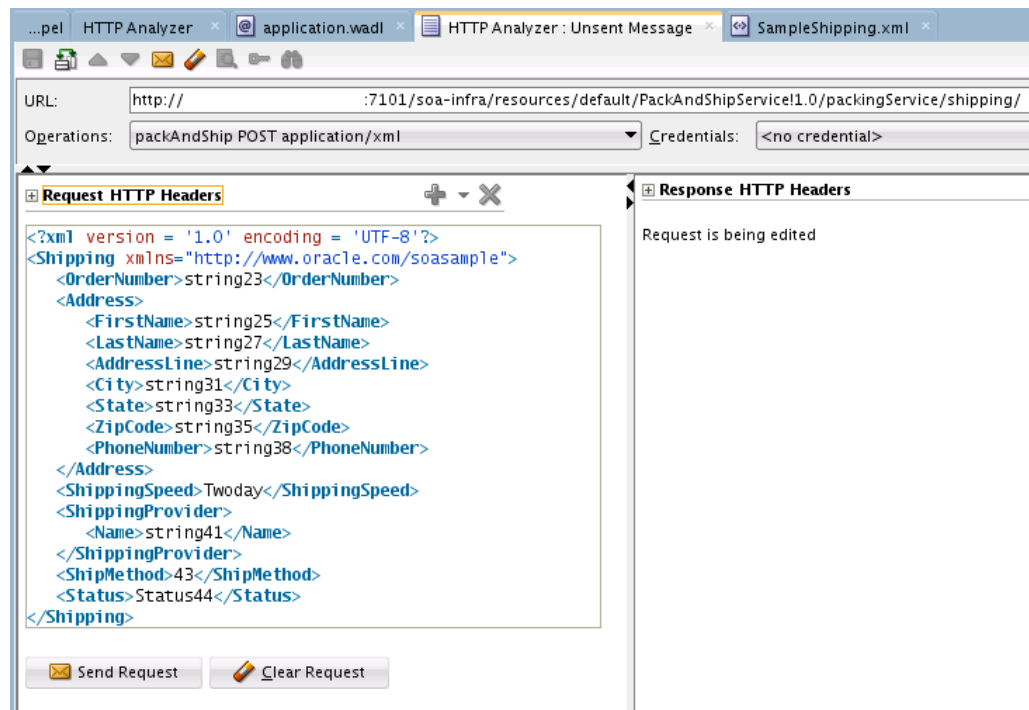
The Service dialog shown in [Figure 6-10](#) displays details about the REST service. Company X clicks **Test**.

Figure 6-10 Service Dialog



Company X copies and pastes the sample request XML payload specified in [Figure 6-2](#) into the **Request HTTP Headers** section and clicks **Send Request**, as shown in [Figure 6-11](#).

Figure 6-11 Request XML Payload Input to HTTP Analyzer

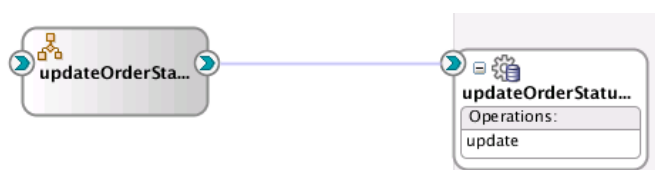


6.2.4 Using Templates and Standalone Subprocesses to Update the Order Status in the Database

In addition to updating the order status in the shipping message, Company X also updates it in the database. Because this is a common task, Company X creates a component template named **updateOrderStatusSP** for reuse as needed in multiple projects. Company X used templates for similar common tasks in [Calculating Payment Status with XSLT Transformations](#) and [Customizing the Contents of the SOA Project Template](#).

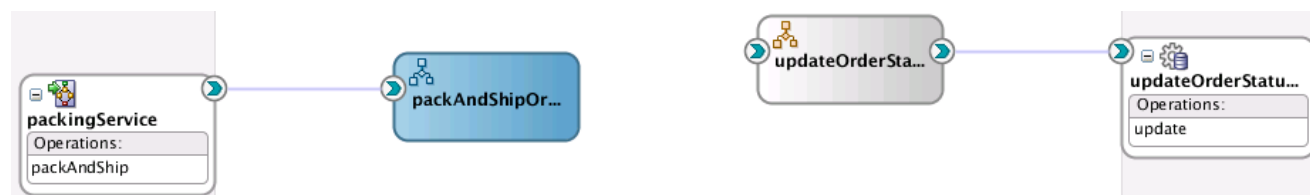
Figure 6-12 shows the component template contents.

Figure 6-12 BPEL Process Component Template Contents



Company X drags the template from the **Component Templates** section of the Components window into the SOA composite application. When fully expanded, the composite looks as shown in Figure 6-13.

Figure 6-13 SOA Composite Application with Expanded Template



The component template includes an invoke activity and an assign activity that takes an order number and an order status and assigns it to the input variable of the database adapter.

The **packAndShipOrder** BPEL process must be connected with the **updateOrderStatusSP** component template. To address this task, Company X uses a standalone BPEL subprocess to call a database adapter reference to update the order status. Subprocesses are similar to templates in that they enable you to reuse functionality in multiple projects. A standalone BPEL subprocess is a fragment of a BPEL process, which includes a number of activities to reuse. Standalone subprocesses do not have an interface and are only called from another BPEL process. A standalone process can have partner links across a number of other BPEL processes.

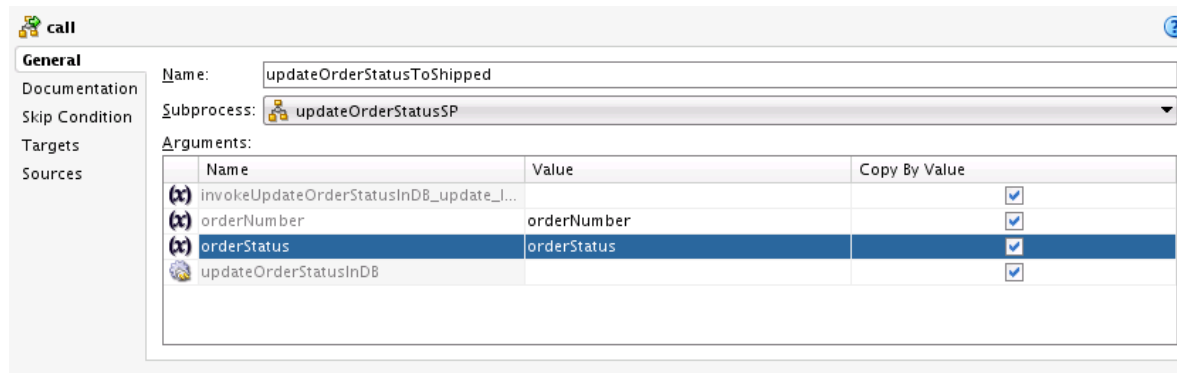
Company X opens the **packAndShipOrder** BPEL process and drags a standalone BPEL process from the **Standalone** section of the Components window into the process.

The standalone BPEL process is displayed as a call activity, which calls the **updateOrderStatusSP** template. It provides the following:

- Order number
- Order status

Figure 6-14 shows the contents of the call activity. A call activity enables you to execute referenced subprocess code in standalone and inline subprocesses.

Figure 6-14 Contents of Call Activity



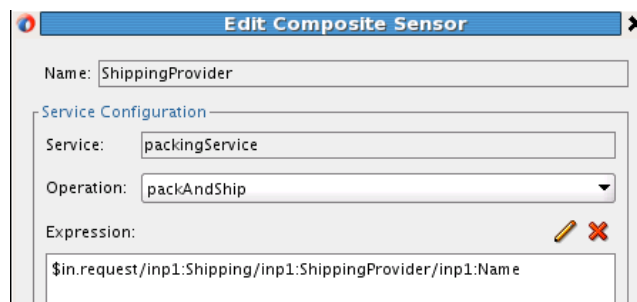
6.2.5 Tracking the Shipping Provider with Composite Sensors

Company X added a composite sensor for tracking the status of order payments in [Tracking Payment Status with Composite Sensors](#) and tracking the order number in [Tracking the Order Number with Composite Sensors](#).

Company X now has an additional requirement for a composite sensor to track the shipping provider. This enables Company X to search for all orders that have been shipped with a specific shipping provider.

Company X defines the composite sensor on the REST service. The definition includes an XPath expression to track the shipping provider, as shown in the Composite Sensor dialog in [Figure 6-15](#).

Figure 6-15 Composite Sensor for Tracking the Shipping Order



The **Enterprise Manager** check box of the Composite Sensor dialog is also selected. This enables you to track composite sensor names and values on the Flow Instances page or the Flow Trace page for a specific business flow instance in Oracle Enterprise Manager Fusion Middleware Control. [Figure 6-16](#) provides details.

Figure 6-16 Composite Sensor Name and Value in Flow Trace Page

Sensor Name	Value
ShippingProvider	USPS

Trace				
Instance	Type	Usage	State	
packingService	Service	Service	Completed	
packAndShipOrderProcess	BPEL		Completed	
updateOrderStatusSP	BPEL Subprocess		Completed	
updateOrderStatusInDB	Reference	Reference	Completed	

6.2.6 Sending Email Notifications to Indicate Order Shipments

Company X must be able to notify customers by email that an order has shipped. To address this task, Company X configures a UMS adapter to send an email notification to customers.

UMS is an Oracle Fusion Middleware component that enables communication between users and applications. UMS supports various messaging channels such as email, SMS, and instant messaging (IM). UMS consists of the following components:

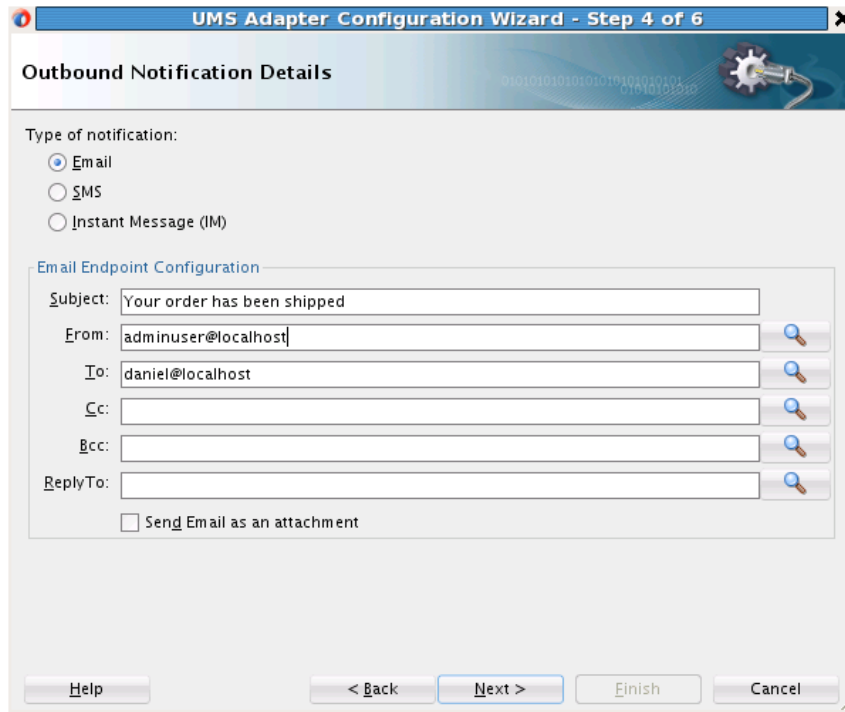
- A UMS server that orchestrates message flows between applications and users.
- UMS drivers that connect UMS to the messaging gateways, adapting content to the various protocols supported by UMS.
- UMS client applications that implement the business logic of sending and receiving messages.

The UMS adapter is dragged from the **Technology** section of the Components window to the **External References** swimlane. Company X configures the UMS adapter to perform the following tasks:

- Send an outbound notification
- Uses email as the notification channel
- Add an email subject of *Your Order Has Been Shipped*
- Configure the **From** and **To** email addresses

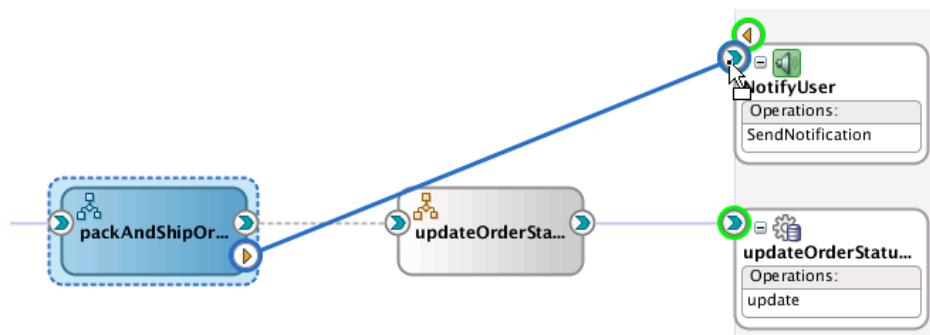
Figure 6-17 provides details.

Figure 6-17 UMS Adapter Configuration Wizard



When UMS configuration is complete, the **packAndShipOrder** BPEL process is connected to the **NotifyUser** UMS adapter reference. [Figure 6-18](#) provides details.

Figure 6-18 BPEL Process Connected to the UMS Adapter

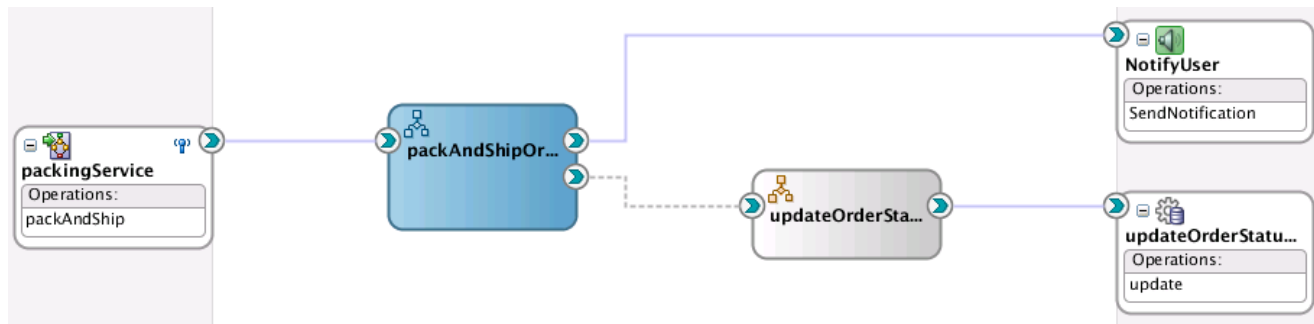


To complete configuration, Company X adds the appropriate activities to the **packAndShipOrder** BPEL process:

- An invoke activity to invoke the UMS adapter (with an input variable)
- An assign activity to populate the payload of the input variable of the invoke activity

[Figure 6-19](#) provides an overview of how this completed business solution appears in the SOA Composite Editor.

Figure 6-19 Completed SOA Composite Application



6.3 Related Documentation

Table 6-2 provides references to documentation that more specifically describes the components and features described in this chapter.

Table 6-2 Related Documentation

For Information About...	See...
Integrating a REST operation	Integrating REST Operations in SOA Composite Applications in <i>Developing SOA Applications with Oracle SOA Suite</i>
Creating and designing a BPEL process	Getting Started with Oracle BPEL Process Manager in <i>Developing SOA Applications with Oracle SOA Suite</i>
Using the HTTP Analyzer	Monitoring HTTP Using the HTTP Analyzer in <i>Developing Applications with Oracle JDeveloper</i>
Creating Oracle SOA Suite templates and standalone BPEL subprocesses	Oracle SOA Suite Templates and Reusable Subprocesses in <i>Developing SOA Applications with Oracle SOA Suite</i>
Creating composite sensors	Defining Composite Sensors in <i>Developing SOA Applications with Oracle SOA Suite</i>
Configuring the UMS Adapter	Oracle JCA Adapter for UMS in <i>Understanding Technology Adapters</i> and <i>Developing Applications with Oracle User Messaging Service</i>
Using the Integrated WebLogic Server	Introducing the Quick Start Distributions in <i>Installing SOA Suite and Business Process Management Suite Quick Start for Developers</i>

7

Fulfilling Orders

This chapter describes how Oracle SOA Suite addresses the business challenge of creating an order fulfillment system. Overviews of how key SOA composite application components are used to address this challenge are provided, including project templates, business rules, composite sensors, REST binding references, and Coherence adapters.

This chapter includes the following sections:

- [Business Challenge](#)
- [Business Solution](#)
- [Related Documentation](#)

7.1 Business Challenge

Company X has a requirement to create a system that listens for orders to be processed, selects a shipping provider (for example, the United States Postal Service (USPS) or UPS), and invokes a packing and shipping service. In this scenario, the packing and shipping service to invoke is the **PackAndShipService** composite that was designed in [Packing and Shipping Orders](#) .

7.2 Business Solution

To address this business challenge, Company X designs a business solution that uses the components described in [Table 7-1](#).

Table 7-1 Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
SOA composite application that includes a project template	An order fulfillment composite created from a project template listens for orders to be processed, selects a shipping provider, and invokes the packing and shipping service (PackAndShipService) created in Packing and Shipping Orders . The order fulfillment composite is triggered when an order is updated as ReadyForShip in the database. It then locates the shipping speed in the order message, determines the shipping method based on the shipping speed and shipping state, reads the preferred shipping provider from the database or Coherence cache, and calls the packing and shipping REST service.	See Table 3-1 for a description of templates.

Table 7-1 (Cont.) Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
Business rule	A business rule (decision table) decides the shipping method based on speed and shipping state. Based on the shipping method, the preferred shipping provider is retrieved from the database.	Business rules enable dynamic decisions at runtime that allow you to automate policies, computations, and reasoning while separating rule logic from underlying application code. This enables more agile rule maintenance and empowers business analysts with the ability to modify rule logic without programmer assistance and without interrupting business processes.
Composite sensor	A composite sensor tracks the order number.	See Table 3-1 for a description of composite sensors.
REST reference	The outbound REST reference delivers the order to the packing and shipping service.	See Table 6-1 for a description of REST bindings.
Coherence adapter	A Coherence adapter initially reads the correct shipping provider from the database, and from Coherence cache for subsequent read operations. An additional Coherence adapter copies the database adapter response into Coherence cache so that the shipping provider is available in cache the next time it is looked up.	A Coherence cache is a collection of data objects that serves as an intermediary between the database and the client applications. Database data can be loaded into a cache and made available to different applications. Coherence cache reduces load on the database and provides faster access to database data.

Subsequent sections of this chapter provide more specific details about how the components in [Table 7-1](#) are used to address the order fulfillment business challenge.

- [Creating a Project from a SOA Template](#)
- [Determining the Shipping Method with a Business Rule](#)
- [Tracking the Order Number with Composite Sensors](#)
- [Delivering the Order to the Packing Service with the REST Interface](#)
- [Reading the Shipping Provider from Cache with the Coherence Adapter](#)
- [Copying the Database Adapter Response into Coherence Cache](#)
- [Deploying the Composite and Testing the Coherence Adapters](#)

7.2.1 Creating a Project from a SOA Template

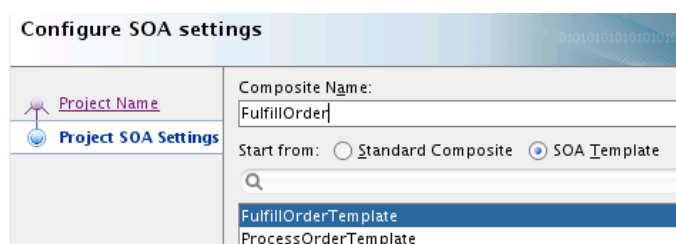
Company X frequently has business requirements for designing SOA composite applications that listen for orders to be processed, select a shipping provider, and invoke a packing and shipping service. To address this challenge, Company X created a project template named **FulfillOrderTemplate** with these capabilities that can be imported into multiple applications in Oracle JDeveloper, as necessary. The template can then be customized for the business requirements of that specific project.

Changes made to that specific imported template are not propagated to projects previously created using this template.

As with previous templates, the **FulfillOrderTemplate** project template is first registered in Oracle JDeveloper by selecting **Tools > Preferences > SOA > Templates**, and specifying the template storage location.

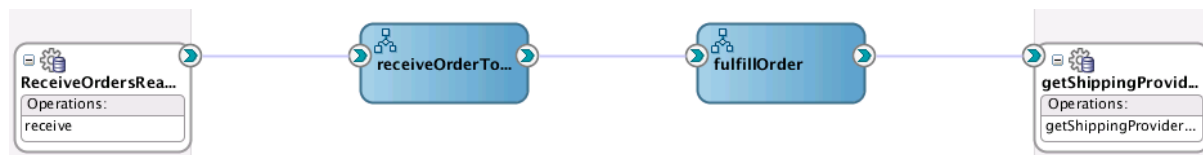
Company X invokes the Create SOA Project wizard to create a new SOA project, and selects to create one based on a template. The project template is imported into the new application by selecting **SOA Template** in the Create SOA Project wizard, which refreshes the dialog to display existing templates for selection. **FulfillOrderTemplate** is selected, then the project name is shortened to **FulfillOrder**, as shown in [Figure 7-1](#).

Figure 7-1 Project Template Selection



When creation is complete, the composite looks as shown in [Figure 7-2](#) with the imported project template.

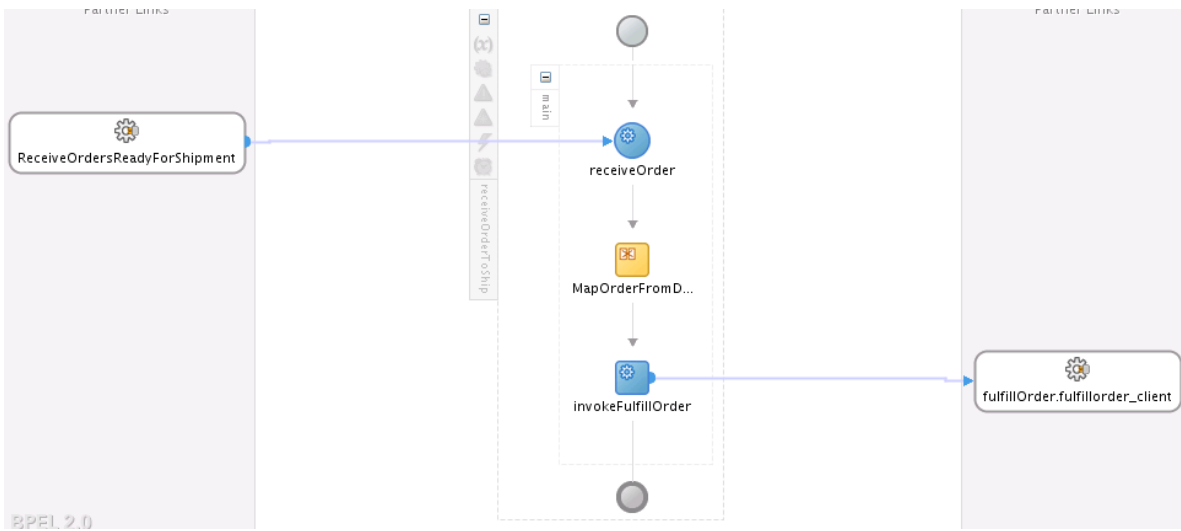
Figure 7-2 Contents of the SOA Composite Application



The imported project template consists of the following components:

- The first database adapter (**ReceiveOrdersReadyForShipment**) listens for orders with a status of **ReadyForShip**, reads the record out of the database, and triggers a new BPEL process for each order. To prevent the order from being read again, it changes the status to **ReadyForPack**.
- The second database adapter (**getShippingProvider**) reads the shipping provider from the database, using the shipping method ID as a primary key. A list of preferred shipping providers per shipping method is maintained in the database. For example, USPS is used for USAFirstClass shipment (shipping method ID =1), UPS is used for USAPriority shipment (shipping method ID =2), and so on.
- The **receiveOrderToShip** BPEL process is open and displayed in [Figure 7-3](#). This process is invoked by the **ReceiveOrdersReadyForShipment** database adapter service. An XSLT map transforms the message into a canonical order message. The **fulfillOrder** BPEL process is invoked with the canonical order message as input.

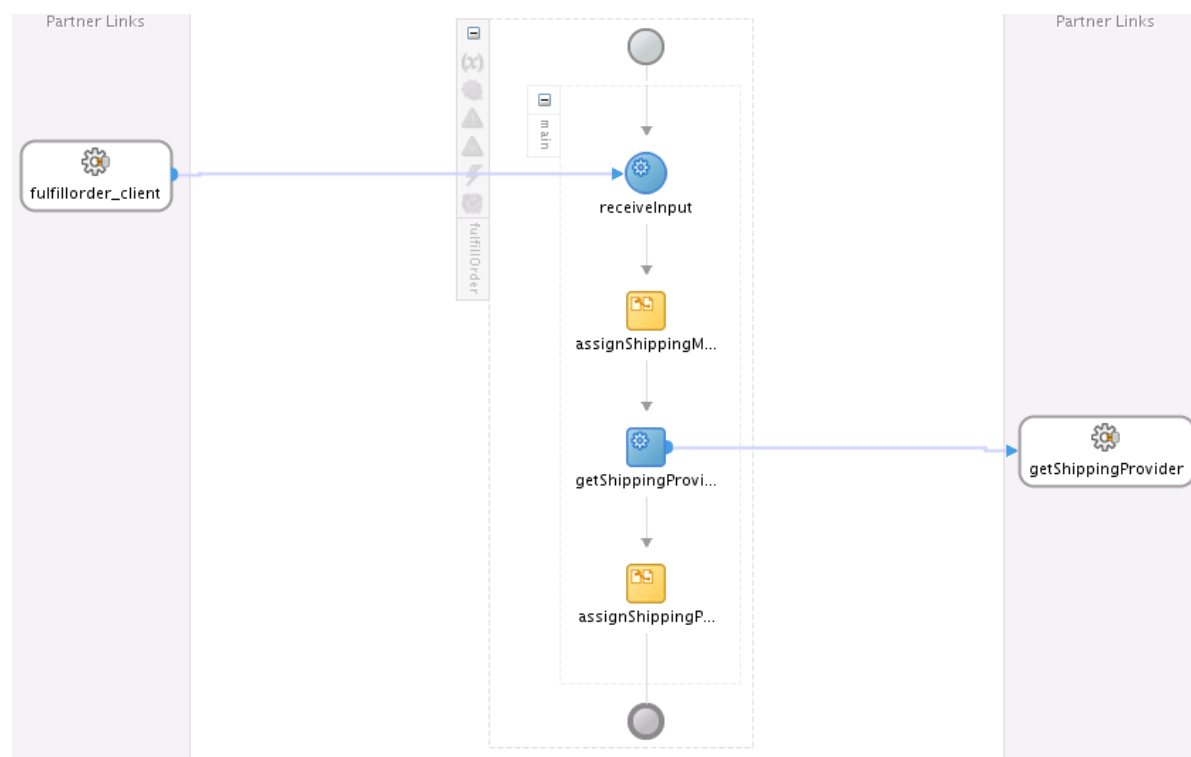
Figure 7-3 receiveOrderToShip BPEL Process Contents



- The **fulfillment** BPEL process is shown in [Figure 7-4](#). The incoming order message includes the shipping speed selected by the customer:
 - One-day shipping
 - Two-day shipping
 - Standard shipping: 3-5 business days
 - Shipping speed does not matter

A business rule determines the shipping method based on shipping speed and shipping address. The shipping method ID is used as input to the database call to retrieve the shipping provider.

Figure 7-4 fulfillment BPEL Process Contents

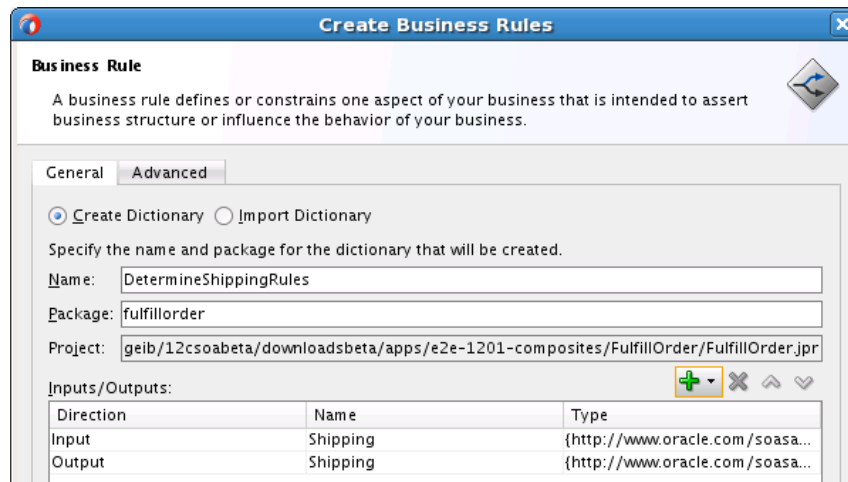


7.2.2 Determining the Shipping Method with a Business Rule

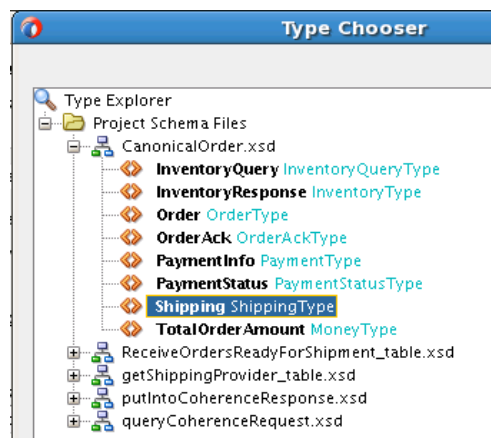
Business rules enable dynamic decisions to be made at runtime. This enables you to automate policies, computations, and reasoning while separating rule logic from underlying application code.

Company X adds a business rule to determine the shipping method ID. The rule takes as input the shipping state and the requested shipping speed and returns the shipping method ID. For example, USPS is used for USAFirstClass shipment (shipping method ID =1), UPS is used for USAPriority shipment (shipping method ID =2), and so on.

Company X drags a **Business Rule** icon from the **Components** section of the Components window into the SOA composite application. After configuration is complete, the Create Business Rules dialog looks as shown in [Figure 7-5](#).

Figure 7-5 Input and Output Facts of Defined Business Rule

Both the input and output facts shown in [Figure 7-5](#) are defined with the **Shipping** element type in the schema file, as shown in [Figure 7-6](#). Facts are the objects on which rules reason. Each fact is an instance of a fact type.

Figure 7-6 Shipping Element Type

After business rule creation, the business rule service component in the composite is clicked to access the Rules Editor. Within the Rules Editor, a decision table is defined, as shown in [Figure 7-7](#). A decision table is an alternative business rule format that is more compact and intuitive when many rules are needed to analyze many combinations of property values. You can use a decision table to create a set of rules that covers all combinations or where no two combinations conflict.

The following rule conditions are defined for speed of delivery. A rule condition represents the IF part of a statement. A rule condition is like a query over the available facts in the Rules Engine, and for every row returned from the query, the rule is activated. The rule condition activates the rule whenever a combination of facts makes the conditional expression true.

- One-day shipping
- Two-day shipping
- Standard shipping: 3-5 business days
- Do not care (shipping speed does not matter). For this delivery method, a state condition of TX (for Texas) is set. No other rule conditions have a state set; delivery speed is the only requirement.

The following shipping method ID rule actions are defined for each rule condition. A rule action represents the THEN part of a statement. The THEN part contains the actions that are executed when the rule is fired. A rule is fired after it is activated and selected among the other rule activations using conflict resolution mechanisms such as priority.

- 1 - USPS is used for USAFirstClass shipping
- 2 - UPS for USAPriority shipping
- 3 - USA free mail
- 4 - UPS next day air

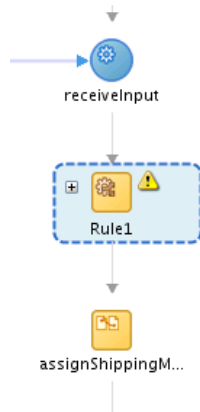
Figure 7-7 Decision Table in Rules Editor

The screenshot shows the Oracle Rules Editor interface for a rule named 'DetermineShippingMethod'. The interface includes a toolbar with various icons for adding, deleting, and navigating rules. The main area displays a decision table with the following structure:

Conditions	R1	R2	R3	R4
C1 ShippingType.shippingSpeed	ONEDAY	TWODAY	STANDARD	-
C2 ShippingType.address.state	-	-	-	"TX"
Conflict Resolution				
Override				R2, R3, R1
Actions				
A1 modify ShippingType shipMethod:Integer)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	1	2	3	4

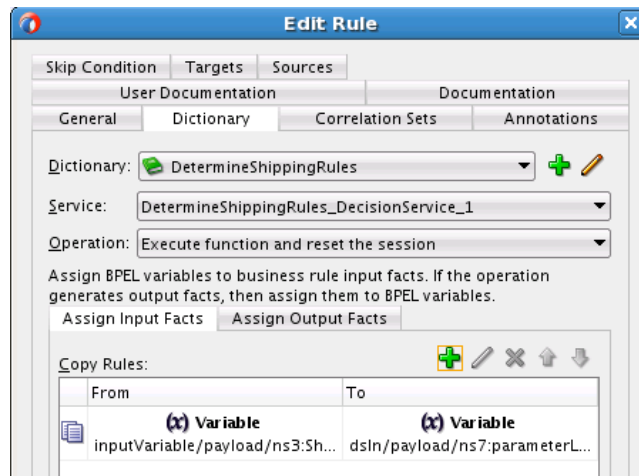
The business rule is integrated by dragging a **Business Rule** icon from the **SOA Components** section of the Components window into the **fulfillment** process, as shown in [Figure 7-8](#).

Figure 7-8 Business Rule Integrated into fulfillment BPEL Process



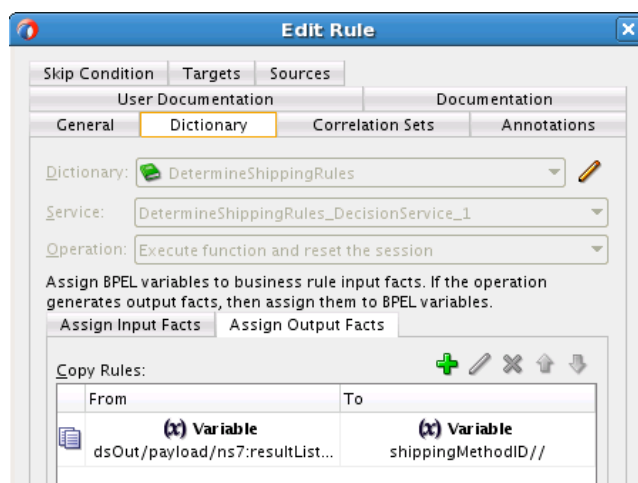
Company X selects the dictionary invoked by this activity. The input and output facts are also defined. For the input copy rule, **ShippingType** is copied from the process **inputVariable** to the **dsIn** (input fact) variable of the business rule. [Figure 7-9](#) provides details.

Figure 7-9 Input Copy Rule



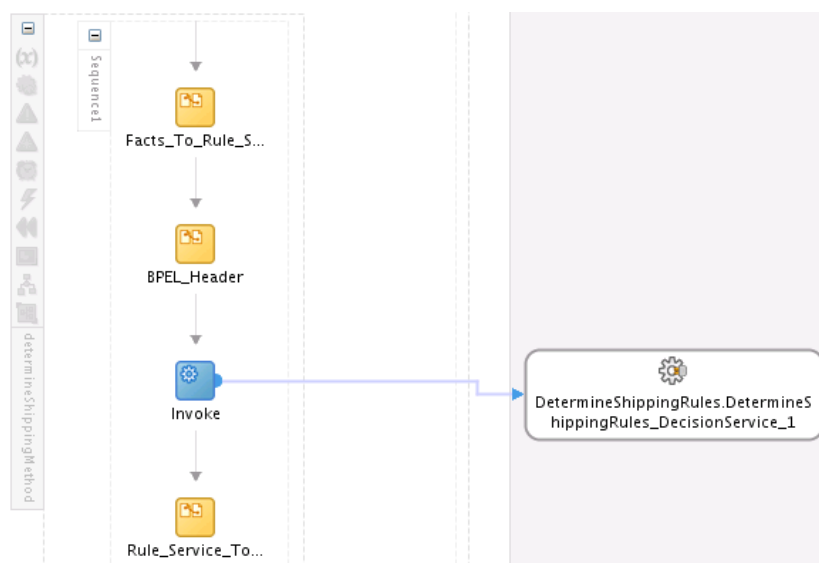
For the output copy rule, **ShippingMethod** is copied from the **dsOut** (output fact) variable of the business rule to the **shippingMethodID** process variable. [Figure 7-10](#) provides details.

Figure 7-10 Output Copy Rule



When design is complete, the **fulFillment** process looks as shown in [Figure 7-11](#).

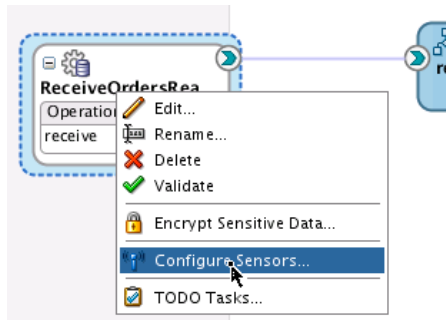
Figure 7-11 Invocation of Rules Dictionary



7.2.3 Tracking the Order Number with Composite Sensors

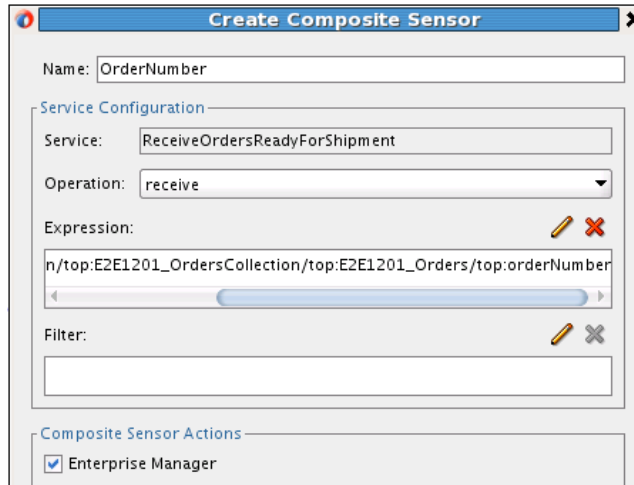
As performed in previous chapters, Company X adds a composite sensor for tracking fields on messages. For this scenario, the status of the order number is tracked. The sensor is set on the **ReceiveOrderReadyForShipment** database adapter service. [Figure 7-12](#) provides details.

Figure 7-12 Composite Sensor



The definition includes an XPath expression to track the order number, as shown in the Composite Sensor dialog in [Figure 7-13](#).

Figure 7-13 Composite Sensor Dialog



The **Enterprise Manager** check box of the Create Composite Sensor dialog is also selected. This enables you to track composite sensor names and values on the Flow Instances page or the Flow Trace page for a specific business flow instance in Oracle Enterprise Manager Fusion Middleware Control. [Figure 7-14](#) provides details.

Figure 7-14 Composite Sensor Name and Value on Flow Trace Page

Sensor Name	Value	Loc
OrderNumber	201371417232929	Rec

Trace					
Instance	Type	Usage	State		
ReceiveOrdersReadyForShipment	Service	Service	Completed	Jul	
receiveOrderToShip	BPEL		Completed	Jul	
fulfillOrder	BPEL		Completed	Jul	
DetermineShippingRules	Decision		Completed	Jul	
getShippingProvider	Reference	Reference	Completed	Jul	

7.2.4 Delivering the Order to the Packing Service with the REST Interface

A REST service was used as an alternative to web services in [Exposing a REST Service with a Packing BPEL Process](#). REST uses HTTP requests to post data (create and update), get data (for example, make queries), update data, and delete data.

For this business scenario, Company X uses a REST reference to call the **PackAndShip** service created in [Packing and Shipping Orders](#). Company X drags a REST binding into the **External References** swimlane of the composite and defines the following details:

- A REST outbound interface.
- A **shipping** REST resource.
- A **packandShip** operation binding based on a WADL file with a **POST** HTTP verb. WADL provides a readable XML description of HTTP-based web applications (typically REST web services). WADL simplifies the reuse of web services based on the existing HTTP architecture of the web. When you select a WADL file, all operation binding details are automatically populated in the Create REST Binding dialog. [Figure 7-15](#) provides details.

Figure 7-15 REST Binding

Create REST binding

REST Binding
Create a REST binding

Name:

Type:

Base URI:

Encoding:

Resources:

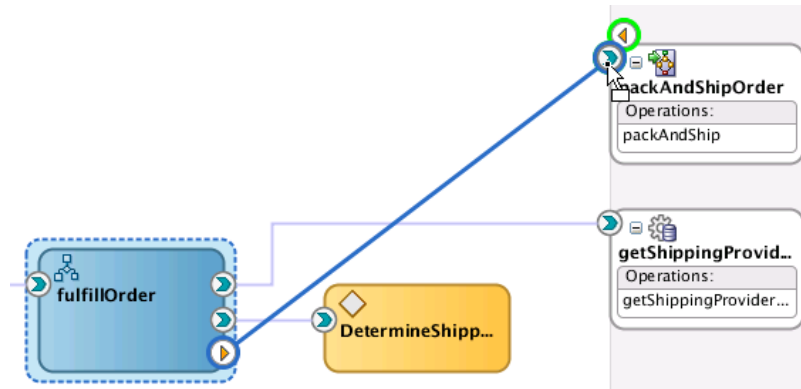
Resource Path
/shipping/

Operation Bindings:

Operation	Resource Path	HTTP Verb	Complete
packAndShip	/shipping/	POST	yes

When configuration is complete, Company X connects the **fulfillOrder** BPEL process to the REST reference, as shown in [Figure 7-16](#).

Figure 7-16 BPEL Process Connected to REST Reference



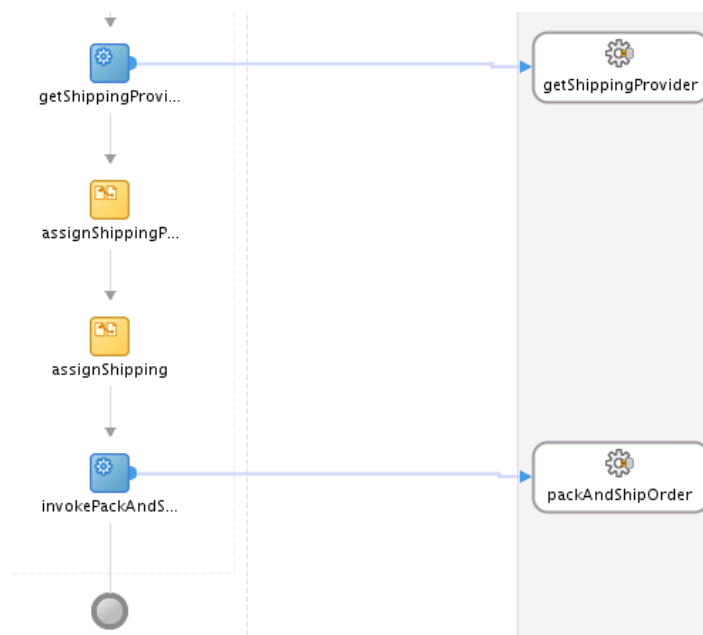
To complete configuration, Company X adds the necessary activities to the **fulfillOrder** process:

- An invoke activity invokes the **PackAndShipOrder** partner link and defines the necessary input and output variables.
- An assign activity maps the **shipping** element in the input variable to the **shipping** element in the input variable for the REST reference.

Because the BPEL process is one-way, there is no need to assign the return value of the REST service.

Figure 7-17 provides details.

Figure 7-17 fulFillment BPEL Process Contents



7.2.5 Reading the Shipping Provider from Cache with the Coherence Adapter

The database adapters used in this composite regularly access the database. To reduce load on the database and to provide faster access to database data, Company X integrates a Coherence adapter into the composite. The Coherence adapter initially puts the data into the cache after it reads from the database the first time.

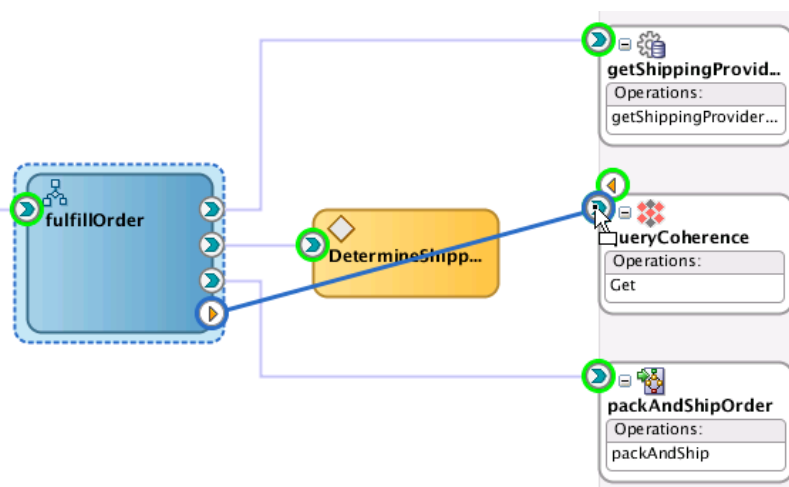
A Coherence cache is a collection of data objects that serves as an intermediary between the database and client applications. Database data can be loaded into a cache and made available to different applications. The Coherence adapter enables you to perform useful Coherence operations such as adding an item to Coherence cache, obtaining an item, removing an item, and querying items.

Company X drags a **Coherence** icon from the **Technology** section of the Components window into the **External References** swimlane of the composite. The Adapter Configuration Wizard guides you through configuring the following Coherence adapter details.

- The JNDI name of the Coherence connection.
- The operation to perform. In this case, a get operation is selected to get data from Coherence cache.
- The cache type (XML).
- The cache name.
- The key type (string) (Populated later with the `java.coherence.Key` property in an invoke activity.).
- The database lookup response schema file (Stores the response from the database lookup directly in Coherence cache.).

When adapter configuration is complete, the **fulfillOrder** BPEL process is connected to the Coherence adapter, as shown in [Figure 7-18](#).

Figure 7-18 fulfillOrder BPEL Process Connected to Coherence Adapter

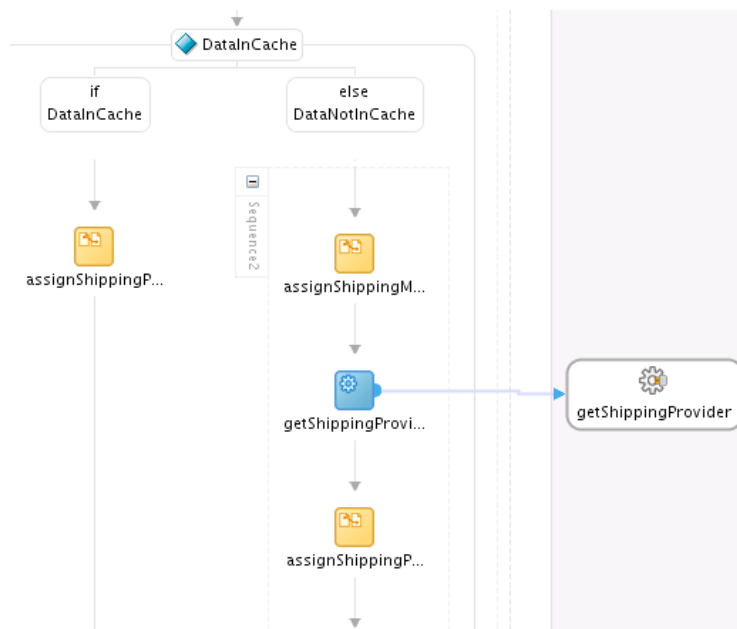


To complete configuration, Company X adds and configures the necessary activities in the **fulfillOrder** process:

- An invoke activity is configured as follows:
 - Invokes the **QueryCoherence** partner link.
 - Defines input and output variables.
 - Assigns the **jca.coherence.Key** property to the **shippingMethodID** value (under the **Properties** tab). This value is sent as the input variable upon invocation of the adapter and eliminates the need to create an assign activity statement in which an input value is assigned to the Coherence query invocation.
- An if activity is configured as follows:
 - The if part assigns the shipping provider name from the Coherence query output variable to the shipping provider name in the process input variable (in the shipping element). This is used later for the **PackAndShipService** designed in [Packing and Shipping Orders](#).
 - An else part includes the **getShippingProvider** database adapter invocation and its two assign activities.

When complete, configuration looks as shown in [Figure 7-19](#).

Figure 7-19 If Statement



7.2.6 Copying the Database Adapter Response into Coherence Cache

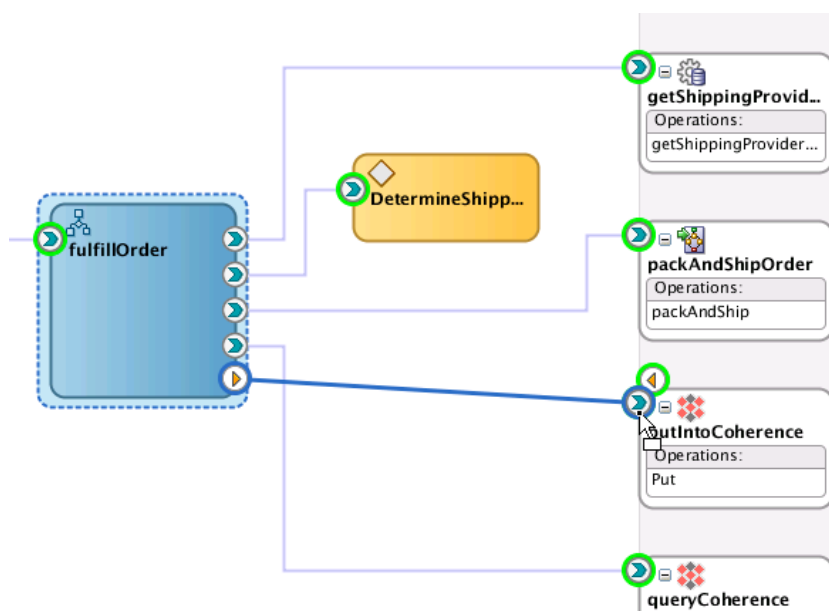
Company X adds another Coherence adapter to the **External References** swimlane of the composite. This adapter copies the database adapter response into Coherence cache so that the shipping provider is available in cache the next time it is looked up.

The Coherence adapter is configured as follows:

- The JNDI name of the Coherence connection.
- The operation to perform. In this case, a put operation is selected to put an item into cache.
- The cache type (XML).
- The cache name.
- The key type (string).
- The key value of **shippingMethodKey**.
- The database lookup response schema file.

To complete configuration, Company X connects the **fulfillment** process to the new Coherence adapter, as shown in [Figure 7-20](#).

Figure 7-20 BPEL Process Connected to Second Coherence Adapter



To complete configuration, Company X adds the necessary activities to the **fulfillOrder** process:

- An invoke activity is configured as follows:
 - Invokes the **putIntoCoherence** partner link.
 - Defines input and output variables.
 - Assigns the **jca.coherence.Key** property to the **shippingMethodID** value (under the **Properties** tab). This value is sent as the input variable upon invocation of the adapter and eliminates the need to create an assign activity statement in which an input value is assigned to the Coherence query invocation.
- An assign activity populates the input variable of the Coherence adapter with the output variable of the database call.

When configuration is complete, the **fulfillment** process looks as shown in [Figure 7-21](#).

Figure 7-21 fulfillment BPEL Process Contents

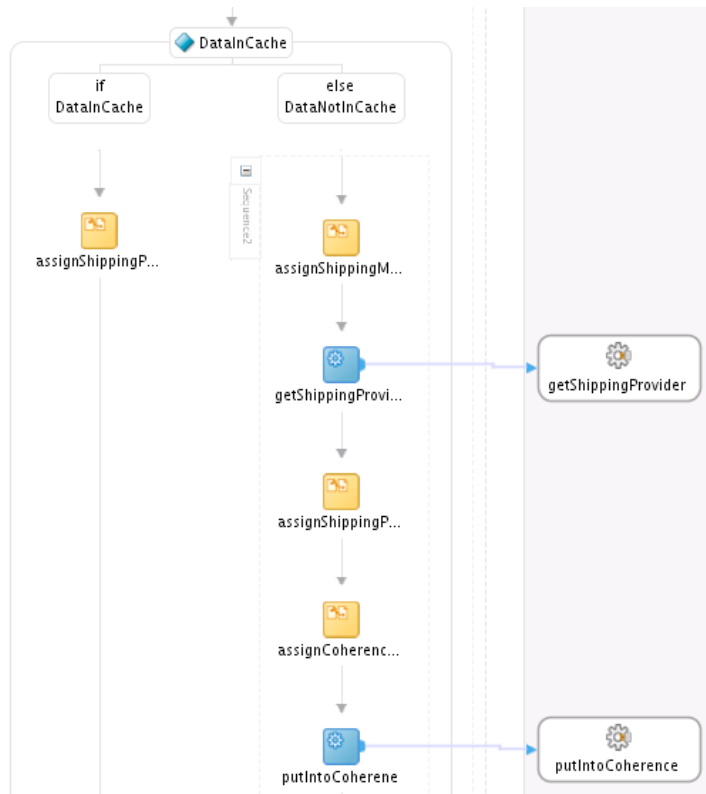
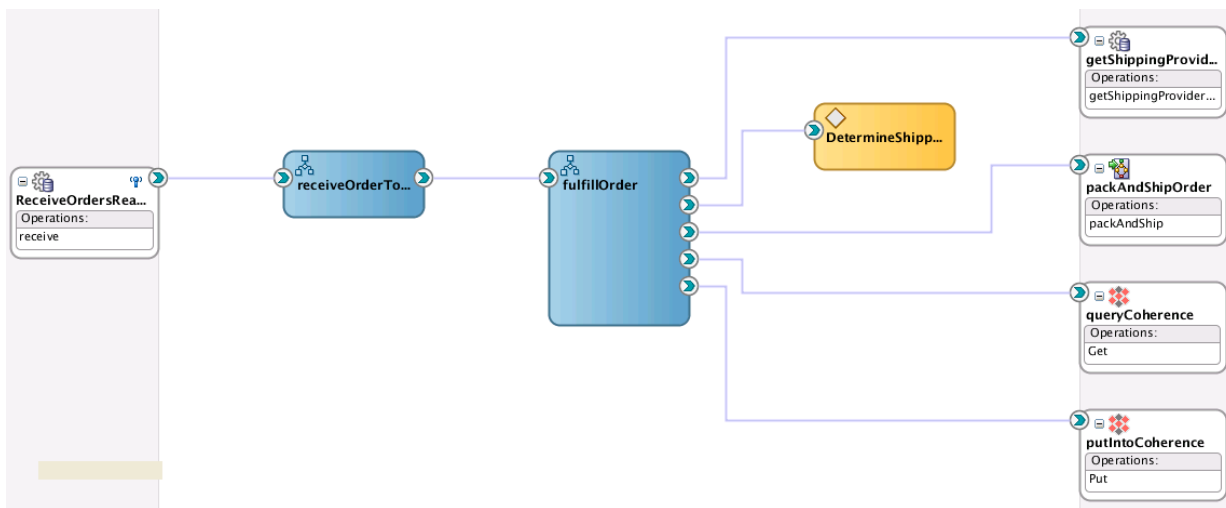


Figure 7-22 shows how this completed business solution appears in the SOA Composite Editor.

Figure 7-22 Completed SOA Composite Application



7.2.7 Deploying the Composite and Testing the Coherence Adapters

Initially both Coherence adapters are executed. The **queryCoherence** reference returns an empty variable because nothing has been put into Coherence cache yet. The **putCoherence** reference then puts the content into Coherence cache. [Figure 7-23](#) provides details.

Figure 7-23 Flow Trace

Trace						
Actions ▾ View ▾ Show Instance IDs <input type="checkbox"/>						
Instance	Type	Usage	State	Time	Compos	
ReceiveOrdersReadyForShipment	Service	Service	Completed	Jul 14, 2013 6:05:37 PM	FulfillOr	
receiveOrderToShip	BPEL		Completed	Jul 14, 2013 6:05:37 PM	FulfillOr	
fulfillOrder	BPEL		Completed	Jul 14, 2013 6:05:37 PM	FulfillOr	
DetermineShippingRules	Decision		Completed	Jul 14, 2013 6:05:37 PM	FulfillOr	
queryCoherence	Reference	Reference	Completed	Jul 14, 2013 6:05:37 PM	FulfillOr	
getShippingProvider	Reference	Reference	Completed	Jul 14, 2013 6:05:37 PM	FulfillOr	
putIntoCoherence	Reference	Reference	Completed	Jul 14, 2013 6:05:37 PM	FulfillOr	
packAndShipOrder	Reference	Reference	Completed	Jul 14, 2013 6:05:37 PM	FulfillOr	
packingService	Service	Service	Completed	Jul 14, 2013 6:05:37 PM	PackAni	
packAndShipOrder	BPEL		Completed	Jul 14, 2013 6:05:37 PM	PackAni	
updateOrderStatusSP	BPEL Subprocess		Completed	Jul 14, 2013 6:05:37 PM	PackAni	
updateOrderStatusInDB	Reference	Reference	Completed	Jul 14, 2013 6:05:37 PM	PackAni	
NotifyUser	Reference	Reference	Completed	Jul 14, 2013 6:05:37 PM	PackAni	

Once the message has been put into Coherence cache, the audit trail changes. [Figure 7-24](#) provides details.

Figure 7-24 Flow Trace with Changes

Trace						
Actions ▾ View ▾ Show Instance IDs <input type="checkbox"/>						
Instance	Type	Usage	State	Time	Compo	
ReceiveOrdersReadyForShipment	Service	Service	Completed	Jul 14, 2013 5:58:42 PM	FulfillIO	
receiveOrderToShip	BPEL		Completed	Jul 14, 2013 5:58:42 PM	FulfillIO	
fulfillOrder	BPEL		Completed	Jul 14, 2013 5:58:42 PM	FulfillIO	
DetermineShippingRules	Decision		Completed	Jul 14, 2013 5:58:42 PM	FulfillIO	
queryCoherence	Reference	Reference	Completed	Jul 14, 2013 5:58:42 PM	FulfillIO	
packAndShipOrder	Reference	Reference	Completed	Jul 14, 2013 5:58:42 PM	FulfillIO	
packingService	Service	Service	Completed	Jul 14, 2013 5:58:42 PM	PackAr	
packAndShipOrder	BPEL		Completed	Jul 14, 2013 5:58:42 PM	PackAr	
updateOrderStatusSP	BPEL Subprocess		Completed	Jul 14, 2013 5:58:42 PM	PackAr	
updateOrderStatusInDB	Reference	Reference	Completed	Jul 14, 2013 5:58:42 PM	PackAr	
NotifyUser	Reference	Reference	Completed	Jul 14, 2013 5:58:42 PM	PackAr	

The **queryCoherence** reference returns the shipping method variable and the database does not need to be queried again. [Figure 7-25](#) provides details.

Figure 7-25 Shipping Method Variable Returned

queryCoherence	
Jul 14, 2013 5:58:42 PM	Started invocation of operation "Get" on partner "queryCoherence".
Jul 14, 2013 5:58:42 PM	Sending property "jca.coherence.Key", value is "3".
Jul 14, 2013 5:58:42 PM	Invoked 2-way operation "Get" on partner "queryCoherence".
View Payload	

7.3 Related Documentation

[Table 7-2](#) provides references to documentation that more specifically describes the components and features described in this chapter.

Table 7-2 Related Documentation

For Information About...	See...
Adding a project template	"Oracle SOA Suite Templates and Reusable Subprocesses" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Designing a business rule	"Overview of Oracle Business Rules" of <i>Designing Business Rules with Oracle Business Process Management</i> "Getting Started with Oracle Business Rules" of <i>Developing SOA Applications with Oracle SOA Suite</i> "Working with Decision Tables" of <i>Designing Business Rules with Oracle Business Process Management</i>
Creating a composite sensor	"Defining Composite Sensors" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Adding a REST reference	"Integrating REST Operations in SOA Composite Applications" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Configuring Coherence adapters	"Oracle JCA Adapter for Coherence" of <i>Understanding Technology Adapters</i>

8

Scheduling Composite Execution

This chapter describes how Oracle SOA Suite addresses the business challenge of maintaining sufficient inventory levels. Overviews of how key SOA composite application components are created and address this challenge are provided, including Oracle Enterprise Scheduler.

This chapter includes the following sections:

- [Business Challenge](#)
- [Business Solution](#)
- [Related Documentation](#)

8.1 Business Challenge

Company X faces the business challenge of maintaining sufficient inventory. As orders are processed, the stock of items in the warehouse is reduced and inventory must be restocked. For each category of products ordered, Company X has a different supplier. At the end of each day, a separate report must be run for each supplier to identify the number of items for each product to be ordered to return the inventory to its original level.

8.2 Business Solution

To address these business challenges, Company X designs a business solution that uses the components described in [Table 8-1](#).

Table 8-1 Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
SOA composite application	A query inventory composite identifies the total number of items of each product ordered for the day for a given category. This query identifies how much inventory has been reduced during the day.	See Table 3-1 for a description of SOA composite applications.
Oracle Enterprise Scheduler job	Oracle Enterprise Scheduler is used to define a web service job for the query inventory composite and then submit the job with a schedule to run at a specified time.	Oracle Enterprise Scheduler enables you to manage job requests, define metadata, and schedule jobs in Oracle Enterprise Manager Fusion Middleware Control.
Oracle Enterprise Scheduler adapter activation and deactivation	Oracle Enterprise Scheduler activates and deactivates the database adapter in the fulfillment service created in Fulfilling Orders using recurring schedules for the activation and deactivation.	Oracle Enterprise Scheduler enables you to schedule adapters in composites to activate and deactivate at specified times.

Subsequent sections of this chapter provide more specific details about how the components in [Table 8-1](#) are used to address the credit validation business challenge.

- [Creating a Web Service Job Definition](#)
- [Submitting a Job Request on a Schedule](#)
- [Applying Schedules to Adapters](#)

8.2.1 Creating a Web Service Job Definition

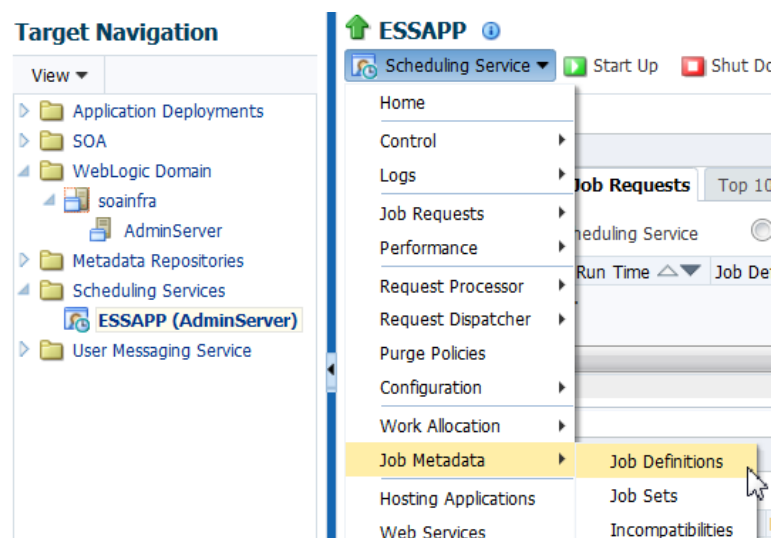
To address the requirement for identifying and maintaining sufficient inventory levels, Company X uses Oracle Enterprise Scheduler.

Oracle Enterprise Scheduler enables you to defer larger transactions to run as jobs at a later time or automate the running of application maintenance work based on a defined schedule. Oracle Enterprise Scheduler enables you to run different job types such as Java, PL/SQL, binary scripts, web services, and EJBs distributed across the nodes in an Oracle WebLogic Server cluster. Oracle Enterprise Scheduler runs jobs securely, providing for high availability, scalability, and load balancing. Oracle Enterprise Scheduler provides monitoring and management through Oracle Enterprise Manager Fusion Middleware Control.

Company X creates a job definition for the **queryInventory** composite that queries their inventory. The composite includes a synchronous BPEL process and a web service as the service binding component. You associate request-specific metadata as job definitions.

Company X creates the job definition by selecting **ESSAPP** in the Oracle Enterprise Manager Fusion Middleware Control navigator, then selecting **Job Metadata > Job Definitions** from the **Scheduling Service** menu. [Figure 8-1](#) provides details.

Figure 8-1 Job Definition Creation



Company X configures a job definition with the following details:

- Job name and display name of **QueryInventory**

- Package value of **soa**
- Job type of **syncWebServiceJobType**

When complete, configuration looks as shown in [Figure 8-2](#).

Figure 8-2 Job Definition Configuration

Scheduling Service Home > Job Definitions > Create Job Definition

Create Job Definition OK Cancel

Application EssNativeHostingApp(V1.0)

Job Definiior

* Name

* Display Name

Package

Description

* Job Type Select Web Service...

Class Name oracle.as.scheduler.job.webservice.SyncWSJob

Application Defined Propertie

Name	Type	Initial Value	Read Only
Category	String		

System Propertie

Name	Type	Initial Value	Read Only
SYS_effectiveApplication	String	EssNativeHostingA...	
SYS_EXT_wsWsdIBaseIrl	String	http://slc01mta.us	<input checked="" type="checkbox"/>

8.2.2 Submitting a Job Request on a Schedule

Company X creates a schedule for running the job definition created in [Creating a Web Service Job Definition](#). A schedule determines when the job runs.

From the **Scheduling Services** menu in the Oracle Enterprise Manager Fusion Middleware Control navigator, Company X selects **Job Requests > Submit Job Request**. Company X selects the **QueryInventory** job definition and defines a schedule for running the job. [Figure 8-3](#) provides details.

Figure 8-3 Job Request Submittal

Submit Job Request

Select the application (J2EE application deployment name) for which you want to submit job request.

Application:

Job Request Details

Submission Notes:

Job Definition

* Job Definition:

Description:

Job Type: SyncWebserviceJobType

Execution Type: Java Type

Job Parameters + Add

Name	Value
Category	123

System Parameters

Name	Value
SYS_EXT_executa...	
SYS_EXT_invokeM...	<ns1:InventoryQuery xmlns:ns1="http://www.oracle.com/soasample">
SYS_selectState	<input type="text"/>
SYS_EXT_ejbOper...	
SYS_bizErrorExitC...	
SYS_successExitC...	
SYS_EXT_cmdLine...	
SYS_EXT_wsOwsm...	

Schedule

Once

Use existing schedule:

Specify schedule

Frequency:

Every: Hour(s) Minute(s)

* Start Date: (UTC-08:00) P

Use End Date:

End Date: (UTC-08:00) P

Enable this flag to save schedule for the selected application.

Save Schedule

Name:

Namespace: /oracle/apps/ess/custom

Package:

After the job runs, you can review the output. Company X selects **Job Requests > Search Job Request** from the **Scheduling Services** menu and navigates to the Request Details page. In the **Log and Output** section at the bottom of the page, details about the web service response are available in an XML file. [Figure 8-4](#) provides details.

Figure 8-4 Output Results of Web Service Response

Request Properties

Submission Notes

- Parent ID 130 (Root Parent 130)
- Job Definition QueryInventory
- Job Type SyncWebserviceJobType
- Execution Type Java Type
- Request Type Child request generated from a Schedule
- Application EssNativeHostingApp
- Submitted By weblogic
- Expiration Time
- Priority 4

Parameters

Name	Value
SYS_priority	4
SYS_EXT_wsPortName	execute_pt
SYS_effectiveApplication	EssNativeHostingApp
SYS_EXT_useExtendedSetup	true
SYS_EXT_wsOperationName	execute
SYS_userName	weblogic
SYS_className	oracle.as.scheduler.j
SYS_retries	0

Execution Trail

Submitted

3/7/13 4:18:16 PM PDT

Start

3/7/13 4:22:15 PM PDT

Succeeded

3/7/13 4:22:16 PM PDT

Scheduled

3/7/13 4:22:07 PM PDT

Wait Time 00:00:08

Run Time 00:00:00.665

Process Group base_domain#AdminServer

Processor AdminServer

Dispatcher AdminServer

Execution Status

Log and Output

File Name	Category	Content Type	Size (bytes)
WebServiceJobOutput-133.txt	Output	Text	234

8.2.3 Applying Schedules to Adapters

Oracle Enterprise Scheduler also enables you to schedule adapters in composites to be activated and deactivated at specified times. You can schedule to activate an adapter during periods when load on the system is minimal. The **fulfillment** composite designed in [Fulfilling Orders](#) includes a database adapter as a service input.

Company X uses Oracle Enterprise Scheduler to activate and deactivate the database adapter using recurring schedules. Company X selects **Job Requests > Define Schedules** from the **Scheduling Services** list. Company X configures activation and deactivation job definitions for the database adapter with the details shown in [Table 8-2](#). The database adapter is configured to active every ten minutes, and then deactivate every ten minutes.

Table 8-2 Configuration of Activation and Deactivation of Adapters

Element	Activation of Adapter	Deactivation of Adapter
Name	activateSched	deactivateSched
Display Name	activateSched	deactivateSched
Package	soa	soa
Frequency	Hourly/Minute	Hourly/Minute

Table 8-2 (Cont.) Configuration of Activation and Deactivation of Adapters

Element	Activation of Adapter	Deactivation of Adapter
Every	10 minutes	10 minutes Deactivation occurs at 5 minutes, 15 minutes, 25 minutes, and so on. Activation occurs at 10 minutes, 20 minutes, 30 minutes, and so on.
Start Date	Ten minutes from now	Five minutes from now
Use End Date	Unchecked	Unchecked

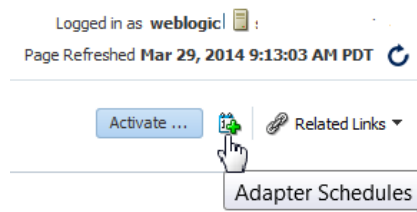
When complete, adapter activation and deactivation configuration looks as shown in [Figure 8-5](#).

Figure 8-5 Activate and Deactivate Adapter Jobs

Results				
Create... Edit... Delete...				
Name	Package	Description	Starts On	Repeat
activateSched	/oracle/apps/ess/custo...	activateSched	Mar 6, 2013 4:00:00 PM	Minutely
deactivateSched	/oracle/apps/ess/custo...	deactivateSched	Mar 6, 2013 3:55:00 PM	Minutely

Company X goes to the home page of the database adapter in Oracle Enterprise Manager Fusion Middleware Control and selects to activate and deactivate the database adapter. [Figure 8-6](#) provides details.

Figure 8-6 Database Adapter Activation and Deactivation on Database Adapter Home Page



Company X selects to activate and deactivate the database adapter at the specified times. [Figure 8-7](#) provides details.

Figure 8-7 Adapter Activation Schedule

Select an activation and a deactivation schedule to enable automated activation for this adapter.

Not all schedules can be used together. When you select an activation schedule, some of the deactivation schedules may not be available, and vice versa. To create a new schedule, click a link below to close this dialog and navigate to the Enterprise Manager Scheduler page.

Only schedules in package /oracle/app/ess/custom/soa can be used for activation and deactivation.

Deactivation Schedule

deactivateSched ▼

deactivateSched

Activation Schedule

activateSched ▼

activateSched

Schedule modifications will go into effect the next time the nearest schedule fires. An older schedule that already has fired, will be allowed to complete.

8.3 Related Documentation

[Table 8-3](#) provides references to documentation that more specifically describes the components and features described in this chapter.

Table 8-3 Related Documentation

For Information About...	See...
Creating a job definition and schedule	"Managing Oracle Enterprise Scheduler Requests" of <i>Administering Oracle Enterprise Scheduler</i>
Activating and deactivating adapters	"Scheduling JCA Adapter Endpoint Activation and Deactivation using Oracle Enterprise Scheduler" of <i>Administering Oracle SOA Suite and Oracle Business Process Management Suite</i>

9

Managing File Transfers

This chapter describes Oracle Managed File Transfer (MFT) usage and provides an overview of how Company X integrates its SOA composite applications with Oracle MFT. This chapter includes the following sections:

- [Business Challenge](#)
- [Business Solution](#)
- [Related Documentation](#)

9.1 Business Challenge

Company X has a requirement for its composites to interact with different endpoint types, amongst them file- and FTP-based endpoint types. For example, Company X must be able to use an FTP server to write files to a file system.

9.2 Business Solution

To address these business challenges, Company X designs a business solution that uses the components described in [Table 9-1](#).

Table 9-1 Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
Oracle MFT transfer	<ul style="list-style-type: none">• An Oracle MFT transfer receives files and writes them to the file system using the MFT embedded FTP server.• Oracle MFT invokes an MFT service in a SOA composite application and dynamically decides based on file size whether to pass the content inline or by reference.	Oracle MFT is a high performance, standards-based, end-to-end managed file gateway. Oracle MFT provides design, deployment, and monitoring of file transfers using a lightweight web-based, design-time console that includes file encryption, scheduling, and embedded FTP and sFTP servers.

Subsequent sections of this chapter provide more specific details about how the components in [Table 9-1](#) are used to address the file transfer business challenge.

- [Creating Transfers_ Sources_ and Targets](#)
- [Creating a SOA Composite Application with an MFT Service](#)
- [Sending the Order File to a SOA Composite](#)
- [Processing Payload Types](#)
- [Invoking the ProcessOrder Composite with an Inline Payload](#)

9.2.1 Creating Transfers, Sources, and Targets

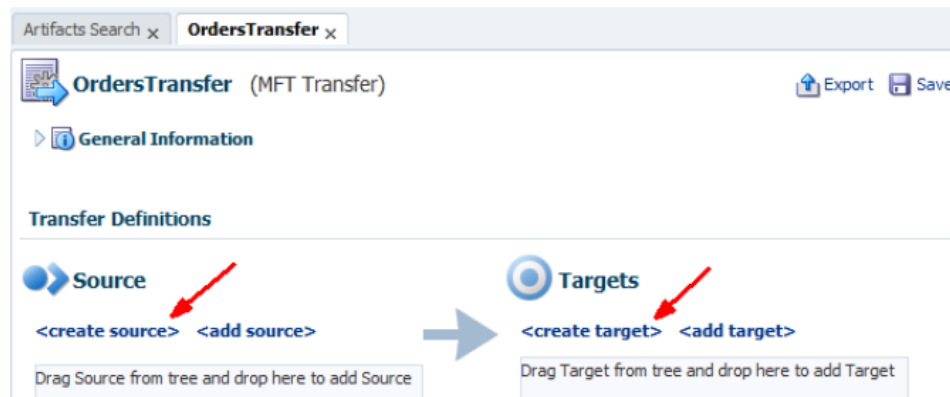
The file delivery structure of Oracle MFT consists of the following types of artifacts:

- Sources define the origin of files.
- Targets define the destination of files.
- Transfers associate a source with one or more targets.

You create these artifacts on the designer page of the Oracle Managed File Transfer Console.

Company X creates a transfer named **OrdersTransfer**, as shown in [Figure 9-1](#). The page includes options for creating sources and targets.

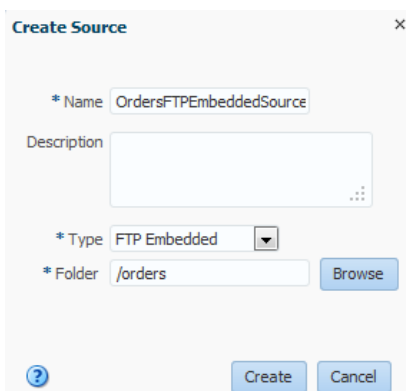
Figure 9-1 Transfer Creation



Company X creates the following source and target artifacts:

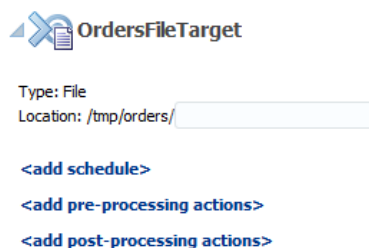
- A source named **CreateSource** in which files are placed in the **/orders** directory. The FTP embedded server is selected for transferring the file. [Figure 9-2](#) provides details. The source location is further defined to process files that adhere to the pattern of **Order*.xml**.

Figure 9-2 Source Location



- A target named **OrdersFileTarget** in which transferred files are placed in the **/tmp/orders** directory. File targets can be reused by overriding the location with a subdirectory such as `/tmp/orders/output`. The target is further defined to select a compression level. [Figure 9-3](#) provides details.

Figure 9-3 Target Location



After deployment, files that adhere to the pattern of **Orders*.xml** in **/orders** are written to **/tmp/orders** in compressed format. The Oracle Managed File Transfer Console in [Figure 9-4](#) shows the transfer results.

Figure 9-4 Transfer Results

Target Instance: OrdersFileTarget Pause Resume Resubmit Target

Summary

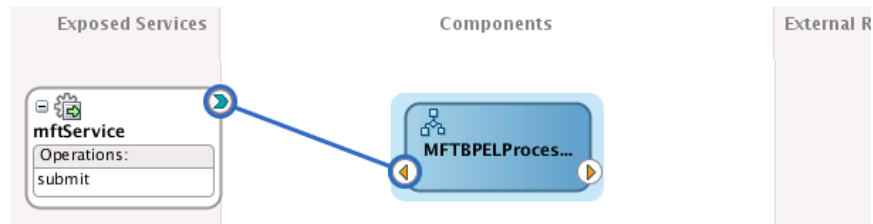
File Name	OrderSample.xml.zip		
Delivered File Name	OrderSample.xml.zip		
Location	/tmp/soabeta2/user_projects/domains/soabeta2_domain/mft/ftp_root/payloads/147/50		
Target Name	OrdersFileTarget	Schedule Details	
Transfer Name	OrdersTransfer	Instance Process Start Time	Aug 27, 2013 1:33 PM
Endpoint	File://localhost/tmp/orders	Instance Process End Time	Aug 27, 2013 1:34 PM
Creation Time	Aug 27, 2013 1:33 PM	Transfer Start Time	Aug 27, 2013 1:34 PM
Status	Completed [Successful]	Transfer Completed Time	Aug 27, 2013 1:34 PM
Bytes Transferred	806	Recent Resubmit Status	
Time Taken	214 milliseconds	Resubmitted Count	0

Target Pre-processing

Name	Status	Creation Time
Compress	Processed	Aug 27, 2013 1:33 PM

9.2.2 Creating a SOA Composite Application with an MFT Service

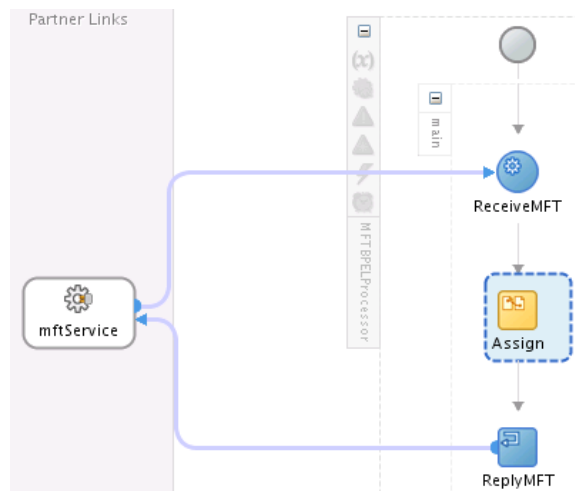
Company X creates a SOA composite named **MFTProcessor** and an empty BPEL process by selecting **Define Service Later** in the Create BPEL Process dialog. In the SOA Composite Editor, Company X creates an Oracle MFT service by dragging an **MFT** icon from the **Technology** section of the Components window into the **Exposed Services** swimlane of the composite. The Oracle MFT service is designed to dynamically decide based on file size whether to pass file content inline or by reference. After configuration is complete, the service is wired to the composite, as shown in [Figure 9-5](#).

Figure 9-5 Oracle MFT Service Connected to a BPEL Process

To complete configuration, Company X adds and configures the necessary activities in the **MFTBPELProcess** BPEL process:

- A receive activity is invoked by the Oracle MFT service and is configured with an input variable.
- An assign activity sends the payload type as a response.
- A reply activity returns an output variable to the Oracle MFT service.

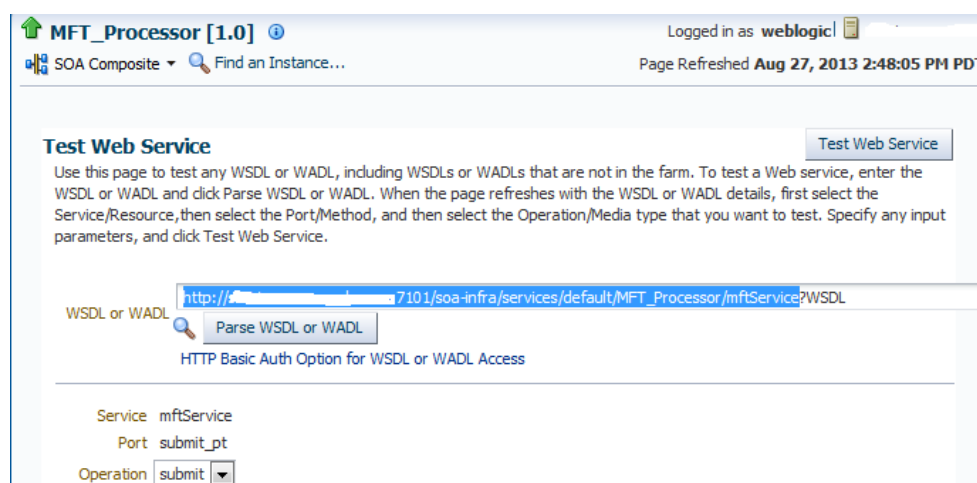
When complete, BPEL process design looks as shown in [Figure 9-6](#).

Figure 9-6 BPEL Process with MFT Service

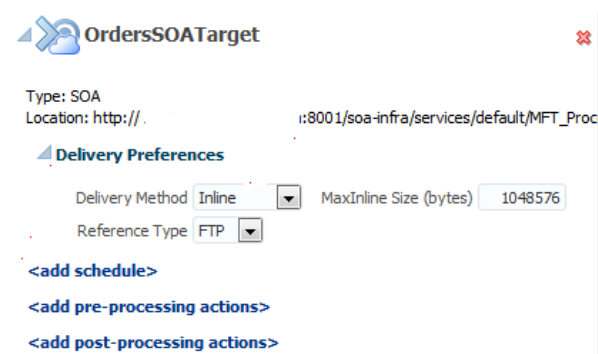
The composite is deployed and verified in Oracle Enterprise Manager Fusion Middleware Control.

9.2.3 Sending the Order File to a SOA Composite

Company X creates an additional Oracle MFT target to invoke the deployed **MFTProcessor** composite. Company X copies the endpoint URL of the **MFTProcessor** composite from the Test Web Service page in Oracle Enterprise Manager Fusion Middleware Control. [Figure 9-7](#) provides details.

Figure 9-7 Copy of Endpoint URL of the Deployed Composite

In the Oracle Managed File Transfer Console, Company X creates an **OrdersSOATarget** target with the URL of the composite copied from the Test Web Service page and selects inline attachment as the file delivery method. [Figure 9-8](#) provides details.

Figure 9-8 MFT Target

After redeployment, files that adhere to the pattern of **Orders*.xml** in the **/orders** directory are transferred to the **/tmp/orders** directory. The Oracle Managed File Transfer Console shows the transfer results in [Figure 9-9](#). The **OrdersSOATarget** target is displayed along with the previously created source **OrdersFileTarget**.

Figure 9-9 Output Results

Source Instance: OrdersFTPEmbeddedSource

Summary

File Name OrderSample.xml
 Location /tmp/soabeta2/user_projects/domains/soabeta2_domain/mft/ftp_root/payloads/ref/148/16

Source Name OrdersFTPEmbeddedSource Source Type External
 Status Completed [Successful] Payload Size 2651 bytes
 Creation Time Aug 27, 2013 3:01 PM Recent Resubmit Status
 Endpoint Embedded-FTP:// :7021/orders/ Resubmitted Count 0

Transfer Instances

Transfer Name	Status	Sub-Status	Content Type	Transfer Initiation Time	Creation Time
OrdersTransfer	Completed	Successful	OrdersTransfer_cf_1	Aug 27, 2013 3:01 PM	Aug 27, 2013 3:01 PM

The **View Payload** link in the audit trail of the business flow instance of the composite in Oracle Enterprise Manager Fusion Middleware Control shows that the file was sent as an FTP reference pointing back to the Oracle MFT embedded FTP server. Figure 9-10 provides details.

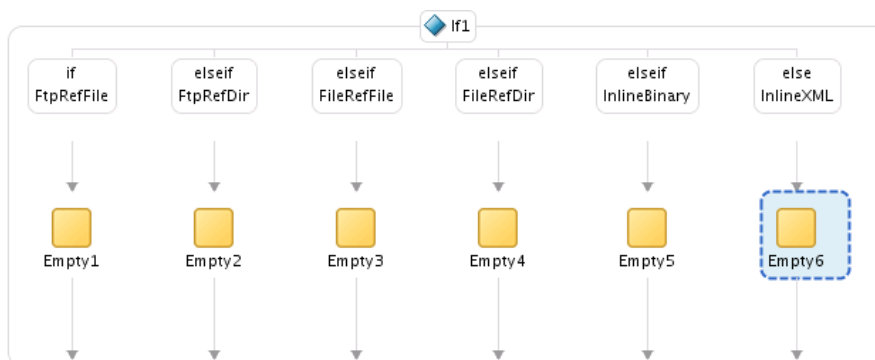
Figure 9-10 Audit Trail

9.2.4 Processing Payload Types

Company X adds an if activity to the BPEL process of the **MFTProcessor** composite. Each if activity branch defines an XPath expression for processing a different type of payload that Oracle MFT sends to a SOA composite and implements inline processing

to call the **ProcessOrder** service created in [Creating an Order Processing System](#). [Figure 9-11](#) provides details.

Figure 9-11 If Activity Branches



The branches are defined as follows:

- **FtpRefFile:** Passes a file by reference. The file is transferred using FTP. This branch uses an XPath expression of `xp20:compare($PayloadType, 'FtpRefFile') = 0`.
- **FtpRefDir:** Passes a directory of files by reference. The directory of files is transferred using FTP. This branch uses an XPath expression of `xp20:compare($PayloadType, 'FtpRefDir') = 0`.
- **FileRefFile:** Passes a file by reference. The file is passed requiring special handling using a file adapter. This branch uses an XPath expression of `xp20:compare($PayloadType, 'FileRefFile') = 0`.
- **FileRefDir:** Passes a directory of files by reference. A directory of files is passed requiring special handling using a file adapter. This branch uses an XPath expression of `xp20:compare($PayloadType, 'FileRefDir') = 0`.
- **InlineBinary:** Passes a binary file inline. This branch uses an XPath expression of `xp20:compare($PayloadType, 'InlineBinary') = 0`.
- **InlineXML:** Passes an XML file inline. Because this is the else branch, no expression is required.

After redeployment, the audit trail of the business flow instance shows two order files (**OrderSample.xml** and **OrderSampleLarge.xml**). Each file takes a different path in the SOA BPEL process based on the XPath expression in the if branch. [Figure 9-12](#) provides details.

Figure 9-12 Audit Trail

SampleOrderLarge.xml → FtpRefFile

[2013/04/23 18:34:55]
Updated variable "PayloadType"
- <PayloadType>
 <PayloadType xmlns:def="http://www.w3.org/2001/XMLSchema" xsi:type="def:string"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">FtpRefFile</PayloadType>
</PayloadType>
[Copy details to clipboard](#)

[2013/04/23 18:34:55]

SampleOrder.xml → InlineXml

[2013/04/23 18:34:54]
Updated variable "PayloadType"
- <PayloadType>
 <PayloadType xmlns:def="http://www.w3.org/2001/XMLSchema" xsi:type="def:string"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">InlineXml</PayloadType>
</PayloadType>
[Copy details to clipboard](#)

In the **Trace** table of the Flow Trace page, there is a link next to the **Managed File Transfer** name that takes you to the Oracle Managed File Transfer Console. [Figure 9-13](#) provides details.

Figure 9-13 Link to Oracle Managed File Transfer Console

Flow Trace ⓘ

This page shows the flow of the message through various composite and component instances.

Faults Composite Sensor Values Composites

Recover View

Error Message	Fault Owner
No faults found.	

Columns Hidden 8

Trace

Actions View Show Instance IDs

Instance	Type	Usage
Managed File Transfer 🔗	Managed File Tra...	
mftOrdersService	Service	Service
OrdersBPELProcess	BPEL	

9.2.5 Invoking the ProcessOrder Composite with an Inline Payload

Company X drags a **SOAP** icon from the **Technology** section of the Components window into the **External References** swimlane of the **MFTProcessor** composite. The SOAP service reference is configured to invoke the **ProcessOrder** endpoint. [Figure 9-14](#) provides details.

Figure 9-14 SOAP Reference

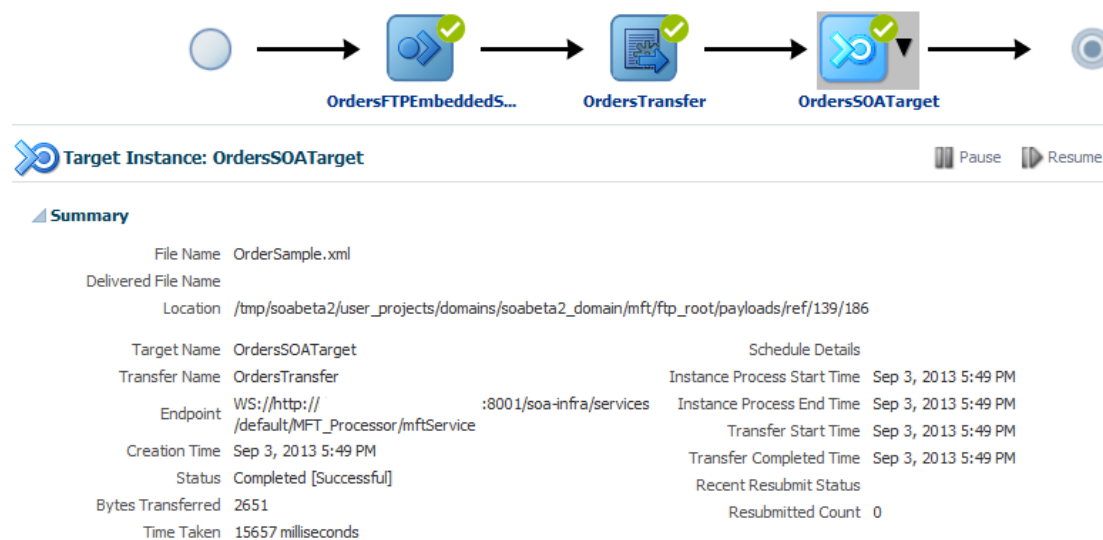


After SOAP configuration is complete, Company X adds and configures the necessary activities in the BPEL process:

- An invoke activity is added to the else part of the if activity to invoke the web service. Input and output variables are created.
- An assign activity maps the MFT service input payload to the **ProcessOrder** input variable.

After redeployment, the **OrdersSample.xml** file is placed in **/orders** and transferred to **/tmp/orders**. The Oracle Managed File Transfer Console shows the transfer results in [Figure 9-15](#).

Figure 9-15 Output File



The audit trail shows the **ProcessOrder** composite was invoked and the order was processed. [Figure 9-16](#) provides details.

Figure 9-16 Audit Trail



9.3 Related Documentation

Table 9-2 provides references to documentation that more specifically describes the features described in this chapter.

Table 9-2 Related Documentation

For Information About...	See...
Key Oracle MFT concepts	"Understanding Oracle Managed File Transfer" of <i>Using Oracle Managed File Transfer</i>
Oracle MFT transfers, targets, and sources	"Designing Artifacts: Transfers, Sources, and Targets" of <i>Using Oracle Managed File Transfer</i>

10

Accepting B2B Orders

This chapter describes how Oracle SOA Suite addresses the business challenge of accepting orders that follow B2B standards such as the Electronic Data Interchange (EDI) document protocol. Overviews of how key SOA composite application components address this challenge are provided, including Oracle B2B, Oracle Managed File Transfer (MFT), and Oracle Service Bus.

This chapter includes the following sections:

- [Business Challenge](#)
- [Business Solution](#)
- [Related Documentation](#)

10.1 Business Challenge

Company X has a requirement for the order processing system to accept EDI XML document orders sent through several different input channels.

10.2 Business Solution

To address this business challenge, Company X designs a business solution that uses the components described in [Table 10-1](#).

Table 10-1 Components That Provide the Business Solution

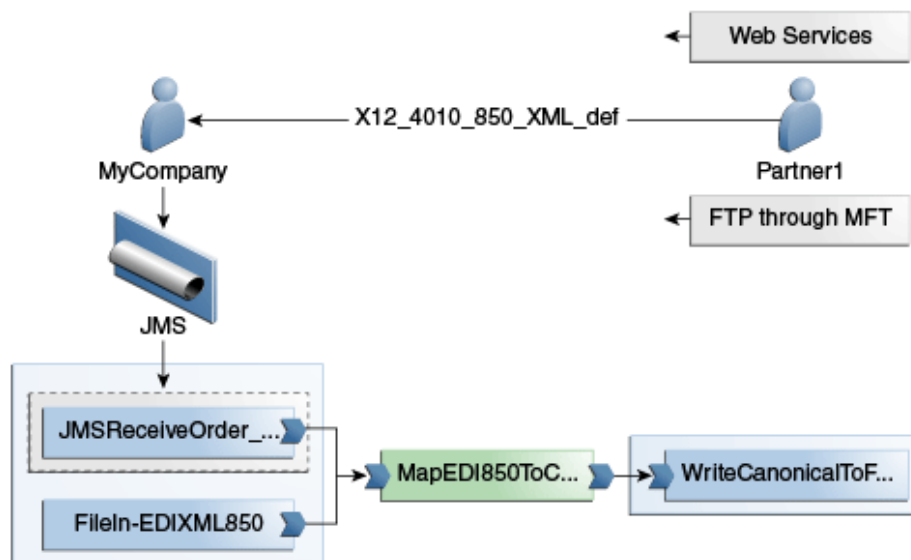
Component	How This Component Addresses The Business Challenge	Component Description
Oracle B2B	The Oracle B2B Console is used to build a document flow that accepts an EDI XML order from a remote trading partner.	Oracle B2B enables you to securely and reliably exchange documents between businesses (for example, retailer, supplier, and manufacturer). B2B e-commerce represents mature business documents, classic business processes, and industry-specific messaging services. B2B e-commerce requires an architecture to manage the complete end-to-end business process. Oracle B2B provides an architecture enabling a unified business process platform, end-to-end instance tracking, visibility, auditing, process intelligence, governance, and security.
Oracle MFT	Oracle MFT is integrated with Oracle B2B, which enables an EDI XML order to be sent by the embedded FTP server to Oracle B2B.	See Table 9-1 for a description of Oracle MFT.

Table 10-1 (Cont.) Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
Oracle Service Bus	Oracle Service Bus is integrated with Oracle B2B. This enables Oracle Service Bus to read orders from the queue and transform them from EDI XML format into canonical order messages for submittal to the ProcessOrder composite.	See Table 3-1 for a description of Oracle Service Bus.

[Figure 10-1](#) provides an overview of how this business solution is implemented.

Figure 10-1 Overview



Subsequent sections of this chapter provide more specific details about how the components in [Table 10-1](#) are used to address the EDI XML document order business challenge.

- [Creating Trading Partners and Trading Partner Agreements with Oracle B2B](#)
- [Integrating an Oracle MFT Target with Oracle B2B](#)
- [Integrating with Oracle B2B](#)
- [Integrating the ProcessOrder Composite with Oracle B2B](#)

10.2.1 Creating Trading Partners and Trading Partner Agreements with Oracle B2B

To address the business challenge of the order processing system being able to accept orders in EDI XML format, Company X uses Oracle B2B. Oracle B2B enables you to create trading partner agreements between Company X and any trading partners that submit orders in EDI XML format. A trading partner agreement consists

of two trading partners: the host trading partner and remote trading partner. The trading partner agreement defines the terms that enable these two trading partners, one acting as the initiator and the other acting as the responder, to exchange business documents.

Company X performs the following administrative tasks in the Oracle B2B Console:

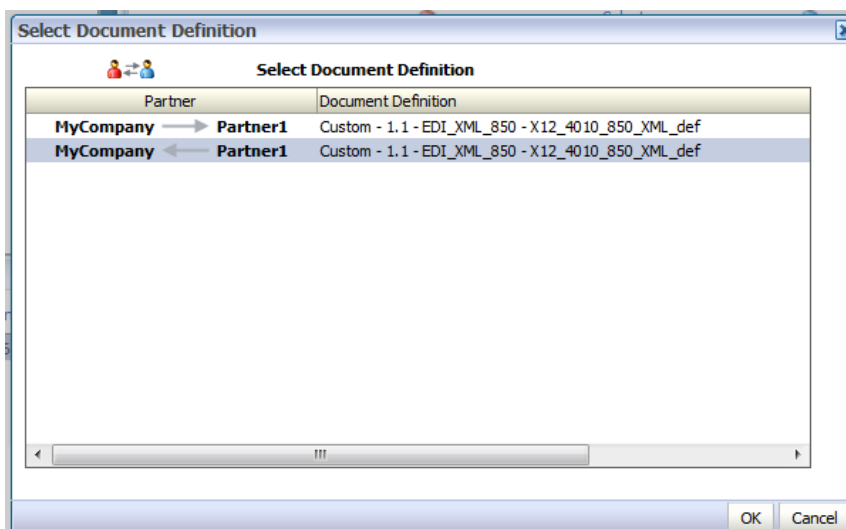
- Sets the queueing delivery method to JMS.
- Creates a document type named **EDI_XML_850**.
- Creates a document definition named **X12_4010_850_XML_Def** for an inbound EDI XML 850 file and a creates a root node name. The document definition defines the transaction structure processed at runtime and includes key identification configurations. When the B2B Gateway finds an XML file with this root node, it matches this document definition, which leads it to the trading partner agreement.
- Imports a WSDL file.
- Creates a web service listening channel.

Company X then creates the following trading partner and trading partner agreement to accept new XML document transactions from the trading partner. A trading partner agreement is similar to a legal contract that specifies which document is traded between which partners, in which direction, and in which protocol, including security parameters such as digital signatures, message encryption, and whether or not an acknowledgement is expected.

- Creates a trading partner named Partner1 and selects the **X12_4010_850_XML_Def** document definition created previously. This informs Oracle B2B that Partner1 is allowed to trade with the host trading partner Company X (referred to as **MyCompany** in the Oracle B2B Console) using this document definition.
- Creates a trading partner agreement that associates Partner1 with the host trading partner (Company X). The agreement specifies the document, message direction, delivery channel, and other settings.

In [Figure 10-2](#), the document definition created previously along with the direction (remote Partner1 sending an inbound EDI XML order to the host Company X, and referred to as **MyCompany** in the Oracle B2B Console) is selected.

Figure 10-2 Document Definition and Direction Selection



After deployment, Company X tests the configuration by submitting an XML payload to the web service listening channel. The Oracle B2B Console **Reports** tab shown in Figure 10-3 provides details.

Figure 10-3 Reports Tab

The screenshot shows the Oracle B2B Reports interface. The top navigation bar includes 'Administration', 'Partners', 'Reports' (highlighted with a red circle), 'Metrics', 'Logout', and 'Help'. Below the navigation bar, there are tabs for 'Business Message', 'Wire Message', 'Application Message', 'Error', and 'Conversation'. The 'Business Message' tab is active, and a 'Generate URL from current search criteria' button is visible. A search panel is displayed with various filters: Match (All/Any), Sender (Contains), Receiver (Contains), Agreement (Contains), Send Time Stamp (Greater Than), Receive Time Stamp (Greater Than), State (Contains), Message Id (Contains), and Flow Id (Contains). Below the search panel, there are buttons for 'Search' and 'Reset'. The results section shows 'Result (Message Count: 1)' with sorting options (Created, Descending) and buttons for 'Purge', 'ReSubmit App Message', and 'ReSubmit Wire Message'. A table displays the search results:

	Details	State	Document Type	Agreement	Sender	Receiver	Receive Time Stamp
1		MSG_COMPL...	EDI_XML_850	P1_MC_EDIXML_850_1_1	Partner1	MyCompany	Apr 2, 2013 3:13 P

Navigating further into the **Details** column link shows that the message was written to the JMS queue **jms/b2b/B2B_IN_QUEUE**. Figure 10-4 provides details.

Figure 10-4 Report Results

The screenshot shows the 'Application Message' details view. It includes a 'ReSubmit' button at the top. The message details are as follows:

- Id: 0AD2284813E14BFF8A70000040C26CE9
- Sender Id Type: Name
- Sender Value: Partner1
- Receiver Id Type: Name
- Receiver Value: MyCompany
- Document Type: EDI_XML_850
- Document Definition: X12_4010_850_XML_def
- Document Protocol Name: Custom
- Document Protocol Version: 1.1
- Refer To Application Message Id: Refer To Application Message Id
- App Conversation Id
- App Message property: {TO_PARTY_IDENTIFIER=Name:MyCompany, MSG_ID=0AD2284813E14BFF8A70000040C26CE5-1, FROM_PARTY_ID_TYPE=Name, DOCUMENT_DEFINITION_NAME=X12_4010_850_XML_def, DOCTYPE_REVISION=1.1, MSG_TYPE=, jms.sender.jndi_destination_location=jms/b2b/B2B_IN_QUEUE, jms.sender.is_topic=false, Protocol Version=1.0, jms.sender.jndi_connection_factory_location=jms/b2b/B2BQueue, FROM_PARTY=Partner1, DOCTYPE_NAME=EDI_XML_850, TO_PARTY_ID_VALUE=MyCompany, TRANSFORM_PAYLOAD=fa, FROM_PARTY_IDENTIFIER=Name:Partner1, tracking_ecid=39579ee6-ee2f3d355962-00000078, DOCUMENT_PROTOCOL_NAME=, TO_PARTY_ID_TYPE=Name, endpoint=jms/b2b/B2B_IN_QUEUE, TO_PARTY=MyCompany, Protocol=JMS, FROM_PARTY_ID_VAL...
- Direction: INBOUND
- State: MSG_COMPLETE
- Error Code
- Error Text
- Error Description
- Created: Apr 16, 2013 2:28 PM

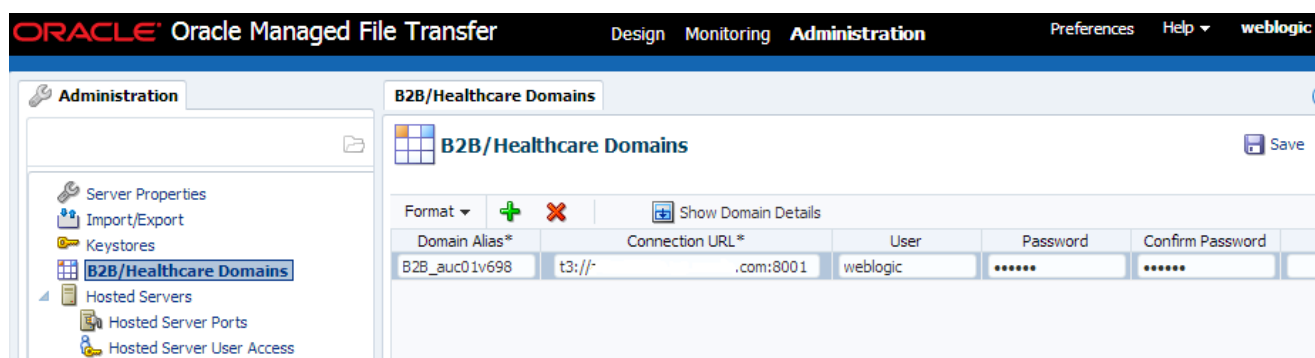
10.2.2 Integrating an Oracle MFT Target with Oracle B2B

Company X also has a requirement to accept EDI XML orders sent by FTP servers. Company X configures Oracle B2B to work with Oracle MFT, which was described in [Managing File Transfers](#). This enables Partner1 to send EDI XML orders to Company X through the following channels:

- Web services (as previously described)
- FTP servers using Oracle MFT

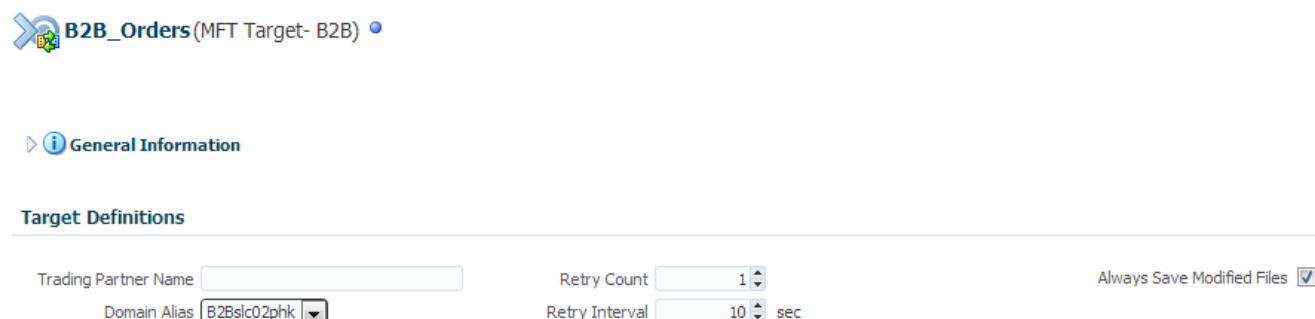
Company X first configures Oracle MFT with a connection to the Oracle B2B server on the **Administration** tab of the Oracle Managed File Transfer Console. [Figure 10-5](#) provides details.

Figure 10-5 Oracle MFT Configuration to the Oracle B2B Server



Company X then creates a target named **B2B_Orders** of type **B2B**. The target defines the destination of files. The domain alias created on the **Administration** tab is selected. [Figure 10-6](#) provides details.

Figure 10-6 B2B_Orders Target



A transfer associates a source with one or more targets. Company X creates a new transfer named **Orders2B2BTransfer**, then configures it as follows:

- Selects the existing **OrdersFTPEmbeddedSource** source created in [Creating Transfers, Sources, and Targets](#). The source defines the origin of files. **OrdersFTPEmbeddedSource** is configured to transfer files in the **/orders** directory using the FTP embedded server.
- Selects the **B2B_Orders** target.
- Enters **EDI_XML_850** as the filtering pattern.
- Selects **Inline** as the delivery method.
- Enters **1000000** in the **Max Inline Size (bytes)** field.

Figure 10-7 provides details.

Figure 10-7 Oracle MFT Transfer with Transfer, Source, and Target Defined

The screenshot displays the Oracle MFT Transfer configuration page. At the top, it shows the transfer name 'Orders2B2BTransfer (MFT Transfer)' and the 'General Information' section. Below this, the 'Transfer Definitions' section is visible, with the 'Source' tab selected. The source configuration includes 'OrdersFTPEmbeddedSource' with a type of 'FTP Embedded' and a location of '/orders'. A 'Content Filters' section is also present, with a filter rule '1 *EDI_XML_850*'. The 'Targets' tab is also visible, showing the 'B2B_Orders' target with a type of 'B2B' and 'Delivery Preferences' set to 'Inline' and 'MaxInline Size (bytes)' set to '1000000'.

After deployment and the placement of an EDI XML file that adheres to the pattern of **EDI_XML_850** in the **/orders** directory, the Reports page in Oracle B2B Console shows that the message was delivered.

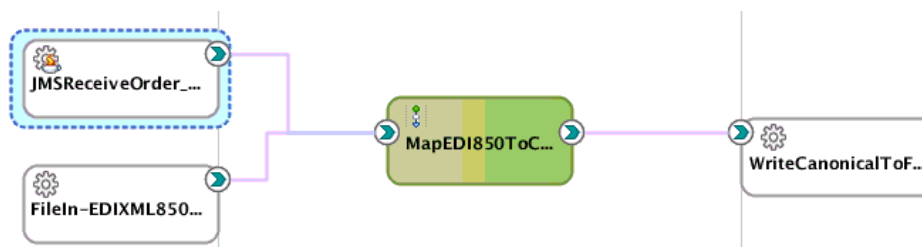
10.2.3 Integrating Oracle Service Bus with Oracle B2B

Company X creates an Oracle Service Bus project named **B2B_SB_ReceiveOrder** in Oracle JDeveloper to integrate with Oracle B2B. Company X's overall intent is for an Oracle Service Bus project to read messages from the queue and transform them from EDI XML into canonical order messages for submittal to the **ProcessOrder** composite created in [Creating an Order Processing System](#).

The Oracle Service Bus project is created within the existing Oracle Service Bus application created in [Registering SOA Composite Applications with](#) . This project retrieves Oracle B2B messages from the JMS queue, transforms them to canonical XML format, and writes them to a file. [Figure 10-8](#) provides details. Once

implemented, Company X extends the Oracle Service Bus process to call the **ValidatePS** process order proxy service created in [Registering SOA Composite Applications with](#) .

Figure 10-8 B2B_SB_ReceiveOrder Project in Oracle Service Bus Application



The components in the project perform the following tasks:

- **JMSReceiveOrder_ProxyService.proxy**: Retrieves Oracle B2B messages (orders) from the **B2B_IN_QUEUE.JMS** queue. The JMS URL port points to the SOA server on which Oracle B2B is running.
- **MapEDI850ToCanonicalOrder.pipeline**: Transforms Oracle B2B messages to canonical order XML format.
- **WriteCanonicalToFile.bix**: Writes the canonical order XML format to a file in the **/tmp/b2b/osbfiles** directory.

After deployment, the orders are retrieved through the web service and Oracle MFT channels, transformed, and written to the directory. The **Message Reports** section in Oracle Enterprise Manager Fusion Middleware Control shows that the messages were processed by Oracle Service Bus. [Figure 10-9](#) provides details.

Figure 10-9 Message Report Details

B2B_SB_ReceiveOrder Logged in as weblogic
 Service Bus Project Page Refreshed Apr 18, 2013 4:07:20 PM PDT

Search

Inbound Service Name Date Range All
 Error Code From To
 Report Index For the last days (hr:min)

Message Reports

View

Report Index	DB Timestamp	Inbound Service	Path
CanonicalOrder/OrderNumber=815455	04/16/2013 12:00:00 AM	MapEDI850ToCanonicalOrder	B2B_SB_ReceiveOrder
Transaction-850/OrderNumber=815455	04/16/2013 12:00:00 AM	MapEDI850ToCanonicalOrder	B2B_SB_ReceiveOrder
CanonicalOrder/OrderNumber=815455	04/16/2013 12:00:00 AM	MapEDI850ToCanonicalOrder	B2B_SB_ReceiveOrder
Transaction-850/OrderNumber=815455	04/16/2013 12:00:00 AM	MapEDI850ToCanonicalOrder	B2B_SB_ReceiveOrder

10.2.4 Integrating the ProcessOrder Composite with Oracle B2B

Company X further integrates Oracle B2B with the **ProcessOrder** composite created in [Creating an Order Processing System](#).

Company X performs the following tasks and tests to ensure that Oracle B2B invokes the **ProcessOrder** composite to receive and process orders.

- Edits the **MapEDI850ToCanonicalOrder** pipeline and changes the route node destination business service to the **ProcessBS** business service created in [Registering the ProcessOrder Composite as a Business Service](#).
- Redeploys and tests the web service and Oracle MFT channels.
- Tracks the order in the Oracle B2B Console **Reports** tab and the Oracle Service Bus Message Reports page in Oracle Enterprise Manager Fusion Middleware Control.
- Checks the **ProcessOrder** composite business flow instance in Oracle Enterprise Manager Fusion Middleware Control to verify that the order was received and processed successfully.

10.3 Related Documentation

[Table 10-2](#) provides references to documentation that more specifically describes the components and features described in this chapter.

Table 10-2 Related Documentation

For Information About...	See...
Understanding Oracle B2B	"Introduction to Oracle B2B" of <i>Using Oracle B2B</i>
Creating a trading partner and a trading partner agreement in Oracle B2B	"Configuring Trading Partners" of <i>Using Oracle B2B</i> "Creating and Deploying Trading Partner Agreements" of <i>Using Oracle B2B</i>
Creating Oracle MFT transfers, targets, and sources	"Designing Artifacts: Transfers, Sources, and Targets" of <i>Using Oracle Managed File Transfer</i>
Adding a pipeline with Oracle Service Bus	"How to Add a Pipeline" of <i>Developing Services with Oracle Service Bus</i>
Creating a proxy with Oracle Service Bus	"How to Create a Proxy Service" of <i>Developing Services with Oracle Service Bus</i>
Transforming data with Oracle Service Bus	"Transforming Data" of <i>Developing Services with Oracle Service Bus</i>

11

Adding Fraud Detection

This chapter describes how Oracle SOA Suite addresses the business challenge of creating a fraud detection system. Overviews of how key components are created and used to address this challenge are provided, including Oracle Event Processing and the Event Delivery Network (EDN).

This chapter includes the following sections:

- [Business Challenge](#)
- [Business Solution](#)
- [Related Documentation](#)

11.1 Business Challenge

Company X has a requirement that a new credit card fraud detection system be implemented to eliminate potential credit card abuses.

11.2 Business Solution

To address this business challenge, Company X designs a business solution that uses the components described in [Table 11-1](#).

Table 11-1 Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
Oracle Event Processing application	An Oracle Event Processing application provides real-time, time-based analysis of orders (events) placed by customers recognized specifically by an associated email address. As each order (event) is passed to the Oracle Event Processing server, it is dynamically accessed for possible fraudulent activity by observing event patterns with an aggregated order dollar amount that exceeds \$1000 in any 24 hour period.	Oracle Event Processing is a high throughput and low latency platform for developing, administering, and managing applications that monitor real-time streaming events. Oracle Event Processing processes event data in real time.
Business events and the Event Delivery Network (EDN)	The Oracle Event Processing application receives events arriving from a composite that publishes an event (named FraudCheckRequest) and subscribes to an event (named FraudCheckResponse) on the EDN.	Business events are raised when a situation of interest occurs. For example, in a loan flow scenario, a BPEL process service component executing a loan process can raise a loan completed event at the completion of the process. Business events are published to the EDN.

Table 11-1 (Cont.) Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
SOA composite application	A SOA composite application is used to test the Oracle Event Processing application by publishing an order event to the Oracle Event Processing application and subscribing to the resulting event that includes an analysis of the results.	See Table 3-1 for a description of SOA composite applications.

Subsequent sections of this chapter provide more specific details about how the components in [Table 11-1](#) are used to address the fraud detection system business challenge.

- [Creating an Application](#)
- [Sending Events to the Application](#)
- [Sending Event Data from](#)

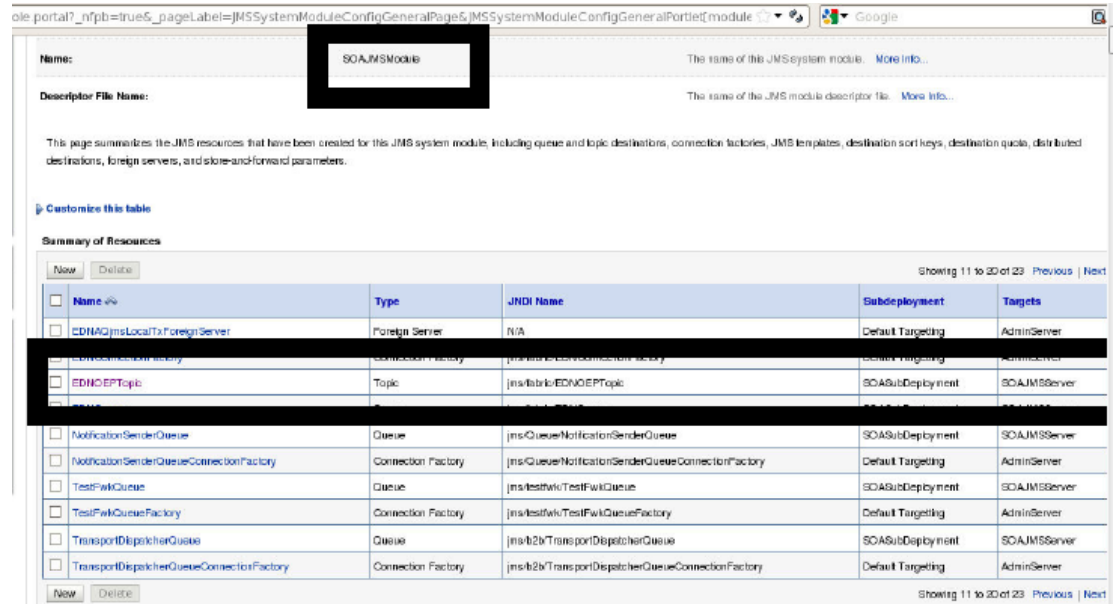
11.2.1 Creating an Oracle Event Processing Application

To address the credit card fraud detection challenge, Company X uses Oracle Event Processing to dynamically access each inbound order (event) and observe the event patterns for possible fraudulent activity.

Company X creates an Oracle Event Processing application named **FraudOEPApplication** in Oracle JDeveloper. This application receives events arriving from a composite that publishes an event (named **FraudCheckRequest**) and subscribes to an event (named **FraudCheckResponse**) on the EDN. The definitions for these events are provided in an event definition language (EDL) file with a related schema file. An EDL file is a schema used to build business event definitions.

The EDN is based on a standard JMS messaging infrastructure. Company X uses a JMS implementation with the Oracle Event Processing application by creating a JMS topic within the **SOAJMSModule** in Oracle WebLogic Server Administration Console. [Figure 11-1](#) provides details.

Figure 11-1 JMS Topic Configuration

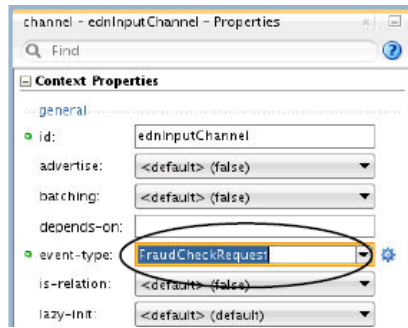


Company X designs the Oracle Event Processing application with the following components that are dragged from the Components window and configured:

- An **EDN Inbound Adapter** named **edn-inbound-adapter** configured with the following artifacts:
 - An EDL file (**FraudCheckEvent.edl**) that contains the EDN event type names used by the application:

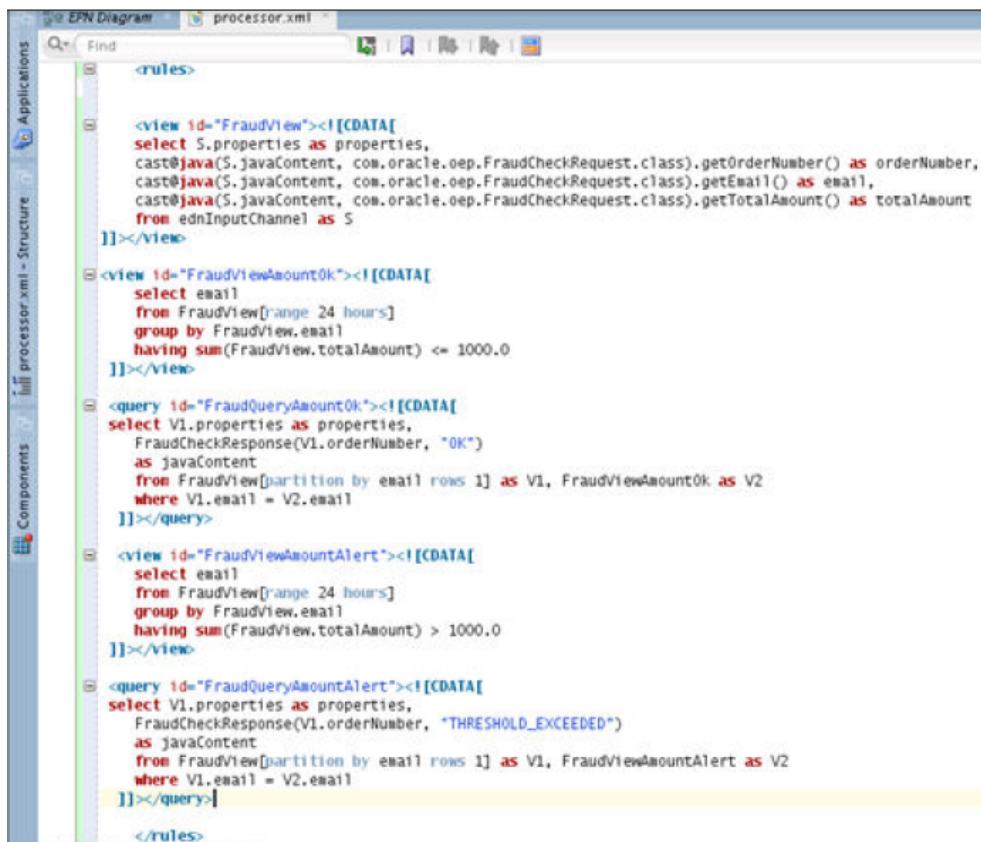

```
<?xml version = '1.0' encoding = 'UTF-8'?>
<ns0:definitions xmlns:ns0="http://schemas.oracle.com/events/edl"
targetNamespace="http://xmlns.oracle.com/Application2/Project1/
FraudCheckEvent" >
  <ns0:schema-import location=" ../Schemas/FraudCheckType.xsd"
namespace="http://www.oracle.com/oe" />
  <ns0:event-definition name="FraudCheckRequest" >
    <ns0:content xmlns:ns1="http://www.oracle.com/oe"
element="ns1:FraudCheckRequest" />
  </ns0:event-definition>
  <ns0:event-definition name="FraudCheckResponse">
    <ns0:content xmlns:ns2="http://www.oracle.com/oe"
element="ns2:FraudCheckResponse" />
  </ns0:event-definition>
</ns0:definitions>
```
 - An event type named **FraudCheckRequest**.
 - A schema file associated with the EDL file.
- An event **Channel** named **ednInputChannel** associated with a **FraudCheckRequest** event type that is selected in the **Context Properties** section, as shown in [Figure 11-2](#). This associates the event type with the channel.

Figure 11-2 Event Type Associated with Inbound Channel

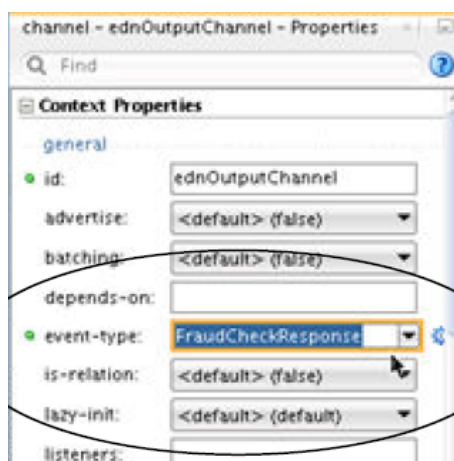


- A **Processor** named **ednProcessor** that is populated with a Complex Query Language (CQL) rule to be applied to the streaming event data. The required CQL relates to fraud detection, as shown in Figure 11-3. For requests of \$1000 and over, the threshold is exceeded.

Figure 11-3 Fraud Detection CQL in Processor



- A second event **Channel** named **ednOutputChannel** associated with a **FraudCheckResponse** event type that is selected in the **Context Properties** section, as shown in Figure 11-4. This associates the event type with the channel.

Figure 11-4 Event Type Associated with Outbound Channel

- An **EDN Outbound Adapter** named **edn-outbound-adapter** is configured with the following artifacts:
 - The EDL file (**FraudCheckEvent.edl**) that contains the EDN event type names used by the application.
 - An event type of **FraudCheckResponse**.

 **Note:**

A schema file is not required.

These components are wired together in the following order in the designer.

edn-inbound-adapter > **ednInputChannel** > **ednProcessor** > **ednOutputChannel** > **edn-outbound-adapter**

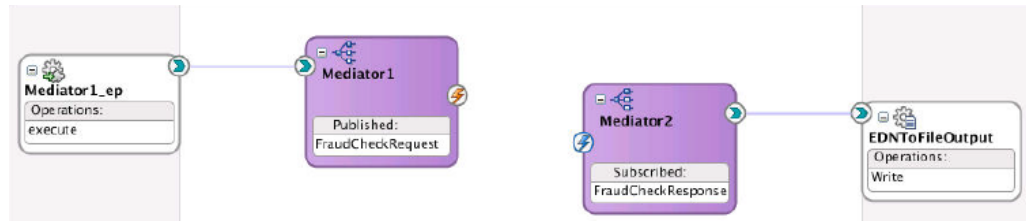
11.2.2 Sending Events to the Oracle Event Processing Application

To test the Oracle Event Processing application, Company X first creates a connection to the Oracle Event Processing server, then deploys the application. Once deployed, the application can wait for events to arrive for analyzing.

Company X has a test composite (**EDNOEPv2Proj**) that can send EDN events to the Oracle Event Processing application. The resulting EDN events are then sent back to the test composite, which uses a file adapter to write the information to a file for review and analysis. [Figure 11-5](#) provides details. The test application consists of two Oracle Mediator service components. Oracle Mediator enables you to route events between different components.

- The first Oracle Mediator publishes the **FraudCheckRequest** event sent to the Oracle Event Processing application.
- The second Oracle Mediator subscribes to the **FraudCheckResponse** event returned to the test composite.

Figure 11-5 Test Composite for Sending and Receiving Events



The **Subscriptions** tab of the Business Events page in Oracle Enterprise Manager Fusion Middleware Control displays both event types. The test composite uses the Oracle WebLogic Server JMS topic mapping for the **FraudCheckRequest** and **FraudCheckResponse** event types shown on this page. [Figure 11-6](#) provides details.

Figure 11-6 Business Events

soa-infra | Logged in as weblogic | SOA Infrastructure | Find an Instance.. | Page Refreshed Aug 7, 2013 3:38:29 PM PDT

Business Events | Related Links

Events | Subscriptions

Events consist of message data sent as the result of an occurrence in a business environment. Select an event in the table to which to test, or to see the event definition.

Search []

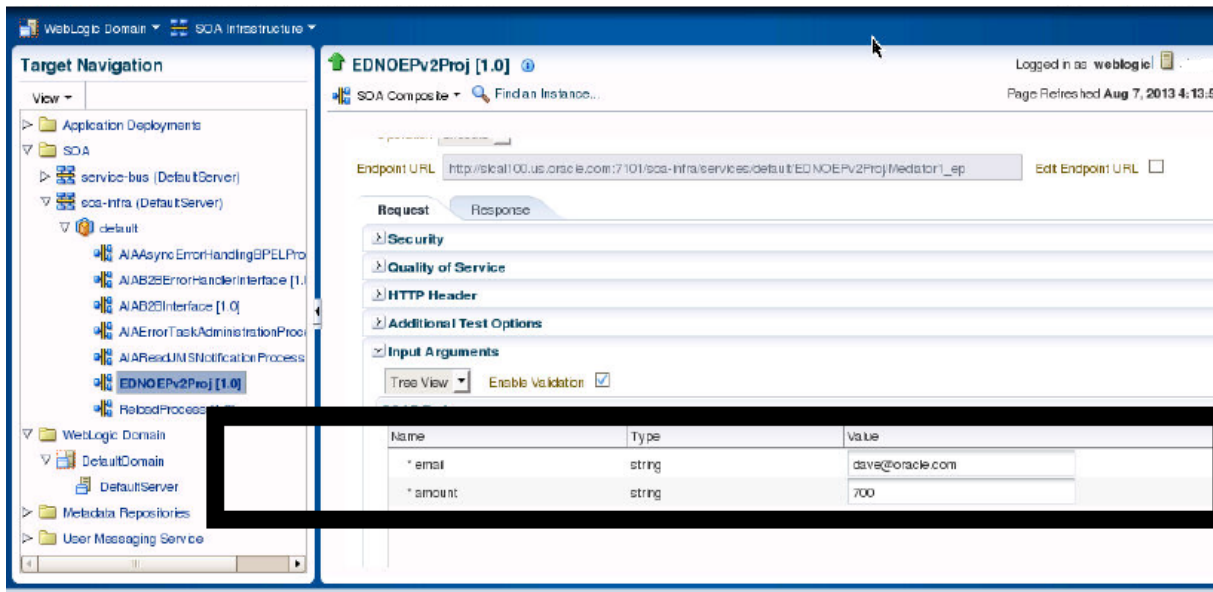
View | Test... | Show Event Definition

Namespaces and Events	JMS Mapping	JMS Type	Subscriptions
http://xmlns.oracle.com/Application2/Project1/FraudCheckEvent			1
FraudCheckRequest	Default	Oracle Weblogic JMS	0
FraudCheckResponse	Default	Oracle Weblogic JMS	1

11.2.3 Sending Event Data from Oracle Enterprise Manager Fusion Middleware Control

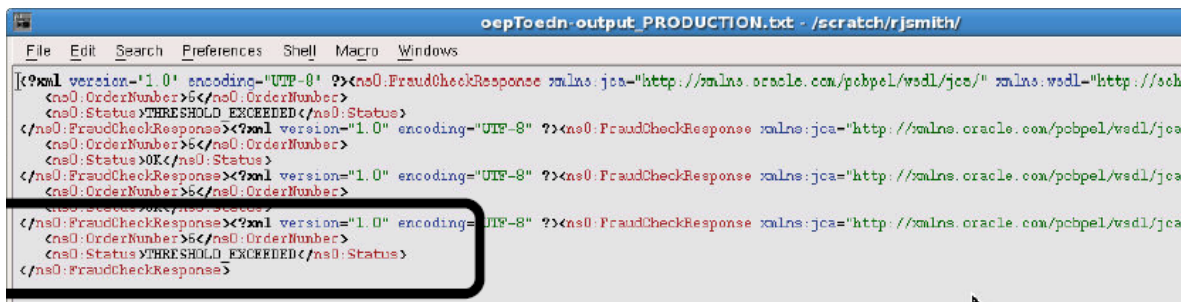
Company X uses the Test Web Service page in Oracle Enterprise Manager Fusion Middleware Control to send event data to the SOA composite to test its integration with the Oracle Event Processing application. This is the email address used by the CQL Group By clause to identify each collection of related orders and the dollar amount value. [Figure 11-7](#) provides details.

Figure 11-7 Test Web Service Page



Once the composite executes with the specified data, a message indicates that the request was successfully processed by the Oracle Event Processing application. The EDN event is successfully published and received by the application, and its payload is analyzed. The results are provided in the output file. If a value of \$1000 or more is specified, the output file indicates that the threshold is exceeded. This may be a potential indicator of credit card fraud by an unauthorized user. The status is determined by the CQL statements specified in the Oracle Event Processing application in [Creating an Application](#). [Figure 11-8](#) provides details.

Figure 11-8 Output File



After testing is complete, Company X can integrate the Oracle Event Processing application with the business solution described in the previous chapters.

11.3 Related Documentation

[Table 11-2](#) provides references to documentation that more specifically describes the components and features described in this chapter.

Table 11-2 Related Documentation

For Information About...	See...
Developing Oracle Event Processing applications	"Introduction to Application Development" of <i>Developing Event Processing Applications for Oracle Stream Analytics</i>
Administering Oracle Event Processing	"Introduction to Server Administration" of <i>Administering Oracle Stream Analytics</i>
Creating and managing business events and using the EDN	"Using Business Events and the Event Delivery Network" of <i>Developing SOA Applications with Oracle SOA Suite</i> "Managing Business Events" of <i>Administering Oracle SOA Suite and Oracle Business Process Management Suite</i>
Using Oracle Mediator to publish and subscribe to business events	"Using the Oracle Mediator Service Component" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Creating test instances in Oracle Enterprise Manager Fusion Middleware Control	"Initiating a Test Instance of a Business Flow" of <i>Administering Oracle SOA Suite and Oracle Business Process Management Suite</i>

12

Gaining Business Insights with Oracle Business Activity Monitoring

This chapter describes how Oracle SOA Suite addresses the business challenge of gaining business insights into customer order requests. Overviews of how key SOA composite application components address this challenge are provided, including process analytics and Oracle Business Activity Monitoring (BAM).

This chapter includes the following sections:

- [Business Challenge](#)
- [Business Solution](#)
- [Related Documentation](#)

12.1 Business Challenge

Company X has a requirement to gain business insights into the customer ordering system to identify the following trends:

- The number of orders approved, received, or rejected.
- The reasons for rejections, such as insufficient income, credit, or age.
- The number of automatic or manual credit card approvals per state.

12.2 Business Solution

To address this business challenge, Company X designs a business solution that uses the components described in [Table 12-1](#).

Table 12-1 Components That Provide the Business Solution

Component	How This Component Addresses The Business Challenge	Component Description
Process analytics	Process analytic measurements and business indicators are defined on activities in a BPEL process.	Process analytics provide a uniform measurement mechanism for collecting disparate data in BPEL processes.
Oracle BAM	When a SOA composite is configured with analytics measurements and business indicators, composite-specific physical and logical data objects are automatically created in Oracle BAM upon the composite's deployment. Oracle BAM Composer is used to create a dashboard of these analytics to gain business insights into customer order requests.	Oracle BAM monitors business processes in real time to help you make informed tactical and strategic business decisions.

Subsequent sections of this chapter provide more specific details about how the components in [Table 12-1](#) are used to address the business insight challenge.

- [Adding Business Indicators and Measurements to a Composite](#)
- [Gaining Business Insights with Oracle BAM Dashboards](#)

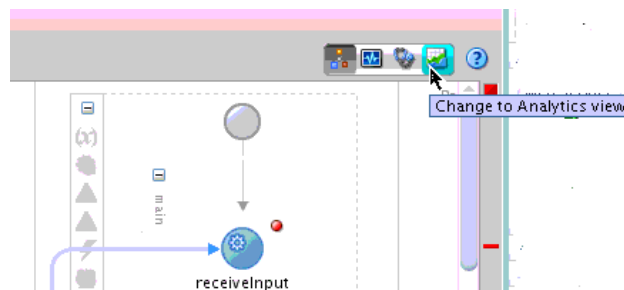
12.2.1 Adding Business Indicators and Measurements to a Composite

Oracle SOA Suite provides a uniform process schema across components such as BPEL processes, Oracle BPM, and human workflow. Oracle BAM models this schema as data objects that are persisted in the Oracle BAM server. These data objects are preseeded and populated by the processes automatically.

Oracle SOA Suite provides a feature called process analytics. This feature enables Company X to specify user metrics such as business indicators and measurements on activities in a BPEL process. When the composite is deployed, corresponding, custom, derived data objects are created and updated in Oracle BAM.

Company X opens a BPEL process in Oracle JDeveloper (for this scenario, named **CCComposite**) in which to specify user metrics and clicks the **Change to Analytics view** icon, as shown in [Figure 12-1](#). This opens the process in analytics view. Analytics view enables you to define business indicators and measurements in the BPEL process.

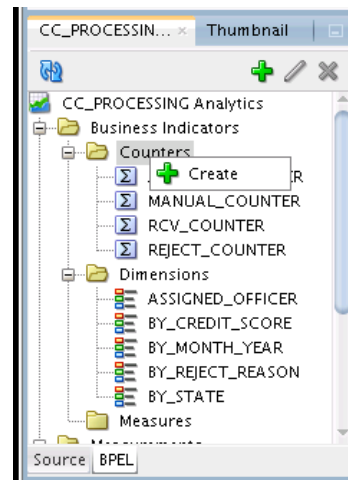
Figure 12-1 Analytics View in a BPEL Process



- Business indicators are defined in the Structure window, and consist of the following:
 - Counters: Track the number of times a process instance completes a marked element such as a BPEL activity.
 - Dimensions: Label group or filter measures.
 - Measures: Store the values of a variable such as a sales amount, an employee salary, and so on.

[Figure 12-2](#) shows defined business indicators in the Structure window.

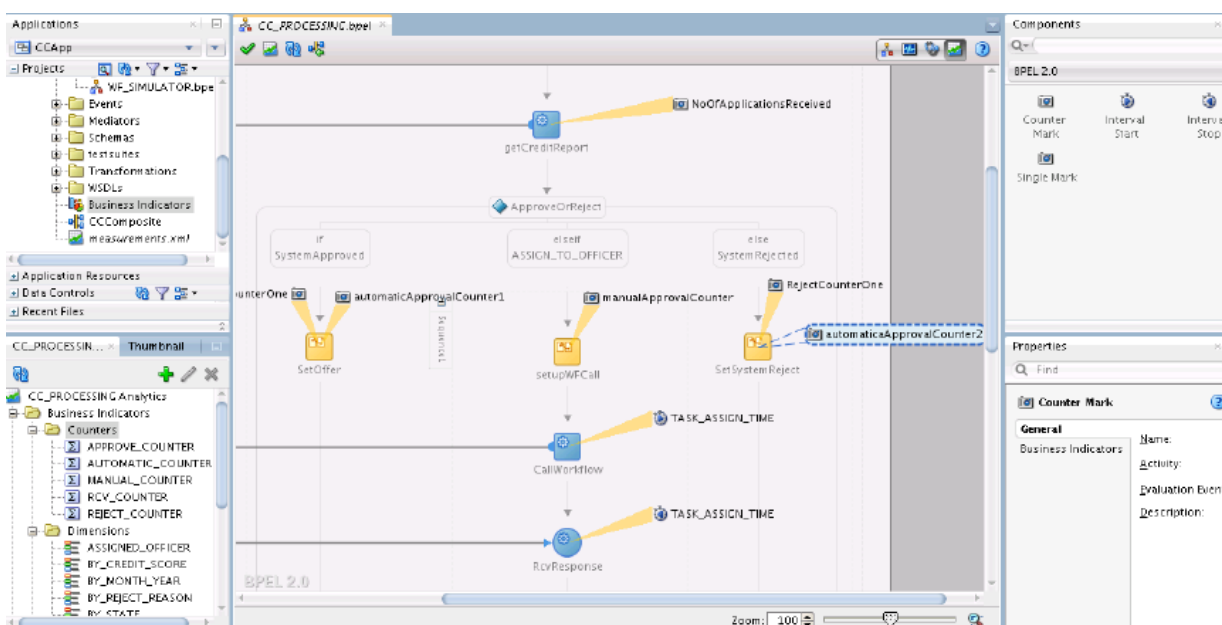
Figure 12-2 Business Indicators Defined in the Structure Window



- Measurements are displayed in the Components window, and are dragged and dropped onto activities for configuration. The following types are available:
 - Counter mark: The BPEL activity on which the counter mark is taken. In this BPEL process, Company X defines counter marks for tracking the number of manual approvals, automatic approvals, and rejected orders.
 - Interval start: The BPEL activity on which the interval starts.
 - Interval stop: The BPEL activity on which the interval ends.
 - Single mark: The BPEL activity on which the single mark is taken.

Figure 12-3 provides details. Measurements that have been dragged from the Components window onto appropriate BEPL activities and configured are indicated by text annotations. The defined business indicators are displayed in the Structure window.

Figure 12-3 BPEL Process with Defined Business Indicators and Measurement Analytics



When a SOA composite is configured with analytics measurements and business indicators, composite-specific physical and logical data objects are automatically created in Oracle BAM upon the composite's deployment. These composite-specific data objects have the columns for business indicators and are populated with analytics information corresponding to processes in that composite.

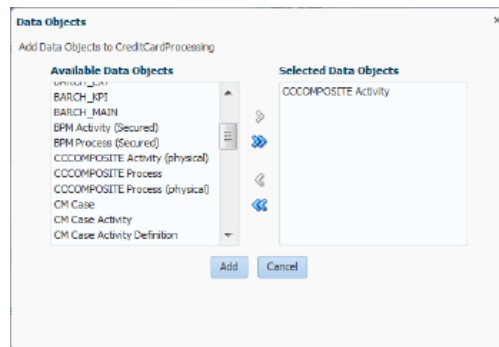
12.2.2 Gaining Business Insights with Oracle BAM Dashboards

Company X deploys the composite, which begins processing order requests.

When Company X specifies business indicators and measurements in a SOA composite application, corresponding, custom, derived data objects are created and updated in Oracle BAM when the composite is deployed. Oracle BAM data objects are populated with appropriate analytics as per the measurements defined in the composite.

Company X logs in to Oracle BAM Composer and creates a new project named **Credit Card Processing** in Oracle BAM Composer. During creation, Company X adds the activity data object corresponding to the deployed **CCComposite** composite into the project, as shown in [Figure 12-4](#). These composite-specific data objects have the columns for business indicators and are populated with analytics information corresponding to processes in that SOA composite.

Figure 12-4 Activity Data Object Selection



Company X then creates a dashboard with a display name of **Credit Card Processing** in the project. Oracle BAM provides a rich set of ready-to-use dashboards for all major components of Oracle BPM Suite and Oracle SOA Suite. These dashboards include metrics such as task queue depth and bottleneck analysis of business processes.

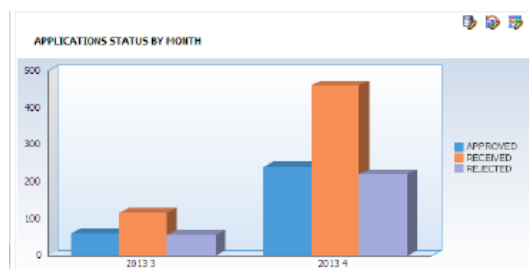
Company X designs a bar graph with three different counters for displaying the approved, received, and rejected applications by month.

- A display name of **APPLICATIONS STATUS BY MONTH**.
- A business view query modeled with measurements and dimensions that Company X designed in the **CCComposite** composite in Oracle JDeveloper.
 - A data object of **/oracle/processanalytics/CCComposite Activity**.
 - A counter for **APPROVE_COUNTER BI** (Display name is changed to **APPROVED**).

- A counter for **RCV_COUNTER BI** (Display name is changed to **RECEIVED**).
- A counter for **REJECT_COUNTER BI** (Display name is changed to **REJECTED**).
- A time dimension of one month.

Figure 12-5 provides details.

Figure 12-5 Bar Graph for Displaying the Approved, Received, and Rejected Applications by Month

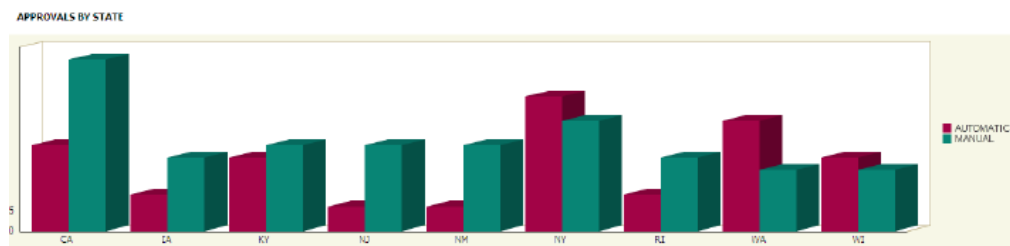


Company X designs a second bar graph for tracking the number of manual and automatic approvals by state.

- A display name of **APPROVALS BY STATE**.
- A business view query modeled with measurements and dimensions that Company X created in the **CCComposite** composite in Oracle JDeveloper.
 - A data object of **oracle/processanalytics/CCComposite Activity**.
 - A counter for **AUTOMATIC_COUNTER BI** (Display name is changed to **AUTOMATIC**).
 - A counter for **MANUAL_COUNTER BI** (Display name is changed to **MANUAL**).
 - A dimension based on state.

Figure 12-6 provides details.

Figure 12-6 Second Bar Graph for Tracking the Number of Manual and Automatic Approvals by State



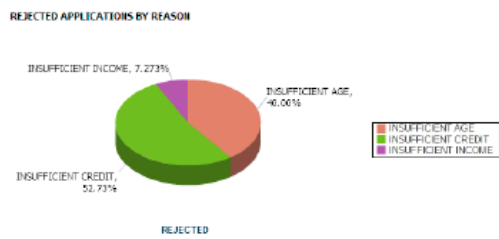
Company X designs a pie graph to the right of the **APPLICATIONS STATUS BY MONTH** graph to track the number of rejected applications due to different reasons.

- A display name of **REJECTED APPLICATIONS BY REASON**.

- A business view query modeled with measurements and dimensions that Company X created in the **CCComposite** composite in Oracle JDeveloper.
 - A data object of **oracle/processanalytics/CCComposite Activity**.
 - A counter for **(REJECT_COUNTER BI)** (Display name is changed to **REJECTED**).
 - A dimension set to **BY REJECT REASON** (due to insufficient age, credit, or income).
 - A **Text Type** set to **Text and Percentage** for the pie slice.

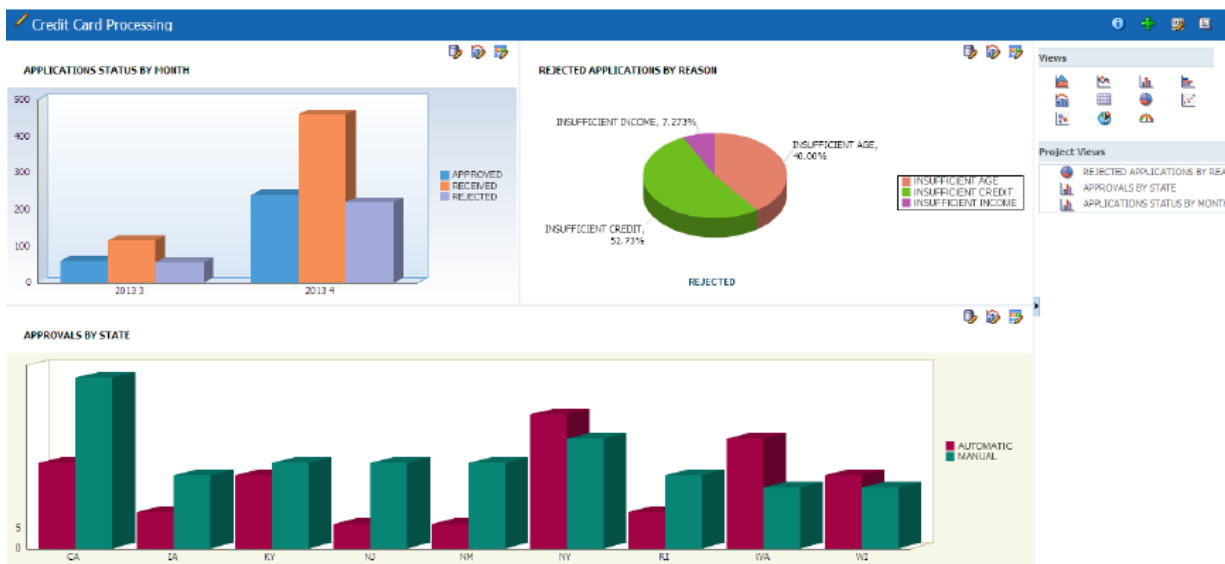
Figure 12-7 provides details.

Figure 12-7 Pie Graph to Track the Number of Rejected Applications Due to Different Reasons



When complete, the entire dashboard looks as shown in Figure 12-8.

Figure 12-8 Oracle BAM Dashboard



12.3 Related Documentation

Table 12-2 provides references to documentation that more specifically describes the features described in this chapter.

Table 12-2 Related Documentation

For Information About...	See...
Creating process analytics	"Configuring BPEL Process Analytics" of <i>Developing SOA Applications with Oracle SOA Suite</i>
Designing Oracle BAM dashboards	"Planning and Creating Projects" of <i>Monitoring Business Activity with Oracle BAM</i> "Creating Dashboards" of <i>Monitoring Business Activity with Oracle BAM</i> "Creating Business Queries" of <i>Monitoring Business Activity with Oracle BAM</i>